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Automatic Transaxle System > General Information > Specifications

SPECIFICATION

Automatic transaxle type		A5HF1
Recommanded transaxle oil		Diamond ATF SP III or SK ATF SP III
Oil quantity		10.9 Liter (Only for the reference)
Oil inspection and supplement		Every one year or every 24,000 km
Replacement	Private use (Normal use)	No service required
	Private use (Severe use)	Every 48,000 Km in severe use(1~4)
	Business use	1. Driving on rough road(bumpy road, gravel road, snowy road, unpaved road etc.) 2. Driving on mountain road, ascent/descent 3. Repetition of short distance driving 4. More than 50% operation in heavy city traffic during hot weather above 32°C 5. Police, Taxi. Commercial type operation
Engine type		3.3 DOHC
Gear ratio	1st	3.789
	2nd	2.064
	3rd	1.421
	4th	1.034
	5th	0.728
	Reverse	3.808
	Final reduction gear ratio	3.333

SERVICE STANDARD

ITEM	VALUE (mm/inch)
Input shaft end play	0.7~1.45 / 0.0276~0.0571
Low & Reverse brake pressure plate end play	1.65~2.11 / 0.0650~0.0831
Reaction plate snap end play	0~0.16 / 0~0.0063
2ND brake pressure plate end play	1.09~1.55 / 0.0429~0.0610
Underdrive sun gear end play	0.25~0.45 / 0.0098~0.0177
Differential bearing spacer end play	0.045~0.105 / 0.0018~0.0041
Underdrive clutch snap ring end play	1.6~1.8 / 0.0630~0.0709
Direct clutch reaction plate snap ring end play	0.6~0.8 / 0.0236~0.0315
Reverse clutch snap ring end play	0~0.09 / 0~0.0035
Overdrive clutch snap ring end play	1.0~1.2 / 0.0394~0.0472
Reverse clutch reaction plate snap ring end play	1.5~1.7 / 0.0591~0.0669

TIGHTENING TORQUE

ITEM	Nm	Kgf.cm	lb-ft
Transfer drive gear	31.4~36.3	320.0~370.0	23.1~26.8
Rear cover	19.6~25.5	200.0~260.0	14.5~18.8
Anchor plug	83.4~112.8	850.0~1150.0	61.5~83.2
Oil pump pipe	9.8~11.8	100.0~120.0	7.2~8.7
Oil pump	19.6~25.5	200.0~260.0	14.5~18.8
Torque converter housing	42.0~54.0	428.0~551.0	31.0~39.9

Valve body	9.8~11.8	100.0~120.0	7.2~8.7
VFS reservoir	9.8~11.8	100.0~120.0	7.2~8.7
Detent spring	4.9~6.9	50.0~70.0	3.6~5.1
Valve body cover	9.8~11.8	100.0~120.0	7.2~8.7
Vehicle speed sensor	3.9~5.9	40.0~60.0	2.9~4.3
Inhibiter switch	9.8~11.8	100.0~120.0	7.2~8.7
Manual control lever	17.7~24.5	180.0~250.0	13.0~18.1
Input/Output speed sensors	9.8~11.8	100.0~120.0	7.2~8.7
Reduction brake piston rod fixing nut	14.7~24.5	150.0~250.0	10.8~18.1
Sub frame bracket	88.3~107.9	900.0~1100.0	65.1~79.6
Valve body inside seperating plate	4.9~6.9	50.0~70.0	3.6~5.1
Valve body cover seperating plate	9.8~11.8	100.0~120.0	7.2~8.7
Direct planetary carrier lock nut	156.9~176.5	1600.0~1800.0	115.7~130.2

SEALANTS

Rear cover liquid gasket	Specified sealant
Rear cover liquid gasket	Threebond 1281B or LOCTITE FMD-546
Torque converter housing liquid gasket	
Valve body liquid gasket	

Snap rings, spacers, thrust washers&races and pressure plates for adjusting

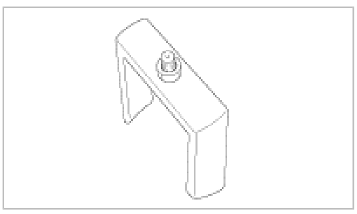
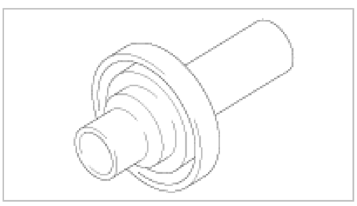
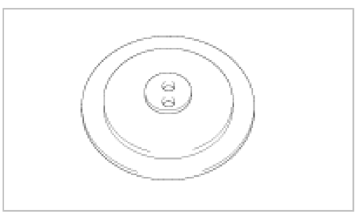
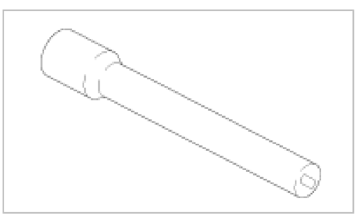
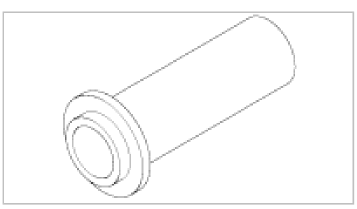
Part name	Part No.	Thickness[mm(inch)]	Identification
Thrust washer (for input shaft end play)	45544-39180	1.8 (0.0709)	
	45544-39200	2.0 (0.0787)	
	45544-39220	2.2 (0.0866)	
	45544-39240	2.4 (0.0945)	
	45544-39260	2.6 (0.1024)	
	45544-39280	2.8 (0.1102)	
Spacer (for differential bearing end play)	45849-39883	0.83 (0.0327)	83
	45849-39886	0.86 (0.0339)	86
	45849-39889	0.89 (0.0350)	89
	45849-39892	0.92 (0.0362)	92
	45849-39895	0.95 (0.0374)	95
	45849-39898	0.98 (0.0386)	98
	45849-39801	1.01 (0.0398)	01
	45849-39804	1.04 (0.0409)	04
	45849-39807	1.07 (0.0421)	07
	45849-39810	1.10 (0.0433)	10
	45849-39813	1.13 (0.0445)	13
	45849-39816	1.16 (0.0457)	16
	45849-39819	1.19 (0.0469)	19
	45849-39822	1.22 (0.0480)	22
	45849-39825	1.25 (0.0492)	25
	45849-39828	1.28 (0.0504)	28
	45849-39831	1.31 (0.0516)	31
	45849-39834	1.34 (0.0528)	34

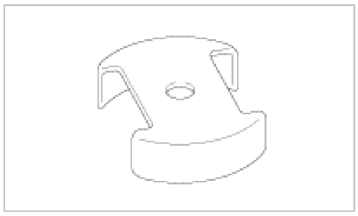
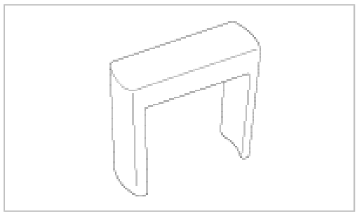
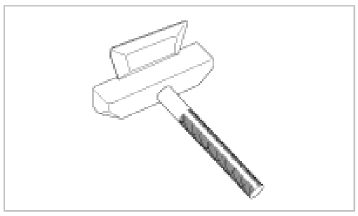
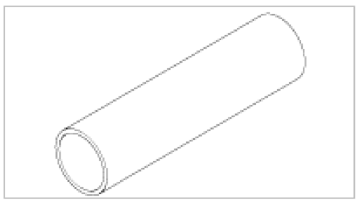
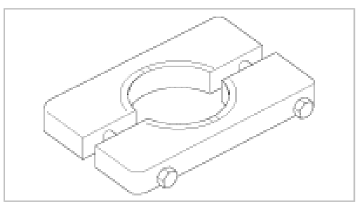
	45849-39837	1.37 (0.0539)	37
Snap ring (for underdrive clutch snap ring end play)	45427-39520	2.0 (0.0787)	
	45427-39521	2.1 (0.0827)	
	45427-39522	2.2 (0.0866)	
	45427-39523	2.3 (0.0906)	
	45427-39524	2.4 (0.0945)	
	45427-39525	2.5 (0.0984)	
	45427-39526	2.6 (0.1024)	
	45427-39527	2.7 (0.1063)	
	45427-39528	2.8 (0.1102)	
	45427-39529	2.9 (0.1142)	
	45427-39530	3.0 (0.1181)	
	45427-39519	1.9 (0.0748)	
	45427-39516	1.6 (0.0630)	
	45427-39517	1.7 (0.0669)	
	45427-39518	1.8 (0.0709)	
Snap ring (for direct clutch snap ring end play)	45556-39520	2.0 (0.0787)	
	45556-39521	2.1 (0.0827)	
	45556-39522	2.2 (0.0866)	
	45556-39523	2.3 (0.0906)	
	45556-39524	2.4 (0.0945)	
	45556-39525	2.5 (0.0984)	
	45556-39526	2.6 (0.1024)	
	45556-39527	2.7 (0.1063)	
	45556-39528	2.8 (0.1102)	
	45556-39529	2.9 (0.1142)	
	45556-39530	3.0 (0.1181)	
	45556-39519	1.9 (0.0748)	
Snap ring (for reverse clutch snap ring end play)	45443-39148		
	45853-39153		
	45459-39158		
	45853-39163		
Snap ring (for overdrive clutch snap ring end play)	45427-39520	2.0 (0.0787)	
	45427-39521	2.1 (0.0827)	
	45427-39522	2.2 (0.0866)	
	45427-39523	2.3 (0.0906)	
	45427-39524	2.4 (0.0945)	
	45427-39525	2.5 (0.0984)	
	45427-39526	2.6 (0.1024)	
	45427-39527	2.7 (0.1063)	
	45427-39528	2.8 (0.1102)	
	45427-39529	2.9 (0.1142)	
	45427-39530	3.0 (0.1181)	
	45427-39519	1.9 (0.0748)	
	45427-39516	1.6 (0.0630)	
	45427-39517	1.7 (0.0669)	

	45427-39518	1.8 (0.0709)	
Snap ring (for reverse clutch reaction plate snap ring end play)	45432-39518	1.8 (0.0709)	
	45432-39517	1.7 (0.0669)	
	45432-39516	1.6 (0.0630)	
	45432-39519	1.9 (0.0748)	
	45432-39528	2.8 (0.1102)	
	45432-39527	2.7 (0.1063)	
	45432-39526	2.6 (0.1024)	
	45432-39525	2.5 (0.0984)	
	45432-39524	2.4 (0.0945)	
	45432-39523	2.3 (0.0906)	
	45432-39522	2.2 (0.0866)	
	45432-39521	2.1 (0.0827)	
	45432-39520	2.0 (0.0787)	

Automatic Transaxle System > General Information > Special Service Tools

SPECIAL TOOLS

Tool (Number and name)	Illustration	Use
09453-3A110 Spring compressor		- Removal and installation of one way clutch inner race snap ring
09431-39000 Oil seal installer		- Installation of differential bearing output race
09456-39100 Clearance dummy plate		- Installation of brake pressure plate
09454-3A110 Reduction socket		- Adjustment of reduction brake piston rod
09452-21200 Oil pump oil seal installer		- Installation of oil seal in a oil pump

09453-24000 Snap ring compressor		- Removal and installation of under drive clutch snap ring
09453-4C400 Spring compressor		- Removal and installation of direct clutch snap ring - Removal and installation of reverse&over drive clutch spring retainer snap ring
09215-3C000 Oil fan remover		- Removal of valve body cover
09455-21100 Bearing installer		- Installation of the ball bearing and the transfer drive gear
09457-22000 Removing plate		- Removal of the differential bearing, the transfer shaft bearing and drive gear bearing

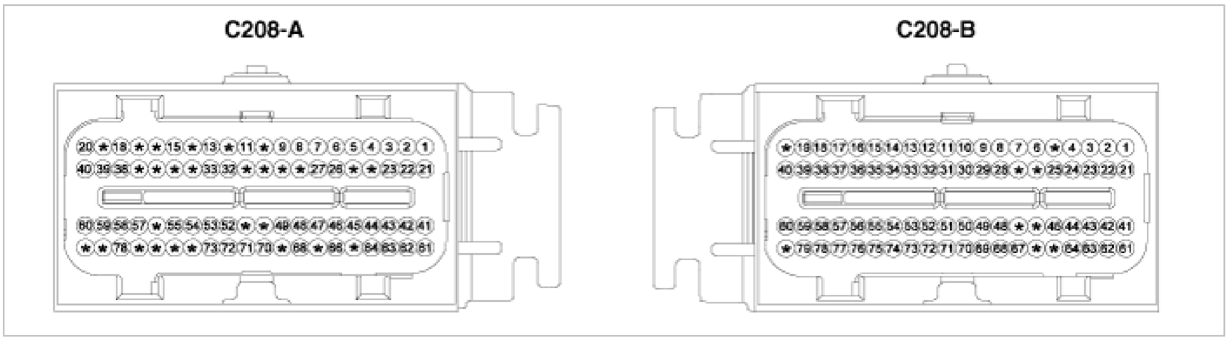
Automatic Transaxle System > Automatic Transaxle System > Troubleshooting

INSPECTION CHART FOR DIAGNOSIS TROUBLE CODES (DTC)

No.	Code	Item	MIL	Remark
1	P0707	Transaxle range switch circuit - LOW input	ON	ATa-9
2	P0708	Transaxle range switch circuit - HIGH input	ON	ATa-15
3	P0711	Transaxle Fluid Temperature Sensor Rationality	ON	ATa-18
4	P0712	Fluid(Oil) Temperature Sensor Circuit - Low	ON	ATa-24
5	P0713	Fluid(Oil) Temperature Sensor Circuit - High	ON	ATa-27
6	P0717	Input Speed Sensor Circuit - No Signal	ON	ATa-29
7	P0722	Output Speed Sensor Circuit - No Signal	ON	ATa-37
8	P0731	Gear 1 Incorrect Ratio	ON	ATa-43
9	P0732	Gear 2 Incorrect Ratio	ON	ATa-51
10	P0733	Gear 3 Incorrect Ratio	ON	ATa-59
11	P0734	Gear 4 Incorrect Ratio	ON	ATa-67
12	P0735	Gear 5 Incorrect Ratio	ON	ATa-74
13	P0736	Reverse Gear Incorrect Ratio	ON	ATa-81
14	P0741	Torque Converter Clutch Circuit - Stuck off	ON	ATa-89

15	P0742	Torque Converter Clutch Circuit - Stuck on	ON	ATa-93
16	P0743	Torque Converter Clutch Circuit - Electrical	ON	ATa-94
17	P0746	Pressure Control Solenoid Valve A - Performance or Stuck Off	OFF	ATa-100
18	P0748	Pressure Control Solenoid Valve A - Electrical	OFF	ATa-106
19	P0750	Shift Control Solenoid Valve A Circuit Malfunction (LR)	ON	ATa-108
20	P0755	Shift Control Solenoid Valve B Circuit Malfunction (UD)	ON	ATa-114
21	P0760	Shift Control Solenoid Valve C Circuit Malfunction (2ND)	ON	ATa-120
22	P0765	Shift Control Solenoid Valve D Circuit Malfunction (OD)	ON	ATa-126
23	P0770	Shift Control Solenoid Valve E Circuit Malfunction (RED)	ON	ATa-131
24	P0885	A/T Relay Circuit Malfunction	ON	ATa-136
25	P0890	AT Relay - Low Circuit	ON	ATa-142
26	P0891	AT Relay - open Circuit	ON	ATa-144

INPUT/OUTPUT SIGNAL VOLTAGE CHECK SHEET



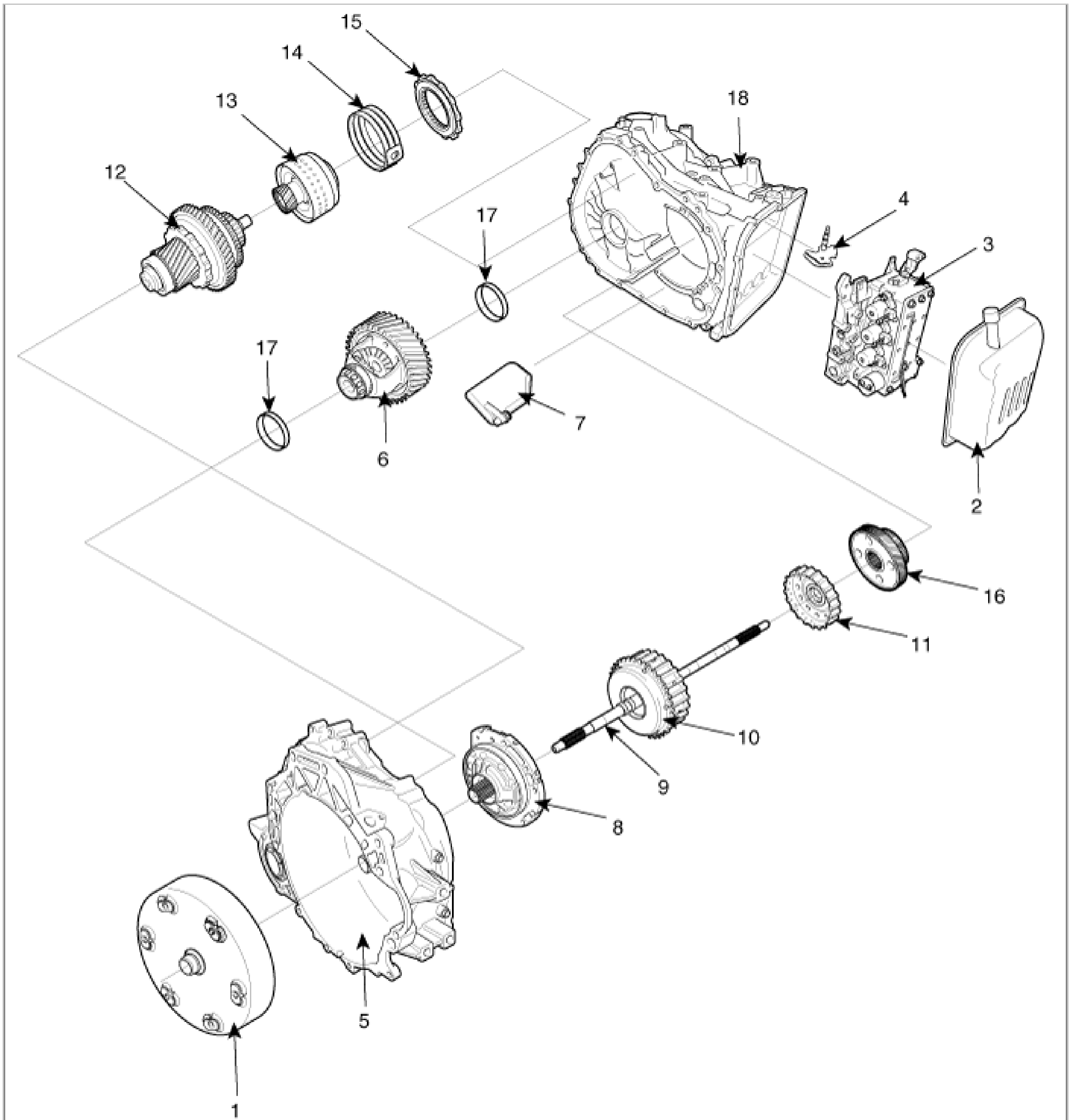
PIN No.	Check item	Condition	Input/Output value		Remarks
			Type	Level	
A01	2nd CAN_HI	-	-	-	-
A02	2nd CAN_LO	-	-	-	-
A03	P Range Selection	P Position Otherwise	DC Voltage	V_BAT Max. 1.0V	
A04	R Range Selection	R Position Otherwise	DC Voltage	V_BAT Max. 1.0V	
A05	N Range Selection	N Position Otherwise	DC Voltage	V_BAT Max. 1.0V	
A06	D Range Selection	D Position Otherwise	DC Voltage	V_BAT Max. 1.0V	
A07	Select Position	-	DC Voltage	V_BAT Max. 1.0V	
A08	Up Position	-	DC Voltage	V_BAT Max. 1.0V	
A09	Down Position	-	DC Voltage	V_BAT Max. 1.0V	
A12	N.A	-	-	-	
A14	N.A	-	-	-	
A19	N.A	-	-	-	
A20	A/T Control Relay	Relay On Relay Off	DC Voltage	V_BAT Max. 1.0V Vpeak : Max. 70V Resistance : 680 Ohm	
		W/H Open		DTC Spec : P0890	
				At transmitting	

A27	Diagnosis "K"	Communicated with GST	Pulse	HI : V_BAT* 80%↑ LO : V_BAT * 20%↓ AT receiving HI : V_BAT* 70%↑ LO : V_BAT*30%↓	V_BAT : 13.2V
A31	N.A	-	-	-	
A32	A/C Pressure Analog	-	-	-	-
A34	N.A	-	-	-	
A36	N.A	-	-	-	
A37	N.A	-	-	-	
A41	CAN_HI	Recessive Dominant	Pulse	2.0 ~ 3.0 V 2.75 ~ 4.5 V	
A42	CAN_LO	Recessive Dominant	Pulse	2.0 ~ 3.0 V 0.5 ~ 2.25 V	
A60	A/T PWR Source	IG Off IG On IG. Key On IG. Key Off Idle Key Off from Idle Fuse 1/2/3 Removal Condition	DC Voltage	Max. 0.5 V V_BAT MAX. +/- 75V (ECU GND) MAX. +/- 75V (ECU GND) MAX. +/- 75V (ECU GND) MAX. +/- 75V (ECU GND) MAX. +/- 75V (ECU GND)	
		W/H Open		DTC Spec : P0888	
A73	Shift Position Signal(To Cluster)	Running 1 gear 2 gear 3 gear 4 gear 5 gear	Pulse Duty ↑ ↑ ↑ ↑	HI : V_BAT LO : Max. 1.0V Freq.: 50±2Hz (Reference) 12.5±2% 27.5±2% 42.5±2% 57.5±2% 72.5±2%	Sports mode
B03	UD Solenoid	Shifting	Pulse	HI : V_BAT LO : Max. 1.0V Vpeak : Max. 70V	
		W/H Open		DTC Spec : P0755	
B05	N.A	-	-	-	
B06	Oil temperature sensor_ATM	Idle	Analog	0.5V ~ 4.5V	16Hz
B09	Output speed sensor	30kph	Pulse	HI : Min. 4.0V LO : Max. 1.0V	
		W/H Open		DTC Spec : P0722	
B10	Input speed sensor	Idle	Pulse	HI : Min. 4.0V LO : Max. 1.0V	630Hz
		W/H Open		DTC Spec : P0717	
B20	N.A	-	-	-	
B22	LR Solenoid	Shifting	Pulse	HI : V_BAT LO : Max. 1.0V Vpeak : Max. 70V	
		W/H Open		DTC Spec : P0750	
B26	N.A	-	-	-	
B27	N.A	-	-	-	
		Idle		Max. 50 mV	WTS &

B33	GND_Sensor	W/H Open	DC Voltage	DTC Spec : P0118/1115	OTS_ATM
B42	OD Solenoid	Shifting	Pulse	HI : V_BAT LO : Max. 1.0V Vpeak : Max. 70V	
		W/H Open		DTC Spec : P0765	
B43	DCC solenoid	Lock_Up on	Pulse	HI : V_BAT LO : Max. 1.0V Vpeak : Max. 70V	
		W/H Open		DTC Spec : P0743	
B44	RED Solenoid	Shifting	Pulse	HI : V_BAT LO : Max. 1.0V Vpeak : Max. 70V	
		W/H Open		DTC Spec : P0770	
B45	2ND Solenoid	Shifting	Pulse	HI : V_BAT LO : Max. 1.0V Vpeak : Max. 70V	
		W/H Open		DTC Spec : P0760	
B46	N.A	-	-	-	
B47	N.A	-	-	-	
B59	Variable Solenoid (-)	Idle	Pulse	HI : V_BAT LO : Max. 1.0V Vpeak : Max. 70V	600Hz
		W/H Open		DTC Spec : P0748	
B65	N.A	-	-	-	
B66	N.A	-	-	-	
B75	Variable Solenoid (+)	Idle	Pulse	HI : V_BAT LO : Max. 1.0V Vpeak : Max. 70V	
		W/H Open		DTC Spec : P0748	
B80	N.A	-	-	-	

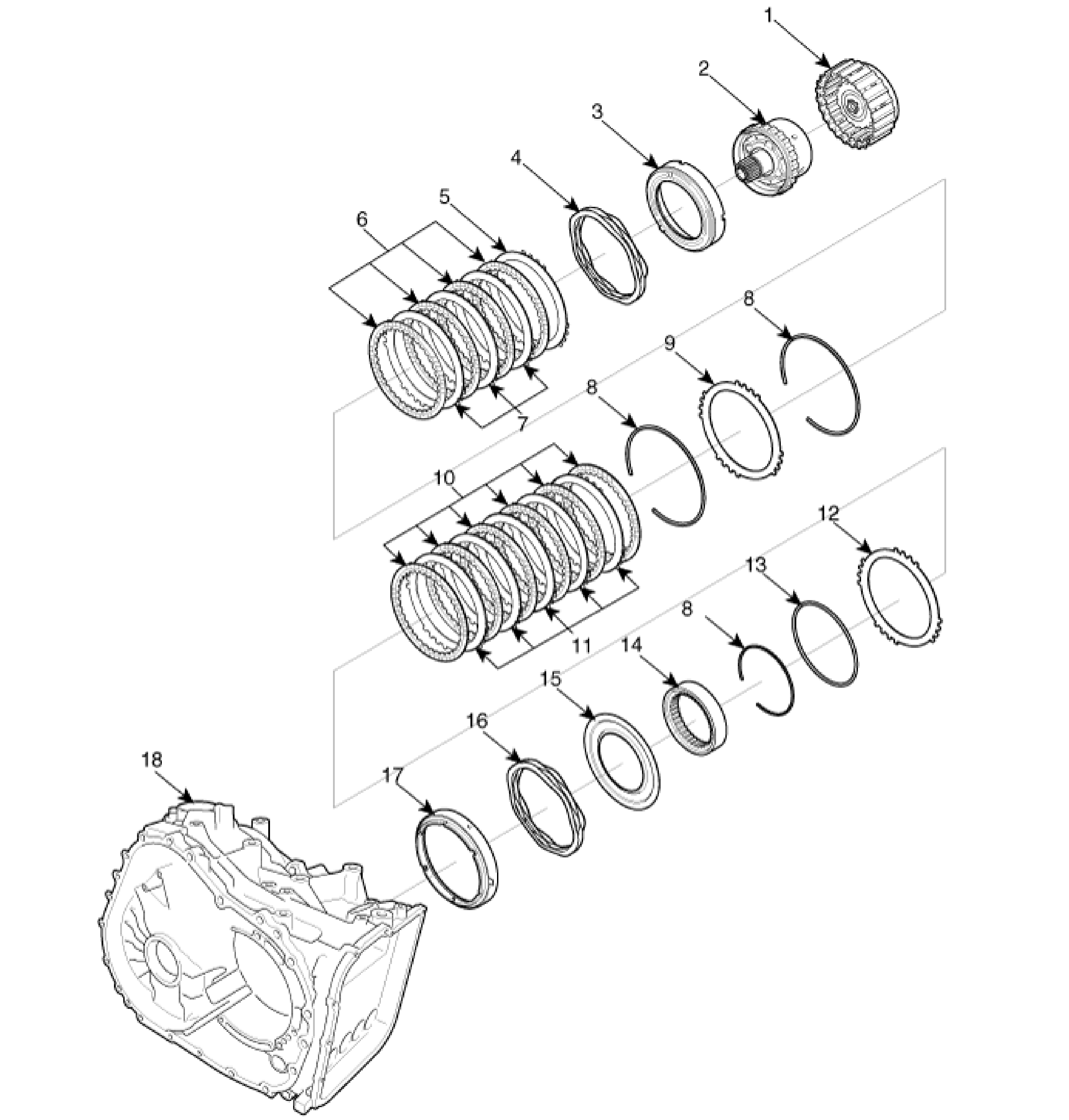
Automatic Transaxle System > Automatic Transaxle System > Automatic Transaxle > Components and Components Location

COMPONENTS(1)



1. Torque converter
2. Valve body cover
3. Valve body assembly
4. Manual control shaft assembly
5. Converter housing
6. Differential assembly
7. Main oil filter
8. Oil pump
9. Input shaft
10. Underdrive clutch assembly
11. Underdrive clutch hub
12. Direct planetary carrier assembly
13. Direct clutch assembly
14. Reduction brake bend
15. One way clutch
16. Transfer drive gear
17. Differential bearing race
18. Transaxle case

COMPONENTS(2)



1. Reverse sun gear	7. 2nd brake plates	13. Wave spring
2. Planetary gear assembly	8. Snap ring	14. Oneway clutch inner race
3. 2nd brake retainer	9. Brake reaction plate	15. Brake spring retainer
4. 2nd brake return spring	10. Brake discs	16. Low&Reverse brake return spring
5. 2nd brake pressure plate	11. Brake plates	17. Low&Reverse brake piston
6. 2nd brake discs	12. Low&Reverse brake pressure plate	18. Transaxle case

Automatic Transaxle System > Automatic Transaxle System > Automatic Transaxle > Repair procedures

REMOVAL

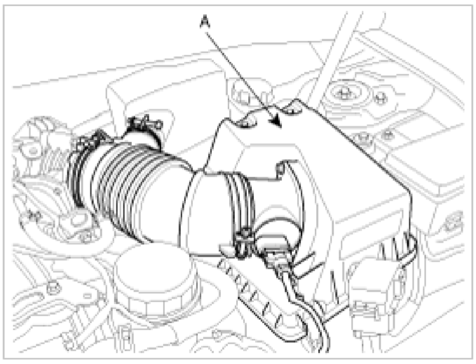
CAUTION

- Use fender covers to avoid damaging painted surfaces.
- To avoid damage, unplug the wiring connectors carefully while holding the connector portion.

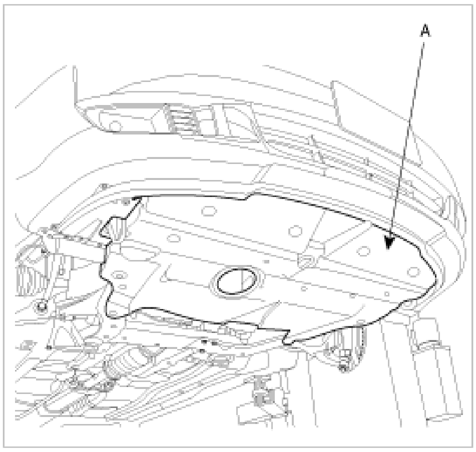
NOTE

- Mark all wiring and hoses to avoid misconnection.
- Turn the crankshaft pulley so that the No.1 piston is at top dead center. (See "EM" group)

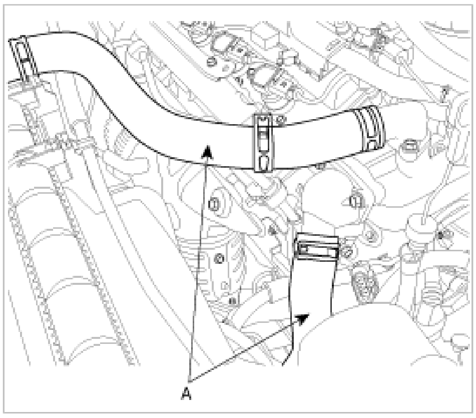
1. Disconnect the negative terminal from the battery.
2. Remove the engine cover.
3. Remove the air duct.
4. Remove the intake air hose and air cleaner assembly.
   (1) Disconnect the AFS connector.
   (2) Disconnect the breather hose from air cleaner hose.
   (3) Disconnect the PCM connectors. (See FL group)
   (4) Remove the intake air hose and air cleaner (A).



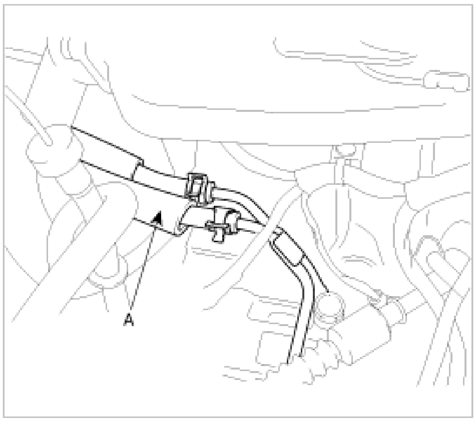
5. Remove the front wheels.
6. Remove the under cover(A).



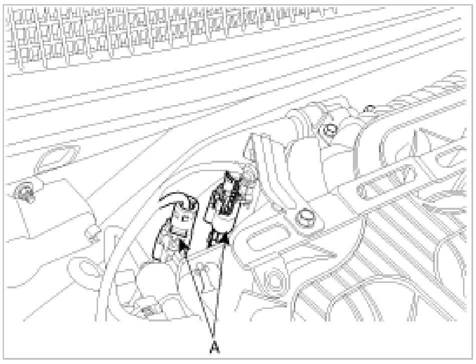
7. Drain the engine coolant and remove the radiator cap to speed up draining.
8. Remove the upper radiator hose and the lower radiator hose(A).



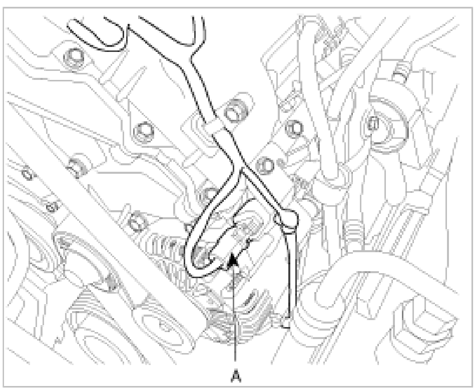
9. Remove transaxle oil cooler hose(A).



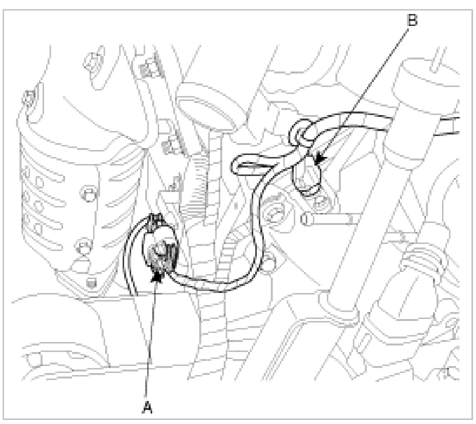
10. Remove engine wiring.
    (1) Disconnect RH oxygen sensor connector(A).



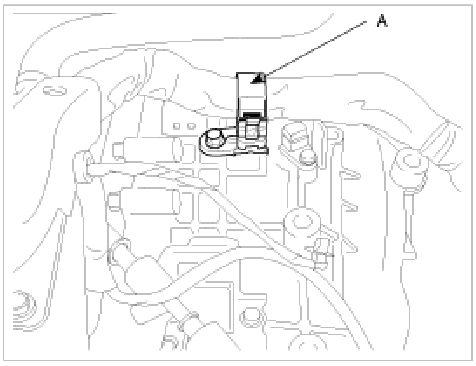
    (2) Disconnect LH front oxygen sensor connector(A).

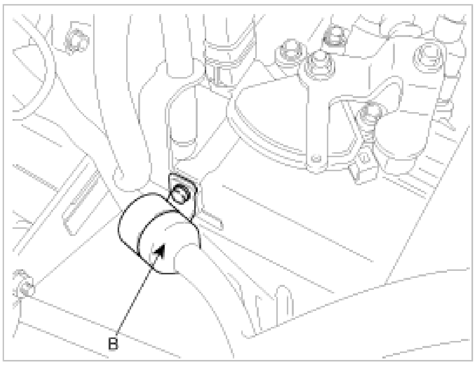


    (3) Disconnect LH rear oxygen sensor connector(A) and CPS connector(B).

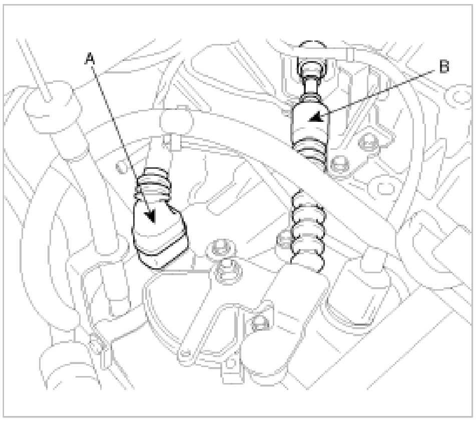


11. Disconnect the transaxle wire harness connector and remove transaxle control cable.
    (1) Remove the wiring brackets(A, B).

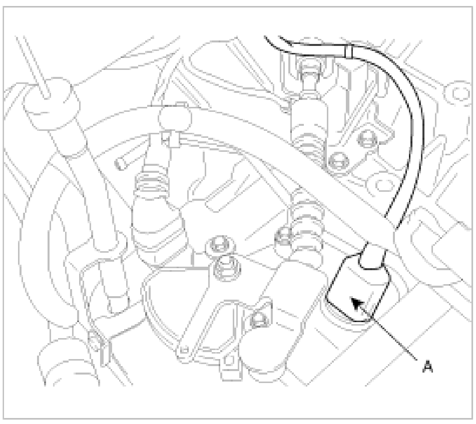




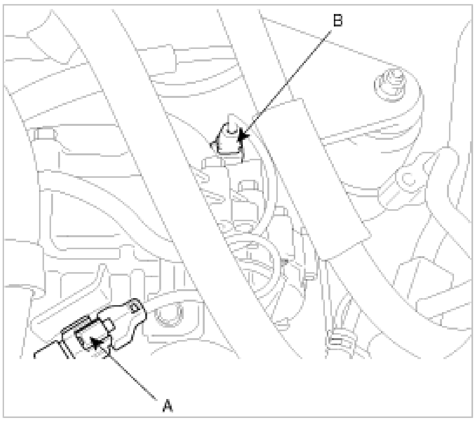
(2) Remove the inhibiter switch connector(A) and shift cable(B).



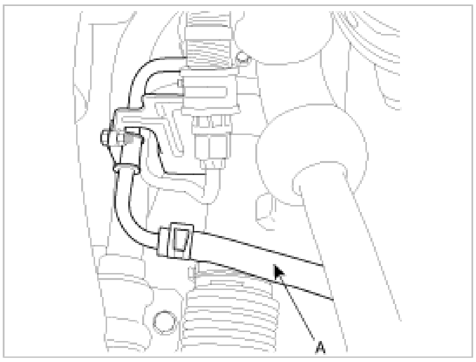
(3) Remove the solenoid valve connector(A).



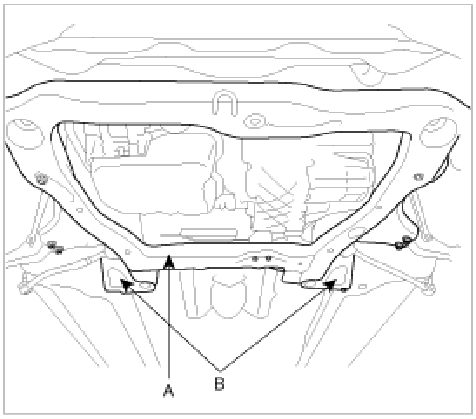
(4) Remove the input speed sensor, output speed sensor(A) and vehicle speed sensor connector(B).



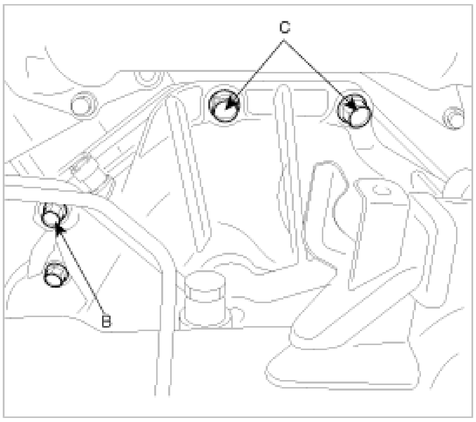
12. Disconnect EPS connector.
13. Remove power steering pump hose(A).

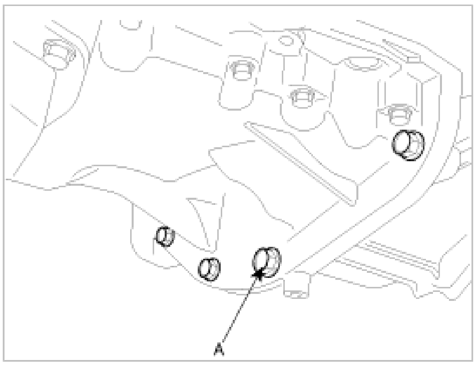


14. Using the SST(09200-38001), hold the engine and transaxle assembly safely.
15. Drain transaxle oil.
16. Remove lower arm ball joint. (See 'DS' group)
17. Remove tie rod end ball joint. (See 'DS' group)
18. Remove stabilizer bar link. (See 'SS' group)
19. After removing a split pin and nut from the steering bar tie rod, disconnect it. (Refer to 'ST'-group)
20. Remove front roll stopper mounting bolt.
21. Remove rear roll stopper mounting bolt.
22. Remove steering u-joint mounting (See 'ST' group)
23. Remove front exhaust pipe.
24. Supporting the cross member(A) with a jack, remove the stays(B) with the mounting bolts.



25. Remove the cross member.
26. Remove drive shaft from transaxle. (See 'DS' group)
27. Install a jack for supporting the transaxle assembly.
28. Remove the transaxle mounting bolts(A, B, C).





29. Lower the vehicle and remove the transaxle mounting bracket.
30. Jack up the vehicle and disassemble the transaxle assembly.

INSTALLATION

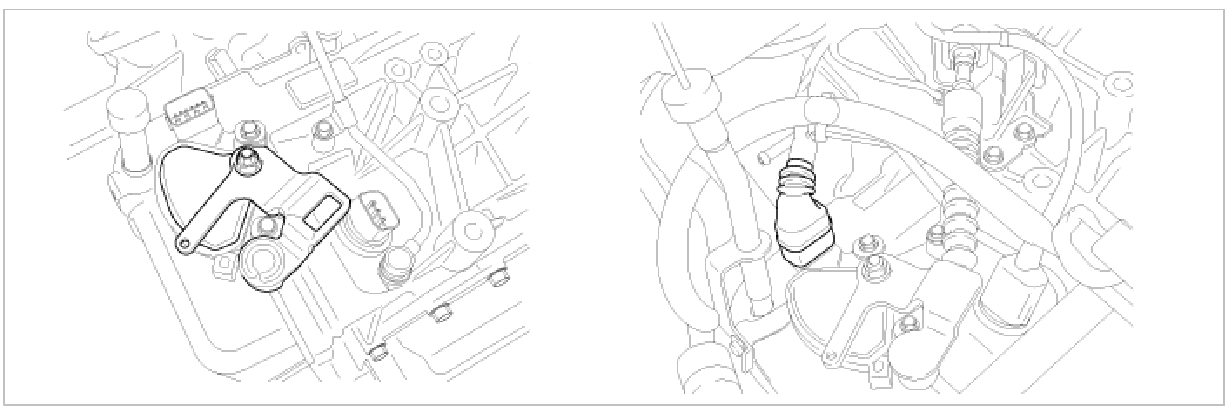
Installation is in the reverse order of removal.
Perform the following :

- Adjust the shift cable.
- Adjust the throttle cable.
- Refill the engine with engine oil.
- Refill the transaxle with fluid.
- Refill the radiator with engine coolant.
- Bleed air from the cooling system with the heater valve open.
- Clean the battery posts and cable terminals with sandpaper, assemble them, and apply grease to prevent corrosion.
- Inspect for fuel leakage.

After assembling the fuel line, turn on the ignition switch (do not operate the starter) so that the fuel pump runs for approximately two seconds and fuel line pressurizes.
Repeat this operation two or three times, then check for fuel leakage at any point in the fuel line.

Automatic Transaxle System > Troubleshooting > P0707

COMPONENT LOCATION



GENERAL DESCRIPTION

Transaxle range switch sends information of the shift lever position to the PCM by using 12V(the battery voltage). By detecting the position of the transaxle range, to start the engine is possible only when the gear position is in the parking or neutral position and the back up lamp is on only in reverse position.

DTC DESCRIPTION

The PCM sets this code when the transaxle range switch has no output signal for more than 30 seconds.

DTC DETECTING CONDITION

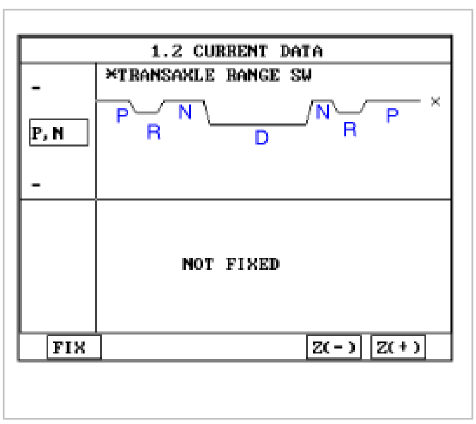
Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check for no signal	• Open or short in circuit • Faulty TRANSAXLE RANGE SWITCH • Faulty PCM
Enable Conditions	• Engine state=Run • PRNDL Diag disabling fault present flag=FALSE • Battery Voltage>11V and<16 V • Throttle position≥ 3%	
Threshold value	• No signal detected	
Diagnostic Time	• More than 30sec	
Fail Safe	• If there are no or multiple signals from the transaxle range switch, the PCM will continue to control with the signal which is detected just before DTC occurs.	

SPECIFICATION

Inspection condition		Reference value
* IG KEY : ON or Engine stall	Shift lever : P	P,N
	Shift lever : R	R
	Shift lever : N	P,N
	Shift lever : D	D

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Ignition "ON" & Engine "OFF".
3. Monitor the "TRANSAXLE RANGE SWITCH" parameter on the scantool.
4. Move selector lever from "P" range to other range.



5. Does "TRANSAXLE RANGE SWITCH" follow the reference data?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification vehicle repair" procedure.

NO

▸ Go to "Terminal&connector inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification vehicle Repair" procedure.

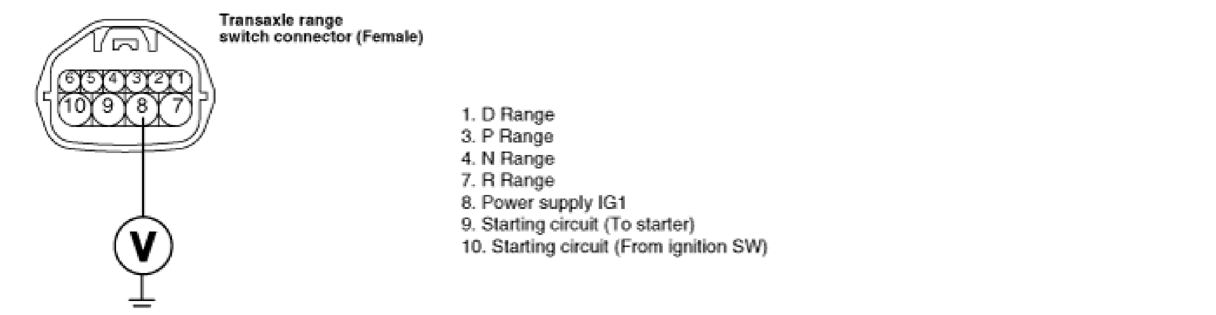
NO

▸ Go to "Power supply circuit inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. CHECK POWER TO RANGE SWITCH
   (1) Disconnect "TRANSAXLE RANGE SWITCH" connector.
   (2) Ignition "ON" & Engine "OFF".
   (3) Measure voltage between teminal "8" of the sensor harness connector and chassis ground.

Specification : approx. B+



(4) Is voltage within specifications?

YES

▸ Go to "Signal circuit inspection" procedure.

NO

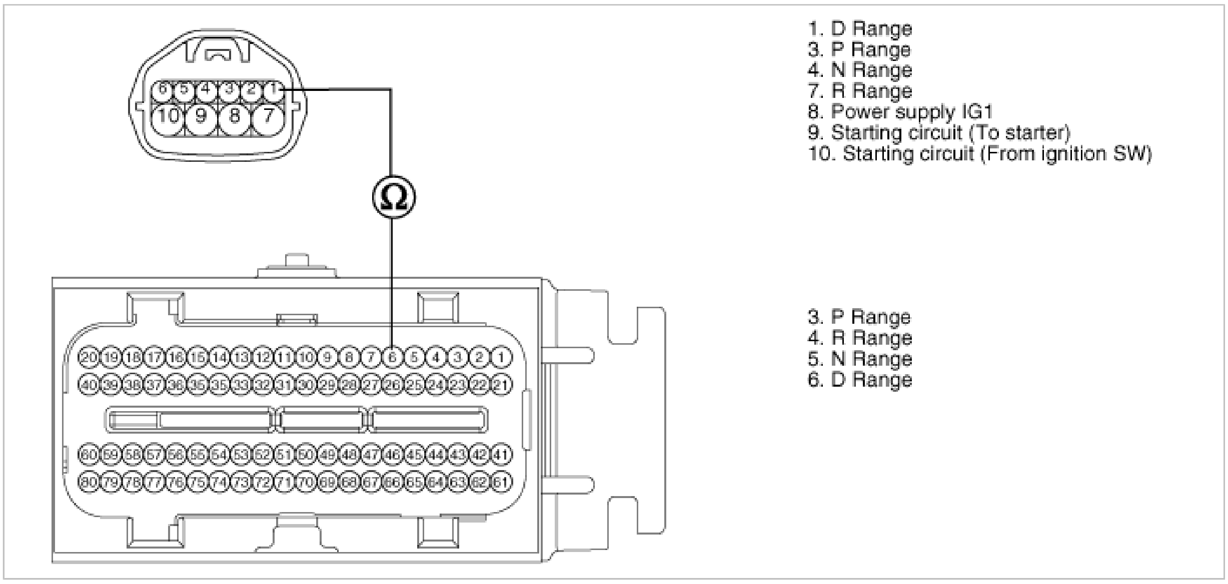
▸ Check that Fuse 10A is installed or not blown.
▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect "TRANSAXLE RANGE SWITCH" and "PCM" connector.
3. Measure resistance between each teminal of the sensor harness connector and PCM harness connector as below.

Specification : Shown below

Pin No of "TRANSAXLE RANGE SWITCH"	No.1	No.3	No.4	No.7
Pin No of "PCM" harness	A-No.6	A-No.3	A-No.5	A-No.4
Specification	0Ω	0Ω	0Ω	0Ω



4. Is resistance within specifications?

YES

▸ Go to "Component inspection" procedure.

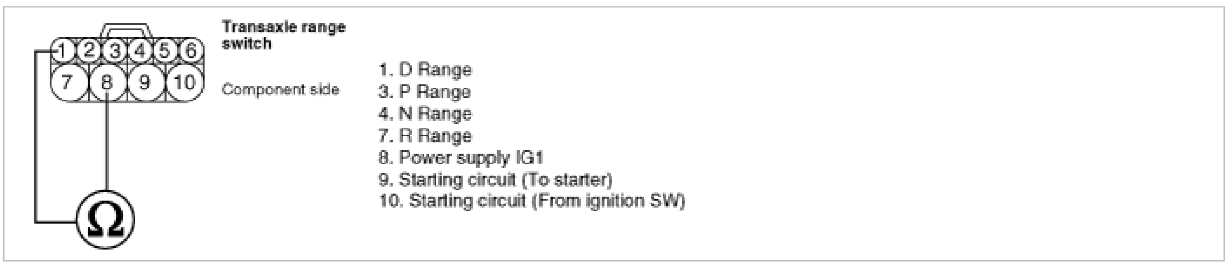
NO

▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Remove "TRANSAXLE RANGE SWITCH".
3. Measure the resistance between each terminal of the sensor.

Specification : approx. 0 Ω



Range	Terminal Number									
	1	2	3	4	5	6	7	8	9	10
P			○					○	○	○
R							○	○		
N				○				○	○	○
D	○							○		

[RANGE SWITCH continuity check table]

4. Is resistance within specifications?

YES

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected, replace PCM as necessary and then go to "Verification of vehicle repair" procedure.

NO

▸ Replace "TRANSAXLE RANGE SWITCH" as necessary and go to "Verification vehicle repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present?

YES

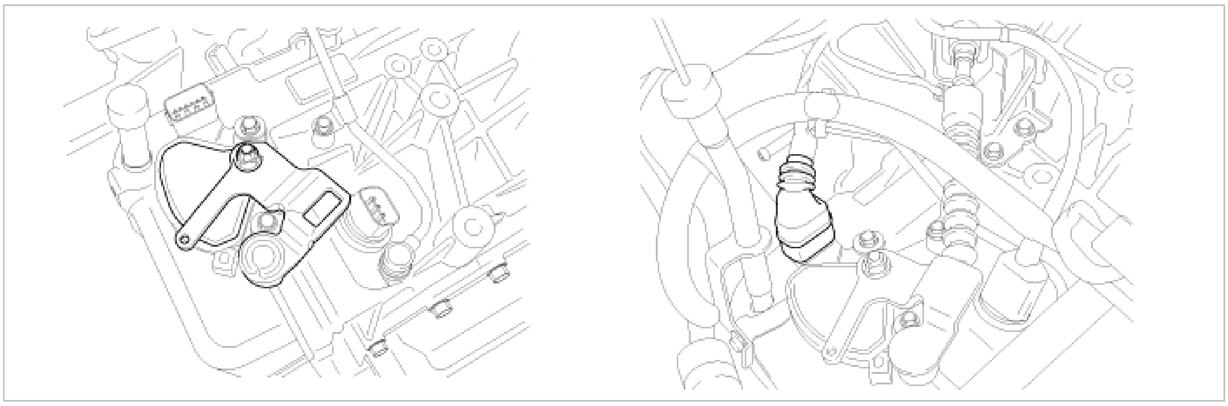
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P0708

COMPONENT LOCATION



GENERAL DESCRIPTION

Transaxle range switch sends information of the shift lever position to the PCM by using 12V(the battery voltage). By detecting the position of the transaxle range, to start the engine is possible only when the gear position is in the parking or neutral position and the back up lamp is on only in reverse position.

DTC DESCRIPTION

The PCM sets this code when the transaxle range switch has two or more output signals for more than 30 seconds.

DTC DETECTING CONDITION

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check for No signal	• Open or short in TRANSAXLE RANGE SWITCH • Faulty TRANSAXLE RANGE SWITCH • Faulty PCM
Enable Conditions	• Engine state=Run • Battery Voltage>11V and<16 V	
Threshold value	• Multiple signal	
Diagnostic Time	• More than 30sec	
Fail Safe	• If there are no or multiple signals from the transaxle range switch, the PCM will continue to control with the signal which is detected just before DTC occurs.	

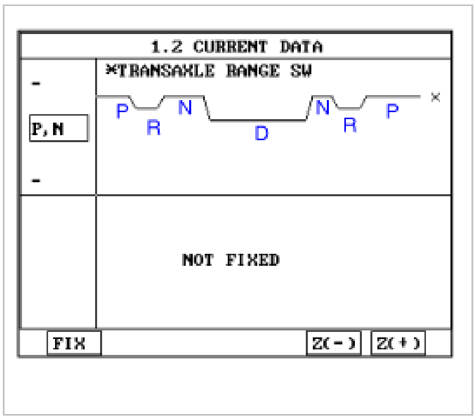
SPECIFICATION

Inspection condition		Reference value
* IG KEY : ON or Engine stall	Shift lever : P	P,N
	Shift lever : R	R
	Shift lever : N	P,N

	Shift lever : D	D

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Ignition "ON" & Engine "OFF".
3. Monitor the "TRANSAXLE RANGE SWITCH" parameter on the scantool.
4. Move selector lever from "P" range to other range.



5. Does "TRANSAXLE RANGE SWITCH" follow the reference data?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification vehicle repair" procedure.

NO

▸ Go to "Terminal&connector inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification vehicle repair" procedure.

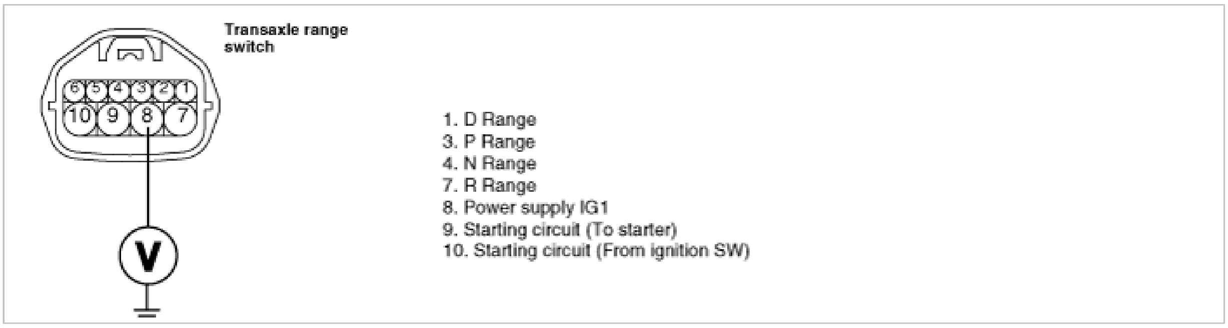
NO

▸ Go to "Power supply circuit inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. CHECK POWER TO RANGE SWITCH
   (1) Disconnect "TRANSAXLE RANGE SWITCH" connector.
   (2) Ignition "ON" & Engine "OFF".
   (3) Measure voltage between teminal "8" of the sensor harness connector and chassis ground.

   Specification : approx. B+



(4) Is voltage within specifications?

YES

▸ Go to "Signal circuit inspection" procedure.

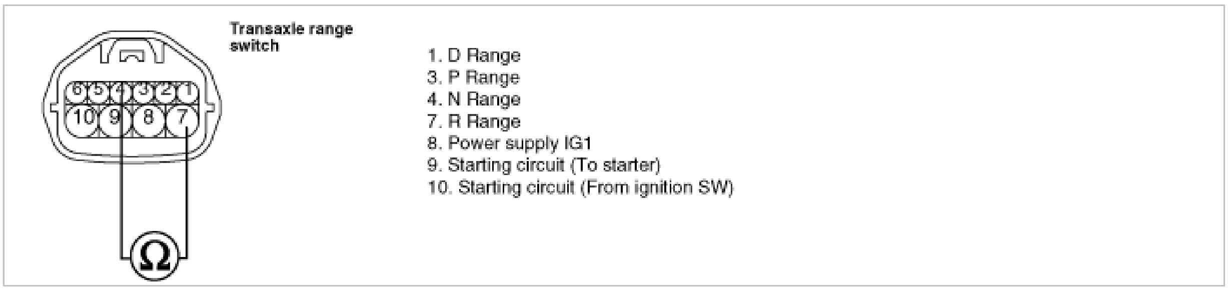
NO

▸ Check for Short in harness. Repair as necessary and Go to "Verification Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect "TRANSAXLE RANGE SWITCH" and "PCM" connector.
3. Measure resistance between each terminals of the sensor harness to check for short.

Specification : Infinite



4. Is resistance within specifications?

YES

▸ Go to "Component inspection" procedure.

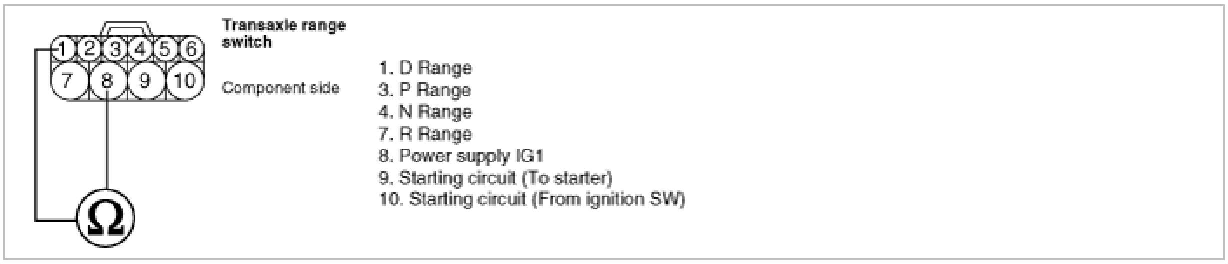
NO

▸ Check for open in harness. Repair as necessary and Go to "Verification Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Remove "TRANSAXLE RANGE SWITCH".
3. Measure the resistance between each terminal of the sensor.

Specification : approx. 0 Ω



Range	Terminal Number									
	1	2	3	4	5	6	7	8	9	10
P			O					O	O	O
R							O	O		
N				O				O	O	O
D	O							O		

[RANGE SWITCH continuity check table]

4. Is resistance within specifications?

YES

▶ Substitute with a known-good PCM and check for proper operation. If the problem is corrected, replace PCM as necessary and then go to "Verification of vehicle repair" procedure.

NO

▶ Replace "TRANSAXLE RANGE SWITCH" as necessary and go to "Verification vehicle repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present?

YES

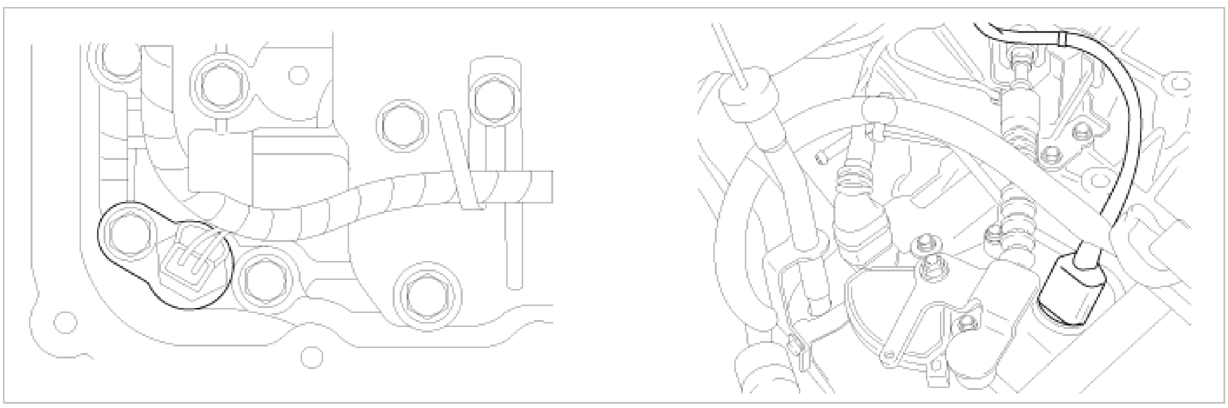
▶ Go to the applicable troubleshooting procedure.

NO

▶ System performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P0711

COMPONENT LOCATION



GENERAL DESCRIPTION

The oil temperature sensor is installed in the valve body and uses a thermistor that resistance changes by temperature change. PCM offers 5V as a reference voltage and the output voltage changes according to the ATF's temperature. The oil temperature sensor signal is important information in detecting torque converter clutch operation or non-operation area, the oil temperature sensor's variable controlling and oil pressure's controlling at shifting.

DTC DESCRIPTION

PCM displays this code if it detects the condition below for more than 1 second. PCM regards that the ATF's oil temperature is 85°C(185°F) since this code is sensed.

DTC DETECTING CONDITION

Item		Detecting Condition & Fail Safe	Possible cause
DTC Strategy		• Check rationality	• Sensor signal circuit is short to ground • Faulty sensor • Faulty PCM
Enable Conditions	**Case 1**	• Intake air temperature(IAT)>-25°C(-13°F) • Engine state=Run • No errors in relative sensors • Engine should be cool enough	
	Case 2	• Intake air temperature(IAT)>-25°C(-13°F) • Engine state=Run • No errors in relative sensors • Engine should be cool enough	
Threshold value	**Case 1**	• Temperature difference between TM oil temp and coolant temp >20°C(68°F) • TM oil temp >coolant temp	
	Case 2	• Temperature difference between TM oil temp and coolant temp >20°C(68°F) • TM oil temp >coolant temp • Absolute value of temperature difference between minimum IAT and coolant temp at key on< 10°C(50°F) • Absolute value of temperature difference between maximum IAT and coolant temp at key on< 10°C(50°F)	
Diagnostic Time		• 1 second	
Fail Safe		• Fluid temperature is regarded as 85°C(185°F)	

SPECIFICATION

Temp.[°C(°F)]	Resistance(kΩ)	Temp.[°C(°F)]	Resistance(kΩ)
-40(-40)	139.5	80(176)	1.08
-20(-4)	47.7	100(212)	0.63
0(32)	18.6	120(248)	0.38
20(68)	8.1	140(284)	0.25
40(104)	3.8	160(320)	0.16
60(140)	1.98		

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   ▸ Repair as necessary and go to "Verification vehicle repair" procedure.

   NO

   ▸ Go to "Component inspection" procedure.

COMPONENT INSPECTION

1. CHECK "TRANSAXLE FLUID TEMPERATURE SENSOR"

   (1) Ignition "OFF".

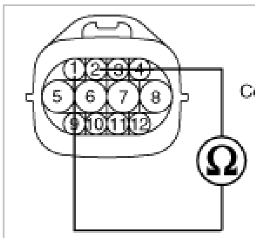
   (2) Disconnect the "TRANSAXLE FLUID TEMPERATURE SENSOR" connector.

(3) Measure the resistance between terminals "1" and "2" of the "TRANSMISSION FLUID TEMPERATURE SENSOR".

Specification : Refer to "Reference data"

[REFERENCE DATA]

Temp.[°C(°F)]	Resistance(kΩ)	Temp.[°C(°F)]	Resistance(kΩ)
-40(-40)	139.5	80(176)	1.08
-20(-4)	47.7	100(212)	0.63
0(32)	18.6	120(248)	0.38
20(68)	8.1	140(284)	0.25
40(104)	3.8	160(320)	0.16
60(140)	1.98		



(4) Is resistance within specifications?

YES

▸ Go to "CHECK PCM" as below.

NO

▸ Replace "TRANSAXLE FLUID TEMPERATURE SENSOR" as necessary and go to "Verification vehicle repair" procedure.

2. CHECK PCM

(1) Ignition "ON" & Engine "OFF".

(2) Connect "TRANSAXLE FLUID TEMPERATURE SENSOR" connector.

(3) Install scantool and select a SIMU-SCAN.

(4) Simulate voltage (0→5V) to "TRANSMISSION FLUID TEMPERATURE SENSOR" signal circuit.

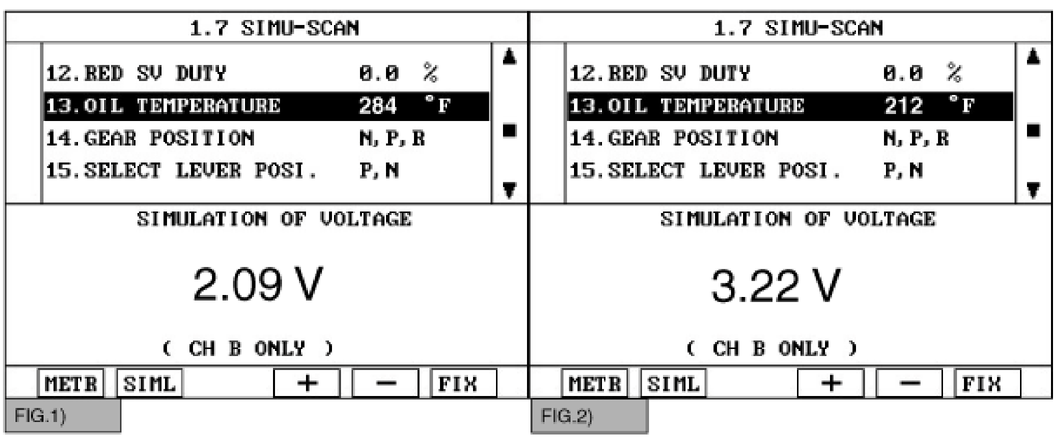


FIG.1) INPUT 2.09V → 140°C(284°F)
FIG.2) INPUT 3.22V → 100°C(212°F)

※ The values are subject to change according to vehicle model

(5) Is FLUID TEMP. SENSOR signal value changed according to simulation voltage?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of vehicle repair" procedure.

NO

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected, replace PCM as necessary and then go to "Verification of vehicle repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present?

YES

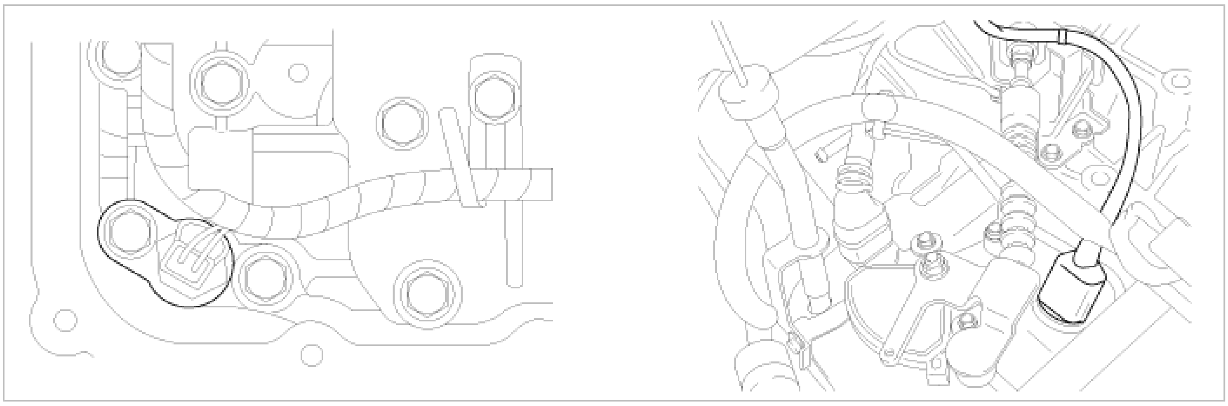
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P0712

COMPONENT LOCATION



GENERAL DESCRIPTION

The oil temperature sensor is installed in the valve body and uses a thermistor that resistance changes by temperature change. PCM offers 5V as a reference voltage and the output voltage changes according to the ATF's temperature. The oil temperature sensor signal is important information in detecting torque converter clutch operation or non-operation area, the oil temperature sensor's variable controlling and oil pressure's controlling at shifting.

DTC DESCRIPTION

PCM displays this code if it detects the condition below for more than 10 seconds. PCM recognizes that the oil temperature is 85°C(185°F) since this code is sensed.

DTC DETECTING CONDITION

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check for ground short	• Sensor signal circuit is short to ground • Faulty sensor • Faulty PCM
Enable Conditions	• Engine state=Run	
Threshold value	• Temperature Input A/D value< 1.4%	
Diagnostic Time	• More than 10 seconds	
Fail Safe	• Fluid temperature is regarded as 85°C(185°F)	

SPECIFICATION

Temp.[°C(°F)]	Resistance(kΩ)	Temp.[°C(°F)]	Resistance(kΩ)
-40(-40)	139.5	80(176)	1.08
-20(-4)	47.7	100(212)	0.63

0(32)	18.6	120(248)	0.38
20(68)	8.1	140(284)	0.25
40(104)	3.8	160(320)	0.16
60(140)	1.98		

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Engine "ON".
3. Monitor the "TRANSAXLE FLUID TEMPERATURE SENSOR" parameter on the scantool.

Specification : Increasing gradually

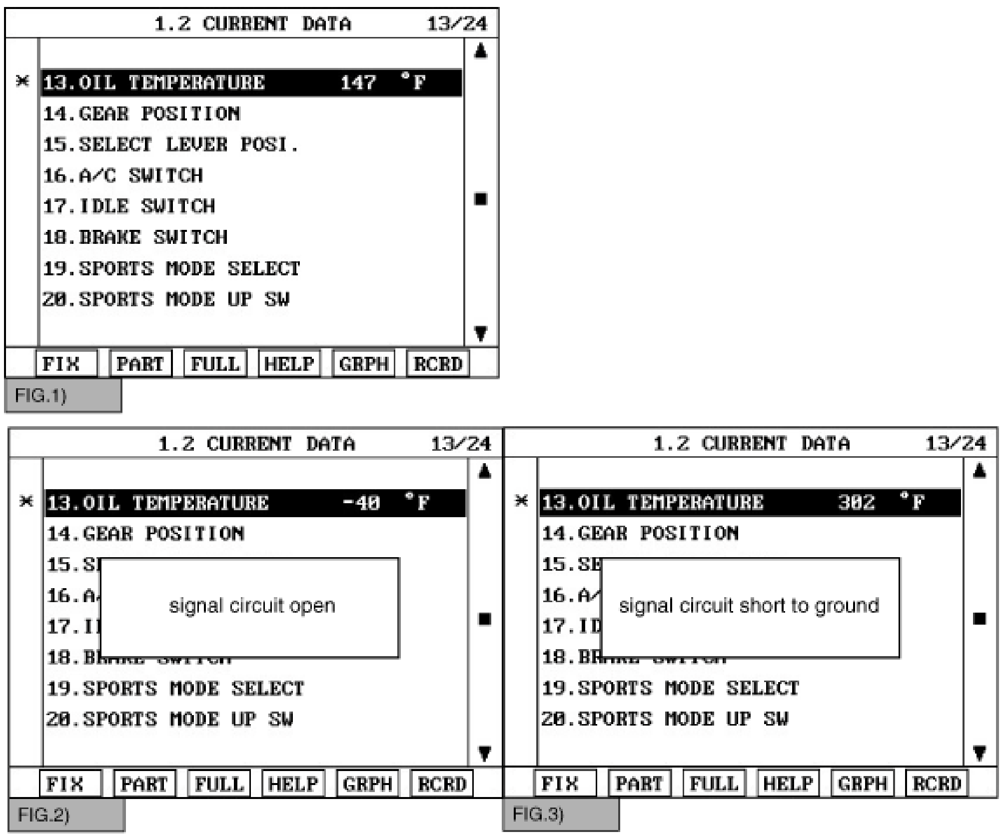


FIG.1) Normal
FIG.2) Signal harness Open
FIG.3) Signal harness Short

4. Does "TRANSAXLE FLUID TEMPERATURE SENSOR " follow the reference data?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification vehicle repair" procedure.

NO

▸ Go to "Terminal&connector inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification vehicle repair" procedure.

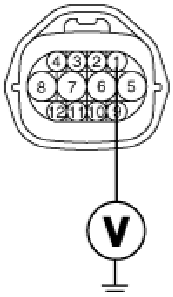
NO

▸ Go to "Component inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Disconnect the "TRANSAXLE FLUID TEMPERATURE SENSOR" connector.
3. Measure the voltage between terminal "1" of the "TRANSMISSION FLUID TEMPERATURE SENSOR" harness connector and chassis ground.

Specification : Approx. 5V



1.TRANSMISSION FLUID TEMPERATURE SENSOR
2.Sensor ground

4. Is voltage within specifications?

YES

▸ Go to "Component inspection" procedure.

NO

▸ Check for short to ground in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

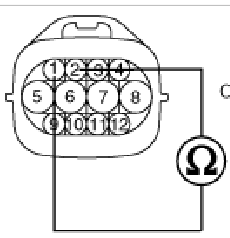
COMPONENT INSPECTION

1. CHECK "TRANSAXLE FLUID TEMPERATURE SENSOR"
   (1) Ignition "OFF".
   (2) Disconnect the "TRANSAXLE FLUID TEMPERATURE SENSOR" connector.
   (3) Measure the resistance between terminals "1" and "2" of the "TRANSMISSION FLUID TEMPERATURE SENSOR".

Specification : Refer to "Reference data"

[REFERENCE DATA]

Temp.[°C(°F)]	Resistance(kΩ)	Temp.[°C(°F)]	Resistance(kΩ)
-40(-40)	139.5	80(176)	1.08
-20(-4)	47.7	100(212)	0.63
0(32)	18.6	120(248)	0.38
20(68)	8.1	140(284)	0.25
40(104)	3.8	160(320)	0.16
60(140)	1.98		



Component side

1.TRANSMISSION FLUID TEMPERATURE SENSOR
2.Sensor ground

(4) Is resistance within specifications?

YES

▸ Go to "CHECK PCM" as below.

NO

▸ Replace "TRANSAXLE FLUID TEMPERATURE SENSOR" as necessary and go to "Verification vehicle repair" procedure.

2. CHECK PCM
   (1) Ignition "ON" & Engine "OFF".
   (2) Connect "TRANSAXLE FLUID TEMPERATURE SENSOR" connector.
   (3) Install scantool and select a SIMU-SCAN.
   (4) Simulate voltage (0→5V) to "TRANSMISSION FLUID TEMPERATURE SENSOR" signal circuit.

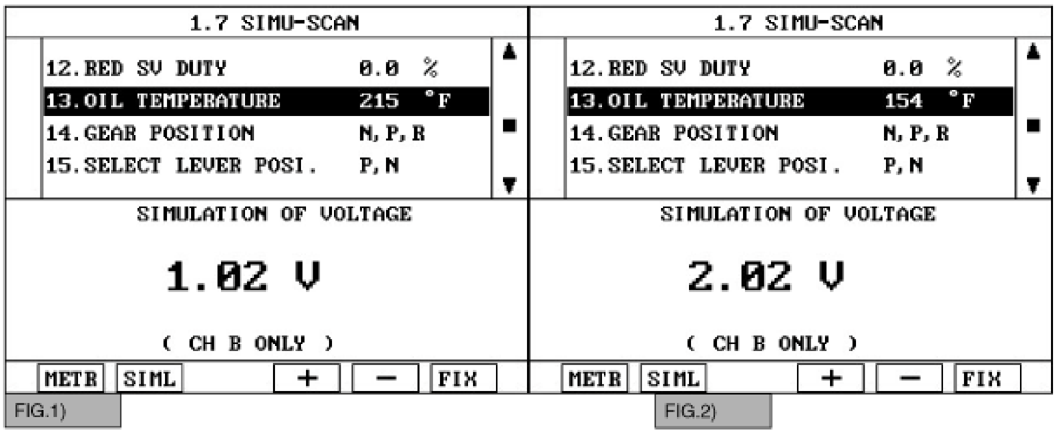


FIG.1) INPUT 1.02V → 215°F
FIG.2) INPUT 2.02V → 154°F

※ The values are subject to change according to vehicle model

   (5) Is FLUID TEMP. SENSOR signal value changed according to simulation voltage?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of vehicle repair" procedure.

NO

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected, replace PCM as necessary and then go to "Verification of vehicle repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present?

YES

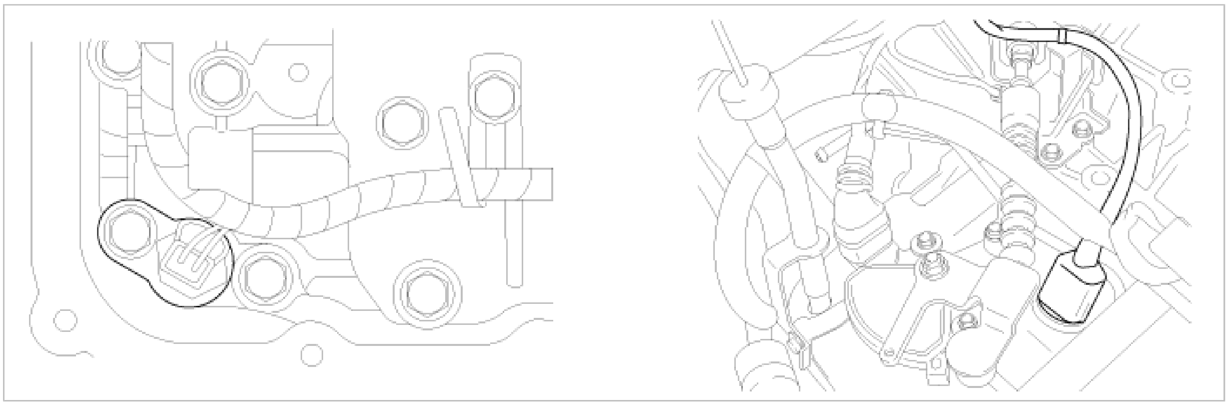
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P0713

COMPONENT LOCATION



GENERAL DESCRIPTION

The oil temperature sensor is installed in the valve body and uses a thermister that resistance changes by temperature change. PCM offers 5V as a reference voltage and the output voltage changes according to the ATF's temperature. The oil temperature sensor signal is important information in detecting torque converter clutch operation or non-operation area, the oil temperature sensor's variable controlling and oil pressure's controlling at shifting.

DTC DESCRIPTION

PCM displays this code if it detects the condition below for more than 1 second. PCM regards that the ATF's oil temperature is 85°C(185°F) since this code is sensed.

DTC DETECTING CONDITION

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check for voltage range	• Sensor signal circuit is short to ground • Faulty sensor • Faulty PCM
Enable Conditions	• Intake air temperature(IAT)>-25°C(-13°F) • Engine state=Run • No errors in relative sensors	
Threshold value	• Temperature Input A/D value >98% • No rise in oil temperature after enough time passed	
Diagnostic Time	• More than 1 sec	
Fail Safe	• Fluid temperature is regarded as 85°C(185°F)	

SPECIFICATION

Temp.[°C(°F)]	Resistance(kΩ)	Temp.[°C(°F)]	Resistance(kΩ)
-40(-40)	139.5	80(176)	1.08
-20(-4)	47.7	100(212)	0.63
0(32)	18.6	120(248)	0.38
20(68)	8.1	140(284)	0.25
40(104)	3.8	160(320)	0.16
60(140)	1.98		

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Engine "ON".
3. Monitor the "TRANSAXLE FLUID TEMPERATURE SENSOR" parameter on the scantool.

Specification : Increasing gradually

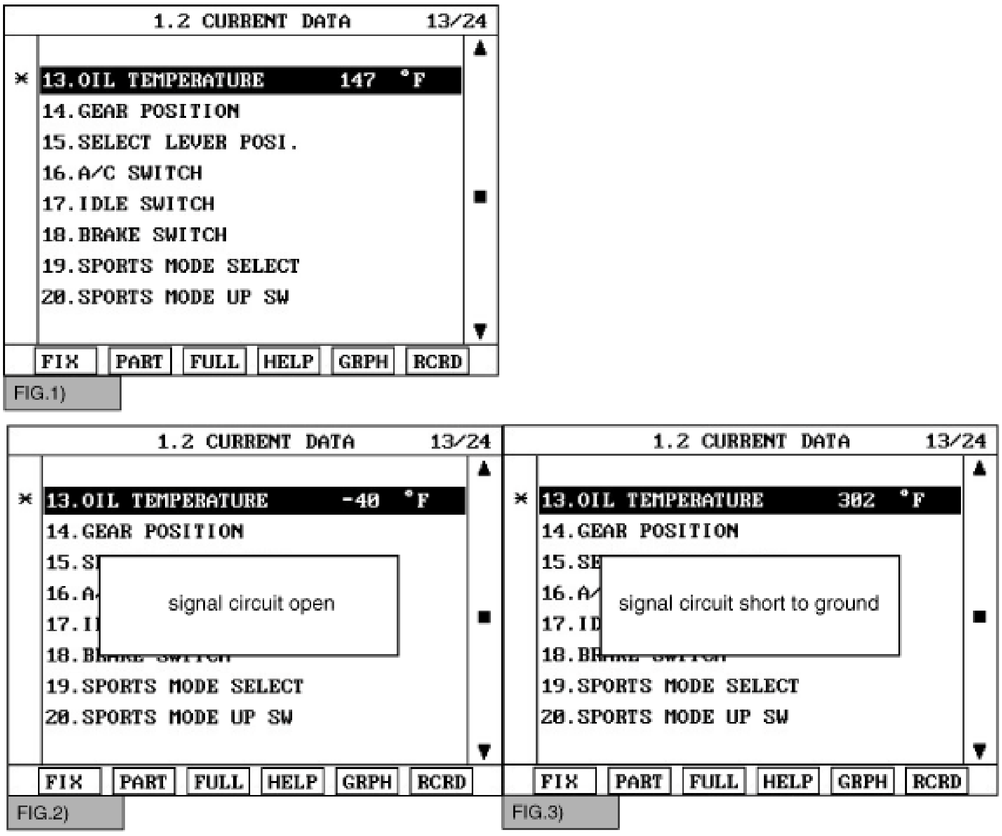


FIG.1) Normal
FIG.2) Signal harness Open
FIG.3) Signal harness Short

4. Does "TRANSAXLE FLUID TEMPERATURE SENSOR " follow the reference data?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification vehicle repair" procedure.

NO

▸ Go to "Terminal&connector inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification vehicle repair" procedure.

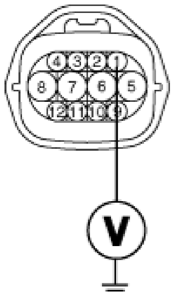
NO

▸ Go to "Component inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Disconnect the "TRANSAXLE FLUID TEMPERATURE SENSOR" connector.
3. Measure the voltage between terminal "1" of the "TRANSMISSION FLUID TEMPERATURE SENSOR" harness connector and chassis ground.

Specification : Approx. 5V



4. Is voltage within specifications?

YES

▸ Go to "Component inspection" procedure.

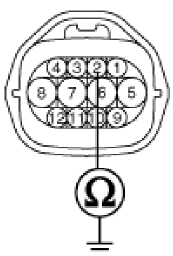
NO

▸ Check for short to ground in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

GROUND CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect the "TRANSAXLE FLUID TEMPERATURE SENSOR" connector.
3. Measure the resistance between terminal "2" of the "TRANSMISSION FLUID TEMPERATURE SENSOR" harness connector and chassis ground.

Specification : Approx. 0 Ω



4. Is resistance within specifications?

YES

▸ Go to "Component inspection" procedure.

NO

▸ Check for open in harness. Repair as necessary and Go to "Verification vehicle repair" procedure.

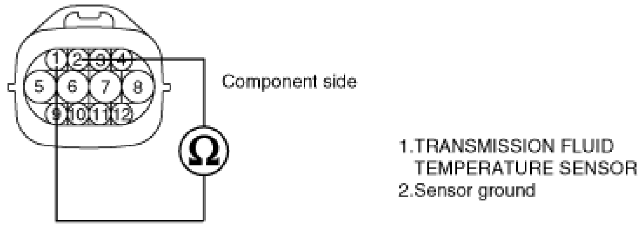
COMPONENT INSPECTION

1. CHECK "TRANSAXLE FLUID TEMPERATURE SENSOR"
   (1) Ignition "OFF".
   (2) Disconnect the "TRANSAXLE FLUID TEMPERATURE SENSOR" connector.
   (3) Measure the resistance between terminals "1" and "2" of the "TRANSMISSION FLUID TEMPERATURE SENSOR".

Specification : Refer to "Reference data"

[REFERENCE DATA]

Temp.[°C(°F)]	Resistance(kΩ)	Temp.[°C(°F)]	Resistance(kΩ)
-40(-40)	139.5	80(176)	1.08
-20(-4)	47.7	100(212)	0.63
0(32)	18.6	120(248)	0.38
20(68)	8.1	140(284)	0.25
40(104)	3.8	160(320)	0.16
60(140)	1.98		



(4) Is resistance within specifications?

YES

▸ Go to "CHECK PCM" as below.

NO

▸ Replace "TRANSAXLE FLUID TEMPERATURE SENSOR" as necessary and go to "Verification vehicle repair" procedure.

2. CHECK PCM
   (1) Ignition "ON" & Engine "OFF".
   (2) Connect "TRANSAXLE FLUID TEMPERATURE SENSOR" connector.
   (3) Install scantool and select a SIMU-SCAN.
   (4) Simulate voltage (0→5V) to "TRANSMISSION FLUID TEMPERATURE SENSOR" signal circuit.

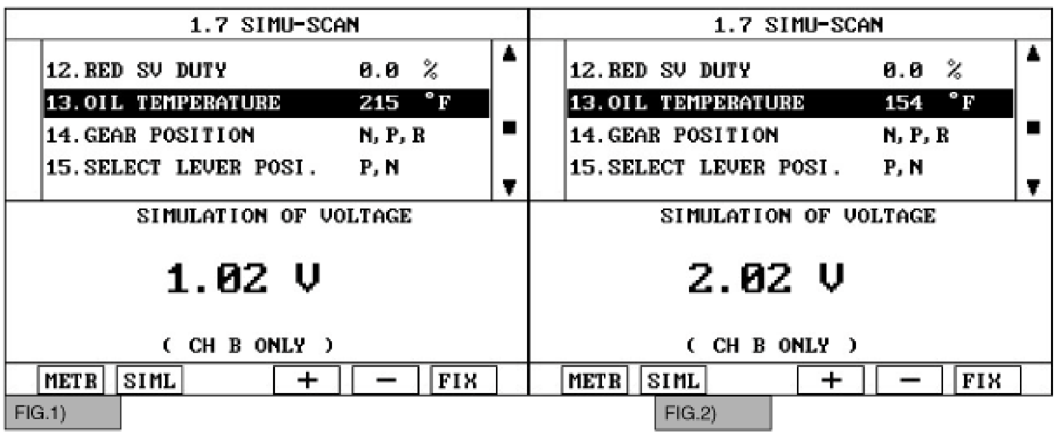


FIG.1) INPUT 1.02V → 215°F
FIG.2) INPUT 2.02V → 154°F

※ The values are subject to change according to vehicle model

(5) Is FLUID TEMP. SENSOR signal value changed according to simulation voltage?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of vehicle repair" procedure.

NO

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected, replace PCM as necessary and then go to "Verification of vehicle repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present?

YES

▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

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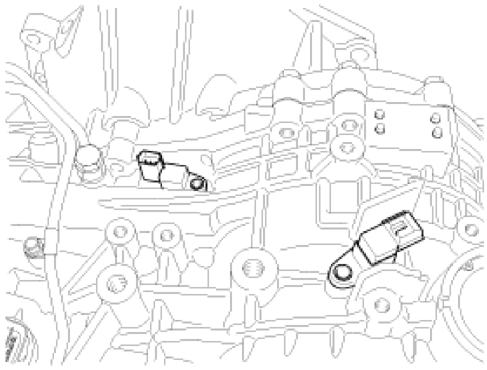
COMPONENT LOCATION



GENERAL DESCRIPTION

The input(turbine) speed sensor outputs pulse-signals according to the revolutions of the input shaft of the transmission. The PCM determines the input shaft speed by counting the frequency of the pulses. This value is mainly used to control the optimum fluid pressure during shifting.

DTC DESCRIPTION

The PCM sets this code if an output pulse-signal is not detected from the input speed sensor, when the vehicle is running faster than 30 km/h. The Fail-Safe function will be set by the PCM if this code is detected.

DTC DETECTING CONDITION

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Speed rationality check	• Signal circuit is open or short • Sensor power circuit is open • Sensor ground circuit is open • Faulty INPUT SPEED SENSOR • Faulty PCM
Enable Conditions	• Engine state=Run • Vehicle Speed >30km/h • Engine RPM at current gear 1 or 2 or Non conditional VRPM when gear is not 1 or 2 >1000rpm • Battery voltage >11V and <16 V • AT oil temp. ≥ -23°C(-9.4°F) • No error in speed sensors	
Threshold value	• No signal	
Diagnostic Time	• More than 1sec	
Fail Safe	• The gear shift position is recognized as follows. 'P' range → realization as 'N' range1 'R' range → realization as 'R' range1 'N' range → realization as 'N' range 'D' range → realization as 3 range SPT mode → CAN shift 2~3 range	

SIGNAL WAVEFORM

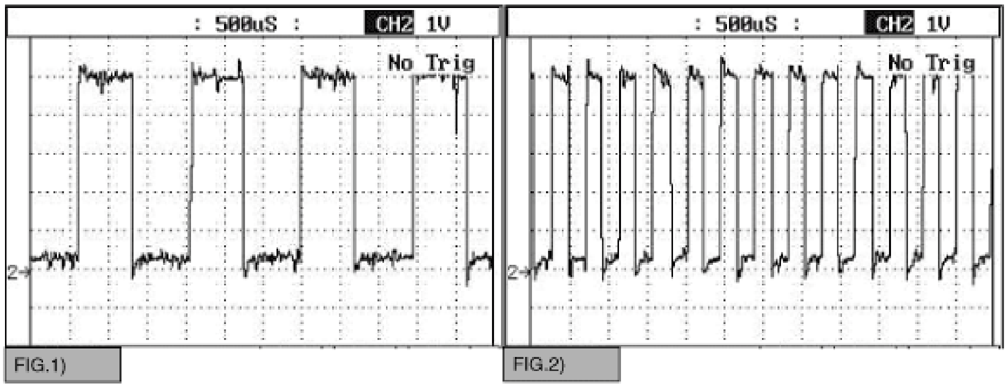
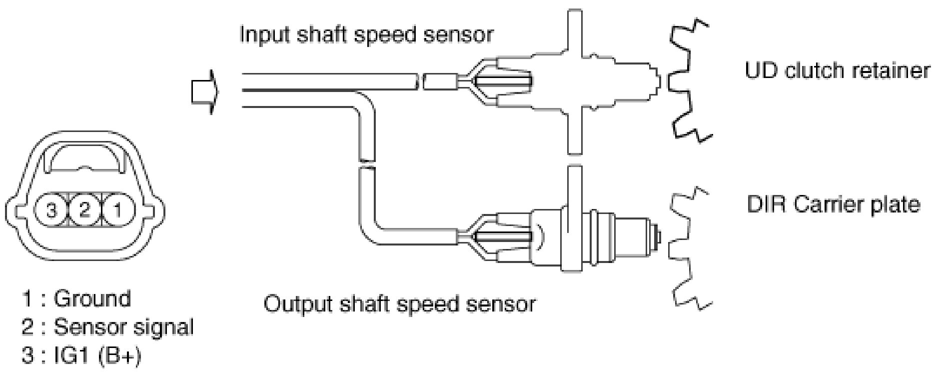


FIG.1) Idling
FIG.2) Accelerating

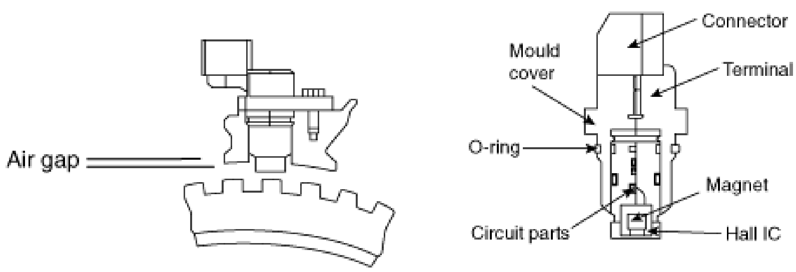
SPECIFICATION

Input shaft & Output shaft speed sensor

- Type : Hall sensor
- Current consumption : 22mA(MAX)
- Sensor body and sensor connector have been unified as one.



Air gap (mm)	Input shaft speed sensor	1.3
	Output shaft speed sensor	0.85
Insulation Resistance	Input shaft speed sensor	over 1MΩ
	Output shaft speed sensor	over 1MΩ
Peak-Peak Voltage	High	more than 4.8V
	Low	less than 0.8V



MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Engine "ON" .
3. Monitor the "INPUT SPEED SENSOR" parameter on the scantool
4. Driving at speed of over 30 Km/h(19 mph).

Specification : Increasing Gradually

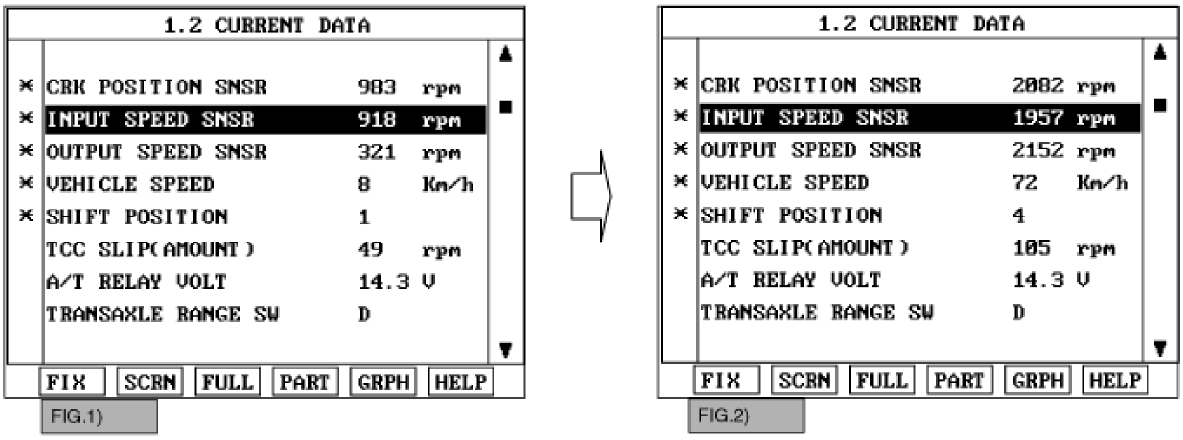


FIG.1) Idling
FIG.2) Accelerating

5. Does "input speed sensor " follow the reference data?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification vehicle repair" procedure.

NO

▸ Go to "Terminal&connector inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system may be caused from poor harness and terminals. These faults can be caused by interference from other electrical systems and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification vehicle repair" procedure.

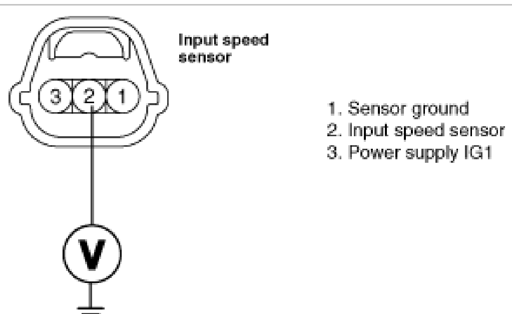
NO

▸ Go to "Signal circuit inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Disconnect the "INPUT SPEED SENSOR" connector.
3. Measure voltage between terminal "2" of the INPUT SPEED SENSOR harness connector and chassis ground.

Specification : approx. 5V



4. Is voltage within specification?

YES

▸ Go to "Power supply circuit inspection" procedure.

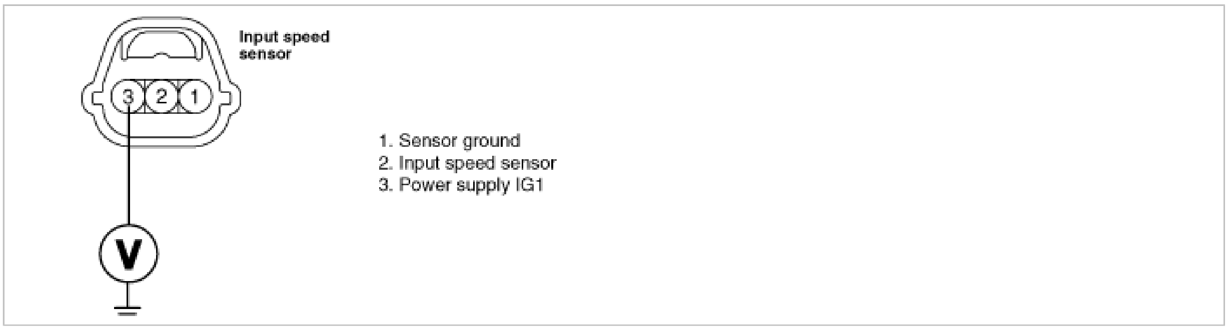
NO

- Check for open or short in harness. Repair as necessary and Go to "Verification vehicle repair" procedure.
- If signal circuit in harness is OK, go to "Check PCM" of the "Component inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Disconnect the "INPUT SPEED SENSOR" connector.
3. Measure voltage between terminal "3" of the INPUT SPEED SENSOR harness connector and chassis ground.

Specification : approx. B+



4. Is voltage within specification ?

YES

- Go to "Ground circuit inspection" procedure.

NO

- Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

GROUND CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Disconnect the "INPUT SPEED SENSOR" connector.
3. Measure resistance between terminal "1" of the INPUT SPEED SENSOR harness connector and chassis ground.

Specification : approx. 0 Ω

4. Is resistance within specification ?

YES

- Go to "Component inspection" procedure.

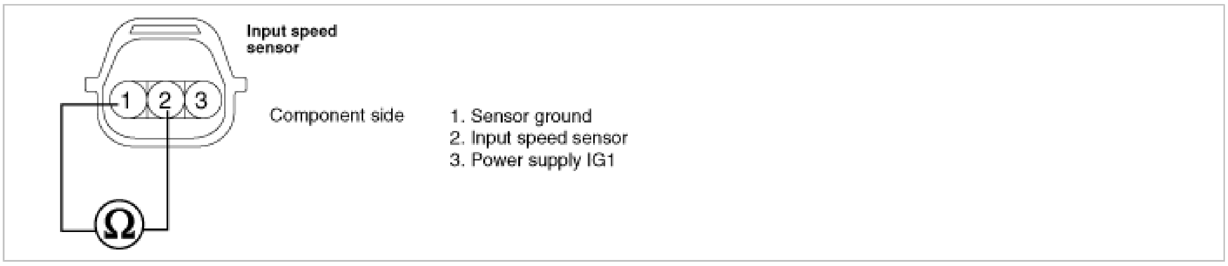
NO

- Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.
- If ground circuit in harness is OK, go to "Check PCM" of the "Component inspection" procedure.

COMPONENT INSPECTION

1. Check "INPUT SPEED SENSOR"
   (1) Ignition "OFF".
   (2) Disconnect the "INPUT SPEED SENSOR" connector.
   (3) Measure resistance between terminal "1","2" and "2","3" and "1","3" of the "INPUT SPEED SENSOR" connector.

Specification : Refer to "Reference data"



(4) Is resistance within specifications?

[REFERENCE DATA]

Air gap (mm)	Input shaft speed sensor	1.3
	Output shaft speed sensor	0.85
Insulation Resistance	Input shaft speed sensor	over 1MΩ
	Output shaft speed sensor	over 1MΩ
Peak-Peak Voltage	High	more than 4.8V
	Low	less than 0.8V

YES

▸ Go to "CHECK PCM" as below.

NO

▸ Replace "INPUT SPEED SENSOR" as necessary and go to "Verification vehicle repair" procedure.

2. CHECK PCM

(1) Ignition "ON" & Engine "OFF".

(2) Connect "INPUT SPEED SENSOR" connector.

(3) Install scantool and select a SIMU-SCAN.

(4) Simulate frequency to INPUT SPEED SENSOR signal circuit.

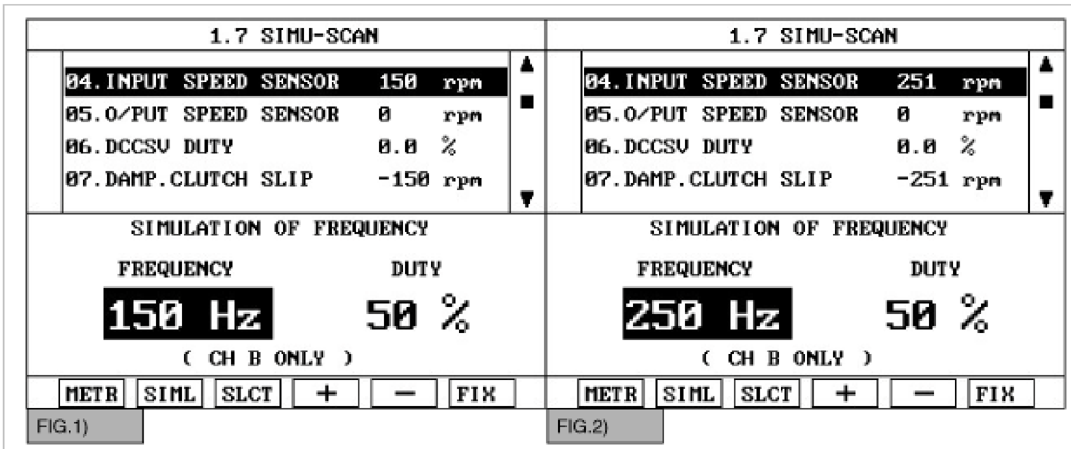


FIG.1) INPUT 150Hz → 150rpm
FIG.2) INPUT 250Hz → 251rpm

(5) Is "INPUT SPEED SENSOR" signal value changed according to simulation frequency?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of vehicle repair" procedure.

NO

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected, replace PCM as necessary and then go to "Verification of vehicle repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Is resistance within specification ?

YES

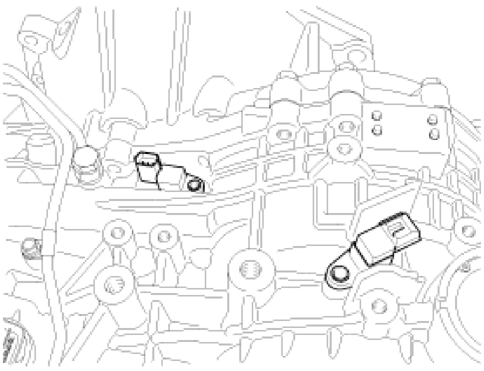
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P0722

COMPONENT LOCATION



GENERAL DESCRIPTION

The output speed sensor calculates the number of rotations of the transfer drive gear, which means that the sensor calculates the frequency of electric signal that is occurred at the transfer drive gear's rotating. The signal is inputted to the PCM and is used as the main signal which decides the optimum gear position with TPS signal.

DTC DESCRIPTION

The PCM sets this code if the calculated value of the pulse-signal from the output speed sensor is noticeably different from the calculated value from vehicle speed sensor, when the vehicle is running faster than 30 km/h. The PCM will initiate the fail safe function if this code is detected.

DTC DETECTING CONDITION

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Speed rationality check	• Signal circuit is open or short • Sensor power circuit is open • Sensor ground circuit is open • Faulty OUTPUT SPEED SENSOR • Faulty PCM
Enable Conditions	• Engine state=Run • Vehicle Speed >30km/h • Engine RPM at current gear 1 or 2 or Non conditional VRPM when gear is not 1 or 2 >1000rpm • Battery voltage >11V and< 16 V • AT oil temp. ≥ -23°C(-9.4°F) • No error in speed sensors	
Threshold value	• Vehicle speed caliculated from TM output speed sensor ≤ 50% × the vehicle speed from vehicle speed sensor	
Diagnostic Time	• More than 1sec	
Fail Safe	• Not in shifting process: The output speed sensor value have been received by calculation from the input speed sensor signal. • In shifting process: Instead of the output speed sensor signal, the vehicle speed sensor signal is used.	

SIGNAL WAVEFORM

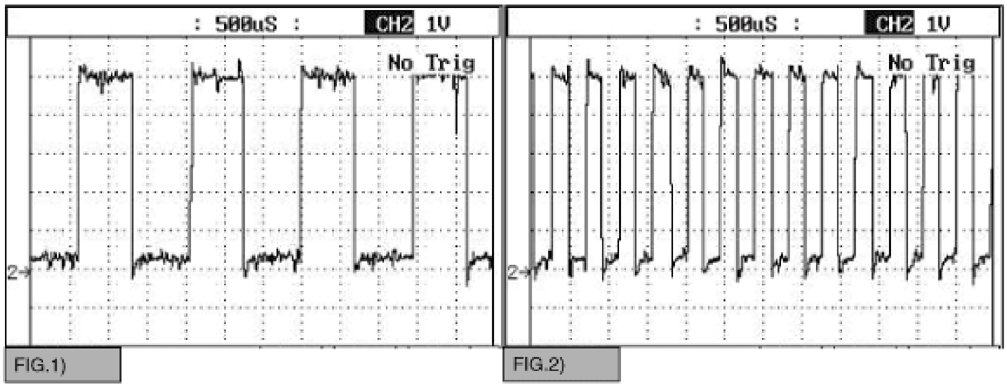
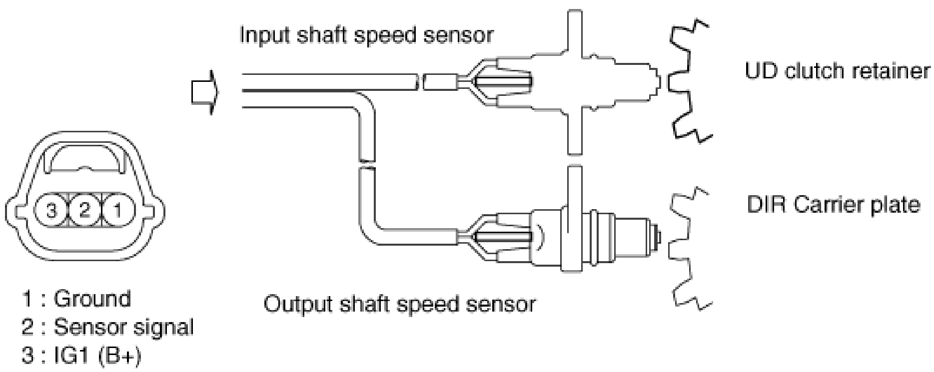


FIG.1) Idling
FIG.2) Accelerating

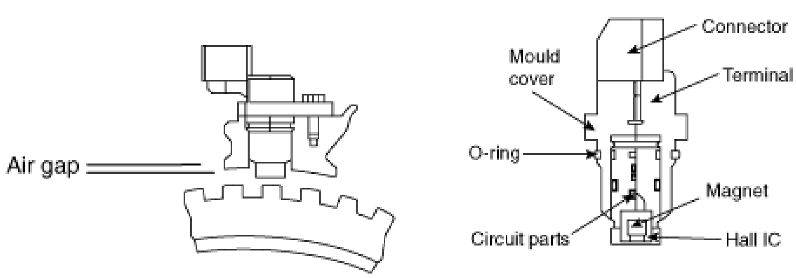
SPECIFICATION

Input shaft & Output shaft speed sensor

- Type : Hall sensor
- Current consumption : 22mA(MAX)
- Sensor body and sensor connector have been unified as one.



Air gap (mm)	Input shaft speed sensor	1.3
	Output shaft speed sensor	0.85
Insulation Resistance	Input shaft speed sensor	over 1MΩ
	Output shaft speed sensor	over 1MΩ
Peak-Peak Voltage	High	more than 4.8V
	Low	less than 0.8V



MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Engine "ON".
3. Monitor the "OUTPUT SPEED SENSOR" parameter on the scantool.

4. Driving at speed of over 30 Km/h(19 mph).

Specification : Increasing Gradually

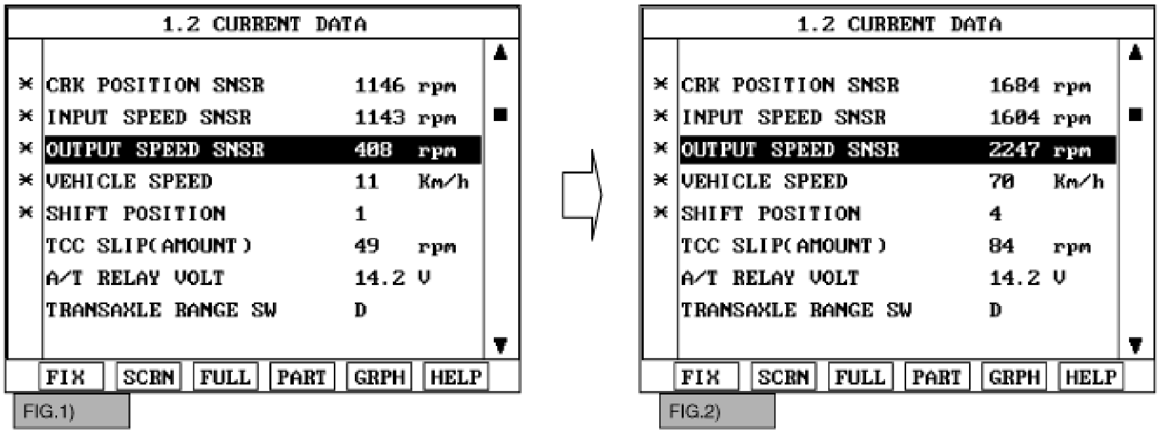


FIG.1) Low-speed
FIG.2) High-speed

5. Does "Output speed sensor" follow the reference data?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification vehicle repair" procedure.

NO

▸ Go to "Terminal&connector inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system may be caused from poor harness and terminals. These faults can be caused by interference from other electrical systems and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification vehicle Repair" procedure.

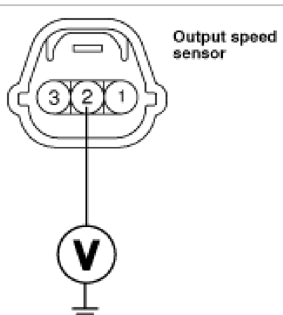
NO

▸ Go to "Signal circuit inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Disconnect the "OUTPUT SPEED SENSOR" connector.
3. Measure voltage between terminal "2" of the OUTPUT SPEED SENSOR harness connector and chassis ground.

Specification : approx. 5V



1. Sensor ground
2. Output speed sensor
3. Power supply IG1

4. Is voltage within specification?

YES

▸ Go to "Power supply circuit inspection" procedure.

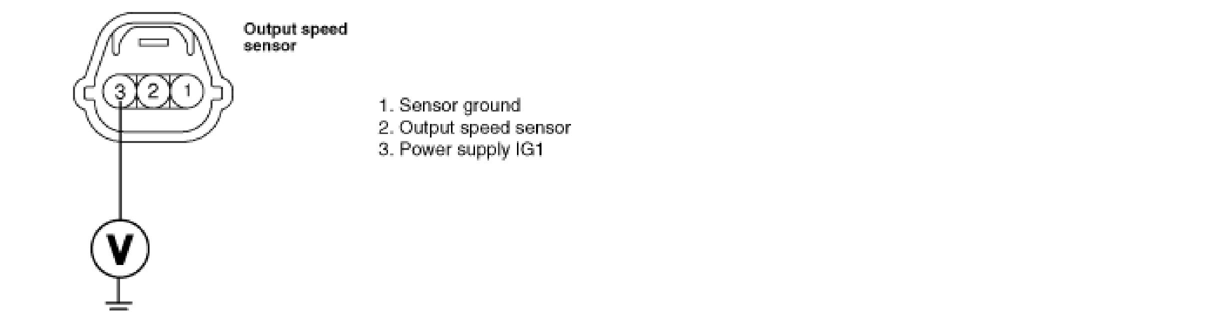
NO

▸ Check for open or short in harness. Repair as necessary and go to "Verification vehicle repair" procedure.
▸ If signal circuit in harness is OK, go to "Check PCM" of the "Component inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Disconnect the "OUTPUT SPEED SENSOR" connector.
3. Measure voltage between terminal "3" of the OUTPUT SPEED SENSOR harness connector and chassis ground.

Specification : approx. B+



4. Is voltage within specification?

YES

▸ Go to "Ground circuit inspection" procedure.

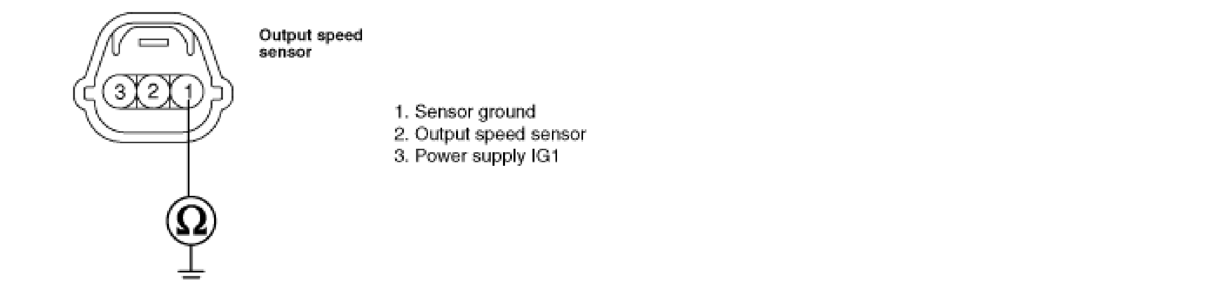
NO

▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

GROUND CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Disconnect the "OUTPUT SPEED SENSOR" connector.
3. Measure resistance between terminal "1" of the OUTPUT SPEED SENSOR harness connector and chassis ground.

Specification : approx. 0 Ω



4. Is resistance within specification?

YES

▸ Go to "Component inspection" procedure.

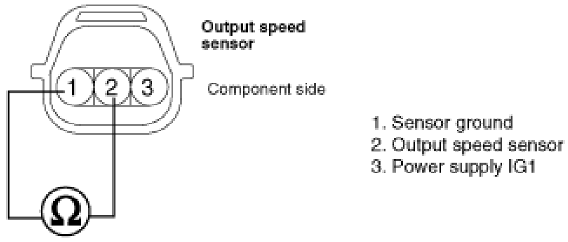
NO

▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.
▸ If ground circuit in harness is OK, go to "Check PCM" of the "Component inspection" procedure.

COMPONENT INSPECTION

1. Check "OUTPUT SPEED SENSOR"
   (1) Ignition "OFF".
   (2) Disconnect the "OUTPUT SPEED SENSOR" connector.
   (3) Measure resistance between terminal "1","2" and "2","3" and "1","3" of the "OUTPUT SPEED SENSOR" connector.

Specification : Refer to "Reference data"



(4) Is resistance within specifications?

[REFERENCE DATA]

Air gap (mm)	Input shaft speed sensor	1.3
	Output shaft speed sensor	0.85
Insulation Resistance	Input shaft speed sensor	over 1MΩ
	Output shaft speed sensor	over 1MΩ
Peak-Peak Voltage	High	more than 4.8V
	Low	less than 0.8V

YES

▸ Go to "CHECK PCM" as below.

NO

▸ Replace "OUTPUT SPEED SENSOR" as necessary and go to "Verification vehicle repair" procedure.

2. CHECK PCM

(1) Ignition "ON" & Engine "OFF".

(2) Connect "OUTPUT SPEED SENSOR" connector.

(3) Install scantool and select a SIMU-SCAN.

(4) Simulate frequency to OUTPUT SPEED SENSOR signal circuit.

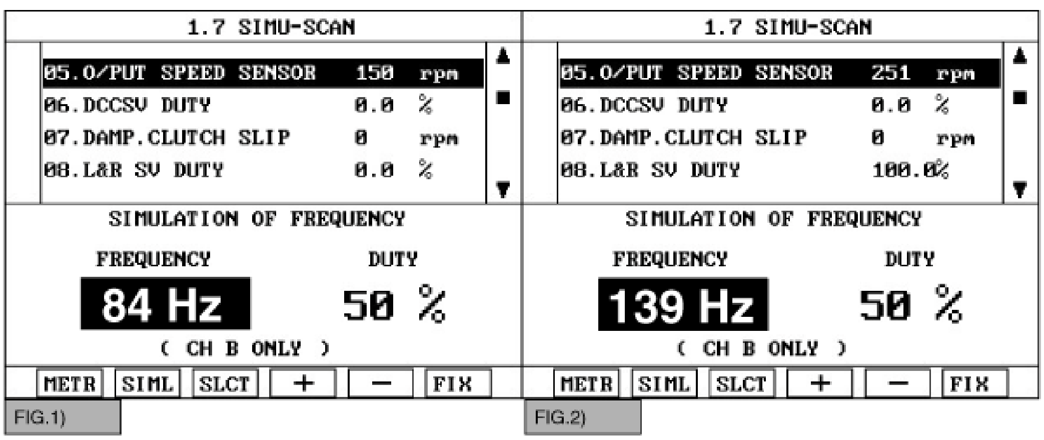


FIG.1) OUTPUT 84Hz → 150rpm
FIG.2) OUTPUT 139Hz → 251rpm

(5) Is "OUTPUT SPEED SENSOR" signal value changed according to simulation frequency?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of vehicle repair" procedure.

NO

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected, replace PCM as necessary and then go to "Verification of vehicle repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Is resistance within specification ?

YES

▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

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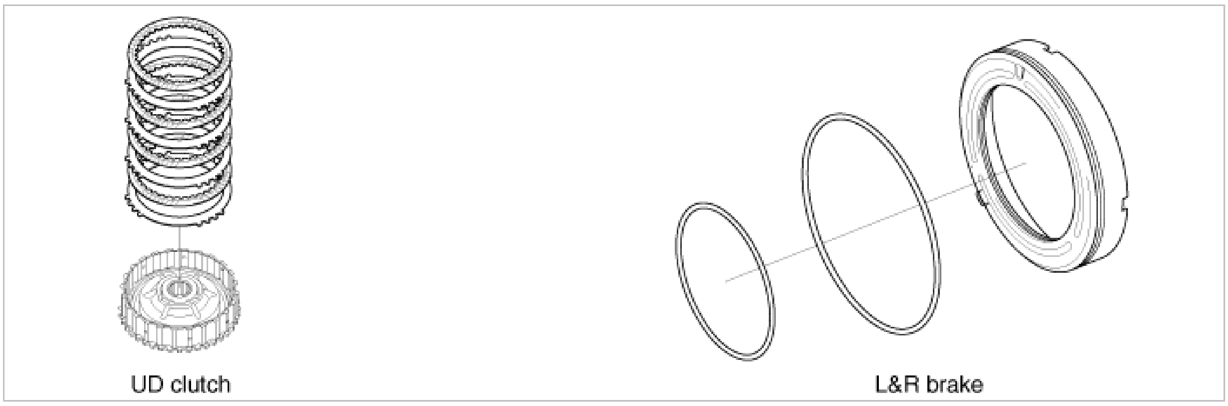
COMPONENT LOCATION



GENERAL DESCRIPTION

The input shaft speed in gear 1 range should be the similar to the value that is what the gear 1 ratio and the output shaft speed are multipled. For example, if the output shaft speed is 1,000 rpm and the gear 1 ratio is 3.789, the input shaft speed may be about 3,789 rpm.

DTC DESCRIPTION

This code is displayed if the input shaft speed does not conform with the value which is what the output shaft speed and the gear 1 ratio are multipled. This is more probably caused by a mechanical defect of adherence of control valves or a breakdown of solenoid controlled valves etc. than a electrical defect.

DTC DETECTING CONDITION

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• 1st gear incorrect ratio	• Faulty input speed sensor • Faulty output speed sensor • Faulty UD clutch or LR brake or Oneway clutch
Enable Conditions	• Engine state=Run • Battery Voltage >11V and< 16 V • TM oil temperature >-23°C(-9.4°F) • Engine speed >450rpm • TM output speed >150rpm • TM Input speed≠ 0rpm • Current gear= 1st • Gear shifting is completed • No PRNDL fail • No error in speed sensors	
Threshold value	• │Measured input speed - calculated input speed│ >200 rpm	
Diagnostic Time	• More than 1sec	
Fail Safe	• Locked into 3rd gear.	

SIGNAL WAVEFORM

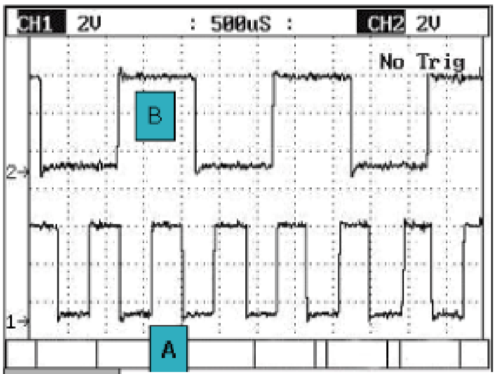


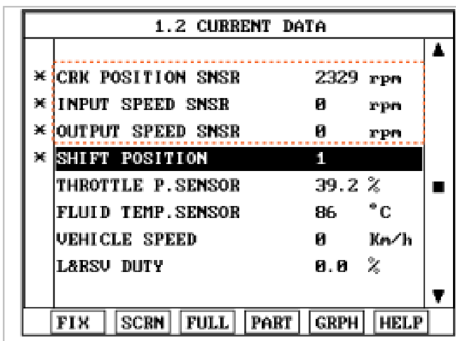
FIG.1)

A : INPUT SPEED SENSOR
B : OUTPUT SPEED SENSOR

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Engine "ON".
3. Monitor the "ENGINE SPEED, INPUT SPEED SENSOR, OUTPUT SPEED SENSOR, GEAR POSITION" parameter on the scantool.
4. Perform the "STALL TEST" with gear position "1"

Specification : 2700~2900 engine rpm



OPERATING ELEMENT OF EACH SHIFTING RANGE

Range		UD clutch	OD clutch	2ND brake	LR brake	REV clutch	RED clutch	DIR clutch	OWC	OWC1
P		-	-	-	O	-	O	-	-	-
R		-	-	-	O	O	O	-	-	-
N		-	-	-	O	-	O	-	-	-
D	1st	O	-	-	O	-	O	-	O	O
	2nd	O	-	O	-	-	O	-	O	-
	3rd	O	O	-	-	-	O	-	O	-
	4th	-	O	O	-	-	O	-	O	-
	5th	-	O	O	-	-	-	O	-	-

UD/C : Underdrive clutch
OD/C : Overdrive clutch
2ND/B : 2ND brake
LR/B : Low&Reverse brake
REV/C: Reverse clutch
RED/B: Reduction brake
DIR/C: Direct clutch

OWC : One way clutch for sub gear shifting
OWC1 : One way clutch for main gear shifting
Stall test procedure in D1 and reason
Procedure

A. Warm up the engine
B. After positioning the select lever in "D", depress the foot brake pedal fully. After that, depress the accelerator pedal to the maximum
   * The slippage of 1st gear operating parts can be detected by stall test in D.

Reason for stall test

A. If there is no mechanical defaults in A/T, all slippage occurs in torque converter.
B. Therfore, engine revolution is output, but input and output speed revolution must be "zero" due to wheel's lock.
C. If 1st gear operating part has faults, input speed revolution will be out of specification.
D. If output speed revolution is output. It means that the foot brake force is not applied fully. Remeasuring is required.

5. Is "STALL TEST " within specification?

YES

▸ Go to "Signal circuit inspection" procedure.

NO

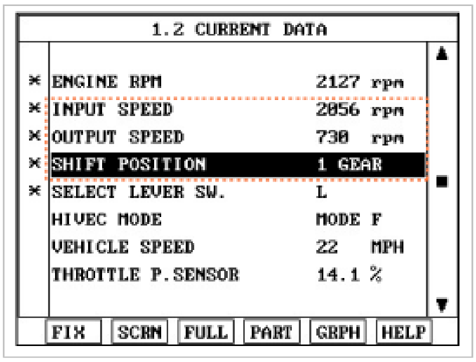
▸ Go to "Component inspection" procedure.

> CAUTION
>
> ● Do not let anybody stand in front of or behind the vehicle while this test is being carried out.
> ● Check the A/T fluid level and temperature and the engine coolant temperature.
>   - Fluid level : At the hot mark on the oil level gauge.
>   - Fluid temperature : 80~100°C(176°F~ 212°F).
>   - Engine coolant temperature : 80~100°C(176°F~ 212°F).
> ● Check both rear wheel(left and right).
> ● Pull the parking brake lever on with the brake pedal fully depressed.
> ● The throttle should not be left fully open for more than eight second.
> ● If carrying out the stall test two or more time, move the select lever to the "N" position and run the engine at 1,000 rpm to let the A/T fluid cool down before carrying out subsequent.

SIGNAL CIRCUIT INSPECTION

1. Connect Scantool.
2. Engine "ON".
3. Monitor the "INPUT&OUTPUT SPEED SENSOR" parameter on the scantool.
4. Accelerate the Engine speed until about 2000 rpm in the 1st gear.

Specification : INPUT SPEED - (OUTPUT SPEED × GEAR RATIO) ≤ 200 RPM



5. Are "INPUT & OUTPUT SPEED SENSOR" within specifications?

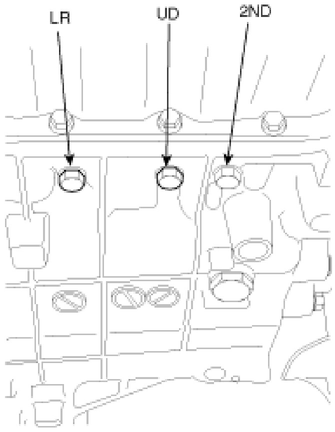
YES

▸ Go to "Component inspection" procedure.

NO

▸ Check for electrical niose of circuit in INPUT & OUTPUT SPEED SENSOR or Replace INPUT & OUTPUT SPEED SENSOR. Repair as necessary and Go to "Verification vehicle repair" procedure.

COMPONENT INSPECTION



1. Connect oil pressure gauge to "UD" and "L/R" ports.
2. Engine "ON".
3. Drive a car with gear position 1 in "SPORTS MODE".
4. Compare it with referance data as below.

Specification : shown below

*1 Each case of increasing and decreasing speed.
* 2 Only for 5 speed A/T.

Manual valve position	VFS current [mA]	RPM	Operation (Duty rate %)						Oil pressure MPa {kgf/cm^2}	
			LR	2ND	UD	OD	DCC	RED*2	UD CLUTCH	LR BRAKE
D	200	2500	0	100	0	100	0	0	1.03±0.02 {10.5±0.2}	1.03±0.02 {10.5±0.2}
			100	0	0	100	0	0	1.03±0.02 {10.5±0.2}	-
R	250		0	100	100	100	0	0	-	1.55±0.25 {15.8±2.5}

Manual valve position (Oil pressure)	VFS current [mA]	RPM	Operation (Duty rate %)						Oil pressure MPa {kgf/cm^2}		
			LR	2ND	UD	OD	DCC	RED*2	4000	1500 (Decreasing)	600 (Decreasing)
D (LR)	200	600→ 4500→ 600	0	100	0	100	0	0	MAX. 1.11 {MAX. 11.3}	-	MIN. 0.55 {MIN. 5.6}
D (UD)			0	100	0	100	0	0	MAX. 1.11 {MAX. 11.3}	-	MIN. 0.55 {MIN. 5.6}
D (UD)			100	0	0	100	0	0	MAX. 1.11 {MAX. 11.3}	-	MIN. 0.55 {MIN. 5.6}
R (LR)	250		0	100	100	100	0	0	MAX. 1.96 {MAX. 20.0}	MIN. 1.14*1 {MIN. 11.6}	MIN. 0.55*1 {MIN. 5.6}

Manual valve position (Oil pressure)	VFS current [mA]	RPM	Operation (Duty rate %)						Oil pressure MPa {kgf/cm^2}		
			LR	2ND	UD	OD	DCC	RED*2	VFS current : 200mA	VFS current : 600mA	VFS current : 1100mA
D (UD)	200→ 1100→ 200	2500	100	100	0	0	100	0	1.03±0.02 {10.5±0.2}	0.69±0.03 {7.0±0.3}	0.36±0.03 {3.7±0.3}

Manual valve position	VFS current [mA]	RPM	Operation (Duty rate %)						ELEMENT	P (MPa)
			LR	2ND	UD	OD	DCC	RED*2		
D	200	2500	0	100	0	100	0	0	LR	1.03±0.02
			60	↑	↑	↑	↑	↑		0.45±0.04
			75	↑	↑	↑	↑	↑		0.19±0.04
			100	↑	↑	↑	↑	↑		0
			100	0	0	100	↑	0	2ND	1.03±0.02
			↑	60	↑	↑	↑	↑		0.50±0.05
			↑	75	↑	↑	↑	↑		0.20±0.05
			↑	100	↑	↑	↑	↑		0
			100	100	0	0	↑	0	OD	1.02±0.02
			↑	↑	↑	60	↑	↑		0.46±0.04
			↑	↑	↑	75	↑	↑		0.19±0.04
			↑	↑	↑	100	↑	↑		0
			100	100	0	0	↑	0	UD	1.03±0.02
			↑	↑	60	↑	↑	↑		0.44±0.05
			↑	↑	75	↑	↑	↑		0.18±0.04
			↑	↑	100	↑	↑	↑		0
			100	0	100	0	↑	0▼	RED	1.03±0.02
			↑	↑	↑	↑	↑	60		0.49±0.04
			↑	↑	↑	↑	↑	75		0.24±0.04
			↑	↑	↑	↑	↑	100		0
			100▼	0	100	0	↑	100	DIR	0
			75	↑	↑	↑	↑	↑		0.25±0.04
			60	↑	↑	↑	↑	↑		0.51±0.04
			0	↑	↑	↑	↑	↑		1.03±0.02

Each case of increasing (0→100%) and decreasing (100→0%) of duty rate to be satisfied.(Except the mark ▼)

Manual valve position (Oil pressure)	VFS current [mA]	RPM	Operation (Duty rate %)						Damper Apply Pressure※ (MPa)	Damper Release Pressure (MPa)
			LR	2ND	UD	OD	DCC	RED*2		
D	200	2500	100	100	0	0	0	0	0.25~0.45	0.50~0.70
			↑	↑	↑	↑	50	↑	0.20~0.45	0
			↑	↑	↑	↑	100	↑	0.96~1.04	0
	900		100	100	0	0	0	0	0.12~0.22	0.25~0.45
			↑	↑	↑	↑	100	↑	MIN. 0.29	0

※ Each case of increasing and decreasing of DCC solenoid duty rate to be satisfied.

● The values are subject to change according to vehicle model or condition.

5. Is oil pressure value within specification?

YES

▸ Repair AUTO TRANSAXLE(Clutch or brake) as necessary and go to "Verification vehicle repair" procedure.

NO

▸ Replace AUTO TRANSAXLE (BODY CONTROL VALVE faulty) as necessary and go to "Verification vehicle repair " procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

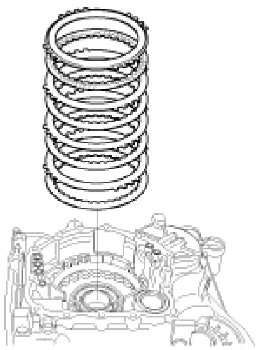
▸ Go to the applicable troubleshooting procedure.

NO

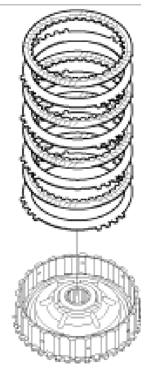
▸ System performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P0732

COMPONENT LOCATION



2ND brake



UD clutch

GENERAL DESCRIPTION

The input shaft speed in gear 2 range should be the similar to the value that is what the gear 2 ratio and the output shaft speed are multipled. For example, if the output shaft speed is 1,000 rpm and the gear 2 ratio is 2.064, the input shaft speed may be about 2,064 rpm.

DTC DESCRIPTION

This code is displayed if the input shaft speed does not conform with the value which is what the output shaft speed and the gear 2 ratio are multipled. This is mainer caused by a mechanical defect of adherence of control valves or a breakdown of solenoid controlled valves etc. than a electrical defect.

DTC DETECTING CONDITION

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• 2nd gear incorrect ratio	• Faulty input speed sensor • Faulty output speed sensor • Faulty UD clutch or 2nd brake
Enable Conditions	• Engine state= Run • Battery Voltage >11V and< 16 V • TM oil temperature >-23°C(-9.4°F) • Engine speed >450rpm • TM output speed >300rpm • TM Input speed ≠ 0rpm • Current gear= 2nd • Gear shifting is completed • No PRNDL fail • No error in speed sensors	
Threshold value	• │Measured input speed - calculated input speed│>200 rpm	
Diagnostic Time	• More than 1sec	
Fail Safe	• Locked into 3 rd gear.	

SIGNAL WAVEFORM

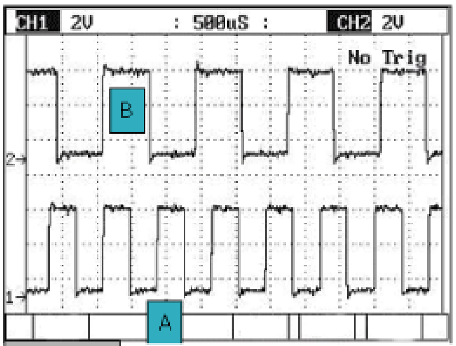


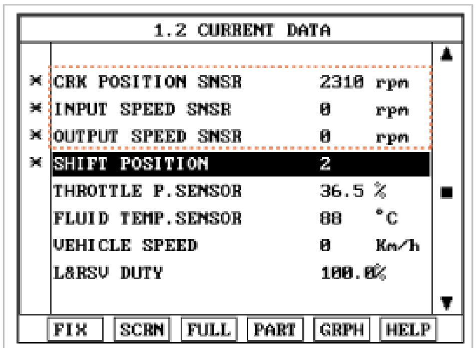
FIG.1)

A : INPUT SPEED SENSOR
B : OUTPUT SPEED SENSOR

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Engine "ON".
3. Monitor the "ENGINE SPEED, INPUT SPEED SENSOR, OUTPUT SPEED SENSOR, GEAR POSITION" parameter on the scantool.
4. Perform the "STALL TEST" with gear position "2".

Specification : 2700~2900 engine rpm



OPERATING ELEMENT OF EACH SHIFTING RANGE

Range		UD clutch	OD clutch	2ND brake	LR brake	REV clutch	RED clutch	DIR clutch	OWC	OWC1
P		-	-	-	O	-	O	-	-	-
R		-	-	-	O	O	O	-	-	-
N		-	-	-	O	-	O	-	-	-
D	1st	O	-	-	O	-	O	-	O	O
	2nd	O	-	O	-	-	O	-	O	-
	3rd	O	O	-	-	-	O	-	O	-
	4th	-	O	O	-	-	O	-	O	-
	5th	-	O	O	-	-	-	O	-	-

UD/C : Underdrive clutch
OD/C : Overdrive clutch
2ND/B : 2ND brake
LR/B : Low&Reverse brake
REV/C: Reverse clutch
RED/B: Reduction brake
DIR/C: Direct clutch

OWC : One way clutch for sub gear shifting
OWC1 : One way clutch for main gear shifting
Stall test procedure in D2 and reason
Procedure

A. Warm up the engine
B. After positioning the select lever in "D", depress the foot brake pedal fully after that, depress the accelerator pedal to the maximum
  * The slippage of 1st gear operating parts can be detected by stall test in D2

Reason for stall test

A. If there is are mechanical defaults in A/T, all slippage occurs in the torque converter.
B. Therfore, engine revolution is output, but input and output speed revolution must be "zero" due to wheel's lock.
C. If 2nd brake system(2nd gear operating part) has faults, input speed revolution will be out of specification.
D. If wheels pin occurs, the applied brake force is not adequate. Retry using more brake force.

5. Is "STALL TEST " within specification?

YES

▸ Go to "Signal circuit inspection" procedure.

NO

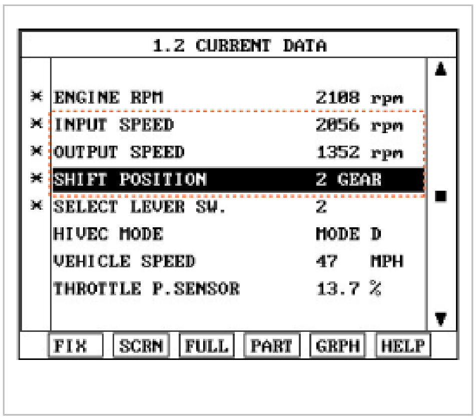
▸ Go to "Component inspection" procedure.

> **CAUTION**
>
> ● Do not let anybody stand in front of or behind the vehicle while this test is being carried out.
> ● Check the A/T fluid level and temperature and the engine coolant temperature.
>   - Fluid level : At the hot mark on the oil level gauge.
>   - Fluid temperature : 80~100°C(176°F~ 212°F).
>   - Engine coolant temperature : 80~100°C(176°F~ 212°F).
> ● Check both rear wheel(left and right).
> ● Pull the parking brake lever on with the brake pedal fully depressed.
> ● The throttle should not be left fully open for more than eight second.
> ● If carrying out the stall test two or more time, move the select lever to the "N" position and run the engine at 1,000 rpm to let the A/T fluid cool down before carrying out subsequent.

SIGNAL CIRCUIT INSPECTION

1. Connect Scantool.
2. Engine "ON".
3. Monitor the "INPUT & OUTPUT SPEED SENSOR" parameter on the scantool.
4. Accelerate the Engine speed until about 2000 rpm in the 2nd gear.

Specification : INPUT SPEED - (OUTPUT SPEED × GEAR RATIO) ≤ 200 RPM



5. Are "INPUT &OUTPUT SPEED SENSOR" within specifications?

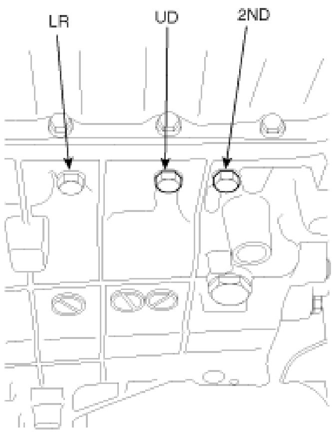
YES

▸ Go to "Component inspection" procedure.

NO

▸ Check for electrical niose of circuit in INPUT & OUTPUT SPEED SENSOR or replace INPUT & OUTPUT SPEED SENSOR. Repair as necessary and go to "Verification vehicle repair" procedure.

COMPONENT INSPECTION



1. Connect oil pressure gauge to "UD" and "2nd" ports.
2. Engine "ON".
3. Drive a car with gear position 2 in "SPORTS MODE".
4. Compare it with referance data as below.

Specification : shown below

*1 Each case of increasing and decreasing speed.
* 2 Only for 5 speed A/T.

Manual valve position	VFS current [mA]	RPM	Operation (Duty rate %)						Oil pressure MPa {kgf/cm²}	
			LR	2ND	UD	OD	DCC	RED*2	UD CLUTCH	LR BRAKE
D	200	2500	0	100	0	100	0	0	1.03±0.02 {10.5±0.2}	1.03±0.02 {10.5±0.2}
			100	0	0	100	0	0	1.03±0.02 {10.5±0.2}	-
R	250		0	100	100	100	0	0	-	1.55±0.25 {15.8±2.5}

Manual valve position (Oil pressure)	VFS current [mA]	RPM	Operation (Duty rate %)						Oil pressure MPa {kgf/cm²}		
			LR	2ND	UD	OD	DCC	RED*2	4000	1500 (Decreasing)	600 (Decreasing)
D (LR)	200	600→ 4500→ 600	0	100	0	100	0	0	MAX. 1.11 {MAX. 11.3}	-	MIN. 0.55 {MIN. 5.6}
D (UD)			0	100	0	100	0	0	MAX. 1.11 {MAX. 11.3}	-	MIN. 0.55 {MIN. 5.6}
D (UD)			100	0	0	100	0	0	MAX. 1.11 {MAX. 11.3}	-	MIN. 0.55 {MIN. 5.6}
R (LR)	250		0	100	100	100	0	0	MAX. 1.96 {MAX. 20.0}	MIN. 1.14*1 {MIN. 11.6}	MIN. 0.55*1 {MIN. 5.6}

Manual valve position (Oil pressure)	VFS current [mA]	RPM	Operation (Duty rate %)						Oil pressure MPa {kgf/cm²}		
			LR	2ND	UD	OD	DCC	RED*2	VFS current : 200mA	VFS current : 600mA	VFS current : 1100mA
D (UD)	200→ 1100→	2500	100	100	0	0	100	0	1.03±0.02 {10.5±0.2}	0.69±0.03 {7.0±0.3}	0.36±0.03 {3.7±0.3}

	200										

Manual valve position	VFS current [mA]	RPM	Operation (Duty rate %)						ELEMENT	P (MPa)
			LR	2ND	UD	OD	DCC	RED*²		
D	200	2500	0	100	0	100	0	0	LR	1.03±0.02
			60	↑	↑	↑	↑	↑		0.45±0.04
			75	↑	↑	↑	↑	↑		0.19±0.04
			100	↑	↑	↑	↑	↑		0
			100	0	0	100	↑	0	2ND	1.03±0.02
			↑	60	↑	↑	↑	↑		0.50±0.05
			↑	75	↑	↑	↑	↑		0.20±0.05
			↑	100	↑	↑	↑	↑		0
			100	100	0	0	↑	0	OD	1.02±0.02
			↑	↑	↑	60	↑	↑		0.46±0.04
			↑	↑	↑	75	↑	↑		0.19±0.04
			↑	↑	↑	100	↑	↑		0
			100	100	0	0	↑	0	UD	1.03±0.02
			↑	↑	60	↑	↑	↑		0.44±0.05
			↑	↑	75	↑	↑	↑		0.18±0.04
			↑	↑	100	↑	↑	↑		0
			100	0	100	0	↑	0▼	RED	1.03±0.02
			↑	↑	↑	↑	↑	60		0.49±0.04
			↑	↑	↑	↑	↑	75		0.24±0.04
			↑	↑	↑	↑	↑	100		0
			100▼	0	100	0	↑	100	DIR	0
			75	↑	↑	↑	↑	↑		0.25±0.04
			60	↑	↑	↑	↑	↑		0.51±0.04
			0	↑	↑	↑	↑	↑		1.03±0.02

Each case of increasing (0→100%) and decreasing (100→0%) of duty rate to be satisfied.(Except the mark ▼)

Manual valve position (Oil pressure)	VFS current [mA]	RPM	Operation (Duty rate %)						Damper Apply Pressure※ (MPa)	Damper Release Pressure (MPa)
			LR	2ND	UD	OD	DCC	RED*²		
D	200	2500	100	100	0	0	0	0	0.25~0.45	0.50~0.70
			↑	↑	↑	↑	50	↑	0.20~0.45	0
			↑	↑	↑	↑	100	↑	0.96~1.04	0
	900		100	100	0	0	0	0	0.12~0.22	0.25~0.45
			↑	↑	↑	↑	100	↑	MIN. 0.29	0

※ Each case of increasing and decreasing of DCC solenoid duty rate to be satisfied.

● The values are subject to change according to vehicle model or condition.

5. Is oil pressure value within specification?

YES

▸ Repair AUTO TRANSAXLE(Clutch or brake) as necessary and go to "Verification vehicle repair" procedure.

NO

▸ Replace AUTO TRANSAXLE (BODY CONTROL VALVE faulty) as necessary and go to "Verification vehicle repair " procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

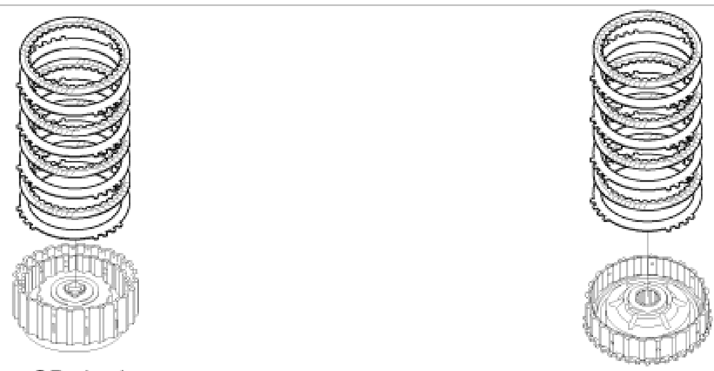
▶ Go to the applicable troubleshooting procedure.

NO

▶ System performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P0733

COMPONENT LOCATION



GENERAL DESCRIPTION

The input shaft speed in gear 3 range should be the similar to the value that is what the gear 3 ratio and the output shaft speed are multipled. For example, if the output shaft speed is 1,000 rpm and the gear 3 ratio is 1.421, the input shaft speed will be about 1,421 rpm.

DTC DESCRIPTION

This code is displayed if the input shaft speed does not conform with the value which is what the output shaft speed and the gear 3 ratio are multipled. This is most likely caused by a mechanical defect of adherence of control valves or a breakdown of solenoid controlled valves etc. than a electrical defect.

DTC DETECTING CONDITION

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• 3rd gear incorrect ratio	• Faulty Input speed sensor • Faulty output speed sensor • Faulty UD clutch or OD clutch
Enable Conditions	• Engine state=Run • Battery Voltage >11V and< 16 V • TM oil temperature >-23°C(-9.4°F) • Engine speed >450rpm • TM output speed >300rpm • TM Input speed≠ 0rpm • Current gear=3rd • Gear shifting is completed • No PRNDL fail • No error in speed sensors	
Threshold value	• │Measured input speed - calculated input speed│>200 rpm	
Diagnostic Time	• More than 1sec	

Fail Safe	• Locked into 3rd gear.	

SIGNAL WAVEFORM

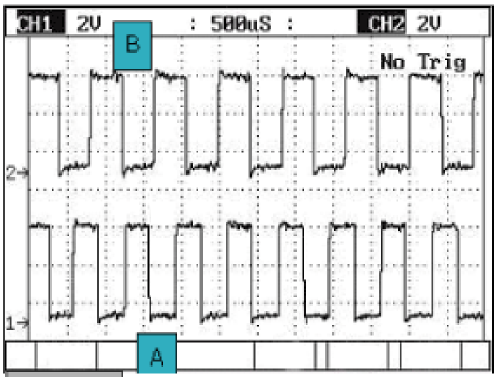


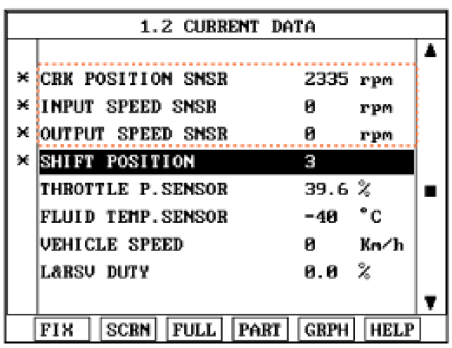
FIG.1)

A : INPUT SPEED SENSOR
B : OUTPUT SPEED SENSOR

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Engine "ON".
3. Monitor the "ENGINE SPEED, INPUT SPEED SENSOR, OUTPUT SPEED SENSOR, GEAR POSITION" parameter on the scantool.
4. Disconnect the solenoide valve connector and perform the "STALL TEST".

Specification : 2700~2900 engine rpm



OPERATING ELEMENT OF EACH SHIFTING RANGE

Range		UD clutch	OD clutch	2ND brake	LR brake	REV clutch	RED clutch	DIR clutch	OWC	OWC1
P		-	-	-	O	-	O	-	-	-
R		-	-	-	O	O	O	-	-	-
N		-	-	-	O	-	O	-	-	-
D	1st	O	-	-	O	-	O	-	O	O
	2nd	O	-	O	-	-	O	-	O	-
	3rd	O	O	-	-	-	O	-	O	-
	4th	-	O	O	-	-	O	-	O	-
	5th	-	O	O	-	-	-	O	-	-

UD/C : Underdrive clutch

OD/C : Overdrive clutch
2ND/B : 2ND brake
LR/B : Low&Reverse brake
REV/C: Reverse clutch
RED/B: Reduction brake
DIR/C: Direct clutch
OWC : One way clutch for sub gear shifting
OWC1 : One way clutch for main gear shifting

Stall test procedure in D3 and reason

Procedure

A. Warm up the engine
B. Set 3rd gear hold by disconnecting the solenoid valve connector. Fully depress the brake pedal, then place the transaxle gear lever into "D" range. Press and hold the accelerator pedal to the floor for no more than eight seconds while observing the engine, input speed,
and output speed RPM values.
* The slippage of 3rd gear operating parts can be detected by stall test in D3.

Reason for stall test

A. If there are no mechanical defaults in A/T, all slippage occurs in torque converter.
B. Therfore, engine revolution is output, but input and output speed revolution must be "zero" due to wheel's lock.
C. If OD clutch system(3rd gear operating part) has faults, input speed revolution will be out of specification.
D. If output speed revolution is output. It means that the foot brake force is not applied fully. Retesting using greater braking force is required.

5. Is "STALL TEST " within specification?

YES

▸ Go to "Signal circuit inspection" procedure.

NO

▸ Go to "Component inspection" procedure.

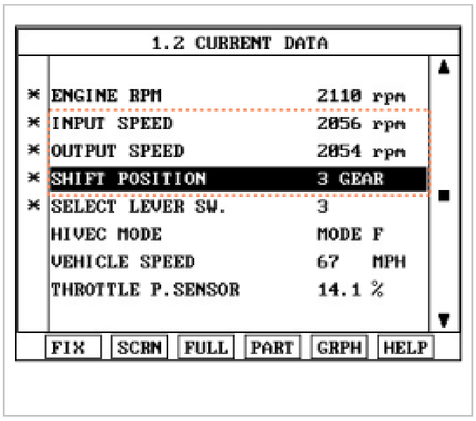
CAUTION

● Do not let anybody stand in front of or behind the vehicle while this test is being carried out.
● Check the A/T fluid level and temperature and the engine coolant temperature.
- Fluid level : At the hot mark on the oil level gauge.
- Fluid temperature : 80~100°C(176°F~ 212°F).
- Engine coolant temperature : 80~100°C(176°F~ 212°F).
● Check both rear wheel(left and right).
● Pull the parking brake lever on with the brake pedal fully depressed.
● The throttle should not be left fully open for more than eight seconds.
● If carrying out the stall test two or more times, move the select lever to the "N" position and run the engine at 1,000 rpm to let the A/T fluid cool down before carrying out subsequent tests.

SIGNAL CIRCUIT INSPECTION

1. Connect Scantool.
2. Engine "ON".
3. Monitor the "INPUT & OUTPUT SPEED SENSOR" parameter on the scantool.
4. Accelerate the Engine speed until about 2000 rpm in the 3rd gear.

Specification : INPUT SPEED - (OUTPUT SPEED × GEAR RATIO) ≤ 200 RPM



5. Are "INPUT & OUTPUT SPEED SENSOR" within specifications?

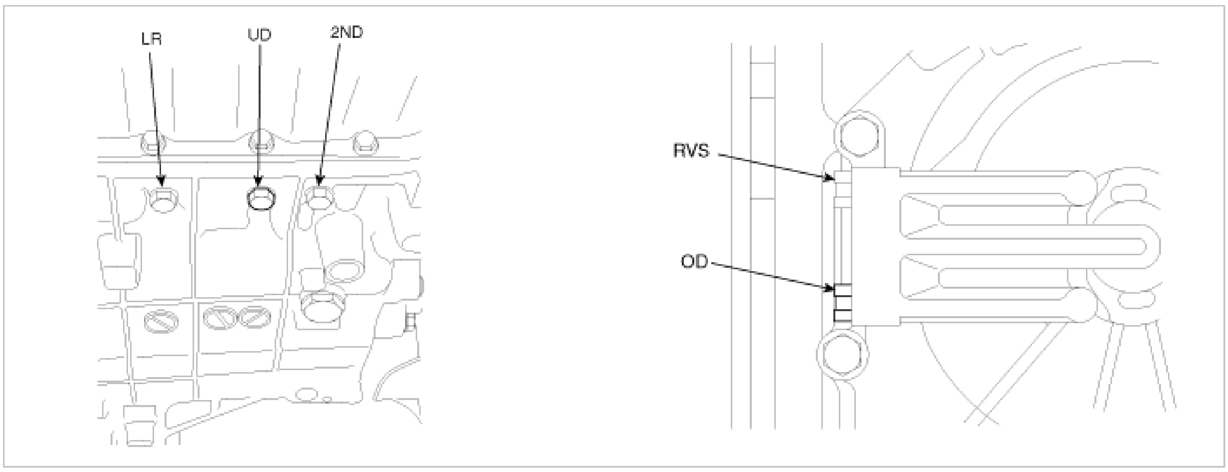
YES

▸ Go to "Component inspection" procedure.

NO

▸ Check for electrical niose of circuit in INPUT & OUTPUT SPEED SENSOR or replace INPUT & OUTPUT SPEED SENSOR. Repair as necessary and go to "Verification vehicle repair" procedure.

COMPONENT INSPECTION



1. Connect Oil pressure gauge to "UD" and "OD" ports.
2. Engine "ON".
3. Drive a car with gear position 3 in "SPORTS MODE".
4. Compare it with referance data as below.

Specification : shown below

*1 Each case of increasing and decreasing speed.
* 2 Only for 5 speed A/T.

Manual valve position	VFS current [mA]	RPM	Operation (Duty rate %)						Oil pressure MPa {kgf/cm²}	
			LR	2ND	UD	OD	DCC	RED*²	UD CLUTCH	LR BRAKE
D	200	2500	0	100	0	100	0	0	1.03±0.02 {10.5±0.2}	1.03±0.02 {10.5±0.2}
			100	0	0	100	0	0	1.03±0.02 {10.5±0.2}	-
R	250		0	100	100	100	0	0	-	1.55±0.25 {15.8±2.5}

Manual valve	VFS		Operation (Duty rate %)	Oil pressure MPa {kgf/cm²}

position (Oil pressure)	current [mA]	RPM	LR	2ND	UD	OD	DCC	RED*2	4000	1500 (Decreasing)	600 (Decreasing)
D (LR)	200	600→ 4500→ 600	0	100	0	100	0	0	MAX. 1.11 {MAX. 11.3}	-	MIN. 0.55 {MIN. 5.6}
D (UD)			0	100	0	100	0	0	MAX. 1.11 {MAX. 11.3}	-	MIN. 0.55 {MIN. 5.6}
D (UD)			100	0	0	100	0	0	MAX. 1.11 {MAX. 11.3}	-	MIN. 0.55 {MIN. 5.6}
R (LR)	250		0	100	100	100	0	0	MAX. 1.96 {MAX. 20.0}	MIN. 1.14*1 {MIN. 11.6}	MIN. 0.55*1 {MIN. 5.6}

Manual valve position (Oil pressure)	VFS current [mA]	RPM	Operation (Duty rate %)						Oil pressure MPa {kgf/cm^2}		
			LR	2ND	UD	OD	DCC	RED*2	VFS current : 200mA	VFS current : 600mA	VFS current : 1100mA
D (UD)	200→ 1100→ 200	2500	100	100	0	0	100	0	1.03±0.02 {10.5±0.2}	0.69±0.03 {7.0±0.3}	0.36±0.03 {3.7±0.3}

Manual valve position	VFS current [mA]	RPM	Operation (Duty rate %)						ELEMENT	P (MPa)
			LR	2ND	UD	OD	DCC	RED*2		
D	200	2500	0	100	0	100	0	0	LR	1.03±0.02
			60	↑	↑	↑	↑	↑		0.45±0.04
			75	↑	↑	↑	↑	↑		0.19±0.04
			100	↑	↑	↑	↑	↑		0
			100	0	0	100	↑	0	2ND	1.03±0.02
			↑	60	↑	↑	↑	↑		0.50±0.05
			↑	75	↑	↑	↑	↑		0.20±0.05
			↑	100	↑	↑	↑	↑		0
			100	100	0	0	↑	0	OD	1.02±0.02
			↑	↑	↑	60	↑	↑		0.46±0.04
			↑	↑	↑	75	↑	↑		0.19±0.04
			↑	↑	↑	100	↑	↑		0
			100	100	0	0	↑	0	UD	1.03±0.02
			↑	↑	60	↑	↑	↑		0.44±0.05
			↑	↑	75	↑	↑	↑		0.18±0.04
			↑	↑	100	↑	↑	↑		0
			100	0	100	0	↑	0▼	RED	1.03±0.02
			↑	↑	↑	↑	↑	60		0.49±0.04
			↑	↑	↑	↑	↑	75		0.24±0.04
			↑	↑	↑	↑	↑	100		0
			100▼	0	100	0	↑	100	DIR	0
			75	↑	↑	↑	↑	↑		0.25±0.04
			60	↑	↑	↑	↑	↑		0.51±0.04
			0	↑	↑	↑	↑	↑		1.03±0.02

Each case of increasing (0→100%) and decreasing (100→0%) of duty rate to be satisfied.(Except the mark ▼)

Manual					

valve position (Oil pressure)	VFS current [mA]	RPM	Operation (Duty rate %)						Damper Apply Pressure※ (MPa)	Damper Release Pressure (MPa)
			LR	2ND	UD	OD	DCC	RED*2		
D	200	2500	100	100	0	0	0	0	0.25~0.45	0.50~0.70
			↑	↑	↑	↑	50	↑	0.20~0.45	0
			↑	↑	↑	↑	100	↑	0.96~1.04	0
	900		100	100	0	0	0	0	0.12~0.22	0.25~0.45
			↑	↑	↑	↑	100	↑	MIN. 0.29	0

※ Each case of increasing and decreasing of DCC solenoid duty rate to be satisfied.

● The values are subject to change according to vehicle model or condition.

5. Is oil pressure value within specification?

YES

▸ Repair AUTO TRANSAXLE(Clutch or brake) as necessary and go to "Verification vehicle repair" procedure.

NO

▸ Replace AUTO TRANSAXLE (BODY CONTROL VALVE faulty) as necessary and go to "Verification vehicle repair " procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

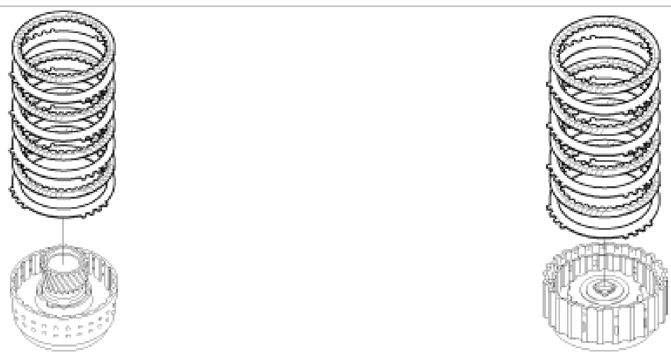
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P0734

COMPONENT LOCATION



Direct clutch   OD clutch

GENERAL DESCRIPTION

The input shaft speed in gear 4 range should be the similar to the value that is what the gear 4 ratio and the output shaft speed are multipled. For example, if the output shaft speed is 1,000 rpm and the gear 4 ratio is 1.034, the input shaft speed may be about 1,034 rpm.

DTC DESCRIPTION

This code is displayed if the input shaft speed does not conform with the value which is what the output shaft speed and the gear 4 ratio are multipled. This is most likely caused by a mechanical defect of adherence of control valves or a breakdown of solenoid controlled valves etc. than a electrical defect.

DTC DETECTING CONDITION

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• 4th gear incorrect ratio	• Faulty input speed sensor • Faulty output speed sensor • Faulty direct clutch or OD clutch
Enable Conditions	• Engine state=Run • Battery Voltage >11V and< 16 V • TM oil temperature >-23°C(-9.4°F) • Engine speed >450rpm • TM output speed >300rpm • TM Input speed≠0rpm • Current gear=4th • Gear shifting is completed • No PRNDL fail • No error in speed sensors	
Threshold value	• │Measured input speed - calculated input speed│>200 rpm	
Diagnostic Time	• More than 1sec	
Fail Safe	• Locked into 3rd gear.	

SIGNAL WAVEFORM

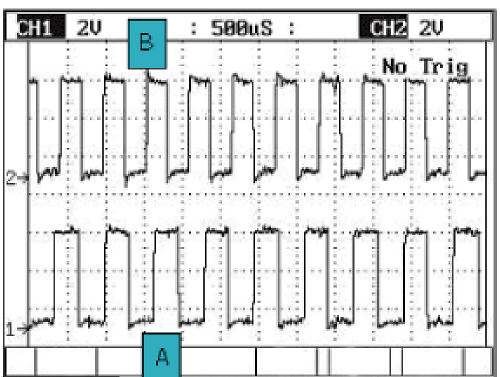


FIG.1)

A : INPUT SPEED SENSOR
B : OUTPUT SPEED SENSOR

MONITOR SCANTOOL DATA

※ It is difficult to "STALL TEST" in 4th gear, therefore Go to "W/Harness Inspection" procedure.

OPERATING ELEMENT OF EACH SHIFTING RANGE

Range		UD clutch	OD clutch	2ND brake	LR brake	REV clutch	RED clutch	DIR clutch	OWC	OWC1
P		-	-	-	O	-	O	-	-	-
R		-	-	-	O	O	O	-	-	-
N		-	-	-	O	-	O	-	-	-
D	1st	O	-	-	O	-	O	-	O	O
	2nd	O	-	O	-	-	O	-	O	-
	3rd	O	O	-	-	-	O	-	O	-
	4th	-	O	O	-	-	O	-	O	-
	5th	-	O	O	-	-	-	O	-	-

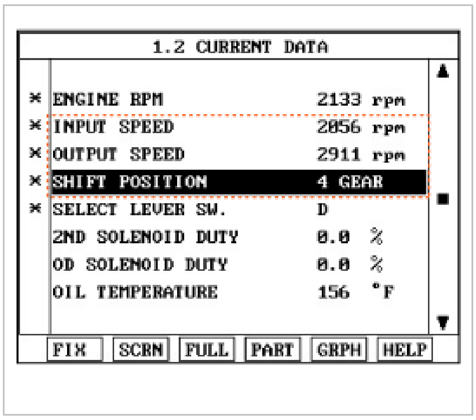
UD/C : Underdrive clutch
OD/C : Overdrive clutch

2ND/B : 2ND brake
LR/B : Low&Reverse brake
REV/C: Reverse clutch
RED/B: Reduction brake
DIR/C: Direct clutch
OWC : One way clutch for sub gear shifting
OWC1 : One way clutch for main gear shifting

SIGNAL CIRCUIT INSPECTION

1. Connect Scantool.
2. Engine "ON".
3. Monitor the "INPUT & OUTPUT SPEED SENSOR" parameter on the scantool.
4. Accelerate the Engine speed until about 2000 rpm in the 4th gear while driving the vehicle on a level road.

Specification : INPUT SPEED - (OUTPUT SPEED × GEAR RATIO) ≤ 200 RPM



5. Doed "INPUT & OUTPUT SPEED SENSOR" within specifications?

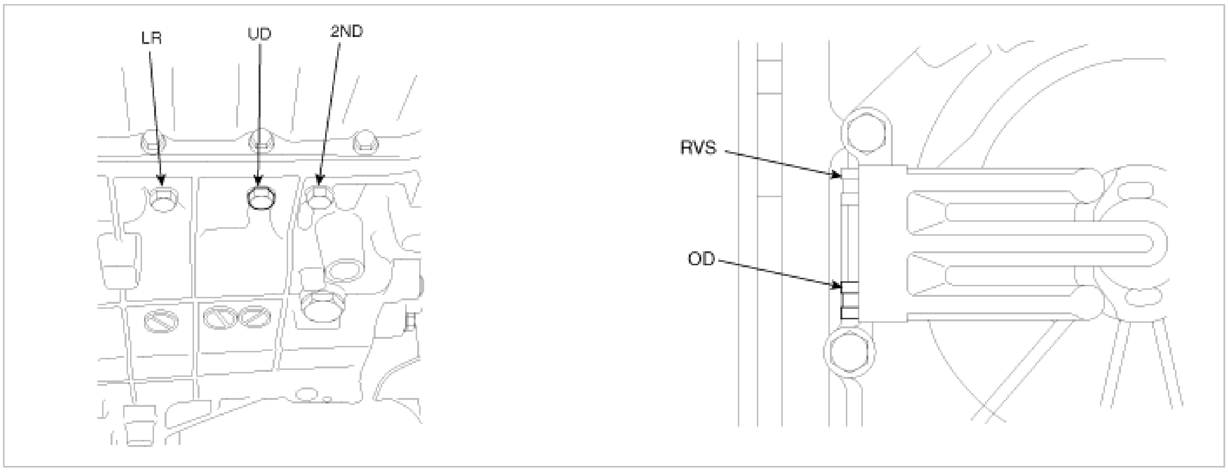
YES

▸ Go to "Component inspection" procedure.

NO

▸ Check for electrical niose of circuit in INPUT & OUTPUT SPEED SENSOR or Replace INPUT & OUTPUT SPEED SENSOR. Repair as necessary and Go to "Verification vehicle repair" procedure.

COMPONENT INSPECTION



1. Connect oil pressure gauge to "UD" and "OD" ports.
2. Engine "ON".
3. Drive a car with gear position "4".
4. Compare it with referance data as below.

Specification : shown below

*1 Each case of increasing and decreasing speed.
* 2 Only for 5 speed A/T.

Manual valve position	VFS current [mA]	RPM	Operation (Duty rate %)						Oil pressure MPa {kgf/cm^2}	
			LR	2ND	UD	OD	DCC	RED*2	UD CLUTCH	LR BRAKE
D	200	2500	0	100	0	100	0	0	1.03±0.02 {10.5±0.2}	1.03±0.02 {10.5±0.2}
			100	0	0	100	0	0	1.03±0.02 {10.5±0.2}	-
R	250		0	100	100	100	0	0	-	1.55±0.25 {15.8±2.5}

Manual valve position (Oil pressure)	VFS current [mA]	RPM	Operation (Duty rate %)						Oil pressure MPa {kgf/cm^2}		
			LR	2ND	UD	OD	DCC	RED*2	4000	1500 (Decreasing)	600 (Decreasing)
D (LR)	200	600→ 4500→ 600	0	100	0	100	0	0	MAX. 1.11 {MAX. 11.3}	-	MIN. 0.55 {MIN. 5.6}
D (UD)			0	100	0	100	0	0	MAX. 1.11 {MAX. 11.3}	-	MIN. 0.55 {MIN. 5.6}
D (UD)			100	0	0	100	0	0	MAX. 1.11 {MAX. 11.3}	-	MIN. 0.55 {MIN. 5.6}
R (LR)	250		0	100	100	100	0	0	MAX. 1.96 {MAX. 20.0}	MIN. 1.14*1 {MIN. 11.6}	MIN. 0.55*1 {MIN. 5.6}

Manual valve position (Oil pressure)	VFS current [mA]	RPM	Operation (Duty rate %)						Oil pressure MPa {kgf/cm^2}		
			LR	2ND	UD	OD	DCC	RED*2	VFS current : 200mA	VFS current : 600mA	VFS current : 1100mA
D (UD)	200→ 1100→ 200	2500	100	100	0	0	100	0	1.03±0.02 {10.5±0.2}	0.69±0.03 {7.0±0.3}	0.36±0.03 {3.7±0.3}

Manual valve position	VFS current [mA]	RPM	Operation (Duty rate %)						ELEMENT	P (MPa)
			LR	2ND	UD	OD	DCC	RED*2		
D	200	2500	0	100	0	100	0	0	LR	1.03±0.02
			60	↑	↑	↑	↑	↑		0.45±0.04
			75	↑	↑	↑	↑	↑		0.19±0.04
			100	↑	↑	↑	↑	↑		0
			100	0	0	100	↑	0	2ND	1.03±0.02
			↑	60	↑	↑	↑	↑		0.50±0.05
			↑	75	↑	↑	↑	↑		0.20±0.05
			↑	100	↑	↑	↑	↑		0
			100	100	0	0	↑	0	OD	1.02±0.02
			↑	↑	↑	60	↑	↑		0.46±0.04
			↑	↑	↑	75	↑	↑		0.19±0.04
			↑	↑	↑	100	↑	↑		0
			100	100	0	0	↑	0	UD	1.03±0.02
			↑	↑	60	↑	↑	↑		0.44±0.05
			↑	↑	75	↑	↑	↑		0.18±0.04

			↑	↑	100	↑	↑	↑		0
			100	0	100	0	↑	0▼	RED	1.03±0.02
			↑	↑	↑	↑	↑	60		0.49±0.04
			↑	↑	↑	↑	↑	75		0.24±0.04
			↑	↑	↑	↑	↑	100		0
			100▼	0	100	0	↑	100	DIR	0
			75	↑	↑	↑	↑	↑		0.25±0.04
			60	↑	↑	↑	↑	↑		0.51±0.04
			0	↑	↑	↑	↑	↑		1.03±0.02

Each case of increasing (0→100%) and decreasing (100→0%) of duty rate to be satisfied.(Except the mark ▼)

Manual valve position (Oil pressure)	VFS current [mA]	RPM	Operation (Duty rate %)						Damper Apply Pressure※ (MPa)	Damper Release Pressure (MPa)
			LR	2ND	UD	OD	DCC	RED*2		
D	200	2500	100	100	0	0	0	0	0.25~0.45	0.50~0.70
			↑	↑	↑	↑	50	↑	0.20~0.45	0
			↑	↑	↑	↑	100	↑	0.96~1.04	0
	900		100	100	0	0	0	0	0.12~0.22	0.25~0.45
			↑	↑	↑	↑	100	↑	MIN. 0.29	0

※ Each case of increasing and decreasing of DCC solenoid duty rate to be satisfied.

● The values are subject to change according to vehicle model or condition.

5. Is oil pressure value within specification?

YES

▸ Repair AUTO TRANSAXLE(Clutch or brake) as necessary and go to "Verification vehicle repair" procedure.

NO

▸ Replace AUTO TRANSAXLE (BODY CONTROL VALVE faulty) as necessary and go to "Verification vehicle repair " procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

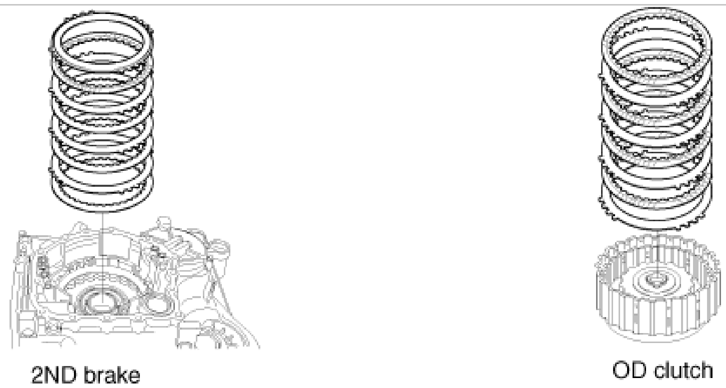
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P0735

COMPONENT LOCATION



GENERAL DESCRIPTION

The input shaft speed in gear 5 range should be the similar to the value that is what the gear 5 ratio and the output shaft speed are multipled. For example, if the output shaft speed is 1,000 rpm and the gear 5 ratio is 0.728, the input shaft speed may be about 728 rpm.

DTC DESCRIPTION

This code is displayed if the input shaft speed does not conform with the value which is what the output shaft speed and the gear 5 ratio are multipled. This is most likely caused by a mechanical defect of adherence of control valves or a breakdown of solenoid controlled valves etc. than a electrical defect.

DTC DETECTING CONDITION

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• 5th gear incorrect ratio	• Faulty input speed sensor • Faulty output speed sensor • Faulty 2nd brake or OD clutch
Enable Conditions	• Engine state=Run • Battery Voltage >11V and< 16 V • TM oil temperature >-23°C(-9.4°F) • Engine speed >450rpm • TM output speed >300rpm • TM Input speed≠0rpm • Current gear=5th • Gear shifting is completed • No PRNDL fail • No error in speed sensors	
Threshold value	• │Measured input speed - calculated input speed│>200 rpm	
Diagnostic Time	• More than 1sec	
Fail Safe	• Locked into 3rd gear.	

SIGNAL WAVEFORM

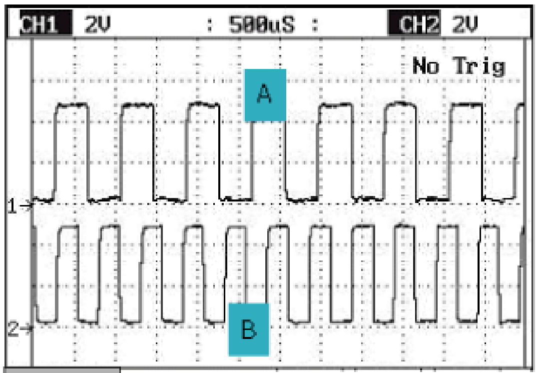


FIG.1)

A: INPUT SPEED SENSOR
B : OUTPUT SPEED SENSOR

MONITOR SCANTOOL DATA

※ It is difficult to "STALL TEST" in 5th gear, therefore Go to "W/Harness inspection" procedure.

OPERATING ELEMENT OF EACH SHIFTING RANGE

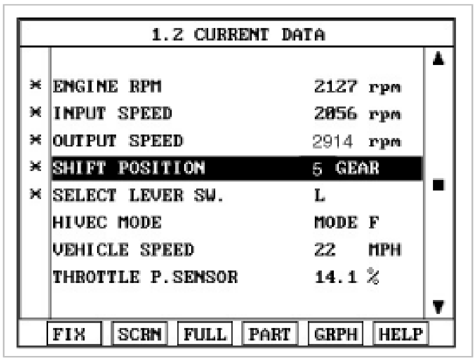
Range		UD clutch	OD clutch	2ND brake	LR brake	REV clutch	RED clutch	DIR clutch	OWC	OWC1
P		-	-	-	O	-	O	-	-	-
R		-	-	-	O	O	O	-	-	-
N		-	-	-	O	-	O	-	-	-
D	1st	O	-	-	O	-	O	-	O	O
	2nd	O	-	O	-	-	O	-	O	-
	3rd	O	O	-	-	-	O	-	O	-
	4th	-	O	O	-	-	O	-	O	-
	5th	-	O	O	-	-	-	O	-	-

UD/C : Underdrive clutch
OD/C : Overdrive clutch
2ND/B : 2ND brake
LR/B : Low&Reverse brake
REV/C: Reverse clutch
RED/B: Reduction brake
DIR/C: Direct clutch
OWC : One way clutch for sub gear shifting
OWC1 : One way clutch for main gear shifting

SIGNAL CIRCUIT INSPECTION

1. Connect Scantool.
2. Engine "ON".
3. Monitor the "INPUT & OUTPUT SPEED SENSOR" parameter on the scantool.
4. Accelerate the Engine speed until about 2000 rpm in the 5th gear while driving the vehicle on a level road.

Specification : INPUT SPEED - (OUTPUT SPEED × GEAR RATIO) ≤ 200 RPM



5. Are "INPUT & OUTPUT SPEED SENSOR" within specifications?

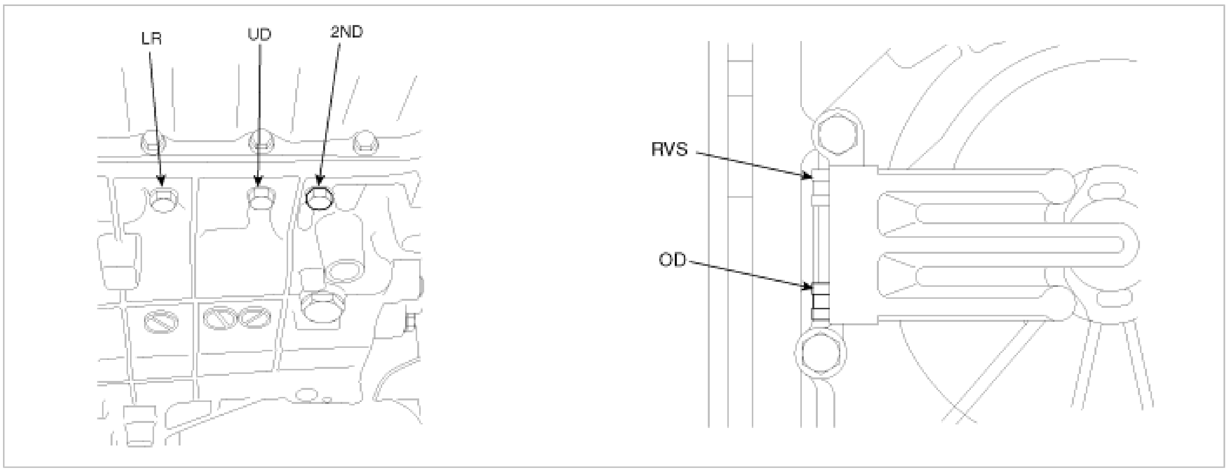
YES

▸ Go to "Component inspection" procedure.

NO

▸ Check for electrical niose of circuit in INPUT & OUTPUT SPEED SENSOR or Replace INPUT & OUTPUT SPEED SENSOR. Repair as necessary and Go to "Verification vehicle repair" procedure.

COMPONENT INSPECTION



1. Connect oil pressure gauge to "2nd" and "OD" ports.
2. Engine "ON".
3. Drive a car with gear position "5".
4. Compare it with referance data as below.

Specification : shown below

*1 Each case of increasing and decreasing speed.
* 2 Only for 5 speed A/T.

Manual valve position	VFS current [mA]	RPM	Operation (Duty rate %)						Oil pressure MPa {kgf/cm²}	
			LR	2ND	UD	OD	DCC	RED*²	UD CLUTCH	LR BRAKE
D	200	2500	0	100	0	100	0	0	1.03±0.02 {10.5±0.2}	1.03±0.02 {10.5±0.2}
			100	0	0	100	0	0	1.03±0.02 {10.5±0.2}	-
R	250		0	100	100	100	0	0	-	1.55±0.25 {15.8±2.5}

Manual valve position (Oil	VFS current [mA]	RPM	Operation (Duty rate %)						Oil pressure MPa {kgf/cm²}		
			LR	2ND	UD	OD	DCC	RED*²	4000	1500	600

pressure)										(Decreasing)	(Decreasing)
D (LR)	200	600→ 4500→ 600	0	100	0	100	0	0	MAX. 1.11 {MAX. 11.3}	-	MIN. 0.55 {MIN. 5.6}
D (UD)			0	100	0	100	0	0	MAX. 1.11 {MAX. 11.3}	-	MIN. 0.55 {MIN. 5.6}
D (UD)			100	0	0	100	0	0	MAX. 1.11 {MAX. 11.3}	-	MIN. 0.55 {MIN. 5.6}
R (LR)	250		0	100	100	100	0	0	MAX. 1.96 {MAX. 20.0}	MIN. 1.14*1 {MIN. 11.6}	MIN. 0.55*1 {MIN. 5.6}

Manual valve position (Oil pressure)	VFS current [mA]	RPM	Operation (Duty rate %)						Oil pressure MPa {kgf/cm^2}		
			LR	2ND	UD	OD	DCC	RED*2	VFS current : 200mA	VFS current : 600mA	VFS current : 1100mA
D (UD)	200→ 1100→ 200	2500	100	100	0	0	100	0	1.03±0.02 {10.5±0.2}	0.69±0.03 {7.0±0.3}	0.36±0.03 {3.7±0.3}

Manual valve position	VFS current [mA]	RPM	Operation (Duty rate %)						ELEMENT	P (MPa)
			LR	2ND	UD	OD	DCC	RED*2		
D	200	2500	0	100	0	100	0	0	LR	1.03±0.02
			60	↑	↑	↑	↑	↑		0.45±0.04
			75	↑	↑	↑	↑	↑		0.19±0.04
			100	↑	↑	↑	↑	↑		0
			100	0	0	100	↑	0	2ND	1.03±0.02
			↑	60	↑	↑	↑	↑		0.50±0.05
			↑	75	↑	↑	↑	↑		0.20±0.05
			↑	100	↑	↑	↑	↑		0
			100	100	0	0	↑	0	OD	1.02±0.02
			↑	↑	↑	60	↑	↑		0.46±0.04
			↑	↑	↑	75	↑	↑		0.19±0.04
			↑	↑	↑	100	↑	↑		0
			100	100	0	0	↑	0	UD	1.03±0.02
			↑	↑	60	↑	↑	↑		0.44±0.05
			↑	↑	75	↑	↑	↑		0.18±0.04
			↑	↑	100	↑	↑	↑		0
			100	0	100	0	↑	0▼	RED	1.03±0.02
			↑	↑	↑	↑	↑	60		0.49±0.04
			↑	↑	↑	↑	↑	75		0.24±0.04
			↑	↑	↑	↑	↑	100		0
			100▼	0	100	0	↑	100	DIR	0
			75	↑	↑	↑	↑	↑		0.25±0.04
			60	↑	↑	↑	↑	↑		0.51±0.04
			0	↑	↑	↑	↑	↑		1.03±0.02

Each case of increasing (0→100%) and decreasing (100→0%) of duty rate to be satisfied.(Except the mark ▼)

Manual valve position	VFS current	RPM	Operation (Duty rate %)						Damper Apply Pressure※	Damper Release

(Oil pressure)	[mA]		LR	2ND	UD	OD	DCC	RED*²	(MPa)	Pressure (MPa)
D	200	2500	100	100	0	0	0	0	0.25~0.45	0.50~0.70
			↑	↑	↑	↑	50	↑	0.20~0.45	0
			↑	↑	↑	↑	100	↑	0.96~1.04	0
	900		100	100	0	0	0	0	0.12~0.22	0.25~0.45
			↑	↑	↑	↑	100	↑	MIN. 0.29	0

※ Each case of increasing and decreasing of DCC solenoid duty rate to be satisfied.
● The values are subject to change according to vehicle model or condition.

5. Is oil pressure value within specification?

YES

▸ Repair AUTO TRANSAXLE(Clutch or brake) as necessary and go to "Verification vehicle repair" procedure.

NO

▸ Replace AUTO TRANSAXLE (BODY CONTROL VALVE faulty) as necessary and go to "Verification vehicle repair " procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

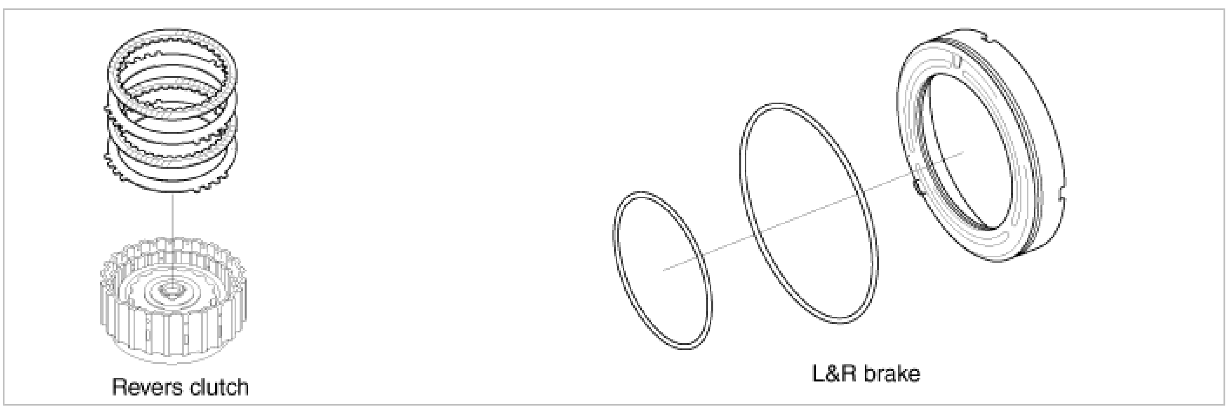
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P0736

COMPONENT LOCATION



GENERAL DESCRIPTION

The input shaft speed in gear reverse range should be the similar to the value that is what the gear reverse ratio and the output shaft speed are multipled. For example, if the output shaft speed is 1,000 rpm and the gear reverse ratio is 3.808, the input shaft speed may be about 3,808 rpm.

DTC DESCRIPTION

This code is displayed if the input shaft speed does not conform with the value which is what the output shaft speed and the gear reverse ratio are multipled. This is most likely caused by a mechanical defect of adherence of control valves or a breakdown of solenoid controlled valves etc. than a electrical defect.

DTC DETECTING CONDITION

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Reverse gear incorrect ratio	• Faulty input speed sensor • Faulty output speed sensor • Faulty RVS clutch or L/R brake
Enable Conditions	• Engine state=Run • Battery Voltage >11V and< 16 V • TM oil temperature>-23°C(-9.4°F) • Engine speed >450rpm • TM output speed >100rpm • TM Input speed≠0rpm • Current gear=reverse • Gear shifting is completed • No PRNDL fail • No error in speed sensors	
Threshold value	• │Measured input speed - calculated input speed│>200 rpm	
Diagnostic Time	• More than 1sec	
Fail Safe	• Locked into 3rd gear.	

SIGNAL WAVEFORM

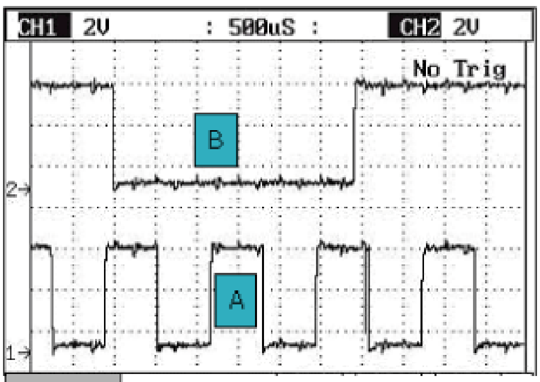


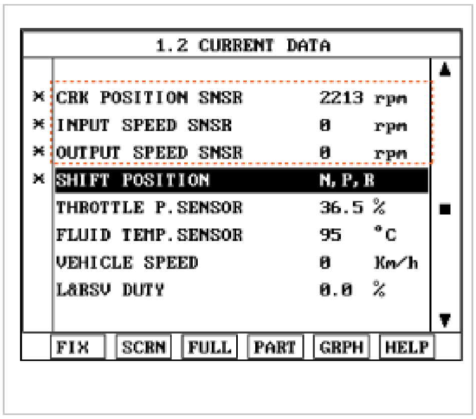
FIG.1)

A : INPUT SPEED SENSOR
B : OUTPUT SPEED SENSOR

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Engine "ON".
3. Monitor the "ENGINE SPEED, INPUT SPEED SENSOR, OUTPUT SPEED SENSOR, GEAR POSITION" parameter on the scantool.
4. Perform the "STALL TEST" with gear position "R".

Specification : 2700~2900 engine rpm



OPERATING ELEMENT OF EACH SHIFTING RANGE

Range		UD clutch	OD clutch	2ND brake	LR brake	REV clutch	RED clutch	DIR clutch	OWC	OWC1
P		-	-	-	O	-	O	-	-	-
R		-	-	-	O	O	O	-	-	-
N		-	-	-	O	-	O	-	-	-
D	1st	O	-	-	O	-	O	-	O	O
	2nd	O	-	O	-	-	O	-	O	-
	3rd	O	O	-	-	-	O	-	O	-
	4th	-	O	O	-	-	O	-	O	-
	5th	-	O	O	-	-	-	O	-	-

UD/C : Underdrive clutch
OD/C : Overdrive clutch
2ND/B : 2ND brake
LR/B : Low&Reverse brake
REV/C: Reverse clutch
RED/B: Reduction brake
DIR/C: Direct clutch
OWC : One way clutch for sub gear shifting
OWC1 : One way clutch for main gear shifting

Stall test procedure in Reverse and reason

Procedure

A. Warm up the engine
B. Fully depress the brake pedal, then place the transaxle gear lever into "R" range. Press and hold the accelerator pedal to the floor for no more than eight seconds while observing the engine, input speed, and output speed RPM values.
   * The slippage of REVERSE clutch and L/R brake can be detected by stall test in R range.

Reason for stall test

A. If there is no mechanical defaults in A/T, all slippage occurs in the torque converter.
B. Therfore, engine revolution is output, but input and output speed revolution must be "zero" due to wheel's lock.
C. If reverse clutch and L/R brake system(reverse gear operating parts) has faults, input speed revolution will be out of specification.
D. If output speed revolution is output. It means that the foot brake force is not applied fully. Remeasuring is required.

5. Is "STALL TEST " within specification?

YES

▸ Go to "Signal circuit inspection" procedure.

NO

▸ Go to "Component inspection" procedure.

CAUTION

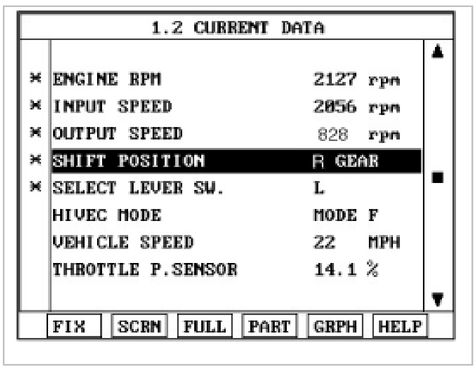
- Do not let anybody stand in front of or behind the vehicle while this test is being carried out.
- Check the A/T fluid level and temperature and the engine coolant temperature.
  - Fluid level : At the hot mark on the oil level gauge.
  - Fluid temperature : 80~100°C (176~212°F).

- Engine coolant temperature : 80~100°C (176~212°F).
● Check both rear wheel(left and right).
● Pull the parking brake lever on with the brake pedal fully depressed.
● The throttle should not be left fully open for more than eight seconds.
● If carrying out the stall test two or more time, move the select lever to the "N" position and run the engine at 1,000 rpm to let the A/T fluid cool down before carrying out subsequent tests.

SIGNAL CIRCUIT INSPECTION

1. Connect Scantool.
2. Engine "ON".
3. Monitor the "INPUT & OUTPUT SPEED SENSOR" parameter on the scantool.
4. Accelerate the Engine speed until about 2000 rpm in the "R" gear.

Specification : INPUT SPEED - (OUTPUT SPEED × GEAR RATIO) ≤ 200 RPM



5. Are "INPUT&OUTPUT SPEED SENSOR" within specifications?

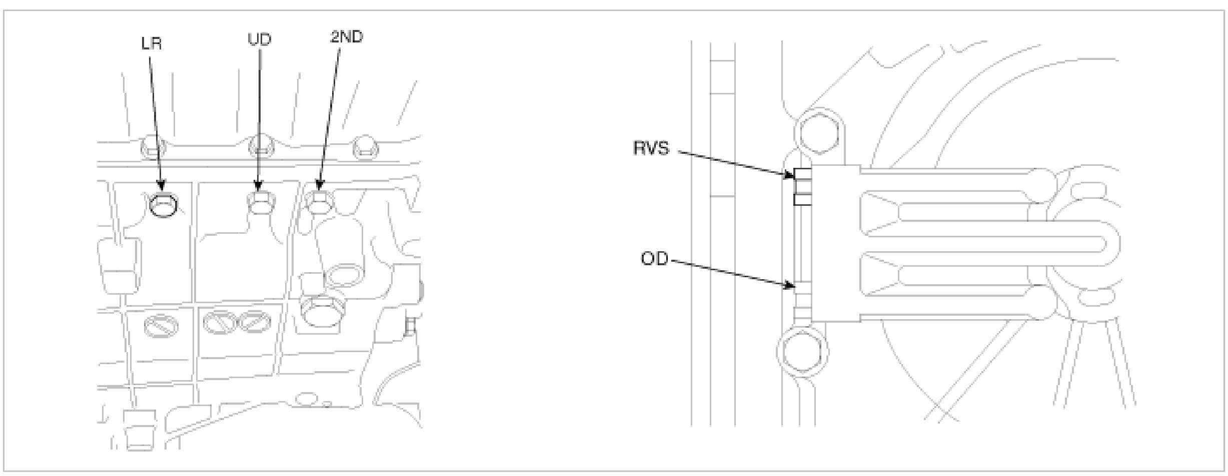
YES

▸ Go to "Component inspection" procedure.

NO

▸ Check for electrical niose of circuit in INPUT & OUTPUT SPEED SENSOR or replace INPUT & OUTPUT SPEED SENSOR. Repair as necessary and go to "Verification vehicle repair" procedure.

COMPONENT INSPECTION



1. Connect oil pressure gauge to "RVS" and "L/R" ports.
2. Engine "ON".
3. Drive a car with gear position R.
4. Compare it with referance data as below.

Specification : shown below

*1 Each case of increasing and decreasing speed.

* 2 Only for 5 speed A/T.

Manual valve position	VFS current [mA]	RPM	Operation (Duty rate %)						Oil pressure MPa {kgf/cm²}	
			LR	2ND	UD	OD	DCC	RED*²	UD CLUTCH	LR BRAKE
D	200	2500	0	100	0	100	0	0	1.03±0.02 {10.5±0.2}	1.03±0.02 {10.5±0.2}
			100	0	0	100	0	0	1.03±0.02 {10.5±0.2}	-
R	250		0	100	100	100	0	0	-	1.55±0.25 {15.8±2.5}

Manual valve position (Oil pressure)	VFS current [mA]	RPM	Operation (Duty rate %)						Oil pressure MPa {kgf/cm²}		
			LR	2ND	UD	OD	DCC	RED*²	4000	1500 (Decreasing)	600 (Decreasing)
D (LR)	200	600→ 4500→ 600	0	100	0	100	0	0	MAX. 1.11 {MAX. 11.3}	-	MIN. 0.55 {MIN. 5.6}
D (UD)			0	100	0	100	0	0	MAX. 1.11 {MAX. 11.3}	-	MIN. 0.55 {MIN. 5.6}
D (UD)			100	0	0	100	0	0	MAX. 1.11 {MAX. 11.3}	-	MIN. 0.55 {MIN. 5.6}
R (LR)	250		0	100	100	100	0	0	MAX. 1.96 {MAX. 20.0}	MIN. 1.14*¹ {MIN. 11.6}	MIN. 0.55*¹ {MIN. 5.6}

Manual valve position (Oil pressure)	VFS current [mA]	RPM	Operation (Duty rate %)						Oil pressure MPa {kgf/cm²}		
			LR	2ND	UD	OD	DCC	RED*²	VFS current : 200mA	VFS current : 600mA	VFS current : 1100mA
D (UD)	200→ 1100→ 200	2500	100	100	0	0	100	0	1.03±0.02 {10.5±0.2}	0.69±0.03 {7.0±0.3}	0.36±0.03 {3.7±0.3}

Manual valve position	VFS current [mA]	RPM	Operation (Duty rate %)						ELEMENT	P (MPa)
			LR	2ND	UD	OD	DCC	RED*²		
D	200	2500	0	100	0	100	0	0	LR	1.03±0.02
			60	↑	↑	↑	↑	↑		0.45±0.04
			75	↑	↑	↑	↑	↑		0.19±0.04
			100	↑	↑	↑	↑	↑		0
			100	0	0	100	↑	0	2ND	1.03±0.02
			↑	60	↑	↑	↑	↑		0.50±0.05
			↑	75	↑	↑	↑	↑		0.20±0.05
			↑	100	↑	↑	↑	↑		0
			100	100	0	0	↑	0	OD	1.02±0.02
			↑	↑	↑	60	↑	↑		0.46±0.04
			↑	↑	↑	75	↑	↑		0.19±0.04
			↑	↑	↑	100	↑	↑		0
			100	100	0	0	↑	0	UD	1.03±0.02
			↑	↑	60	↑	↑	↑		0.44±0.05
			↑	↑	75	↑	↑	↑		0.18±0.04

			↑	↑	100	↑	↑	↑		0
			100	0	100	0	↑	0▼	RED	1.03±0.02
			↑	↑	↑	↑	↑	60		0.49±0.04
			↑	↑	↑	↑	↑	75		0.24±0.04
			↑	↑	↑	↑	↑	100		0
			100▼	0	100	0	↑	100	DIR	0
			75	↑	↑	↑	↑	↑		0.25±0.04
			60	↑	↑	↑	↑	↑		0.51±0.04
			0	↑	↑	↑	↑	↑		1.03±0.02

Each case of increasing (0→100%) and decreasing (100→0%) of duty rate to be satisfied.(Except the mark ▼)

Manual valve position (Oil pressure)	VFS current [mA]	RPM	Operation (Duty rate %)						Damper Apply Pressure※ (MPa)	Damper Release Pressure (MPa)
			LR	2ND	UD	OD	DCC	RED*2		
D	200	2500	100	100	0	0	0	0	0.25~0.45	0.50~0.70
			↑	↑	↑	↑	50	↑	0.20~0.45	0
			↑	↑	↑	↑	100	↑	0.96~1.04	0
	900		100	100	0	0	0	0	0.12~0.22	0.25~0.45
			↑	↑	↑	↑	100	↑	MIN. 0.29	0

※ Each case of increasing and decreasing of DCC solenoid duty rate to be satisfied.

● The values are subject to change according to vehicle model or condition.

5. Is oil pressure value within specification?

YES

▸ Repair AUTO TRANSAXLE(Clutch or brake) as necessary and go to "Verification vehicle repair" procedure.

NO

▸ Replace AUTO TRANSAXLE (BODY CONTROL VALVE faulty) as necessary and go to "Verification vehicle repair " procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P0741

GENERAL DESCRIPTION

The PCM controls the locking or unlocking of the Torque Converter Clutch (or Damper Clutch) by appling hydraulic pressure. The main purpose of the TCC control is to save fuel by decreasing the hydraulic load inside the torque converter. The PCM outputs duty pulses to control the torque converter clutch control solenoid valve and hydraulic pressure is applied to the torque converter according to the torque converter clutch duty ratio value. When the duty ratio is high, high pressure is applied and the torque converter clutch is locked. The normal operating range of the torque converter clutch control duty ratio value is from 30% (unlocked) to 85%(locked).

DTC DESCRIPTION

The PCM increases the duty ratio to engage the torque converter clutch, monitoring the slip rpms (difference beteween engine speed and turbine speed). To decrease the slip of the torque converter clutch, the PCM applies more hydraulic pressure by increasing the duty ratio. When the slip rpm does not drop down below the specification with 100% duty ratio, the PCM determines that the torque converter clutch is stuck OFF and sets this code.

DTC DETECTING CONDITION

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Stuck "OFF"	※ TORQUE CONVERTER (DAMPER) CLUTCH : TCC • Faulty TCC or oil pressure system • Faulty TCC solenoid valve • Faulty body control valve • Faulty PCM
Enable Conditions	• TCC Duty cycle≠0 or TCC Abnormal slip counters ≥ 4	
Threshold value	• TCC slip counter ≥4 counts	
Diagnostic Time	• 1 second	
Fail Safe	• Stop the torque converter clutch control	

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Engine "ON".
3. Sellect "D RANGE" and drive vehicle.
4. Monitor the "TORQUE CONVERTER(DAMPER) CLUTCH" parameter on the scantool.

Specification : TCC SLIP<160RPM(In condition that TCC SOL. DUTY > 80%)

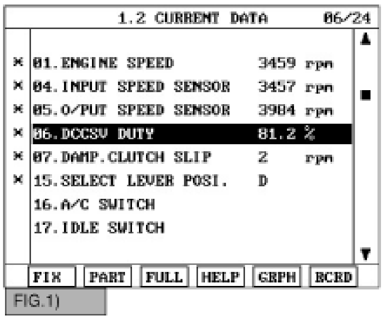


FIG.1) : Normal status

5. Are "TCC SOLENOID DUTY and TCC SLIP" within specifications?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Throughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification vehicle repair" procedure.

NO

▸ Go to "Component inspection" procedure.

COMPONENT INSPECTION

1. CHECK TORQUE CONVERTER CLUTCH SOLENOID VALVE
   (1) Connect scantool to data link connector(DLC).
   (2) Ignition "ON" & Engine "OFF".
   (3) Select A/T solenoid valve actuator test and operate actuator test.
   (4) Can you hear operating tone for using TCC SOLENOID VALVE actuator testing function?

   YES

   ▸ Go to "CHECK OIL PRESSURE" as below.

   NO

   ▸ Replace "TCC SOLENOID VALVE" as necessary and go to "Verification vehicle repair" procedure.

2. CHECK OIL PRESSURE

(1) Connect oil pressure gauge to "DA" and "DR" ports.

(2) Ignition "ON" & Engine "OFF".

(3) After connecting Scantool and monitor the "TCC SOLENIOD VALVE DUTY" parameter on the scantool data list.

(4) Select the "D" range and accelerate engine speed to 2500 rpm.

(5) Measure oil pressure.

Specification :

Manual valve position	VFS current (mA)	RPM	Operation (Duty rate %)						Damper Apply Pressure※ (MPa)	Damper Release Pressure (MPa)
			LR	2ND	UD	OD	DCC	RED*		
D	200	2500	100	100	0	0	0	0	0.25~0.45	0.50~0.70
			↑	↑	↑	↑	50	↑	0.20~0.45	0
			↑	↑	↑	↑	100	↑	0.96~1.04	0
	900		100	100	0	0	0	0	0.12~0.22	0.25~0.45
			↑	↑	↑	↑	100	↑	MIN. 0.29	0

※ Each case of increasing and decreasing of DCC solenoid duty rate to be satisfied.

(6) Is oil pressure value within specification?

YES

▸ Repair TORQUE CONVERTER CLUTCH(REPLACE Torque Converter) as necessary and go to "Verification vehicle repair " procedure.

NO

▸ Replace A/T assembly (or valve body assembly) as necessary and go to "Verification vehicle repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P0742

GENERAL DESCRIPTION

The PCM controls the locking or unlocking of the Torque Converter Clutch (or Damper Clutch) by appling hydraulic pressure. The main purpose of the TCC control is to save fuel by decreasing the hydraulic load inside the torque converter. The PCM outputs duty pulses to control the torque converter clutch control solenoid valve and hydraulic pressure is applied to the torque converter according to the torque converter clutch duty ratio value. When the duty ratio is high, high pressure is applied and the torque converter clutch is locked. The normal operating range of the torque converter clutch control duty ratio value is from 30% (unlocked) to 85%(locked).

DTC DESCRIPTION

The PCM sets this code when the absolute value of RPM difference between engine speed and input shaft speed is less than 20 RPM.

DTC DETECTING CONDITION

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Stuck "ON"	※ TORQUE CONVERTER (DAMPER) CLUTCH : TCC • Faulty TCC or oil pressure system • Faulty TCC solenoid valve • Faulty body control valve • Faulty PCM
Enable Conditions	• Engine state=Run • Throttle position sensor value ≥ 20% • TM output speed ≥ 500 rpm • Manifold air pressure >60 kPa • Current gear = 1 or 2 or 3 or 4 or 5	
Threshold value	• Absolute value of RPM difference between engine and TM input speed≤ 20 rpm	
Diagnostic Time	• 1 second	
Fail Safe	• Stop the torque converter clutch control	

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Engine "ON".
3. Sellect "D RANGE" and drive vehicle.
4. Monitor the "TORQUE CONVERTER(DAMPER) CLUTCH" parameter on the scantool.

Specification : TCC SLIP<160RPM(In condition that TCC SOL. DUTY > 80%)

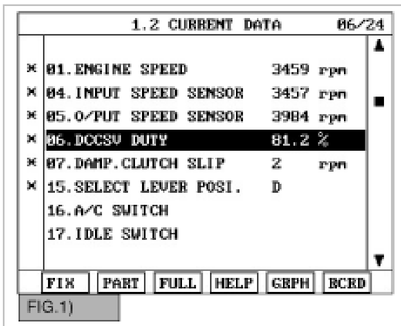


FIG.1) : Normal status

5. Are "TCC SOLENOID DUTY and TCC SLIP" within specifications?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Throughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification vehicle repair" procedure.

NO

▸ Go to "Component inspection" procedure.

COMPONENT INSPECTION

1. CHECK TORQUE CONVERTER CLUTCH SOLENOID VALVE
   (1) Connect scantool to data link connector(DLC).

(2) Ignition "ON" & Engine "OFF".

(3) Select A/T solenoid valve actuator test and operate actuator test.

(4) Can you hear operating tone for using TCC SOLENOID VALVE actuator testing function?

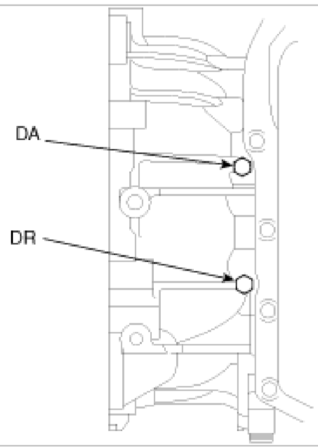
YES

▸ Go to "CHECK OIL PRESSURE" as below.

NO

▸ Replace "TCC SOLENOID VALVE" as necessary and go to "Verification vehicle repair" procedure.

2. CHECK OIL PRESSURE



(1) Connect oil pressure gauge to "DA" and "DR" ports.

(2) Ignition "ON" & Engine "OFF".

(3) After connecting Scantool and monitor the "TCC SOLENIOD VALVE DUTY" parameter on the scantool data list.

(4) Select the "D" range and accelerate engine speed to 2500 rpm.

(5) Measure oil pressure.

Specification :

Manual valve position	VFS current (mA)	RPM	Operation (Duty rate %)						Damper Apply Pressure※ (MPa)	Damper Release Pressure (MPa)
			LR	2ND	UD	OD	DCC	RED*		
D	200	2500	100	100	0	0	0	0	0.25~0.45	0.50~0.70
			↑	↑	↑	↑	50	↑	0.20~0.45	0
			↑	↑	↑	↑	100	↑	0.96~1.04	0
	900		100	100	0	0	0	0	0.12~0.22	0.25~0.45
			↑	↑	↑	↑	100	↑	MIN. 0.29	0

※ Each case of increasing and decreasing of DCC solenoid duty rate to be satisfied.

(6) Is oil pressure value within specification?

YES

▸ Repair TORQUE CONVERTER CLUTCH(REPLACE Torque Converter) as necessary and go to "Verification vehicle repair " procedure.

NO

▸ Replace A/T assembly (or valve body assembly) as necessary and go to "Verification vehicle repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

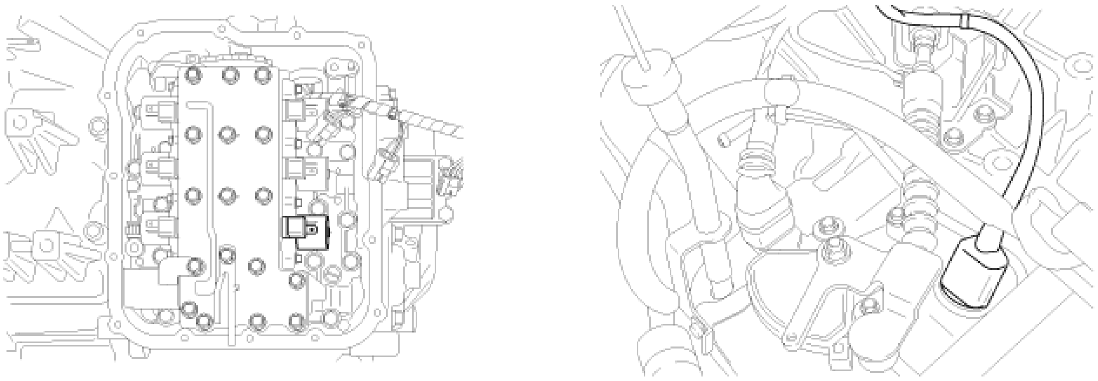
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P0743

COMPONENT LOCATION



GENERAL DESCRIPTION

The PCM controls the locking or unlocking of the Torque Converter Clutch (or Damper Clutch) by appling hydraulic pressure. The main purpose of the TCC control is to save fuel by decreasing the hydraulic load inside the torque converter. The PCM outputs duty pulses to control the torque converter clutch control solenoid valve and hydraulic pressure is applied to the torque converter according to the torque converter clutch duty ratio value. When the duty ratio is high, high pressure is applied and the torque converter clutch is locked. The normal operating range of the torque converter clutch control duty ratio value is from 30% (unlocked) to 85%(locked).

DTC DESCRIPTION

The PCM checks the torque converter clutch control signal by monitoring the feedback signal from the solenoid valve drive circuit. If an unexpected signal is monitored (for example, high voltage is detected when low voltage is expected, or low voltage is detected when high voltage is expected), the PCM judges that the torque converter clutch solenoid valve circuit is malfunctioning and sets this code.

DTC DETECTING CONDITION

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check voltage range	※ TORQUE CONVERTER (DAMPER) CLUTCH : TCC • Open or short in circuit • Faulty TCC SOLENOID VALVE • Faulty PCM
Enable Conditions	• Engine state=Run • Engine runtime >0.5 secs • Battery voltage >11V and 16 V • Transmission relay state : Relay on • Gear shifting is completed	
Threshold value	• When the PCM detects electric or electronic abnormalness such as short circuit or out of range voltage.	
Diagnostic Time	• More than 5 seconds	
Fail Safe	• Locked in 3rd gear.(Control relay off)	

SPECIFICATION

Solenoid Valve for Pressure Control

- Sensor type : Normal open 3-way
- Operating temperature : -22~266°F(-30°C~130°C)
- Frequency :

- LR, 2ND, UD, OD, RED : 61.27Hz (at the ATF temp. -20°C above)
- DCC : 30.64Hz
- VFS : 600 ± 20Hzs

• Internal resistance :

- 2.6~3.4Ω(68°F or 20°C) - LR, 2ND, UD, OD, RED, DCC
- 4.0~4.7Ω(68°F or 20°C) - VFS

• Surge voltage : 56 V(except VFS)

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC)
2. Engine "ON".
3. Monitor the "TCC SOL. VALVE" parameter on the scantool
4. Sellect "D RANGE" and Operate "TCC SOLENOID DUTY" more than 85%

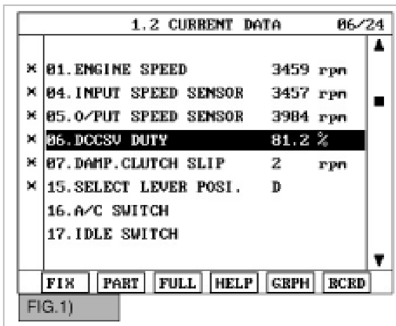


FIG.1) : Normal status

1. Does "TCC SOLENOID DUTY " follow the reference data?

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification vehicle repair" procedure.

NO

▶ Go to "Terminal&connector inspection " procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of vehicle repair" procedure.

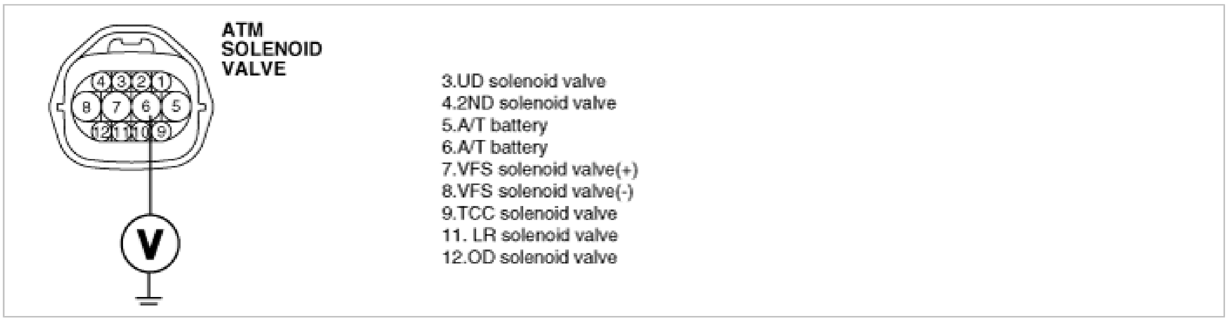
NO

▶ Go to "Power supply circuit inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Disconnect "A/T SOLENOID VALVE" connector.
2. Measure voltage between teminal "6" of the sensor harness connector and chassis ground.
3. Turn ignition switch OFF → ON

Specification: 12V is measured only for approx. 0.5sec



4. Is voltage within specifications?

YES

▸ Go to "Signal circuit inspection" procedure.

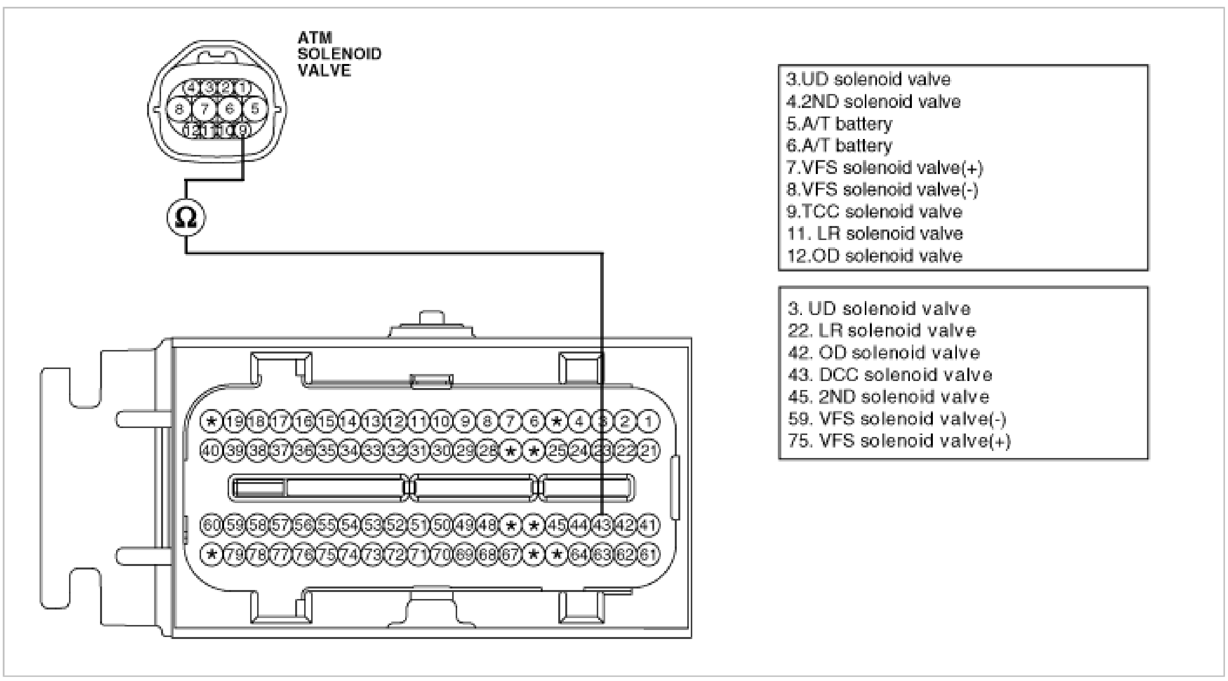
NO

▸ Check that A/T-20A fuse in engine room junction is installed or not blown.
▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check signal circuit open inspection.
   (1) Ignition "OFF".
   (2) Disconnect "A/T SOLENOID VALVE" connector and "PCM" connector.
   (3) Measure resistance between terminal "9" of the ATM SOLENOID VALVE harness connector and terminal "43" of the PCM harness connector B.

Specification: approx. 0 Ω



   (4) Is resistance within specifications?

YES

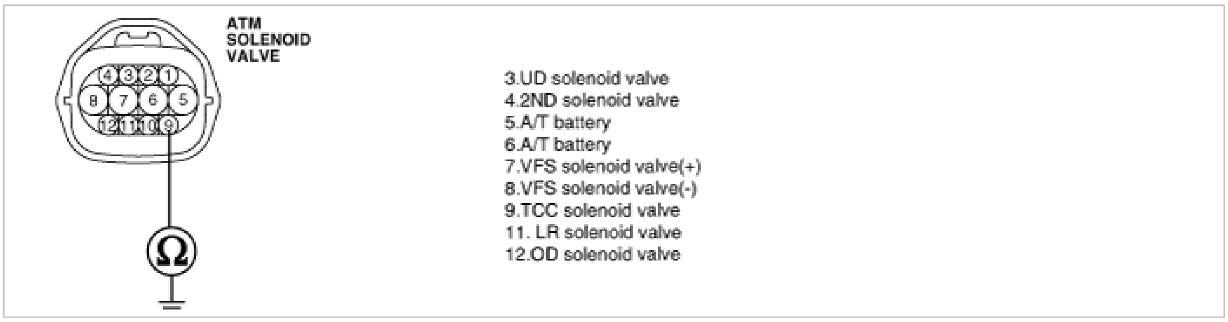
▸ Go to "Check signal circuit short inspection" procedure.

NO

▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

2. Check signal circuit short inspection
   (1) Ignition "OFF".
   (2) Disconnect "A/T SOLENOID VALVE" connector and "PCM" connector.
   (3) Measure resistance between terminal "9" of the ATM SOLENOID VALVE harness and chassis ground.

Specification: Infinite



(4) Is resistance within specifications?

YES

▸ Go to "Component inspection" procedure.

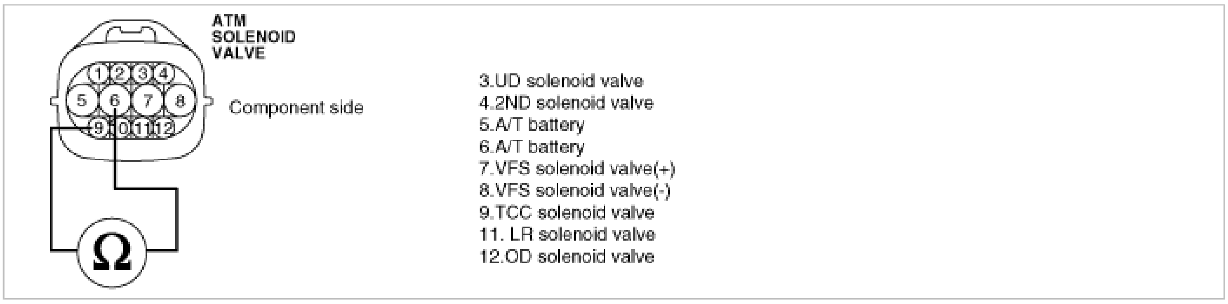
NO

▸ Check for short to ground in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

COMPONENT INSPECTION

1. CHECK SOLENOID VELVE
   (1) Ignition "OFF".
   (2) Disconnect "A/T SOLENOID VALVE" connector.
   (3) Measure resistance between terminal "9" and terminal "6" of the ATM SOLENOID VALVE harness connector.

Specification: Approximately 2.6~3.4 Ω [20°C(68°F)]



(4) Is resistance within specification?

YES

▸ Go to "CHECK PCM" as below.

NO

▸ Replace TCC SOLENOID VALVE as necessary and go to "Verification vehicle repair" procedure.

2. CHECK PCM
   (1) Connect scantool to data link connector(DLC).
   (2) Ignition "ON" & Engine "OFF".
   (3) Select A/T solenoid valve actuator test and operate actuator test.
   (4) Can you hear operating sound for TCC SOLENOID VALVE actuator testing function?

YES

▸ Go to "Verification vehicle repair" procedure.

NO

▸ Replace PCM as necessary and go to "Verification vehicle repair" procedure.

ACTUATOR TEST CONDITION

A. IG SWITCH ON
B. TRANSAXLE RANGE SWITCH is normal
C. P RANGE
D. Vehicle Speed 0km/h
E. Throttle position sensor< 1V
F. IDLE SWITCH ON

G. ENGINE RPM 0

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present?

YES

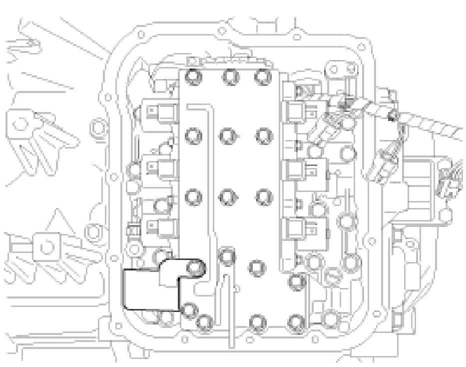
▸ Go to the applicable troubleshooting procedure.

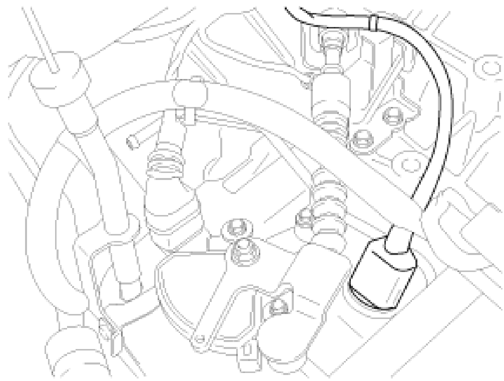
NO

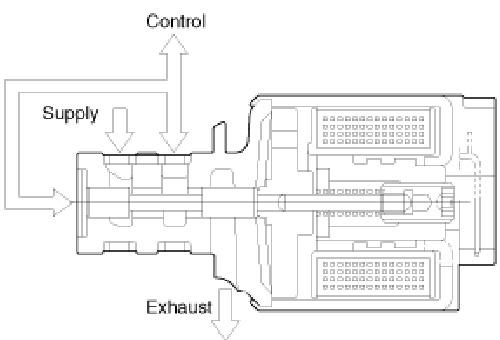
▸ System performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P0746

COMPONENT LOCATION







GENERAL DESCRIPTION

In order to control the optimum line pressure and improve the efficiency of power according to the maximum efficiency of an oil pump, VFS (Variable Force Solenoid) valve has been added in the valve body hydraulic circuit.
VFS(Variable Force Solenoid): It can be said as a linear solenoid and makes detailed spool contorl available with the closer duty (600 ± 20Hz) than PWM(Pulse Width Modulation-60Hz). PWM repeats ON/OFF signals and decides the operation flux according to the 'ON' time. But, VFS decides the operation flux according to the degree that the spool jams water course.

DTC DETECTING CONDITION

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check oil pressure and feedback current value	• Open or short in circuit • Faulty VFS SOLENOID VALVE • Faulty PCM
Enable Conditions	• Engine state=Run • VFS is enabled	
Threshold value	• Current operating state of VFS : Locked off until reset	
Diagnostic Time	• More than 1 second	

Fail Safe	• Stop the VFS control	

SPECIFICATION

Solenoid Valve for Pressure Control

- Sensor type : Normal open 3-way
- Operating temperature : -22~266°F(-30°C~130°C)
- Frequency :
  - LR, 2ND, UD, OD, RED : 61.27Hz (at the ATF temp. -20°C above)
  - DCC : 30.64Hz
  - VFS : 600 ± 20Hz
- Internal resistance :
  - 2.6~3.4Ω(68°F or 20°C) - LR, 2ND, UD, OD, RED, DCC
  - 4.0~4.7Ω(68°F or 20°C) - VFS
- Surge voltage : 56 V(except VFS)

Type: 3 way VFS valve for hydraulic control
Dither Frequency : 600±20 Hz
Sweep time : 20 sec
VFS Control pressurs

Input Current(mA)	Control Pressure (No line pressure)			
	Increasing Current			Decreasing Current
	MAX. (Kgf/cm^2) [Kpa]	MIN. (Kgf/cm^2) [Kpa]	Δ (Kgf/cm^2) [Kpa]	MIN. (Kgf/cm^2) [Kpa]
100	6.52 [639]	5.87 [575]	[64]	
200	6.23 [611]	5.70 [559]	[52]	5.43 [532]
300	5.76 [564]	5.24 [514]	[50]	4.49 [484]
400	5.08 [498]	4.59 [450]	[48]	4.30 [421]
500	4.24 [416]	3.78 [370]	[46]	3.52 [345]
700	2.29 [224]	1.82 [178]	[46]	1.51 [148]
800	1.41 [138]	0.09 [88]	[50]	0.58 [57]
900	0.65 [64]	0.14 [14]	[50]	0 [0]
1,000	0.24 [24]	0 [0]	[24]	
1,100	0.24 [24]	0 [0]	[24]	

*Test condition
Ps : Supply Pressure (Ps = 7.1±0.3 KGf/cm^2)
Pc : Control Pressure
Pex : Exhaust Pressure (Atmosphere pressure)
ATF : DIAMOND ATF SP-III
ATF temperature : 30±3°C (86°F)
- Coil resistance : 4.35±35Ω
- Dither freauency : 600±20Hz

In case of VFS solenoid valve, the relation between duty and oil pressure can't be expressed.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   ▸ Repair as necessary and then go to "Verification of vehicle repair" procedure.

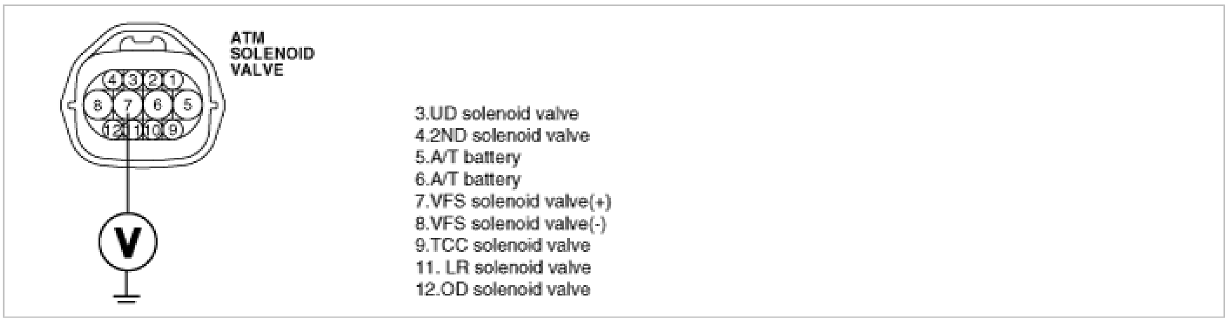
   NO

   ▸ Go to "Power supply circuit inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Disconnect "A/T SOLENOID VALVE" connector.
2. Measure voltage between teminal "7" of the sensor harness connector and chassis ground.
3. Turn ignition switch OFF → ON

Specification: 12V is measured only for approx. 0.5sec



4. Is voltage within specifications?

YES

▸ Go to "Signal circuit inspection" procedure.

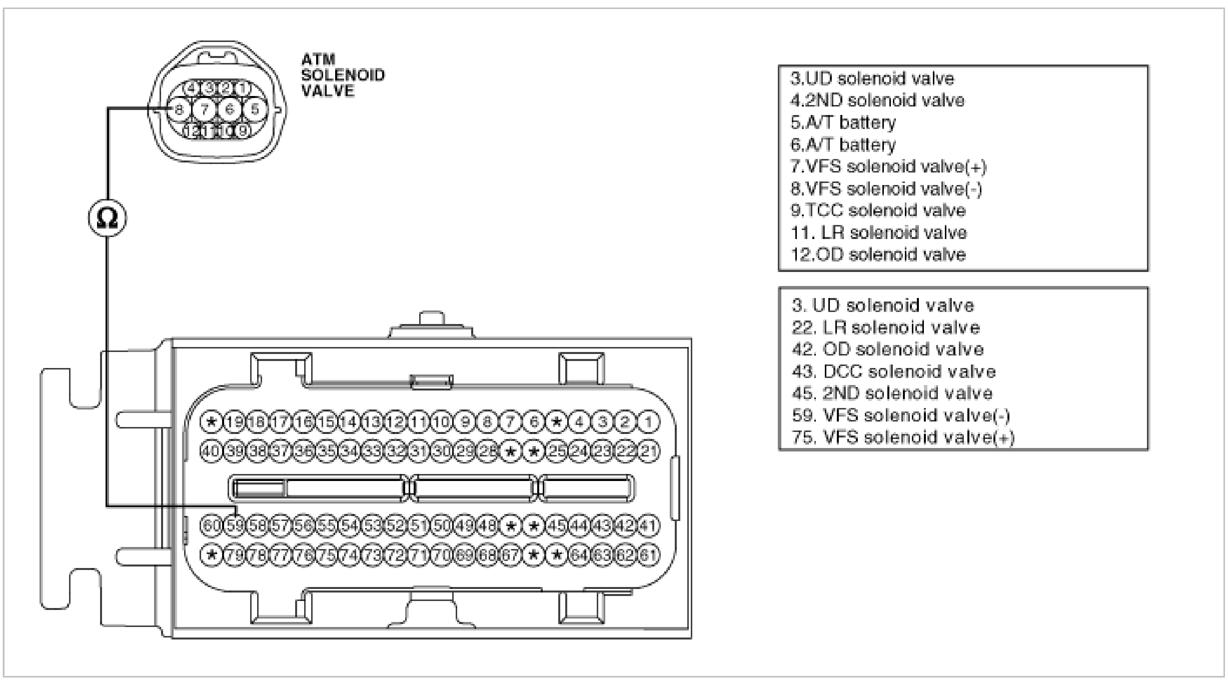
NO

▸ Check that A/T-20A fuse in engine room junction is installed or not blown.
▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check signal circuit open inspection.
   (1) Ignition "OFF".
   (2) Disconnect "ATM SOLENOID VALVE" connector and "PCM" connector.
   (3) Measure resistance between terminal "8" of the ATM SOLENOID VALVE harness connector and terminal "59" of the PCM harness connector.

   Specification: approx. 0 Ω



   (4) Is resistance within specifications?

YES

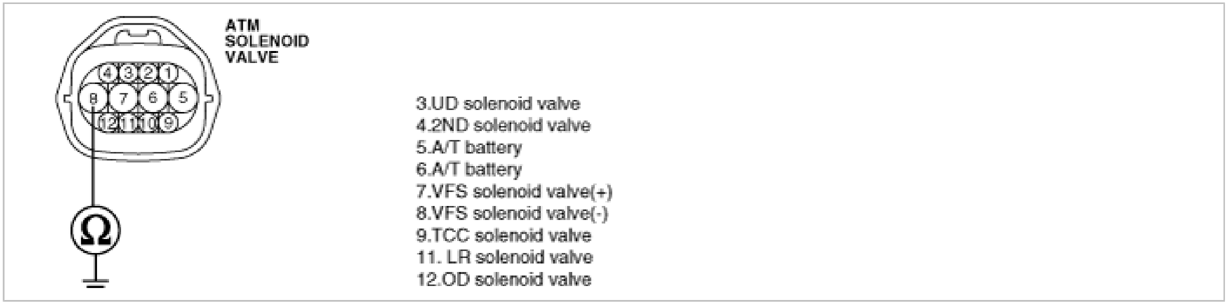
▸ Go to "Check signal circuit short inspection" procedure.

NO

▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

2. Check signal circuit short inspection
   (1) Ignition "OFF".
   (2) Disconnect "ATM SOLENOID VALVE" connector and "PCM" connector
   (3) Measure resistance between terminal "8" of the ATM SOLENOID VALVE harness and chassis ground.

Specification: Infinite



   (4) Is resistance within specifications?

YES

▸ Go to "Component inspection" procedure.

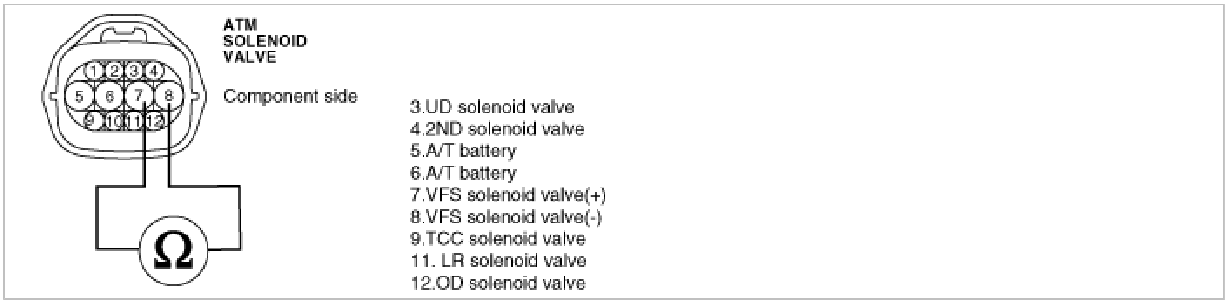
NO

▸ Check for short to ground in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

COMPONENT INSPECTION

1. CHECK SOLENOID VELVE
   (1) Ignition "OFF".
   (2) Disconnect "ATM SOLENOID VALVE" connector.
   (3) Measure resistance between terminal "7" and terminal "8" of the ATM SOLENOID VALVE harness connector.

Specification: Approximately 4.0~4.7 Ω [20°C(68°F)]



   (4) Is resistance within specification?

YES

▸ Go to "CHECK PCM" as below.

NO

▸ Replace VFS SOLENOID VALVE as necessary and go to "Verification vehicle repair" procedure.

2. CHECK PCM
   (1) Connect scantool to data link connector(DLC).
   (2) Ignition "ON" & Engine "OFF".
   (3) Select A/T Solenoid valve Actuator test and Operate Actuator test.
   (4) Can you hear operating sound for VFS SOLENOID VALVE actuator testing function?

YES

▸ Go to "Verification vehicle repair" procedure.

NO

▸ Replace PCM as necessary and go to "Verification vehicle repair" procedure.

ACTUATOR TEST CONDITION

A. IG SWITCH ON
B. TRANSAXLE RANGE SWITCH is normal
C. P RANGE
D. Vehicle Speed 0km/h
E. Throttle position sensor< 1V
F. IDLE SWITCH ON
G. ENGINE RPM 0

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present?

YES

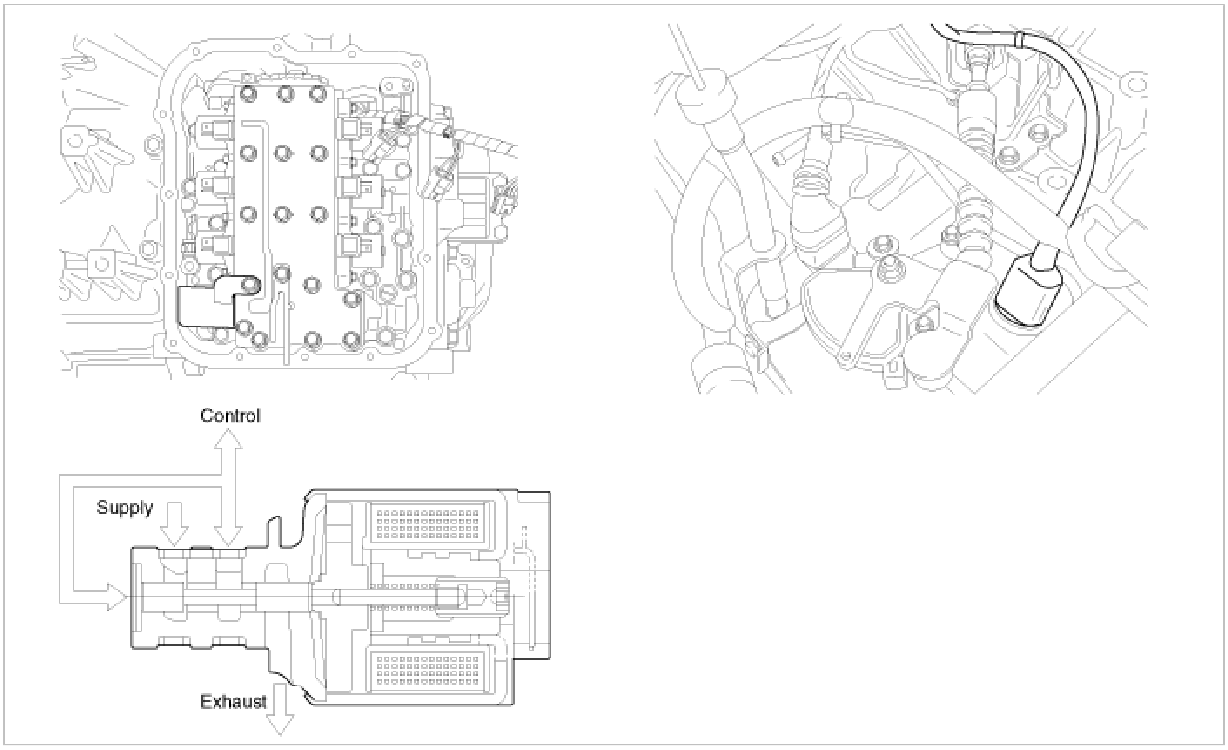
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P0748

COMPONENT LOCATION



GENERAL DESCRIPTION

In order to control the optimum line pressure and improve the efficiency of power according to the maximum efficiency of an oil pump, VFS (Variable Force Solenoid) valve has been added in the valve body hydraulic circuit.
VFS(Variable Force Solenoid): It can be said as a linear solenoid and makes detailed spool contorl available with the closer duty (600 ± 20Hz) than PWM(Pulse Width Modulation-60Hz). PWM repeats ON/OFF signals and decides the operation flux according to the 'ON' time. But, VFS decides the operation flux according to the degree that SPOOL jams water course.

DTC DESCRIPTION

PCM inspects VFS by monitoring the feedback signal from the solenoid controlled valves. When such malfunction as case that, for example, low voltage should be inputted but High voltage is inputted and vice versa), PCM decides that VFS is malfunctioning and gives this code.

DTC DETECTING CONDITION

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check oil pressure and feedback current value	• Open or short in circuit • Faulty VFS SOLENOID VALVE • Faulty PCM
Enable Conditions	• Engine state=Run • Engine runtime >0.5 secs • Battery voltage>11V and 16V • Transmission relay state : Relay on • Gear shifting is completed	
Threshold value	• When the PCM detects electric or electronic abnormalness such as short circuit or out of range voltage	
Diagnostic Time	• More than 5 seconds	
Fail Safe	• Stop the VFS control	

SPECIFICATION

Solenoid Valve for Pressure Control

- Sensor type : Normal open 3-way
- Operating temperature : -22~266°F(-30°C~130°C)
- Frequency :
  - LR, 2ND, UD, OD, RED : 61.27Hz (at the ATF temp. -20°C above)
  - DCC : 30.64Hz
  - VFS : 600 ± 20Hz
- Internal resistance :
  - 2.6~3.4Ω(68°F or 20°C) - LR, 2ND, UD, OD, RED, DCC
  - 4.0~4.7Ω(68°F or 20°C) - VFS
- Surge voltage : 56 V(except VFS)

Type: 3 way VFS valve for hydraulic control
Dither Frequency : 600±20 Hz
Sweep time : 20 sec

VFS Control pressurs

Input Current(mA)	Control Pressure (No line pressure)			
	Increasing Current			Decreasing Current
	MAX. (Kgf/cm²) [Kpa]	MIN. (Kgf/cm²) [Kpa]	Δ (Kgf/cm²) [Kpa]	MIN. (Kgf/cm²) [Kpa]
100	6.52 [639]	5.87 [575]	[64]	
200	6.23 [611]	5.70 [559]	[52]	5.43 [532]
300	5.76 [564]	5.24 [514]	[50]	4.49 [484]
400	5.08 [498]	4.59 [450]	[48]	4.30 [421]
500	4.24 [416]	3.78 [370]	[46]	3.52 [345]
700	2.29 [224]	1.82 [178]	[46]	1.51 [148]
800	1.41 [138]	0.09 [88]	[50]	0.58 [57]
900	0.65 [64]	0.14 [14]	[50]	0 [0]
1,000	0.24 [24]	0 [0]	[24]	
1,100	0.24 [24]	0 [0]	[24]	

*Test condition
Ps : Supply Pressure (Ps = 7.1±0.3 KGf/cm²)
Pc : Control Pressure
Pex : Exhaust Pressure (Atmosphere pressure)

ATF : DIAMOND ATF SP-III
ATF temperature : 30±3°C (86°F)
- Coil resistance : 4.35±35Ω
- Dither freauency : 600±20Hz
In case of VFS solenoid valve, the relation between duty and oil pressure can't be expressed.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and then go to "Verification of vehicle repair" procedure.

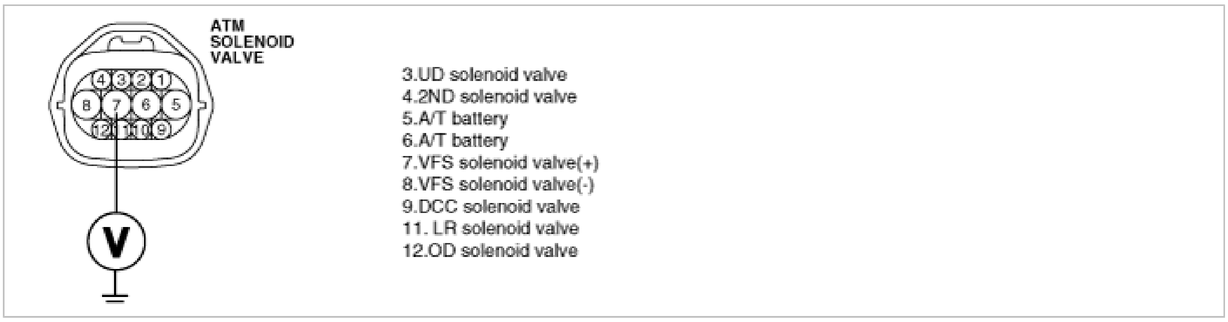
NO

▸ Go to "Power supply circuit inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Disconnect "ATM SOLENOID VALVE" connector.
2. Measure voltage between teminal "7" of the sensor harness connector and chassis ground.
3. Turn ignition switch OFF → ON

Specification: 12V is measured only for approx. 0.5sec



4. Is voltage within specifications?

YES

▸ Go to "Signal circuit inspection" procedure.

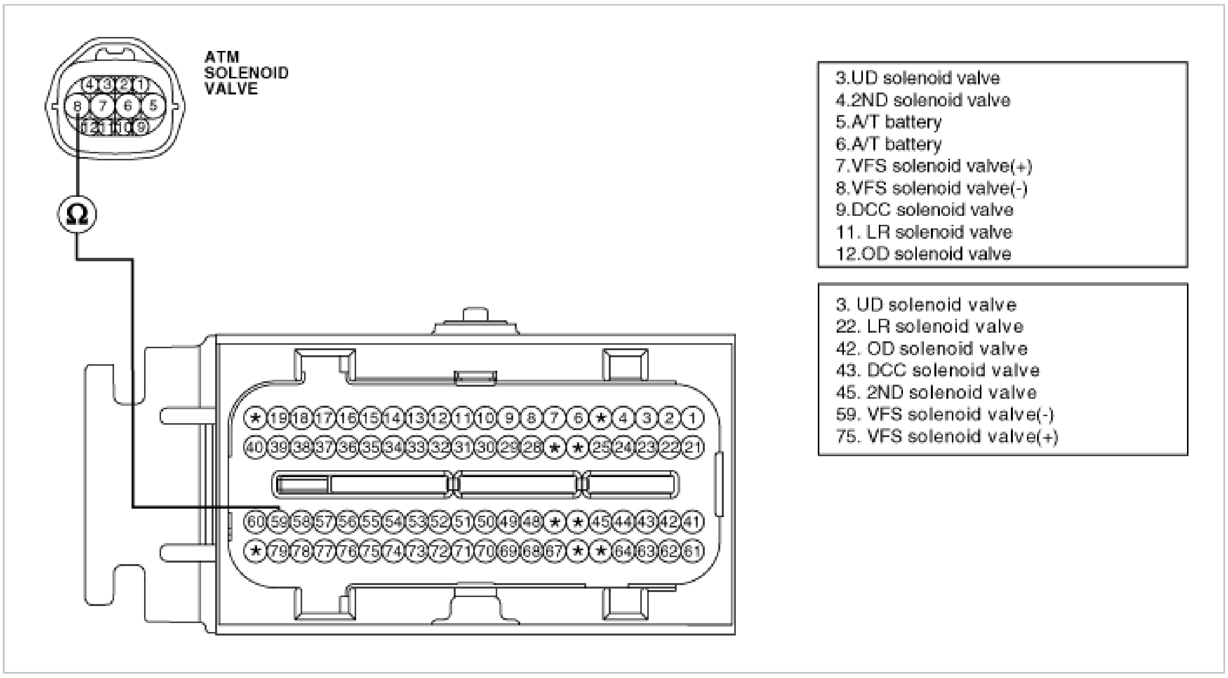
NO

▸ Check that A/T-20A fuse in engine room junction is installed or not blown.
▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check signal circuit open inspection.
   (1) Ignition "OFF".
   (2) Disconnect "ATM SOLENOID VALVE" connector and "PCM" connector.
   (3) Measure resistance between terminal "8" of the ATM SOLENOID VALVE harness connector and terminal "59" of the PCM harness connector.

   Specification: approx. 0 Ω



(4) Is resistance within specifications?

YES

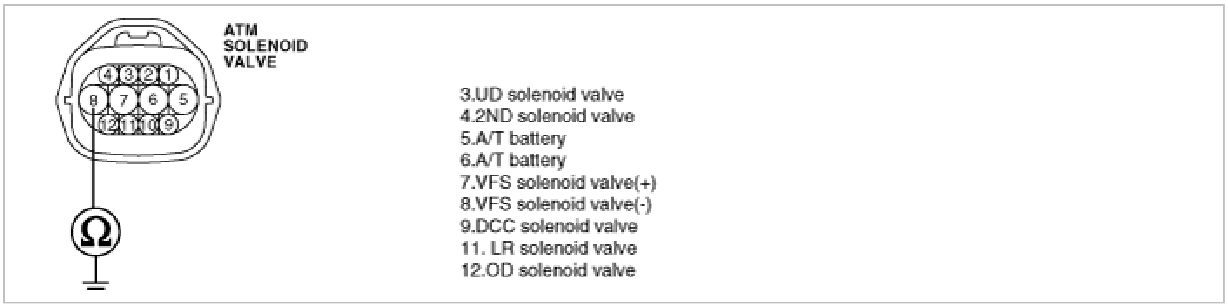
▶ Go to "Check signal circuit short inspection" procedure.

NO

▶ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

2. Check signal circuit short inspection
   (1) Ignition "OFF".
   (2) Disconnect "ATM SOLENOID VALVE" connector and "PCM" connector
   (3) Measure resistance between terminal "8" of the ATM SOLENOID VALVE harness and chassis ground.

Specification: Infinite



(4) Is resistance within specifications?

YES

▶ Go to "Component inspection" procedure.

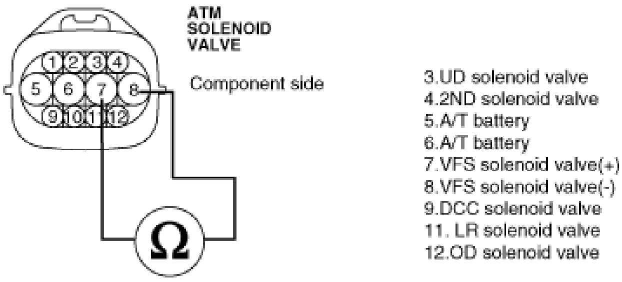
NO

▶ Check for short to ground in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

COMPONENT INSPECTION

1. CHECK SOLENOID VELVE
   (1) Ignition "OFF".
   (2) Disconnect "ATM SOLENOID VALVE" connector.
   (3) Measure resistance between terminal "7" and terminal "8" of the ATM SOLENOID VALVE harness connector.

Specification: Approximately 4.0~4.7 Ω [20°C(68°F)]



(4) Is resistance within specification?

YES

▸ Go to "CHECK PCM" as below.

NO

▸ Replace VFS SOLENOID VALVE as necessary and go to "Verification vehicle repair" procedure.

2. CHECK PCM
   (1) Connect scantool to data link connector(DLC).
   (2) Ignition "ON" & Engine "OFF".
   (3) Select A/T Solenoid valve Actuator test and Operate Actuator test.
   (4) Can you hear operating sound for VFS SOLENOID VALVE actuator testing function?

YES

▸ Go to "Verification vehicle repair" procedure.

NO

▸ Replace PCM as necessary and go to "Verification vehicle repair" procedure.

ACTUATOR TEST CONDITION

A. IG SWITCH ON
B. TRANSAXLE RANGE SWITCH is normal
C. P RANGE
D. Vehicle Speed 0km/h
E. Throttle position sensor< 1V
F. IDLE SWITCH ON
G. ENGINE RPM 0

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present?

YES

▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

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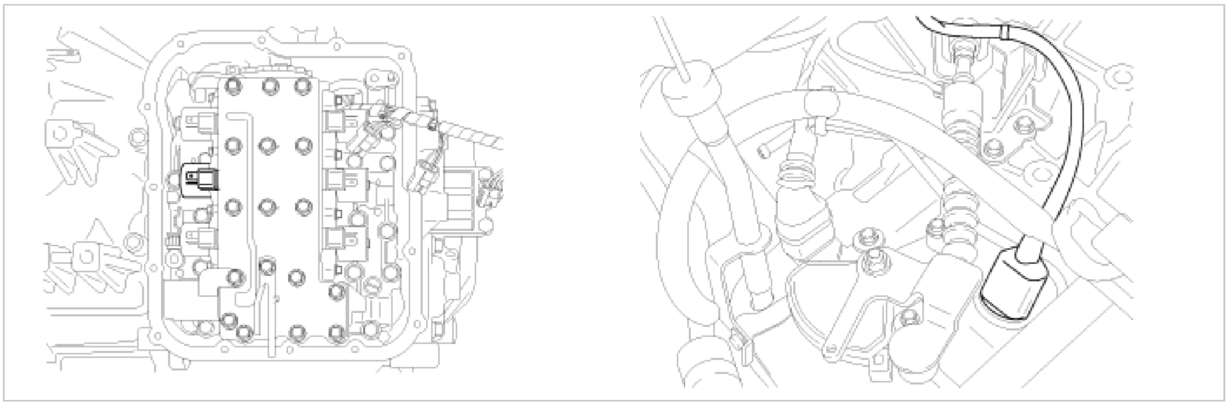
COMPONENT LOCATION



GENERAL DESCRIPTION

The Automatic transmission changes the gear position of the transmission by utilizing a combination of clutches and brakes, which are controlled by solenoid valves. This automatic transmission consists of a: LR (Low and Reverse Brake), 2ND (2nd Brake), UD (Under Drive Clutch), OD (Over Drive Clutch), REV (Reverse Clutch), and a RED (Reduction Brake, only for 5 speed transmissions). The LR brake is engaged in the 1st gear and P/R/N gear positions.

DTC DESCRIPTION

The PCM checks the low and reverse control signal by monitoring the feedback signal from the solenoid valve drive circuit. If an unexpected signal is monitored (for example, high voltage is detected when low voltage is expected, or low voltage is detected when high voltage is expected), the PCM judges that the low and reverse control solenoid circuit is malfunctioning and sets this code.

DTC DETECTING CONDITION

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check voltage range	• Open or short in circuit • Faulty LR SOLENOID VALVE • Faulty PCM
Enable Conditions	• Engine state=Run • Engine runtime >0.5 secs • Battery voltage >11V and 16 V • Transmission relay state : Relay on • Gear shifting is completed	
Threshold value	• When the PCM detects electric or electronic abnormalness such as short circuit or out of range voltage.	
Diagnostic Time	• More than 5 seconds	
Fail Safe	• Locked in 3rd gear.(Control relay off)	

SPECIFICATION

Solenoid Valve for Pressure Control

- Sensor type : Normal open 3-way
- Operating temperature : -22~266°F(-30°C~130°C)
- Frequency :
  - LR, 2ND, UD, OD, RED : 61.27Hz (at the ATF temp. -20°C above)
  - DCC : 30.64Hz
  - VFS : 600 ± 20Hzs
- Internal resistance :
  - 2.6~3.4Ω(68°F or 20°C) - LR, 2ND, UD, OD, RED, DCC
  - 4.0~4.7Ω(68°F or 20°C) - VFS
- Surge voltage : 56 V(except VFS)

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).

2. Engine "ON".
3. Monitor the "LR SOL. VALVE" parameter on the scantool.
4. Shift gear position 1st to 2nd.

Specification: 1st → 0%, 2nd → 100%

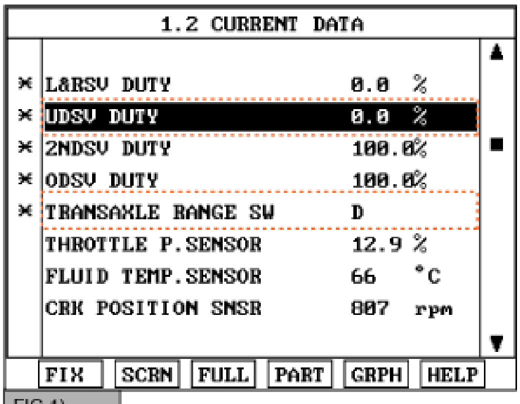


FIG.1)

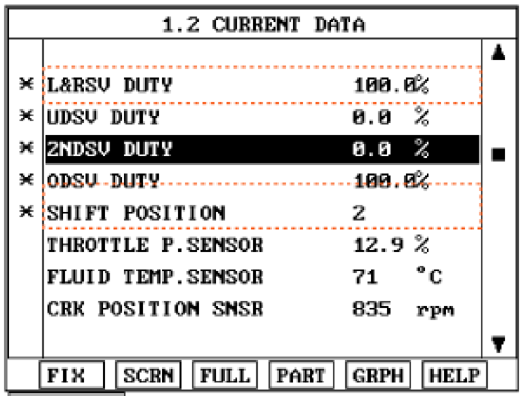


FIG.2)

FIG. 1) 1st gear
FIG. 2) 2nd gear

5. Does "LR SOLENOID DUTY " follow the reference data?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification vehicle repair" procedure.

NO

▸ Go to "Terminal&connector inspection " procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and then go to "Verification of vehicle repair" procedure.

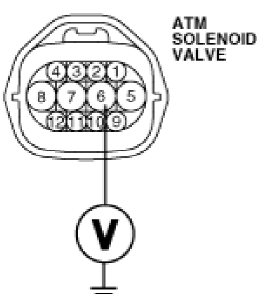
NO

▸ Go to "Power supply circuit inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Disconnect "ATM SOLENOID VALVE" connector.
2. Measure voltage between terminal "6" of the sensor harness connector and chassis ground.
3. Turn ignition switch OFF → ON.

Specification: 12V is measured only for approx. 0.5sec



3.UD solenoid valve
4.2ND solenoid valve
5.A/T battery
6.A/T battery
7.VFS solenoid valve(+)
8.VFS solenoid valve(-)
9.DCC solenoid valve
11. LR solenoid valve
12.OD solenoid valve

4. Is voltage within specifications?

YES

▸ Go to "Signal circuit inspection" procedure.

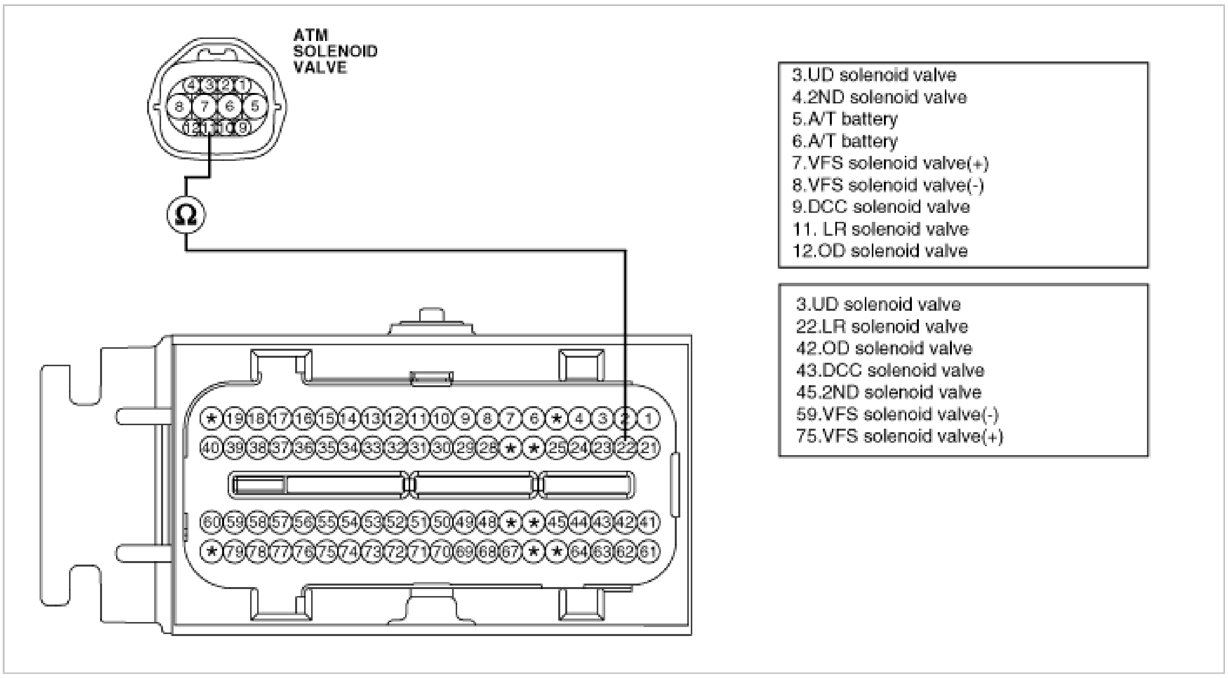
NO

▸ Check that A/T-20A fuse in engine room junction is installed or not blown.
▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check signal circuit open inspection
   (1) Ignition "OFF".
   (2) Disconnect "ATM SOLENOID VALVE" connector and "PCM" connector.
   (3) Measure resistance between terminal "11" of the ATM SOLENOID VALVE harness connector and terminal "22" of the PCM harness connector B.

   Specification: approx. 0 Ω



   (4) Is resistance within specifications?

   YES

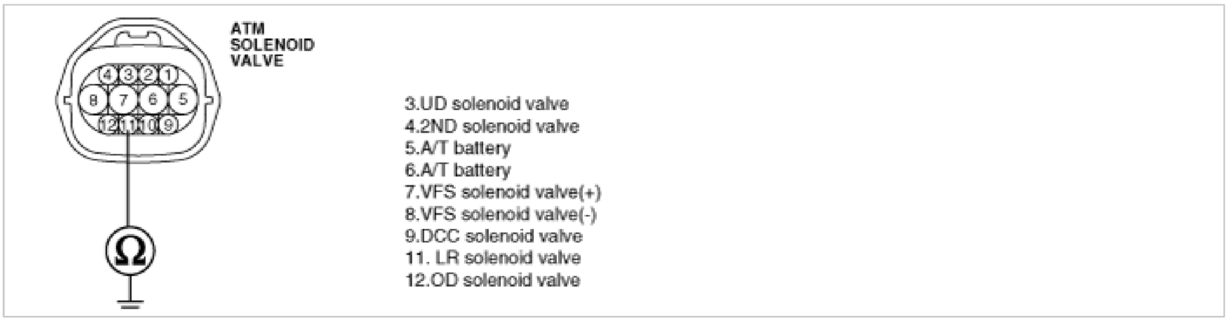
   ▸ Go to "Check signal circuit short inspection" procedure.

   NO

   ▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

2. Check signal circuit short inspection
   (1) Ignition "OFF".
   (2) Disconnect "ATM SOLENOID VALVE" connector and "PCM" connector.
   (3) Measure resistance between terminal "11" of the ATM SOLENOID VALVE harness and chassis ground.

   Specification: Infinite



(4) Is resistance within specifications?

YES

▸ Go to "Component inspection" procedure.

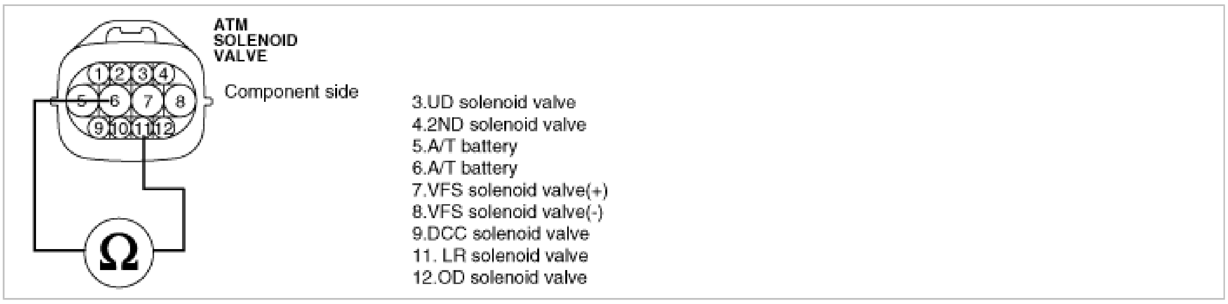
NO

▸ Check for short to ground in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

COMPONENT INSPECTION

1. CHECK SOLENOID VELVE
   (1) Ignition "OFF".
   (2) Disconnect "ATM SOLENOID VALVE" connector.
   (3) Measure resistance between terminal "11" and terminal "6" of the ATM SOLENOID VALVE harness connector.

Specification: Approximately 2.6~3.4 Ω [20°C(68°F)]



(4) Is resistance within specification?

YES

▸ Go to "CHECK PCM" as below.

NO

▸ Replace LR SOLENOID VALVE as necessary and go to "Verification vehicle repair" procedure.

2. CHECK PCM
   (1) Connect scantool to data link connector(DLC).
   (2) Ignition "ON" & Engine "OFF".
   (3) Select A/T solenoid valve actuator test and operate actuator test.
   (4) Can you hear operating sound for LR SOLENOID VALVE actuator testing function?

YES

▸ Go to "Verification vehicle repair" procedure.

NO

▸ Replace PCM as necessary and go to "Verification vehicle repair" procedure.

ACTUATOR TEST CONDITION

A. IG SWITCH ON
B. TRANSAXLE RANGE SWITCH is normal
C. P RANGE
D. Vehicle Speed 0km/h
E. Throttle position sensor < 1V
F. IDLE SWITCH ON
G. ENGINE RPM 0

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

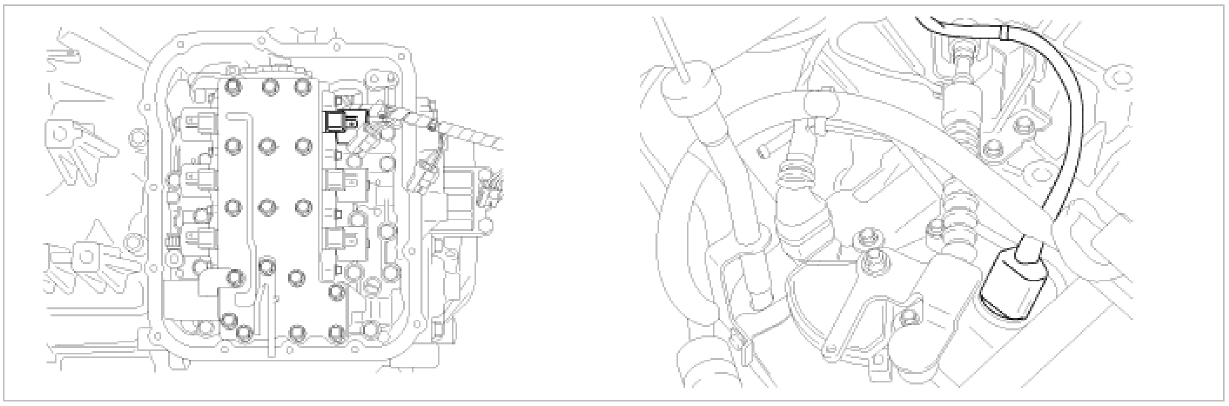
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P0755

COMPONENT LOCATION



GENERAL DESCRIPTION

The Automatic transmission changes the gear position of the transmission by utilizing a combination of clutches and brakes, which are controlled by solenoid valves. This automatic transmission consists of a: LR (Low and Reverse Brake), 2ND (2nd Brake), UD (Under Drive Clutch), OD (Over Drive Clutch), REV (Reverse Clutch), and a RED (Reduction Brake, only for 5 speed transmissions).
The UD clutch is engaged in the 1st/2nd/3rd/4th gear positions.

DTC DESCRIPTION

The PCM checks the UD clutch control signal by monitoring the feedback signal from the solenoid valve drive circuit. If an unexpected signal is monitored (for example, high voltage is detected when low voltage is expected, or low voltage is detected when high voltage is expected), the PCM judges that the UD clutch control solenoid circuit is malfunctioning and sets this code.

DTC DETECTING CONDITION

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check voltage range	• Open or short in circuit • Faulty UD SOLENOID VALVE • Faulty PCM
Enable Conditions	• Engine state=Run • Engine runtime >0.5 secs • Battery voltage >11V and 16 V • Transmission relay state : Relay on • Gear shifting is completed	
Threshold value	• When the PCM detects electric or electronic abnormalness such as short circuit or out of range voltage.	
Diagnostic Time	• More than 5 seconds	
Fail Safe	• Locked in 3rd gear.(Control relay off)	

SPECIFICATION

Solenoid Valve for Pressure Control

- Sensor type : Normal open 3-way
- Operating temperature : -22~266°F(-30°C~130°C)
- Frequency :
  - LR, 2ND, UD, OD, RED : 61.27Hz (at the ATF temp. -20°C above)
  - DCC : 30.64Hz
  - VFS : 600 ± 20Hzs
- Internal resistance :
  - 2.6~3.4Ω(68°F or 20°C) - LR, 2ND, UD, OD, RED, DCC
  - 4.0~4.7Ω(68°F or 20°C) - VFS
- Surge voltage : 56 V(except VFS)

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC)
2. Engine "ON".
3. Monitor the "UD SOL. VALVE" parameter on the scantool.
4. Shift gear position "N" to "D".

Specification: P/N → 100%, D → 0.0%

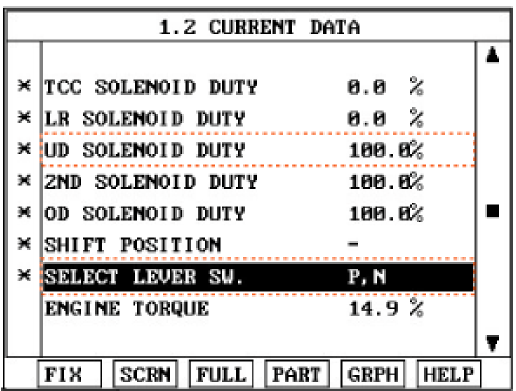


FIG.1)

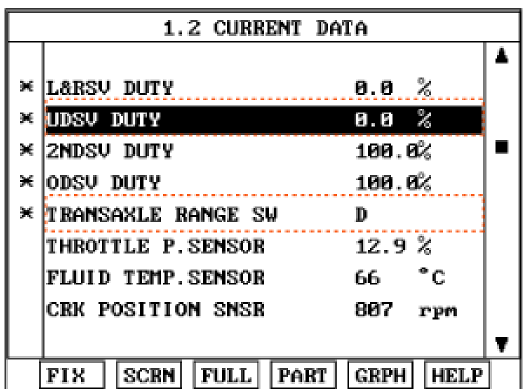


FIG.2)

FIG. 1) P/N Range
FIG. 2) D Range

5. Does "UD SOLENOID DUTY " follow the reference data?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification vehicle repair" procedure.

NO

▸ Go to "Terminal&connector inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and then go to "Verification of vehicle repair" procedure.

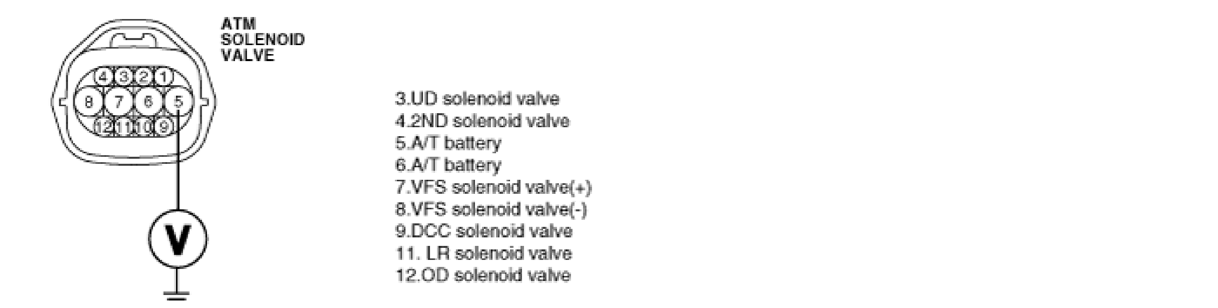
NO

▸ Go to "Power supply circuit inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Disconnect "ATM SOLENOID VALVE" connector.
2. Measure voltage between terminal "5" of the sensor harness connector and chassis ground.
3. Turn ignition switch OFF → ON.

Specification: 12V is measured only for approx. 0.5sec



4. Is voltage within specifications?

YES

▸ Go to "Signal circuit inspection" procedure.

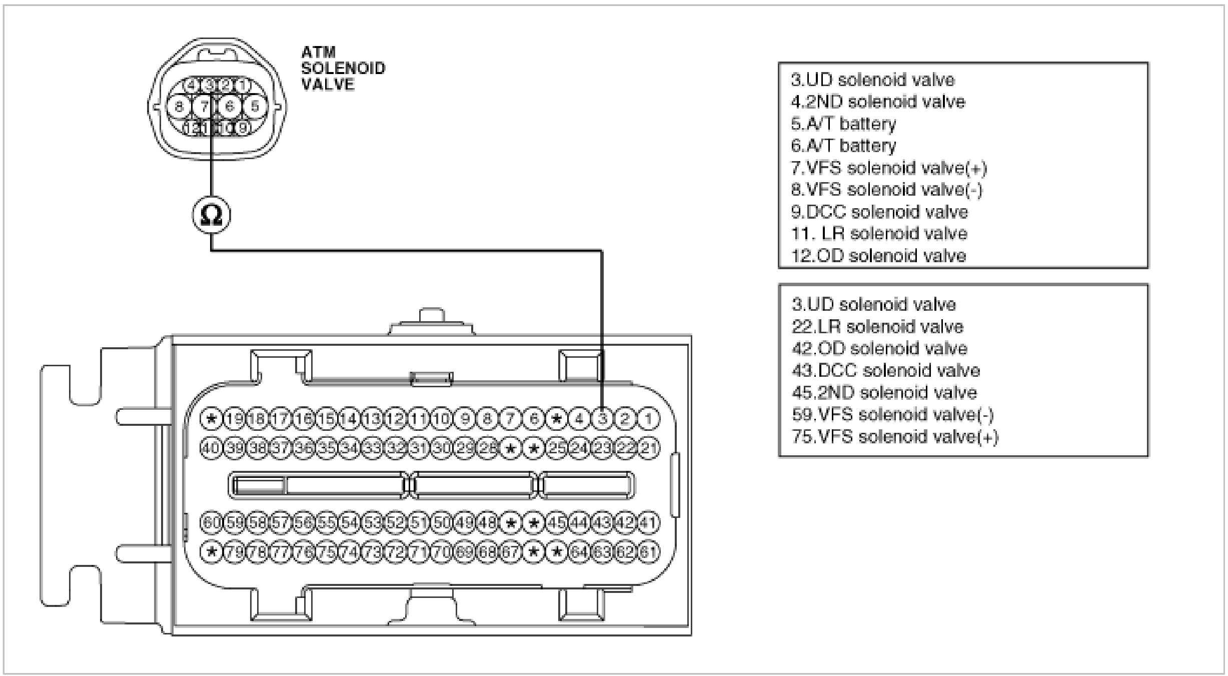
NO

▸ Check that A/T-20A fuse in engine room junction is installed or not blown.
▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check signal circuit open inspection
   (1) Ignition "OFF".
   (2) Disconnect "ATM SOLENOID VALVE" connector and "PCM" connector.
   (3) Measure resistance between terminal "3" of the ATM SOLENOID VALVE harness connector and terminal "3" of the PCM harness connector B.

   Specification: approx. 0 Ω



   (4) Is resistance within specifications?

YES

▸ Go to "Check signal circuit short inspection" procedure.

NO

▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

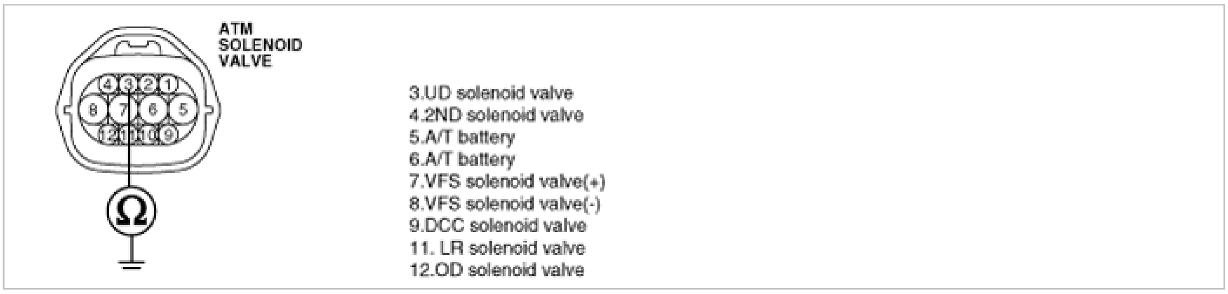
2. Check signal circuit short inspection

(1) Ignition "OFF".

(2) Disconnect "ATM SOLENOID VALVE" connector and "PCM" connector.

(3) Measure resistance between terminal "3" of the ATM SOLENOID VALVE harness and chassis ground.

Specification: Infinite



(4) Is resistance within specifications?

YES

▸ Go to "Component inspection" procedure.

NO

▸ Check for short to ground in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

COMPONENT INSPECTION

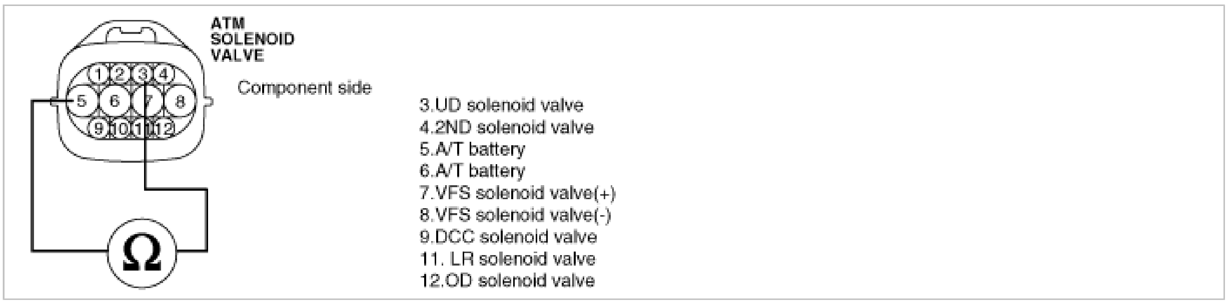
1. CHECK SOLENOID VELVE

(1) Ignition "OFF".

(2) Disconnect "ATM SOLENOID VALVE" connector.

(3) Measure resistance between terminal "3" and terminal "5" of the ATM SOLENOID VALVE harness connector.

Specification: Approximately 2.6~3.4 Ω [20°C(68°F)]



(4) Is resistance within specification?

YES

▸ Go to "CHECK PCM" as below.

NO

▸ Replace UD SOLENOID VALVE as necessary and go to "Verification vehicle repair" procedure.

2. CHECK PCM

(1) Connect scantool to data link connector(DLC).

(2) Ignition "ON" & Engine "OFF".

(3) Select ATM solenoid valve actuator test and operate actuator test.

(4) Can you hear operating sound for UD SOLENOID VALVE actuator testing function?

YES

▸ Go to "Verification vehicle repair" procedure.

NO

▸ Replace PCM as necessary and go to "Verification vehicle repair" procedure.

ACTUATOR TEST CONDITION

A. IG SWITCH ON

B. TRANSAXLE RANGE SWITCH is normal
C. P RANGE
D. Vehicle Speed 0km/h
E. Throttle position sensor < 1V
F. IDLE SWITCH ON
G. ENGINE RPM 0

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

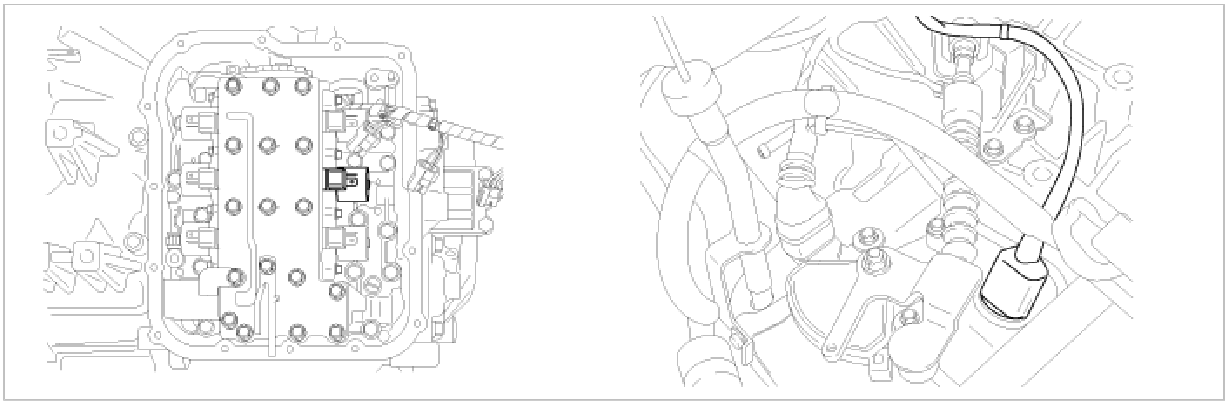
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P0760

COMPONENT LOCATION



GENERAL DESCRIPTION

The Automatic transmission changes the gear position of the transmission by utilizing a combination of clutches and brakes, which are controlled by solenoid valves. This automatic transmission consists of a: LR (Low and Reverse Brake), 2ND (2nd Brake), UD (Under Drive Clutch), OD (Over Drive Clutch), REV (Reverse Clutch), and a RED (Reduction Brake, only for 5 speed transmissions).
The 2ND brake is engaged in the 2nd and 5th gear positions.

DTC DESCRIPTION

The PCM checks the 2ND brake control signal by monitoring the feedback signal from the solenoid valve drive circuit. If an unexpected signal is monitored (for example, high voltage is detected when low voltage is expected, or low voltage is detected when high voltage is expected), the PCM judges that the 2ND brake control solenoid circuit is malfunctioning and sets this code.

DTC DETECTING CONDITION

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check voltage range	• Open or short in circuit • Faulty 2nd SOLENOID VALVE • Faulty PCM
Enable Conditions	• Engine state=Run • Engine runtime >0.5 secs • Battery voltage >11V and 16 V • Transmission relay state : Relay on • Gear shifting is completed	

Threshold value	• When the PCM detects electric or electronic abnormalness such as short circuit or out of range voltage.	
Diagnostic Time	• More than 5 seconds	
Fail Safe	• Locked in 3rd gear.(Control relay off)	

SPECIFICATION

Solenoid Valve for Pressure Control

- Sensor type : Normal open 3-way
- Operating temperature : -22~266°F(-30°C~130°C)
- Frequency :
  - LR, 2ND, UD, OD, RED : 61.27Hz (at the ATF temp. -20°C above)
  - DCC : 30.64Hz
  - VFS : 600 ± 20Hzs
- Internal resistance :
  - 2.6~3.4Ω(68°F or 20°C) - LR, 2ND, UD, OD, RED, DCC
  - 4.0~4.7Ω(68°F or 20°C) - VFS
- Surge voltage : 56 V(except VFS)

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC)
2. Engine "ON".
3. Monitor the "2nd SOL. VALVE" parameter on the scantool.
4. Shift gear position 1st to 2nd.

Specification: 1st gear → 100%, 2nd gear → 0.0%

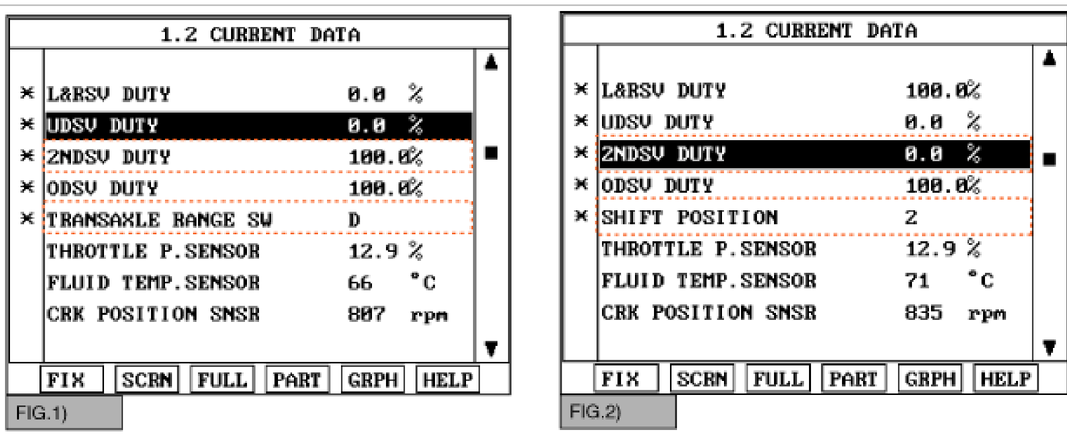


FIG. 1) 1st gear
FIG. 2) 2nd gear

5. Does "2nd SOLENOID DUTY " follow the reference data?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification vehicle repair" procedure.

NO

▸ Go to "Terminal&connector inspection " procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

YES

▸ Repair as necessary and then go to "Verification of vehicle repair" procedure.

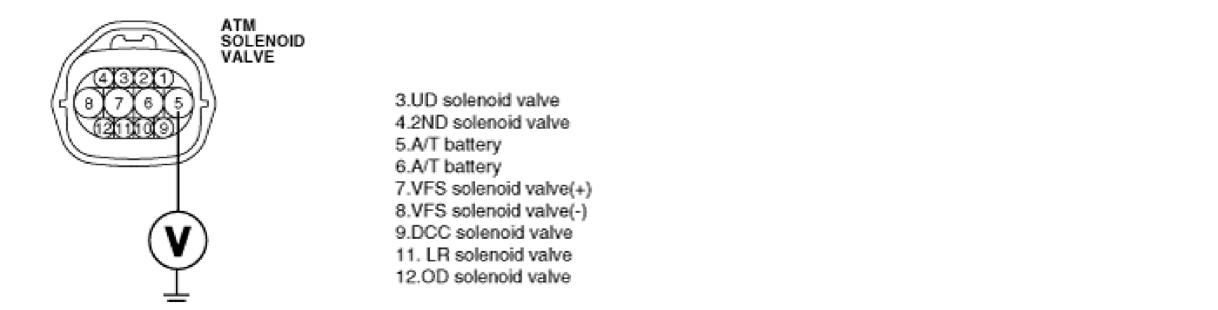
NO

▸ Go to "Power supply circuit inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Disconnect "ATM SOLENOID VALVE" connector.
2. Measure voltage between terminal "5" of the sensor harness connector and chassis ground.
3. Turn ignition switch OFF → ON.

Specification: 12V is measured only for approx. 0.5sec



4. Is voltage within specifications?

YES

▸ Go to "Signal circuit inspection" procedure.

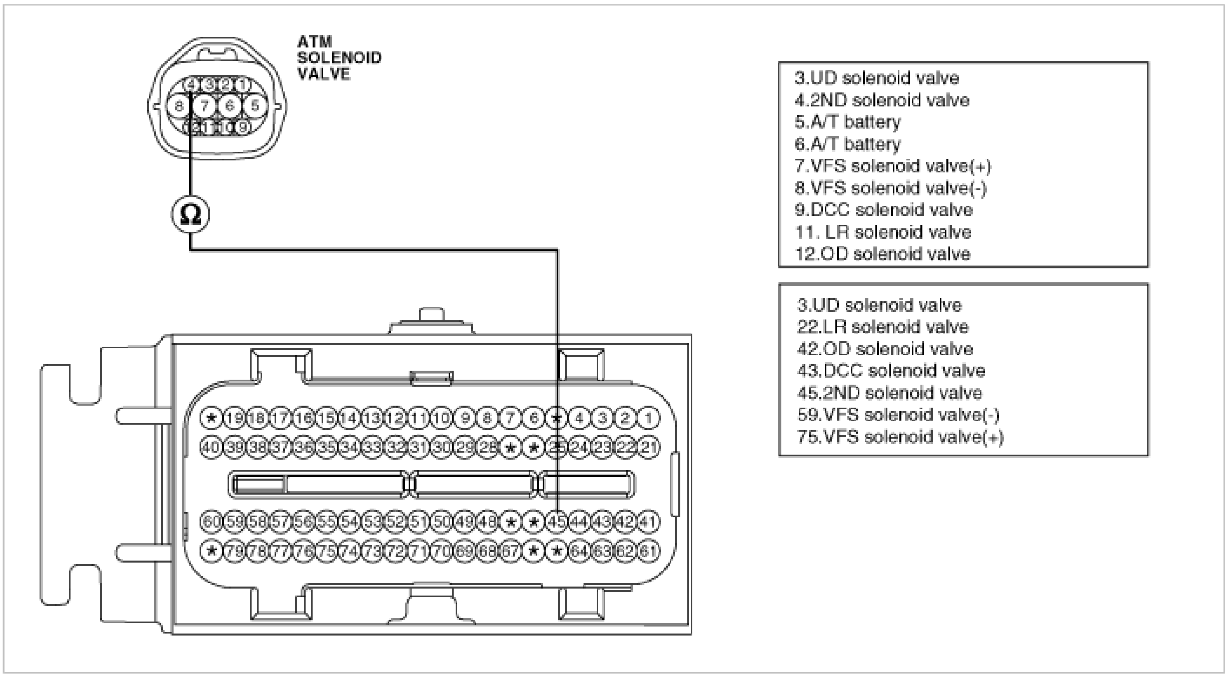
NO

▸ Check that A/T-20A fuse in engine room junction is installed or not blown.
▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check signal circuit open inspection
   (1) Ignition "OFF".
   (2) Disconnect "ATM SOLENOID VALVE" connector and "PCM" connector.
   (3) Measure resistance between terminal "4" of the ATM SOLENOID VALVE harness connector and terminal "45" of the PCM harness connector B.

   Specification: approx. 0 Ω



(4) Is resistance within specifications?

YES

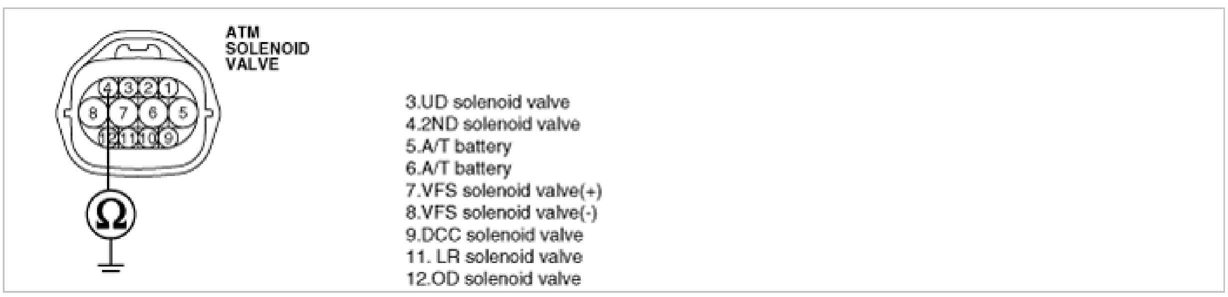
▶ Go to "Check signal circuit short inspection" procedure.

NO

▶ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

2. Check signal circuit short inspection
   (1) Ignition "OFF".
   (2) Disconnect "ATM SOLENOID VALVE" connector and "PCM" connector.
   (3) Measure resistance between terminal "4" of the ATM SOLENOID VALVE harness and chassis ground.

Specification: Infinite



(4) Is resistance within specifications?

YES

▶ Go to "Component inspection" procedure.

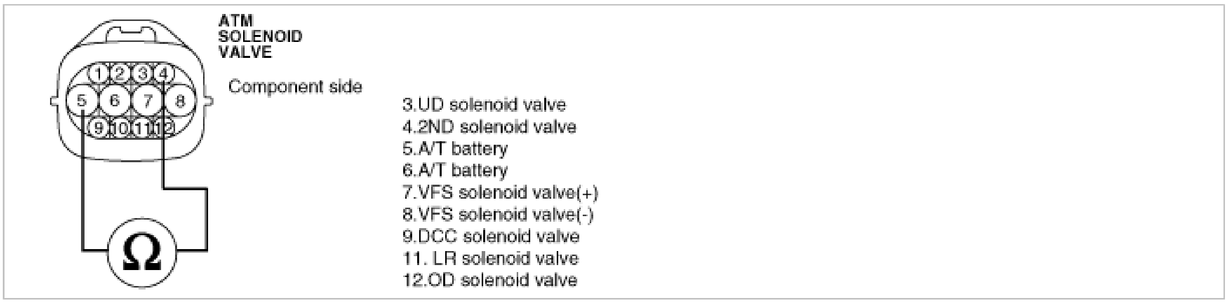
NO

▶ Check for short to ground in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

COMPONENT INSPECTION

1. CHECK SOLENOID VELVE
   (1) Ignition "OFF".
   (2) Disconnect "ATM SOLENOID VALVE" connector.
   (3) Measure resistance between terminal "4" and terminal "5" of the ATM SOLENOID VALVE harness connector.

Specification: Approximately 2.6~3.4 Ω [20°C(68°F)]



(4) Is resistance within specification?

YES

▸ Go to "CHECK PCM" as below.

NO

▸ Replace 2nd SOLENOID VALVE as necessary and go to "Verification vehicle repair" procedure.

2. CHECK PCM
   (1) Connect scantool to data link connector(DLC).
   (2) Ignition "ON" & Engine "OFF".
   (3) Select A/T solenoid valve actuator test and operate actuator test.
   (4) Can you hear operating sound for 2nd SOLENOID VALVE actuator testing function?

YES

▸ Go to "Verification vehicle repair" procedure.

NO

▸ Replace PCM as necessary and go to "Verification vehicle repair" procedure.

ACTUATOR TEST CONDITION

A. IG SWITCH ON
B. TRANSAXLE RANGE SWITCH is normal
C. P RANGE
D. Vehicle Speed 0km/h
E. Throttle position sensor < 1V
F. IDLE SWITCH ON
G. ENGINE RPM 0

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

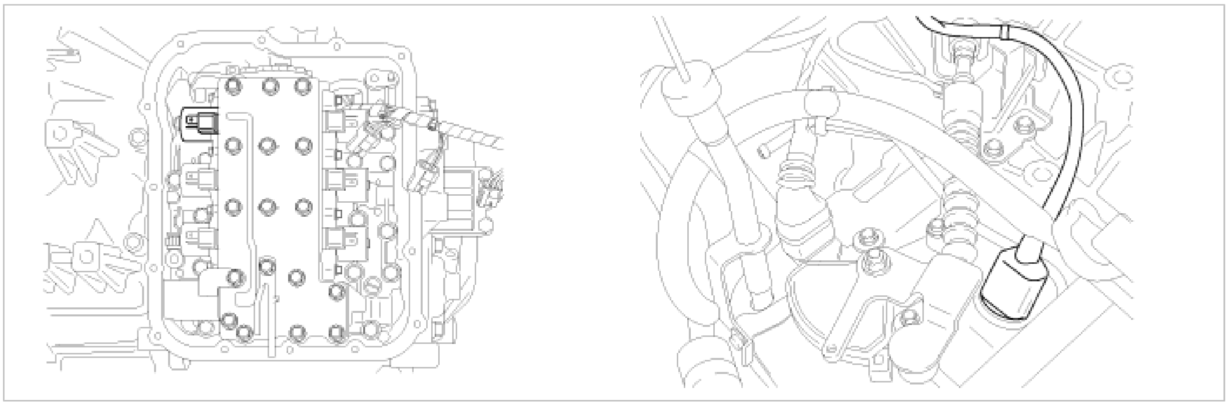
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P0765

COMPONENT LOCATION



GENERAL DESCRIPTION

The Automatic transmission changes the gear position of the transmission by utilizing a combination of clutches and brakes, which are controlled by solenoid valves. This automatic transmission consists of a: LR (Low and Reverse Brake), 2ND (2nd Brake), UD (Under Drive Clutch), OD (Over Drive Clutch), REV (Reverse Clutch), and a RED (Reduction Brake, only for 5 speed transmissions).
The OD clutch is engaged in the 3rd/4th/5th gear positions.

DTC DESCRIPTION

The PCM checks the OD clutch control signal by monitoring the feedback signal from the solenoid valve drive circuit. If an unexpected signal is monitored (for example, high voltage is detected when low voltage is expected, or low voltage is detected when high voltage is expected), the PCM judges that the OD clutch control solenoid circuit is malfunctioning and sets this code.

DTC DETECTING CONDITION

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check voltage range	• Open or short in circuit • Faulty OD SOLENOID VALVE • Faulty PCM
Enable Conditions	• Engine state=Run • Engine runtime >0.5 secs • Battery voltage >11V and 16 V • Transmission relay state : Relay on • Gear shifting is completed	
Threshold value	• When the PCM detects electric or electronic abnormalness such as short circuit or out of range voltage.	
Diagnostic Time	• More than 5 seconds	
Fail Safe	• Locked in 3rd gear.(Control relay off)	

SPECIFICATION

Solenoid Valve for Pressure Control

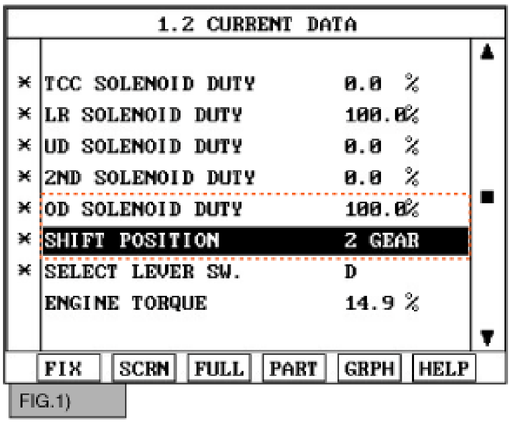
- Sensor type : Normal open 3-way
- Operating temperature : -22~266°F(-30°C~130°C)
- Frequency :
  - LR, 2ND, UD, OD, RED : 61.27Hz (at the ATF temp. -20°C above)
  - DCC : 30.64Hz
  - VFS : 600 ± 20Hzs
- Internal resistance :
  - 2.6~3.4Ω(68°F or 20°C) - LR, 2ND, UD, OD, RED, DCC
  - 4.0~4.7Ω(68°F or 20°C) - VFS
- Surge voltage : 56 V(except VFS)

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).

2. Engine "ON".
3. Monitor the "OD SOL. VALVE" parameter on the scantool.
4. Shift gear position 2nd to 3rd.

Specification: 2nd gear → 100%, 3rd gear → 0.0%



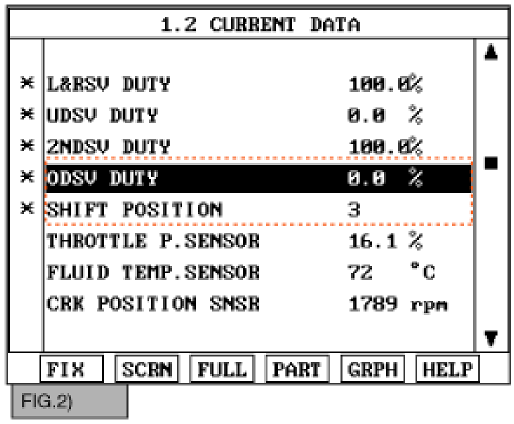


FIG. 1) 2nd gear
FIG. 2) 3rd gear

Does "OD SOLENOID DUTY " follow the reference data?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification vehicle repair" procedure.

NO

▸ Go to "Terminal&connector inspection " procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and then go to "Verification of vehicle repair" procedure.

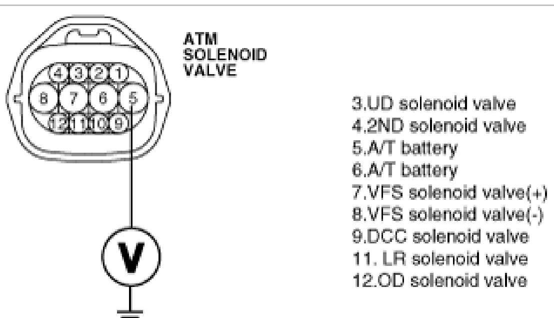
NO

▸ Go to "Power supply circuit inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Disconnect "ATM SOLENOID VALVE" connector.
2. Measure voltage between terminal "5" of the sensor harness connector and chassis ground.
3. Turn ignition switch OFF → ON.

Specification: 12V is measured only for approx. 0.5sec



4. Is voltage within specifications?

YES

▸ Go to "Signal circuit inspection" procedure.

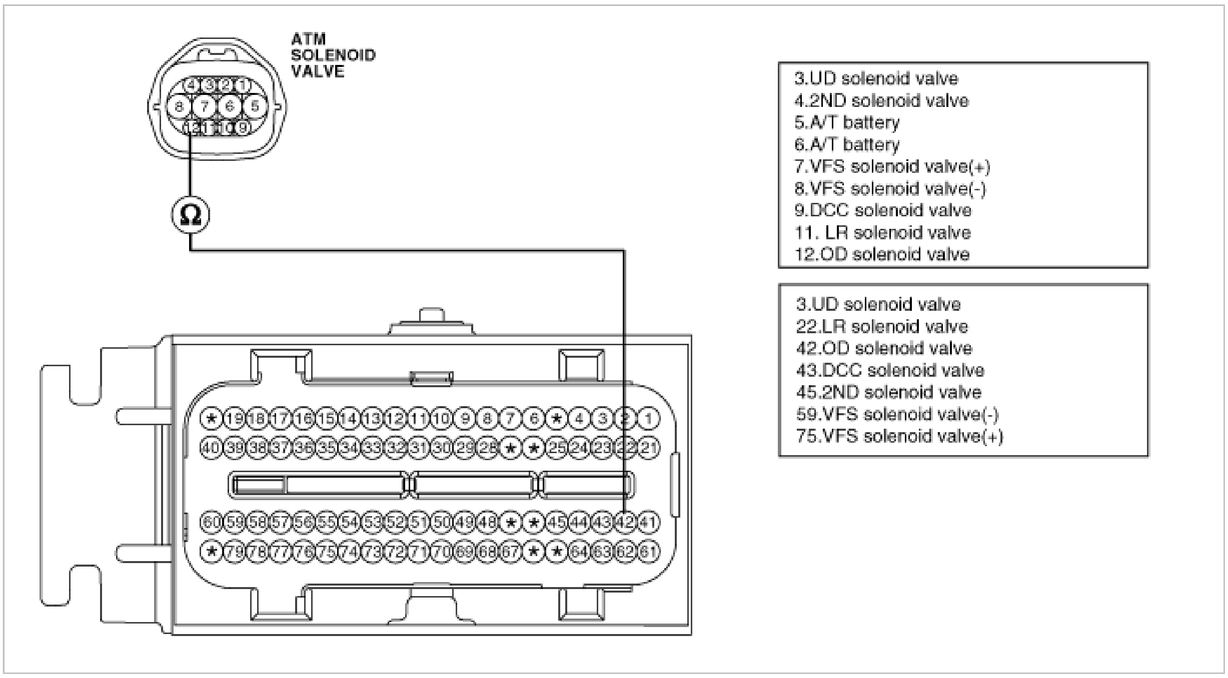
NO

▸ Check that A/T-20A fuse in engine room junction is installed or not blown.
▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check signal circuit open inspection
   (1) Ignition "OFF".
   (2) Disconnect "ATM SOLENOID VALVE" connector and "PCM" connector.
   (3) Measure resistance between terminal "12" of the ATM SOLENOID VALVE harness connector and terminal "42" of the PCM harness connector B.

   Specification: approx. 0 Ω



   (4) Is resistance within specifications?

   YES

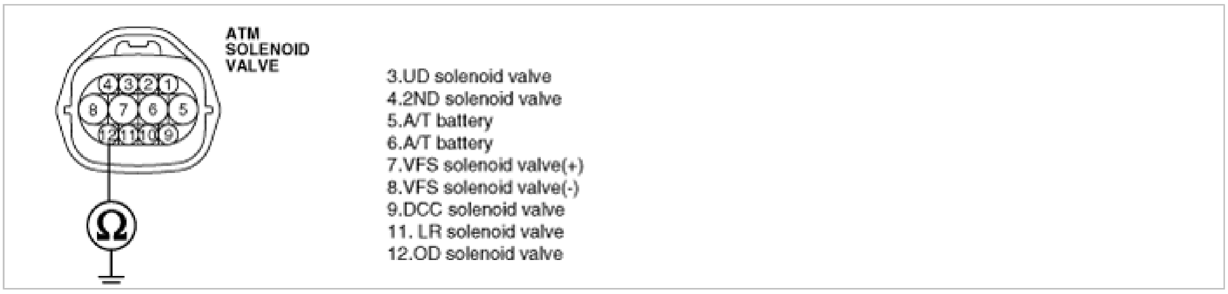
   ▸ Go to "Check signal circuit short inspection" procedure.

   NO

   ▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

2. Check signal circuit short inspection
   (1) Ignition "OFF".
   (2) Disconnect "ATM SOLENOID VALVE" connector and "PCM" connector.
   (3) Measure resistance between terminal "12" of the ATM SOLENOID VALVE harness and chassis ground.

   Specification: Infinite



   (4) Is resistance within specifications?

YES

▸ Go to "Component inspection" procedure.

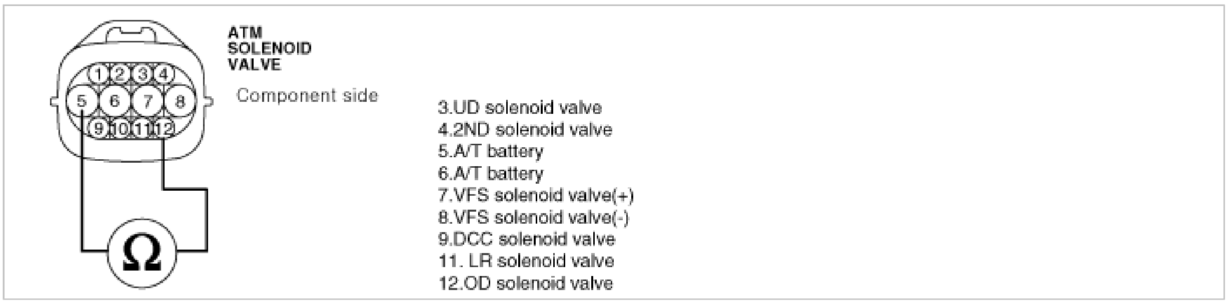
NO

▸ Check for short to ground in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

COMPONENT INSPECTION

1. CHECK SOLENOID VELVE
   (1) Ignition "OFF".
   (2) Disconnect "ATM SOLENOID VALVE" connector.
   (3) Measure resistance between terminal "12" and terminal "5" of the ATM SOLENOID VALVE harness connector.

Specification: Approximately 2.6~3.4 Ω [20°C(68°F)]



   (4) Is resistance within specification?

YES

▸ Go to "CHECK PCM" as below.

NO

▸ Replace OD SOLENOID VALVE as necessary and go to "Verification vehicle repair" procedure.

2. CHECK PCM
   (1) Connect scantool to data link connector(DLC).
   (2) Ignition "ON" & Engine "OFF".
   (3) Select A/T solenoid valve actuator test and operate actuator test.
   (4) Can you hear operating sound for OD SOLENOID VALVE actuator testing function?

YES

▸ Go to "Verification vehicle repair" procedure.

NO

▸ Replace PCM as necessary and go to "Verification vehicle repair" procedure.

ACTUATOR TEST CONDITION

A. IG SWITCH ON
B. TRANSAXLE RANGE SWITCH is normal
C. P RANGE
D. Vehicle Speed 0km/h
E. Throttle position sensor < 1V
F. IDLE SWITCH ON
G. ENGINE RPM 0

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

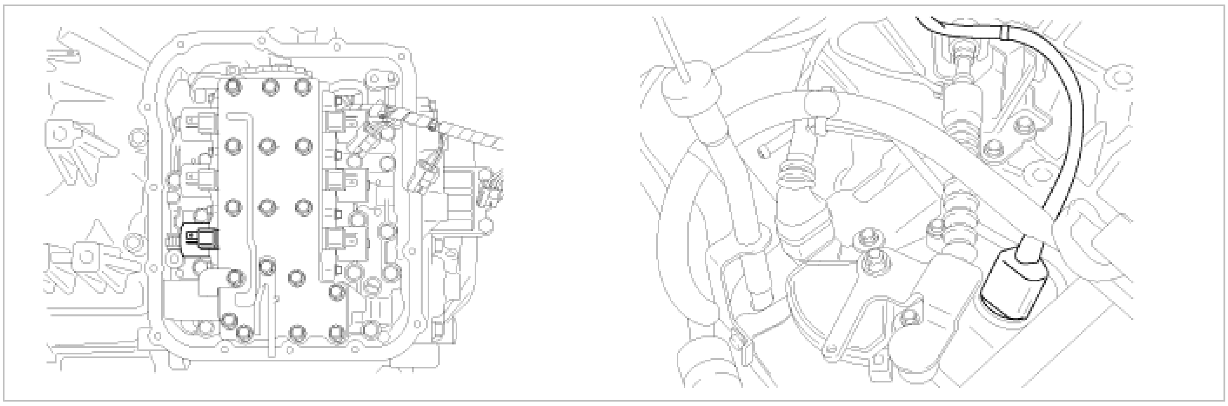
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P0770

COMPONENT LOCATION



GENERAL DESCRIPTION

The Automatic transmission changes the gear position of the transmission by utilizing a combination of clutches and brakes, which are controlled by solenoid valves. This automatic transmission consists of a: LR (Low and Reverse Brake), 2ND (2nd Brake), UD (Under Drive Clutch), OD (Over Drive Clutch), REV (Reverse Clutch), and a RED (Reduction Brake, only for 5 speed transmissions).
The RED clutch is engaged in the P/R/N/1st/2nd/3rd gear positions.

DTC DESCRIPTION

The PCM checks the RED clutch control signal by monitoring the feedback signal from the solenoid valve drive circuit. If an unexpected signal is monitored (for example, high voltage is detected when low voltage is expected, or low voltage is detected when high voltage is expected), the PCM judges that the RED clutch control solenoid circuit is malfunctioning and sets this code.

DTC DETECTING CONDITION

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check voltage range	• Open or short in circuit • Faulty RED SOLENOID VALVE • Faulty PCM
Enable Conditions	• Engine state=Run • Engine runtime >0.5 secs • Battery voltage >11V and 16 V • Transmission relay state : Relay on • Gear shifting is completed	
Threshold value	• When the PCM detects electric or electronic abnormalness such as short circuit or out of range voltage.	
Diagnostic Time	• More than 5 seconds	
Fail Safe	• Locked in 3rd gear.(Control relay off)	

SPECIFICATION

Solenoid Valve for Pressure Control

- Sensor type : Normal open 3-way
- Operating temperature : -22~266°F(-30°C~130°C)
- Frequency :
  - LR, 2ND, UD, OD, RED : 61.27Hz (at the ATF temp. -20°C above)
  - DCC : 30.64Hz
  - VFS : 600 ± 20Hzs
- Internal resistance :

- 2.6~3.4Ω(68°F or 20°C) - LR, 2ND, UD, OD, RED, DCC
- 4.0~4.7Ω(68°F or 20°C) - VFS

• Surge voltage : 56 V(except VFS)

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Engine "ON".
3. Monitor the "RED SOL. VALVE" parameter on the scantool.
4. Shift gear position 3nd to 4th.

Specification: 3rd gear → 0%, 4th gear → 100%

Does "RED SOLENOID DUTY " follow the reference data?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification vehicle repair" procedure.

NO

▸ Go to "Terminal&connector inspection " procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and then go to "Verification of vehicle repair" procedure.

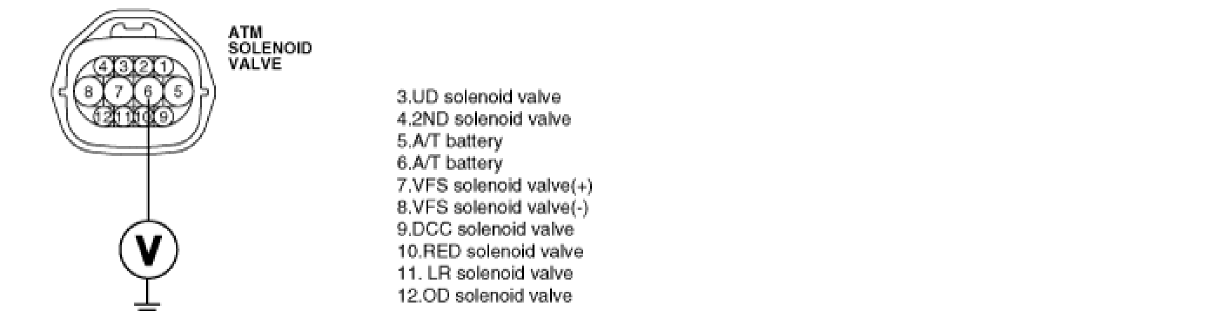
NO

▸ Go to "Power supply circuit inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Disconnect "ATM SOLENOID VALVE" connector.
2. Measure voltage between terminal "6" of the sensor harness connector and chassis ground.
3. Turn ignition switch OFF → ON.

Specification: 12V is measured only for approx. 0.5sec



4. Is voltage within specifications?

YES

▸ Go to "Signal circuit inspection" procedure.

NO

▸ Check that A/T-20A fuse in engine room junction is installed or not blown.
▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

SIGNAL CIRCUIT INSPECTION

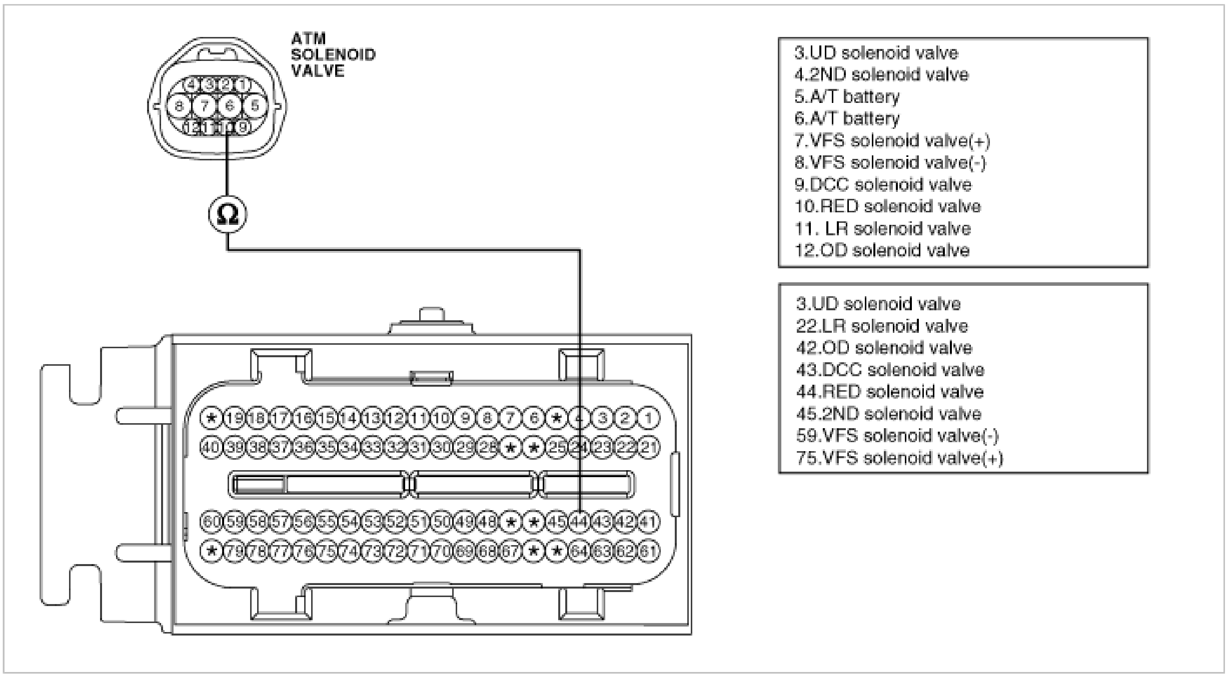
1. Check signal circuit open inspection

(1) Ignition "OFF".

(2) Disconnect "ATM SOLENOID VALVE" connector and "PCM" connector.

(3) Measure resistance between terminal "10" of the ATM SOLENOID VALVE harness connector and terminal "44" of the PCM harness connector B.

Specification: approx. 0 Ω



(4) Is resistance within specifications?

YES

▸ Go to "Check signal circuit short inspection" procedure.

NO

▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

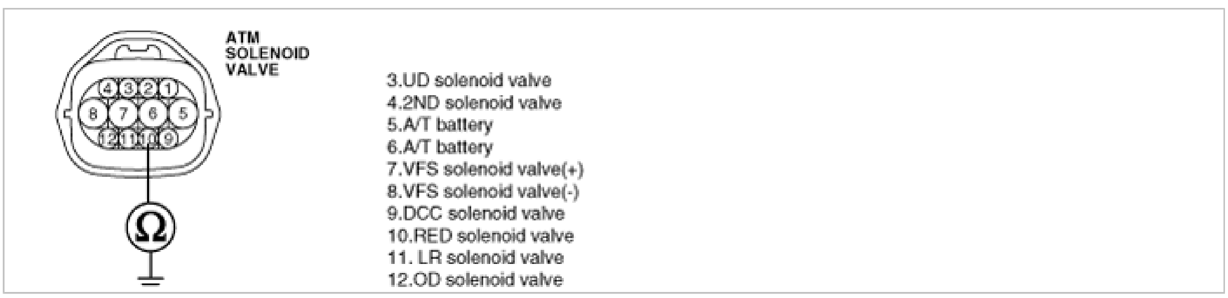
2. Check signal circuit short inspection

(1) Ignition "OFF".

(2) Disconnect "ATM SOLENOID VALVE" connector and "PCM" connector.

(3) Measure resistance between terminal "10" of the ATM SOLENOID VALVE harness and chassis ground.

Specification: Infinite



(4) Is resistance within specifications?

YES

▸ Go to "Component inspection" procedure.

NO

▸ Check for short to ground in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

COMPONENT INSPECTION

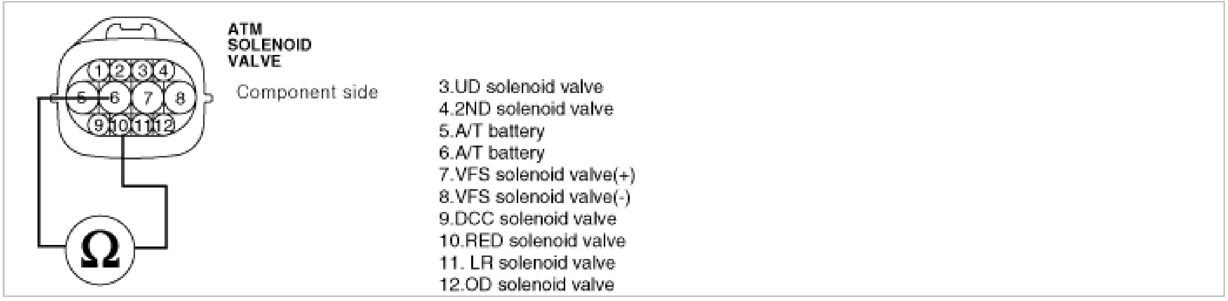
1. CHECK SOLENOID VELVE

(1) Ignition "OFF".

(2) Disconnect "ATM SOLENOID VALVE" connector.

(3) Measure resistance between terminal "6" and terminal "10" of the ATM SOLENOID VALVE harness connector.

Specification: Approximately 2.6~3.4 Ω [20°C(68°F)]



(4) Is resistance within specification?

YES

▸ Go to "CHECK PCM" as below.

NO

▸ Replace RED SOLENOID VALVE as necessary and go to "Verification vehicle repair" procedure.

2. CHECK PCM

(1) Connect scantool to data link connector(DLC).

(2) Ignition "ON" & Engine "OFF".

(3) Select A/T solenoid valve actuator test and operate actuator test.

(4) Can you hear operating sound for RED SOLENOID VALVE actuator testing function?

YES

▸ Go to "Verification vehicle repair" procedure.

NO

▸ Replace PCM as necessary and go to "Verification vehicle repair" procedure.

ACTUATOR TEST CONDITION

A. IG SWITCH ON

B. TRANSAXLE RANGE SWITCH is normal

C. P RANGE

D. Vehicle Speed 0km/h

E. Throttle position sensor < 1V

F. IDLE SWITCH ON

G. ENGINE RPM 0

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

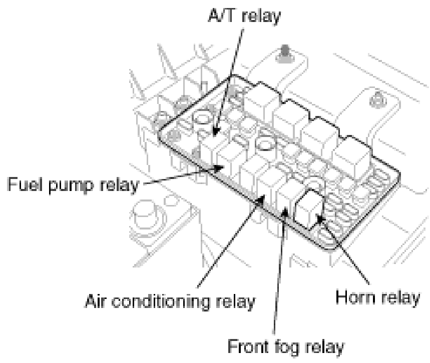
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P0885

COMPONENT LOCATION



GENERAL DESCRIPTION

The automatic transmission supplies power to the solenoid valves by way of a control relay. When the PCM sets the relay to ON, the relay operates and the battery power is supplied to all the sonenoid valves. When the PCM sets the relay to OFF, all solenoid valve power is shut off and the transmission is held in the 3rd gear position. (Fail Safe Mode)

DTC DESCRIPTION

The PCM checks the A/T control relay signal by monitoring the control signal. If, after the iginiton key is turned on, an unexpected voltage value, which is quite a bit lower than battery voltage, is detected, the PCM sets this code.
This code can also be set when the battery power fuse in the ignition switch has been shorted.

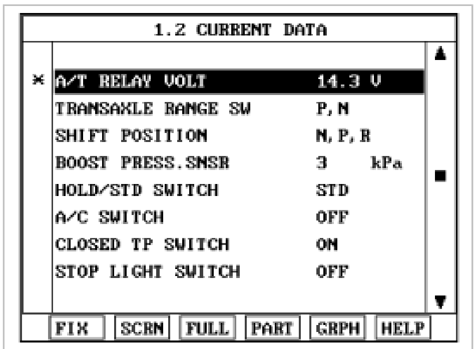
DTC DETECTING CONDITION

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check voltage range	• Open or short in circuit • Faulty A/T control relay • Faulty PCM
Enable Conditions	• Engine state=Run • Engine runtime >0.5 secs • Battery voltage >11V and 16 V • Transmission relay state : Relay on • Gear shifting is completed	
Threshold value	• PCM detects abnormally low voltage	
Diagnostic Time	• 2.375 second	
Fail Safe	• Locked in 3rd gear.(Control relay off)	

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Ignition "ON" & Engine "OFF".
3. Monitor the "A/T CON. RELAY VOLT" parameter on the scantool.

Specification : Approx. B+



4. Is A/T RELAY VOLT within specifications?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification vehicle repair" procedure.

NO

▸ Go to "Terminal&connector inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and then go to "Verification of vehicle repair" procedure.

NO

▸ Replace the PCM.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

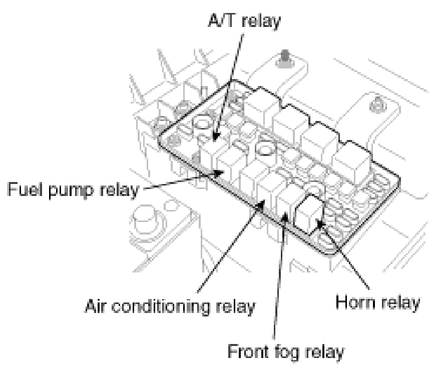
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P0890

COMPONENT LOCATION



GENERAL DESCRIPTION

The automatic transmission supplies power to the solenoid valves by way of a control relay. When the PCM sets the relay to ON, the relay operates and the battery power is supplied to all the sonenoid valves. When the PCM sets the relay to OFF, all solenoid valve power is shut off and the transmission is held in the 3rd gear position. (Fail Safe Mode)

DTC DESCRIPTION

The PCM checks the A/T control relay signal by monitoring the control signal. If, the voltage applied to A/T solenoids is lower than 0.5V, the PCM sets this code.

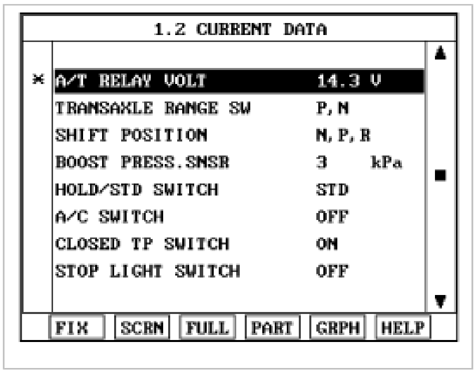
DTC DETECTING CONDITION

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check voltage range	• Open or short in circuit • Faulty A/T control relay • Faulty PCM
Enable Conditions	• Engine state≠Power off relay or engine shutdown process • Battery voltage>11V and<16V • A/T power relay is enabled • No TCM power relay diag fail	
Threshold value	• Voltage applied to A/T solenoids<= 0.5 V	
Diagnostic Time	• 2 seconds	
Fail Safe	• Locked in 3rd gear.(Control relay off)	

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Ignition "ON" & Engine "OFF".
3. Monitor the "A/T CON. RELAY VOLT" parameter on the scantool.

Specification : Approx. B+



4. Is A/T RELAY VOLT within specifications?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification vehicle repair" procedure.

NO

▸ Go to "Terminal&connector inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and then go to "Verification of vehicle repair" procedure.

NO

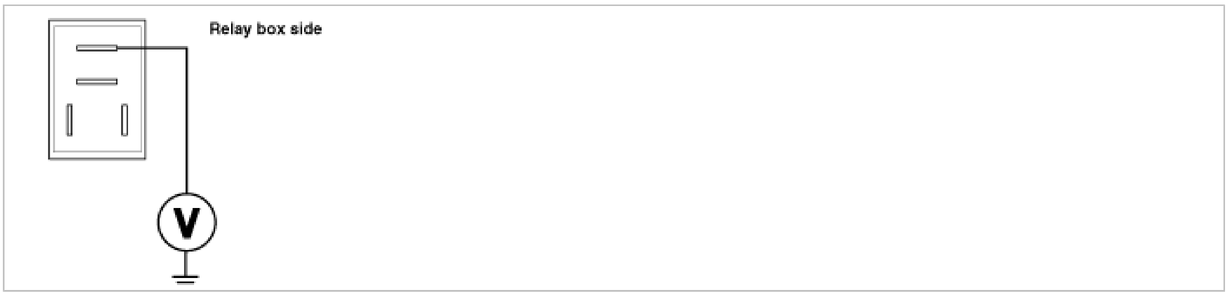
▸ Go to "Power supply circuit inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Disconnect the "A/T CONTROL RELAY" connector.
3. Measure the voltage between the power terminal of the "A/T CONTROL RELAY" in the engine room relay box and chassis

ground.

Specification : Approx. B+



4. Is voltage within specifications?

YES

▸ Go to "Signal circuit inspection" procedure.

NO

▸ Check that A/T-20A fuse in engine room junction is installed or not blown.
▸ Check for Open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. CHECK A/T control relay harness
   (1) Ignition "OFF".
   (2) Disconnect the "ATM CONTROL RELAY" connector.
   (3) Measure the voltage between terminal "60" of the "PCM" harness connector A and chassis ground.
   (4) Turn ignition switch OFF → ON.

   Specification: 12V is measured only for approx. 0.5sec

   (5) Is voltage within specifications?

   YES

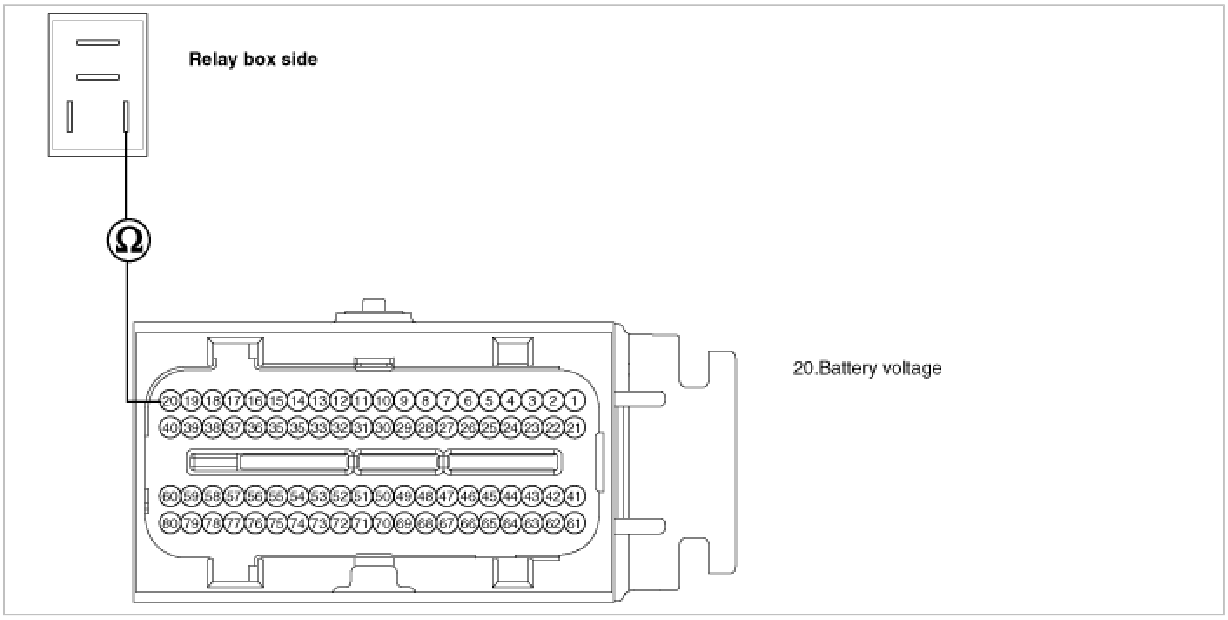
   ▸ Go to "Check supplying power to solenoid valve" procedure.

   NO

   ▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure
   ▸ If signal circuit is OK, Substitute with a known-good PCM and check for proper operation. If the problem is corrected, replace PCM and then go to "Verification of vehicle repair" procedure.

2. CHECK supplying power to solenoid valve harness
   (1) Ignition "OFF".
   (2) Disonnect the "ATM CONTROL RELAY" and PCM connector.
   (3) Measure the resistance between the terminal shown below of the "A/T CONTROL RELAY" in the engine room relay box and terminal "20" of the PCM harness connector A.

   Specification : Approx. 0 Ω



(4) Is resistance within specifications?

YES

▸ Go to "Ground circuit inspection" procedure.

NO

▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

GROUND CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect the "A/T CONTROL RELAY" connector.
3. Measure the resistance between the terminal shown below of the "A/T CONTROL RELAY" in the engine room relay box and chassis ground.

Specification : Approx. 0 Ω

4. Is resistance within specifications?

YES

▸ Go to "Component inspection" procedure.

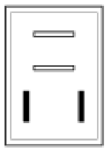
NO

▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Remove "A/T CONTROL RELAY"
3. Measure the resistance between each terminal of the sensor.

Specification: ∞ except between those two terminals below



4. Is resistance with in specification?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of vehicle repair" procedure.

NO

▸ Replace ATM CONTROL RELAY and then go to "Verification of vehicle repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

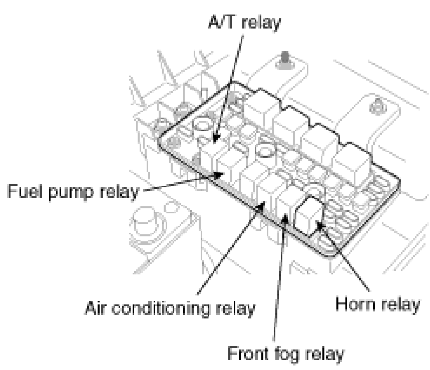
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P0891

COMPONENT LOCATION



GENERAL DESCRIPTION

The automatic transmission supplies power to the solenoid valves by way of a control relay. When the PCM sets the relay to ON, the relay operates and the battery power is supplied to all the sonenoid valves. When the PCM sets the relay to OFF, all solenoid valve power is shut off and the transmission is held in the 3rd gear position. (Fail Safe Mode)

DTC DESCRIPTION

The PCM checks the A/T control relay signal by monitoring the control signal. If, the voltage applied to A/T solenoids is higher than 20V, the PCM sets this code.

DTC DETECTING CONDITION

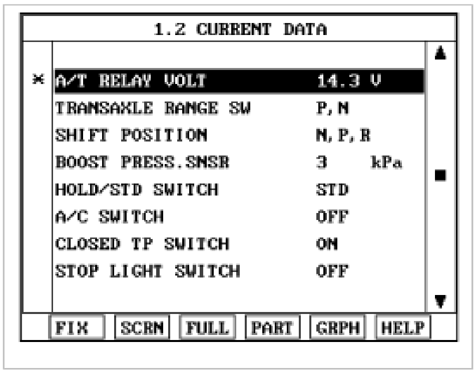
Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check voltage range	• Open or short in circuit • Faulty A/T control relay • Faulty PCM
	• Engine state≠Power off relay or engine shutdown process	

Enable Conditions	• Engine runtime >0.5 secs • Battery voltage >11V and 16 V • Transmission relay state : Relay on • Gear shifting is completed	
Threshold value	• Voltage applied to A/T solenoids>= 20 V	
Diagnostic Time	• 2 seconds	
Fail Safe	• Locked in 3rd gear.(Control relay off)	

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Ignition "ON" & Engine "OFF".
3. Monitor the "A/T CON. RELAY VOLT" parameter on the scantool.

Specification : Approx. B+



4. Is A/T RELAY VOLT within specifications?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification vehicle repair" procedure.

NO

▸ Go to "Terminal&connector inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and then go to "Verification of vehicle repair" procedure.

NO

▸ Go to "Power supply circuit inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Disconnect the "A/T CONTROL RELAY" connector.
3. Measure the voltage between the power terminal of the "A/T CONTROL RELAY" in the engine room relay box and chassis ground.

Specification : Approx. B+

4. Is voltage within specifications?

YES

▸ Go to "Signal circuit inspection" procedure.

NO

▸ Check that A/T-20A fuse in engine room junction is installed or not blown.
▸ Check for Open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. CHECK A/T control relay harness
   (1) Ignition "OFF".
   (2) Disconnect the "ATM CONTROL RELAY" connector.
   (3) Measure the voltage between terminal "60" of the "PCM" harness connector A and chassis ground.
   (4) Turn ignition switch OFF → ON.

   Specification: 12V is measured only for approx. 0.5sec

   (5) Is voltage within specifications?

   YES

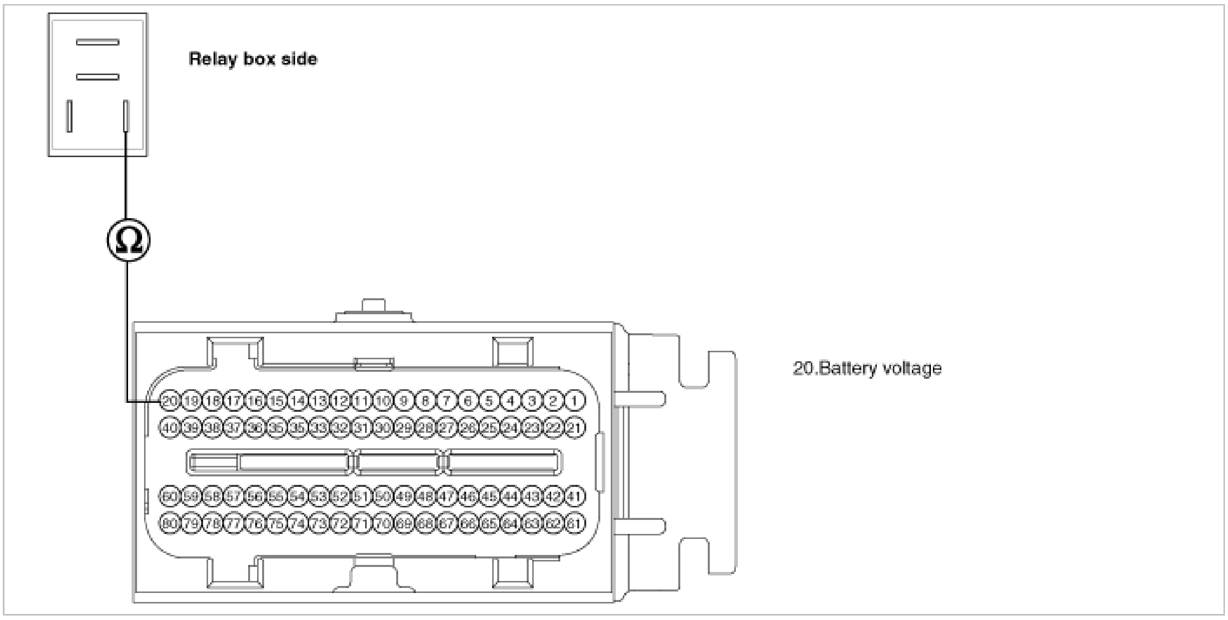
   ▸ Go to "Check supplying power to solenoid valve" procedure.

   NO

   ▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure
   ▸ If signal circuit is OK, Substitute with a known-good PCM and check for proper operation. If the problem is corrected, replace PCM and then go to "Verification of vehicle repair" procedure.

2. CHECK supplying power to solenoid valve harness
   (1) Ignition "OFF".
   (2) Disonnect the "ATM CONTROL RELAY" and PCM connector.
   (3) Measure the resistance between the terminal shown below of the "A/T CONTROL RELAY" in the engine room relay box and terminal "20" of the PCM harness connector A.

   Specification : Approx. 0 Ω



(4) Is resistance within specifications?

YES

▸ Go to "Ground circuit inspection" procedure.

NO

▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

GROUND CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect the "A/T CONTROL RELAY" connector.
3. Measure the resistance between the terminal shown below of the "A/T CONTROL RELAY" in the engine room relay box and chassis ground.

Specification : Approx. 0 Ω

4. Is resistance within specifications?

YES

▸ Go to "Component inspection" procedure.

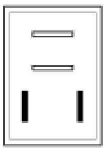
NO

▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Remove "A/T CONTROL RELAY"
3. Measure the resistance between each terminal of the sensor.

Specification: ∞ except between those two terminals below



AT relay component side

4. Is resistance with in specification?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of vehicle repair" procedure.

NO

▸ Replace ATM CONTROL RELAY and then go to "Verification of vehicle repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

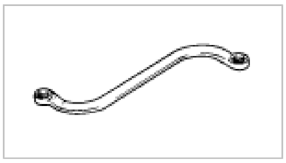
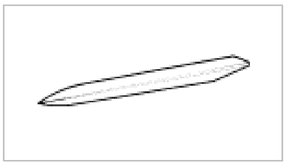
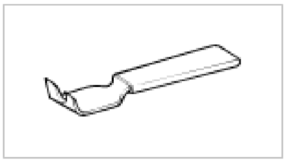
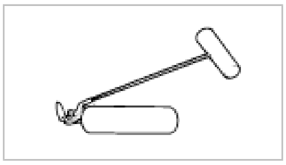
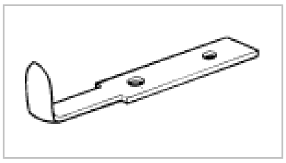
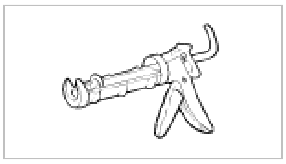
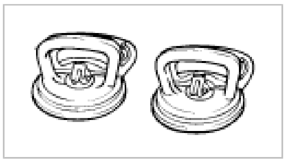
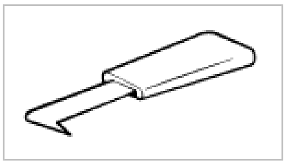
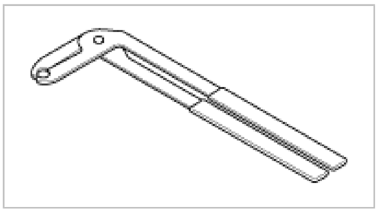
YES

▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

SPECIAL TOOLS

Tool (Number and name)	Illustration	Use
09793-21000 Door hinge adjusting wrench		Adjustment, removal and installationOf the door hinge
09800-21000 Ornament remover		Trim removal
09853-31000 Headliner clip remover		Removal of the headliner clips
09861-31100 Sealant cut-out tool		Cutting the sealant of the windshield (Use with 09861-31200)
09861-31200 Sealant cutting blade		Cutting the sealant of the windshield (Use with 09861-31100)
09861-31300 Sealant gun		Application of the sealant to the windshield
09861-31400 Glass holder		Removal and installation of the windshield
09861-31000 Windshield moulding remover		Removal of the windshield moulding
09880-4F000 Hogring clip installer		Installation of the hogring clip

Body (Interior and Exterior) > General Information > Troubleshooting

TROUBLESHOOTING

Symptom	Suspect Area	Remedy
Water leaks from sunroof	Dirt accumulated in drain tube	Clear dirt inside of drain
	Clogged drain tube	Blow air into drain to remove dirt
	Broken or dislocated drain tube, defectiveOr cracked clip	Check tube installation and Flange contact
	Deteriorated roof lid weatherstrip	Replace
	Excessive roof lid-to-body clearance and Improperly fitted weatherstrip	Adjust
Wind noise around sunroof	Loose or deformed deflector, gaps In body work	Retighten adjust or replace
Sunroof lid makes a noise when move	Foreign particles lodged in guide rail	Check drive cable and guide Rails for foreign particles
	Loose guide rails and lid	Retighten
Motor runs but sunroof Does not move or moves only partially	Foreign particles lodged in guide rail	Check drive cable and guide Rails for foreign particles
	Incorrect engagement of motor pinion With drive cable	Check for loose motor installation And damaged pinion
	Decrease in motor`s clutch slipping force	Adjust
	Increased sunroof sliding resistance Or interference of sunroof with drive Cables, weatherstrip, etc. due to Maladjustment of sunroof	Adjust or replace
Noise in motor clutch slipping Noise from motor when sunroof Is fully opened or closed is not An unusual noise	Incorrect engagement of motor pinion With drive cable	Check pinion installation and Retighten motor
	Worn out or damaged motor pinion bearing	Replace motor assembly
	Worn out or deformed drive cable	Replace
Door glass fails to operate Up and down	Incorrect window glass installation	Adjust position
	Damaged or faulty regulator arm or regulator	Correct or replace
Door does not open or close completely	Incorrect door installation	Adjust position
	Defective door check assembly	Correct or replace
	Door hinge requires grease	Apply grease
Hood does not open or close completely	Striker and latch not properly aligned	Adjust
	Incorrectly installed hood	Adjust
	Incorrect hood bumper height	Adjust
Water leak through windshield end rear window	Defective seal	Fill with sealant
	Defective flange	Correct

Body (Interior and Exterior) > General Information > Specifications

SPECIFICATIONS

HOOD	

Type	Rear hinged, gas lifter type
FRONT DOOR Construction Regulator system Locking system	 Front hinged, full door construction Wire drum type Pin-fork system
REAR DOOR Construction Regulator system Locking system	 Front hinged, full door construction Wire drum type Pin-fork system
TRUNK LID Type	 Inner hinged, gas lifter type
GLASS THICKNESS Windshield glass Front door glass Rear door glass Rear window glass	Laminated clear, tinted 5mm 4mm 4mm 3.5mm
SEAT BELTS Front Rear	 3 point type with Emergency Locking Retractor (E.L.R) 3 point type with Emergency Locking Retractor (E.L.R) 2 point type

TIGHTENING TORQUE

Items	N·m	Kgf·m	lb·ft
Front and rear doors Door hinge to body Door hinge to door	 12.7~25.5 12.7~25.5	 1.3~2.6 1.3~2.6	 9.4~18.8 9.4~18.8
Trunk lid Trunk lid lift to trunk lid Trunk lid latch to trunk lid	 6.9~10.8 6.9~10.8	 0.7~1.1 0.7~1.1	 5.1~8.0 5.1~8.0
Hood Hood hinge to body Hood hinge to hood Hood latch to body Gas lifter seat mounting bolts	 21.6~26.5 21.6~26.5 6.9~8.8 6.9~8.8	 2.2~2.7 2.2~2.7 0.7~0.9 2.2~2.7	 15.9~19.5 15.9~19.5 5.1~6.5 15.9~19.5
Seat Front seat mounting bolts Front seat mounting nut Rear seat mounting bolts	 34.3~53.9 23.5~35.3 9.8~14.7	 3.5~5.5 2.4~3.6 1.0~1.5	 25.3~39.8 17.4~26.0 7.2~10.8
Seat belt Front seat bet height adjuster Front seat belt buckle mounting bolt Front seat belt anchor mounting bolt Front seat belt lower anchor Front seat belt upper anchor Rear seat belt anchor attaching bolt Rear seat belt retractor mounting bolt	 39.2~53.9 39.2~53.9 39.2~53.9 39.2~53.9 39.2~53.9 39.2~53.9 39.2~53.9	 4.0~5.5 4.0~5.5 4.0~5.5 4.0~5.5 4.0~5.5 4.0~5.5 4.0~5.5	 28.9~39.8 28.9~39.8 28.9~39.8 28.9~39.8 28.9~39.8 28.9~39.8 28.9~39.8

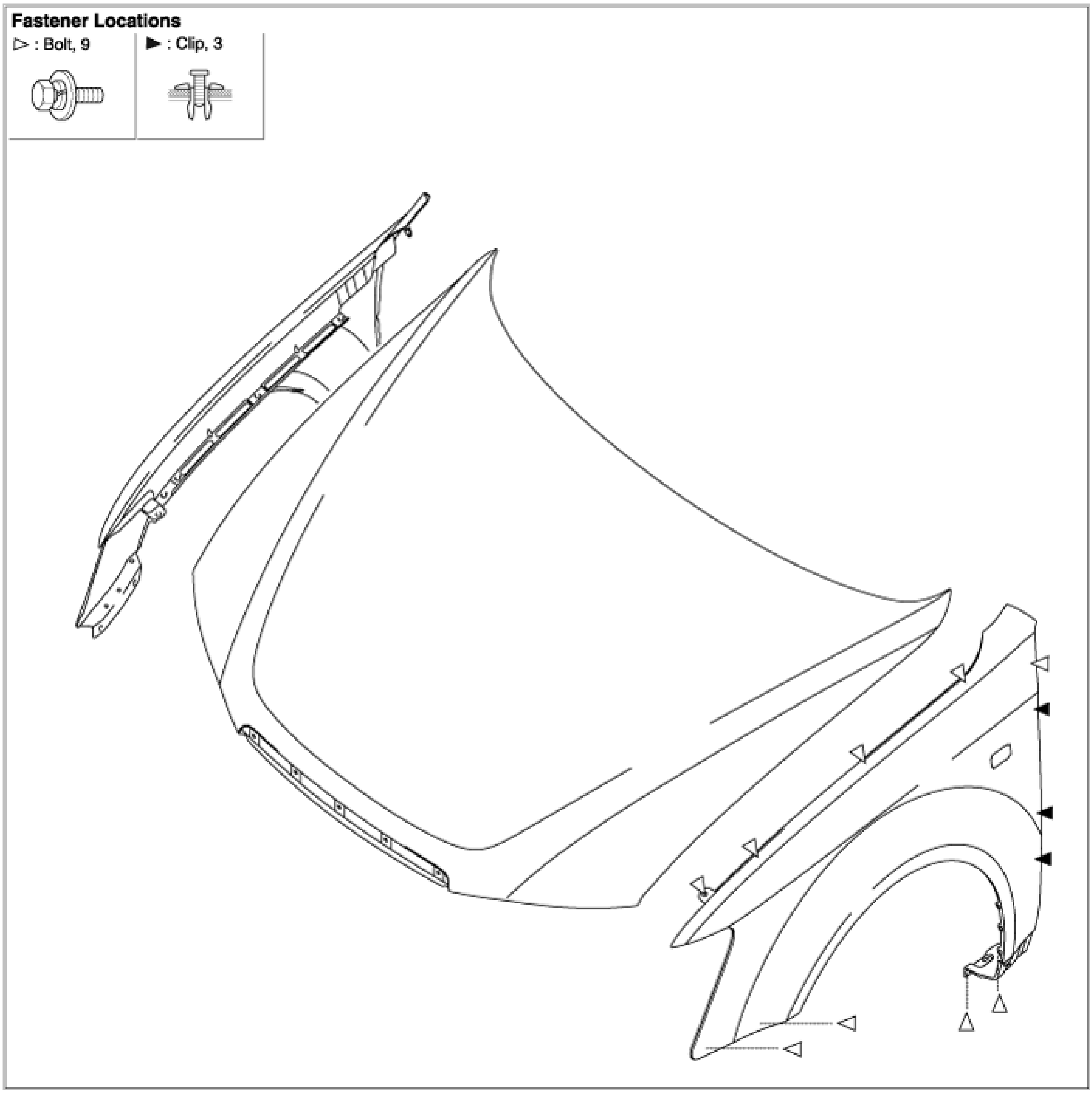
Body (Interior and Exterior) > Exterior > fender > Repair procedures

REPLACEMENT

NOTE

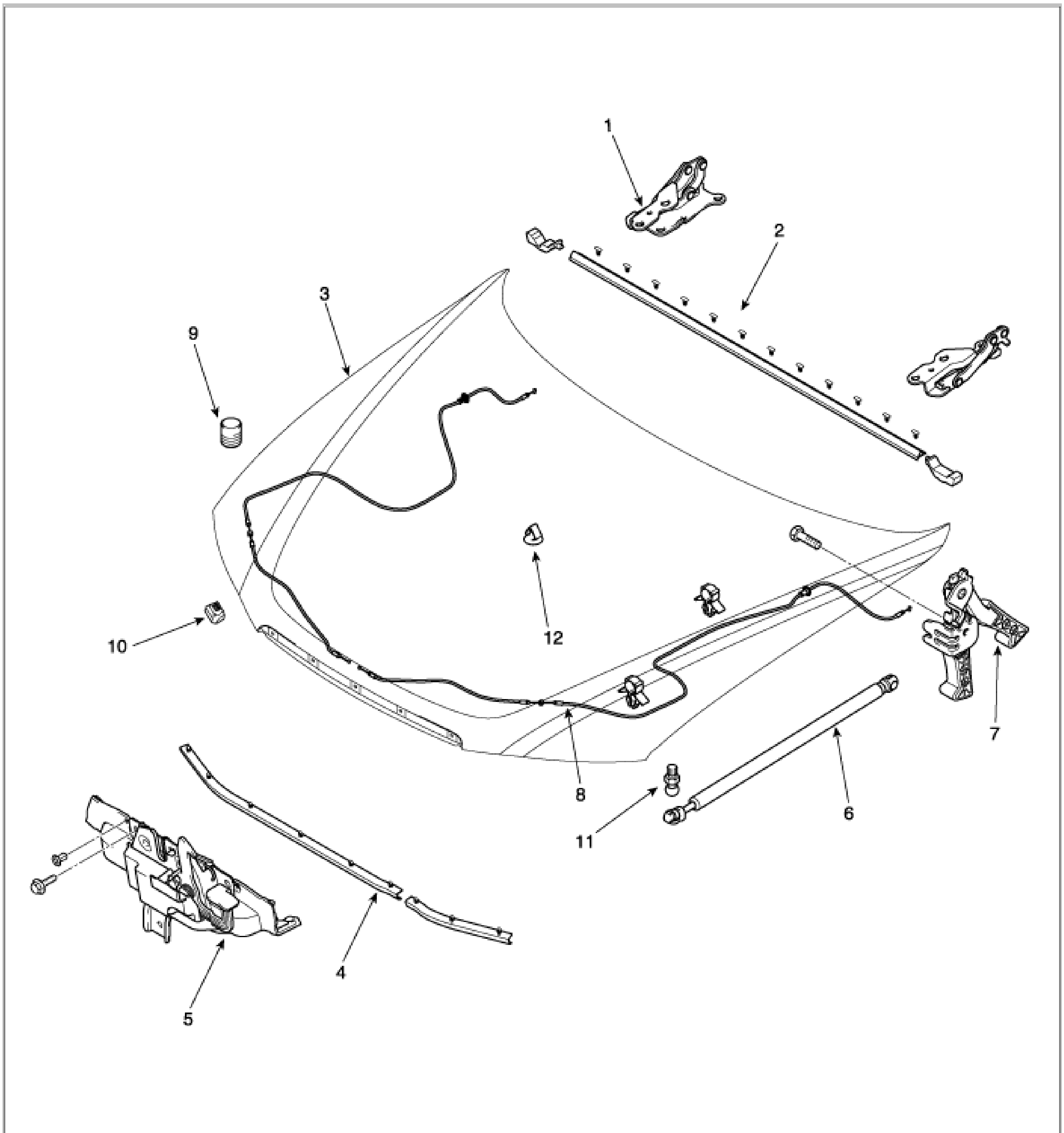
- When prying with a flat-tip screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Put on gloves to protect your hands.
- Take care not to scratch the body surface.

1. Remove the following items.
   A. Side garnish.
   B. Front bumper.
   C. Wheel guard.
   D. Headlamp.
2. Installation is the reverse of removal.



Body (Interior and Exterior) > Exterior > hood > Components and Components Location

COMPONENTS



1. Hood hinge	5. Hood latch	9. Hood overslam bumper
2. Hood weatherstrip	6. Hood lift	10. Hood stop bumper
3. Hood	7. Hood release handle	11. Bal l joint
4. Hood seal weatherstrip	8. Hood release cable	12. Mounting clip

Body (Interior and Exterior) > Exterior > hood > Repair procedures

REPLACEMENTS

HOOD ASSEMBLY REPLACEMENT

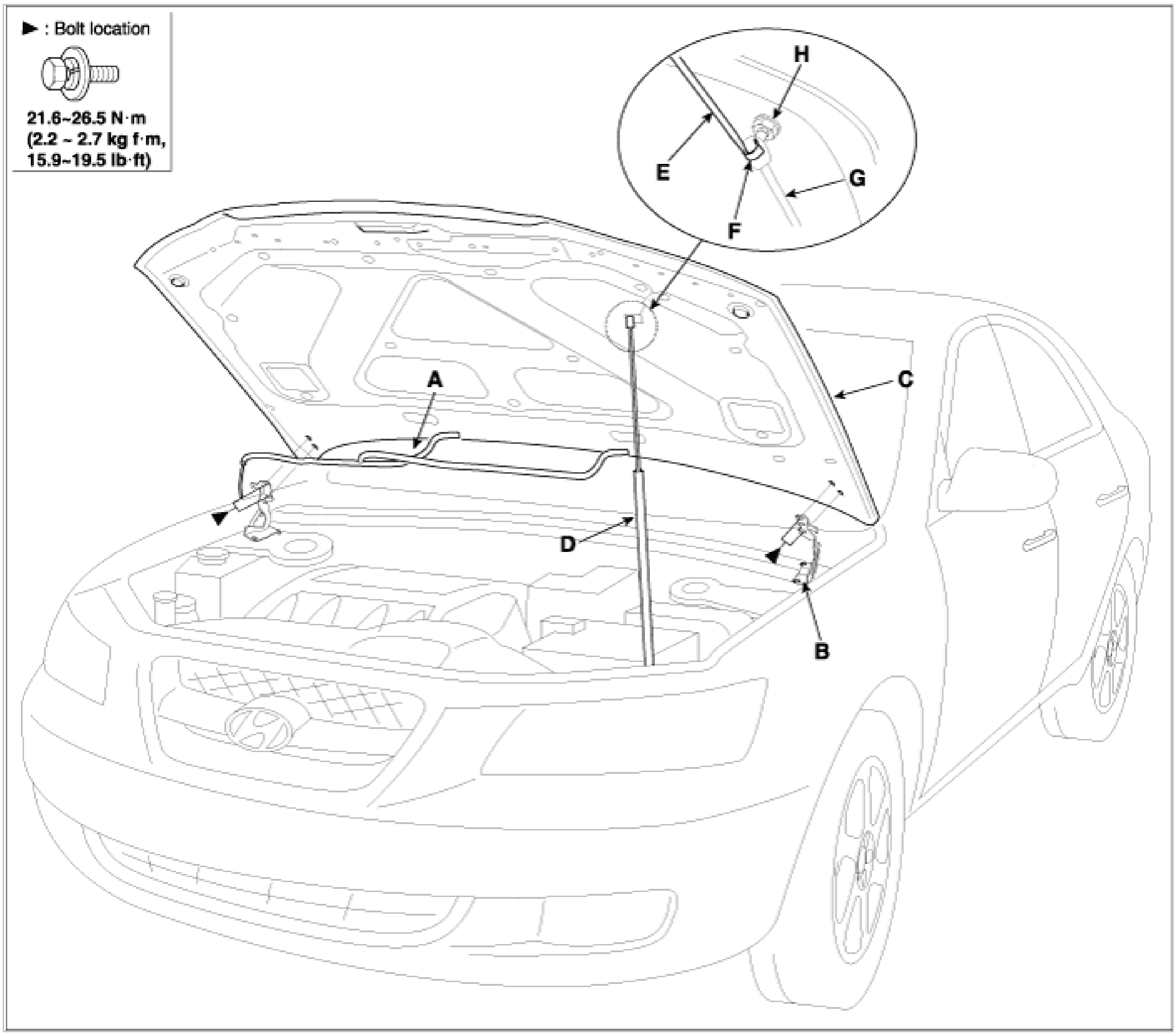
NOTE

- When removing and installing the hood, an assistant is necessary.
- Take care not to damage the hood and body.
- When removing the clips, use a clip remover.

1. Disconnect the windshield washer nozzle connecting tube (A).
2. After loose the hood hinge (B) mounting bolts, remove the hood (C).
3. Using a screwdriver (E), lift up slightly the socket clips (F) of both ends on the lifer (G), and then remove the lifter from the bracket (H).
4. Installation is the reverse of removal.

NOTE

- Make sure the hood opens properly and locks securely.
- Adjust the hood alignment.

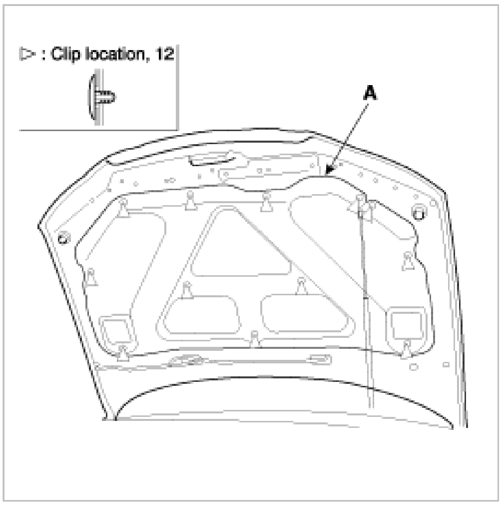


HOOD INSULATOR REPLACEMENT

1. Using a clip remover, detach the clips, and remove the hood insulator (A).

NOTE

- Take care not to scratch the hood panel.



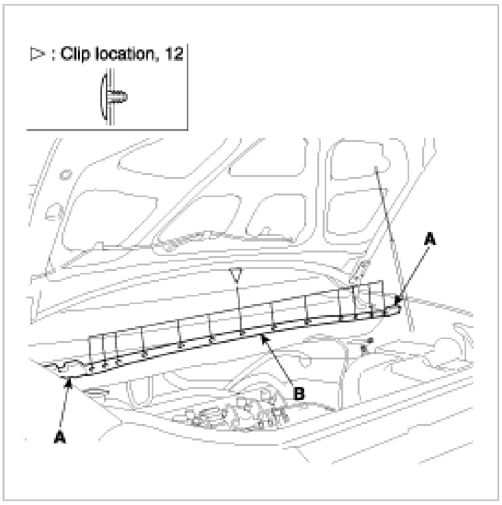
2. Installation is the reverse of removal.

NOTE

- Replace any damaged clips.

HOOD SEAL WEATHERSTRIP REPLACEMENT

1. Detach the clips, then remove the hood weatherstrip(A).
   Take care not to scratch the hood.



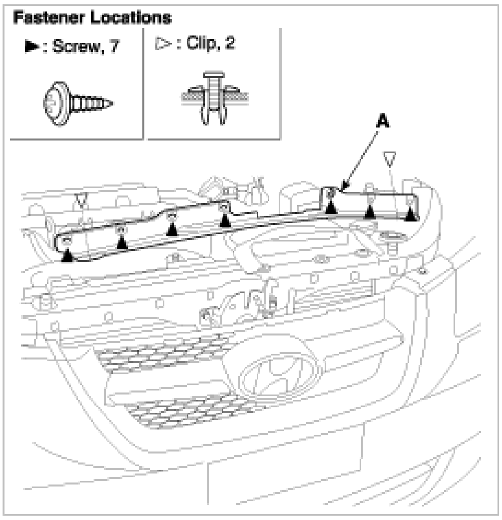
2. Installation is the reverse of removal.

NOTE

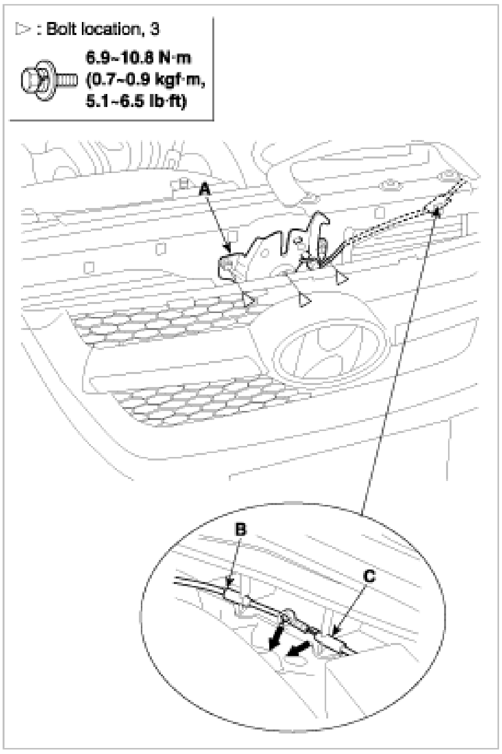
- Replace any damaged clips.

HOOD LATCH REPLACEMENT

1. Remove the radiator guard (A).



2. Remove the hood latch (A) mounting bolts.
3. Disconnect the hood latch cable (B) and release cable (C).

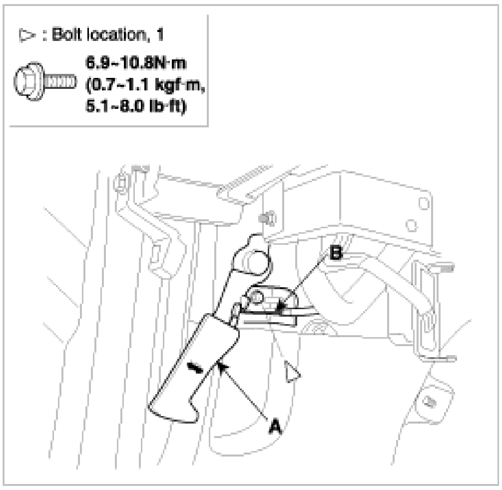


4. Installation is the reverse of removal.

> NOTE
>
> - Make sure the hood latch cable is connected properly.
> - Make sure the hood locks securely.

HOOD RELEASE HANDLE REPLACEMENT

1. Remove the mounting bolt, then remove the hood release handle (A).
2. Disconnect the hood latch cable (B) from the hood release handle. Take care not to bend the cable.



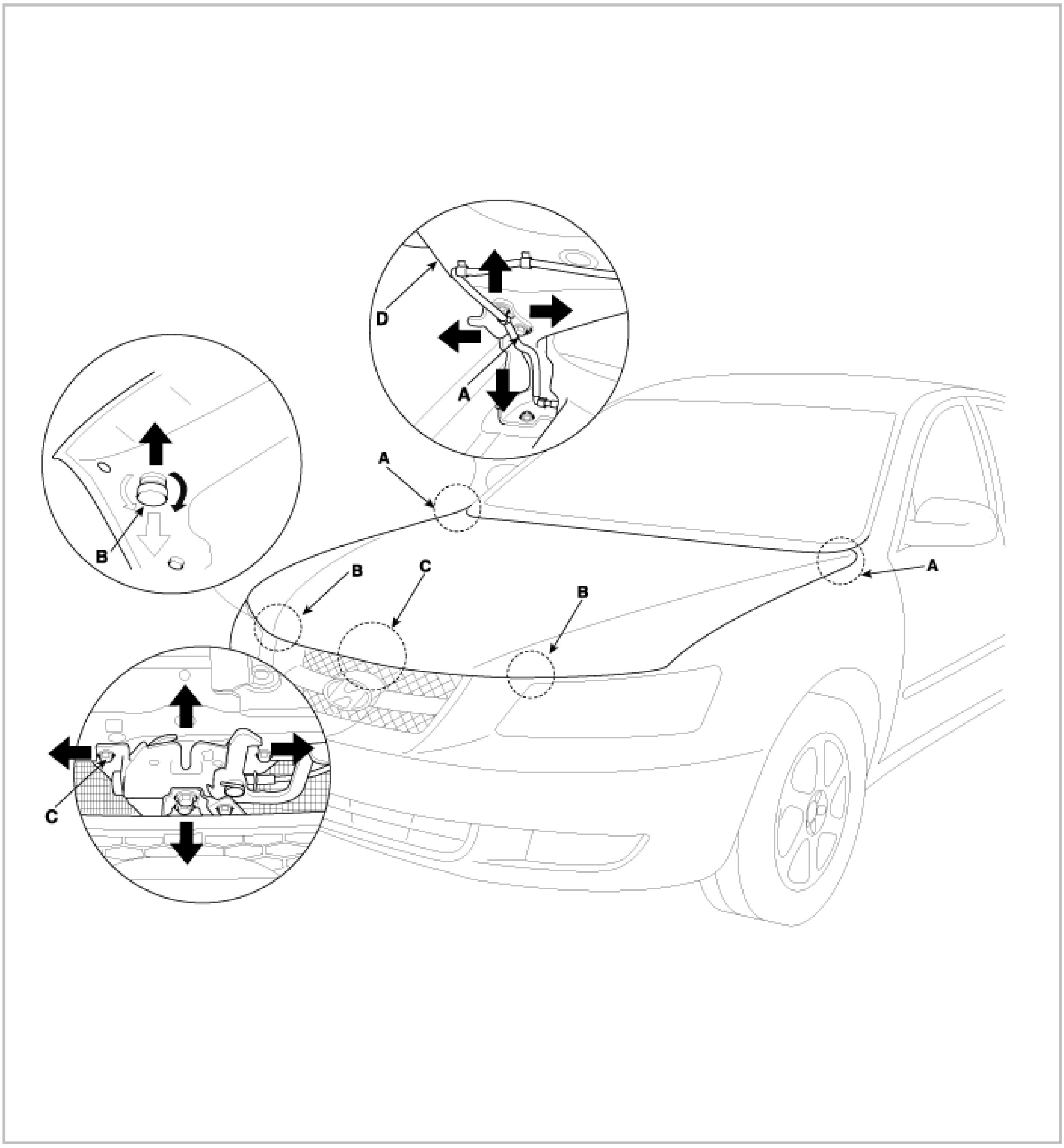
3. Installation is the reverse of removal.

> **NOTE**
>
> - Make sure the hood latch cable is connected properly.
> - Make sure the hood locks securely.

ADJUSTMENT

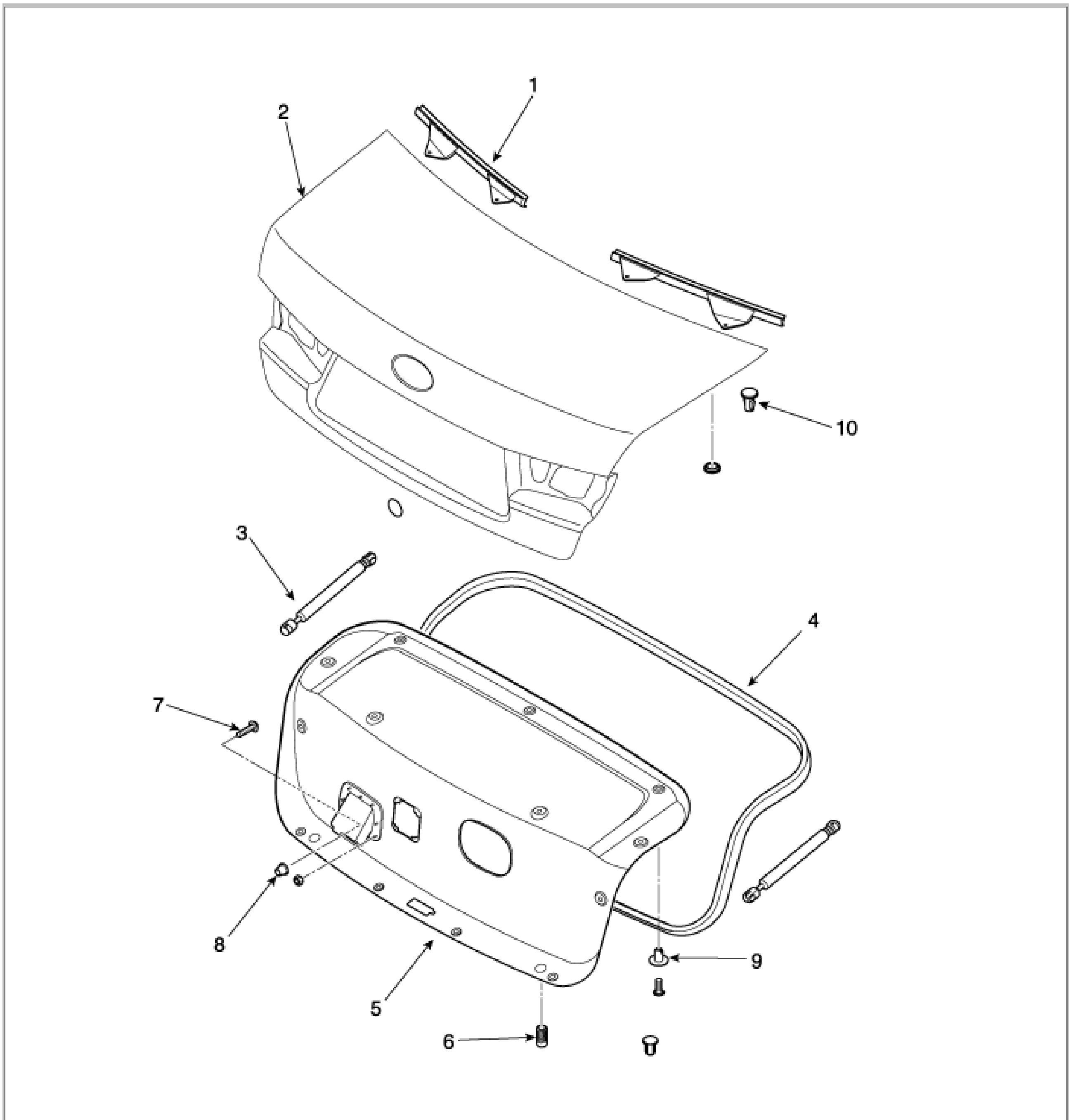
ADJUST HOOD

1. After loosening the hinge (A) mounting bolt, adjust the hood (D) by moving it up or down, or right or left.
2. Adjust the hood height by turning the hood overslam bumpers (B).
3. After loosening the hood latch (C) mounting bolts, adjust the latch by moving it up or down, or right or left.



Body (Interior and Exterior) > Exterior > trunk lid > Components and Components Location

COMPONENTS



1. Trunk seal	4. Trunk lid weatherstrip	7. Screw
2. Trunk lid	5. Trunk lid trim	8. Screw glow bet
3. Lift	6. Overslam bumper	9. Bumper cover mounting retainer
		10. Trunk lid hinge stop clip

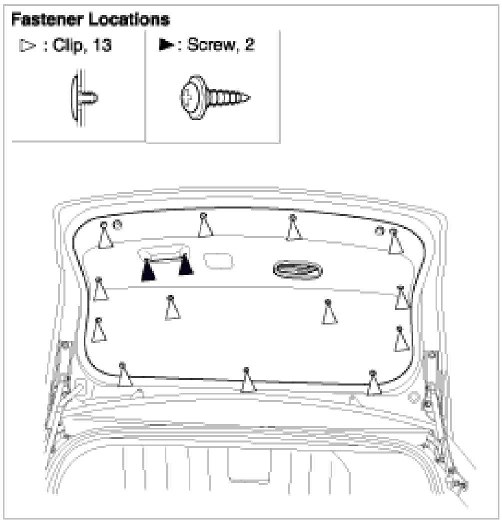
Body (Interior and Exterior) > Exterior > trunk lid > Repair procedures

REPLACEMENT

TRUNK LID TRIM REPLACEMENT

NOTE

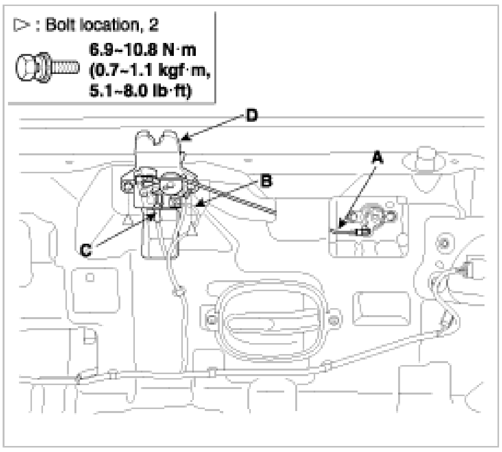
- When removing and installing the trunk lid, an assistant is necessary.
- Wear gloves to protect hands from injury.



1. Installation is the reverse of removal.

TRUNK LID LATCH REPLACEMENT

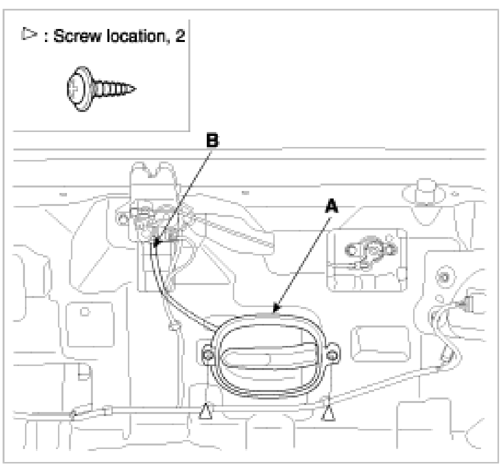
1. Remove the trunk lid trim.
2. Disconnect the key cylinder (A), connector (B) and cable (C).
3. After loosening the mounting bolt, then remove the latch assembly (D).



4. Installation is the reverse of removal.

TRUNK LID INSIDE HANDLE

1. Disconnect the inside handle cable (B).
2. After loosening the inside handle mounting screws, then remove the inside handle (A).



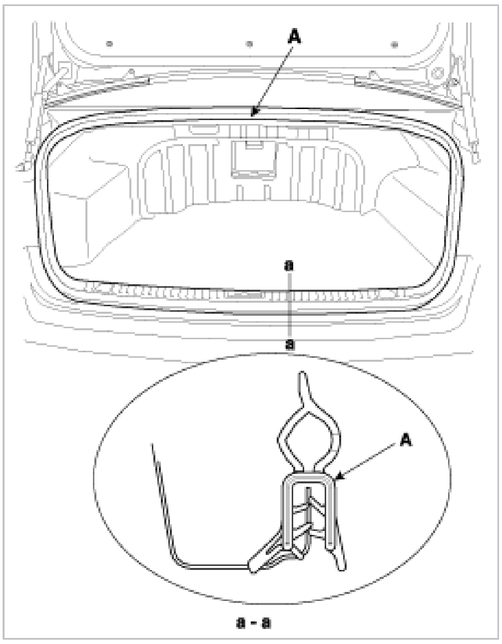
3. Installation is the reverse of removal.

NOTE

- Make sure the trunk lid latch cable is connected properly.
- Make sure the trunk lid opens properly and locks securely.

TRUNK LID WEATHERSTRIP REPLACEMENT

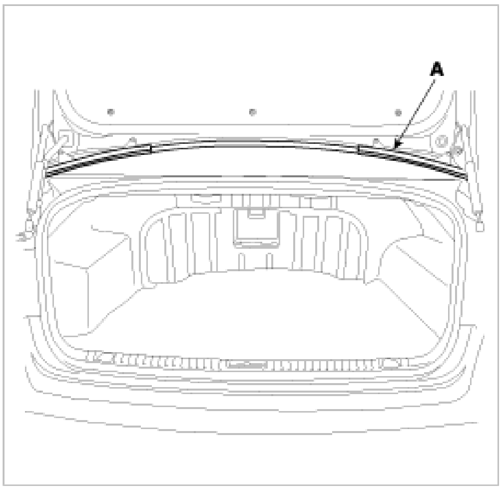
1. Remove the trunk lid weatherstrip (A).



2. Installation is the reverse of removal.

TRUNK LID SEAL WEATHERSTRIP REPLACEMENT

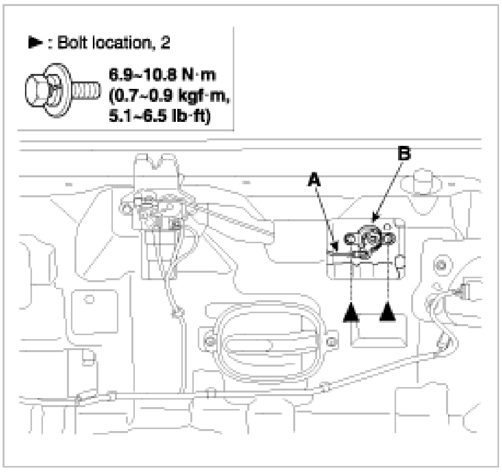
1. Detach the clips, then remove the trunk lid weatherstrip (A).



2. Installation is the reverse of removal.

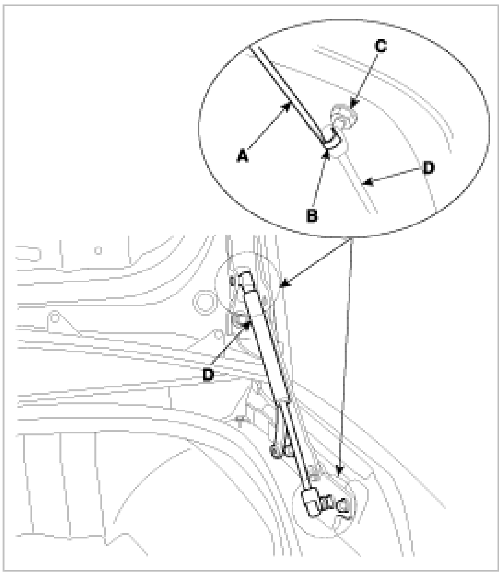
KEY HOLDER REPLACEMENT

1. Remove the trunk lid trim.
2. After loosening the mounting bolts, disconnect the connector (A).
3. Remove key holder (B).



TRUNK LID LIFT REPLACEMENT

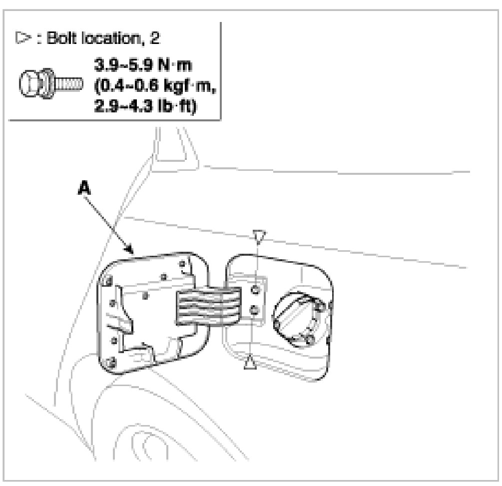
1. Using a screwdriver (A), lift up slightly the socket clips (B) of both ends on the lifter (C), and then remove the lifter from the bracket (D).



2. Push the socket of the lifter into the bracket for installation.

FUEL FILL DOOR REPLACEMENT

1. Loosen the bolts, then remove the fuel filler door (A).

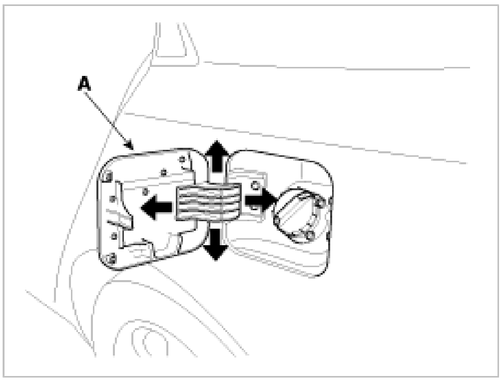


2. Installation is the reverse of removal.

NOTE

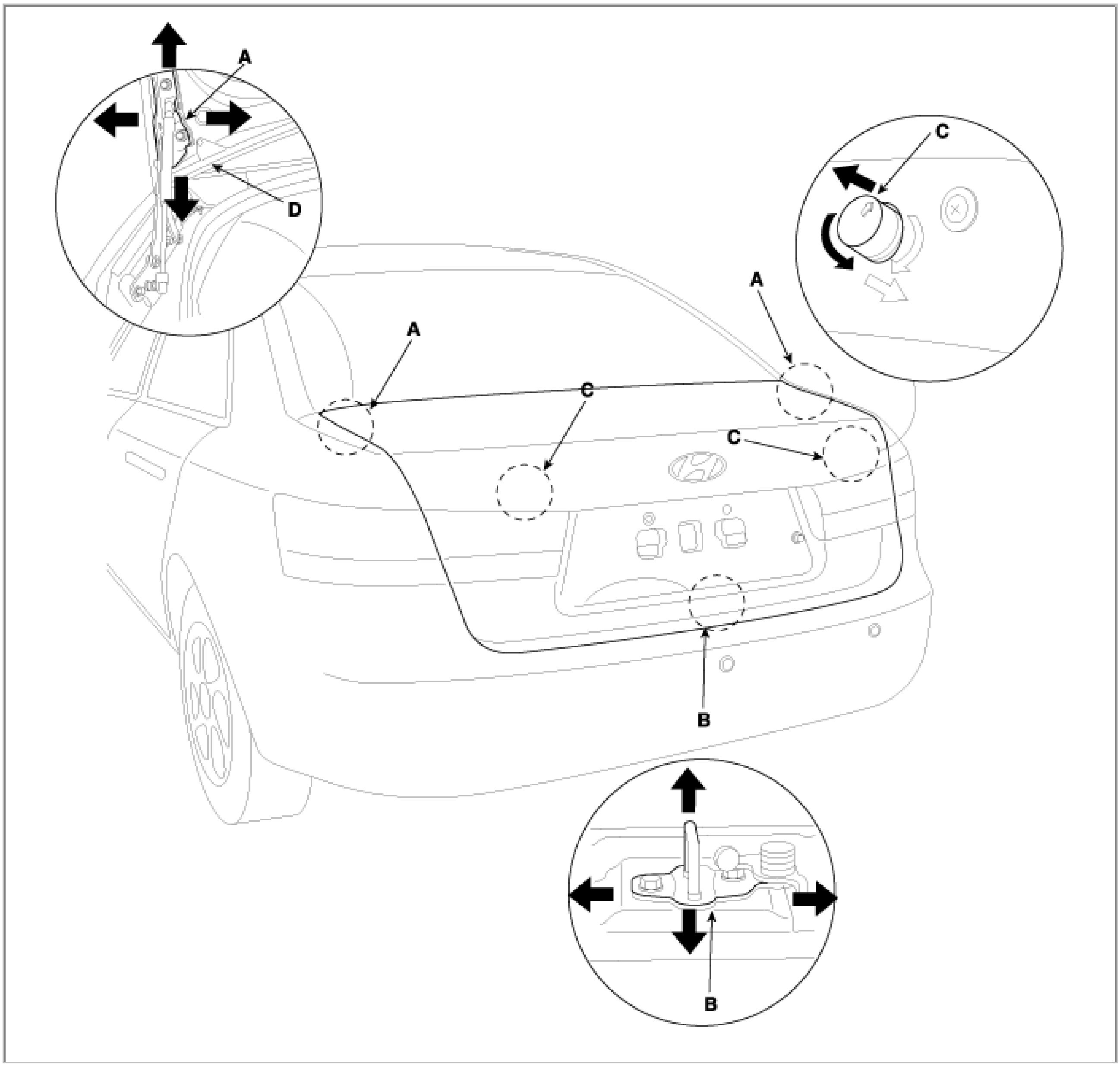
- Make sure the fuel fill door opens properly and locks securely.

3. Check that the fuel fill door (A) fits flush against the body.
   If necessary, adjust it.



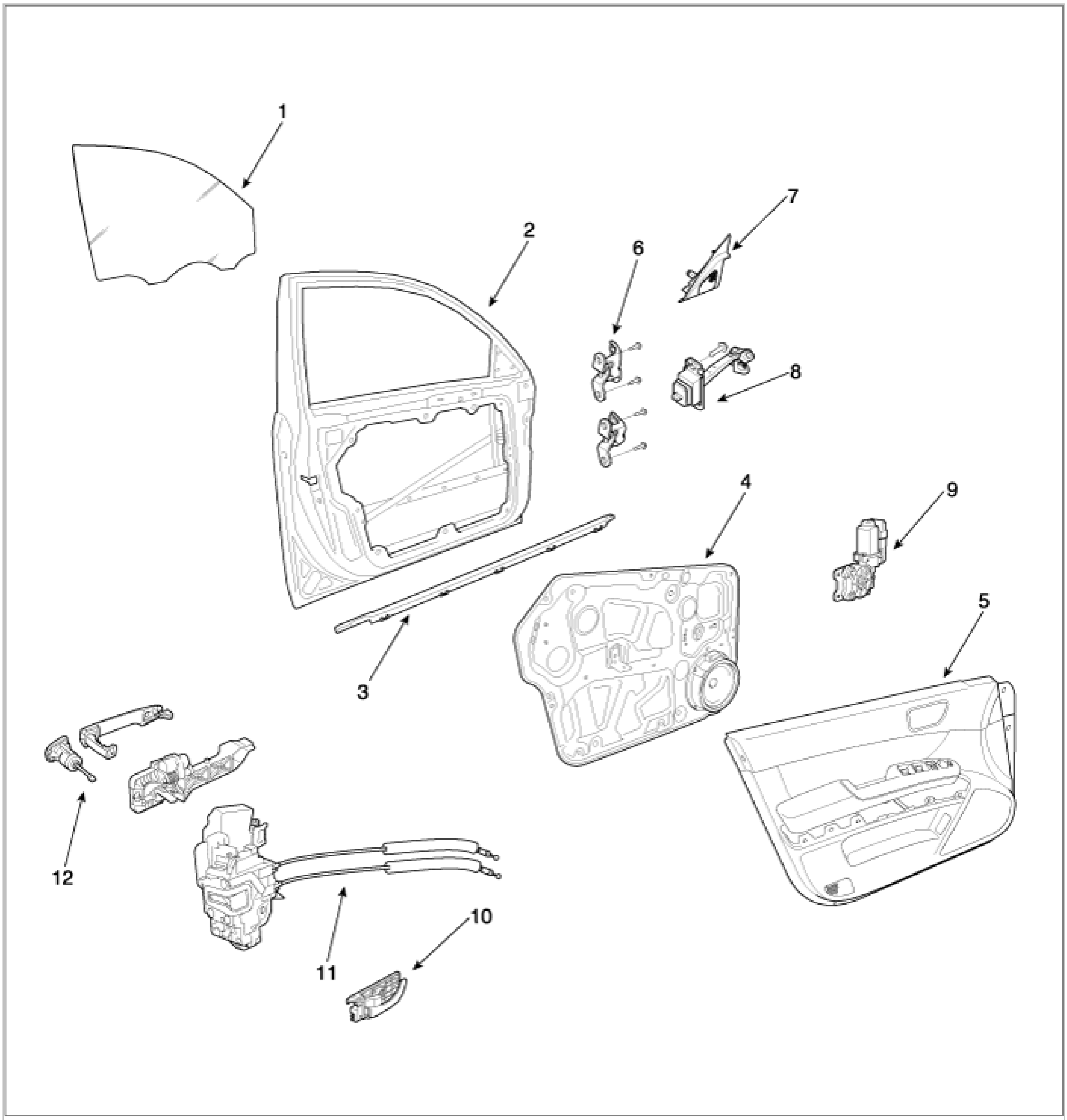
ADJUSTMENT

1. After loosening the trunk lid hinge (A) mounting bolt, adjust the hood (D) by moving it up or down, or right or left.
2. Adjust the trunk lid height by turning the trunk lid overslam bumpers (C).
3. After loosening the trunk lid latch (B) mounting bolts, adjust the trunk lid latch by moving it up or down, or right or left.



Body (Interior and Exterior) > Exterior > front door > Components and Components Location

COMPONENTS



1. Front door glass	5. Front door trim	9. Power window motor
2. Front door panel	6. Door hinge	10. Inside handle
3. Door belt weatherstrip	7. Quadrant inner cover	11. Latch assemble
4. Front door module	8. Front door checker	12. Key cylinder

Body (Interior and Exterior) > Exterior > front door > Repair procedures

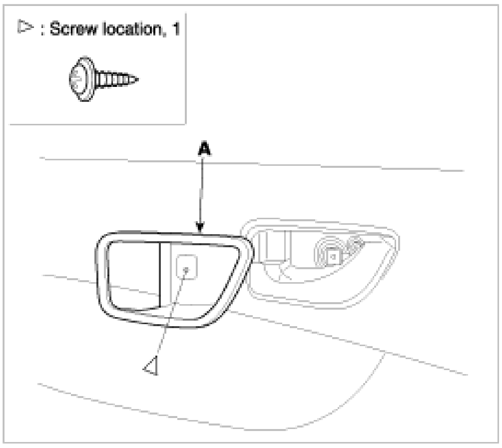
REPLACEMENT

FRONT DOOR TRIM REPLACEMENT

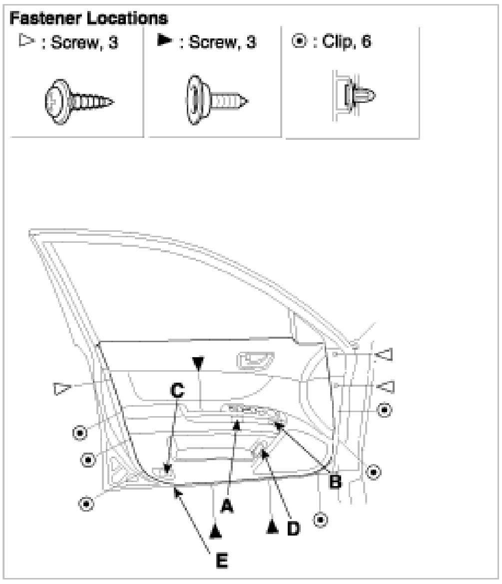
NOTE

- Take care not to scratch the door trim and other parts.
- Put on gloves to protect your hands.

1. Remove the quadrant inner cover.
2. Remove the inside handle cover (A).



3. Loosen the door trim (E) mounting screws. Release the clips that hold the door trim, then remove the door trim by pulling it upward. Disconnect the power window switch connector(A), power mirror connector (B), and door courtesy lamp connector(C), trunk lid connector (D).



4. Installation is the reverse of removal.

NOTE

- Make sure of connectors is plugged in properly and each rod is connected securely.
- Make sure the door lock and opens properly.

GLASS REPLACEMENT

NOTE

- Put on gloves to protect your hands.

1. Remove the front door trim.

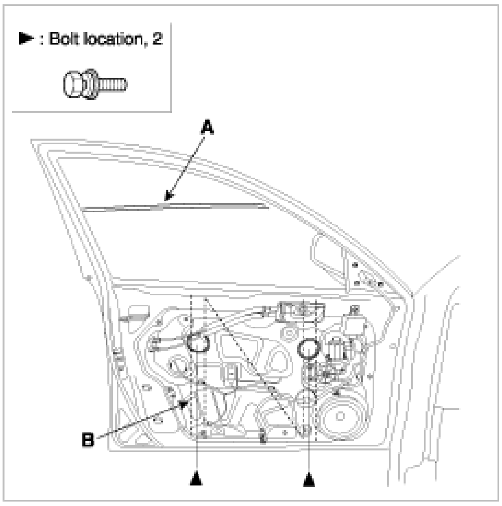
NOTE

- Use the door switch to align the mounting hole with the hole on the door glass.
- If it is impossible, align the hole with hands after removing the motor.

2. Carefully move the glass (A) until you can see the bolts, then loosen them. Separate the glass from the glass run and carefully pull the glass out through the window slot (B).

CAUTION

- Take care not to drop to glass and scratch the glass surface.

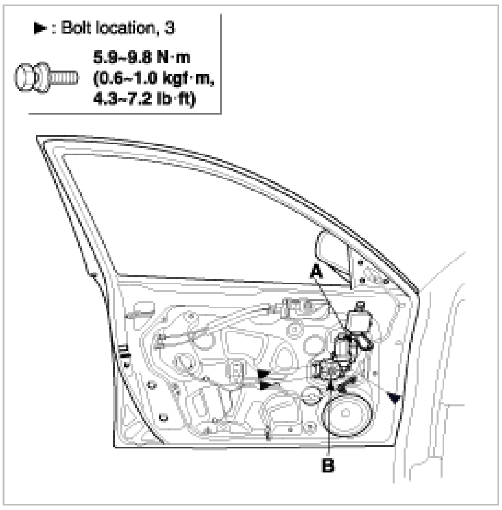


3. Installation is the reverse of removal.

> NOTE
>
> - Roll the glass up down to see if it move freely without binding.
> - Adjust the position of the glass as necessary.

POWER WINDOW MOTOR REPLACEMENT

1. Remove the front door trim.
2. After disconnecting the connector (A), remove the power window motor (B).

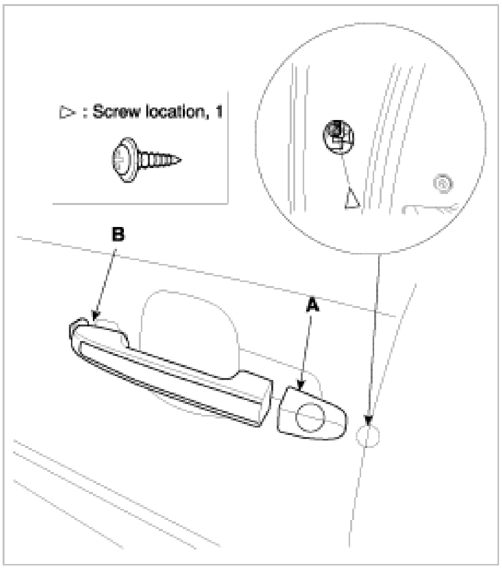


3. Installation is the reverse of removal.

> NOTE
>
> - Roll the glass up down to see if it move freely without binding.

OUT SIDE HANDLE REPLACEMENT

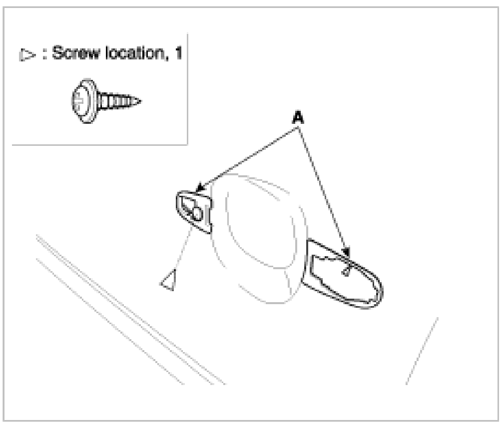
1. Remove the following parts.
   A. Remove the front door trim.
   B. Remove the glass.
   C. Remove inside handle.
2. After disconnecting the cover (A), remove the outside handle base (B).



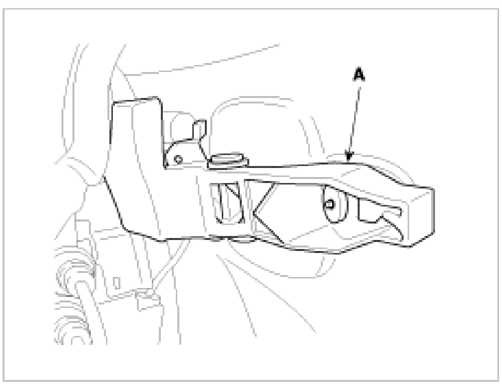
3. Remove door module.
4. Installation is the reverse of removal.

FRONT DOOR LATCH REPLACEMENT

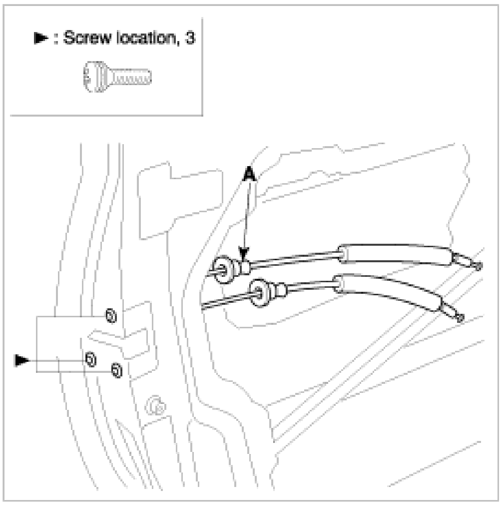
1. Remove the following parts.
   A. Remove the front door trim.
   B. Remove the glass.
   C. Remove the inside handle.
   D. Remove the door module.
2. Remove the outside handle.
3. Remove the outside handle pad (A).



4. Remove the outside handle base (A).



5. After loose the latch mounting bolts, remove the front door latch (A).

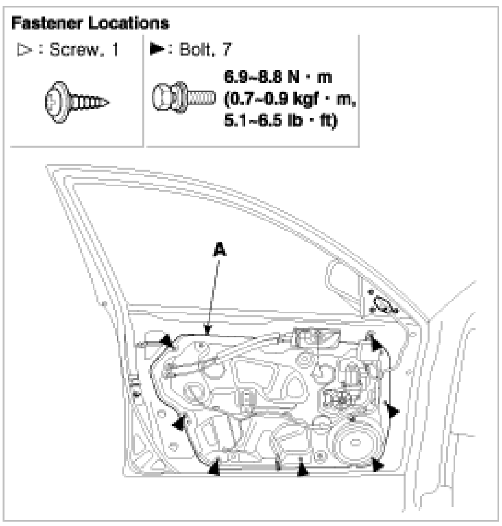


6. Installation is the reverse the removal.

> NOTE
>
> - Make sure the door locks and opens properly.

FRONT DOOR MODULE

1. Remove the front door trim.
2. Remove the glass.
3. Remove the inside handle.
4. Remove the outside handle.
5. After loose the door module mounting bolts, remove the door module (A).

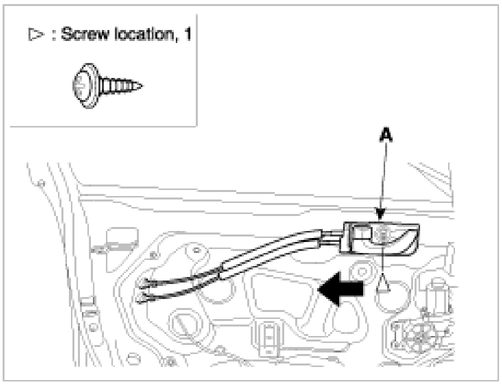


6. Installation is the reverse of removal.

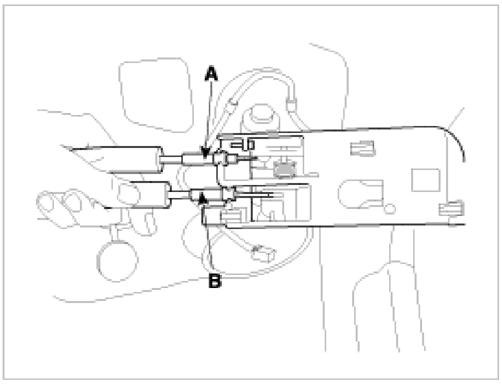
> NOTE
>
> - Make sure the connector is plugged in properly and each rod is connected securely.
> - Make sure the door lock and open properly.

INSIDE HANDLE REPLACEMENT

1. Remove the front door trim.
2. Loose the inside handle (A) mounting screw.
   Push the inside handle rearward to disconnect from the door module.



3. Disconnect the lock cable and (A) inside connect cable (B).

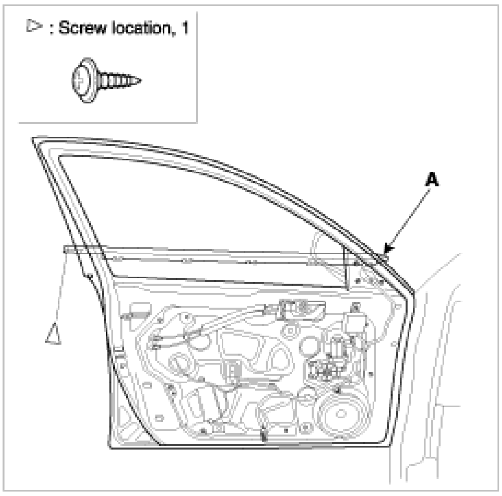


4. Installation is the reverse of removal.

> NOTE
>
> - Make sure the door lock and open properly.

DOOR BELT WEATHERSTRIP REPLACEMENT

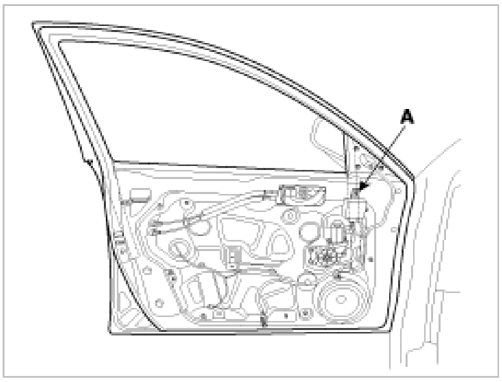
1. Remove the front door trim.
2. Release the hook (A), and then remove the door belt weatherstrip (B).



3. Installation is the reverse of removal.

GLASS RUN REPLACEMENT

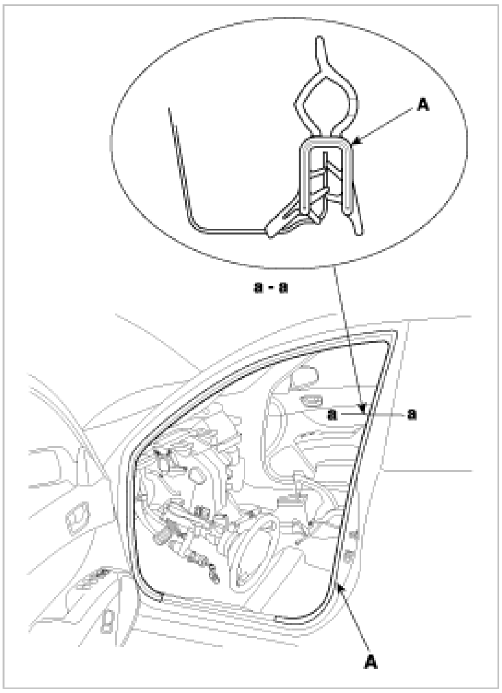
1. Remove the front door trim.
2. Remove the glass.
3. Remove the glass run channel (A) front the lower part.



4. Installation is the reverse of removal.

BODY WEATHHERSTRIP REPLACEMENT

1. Release the clips then remove the body weatherstrip(A).



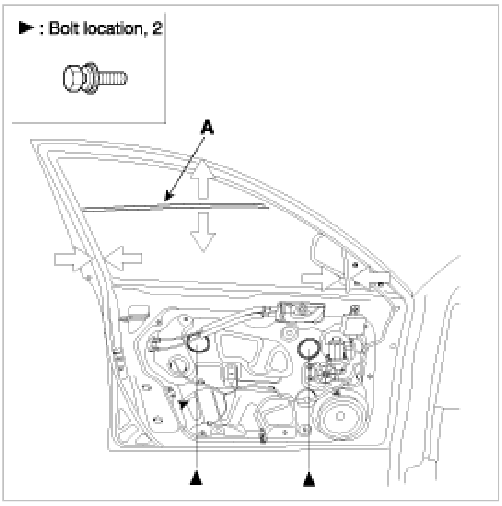
2. Installation is the reverse the removal.

ADJUSTMENT

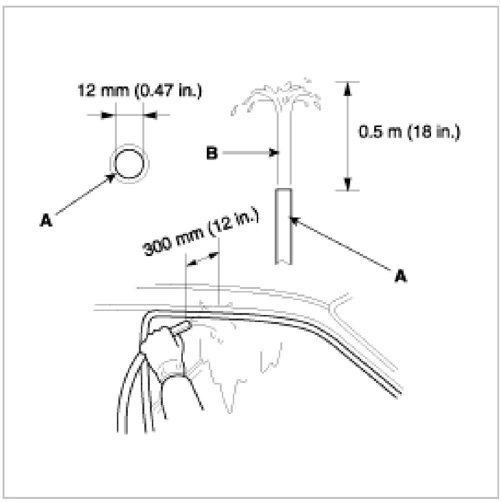
GLASS ADJUSTMENT

> NOTE
>
> - Check the glass run channel for damage or deterioration, and replace them necessary.

1. Remove the following parts.
   A. Quadrant cover.
   B. Door trim.
2. Carefully move the glass (A) until you can see the glass mounting bolts(B), then loosen them.



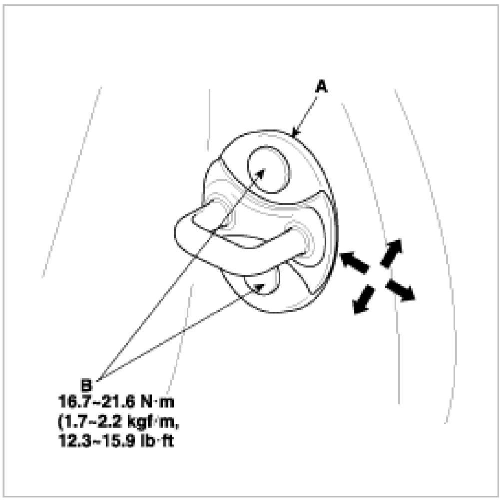
3. Push the glass (A) against the channel (C), then tighten the glass mounting bolts.
4. Check that the glass moves smoothly.
5. Raise the glass fully, and check for gaps.
   Check that the glass contacts the glass run channel evenly.
6. Check for water leaks. Run water over the roof and on the sealing area as shown, and note these items:
   A. Use a 12mm (1/2Iin.) diameter hose (A).
   B. Adjust the rate of water flow as shown (B).
   C. Do not use a nozzle.
   D. Hold the hose about 300mm(12in.) away from the door (C).



DOOR STRIKER ADJUSTMENT

Make sure the door latches securely without slamming it. If necessary, adjust the striker (A): The strike nuts are fixed. The strike can be fine adjusted up or down, and in or out.

1. Loosen the screws (B), then insert a shop towel between the body and striker.



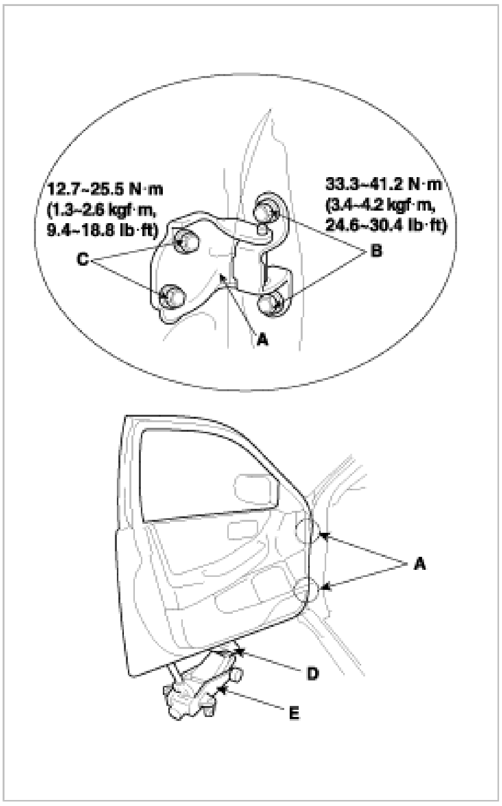
2. Lightly tighten the screws.
3. Wrap the striker with a shop towel, then adjust the striker by tapping it with a plastic hammer.
   Do not tap the striker too hard.
4. Loosen the screws and remove the shop towel.
5. Lightly tighten the screws.
6. Hold the outer handle out, and push the door against the body to be sure the striker allows a flush fit. If the door latches properly, tighten the screwsand recheck.

DOOR POSITION ADJUSTMENT

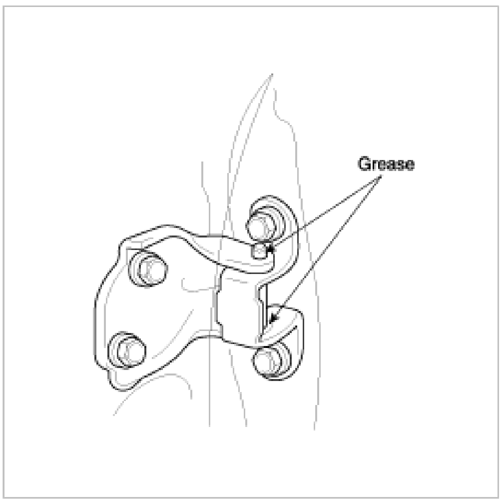
NOTE

After installing the door, check for a flush fit with the Body, then check for equal gaps between the front, rear, and bottom, door edges and the body. Check that the door and body edges are parallel. before adjusting, replace the mounting bolts.

1. Place the vehicle on a firm, level surface when adjusting the doors.
2. Adjust at the hinges (A):
   A. Loosen the door mounting bolts (B) slightly, and move the door IN or OUT until it aligns flush with the body.
   B. Loosen the hinge mounting bolts (C) slightly, and move the door BACKWARD or FORWARD, UP or DOWN as necessary to equalize the gaps.
   C. Place a shop towel (D) on the jack (E) to prevent damage to the door when adjusting the door.
3. Check that the door and body edges are parallel.



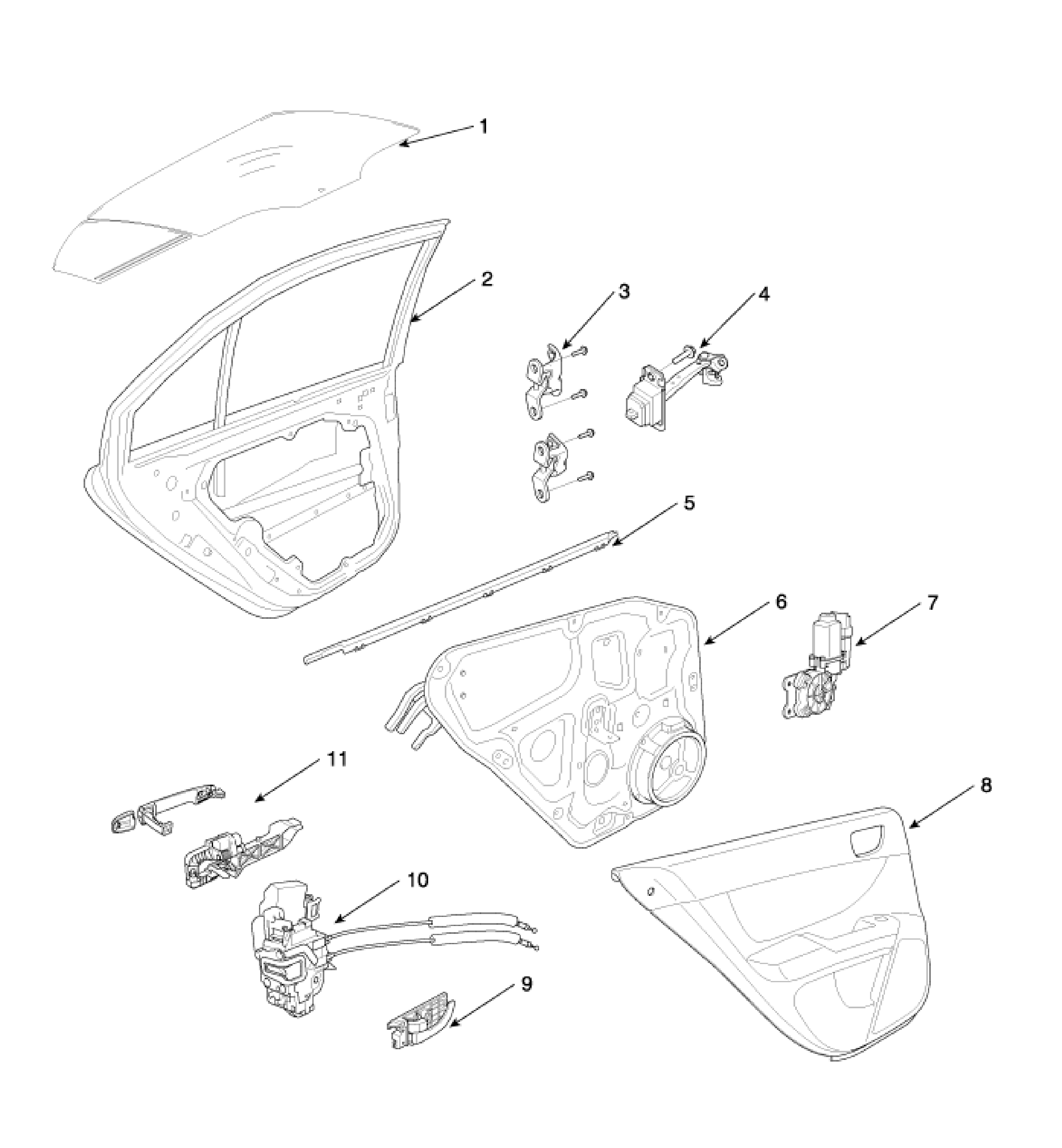
4. Grease the pivot portions of the hinges indicated by the arrows.



5. Check for water leaks.

Body (Interior and Exterior) > Exterior > rear door > Components and Components Location

COMPONENTS



1. Door grass	5. Door belt weatherstrip	9. Inside handle
2. Rear door panel	6. Door module	10. Latch assemble
3. Door hinge	7. Power window motor	11. Out side handle
4. Door checker	8. Door trim	

Body (Interior and Exterior) > Exterior > rear door > Repair procedures

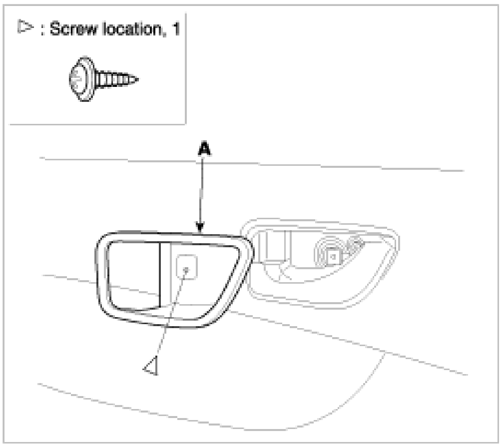
REPLACEMENT

REAR DOOR TRIM REPLACEMENT

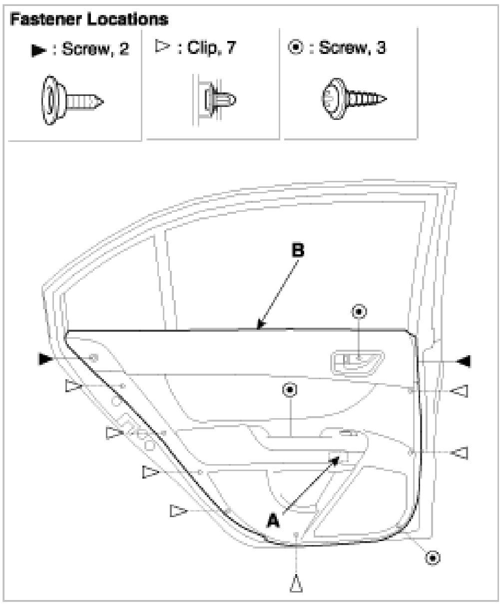
NOTE

- Take care not to scratch the door trim and other parts.
- Put on gloves to protect your hands.

1. Remove the inside handle cover (A).



2. Loosen the door trim (B) mounting screws. Release the clips that hold the door trim, then remove the door trim by pulling it upward. Disconnect the power window switch connector(A).



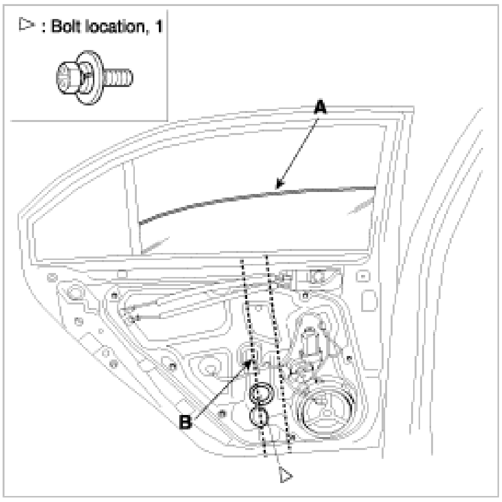
3. Installation is the reverse of removal.

> NOTE
>
> - Make sure of connectors is plugged in properly and each rod is connected securely.
> - Make sure the door lock and opens properly.

GLASS REPLACEMENT

> NOTE
>
> - Put on gloves to protect your hands.

1. Remove the rear door trim.
2. Carefully move the glass (A) until you can see the bolts, then loosen them. Separate the glass from the glass run and carefully pull the glass out through the window slot (B).



CAUTION

Take care not to drop to glass and scratch the glass surface.

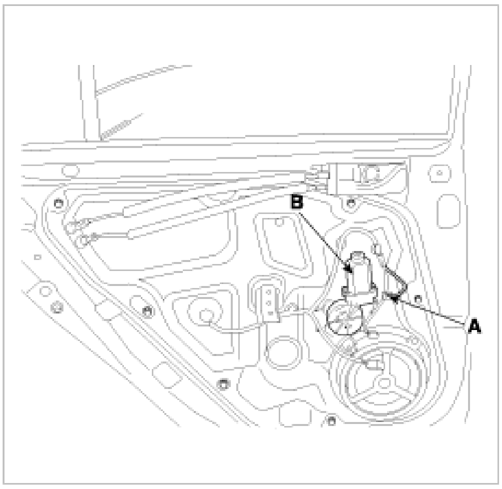
3. Installation is the reverse of removal.

NOTE

- Roll the glass up down to see if it move freely without binding.
- Adjust the position of the glass as necessary.

POWER WINDOW MOTOR REPLACEMENT

1. Remove the rear door trim.
2. After disconnecting the connector (A), remove the power window motor(B).



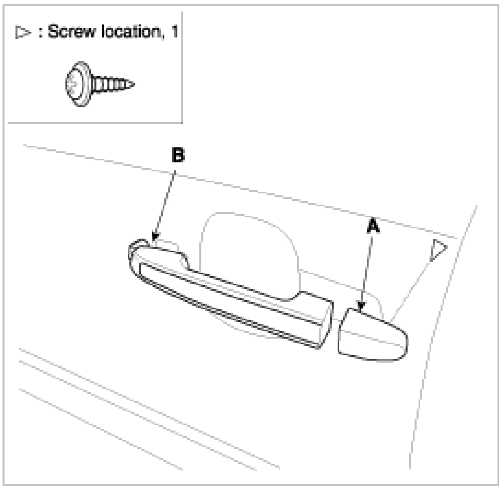
3. Installation is the reverse of removal.

NOTE

- Roll the glass up down to see if it move freely without binding.

OUT SIDE HANDLE REPLACEMENT

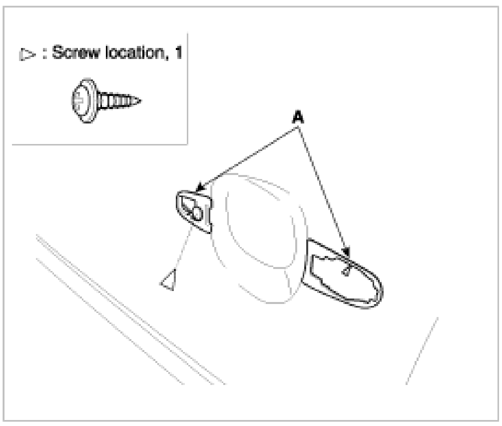
1. Remove the rear door trim.
2. Remove the glass.
3. Remove inside handle.
4. After disconnecting the cover (A), remove the outside handle base(B).



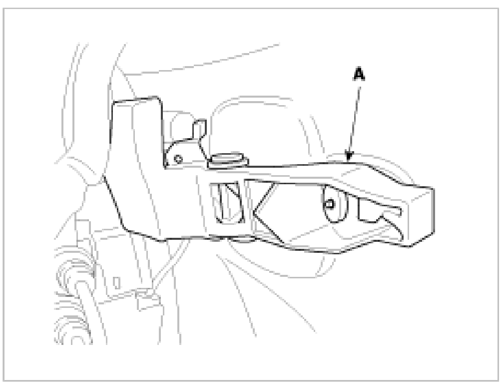
5. Remove rear door module.
6. Installation is the reverse of removal.

REAR DOOR LATCH REPLACEMENT

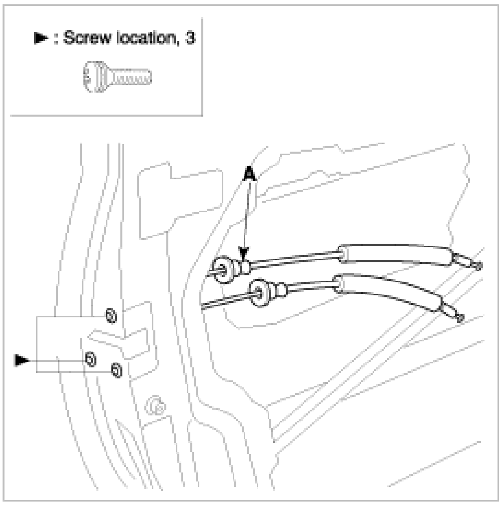
1. Remove the rear door trim.
2. Remove the glass.
3. Remove the inside handle.
4. Remove the door module.
5. Remove the out side handle.
6. Remove the out side handle pad (A).



7. Remove the out side handle base (A).



8. After loose the latch mounting bolts, remove the rear door latch(A).



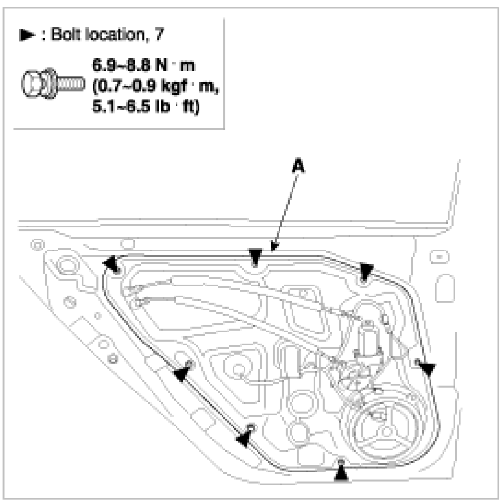
9. Installation is the reverse the removal.

NOTE

- Make sure the door lock and opens properly.

REAR DOOR MODULE REPLACEMENT

1. Remove the rear door trim.
2. Remove the glass.
3. Remove the inside handle.
4. Remove the out side handle.
5. After loose the door module mounting bolts, remove the door module (A).



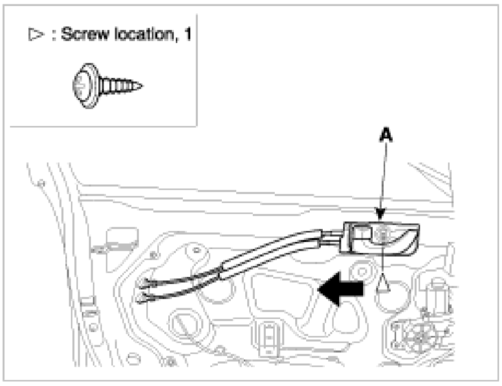
6. Installation is the reverse of removal.

NOTE

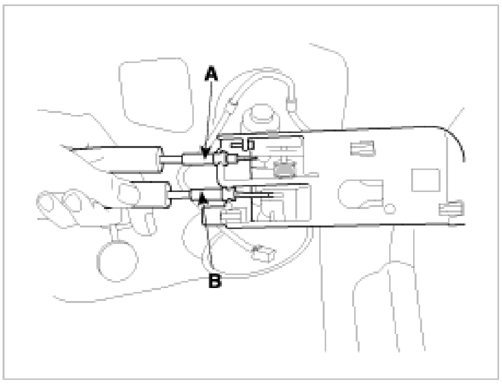
- Make sure the connector is plugged in properly and each rod is connected securely.
- Make sure the door locks and opens properly.

INSIDE HANDLE REPLACEMENT

1. Remove the rear door trim.
2. Loose the inside handle (A) mounting screw.
   Push the inside handle rearward to disconnect from the door module.



3. Disconnect the lock cable and (A) inside connect cable (B).



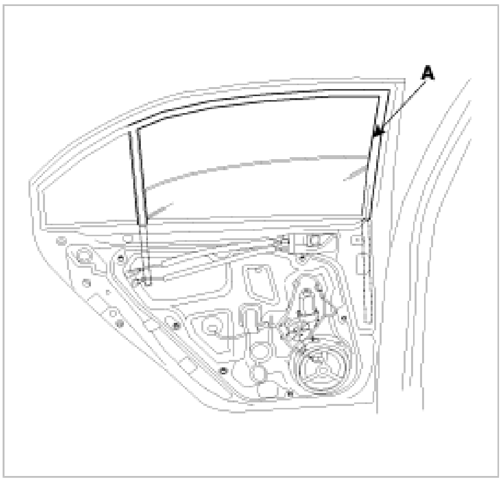
4. Installation is the reverse of removal.

> NOTE
>
> - Make sure the door lock and open properly.

DOOR BELT WEATHERSTRIP REPLACEMENT

GLASS RUN REPLACEMENT

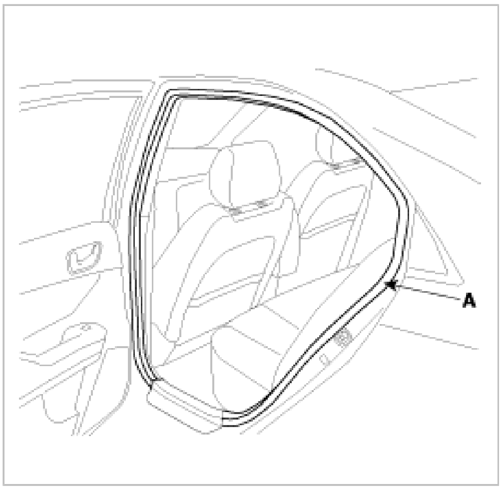
1. Remove the rear door trim.
2. Remove the glass.
3. Remove the glass run channel (A) front the lower part.



4. Installation is the reverse of removal.

BODY WEATHHERSTRIP REPLACEMENT

1. Release the clips then remove the body weatherstrip (A).



2. Installation is the reverse the removal.

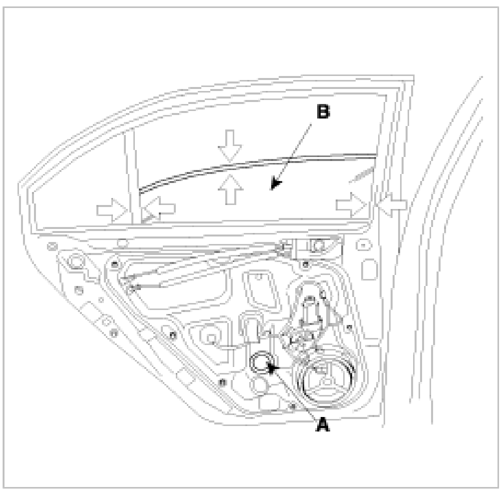
ADJUSTMENT

GLASS ADJUSTMENT

NOTE

- Check the glass run channel for damage or deterioration, and replace them necessary.

1. Remove the following parts.
   A. Door trim.
2. Carefully move the glass (A) until you can see the glass mounting bolts(B), then loosen them.

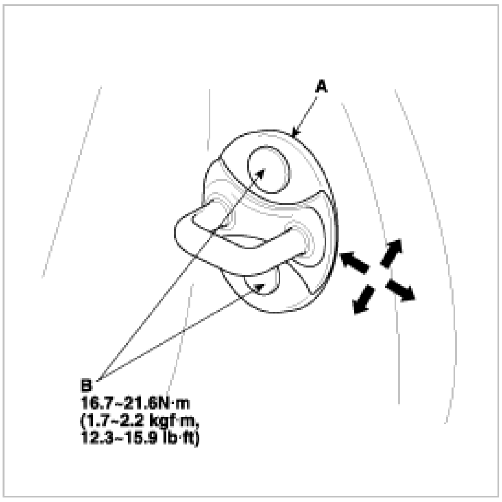


3. Push the glass (A) against the channel (C), then tighten the glass mounting bolts.
4. Check that the glass moves smoothly.
5. Raise the glass fully, and check for gaps.
   Check that the glass contacts the glass run channel evenly.
6. Check for water leaks. Run water over the roof and on the sealing area as shown, and note these items:
   A. Use a 12mm (1/2Iin.) diameter hose (A).
   B. Adjust the rate of water flow as shown (B).
   C. Do not use a nozzle.
   D. Hold the hose about 300mm(12in.) away from The door (C).

DOOR STRIKER ADJUSTMENT

Make sure the door latches securely without slamming It. If necessary, adjust the striker (A): The strike nuts are fixed. The strike can be fine adjusted up or down, and in or out.

1. Loosen the screws (B), then insert a shop towel between the body and striker.



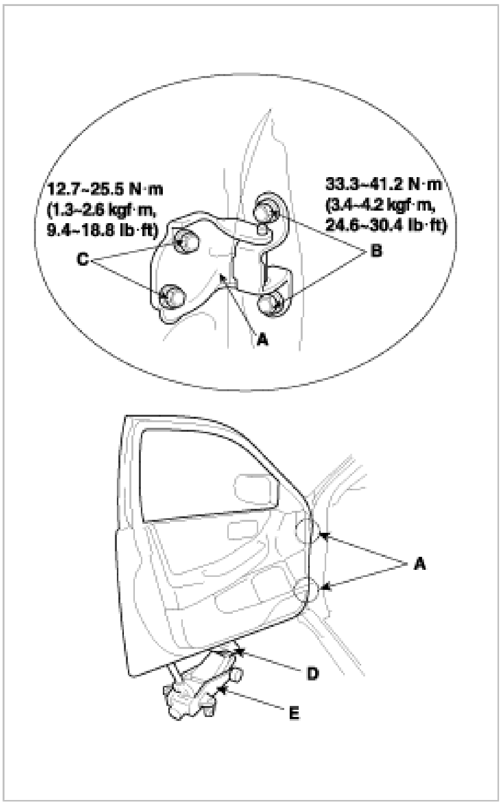
2. Lightly tighten the screws.
3. Wrap the striker with a shop towel, then adjust the striker by tapping it with a plastic hammer.
   Do not tap the striker too hard.
4. Loosen the screws and remove the shop towel.
5. Lightly tighten the screws.
6. Hold the outer handle out, and push the door against the body to be sure the striker allows a flush fit. If the door latches properly, tighten the screws and recheck.

DOOR POSITION ADJUSTMENT

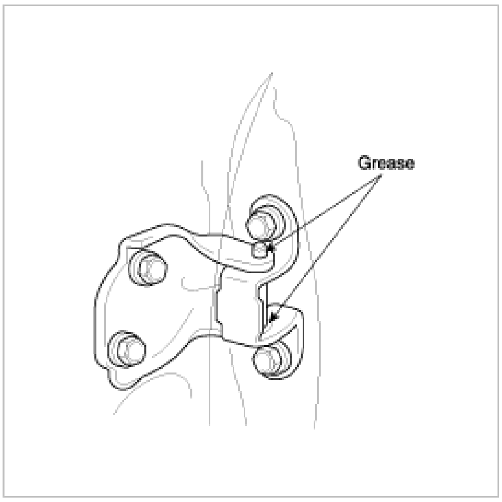
NOTE

After installing the door, check for a flush fit with the body, then check for equal gaps between the front, rear, and bottom, door edges and the body. Check that the door and body edges are parallel. before a djusting, replace the mounting bolts.

1. Place the vehicle on a firm, level surface when adjusting the doors.
2. Adjust at the hinges (A):
   A. Loosen the door mounting bolts (B) slightly, and move the door IN or OUT until it aligns flush with the body.
   B. Loosen the hinge mounting bolts (C) slightly, and move the door BACKWARD or FORWARD, UP or DOWN as necessary to equalize the gaps.
   C. Place a shop towel (D) on the jack (E) to prevent damage to the door when adjusting the door.
3. Check that the door and body edges are parallel.



4. Grease the pivot portions of the hinges indicated by the arrows.



5. Check for water leaks.

Body (Interior and Exterior) > Exterior > body side moldings > Repair procedures

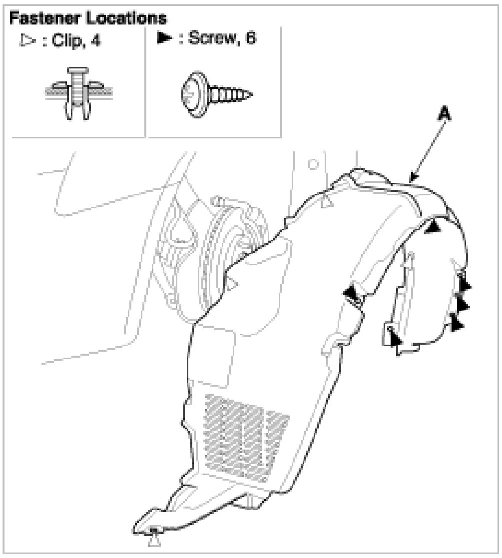
REPLACEMENT

FRONT MUD GUARD AND WHEEL GUARD

NOTE

- When prying with tip screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Put on gloves to protect your hands.
- Take care not to scratch the body surface.

1. Remove the wheel guard (A).



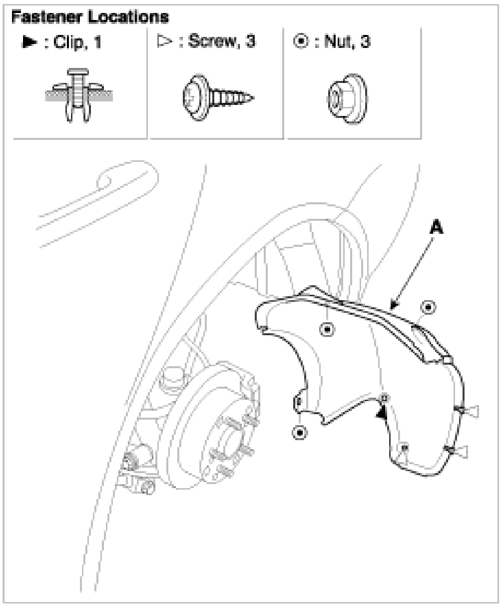
2. Installation is the reverse of removal.

REAR MUD GUARD AND WHEEL GUARD

NOTE

- When prying with tip screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Put on gloves to protect your hands.
- Take care not to scratch the body surface.

1. Remove the wheel guard (A).

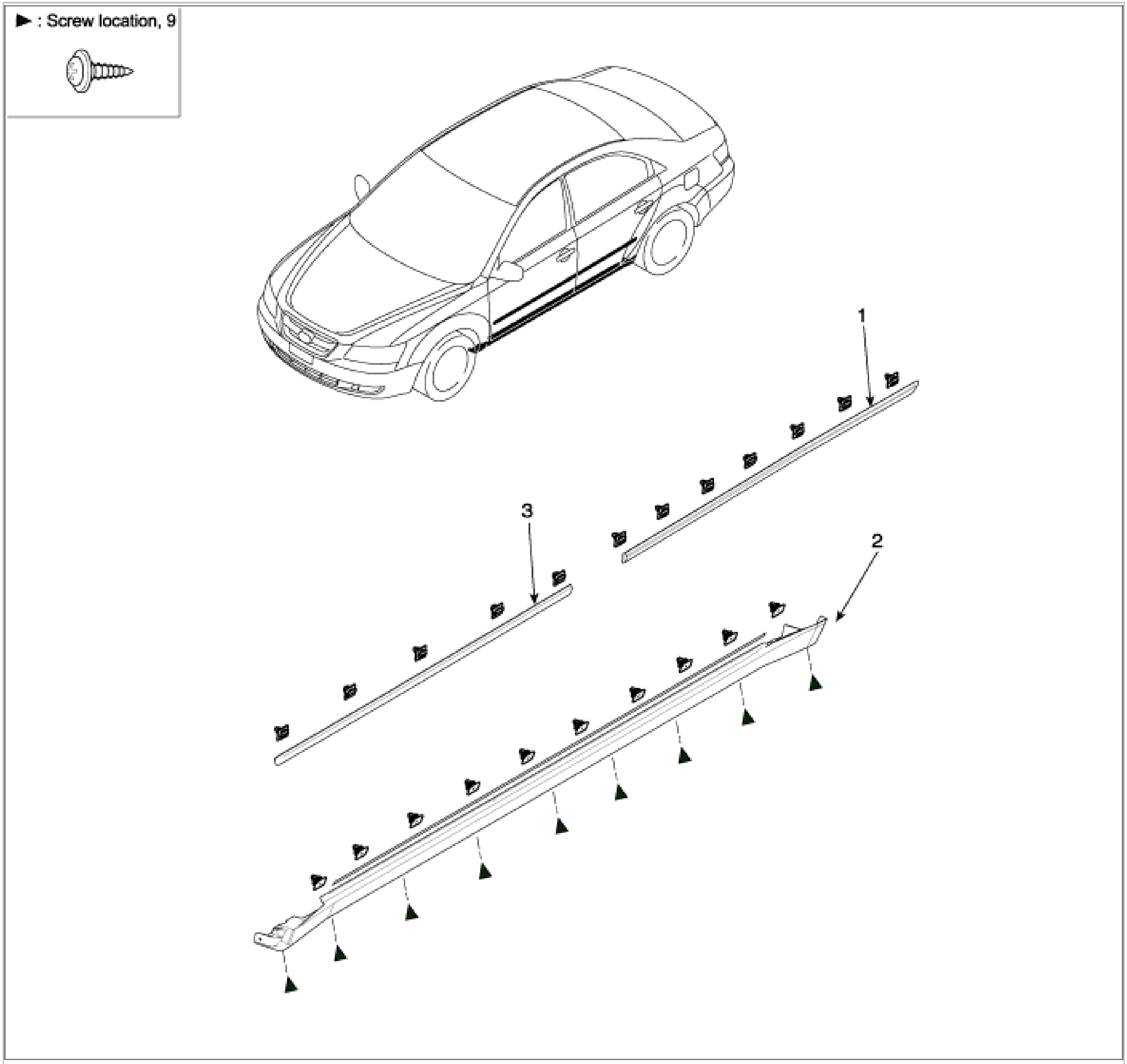


2. Installation is the reverse of removal.

SIDE GARNISH AND SIDE SILL REPLACEMENT

NOTE

- When prying with a flat-tip screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Put on gloves to protect your hands.
- Take care not to scratch the body surface.

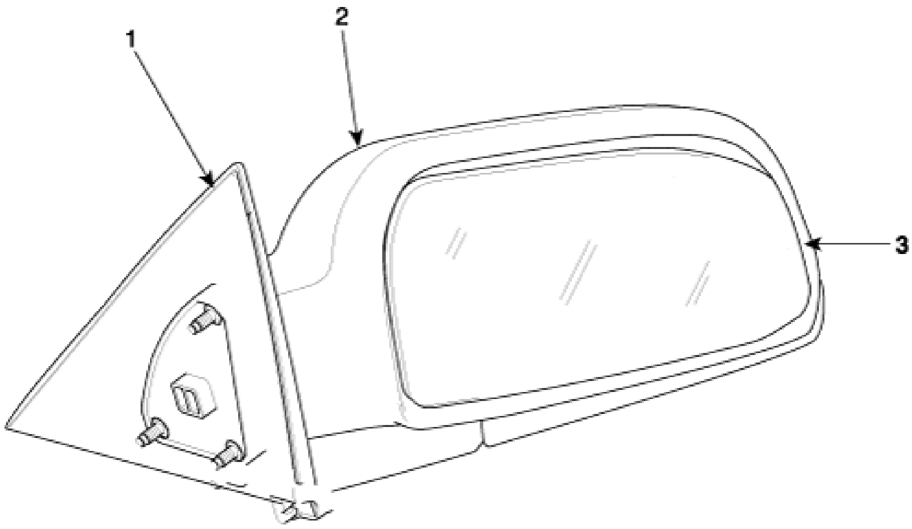


1. Rear door molding
2. Side seal molding
3. Front door molding

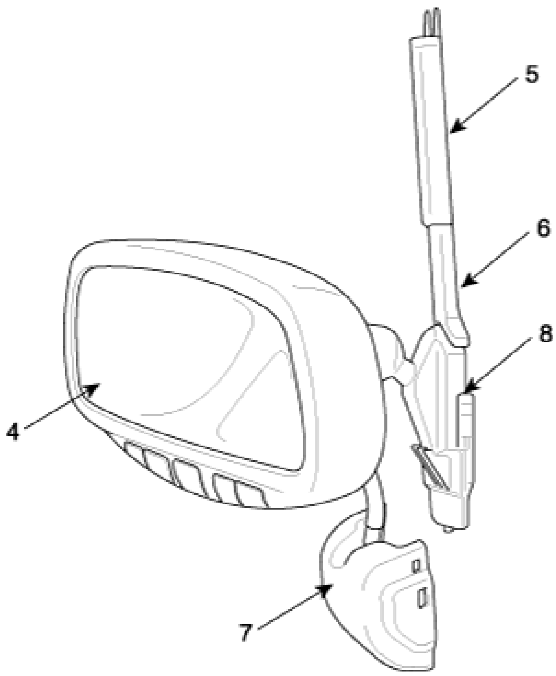
Body (Interior and Exterior) > Exterior > mirror > Components and Components Location

COMPONENETS

[Outside rearview mirror]



[Inside rearview mirror]



1. Base	4. Mirror	7. cover
2. Housing	5. Wire home link cover	8. Base
3. Mirror	6. Wire home link	

Body (Interior and Exterior) > Exterior > mirror > Repair procedures

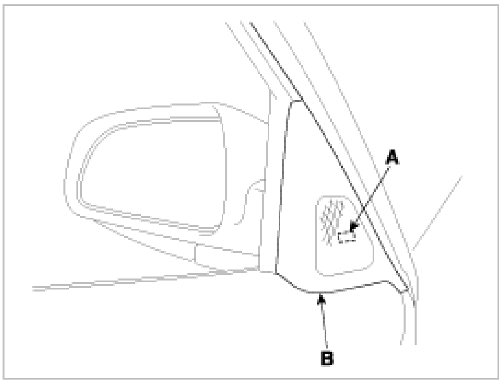
REPLACEMENT

OUTSIDE REAR VIEW MIRROR RELPLACEMENT

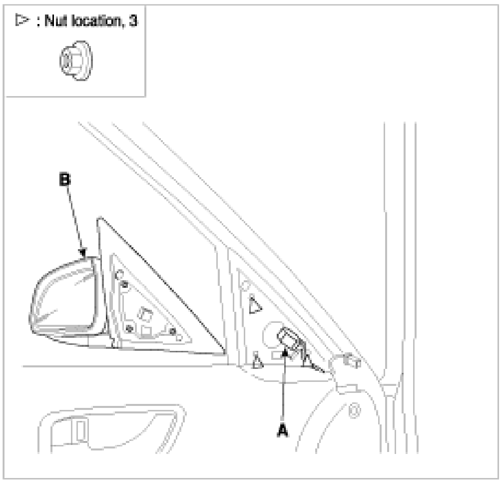
NOTE

- When prying with tip screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Put on gloves to protect your hands.

1. Remove the quadrant inner cover (A), then disconnect the connector (B).



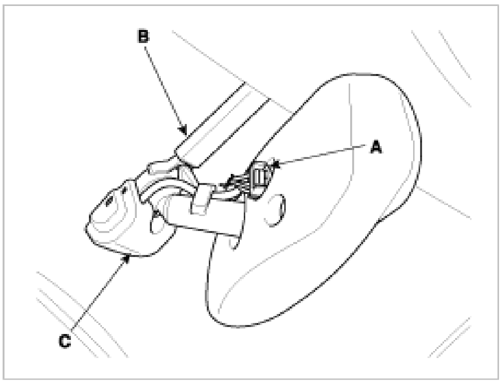
2. After disconnecting the connector (A), remove the outside rear view mirror (B).



3. Installation is the reverse of removal.

ECM MIRROR REPLACEMENT

1. Remove the connector (A) and cover (B,C).

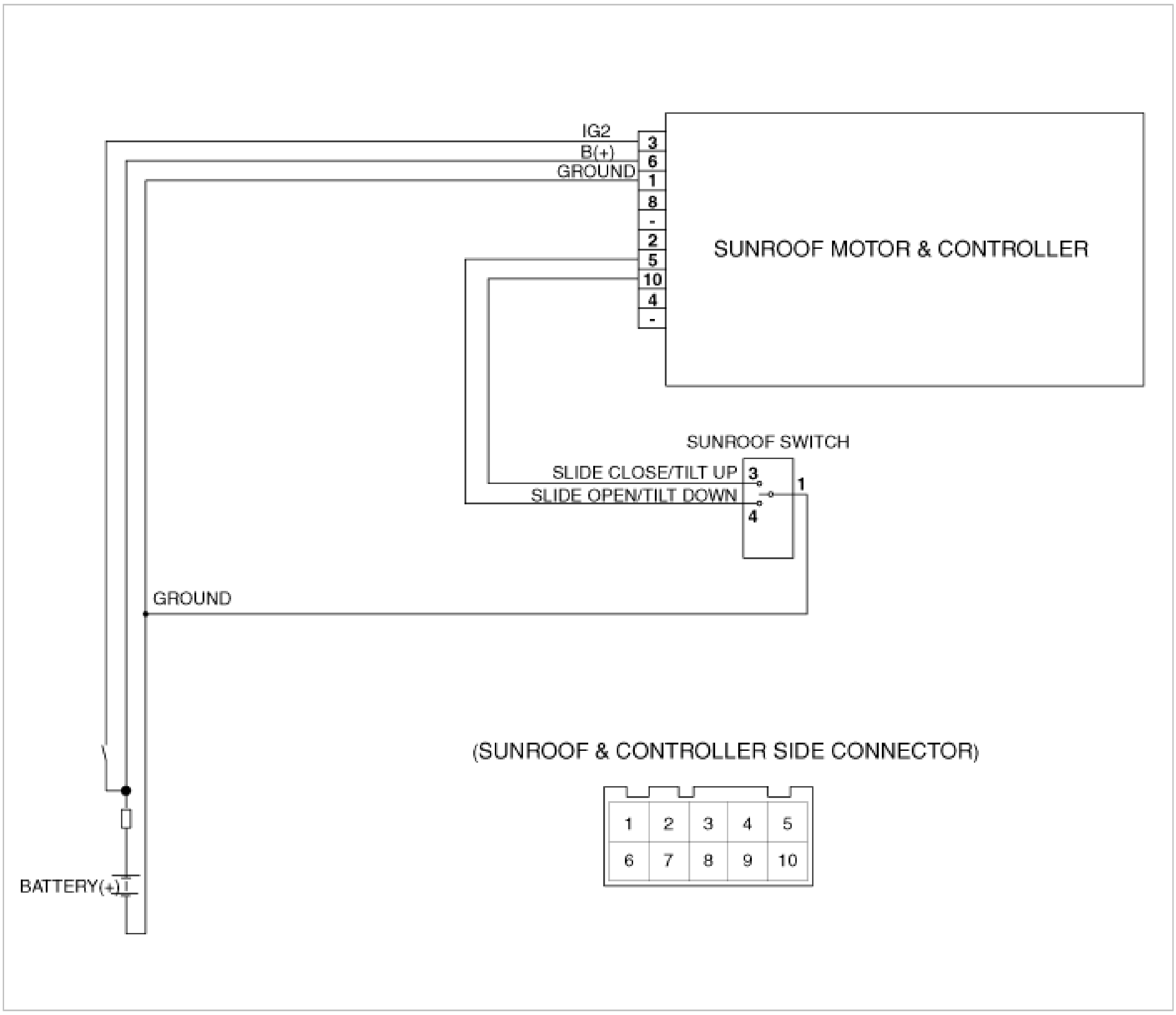


2. Loesen the mounting screw. Push the ECM mirror base up to remove the ECM mirror assembly (A).

3. Installation is the reverse of removal.

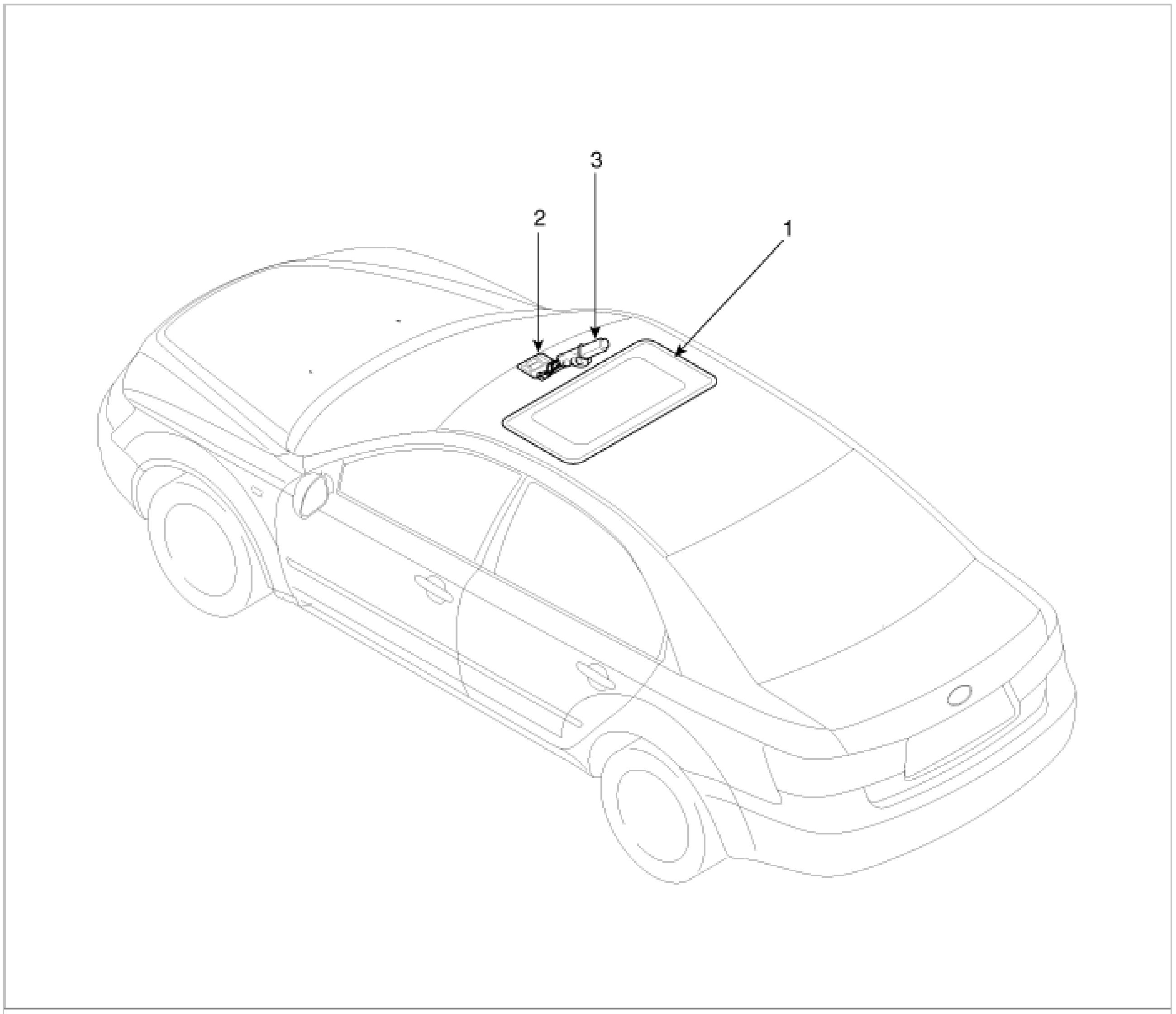
Body (Interior and Exterior) > Sun Roof > Schematic Diagrams

CIRCUIT DIAGRAM



Body (Interior and Exterior) > Sun Roof > Components and Components Location

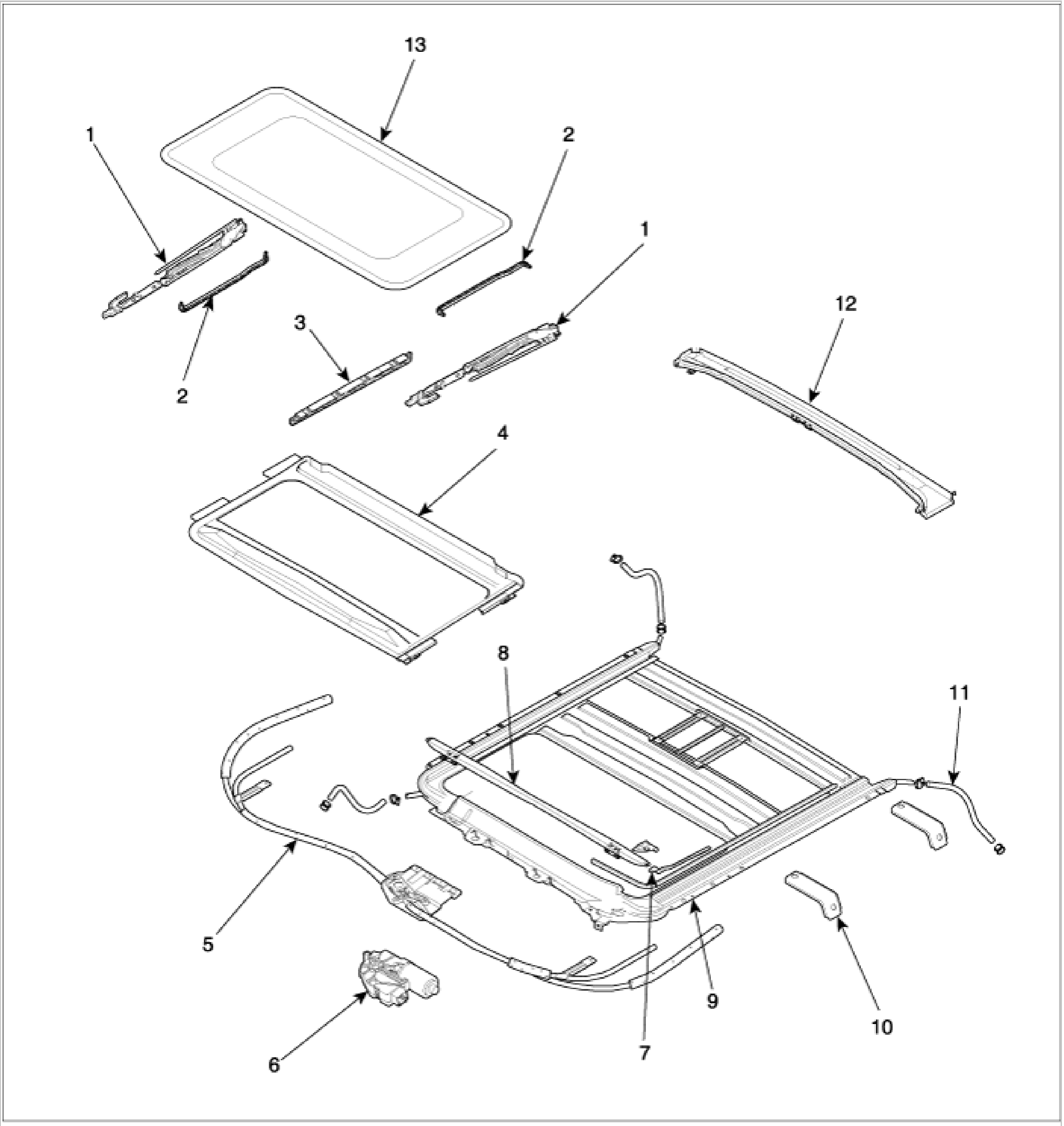
COMPONENT LOCATION



1. Sunroof	3. Sunroof motor & controller
2. Sunroof switch	

Body (Interior and Exterior) > Sun Roof > sun roof assembly > Components and Components Location

COMPONENTS



1. Guide assembly	6. Motor	11. Drain tube
2. Drip link	7. Defector link	12. Drip rail
3. Decoration cover	8. Defector	13. Glass
4. Sunshade	9. Frame	
5. Drive unit	10. Set bracket	

Body (Interior and Exterior) > Sun Roof > sun roof assembly > Repair procedures

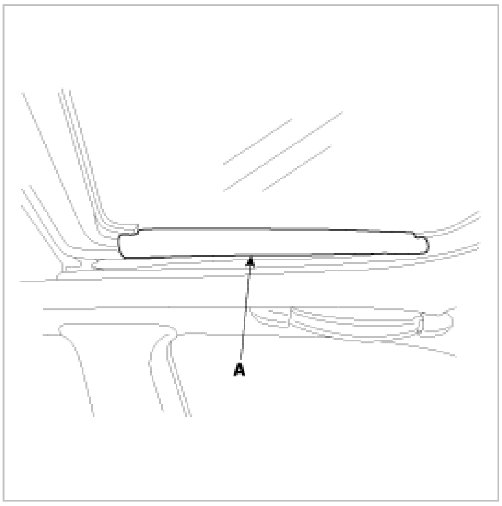
REPLACEMENT

GLASS REPLACEMENT

NOTE

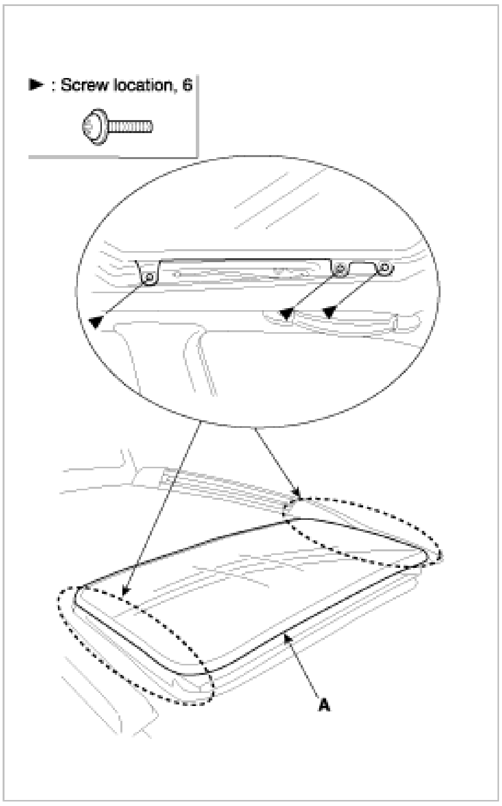
- Put on glove to protect your hands.

1. Remove both decoration cover (A).



2. Remove the glass (A) by lifting it up.

> NOTE
>
> - Do not damage the roof panel



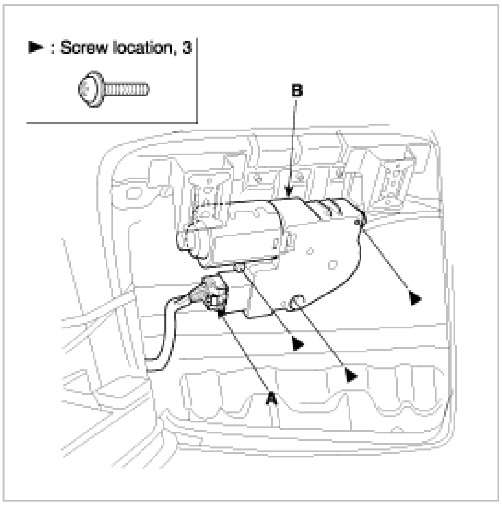
3. Installation is the reverse of removal.

MOTOR REPLACEMENT

1. Remove the over head console.

> NOTE
>
> - Confirm the position of guide whether it is closed or not when you remove the motor.

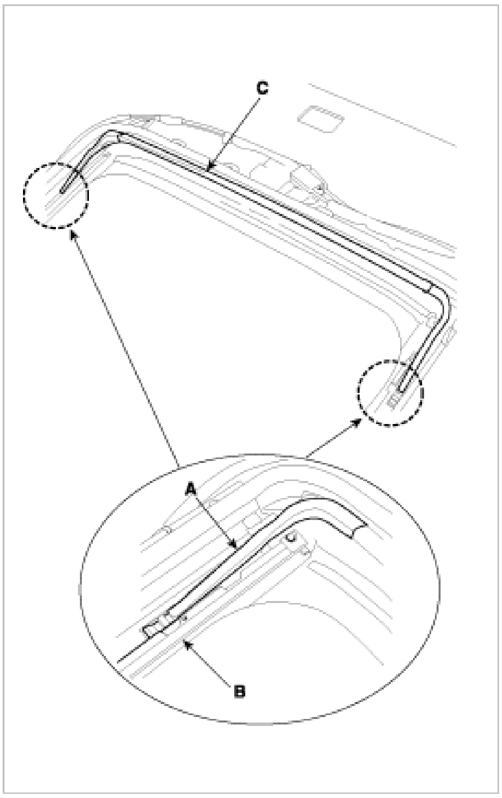
2. Disconnect the motor connector (A), remove the screws and then remove the motor (B).



3. Installation is the reverse of removal.

DEFLECTOR REPLACEMENT

1. Open the glass fully.
2. Disconnect the deflector link (A) from the frame (B), and then remove the deflector (C).



3. Installation is the reverse of removal.

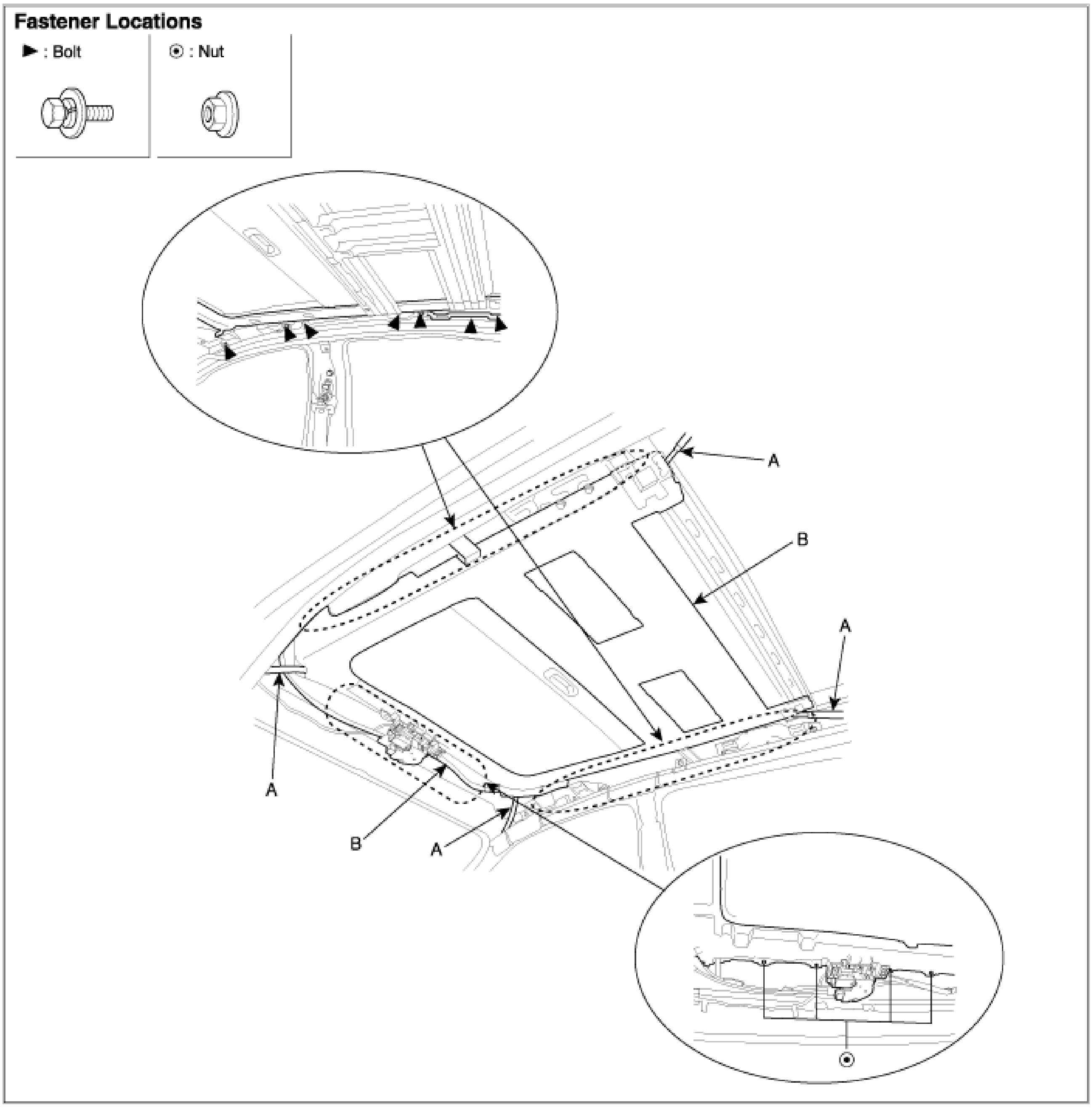
SUNROOF ASSEMBLY REPLACEMENT

1. Remove the follows parts.
   A. Front and door scuff trim.
   B. Front, center and rear pillar trim.
   C. Headlining.
   D. Sunroof glass.
2. Disconnect the drain tubes (A).
3. After loosening the mounding bolts and nuts, remove the sunroof assembly (B).

NOTE

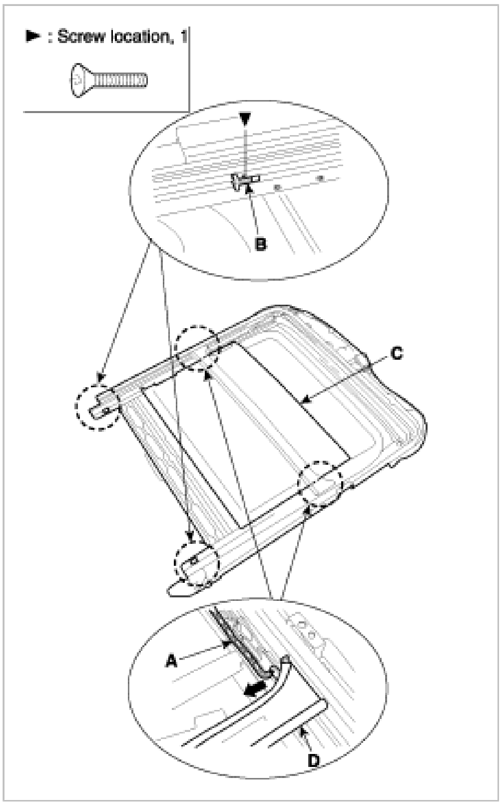
- Take care not to scratch the interior trims and other parts.

4. Installation is the reverse of removal.



SUNSHADE AND DRIP RAIL REPLACEMENT

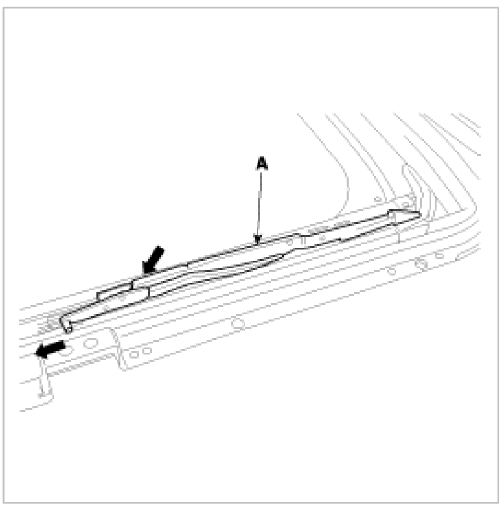
1. Remove the sunroof assembly.
2. Remove the drip link (A) and sunshade stopper (B).
3. Remove the sunshade (C) and drip rail (D).



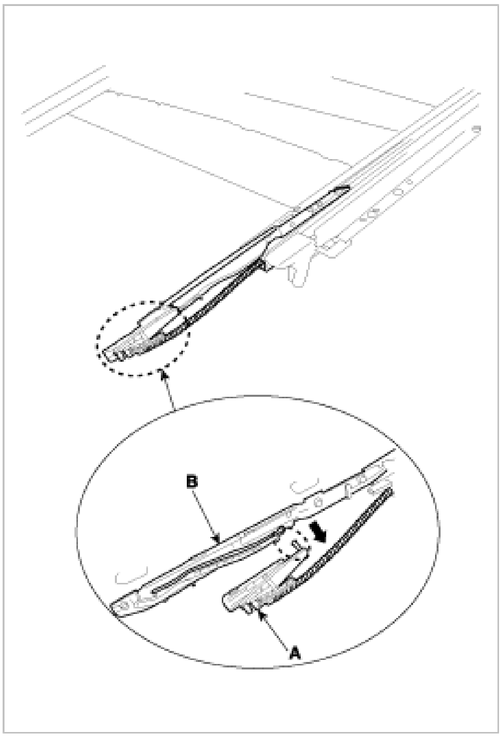
4. Installation is the reverse of removal.

GUIDE ASSEMBLY REPLACEMENT

1. Remove the sunroof assembly.
2. Remove a guide assembly (A) after lowering a guide thoroughly by pushing a slide (B) to rear.



3. Remove the guide (A) and slide (B).



4. Installation is the reverse of removal.

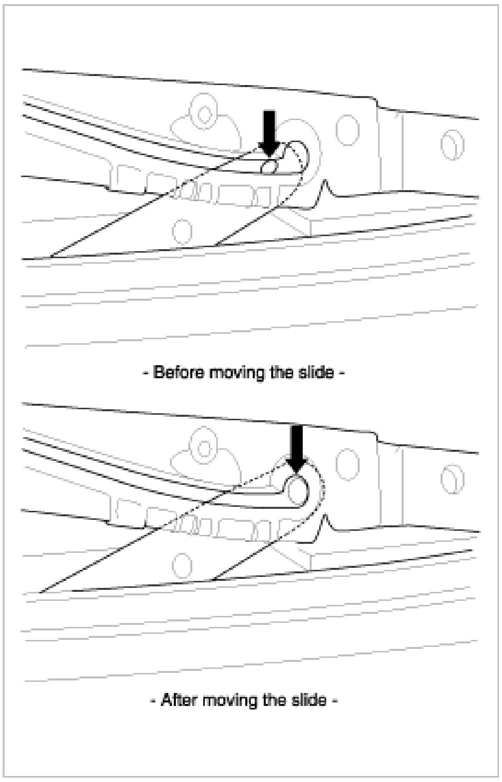
NOTE

- Make sure to align the slide with the center of “A” and “B”
- Make sure to initialize the motor.

ADJUSTMENT

HOW TO INITIALIZE

1. Check that the glass has been installed.
   A. Finished height adjustment.
2. Push the up switch. (Keep on pushing the switch)
   A. The slide moved 5mm forward after 15 seconds.



3. After moving the slide 5mm forward, turn OFF the switch and push the UP switch (Keeping on pushing the switch with continuous operation).
   A. If the operation above is normal condition, the sunroof once and closes.
4. When the sunroof is closed completely, turn OFF the UP switch initialize the motor completely.

WHEN TO INITIALIZE THE MOTOR

1. First operation the vehicle after manufacture it.
2. Initial value is erased or damaged because of short power electric discharge during operation.
3. After using the manual handle.

OPERATING THE SUNROOF EMERGENCY HANDLE

1. Use the sunroof emergency handle to close and open the sunroof manually for the following case only.
   A. To close the sunroof before driving a vehicle in a rainy day or on the highway if the sunroof cannot be closed due to failure of the sunroof motor or controller.
2. Operating method.
   A. Remove the overhead console.
   B. Push the emergency handle up into the hexagonal drive (A) of the sunroof motor. You must push hard enough to disengage the motor clutch; otherwise the emergency handle will slip due to incomplete fit in the motor.
   C. Carefully turn the emergency handle clockwise to close the sunroof.
   D. After closing the sunroof, wiggle the handle back and forth as you remove the tool from the motor, to ensure the motor clutch reengages.
   E. A 5mm hex socket may be used in place of the emergency handle, with a" Speeder" type handle.

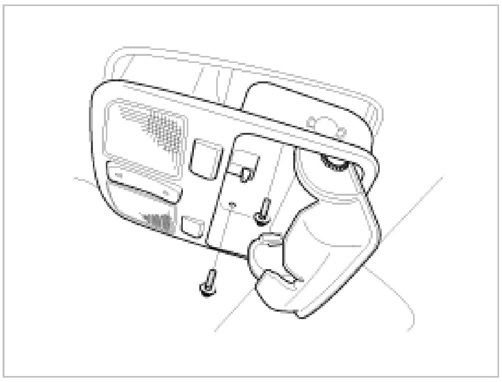
> **CAUTION**
>
> Do not use power tools to operate the sunroof.
> Damage to the components may occur.

Body (Interior and Exterior) > Sun Roof > sun roof switch > Repair procedures

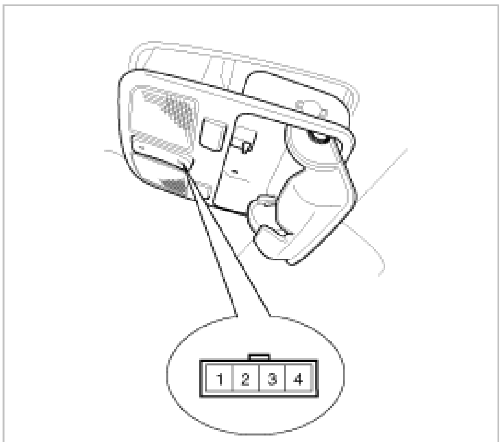
INSPECTION

1. Disconnect the negative (-) battery terminal.

2. Open the sunglass case cover from the overhead console then remove the 2 screws (B) holding the overhead console.



3. Disconnect the connector then remove the overhead console lamp assembly from the headliner. Check for continuity between the terminals. If the continuity is not as specified, replace the sunroof switch.



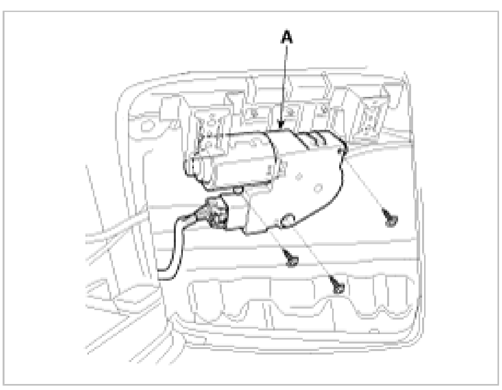
[Switch side connector]

Terminal / position	1	3	4
Slide open	O	—	O
Tilt down	O	—	O
Tilt up	O	O	

Body (Interior and Exterior) > Sun Roof > sun roof moter > Repair procedures

REPLACEMENT

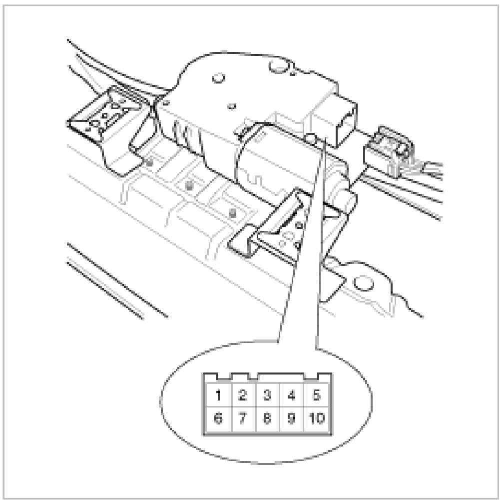
1. Disconnect the negative (-) battery terminal.
2. Open the sunglass case cover from the overhead console then remove the 2 screws holding the overhead console. Disconnect the connector then remove the overhead console lamp assembly from the headliner.
3. Remove the head lining. (Refer to Body group - sunroof)
4. Remove the sunroof motor (A) after removing 3 screws and disconnect.



5. Installation is the reverse of removal.

INSPECTION

1. Disconnect the negative (-) battery terminal.
2. Apply the battery voltage to terminal 3, 6 and ground the terminal 1.



3. Ground the terminals as below table, and check that the sunroof unit operates as below table.

Terminal / position	3	4	5	10
Slide close/Tilt up	⊕			⊖
Slide open/Tilt down	⊕		⊖	

4. Make these input tests at the connector
   If any test indicates a problem, find and correct the cause, then recheck the system.
   If all the input tests prove OK, the sunroof motor must be faulty; replace it.

Terminal	Test condition	Test: Desired result
3	IG2 ON	Check for voltage to ground: There should be battery voltage.
1	Under all conditions	Check for continuity to ground: There should be continuity.
6	Under all conditions	Check for voltage to ground: There should be battery voltage.

RESETTING THE SUNROOF

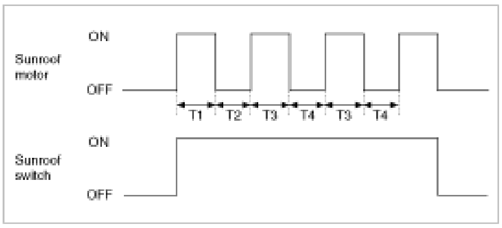
Whenever the vehicle battery is disconnected or discharged, or you use the emergency handle to operate the sunroof, you have to reset your sunroof system as follows:.

1. Turn the ignition key to the ON position.
2. According to the position of the sunroof, do as follows.
   (1) In case that the sunroof has closed completely or been tilted :
   Press the TILT UP button until the sunroof has tilted upward completely.
   (2) In case that the sunroof has slide-opened:
   Press and hold the CLOSE button for more than 5 seconds until the sunroof has closed completely.
   Press and hold the CLOSE button for more than 5 seconds after the sunroof has closed completely. Press the TILT UP button until the sunroof has tilted upward completely.
3. Release the TILT UP button.
4. Press and hold the TILT UP button once again until the sunroof has returned to the original position of TILT UP after it is raised a little higher than the maximum TILT UP position.
   When this is complete, the sunroof system is reset.

PROTECTING THE OVERHEATED MOTOR

In order to protect the overheated sunroof motor by continuous motor operation, the sunroof ECU controls the Run-time and Cool-time of motor as followings;

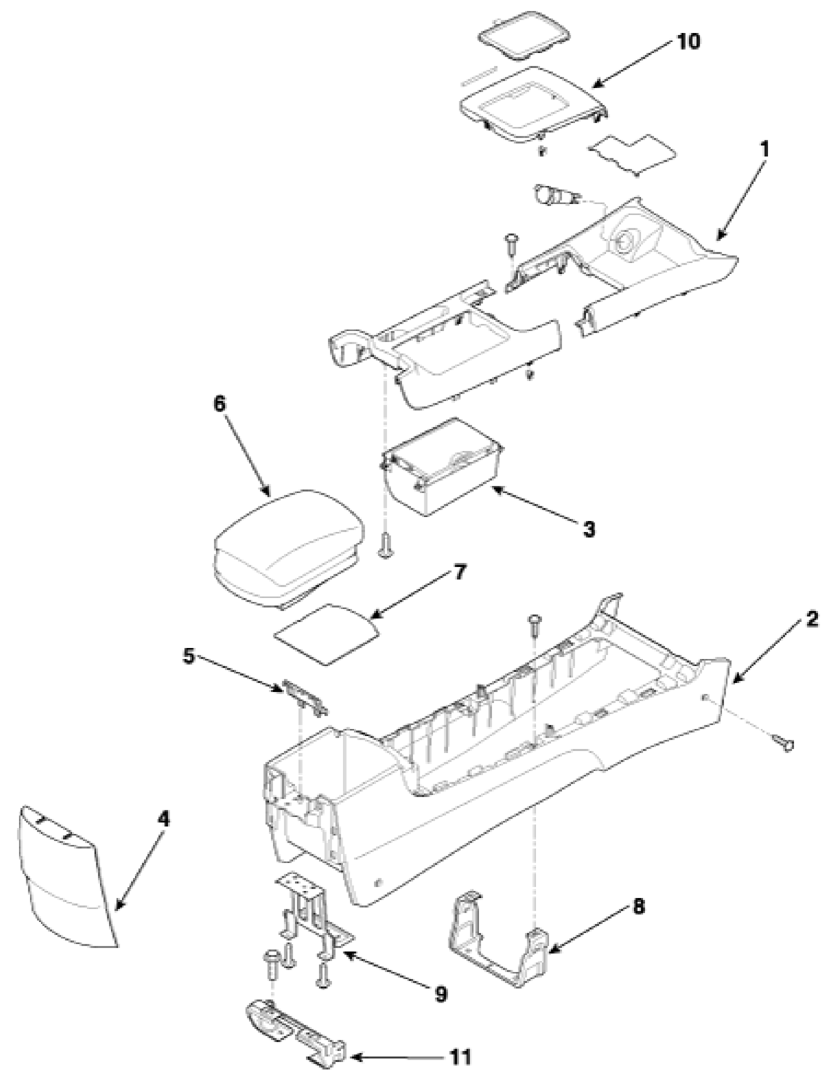
1. The Sunroof ECU detects the Run- time of motor
2. Motor can be operated continuously for the 1st Run-time(120 ± 10sec.).
3. The continuously operated motor stops operating after the 1st Run-time(120 ± 10sec.).
4. And then Motor is not operated for the 1st Cool-time(18 ± 2sec.).
5. Motor is operated for the 2nd Run-time(10 ± 2sec.) at the continued motor operation after 1st Cool-time(18 ± 2sec.)
6. The continuously operated motor stops operating after the 2st Run-time(120 ± 10sec.)
7. Motor is not operated for the 2st Cool-time(18 ± 2sec.).
8. Motor repeats the 2nd Run-time and 2nd Cool-time at the continued motor operation.
   A. In case that motor is not operated continuously, the Run-time which is limited for protecting the overheated motor is increased.
   B. The Run-Time of motor is initialized to "0" if the battery or fuse is reconnected after being disconnected, discharged or blown.



T1 : 120 ± 10 sec., T2 : 18 ± 2 sec.,
T3 : 10 ± 2 sec., T4 : 18 ± 2 sec.

Body (Interior and Exterior) > Interior > console > Components and Components Location

COMPONENTS



1. Upper cover	5. Armrest ballank	9. Armrest
2. Floor console	6. Armrest	10. Center cover
3. Strage box	7. Floor console pad	11. Rear mounting bracket
4. Rear console cover	8. Armrest center mounting bracket	

Body (Interior and Exterior) > Interior > console > Repair procedures

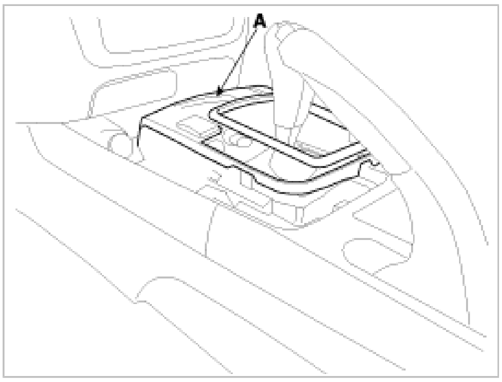
REPLACEMENT

FLOOR CONSOLE REPLACEMENT

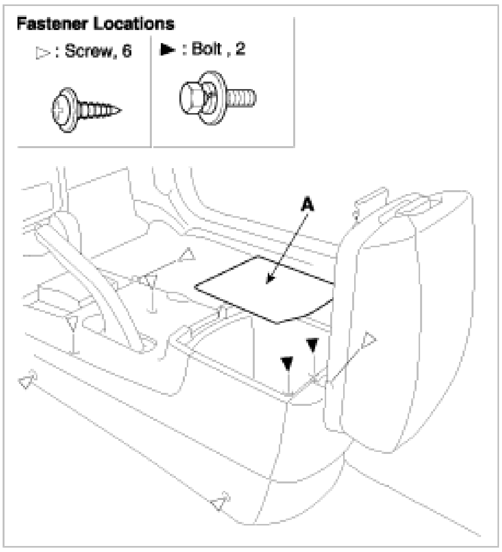
NOTE

- When prying with tip screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Put on gloves to protect your hands.

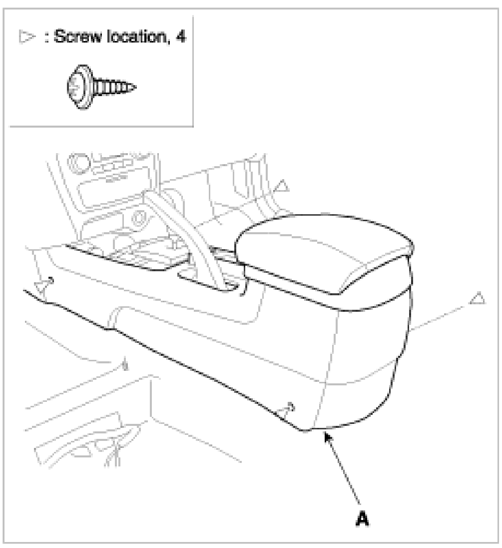
1. Remove the front seat.
2. After remove the center cover (A), disconnect the connector (B).



3. Remove the floor console pad (A).



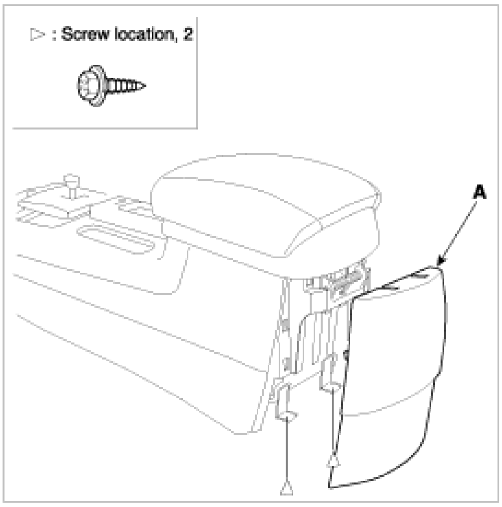
4. After loosening the console mounting screw, remove the floor console assembly(A).



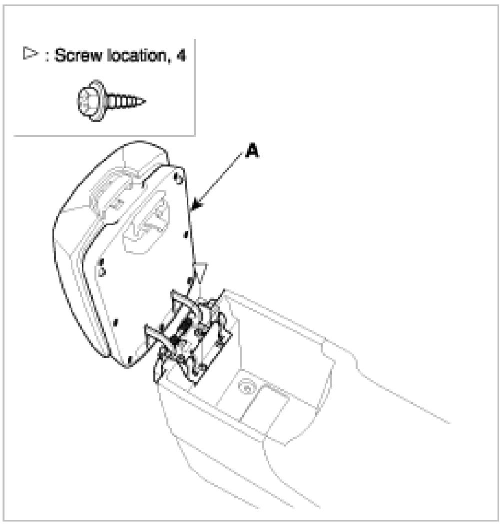
5. Installation is the reverse of removal.

ARMREST REPLACEMENT

1. Remove the console assembly.
2. Remove rear cover (A).



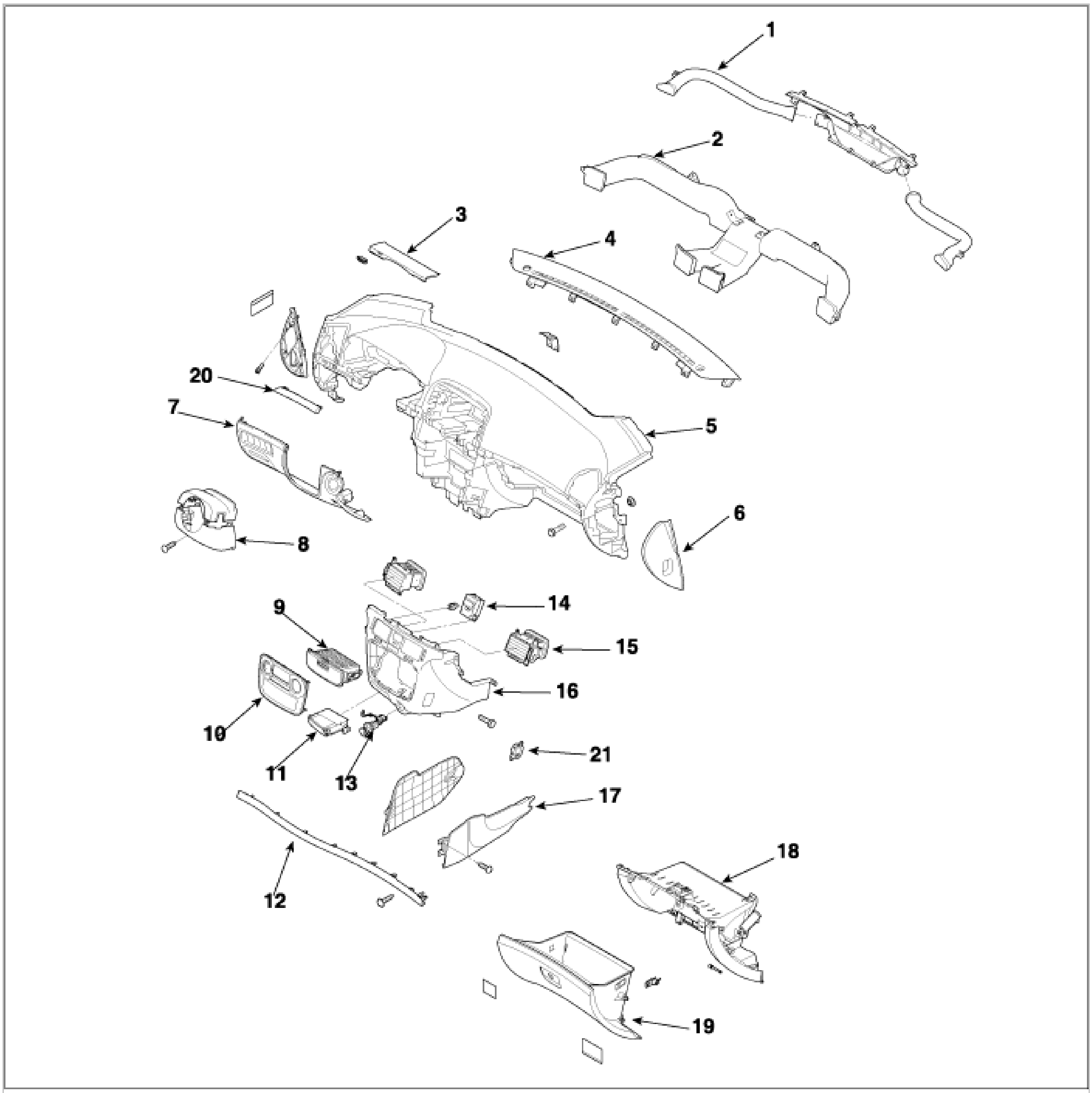
3. After loosening the armrest mounting screw, remove the armrest (A).



4. Installation is the reverse of removal.

Body (Interior and Exterior) > Interior > crash pad > Components and Components Location

CONPONENTS



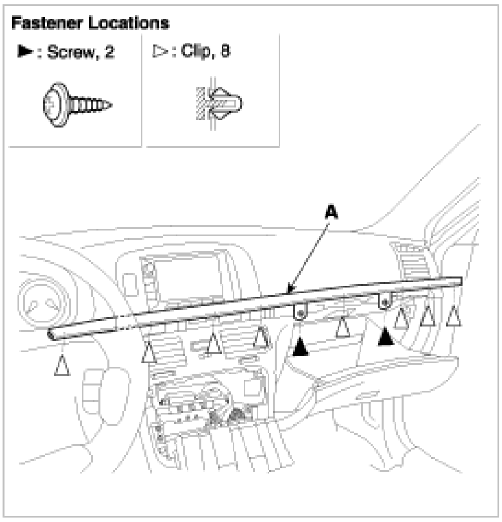
1. Defroster hose	6. Side cover	11. Ashtay	16. Center crash pad panel
2. Air vent	7. Crash pad lower panel	12. Center guarsh	17.Center lower cover
3. Cluster facia panel	8. Steering column shroud	13. Cigar lighter	18. Lower crash pad panel
4. Center	9. Center facia	14. Digtal clock	19. Glove box
5. Main crash pad	10. Center facia lower panel	15. Air vent	20. Side cover
			21. hanger

Body (Interior and Exterior) > Interior > crash pad > Repair procedures

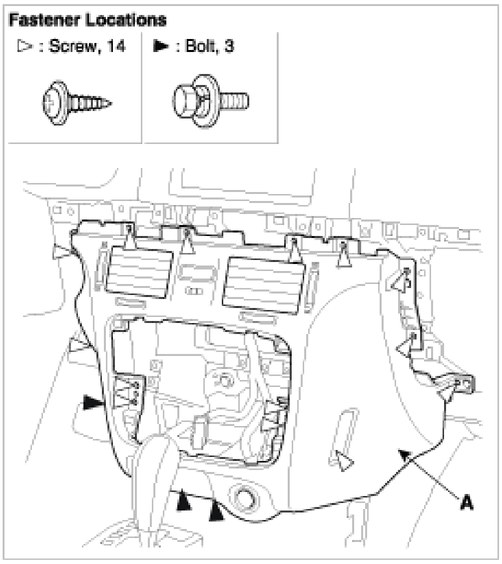
REPLACEMENT

CRASH PAD CENTER PANEL REPLACEMENT

1. Remove floor console assembly.
2. Remove the center garnish (A).
3. Remove the glove box.
4. Remove the center facia upper panel.



5. After loosening the crash pad lower panel mounting screw, then crash pad lower panel (A).

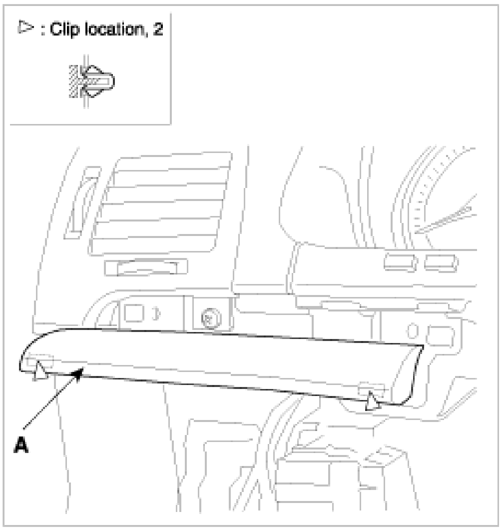


6. Installation is the reverse of removal.

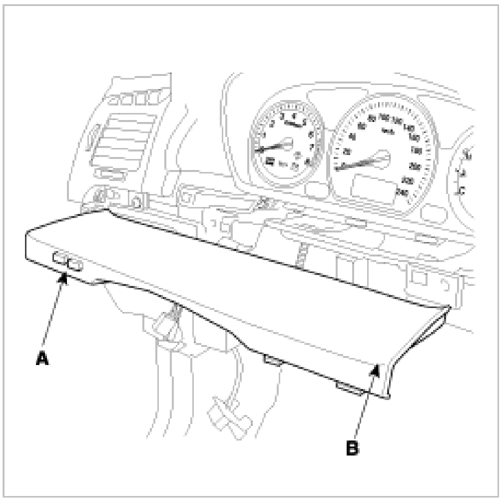
CLUSTER FACIA PANEL REPLACEMENT

> **NOTE**
>
> - When prying with tip screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
> - Put on gloves to protect your hands.

1. Tilt the steering column down.
2. Remove the center garnish (A).



3. After disconnecting the trip sensor connector (A), remove the cluster facia panel (B).



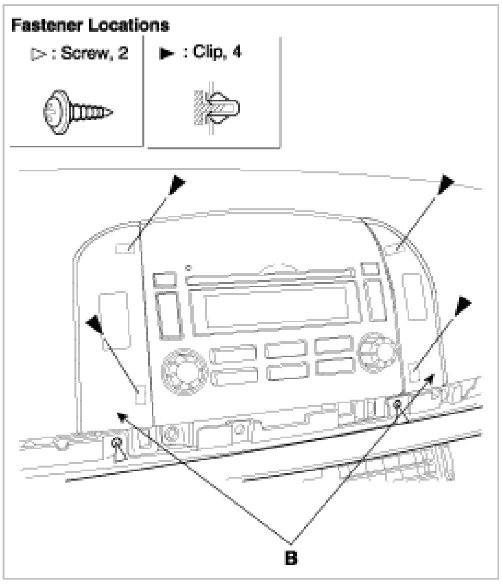
4. Installation is the reverse of removal.

> NOTE
>
> - Make sure the connector is plugged in properly.

CENTER FACIA PANEL REPLACEMENT

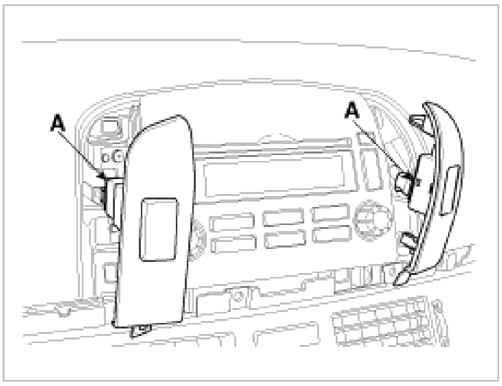
1. After disconnecting the connector (A), remove the center facia panel (B).

> NOTE
>
> - When prying with tip screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
> - Put on gloves to protect your hands.



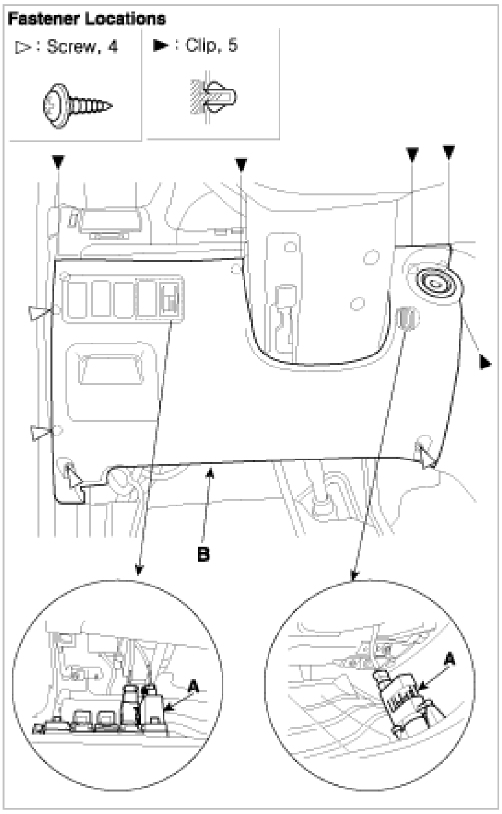
2. Installation is the reverse of removal.

> **NOTE**
>
> - Make sure the connector is plugged in properly.



LOWER CRASH PAD PANEL REPLACEMENT

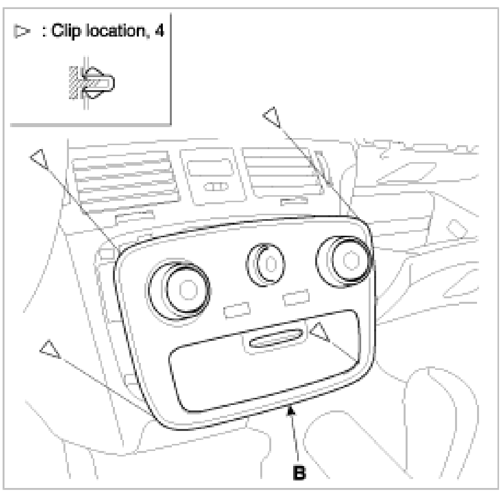
1. Remove the center garnish.
2. Loosening the crash pad lower panel mounting screw.
3. After Disconnecting the connector(A), remove lower panel (B).

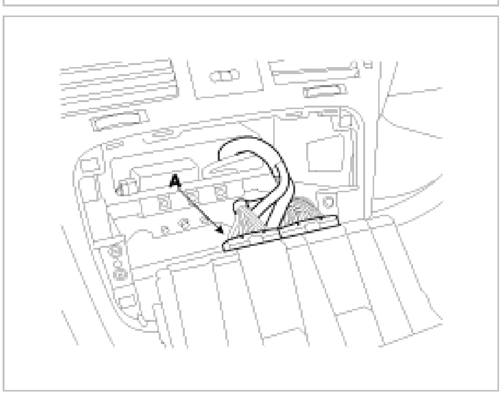


4. Installation is the reverse of removal.

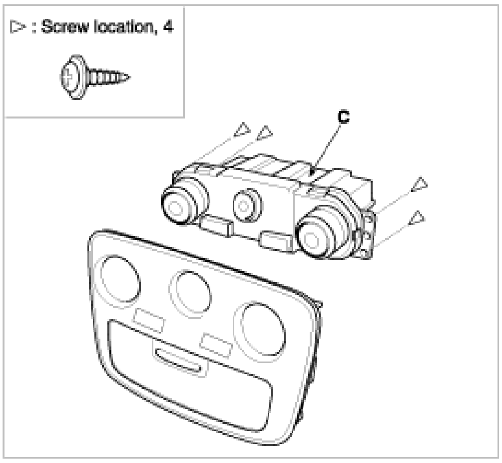
HEATER CONTROL UNIT REPLACEMENT

1. After disconnecting the connector (A), remove the center facia lower panel (B).





2. Loosening the heater control mounting screw, remove heater control unit (C).

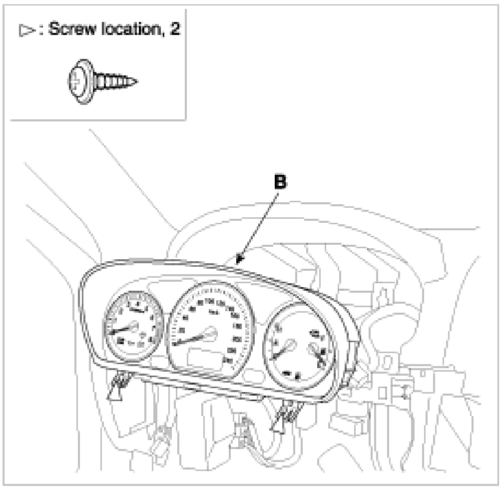


3. Installation is the reverse of removal.

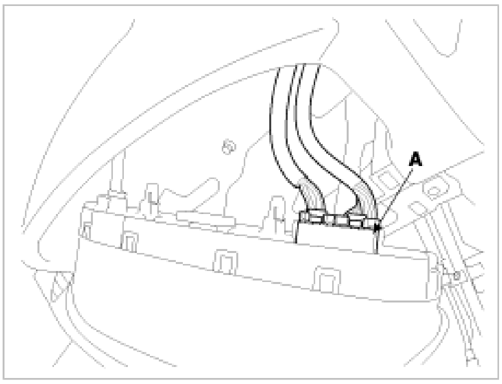
> NOTE
>
> - Make sure the connector is plugged in properly.

CLUSTER REPLACEMENT

1. Remove the cluster facia panel.
2. Loosen the screws.



3. Disconnect the cluster connector (A), then remove the cluster (B).

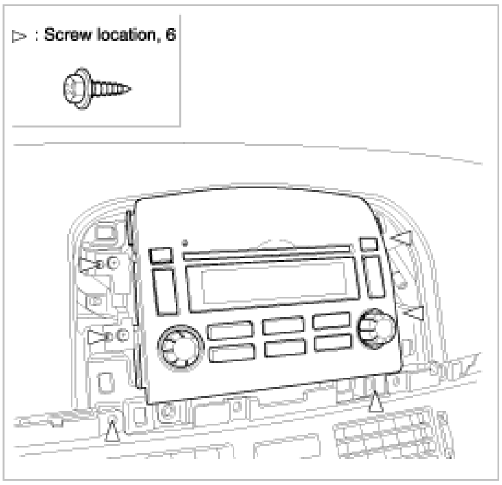


4. Installation is the reverse of removal.

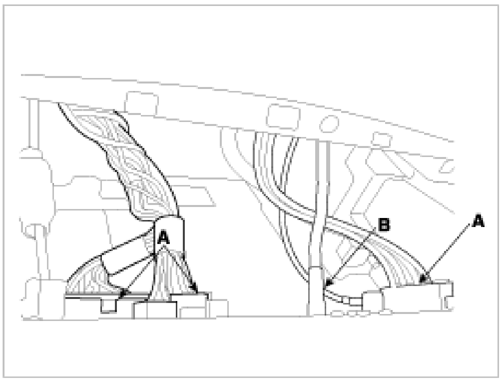
> NOTE
>
> - Make sure the connector is plugged in properly.

AUDIO ASSEMBLY REPLACEMENT

1. Remove the center facia panel.
2. Loosen the screws.



3. Disconnect the audio connector (A) and antenna cable (B), then remove the audio assembly (C).

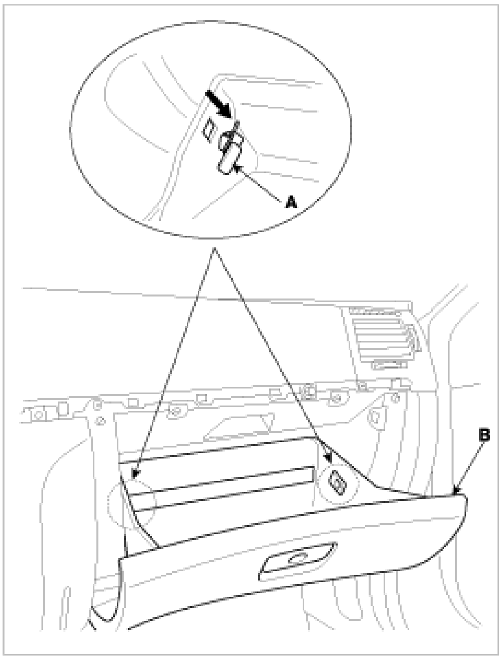


4. Installation is the reverse of removal.

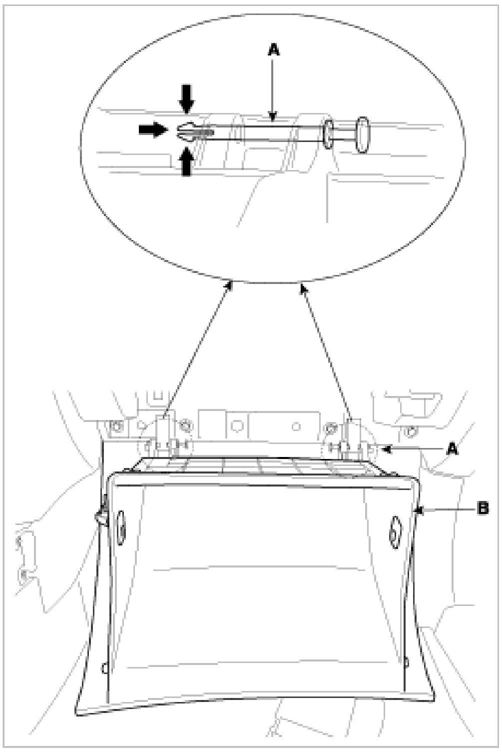
> NOTE
>
> - Make sure the connector is plugged in properly.

GLOVE BOX REPLACEMENT

1. Disconnect the damper (A) from the glove box (B).



2. Disconnect the pine (A), then remove the glove box (C).



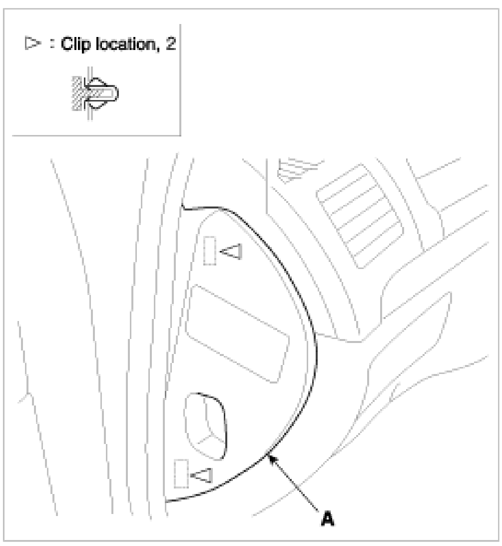
3. Installation is the reverse of removal.

COVER REPLACEMENT

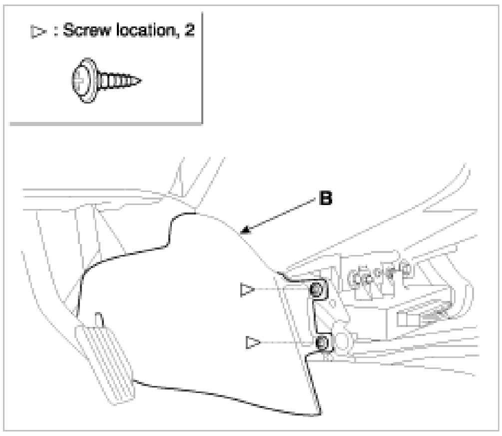
NOTE

- When prying with tip screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Put on gloves to protect your hands.

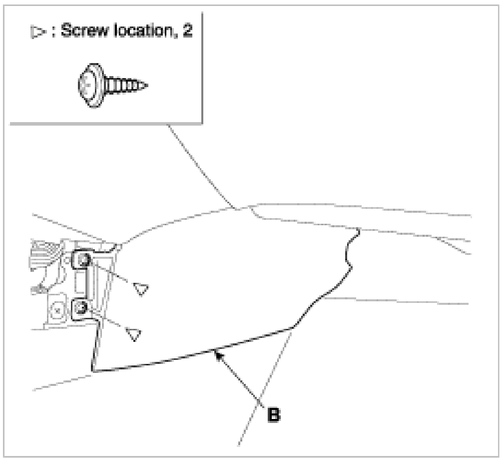
1. Remove the crash pad side cover (A), crash pad center under cover (B).
   A. Crash pad side cover.



   B. Front crash pad center under cover, LH
      - Remove the console assembly.



C. Front crash pad center under cover, RH
- Remove the console assembly.

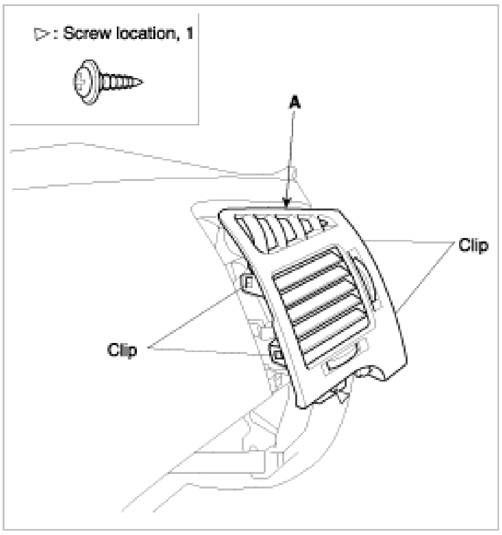


AIR VENT REPLACEMENT

NOTE

- When prying with tip screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Put on gloves to protect your hands.

1. Remove the air vent (A) by detaching the clips.



2. Installation is the reverse of removal.

CRASH PAD REPLACEMENT

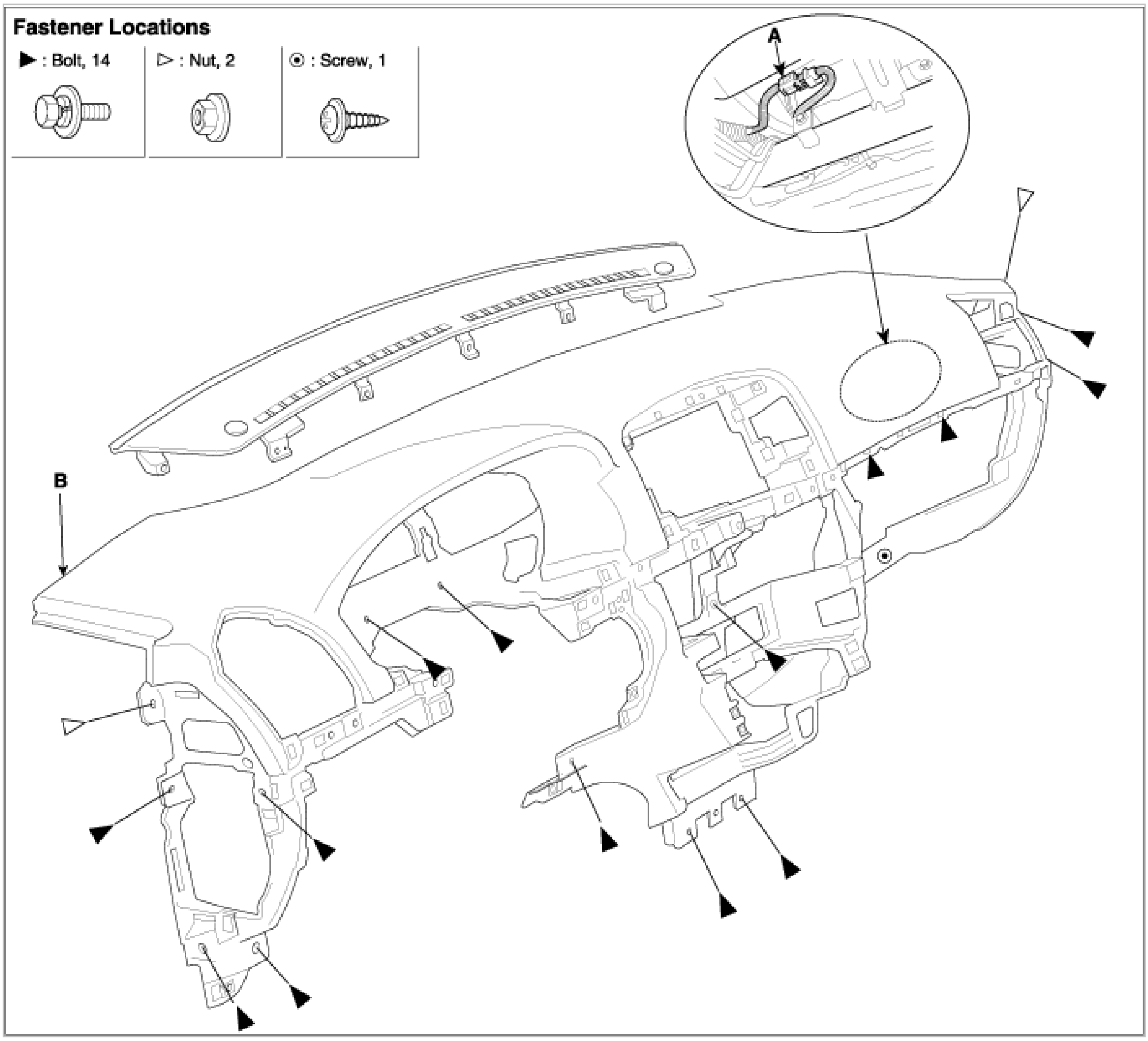
NOTE

- When prying with tip screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Put on gloves to protect your hands.

1. Remove the following items.
   A. Front seat.
   B. Cluster facia panel, cluster.
   C. Audio assembly.
   D. Glove box.
   E. Side cover, center under cover.
   F. Front pillar trim.
2. Disconnect the passenger`s air bag connector (A).
   Loosen the bolt and nut, then remove the crash pad (B).
3. Installation is the reverse of removal.

NOTE

- Make sure the crash pad fits onto the guide pins correctly.
- Before tightening the bolts, make sure the crash pad wire harnesses are not pinched.
- Make sure the connectors are plugged in properly, and the antenna lead is connected properly,
- Enter the anti- theft code for the radio, then enter the customer`s radio station presets.



Body (Interior and Exterior) > Interior > interior trim > Repair procedures

REPLACEMENT

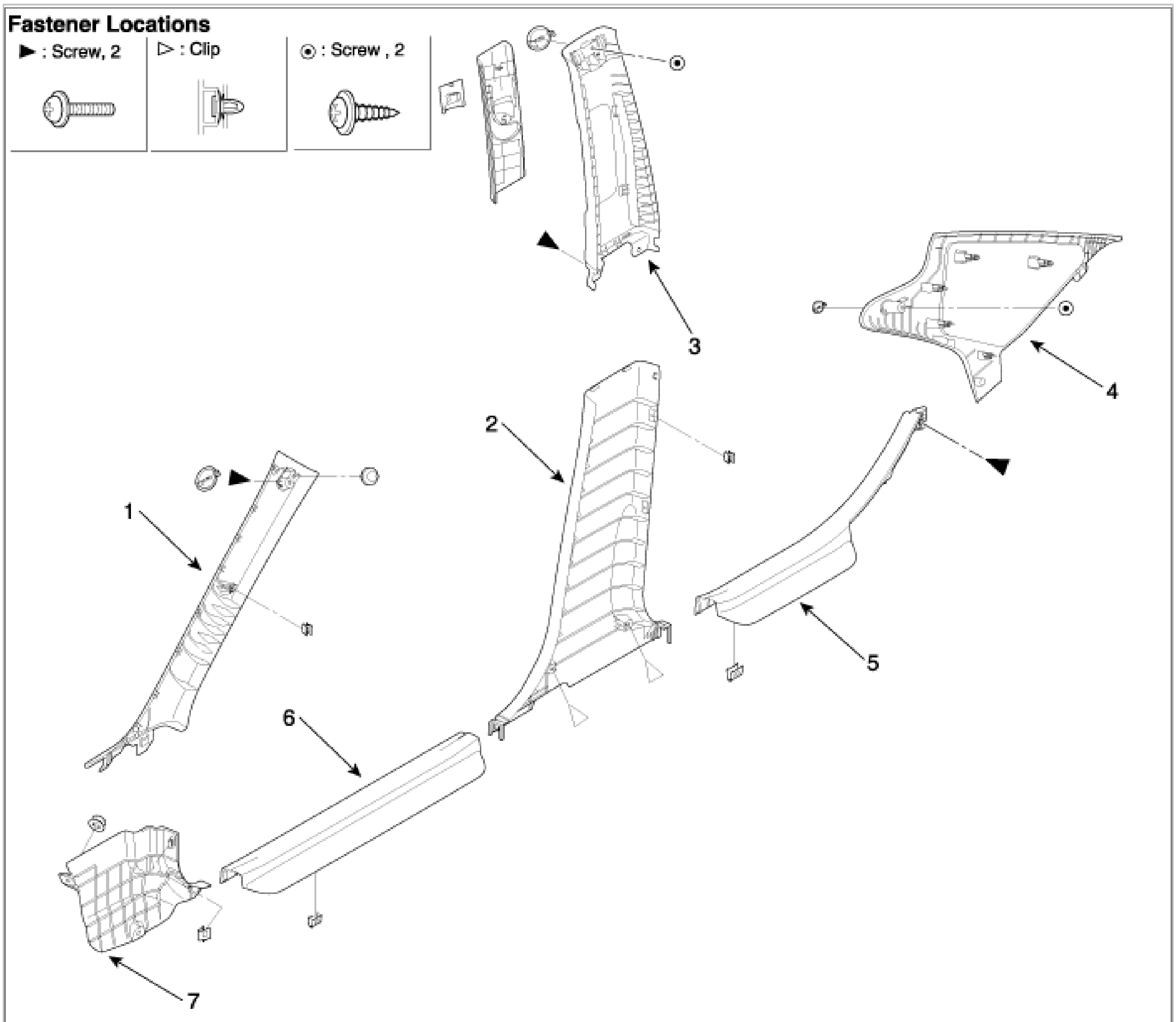
FLOOR AND SIDE TRIM

1. Remove the trim.

> NOTE
>
> - Put on gloves to protect your hands.
> - When prying with a flat-tip screwdriver, wrap it with protective tape to prevent damage.
> - Take care not to bend or scratch the trim and panels.

2. Installation is the reverse of removal.

> NOTE
>
> - Replace any damage clips.



1. Front pillar
2. Center lower pillar trim
3. Center upper pillar trim
4. Rear pillar trim
5. Rear door scuff trim
6. Front door scuff trim
7. Cowl side trim

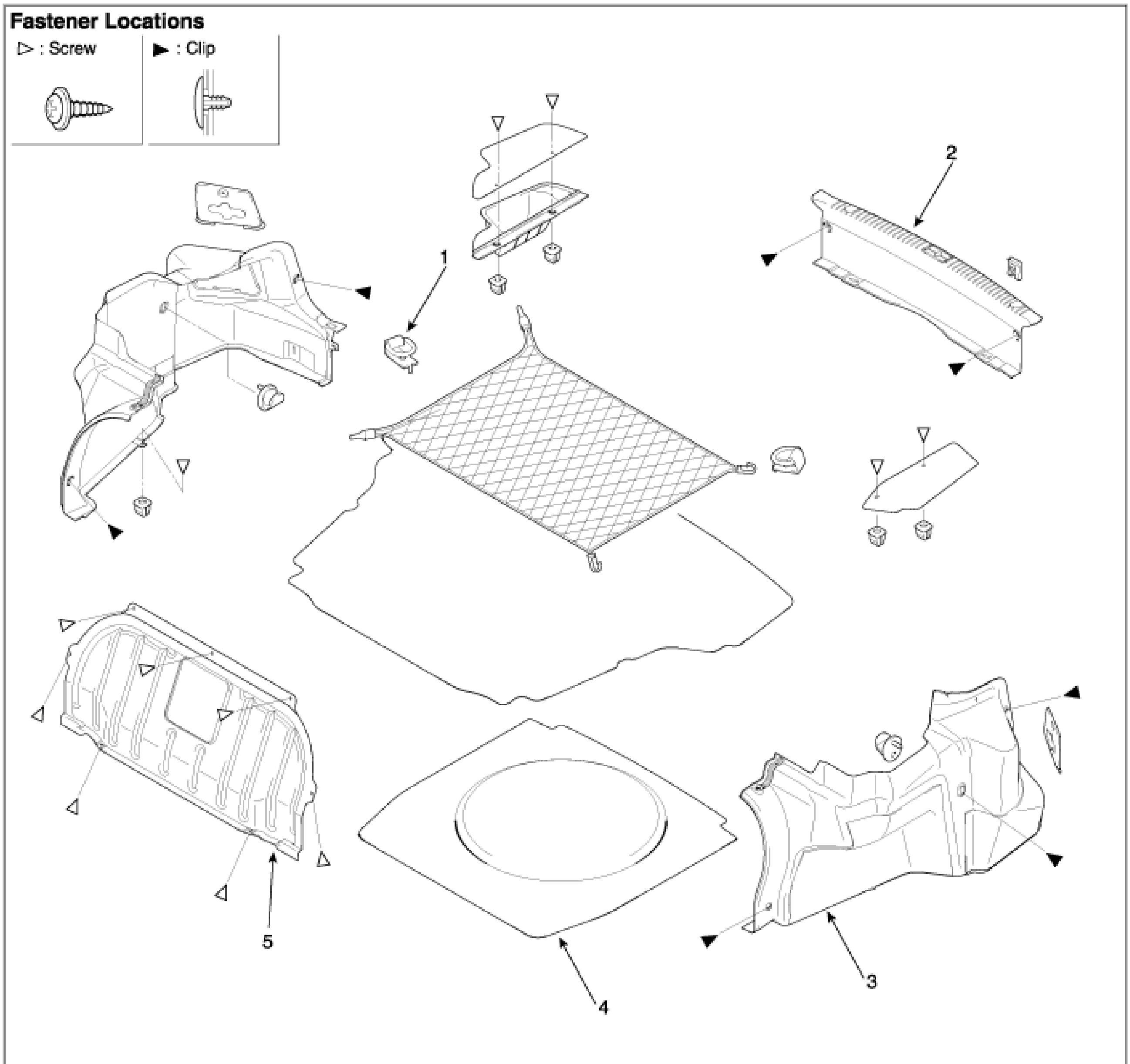
TRUNK TRIM

1. Remove the trim.

> **NOTE**
>
> - Put on gloves to protect your hands.
> - When prying with a flat-tip screwdriver, wrap it with protective tape to prevent damage.
> - Take care not to bend or scratch the trim and panels.

2. Installation is the reverse of removal.

> **NOTE**
>
> - Replace any damage clips.



1. Luggage flower hook
2. Rear transverse trim
3. Luggage side trim
4. Luggage cover met
5. Luggage partition trim

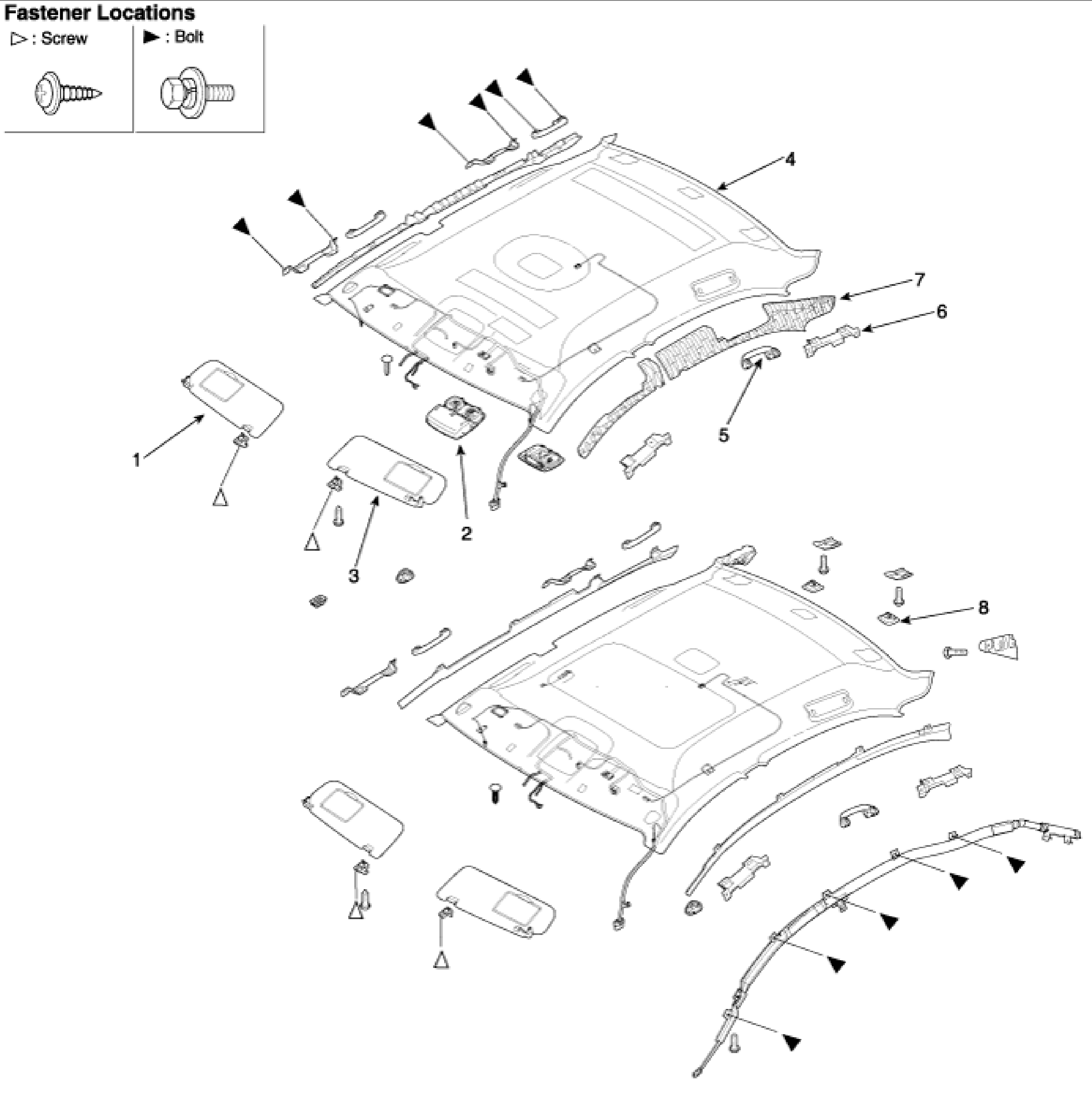
ROOF TRIM

1. Remove the trim.

> **NOTE**
>
> - Put on gloves to protect your hands.
> - When prying with a flat-tip screwdriver, wrap it with protective tape to prevent damage.
> - Take care not to bend or scratch the trim and panels.

2. Installation is the reverse of removal.

> **NOTE**
>
> - Replace any damage clips.



1. Sunvisor	5. Assist handle
2. Over head console lamp	6. Assist handle bracket
3. Sunvisor retainer	7. Roof absorber
4. Head lining	8. Coat hook

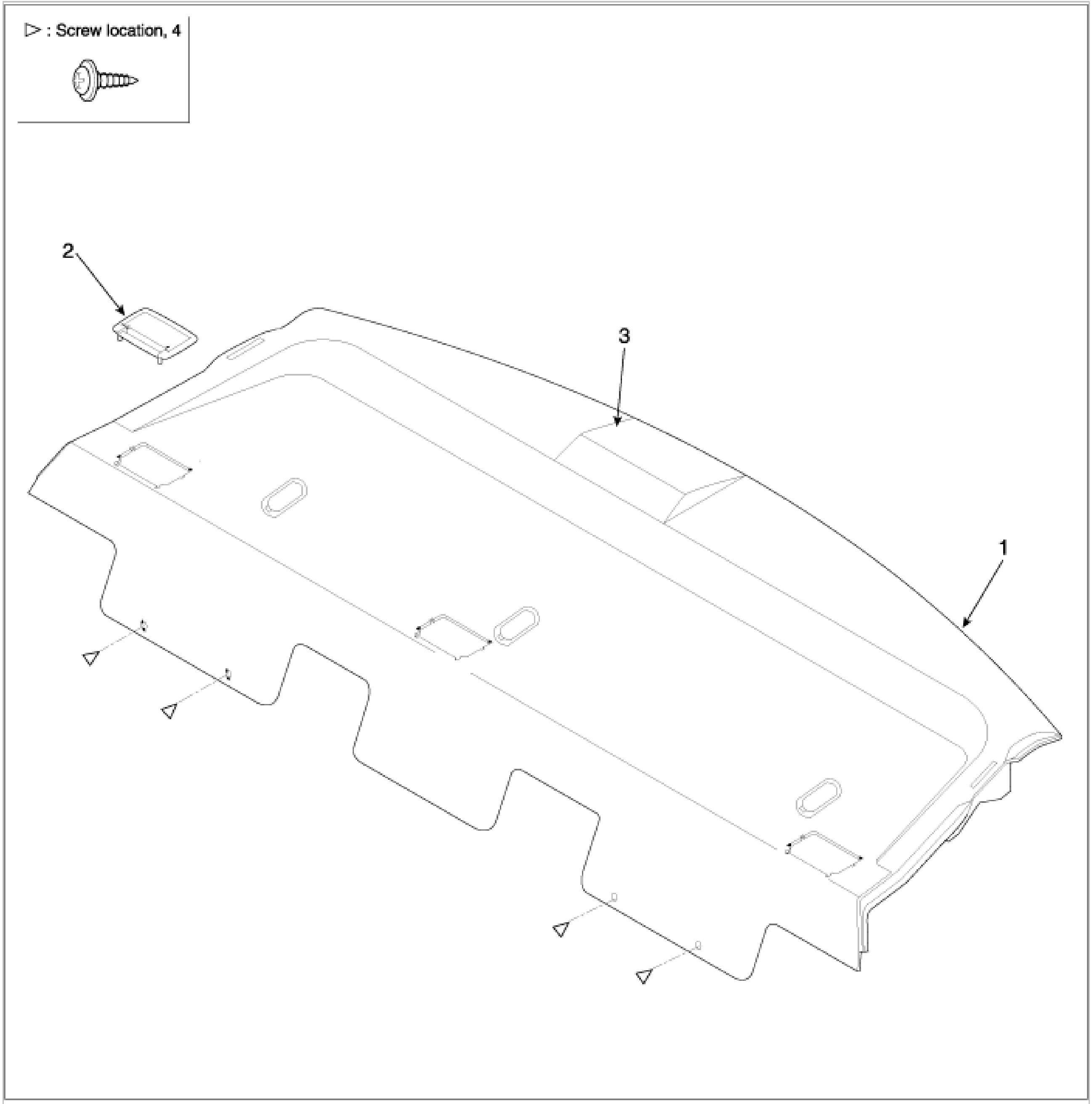
PACKAGE TRAY

1. Remove the trim.

> NOTE
>
> - Put on gloves to protect your hands.
> - When prying with a flat-tip screwdriver, wrap it with protective tape to prevent damage.
> - Take care not to bend or scratch the trim and panels.

2. Installation is the reverse of removal.

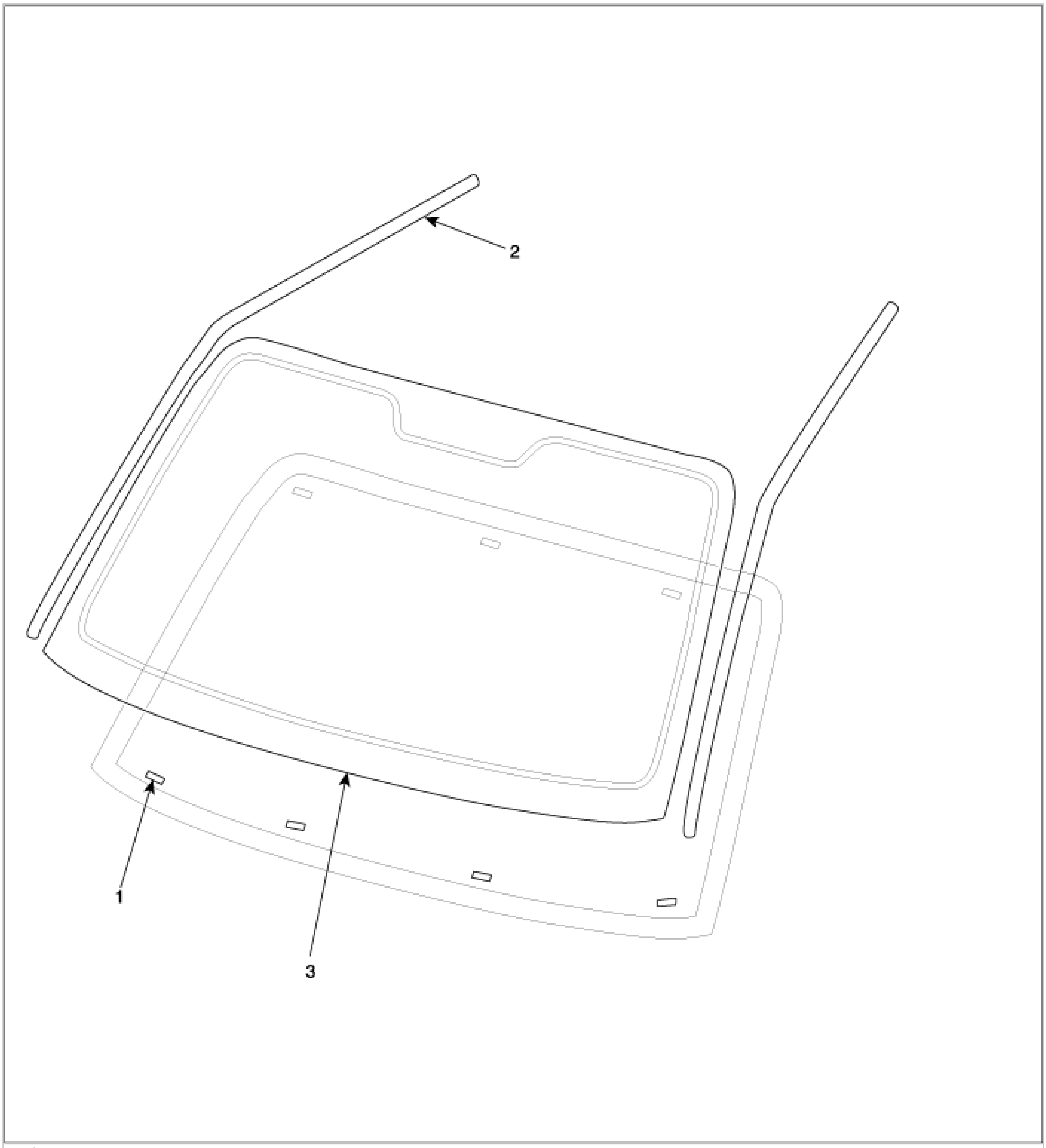
> NOTE
>
> - Replace any damage clips.



1. Package tray
2. Rear seat belt guide
3. High mount stop lamp

Body (Interior and Exterior) > Interior > windshield glass > Components and Components Location

COMPONENTS



1. Glass pad 2. Wind shield molding	3. Wind shield glass

Body (Interior and Exterior) > Interior > windshield glass > Repair procedures

REPLACEMENT

REMOVAL

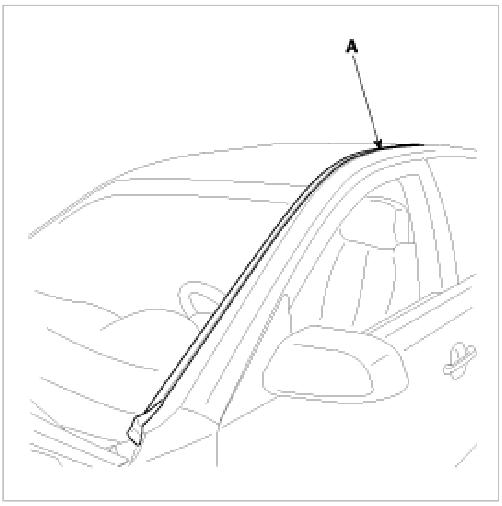
NOTE

- Put on gloves to protect your hands.
- Use seat covers to avoid damaging any surfaces.

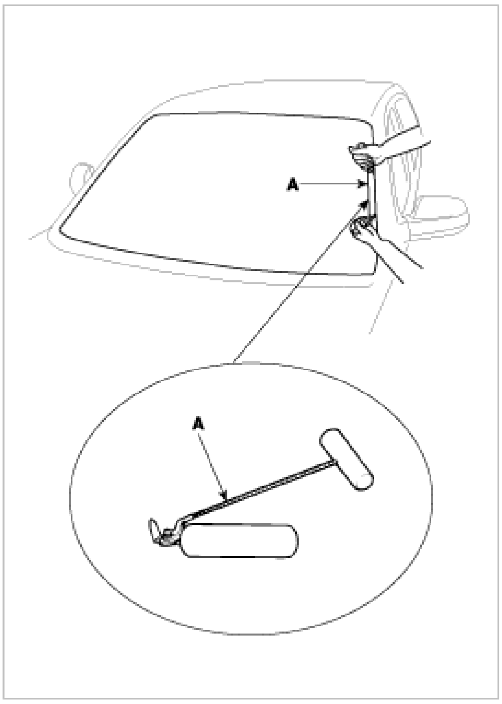
1. Remove the following items.
   A. Inside rear view mirror.
   B. Sun visors and holders, both side, overhead console, grab handles, both sides.

C. Front pillar trim, both sides.
D. Windshield wiper arms and cowl cover.

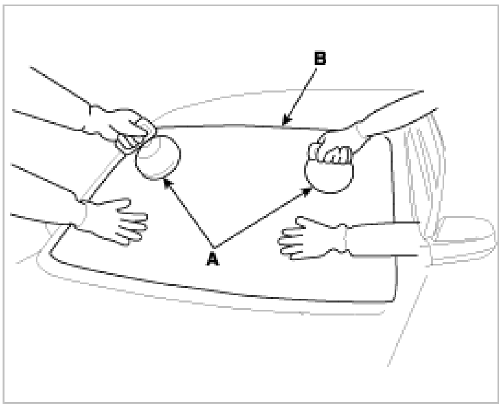
2. Remove the windshield glass side molding (A).



3. Pull down the front portion of the headliner. Take care not to bend the headliner excessively, or you may crease or break it.
4. Cut out the sealant using the sealant cutting tooln (A)(09861-31100).

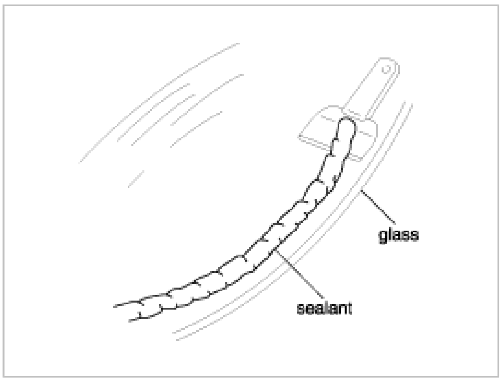


5. Remove the windshield (A) carefully using the glassholder (B)(09861-31100).

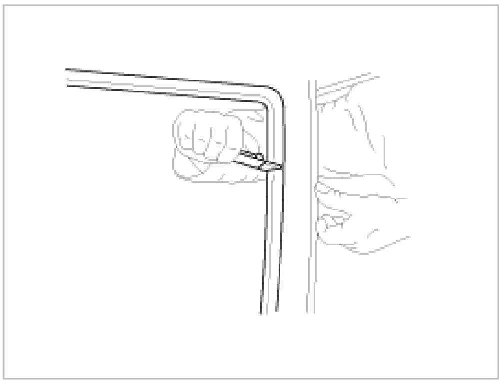


INSTALLTION

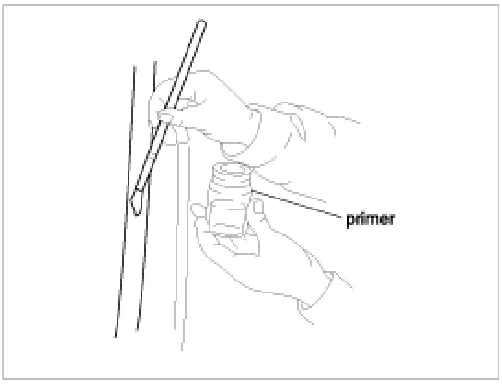
1. Remove the excess sealant from the glass with a window scraper.



2. Remove the excess sealant and foam dam from the body with a knife.



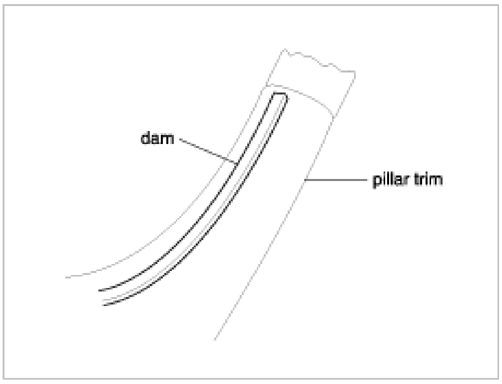
3. Clean the inside of the glass with commercial glass cleaner and a lint-free cloth.
4. Prime an area approximately 20 mm(3/4 inch) wide around the complete perimerter of the glass.
5. Prime the contact area on the body.



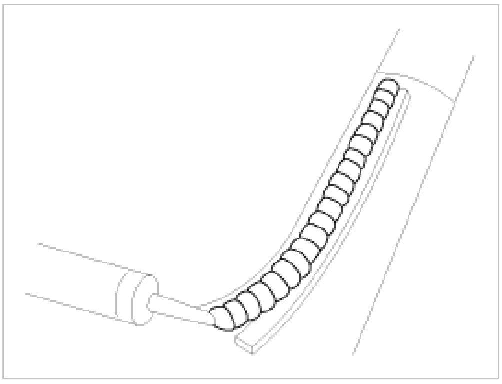
6. Reprime the same area on the inside surface of the glass.

> CAUTION
>
> Do not permit any primed surface to becom contaminated with dirt, water, oil, etc.
> Do not touch primed surfaces with your hands.
> Contamination will affect adhesion.

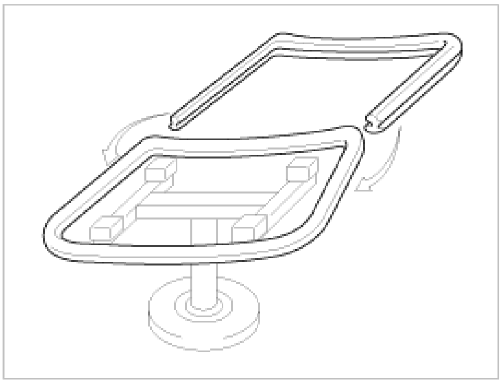
7. Install the self-adhesive foam dam to the body where the original dam had been.



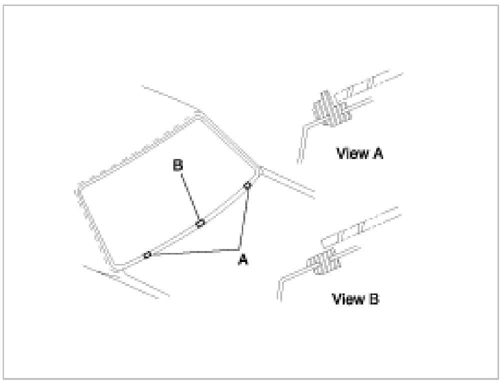
8. Apply the sealant bead to the body just outside the dam. The bead should be slightly higher than the dam.



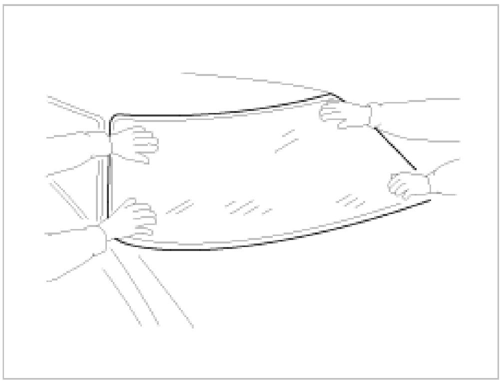
9. Install molding on the glass.

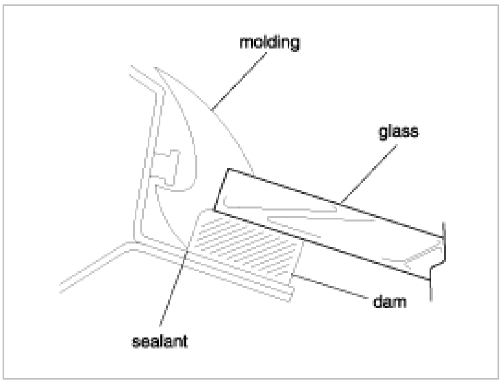


10. Install the glass into the body making sure the glass rests upon the two spacers at the bottom of the windshield.



11. Press glass firmly into place.





CAUTION

Lower both front door windows and leave them in that condition until the vehicle can be put back into service. If the vehicle were completelyclosed, quickly closing a door could break the seal.

12. Remove excess sealant, if any.
13. Press molding molding firmly into place.
14. Perform water leak test immediately.
15. Clean the outside of the windshield.
16. Install both of the front pillar trim.
17. Install the inside rearview mirror.
18. Install the cowl top cover with three fasteners.
19. Install both wiper arm assemblies with one nut eatch.

Body (Interior and Exterior) > Bumper > front bumper > Repair procedures

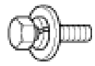
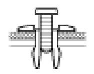
REPLACEMENT

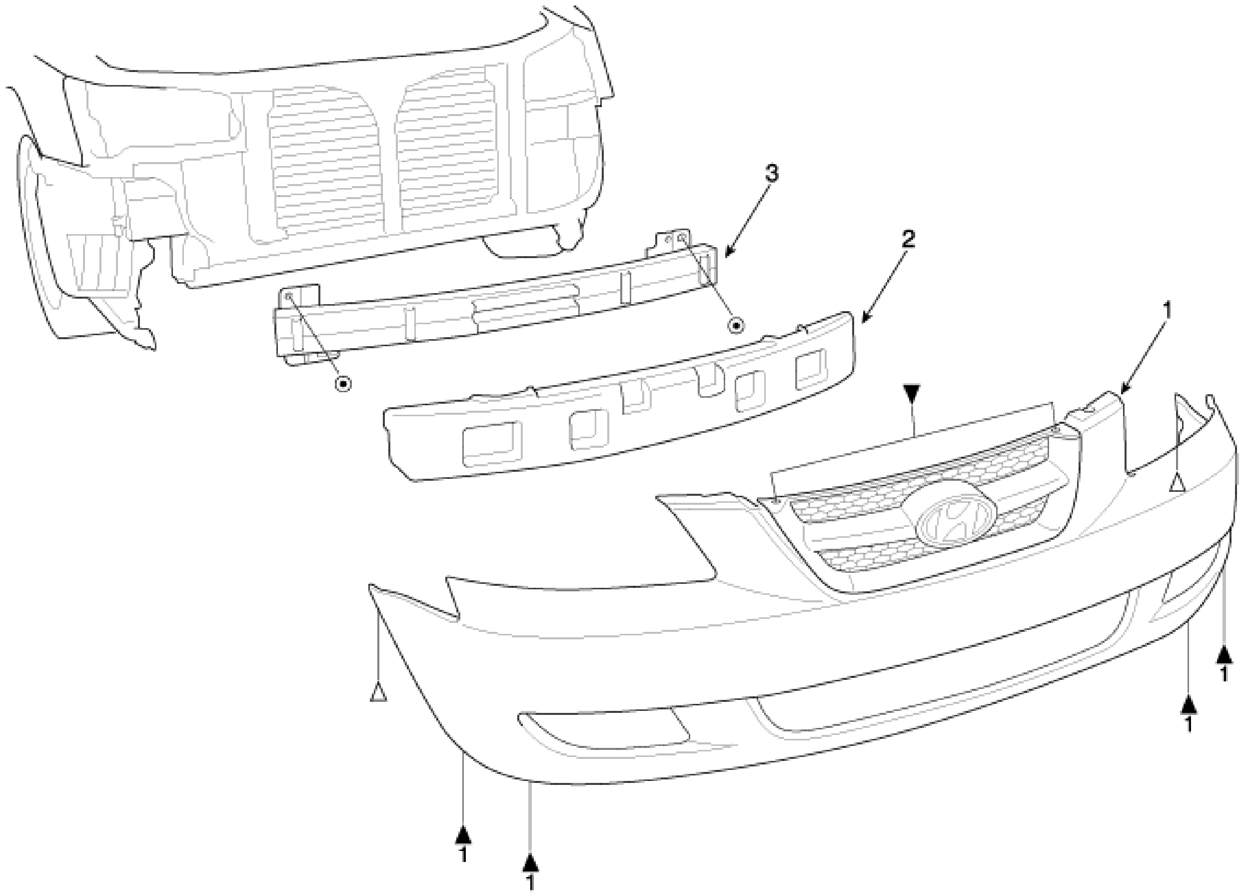
1. Remove the radiator upper cover.
2. Remove the headlamp.

NOTE

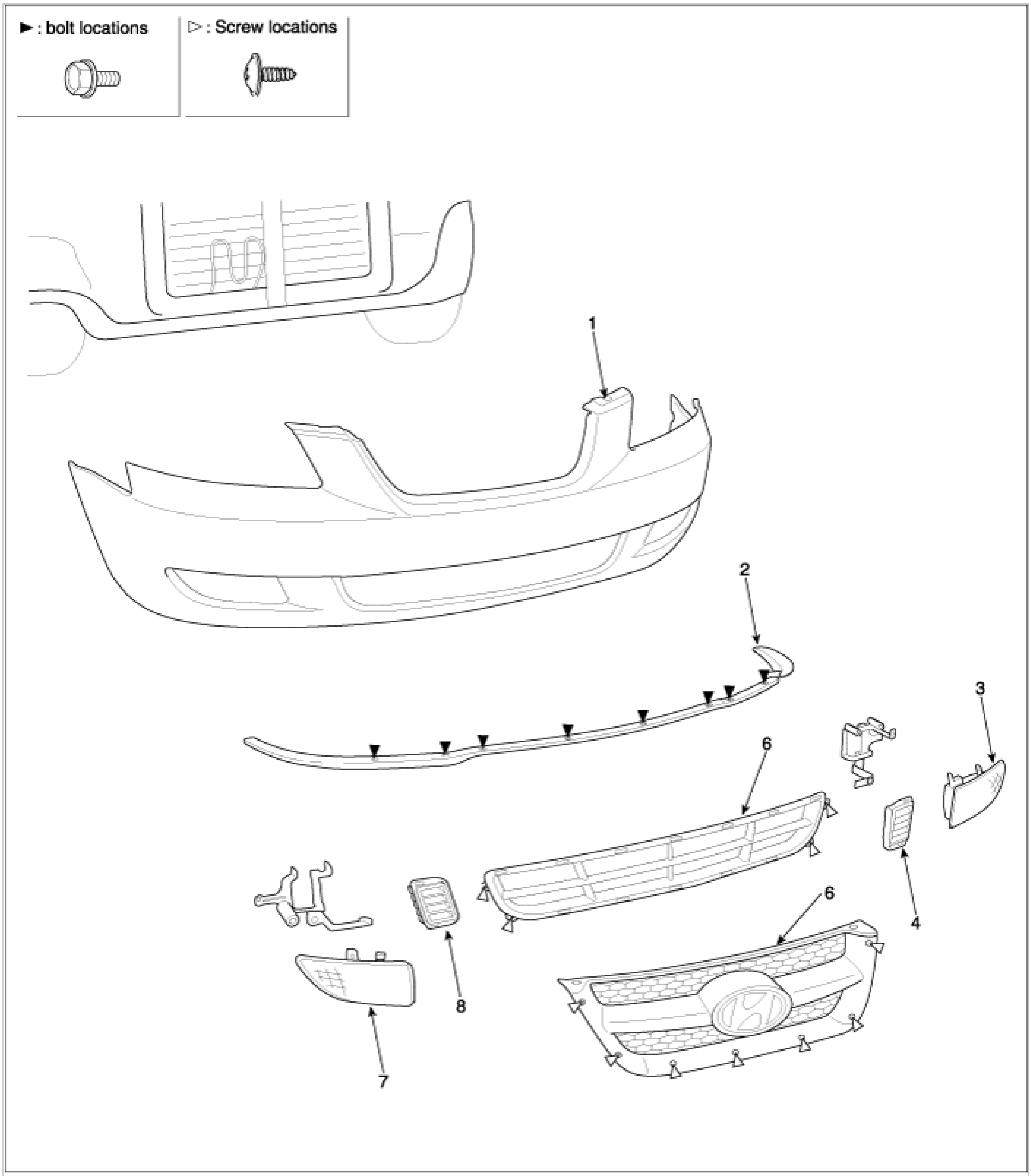
- Put on gloves to protect your hands.
- When prying with tip screwdriver, wrap it with protective tape to prevent damage.

Fastener Locations

⊙ : Nut	► : Bolt	►1 : Clip	▷ : Screw
			



1. Front bumper cover
2. Front bumper energy absorber foam
3. Front bumper rail



1. Front bumper cover	4. Fog grille	7. Fog lamp
2. Front bumper lip	5. Radiator grille	8. Fog grille
3. Fog lamp	6. Bumper grille	

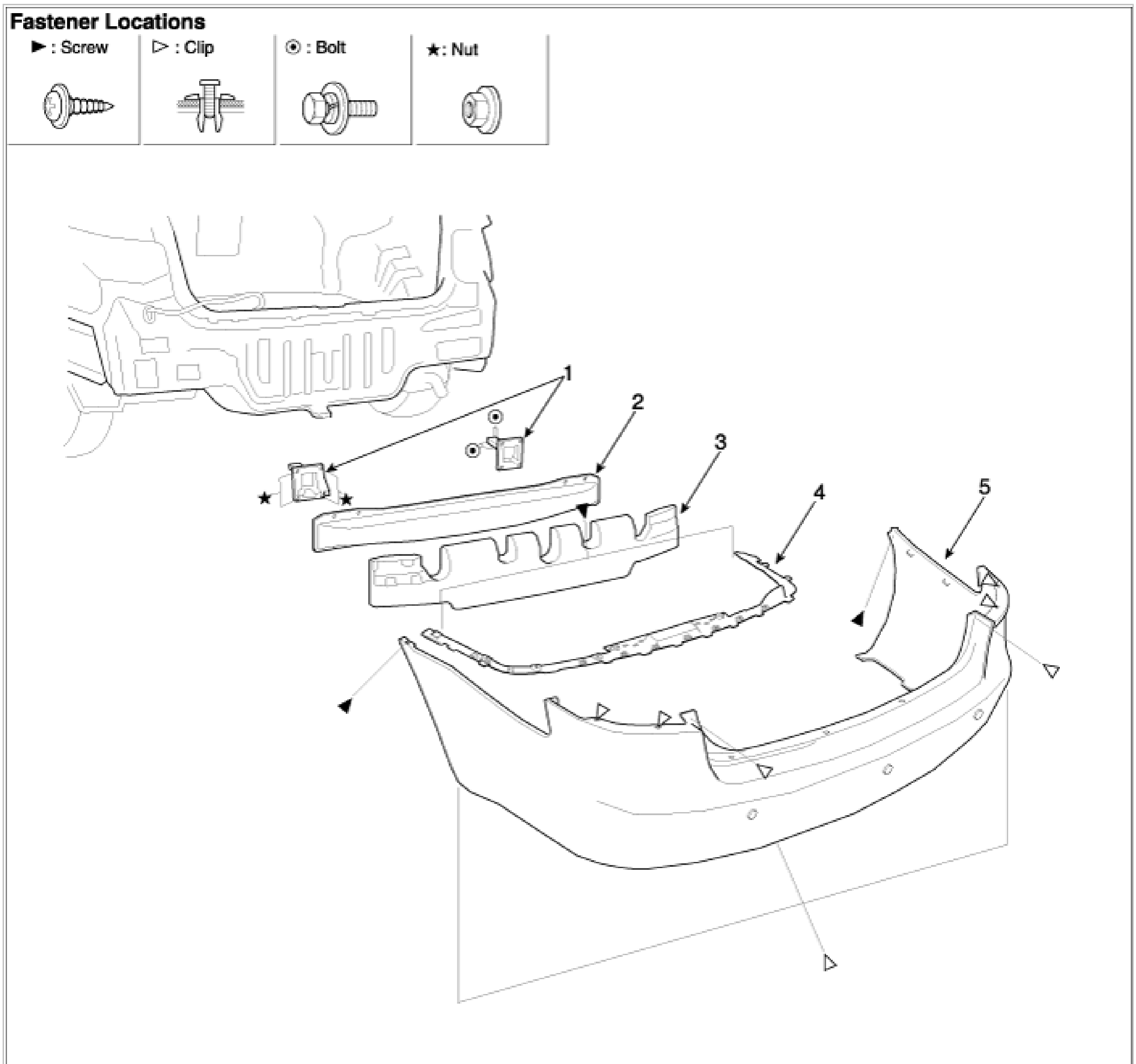
Body (Interior and Exterior) > Bumper > rear bumper > Repair procedures

REPLACEMENT

NOTE

- After remove the rear combination lamp.
- When prying with tip screwdriver, wrap it with protective tape , and apply protective tape around the related parts your hands.
- Put on gloves to protect your hands.

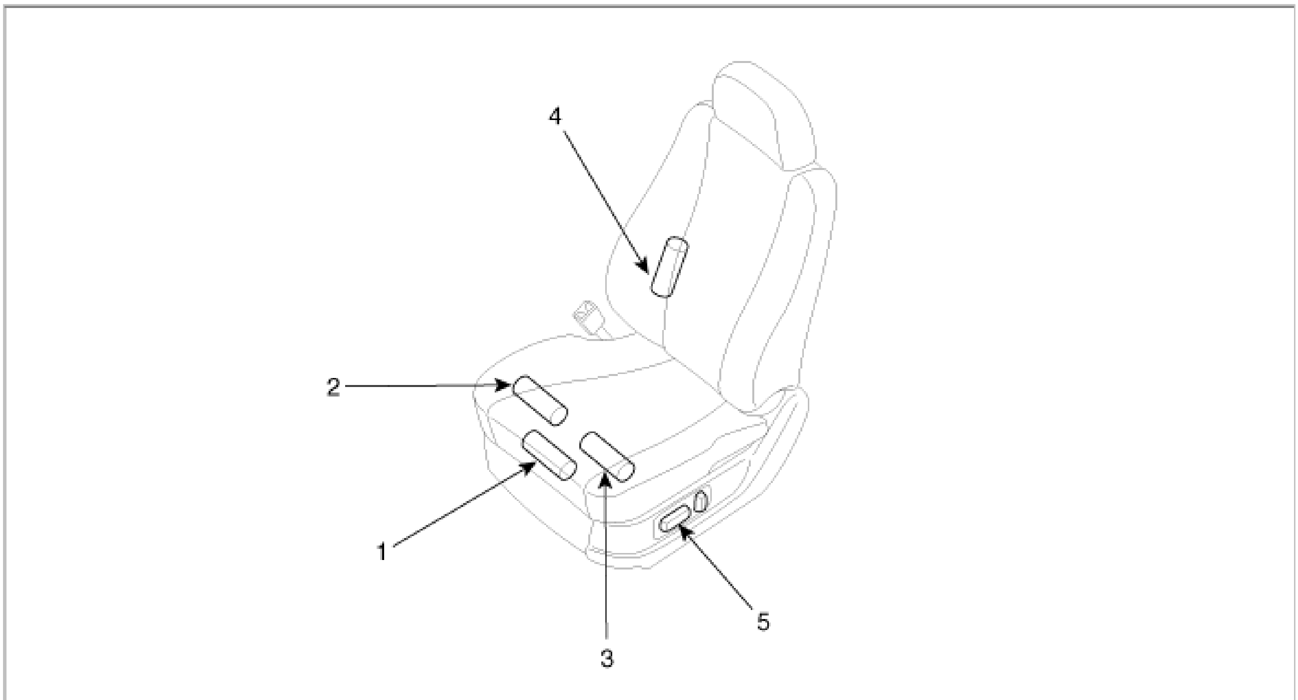
- Take care not bend or scratch the cover and other parts.
- Replace any damage clips.



1. Rear bumper stuy
2. Rear bumper beam
3. Energy absorber
4. Under cover
5. Rear bumper cover

Body (Interior and Exterior) > Seat & Power Seat > Components and Components Location

COMPONENT LOCATION



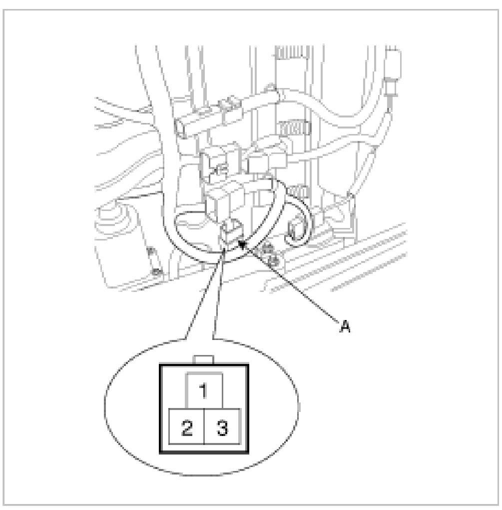
1. Slide motor
2. Front height motor
3. Rear height motor
4. Reclining motor
5. Power seat switch

Body (Interior and Exterior) > Seat & Power Seat > power seat moter > Repair procedures

INSPECTION

SLIDE MOTOR LIMIT SWITCH

1. Disconnect the limit switch (A) and operate the limit switch.
2. Check for continuity between the terminals.
3. Make sure that the seat operation is normal in the reverse after the maximum operation.
4. If there is an abnormality, replace the limit switch.

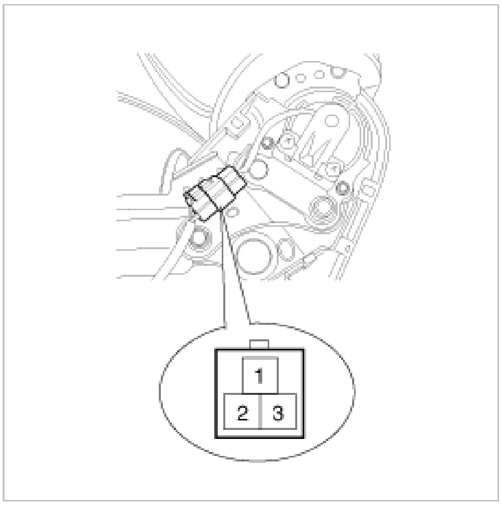


Position \ Terminal NO.	1	2	3
Frontward	O	―	O
Backward	O	O	

RECLINING MOTOR LIMIT SWITCH

1. Disconnect the limit switch and operate the limit switch.

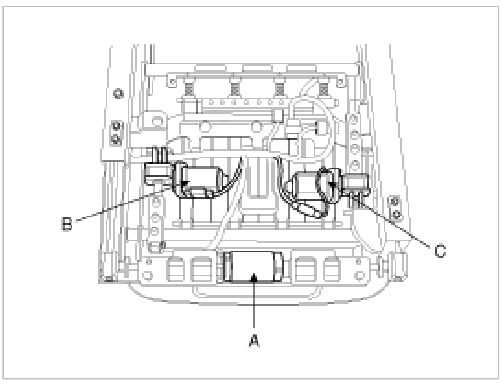
2. Check for continuity between the terminals.
3. Make sure that the seat operation is normal in the reverse after the maximum operation.
4. If there is an abnormality, replace the limit switch.



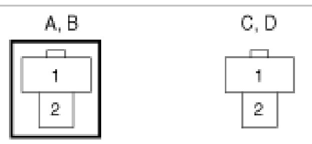
Position \ Terminal NO.	1	2	3
Frontward	○	—	○
Backward	○	○	

POWER SEAT MOTOR

1. Disconnect the connectors for each motor.



2. With the battery connected directly to the motor terminals, check if the motors run smoothly.
3. Reverse the connections and check that the motor turns in reverse.
4. If there is an abnormality, replace the motors.



Position \ Terminal NO.		1	2
Slide motor A	Front ward	⊖	⊕
	Back ward	⊕	⊖
Reclining motor D	For ward	⊕	⊖
	Rear ward	⊖	⊕

<Driver>

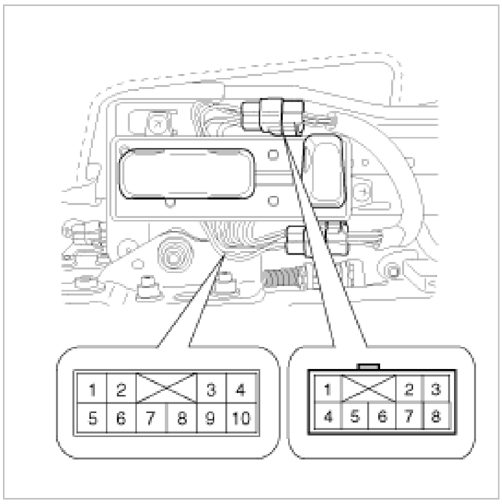
Position		Terminal NO. 1	2
Front height motor B	UP	⊖	⊕
	DOWN	⊕	⊖
Rear height motor C	UP	⊕	⊖
	DOWN	⊖	⊕

<Driver>

Body (Interior and Exterior) > Seat & Power Seat > powr seat control switch > Repair procedures

INSPECTION

With the power seat switch in each position, make sure that continuity exists between the terminals below. If continuity is not as specified, replace the power seat switch.

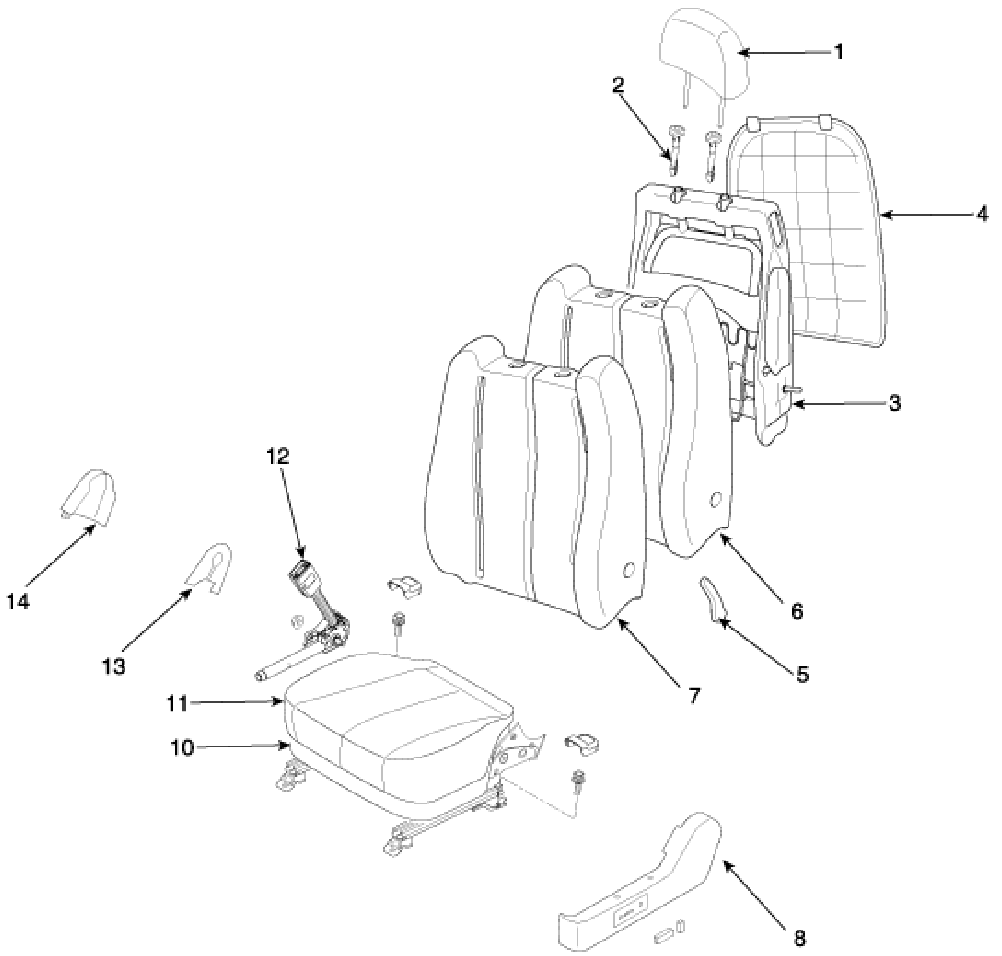


Position		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	B5	B6	B7	B8
Slide switch	Front ward	○										○			○	○			
	Back ward	○				○									○	○			
Front height switch	UP				○								○	○		○			
	DOWN		○		○								○			○			
Rear height switch	UP						○		○							○	○		
	DOWN						○	○								○	○		
Reclining switch	Front ward									○						○		○	○
	Back ward									○	○					○			○

<Driver>

Body (Interior and Exterior) > Seat & Power Seat > front seat > Components and Components Location

COMPONENTS



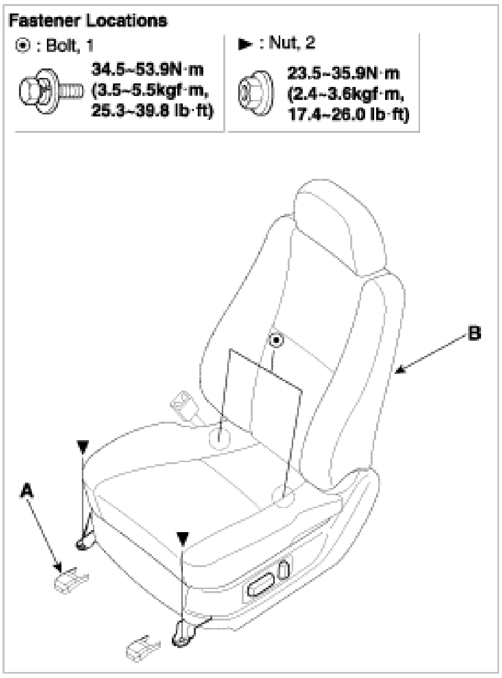
1. Headrest	5. Lumbar support lever	9. Cover
2. Headrest guide	6. Seat back	10. Seat cushion
3. Back frame	7. Seat back frame	11. Seat cushion cover
4. Back panel	8. Power sild cover	12. Seat back buckle

Body (Interior and Exterior) > Seat & Power Seat > front seat > Repair procedures

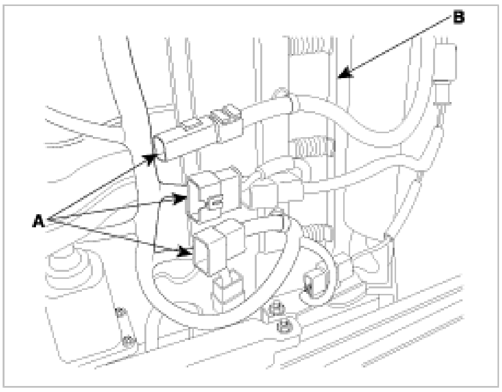
REPLACCEMENT

SEAT ASSEMBLY REPLACEMENT

1. Remove the seat assembly mounting cover (A).
2. After loosening the seat assembly mounting bolt and nut, remove the seat assembly (B).



3. Disconnect the connector (A), and remove the seat assembly.

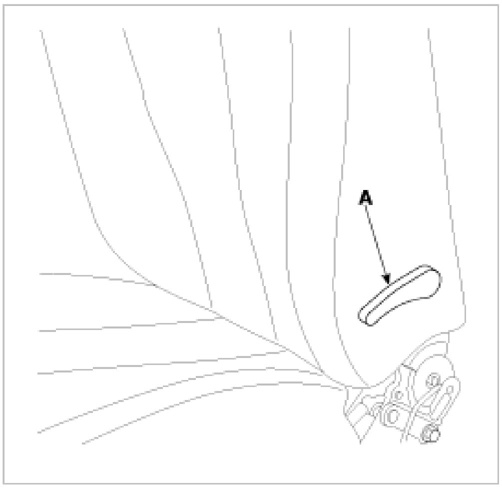


4. Installation is the reverse of removal.

> **CAUTION**
>
> SEAT MOUNTING BOLT INSTALLATION PROCEDURE
>
> - Set the into the most rearward position.
>   Check then each slide is locked, and then tighten the front mounting bolt temporarily.
> - Set the seat into most forward position.
>   Check that each slide is locked, and then Tighten the rear mounting bolt completely.
> - Set the seat into the most rearward position.
>   Check the front mounting bolt completely.
> - Check that the seat operates to and fro smoothy and the locking portion locks properly.

LUMBER SUPPORT LEVER REPLACEMENT

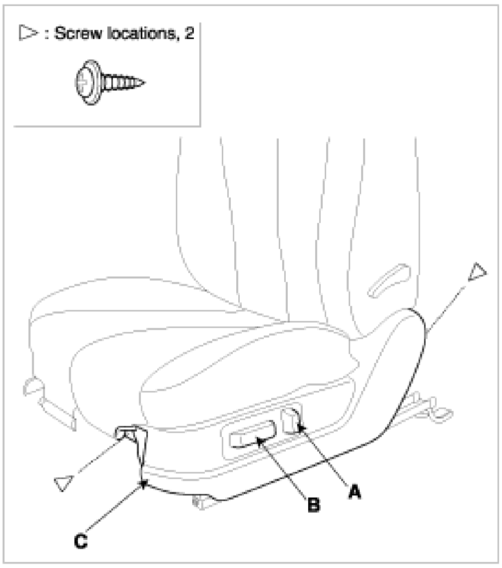
1. Remove the lumbar support lever (A).



2. Installation is the reverse of removal.

RECLINER LEVER AND HEIGHT KNOB REPLACEMENT

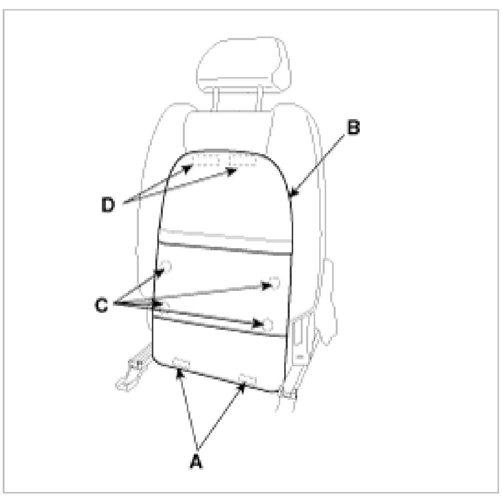
1. Remove the height adjuster knob (A) and recliner lever (B).
2. Loosen the recliner mounting screw and clip, then remove the recliner cover(C).



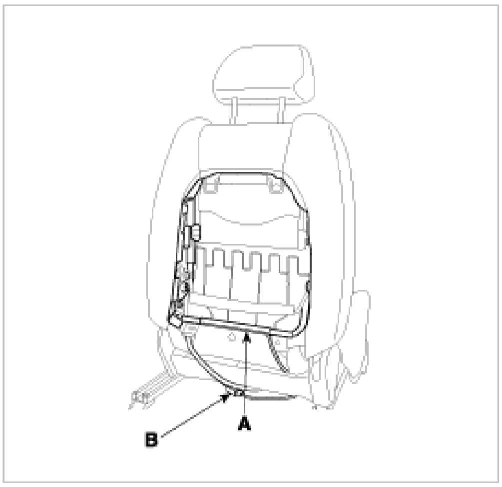
3. Installation is the reverse of removal.

SEAT BACK COVER REPLACEMENT

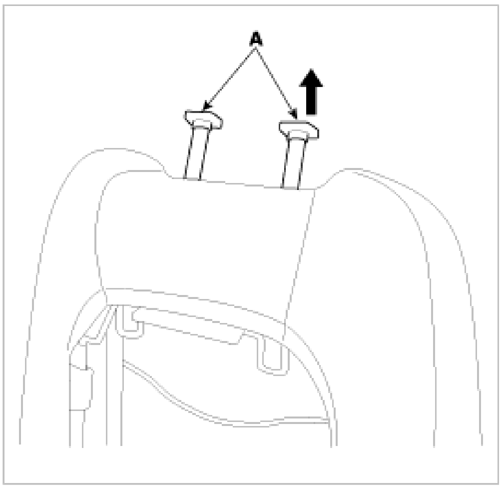
1. Remove the lumbar sport lever.
2. After disconnecting the scuff band (A), remove the seat back panel (B).



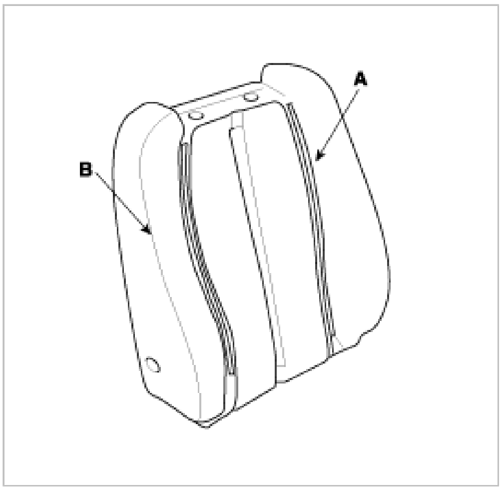
3. After disconnect the protector (A) from the back frame, then disconnect the connector (B).



4. Remove the headrest and headrest guide (A).



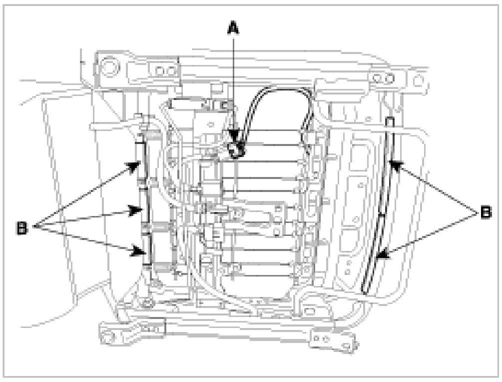
5. After removing the hogring clips (A) on the front of seat back remove the seat back cover (B).



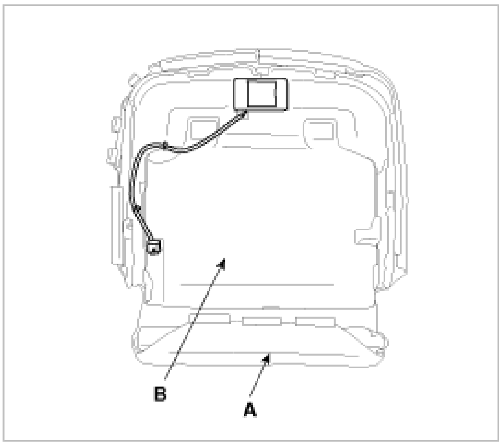
6. Installation is the reverse of removal.

SEAT CUSHION COVER REPLACEMENT

1. Remove front seat assembly.
2. Remove the scuff band.
3. After disconnect the protector (B)from the back frame, then disconnect the connector (A).

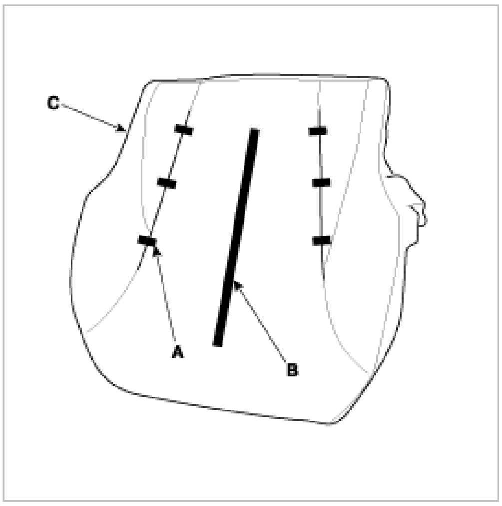


4. Remove the seat cushion(A).



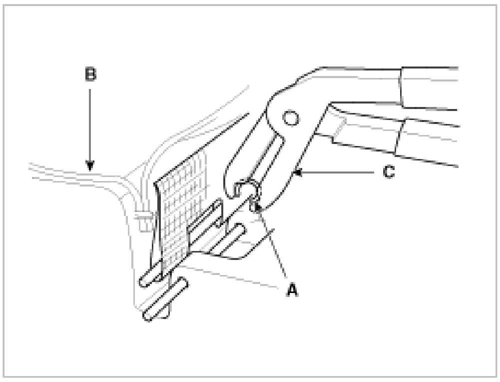
5. After removing the hogring clip (A) on the front of seat cushion and remove the seat cushion cover (C).

> CAUTION
>
> When removing the hogring clip, remove the hogring clip while pressing the wire so as not to separate the wire from the sponge.



6. Installation is the reverse of removal.

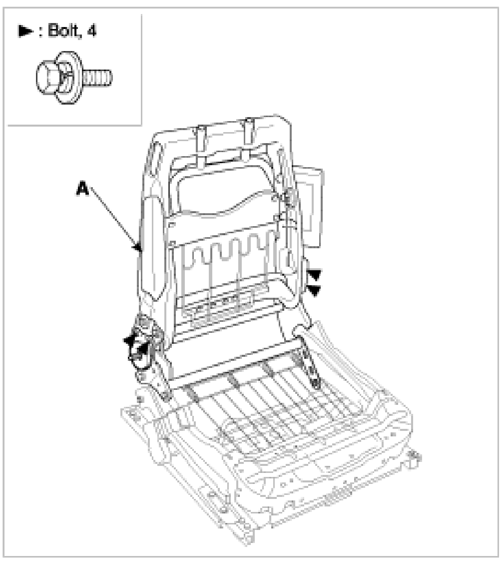
> NOTE
>
> - To prevent wrinkles, make sure the material is stretched evenly over the cover (B) before securing the hogring clips (A).
> - Replace the hogring clips with new ones using special tool (C).



SEAT BACK FRAME REPLACEMENT

1. Remove the lumbar support.
2. Remove the seat back panel.
3. Remove the headrest guide.
4. Remove the seat back cover and pad from frame.
5. Loosen the mounting bolts, then remove the seat back frame (A).

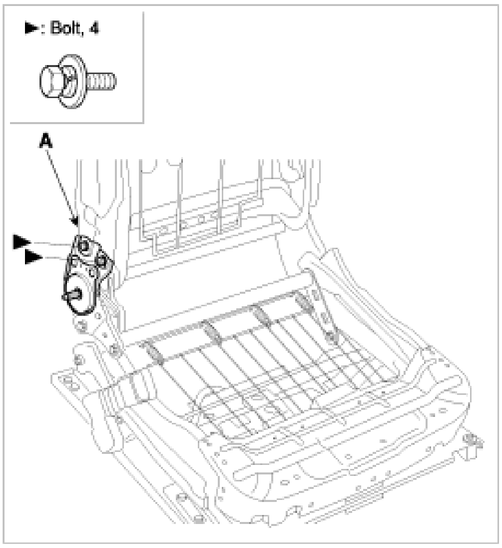
> NOTE
>
> - Remove the side air bag for replacing side air bag installation seat.
> - Be fore service, be fully aware of precautions and service procedure relevant to air bag (See page RT-Airbag).



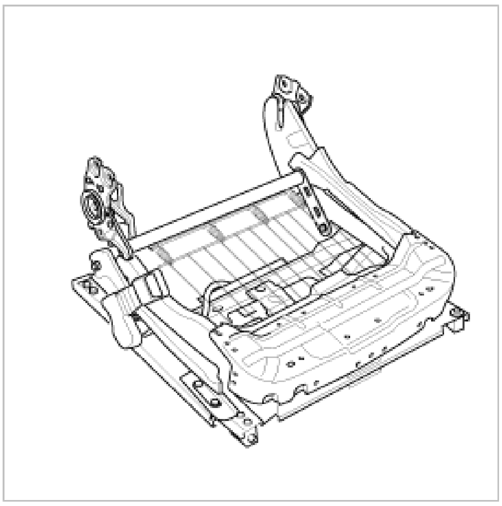
6. Installation is the reverse of removal.

SEAT TRACK REPLACEMENT

1. After removing the seat back panel, disconnect the protector.
2. Remove the recliner cover, knob and height knob.
3. Remove the seat assembly (A).



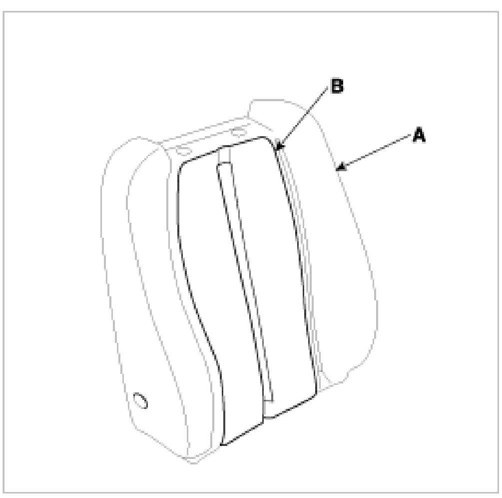
4. Remove the seat cushion.
5. Remove the seat track (A).



6. Installation is the reverse of removal.

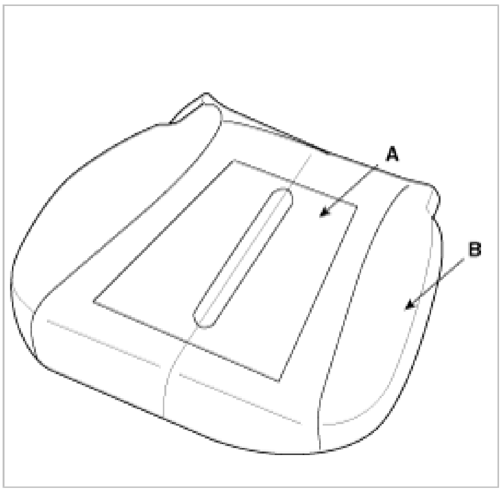
SEAT BACK HEATER REPLACEMENT

1. Remove the seat back cover.
2. Cut the heater (A)attached to the pad (B), as shown in the picture.
3. Take off the paper from the backside of the heater assembly.
4. Attach the heater to the main part of pad.
5. Install the seat back cover.



SEAT CUSHION HEATER REPLACEMENT

1. Remove the seat back cover.
2. Cut the heater (A)attached to the pad (B), as shown in the picture.
3. Take off the paper from the backside of the heater assembly.
4. Attach the heater to the main part of pad.
5. Install the seat back cover.

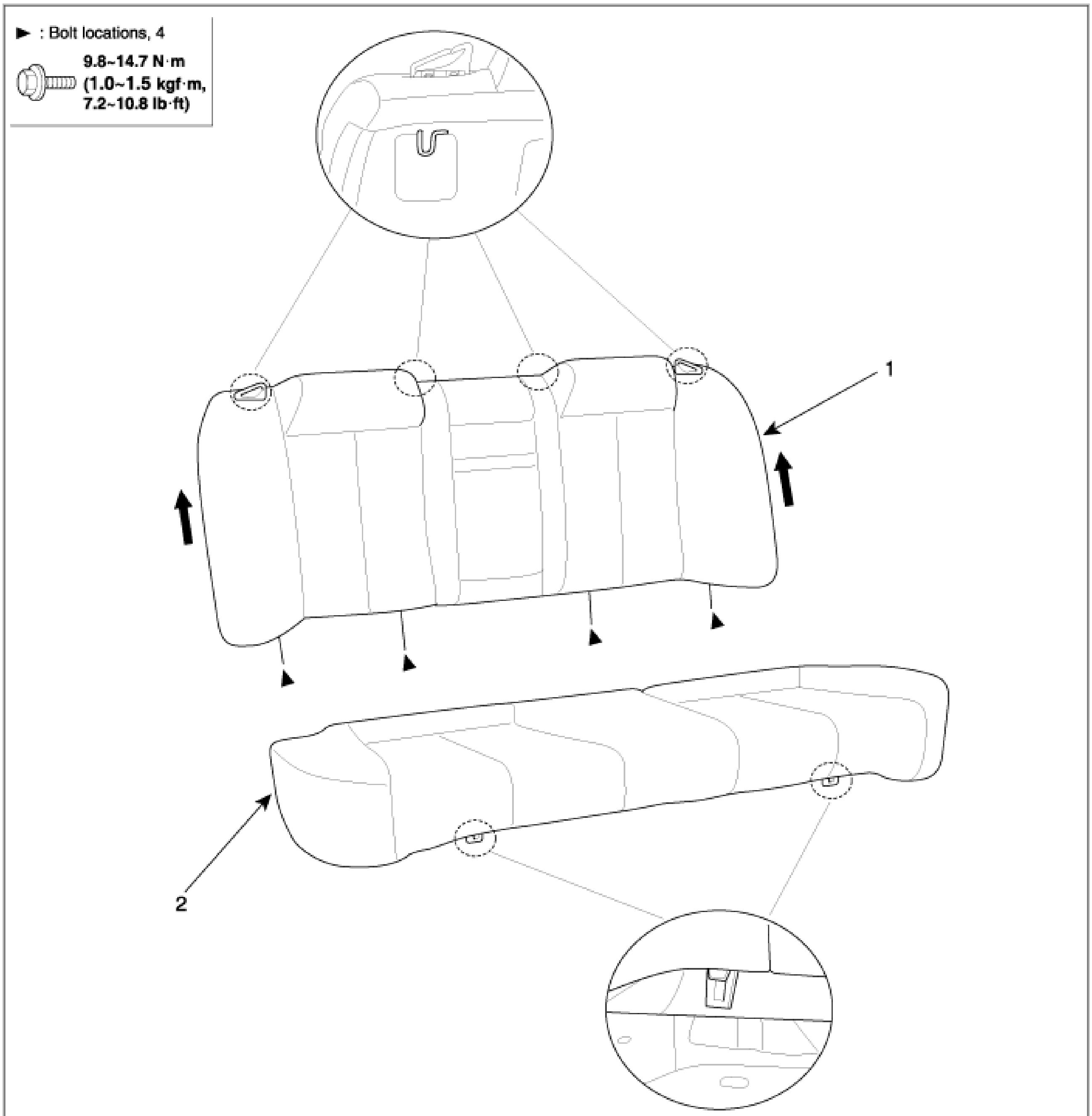


Body (Interior and Exterior) > Seat & Power Seat > rear seat > Repair procedures

REPLACEMENT

SEAT ASSEMBLY REPLACEMENT

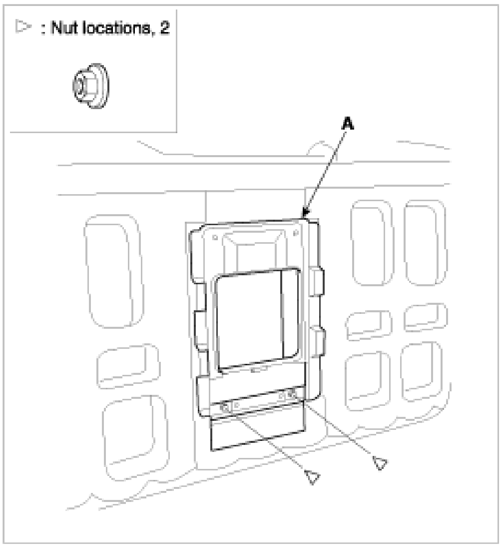
1. Remove the rear seat cushion.
2. Remove the rear seat back.
3. Installation is the reverse of removal.

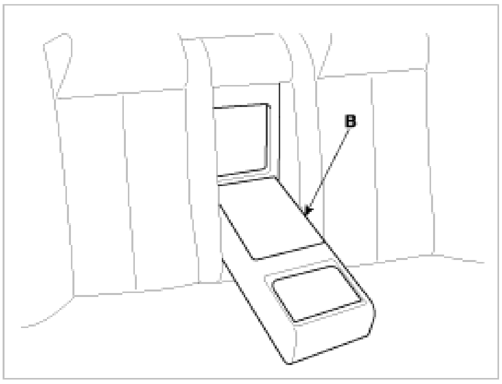


1. Seat back 2. Seat cushion

ARMREST REPLACEMENT

1. Loosening the armrest cover mounting screw.
2. After disconnecting the armrest cover (A), remove the armrest (B).

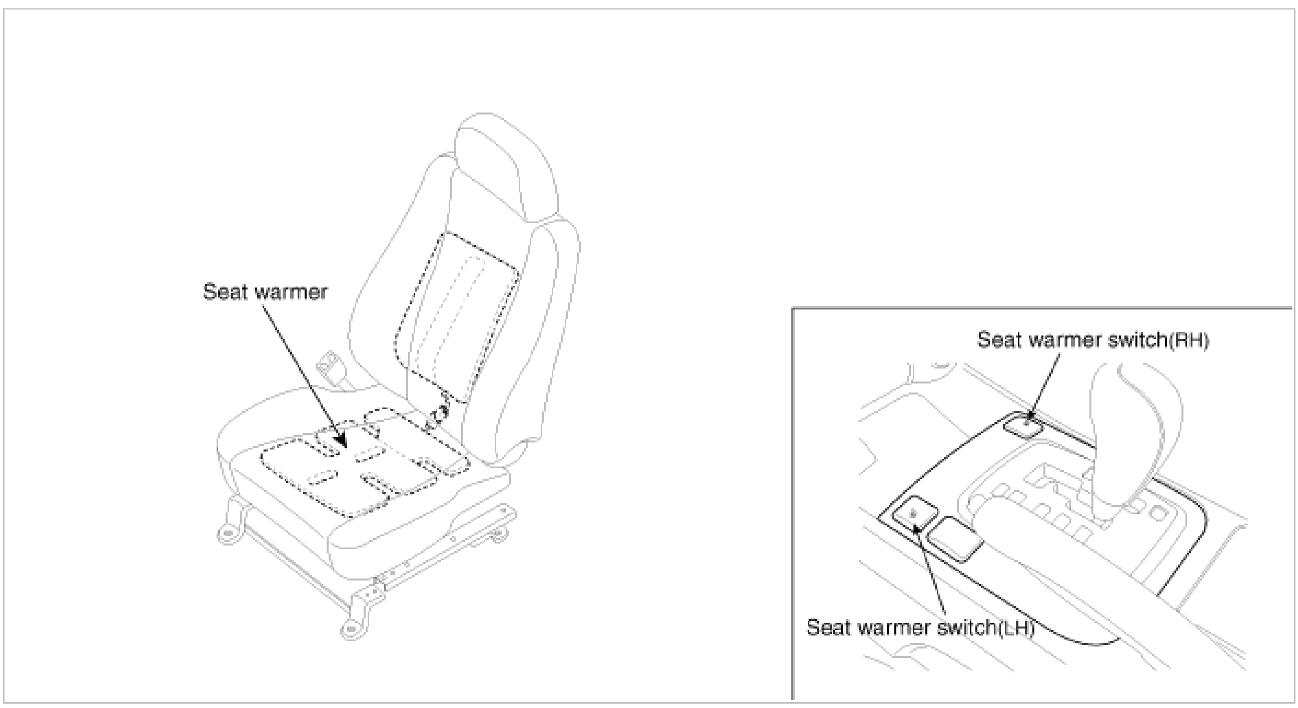




3. Installation is the reverse of removal.

Body (Interior and Exterior) > Seat Heater > Components and Components Location

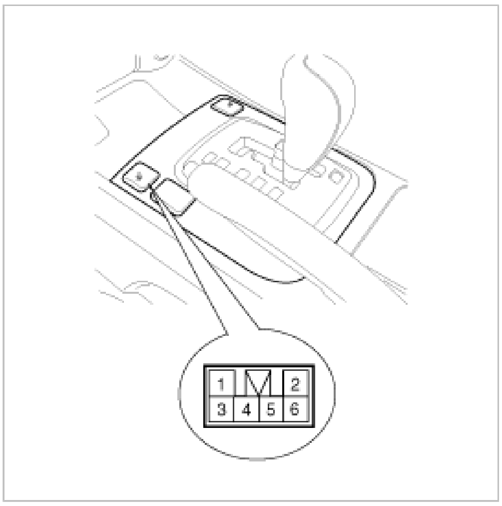
COMPONENT LOCATION



Body (Interior and Exterior) > Seat Heater > Seat Heater switch > Repair procedures

INSPECTION

1. Disconnect the negative (-) battery terminal.
2. Remove the seat warmer switch from the floor console upper cover with scraper.



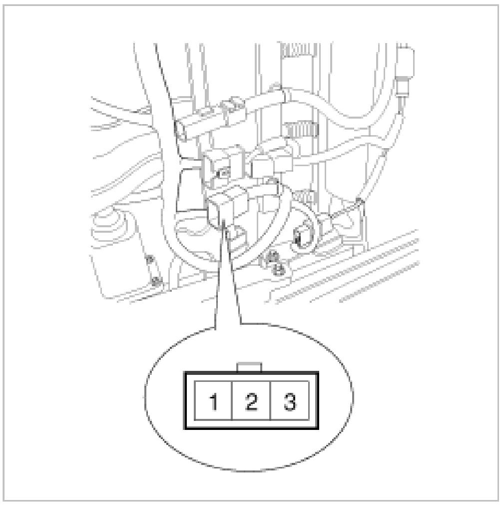
3. Check for continuity between the terminals in each switch position according to the table.

Position \ Terminal	2	6	3	4	1
ON	O	O	O	O (IND.)	O
OFF		Illumination			

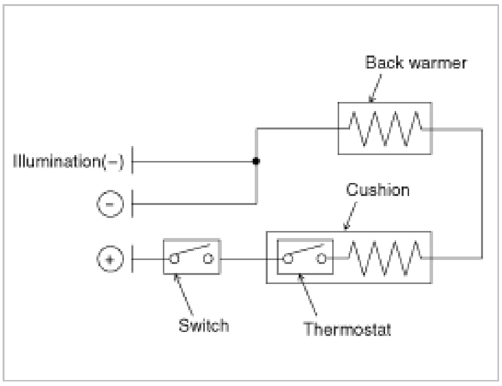
Body (Interior and Exterior) > Seat Heater > Seat heater > Repair procedures

INSPECTION

1. Check for continuity and measure the resistance between No.1 and NO.3 terminals.



Standard value: 2.45Ω ± 10%
(Cushion: 1.2Ω ± 10%, Back: 1.2Ω ± 10%)

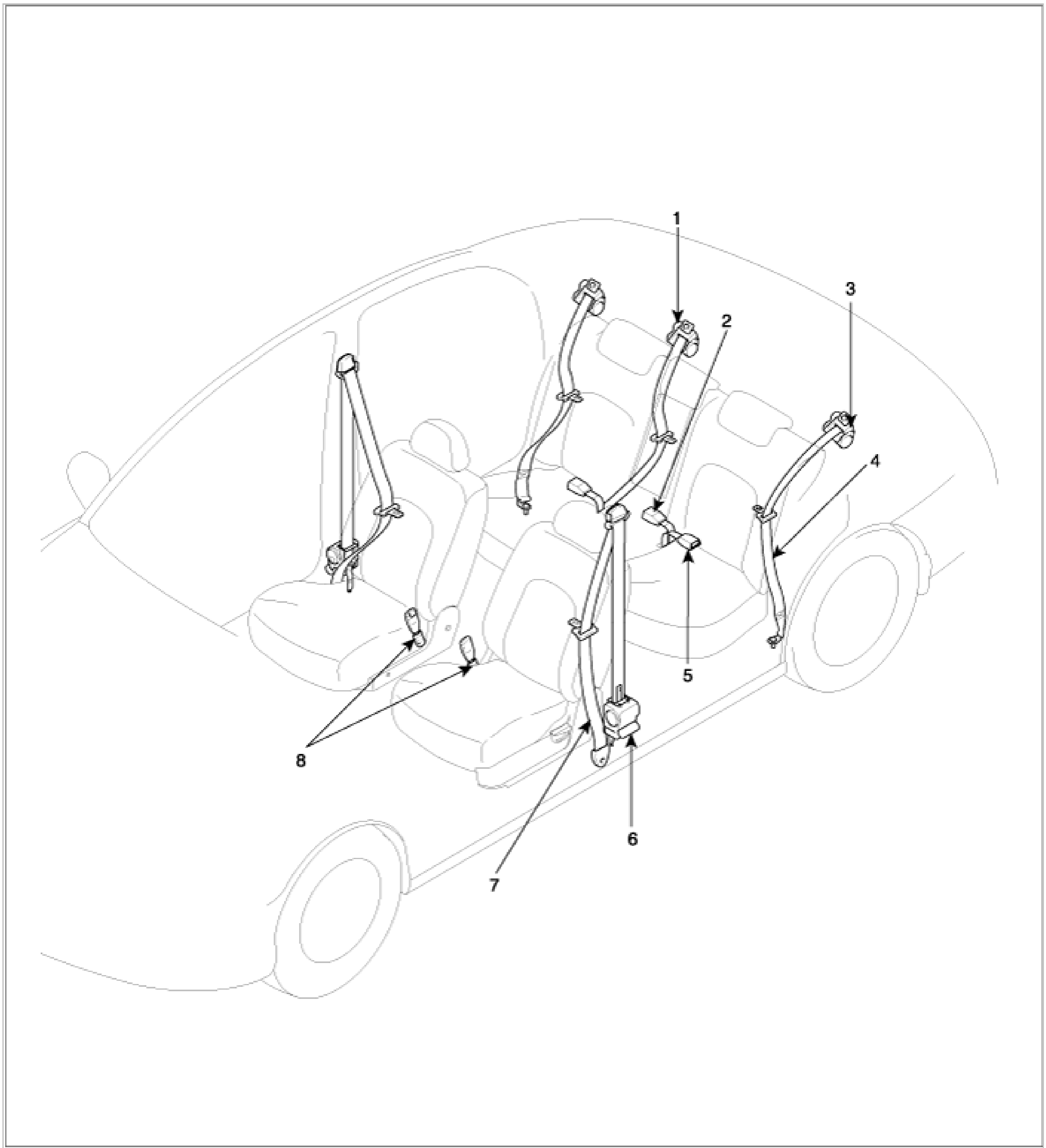


2. Operate the seat warmer after connecting the 3P connector, and then check the thermostat by measuring the temperature of seat surface.
3. Check for continuity between the terminals after disconnecting the 3P connector.

Standard value :
28 ± 3.5°C(Continuity), 37 ± 3.0°C(Short)

Body (Interior and Exterior) > Seat Belt > front seat belt > Components and Components Location

COMPONENTS



1. Rear center seat belt	4. Rear seat belt	7. Front seat belt
2. Rear center seat buckle	5. Rear seat buckle	8. Front seat buckle
3. Rear seat belt retractor	6. Front seat belt retractor	

Body (Interior and Exterior) > Seat Belt > front seat belt > Repair procedures

REPLACEMENT

FRONT SEAT BELT REPLACEMENT

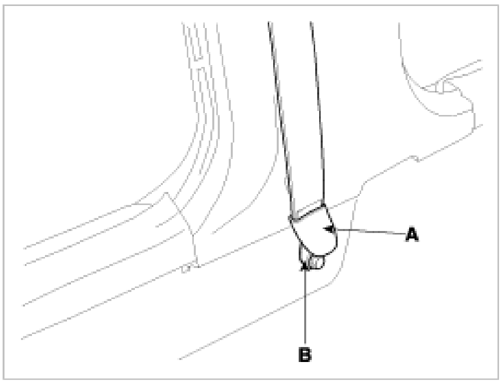
CAUTION

When installing the belt, make sure not to damage the pretensioner.

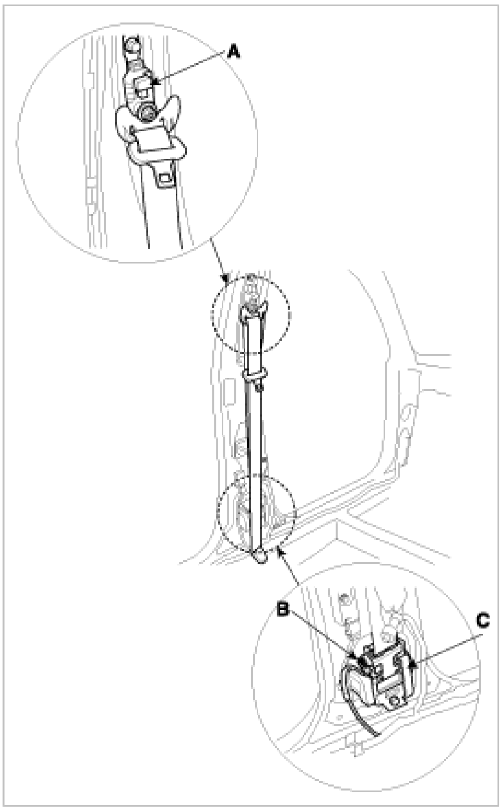
1. Remove the following items fist.

A. Front seat assembly.
B. Front and rear door scuff trim.

2. After raise the lower anchor cover (A), loosen the lower anchor mounting bolt (B).



3. Remove the center pillar lower trim.
4. Remove the center pillar upper trim.
5. Remove the upper anchor (A).



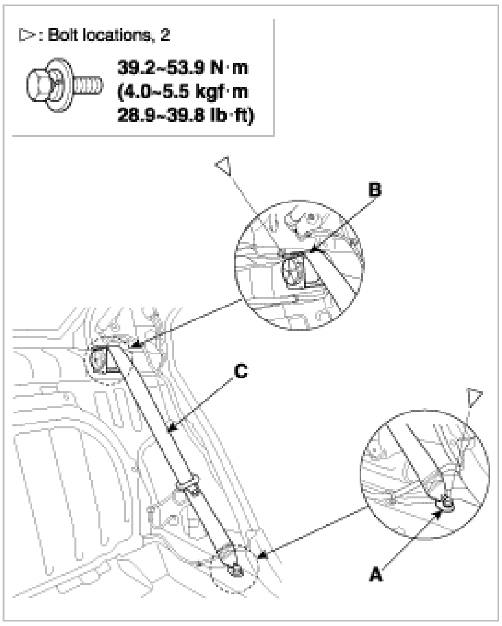
6. After disconnecting the pretensioner connector lock pin, remove the connector(B), Loosen the mounting bolt, then remove the pretensioner (C).

REAR SEAT BELT RELACEMENT

> CAUTION
>
> When installing the belt, make sure not to damage the pretensioner.

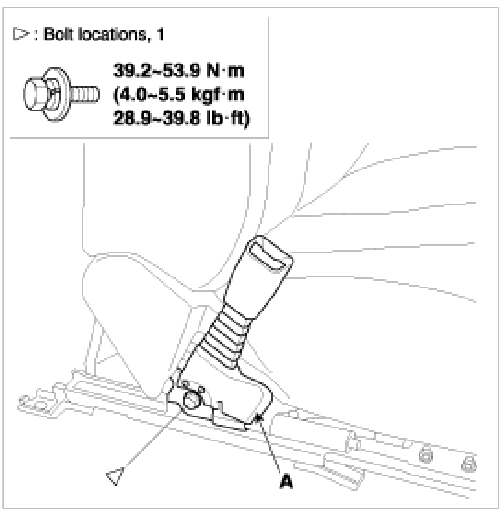
1. Remove the following items first.
   A. Rear seat assembly.
   B. Front and rear door scuff trim.
   C. Rear filler trim.
2. Remove the lower anchor (A).
3. Remove the package tray trim.

4. After loosening the retractor (B) mounting bolt, remove the rear seat belt (C).



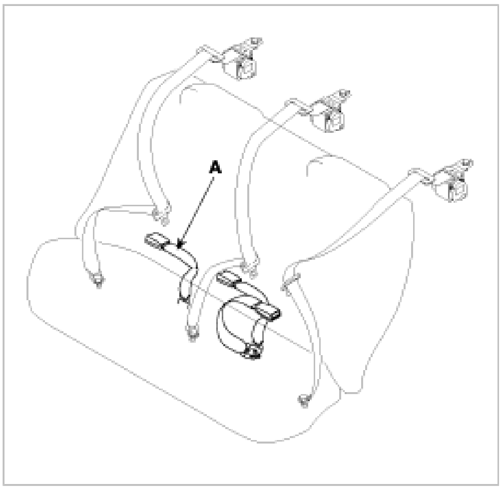
FRONT SEAT BELT BUCKLE REPLACEMENT

1. Remove the following items first.
   A. Front seat assembly.
2. Remove the wire harness of buckle from seat.
3. Remove the seat belt buckle (A).
4. Installation is the reverse of removal.



REAR SEAT BELT BUCKLE REPLACEMENT

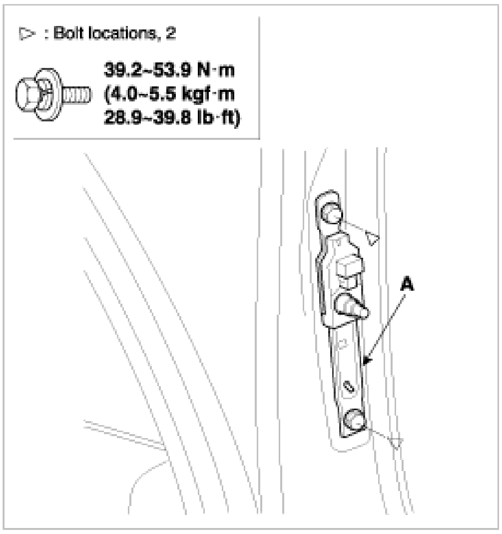
1. After cushion frame hinge mounting bolt, fold the cushion.
2. Remove the seat belt buckle (A).



3. Installation is the reverse of removal.

HIGHT ADJUSTER REPLACEMENT

1. Remove the following items first.
   A. Front seat assembly.
   B. Front and rear door scuff trim.
   C. Front seat belt upper and lower anchor.
   D. Center pillar lower and upper trim.
2. Loosen the mounting bolt, then remove the height adjuster (A).



3. Installation is the reverse of removal.

GENERAL TROUBLESHOOTING INFORMATION

BEFORE TROUBLESHOOTING

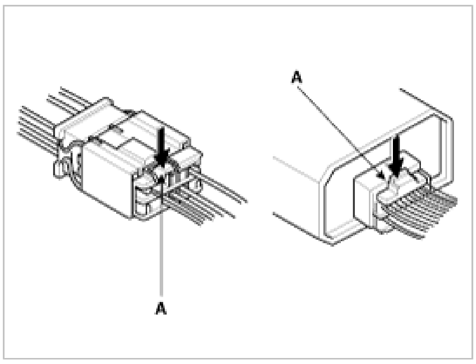
1. Check applicable fuses in the appropriate fuse/relay box.
2. Check the battery for damage, state of charge, and clean and tight connections.

> NOTE
>
> - Do not quick-charge a battery unless the battery ground cable has been disconnected, otherwise you will damage the alternator diodes.
> - Do not attempt to crank the engine with the battery ground cable loosely connected or you will severely damage the wiring.

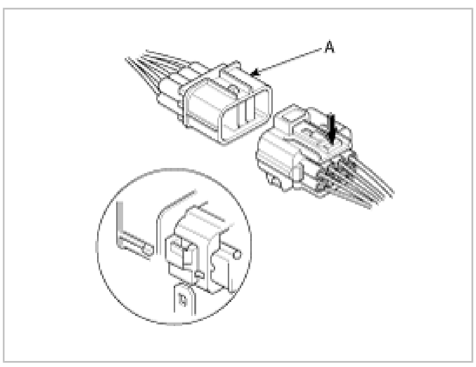
3. Check the alternator belt tension.

HANDLING CONNECTORS

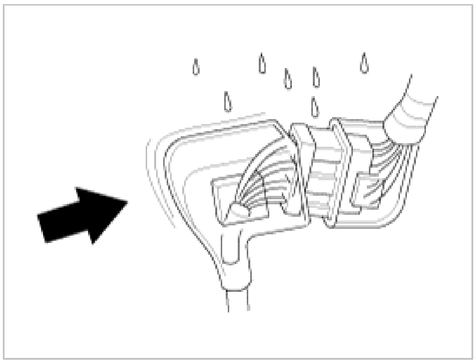
1. Make sure the connectors are clean and have no loose wire terminals.
2. Make sure multiple cavity connectors are packed with grease (except watertight connectors).
3. All connectors have push-down release type locks (A).



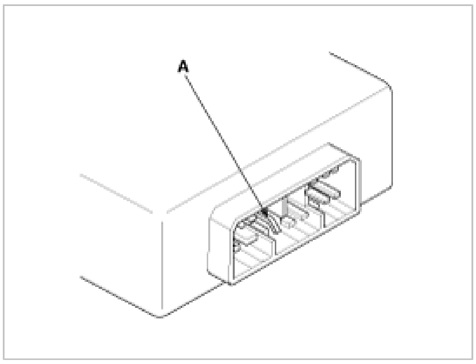
4. Some connectors have a clip on their side used to attach them to a mount bracket on the body or on another component. This clip has a pull type lock.
5. Some mounted connectors cannot be disconnected unless you first release the lock and remove the connector from its mount bracket (A).



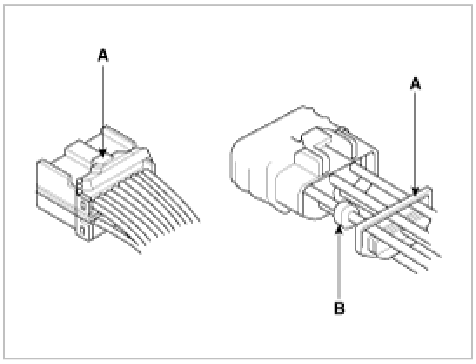
6. Never try to disconnect connectors by pulling on their wires; pull on the connector halves instead.
7. Always reinstall plastic covers.



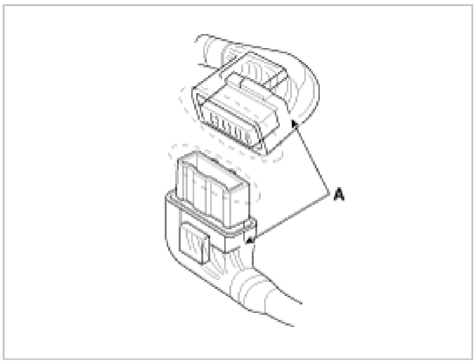
8. Before connecting connectors, make sure the terminals (A) are in place and not bent.



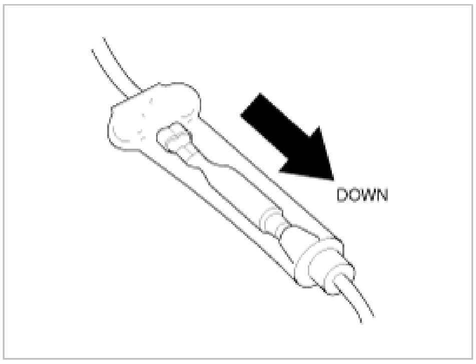
9. Check for loose retainer (A) and rubber seals (B).



10. The backs of some connectors are packed with grease. Add grease if necessary. If the grease (A) is contaminated, replace it.

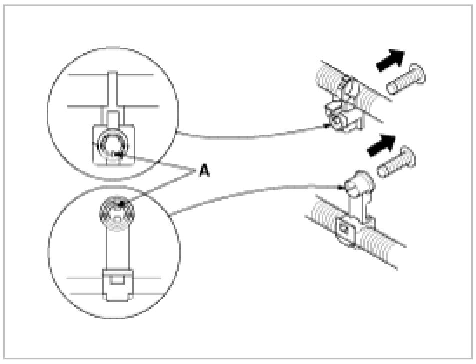


11. Insert the connector all the way and make sure it is securely locked.
12. Position wires so that the open end of the cover faces down.

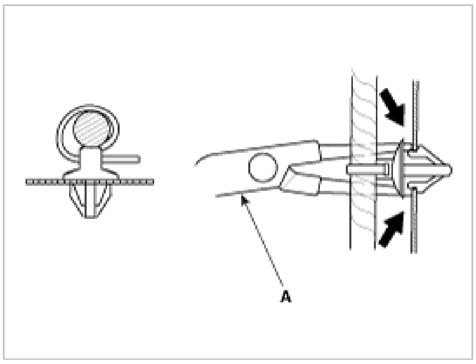


HANDLING WIRES AND HARNESSES

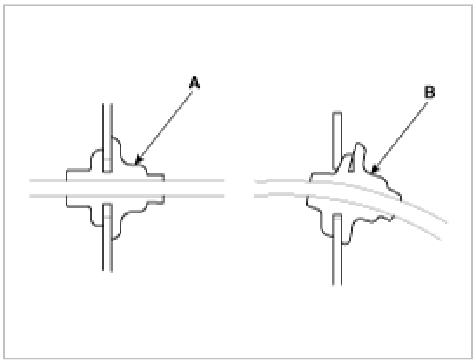
1. Secure wires and wire harnesses to the frame with their respective wire ties at the designated locations.
2. Remove clips carefully; don't damage their locks (A).



3. Slip pliers (A) under the clip base and through the hole at an angle, and then squeeze the expansion tabs to release the clip.



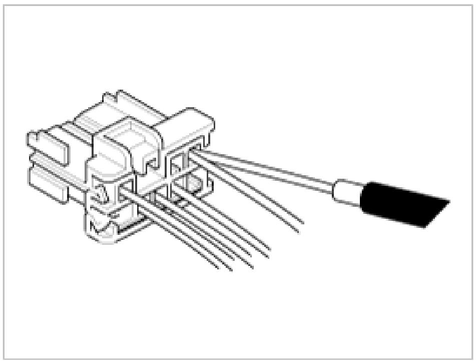
4. After installing harness clips, make sure the harness doesn't interfere with any moving parts.
5. Keep wire harnesses away from exhaust pipes and other hot parts, from sharp edges of brackets and holes, and from exposed screws and bolts.
6. Seat grommets in their grooves properly (A). Do not leave grommets distorted (B).



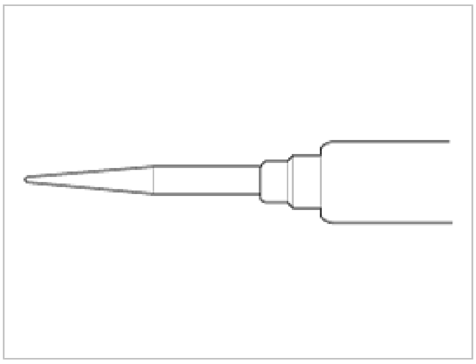
TESTING AND REPAIRS

1. Do not use wires or harnesses with broken insulation.
   Replace them or repair them by wrapping the break with electrical tape.
2. After installing parts, make sure that no wires are pinched under them.

3. When using electrical test equipment, follow the manufacturer's instructions and those described in this manual.
4. If possible, insert the probe of the tester from the wire side (except waterproof connector).



5. Use a probe with a tapered tip.

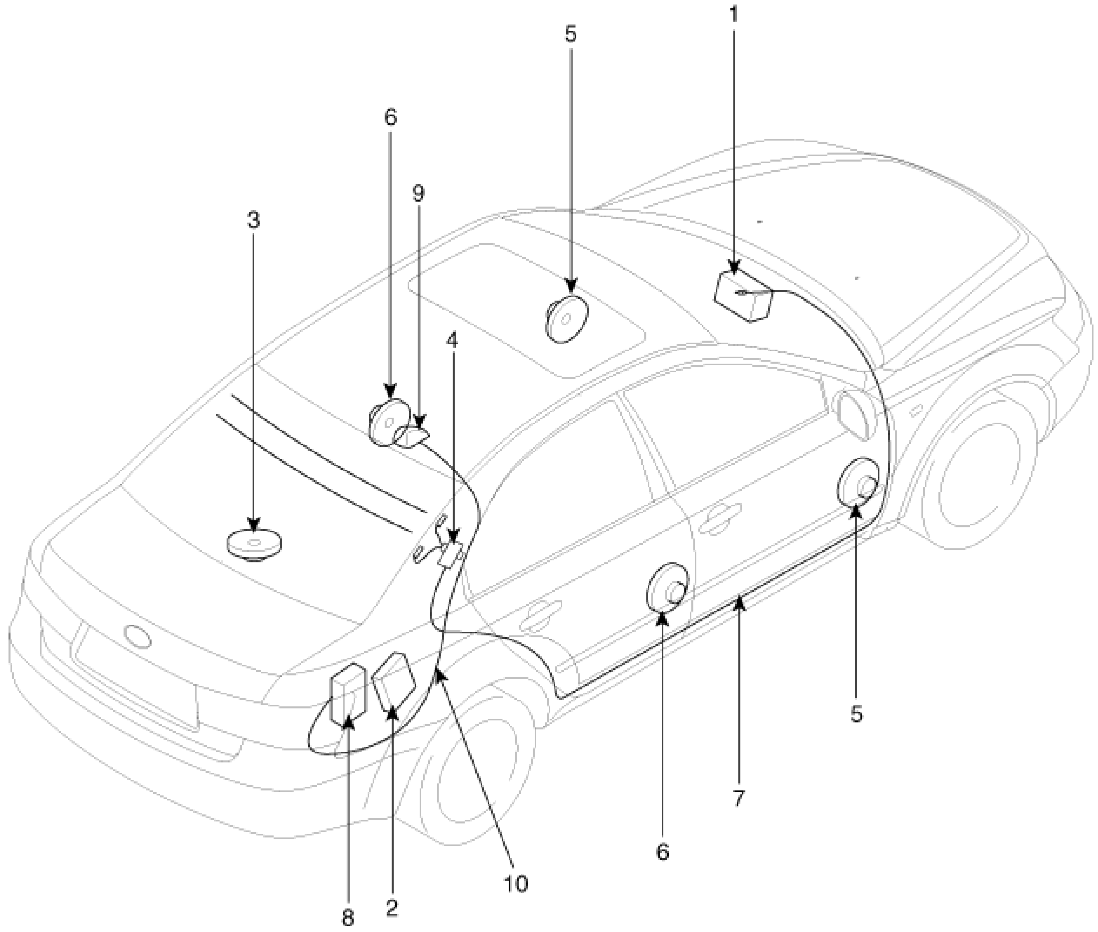


FIVE-STEP TROUBLESHOOTING

1. Verify the complaint
   Turn on all the components in the problem circuit to verify the customer complaint. Note the symptoms. Do not begin disassembly or testing until you have narrowed down the problem area.
2. Analyze the schematic
   Look up the schematic for the problem circuit.
   Determine how the circuit is supposed to work by tracing the current paths from the power feed through the circuit components to ground. If several circuits fail at the same time, the fuse or ground is a likely cause.
   Based on the symptoms and your understanding of the circuit operation, identify one or more possible causes of the problem.
3. Isolate the problem by testing the circuit.
   Make circuit tests to check the diagnosis you made in step 2. Keep in mind that a logical, simple procedure is the key to efficient troubleshooting.
   Test for the most likely cause of failure first. Try to make tests at points that are easily accessible.
4. Fix the problem
   Once the specific problem is identified, make the repair. Be sure to use proper tools and safe procedures.
5. Make sure the circuit works
   Turn on all components in the repaired circuit in all modes to make sure you've fixed the entire problem. If the problem was a blown fuse, be sure to test all of the circuits on the fuse. Make sure no new problems turn up and the original problem does not recur.

Body Electrical System > Audio > Components and Components Location

COMPONENT LOCATION



* SDARS : Satellite Digital Audio Radio Service

1. Audio unit	6. Rear door speaker
2. External amp	7. Antenna feeder cable
3. Woofer speaker	8. Set top box (SDARS)
4. Glass antenna	9. SDARS roof antenna
5. Front door speaker	10. SDARS roof antenna cable

Body Electrical System > Audio > Troubleshooting

TROUBLESHOOTING

There are six areas where a problem can occur: wiring harness, the radio, the cassette tape deck, the CD player, and speaker. Troubleshooting enables you to confine the problem to a particular area.

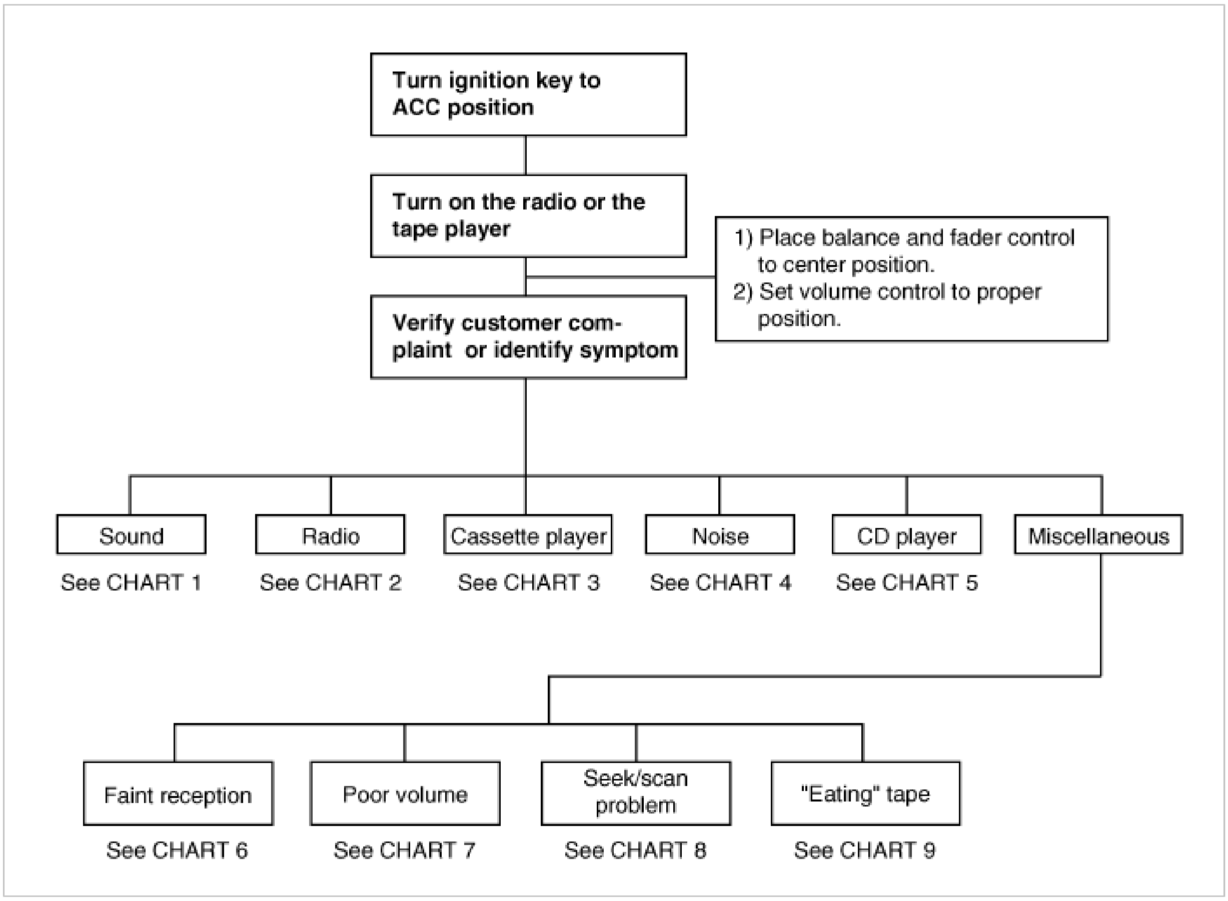

Turn ignition key to ACC position
Turn on the radio or the tape player
1) Place balance and fader control to center position.
2) Set volume control to proper position.
Verify customer com- plaint or identify symptom
Sound
See CHART 1
Radio
See CHART 2
Cassette player
See CHART 3
Noise
See CHART 4
CD player
See CHART 5
Miscellaneous
Faint reception
See CHART 6
Poor volume
See CHART 7
Seek/scan problem
See CHART 8
"Eating" tape
See CHART 9

CHART 1

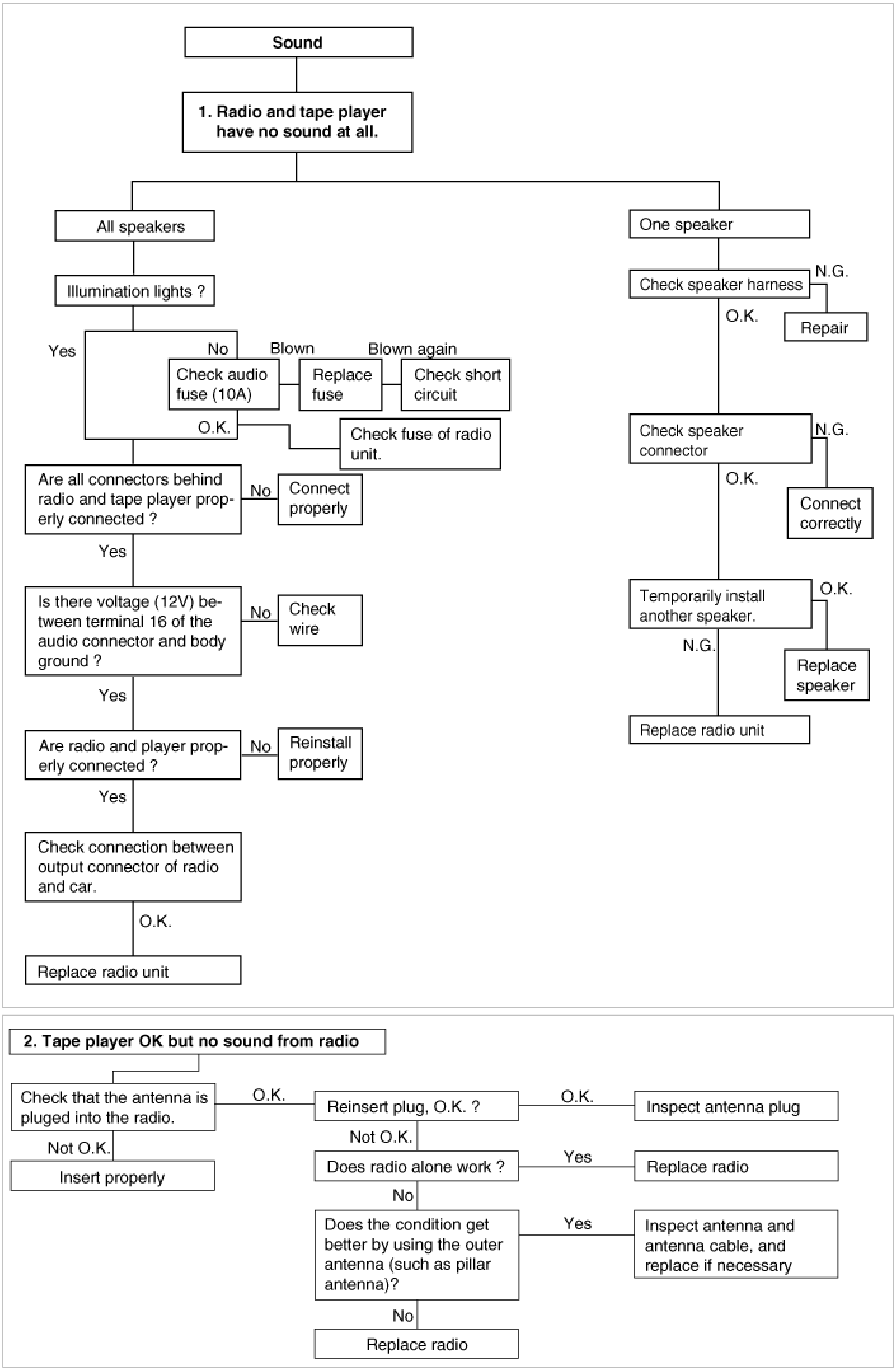

Sound
1. Radio and tape player have no sound at all.
All speakers
Illumination lights ?
Yes
No
Check audio fuse (10A)
Blown
Replace fuse
Blown again
Check short circuit
O.K.
Check fuse of radio unit.
Are all connectors behind radio and tape player properly connected ?
No
Connect properly
Yes
Is there voltage (12V) between terminal 16 of the audio connector and body ground ?
No
Check wire
Yes
Are radio and player properly connected ?
No
Reinstall properly
Yes
Check connection between output connector of radio and car.
O.K.
Replace radio unit
One speaker
Check speaker harness
N.G.
Repair
O.K.
Check speaker connector
N.G.
Connect correctly
O.K.
Temporarily install another speaker.
O.K.
Replace speaker
N.G.
Replace radio unit
2. Tape player OK but no sound from radio
Check that the antenna is pluged into the radio.
Not O.K.
Insert properly
O.K.
Reinsert plug, O.K. ?
O.K.
Inspect antenna plug
Not O.K.
Does radio alone work ?
Yes
Replace radio
No
Does the condition get better by using the outer antenna (such as pillar antenna)?
Yes
Inspect antenna and antenna cable, and replace if necessary
No
Replace radio

CHART 2

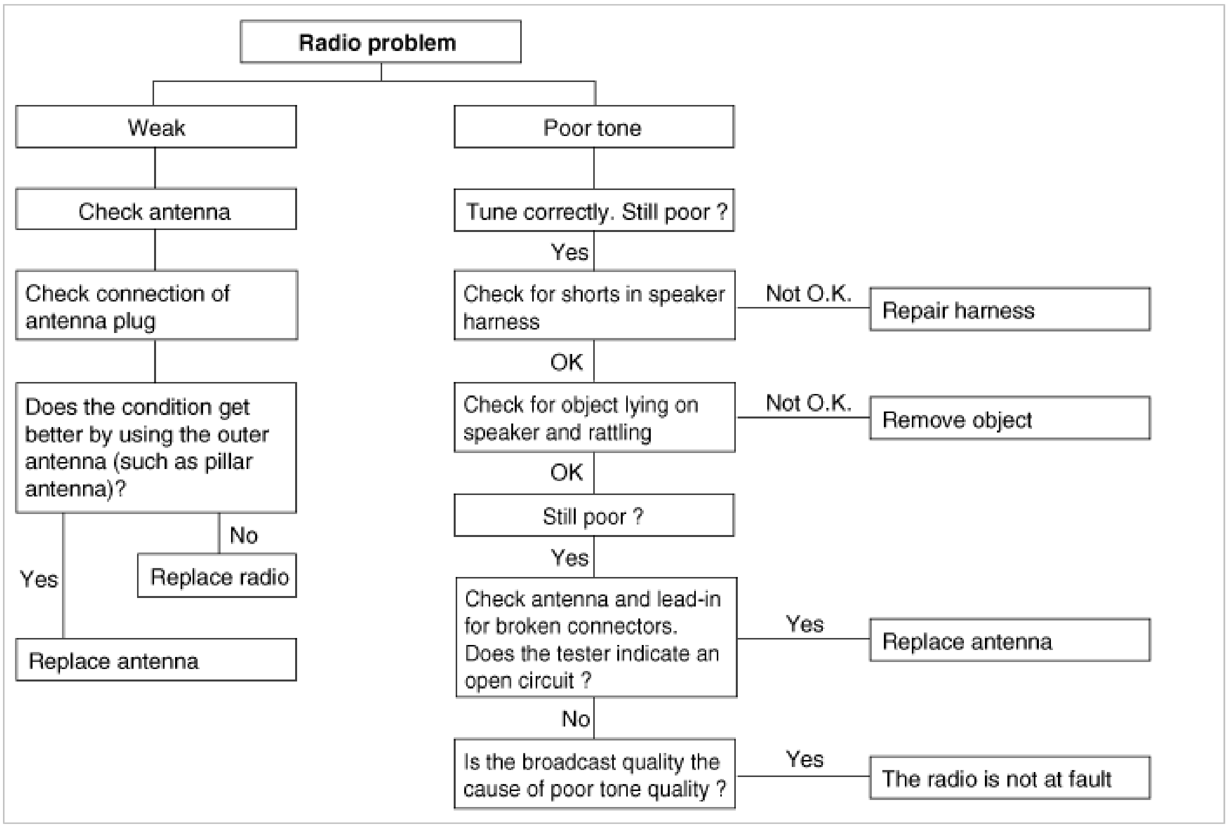

Radio problem
Weak
Check antenna
Check connection of antenna plug
Does the condition get better by using the outer antenna (such as pillar antenna)?
No
Replace radio
Yes
Replace antenna
Poor tone
Tune correctly. Still poor ?
Yes
Check for shorts in speaker harness
Not O.K.
Repair harness
OK
Check for object lying on speaker and rattling
Not O.K.
Remove object
OK
Still poor ?
Yes
Check antenna and lead-in for broken connectors. Does the tester indicate an open circuit ?
Yes
Replace antenna
No
Is the broadcast quality the cause of poor tone quality ?
Yes
The radio is not at fault

CHART 3

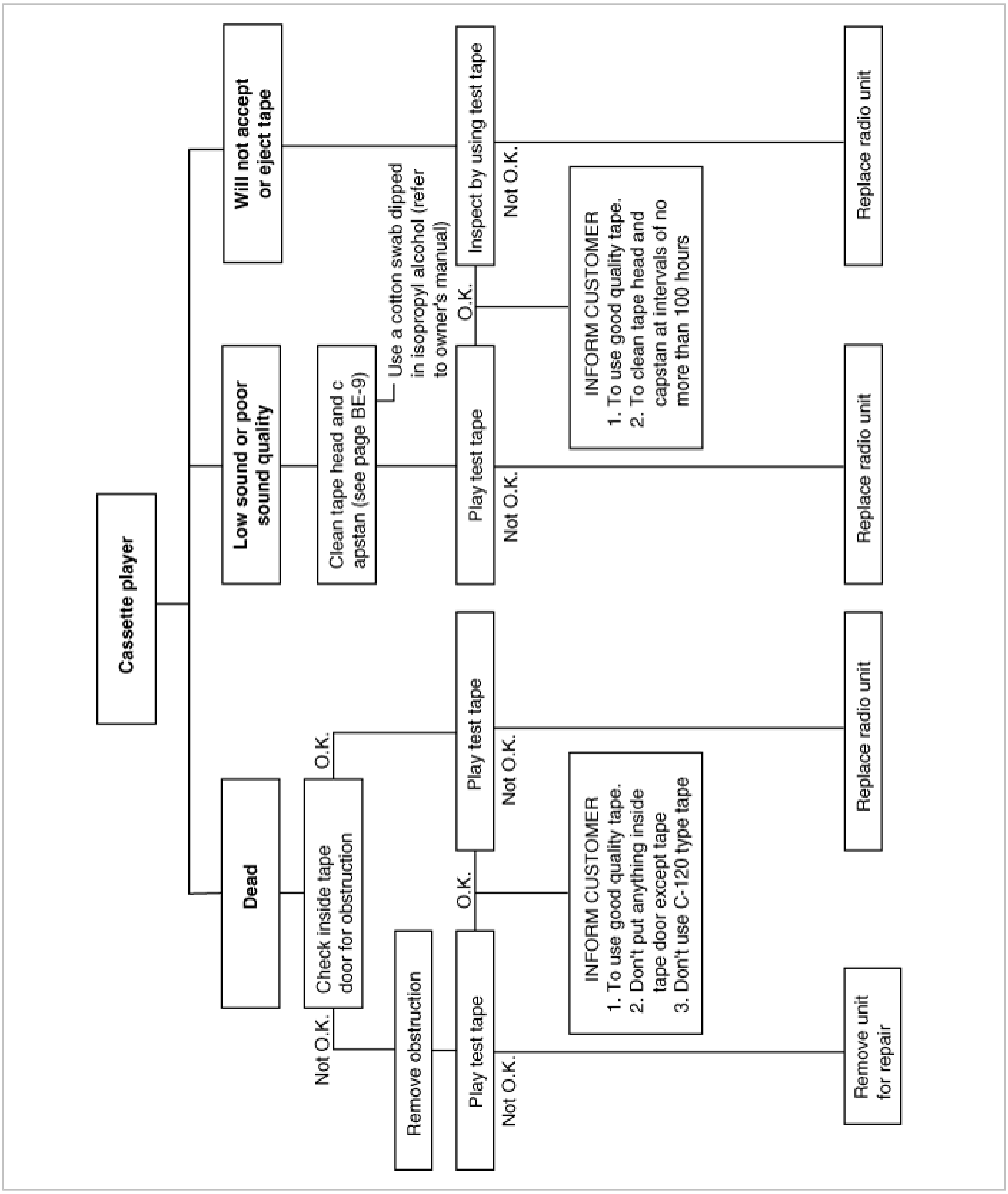
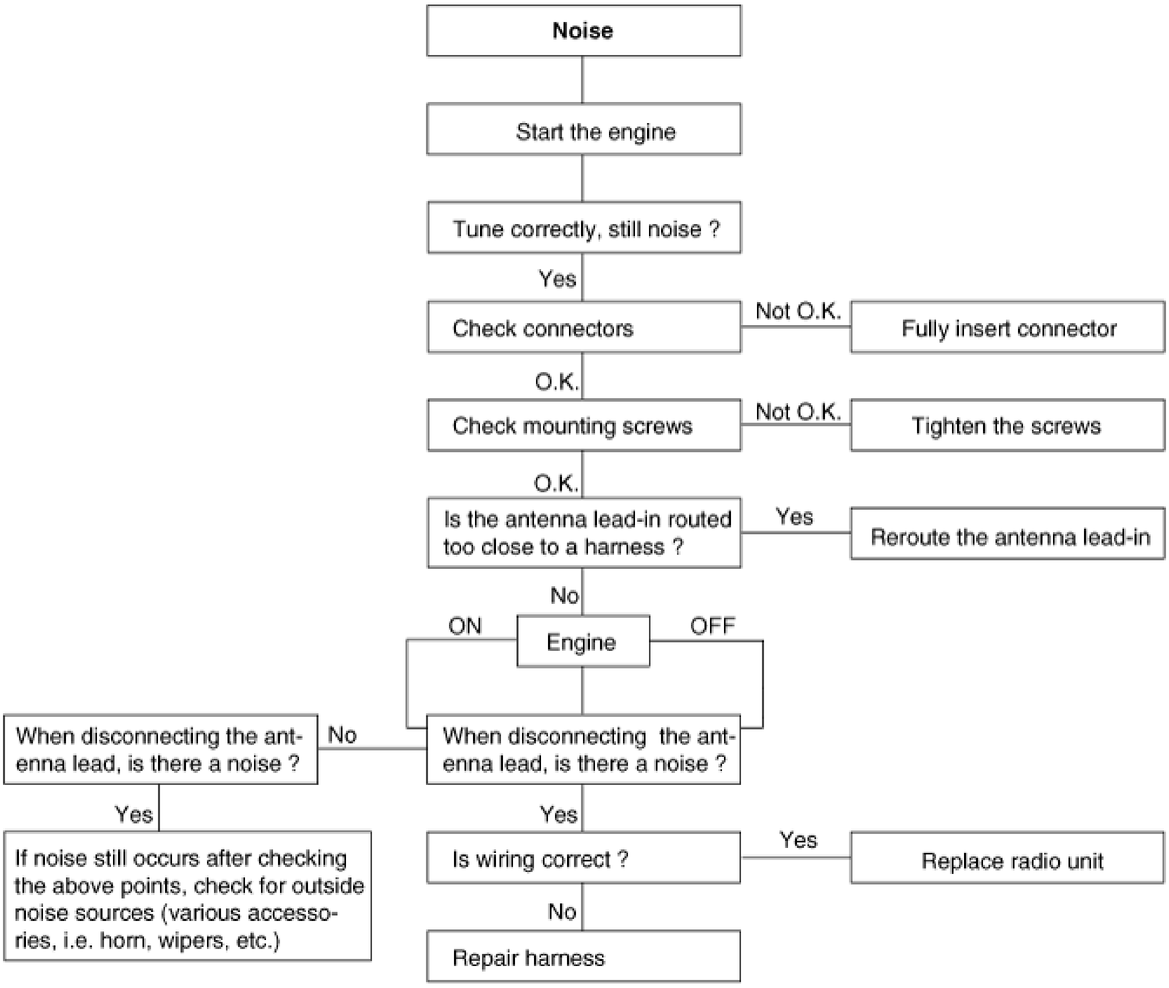

Cassette player
Dead
Low sound or poor sound quality
Will not accept or eject tape
Check inside tape door for obstruction
O.K.
Not O.K.
Remove obstruction
Play test tape
O.K.
Not O.K.
Play test tape
O.K.
Not O.K.
INFORM CUSTOMER
1. To use good quality tape.
2. Don't put anything inside tape door except tape
3. Don't use C-120 type tape
Replace radio unit
Remove unit for repair
Clean tape head and c apstan (see page BE-9)
Use a cotton swab dipped in isopropyl alcohol (refer to owner's manual)
Play test tape
O.K.
Not O.K.
INFORM CUSTOMER
1. To use good quality tape.
2. To clean tape head and capstan at intervals of no more than 100 hours
Replace radio unit
Inspect by using test tape
Not O.K.
Replace radio unit

CHART 4

1. RADIO



2. TAPE

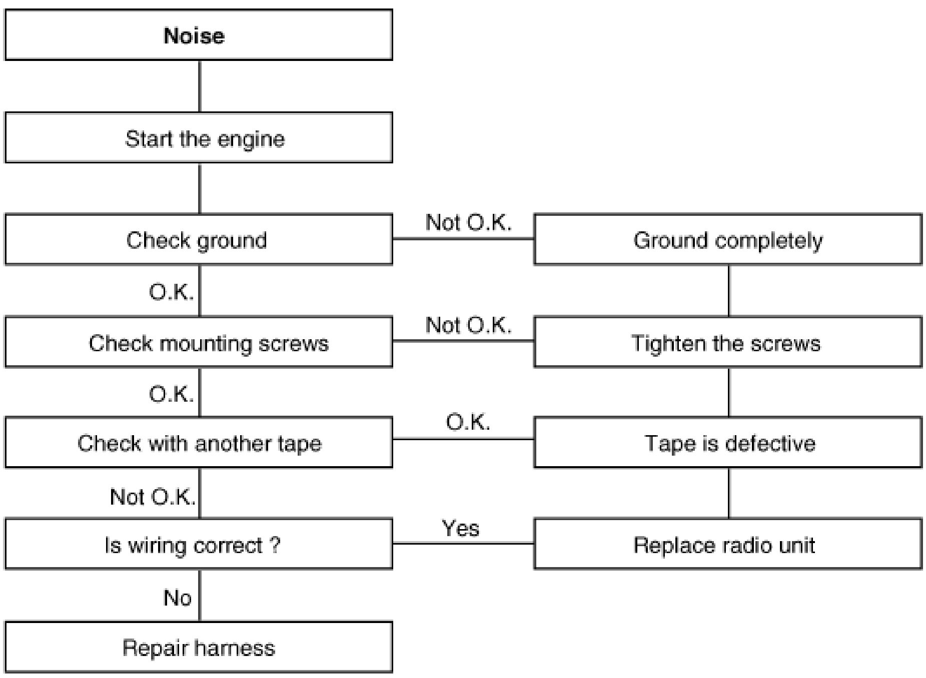
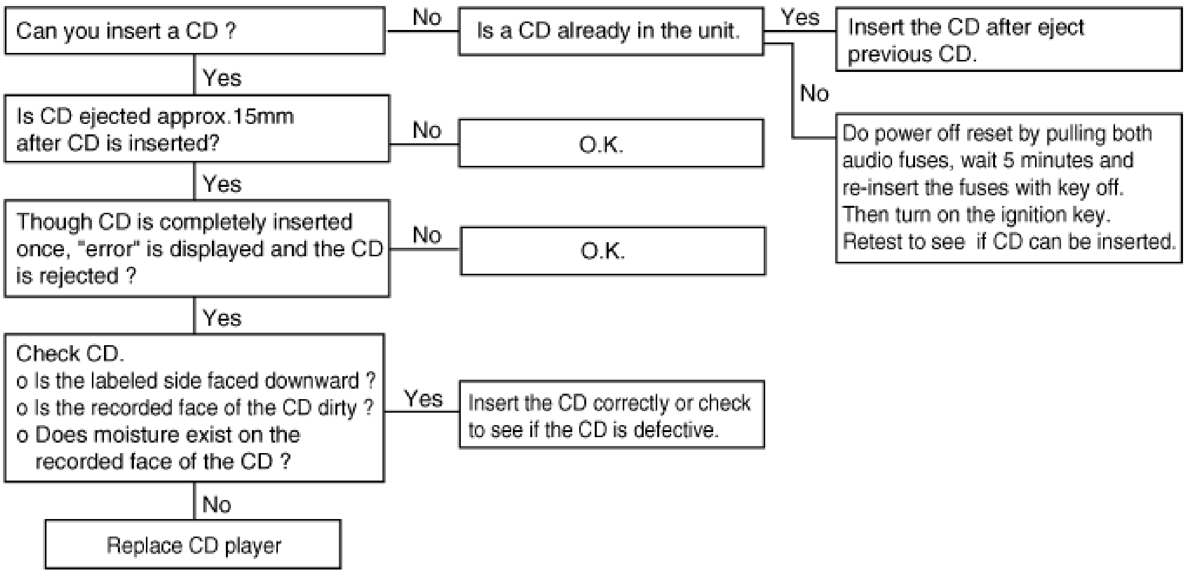
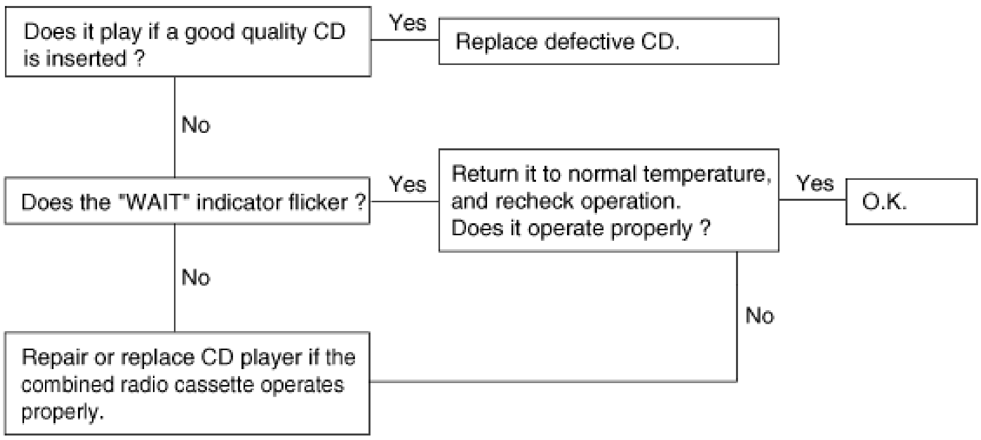


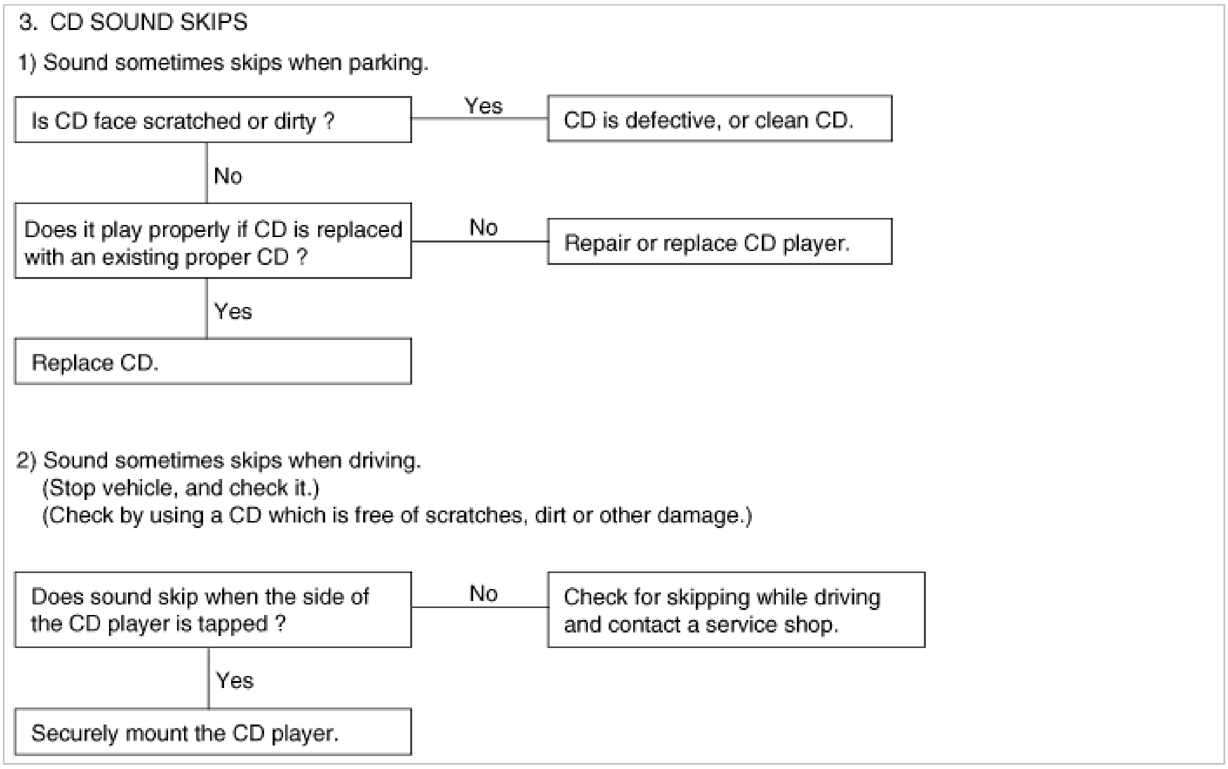
CHART 5

1. CD WILL NOT BE ACCEPTED



2. NO SOUND




3. CD SOUND SKIPS
1) Sound sometimes skips when parking.
Is CD face scratched or dirty ?
Yes
CD is defective, or clean CD.
No
Does it play properly if CD is replaced with an existing proper CD ?
No
Repair or replace CD player.
Yes
Replace CD.
2) Sound sometimes skips when driving.
(Stop vehicle, and check it.)
(Check by using a CD which is free of scratches, dirt or other damage.)
Does sound skip when the side of the CD player is tapped ?
No
Check for skipping while driving and contact a service shop.
Yes
Securely mount the CD player.

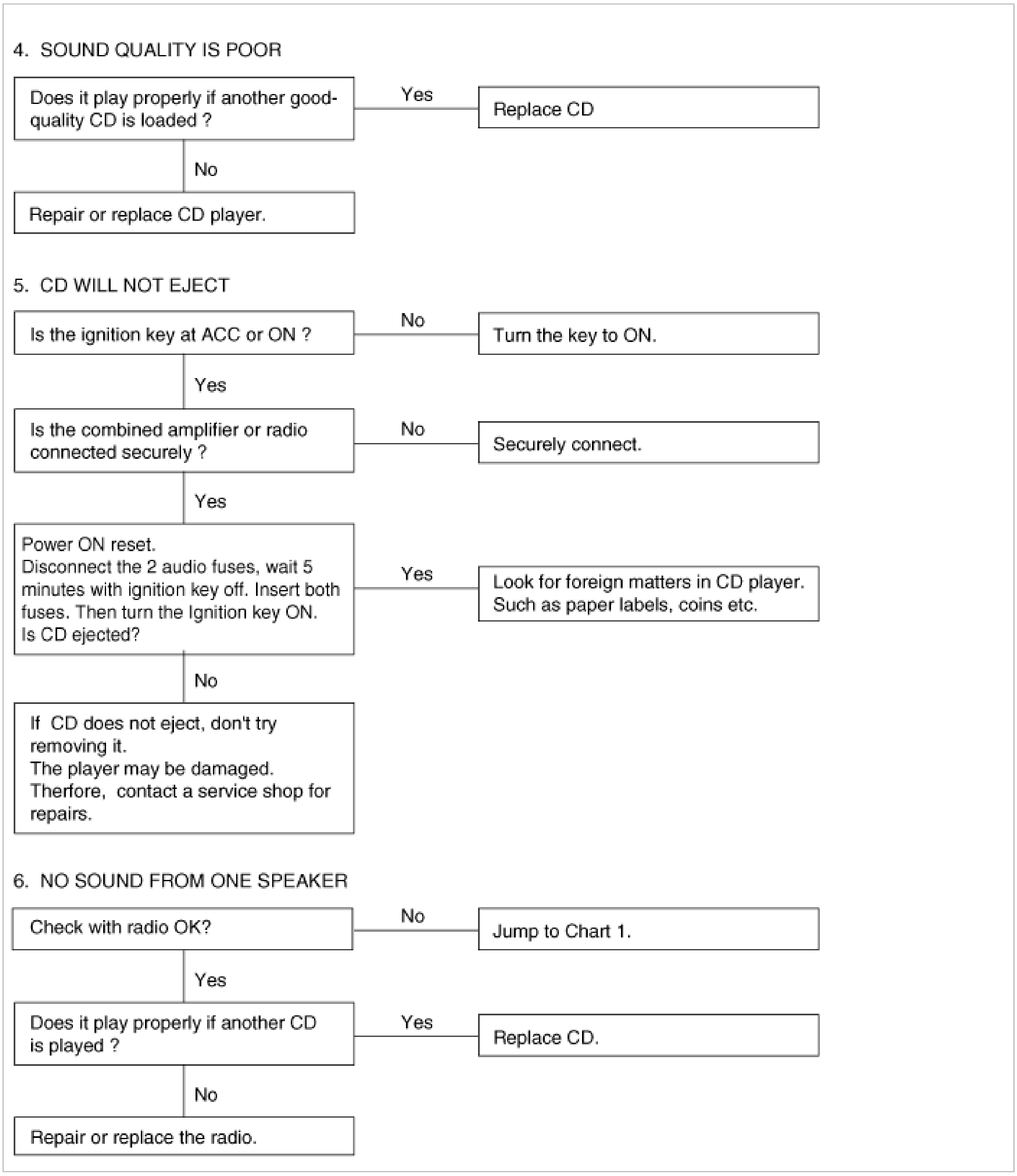

4. SOUND QUALITY IS POOR
Does it play properly if another good-quality CD is loaded ?
Yes
Replace CD
No
Repair or replace CD player.
5. CD WILL NOT EJECT
Is the ignition key at ACC or ON ?
No
Turn the key to ON.
Yes
Is the combined amplifier or radio connected securely ?
No
Securely connect.
Yes
Power ON reset.
Disconnect the 2 audio fuses, wait 5 minutes with ignition key off. Insert both fuses. Then turn the Ignition key ON.
Is CD ejected?
Yes
Look for foreign matters in CD player. Such as paper labels, coins etc.
No
If CD does not eject, don't try removing it.
The player may be damaged.
Therfore, contact a service shop for repairs.
6. NO SOUND FROM ONE SPEAKER
Check with radio OK?
No
Jump to Chart 1.
Yes
Does it play properly if another CD is played ?
Yes
Replace CD.
No
Repair or replace the radio.

CHART 6

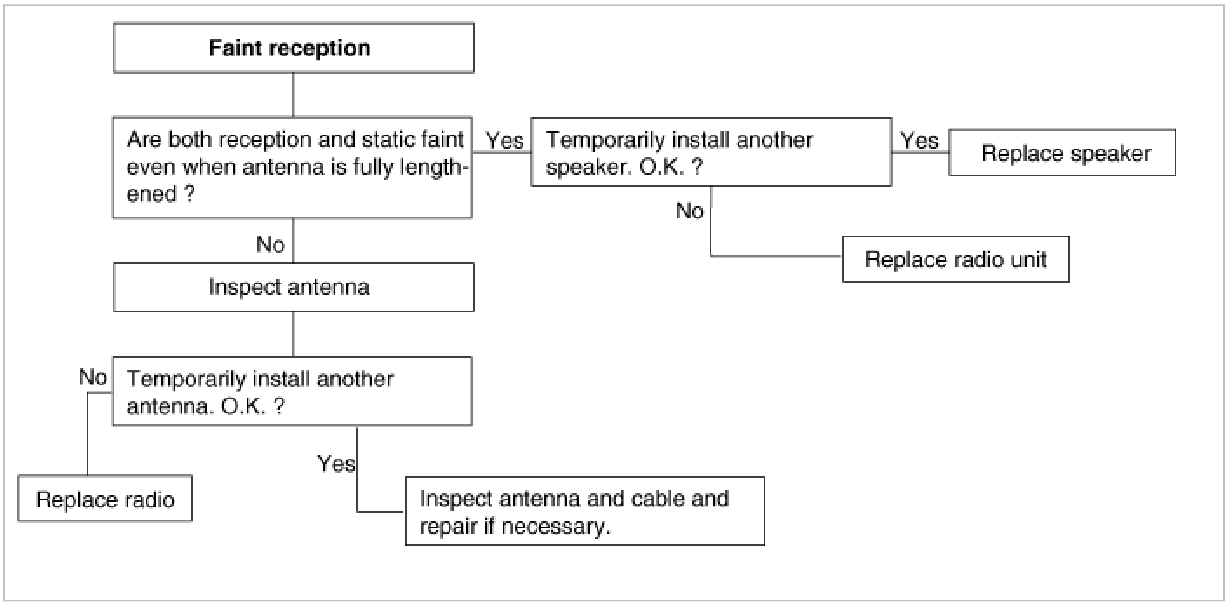


CHART 7

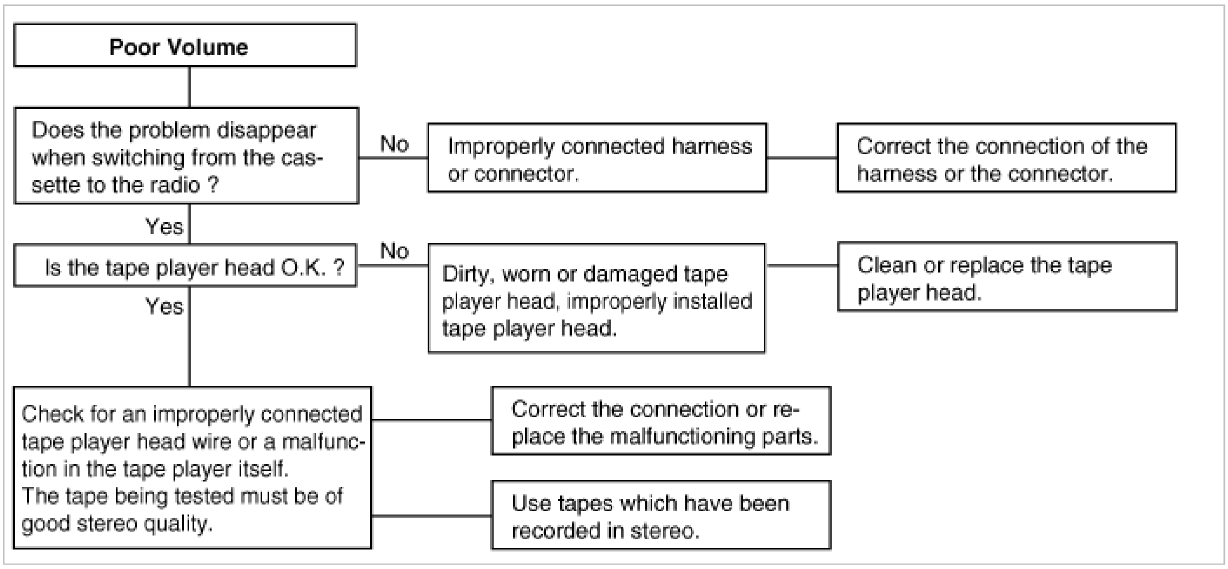


CHART 8

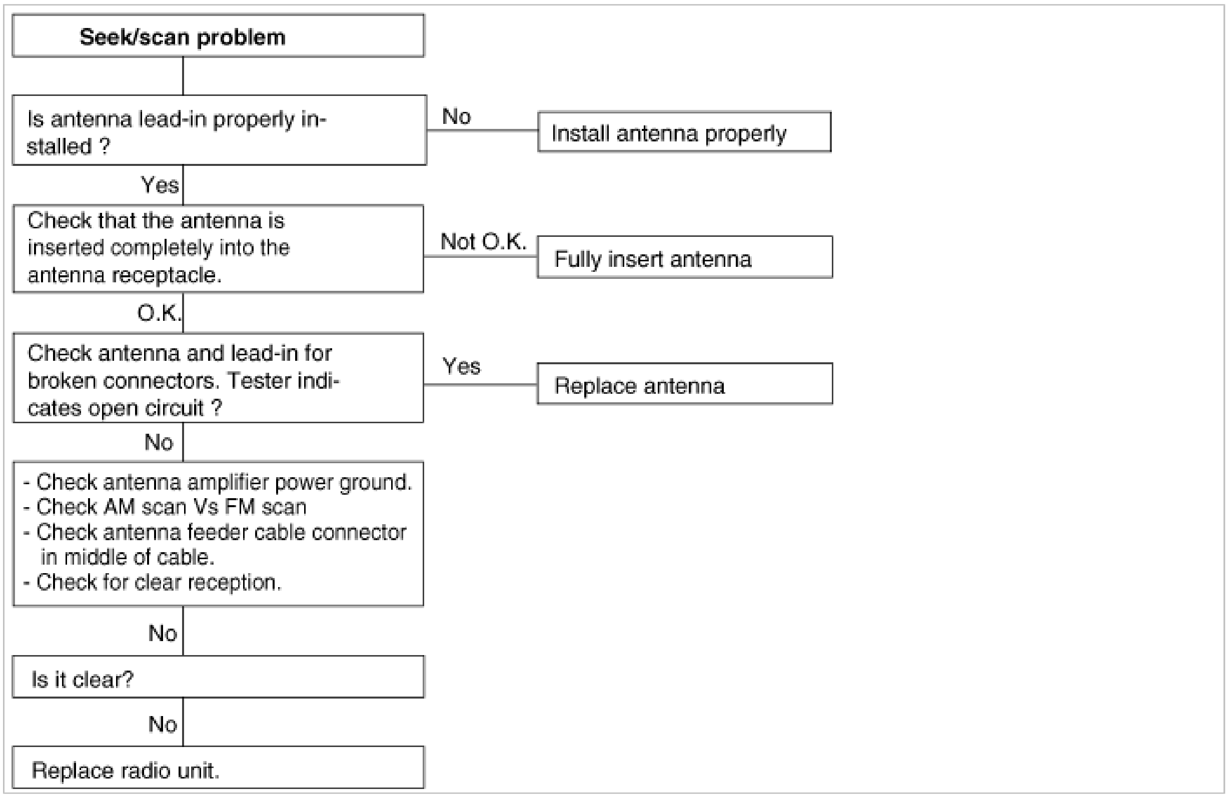
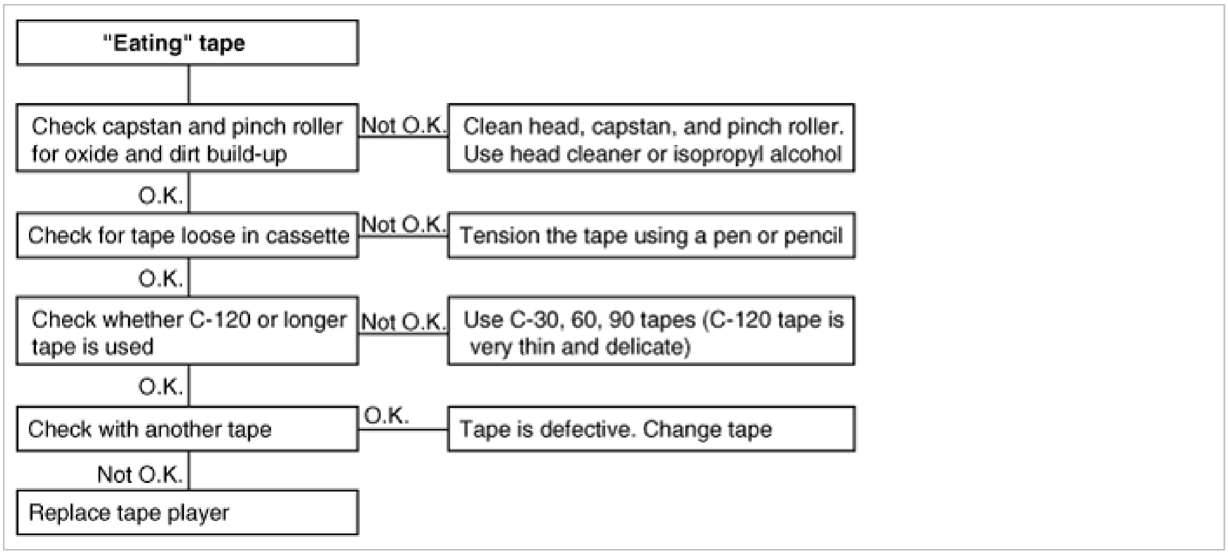


CHART 9



Body Electrical System > Audio > Specifications

SPECIFICATION

AUDIO

Item	Specification			
Model	AM / FM / CD / MP3 (V480)	AM / FM / MX / CD / MP3 (V480S)	AM / FM / MP3 / 6CDC (V490 / V490 PREMIUM)	AM / FM / XM / MP3 / 6CDC (V490S)
Power supply	DC 14.4V			
Rated output	Max 20W x 4		5.4Vrms	
Antenna	90PF 100Ω			
Tuning type	PLL synthesized type			
The others	-		External amp, woofer speaker	

Frequency range / Channel space	FM	87.9~107.9 MHz/ 220KHz
	AM	530~1710 KHz/ 10 KHz

* XM : Satellite Radio

SPEAKER

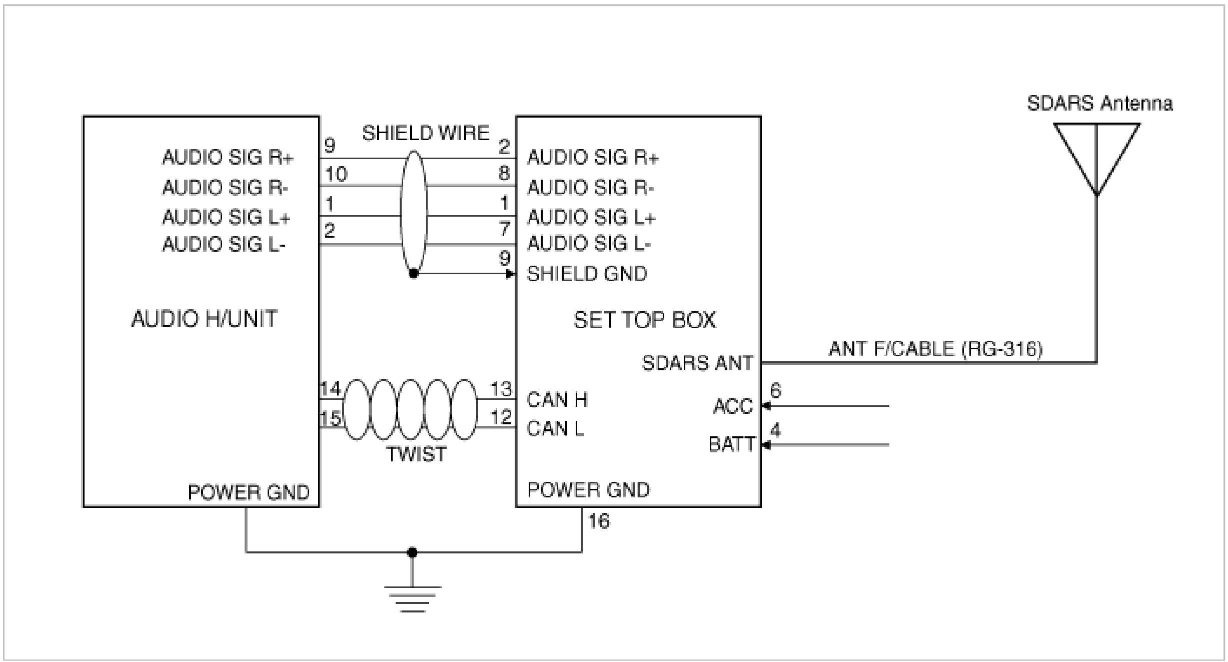
Item		V480	V490	V490/V490S PREMIUM
Input Power	Front	Max. 40W	Max. 40W	Max. 6.3 Vrms
	Rear	Max. 40W	Max. 40W	Max. 6.3 Vrms
	Tweeter	Max. 20W	Max. 20W	20 W
	Woofer	-	Max. 80W	64 W
Speaker Impedance (Ω)	Front	4	2	Min. 1.6 @ 400Hz
	Rear	4	2	Min. 1.6 @ 400Hz
	Tweeter	4	2	3.6 ± 0.4 @ 5KHz
	Woofer	-	2 + 2	1.35± 0.2 @200Hz
Speaker Number		6	7	7

EXTERNAL AMPLIFIER

Item	V480/V480S	V490/V490S	V490/V490S PREMIUM
Power supply	-	DC 14.4V	DC 14.4V
Output power	-	Max 240W (40W x 6CH)	Max 270W (45W x 6CH)
Speaker Impedance (Ω)	-	2	2

Body Electrical System > Audio > Audio Unit > Schematic Diagrams

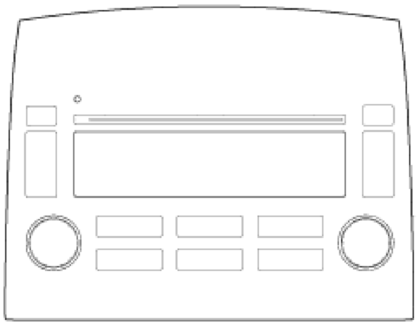
CIRCUIT DIAGRAM

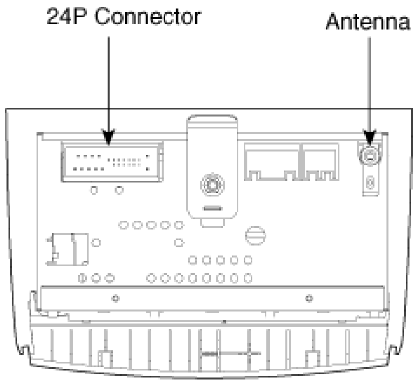


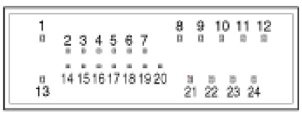
Body Electrical System > Audio > Audio Unit > Components and Components Location

COMPONENT

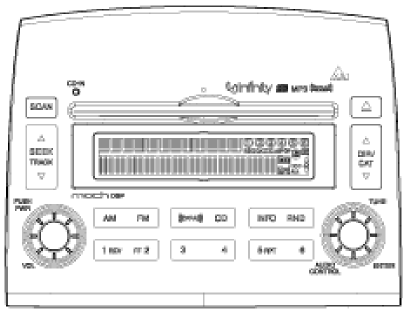
[AM/FM/CD/MP3 (V480)]
[AM/FM/MP3/6CDC (V490)]

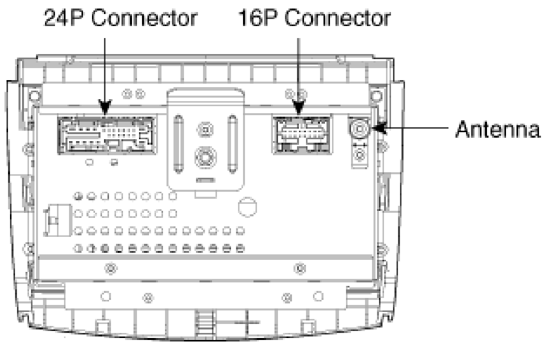


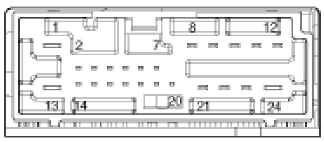


Audio connector	Terminal	Description	Terminal	Description
	1	Battery	13	Ground
	2	ACC	14	-
	3	Illumination (+)	15	-
	4	Illumination (-)	16	-
	5	External amp	17	-
	6	-	18	Steering remote control
	7	MUTE	19	Remote control ground
	8	Front left speaker (+)	20	-
	9	Rear left speaker (+)	21	Front left speaker (-)
	10	Rear right speaker (+)	22	Rear left speaker (-)
	11	Front right speaker (+)	23	Rear right speaker (-)
	12	Front right speaker (-)	24	Antenna B+

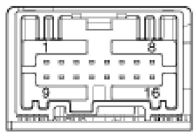
[AM/FM/XM/CD/MP3 (V480S)]







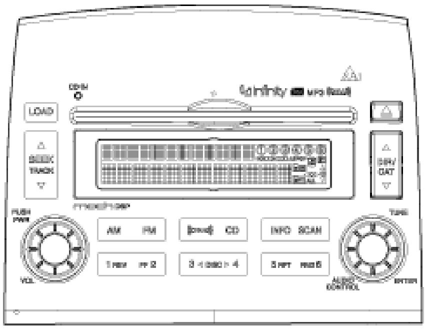
24P Connector

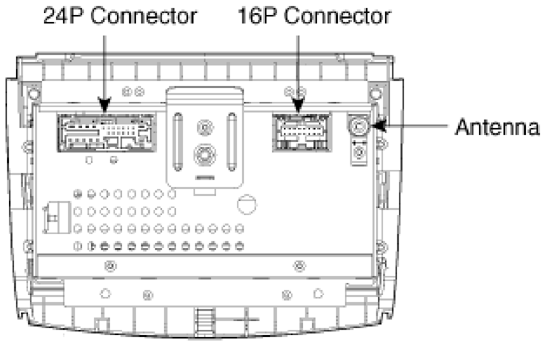


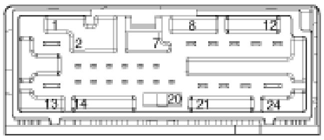
16P Connector

Pin	Description	Pin	Description	Pin	Description	Pin	Description
1	Battery	13	Power ground	1	XM SDARS L+	13	-
2	Run/Acc	14	LS CAN HI	2	XM SDARS L-	14	-
3	Illumination +	15	LS CAN LO	3	XM SDARS shield	15	-
4	Illumination -	16	-	4	-	16	-
5	-	17	-	5	-		
6	-	18	Remocon-SWC	6	-		
7	-	19	Remocon-GND	7	-		
8	Left front speaker +	20	-	8	-		
9	Left rear speaker +	21	Left front speaker -	9	XM SDARS R+		
10	Right rear speaker +	22	Left rear speaker -	10	XM SDARS R-		
11	Right front speaker +	23	Right rear speaker -	11	-		
12	Right front speaker -	24	Glass antenna amp enable	12	-		

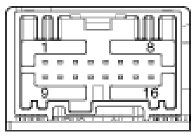
[AM/FM/XM/MP3/6CDC (V490S)]







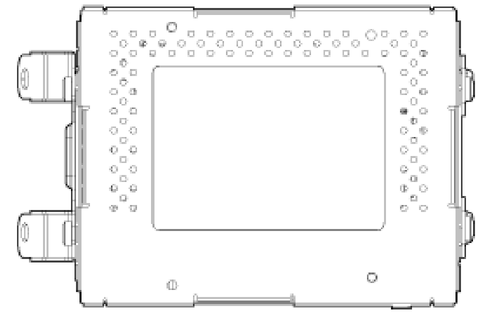
24P Connector

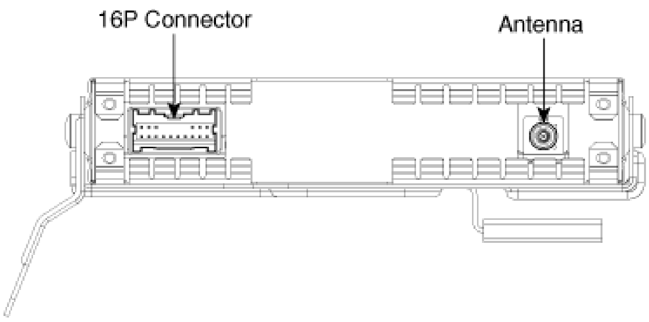


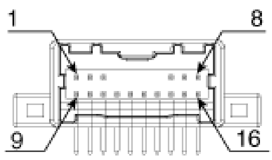
16P Connector

Pin	Description	Pin	Description	Pin	Description	Pin	Description
1	Battery	13	Power ground	1	XM SDARS L+	13	-
2	Run/Acc	14	LS CAN HI	2	XM SDARS L-	14	-
3	Illumination +	15	LS CAN LO	3	XM SDARS shield	15	-
4	Illumination -	16	-	4	-	16	-
5	Remote audio amplifier enable	17	-	5	-		
6	-	18	Remocon-SWC	6	-		
7	-	19	Remocon-GND	7	-		
8	Left front speaker +	20	-	8	-		
9	Left rear speaker +	21	Left front speaker -	9	XM SDARS R+		
10	Right rear speaker +	22	Left rear speaker -	10	XM SDARS R-		
11	Right front speaker +	23	Right rear speaker -	11	-		
12	Right front speaker -	24	Glass antenna amp enable	12	-		

[SET TOP BOX]



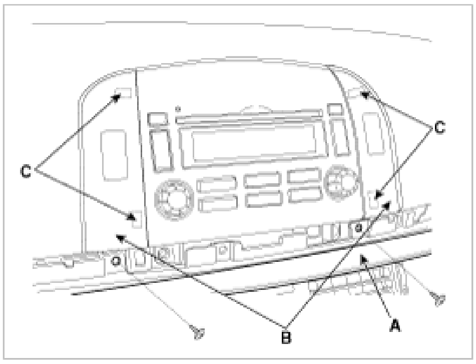


16P Connector	Pin	Description	Pin	Description
	1	SAT LCH (+)	9	EARTH (SIG)
	2	SAT RCH (+)	10	N.C
	3	DATA EARTH	11	N.C
	4	VBATT	12	CAN-L
	5	N.C	13	CAN-H
	6	ACC	14	N.C
	7	SAT LCH (-)	15	N.C
	8	SAT RCH (-)	16	EARTH (CASE)

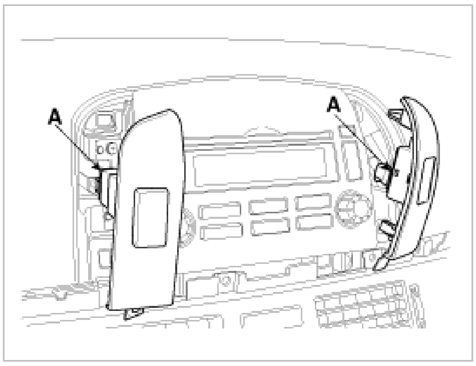
Body Electrical System > Audio > Audio Unit > Repair procedures

REPLACEMENT

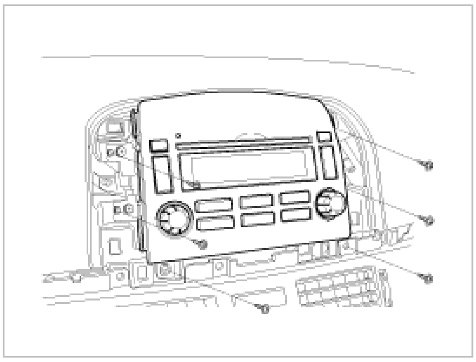
1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad garnish (A) after pulling it by using regular screw driver (-). Take care of fixing clips(C).
3. Remove the center facia panel (B) after loosening the screws.



4. Remove the connectors(A).



5. Remove the mounting screws then remove the audio unit (A).

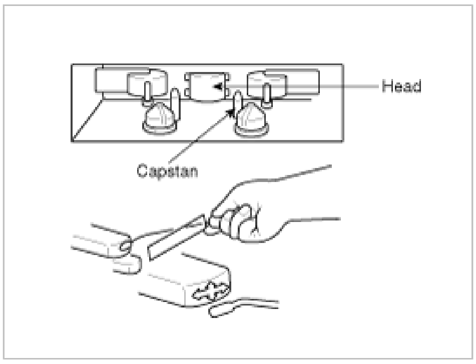


6. Installation is the reverse of removal.

INSPECTION

TAPE HEAD AND CAPSTAN CLEANING

1. To obtain optimum performance clean the head, and capstan as often as necessary, depending on frequency of use and tape cleanness.
2. To clean the tape head and capstan, use a cotton swab dipped in ordinary rubbing an alcohol. Wipe the head and capstan.

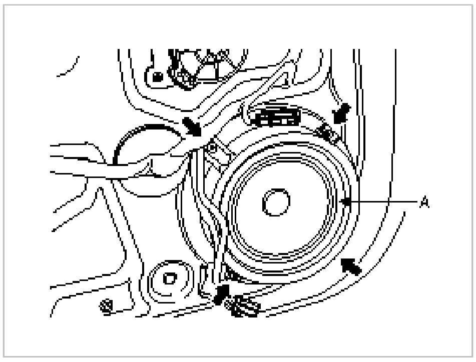


Body Electrical System > Audio > Speakers > Repair procedures

REPLACEMENT

FRONT SPEAKER

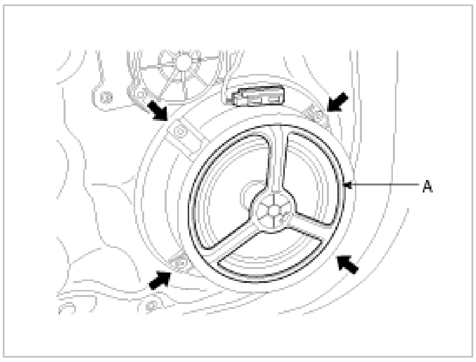
1. Remove the front door trim panel (Refer to the Body group - front door).
2. Remove the front speaker (A) after removing 4 rivets.



3. Installation is the reverse of removal.

REAR SPEAKER

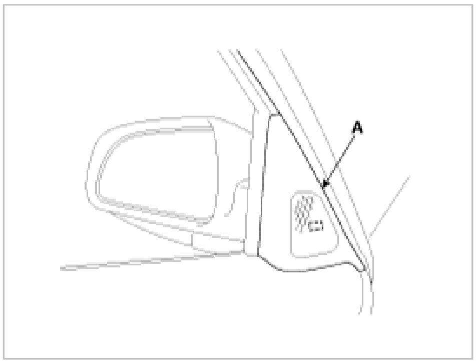
1. Remove the rear door trim panel (Refer to the Body group - rear door).
2. Remove the rear speaker (A) after removing 4 rivets.



3. Installation is the reverse of removal.

TWEETER SPEAKER

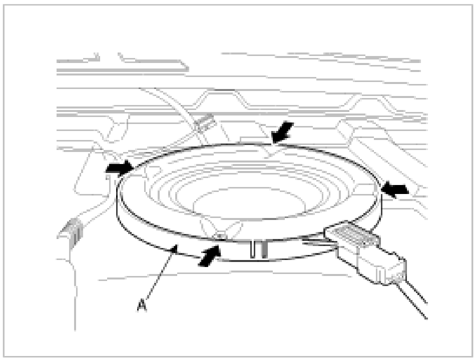
1. Remove the front door quadrant inner cover (A) (Refer to the Body group - front door).
2. Remove the tweeter speaker after disconnecting the connector.



3. Installation is the reverse of removal.

WOOFER SPEAKER

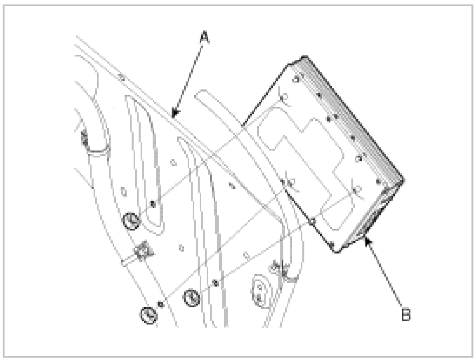
1. Remove the rear seat. (Refer to the Body group - rear seats)
2. Remove the rear package tray. (Refer to the Body group - package tray)
3. Remove the woofer speaker (A) after removing 4 bolts.



4. Installation is the reverse of removal.

EXTERNAL AMP

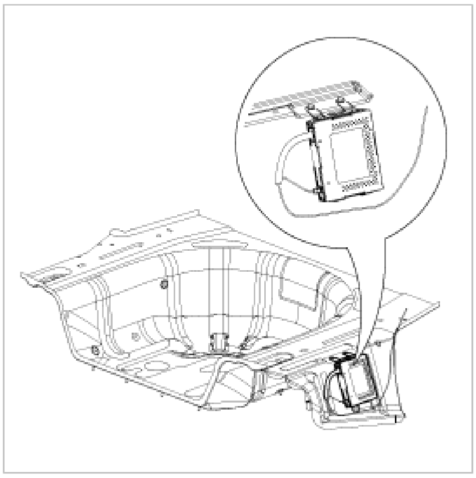
1. Remove the luggage side trim.
2. Remove the external amp (B) from the quarter inner panel (A) after removing 3 nuts.



3. Installation is the reverse of removal.

SET TOP BOX (FOR SDARS)

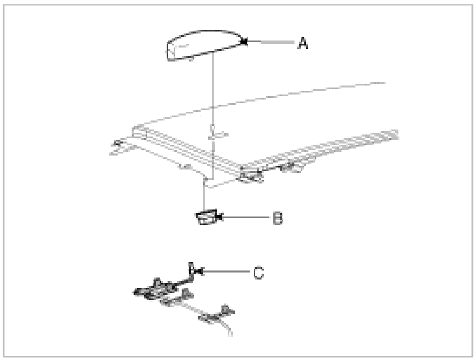
1. Remove the right lugguage side trim.
   (Refer to the Body Group - Trunk trim)
2. Remove the set top box(A) after loosening 2 bolts and disconnecting the cable and connector.



3. Installation is the reverse of removal.
4. Installation is the reverse of removal.

SDARS ROOF ANTENNA

1. Remove the rear headlining.
2. Remove the SDARS roof antenna(A) from the roof inner panel after loosening the mounting nut(B) and disconnecting the cable (C).

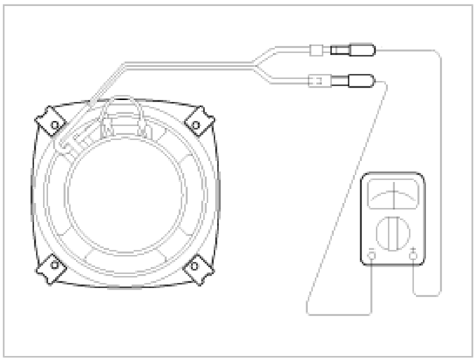


3. Installation is the reverse of removal.

INSPECTION

1. Check the speaker with an ohmmeter. If an ohmmeter indicates the correct impedance of the speaker when checking between the speaker (+) and speaker (-) of the same channel, the speaker is OK.

Specified impedance : 2 ~ 4Ω

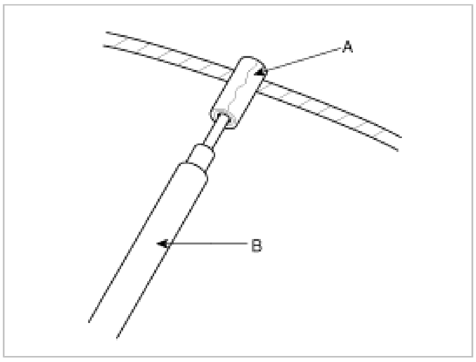


Body Electrical System > Audio > Antenna > Repair procedures

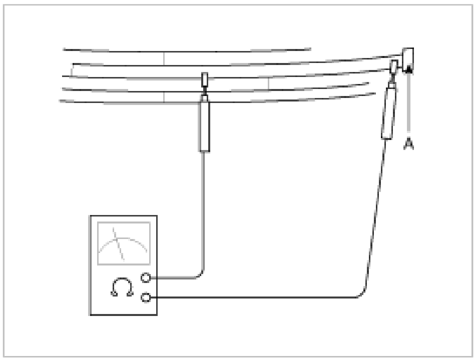
INSPECTION

GLASS ANTENNA TEST

1. Wrap aluminum foil (A) around the tip of the tester probe (B) as shown.



2. Touch one tester probe to the glass antenna terminal (A) hear, and move the other tester probe along the antenna wires to check that continuity exists.

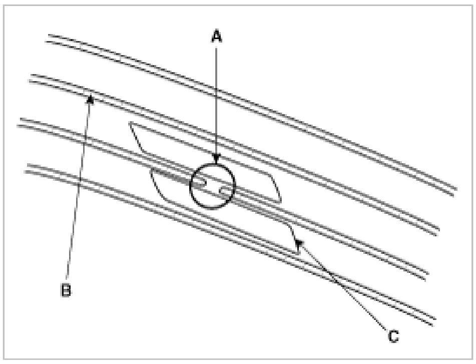


GLASS ANTENNA REPAIR

NOTE

To make an effective repair, the broken section must be no longer than one inch.

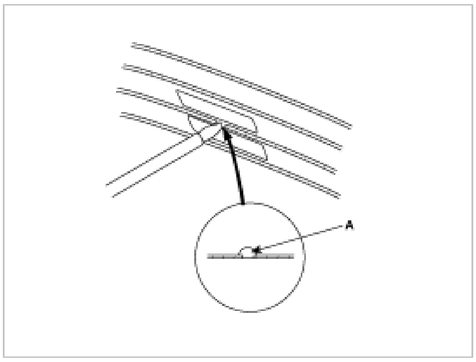
1. Lightly rub the area around the broken section (A) with fine steel wool, and then clean it with alcohol.



2. Carefully mask above and below the broken portion of the glass antenna wire (B) with cellophane tape (C).
3. Using a small brush, apply a heavy coat of silver conductive paint (A) extending about 1/8″on both sides of the break. Allow 30 minutes to dry.

NOTE

Thoroughly mix the paint before use.

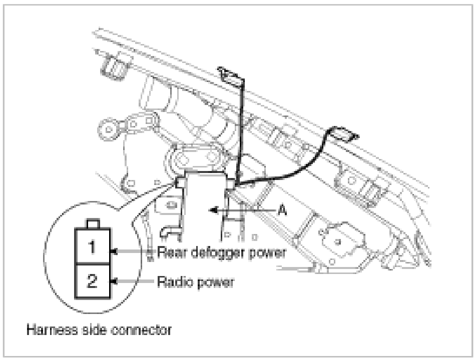


4. Check for continuity in the repaired wire.
5. Apply a second coat of paint in the same way. Let it dry three hours before removing the tape.

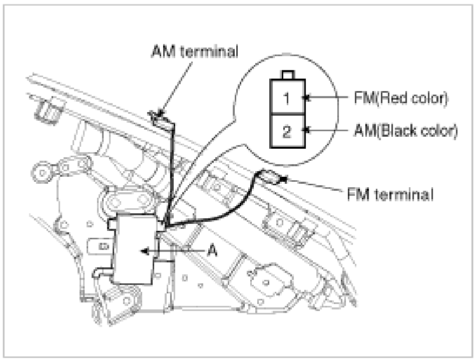
GLASS ANTENNA CIRCUIT INSPECTION

1. Remove the right side rear pillar trim. Then disconnect the 2P power connector from the glass antenna amp (A).
2. Turn the radio ON.
   Measure the voltage between terminal 2 of the harness side power connector (A) and body ground.

OK : approximately 12V (ACC+)



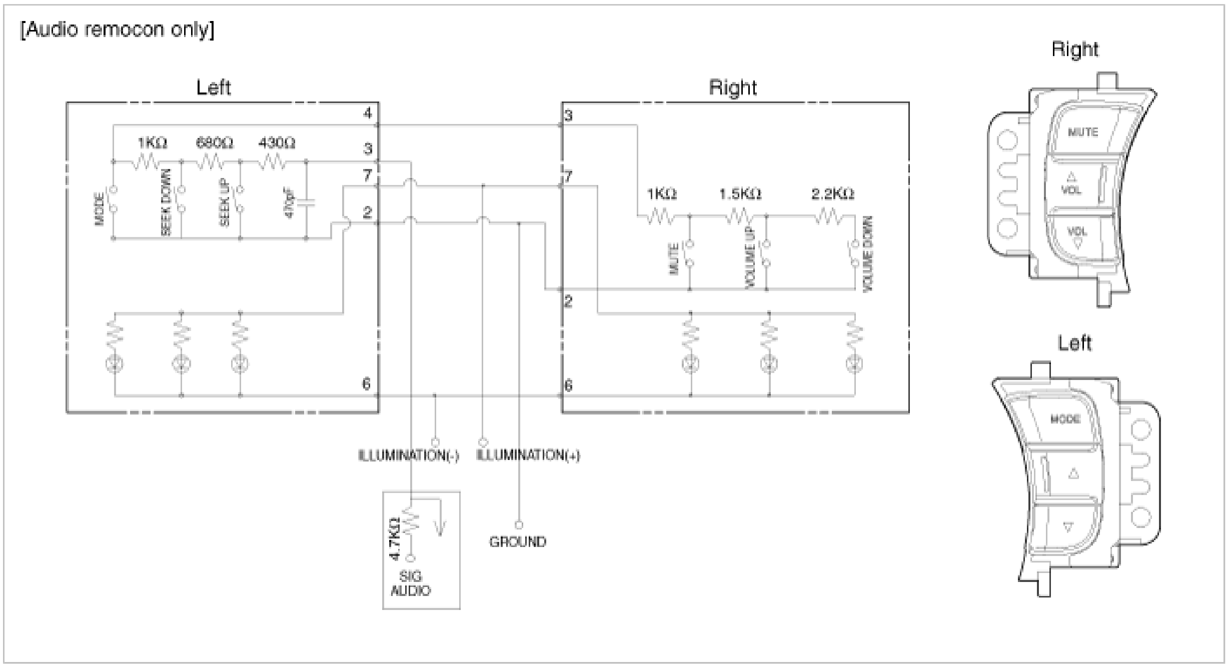
3. Disconnect the 2P connector of radio wiring from the glass antenna amp (A).
4. Check for continuity between terminals of harness side connector and antenna grid terminals (AM, FM).

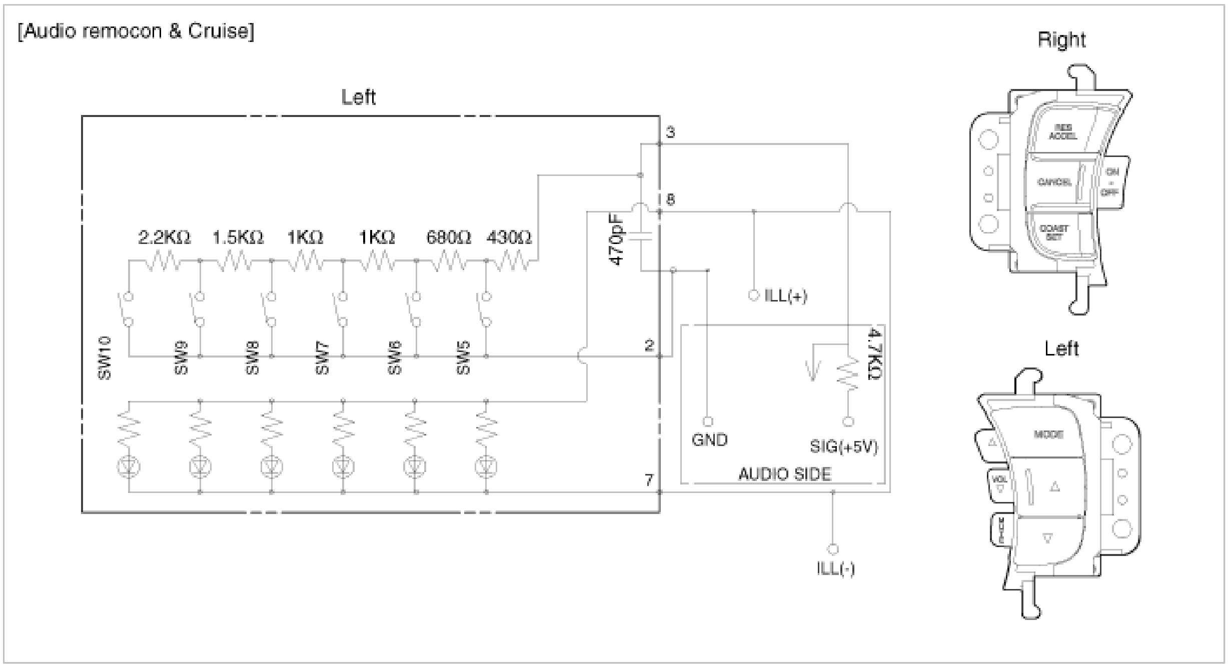


5. Check the grid lines that continuity exists.
6. When a poor radio reception is not repaired through the above inspection methods, replace the amp.
   If the radio reception is still poor, check the radio cable for short and radio head unit for failure.

Body Electrical System > Audio > Audio Remote control > Schematic Diagrams

CIRCUIT DIAGRAM

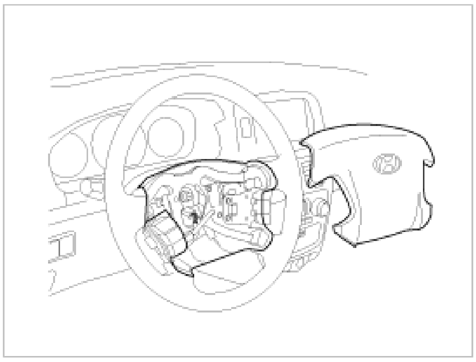




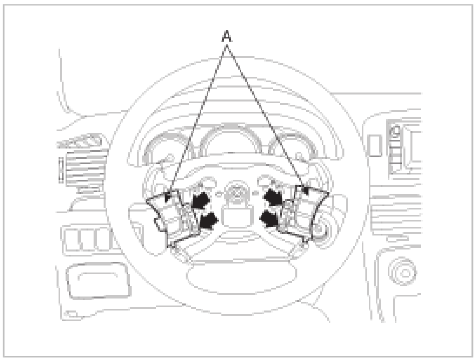
Body Electrical System > Audio > Audio Remote control > Repair procedures

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the driver airbag module(A). (Refer to the airbag group)



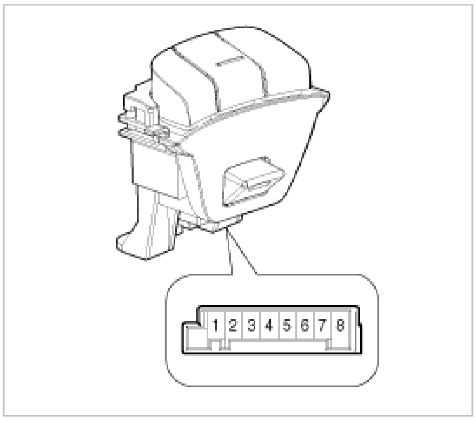
3. Remove the audio remote control switch (A) after remove the steering wheel remote control switch connector and 2 screws.



4. Installation is the reverse of removal.

INSPECTION

1. Check for resistance between No.2 and No.3 terminals in each switch position.



[Audio Remocon Only]

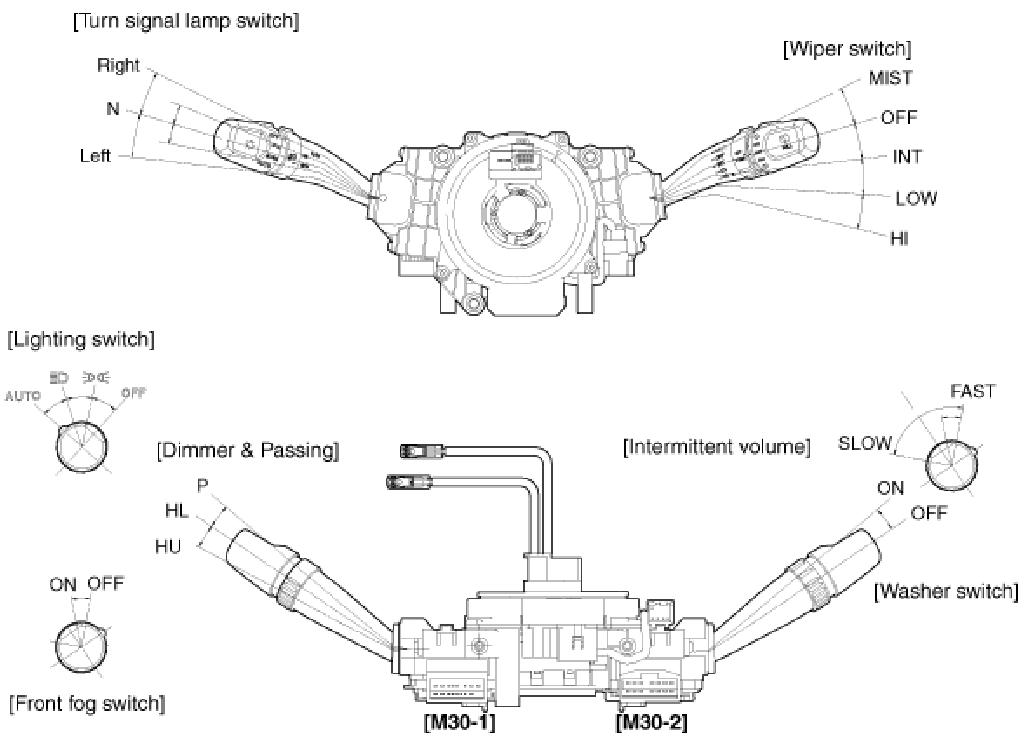
Switch	Connector terminal	Resistance (±5%)
VOLUME DOWN	2 - 3 (Right)	6.81 kΩ
VOLUME UP	2 - 3 (Right)	4.61 kΩ
SEEK UP	2 - 3 (Left)	430 Ω
SEEK DOWN	2 - 3 (Left)	1.11 kΩ
MODE	2 - 3 (Left)	2.11 kΩ
MUTE	2 - 3 (Right)	3..11 kΩ

[Audio Remocon & Cruise]

Switch	Connector terminal	Resistance (±5%)
VOLUME DOWN (SW 10)	2 - 3 (Left)	6.81 kΩ
VOLUME UP (SW 9)	2 - 3 (Left)	4.61 kΩ
MUTE (SW 8)	2 - 3 (Left)	3.11 kΩ
MODE (SW 7)	2 - 3 (Left)	2.11 kΩ
SEEK DOWN (SW 6)	2 - 3 (Left)	1.11 kΩ
SEEK UP (SW 5)	2 - 3 (Left)	430 Ω

Body Electrical System > Multifunction switch > Components and Components Location

COMPONENTS



[M30-1]

1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18

[M30-2]

1	2	3	4	5	6	7
8	9	10	11	12	13	14

Circuit connection

Connector No.	Terminal No.	Description	Connector No.	Terminal No.	Description
M30-1	1	Head lamp passing	M30-2	1	Wiper high speed
	2	Head lamp high beam power		2	Wiper low speed
	7	Turn signal lamp (RH)		3	Wiper parking
	8	Flasher unit power		4	Mist switch
	9	Turn signal lamp (LH)		5	IG2
	10	Head lamp low beam power		6	Intermittent wiper
	11	Dimmer & passing ground		7	Front washer switch
	12	Front fog switch		8	-
	13	Front fog switch ground		9	-
	14	Tail lamp switch		10	-
	15	Head lamp switch		11	-
	16	Auto light switch		12	-
	17	Lighting switch ground		13	Intermittent wiper volume
	18	-		14	Intermittent wiper ground

Body Electrical System > Multifunction switch > Specifications

SPECIFICATIONS

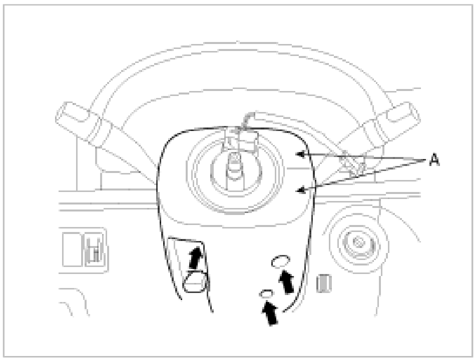
Items	Specifications
Rated voltage	DC 12 V
Operating temperature range	-30°C ~ +80°C (-22 ~ +176°F)
Rated load Dimmer & passing switch Lighting switch Turn signal & lane change switch Front fog lamp switch	 High : 1A (Relay load) Low : 1A (Relay load) Passing : 1A (Relay load) Lighting : 1A (Relay load) 6.6±0.5A (Lamp load) 1A (Relay load)

Wiper & mist switch	Low, High : 4.5A (Motor load) Intermittent : 0.22±0.05A (Relay load) Lock : Max. 28A (Motor load) Mist: 4A (Motor load)
Washer switch	4A (Motor load)
Variable intermittent volume switch	Max. 25mA

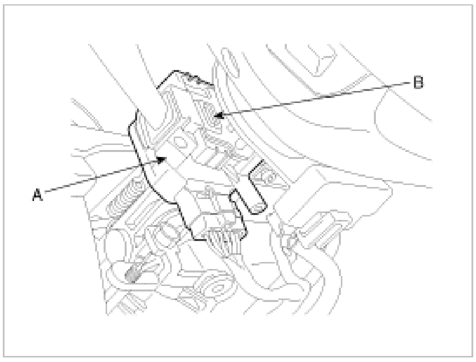
Body Electrical System > Multifunction switch > Multi Function Switch > Repair procedures

REPLACEMENT

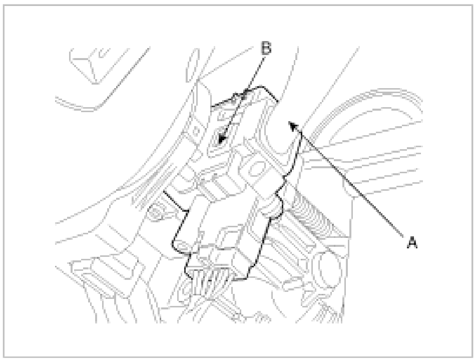
1. Disconnect the negative (-) battery terminal.
2. Remove the steering column upper and lower shrouds (A) after removing 3 screws.



3. Remove the light switch (A) by pushing the lock pin (B) after disconnecting the connector.



4. Remove the wiper switch (A) by pushing the lock pin (B) after disconnecting the connector.

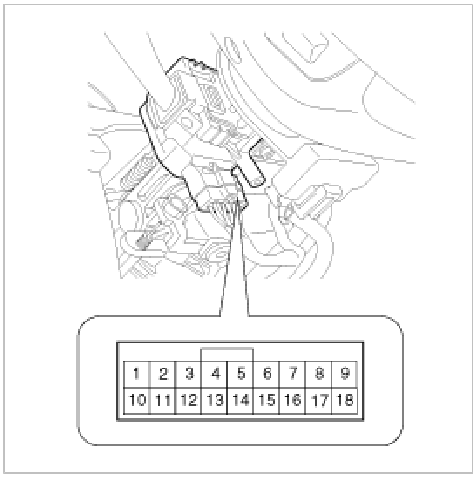


5. Installation is the reverse of removal.

INSPECTION

LIGHTING SWITCH INSPECTION

With the multi function switch in each position, make sure that continuity exists between the terminals below. If continuity is not as specified, replace the multi-function switch.



LIGHTING SWITCH (AUTO LIGHT)

Position \ Terminal	14	15	16	17
OFF				
I	○	—	—	○
II	○	○	—	○
AUTO			○	○

LIGHTING SWITCH

Position \ Terminal	14	15	16	17
OFF				
I	○	—	—	○
II	○	○	○	○

DIMMER AND PASSING SWITCH

Position \ Terminal	1	2	10	11
HU		○	—	○
HL			○	○
P	○	○	—	○

HU : Head lamp high beam
HL : Head lamp low beam
P : Head lamp passing switch

TURN SIGNAL SWITCH

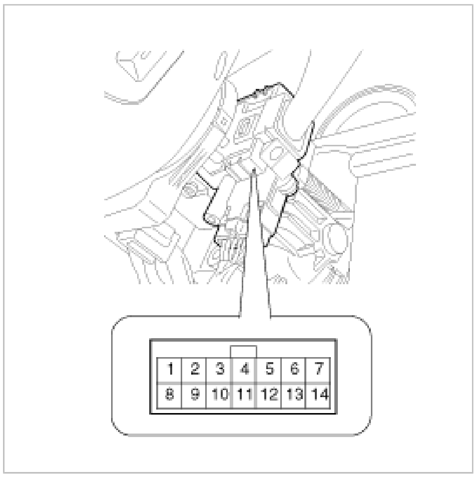
Hazard switch	Trun signal switch \ Terminal	7	8	9
OFF	L		○	○
	N			
	R	○	○	

FRONT FOG LAMP SWITCH

Position \ Terminal	12	13
OFF		
ON	○	○

WIPER AND WASHER SWITCH INSPECTION

With the multi function switch in each position, make sure that continuity exists between the terminals below. If continuity is not as specified, replace the multi-function switch.



WIPER SWITCH

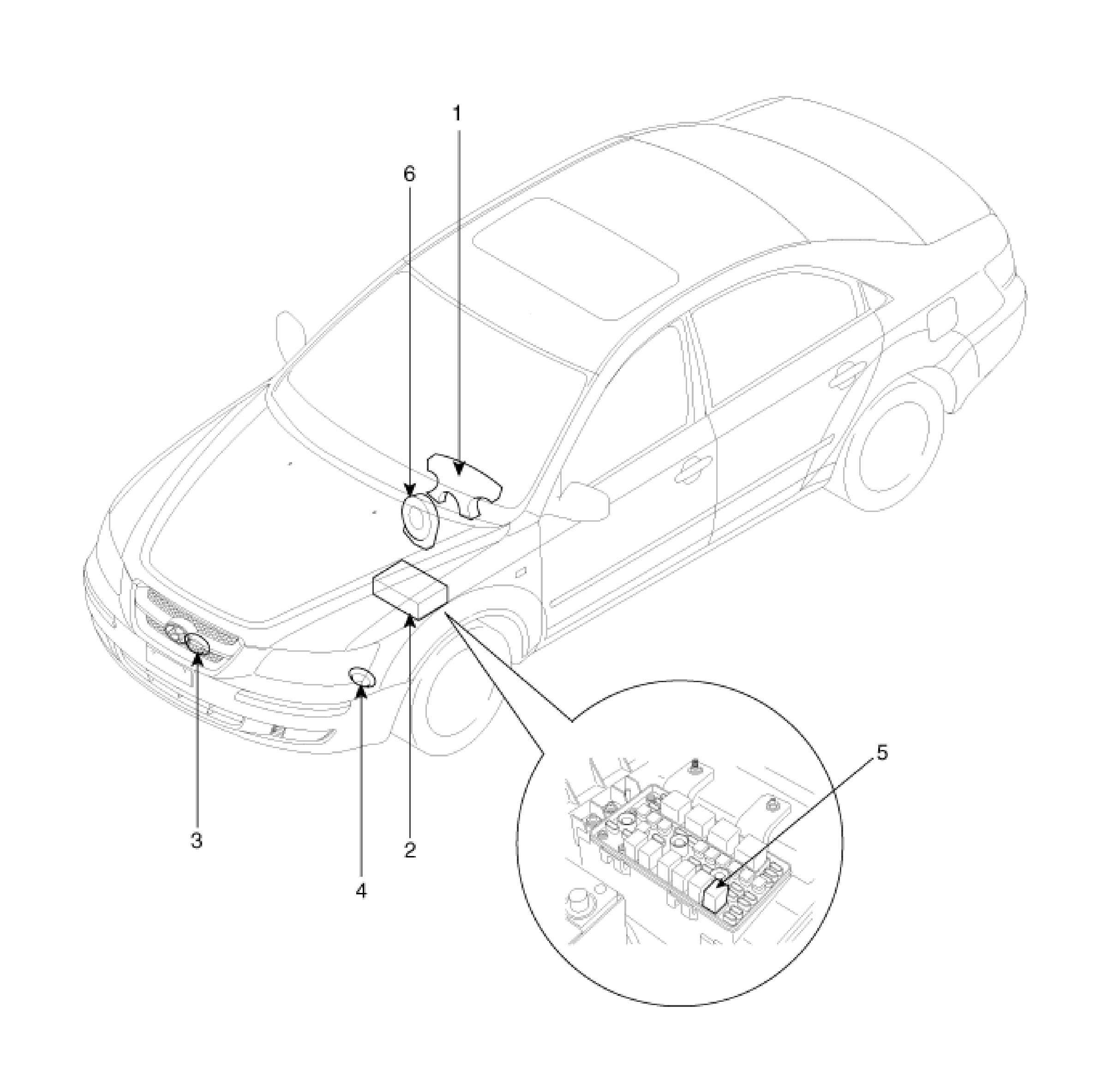
Position \ Terminal	1	2	3	4	5	6	13	14
MIST				○	○			
OFF		○	○					
INT		○	○		○	○	○	○
LOW		○			○			
HI	○				○			

WASHER SWITCH

Position \ Terminal	5	7
OFF		
ON	○	○

Body Electrical System > Horn > Components and Components Location

COMPONENT LOCATION

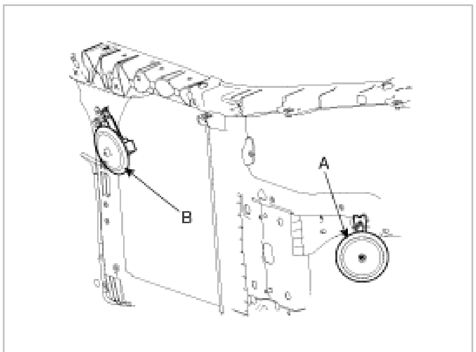


1. Horn switch	4. Horn (High pitch)
2. Relay box (Engine room compartment)	5. Horn relay
3. Horn (Low pitch)	6. Clock spring

Body Electrical System > Horn > Repair procedures

REPLACEMENT

1. Remove the front bumper. (Refer to the Body group - front bumper).
2. Remove the bolt and disconnect the horn connector, then remove the high pitch horn (A) and low pitch horn (B).



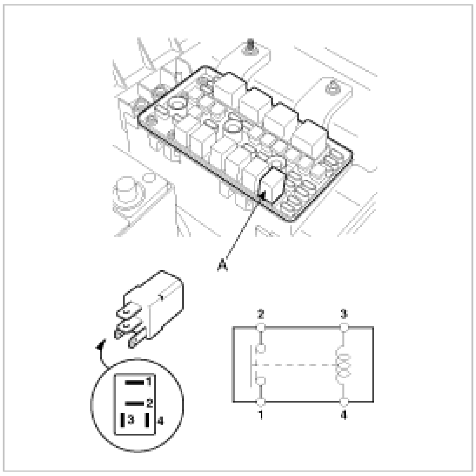
3. Installation is the reverse of removal.

INSPECTION

Test the horn by connecting battery voltage to the 1 terminal and ground the 2 terminal.
The horn should make a sound. If the horn fails to make a sound, replace it.

HORN RELAY INSPECTION

1. Remove the horn relay (A) from the engine room relay box.
2. There should be continuity between the No.1 and No.2 terminals when power and ground are connected to the No.3 and No.4 terminals.
3. There should be no continuity between the No.1 and No.2 terminals when power is disconnected.



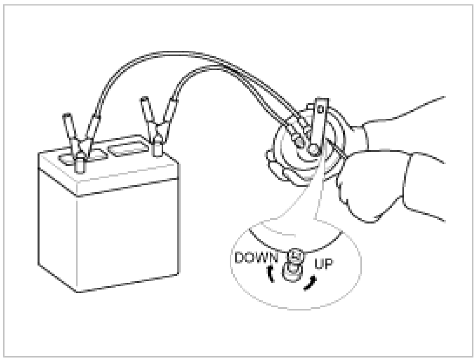
Terminal / Power (No.3-No.4)	1	2	3	4
Disconnected			○	○
Connected	○	○	⊖	⊕

ADJUSTMENT

Operate the horn, and adjust the tone to a suitable level by turning the adjusting screw.

NOTE

After adjustment, apply a small amount of paint around the screw head to keep it from loosening.



Body Electrical System > Keyless Entry And > Description and Operation

DESCRIPTION

BURGLAR ALARM SYSTEM

The burglar alarm system is armed automatically after the doors, hood, and trunk lid are closed and locked.
The system is set off when any of these things occur:

- A door is forced open.
- A door is unlocked without using the transmitter & key.
- The trunk lid is opened without using the key.
- The hood is opened.
- The engine starter circuit and battery circuit are bypassed by breaking the ignition switch.

When the system is set off, the alarm (horn) sounds and the hazard lamp flash for about two minutes or until the system is disarmed by unlocking the transmitter.
For the system to arm, the ignition switch must be off and the key removed. Then, the body control module must receive signals that the doors, hood, and trunk lid are closed and locked. When everything is closed and locked, none of the control unit inputs are grounded.
The door switches, hood switch and trunk lid switch are all close and lock the doors with the remote transmitter and then the system arms immediately.
If anything is opened or improperly unlocked after the system is armed, the body control module gets a ground signal from that switch, and the system is set off.
If one of the switches is misadjusted or there is a short in the system, the system will not arm. As long as the body control module continues to get a ground signal, it thinks the vehicle is not closed and locked and will not arm.
The receiver is integrated in the body control module.

KEYLESS ENTRY SYSTEM

The burglar alarm system is integrated with the keyless entry system. The keyless entry system allows you to lock and unlock the vehicle with the remote transmitter. When you push the LOCK button, all doors lock. When you push the UNLOCK button, driver door unlock. If the unlock button is pressed a second time right away, the remain doors unlock.
The room lamp, if its switch is in the center position, will come on when you press the UNLOCK button. If you do not open a door, the light will go off in about 30 seconds, the doors will automatically relock, and the burglar alarm system will rearm. If you relock the doors with the remote transmitter within 30 seconds, the light will go off immediately.
You cannot lock or unlock the doors with the remote transmitter if the key is in the ignition switch.
The system will signal you when the doors lock and unlock by flashing the hazard lamp once when they lock, and twice when they unlock.

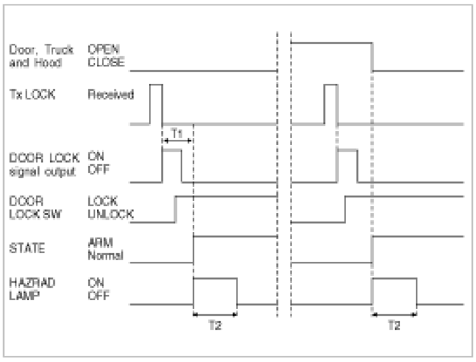
PANIC MODE

The panic mode causes the BCM to sound the alarm with the remote transmitter in order to attract attention. When the PANIC button is pressed and held for 2 seconds, the alarm will sound and exterior lights will flash for about 30 seconds.
The panic mode can be canceled at any time by pressing any button on the remote transmitter or by turning the ignition switch ON. The panic mode will not function if the key in.
The panic mode can be canceled by lock or unlock with the key.

FUNCTIONS

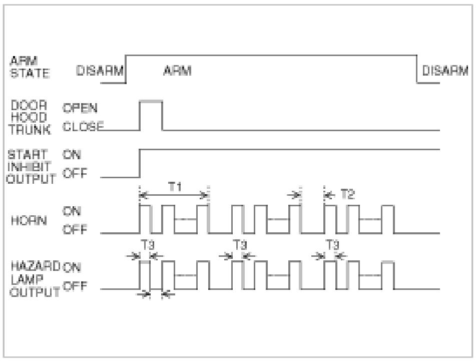
ANTI-THEFT FUNCTION

1. ARM Function
   (1) When using LOCK on the RKE (Remote Keyless Entry) or DOOR KEY the doors will lock, the hazard lamp will blink once within 0.6 seconds and the Anti-Theft System will ARM, if the following conditions have been met.
      A. The ignition key is removed from the ignition switch.
      B. All entry points are closed (doors, trunk, and hood)
      ※ Hazard lamp will not blink when driver door key lock switch transits to ARM mode by OFF→ON.
   (2) If either the door or trunk or hood is open when activating LOCK using the RKE, the doors will lock, however the hazard lamp will not flash and the Anti-Theft System will not arm.
   (3) In Step 2) if the opened entry points are subsequently closed… the door will lock, the hazard lamp will blink once and the Anti-Theft System will ARM.
   (4) If the UNLOCK signal is sent by the RKE or DOOR KEY, and either the ignition key is not inserted or entry (door, trunk, hood) to the vehicle is not made within 30 seconds, the LOCK mode will be automatically reset, the hazard lamps will blink, and the Anti-Theft System will rearm. (Key IN = Key Insertion)
   (Provided that there is no automatic lock function at a period of 30 seconds, when the UNLOCK is done by the RKE with an entry being open).



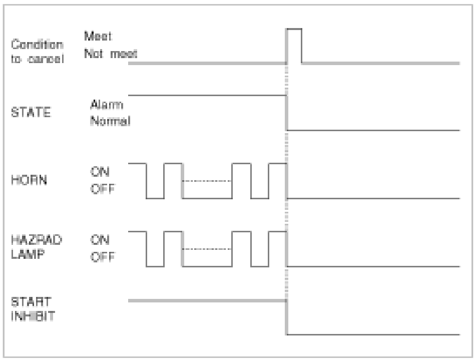
T1 : 0.6 sec,
T2 : 1.0 ±0.2 sec

2. ALARM Function
   (1) When a point of entry is opened without RKE or DOOR KEY unlock signal without RKE or DOOR KEY unlock signal while the Anti-Theft System is in the ARM mode, the hazard lamp and horn alarm will activate (ON/OFF 3 times each) for a period of 27 seconds.
   (2) Output intervals for the horn alarm and hazard lamps are identical.
   (3) The alarm sequence, when activated will continue for the duration of the alarm period even when the entry point is closed. (The alarm will reactivate if entry port is reopened after the initial alarm sequence completes.)



T1 : 27 ± 2 sec,
T2 : 10 ± 1 sec,
T3 : 0.45 ± 0.1 sec.

3. ALARM CLEARANCE
   (1) UNLOCK signal is output for 0.5s, alarm and start inhibit signal output become OFF when RKE UNLOCK signal is received or DOOR KEY UNLOCK signal is received.
   (2) LOCK signal is output for 0.5s, and alarm and start inhibit signal output become OFF when RKE LOCK signal is received or DOOR KEY LOCK signal is received.
   (3) Alarm and start inhibit signal output become OFF and the state becomes DISARM if "KEY IN SW=ON & IGN1 SW=ON & IGN2 SW=ON" is continued for 30s.
   In ARM mode, the state becomes DISARM in case of "KEY IN SW=ON & IGN1 SW=ON & IGN2 SW=ON".
   (4) In ARM mode, the state becomes DISARM at FRONT DOOR KEY UNLOCK ON and the state becomes Alarm Hold state at TRUNK KEY UNLOCK ON.
   (5) Under ALARM, FRONT DOOR or TRUNK KEY UNLOCK is turned ON, start inhibit signal output becomes OFF, then the state becomes DISARM.
   (6) If trunk is not opened after TRUNK UNLOCK signal is received with RKE or KEY, the mode enters into ARM mode 30s later after that.
   (7) If trunk is opened and closed again after TRUNK UNLOCK signal is received with RKE or KEY, the mode enters into ARM mode 30s later after that.



4. Battery Separation
   (1) When the battery is reconnected after having been disconnected/removed while in ARM mode. ARM mode continues.
   (2) When the battery is reconnected after having been disconnected/removed, and after the alarm completes, the alarm will restart.
   (3) When battery is reconnected after having been disconnected/ removed during an active alarm, the alarm sequence will restart from the beginning.

5. SECURITY INDICATOR
   (1) Security indicator: 0.3s ON, 2s OFF under key off.

(2) After entering to ARM, security indicator: 0.3s ON, 0.5s OFF in first 8s.

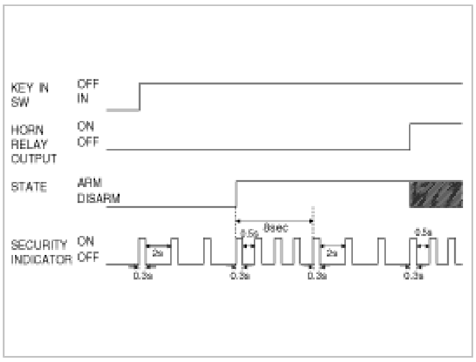
(3) After entering to ARM, the first 8s-TIMER is not reset when receiving RKE LOCK or KEY LOCK signal during the cycle: 0.3s ON, 0.5s OFF in the first 8s.

(4) 0.3s ON, 2s OFF if ARM is canceled during the cycle 0.3s ON, 0.5s OFF in the first 8s after entering to ARM.

(5) After entering to ARM, 0.3s ON, 2s OFF after the first 8s.

(6) Security indicator is OFF under key insert to key cylinder.

(7) 0.3s ON 0, 5s OFF during ALARM mode and PANIC mode.



6. DOOR UNLOCK BY P/WINDOW AND TRUNK OPEN INHIBITION FUNCTIONS

(1) Unlock signal output with door unlock switch by P/window and trunk switch is prohibited in case of RKE LOCK under ignition key off.

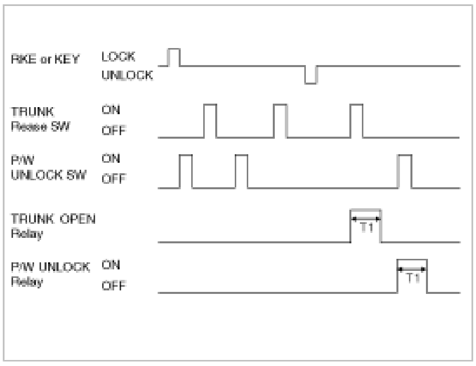
(2) Unlock signal output with door unlock switch and trunk switch by P/window is inhibited in case of door lock with door key under ignition key off.

(3) Unlock inhibition function is cancelled in case of RKE UNLOCK while door unlock inhibition function activates.

(4) Unlock inhibition function by P/window is cancelled in case of door unlock with door key while door unlock inhibition function activates.

(5) Unlock inhibition function by P/window is cancelled at ignition key in & on.

(6) In ARM mode, unlock signal by by P/window input is not output.



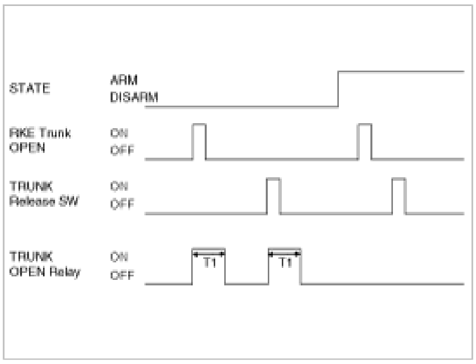
T1 : 0.5 ± 0.1 sec.

7. TRUNK OPEN WITH RKE

(1) Trunk release relay is turned ON for 0.5s if trunk signal of RKE is received. (Hold mode under ARM)

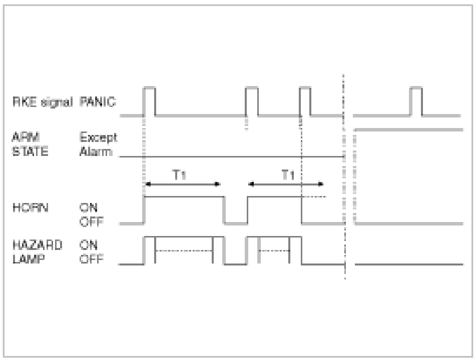
(2) Trunk release relay is turned ON for 0.5s in case of Trunk release switch OFF→ON.

(3) In ARM mode, signal by Trunk release switch input is not output.



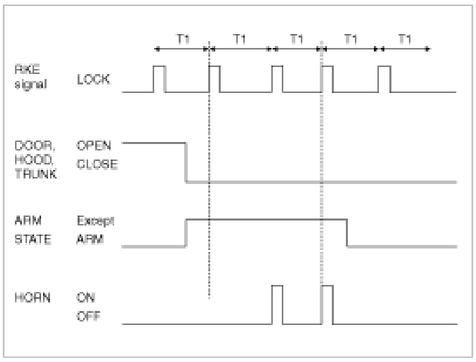
T1 : 0.5 ± 0.1 sec.

8. PANIC ALARM
   (1) PANIC alarm is turned ON for T1 by using horn and hazard if RKE PANIC signal is received.
   (2) PANIC alarm is turned OFF if (RKE LOCK/UNLOCK/PANIC/TRUNK UNLOCK /KEY IN /DOOR KEY LOCK/DOOR KEY UNLOCK / TRUNK KEY UNLOCK) signals are received during PANIC alarm.
   (3) PANIC signal output is immediately turned OFF and the state becomes ARM state if the condition for ARM is met during PANIC alarm.
   (4) The below is about antitheft alarm.
      A. Antitheft alarm does not stop even when PANIC signal of RKE is received during the alarm. (PANIC signal reception is ignored)
      B. Antitheft alarm signal is output when the condition for antitheft is met during PANIC alarm. (PANIC signal output : OFF)
      C. PANIC alarm is turned ON with continuing antitheft function when PANIC signal is received in ARM stand-by / ARM / Alarm end / RELOCK stand-by mode.



T1 : 30 ± 3 sec

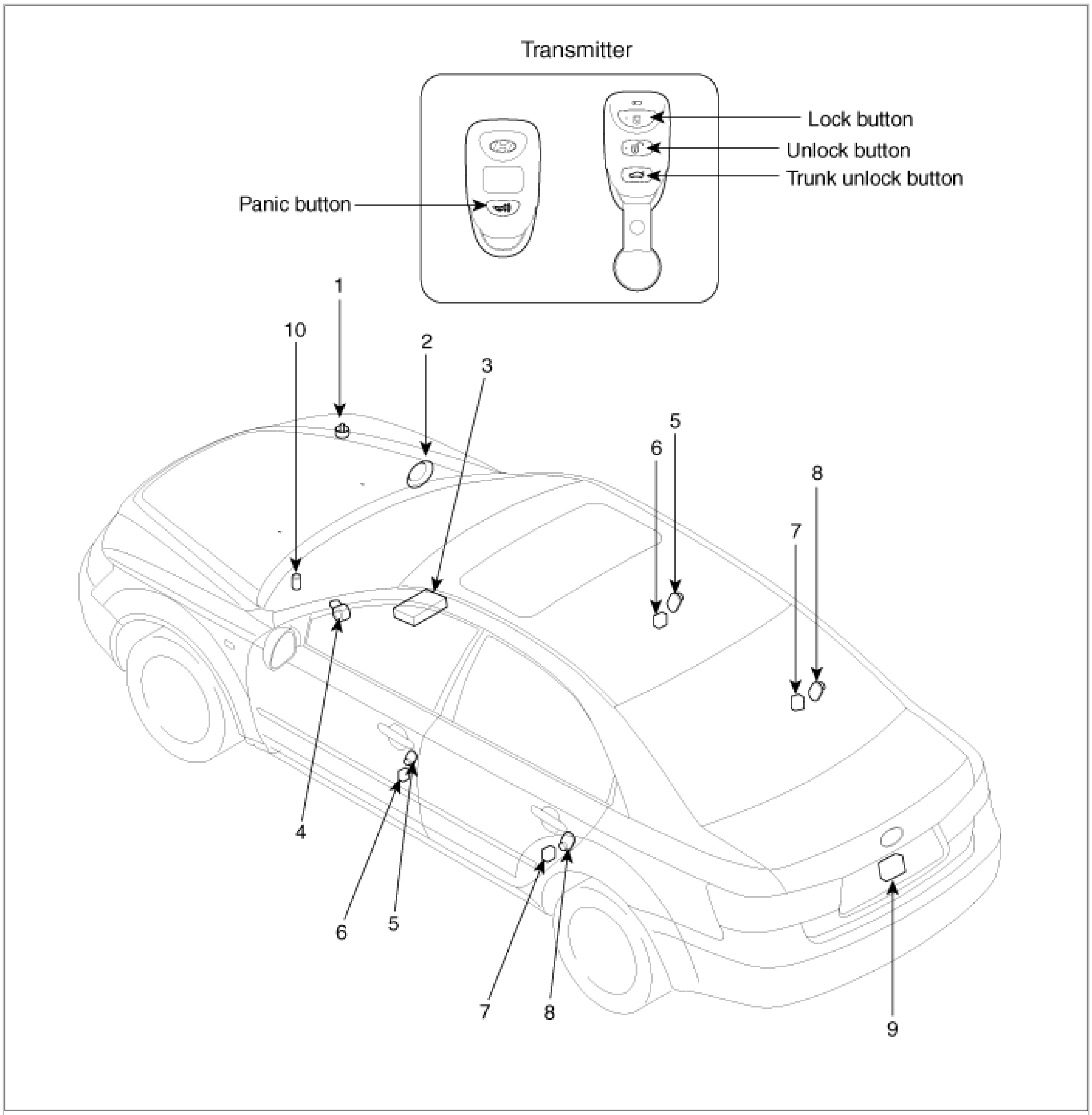
9. HORN ANSWER BACK
   (1) Under DOOR, TRUNK or HOOD: closed, horn and hazard(1s-output) signals are output if RKE LOCK signal is received again within T1 from the moment when the mode transits to ARM mode by RKE LOCK operation and ARM mode is kept.
   (2) Horn and hazard signals are not output if ARM mode is cancelled for T1.
   (3) Horn and hazard signal are output even when other LOCK signals of RKE, registered during T1, are received.



T1 : within 4sec

Body Electrical System > Keyless Entry And > Components and Components Location

COMPONENT LOCATION

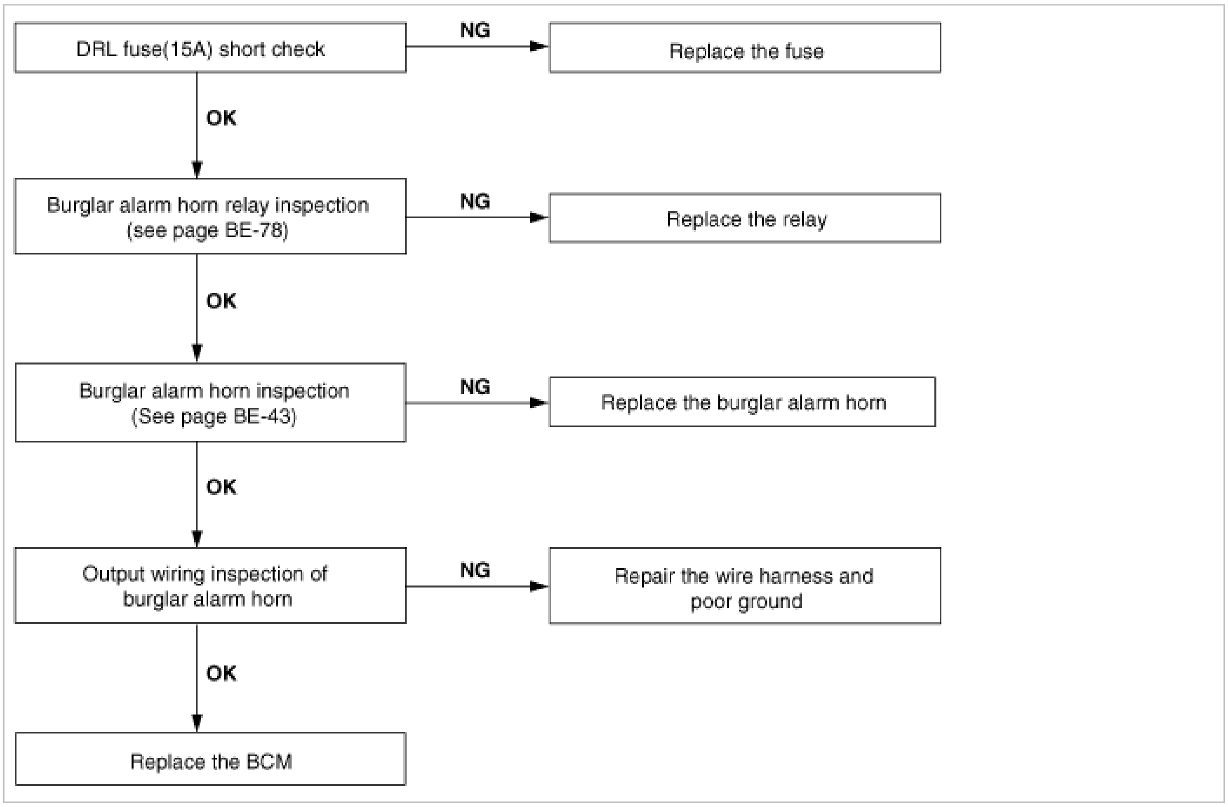


1. Hood switch	6. Front door lock actuator & switch
2. Burglar horn	7. Rear door lock actuator & switch
3. Body control module	8. Rear door switch
4. Key warning switch	9. Trunk lid lock actuator
5. Front door switch	10. Security indicator

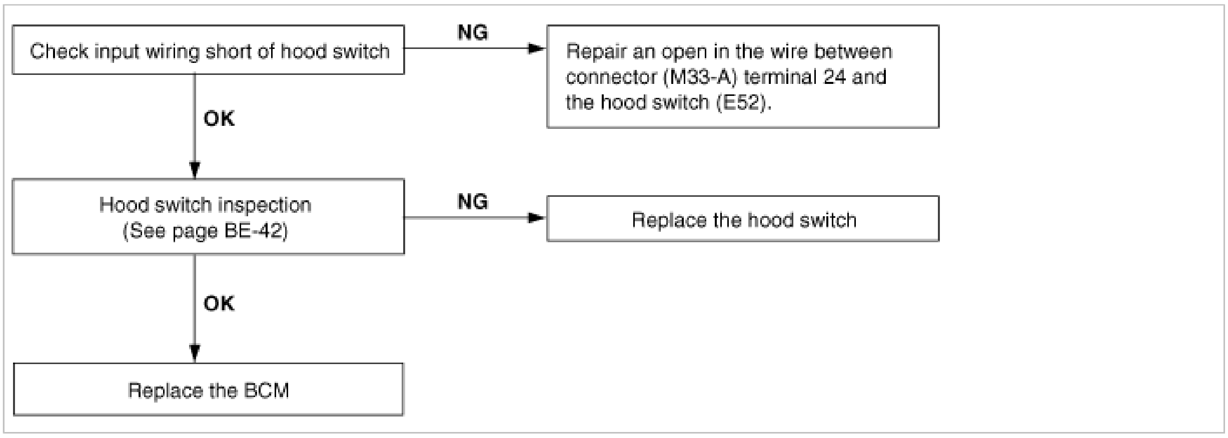
Body Electrical System > Keyless Entry And > Troubleshooting

TROUBLESHOOTING

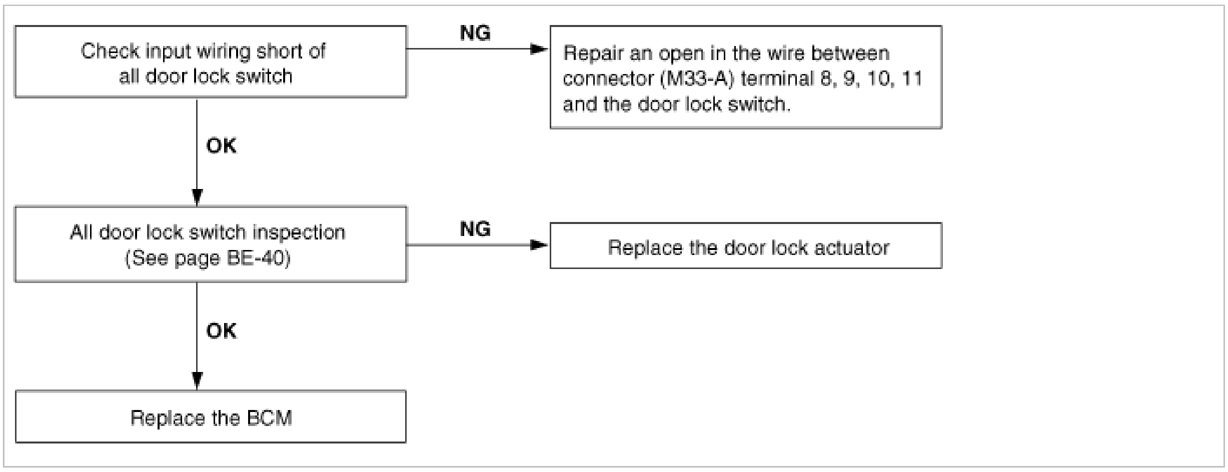
1. Alarm does not work. (Hazard lamps work)



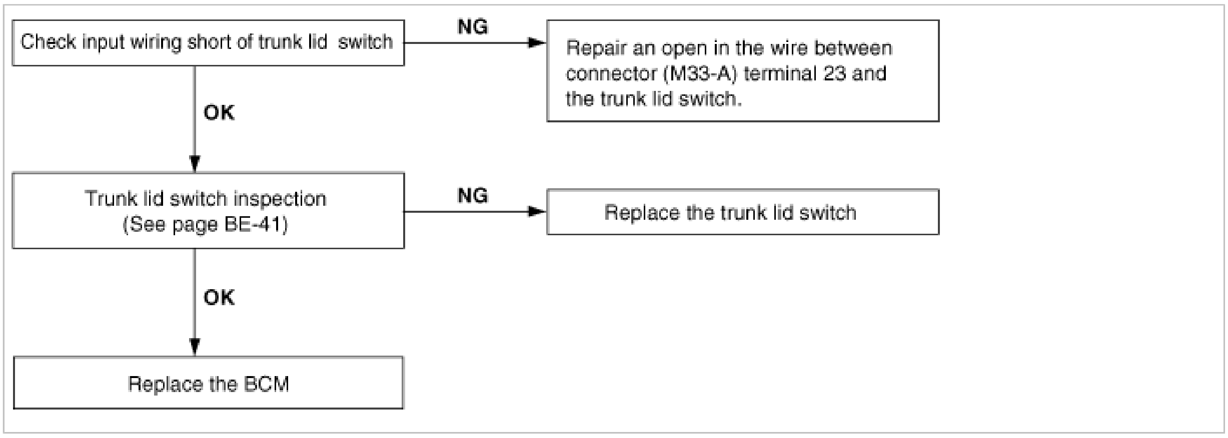
2. When hood is opened inside the car, burglar horn does not work.



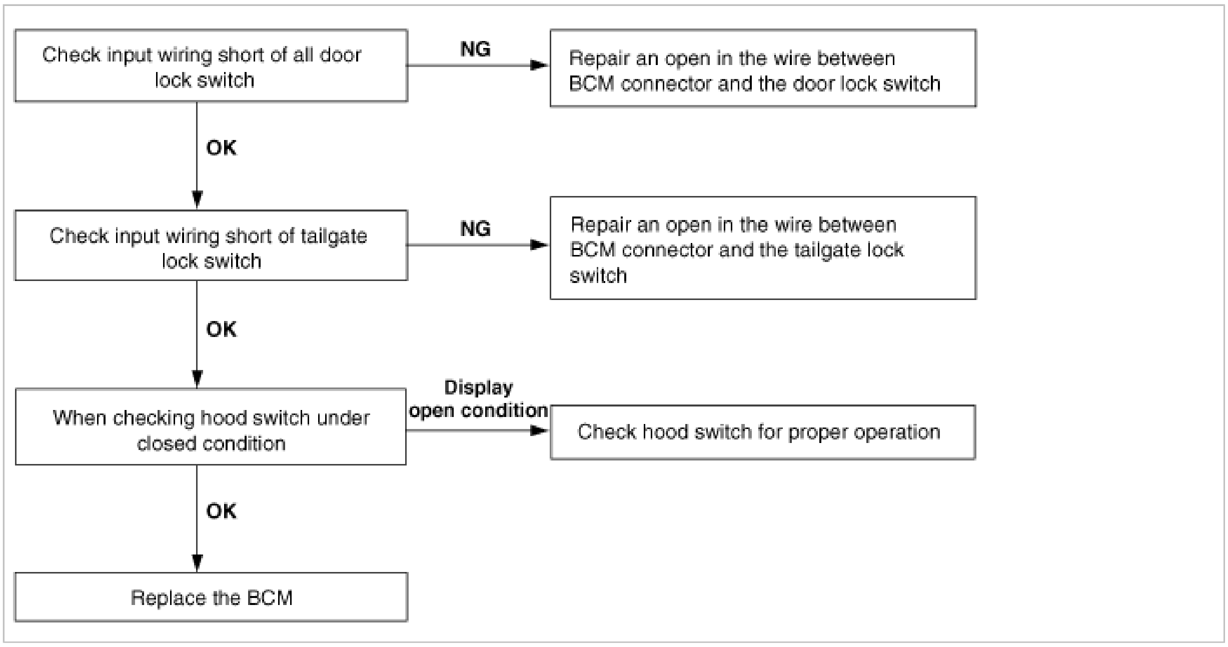
3. When door is opened inside the car, burglar horn does not work (If tailgate and hood is opened, alarm works)



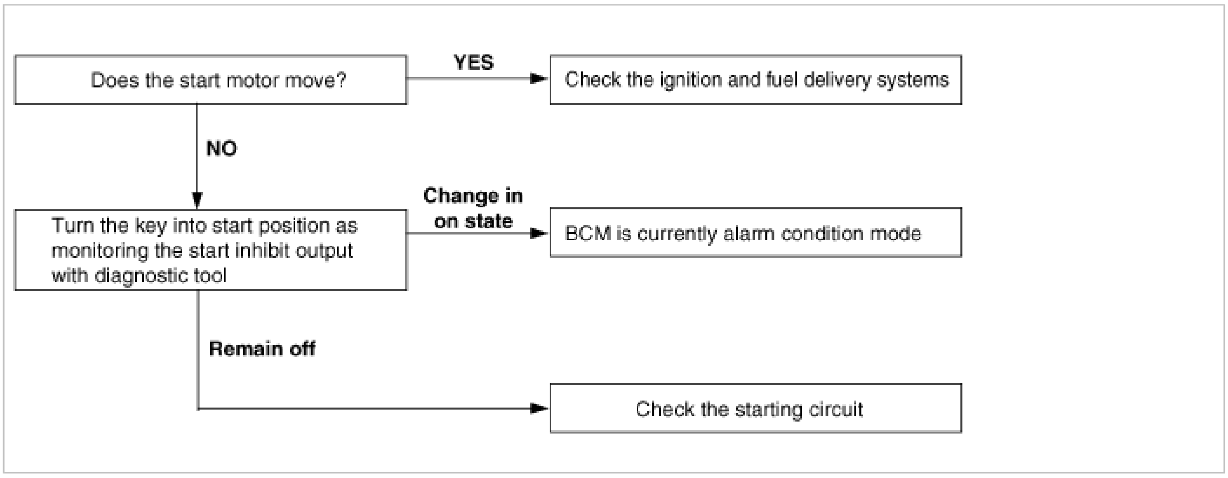
4. When trunk lid is opened inside the car, siren does not work.



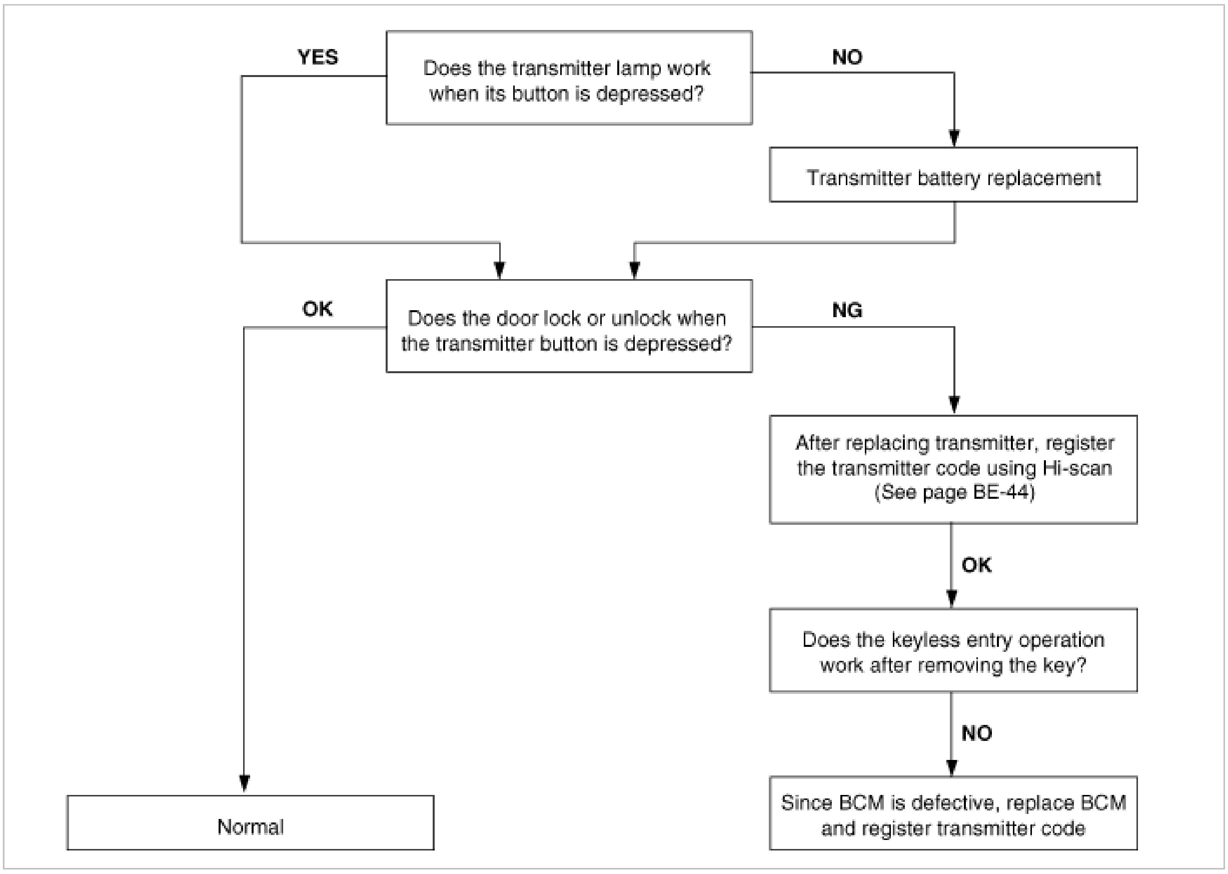
5. When the vehicle is locked by the transmitter, central door lock function works but hazard lamp doesn't blink.



6. Engine does not start, even when the alarm is disarmed.



7. Central door lock function works, but keyless entry system does not work.

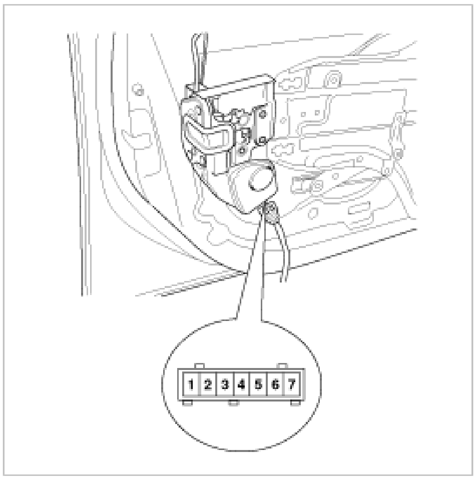


Body Electrical System > Keyless Entry And > Repair procedures

INSPECTION

FRONT DOOR LOCK ACTUATOR INSPECTION

1. Remove the front door trim panel. (Refer to the Body group - front door)
2. Disconnect the 7P connector from the actuator.

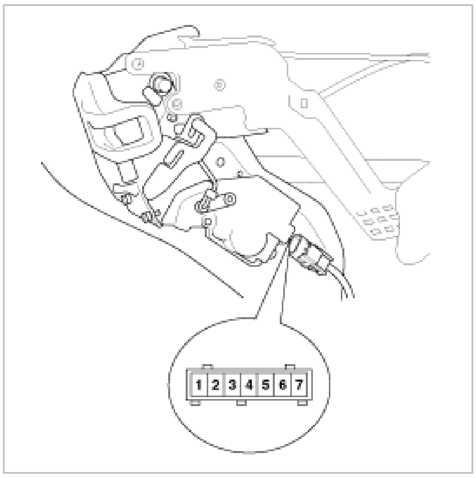


3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal		5	3	6	2
Front left	Lock	⊕		⊖	
	Unlock	⊖		⊕	
Front right	Lock		⊕		⊖
	Unlock		⊖		⊕

REAR DOOR LOCK ACTUATOR INSPECTION

1. Remove the rear door trim panel. (Refer to the Body group - rear door)
2. Disconnect the 7P connector from the actuator.

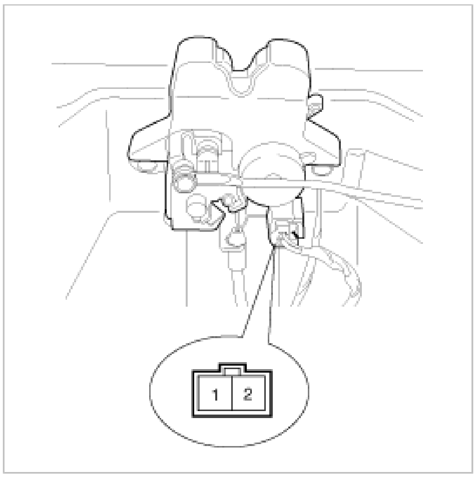


3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal		5	3	6	2
Rear left	Lock	⊕		⊖	
	Unlock	⊖		⊕	
Rear right	Lock		⊕		⊖
	Unlock		⊖		⊕

TRUNK LID RELEASE ACTUATOR INSPECTION

1. Remove the trunk lid trim panel. (Refer to the Body group-trunk lid)
2. Disconnect the 2P connector from the actuator.

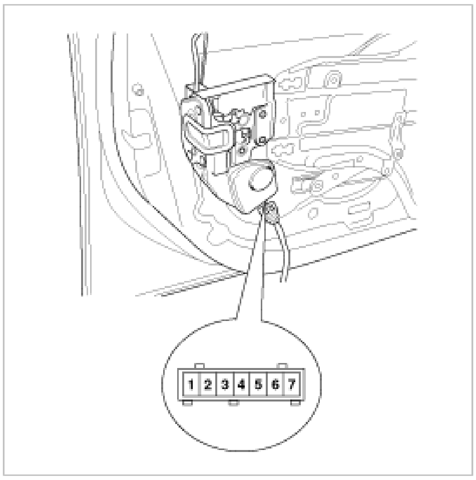


3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal	2	Chassis ground
Open	⊕	⊖

FRONT DOOR LOCK SWITCH INSPECTION

1. Remove the front door trim panel. (Refer to the Body group - front door)
2. Disconnect the 7P connector from the actuator.

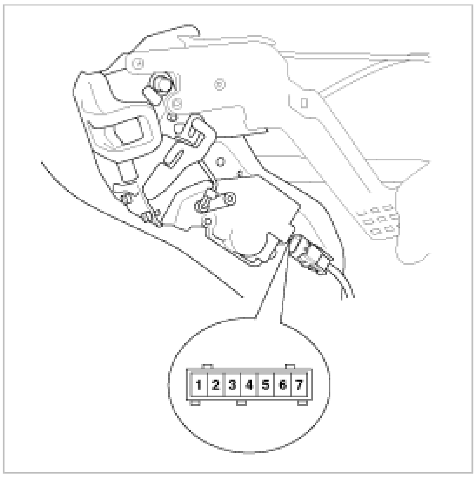


3. Check for continuity between the terminals in each switch position according to the table.

Position \ Terminal		1	5	3	7
Front left	Lock				
	Unlock	O		O	
Front right	Lock				
	Unlock		O		O

REAR DOOR LOCK SWITCH INSPECTION

1. Remove the rear door trim panel. (Refer to the Body group - rear door)
2. Disconnect the 7P connector from the actuator.

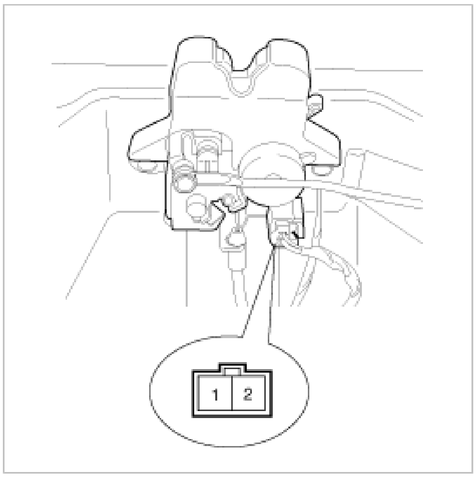


3. Check for continuity between the terminals in each switch position according to the table.

Position \ Terminal		1	5	3	7
Rear left	Lock				
	Unlock	O		O	
Rear right	Lock				
	Unlock		O		O

TRUNK LID OPEN SWITCH INSPECTION

1. Remove the trunk lid trim panel. (Refer to the Body group-trunk lid)
2. Disconnect the 2P connector from the actuator.

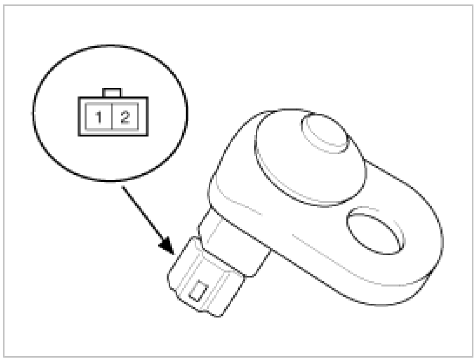


3. Check for continuity between the terminals in each switch position according to the table.

Position \ Terminal	1	Chassis ground
Open	⊕	⊖

DOOR SWITCH INSPECTION

Remove the door switch and check for continuity between the terminals.



[FRONT DOOR SWITCH]

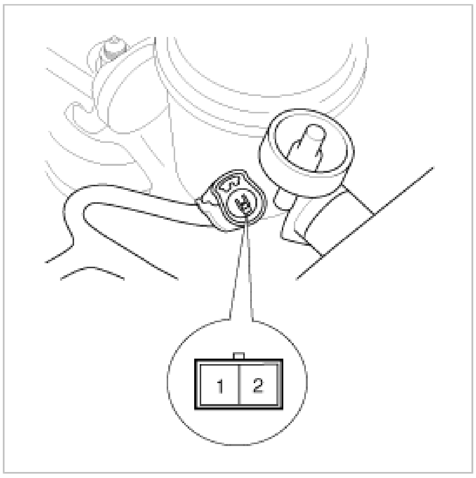
Position \ Terminal	1	2	Body (Ground)
Free(Door open)	○	○	○
Push(Door close)			

[REAR DOOR SWITCH]

Position \ Terminal	1	Ground
Free(Door open)	○	○
Push(Door close)		

HOOD SWITCH INSPECTION

1. Disconnect the 2P connector from the hood switch.

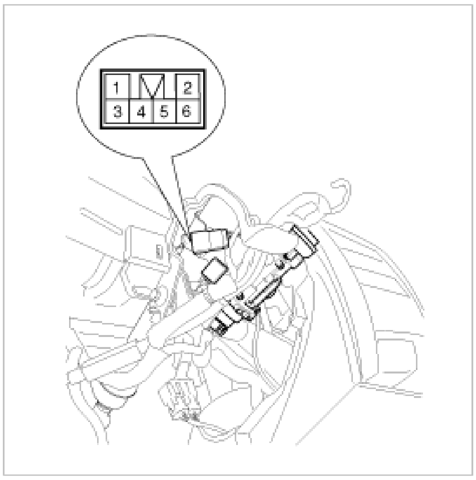


2. Check for continuity between the terminals and ground according to the table.

Position \ Terminal	1	2
Hood open (Free)	O	O
Hood close (Push)		

KEY WARNING SWITCH INSPECTION

1. Remove the driver's crash pad lower panel. (see Body group-crash pad)
2. Disconnect the 6P connector from the door warning switch.

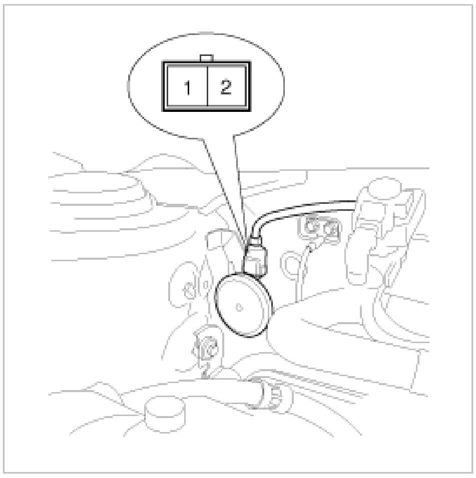


3. Check for continuity between the terminals in each position according to the table.

Key position \ Terminal	5	6
Insert	O	O
Removal		

BURGLAR HORN INSPECTION

1. Remove the burglar horn after removing 2 bolts and disconnect the 2P connector from the burglar horn.
2. Test the burglar horn by connecting battery power to the terminal 1 and ground the terminal 2.



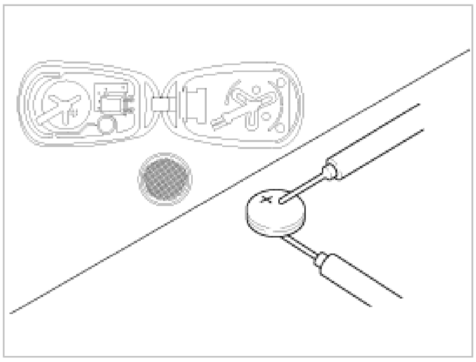
3. The burglar horn should make a sound. If the burglar horn fails to make a sound replace it.

Body Electrical System > Keyless Entry And > Transmitter > Repair procedures

INSPECTION

1. Check that the red light flickers when the door lock or unlock button is pressed on the transmitter.
2. Remove the battery and check voltage if the red light doesn't flicker.

Standard voltage : 3V



3. Replace the transmitter battery with a new one, if voltage is below 3V then try to lock and unlock the doors with the transmitter by pressing the lock or unlock button five or six times.
4. If the doors lock and unlock, the transmitter is O.K, but if the doors don't lock and unlock, register the transmitter code, then try to lock and unlock the doors.
5. If the doors lock and unlock, the transmitter is O.K, but if the doors don't lock and unlock, replace the transmitter.

TRANSMITTER CODE REGISTRATION

1. Connect the DLC cable of hi-scan to the data link connector (16 pins) in driver side crash pad lower panel, turn the power on hi-scan.

2. Select the vehicle model and then do "CODE SAVING"

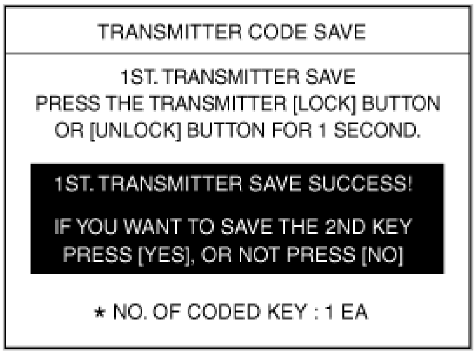
```
1. HYUNDAI VEHICLE DIAGNOSIS

MODEL   :                    ALL

02. ENGINE
03. AUTOMATIC TRANSAXLE
04. ANTI-LOCK BRAKE SYSTEM
            :
            :
            :
07. CODE SAVING
```

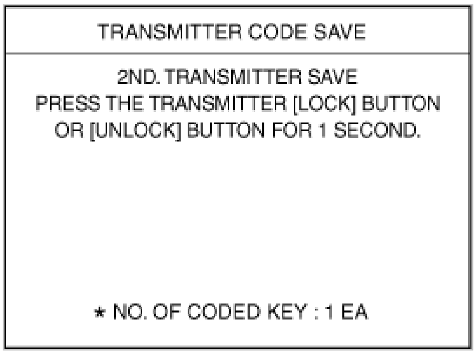
3. After selecting "CODE SAVING" menu, push "ENTER" key, then the screen will be shown as below.

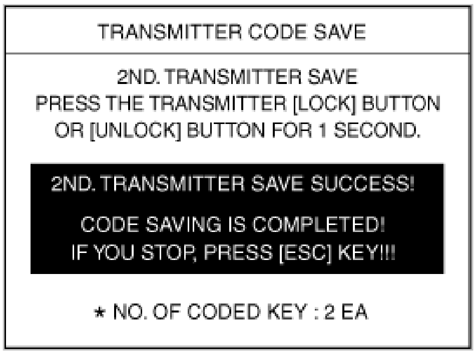
```
TRANSMITTER CODE SAVE

REMOVE THE IG. KEY FROM THE KEY
CYLINDER. CONNECT THE DLC CABLE
AND 16 PIN CONNECTOR OF THE VEHICLE.

PRESS [ENTER], IF YOU ARE READY!
```

4. After removing the ignition key from key cylinder, push "ENTER" key to proceed to the next mode for code saving. Follow steps 1 to 4 and then code saving is completed.

```
TRANSMITTER CODE SAVE

1ST. TRANSMITTER SAVE
PRESS THE TRANSMITTER [LOCK] BUTTON
OR [UNLOCK] BUTTON FOR 1 SECOND.

* NO. OF CODED KEY : 0 EA
```







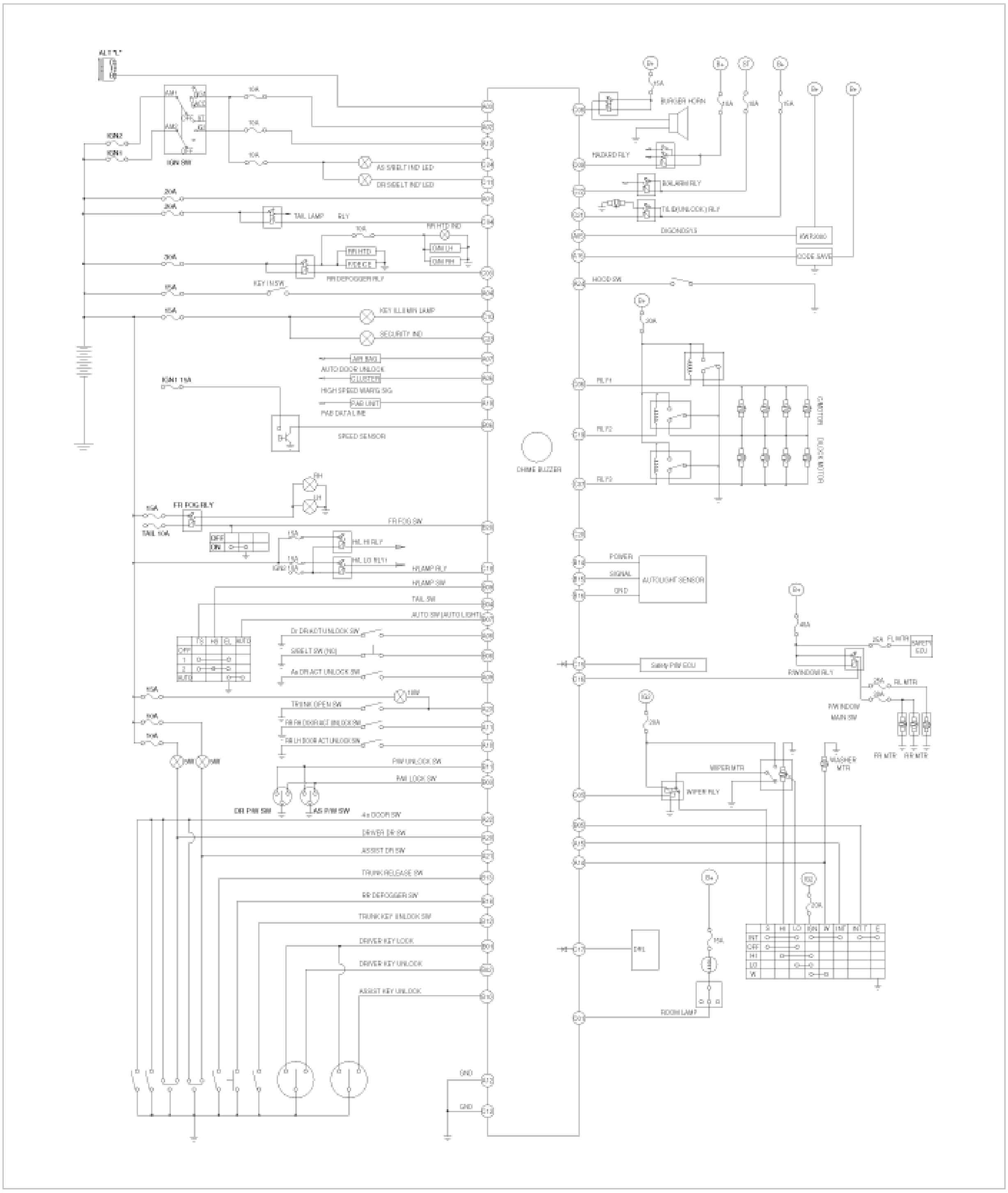
Body Electrical System > Keyless Entry And > Transmitter > Specifications

SPECIFICATIONS

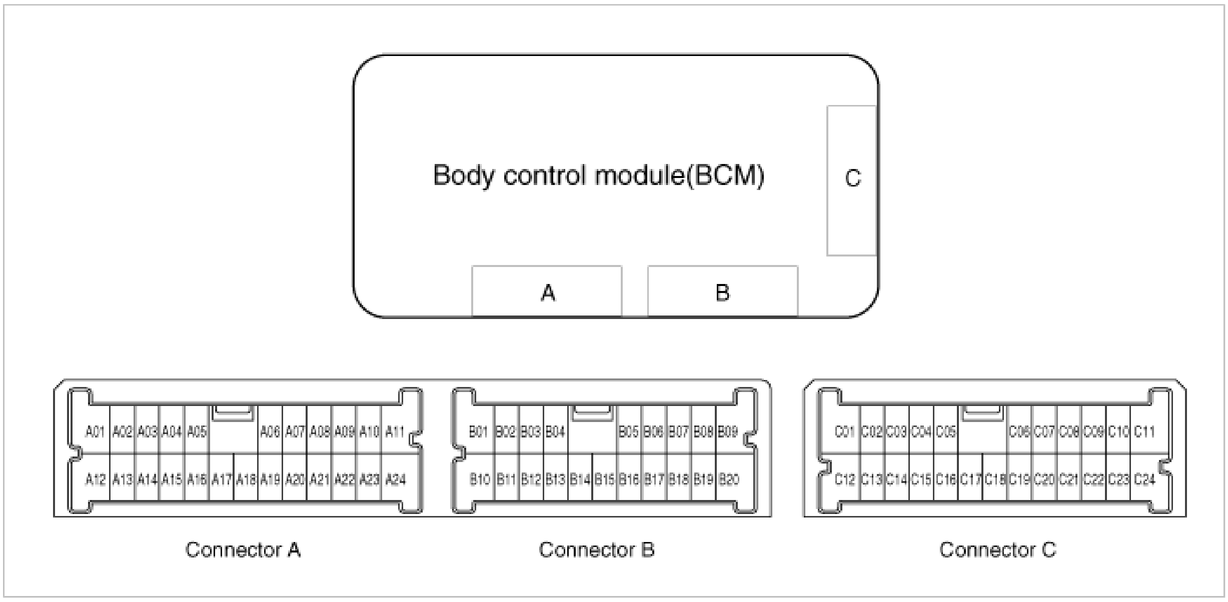
Items	Specifications
Keyless entry transmitter Power source	Lithium 3V battery (1EA)
Transmissible distance	10m or more
Life of battery	2 years or more (at 20 times per day)
Button	Door lock, Door unlock, Trunk lid open, Panic
Transmission frequency	313.85 MHz

Body Electrical System > ETACS (Electronic Time > Body Control Module > Schematic Diagrams

CIRCUIT DIAGRAM



BCM CONNECTOR TERMINALS



Terminal No.	Connector A	Connector B	Connector C
1	B+ [For BCM]	Driver door key lock switch	Room lamp
2	IGN 1	Driver door key unlock switch	-
3	Alternator (L)	Central door key lock switch	Rear defogger relay
4	Key warning switch	Tail lamp switch	Tail lamp relay
5	Diagnosis	Intermittent wiper volume	Wiper relay
6	Over speed (Cluster)	Speed sensor	Door lock relay 1
7	Crash unlock (Air bag)	Auto light switch	Door lock relay 3
8	Driver door unlock switch	Driver seat belt switch	Horn relay
9	Assist door unlock switch	Head lamp switch	Hazard lamp relay
10	Rear left unlock switch	Assist door key unlock switch	Key hole illumination
11	Rear right unlock switch	Central door unlock switch	Driver seat belt indicator
12	Ground	Trunk key unlock switch	Ground
13	IGN 2	Trunk open switch	-
14	Washer switch	Auto light (Power)	-
15	Intermittent wiper switch	Auto light (signal)	Safety power window ECU
16	Code saving	Auto light (Ground)	Power window relay
17	-	-	-
18	-	Rear defogger switch	Head lamp relay
19	Seat belt reminder signal	-	Door lock relay 2
20	Driver door switch	Front fog lamp switch	-
21	Assist door switch		Trunk lid open relay
22	4 door open switch		Start inhibit relay
23	Trunk open switch		Security indicator
24	Hood switch		Assist seat belt indicator

BCM MODULE INPUT SIGNAL TEST

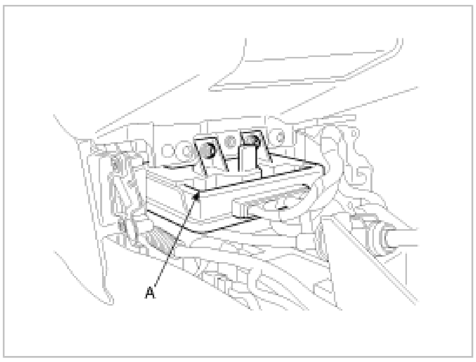
Pin No.	Input signal name	Test condition	Measured value	Ordinary
A1	B+ [For BCM]	Constant	Battery voltage	10V or more
A2	IGN1	Ignition switch ON	Battery voltage	1V or less
A3	Alternator (L)	Engine start condition	Battery voltage	1V or less

A4	Key warning switch	Key is inserted into the ignition switch	10V or more	1V or less
A7	Crash unlock (Air bag)	Crash sensor signal input	1V or less	10V or more
A8	Driver door unlock switch	Driver door unlock	1V or less	4V or more (Lock)
A9	Assist door unlock switch	Assist door unlock	1V or less	4V or more (Lock)
A10	Rear left unlock switch	Rear left unlock	1V or less	4V or more (Lock)
A11	Rear right unlock switch	Rear right unlock	1V or less	4V or more (Lock)
A13	IGN2	Ignition switch ON	Battery voltage	1V or less
A14	Washer switch	Washer switch ON	10V or more	1V or less
A15	Intermittent wiper switch	Intermittent wiper switch ON	10V or more	1V or less
A16	Code saving	Code saving	1V or less	4V or more
A20	Driver door switch	Driver door open	1V or less	4V or more
A21	Assist door switch	Driver door open	1V or less	4V or more
A22	4 door open switch	4 door close	4V or more	1V or less
A23	Trunk open switch	Trunk open	1V or less	4V or more
A24	Hood switch	Hood open	1V or less	4V or more
B1	Driver door key lock switch	Driver door key lock switch ON	1V or less	4V or more
B2	Driver door key unlock switch	Driver door key unlock switch ON	1V or less	4V or more
B3	Central door key lock switch	Central door key lock switch ON	1V or less	4V or more
B4	Tail lamp switch	Tail lamp switch ON	1V or less	4V or more
B5	Intermittent wiper volume	-	0 ~ 2.5V	-
B6	Speed sensor	Ignition switch ON	0~5V (Pulse)	-
B8	Driver seat belt switch	Fasten (Open), Unfasten (Ground)	4V or more (Fasten)	1V or less
B9	Head lamp switch	Head lamp switch ON	1V or less	4V or more
B10	Assist door key unlock switch	Assist door key unlock switch ON	1V or less	4V or more
B11	Central door key unlock switch	Central door key unlock switch ON	1V or less	4V or more
B12	Trunk key unlock switch	Trunk key unlock switch ON	1V or less	4V or more
B13	Trunk open switch	Trunk open switch ON	1V or less	4V or more
B18	Rear defogger switch	Rear defogger switch ON	1V or less	4V or more
B19	-	-	-	-
B20	Front fog lamp switch	Front fog lamp switch ON	1V or less	4V or more

Body Electrical System > ETACS (Electronic Time > Body Control Module > Description and Operation

DESCRIPTION

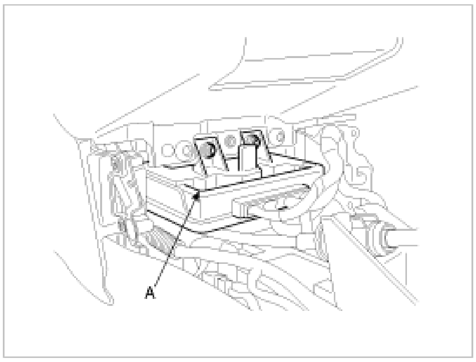
Body control module (A) receives various input switch signals controlling time and alarm functions for the intermittent wiper timer, washer timer, rear defogger timer, seat belt reminder, delayed out room lamp, central door lock, ignition key reminder, power window timer, door warning, tail lamp auto cut, crash door unlock, auto door lock, 2-Turn unlock, ignition key hole illumination control and keyless entry & burglar alarm.



Body Electrical System > ETACS (Electronic Time > Body Control Module > Repair procedures

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the floor console (Refer to the Body group-console).
3. Remove the keyless antenna cable and body control module (A) after loosening 2 nuts.

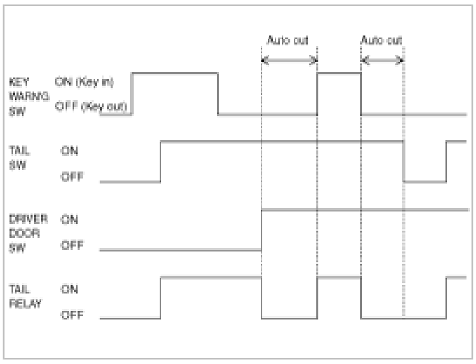


4. Installation is the reverse of removal.

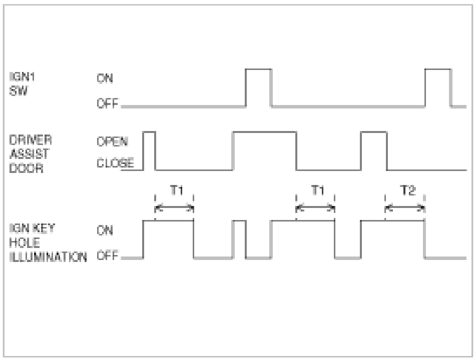
INSPECTION

Verify each components operation using related timing charts.

1. TAIL LAMP AUTO CUT
   (1) With the tail lamp switched ON, if the ignition
   Is switched OFF and the driver's door opened, the tail lamp should be automatically turned OFF.
   (2) With the ignition switch ON, if the driver's door is opened and the ignition is switched to OFF, the tail lamp should be automatically turned OFF.
   (3) When the tail lamp is cut automatically and the tail lamp switch is turned OFF and ON, the tail lamp illuminates and auto cut function is cancelled.
   (4) When the tail lamp is cut automatically and the ignition key is inserted, the tail lamp illuminates and auto cut function is canceled.

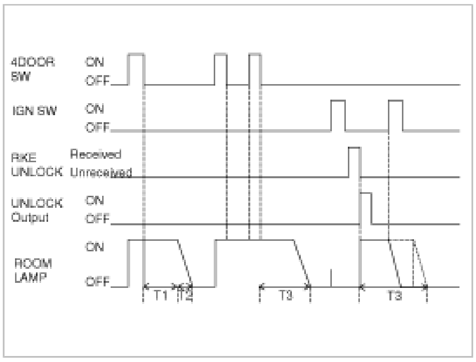


2. IGNITION KEYHOLE ILLUMINATION
   (1) Ignition keyhole illumination is turned ON when the driver or passenger door is opened.
   (2) The "ON" state for ignition keyhole illumination is delayed 10 seconds when the door is closed as in Step 1).
   (3) Ignition keyhole illumination is turned off if the ignition switch is turned ON as in Step 1) & 2).
   (4) Ignition keyhole illumination is turned off if ARM state is entered. See Steps 1) & 2).



T1 : 10 ± 1 sec.
T2 : 0 ~ 10 sec.

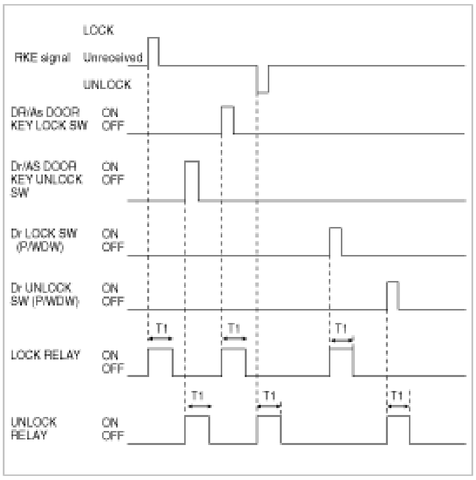
3. DELAYED ROOM LAMP
   (1) When the first door (driver, or assist or 4doors) is opened, room lamp is turned on.
   (2) When the door is closed, the room lamp is faded out for 2 seconds after there is on for 30 seconds.
   (3) Regardless of ignition ON/OFF in door open state, room lamp output is ON.
   (4) When remote control unlock is received, room lamp is turned on for 30 seconds.
   (5) While room lamp is on due to Remote control unlock, if another remote control unlock is received, then room lamp is again on for 30 sec.



T1 : 30 ± 3 sec.,
T2 : 2 ± 0.2 sec.,
T3 : 32 ± 3.2sec.

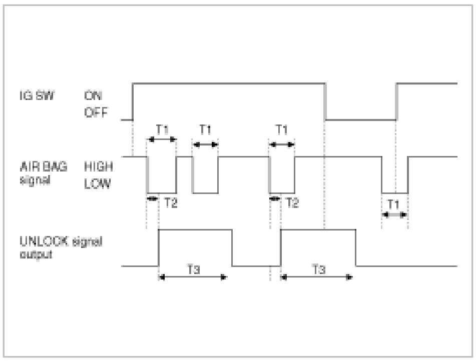
4. CENTRAL DOOR LOCK/UNLOCK
   (1) Central door lock/unlock

Function	Option	Centeral door Lock	Transmitter (RKE)
Door key UNLOCK	Driver	2-Turn unlock	2-Turn unlock
	Assist	2-Turn unlock	2-Turn unlock
Door key LOCK	Driver	All lock	All lock
	Assist	All lock	All lock
Transmitter (RKE)	Lock	–	All lock
	Unlock	–	2-Turn unlock
Driver's knob	Lock	Driver lock	Driver lock
	Unlock	Driver unlock	Driver unlock
Assist knob	Lock	Assist lock	Assist lock
	Unlock	Assist unlock	Assist unlock
Door Lock switch	Lock	All lock	All lock
	Unlock	All unlock	All unlock



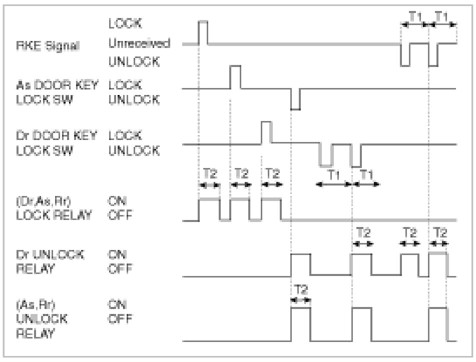
T1 : 0.5 ±0.1 sec.

5. CRASH DOOR UNLOCK
   (1) UNLOCK signal is always output when AIR BAG signal is input under IG SW = ON.
   (2) UNLOCK signal is output for the remaining time even when IG SW ON is turned to OFF during UNLOCK output.
   (3) UNLOCK signal is not output when IG SW OFF is turned to ON after AIR BAG signal is input in advance.
   (4) UNLOCK signal is output for T3 when driver, Assist or rear DOOR LOCK SW is locked from UNLOCK after UNLOCK signal is output.
   (5) AUTO DOOR LOCK function is not performed when CRASH UNLOCK condition is met.
   (6) CENTRAL DOOR LOCK function is not performed during or after CRASH UNLOCK signal output.
   But, CENTRAL DOOR LOCK function is performed normally if CRASH UNLOCK function is reset after IG OFF.



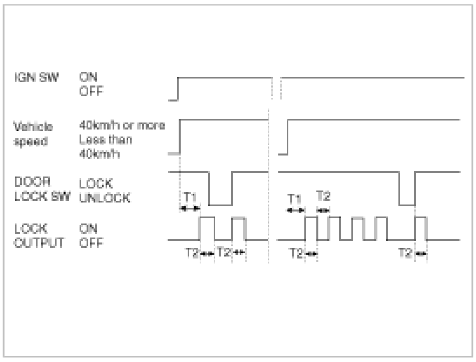
T1 : 0.2 ± 0.02 sec.,
T2 : 0.04 sec.,
T3 : 5 ± 0.5 sec.

6. 2-TURN UNLOCK
   (1) All door unlock signals are output for T2 if driver door key unlock switch is turned ON within T1 after changing driver door key unlock switch from OFF to ON(mechanically, driver door key unlock switch is unlocked and BCM signal is not output). (All door unlock signals are output even within T1 after RKE UNLOCK signal is received.)
   (2) Driver door unlock signal is output for T2 when RKE UNLOCK signal is received. But, all door unlock signals are output for T2 if RKE UNLOCK signal is received within T1.



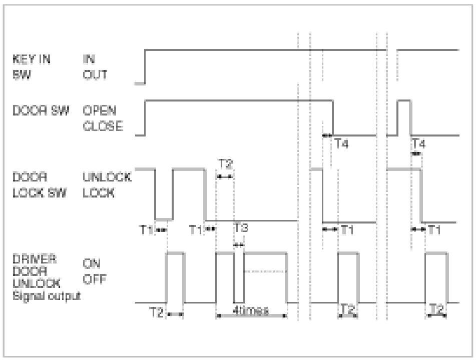
T1 : within 4 ± 1sec,
T2 : 0.5 ± 0.1sec.

7. AUTO DOOR LOCK (USER OPTION)
   (1) This does not activate when vehicle speed is less than 5km/h.
   (2) Lock signal is output if vehicle speed is 5km/h or more for at least 1s under ALT"L" ON, IGN SW = ON. But, lock signal is not output if all doors are locked or all doors are fail in advance.
   (3) Lock signal is output 3 times as Max ((2) is ignored) if either one door is unlocked after lock signal output in (2).(1s cycle) But, door, which is locked from unlock state during 3-time output, is ignored.
   (4) Relevant door is fail if the state is unlock after 3-time output.
   (5) Lock signal is output once if the fail door is unlocked again after the door is locked.
   (6) Lock signal is output once if locked doors, which are lock state after lock signal output in (2),are unlocked again. But, lock signal is output once for the relevant door even when unlock state continues after lock signal output.
   (7) Fail door is cleared at IGN SW = OFF.
   (8) Auto door lock function is not performed when crash unlock condition is met.



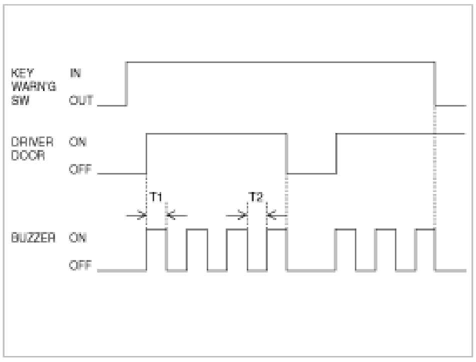
T1 : 1 ± 0.1sec,
T2 : 0.5 ± 0.1sec.

8. IGNITION KEY REMINDER
   (1) This function is not performed when vehicle speed is 3km/h or more.
   (2) DRIVER UNLOCK signal is output for 1s after 0.5s from when the state becomes KEY IN SW = IN & DRIVER DOOR = OPEN & DRIVER DOOR LOCK SW = LOCK.
   (3) ALL DOOR UNLOCK signals are output for 1s after 0.5s from when the state becomes KEY IN SW = IN & ASSIST DOOR = OPEN & ASSIST DOOR LOCK SW = LOCK.
   (4) UNLOCK signal is output 3times as Max (1s-output is excluded) in case LOCK state is held even when UNLOCK signal is output for 1s in (2),(3). (1s cycle: 0.5s ON/OFF)



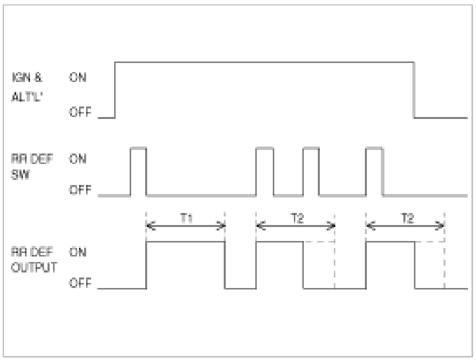
T1 : 0.5 ± 0.1 sec.
T2 : 1.0 ± 0.1 sec.
T3 : 0.5 ± 0.1 sec.
T4 : 0.5 sec.

9. KEY OPERATED WARNING
   (1) If the key is in the key cylinder and the driver door is opened, the buzzer is sounded (period: 0.7 sec., duty rate: 50%).
   (2) If the ignition key is removed, or the door is closed, the buzzer is switched OFF immediately.



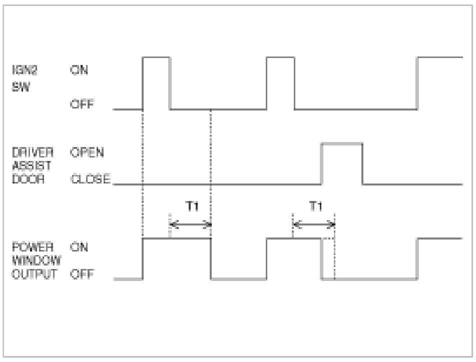
T1, T2 : 0.35 ± 0.1sec.

10. WINDSHIELD DEICER & DEFOGGER TIMER
    (1) Once ALT "L" is ON, if the defogger is switched ON, the defogger will stay ON for 20 minutes duration.
    (2) If defogger switch is pressed again (see Step 1), or if ignition is switched OFF, the defogger will shut OFF.



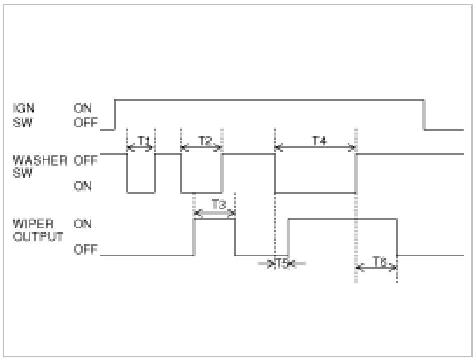
T1 : 20 ± 1 min.
T2 : MAX 20 ± 1 min.

11. POWER WINDOW TIMER
    (1) When the ignition is switched OFF, power window output remains ON for 30 seconds and then turns OFF.
    (2) Related to Step 1), if the driver’s door or assist door is opened, window power output is turned OFF immediately.
    (3) When the driver's door or assist door is opened, the power window relay output is turned OFF immediately.



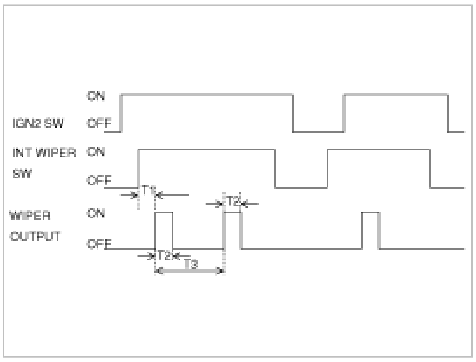
T1 : 30 ± 3 sec.

12. WIPER RELATED TO WASHER
    (1) When the ignition switch is turned ON :
        A. If washer switch is turned on, wiper output is ON after 0.3 sec. (T5)
        B. If washer switch is turned OFF, wiper output is OFF after 3.8 sec. (T6)
    (2) If the washer switch is turned OFF within 0.6 sec. (T2), the wiper will remain ON for up to 0.7 sec. (T3) from the moment that washer switch is turned OFF.



T1 : Less than 0.2 sec.
T2 : 0.2 ~0.6 sec. (MIST Function)
T3 : 0.7 ± 0.1sec.
T4 : More than 0.6 sec.
T5 : 0.3 sec.
T6 : 2.5 ~3.8 sec.

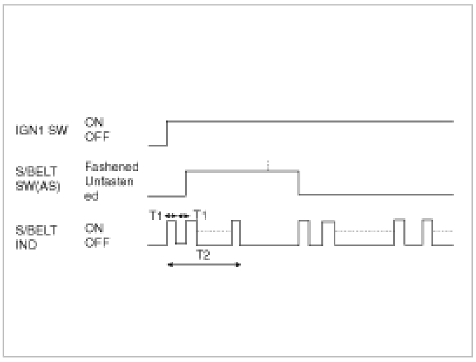
13. VARIABLE INTERMITTENT WIPER (WINDSHIELD WIPER)
    (1) With the ignition switch ON, if the intermittent wiper switch is turned on, wiper output is ON according to the setting.
    (2) When the intermittent wiper switch is ON, if the ignition switch is turned ON, wiper output is ON.



T1 : MAX 0.5 sec.
T2 : 0.7 ± 0.1sec.
T3 : 2.6 ± 0.7 sec. (FAST),
T3 : 18.0 ± 1.0sec. (SLOW) vehicle speed 0 km/h

14. SEAT BELT REMINDER FUNCTION (DRIVER)
    (1) Warning lamp lights every 0.6sec and buzzer sounds every 1sec for 6sec when IGN is ON under unfastened seat belt.
    (Warning lamp continues to light for 6sec if seat belt is fastened within 6sec)
    30sec- time count starts at ALT"L" ON under this state.
    (30sec- time count starts after 6sec. if ALT"L" is ON within initial 6sec)
    (2) Buzzer stops and the warning lamp is turned OFF when IGN is turned OFF within 6sec-output.
    (3) Buzzer stops and the warning lamp is turned OFF and 30sec- time count also stops when seat belt is fastened after IGN ON.
    (4) If unfastened seat belt state continues after 60sec- time count from ALT"L"ON, the warning lamp flashes and buzzer sounds 11 times in 30sec-cycle (6sec ON/ 24sec OFF) after 30sec from ALT"L" ON.
    (5) Warning lamp & buzzer are turned OFF when IGN is OFF or seat belt is fastened during (4).
    (6) Operation in (1) is performed when seat belt is unfastened again under ALT"L" ON and fastened seat belt.
    (7) Operation in (4) is performed when ALT "L" is turned ON again after turning OFF under unfastened seat belt.

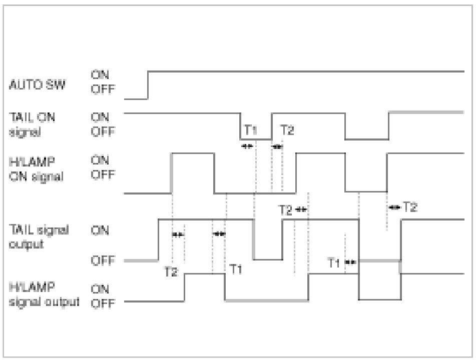
15. SEAT BELT REMINDER FUNCTION(ASSIST)
    (1) Warning lamp lights continuously every 0.6sec when IGN is turned ON under unfastened seat belt.
    (2) Warning lamp is turned OFF when IGN is turned OFF within 0.6sec.
    (3) When IGN is ON under unfastened seat belt, the warning lamp lights. The lamp continues to light for remaining time of 6sec when seat belt is fastened within 6sec. The lamp is OFF if seat belt is fastened after 6sec.
    (4) After 6 sec from IGN ON, warning lamp contitutes to flash when S/BELT is unfastened and stop immediately when S/BELT is fastended.



T1 : 0.3 ± 0.1sec,
T2 : 6 ± 1sec.

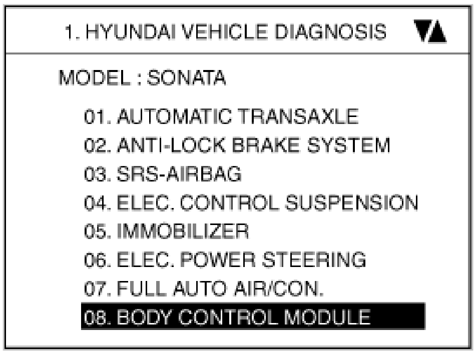
16. AUTO LIGHT CONTROL
    (1) Auto light sensor value is always read at IGN ON.
    (2) Light is turned ON after 2sec±0.2sec when auto light sensor value is same as light ON input value.
    (3) Light is turned OFF after 2sec±0.2sec when sensor value is same as light OFF input value.
    (4) Tail lamp and head lamp are turned ON when sensor value is same as tail lamp ON input value.
    (5) Light ON value of sensor is based on the below table.
    (6) Head lamp signal is output when head lamp switch is ON.
    (7) After head lamp is turned OFF, head lamp signal output is kept if head lamp ON luminance condition is met at auto light switch ON.
    (8) After head lamp is turned OFF, head lamp signal output is immediately stopped if head lamp OFF luminance condition is met at auto light switch ON.
    (9) After head lamp is turned OFF, head lamp signal output is immediately stopped at tail switch signal input.
    (10) After head lamp is turned OFF, head lamp signal output is stopped after 0.7s if there is no input of auto light switch or tail switch. (Shall be no flashing of head lamp)
    (11) Head lamp signal output is stopped when switch position is changed from AUTO to head lamp switch during head lamp ON with auto light. (Shall be no flashing of head lamp)
    (12) The condition of head lamp ON/OFF is same as the one of tail lamp ON/OFF at auto light switch ON. Light ON value of the input sensor is based on the table.

	TAIL LAMP	HEAD LAMP
ON	0.81V+/-0.08V	Same as tail sensor value
OFF	1.41V+/-0.10V	Same as tail sensor value

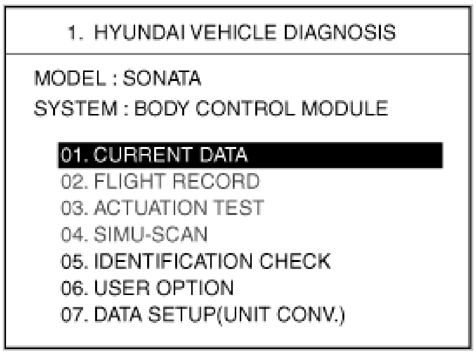


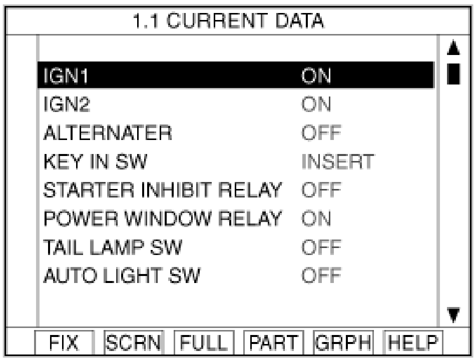
TROUBLE DIAGNOSTICS WHEN USING DIAGNOSIS TOOL

1. The body control module can diagnose by using the diagnosis tool more quickly.
   The BCM communicates with the diagnosis tool and then reads the input/output value and drives the actuator.
2. To diagnose the BCM function, select the menu of model and body control module.

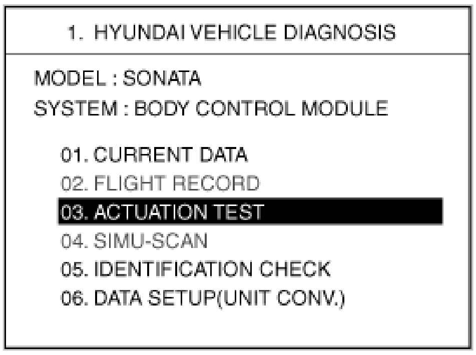


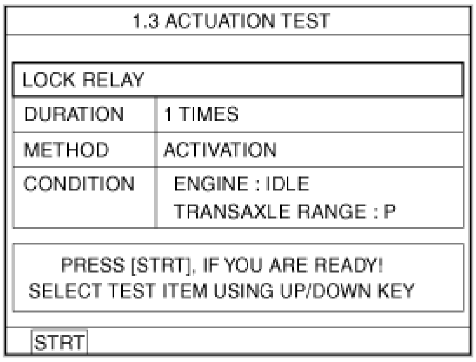
3. To consult the present input/out value of BCM, "02. INPUT/OUTPUT MONITORING". It provides information of BCM input/output conditions of power supply, turn signal/brake lamp, headlamp, door, locks, outside mirror, wiper, auto-light and transmitters etc.





4. To perform compulsory operation on BCM input factors, select "03. ACTUATION TEST"



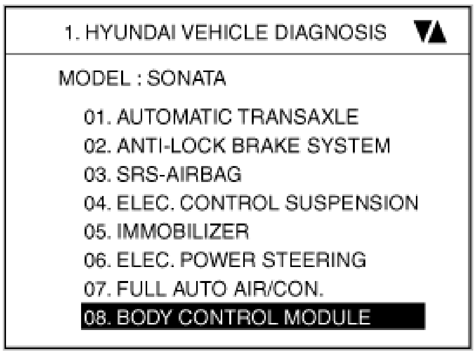


USER OPTION MODE

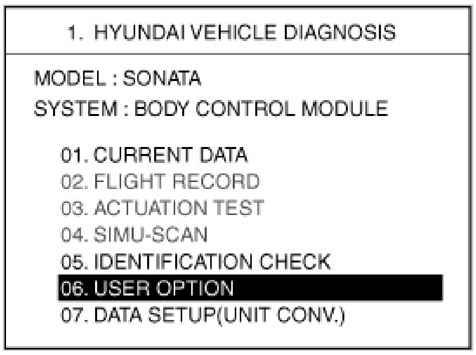
The BCM offers 3 items user option mode for a user convenience (Auto door lock, door key burglar alarm, door lock state inform horn)

- It is able to set up the enable or disable of AUTO DOOR LOCK function or AUTO DOOR LOCK operation vehicle speed when using it.
- It is able to set up the enable or disable of enter the burglar alarm mode when using door lock by the key.
- It is able to set up the enable or disable of horn inform function when using door lock by the key or RKE.

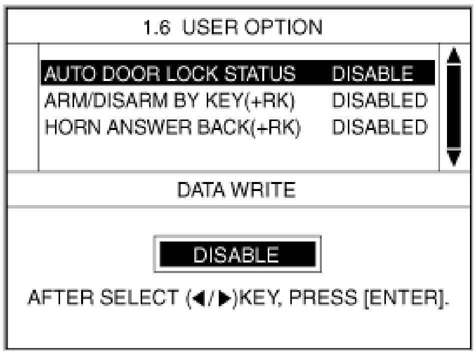
1. Select option "SONATA(NF)" and press ENTER.
2. Select option "BODY CONTROL MODULE" and press ENTER.



3. Select option "USER OPTION" and press ENTER.



4. Select option "AUTO DOOR LOCK STATUS by using the direction button(▲ / ▼).
5. Select the parameter by using the direction button(◂ / ▸) and press ENTER to save it.
(Disable / 5km/h / 10km/h / 15km/h / 20km/h / 25km/h /30km/h / 35km/h / 40km/h)



6. Select option "ARM/DISARM BY KEY(+RKE)" by using the direction button(▲ / ▼).
7. Select the parameter by using the direction button(◂ / ▸) and press ENTER to save it.
(Disable / Enable)
8. Select option "HORN ANSWER BACK (+RK)" by using the direction button(▲ / ▼).
9. Select the parameter by using the direction button(◂ / ▸) and press ENTER to save it.
(Disable / Enable)

Body Electrical System > ETACS (Electronic Time > Body Control Module > Specifications

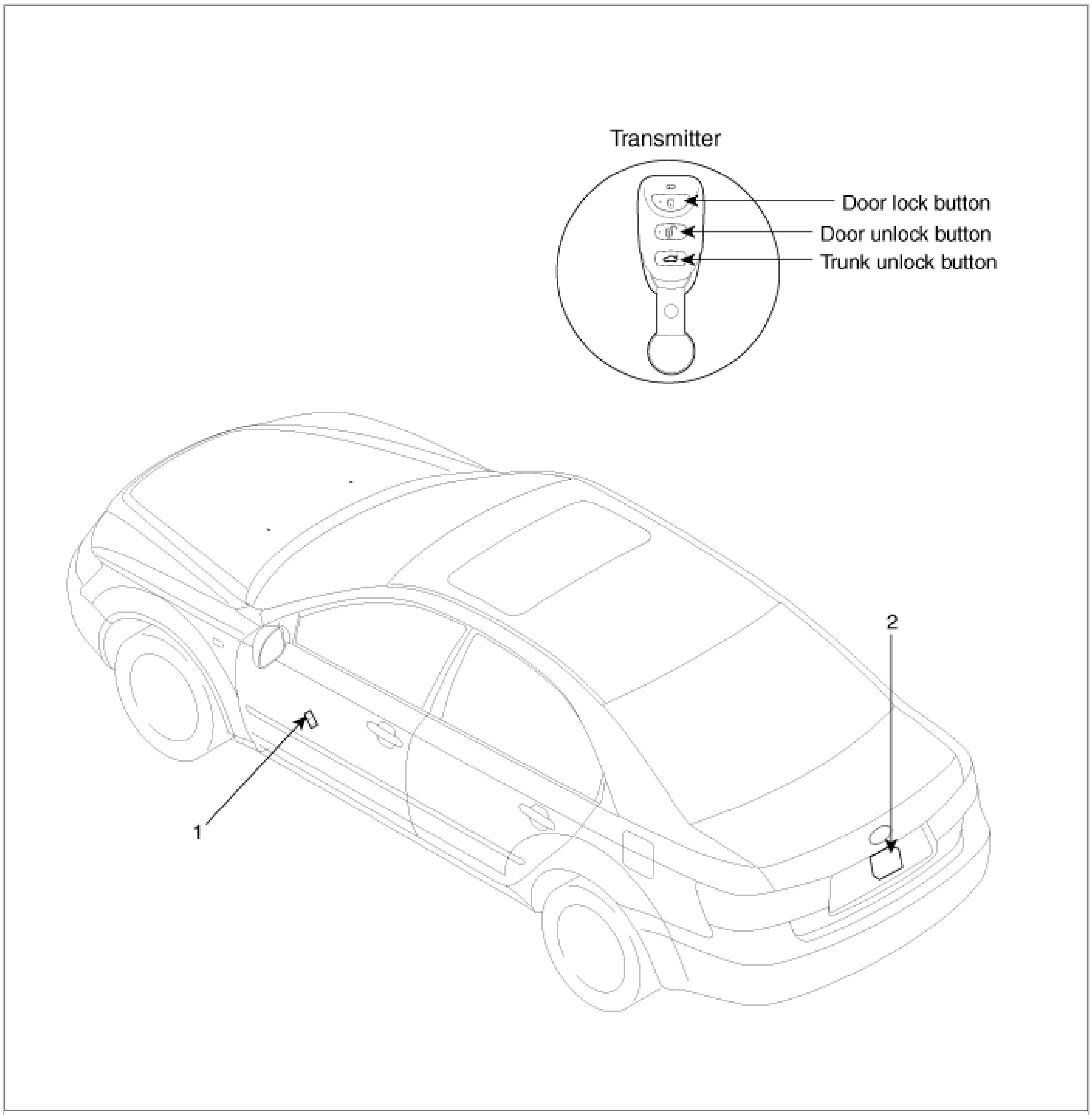
SPECIFICATIONS

Items	Specifications

Rated voltage	DC 12V
Operating voltage	DC 9 ~ 16V
Operating temperature	-22°F~167°F(-30°C~ 75°C)
Insulation resistance	100MΩ or more
Dark current	Less than 5.5mA (12.8 V) - BCM & Receiver Less than 4mA (12.8V) - BCM
Rated load Burglar relay Horn relay Tail lamp relay Security indicator Head lamp relay Rear defogger relay Power window timer relay Seat belt warning indicator (Driver/Assist) Key hole illumination lamp Room lamp Intermittent wiper relay DRL relay (For CANADA) Door lock relay Door unlock relay Hazard lamp relay Driver door unlock relay Trunk lid lock actuator	 DC 12V, 200mA (Inductance load) DC 12V, 200mA (Inductance load) DC 12V, 200mA (Inductance load) DC 12V, 1W (LED load) DC 12V, 200mA (Inductance load) DC 12V, 200mA (Inductance load) DC 12V, 200mA (Inductance load) DC 12V, 1.2W (LED load) DC 12V, 2W (Lamp load) DC 12V, 21W (Lamp load) DC 12V, 200mA (Inductance load) DC 12V, 200mA (Inductance load) DC 12V, 200mA (Inductance load) DC 12V, 200mA (Inductance load) DC 12V, 200mA (Inductance load) DC 12V, 200mA (Inductance load) DC 12V, 200mA (Inductance load)

Body Electrical System > Trunk lid > Components and Components Location

COMPONENT LOCATION

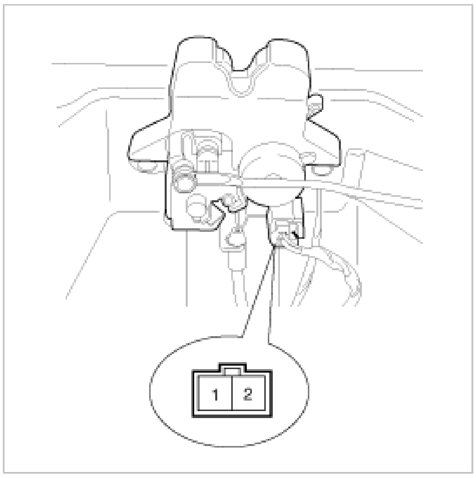


1. Trunk lid open switch 2. Trunk lid release actuator

Body Electrical System > Trunk lid > Trunk Lid Release Actuator > Repair procedures

INSPECTION

1. Remove the trunk lid trim panel. (Refer to the Body group-trunk lid)
2. Disconnect the 2P connector from the actuator.



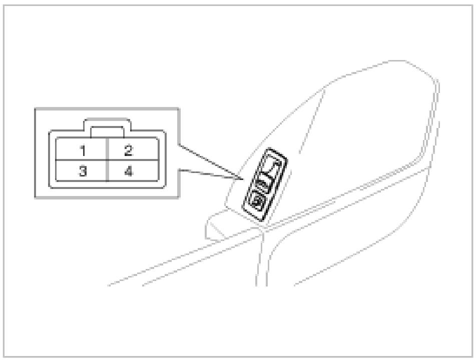
3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal	2	Chassis ground
Open	⊕	⊖

Body Electrical System > Trunk lid > Trunk Lid Open Switch > Repair procedures

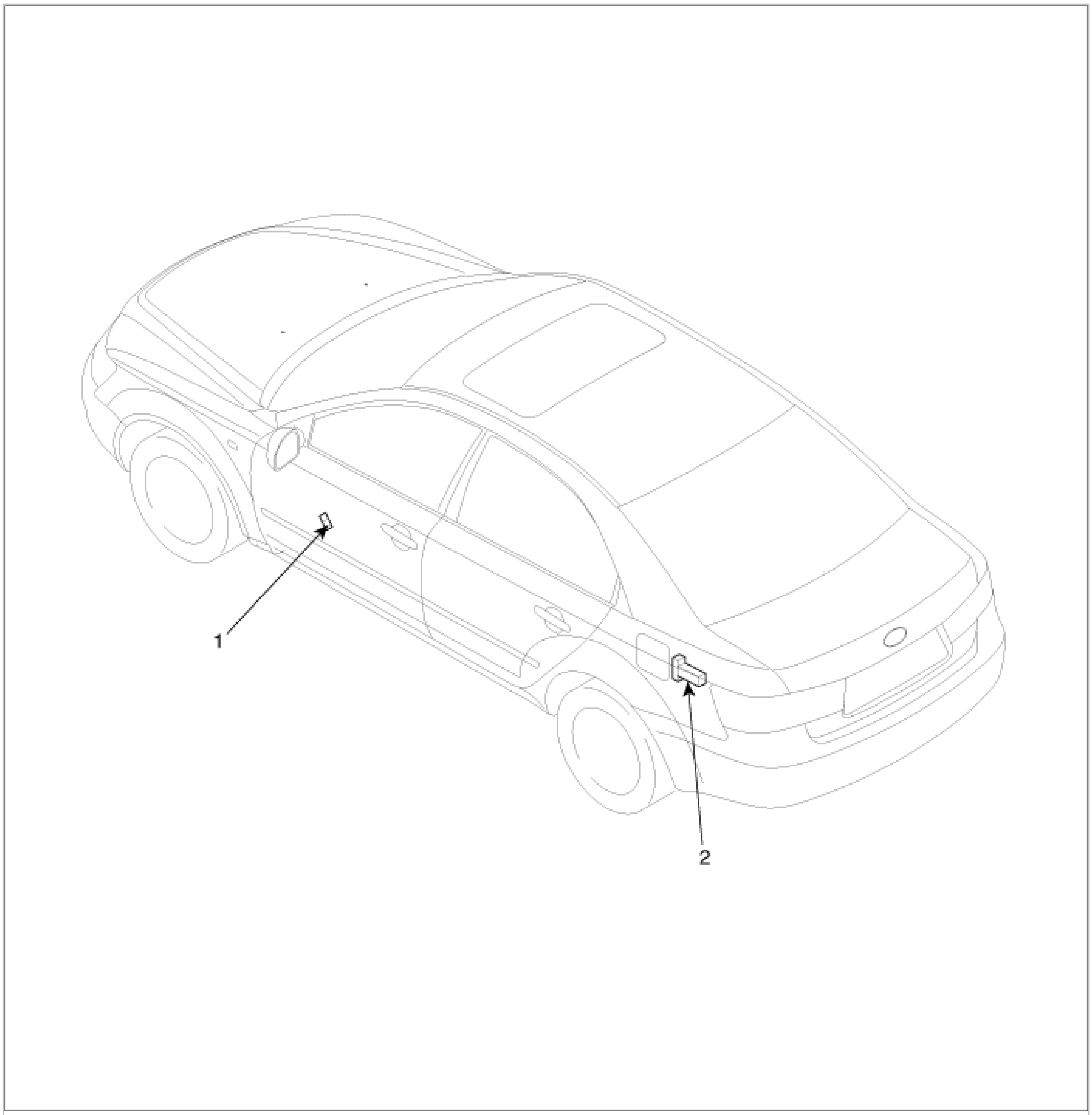
INSPECTION

1. Remove the front door trim panel. (Refer to the Body group-front door)
2. Check the switch for continuity between the No. 3 and No. 4 terminals.
3. If the continuity is not as specified, replace the switch.



Body Electrical System > Fuel Filler Door > Components and Components Location

COMPONENT LOCATION

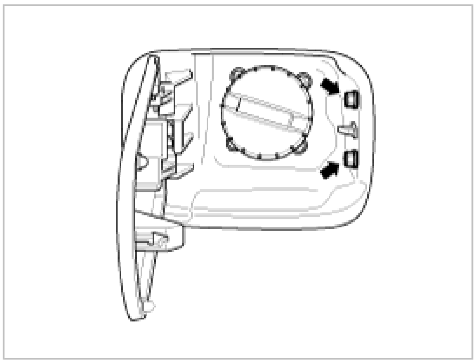


1. Fuel filler door open switch 2. Fuel filler door release actuator

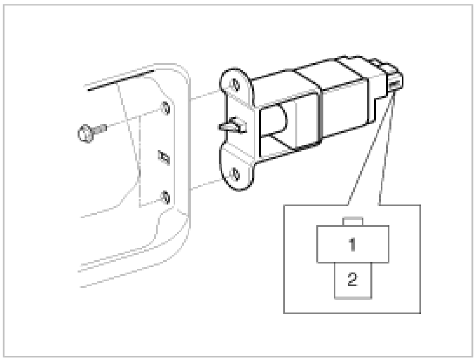
Body Electrical System > Fuel Filler Door > Fuel Filler Door Release Actuator > Repair procedures

INSPECTION

1. Remove the trunk room left trim.
2. Open the fuel filler door and remove the fuel filler door release actuator.



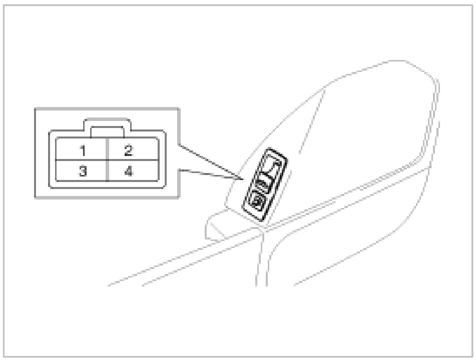
3. Check for continuity between terminal No. 1 and No. 2. If there is no continuity replace the fuel filler door opener.



Body Electrical System > Fuel Filler Door > Fuel Filler Door Open Switch > Repair procedures

INSPECTION

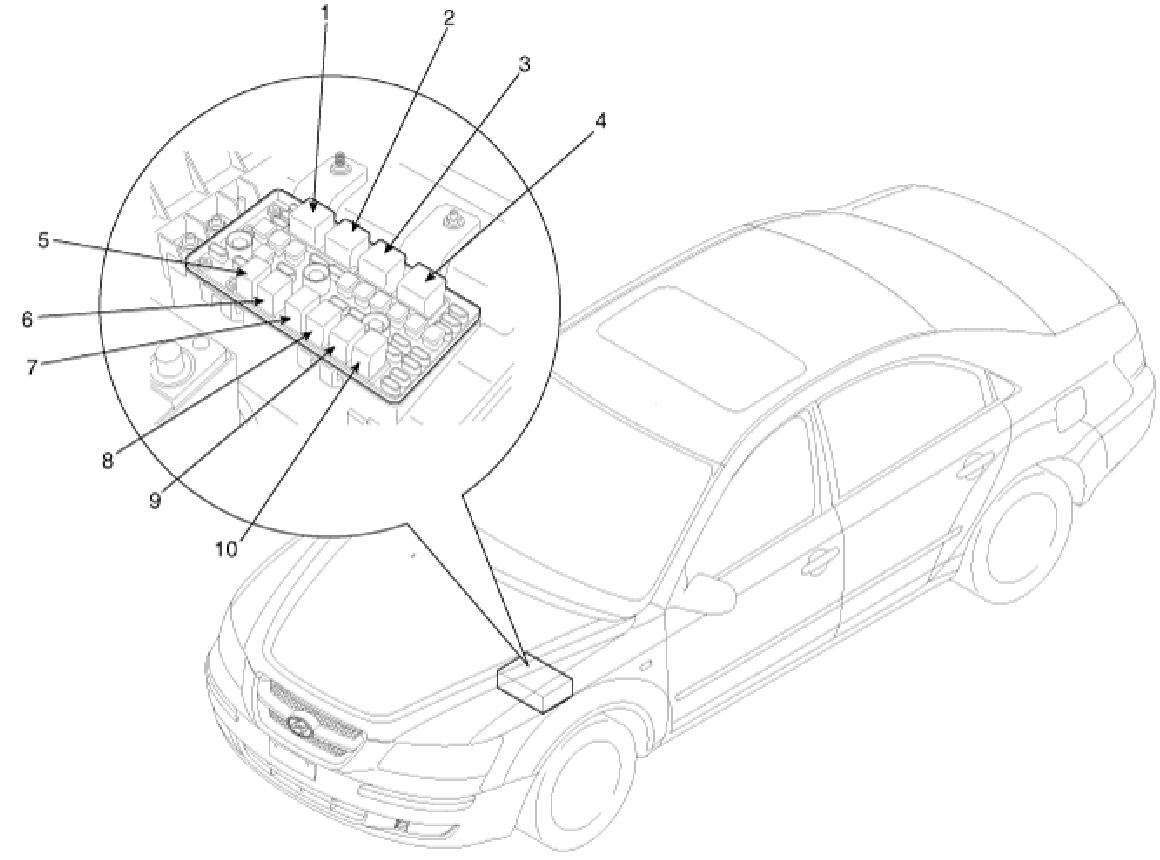
1. Remove the front door trim panel. (Refer to the Body group-front door)
2. Check the switch for continuity between the No. 1 and No. 2 terminals.
3. If the continuity is not as specified, replace the switch.



Body Electrical System > Fuses And Relays > Components and Components Location

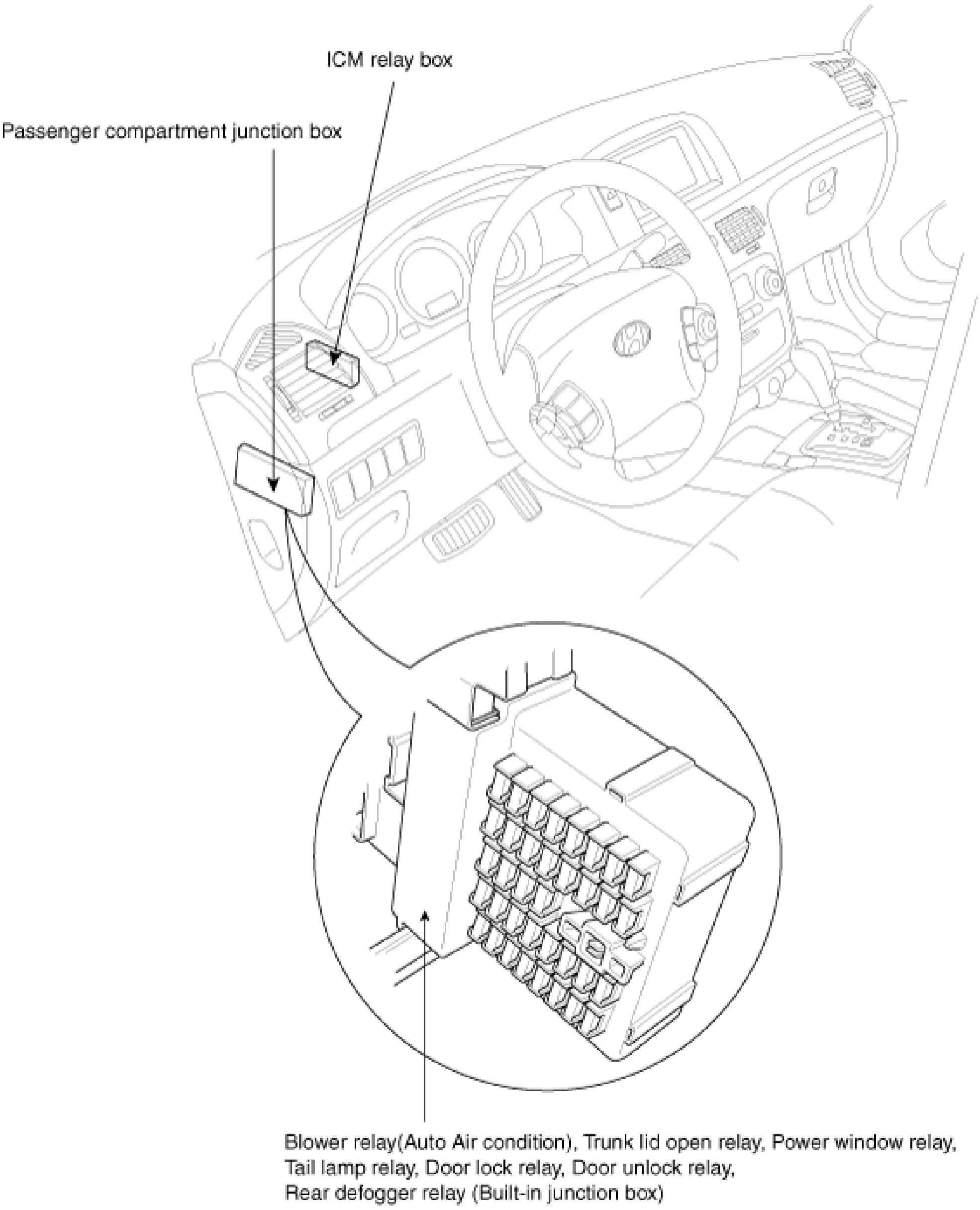
COMPONENT LOCATION

[Engine room relay box]



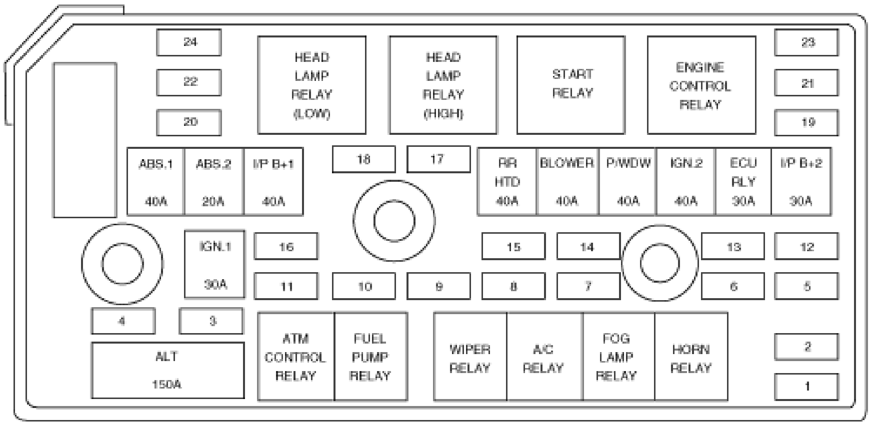
1. Head lamp relay (Low)	6. Fuel pump relay
2. Head lamp relay (High)	7. Wiper relay
3. Start relay	8. Air conditioning relay
4. E/G control relay	9. Front fog relay
5. A/T relay	10. Horn relay

[Passenger compartment relay box]



Body Electrical System > Fuses And Relays > Relay Box (Engine Compartment) > Components and Components Location

COMPONENTS



Description			(A)	Circuit Protected
FUSIBLE LINK	ABS.1		40A	ABS/ESP control module, Multipurpose check connector
	ABS.2		20A	ABS/ESP control module, Multipurpose check connector
	I/P B+1		40A	Fuse 23, 24, 30, 31, 32, 33, 34, 35
	RR HTD		40A	Defogger relay
	BLOWER		40A	Blower relay
	P/WDW		40A	Power window relay, Fuse 16
	IGN.2		40A	Start relay, Ignition switch (IG2, START)
	ECU RLY		30A	Engine control relay
	I/P B+2		30A	Power connector. 1/2, Fuse 21, 22
	IGN.1		30A	Ignition switch (ACC, IG1)
	ALT		150A	FUSIBLE LINK (ABS.1, ABS.2, RR HTD, BLOWER)
FUSE	1	HORN	15A	Horn relay
	2	TAIL LAMP	20A	Tail lamp relay
	3	ECU	10A	PCM
	4	IGN.1	10A	(SPARE)
	5	DRL	15A	DRL control module
	6	FR FOG	15A	Front fog lamp relay
	7	A/CON	10A	A/C relay
	8	F/PUMP	20A	Fuel pump relay
	9	DIODE	-	(SPARE)
	10	ATM	20A	ATM control relay
	11	STOP	15A	Stop lamp switch
	12	H/LP LO RH	15A	(SPARE)
	13	SUN ROOF	15A	Sunroof control module
	14	H/LP WASHER	20A	(SPARE)
	15	H/LP HI	20A	Head lamp relay (High)
	16	ECU	10A	PCM (3.3L)
	17	SNSR.3	10A	A/C relay, Cooling fan relay, Injectors
	18	SNSR.1	15A	Mass air flow sensor, Oil control valve, SMATRA, Canister close valve
	19	SNSR.2	15A	Oxygen sensor, Fuel pump relay
	20	B/UP	10A	Back-up lamp switch, Pulse generator, Vehicle speed sensor
	21	IGN COIL	20A	Ignition coils, condenser
	22	ECU	10A	PCM
	23	H/LP LO	20A	Head lamp relay (Low)
	24	ABS	10A	ABS/ESP control module, Multipurpose check connector

※ USE THE DESIGNATED FUSE ONLY

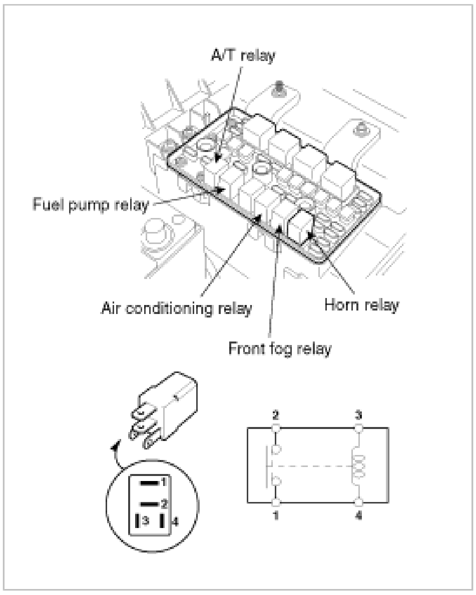
Body Electrical System > Fuses And Relays > Relay Box (Engine Compartment) > Repair procedures

INSPECTION

POWER RELAY TEST (TYPE A)

Check for continuity between the terminals.

1. There should be continuity between the No.1 and No.2 terminals when power and ground are connected to the No.3 and No.4 terminals.
2. There should be no continuity between the No.1 and No.2 terminals when power is disconnected.

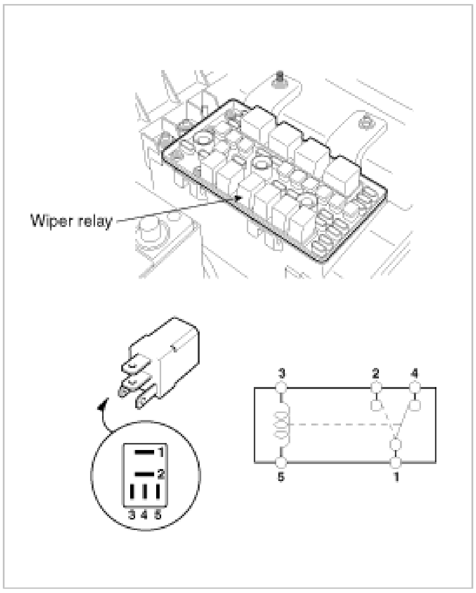


Terminal / Power (No.3-No.4)	1	2	3	4
Disconnected			O	O
Connected	O	O	⊖	⊕

POWER RELAY TEST (TYPE B)

Check for continuity between the terminals.

1. There should be continuity between the No.1 and No.2 terminals when power and ground are connected to the No.3 and No.5 terminals.
2. There should be continuity between the No.1 and No.4 terminals when power is disconnected.

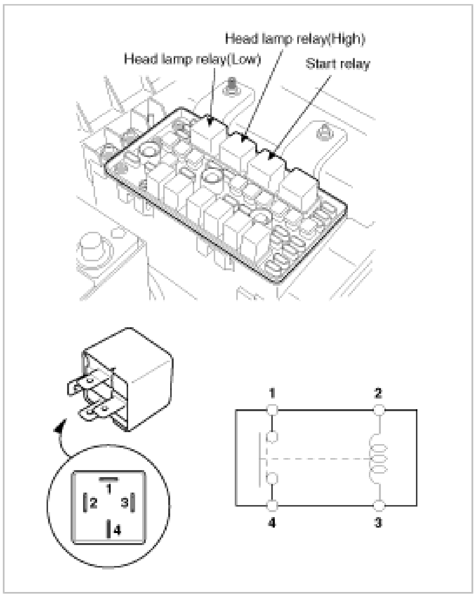


Terminal / Power (No.3-No.5)	3	5	1	2	4
Disconnected			O		O
Connected	⊖	⊕	O	O	

POWER RELAY TEST (TYPE C)

Check for continuity between the terminals.

1. There should be continuity between the No.1 and No.4 terminals when power and ground are connected to the No.2 and No.3 terminals.
2. There should be no continuity between the No.1 and No.4 terminals when power is disconnected.

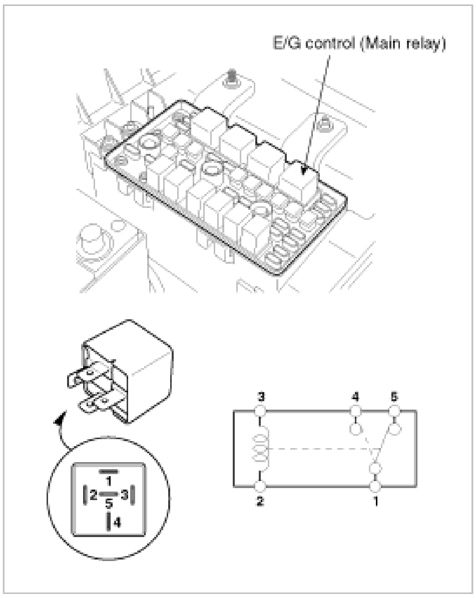


Terminal / Power (No.2-No.3)	2	3	1	4
Disconnected	○	○		
Connected	⊖	⊕	○	○

POWER RELAY TEST (TYPE D)

Check for continuity between the terminals.

1. There should be continuity between the No.1 and No.4 terminals when power and ground are connected to the No.2 and No.3 terminals.
2. There should be continuity between the No.1 and No.5 terminals when power is disconnected.



Terminal / Power (No.2-No.3)	2	3	1	4	5
Disconnected			○		○
Connected	⊖	⊕	○	○	

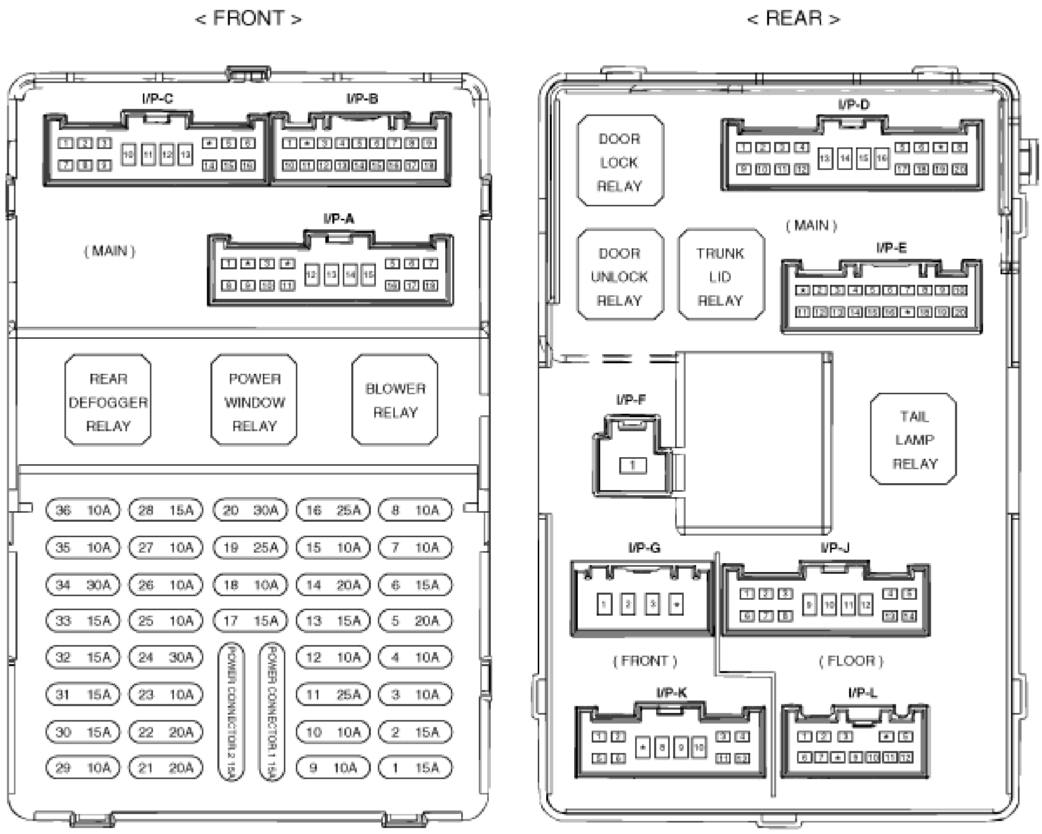
FUSE INSPECTION

1. Be sure there is no play in the fuse holders, and that the fuses are held securely.
2. Are the fuse capacities for each circuit correct?
3. Are there any blown fuses?
   If a fuse is to be replaced, be sure to use a new fuse of the same capacity. Always determine why the fuse blew first and

completely eliminate the problem before installing a new fuse.

Body Electrical System > Fuses And Relays > Relay Box (Passenger Compartment) > Components and Components Location

COMPONENTS



※ USE THE DESIGNATED FUSE ONLY

CIRCUIT

FUSE	(A)	Circuit Protected
1	15A	(SPARE)
2	15A	Seat warmer switch
3	10A	BCM, Sunroof control module, Home link connector
4	10A	Active incar & humidity sensor, Instrument cluster
5	20A	Cigarette lighter
6	15A	(SPARE)
7	10A	Illumination lamps, Right : License lamp, Rear combination lamp, Head lamp, Glove box lamp
8	10A	Front fog lamp relay, Left : License lamp, Rear combination lamp, Head lamp
9	10A	(SPARE)
10	10A	DRL control module, Head lamp relay, AQS & ambient sensor
11	25A	Wiper & washer
12	10A	A/C control module
13	15A	SRS control module, Telltale lamp, Passenger seat track position sensor
14	20A	Front accessory socket, Rear power outlet
15	10A	Digital clock, Audio, ATM key lock control module, Power outside mirror switch
16	25A	Safety window module
17	15A	(SPARE)
18	10A	ATM key lock control module, Tire pressure monitoring module
19	25A	Power window main switch, Left rear power window switch
20	30A	Power window main switch, Right power window switch
21	20A	Audio amp, JBL amp
22	20A	Door lock/unlock relay
23	10A	Hazard switch, Hazard relay
24	30A	(SPARE)
25	10A	Instrument cluster
26	10A	Hazard switch
27	10A	BCM, Instrument cluster, Yaw rate sensor, ESP switch
28	15A	(SPARE)
29	10A	Burglar alarm relay
30	15A	Adjustable pedal relay
31	15A	(SPARE)
32	15A	Trunk lid relay, Fuel filler door & trunk lid switch
33	15A	(SPARE)
34	30A	Power seat manual switch (LH)
35	10A	Sport mode switch, Key solenoid
36	10A	A/C control module, Outside mirror motor
POWER CONNECTOR.1	15A	Audio
POWER CONNECTOR.2	15A	BCM, Digital clock, Instrument cluster, A/C control module, Courtesy lamps

※ USE THE DESIGNATED FUSE ONLY

Body Electrical System > Fuses And Relays > Relay Box (Passenger Compartment) > Repair procedures

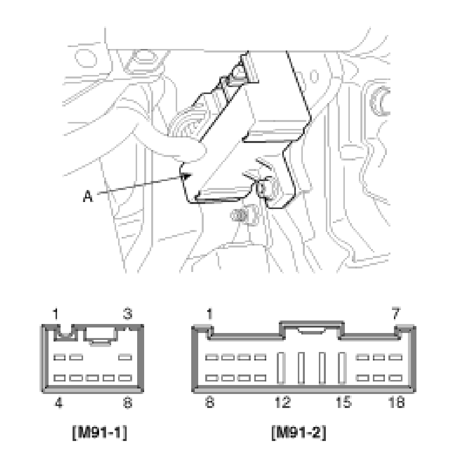
FUSE INSPECTION

1. Be sure there is no play in the fuse holders, and that the fuses are held securely.
2. Are the fuse capacities for each circuit correct?
3. Are there any blown fuses?
   If a fuse is to be replaced, be sure to use a new fuse of the same capacity. Always determine why the fuse blew first and completely eliminate the problem before installing a new fuse.

Body Electrical System > Fuses And Relays > ICM (Integrated Circuit Module) Relay Box > Description and Operation

DESCRIPTION

The ICM is united with many kinds of relays and installed below the relay box (passenger compartment).



Body Electrical System > Fuses And Relays > ICM (Integrated Circuit Module) Relay Box > Repair procedures

INSPECTION

HAZARD LAMP

Check for continuity between the terminals.

1. There should be continuity between the No.12 and No.13 terminals when power and ground are connected to the No.13 and No.3 in the M91-2 terminals.
2. There should be no continuity between the No12 and No.13 terminals when power is disconnected.

BURGLAR ALARM HORN

Check for continuity between the terminals.

1. There should be continuity between the No.8 and No.9 terminals when power and ground are connected to the No.1 and No.8 in the M91-2 terminals.
2. There should be no continuity between the No.8 and No.9 terminals when power is disconnected.

BURGLAR ALARM

Check for continuity between the terminals.

1. There should be no continuity between the No.11 and No.10 terminals when power and ground are connected to the No.11 and No.4 in the M91-2 terminals.
2. There should be continuity between the No.11 and No.10 terminals when power is disconnected.

ADJUST PEDAL

Check for continuity between the terminals.

1. There should be continuity between the No.15 and No.5 terminals when power and ground are connected to the No.15 and No.2 in the M91-2 terminals.
2. There should be no continuity between the No.15 and No.5 terminals when power is disconnected.

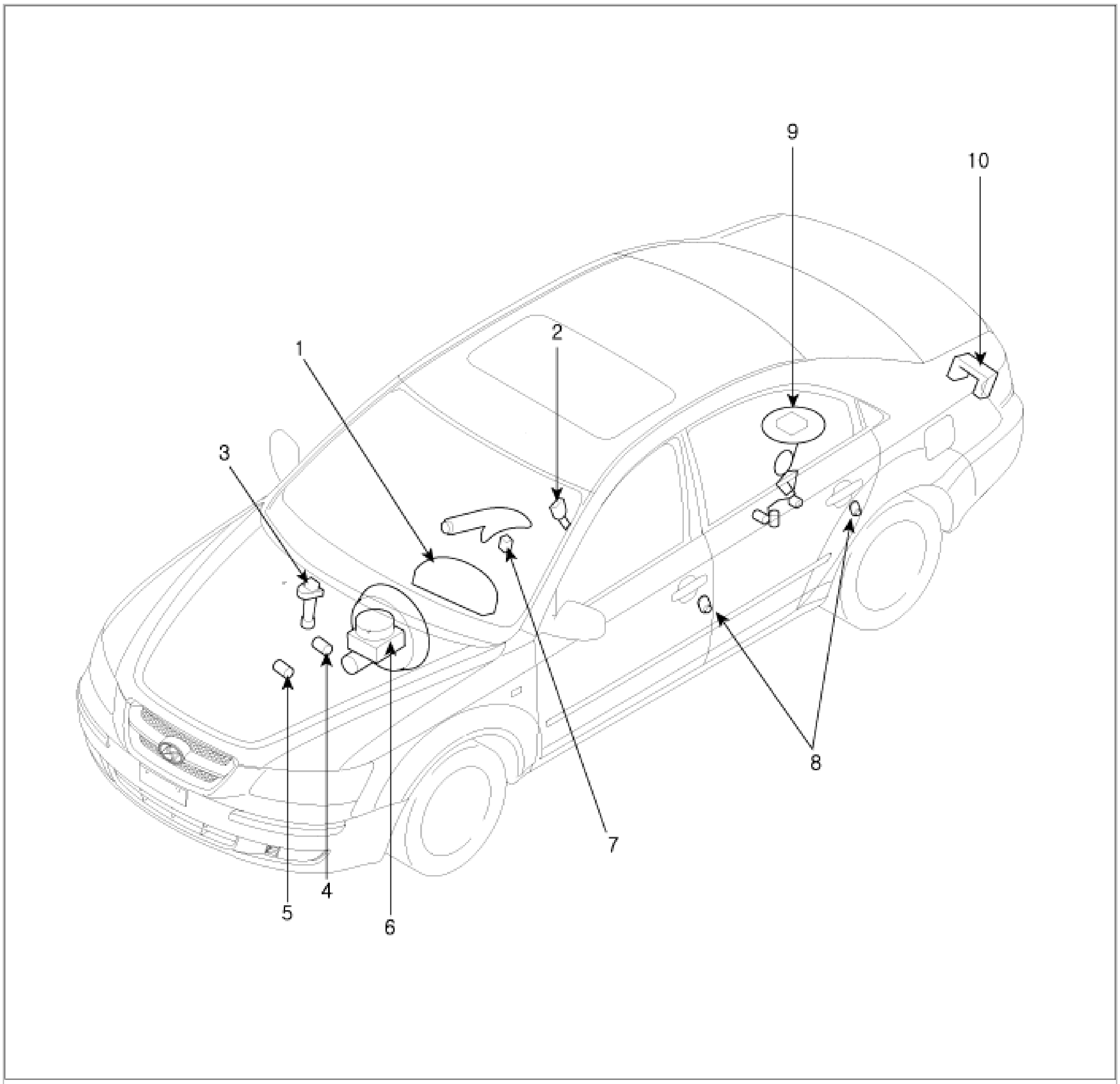
DRIVER DOOR TWO TURN UNLOCK

Check for continuity between the terminals.

1. There should be continuity between the No.7 and No.4 terminals when power and ground are connected to the No.6 and No.4 in the M91-1 terminals.
2. There should be continuity between the No.7 and No.5 terminals when power and ground are disconnected.

Body Electrical System > Indicators And Gauges > Components and Components Location

COMPONENT LOCATION



1. Cluster assembly	6. Brake fluid level warning switch
2. Seat belt switch	7. Parking brake switch
3. Vehicle speed sensor	8. Door switch
4. Engine coolant temperature sender	9. Fuel gauge sender
5. Oil pressure switch	10. Trunk lid open actuator

Body Electrical System > Indicators And Gauges > Troubleshooting

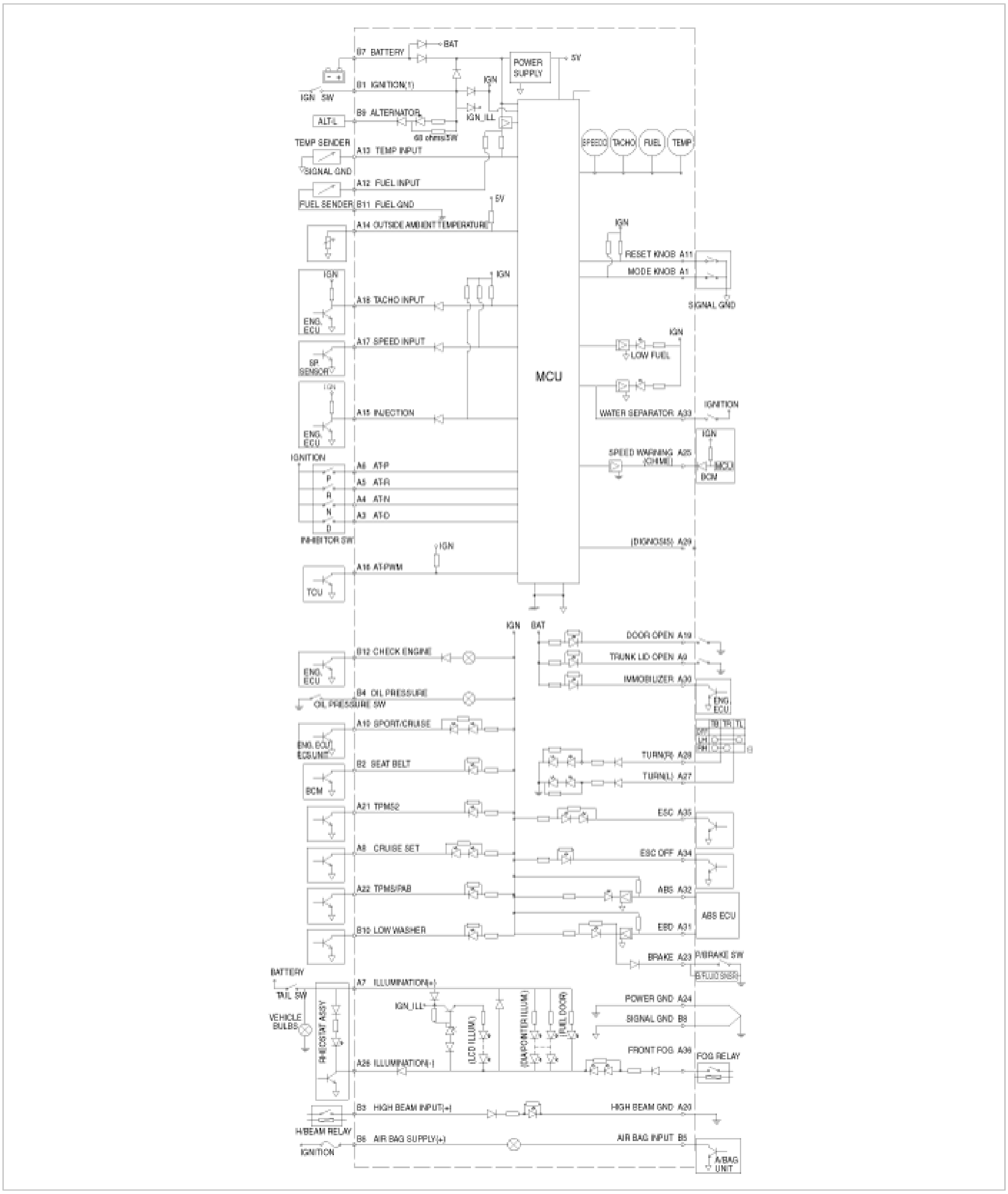
TROUBLESHOOTING

Symptom Poss	ible cause	Remedy
Speedometer does not operate	Cluster fuse (10A) blown	Check for short and replace fuse
	Speedometer faulty	Check speedometer
	Vehicle speed sensor faulty	Check vehicle speed sensor
	Wiring or ground faulty	Repair if necessary
Tachometer does not operate	Cluster fuse (10A) blown	Check for short and replace fuse
	Tachometer faulty	Check tachometer
	Wiring or ground faulty	Repair if necessary
Fuel gauge does not operate	Cluster fuse (10A) blown	Check for short and replace fuse
	Fuel gauge faulty	Check gauge
	Fuel sender faulty	Check fuel sender

	Wiring or ground faulty	Repair if necessary
Low fuel warning lamp does not light up	Cluster fuse (10A) blown	Check for short and replace fuse
	Bulb burned out	Replace bulb
	Fuel sender faulty	Check fuel sender
	Wiring or ground faulty	Repair if necessary
Water temperature gauge does not operate	Cluster fuse (10A) blown	Check for short and replace fuse
	Water temperature gauge faulty	Check gauge
	Water temperature sender faulty	Check sender
	Wiring or ground faulty	Repair if necessary
Oil pressure warning lamp does not light up	Cluster fuse (10A) blown	Check for short and replace fuse
	Bulb burned out	Replace bulb
	Oil pressure switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Parking brake warning lamp does not light up	Cluster fuse (10A) blown	Check for short and replace fuse
	Bulb burned out	Replace bulb
	Brake fluid level warning switch faulty	Check switch
	Parking brake switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Open door warning lamp and trunk lid warning lamp do not light up	Memory fuse (15A) blown	Check for short and replace fuse
	Bulb burned out	Replace bulb
	Door switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Seat belt warning lamp does not light up	Cluster fuse (10A) blown	Check for short and replace fuse
	Bulb burned out	Replace bulb
	Seat belt switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary

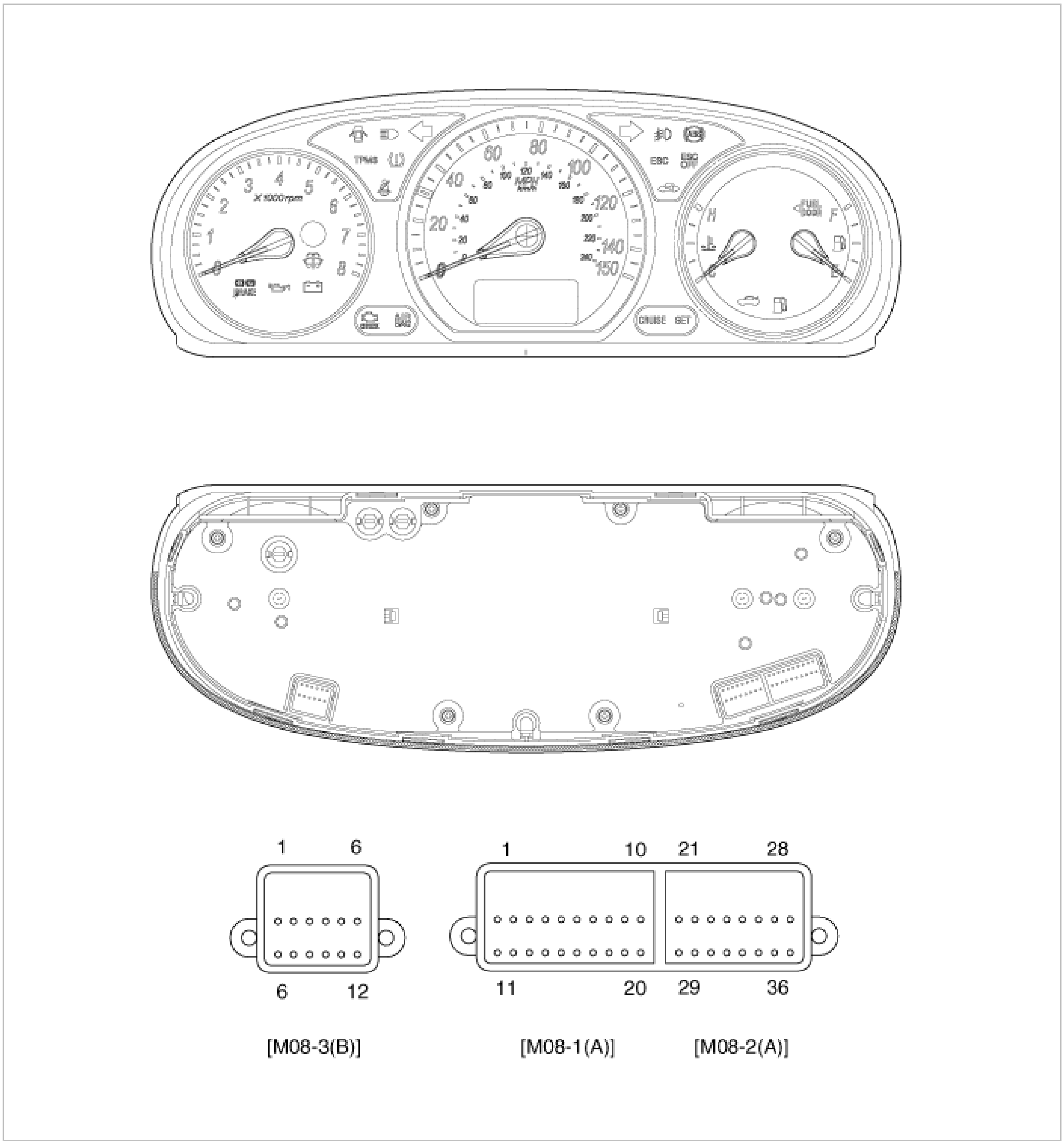
Body Electrical System > Indicators And Gauges > Instrument Cluster > Schematic Diagrams

CIRCUIT DIAGRAM



Body Electrical System > Indicators And Gauges > Instrument Cluster > Components and Components Location

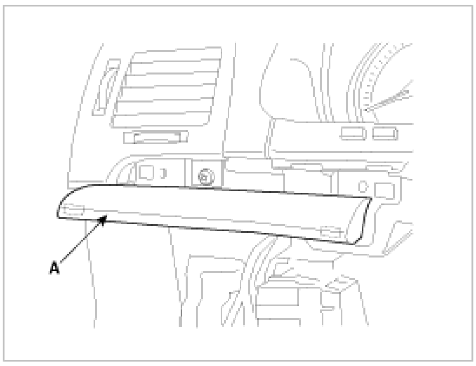
COMPONENTS



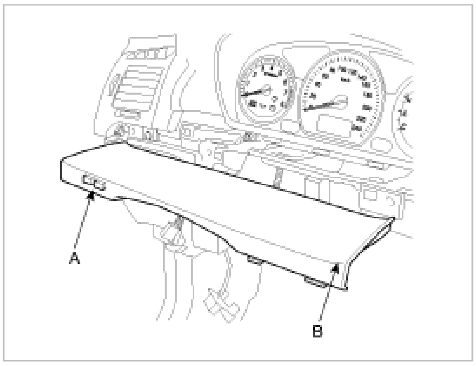
Body Electrical System > Indicators And Gauges > Instrument Cluster > Repair procedures

REPLACEMENT

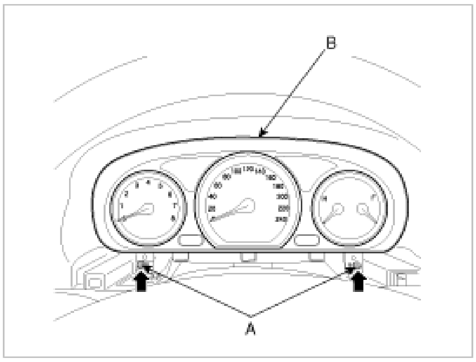
1. Disconnect the negative (-) battery terminal.
2. Remove the center garnish (A) (Refer to Body group-crash pad)



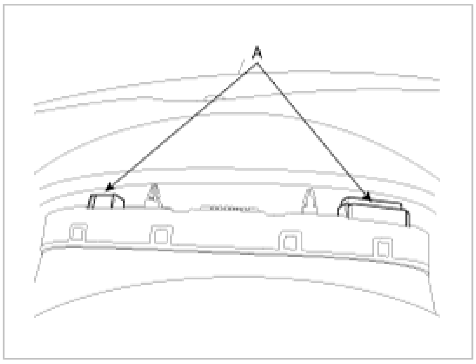
3. Remove the cluster facia panel (B) after disconnecting the connector of trip switch (A).



4. Remove the cluster from the housing (B) after removing 2 screws (A).



5. Disconnect the cluster connecter (A) and then remove the cluster.



6. Installation is the reverse of removal.

INSPECTION

SPEEDOMETER

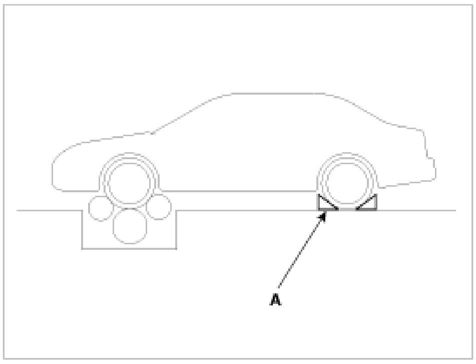
1. Adjust the pressure of the tires to the specified level.
2. Drive the vehicle onto a speedometer tester. Use wheel chocks as appropriate.
3. Check if the speedometer indicator range is within the standard values.

CAUTION

Do not operate the clutch suddenly or increase/ decrease speed rapidly while testing.

NOTE

Tire wear and tire over or under inflation will increase the indication error.



[CANADA - km/h]

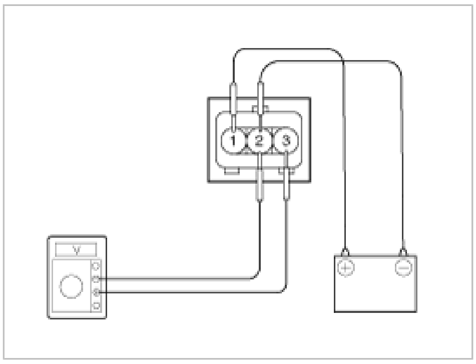
Velocity (km/h)	20	40	60	80	100	120
Tolerance (km/h)	+5.0 +0.2	+5.0 +0.2	+5.8 +0.2	+6.5 +0.5	+7.0 +1.5	+8.5 +1.5
Velocity (km/h)	140	160	180	200	220	240
Tolerance (km/h)	+10 +1.5	+11 +2.0	+12 +2.5	+13 +2.5	+14 +2.5	+15 +2.5

[USA MPH]

Velocity (MPH)	10	20	40	60	80
Tolerance (MPH)	+2.5 -1.0	+2.5 -1.0	+3.5 -1.0	+4.0 -1.0	+4.5 -1.0
Velocity (MPH)	100	120	140	150	-
Tolerance (MPH)	+5.0 -1.0	+6.0 -1.0	+6.5 -1.0	+7.0 -1.0	-

VEHICLE SPEED SENSOR

1. Connect the positive (+) lead from battery to terminal 1 and negative (-) lead to terminal 2.
2. Connect the positive (+) lead from tester to terminal 3 and the negative (-) lead to terminal 2.
3. Rotate the shaft.
4. Check that there is voltage change from approx. 0V to 11V or more between terminals 3 and 2.
5. The voltage change should be 4 times for every revolution of the speed sensor shaft.
   If operation is not as specified, replace the sensor.



TACHOMETER

1. Connect the scan tool to the diagnostic link connector or install a tachometer.
2. With the engine started, compare the readings of the tester with that of the tachometer. Replace the tachometer if the tolerance is exceeded.

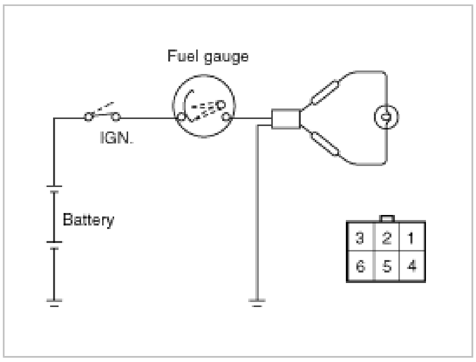
CAUTION

1. Reversing the connections of the tachometer will damage the transistor and diodes inside.
2. When removing or installing the tachometer, be careful not to drop it or subject it to severe shock.

Revolution(rpm)	1,000	2,000	3,000
Tolerance(rpm)	±120	±140	±170
Revolution(rpm)	4,000	5,000	6,000
Tolerance(rpm)	±170	±200	±200

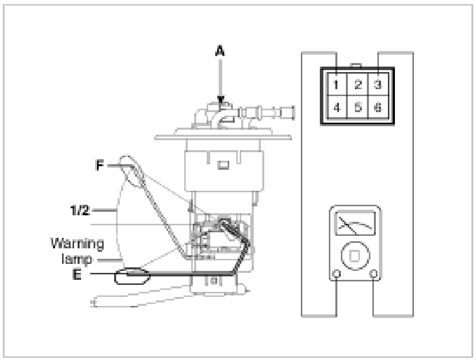
FUEL GAUGE

1. Disconnect the fuel sender connector from the fuel sender.
2. Connect a 3.4 watt, 12V test bulb to terminals 1 and 3 on the wire harness side connector.
3. Turn the ignition switch to the ON, and then check that the bulb lights up and the fuel gauge needle moves to full.



MAIN FUEL GAUGE SENDER

1. Using an ohmmeter, measure the resistance between terminals 1 and 3 of sender connector (A) at each float level.



2. Also check that the resistance changes smoothly when the float is moved from "E" to "F"

Position	Resistance(Ω)
Sender (E)	184 ± 2
Warning lamp	170 ± 2
1/2	66 ± 2
Sender (F)	15 ± 2

3. If the height resistance is unsatisfactory, replace the fuel sender as an assembly.

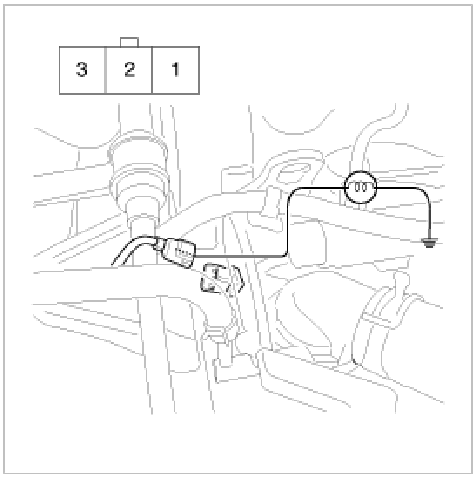
CAUTION

After completing this test, wipe the sender dry and reinstall it in the fuel tank.

ENGINE COOLANT TEMPERATURE GAUGE

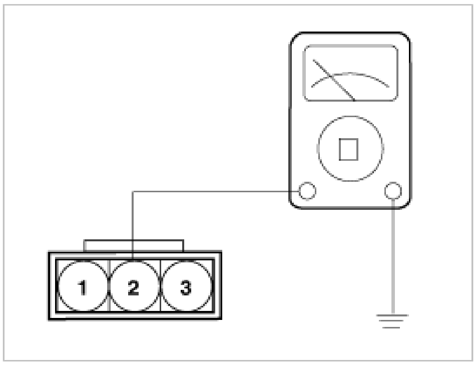
1. Disconnect the wiring connector (A) from the engine coolant temperature sender in the engine compartment.
2. Turn the ignition switch ON. Check that the gauge needle indicates cool. Turn the ignition switch OFF.

3. Connect a 12V, 3.4 wattages test bulb between the harness side connector and ground.
4. Turn the ignition switch ON.
5. Verify that the test bulb flashes and that the indicator moves to HOT.
   If operation is not as specified, replace the engine coolant temperature gauge. Then recheck the system.



ENGINE COOLANT TEMPERATURE SENDER

1. Using an ohmmeter, measure the resistance between the terminal 2 and ground.

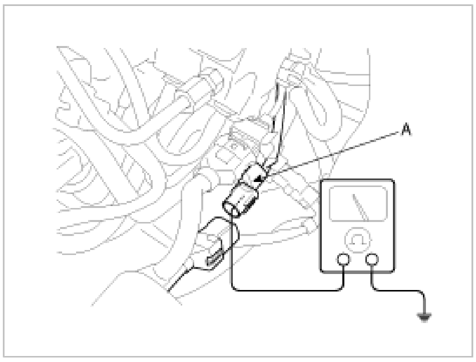


2. If the resistance value is not as shown in the table, replace the temperature sender.

Temperature [°F(°C)]	140(60)	185(85)	230(110)	257(125)
Gauge angle (°)	0	33	33	75
Resistance (Ω)	142±1	58±1	26±1	17.5±1

OIL PRESSURE SWITCH

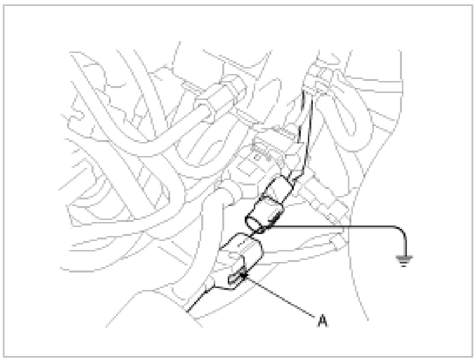
1. Check that there is continuity between the oil press switch terminal (A) and ground with the engine off.
2. Check that there is no continuity between the terminal and ground with the engine running.
3. If operation is not as specified, replace the switch.



OIL PRESSURE WARNING LAMP

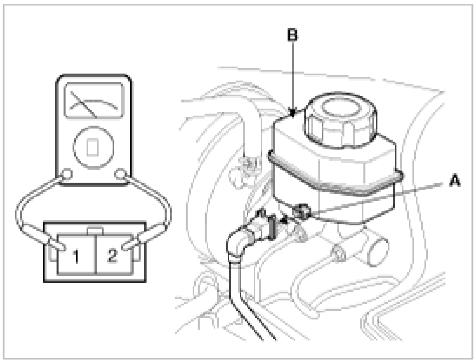
1. Disconnect the connector (A) from the warning switch and ground the terminal on the wire harness side connector.

2. Turn the ignition switch ON. Check that the warning lamp lights up. If the warning lamp doesn't light, test the bulb or inspect the wire harness.



BRAKE FLUID LEVEL WARNING SWITCH

1. Remove the connector(A) from the switch located at the brake fluid reservoir(B).
2. Verify that continuity exists between switch terminals 1 and 2 while pressing the switch (float) down with a rod.



BRAKE FLUID LEVEL WARNING LAMP

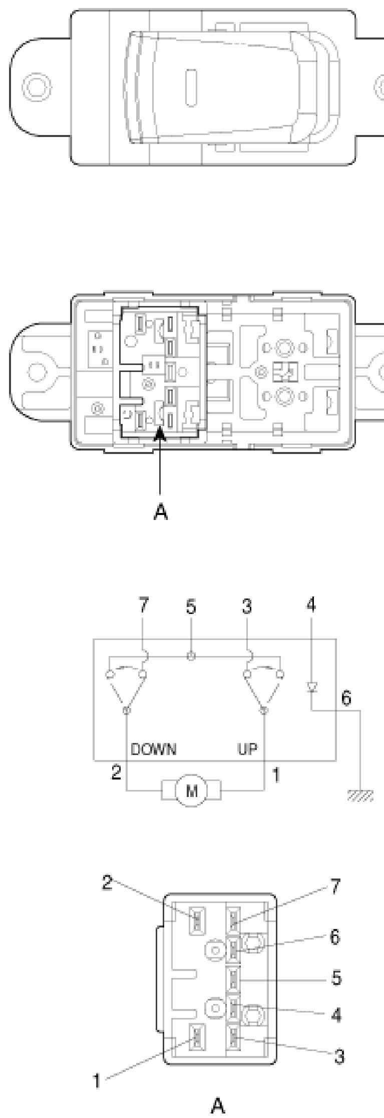
1. Ignition "ON"
2. Release the parking brake.
3. Remove the connector from the brake fluid level warning switch.
4. Ground the connector at the harness side.
5. Verify that the warning lamp lights.

PARKING BRAKE SWITCH

The parking brake switch (A) is a pulling type. It is located under the parking brake lever. To adjust, move the switch mount up and down with the parking brake lever released all the way.

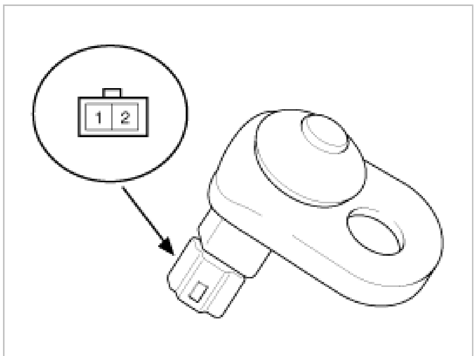
1. Check that there is continuity between the terminal and switch body with the switch ON (Lever is pulled).
2. Check that there is no continuity between the terminal and switch body with the switch OFF (Lever is released).
   If continuity is not as specified, replace the switch or inspect its ground connection.

[Assist & rear]



DOOR SWITCH

Remove the door switch and check for continuity between the terminals.



[FRONT DOOR SWITCH]

Position \ Terminal	1	2	Body (Ground)
Free(Door open)	○	○	○
Push(Door close)			

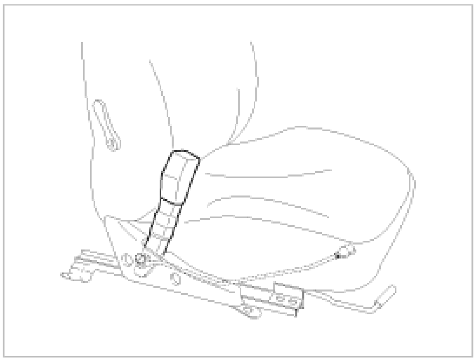
[REAR DOOR SWITCH]

Position \ Terminal	1	Ground
Free(Door open)	○	○
Push(Door close)		

SEAT BELT SWITCH

1. Remove the connector from the switch.
2. Check for continuity between terminals.

Seat belt condition	Continuity
Fastened	Non-conductive (∞Ω)
Not fastened	Conductive (Ω)



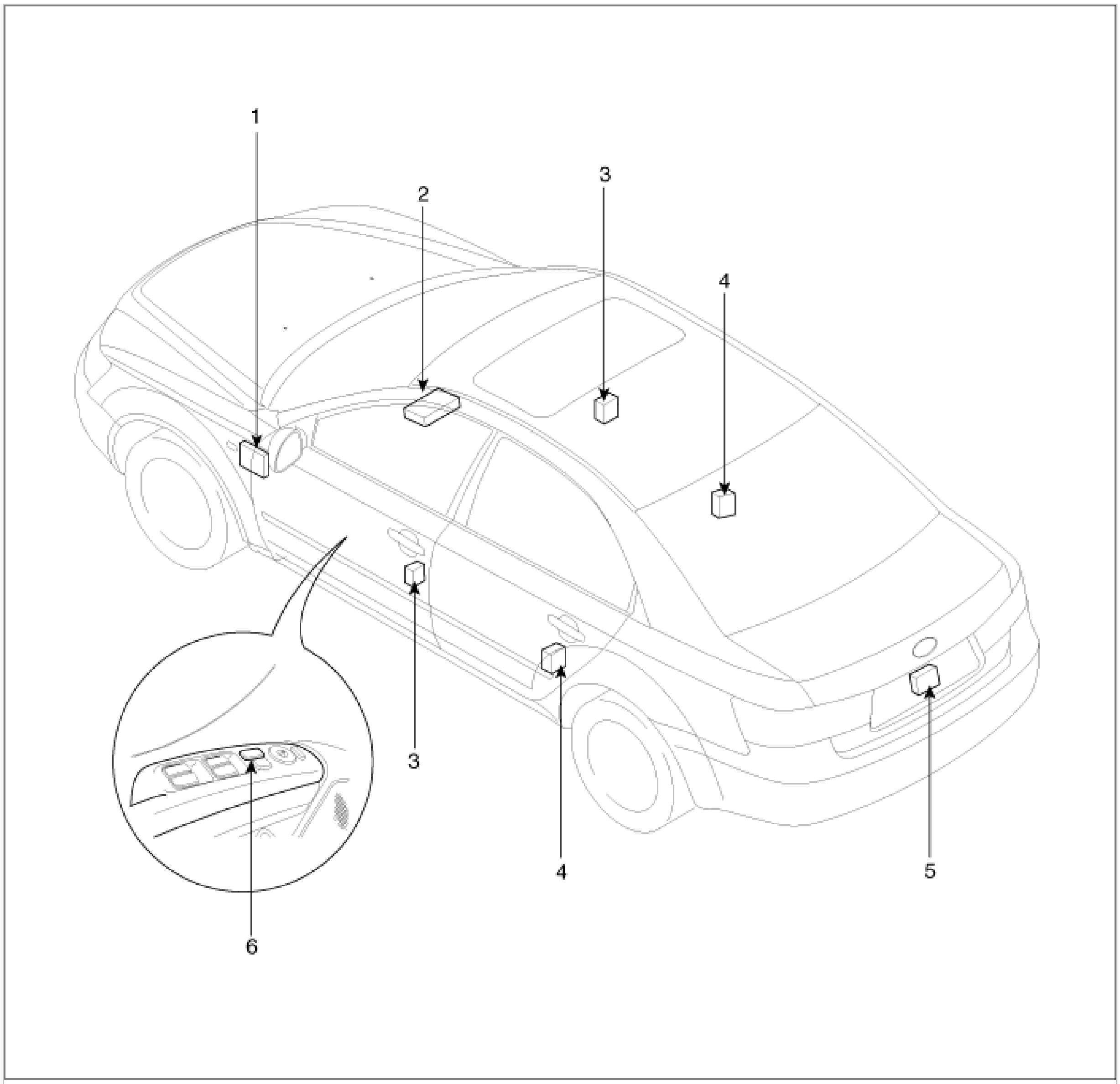
SEAT BELT WARNING LAMP

With the ignition switch turned ON, verify that the lamp glows.

Seat belt condition	Warning lamp
Fastened	OFF
Not fastened	ON

Body Electrical System > Power Door Locks > Components and Components Location

COMPONENT LOCATION

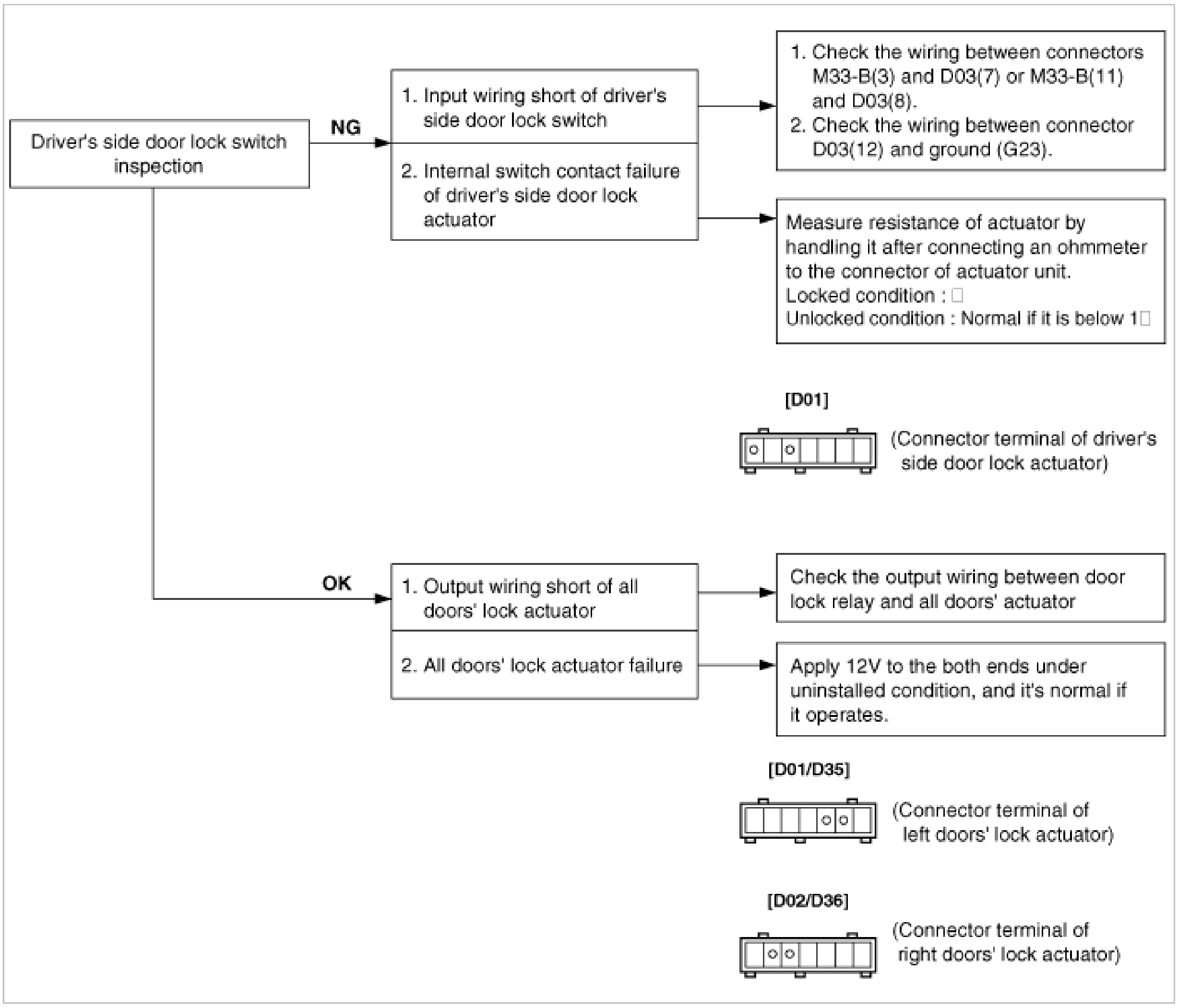


1. Junction box (Door lock/unlock relay)
2. Body control box
3. Front door lock actuator & switch
4. Rear door lock actuator & switch
5. Trunk lid release actuator
6. Door lock switch

Body Electrical System > Power Door Locks > Troubleshooting

TROUBLESHOOTING

1. Lock function works but unlock function does not work. → Since door unlock relay is malfunction, replace the door unlock relay.
2. Unlock function works but lock function does not work. → Since door lock relay is malfunction, replace the door lock relay.
3. When passenger side knob is controlled, all doors locks, but when driver side knob is controlled, all doors do not lock.

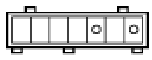


4. When driver side knob is controlled. All doors lock. But when the passenger side knob is controlled, all doors do not lock.

Passenger's side door lock switch inspection

- **NG** →
  - 1. Input wiring short of passenger's side door lock switch → 1. Check the wiring between connectors M33-B(3) and D04(2) or M33-B(11) and D04(1) . 2. Check the wiring between connector D04(8) and ground (G28).
  - 2. Internal switch contact failure of passenger's side door lock actuator → Measure resistance of actuator by handling it after connecting an ohmmeter to the connector of actuator unit. Locked condition : □ Unlocked condition : Normal if it is below 1□

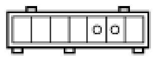
[D02]



(Connector terminal of passenger's side door lock actuator)

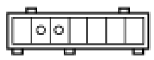
- **OK** →
  - 1. Output wiring short of all doors' lock actuator → Check the output wiring between door lock relay and all doors' actuator.
  - 2. All doors' lock actuator failure → Apply 12V to the both ends under uninstalled condition, and it's normal if it operates.

[D01/D35]



(Connector terminal of left doors' lock actuator)

[D02/D36]



(Connector terminal of right doors' lock actuator)

5. Both sides do not lock either.

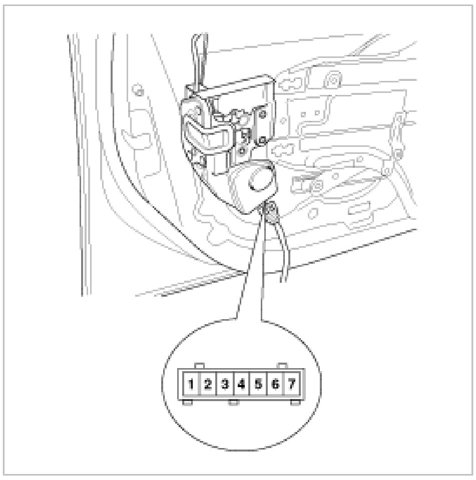
- Door lock fuse(20A) short check — **NG** → Replace the fuse
- **OK** ↓
- Door lock/unlock relay inspection (See page BE-93) — **NG** → Replace the relay
- **OK** ↓
- Door lock switch input signal inspection (BCM connector M33-C terminal 6) — **NG** → Check for an open in the wire
- **OK** ↓
- Door unlock switch input signal inspection (BCM connector M33-C terminal 19) — **NG** → Check for an open in the wire
- **OK** ↓
- Replace the BCM

Body Electrical System > Power Door Locks > Power Door Lock Actuators > Repair procedures

INSPECTION

FRONT DOOR LOCK ACTUATOR INSPECTION

1. Remove the front door trim panel. (Refer to the Body group - front door)
2. Disconnect the 7P connector from the actuator.

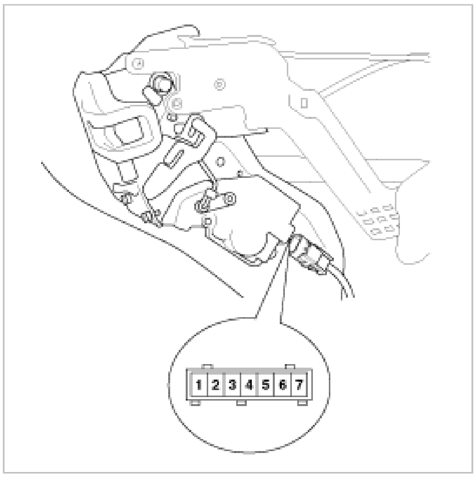


3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal		5	3	6	2
Front left	Lock	⊕		⊖	
	Unlock	⊖		⊕	
Front right	Lock		⊕		⊖
	Unlock		⊖		⊕

REAR DOOR LOCK ACTUATOR INSPECTION

1. Remove the rear door trim panel. (Refer to the Body group - rear door)
2. Disconnect the 7P connector from the actuator.

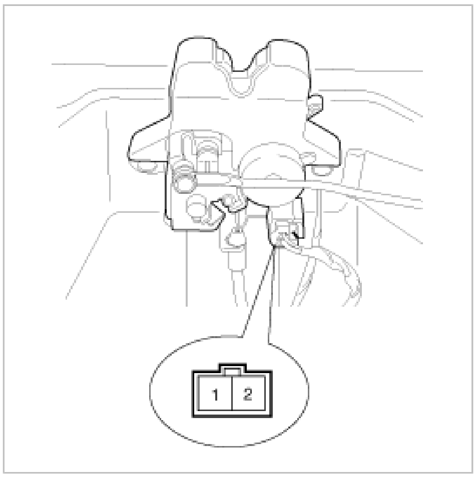


3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal		5	3	6	2
Rear left	Lock	⊕		⊖	
	Unlock	⊖		⊕	
Rear right	Lock		⊕		⊖
	Unlock		⊖		⊕

TRUNK LID RELEASE ACTUATOR INSPECTION

1. Remove the trunk lid trim panel. (Refer to the Body group - trunk lid)
2. Disconnect the 2P connector from the actuator.

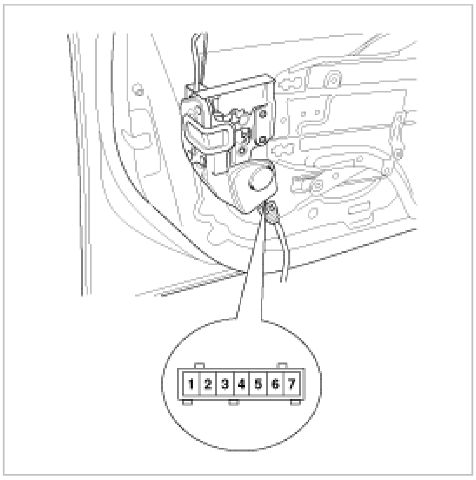


3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal	2	Chassis ground
Open	⊕	⊖

FRONT DOOR LOCK SWITCH INSPECTION

1. Remove the front door trim panel. (Refer to the Body group - front door)
2. Disconnect the 7P connector from the actuator.

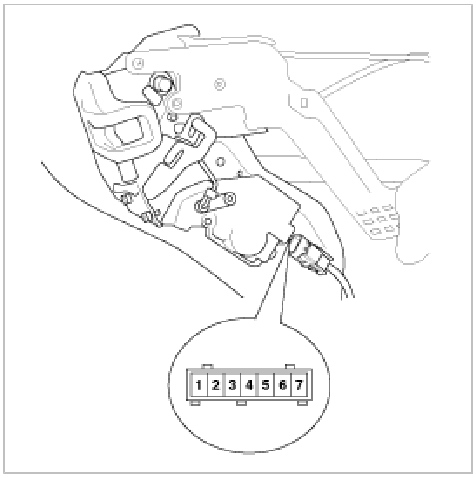


3. Check for continuity between the terminals in each switch position according to the table.

Position \ Terminal		1	5	3	7
Front left	Lock				
	Unlock	○		○	
Front right	Lock				
	Unlock		○		○

REAR DOOR LOCK SWITCH INSPECTION

1. Remove the rear door trim panel. (Refer to the Body group - rear door)
2. Disconnect the 7P connector from the actuator.

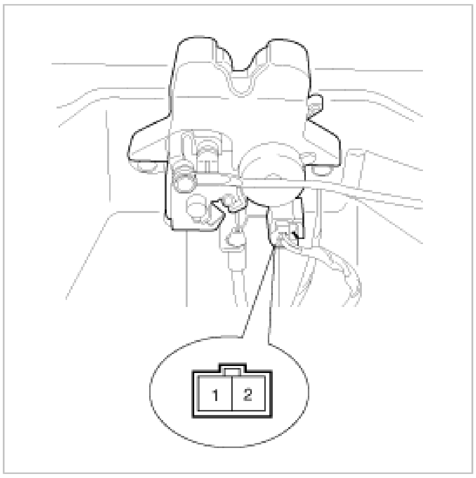


3. Check for continuity between the terminals in each switch position according to the table.

Position \ Terminal		1	5	3	7
Rear left	Lock				
	Unlock	O	—	O	
Rear right	Lock				
	Unlock		O	—	O

TRANK LID OPEN SWITCH INSPECTION

1. Remove the trunk lid trim panel. (Refer to the Body group - trunk lid)
2. Disconnect the 2P connector from the actuator.



3. Check for continuity between the terminals in each switch position according to the table.

Position \ Terminal	1	Chassis ground
Open	⊕	⊖

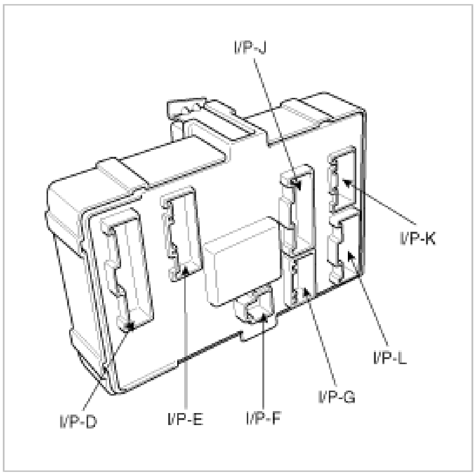
Body Electrical System > Power Door Locks > Power Door Lock Relay > Repair procedures

INSPECTION

1. Disconnect the negative (-) battery terminal.
2. Remove the junction box.
3. Check for continuity between the terminals.

DOOR LOCK

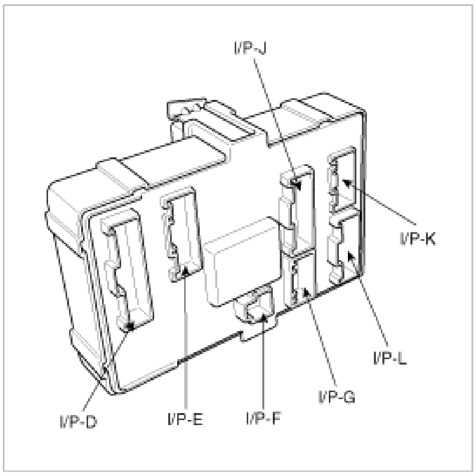
1. There should be continuity between the No.12 and No.9 terminals in the I/P-D when power and ground are connected to the No.12 terminal in the I/P-E and No.9 terminal in the I/P-D.
2. There should be no continuity between the No.12 terminal in the I/P-E and No.9 terminal in the I/P-D when power is disconnected.



Terminal / Position	I/P-K (9)	I/P-A (15)	I/P-D (16)	I/P-B (13)
Disconnected			○	○
Connected	○	○	⊖	⊕

DOOR UNLOCK

1. There should be continuity between the No.3 terminal in the I/P-E and No.9 terminal in the I/P-D when power and ground are connected to the No.11 terminal in the I/P-E and No.9 terminal in the I/P-D.
2. There should be no continuity between the No.11 terminal in the I/P-E and No.9 terminal in the I/P-D when power is disconnected.



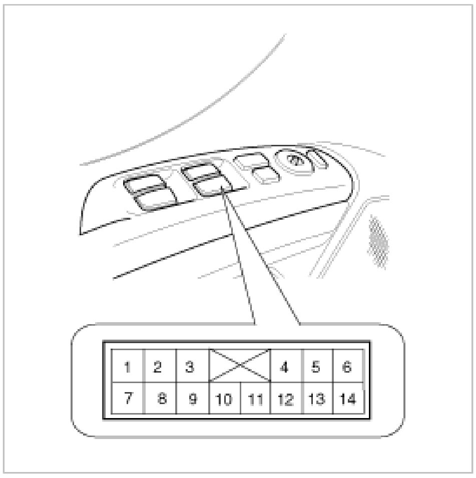
Terminal / Power	I/P-D (9)	I/P-E (11)	I/P-E (3)	I/P-D (9)
Disconnected			○	○
Connected	○	○	⊖	⊕

Body Electrical System > Power Door Locks > Power Door Lock Switch > Repair procedures

INSPECTION

DRIVER DOOR LOCK SWITCH INSPECTION

1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim panel. (Refer to the Body group - front door)
3. Disconnect the 14P connector from the switch.

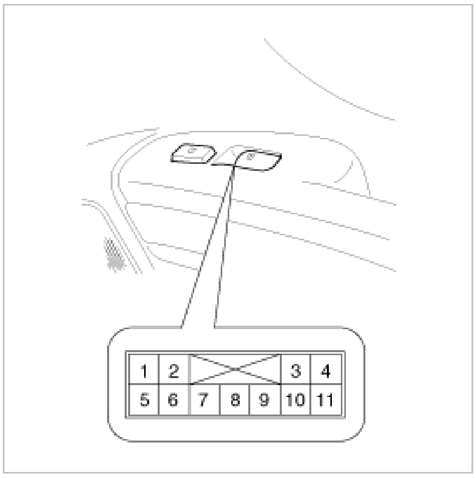


4. Check for continuity between the terminals in each switch position according to the table.

Terminal / Position	8	12	7
Lock		O	O
Unlock	O	O	

ASSIST DOOR LOCK SWITCH INSPECTION

1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim panel. (Refer to the Body group - front door)
3. Disconnect the 11P connector from the switch.

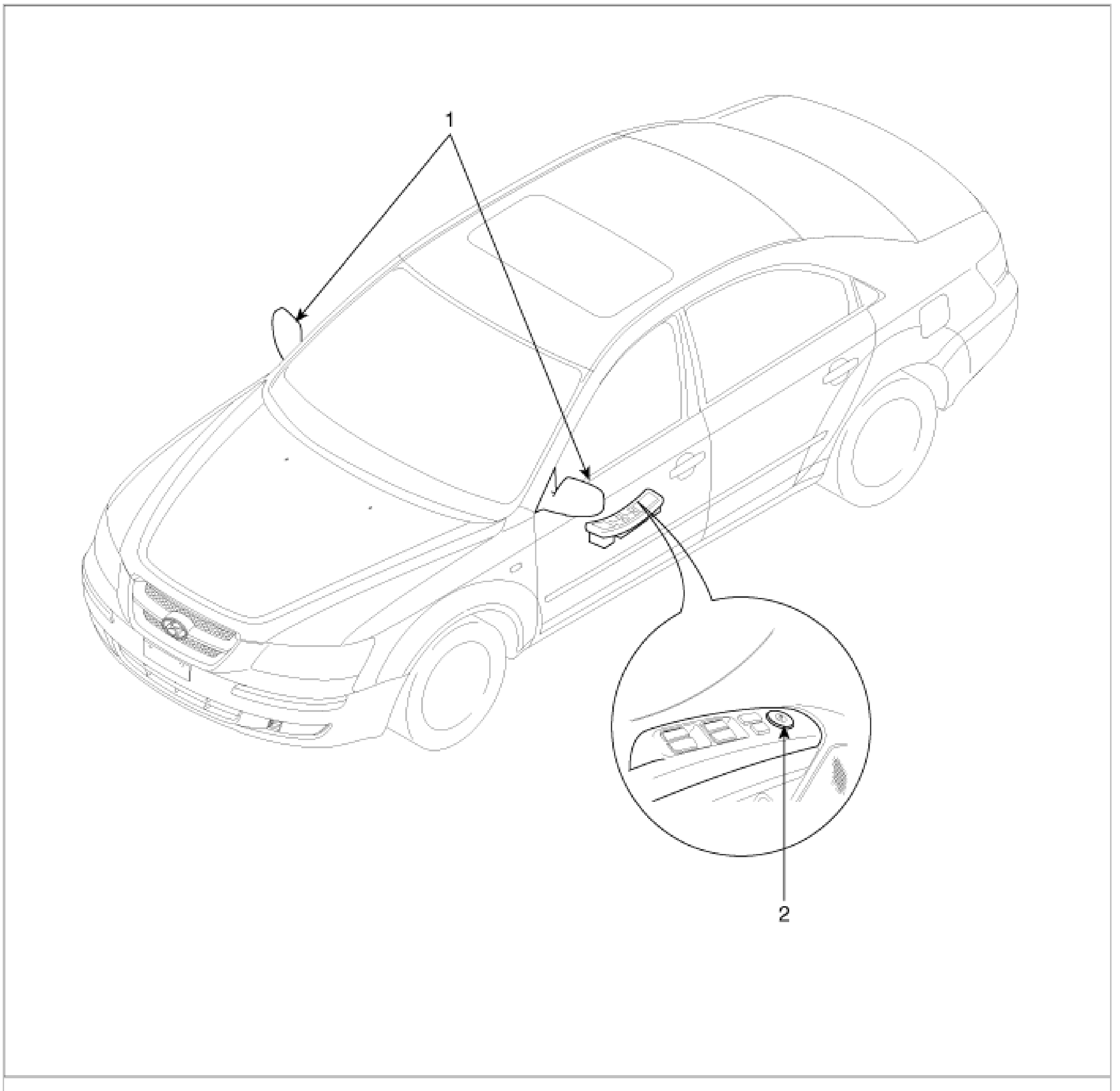


4. Check for continuity between the terminals in each switch position according to the table.

Terminal / Position	1	2	8
Lock		O	O
Unlock	O		O

Body Electrical System > Power Door Mirrors > Components and Components Location

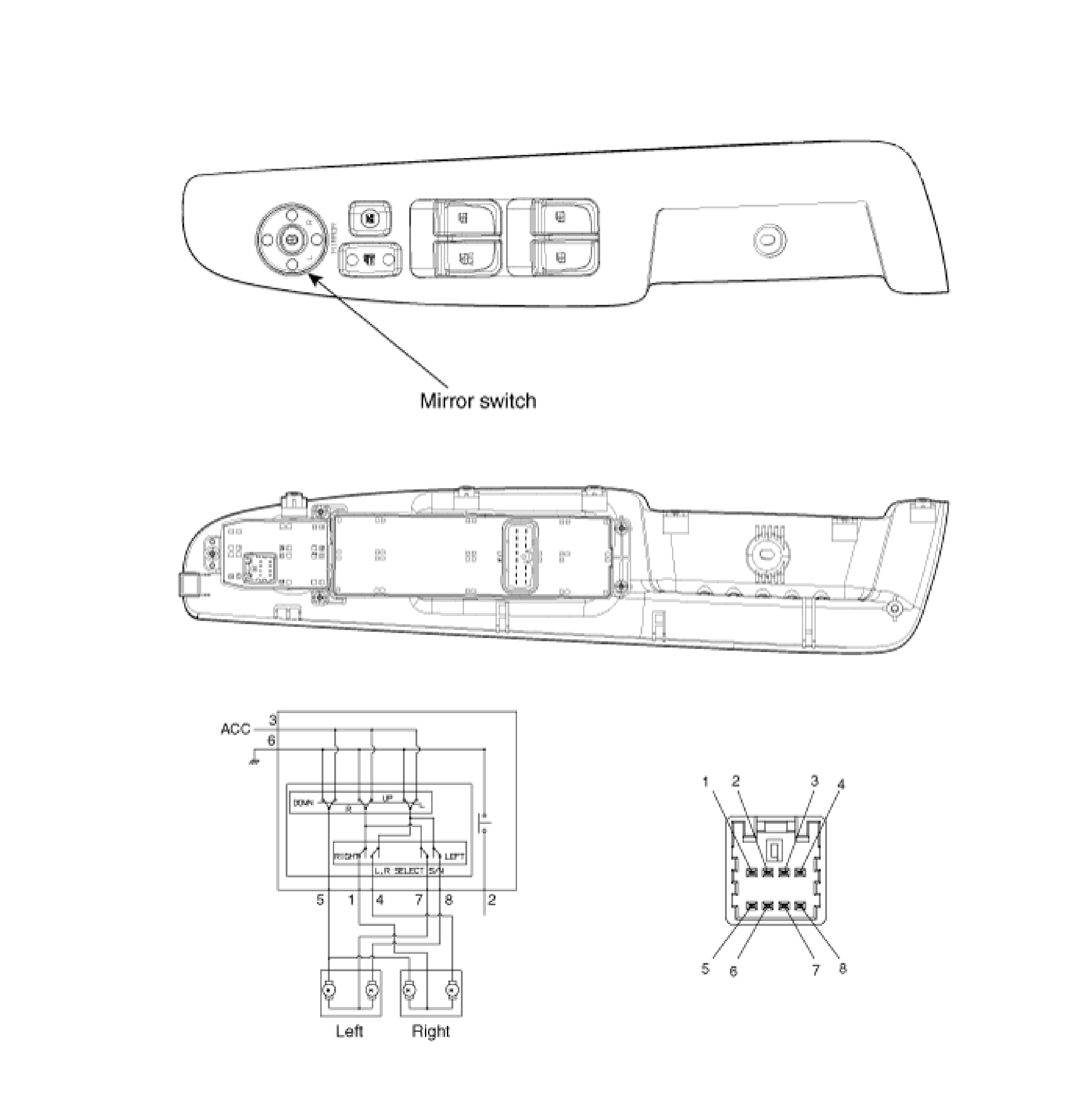
COMPONENT LOCATION



1. Power door mirror	2. Power door mirror switch

Body Electrical System > Power Door Mirrors > Power out side mirror switch > Components and Components Location

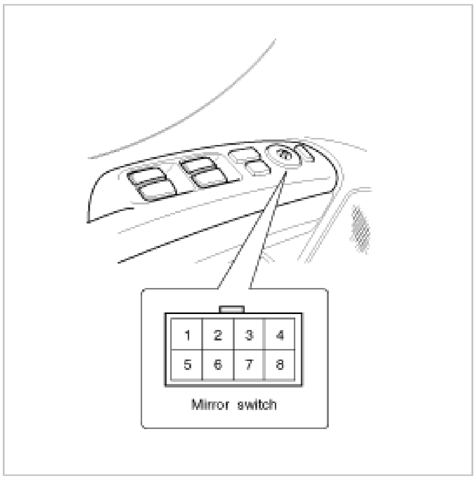
CIRCUIT DIAGRAM



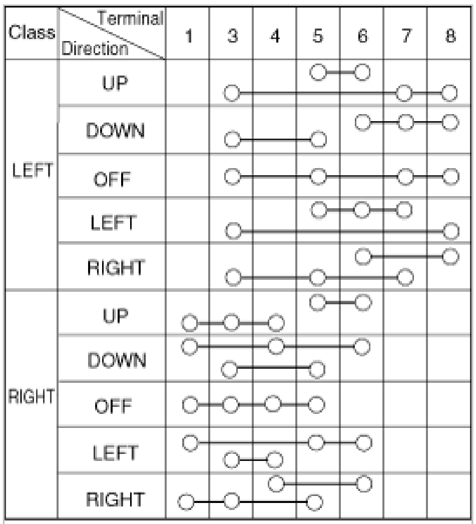
Body Electrical System > Power Door Mirrors > Power out side mirror switch > Repair procedures

INSPECTION

1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim panel. (Refer to the Body group-front door)
3. Disconnect the 8P connector from the switch.



4. Check for continuity between the terminals in each switch position according to the table.

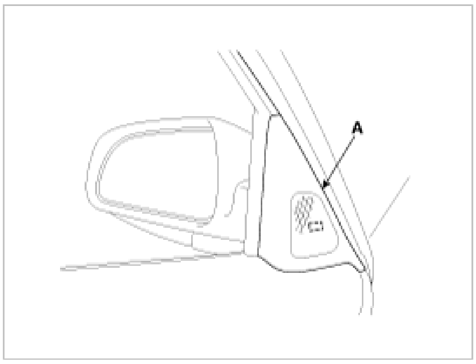


<Mirror switch>

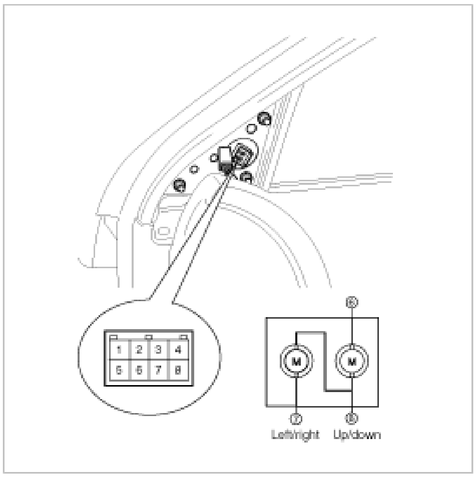
Body Electrical System > Power Door Mirrors > Power Door Mirror Actuator > Repair procedures

INSPECTION

1. Remove the front door quadrant inner cover (A) (Refer to the Body group - front door)



2. Disconnect the power door mirror connector from the harness.
3. Apply battery voltage to each terminal as shown in the table and verify that the mirror operates properly.



Terminal / Position	6	7	8
UP	⊖	⊕	⊕
DOWN	⊕	⊖	⊖
OFF	⊕	⊕	⊕
LEFT	⊖	⊕	⊖
RIGHT	⊕	⊖	⊕

MIRROR HEATER INSPECTION

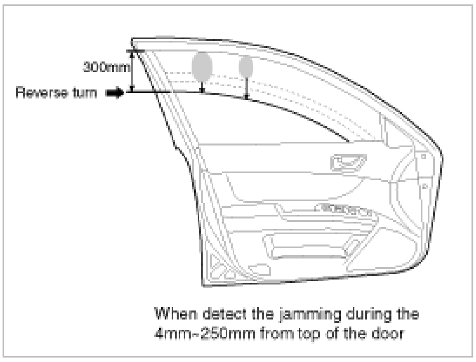
Terminal / Position	1	2
Heater	○	○

Body Electrical System > Power Windows > Description and Operation

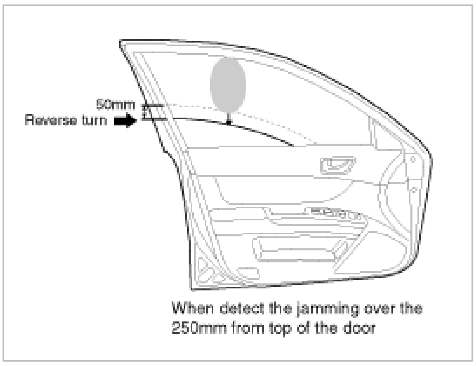
FUNCTION OF SAFETY POWER WINDOW

When driver door power window auto-up switch is operated, safety function is activated.

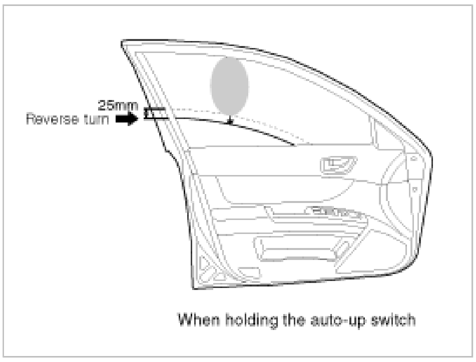
1. Safety function condition
   When detect the force of 100N during the window rising, window is reversed.
2. Length of window reversing (except holding the auto-up switch)
   A. When detect the jamming during the 4mm ~ 250mm from top of the door.
   → Window is reversed until 300mm from top of the door.



   B. When detect the jamming over the 250mm from top of the door.
   → Window is reversed until 50mm from jamming position.



3. Length of window reversing (holding the auto-up switch)
   A. When detect the jamming during holding the auto-up switch.
      → Window is reversed until 25mm from jamming position.
   B. Auto-up function is not available during the 5 seconds from above condition.
      → When holding the auto-up switch, window is operated as a manual-up function. (Safety function is not activated.)
   C. When holding the auto-up switch after 5 seconds from above condition.
      → Window is reverse until 25mm from jamming position.



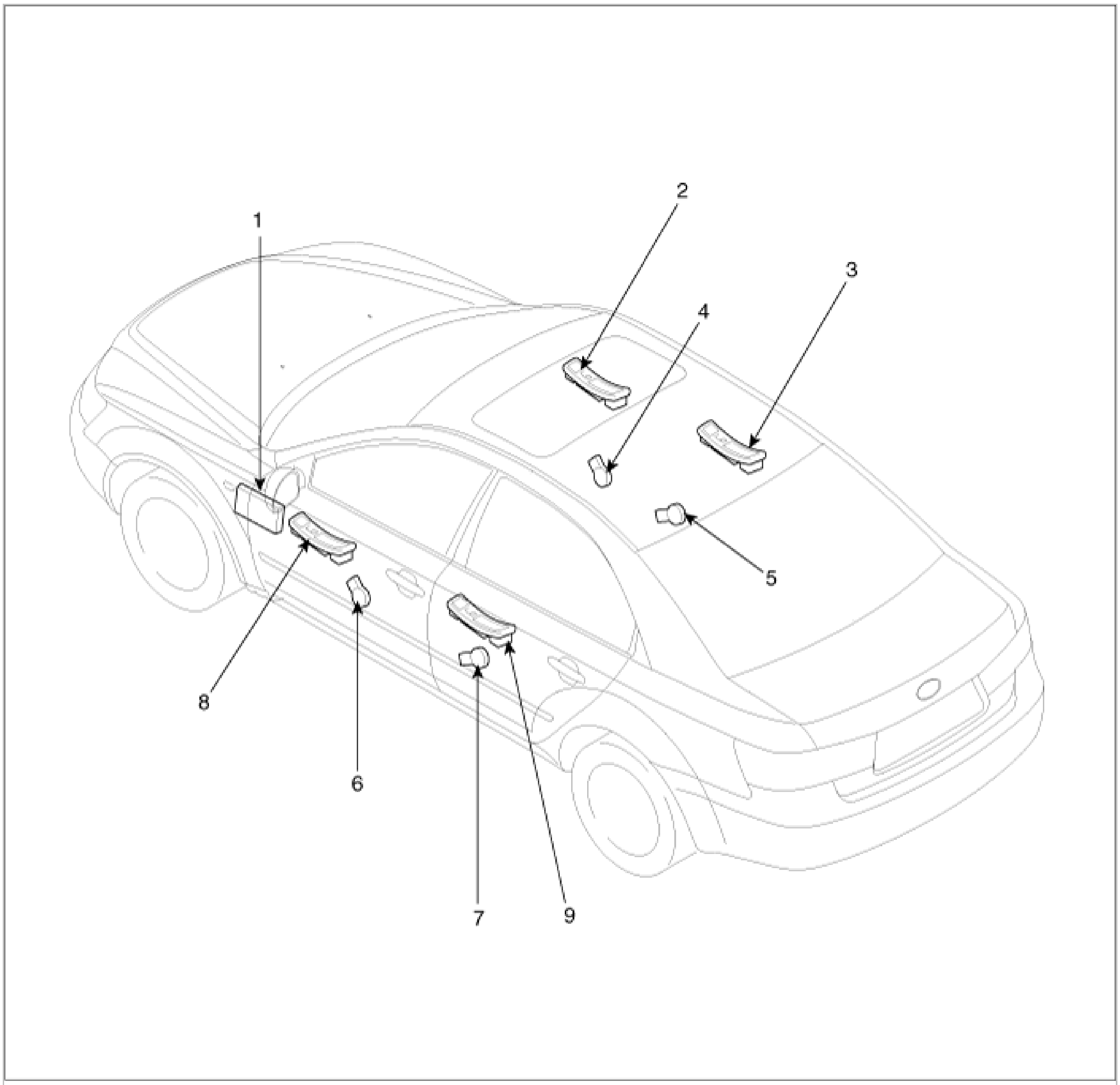
4. Safety function is not available area
   Safety function is not available during the 4mm from top of the door.

INITIALIZING METHOD OF THE SAFETY POWER WINDOW

1. Initializing of Battery Connection
   When the battery is not connected the vehicle over the 5 minutes, safety power window switch need the initializing.
   (1) Power window operation before initializing
      A. Manual-Up/Down function is available
      B. Auto-Up function is not available
         (When holding the auto-up/down switch, window is operated as a manual-up/down.)
   (2) Initializing method
      Close the window in window open position, and holding the switch in window full close position over the 0.2 second.
      (If start the closing the window in window full close position, initializing could be failed.)
   (3) If initialize the safety power window in jamming status, could occur below conditions.
      A. Safety function is not available
2. Initializing of fail safe mode
   (1) If the window moved by compulsion and motor have a problem, power window switch could be entering the fail safe mode for user's safety.
   (2) Power window operation in fail mode
      A. Auto/Manual-Down function is available
      B. Auto/Manual-Up function is not available
         (When auto/manual-up is operated, window is rising 20mm and is stopped the moving.)

Body Electrical System > Power Windows > Components and Components Location

COMPONENT LOCATION

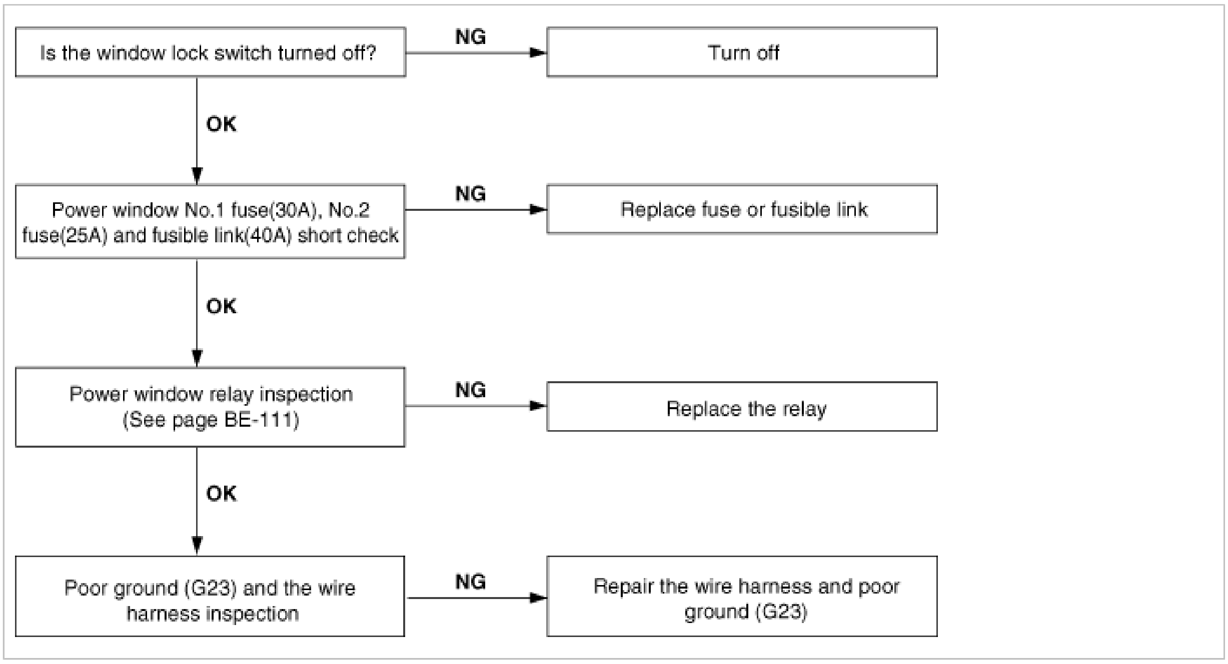


1. Passenger compartment junction box (Power window relay)
2. Assist window switch
3. Rear window switch
4. Front window motor
5. Rear window motor
6. Front window motor (Safety window)
7. Rear window motor
8. Driver window main switch
9. Rear window switch

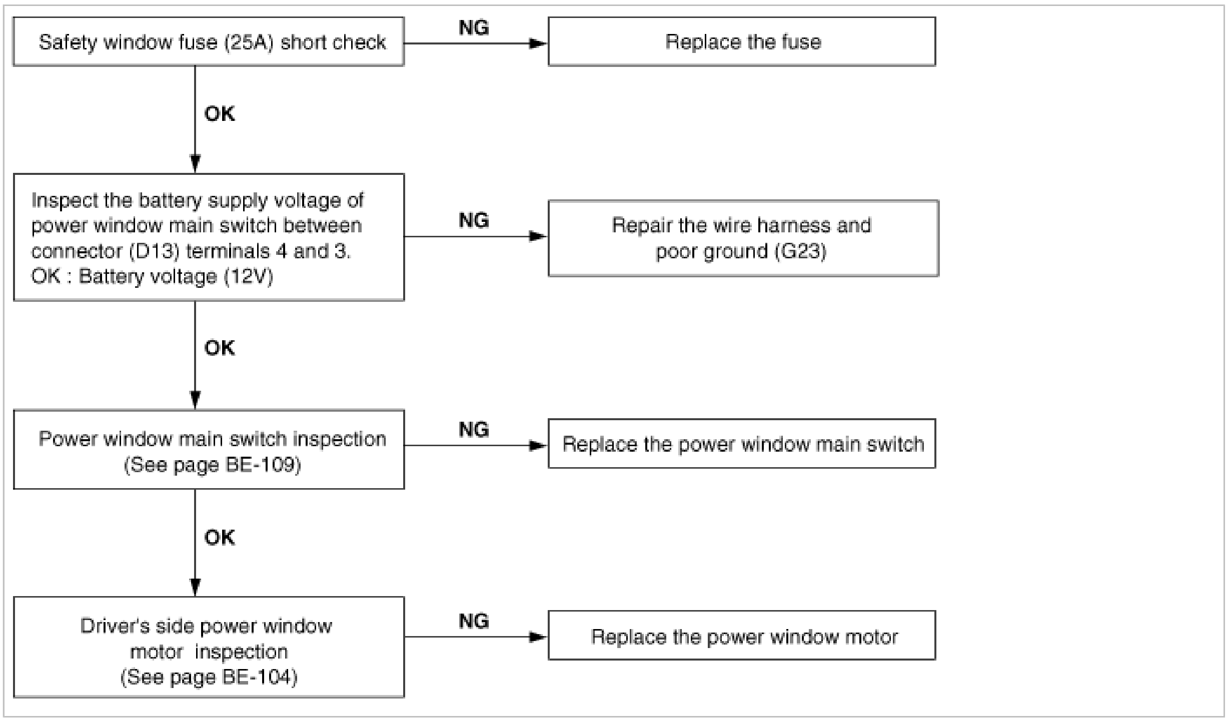
Body Electrical System > Power Windows > Troubleshooting

TROUBLESHOOTING

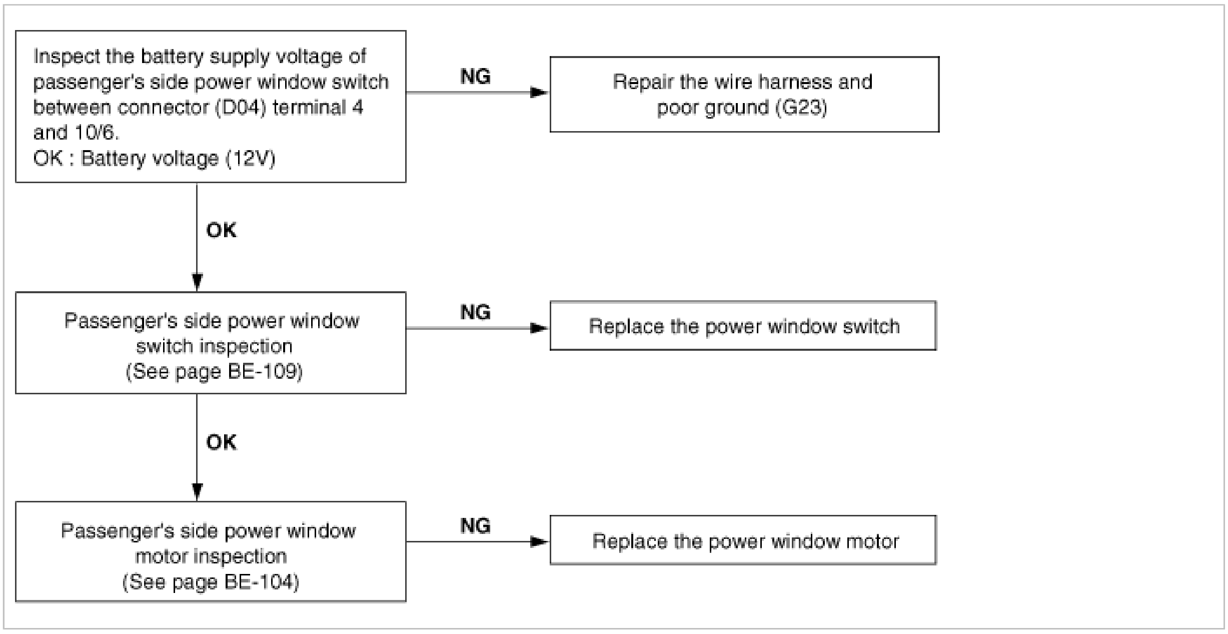
1. No windows operate from the main switch on the driver's door.



2. Driver's side window does not operate.



3. Passenger's side window does not operate.

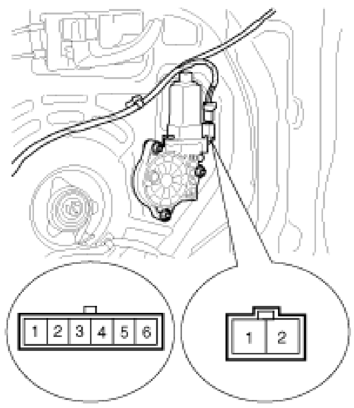


Body Electrical System > Power Windows > Power Window Motor > Repair procedures

INSPECTION

FRONT POWER WINDOW MOTOR INSPECTION

1. Remove the front door trim panel. (Refer to the Body group-front door)
2. Disconnect the connector from the motor.



[Safety power window]

3. Connect the motor terminals directly to battery voltage (12V) and check that the motor operates smoothly. Next, reverse the polarity and check that the motor operates smoothly in the reverse direction. If the operation is abnormal, replace the motor.

Position \ Terminal			1	2
LH	UP	Clockwise	⊖	⊕
	DOWN	Counter-clockwise	⊕	⊖
RH	DOWN	Clockwise	⊕	⊖
	UP	Counter-clockwise	⊖	⊕

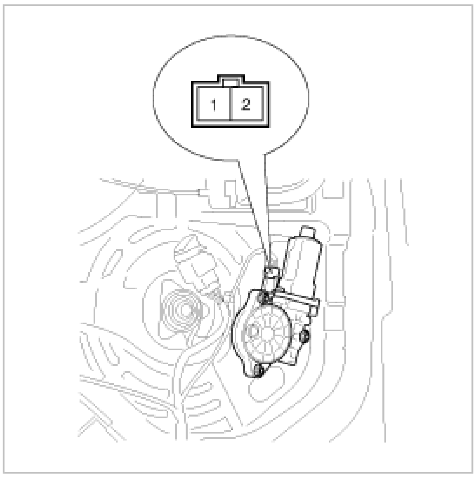
[With driver's side safety window]

Position \ Terminal			1	2	3	4	6
Driver's side	UP	Clockwise		⊕	⊖	⊕	⊖
	DOWN	Counter-clockwise	⊕		⊖	⊕	⊖

REAR POWER WINDOW MOTOR INSPECTION

1. Remove the rear door trim panel. (Refer to the Body group-rear door)

2. Disconnect the 2P connector from the motor.

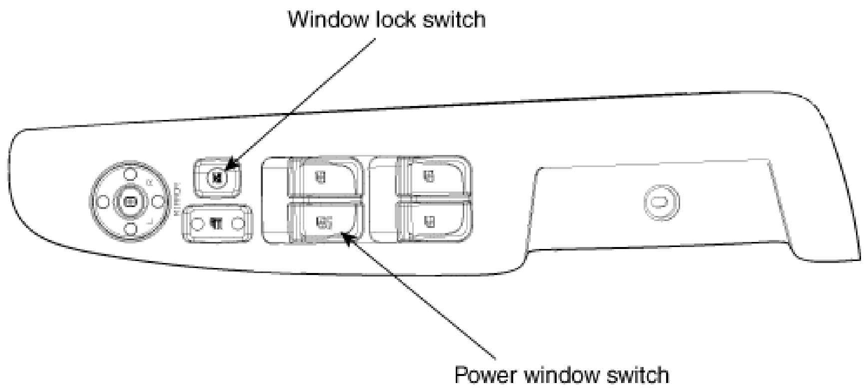


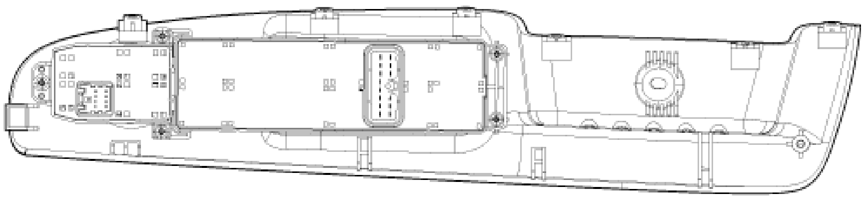
3. Connect the motor terminals directly to battery voltage (12V) and check that the motor operates smoothly. Next, reverse the polarity and check that the motor operates smoothly in the reverse direction. If the operation is abnormal, replace the motor.

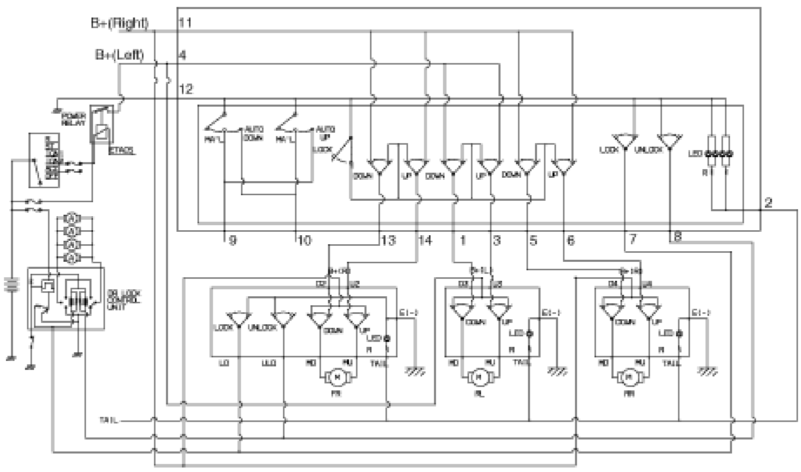
Position		Terminal	1	2
LH	UP	Clockwise	⊖	⊕
LH	DOWN	Counter-clockwise	⊕	⊖
RH	DOWN	Clockwise	⊕	⊖
RH	UP	Counter-clockwise	⊖	⊕

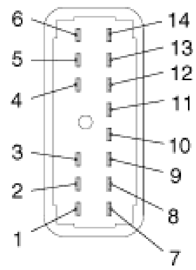
Body Electrical System > Power Windows > Power Window Switch > Schematic Diagrams

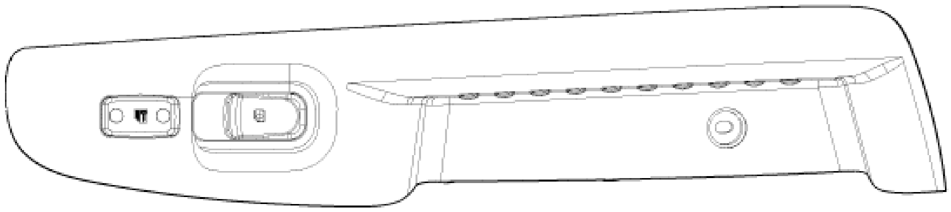
CIRCUIT DIAGRAM

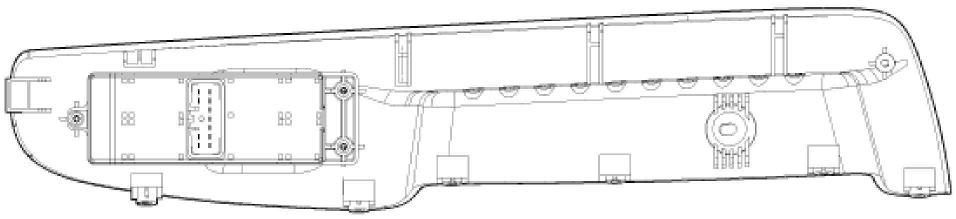

Window lock switch
Power window switch

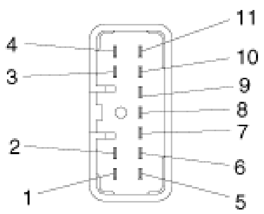



B+(Right)
B+(Left)

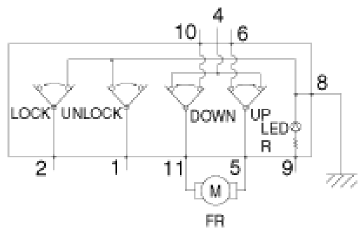

6
5
4
3
2
1
14
13
12
11
10
9
8
7



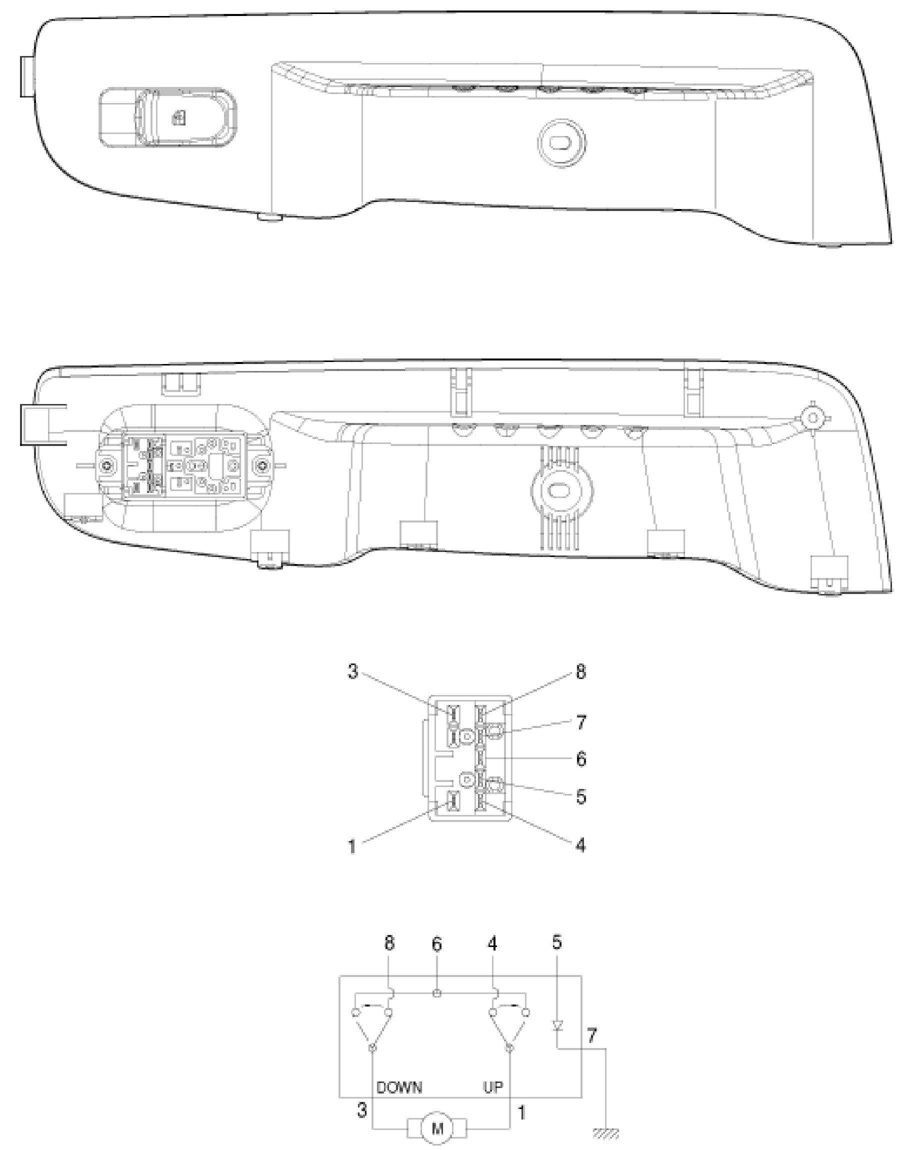




4
3
2
1
11
10
9
8
7
6
5



10
4
6
8
LOCK
UNLOCK
DOWN
UP
LED
R
2
1
11
5
9
M
FR

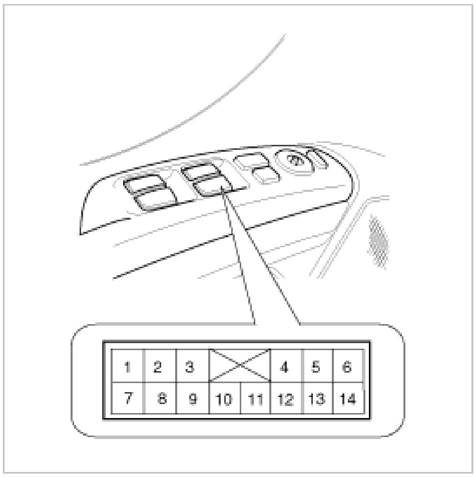


Body Electrical System > Power Windows > Power Window Switch > Repair procedures

INSPECTION

POWER WINDOW MAIN SWITCH INSPECTION

1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim panel. (Refer to the Body group - front door)
3. Disconnect the 14P connector from the switch.



4. Check for continuity between the terminals in each switch position according to the table. If the continuity condition is not normal, replace the switch.

Terminal / Position	Front left 4	Front left 9	Front left 10	Front left 12	Front right 11	Front right 12	Front right 13	Front right 14
UP			○	○	○	○	○	○
OFF		○		○		○	○	○
DOWN	○	○	○	○	○	○	○	○

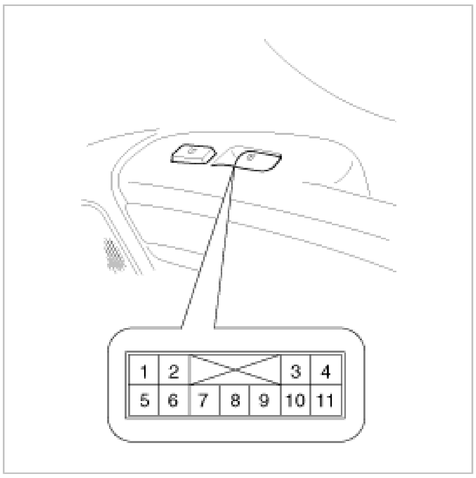
Terminal / Position	Rear left 1	Rear left 3	Rear left 4	Rear left 12	Rear right 5	Rear right 6	Rear right 11	Rear right 12
UP	○	○	○	○	○	○	○	○
OFF	○	○		○	○	○		○
DOWN	○	○	○	○	○	○	○	○

POWER WINDOW LOCK SWITCH

Terminal / Position	1	12
NORMAL	○	○
LOCK		

ASSIST POWER WINDOW SWITCH INSPECTION

1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim panel. (Refer to the Body group - front door)
3. Disconnect the 11P connector from the switch.

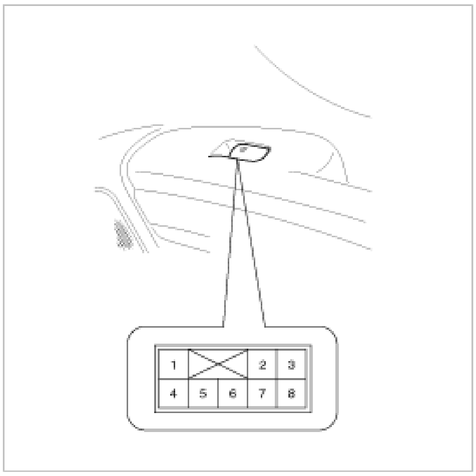


4. Check for continuity between the terminals in each switch position according to the table. If the continuity condition is not normal, replace the switch.

Position \ Terminal	4	5	6	10	11
UP	○	○		○	○
OFF		○	○	○	○
DOWN	○	○	○		○

REAR POWER WINDOW SWITCH INSPECTION

1. Disconnect the negative (-) battery terminal.
2. Remove the rear door trim panel. (Refer to the Body group - rear door)
3. Disconnect the 8P connector from the switch.



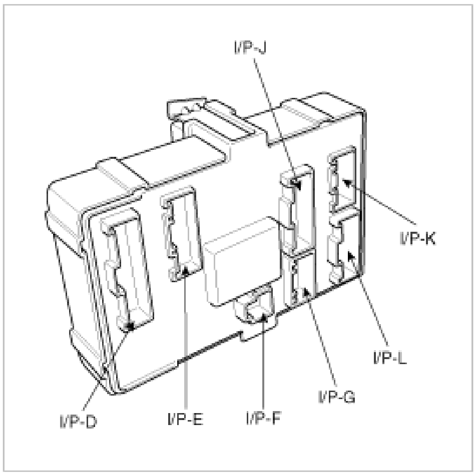
4. Check for continuity between the terminals in each switch position according to the table. If the continuity condition is not normal, replace the switch.

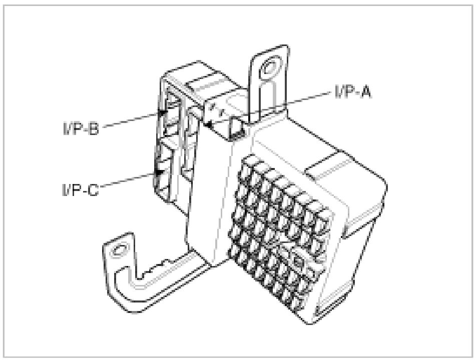
Position \ Terminal	1	3	4	6	8
UP	○	○		○	○
OFF	○	○	○		○
DOWN	○	○	○	○	

Body Electrical System > Power Windows > Power Window Relay > Repair procedures

INSPECTION

1. Disconnect the negative (-) battery terminal.
2. Remove the junction box.
3. Check for continuity between the terminals.
4. There should be continuity between the No.1 in the I/P-G and No.12 terminal in the I/P-A when power and ground are connected to the No.1 terminal in the I/P-G and No.2 terminal in the I/P-A.
5. There should be no continuity between the No.1 terminal in the I/P-G and No.12 terminal in the I/P-A when power is disconnected.





Terminal / Power	I/P-A (12)	I/P-G (1)	I/P-A (2)	I/P-G (1)
Disconnected			○	○
Connected	○	○	⊖	⊕

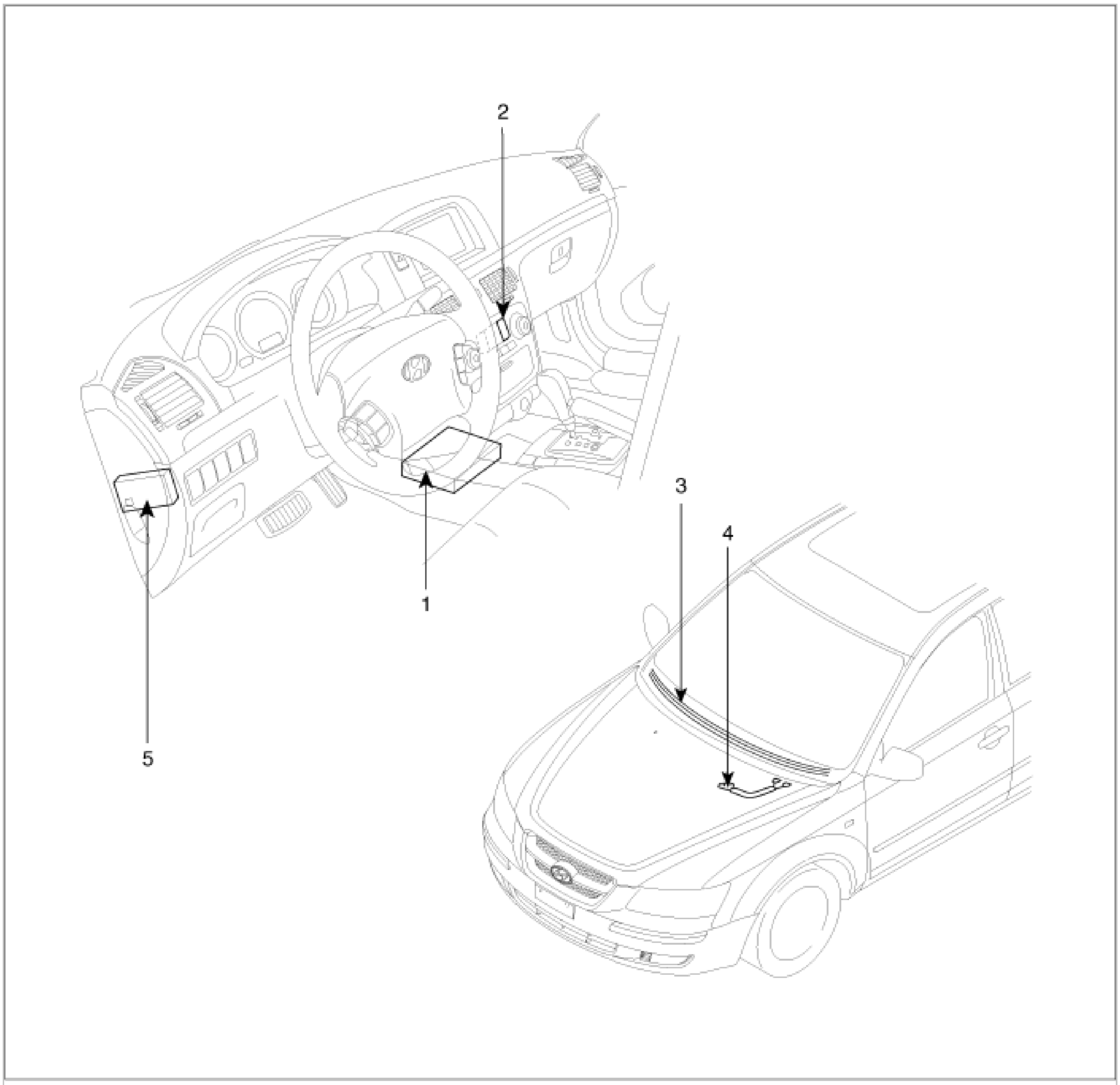
Body Electrical System > Windshield Deicer > Description and Operation

DESCRIPTION

Windshield deicer system prevent windshield wiper from freezing in the winter season. It consists of deicer in the lower part of windshield, switch and relay. Body control module receives an input signal from the deicer switch, then controls relay. Operating condition is the same that of rear window defogger system.
Since the generator "L" is switched ON, if the deicer switch is ON, then deicer output is ON for 20 minutes.

Body Electrical System > Windshield Deicer > Components and Components Location

COMPONENT LOCATION

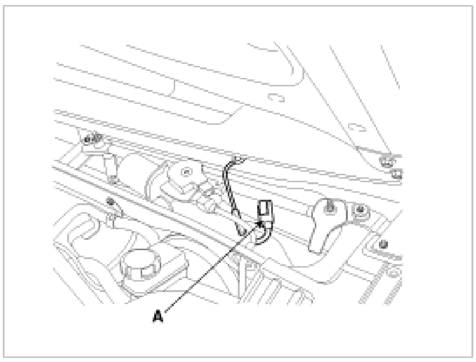


1. Body control module
2. Windshield deicer switch
3. Windshield deicer
4. Deicer connector
5. Windshield deicer relay (Built-in junction box)

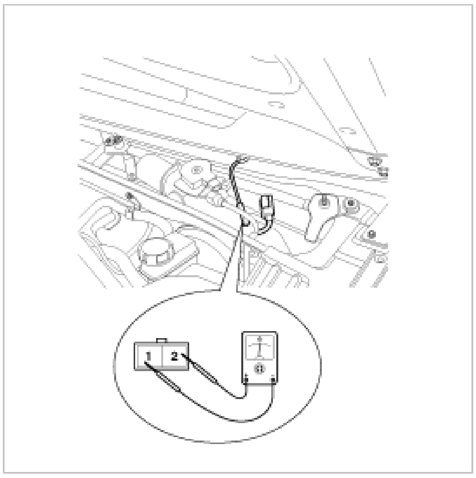
Body Electrical System > Windshield Deicer > Windshield Deicer > Repair procedures

INSPECTION

1. Remove the cowl top cover.(Refer to the wiper)
2. Disconnect the windshield deicer connector (A) from the wiper motor linkage.

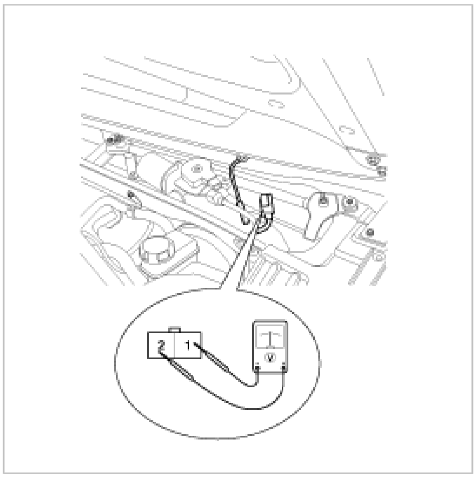


3. Check for continuity between the terminals of deicer lines.



4. Turn the ignition switch ON and the windshield deicer switch ON, then measure the voltage between the terminals of harness side deicer connector.

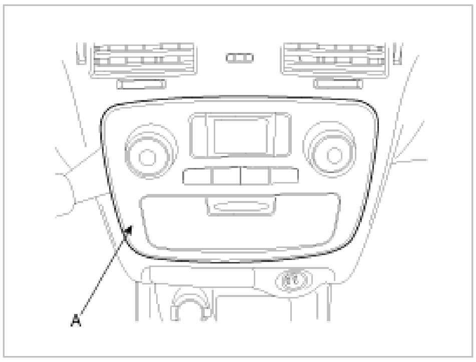
OK: approx. Battery voltage



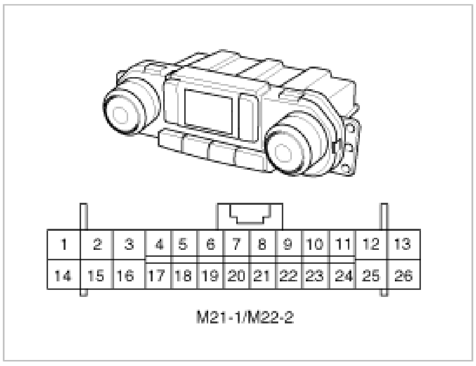
Body Electrical System > Windshield Deicer > Windshield Deicer Switch > Repair procedures

INSPECTION

1. Disconnect the negative (-) battery terminal.
2. Remove the center facia panel(A) by using a scraper (B). Take care of fixing clip.



3. Disconnect the connectors.
4. Using an ohmmeter, inspection the continuity between the terminals after removing to the switch connector.



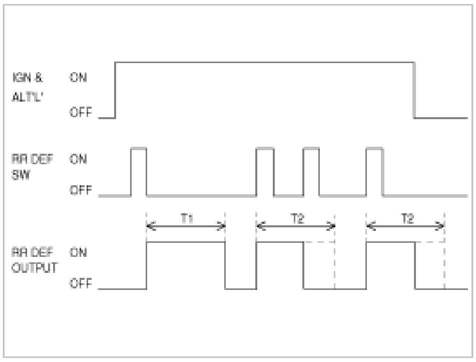
Terminal / Position	M22-2 (23)	M22-2 (26)	M21-1 (26)	M21-1 (10)
ON (Manual)	O	O		
ON (Auto)			O	O
OFF				

Body Electrical System > Windshield Deicer > Windshield Deicer Timer > Repair procedures

INSPECTION

While operating the components, check whether the operations are normal as shown in the timing chart.

1. Once ALT "L" is ON, if the defogger is switched ON, the defogger will stay ON for 20 minutes duration.
2. If defogger switch is pressed again (see Step 1), or if ignition is switched OFF, the defogger will shut OFF.

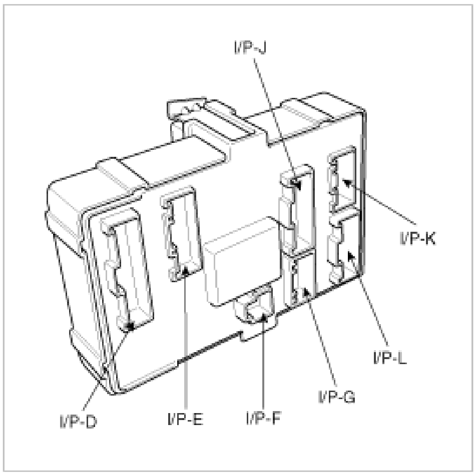


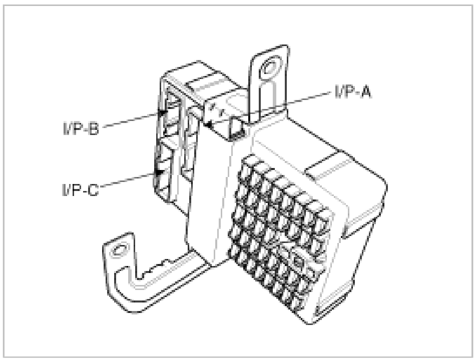
T1 : 20 ± 1 min.
T2 : MAX 20 ± 1 min.

Body Electrical System > Windshield Deicer > Windshield Deicer Relay > Repair procedures

INSPECTION

1. Disconnect the negative (-) battery terminal.
2. Remove the junction box.
3. Check for continuity between the terminals.
4. There should be continuity between the No.2 in the I/P-G and No.8 terminal in the I/P-K when power and ground are connected to the No.2 terminal in the I/P-G and No.8 terminal in the I/P-C.
5. There should be no continuity between the No.2 terminal in the I/P-G and No.8 terminal in the I/P-K when power is disconnected.

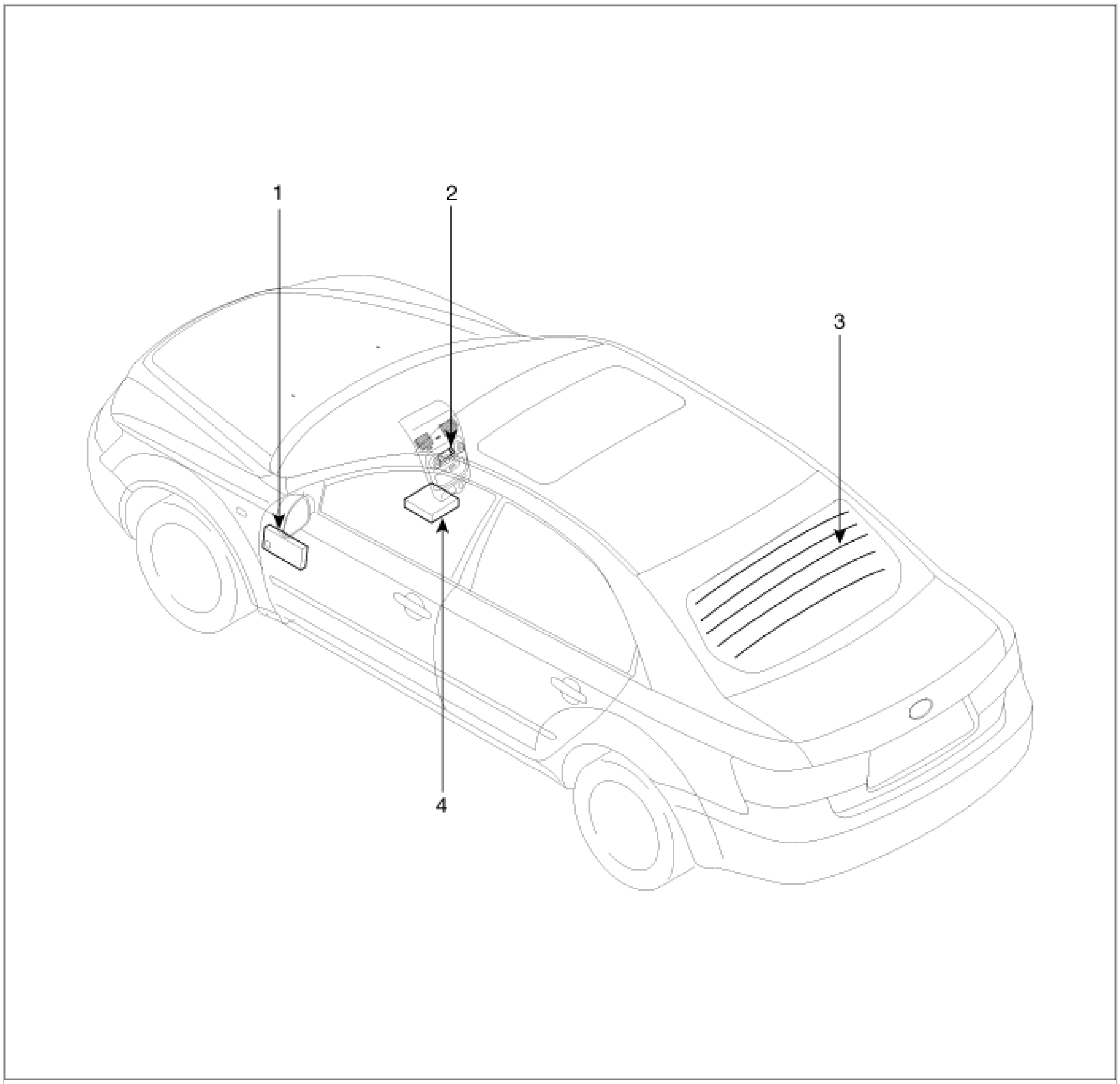




Terminal / Power	I/P-K (8)	I/P-G (2)	I/P-C (8)	I/P-G (2)
Disconnected			○	○
Connected	○	○	⊖	⊕

Body Electrical System > Rear Window Defogger > Components and Components Location

COMPONENT LOCATION



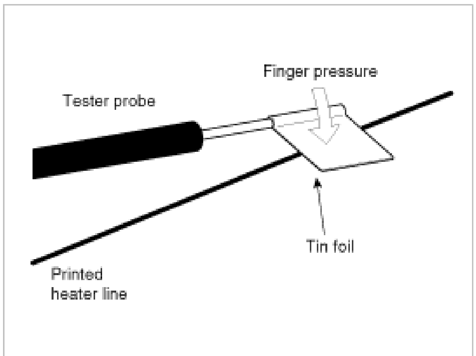
1. Junction box (Rear window defogger)
2. Rear window defogger switch (A/C controller)
3. Rear window defogger
4. Body control module

Body Electrical System > Rear Window Defogger > Rear Window Defogger Printed Heater > Repair procedures

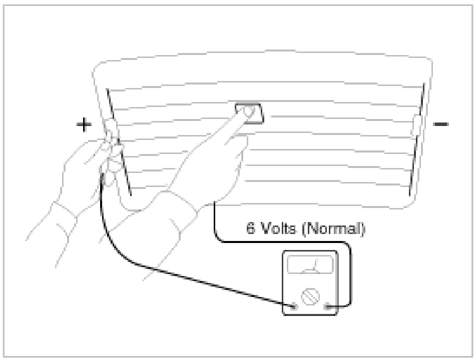
INSPECTION

CAUTION

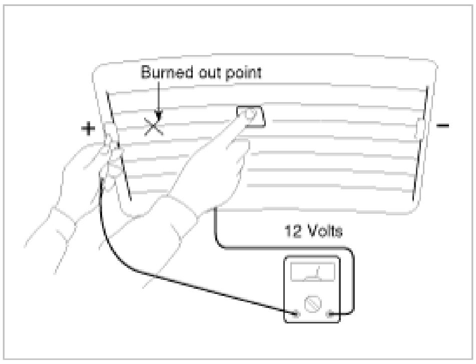
Wrap tin foil around the end of the voltmeter test lead to prevent damaging the heater line. Apply finger pressure on the tin foil, moving the tin foil along the grid line to check for open circuits.



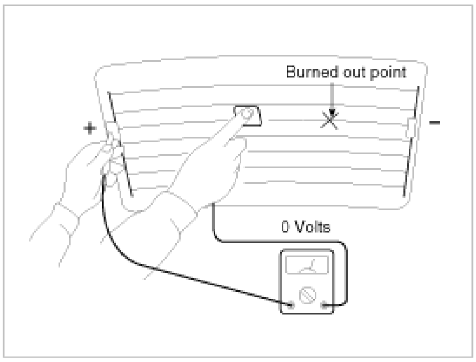
1. Turn on the defogger switch and use a voltmeter to measure the voltage of each heater line at the glass center point. If a voltage of approximately 6V is indicated by the voltmeter, the heater line of the rear window is considered satisfactory.



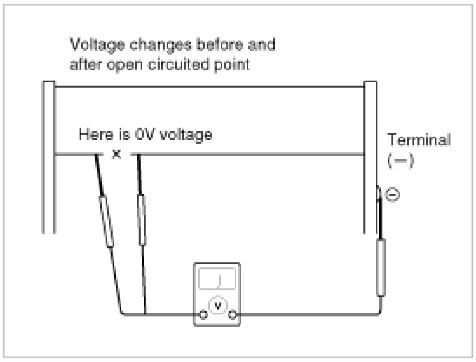
2. If a heater line is burned out between the center point and (+) terminal, the voltmeter will indicate 12V.



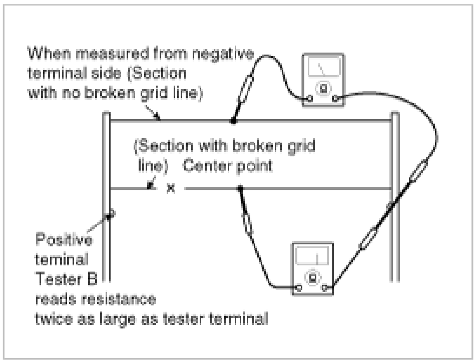
3. If a heater line is burned out between the center point and (-) terminal, the voltmeter will indicate 0V.



4. To check for open circuits, slowly move the test lead in the direction that the open circuit seems to exist. Try to find a point where a voltage is generated or changes to 0V. The point where the voltage has changed is the open-circuit point.



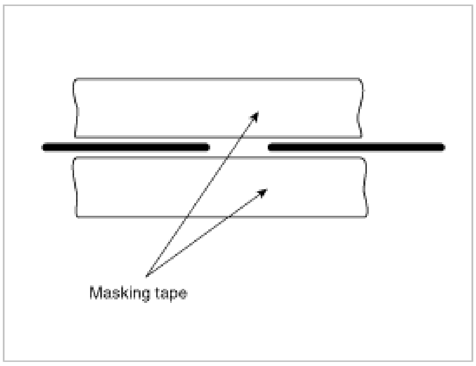
5. Use an ohmmeter to measure the resistance of each heater line between a terminal and the center of a grid line, and between the same terminal and the center of one adjacent heater line. The section with a broken heater line will have a resistance twice as that in other sections. In the affected section, move the test lead to a position where the resistance sharply changes.



REPAIR OF BROKEN HEATER LINE

Prepare the following items:

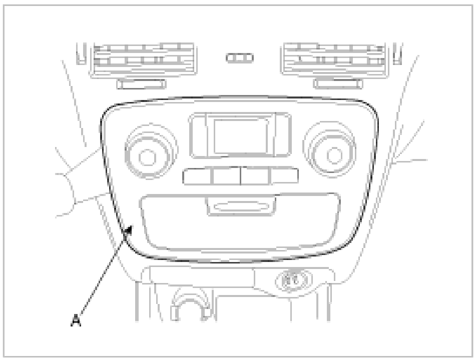
1. Conductive paint.
2. Paint thinner.
3. Masking tape.
4. Silicone remover.
5. Using a thin brush:
   Wipe the glass adjacent to the broken heater line, clean with silicone remover and attach the masking tape as shown. Shake the conductive paint container well, and apply three coats with a brush at intervals of about 15 minutes apart. Remove the tape and allow sufficient time for drying before applying power. For a better finish, scrape away excess deposits with a knife after the paint has completely dried. (Allow 24 hours).



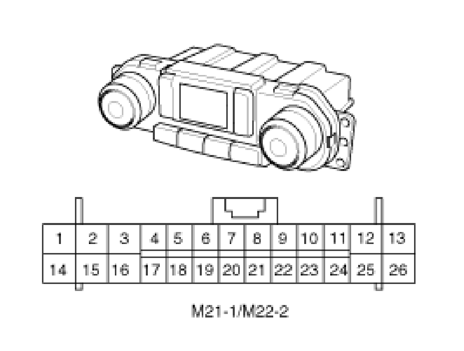
Body Electrical System > Rear Window Defogger > Rear Window Defogger Switch > Repair procedures

INSPECTION

1. Disconnect the negative (-) battery terminal.
2. Remove the center facia panel(A) by using a scraper (B). Take care of fixing clip.



3. Disconnect the connectors.
4. Using an ohmmeter, inspection the continuity between the terminals after removing to the switch connector.

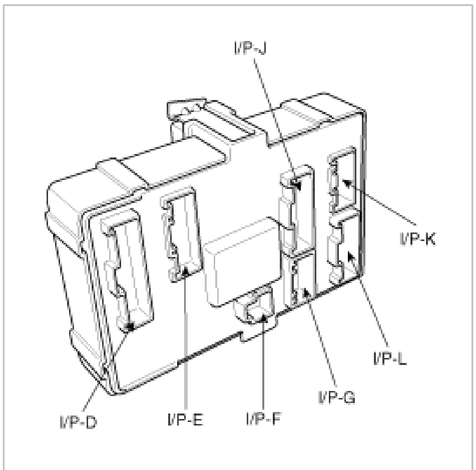


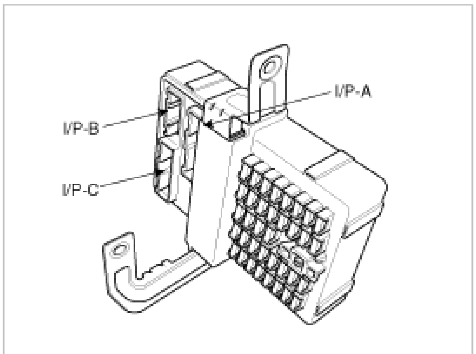
Position \ Terminal	M22-2 (23)	M22-2 (26)	M21-1 (26)	M21-1 (10)
ON (Manual)	O	O		
ON (Auto)			O	O
OFF				

Body Electrical System > Rear Window Defogger > Rear Window Defogger Relay > Repair procedures

INSPECTION

1. Disconnect the negative (-) battery terminal.
2. Remove the junction box.
3. Check for continuity between the terminals.
4. There should be continuity between the No.2 in the I/P-G and No.7 terminal in the I/P-C when power and ground are connected to the No.2 terminal in the I/P-G and No.8 terminal in the I/P-C.
5. There should be no continuity between the No.2 terminal in the I/P-G and No.7 terminal in the I/P-C when power is disconnected.





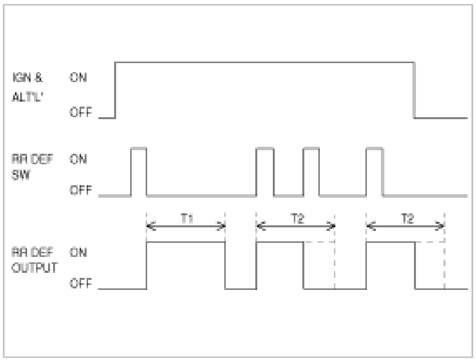
Power \ Terminal	I/P-C (7)	I/P-G (2)	I/P-C (8)	I/P-G (2)
Disconnected			○—	—○
Connected	○—	—○	⊖—	—⊕

Body Electrical System > Rear Window Defogger > Rear Window Defogger Timer > Repair procedures

INSPECTION

While operating the components, check whether the operations are normal as shown in the timing chart.

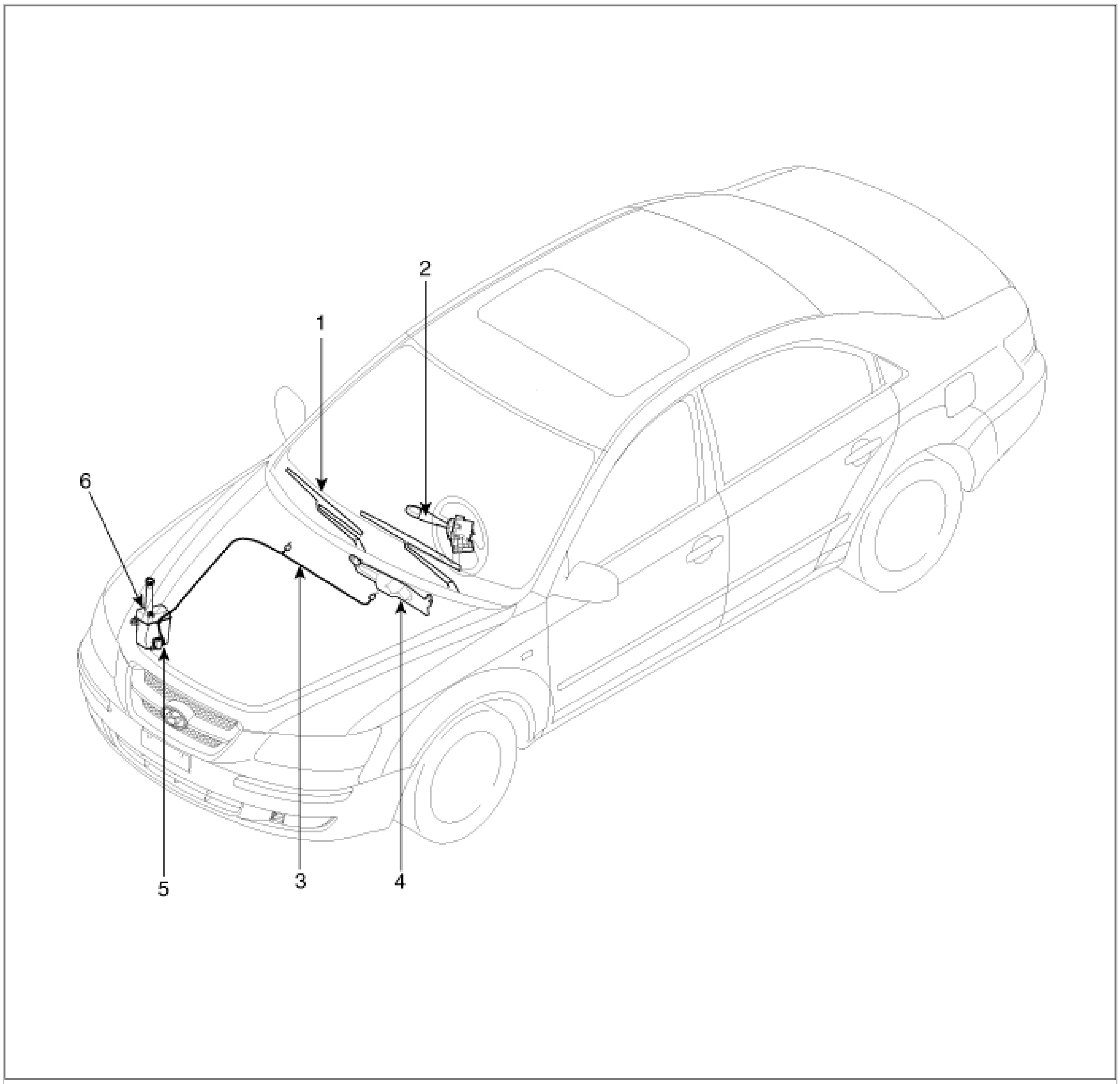
1. Once ALT "L" is ON, if the defogger is switched ON, the defogger will stay ON for 20 minutes duration.
2. If defogger switch is pressed again (see Step 1), or if ignition is switched OFF, the defogger will shut OFF.



T1 : 20 ± 1 min.
T2 : MAX 20 ± 1 min.

Body Electrical System > Windshield Wiper/Washer > Components and Components Location

COMPONENT LOCATION

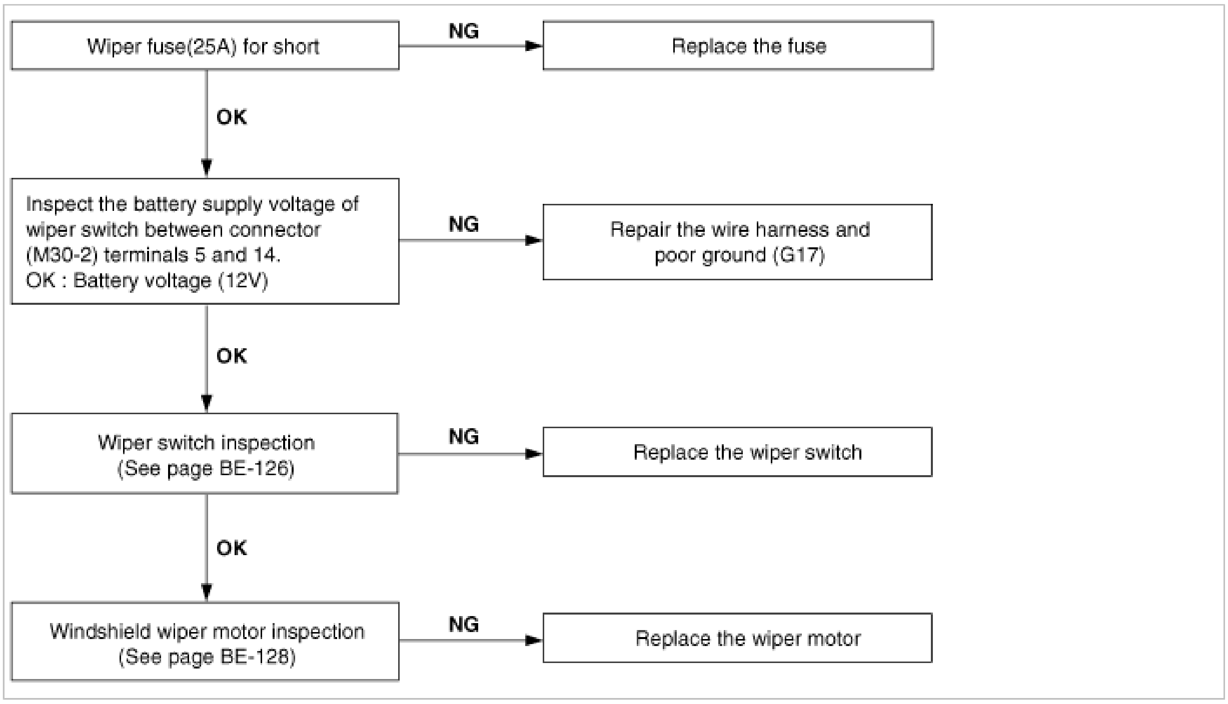


1. Windshield wiper arm & blade
2. Wiper & washer switch
3. Windshield washer hose
4. Windshield wiper motor & linkage
5. Washer motor
6. Washer reservoir

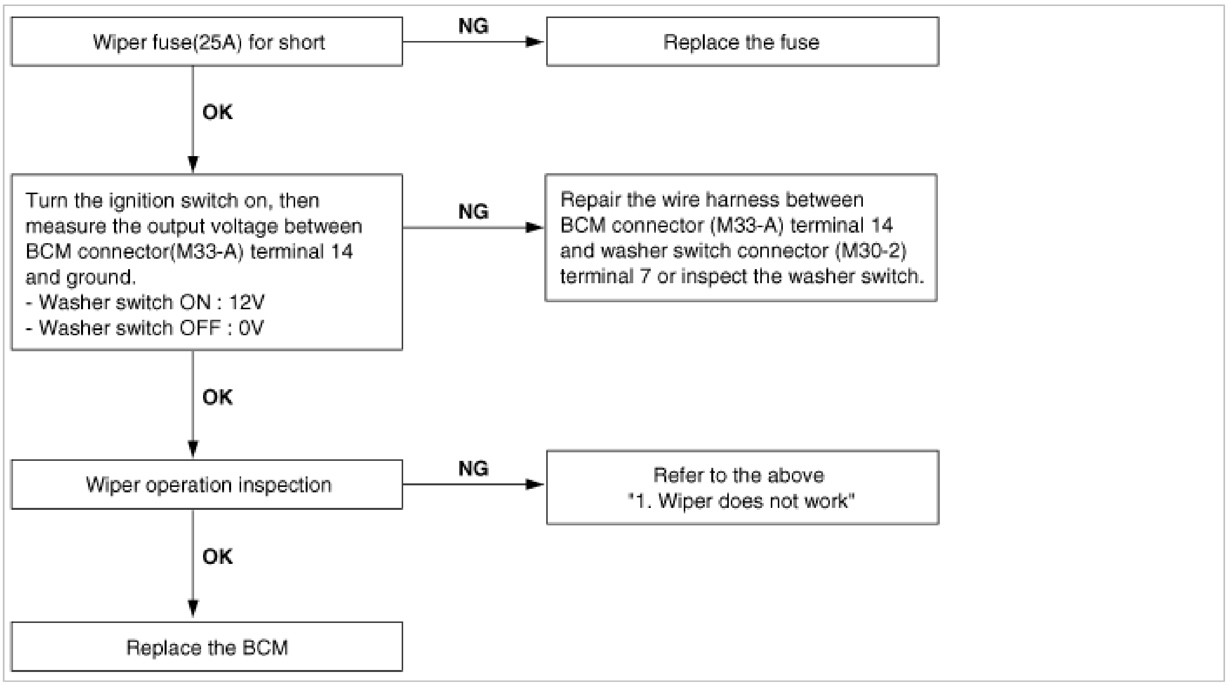
Body Electrical System > Windshield Wiper/Washer > Troubleshooting

TROUBLESHOOTING

1. Wiper low and wiper high do not work.



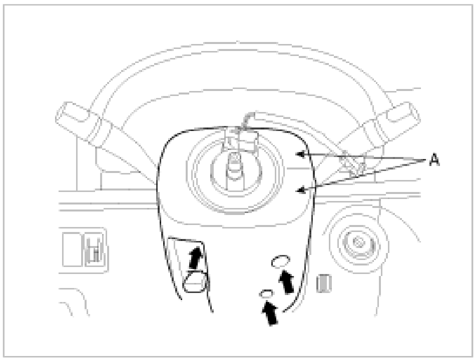
2. When washer switch is on, wiper does not work.



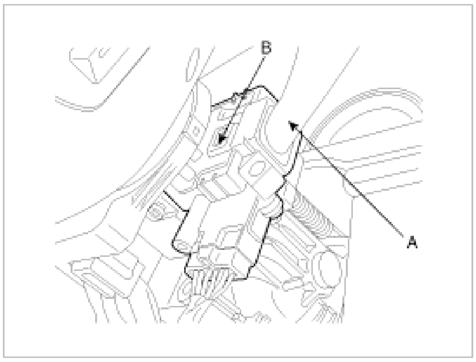
Body Electrical System > Windshield Wiper/Washer > Windshield Wiper/Washer Switch > Repair procedures

REPLACEMENT

1. Remove the steering column upper and lower shrouds (A) after removing 3 screws.



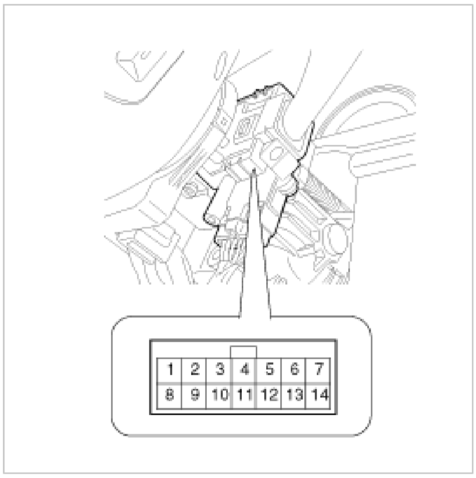
2. Remove the wiper switch (A) by pushing the lock pin (B) after disconnecting the connector.



3. Installation is the reverse of removal.

INSPECTION

Check for continuity between the terminals while operating the wiper and washer switch. If it is not normal condition, replace wiper and wiper switch.



WIPER SWITCH

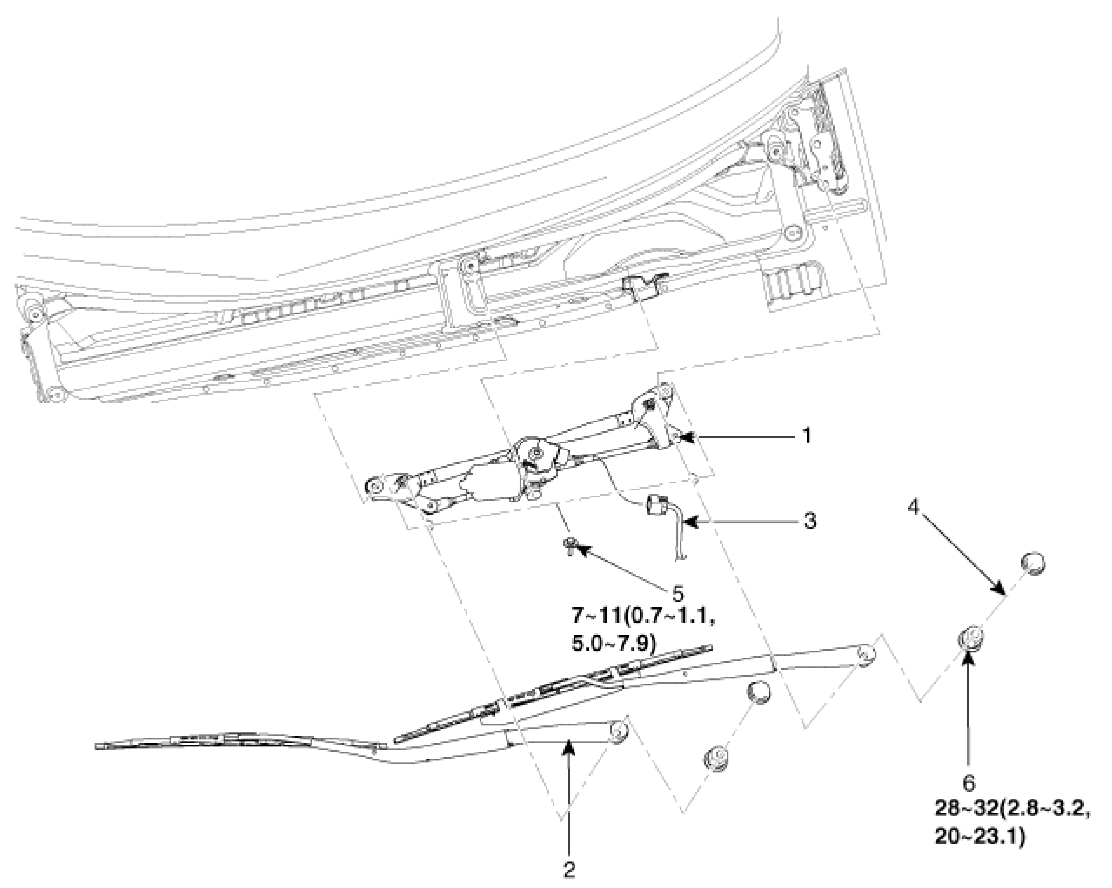
Position \ Terminal	1	2	3	4	5	6	13	14
MIST				O	O			
OFF		O	O					
INT		O	O		O	O	O	O
LOW		O			O			
HI	O				O			

WASHER SWITCH

Position \ Terminal	5	7
OFF		
ON	O	O

Body Electrical System > Windshield Wiper/Washer > Front Wiper Motor > Components and Components Location

COMPONENT LOCATION



TORQUE : Nm(kgf.m, lbf.ft)

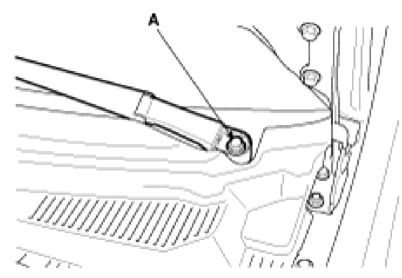
1. Wiper motor & linkage assembly	4. Cap
2. Wiper arm & blade	5. Bolt
3. Wiper motor connector	6. Nut

Body Electrical System > Windshield Wiper/Washer > Front Wiper Motor > Repair procedures

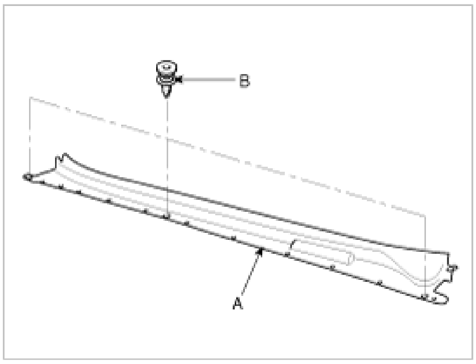
REMOVAL

1. Remove the windshield wiper arm and blade after removing a nut (A).

TORQUE: 28~32 Nm (2.8~3.2 kgf.m, 20~23.1 lbf.ft)

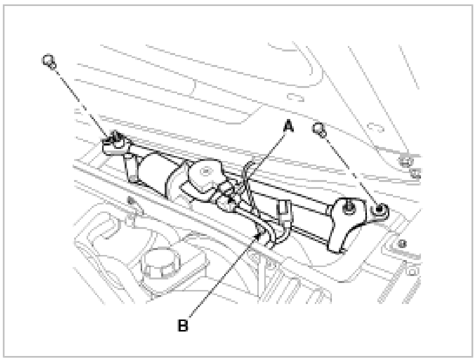


2. Remove the weather strip then remove the cowl top cover (A) after removing 3 clips (B).



3. Remove the windshield wiper motor and linkage assembly after removing 2 bolts. Disconnect the wiper motor connector (A) and windshield deicer connector (B) from the wiper motor & linkage assembly.

TORQUE: 7-11Nm (0.7-1.1, kgf.m, 5.0-7.9 lbf.ft)

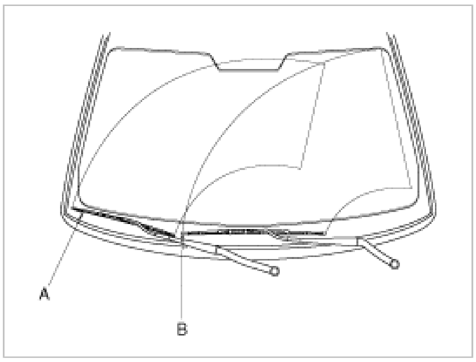


4. Installation is the reverse of removal.

INSTALLATION

1. Install the wiper arm and blade to the specified position.

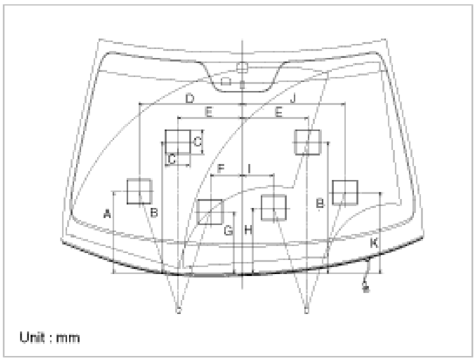
Specified position	A	B
Distance [in (mm)]	1.26+0.2/0 (32+5/0)	0.98+0.2/0 (25+5/0)



2. Set the washer nozzle on the specified spray position.

Specified position	**Distance [in (mm)]**
A	13.3 (337.5)
B	21.5 (545)
C	3.9 (100)
D	16.9 (429.5)
E	10.6 (270)
F	5.3 (134)

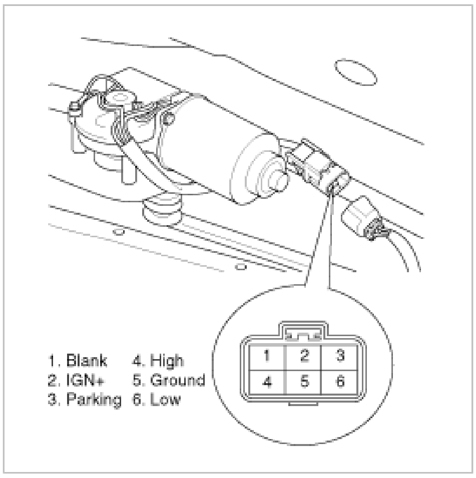
G	10.1(255.5)
H	10.7(271.5)
I	5.0(128)
J	16.7(424)
K	13.2(335.5)



INSPECTION

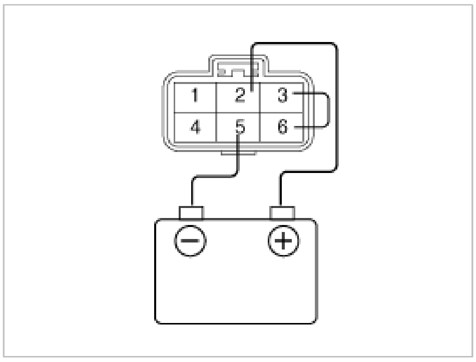
SPEED OPERATION CHECK

1. Remove the connector from the wiper motor.
2. Attach the positive (+) lead from the battery to terminal 6 and the negative (-) lead to terminal 5.
3. Check that the motor operates at low speed.
4. Connect the positive (+) lead from the battery to terminal 4 and the negative (-) lead to terminal 5.
5. Check that the motor operates at high speed.



AUTOMATIC STOP OPERATION CHECK

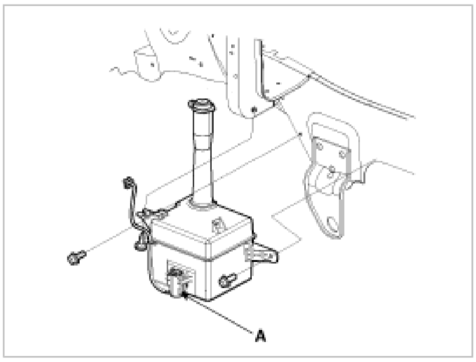
1. Operate the motor at low speed using the stalk control.
2. Stop the motor operation anywhere except at the off position by disconnecting terminal 6.
3. Connect terminals 3 and 6.
4. Connect the positive (+) lead from the battery to terminal 2 and the negative (-) lead to terminal 5.
5. Check that the motor stops running at the off position.



Body Electrical System > Windshield Wiper/Washer > Front Washer Motor > Repair procedures

REPLACEMENT

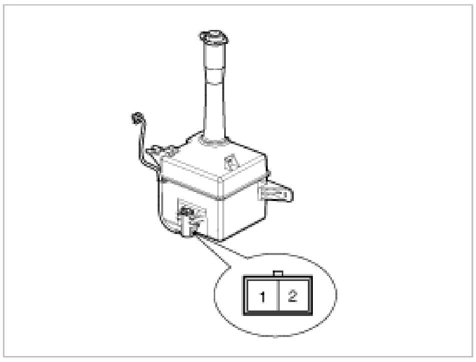
1. Disconnect the negative (-) battery terminal.
2. Remove the front bumper cover. (Refer to Body group-Front bumper)
3. Remove the washer hose and the washer motor connector (A).
4. Remove the washer reservoir after removing 3 bolts.

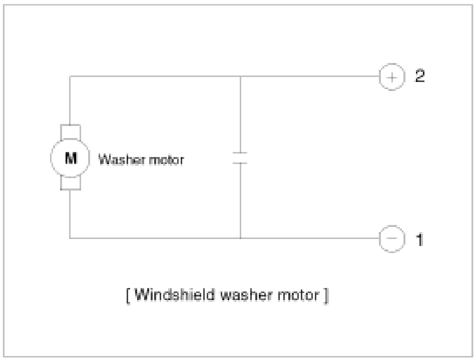


5. Installation is the reverse of removal.

INSPECTION

1. With the washer motor connected to the reservoir tank, fill the reservoir tank with water.
2. Connect positive (+) battery cables to terminal 2 and negative (-) battery cables to terminal 1 respectively.
3. Check that the motor operates normally and the washer motor runs and water sprays from the front nozzles.
4. If they are abnormal, replace the washer motor.

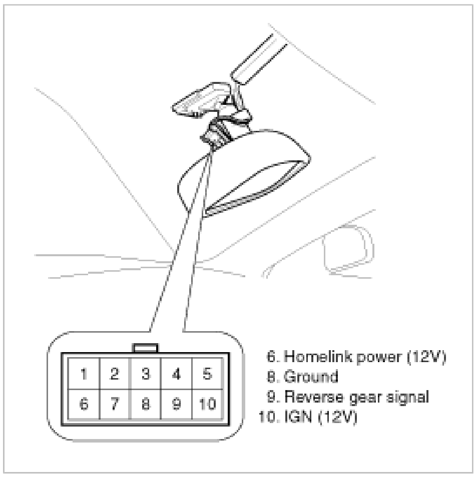




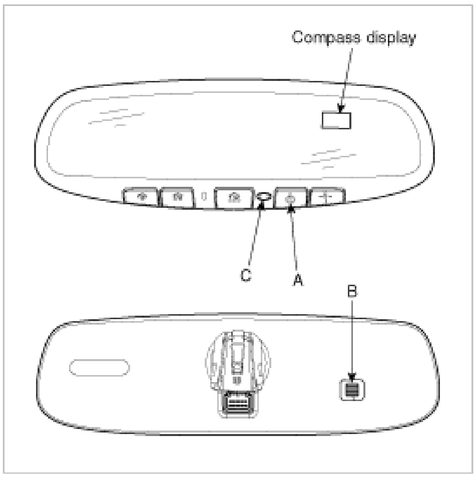
Body Electrical System > Electro chromic Inside > Electro chromic Inside Rear View Mirror > Description and Operation

DESCRIPTION

The ECM (Electro Chromic inside rear view Mirror) is for dimming the reflecting light from a vehicle behind at night, in order the user not to be dazzled by the light. The front looking sensor detects brightness of the surroundings, while the rearward looking sensor the strength of the reflecting light so that adjusts the reflexibility of the mirror in the range of 10~70%. But, when the reverse gear is engaged, it stops functioning.



1. The front looking sensor sees if the brightness of the surroundings is low enough for the mirror to operate its function.
2. The rearward looking sensor detects glaring of the reflecting light from a vehicle behind.
3. The ECM is darkened to the level as determined by the rearward looking sensor. When the glaring is no longer detected, the mirror stops functioning.



Body Electrical System > Electro chromic Inside > Electro chromic Inside Rear View Mirror > Repair procedures

INSPECTION

Check it by the procedure below to see if the function of the ECM is normal.

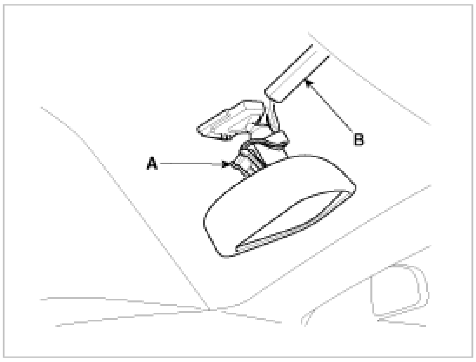
1. Turn the ignition key to the "ON" position.
2. Press the A button to turn the automatic dimming function ON/OFF.
3. Cover the front looking sensor (B) to stop functioning.
4. Head a light to the rearward looking sensor(C).
5. The ECM should be darkened as soon as the rearward looking sensor detects the light.

> NOTE
>
> If this test is performed in daytime, the ECM may be darkened as soon as the front looking sensor is covered.

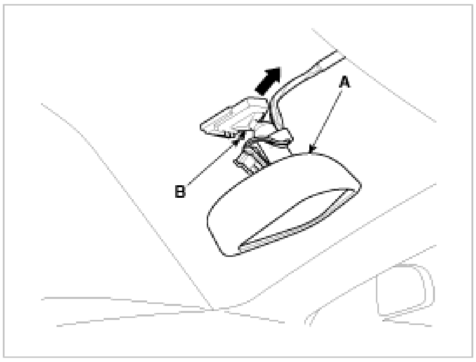
6. When the reverse gear is engaged, the ECM should not be darkened.
7. When heading lights to both the front looking and rearward looking sensors, the ECM should not be darkened.

REPLACEMENT

1. Remove the connector(A) and honelink cover (B).



2. Push the ECM base up to remove the ECM assembly (A) after loosening the mounting screw (B).



3. Installation is the reverse of removal.

Body Electrical System > Electro chromic Inside > Compass Mirror > Description and Operation

FUNCTION

1. Push the A button lower of the rear view mirror to turn on the function of the compass mirror so that displays a sign of a direction on the small board in the upper-right side of the mirror.
2. Push the A button again to turn off its function.

Body Electrical System > Electro chromic Inside > Compass Mirror > Repair procedures

CALIBRATION PROCEDURE

If the compass has been calibrated or set to variance zone number incorrectly, or you are driving in specific places (tunnel, parking lot in building, underground parking lot, near transformer substation, etc.), some phenomenon is occur as follows:

- The display read "C".
- The compass headings become inaccurate.
- The compass heading is not changed.
- Some compass headings are not displayed.

• The compass headings are inaccurate in long distance driving.

This compass automatically calibrates itself while the vehicle is driven as your route takes you in complete circles.

If the vehicle's compass headings become inaccurate continuously, the compass should be manually calibrated as follows:

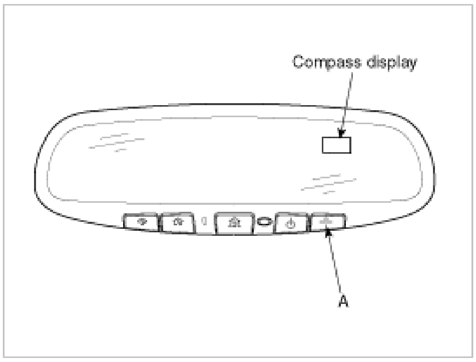
1. Move the vehicle from the large steel structure or electric power supply cable.
2. Turn on the compass by pressing the A button.
3. Check the zone number by pressing the A button for more than 4 seconds until the current zone number appears in the display.
   To re-calibrate, hold the A button for 3 seconds until C is displayed. If the zone number is different for your country, set the correct zone number referring to "Setting the compass zone" and do the "calibration procedure" again.
4. Drive your vehicle in at least 2 circles at less than 5 miles per hour (8 km/h) until the compass heading appears. Driving in a circle in right-handed direction and opposite direction is possible and if possible, stops the wiper operation.
5. If the vehicle's compass headings become inaccurate as before, do the following procedure again.

> NOTE
>
> If new vehicle is first driven or if the battery has been disconnected, do the calibration procedure as above.

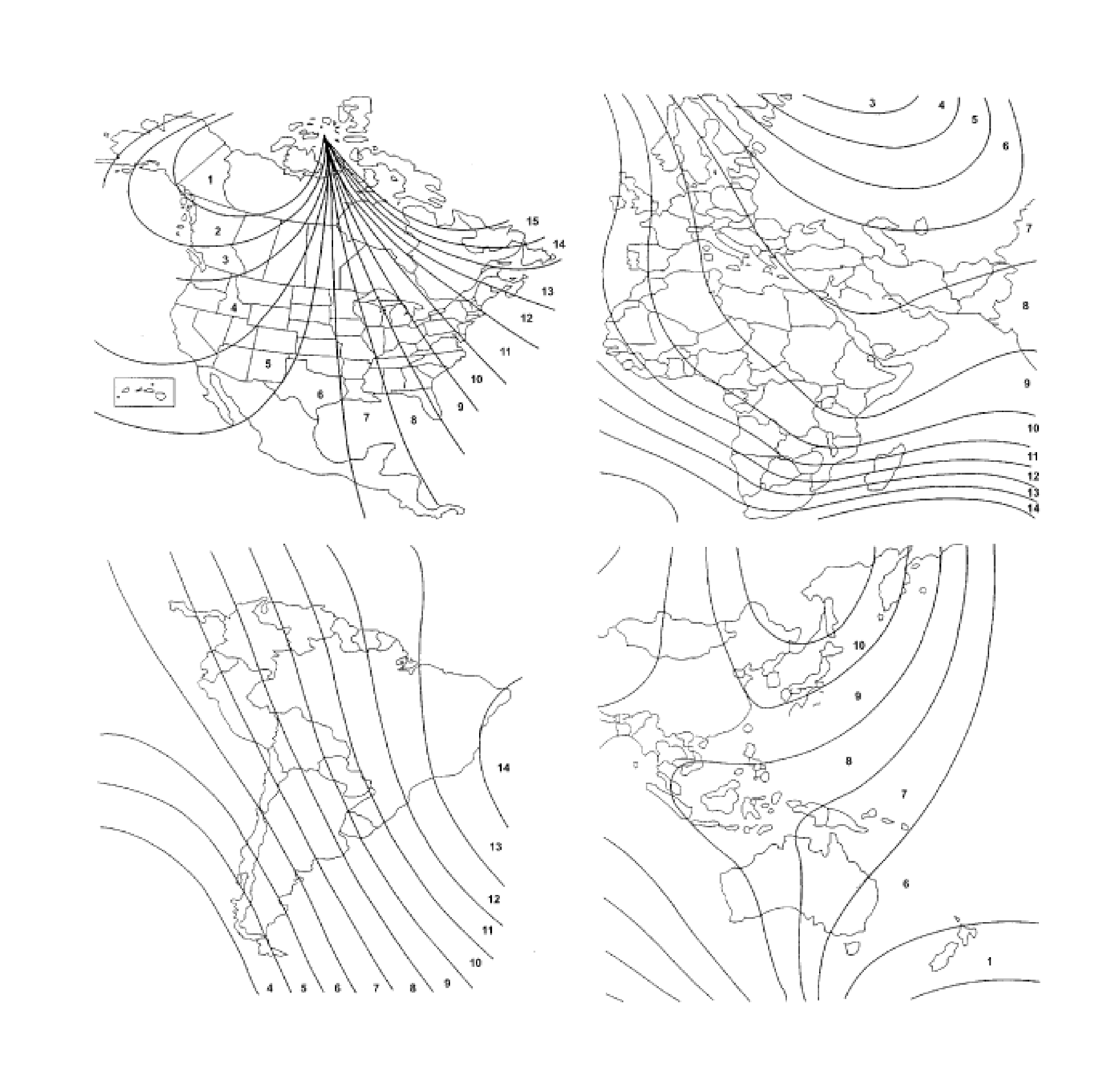
SETTING THE COMPASS ZONE

This compass must be set to compensate for the variation between true north and magnetic north. To set variation:

1. Find your current location and variance zone number on the zone map.
2. Press the A button for more than 4 seconds. The current zone number will appear in the display.
3. Release and press the A button until the new zone number appears in the display. After you stop pressing the button in, the display will show a compass direction within a few seconds.



ZONE MAP

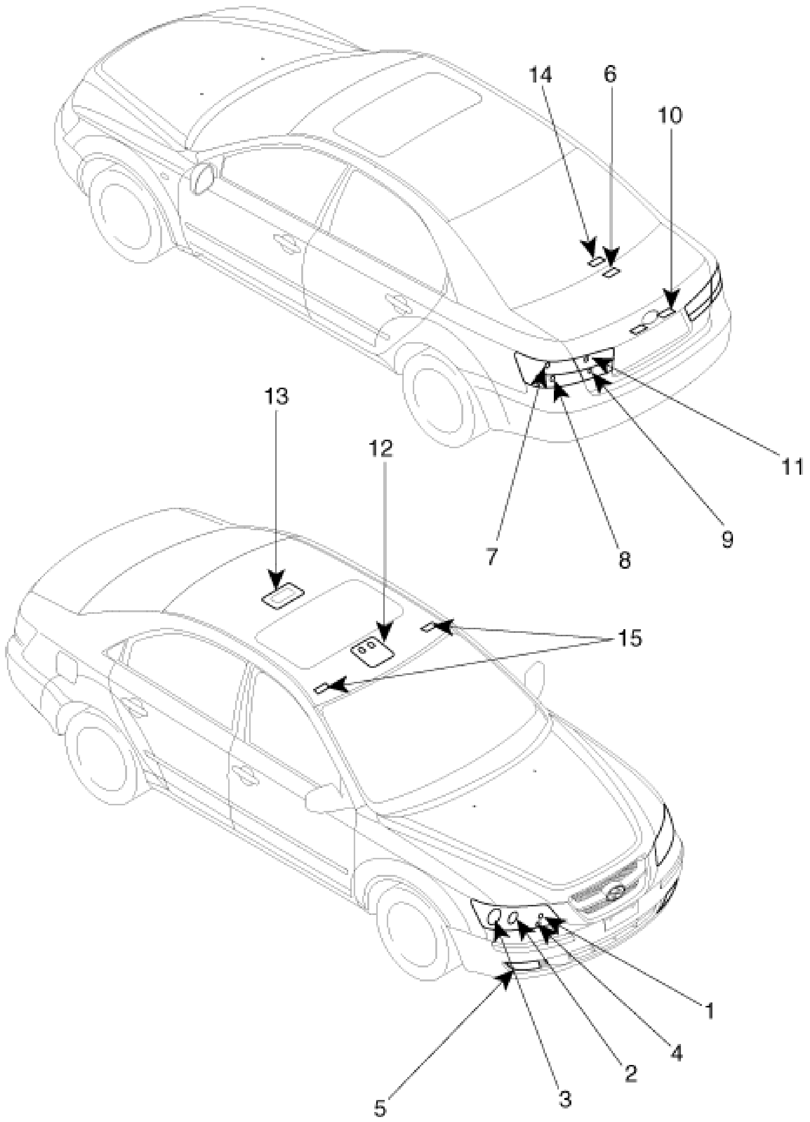


WARNING

1. Do not install the ski rack, antenna, etc. which are attached to the vehicle by means of a magnet. They affect the operation of the compass.
2. If the compass deviates from the correct indication soon after repeated adjustment, have the compass checked at an authorized dealer.
3. The compass may not indicate the correct compass point in tunnels or while driving up or down a steep hill. (The compass returns to the correct compass point when the vehicle moves to an area where the geomagnetism is stabilized.)

Body Electrical System > Lighting System > Components and Components Location

COMPONENT LOCATION



1. Head lamp (High)	9. Back up lamp
2. Head lamp (Low)	10. License plate lamp
3. Front turn signal lamp/Side marker	11. Tail lamp
4. Position lamp	12. Overhead console lamp (Map lamp)
5. Front fog lamp	13. Room lamp
6. Luggage lamp	14. High mounted stop lamp
7. Tail/stop lamp	15. Vanity lamp
8. Rear turn signal lamp	

Body Electrical System > Lighting System > Troubleshooting

TROUBLESHOOTING

Symptom Poss	ible cause	Remedy
One lamp does not light (all exterior)	Bulb burned out	Replace bulb
	Socket, wiring or ground faulty	Repair if necessary
Head lamps do not light	Bulb burned out	Replace bulb
	Ignition fuse (LOW:20A, HIGH:20A) blown	Check for short and replace fuse
	Head lamp fuse (10A) blown	Check for short and replace fuse
	Head lamp relay faulty	Check relay
	Lighting switch faulty	Check switch

	Wiring or ground faulty	Repair if necessary
Tail lamps and license plate lamps do not light	Bulb burned out	Replace bulb
	Tail lamp fuse (20A) blown	Check for short and replace fuse
	Tail lamp relay faulty	Check relay
	Lighting switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Stop lamps do not light	Bulb burned out	Replace bulb
	Stop lamp fuse (15A) blown	Check for short and replace fuse
	Stop lamp switch faulty	Adjust or replace switch
	Wiring or ground faulty	Repair if necessary
Stop lamps do not turn off	Stop lamp switch faulty	Repair or replace switch
Instrument lamps do not light (Tail lamps light)	Rheostat faulty	Check rheostat
	Wiring or ground faulty	Repair if necessary
Turn signal lamp does not flash on one side	Bulb burned out	Replace bulb
	Turn signal switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Turn signal lamps do not light	Bulb burned out	Replace bulb
	Turn signal lamp fuse (10A) blown	Check for short and replace fuse
	Flasher unit faulty	Check flasher unit
	Turn signal switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Hazard warning lamps do not light	Bulb burned out	Replace bulb
	Hazard warning lamp fuse (10A) blown	Check for short and replace fuse
	Flasher unit faulty	Check flasher unit
	Hazard switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Flasher rate too slow or too fast	Lamps' wattages are smaller or larger than specified	Replace lamps
	Flasher unit faulty	Check flasher unit
Back up lamps do not light	Bulb burned out	Replace bulb
	Back up lamp fuse (10A) blown	Check for short and replace fuse
	Back up lamp switch (M/T) faulty	Check switch
	Transaxle range switch (A/T) faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Room lamp does not light	Bulb burned out	Replace bulb
	Room lamp fuse (15A) blown	Check for short and replace fuse
	Room lamp switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Front fog lamps do not light	Bulb burned out	Replace bulb
	Front fog lamp fuse (15A) blown	Check for short and replace fuse
	Front fog lamp relay faulty	Check relay
	Front fog lamp switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Map lamp does not light	Bulb burned out	Replace bulb
	Room lamp fuse (10A) blown	Check for short and replace fuse
	Map lamp switch faulty	Check switch

	Wiring or ground faulty	Repair if necessary
Trunk room lamp does not light	Bulb burned out	Replace bulb
	Room lamp fuse (10A) blown	Check for short and replace fuse
	Trunk room lamp switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary

Body Electrical System > Lighting System > Specifications

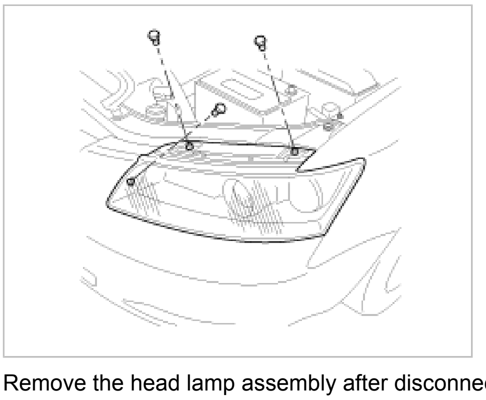
SPECIFICATION

Items	Bulb Wattage (W)
Head lamp (High/Low)	55/55
Front turn signal lamp/Side marker	28/8
Front position lamp	8
Front fog lamp	27
Rear tail/stop lamp (Outside)	28/8
Rear tail lamp (Inner)	8
Back up lamp	16
Rear turn signal lamp	27
License plate lamp	5
Room lamp	10
Overhead console lamp	10 x 2
High mounted stop lamp	16
Glove box lamp	5
Luggage lamp	5
Door courtesy lamp	5
Vanity lamp	5
Rear side marker	5

Body Electrical System > Lighting System > Head Lamps > Repair procedures

REPLACEMENT

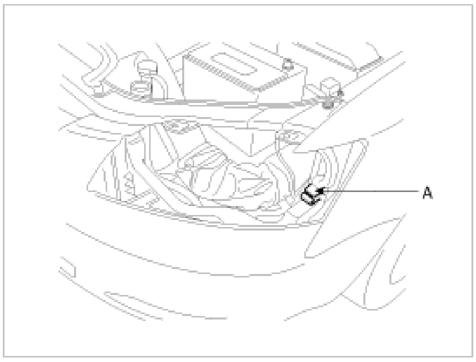
1. Disconnect the negative (-) battery terminal.
2. Loose the mounting bolts (3EA) of head lamp.



3. Remove the head lamp assembly after disconnecting the lamp connectors.

NOTE

Take care that holding clip (A) is not to be damaged.



4. Installation is the reverse of removal.

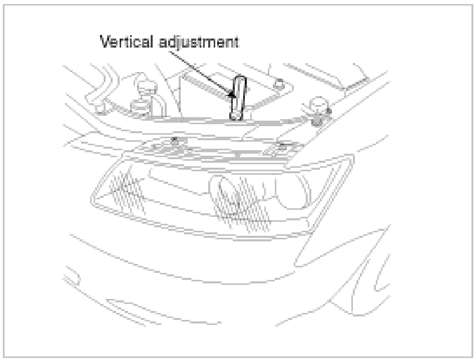
HEAD LAMP AIMING INSTRUCTIONS

The head lamps should be aimed with the proper beam-setting equipment, and in accordance with the equipment manufacturer's instructions.

> NOTE
>
> If there are any regulations pertinent to the aiming of head lamps in the area where the vehicle is to be used, adjust so as to meet those requirements.

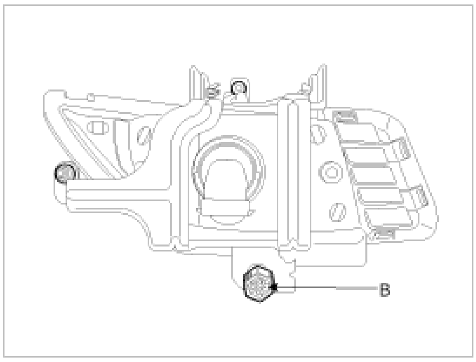
Alternately turn the adjusting gear to adjust the head lamp aiming. If beam-setting equipment is not available, proceed as follows:

1. Inflate the tires to the specified pressure and remove any loads from the vehicle except the driver, spare tire, and tools.
2. The vehicle should be placed on a flat floor.
3. Draw vertical lines (Vertical lines passing through respective head lamp centers) and a horizontal line (Horizontal line passing through center of head lamps) on the screen.
4. With the head lamp and battery in normal condition, aim the head lamps so the brightest portion falls on the horizontal and vertical lines.
   Make vertical adjustment to the lower beam using the adjusting wheel.

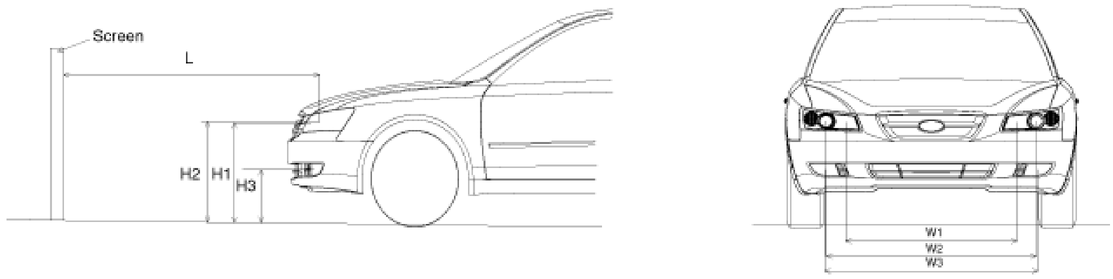


FRONT FOG LAMP AIMING

The front fog lamps should be aimed as the same manner of the head lamps aiming.
With the front fog lamps and battery normal condition, aim the front fog lamps by turning the adjusting gear.



HEAD LAMP AND FOG LAMP AIMING POINT

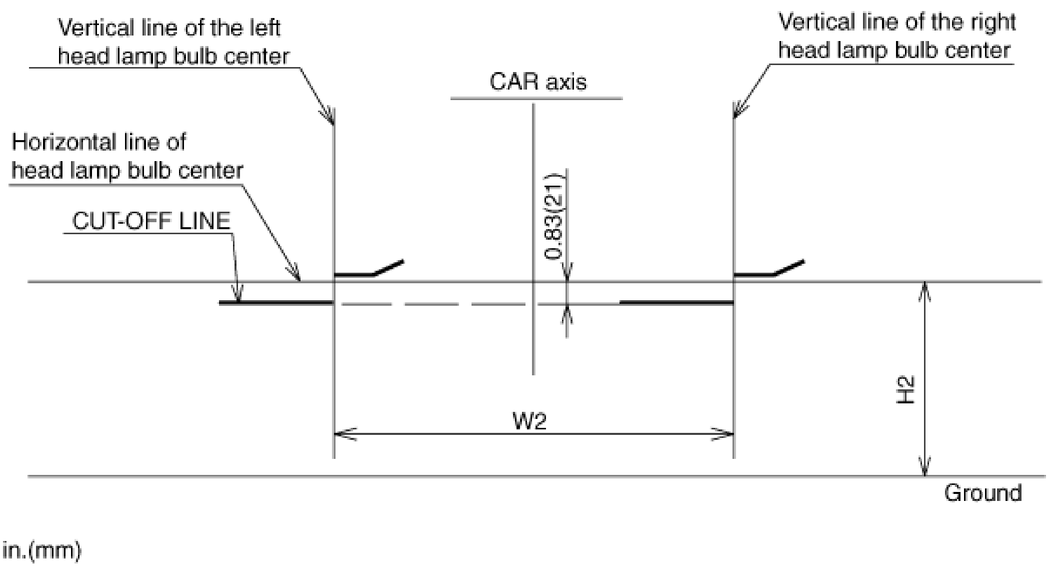


H1 : Height between the head lamp bulb center and ground (High beam)
H2 : Height between the head lamp bulb center and ground (Low beam)
H3 : Height between the fog lamp bulb center and ground
W1 : Distance between the two head lamp bulbs centers (High beam)
W2 : Distance between the two head lamp bulbs centers (Low beam)
W3 : Distance between the two fog lamp bulbs centers
L : Distance between the head lamp bulb center and screen

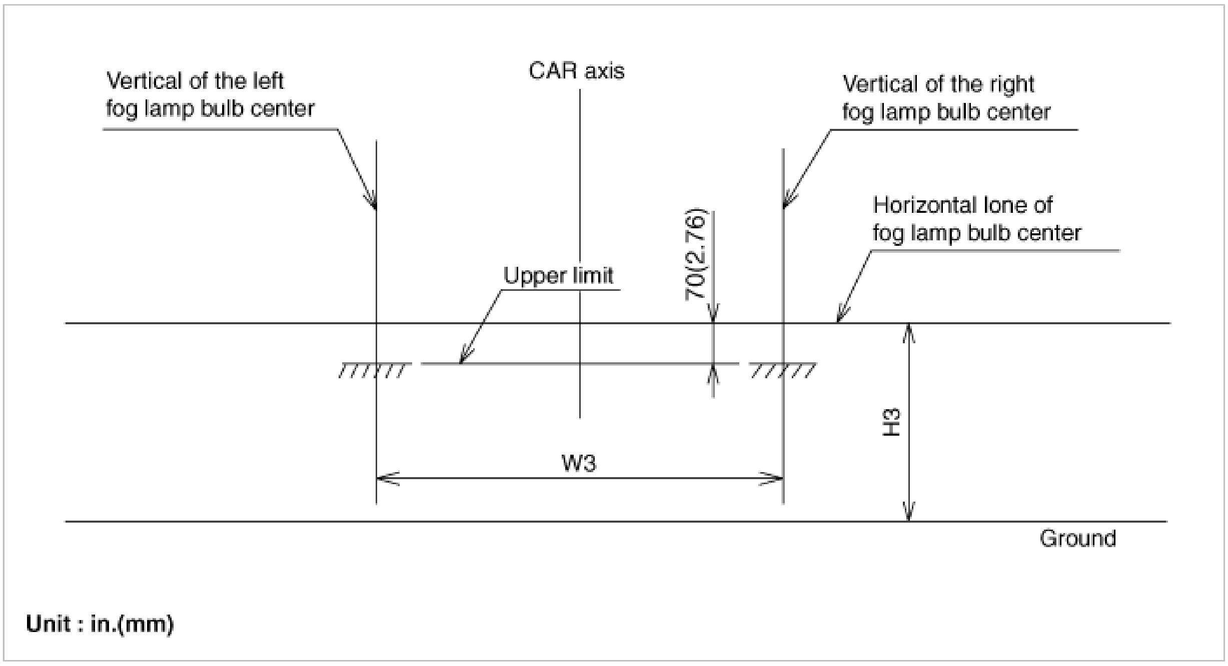
Unit : in(mm)

Vehicle condition	H1	H2	H2	W1	W2	W3	L
Without driver	26.7(679)	27.0(686)	14.3(362)	42.0(1,066)	51.4(1,306)	52.1(1,324)	118.1(3,000)
With driver	26.5(672)	26.7(679)	14.0(355)				

1. Turn the low beam on without driver aboard.
   The cut-off line should be projected in the allowable range (shaded region).

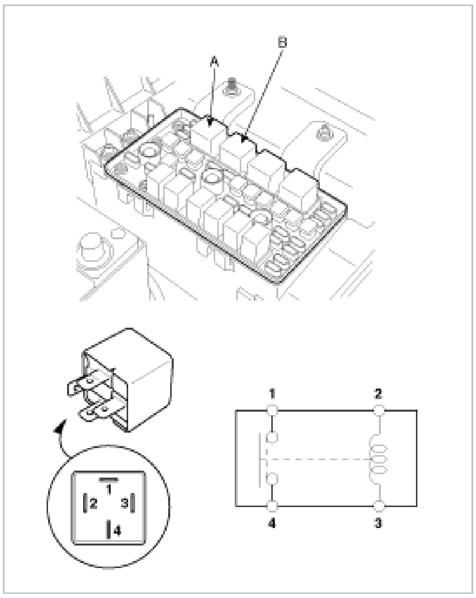


2. Turn the front fog lamp on without the driver aboard.
   The cut-off line should be projected in the allowable range (shaded region)



HEAD LAMP RELAY INSPECTION

1. Pull out the head lamp relay (Low) (A) and head lamp relay (High) (B) from the engine compartment relay box.



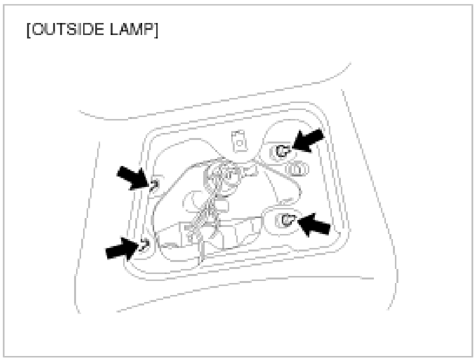
2. Check for continuity between terminals. There should be continuity between the No.1 and No.4 terminals when power and ground are connected to the No.2 and No.3 terminals.
3. There should be no continuity between the No.1 and No.4 terminals when power is disconnected.

Terminal / Power (No.2-No.3)	2	3	1	4
Disconnected	○	○		
Connected	⊖	⊕	○	○

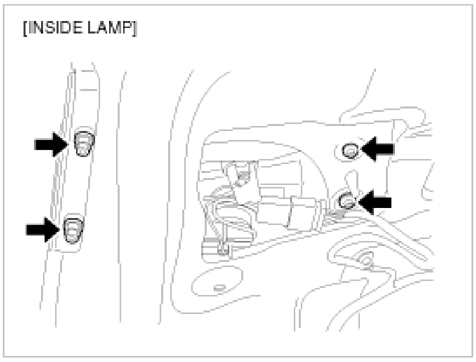
Body Electrical System > Lighting System > Turn Signal Lamp > Repair procedures

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Loose the nuts holding the rear combination lamp then disconnect the 4P connector then remove the outside rear combination lamp.



3. Loose the nuts holding the rear combination lamp then disconnect the 4P connector then remove the inner rear combination lamp.

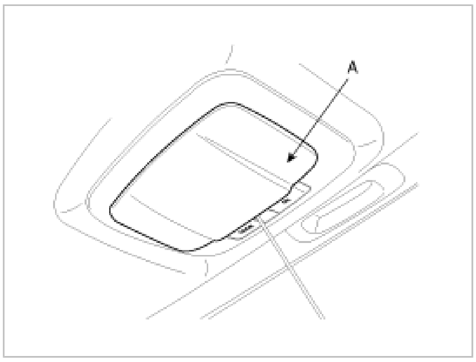


4. Installation is the reverse of removal.

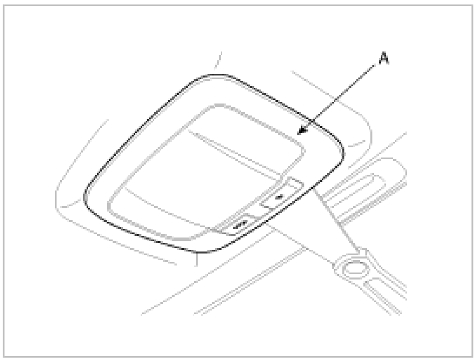
Body Electrical System > Lighting System > Room Lamp > Repair procedures

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Detach the lamp lens (A) from the room lamp with a flat-tip screwdriver then replace the bulb (B).



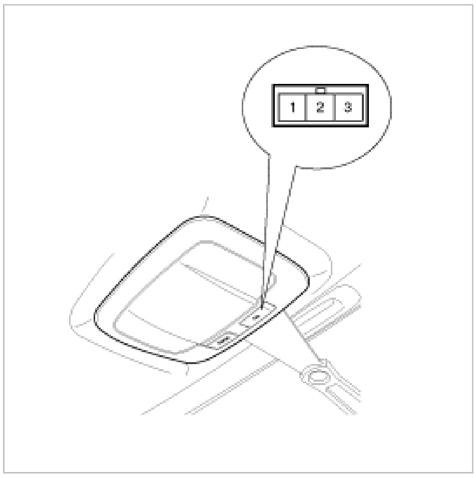
3. Remove the room lamp assembly after removing 2 screws and disconnecting the 3P connector (Standard type).
Remove the room lamp assembly by using the scraper and then disconnect the 3P connector (Sunroof type).



4. Installation is the reverse of removal.

INSPECTION

Remove the room lamp assembly then check for continuity between terminals.

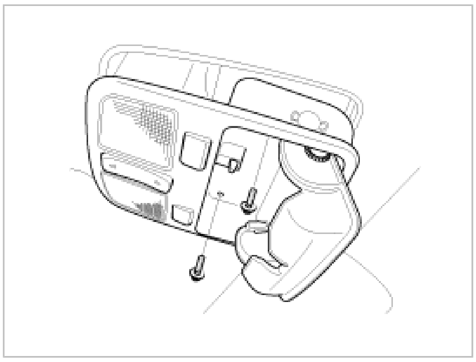


Position \ Terminal	1	2	3
ON		O—SW—	—O
DOOR	O—SW—	—O	
OFF			

Body Electrical System > Lighting System > Overhead Console Lamp > Repair procedures

REPLACEMENT

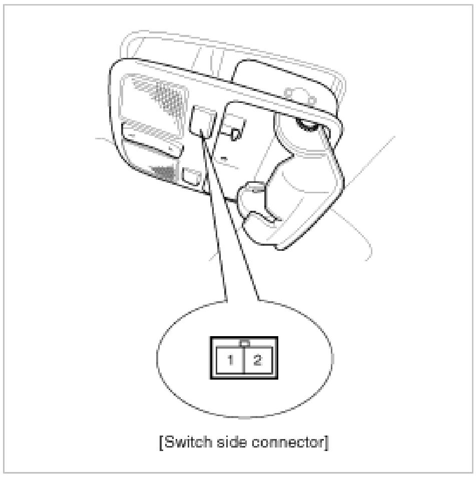
1. Disconnect the negative (-) battery terminal.
2. Open the sunglass case cover then remove the 2 screws holding the overhead console.



3. Disconnect the connector (4P) of sunroof switch and the connector (2P) of map lamp then remove the overhead console lamp assembly from the headliner.
4. Installation is the reverse of removal.

INSPECTION

Remove the overhead console lamp assembly then check for continuity between terminals. If the continuity is not as specified, replace the map lamp switch.



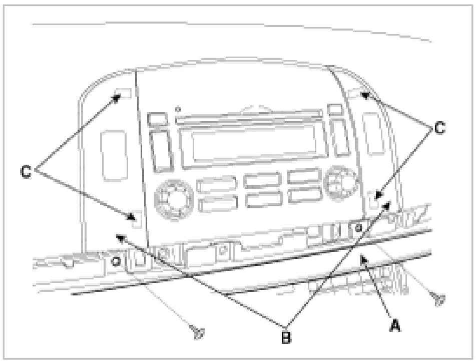
[Switch side connector]

Body Electrical System > Lighting System > Hazard Lamp Switch > Repair procedures

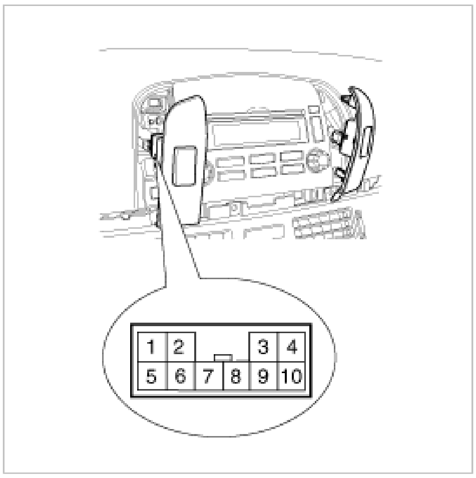
INSPECTION

HAZARD LAMP SWITCH

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad garnish (A) after pulling it by using regular screw driver (-). Take care of fixing clips(C).
3. Remove the center facia panel (B) after loosening the screws.



4. Disconnect the connectors(A).
5. Remove the hazard lamp switch from the center facia panel.



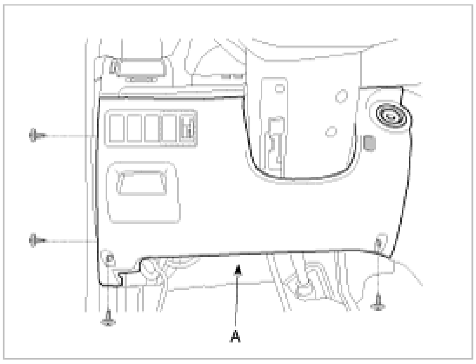
6. Operate the switch and check for continuity between terminals with an ohmmeter.

Position \ Terminal	2	3	6	9	10	5	7	8
OFF	○	○				○	—	○
ON	Illumination		○	○	○		○	○

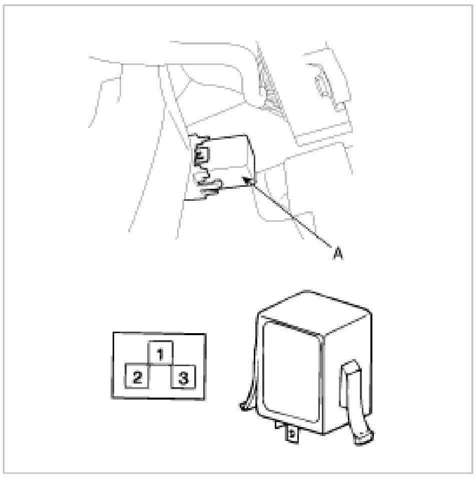
Body Electrical System > Lighting System > Flasher Unit > Repair procedures

INSPECTION

1. Disconnect the negative (-) battery terminal.
2. Disconnect the hood release cable from the hood release handle.
3. Remove the crash pad side cover (A).



4. Remove the flasher unit (A) after loosening the nut and disconnecting the connector.



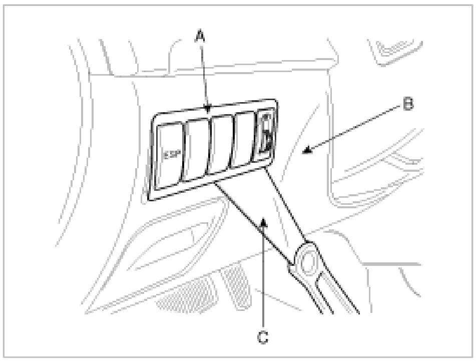
5. Connect the positive (+) lead from the battery to terminal 2 and the negative (-) lead to terminal 3.
6. Connect the two turn signal lamps in parallel to terminals 1 and 3. Check that the bulbs turn on and off.

> NOTE
>
> The turn signal lamps should flash 60 to 120 times per minute. If one of the front or rear turn signal lamps has an open circuit, the number of flashes will be more than 120 per minute. If operation is not as specified, replace the flasher unit.

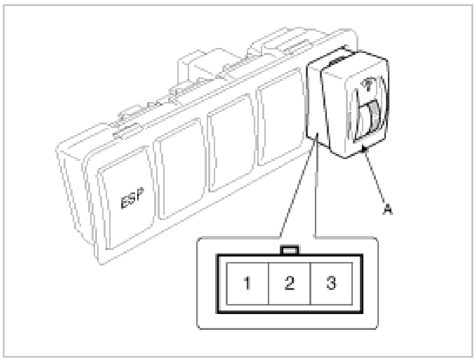
Body Electrical System > Lighting System > Rheostat > Repair procedures

INSPECTION

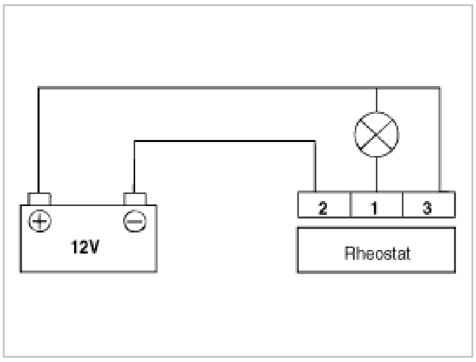
1. Disconnect the negative (-) battery terminal.
2. Remove the lower crash pad switch (A) from the side crash pad cover (B) by using the scraper (C) and then disconnect the connectors.



3. Remove the rheostat (A) from lower crash pad switch.



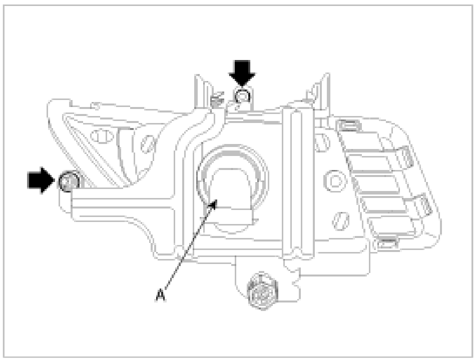
4. Check for intensity. If the light intensity of the lamps changes smoothly without any flickering when the rheostat is turned, it can be assumed that the rheostat is normal.



Body Electrical System > Lighting System > Front Fog Lamps > Repair procedures

REPLACEMENT

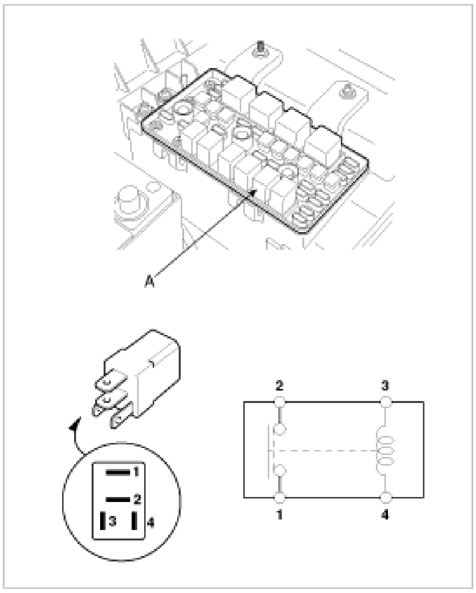
1. Disconnect the negative (-) battery terminal.
2. Remove the front bumper. (Refer to the BD group - front bumper).
3. Remove the front fog lamp (A) after loosening the screws and disconnecting the fog lamp connector.



4. Installation is the reverse of removal.

FRONT FOG LAMP RELAY INSPECTION

1. Pull out the front fog lamp (A) relay from the engine compartment relay box.
2. Check for continuity between terminals. There should be continuity between the No.1 and No.2 terminals when power and ground are connected to the No.3 and No.4 terminals.
3. There should be no continuity between the No.1 and No.2 terminals when power is disconnected.

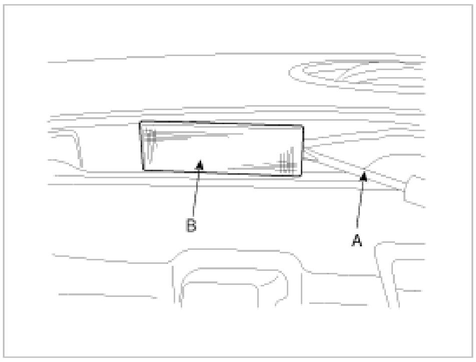


Terminal / Power (No.3-No.4)	1	2	3	4
Disconnected			○	○
Connected	○	○	⊖	⊕

Body Electrical System > Lighting System > License Lamps > Repair procedures

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Detach the lamp lens (A) from the room lamp with a flat-tip screwdriver (B).



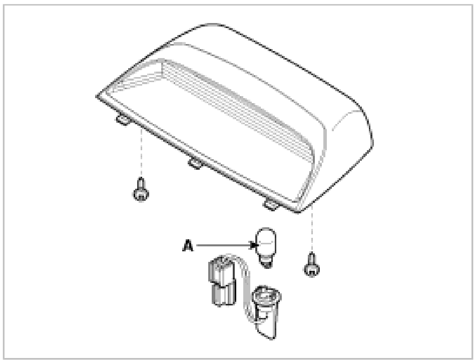
3. Replace the bulb.
4. Installation is the reverse of removal.

Body Electrical System > Lighting System > High Mounted stop lamp > Repair procedures

REPLACEMENT

HIGH MOUNTED STOP LAMP

1. Disconnect the negative(-) battery terminal.
2. Open the trunk lid and then disconnect the connector of high mounted stop lamp.
3. Remove the package tray (Refer to the Body group-package tray).
4. Replace the bulb(A) from the package tray.

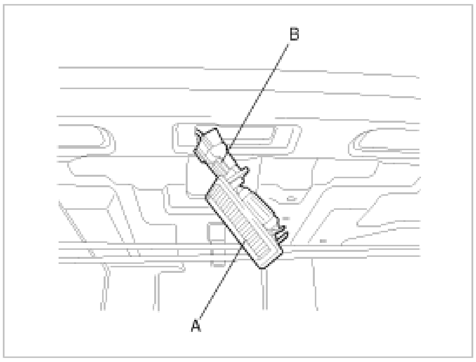


5. Installation is the reverse of removal.

Body Electrical System > Lighting System > Trunk Lamps > Repair procedures

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Open the trunk lid, then remove the trunk room lamp (A) with a flat-tip screwdriver and disconnect the 2P connector (B).



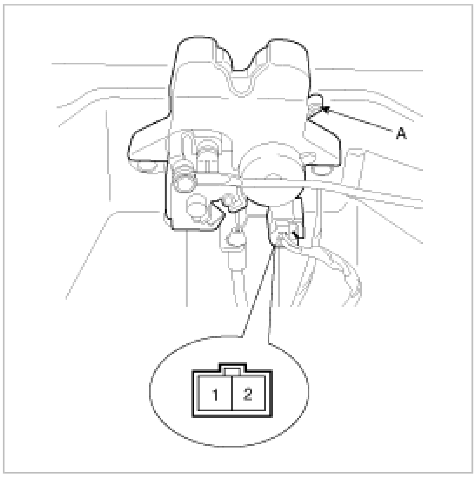
3. Replace the bulb.
4. Installation is the reverse of removal.

INSPECTION

TRUNK ROOM LAMP SWITCH

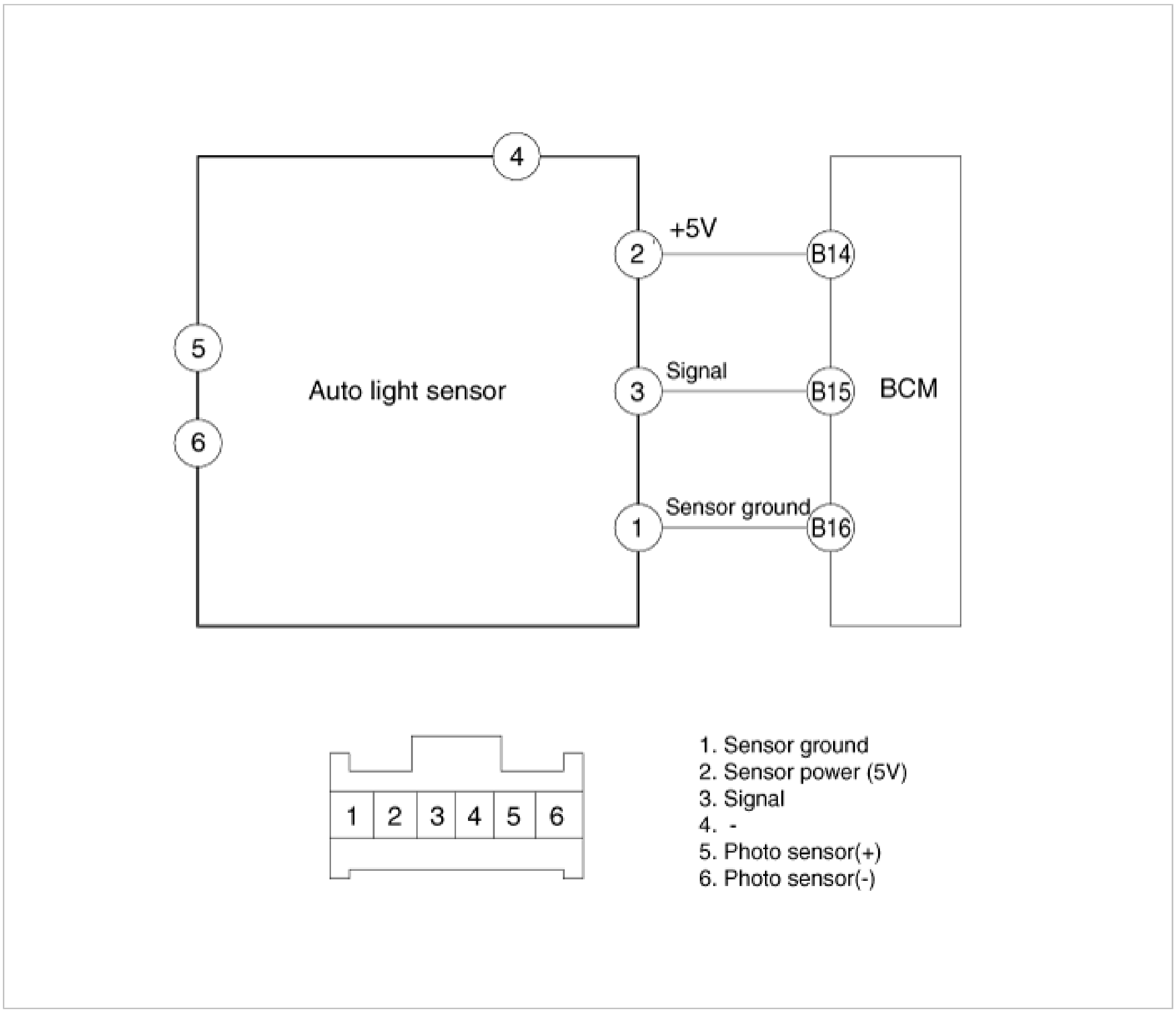
1. Disconnect the negative (-) battery terminal.
2. Remove the trunk lid trim panel. (Refer to the Body group - trunk lid)
3. Disconnect the 2P connector from the actuator.
4. Check for continuity between the terminal No. 1 and body while pushing the rod (A).

Switch rod condition	Continuity
Pushed (OFF)	Non-conductive (∞Ω)
Released (ON)	Conductive (0Ω)



Body Electrical System > Auto Lighting Control System > Schematic Diagrams

CIRCUIT DIAGRAM



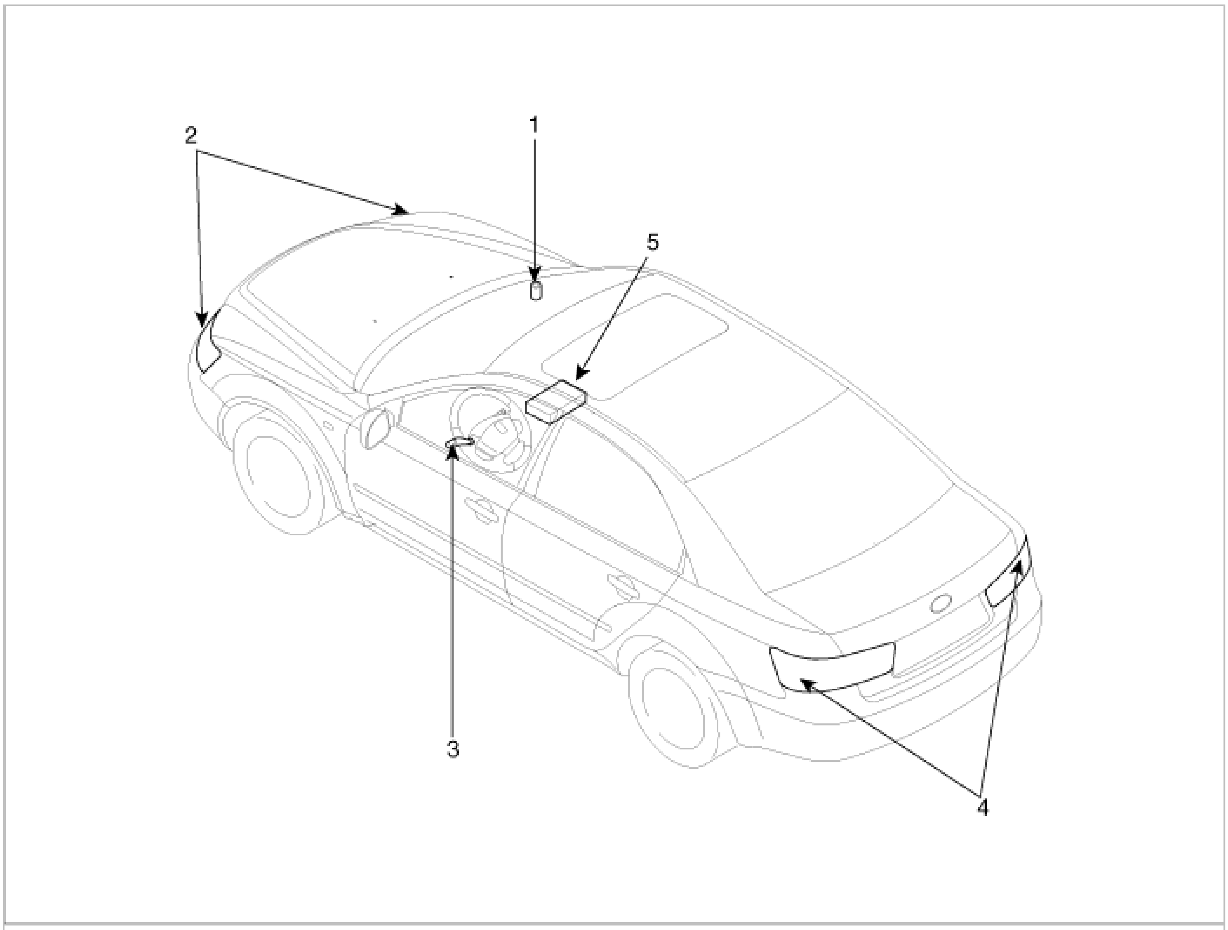
Body Electrical System > Auto Lighting Control System > Description and Operation

DESCRIPTION

The auto light control system operates by using the auto light switch.
If you set the multi-function switch to "AUTO" position, the tail lamp and head lamp will be turned automatically on or off according to external illumination.

Body Electrical System > Auto Lighting Control System > Components and Components Location

COMPONENT LOCATION



1. Auto light sensor	4. Tail lamps
2. Head lamps	5. Body control module
3. Lighting switch (Auto)	

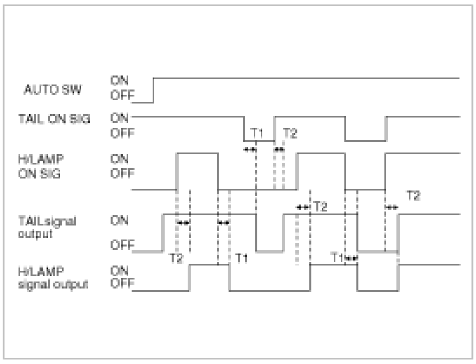
Body Electrical System > Auto Lighting Control System > Repair procedures

INSPECTION

1. While operating the auto light switch, check if the operations are normal as shown in the timing chart.
2. If operations are abnormal, check the body control module.
   (1) Auto light sensor value is always read at IGN ON.
   (2) Light is turned ON after 2sec±0.2sec when auto light sensor value is same as light ON input value.
   (3) Light is turned OFF after 2sec±0.2sec when sensor value is same as light OFF input value.
   (4) Tail lamp and head lamp are turned ON when sensor value is same as tail lamp ON input value.
   (5) Light ON value of sensor is based on the below table.
   (6) Head lamp signal is output when head lamp switch is ON.
   (7) After head lamp is turned OFF, head lamp signal output is kept if head lamp ON luminance condition is met at auto light switch ON.
   (8) After head lamp is turned OFF, head lamp signal output is immediately stopped if head lamp OFF luminance condition is met at auto light switch ON.
   (9) After head lamp is turned OFF, head lamp signal output is immediately stopped at tail switch signal input.
   (10) After head lamp is turned OFF, head lamp signal output is stopped after 0.7s if there is no input of auto light switch or tail switch. (Shall be no flashing of head lamp)
   (11) Head lamp signal output is stopped when switch position is changed from AUTO to head lamp switch during head lamp ON with auto light. (Shall be no flashing of head lamp)

(12) The condition of head lamp ON/OFF is same as the one of tail lamp ON/OFF at auto light switch ON. Light ON value of the input sensor is based on the table.

	TAIL LAMP	HEAD LAMP
ON	0.81V±0.08V	Same as tail sensor value
OFF	1.41V±0.10V	Same as tail sensor value



T1/T2 : 2.0 ± 0.2sec.

Body Electrical System > Auto Lighting Control System > Specifications

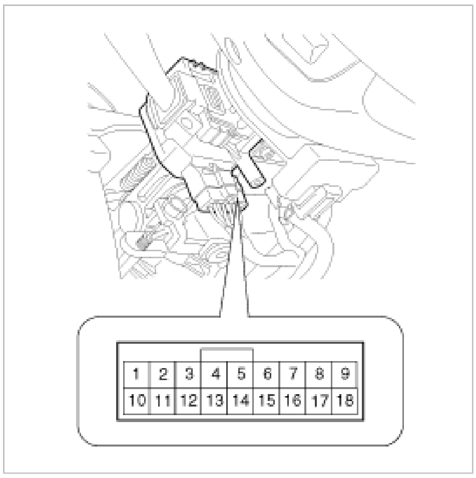
SPECIFICATIONS

Items	Specifications
Rated voltage	12V
Load	Max. 1mA
Detection illuminations Tail lamp / Head lamp	ON : 24 ± 5.2 (Lux), 0.81 ±0.08 (V) OFF : 48 ± 10.5 (Lux), 1.41 ±0.10 (V)

Body Electrical System > Auto Lighting Control System > Auto Light Switch > Repair procedures

INSPECTION

Operate the auto light switch, then check for continuity between terminals of 18P multi-function switch connector.

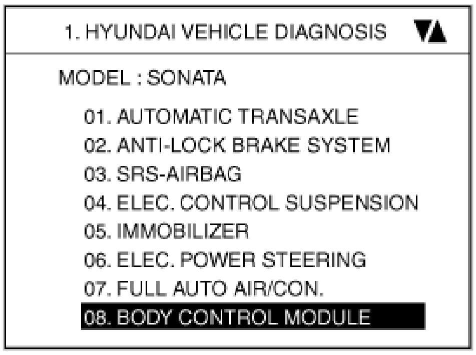


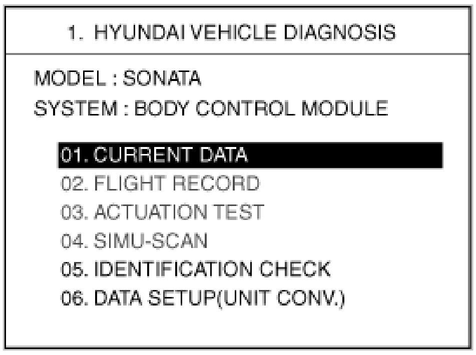
Position \ Terminal	14	15	16	17
OFF				
I	○			○
II	○	○		○
AUTO			○	○

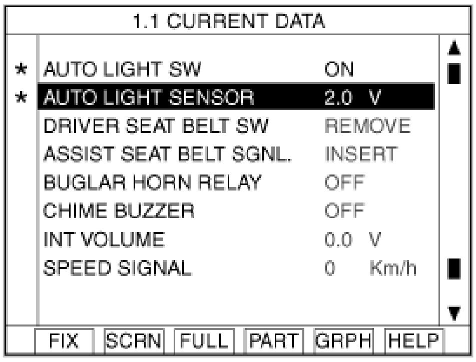
Body Electrical System > Auto Lighting Control System > Auto Light Sensor > Repair procedures

INSPECTION

1. Ignition "ON"
2. Using the scan tool.
3. Emit intensive light toward auto light sensor using sunshine, and check the output voltage change.
4. The voltage will rise with higher intensive light and reduce with lower intensive light.

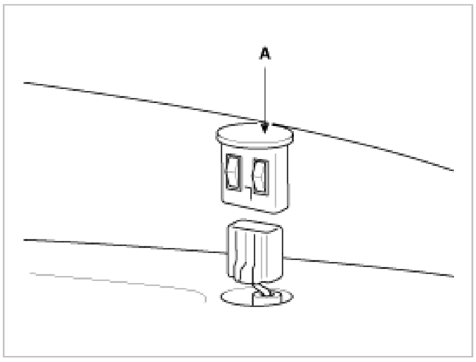






> **NOTE**
>
> When checking auto light sensor, select a place where sun shines directly on it.

5. If the measured resistance is not specification, substitute with a known-good auto light sensor and check for proper operation.
6. If the problem is corrected, replace the auto light sensor.
7. Remove the photo & auto light sensor (A) from the upper crash pad.



8. Disconnect the 6P connector from the auto light sensor then inspect the connector on the wire harness side, as shown in the chart.

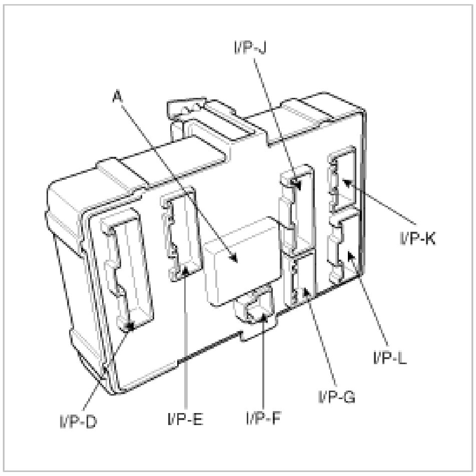
Tester connection	Condition	Specified condition
1-Ground	Auto light switch ON	Continuity
2-Ground	Sensor power	5V

9. If the circuit is not as specified, inspect the circuits connected to other parts.

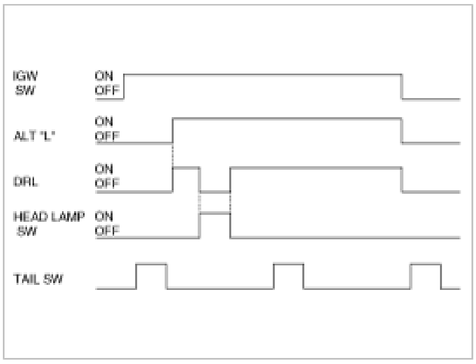
Body Electrical System > Daytime Running Lights > DRL Control Module > Repair procedures

INSPECTION

1. The daytime running light unit (A) is integrated in the junction box.



2. Check that the light operate according to the following timing chart.

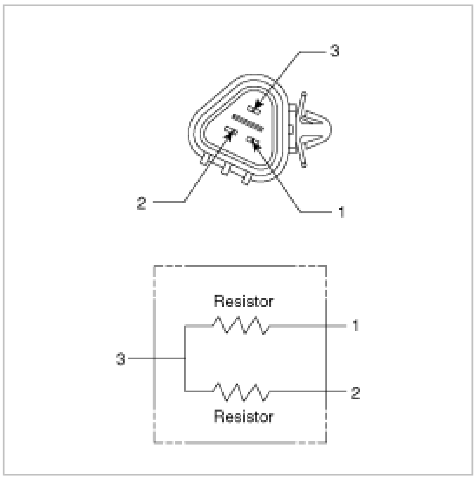


3. If the daytime running light is not operated well, inspect the connector and terminals to be sure they are all making good contact.
   If the terminals are bent, loose or corroded, repair them as necessary, and recheck the system.
   If the terminals look OK, go to step 4.
4. Make these input tests at the connector
   If any test indicates a problem, find and by using ETM correct the cause, then recheck the system.
   If all the input tests prove OK, the junction box must be faulty; replace it.

INSPECTION

1. Check for continuity and measure the resistance between No.1 and NO.3 terminals.

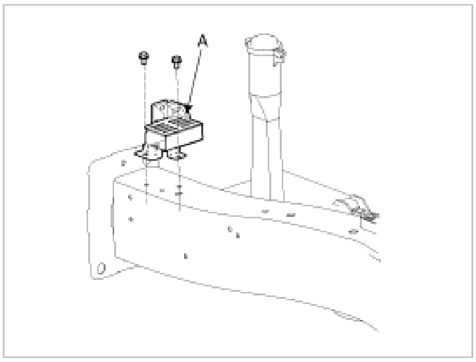
Standard value : 2.5Ω ± 5%



2. If resistance is not as specified, replace the DRL resistor.

REPLACEMENT

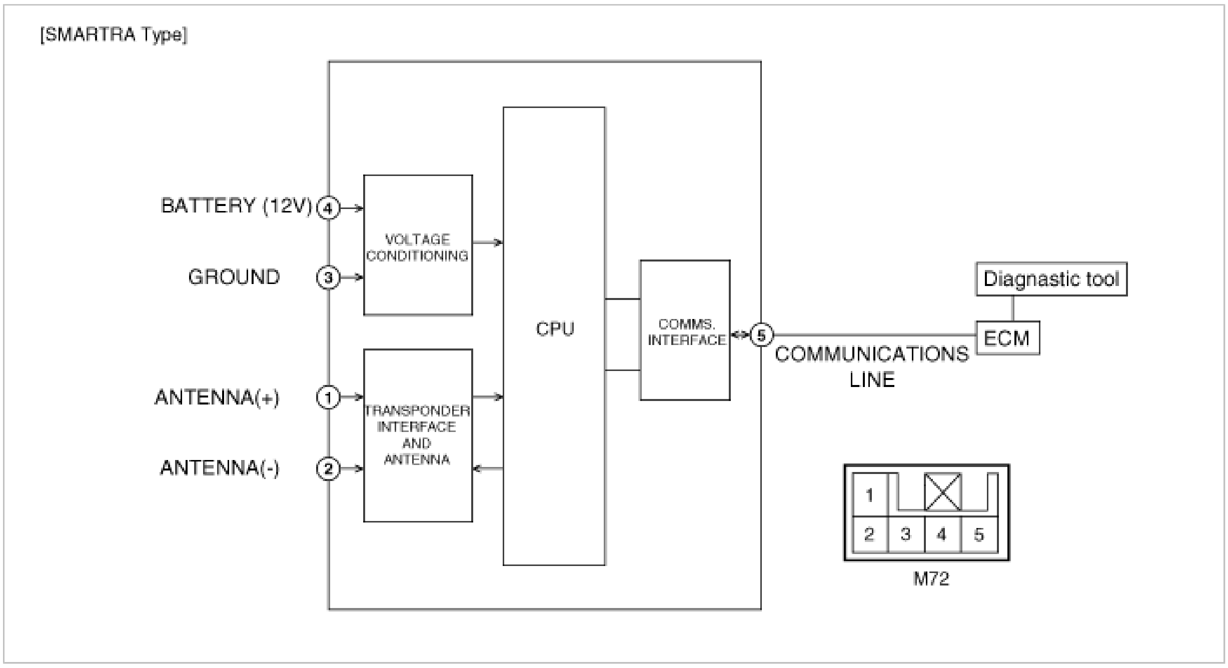
1. Disconnect the negative (-) battery terminal.
2. Remove the right head lamp assembly (Refer to the head lamp).
3. Disconnect the connector and then remove the DRL resistor (A) under the right head lamp after loosening the bolts (2EA).



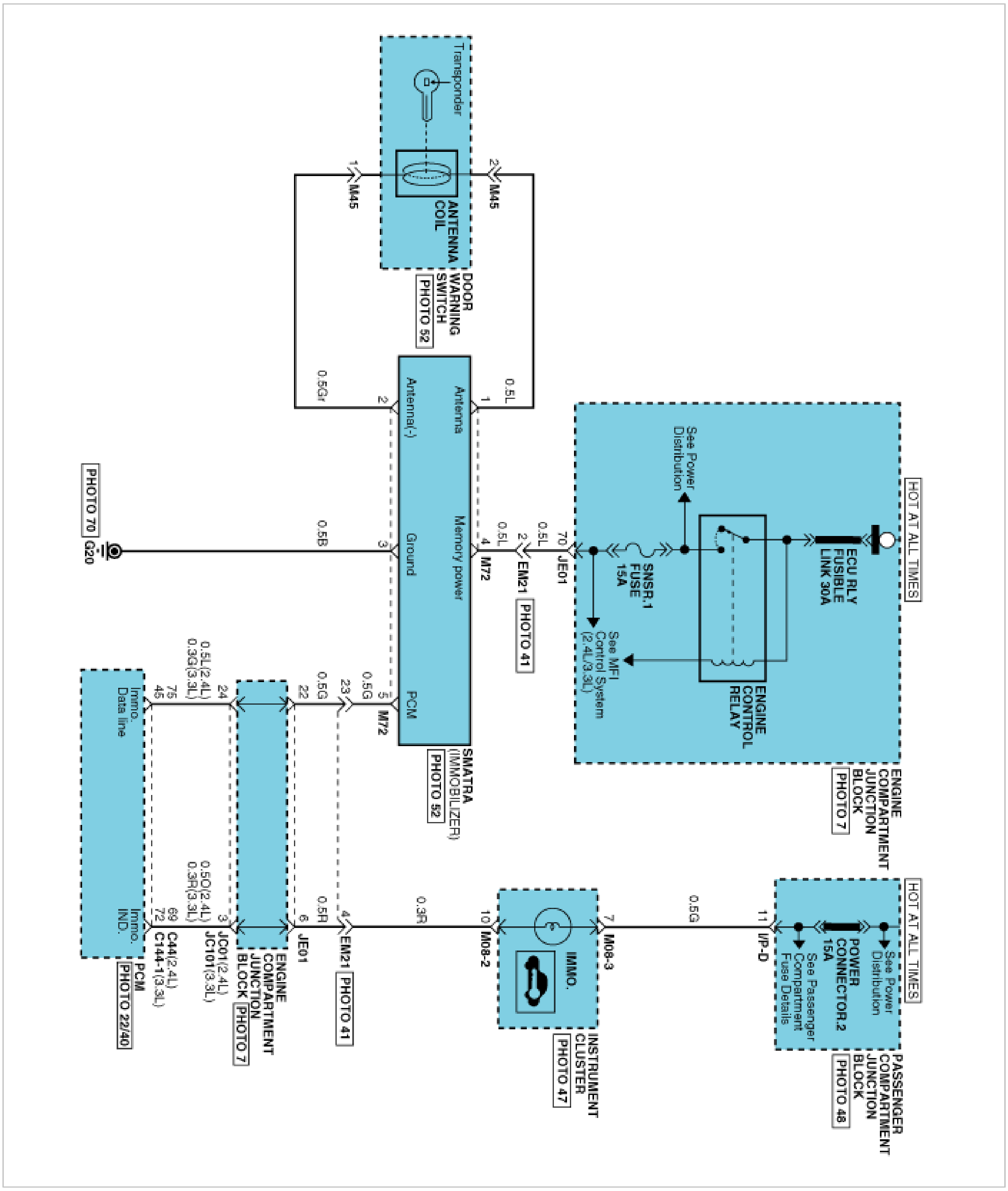
4. Installation is the reverse of removal procedure.

Body Electrical System > Immobilizer System > Schematic Diagrams

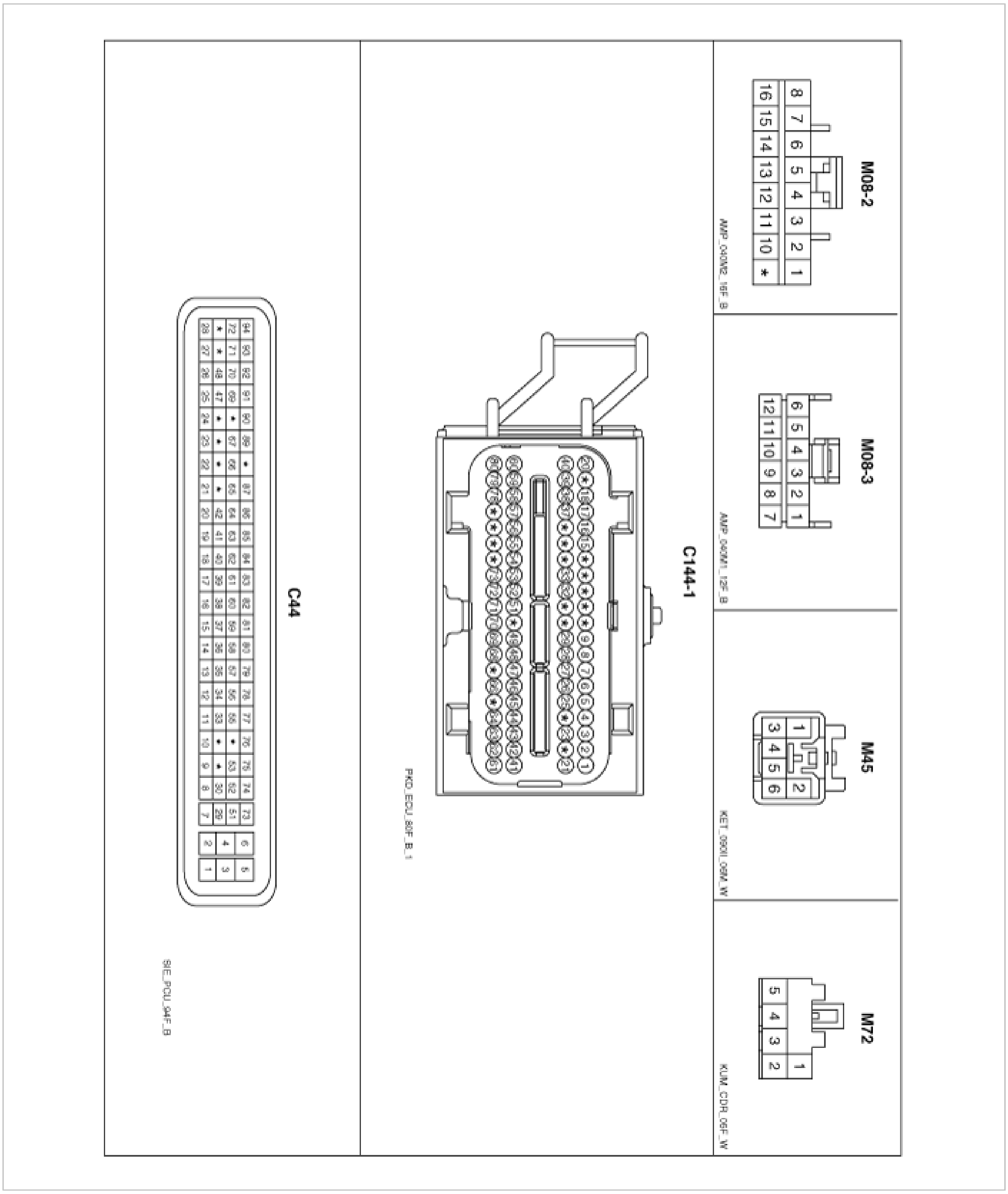
SYSTEM BLOCK DIAGRAM



CIRCUIT DIAGRAM



HOT AT ALL TIMES
ECU RLY FUSIBLE LINK 30A
ENGINE CONTROL RELAY
See Power Distribution
SNSR.1 FUSE 15A
See MFI Control System (2.4L/3.3L)
ENGINE COMPARTMENT JUNCTION BLOCK
PHOTO 7
JE01
EM21
PHOTO 41
M72
Transponder
ANTENNA COIL
M45
DOOR WARNING SWITCH
PHOTO 52
Antenna
Antenna(-)
Memory power
Ground
PCM
SMATRA (IMMOBILIZER)
0.5L
0.5Gr
0.5B
0.5G
PHOTO 70
G20
Immo. Data line
Immo. IND.
0.5L(2.4L)
0.3G(3.3L)
0.5O(2.4L)
0.3R(3.3L)
0.5R
0.3R
JC01(2.4L)
JC101(3.3L)
C44(2.4L)
C144-1(3.3L)
PCM
PHOTO 22/40
HOT AT ALL TIMES
See Power Distribution
POWER CONNECTOR.2 15A
See Passenger Compartment Fuse Details
PASSENGER COMPARTMENT JUNCTION BLOCK
PHOTO 48
I/P-D
M08-3
M08-2
IMMO.
INSTRUMENT CLUSTER
PHOTO 47



Body Electrical System > Immobilizer System > Description and Operation

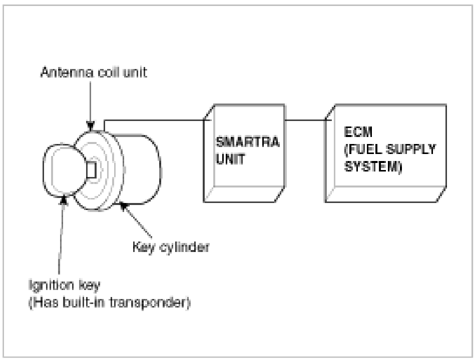
DESCRIPTION

The immobilizer system will disable the vehicle unless the proper ignition key is used, in addition to the currently available anti-theft systems such as car alarms, the immobilizer system aims to drastically reduce the rate of auto theft.

1. SMARTRA type immobilizer
   A. The SMARTRA system consists of a transponder located in the ignition key, an antenna coil, a SMARTRA unit, an indicator light and the ECM.
   B. The SMARTRA communicates to the ECM (Engine Control Module) via a dedicated communications line. Since the vehicle engine management system is able to control engine mobilization, it is the most suitable unit to control the SMARTRA.
   C. When the key is inserted in the ignition and turned to the ON position, the antenna coil sends power to the transponder in the ignition key. The transponder then sends a coded signal back through the SMARTRA unit to the ECM.
   D. If the proper key has been used, the ECM will energize the fuel supply system. The immobilizer indicator light in the cluster will simultaneously come on for more than five seconds, indicating that the SMARTRA unit has recognized the code sent by

the transponder.

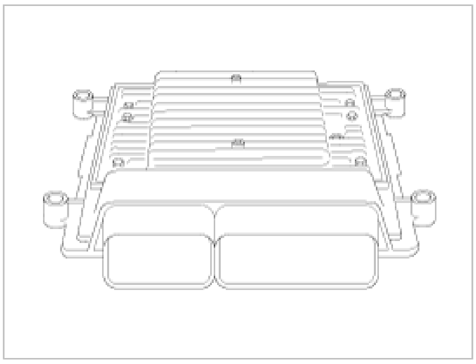
E. If the wrong key has been used and the code was not received or recognized by the ECM the indicator light will continue blinking for about five seconds until the ignition switch is turned OFF.
F. If it is necessary to rewrite the ECM to learn a new key, the dealer needs the customer's vehicle, all its keys and the Hi-scan (pro) equipped with an immobilizer program card. Any key that is not learned during rewriting will no longer start the engine.
G. The immobilizer system can store up to four key codes.
H. If the customer has lost his key, and cannot start the engine, contact HMC motor service station.



COMPONENTS OPERATIONS

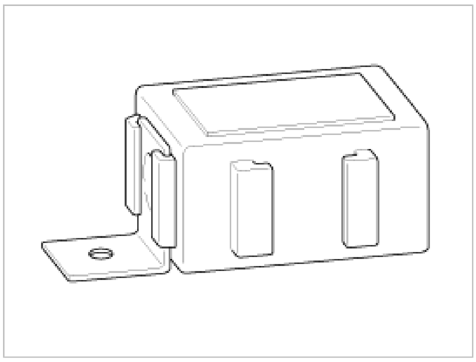
ECM (Engine Control Module)

1. The ECM carries out a check of the ignition key using a special encryption algorithm, which is programmed into the transponder as well as the ECM simultaneously. Only if the results are equal, the engine can be started. The data of all transponders, which are valid for the vehicle, are stored in the ECM.



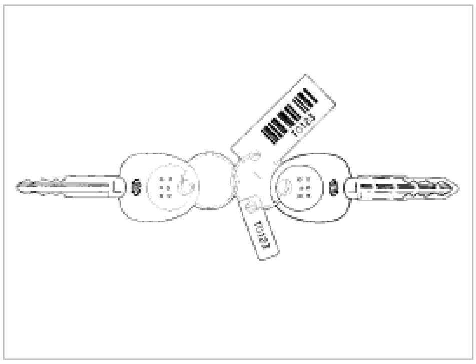
SMARTRA unit

The SMARTRA carries out communication with the built-in transponder in the ignition key. This wireless communication runs on RF (Radio frequency of 125 kHz). The SMARTRA is mounted behind of the crush pad under panel close to the antenna coil for RF transmission and receiving.
The RF signal from the transponder, received by the antenna coil, is converted into messages for serial communication by the SMARTRA device. And, the received messages from the ECM are converted into an RF signal, which is transmitted to the transponder by the antenna.
The SMARTRA does not carry out the validity check of the transponder or the calculation of encryption algorithm. This device is only an advanced interface, which converts the RF data flow of the transponder into serial communication to the ECM and vice versa.



TRANSPONDER (Built-in keys)

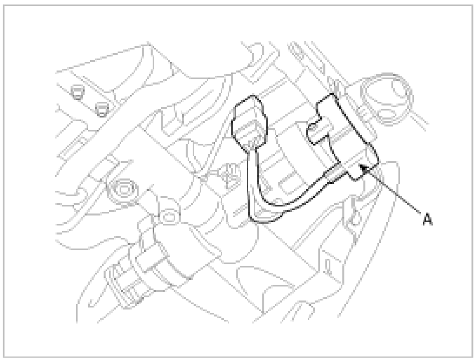
The transponder has an advanced encryption algorithm. During the key teaching procedure, the transponder will be programmed with vehicle specific data. The vehicle specific data are written into the transponder memory. The write procedure is once only; therefore, the contents of the transponder can never be modified or changed.



Antenna coil

The antenna coil (A) has the following functions.

- The antenna coil supplies energy to the transponder.
- The antenna coil receives signal from the transponder.
- The antenna coil sends transponder signal to the SMARTRA.
  It is located directly in front of the steering handle lock.



Body Electrical System > Immobilizer System > Troubleshooting

DIAGNOSIS OF IMMOBILIZER FAULTS

- Communication between the ECM and the SMARTRA.
- Function of the SMARTRA and the transponder.
- Data (stored in the ECM related to the immobilizer function.

The following table shows the assignment of immobilizer related faults to each type:

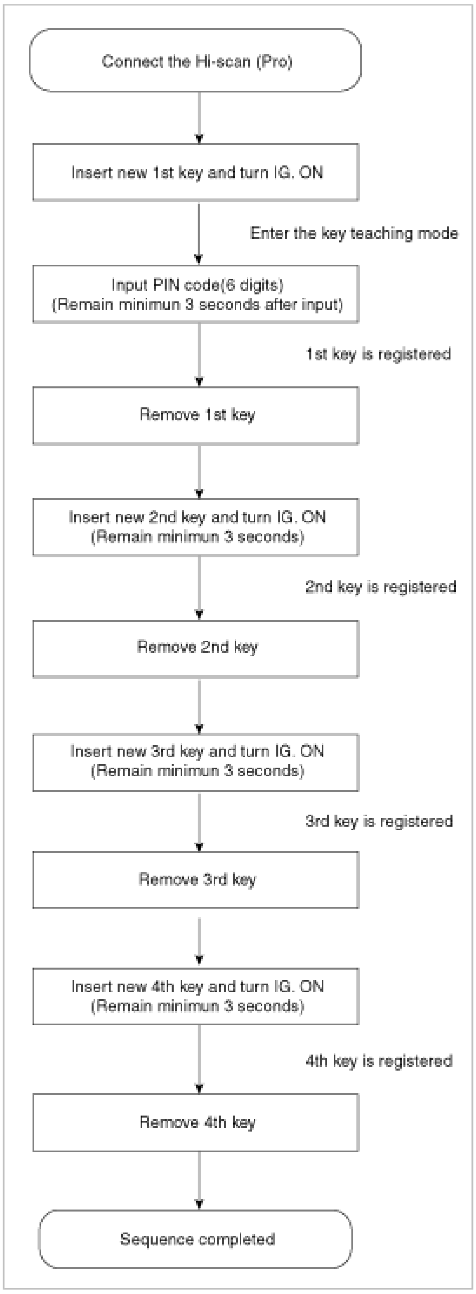
Immobilizer Related Faults	Fault types	Diagnostic codes
Transponder key fault	1. Transponder not in password mode. 2. Transponder transport data has been changed.	P1674 (Transponder status error)
Transponder key fault	1. Transponder programining error	P1675 (Transponder programming error)
SMARTRA fault	1. Invalid message from SMARTRA to ECM.	P1676 (SMARTRA message error)
SMARTRA fault	1. No response from SMARTRA (Communication Line Error - Open or Short etc.)	P1690 (SMARTRA no response)
Antenna coil fault	1. Antenna coil open/short circuit	P1691 (Antenna coil error)
Transponder key fault	1. Corrupted data from transponder 2. More than one transponder in the magnetic field (Antenna coil) 3. No transponder (Key without transponder) in the magnetic field (Antenna coil)	P1693 (Transponder no response error/invalid response)

ECM fault	1. Request from ECM is invalid (Protocol layer violation- Invalid request, check sum error etc.)	P1694 (ECM message error)
ECM internal permanent memory (EEPROM) fault	1. ECM internal permanent memory (EEPROM) fault 2. Invalid write operation to permanent memory (EEPROM)	P1695 (ECM memory error)
Invalid key fault	1. Virgin transponder at ECM status "Learnt" 2. Learnt (Invalid) Transponder at ECM status "Learnt"(Authentication fail)	P1696 (Authentication fail)
Locked by timer	1. Exceeding the maximum limit of Twice IGN ON (⊇ 32 times)	P1699 (Twice IG ON over trial)

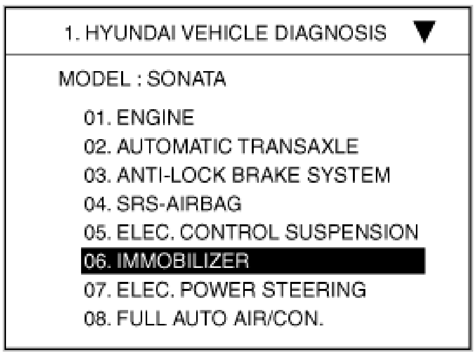
Body Electrical System > Immobilizer System > Repair procedures

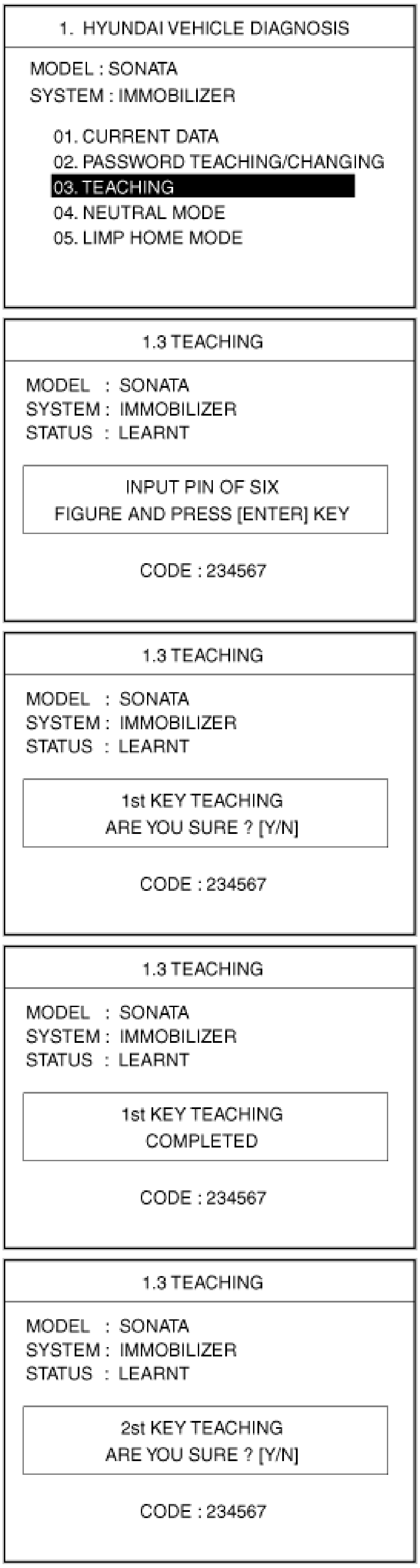
TEACHING PROCEDURES

1. Key Teaching Procedure
   Key teaching must be done after replacing a defective ECM or when providing additional keys to the vehicle owner.
   The procedure starts with an ECM request for vehicle specific data (PIN code: 6digits) from the tester. The "virgin" ECM stores the vehicle specific data and the key teaching can be started. The "learnt" ECM compares the vehicle specific data from the tester with the stored data. If the data are correct, the teaching can proceed.
   If incorrect vehicle specific data have been sent to the ECM three times, the ECM will reject the request of key teaching for one hour. This time cannot be reduced by disconnecting the battery or any other manipulation. After reconnecting the battery, the timer starts again for one hour.
   The key teaching is done by ignition on with the key and additional tester commands. The ECM stores the relevant data in the EEPROM and in the transponder. Then the ECM runs the authentication required for confirmation of the teaching process. The successful programming is then confirmed by a message to the tester.
   If the key is already known to the ECM from a previous teaching, the authentication will be accepted and the EEPROM data are updated. There is no changed transponder content (this is impossible for a learnt transponder).
   The attempt to repeatedly teach a key, which has been taught already during the same teaching cycle, is recognized by the ECM. This rejects the key and a message is sent to the tester.
   The ECM rejects invalid keys, which are presented for teaching. A message is sent to the tester. The key can be invalid due to faults in the transponder or other reasons, which result from unsuccessful programming of data. If the ECM detects different authenticators of a transponder and an ECM, the key is considered to be invalid.
   The maximum number of taught keys is 4
   If an error occurs during the Immobilizer Service Menu, the ECM status remains unchanged and a specific fault code is stored.
   If the ECM status and the key status do not match for teaching of keys, the tester procedure will be stopped and a specific fault code will be stored at ECM.



(1) ECM learnt status.




1. HYUNDAI VEHICLE DIAGNOSIS
MODEL : SONATA
SYSTEM : IMMOBILIZER
01. CURRENT DATA
02. PASSWORD TEACHING/CHANGING
03. TEACHING
04. NEUTRAL MODE
05. LIMP HOME MODE
1.3 TEACHING
MODEL : SONATA
SYSTEM : IMMOBILIZER
STATUS : LEARNT
INPUT PIN OF SIX
FIGURE AND PRESS [ENTER] KEY
CODE : 234567
1.3 TEACHING
MODEL : SONATA
SYSTEM : IMMOBILIZER
STATUS : LEARNT
1st KEY TEACHING
ARE YOU SURE ? [Y/N]
CODE : 234567
1.3 TEACHING
MODEL : SONATA
SYSTEM : IMMOBILIZER
STATUS : LEARNT
1st KEY TEACHING
COMPLETED
CODE : 234567
1.3 TEACHING
MODEL : SONATA
SYSTEM : IMMOBILIZER
STATUS : LEARNT
2st KEY TEACHING
ARE YOU SURE ? [Y/N]
CODE : 234567

1.3 TEACHING

MODEL : SONATA
SYSTEM : IMMOBILIZER
STATUS : LEARNT

2st KEY TEACHING
COMPLETED

CODE : 234567

(2) ECM virgin status.
After replacing new "ECM" scantool displays that ECM is virgin status in Key Teaching mode.
"VIRGIN" status means that ECM has not matched any PIN code before.

1.3 TEACHING

MODEL : SONATA
SYSTEM : IMMOBILIZER
STATUS : VIRGIN

INPUT PIN OF SIX
FIGURE AND PRESS [ENTER] KEY

CODE : 234567

1.3 TEACHING

MODEL : SONATA
SYSTEM : IMMOBILIZER
STATUS : VIRGIN

1st KEY TEACHING
ARE YOU SURE ? [Y/N]

CODE : 234567

1.3 TEACHING

MODEL : SONATA
SYSTEM : IMMOBILIZER
STATUS : VIRGIN

1st KEY TEACHING
COMPLETED

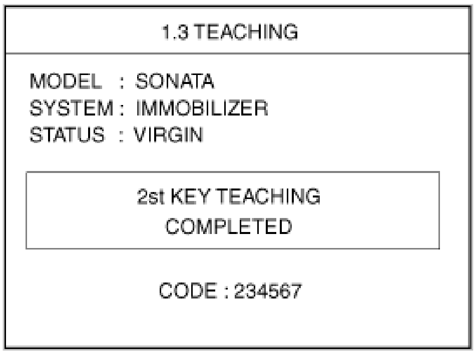
CODE : 234567

1.3 TEACHING

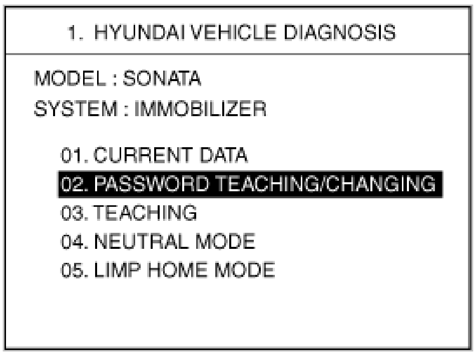
MODEL : SONATA
SYSTEM : IMMOBILIZER
STATUS : VIRGIN

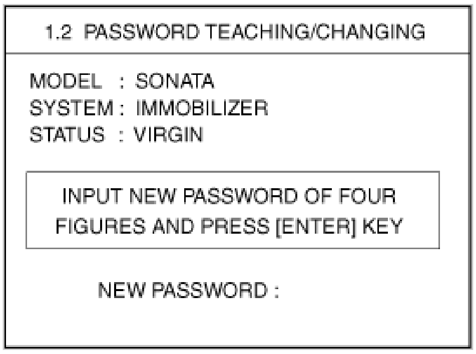
2st KEY TEACHING
ARE YOU SURE ? [Y/N]

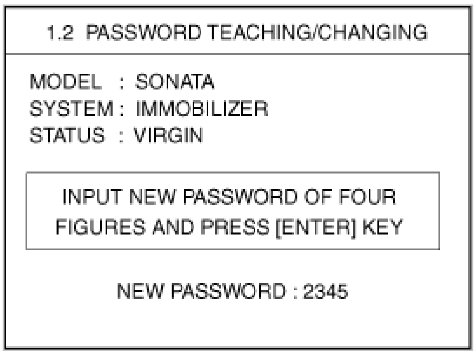
CODE : 234567



2. User Password Teaching Procedure
   The user password for limp home is taught at the service station. The owner of the vehicle can select a number with four digits. User password teaching is only accepted by a "learnt" ECM. Before first teaching of user password to an ECM, the status of the password is "virgin" No limp home function is possible.
   The teaching is started by ignition on, with a valid key and sending the user password by tester. After successful teaching, the status of the user password changes from "virgin" to "learnt"
   The learnt user password can also be changed. This can be done if the user password status is "learnt" and the tester sends authorization of access, either the old user password or the vehicle specific data. After correct authorization, the ECM requests the new user password. The status remains "learnt" and the new user password will be valid for the next limp home mode.
   If incorrect user passwords or wrong vehicle specific data have been sent to the ECM three times, the ECM will reject the request to change the password for one hour. This time cannot be reduced by disconnecting the battery or any other actions. After reconnecting the battery, the timer starts again for one hour.
   (1) User password teaching







1.2 PASSWORD TEACHING/CHANGING

MODEL : SONATA
SYSTEM : IMMOBILIZER
STATUS : VIRGIN

ARE YOU SURE ? [Y/N]

NEW PASSWORD : 2345

1.2 PASSWORD TEACHING/CHANGING

MODEL : SONATA
SYSTEM : IMMOBILIZER
STATUS : VIRGIN

COMPLETED
PRESS [ESC] TO EXIT

NEW PASSWORD : 2345

※ In case of putting wrong password, retry from first step after 10 seconds.

(2) User password changing

1. HYUNDAI VEHICLE DIAGNOSIS

MODEL : SONATA
SYSTEM : IMMOBILIZER

01. CURRENT DATA
02. PASSWORD TEACHING/CHANGING
03. TEACHING
04. NEUTRAL MODE
05. LIMP HOME MODE

1.2 PASSWORD TEACHING/CHANGING

MODEL : SONATA
SYSTEM : IMMOBILIZER
STATUS : LEARNT

INPUT OLD PASSWORD OF FOUR
FIGURES AND PRESS [ENTER] KEY

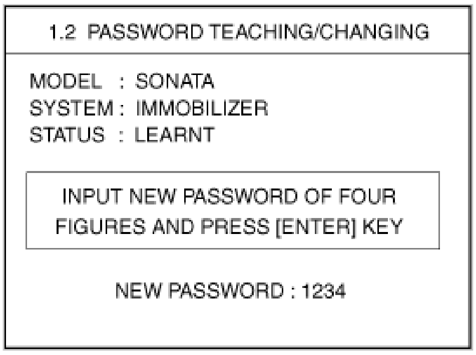
OLD PASSWORD :

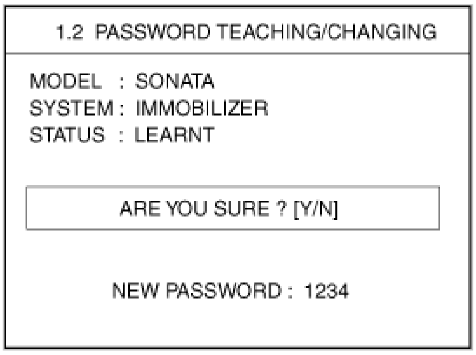
1.2 PASSWORD TEACHING/CHANGING

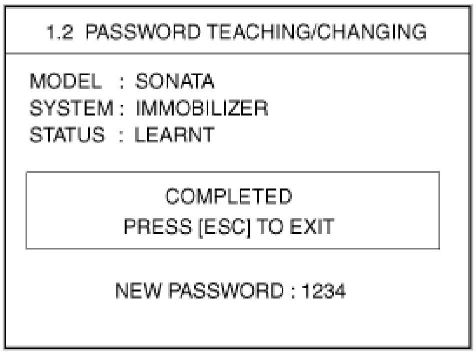
MODEL : SONATA
SYSTEM : IMMOBILIZER
STATUS : LEARNT

INPUT OLD PASSWORD OF FOUR
FIGURES AND PRESS [ENTER] KEY

OLD PASSWORD : 2345

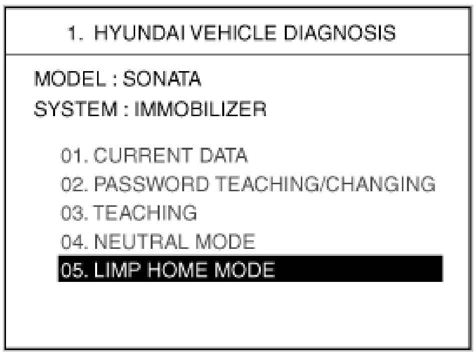


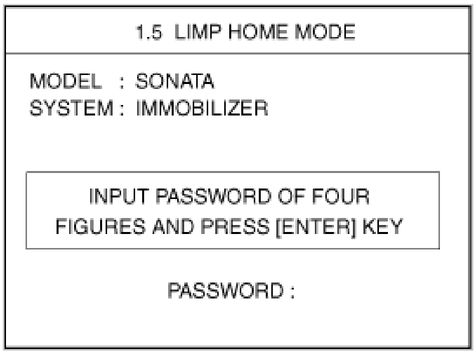


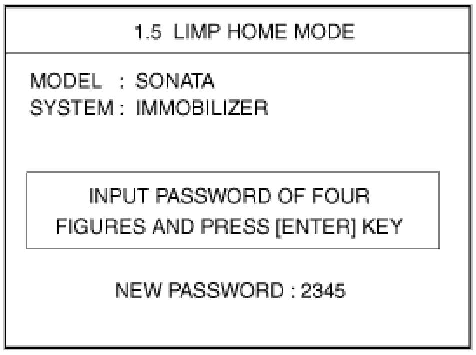


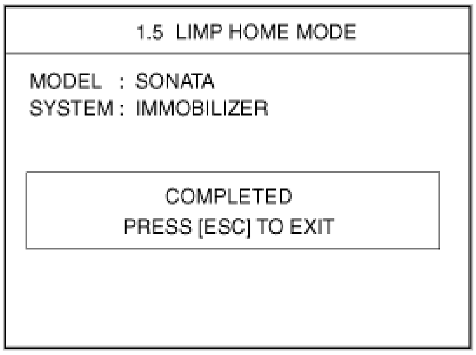
LIMP HOME FUNCTION

1. LIMP HOME BY TESTER
   If the ECM detects the fault of the SMARTRA or transponder, the ECM will allow limp home function of the immobilizer. Limp home is only possible if the user password (4 digits) has been given to the ECM before. This password can be selected by the vehicle owner and is programmed at the service station.
   The user password can be sent to the ECM via the special tester menu.
   Only if the ECM is in status "learnt" and the user password status is "learnt" and the user password is correct, the ECM will be unlocked for a period of time (30 sec.). The engine can only be started during this time. After the time has elapsed, engine start is not possible.
   If the wrong user password is sent, the ECM will reject the request of limp home for one hour. Disconnecting the battery or any other action cannot reduce this time. After connecting the battery to the ECM, the timer starts again for one hour.

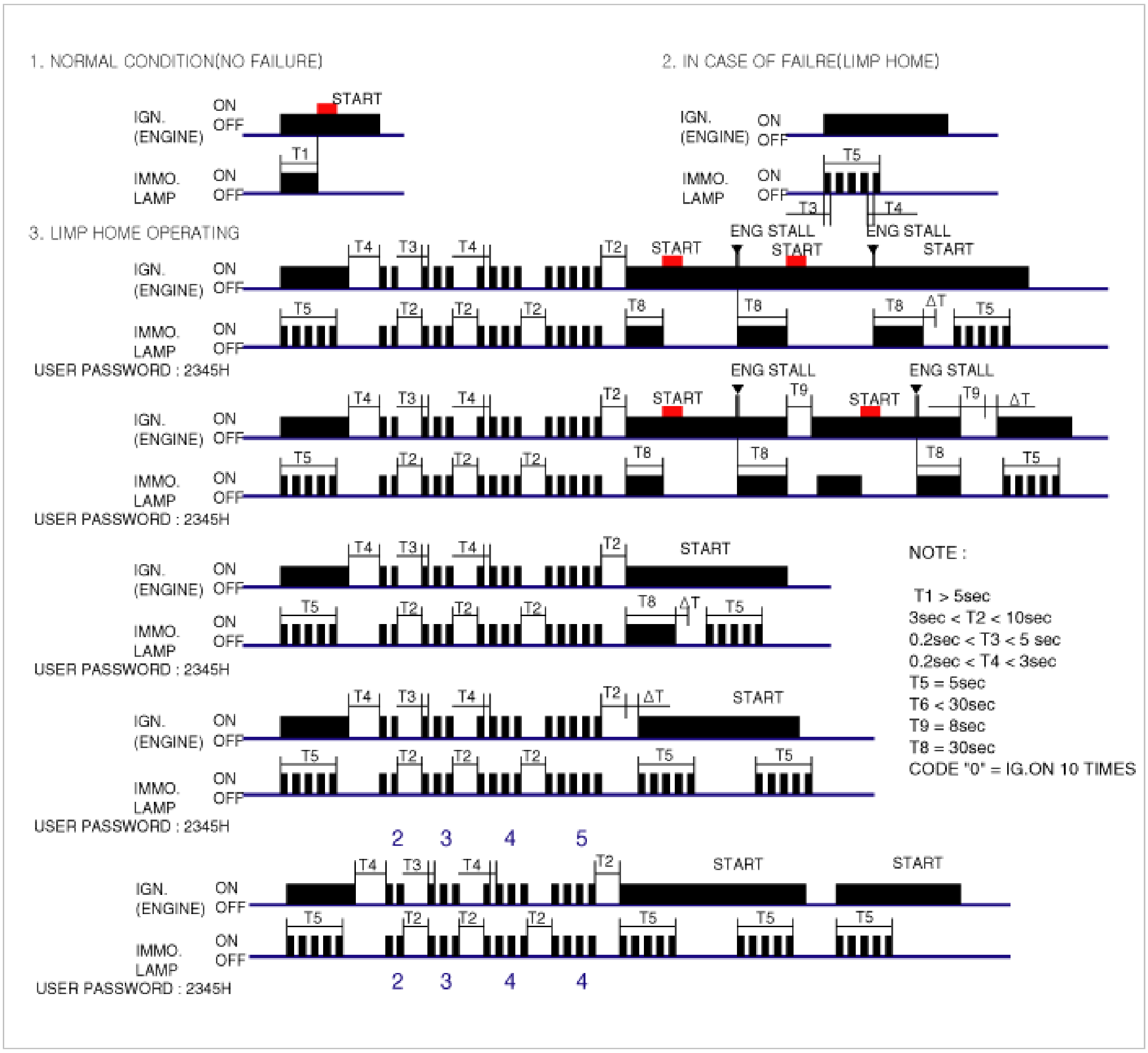








2. LIMP HOME BY IGNITION KEY
   The limp home can be activated also by the ignition key. The user password can be input to the ECM by a special sequence of ignition on/off.
   Only if the ECM is in status "learnt" and the user password status is "learnt" and the user password is correct, the ECM will be unlocked for a period of time (30 sec.). The engine can be started during this time. After the time has elapsed, engine start is not possible. After a new password has been input, the timer (30 sec.) will start again.
   After ignition off, the ECM is locked if the timer has elapsed 8 seconds. For the next start, the input of the user password is requested again.



PROBLEMS AND REPLACEMENT PARTS:

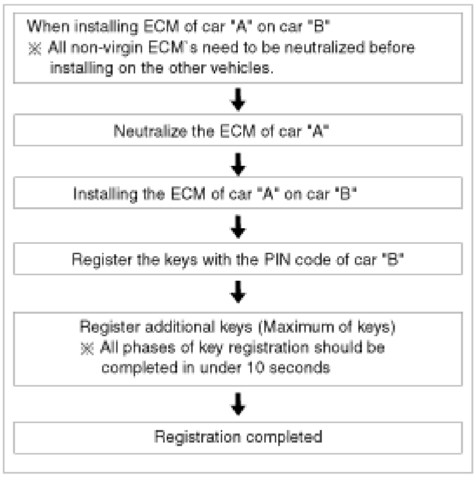
Problem	Part set	Scan tool required?
All keys have been lost	Blank key (4)	YES
Antenna coil unit does not work	Antenna coil unit	NO
ECM does not work	ECM	YES
Ignition switch does not work	Ignition switch with Antenna coil unit	YES
Unidentified vehicle specific data occurs	Key, ECM	YES
SMARTRA unit does not work	SMARTRA unit	NO

REPLACEMENT OF ECM AND SMARTRA

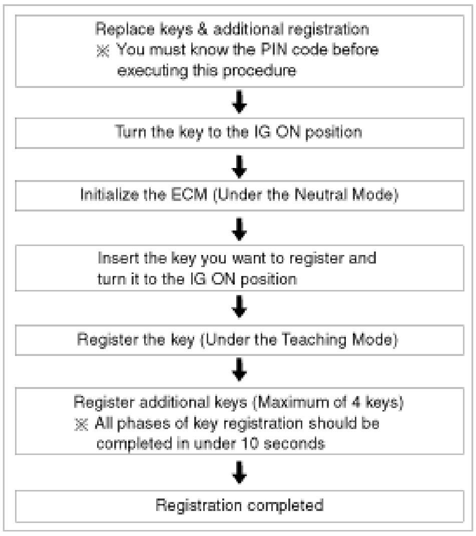
In case of a defective ECM, the unit has to be replaced with a "virgin" or "neutral" ECM. All keys have to be taught to the new ECM. Keys, which are not taught to the ECM, are invalid for the new ECM (Refer to key teaching procedure). The vehicle specific data have to be left unchanged due to the unique programming of transponder.

In case of a defective SMARTRA, there is no special procedure required. A new SMARTRA device simply replaces the old one. There are no transponder-related data stored in this device.

1. Things to remember before a replacement (ECM)



2. Things to remember before a replacement (Keys & Additional registration)



NOTE

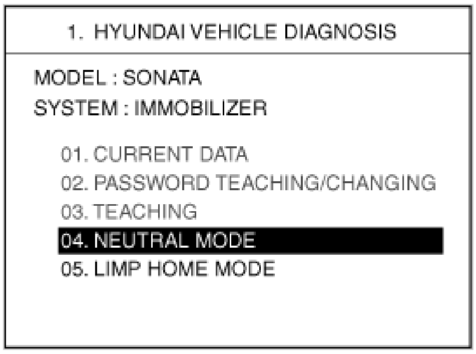
1. When there is only one key registered and you wish to register another key, you need to re-register the key which was already registered.
2. When the key #1 is registered and key #2 is not registered, Put the key #1 in the IG/ON or the start position and remove it. The engine can be started with the unregistered key #2.
   (Note that key #2 must be used within 10 seconds of removing key #1)
3. When the key #1 is registered and key #2 is not registered, put the unregistered master key #2 in the IG/ON or the start position.
   The engine cannot be started even with the registered key #1.
   (Note that key #1 must be used within 10 seconds of removing key #2)
4. When you inspect the immobilizer system, refer to the above paragraphs 1, 2 and 3.
   Always remember the 10 seconds zone.
5. If the pin code & password are entered incorrectly on three consecutive inputs, the system will be locked for one hour.
6. Be cautious not to overlap the transponder areas.
7. Problems can occur at key registration or vehicle starting if the transponders should overlap.

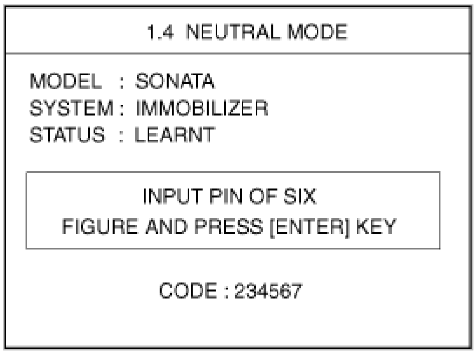
NEUTRALISING OF ECM

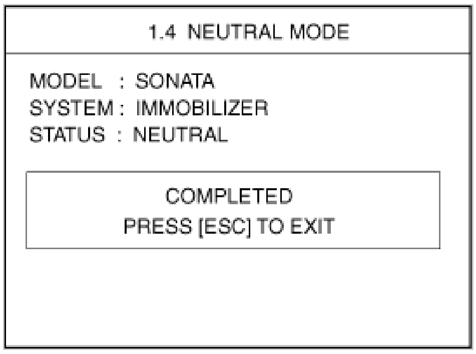
The ECM can be set to the "neutral" status by a tester.
A valid ignition key is inserted and after ignition on is recorded, the ECM requests the vehicle specific data from the tester. The communication messages are described at "Neutral Mode" After successfully receiving the data, the ECM is neutralized.
The ECM remains locked. Neither the limp home mode nor the "twice ignition on" function, is accepted by the ECM.
The teaching of keys follows the procedure described for the virgin ECM. The vehicle specific data have to be unchanged due to the unique programming of the transponder. If data should be changed, new keys with a virgin transponder are requested.
This function is for neutralizing the ECM. Ex) when lost key, Neutralize the ECM then teach keys.
(Refer to the Things to do when Key & PIN Code the ECM can be set to the "neutral" status by a scanner. A valid ignition key is inserted and after ignition on is recorded, the ECM requests the vehicle specific data from the scanner. The communication messages are described at" Neutral Mode". After successfully receiving the data, the ECM is neutralized.

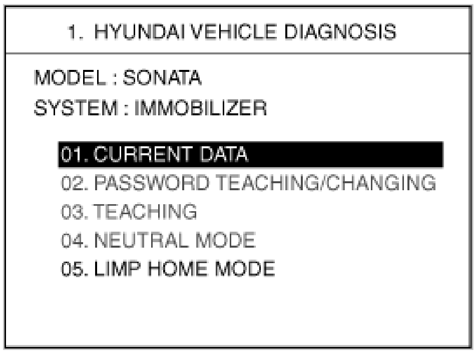
The ECM remains locked. Neither the limp home mode nor the "twice ignition on" function is accepted by ECM.
The teaching of keys follows the procedure described for virgin ECM. The vehicle specific data have to be unchanged due to the unique programming of transponder. If data should be changed, new keys with virgin transponder are requested.

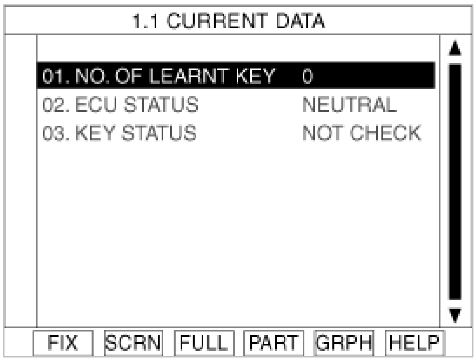
> **NOTE**
>
> - Neutralizing setting condition
>   - In case of ECM status "Learnt" regardless of user password "Virgin or Learnt"
>   - Input correct PIN code by scanner.
>   - Neutralizing meaning .
>   : PIN code (6) & user password (4) deletion.
>   : Locking of ECM (except key teaching permission)











Body Electrical System > Immobilizer System > P1674

GENERAL DESCRIPTION

During the key teaching procedure the transponder will be programmed with vehicle specific data. The vehicle specific data are written into the transponder memory. The write procedure is unique; therefore the content of transponder can never be modified or changed. The data are a string of 9 bytes defined by vehicle manufacturer.
The transponder memory is split into two strings called authenticator and key password after this programming the transponder memory is locked and the data (PIN code) cannot be read or changed respectively. The transponder status changes from "virgin" to "learnt" Additionally every transponder includes a unique IDE (Identifier number) of 32 bit. Unique means that the IDE of all transponder is different from each other. The IDE is programmed by the transponder manufacturer and is a read-only value. The authenticator and the key password are not transferred from ECM to transponder or vice versa. Only the results from the encryption algorithm are transferred. It is almost impossible to calculate the vehicle specific data from the encryption result.
For teaching of keys and special purposes the ECM is connected to the tester device.
When IG is ON, the coil supplies energy to the transponder which in turn accumulates energy in the condenser.
Once the energy supply from the coil has stopped, using the stored energy in the condenser, the transponder transmits the ID CODE (stored within the ASIC).

DTC DESCRIPTION

This DTC is defined as TP not in password mode, or Transponder transport data has been changed.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
Enable Condition	• IG ON	• Transponder Key
Detecting Factors	• Password mode invalid	
Detecting Window	• During Transponder Write or Read EEPROM Page	
Detecting Criteria	• TP not in password mode, or Transponder transport data has been changed	

MONITOR SCANTOOL DATA

1. Ignition "ON" & Engine "OFF".
2. Connect Scan tool and clear the DTCs.
3. If the DTCs are retrieved again, monitor "CURRENT DATA" to check No. of Learnt key, ECM and KEY status.

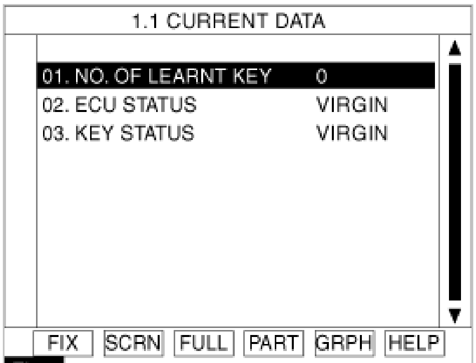


Fig 1

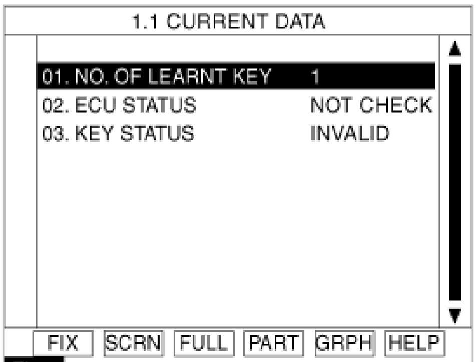


Fig 2

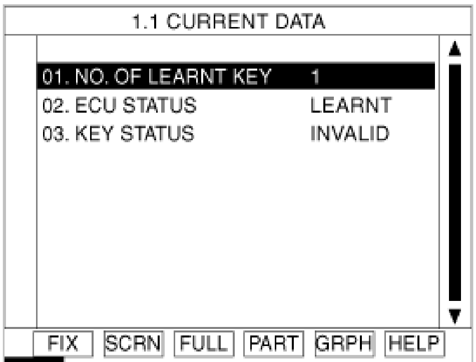


Fig 3

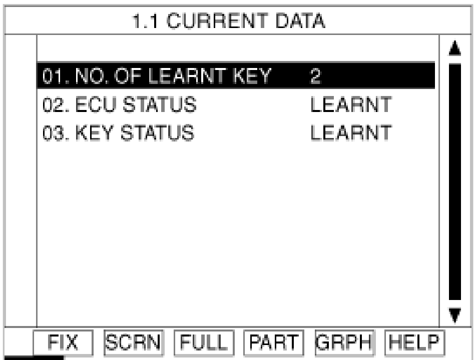


Fig 4

Fig 1 : ECM has not matched with any Key yet.
Fig 2 : ECM Internal Failure.
Fig 3 : IG On with unmatched key.
Fig 4 : 2(two) Keys have been matched with ECM.

4. Are both Key and ECM status learnt?

YES

Fault is intermittent caused by poor contact in the SMARTRA's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Go to "Component Inspection" procedure.

COMPONENT INSPECTION

1. Check Transponder
   (1) Ignition "ON" & Engine "OFF".
   (2) Perform neutral mode, key teaching and password teaching/changing.
   (Refer to "Reference Data in General Information")

   NOTE
   Be sure that PIN code is prepared before performing neutral mode.

   (3) Is the neutral, teaching and password teaching/changing mode possible?

   YES
   Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
   Repair or replace as necessary and then go to " Verification of Vehicle Repair" procedure.

   NO
   Substitute with a known-good virgin Transponder and monitor CURRENT DATA.
   If the key status is displayed as "Virgin", replace Transponder.
   Perform key teaching mode in " Reference Data"
   Go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and monitor CURRENT DATA to check No. of Learnt key, ECM and KEY status.
2. Select Diagnostic Trouble Codes(DTCs)" mode and Clear the DTCs.
3. Are any DTCs present?

YES
Go to the applicable troubleshooting procedure.

NO
System is performing to specification at this time.

Body Electrical System > Immobilizer System > P1675

GENERAL DESCRIPTION

During the key teaching procedure the transponder will be programmed with vehicle specific data. The vehicle specific data are written into the transponder memory. The write procedure is unique; therefore the content of transponder can never be modified or changed. The data are a string of 9 bytes defined by vehicle manufacturer.
The transponder memory is split into two strings called authenticator and key password after this programming the transponder memory is locked and the data(PIN code) cannot be read or changed respectively. The transponder status changes from "virgin" to "learnt" Additionally every transponder includes a unique IDE (Identifier number) of 32 bit. Unique means that the IDE of all transponder is different from each other. The IDE is programmed by the transponder manufacturer and is a read-only value. The authenticator and the key password are not transferred from ECM to transponder or vice versa. Only the results from the encryption algorithm are transferred. It is almost impossible to calculate the vehicle specific data from the encryption result.
For teaching of keys and special purposes the ECM is connected to the tester device.
When IG is ON, the coil supplies energy to the transponder which in turn accumulates energy in the condenser.
Once the energy supply from the coil has stopped, using the stored energy in the condenser, the transponder transmits the ID CODE (stored within the ASIC).

DTC DESCRIPTION

This DTC is defined as Invalid Transponder Data.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
Enable Condition	• IG ON	• Transponder Key
Detecting Factors	• TP programming error	

Detecting Window	• During Transponder Write EEPROM Page request while Transponder is in authorized state.	
Detecting Criteria	• Corrupted data form Transponder (Tp), or more than one TP in the field, or no TP in the magnetic field.	

MONITOR SCANTOOL DATA

1. Ignition "ON" & Engine "OFF".
2. Connect Scan tool and clear the DTCs.
3. If the DTCs are retrieved again, monitor "CURRENT DATA" to check No. of Learnt key, ECM and KEY status.

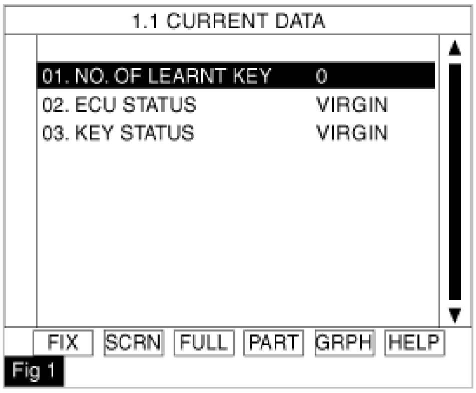


Fig 1

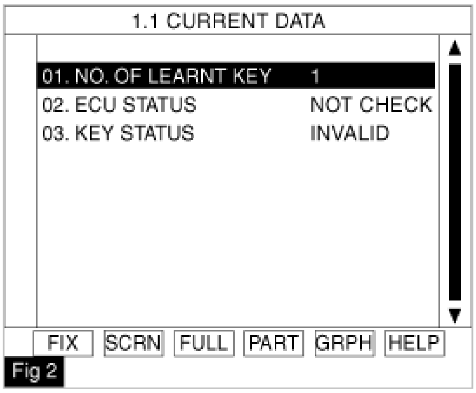


Fig 2

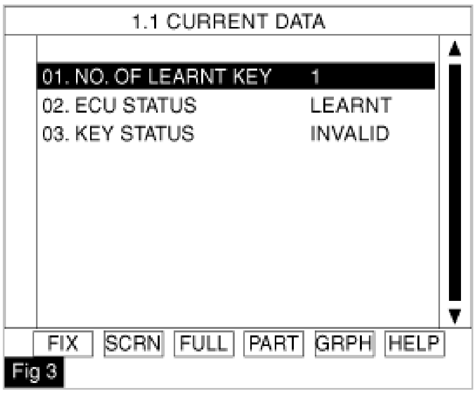


Fig 3

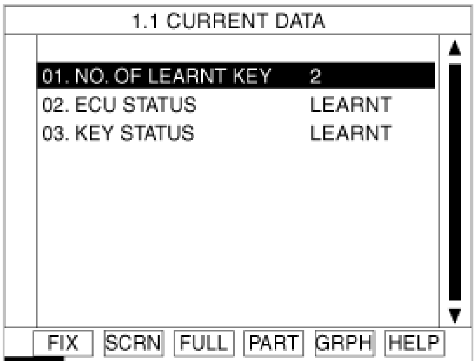


Fig 4

Fig 1 : ECM has not matched with any Key yet.
Fig 2 : ECM Internal Failure.
Fig 3 : IG On with unmatched key.
Fig 4 : 2(two) Keys have been matched with ECM.

4. Are both Key and ECM status learnt?

YES

Fault is intermittent caused by poor contact in the SMARTRA's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Go to "Component Inspection" procedure.

COMPONENT INSPECTION

1. Check Transponder
   (1) Ignition "ON" & Engine "OFF".
   (2) Perform neutral mode, key teaching and password teaching/changing.
   (Refer to "Reference Data in General Information")

   > NOTE
   >
   > Be sure that PIN code is prepared before performing neutral mode.

   (3) Is the neutral, teaching and password teaching/changing mode possible?

   YES

   Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
   Repair or replace as necessary and then go to " Verification of Vehicle Repair" procedure.

   NO

   Substitute with a known-good virgin Transponder and monitor CURRENT DATA.
   If the key status is displayed as "Virgin", replace Transponder.
   Perform key teaching mode in " Reference Data"
   Go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and monitor CURRENT DATA to check No. of Learnt key, ECM and KEY status.
2. Select Diagnostic Trouble Codes(DTCs)" mode and Clear the DTCs.
3. Are any DTCs present?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

Body Electrical System > Immobilizer System > P1676

GENERAL DESCRIPTION

The SMARTRA carries out communication with the built-in transponder of the ignition key. This wireless communication runs on RF (Radio frequency of 125 kHz). The SMARTRA is mounted at the ignition lock close to the antenna coil for RF transmission and receiving.
The RF signal from the transponder received by the antenna coil is converted into messages for serial communication by the SMARTRA device. And the received messages from the ECM are converted into an RF signal, which is transmitted, to the transponder by the antenna. The SMARTRA does not carry out the validity check of transponder or the calculation of encryption algorithm. This device is only an advanced interface, which converts the RF data flow of the transponder into serial communication to ECM and vice versa.
SMARTRA : SMARt TRansponder Antenna

DTC DESCRIPTION

This DTC defines Invalid message from SMARTRA to ECM.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
Enable Condition	• IG ON	• Open or Short in SMARTRA Circuit • Faulty SMARTRA
Detecting Criteria	• No response from SMARTRA Invalid message from SMARTRA to ECM	

MONITOR SCANTOOL DATA

1. Ignition "ON" & Engine "OFF".
2. Connect Scan tool and clear the DTCs.
3. If the DTCs are retrieved again, monitor "CURRENT DATA" to check No. of Learnt key, ECM and KEY status.

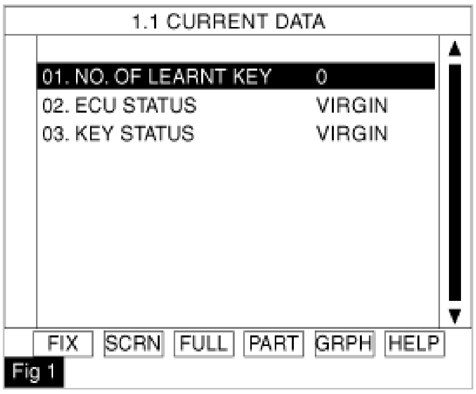


Fig 1

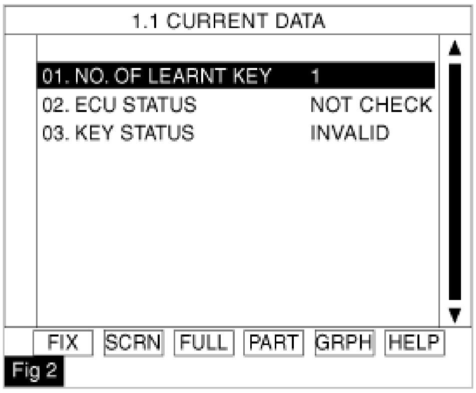


Fig 2

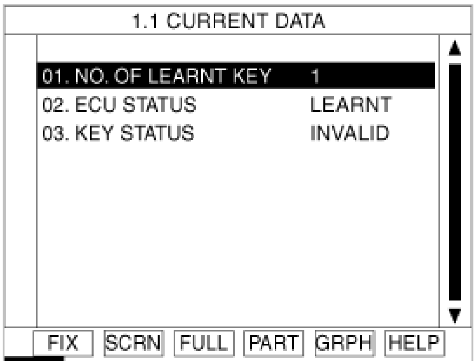


Fig 3

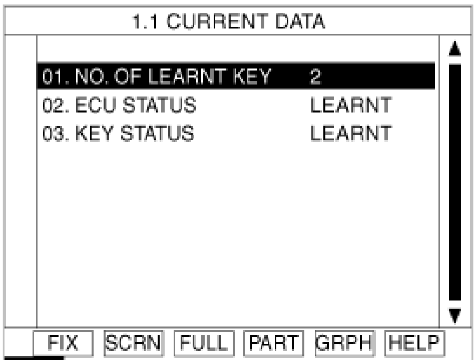


Fig 4

Fig 1 : ECM has not matched with any Key yet.
Fig 2 : ECM Internal Failure.
Fig 3 : IG On with unmatched key.
Fig 4 : 2(two) Keys have been matched with ECM.

4. Are both Key and ECM status learnt?

YES

Fault is intermittent caused by poor contact in the SMARTRA's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Go to "Component Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to " Power Circuit Inspection " procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect SMARTRA connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 4 of the SMARTRA harness connector and chassis ground.

Specification : B+

5. Is the measured voltage within specifications?

YES

Go to "Signal Circuit Inspection" procedure.

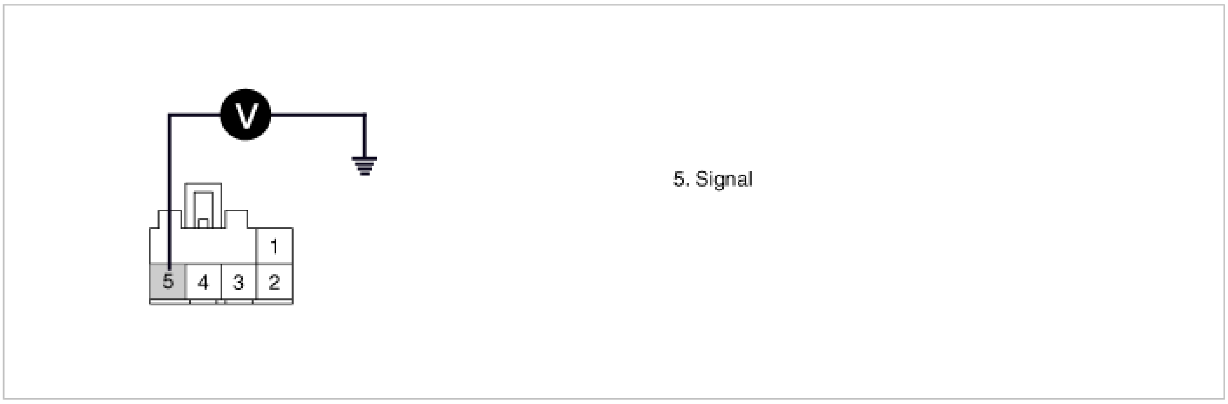
NO

Check open or short in power harness.
Check that 15A SENSOR fuse located between Main relay and SMARTRA is open or blown off.
Repair as necessary and go to "Verification of Vehicle repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check for short in harness.
   (1) Ignition "OFF".
   (2) Disconnect SMARTRA connector.
   (3) Ignition "ON" & Engine "OFF".
   (4) Measure voltage between terminal 5 of the SMARTRA harness connector and chassis ground.

   Specification : Approx. 10.2V



   (5) Is the measured voltage within specifications?

   YES

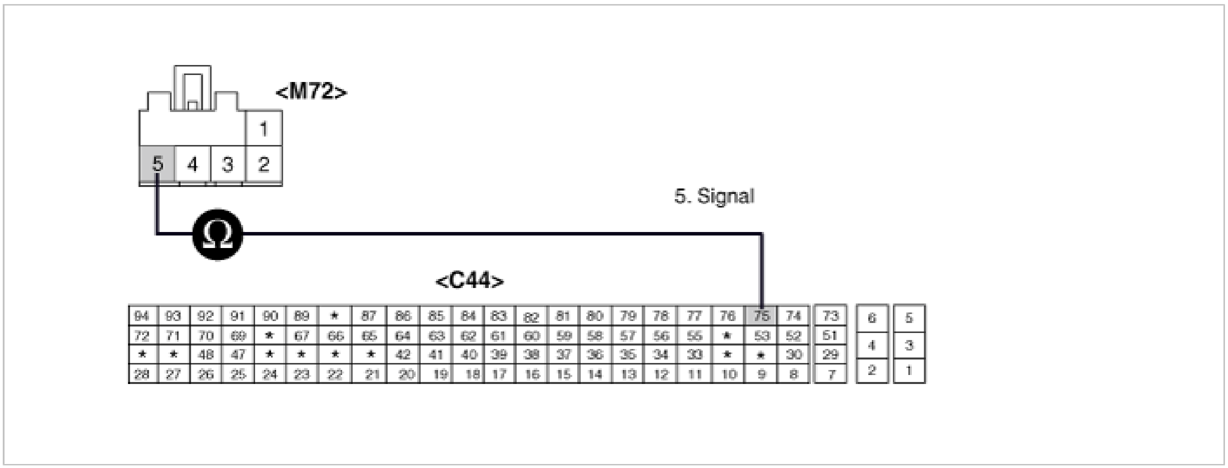
   Go to "Check for open in harness" as below.

   NO

   Check short in signal harness.
   Repair as necessary and go to "Verification of Vehicle repair" procedure.

2. Check for open in harness
   (1) Ignition "OFF".
   (2) Disconnect SMARTRA connector.
   (3) Measure resistance between terminal 5 of the SMARTRA harness connector and terminal 75 of ECM harness connector.

   Specification : Approx. below 1Ω



(4) Is the measured resistance within specifications?

YES

Go to "Ground Circuit Inspection" procedure.

NO

Check for open in signal harness.
Repair as necessary and go to "Verification of Vehicle repair" procedure.

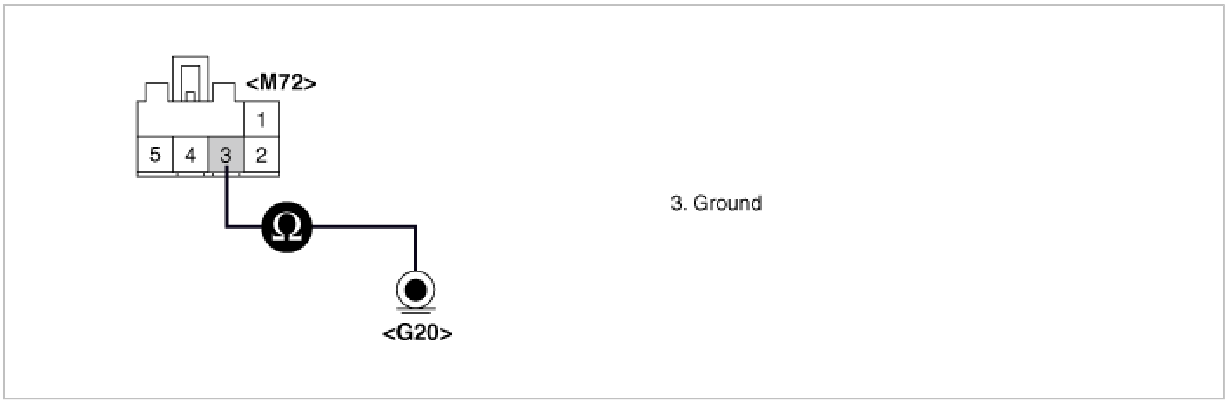
GROUND CIRCUIT INSPECTION

1. Check for open in harness between SMARTRA and Chassis ground.
   (1) Ignition "OFF".

   (2) Disconnect SMARTRA connector.

   (3) Measure resistance between terminal 3 of the SMARTRA harness connector and Chassis ground.

Specification : Approx. below 1Ω



(4) Is the measured resistance within specifications?

YES

Go to "Component Inspection" procedure.

NO

Check for open in ground harness.
Make sure that Chassis ground G20 is firmly tightened properly.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check SMARTRA
   (1) Ignition " ON" & Engine "OFF".

   (2) Perform the Neutral, Teaching, and Password teaching/ changing mode according to 2. ECM neutralization, 3.Key Teaching Procedure, 4. Password teaching/Changing in "Reference Data" described in General Information.

NOTE

Be sure that PIN code is prepared before performing neutral mode.

(3) Is Key teaching completed?

YES

Fault is intermittent caused by poor contact in the SMARTRA and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Substitute with a known-good SMARTRA and check for proper operation. If the problem is corrected, replace SMARTRA and go to "Go to "Verification of Vehicle Repair" procedure.

NOTE

In case of faulty SMARTRA, there are no special procedures required. A new SMARTRA device simply replaces the old one. (There are no transponder-related data stored in this device.)

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and monitor CURRENT DATA to check No. of Learnt key, ECM and KEY status.
2. Select Diagnostic Trouble Codes(DTCs)" mode and Clear the DTCs.
3. Are any DTCs present?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

Body Electrical System > Immobilizer System > P1690

GENERAL DESCRIPTION

The SMARTRA carries out communication with the built-in transponder of the ignition key. This wireless communication runs on RF (Radio frequency of 125 kHz). The SMARTRA is mounted at the ignition lock close to the antenna coil for RF transmission and receiving.
The RF signal from the transponder received by the antenna coil is converted into messages for serial communication by the SMARTRA device. And the received messages from the ECM are converted into an RF signal, which is transmitted, to the transponder by the antenna. The SMARTRA does not carry out the validity check of transponder or the calculation of encryption algorithm. This device is only an advanced interface, which converts the RF data flow of the transponder into serial communication to ECM and vice versa.
SMARTRA : SMARt TRansponder Antenna

DTC DESCRIPTION

This DTC is defined as No answer from SMARTRA because of communication line error(Open or short etc.)

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
Enable Condition	• IG ON	• Open or Short in SMARTRA Circuit • Faulty SMARTRA
Detecting Criteria	• No response from SMARTRA (Communication Line Error - Open or Short etc.)	

SIGNAL WAVEFORM

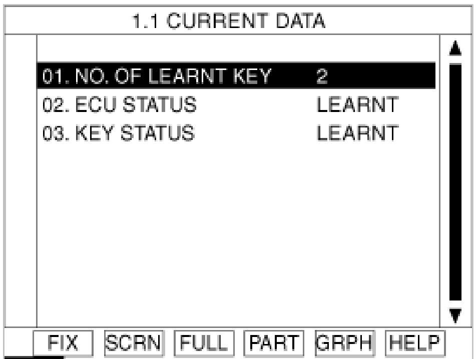


Fig 1

EMS Status	Engine start with valid key	Engine start by limp home	Teaching of key	Teaching or changing of user password	Twice ignition of function
Not yet checked	No	No	No	No	No
Virgin	No	No	Yes	No	Yes, with virgin key
Learnt	Yes	Yes, with learnt user password	Yes	Yes	No
Neutral	No	No	Yes	No	No
Locked by timer	No	No	No	No	No

Fig 2

1. ECM :
   (1) Virgin(This is status at the end of ECM production line before delivery to customer)

   (2) Neutral (This is a status that is erased all data regarding immobilizer by special command from scanner)

   (3) Not Check (The status is stored in permanent memory (EEPROM or Flash etc.)
   In case of not plausible data from this circuit the ECM cannot check the status.

   (4) Locked by timer (After a certain number of incorrect user Password(4) or PIN Code(6) the ECM is locked for one hour and no inputs are accepted during this time)

2. KEY :
   (1) Virgin (It means the key in the key cylinder has not matched with ECM yet)

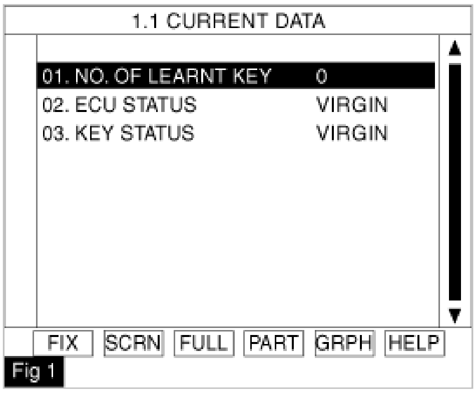
   (2) Invalid (It means that data is mismatched between ECM and transponder)

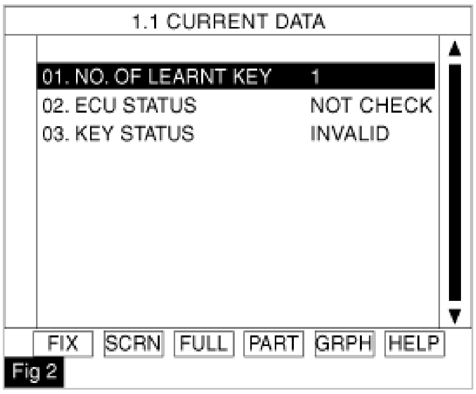
   (3) Not Checked (It means that ECM cannot check the transponder data in the key cylinder)
   A. ECM cannot check the transponder data because of SMARTRA error or antenna coil error.
   B. ECM cannot check the transponder data because of communication circuit problem between ECM and SMARTRA.
   C. Key with NO Transponder
   D. More than 1(One) Transponder in the magnetic field
   E. No Transponder in the magnetic field
   F. TP data blocked
   G. TP data does not exist
   H. TP data changed
   I. TP Teaching error
   J. Multiple TP data input

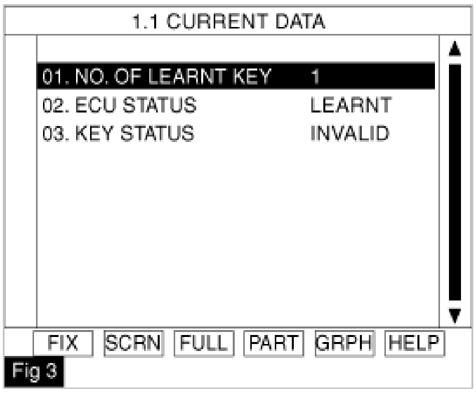
Current Data from Immobilizer will show the numbers of Key learnt, ECM status, and Key status as
Fig 1. The current data provides an indication of the probable cause.
Fig 2. shows possibility of Engine start, Teaching or changing of user password according to ECM status.

MONITOR SCANTOOL DATA

1. Ignition "ON" & Engine "OFF".
2. Connect Scan tool and clear the DTCs.
3. If the DTCs are retrieved again, monitor "CURRENT DATA" to check No. of Learnt key, ECM and KEY status.







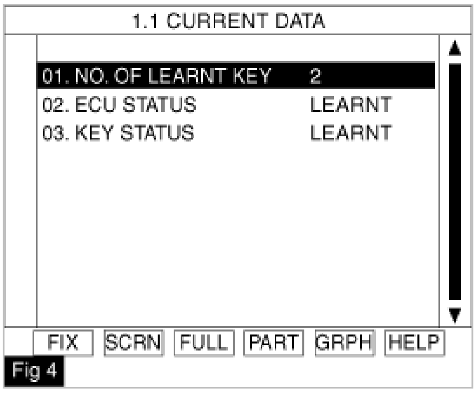


Fig 1 : ECM has not matched with any Key yet.
Fig 2 : ECM Internal Failure.
Fig 3 : IG On with unmatched key.
Fig 4 : 2(two) Keys have been matched with ECM.

4. Are both Key and ECM status learnt?

YES

Fault is intermittent caused by poor contact in the SMARTRA's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Go to "Component Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

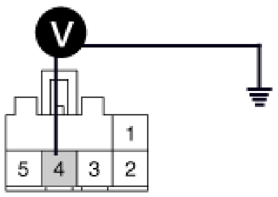
NO

Go to " Power Circuit Inspection " procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect SMARTRA connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 4 of the SMARTRA harness connector and chassis ground.

Specification : B+



5. Is the measured voltage within specifications?

YES

Go to "Signal Circuit Inspection" procedure.

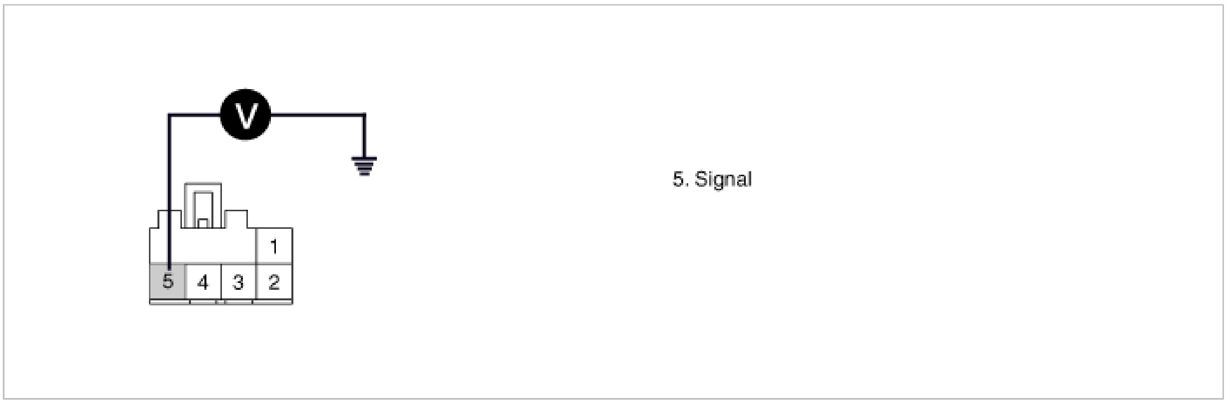
NO

Check open or short in power harness.
Check that 15A SENSOR fuse located between Main relay and Smartra is open or blown off.
Repair as necessary and go to "Verification of Vehicle repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check for short in harness.
   (1) Ignition "OFF".
   (2) Disconnect SMARTRA connector.
   (3) Ignition "ON" & Engine "OFF".
   (4) Measure voltage between terminal 5 of the SMARTRA harness connector and chassis ground.

   Specification : Approx. 10.2V



(5) Is the measured voltage within specifications?

YES

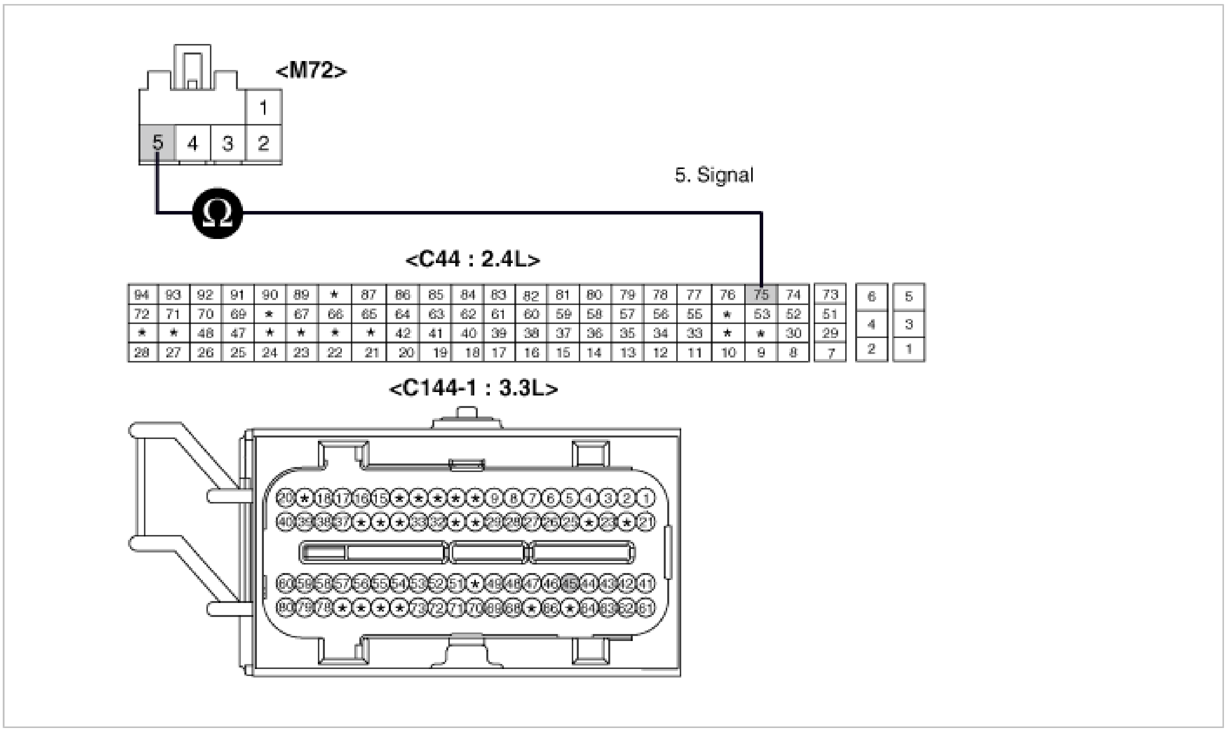
Go to "Check for open in harness" as below.

NO

Check short in signal harness.
Repair as necessary and go to "Verification of Vehicle repair" procedure.

2. Check for open in harness
   (1) Ignition "OFF".
   (2) Disconnect SMARTRA connector.
   (3) Measure resistance between terminal 5 of the SMARTRA harness connector and terminal 75(2.4L), 45(3.3L) of ECM harness connector.

Specification : Approx. below 1Ω



(4) Is the measured resistance within specifications?

YES

Go to "Ground Circuit Inspection" procedure.

NO

Check for open in signal harness.
Repair as necessary and go to "Verification of Vehicle repair" procedure.

GROUND CIRCUIT INSPECTION

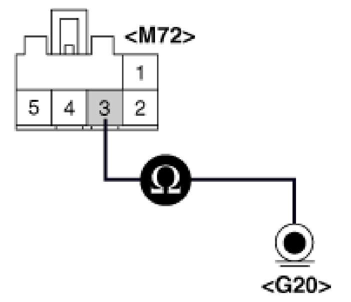
1. Check for open in harness between SMARTRA and Chassis ground.

(1) Ignition "OFF".

(2) Disconnect SMARTRA connector.

(3) Measure resistance between terminal 3 of the SMARTRA harness connector and Chassis ground.

Specification : Approx. below 1Ω



(4) Is the measured resistance within specifications?

YES

Go to "Component Inspection" procedure.

NO

Check for open in ground harness.
Make sure that Chassis ground G20 is firmly tightened properly.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check SMARTRA

(1) Ignition " ON" & Engine "OFF".

(2) Perform the Neutral, Teaching, and Password teaching/ changing mode according to 2. ECM neutralization, 3.Key Teaching Procedure, 4. Password teaching/Changing in "Reference Data" described in General Information.

> **NOTE**
>
> Be sure that PIN code is prepared before performing neutral mode.

(3) Is Key teaching completed?

YES

Fault is intermittent caused by poor contact in the SMARTRA and/or EMC's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Substitute with a known-good SMARTRA and check for proper operation. If the problem is corrected, replace SMARTRA and go to "Go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> In case of faulty SMARTRA, there are no special procedures required. A new SMARTRA device simply replaces the old one. (There are no transponder-related data stored in this device.)

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and monitor CURRENT DATA to check No. of Learnt key, ECM and KEY status.
2. Select Diagnostic Trouble Codes(DTCs)" mode and Clear the DTCs.
3. Are any DTCs present?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

Body Electrical System > Immobilizer System > P1691

GENERAL DESCRIPTION

This wireless communication runs on RF . The SMARTRA is mounted at the ignition lock close to the antenna coil for RF transmission and receiving. The RF signal from the transponder received by the antenna coil is converted into messages for serial communication by the SMARTRA device. And the received messages from the EMS are converted into an RF signal, which is transmitted, to the transponder by the antenna.

DTC DESCRIPTION

This DTC is defined as Antenna coil open or short circuit.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
Enable Condition	• IG ON	• Open or short in coil circuit • Faulty Antenna Coil • Faulty SMARTRA
Detecting factors	• Antenna signal error	
Detecting Window	• Before transponder communications	
Detecting Criteria	• Antenna open/short circuit	

MONITOR SCANTOOL DATA

1. Ignition "ON" & Engine "OFF".
2. Connect Scan tool and clear the DTCs.
3. If the DTCs are retrieved again, monitor "CURRENT DATA" to check No. of Learnt key, ECM and KEY status.

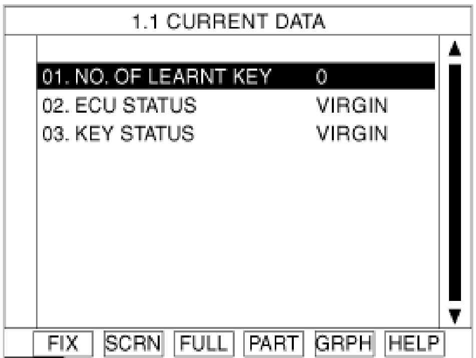


Fig 1

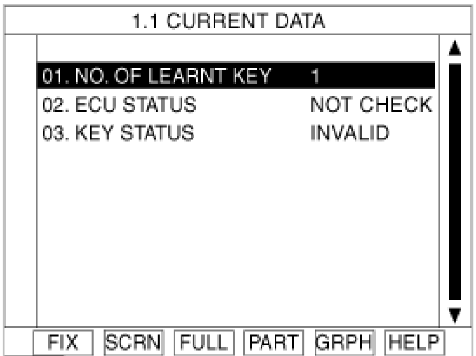


Fig 2

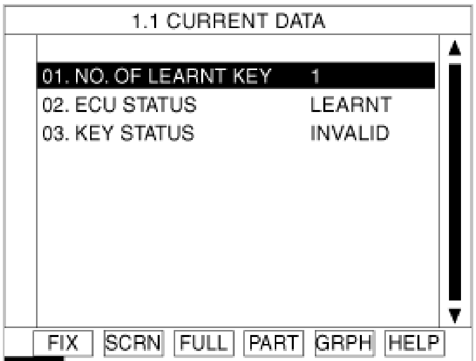


Fig 3

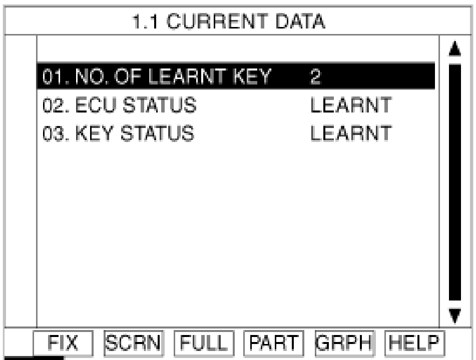


Fig 4

Fig 1 : ECM has not matched with any Key yet.
Fig 2 : ECM Internal Failure.
Fig 3 : IG On with unmatched key.
Fig 4 : 2(two) Keys have been matched with ECM.

4. Are both Key and ECM status learnt?

YES

Fault is intermittent caused by poor contact in the SMARTRA's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Go to "Component Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

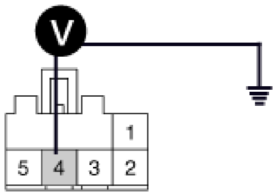
NO

Go to " Power Circuit Inspection " procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect SMARTRA connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 4 of the SMARTRA harness connector and chassis ground.

Specification : B+



5. Is the measured voltage within specifications?

YES

Go to "Signal Circuit Inspection" procedure.

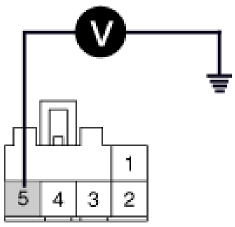
NO

Check open or short in power harness.
Check that 15A SENSOR fuse located between Main relay and Smartra is open or blown off.
Repair as necessary and go to "Verification of Vehicle repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check for short in harness.
   (1) Ignition "OFF".
   (2) Disconnect SMARTRA connector.
   (3) Ignition "ON" & Engine "OFF".
   (4) Measure voltage between terminal 5 of the SMARTRA harness connector and chassis ground.

   Specification : Approx. 10.2V



   (5) Is the measured voltage within specifications?

   YES

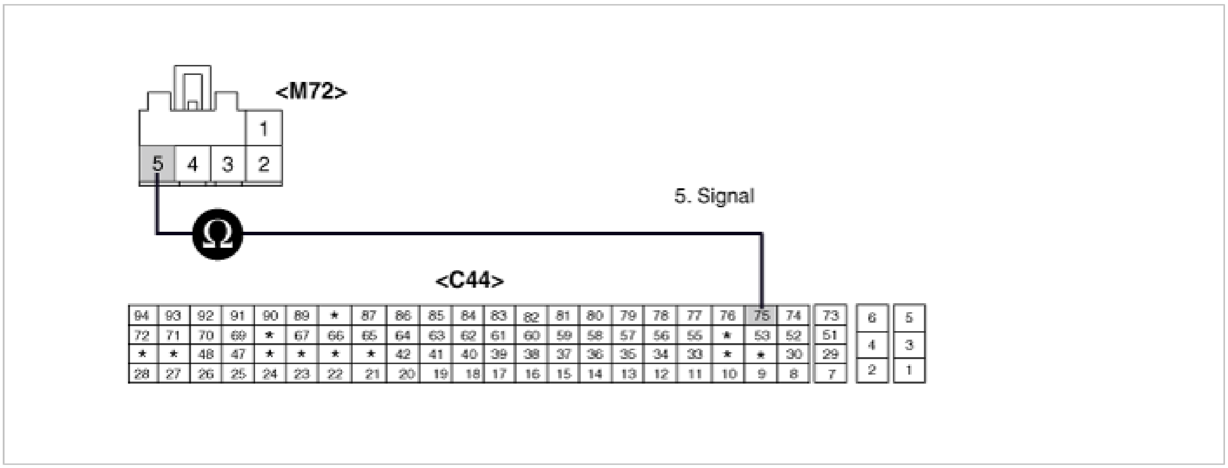
   Go to "Check for open in harness" as below.

   NO

   Check short in signal harness.
   Repair as necessary and go to "Verification of Vehicle repair" procedure.

2. Check for open in harness
   (1) Ignition "OFF".
   (2) Disconnect SMARTRA connector.
   (3) Measure resistance between terminal 5 of the SMARTRA harness connector and terminal 75 of ECM harness connector.

   Specification : Approx. below 1Ω



(4) Is the measured resistance within specifications?

YES

Go to "Ground Circuit Inspection" procedure.

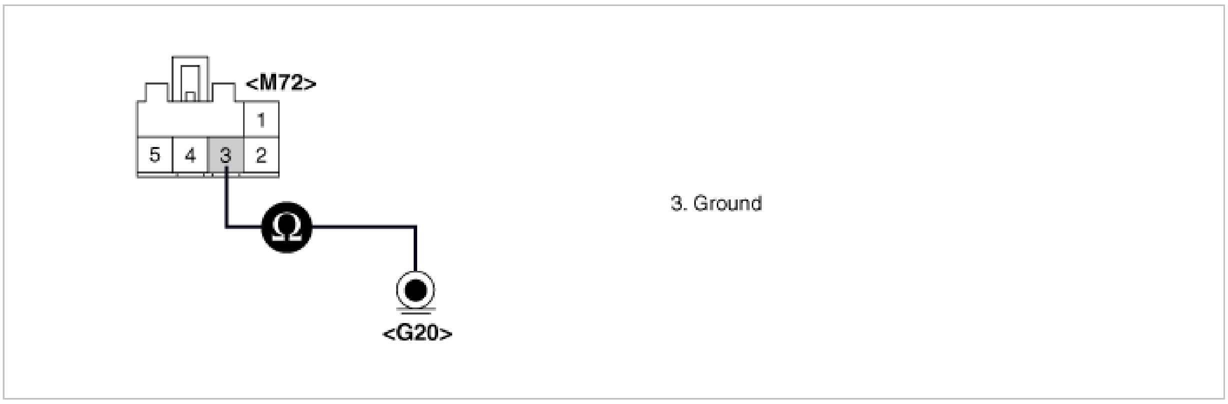
NO

Check for open in signal harness.
Repair as necessary and go to "Verification of Vehicle repair" procedure.

GROUND CIRCUIT INSPECTION

1. Check for open in harness between SMARTRA and Chassis ground.
   (1) Ignition "OFF".
   (2) Disconnect SMARTRA connector.
   (3) Measure resistance between terminal 3 of the SMARTRA harness connector and Chassis ground(G20).

Specification : Approx. below 1Ω



(4) Is the measured resistance within specifications?

YES

Go to "Component Inspection" procedure.

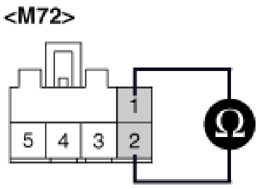
NO

Check for open in ground harness.
Make sure that Chassis ground G20 is firmly tightened properly.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check Antenna Coil
   (1) Ignition " OFF".
   (2) Disconnect SMARTRA connector.
   (3) Measure resistance between terminal 1 and 2 of the SMARTRA connector (Component side)

Specification : Approx. 9Ω



(4) Is the measured resistance within specifications?

YES

Go to " Check SMARTRA" as below.

NO

Check for open in harness between SMARTRA and Antenna coil, repair or replace as necessary.
Substitute with a known-good Antenna Coil and check for proper operation. If the problem is corrected, replace Antenna Coil. And then, go to "Verification of Vehicle Repair" procedure.

2. Check SMARTRA
   (1) Ignition " ON" & Engine "OFF".
   (2) Perform neutral mode, key teaching/changing and password teaching according to description in "System inspection" procedure.

> NOTE
>
> Be sure that PIN code is prepared before performing neutral mode.

   (3) Is Key teaching completed?

YES

Fault is intermittent caused by poor contact in the SMARTRA and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Substitute with a known-good SMARTRA and check for proper operation. If the problem is corrected, replace SMARTRA and Go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> In case of faulty SMARTRA, there are no special procedures required. A new SMARTRA device simply replaces the old one. (There are no transponder-related data stored in this device.)

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and monitor CURRENT DATA to check No. of Learnt key, ECM and KEY status.
2. Select Diagnostic Trouble Codes(DTCs)" mode and Clear the DTCs.
3. Are any DTCs present?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

Body Electrical System > Immobilizer System > P1693

GENERAL DESCRIPTION

During the key teaching procedure the transponder will be programmed with vehicle specific data. The vehicle specific data are written into the transponder memory. The write procedure is unique; therefore the content of transponder can never be modified or

changed. The data are a string of 9 bytes defined by vehicle manufacturer.
The transponder memory is split into two strings called authenticator and key password after this programming the transponder memory is locked and the data(PIN code) cannot be read or changed respectively. The transponder status changes from "virgin" to "learnt". Additionally every transponder includes a unique IDE (Identifier number) of 32 bit. Unique means that the IDE of all transponder is different from each other. The IDE is programmed by the transponder manufacturer and is a read-only value. The authenticator and the key password are not transferred from ECM to transponder or vice versa. Only the results from the encryption algorithm are transferred. It is almost impossible to calculate the vehicle specific data from the encryption result.
For teaching of keys and special purposes the ECM is connected to the tester device.
When IG is ON, the coil supplies energy to the transponder which in turn accumulates energy in the condenser.
Once the energy supply from the coil has stopped, using the stored energy in the condenser, the transponder transmits the ID CODE (stored within the ASIC).

DTC DESCRIPTION

This DTC is defined as Invalid Transponder Data.

DTC DESCRIPTION

Item	Detecting Condition	Possible cause
Enable Condition	• IG ON	• Transponder Key
Detecting factors	• Invalid Transponder Data	
Detecting Window	• During Transponder IDE • During Transponder Authentication requests • During Transponder Write EEPROM page requests • During Transponder Read EEPROM page requests	
Detecting Criteria	• Corrupted data form Transponder (Tp), or more than one TP in the field, or no TP in the magnetic field.	

MONITOR SCANTOOL DATA

1. Ignition "ON" & Engine "OFF".
2. Connect Scan tool and clear the DTCs.
3. If the DTCs are retrieved again, monitor "CURRENT DATA" to check No. of Learnt key, ECM and KEY status.

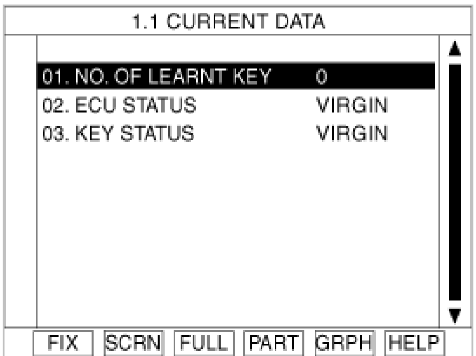


Fig 1

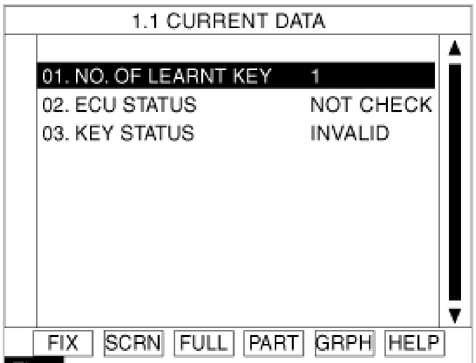


Fig 2

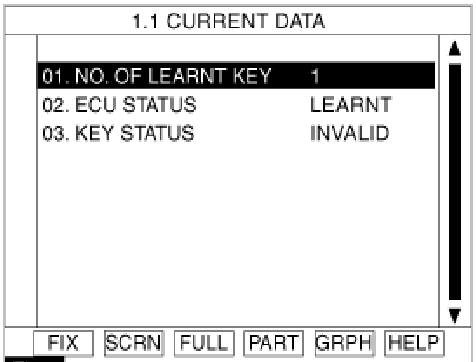


Fig 3

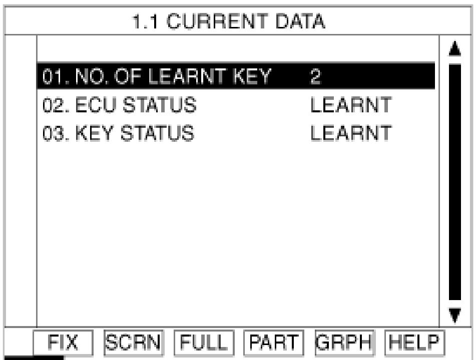


Fig 4

Fig 1 : ECM has not matched with any Key yet.
Fig 2 : ECM Internal Failure.
Fig 3 : IG On with unmatched key.
Fig 4 : 2(two) Keys have been matched with ECM.

4. Are both Key and ECM status learnt?

YES

Fault is intermittent caused by poor contact in the SMARTRA's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Go to "Component Inspection" procedure.

COMPONENT INSPECTION

1. Check Transponder
   (1) Ignition "ON" & Engine "OFF".
   (2) Perform neutral mode, key teaching and password teaching/changing according to "3. ECM Neutralization, 2. Key Teaching Procedure,4. Password Teaching in Reference Data" described in General Information.

> **NOTE**
>
> Be sure that PIN code is prepared before performing neutral mode.

(3) Is the neutral, teaching and password teaching/changing mode completed?

YES

Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to " Verification of Vehicle Repair" procedure.

NO

Substitute with a known-good virgin Transponder and monitor CURRENT DATA.
If the key status is displayed as "Virgin", replace Transponder.
Perform key teaching mode according to "2.Key Teaching Procedure belongs to Reference Data" described in General Information.
Go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and monitor CURRENT DATA to check No. of Learnt key, ECM and KEY status.
2. Select Diagnostic Trouble Codes(DTCs)" mode and Clear the DTCs.
3. Are any DTCs present?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

Body Electrical System > Immobilizer System > P1694

GENERAL DESCRIPTION

The ECM and the SMARTRA communicate by dedicated line. During this communication of ECM and SMARTRA the K line of ECM cannot be used for communication. The ECM controls the communication either to SMARTRA or to other devices(e.g. scanner) on K line by switching of a multiplexer and specific communication procedures. The multiplexer is a part of ECM hard ware.

DTC DESCRIPTION

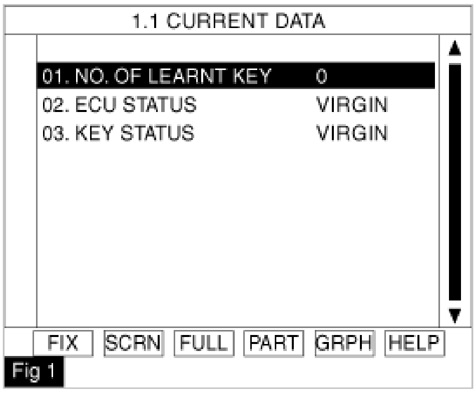
This DTC is defined as invalid request from ECM or corrupted data.

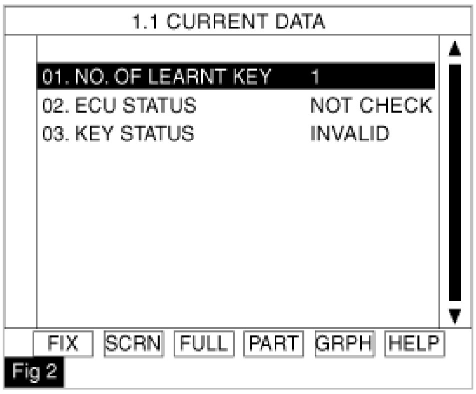
DTC DETECTING CONDITION

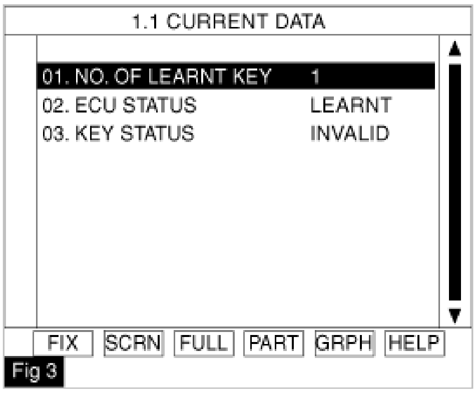
Item	Detecting Condition	Possible cause
Enable Condition	• IG ON	• Faulty ECM
Detecting factors	• Request from Control unit is invalid	
Detecting Window	• End of ECM request message	
Detecting Criteria	• Protocol layer violation - Invalid request, Invalid check sum.)	

MONITOR SCANTOOL DATA

1. Ignition "ON" & Engine "OFF".
2. Connect Scan tool and clear the DTCs.
3. If the DTCs are retrieved again, monitor "CURRENT DATA" to check No. of Learnt key, ECM and KEY status.







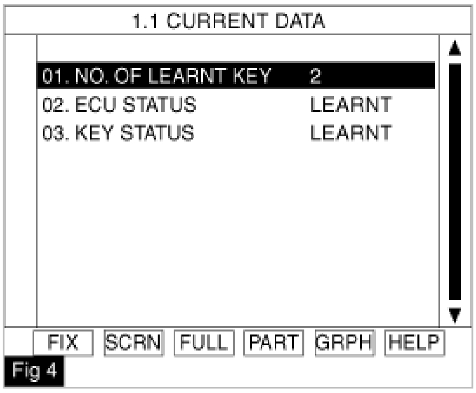


Fig 1 : ECM has not matched with any Key yet.
Fig 2 : ECM Internal Failure.
Fig 3 : IG On with unmatched key.
Fig 4 : 2(two) Keys have been matched with ECM.

4. Are both Key and ECM status learnt?

YES

Fault is intermittent caused by poor contact in the SMARTRA's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Go to "Component Inspection" procedure.

COMPONENT INSPECTION

1. Check ECM
   (1) Ignition " ON" & Engine "OFF".
   (2) Perform Key Teaching Procedure in "Reference Data" described in General Information.
   (3) Is the Key teaching completed?

YES

Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to " Verification of Vehicle Repair" procedure.

NO

Substitute with a known-good ECM and check for proper operation. If the problem is corrected, replace ECM and then go to " Verification of Vehicle repair" procedure.

> NOTE
>
> 1. Don't forget to prepare for the PIN of the vehicle before removing ECM from the vehicle.
> 2. Remember that substituting with a known-good ECM should be followed "The things to remember before repair(1)" in "Reference Data in General Information".
>   (In case of faulty ECM, it has to be replaced with "VIRGIN" or " NEUTRAL" ECM.)
> 3. Ensure that the correct PIN is entered when replacing a new ECM.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and monitor CURRENT DATA to check No. of Learnt key, ECM and KEY status.
2. Select Diagnostic Trouble Codes(DTCs)" mode and Clear the DTCs.
3. Are any DTCs present?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

Body Electrical System > Immobilizer System > P1695

GENERAL DESCRIPTION

The relevant data for the immobilizer function are stored at permanent memory (EEPROM or Flash etc.).
The immobilizer data are stored by three independent entries.
The data from EEPROM are evaluated by "2 of 3 decision". That means all three entries are read and the content is compared before authentication process.
If the contents of all entries are equal, the authentication will run without additional measures.
If only the contents of two entries are equal, the authentication will run and fault code "EEPROM defective“ is stored at ECM.
If the contents of all three entries are different from each other, no authentication will be possible and the fault code "EEPROM defective“ will be stored. The limp home function cannot be activated. The ECM shall be replaced if the EEPROM related fault occurs again after new teaching of all keys.

DTC DESCRIPTION

This DTC is defined as not only ECM have inconsistent data of EEPROM for number of keys taught, user password state and invalid write operation to EEPROM but ECM can not recognize the unique PIN code during Key Authentication.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
Enable Condition	• IG ON	• Faulty ECM
Detecting Criteria	• ECM internal permanent memory (EEPROM or Flash etc.) fault. • Invalid write operation to permanent	

	memory(EEPROM or Flash etc.) fault.	

MONITOR SCANTOOL DATA

1. Ignition "ON" & Engine "OFF".
2. Connect Scan tool and clear the DTCs.
3. If the DTCs are retrieved again, monitor "CURRENT DATA" to check No. of Learnt key, ECM and KEY status.

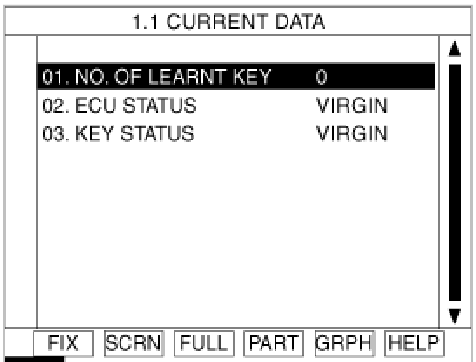


Fig 1

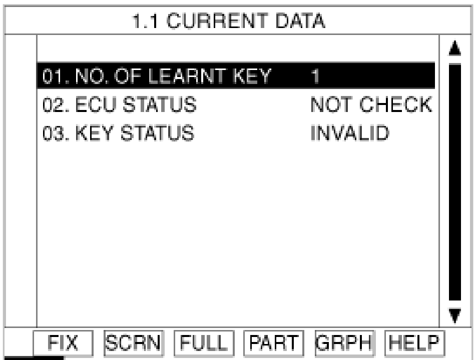


Fig 2

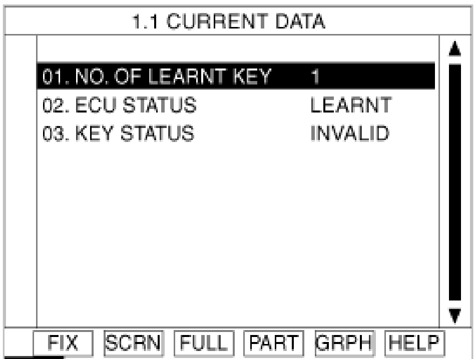


Fig 3

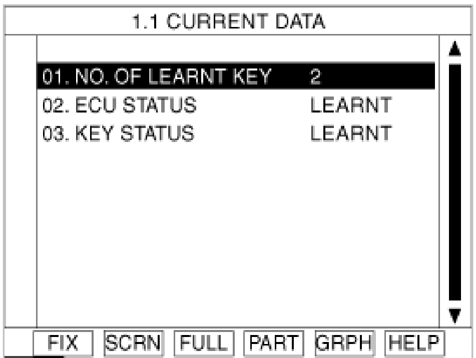


Fig 4

Fig 1 : ECM has not matched with any Key yet.
Fig 2 : ECM Internal Failure.
Fig 3 : IG On with unmatched key.

Fig 4 : 2(two) Keys have been matched with ECM.

4. Are both Key and ECM status learnt?

YES

Fault is intermittent caused by poor contact in the SMARTRA's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Go to "Component Inspection" procedure.

COMPONENT INSPECTION

1. Check ECM
   (1) Ignition " ON" & Engine "OFF".
   (2) Perform the Neutral, Teaching, and Password teaching/ changing mode according to 2. ECM neutralization, 3.Key Teaching Procedure, 4. Password teaching/Changing in "Reference Data" described in General Information.
   (3) Are both neutral and teaching mode completed?

   YES

   Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
   Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

   NO

   Substitute with a known-good ECM and check for proper operation. If the problem is corrected, replace ECM and then go to " Verification of Vehicle repair" procedure.

   NOTE

   1. Don't forget to prepare for the PIN of the vehicle before removing ECM from the vehicle.
   2. Remember that substituting with a known-good ECM should be followed "The things to remember before repair(1) in "Reference Data in General Information" (In case of faulty ECM, it has to be replaced with "VIRGIN" or " NEUTRAL" ECM.)
   3. Ensure that the correct PIN is entered when replacing a new ECM.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and monitor CURRENT DATA to check No. of Learnt key, ECM and KEY status.
2. Select Diagnostic Trouble Codes(DTCs)" mode and Clear the DTCs.
3. Are any DTCs present?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

Body Electrical System > Immobilizer System > P1696

GENERAL DESCRIPTION

The relevant data for the immobilizer function are stored at permanent memory (EEPROM or Flash etc.).
The immobilizer data are stored by three independent entries.
The data from EEPROM are evaluated by "2 of 3 decision". That means all three entries are read and the content is compared before authentication process.
If the contents of all entries are equal, the authentication will run without additional measures.
If only the contents of two entries are equal, the authentication will run and fault code "EEPROM defective“ is stored at ECM.
If the contents of all three entries are different from each other, no authentication will be possible and the fault code "EEPROM defective“ will be stored. The limp home function cannot be activated. The ECM shall be replaced if the EEPROM related fault occurs again after new teaching of all keys.

DTC DESCRIPTION

This DTC is defined as Virgin TP or Invalid TP with “Learnt” ECM status (Authentication fail).

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
Enable Condition	• IG ON	• Faulty TP(Virgin or Invalid)
Detecting Criteria	• Virgin TP at EMS STATUS "Learnt" • Learnt(Invalid) TP at EMS status "Learnt"(Authentication fail)	

MONITOR SCANTOOL DATA

1. Ignition "ON" & Engine "OFF".
2. Connect Scan tool and clear the DTCs.
3. If the DTCs are retrieved again, monitor "CURRENT DATA" to check No. of Learnt key, ECM and KEY status.

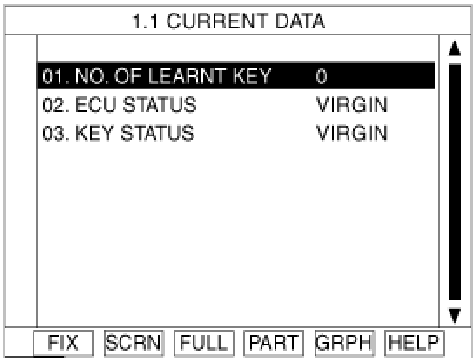


Fig 1

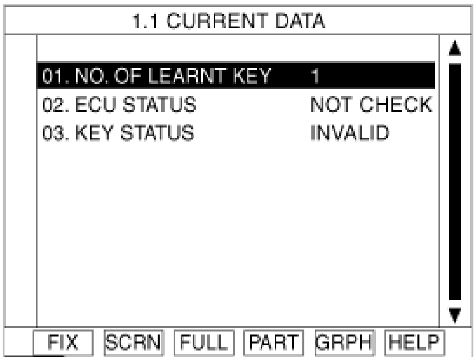


Fig 2

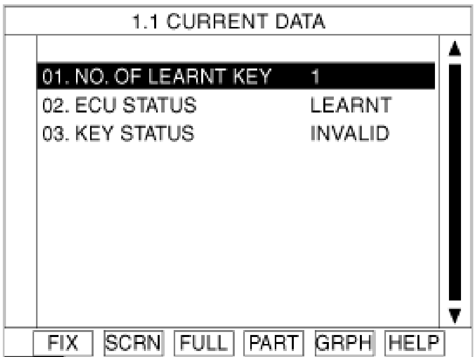


Fig 3

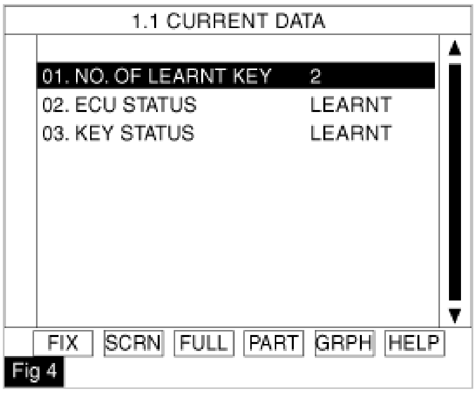


Fig 1 : ECM has not matched with any Key yet.
Fig 2 : ECM Internal Failure.
Fig 3 : IG On with unmatched key.
Fig 4 : 2(two) Keys have been matched with ECM.

4. Are both Key and ECM status learnt?

YES

Fault is intermittent caused by poor contact in the SMARTRA's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Go to "Component Inspection" procedure.

COMPONENT INSPECTION

1. Check Transponder
   (1) Ignition "ON" & Engine "OFF".
   (2) Perform neutral mode, key teaching and password teaching/changing.
   (Refer to "Reference Data in General Information")

   > **NOTE**
   >
   > Be sure that PIN code is prepared before performing neutral mode.

   (3) Is the neutral, teaching and password teaching/changing mode possible?

   YES

   In case that key status is "Invalid", Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary, and then go to " Verification of Vehicle Repair" procedure.
   In case that key status is "Learnt", go to "Verification of Vehicle Repair" procedure.

   NO

   Substitute with a known-good virgin Transponder and monitor CURRENT DATA.
   If the key status is displayed as "Virgin", replace Transponder.
   Perform key teaching mode in " Reference Data"
   Go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and monitor CURRENT DATA to check No. of Learnt key, ECM and KEY status.
2. Select Diagnostic Trouble Codes(DTCs)" mode and Clear the DTCs.
3. Are any DTCs present?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

Body Electrical System > Immobilizer System > P1699

GENERAL DESCRIPTION

This is a special function for engine start by vehicle manufacturer. The engine can be started for moving from the production line to an area where the key teaching is proceeded.

DTC DESCRIPTION

This DTC is defined as exceeding the maximum limit of twice ignition On.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
Enable Condition	• IG ON	• Locked by timer
Detecting Criteria	• Exceeding the maximum limit of Twice IGN ON (⊇ 32 times)	

MONITOR SCANTOOL DATA

1. Ignition "ON" & Engine "OFF".
2. Connect Scan tool and clear the DTCs.
3. Monitor Current Data for Immobilizer System.
4. Retry to communication from the vehicle selection menu although once communication is failed.

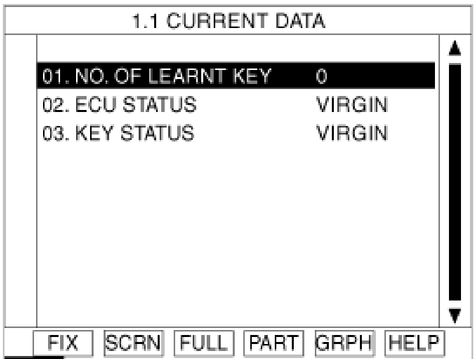


Fig 1

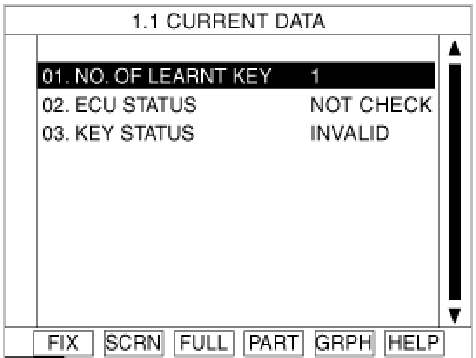


Fig 2

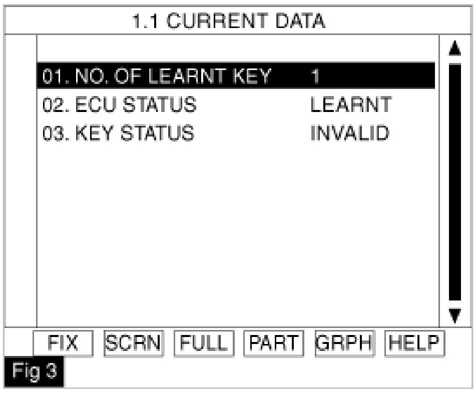


Fig 3

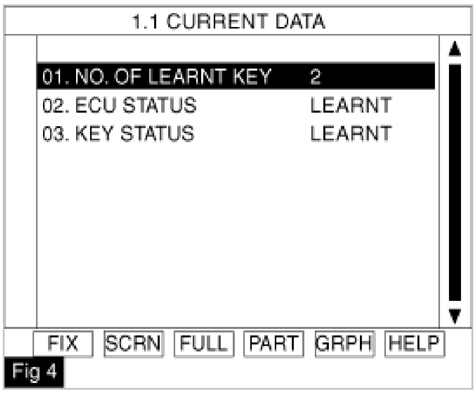


Fig 4

Fig 1 : ECM has not matched with any Key yet.
Fig 2 : ECM Internal Failure.
Fig 3 : IG On with unmatched key.
Fig 4 : 2(two) Keys have been matched with ECM.

5. Is the communication possible between scan tool and Immobilizer system?

YES

Wait for one hour with IG Key On. Be sure that the battery is fully enough to stay for an hour with IG ON.
Disconnecting battery or others manipulation can not reduce this time. After connecting the battery the timer starts again for one hour.
And then, reperform key teaching procedure(Refer to "Reference Data" in General Information")
Go to " Verification of Vehicle Repair" procedure

NO

Fault is intermittent caused by poor contact in the SMARTRA and/or ECM connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination. deterioration, or damage.
Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and monitor CURRENT DATA to check No. of Learnt key, ECM and KEY status.
2. Select Diagnostic Trouble Codes(DTCs)" mode and Clear the DTCs.
3. Are any DTCs present?

YES

Go to the applicable troubleshooting procedure.

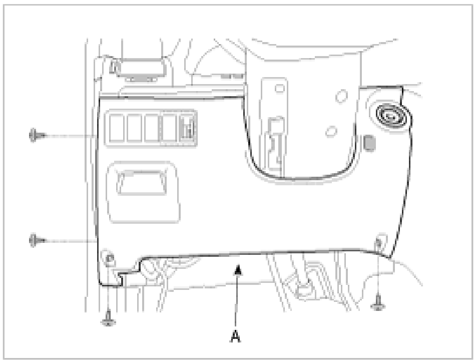
NO

System is performing to specification at this time.

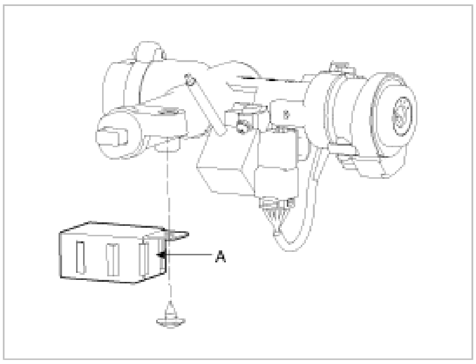
Body Electrical System > Immobilizer System > Immobilizer Control Unit > Repair procedures

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad side cover (A).



3. Remove the steering column shaft (Refer to the ST group).
4. Disconnect the 5P connector of the SMARTRA unit and then remove the SMARTRA unit (A) after loosening the screw.

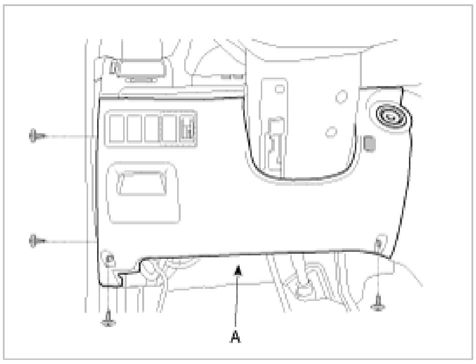


5. Installation is the reverse of removal procedure.

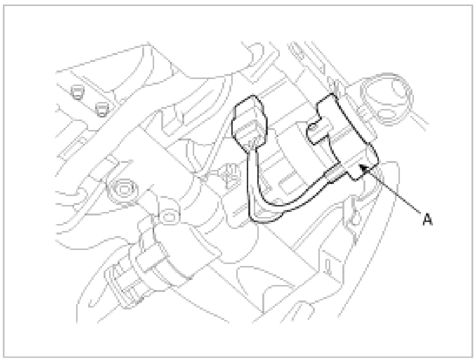
Body Electrical System > Immobilizer System > Coil Antenna > Repair procedures

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad side cover (A).



3. Remove the steering column shaft (Refer to the ST group).
4. Disconnect the 6P connector of the coil antenna and then remove the coil antenna (A) after loosening the screw.

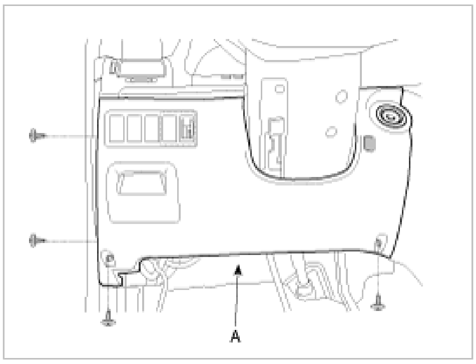


5. Installation is the reverse of removal procedure.

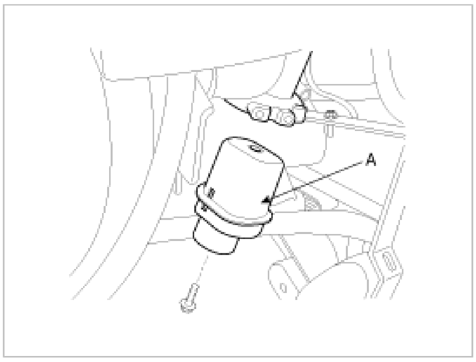
Body Electrical System > Ignition System > Ignition Switch > Repair procedures

REPLACEMENT

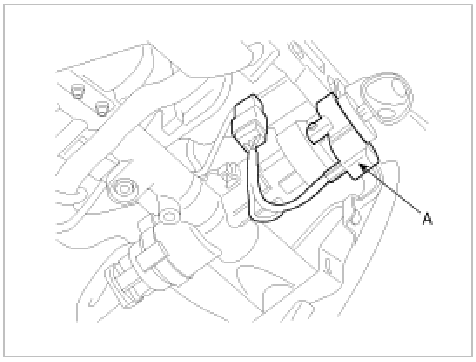
1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad side cover (A).



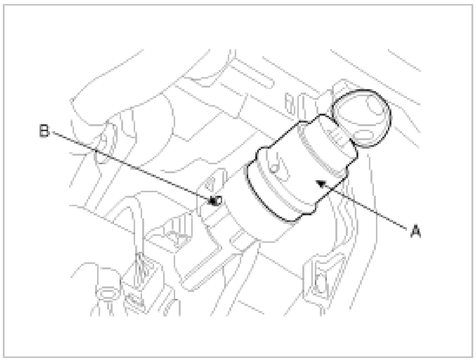
3. Remove the ignition switch (A) after loosening the screw and disconnecting the 6P connector.



4. Remove the steering column shaft (Refer to the ST group).
5. Remove the key warning switch and key illumination lamp (A) after loosening the screws and disconnecting the 6P connector.

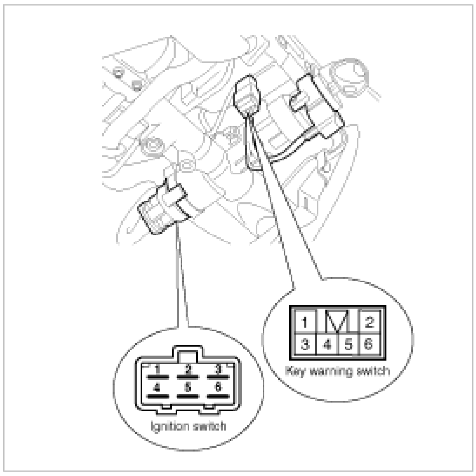


6. If it is necessary to remove the key lock cylinder (A), Remove the key lock cylinder (A) after pushing lock pin (B) with key ON.



7. Installation is the reverse of removal procedure.

INSPECTION

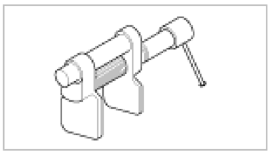


1. Disconnect the ignition switch connector and key warning switch connector from under the steering column.
2. Check for continuity between the terminals.
3. If continuity is not specified, replace the switch.

POSITION \ KEY \ TERMINAL		IGNITION SWITCH						STEERING		KEY WARNING SWITCH		KEY HOLE ILLUMINATION	
		2	4	6	5	3	1	TRAVEL	TRAVEL	5	6	3	4
LOCK	REMOVAL							LOCK				O	O
LOCK	INSERT							LOCK	UNLOCK	O	O	O	O
ACC	INSERT	O	O					UNLOCK		O	O	O	O
ON	INSERT	O	O	O	O	O		UNLOCK		O	O	O	O
START	INSERT	O		O	O	O	O	UNLOCK		O	O	O	O

Brake System > General Information > Special Service Tools

SPECIAL TOOL

Tool(Number and Name)	Illustration	Use
09581-11000 Piston expander		Spreading the front disc brake piston

Brake System > General Information > Troubleshooting

TROUBLESHOOTING

PROBLEM SYMPTOMS TABLE

Symptom	Suspect Area	Reference
Lower pedal or spongy pedal	1. Brake system (Fluid leaks) 2. Brake system (Air in) 3. Piston seals (Worn or damaged) 4. Rear brake shoe clearance(Out of adjustment) 5. Master cylinder (Faulty)	repair air·bleed replace adjust replace
Brake drag	1. Brake pedal freeplay (Minimum) 2. Parking brake lever travel (Out of adjustment) 3. Parking brake wire (Sticking) 4. Rear brake shoe clearance(Out of adjustment) 5. Pad or lining (Cracked or distorted) 6. Piston (Stuck) 7. Piston (Frozen) 8. Anchor or Return spring (Faulty) 9. Booster system (Vacuum leaks) 10. Master cylinder (Faulty)	adjust adjust repair adjust replace replace replace replace repair replace
Brake pull	1. Piston (Sticking) 2. Pad or lining (Oily) 3. Piston (Frozen) 4. Disc (Scored) 5. Pad or lining (Cracked or distorted)	replace replace replace replace replace
Hard pedal but brake inefficient	1. Brake system (Fluid leaks) 2. Brake system (Air in) 3. Pad or lining (Worn) 4. Pad or lining (Cracked or distorted) 5. Rear brake shoe clearance(Out of adjustment) 6. Pad or lining (Oily) 7. Pad or lining (Glazed) 8. Disc (Scored) 9. Booster system (Vacuum leaks)	repair air·bleed replace replace adjust adjust replace replace repair
Noise from brake	1. Pad or lining (Cracked or distorted) 2. Installation bolt (Loosen) 3. Disc (Scored) 4. Sliding pin (Worn) 5. Pad or lining (Dirty) 6. Pad or lining (Glazed) 7. Anchor or Return spring (Faulty) 8. Brake pad shim (Damage)	replace adjust replace replace clean replace replace replace

	9. Shoe hold-down spring (Damage)	replace
Brake fades	1. master cylinder	replace
Brake vibration, pulsation	1. brake booster 2. pedal free play 3. master cylinder 4. caliper 5. master cylinder cap seal 6. damaged brake lines	replace adjust replace replace replace replace
Brake Chatter	Brake chatter is usually caused by loose or worn components, or glazed or burnt linings. Rotors with hard spots can also contribute to brake chatter. Additional causes of chatter are out-of-tolerance rotors, brake lining not securely attached to the shoes, loose wheel bearings and contaminated brake lining.	

Brake System > General Information > Specifications

SPECIFICATIONS

Item	Specification	
Master cylinder · Type · I.D. mm(in) · Piston stroke mm(in) · Output port(ABS/ESC) · Fluid level warning sensor	Tandem type 25.4(1.0) 31(1.22) 2port Provided	
Brake booster · Type · Effective dia. mm(in.) · Boosting ratio	Vacuum 8+9 in 9:1	
Front brake(Disc)	2.4 L	3.3 L
· Type · Disc O.D. · Disc I.D. · Disc thickness · Pad thickness · Cylinder type · Cylinder I.D.	Floating type with ventilated disc 280 mm (11.02 in) 172 mm (6.77 in) 26 mm (1.02 in) 11 mm (0.43 in) single piston 57.2 mm (2.25 in.)	Floating type with ventilated disc 300 mm (11.8 in) 186 mm (7.32 in.) 28 mm (1.10 in) 11 mm (0.43 in) single piston 60 mm (2.36 in.)
Rear brake(Disc)	2.4 L	3.3 L
· Type · Disc O.D. · Parking Brake Drum I.D · Disc thickness · Pad thickness · Cylinder type · Cylinder I.D	Floating type with solid disc 262 mm (10.31 in) 168 mm (6.61 in) 10 mm (0.39 in) 10 mm (0.39 in) single piston 34 mm (1.34 in)	Floating type with solid disc 284 mm (11.18 in) 168 mm (6.61 in) 10 mm (0.39 in) 15 mm (0.59 in) single piston 34 mm (1.34 in)
Parking brake · Actuation · Cable arrangement	Mechanical brake acting on rear wheels Lever	

O.D=Outer Diameter
I.D=Inner Diameter

NOTE

ABS : Anti-lock Brake System

ESC : Electronic Stability Control

SPECIFICATION (ABS)

Part	Item	Standard value	Remark
HECU(Hydraulic and Electronic Control Unit)	System	4 channel 4 sensor (Solenoid)	·ABS system:ABS & EBD control
	Type	Motor, valve relay intergrated type	
	Operating voltage	10 V ~ 16 V(DC)	
	Operating temperature	-40 ~ 120 °C(-40 ~ 248 °F)	
Warning lamp	Operating voltage	12 V	·ABS W/L:ABS failure ·Brake W/L:Parking, brake oil, EBD failure
	Current consumption	80 mA	
Acitve wheel speed sensor (ABS)	Supply voltage	DC 4.5 ~ 2.0 V	
	Output current low	5.9 ~ 8.4 mA	Typ.7 mA
	Output current High	11.8 ~ 16.8 mA	Typ.14 mA
	Frequency range	1 ~ 2500 Hz	
	Air gap	0.4 ~ 1.0 mm (0.0157 ~ 0.04 in.)	
	Tone wheel	47 teeth	
	Output duty	30~70 %	

SPECIFICATION(ESC)

Part	Item	Standard Value	Remark
HECU(Hydraulic and Electronic Control Unit)	System	4 channel 4 sensor(Solenoid)	·Total control(ABS, EBD, TCS, ESC)
	Type	Motor, valve relay intergrated type	
	Operating voltage	10V ~ 16V(DC)	
	Operating temperature	-40 ~ 120 °C(-40 ~ 248 °F)	
Warning lamp	Operating voltage	12 V	·ESC Operating Lamp ·ESC Warning Lamp
	Current consumption	80 mA	
Active wheel speed sensor	Supply voltage	DC4.5 ~ 20V	
	Output current low	5.9~8.4 mA	
	Output current high	11.8 ~ 16.8 mA	
	Tone wheel	47 teeth	
	Frequency range	1~2500 HZ	
	Airgap	0.4 ~ 1.0 mm (0.02~0.04 in)	
Steering Wheel Angle Sensor	Operating Voltage	8V ~ 16 V	
	Current Consumption	Max 150 mA	
	Operating Angular velocity	Max ±2000 °/sec	
Yaw-rate & Lateral G sensor	Operating Voltage	8 V ~ 16 V	
	Current Consumption	Max. 120 mA	
	Output Voltage	0.35V ~ 4.65 V	
	Yaw Sensor Operating Range	±100 ° /s	
	G Sensor Operating Range	±1.8 G	
	Reference voltage output	2.464 ~ 2.536 V	Typ. 2.5 V

SERVICE STANDARD

	Standard value	Service limit
Brake pedal height	184.5 mm(7.264 in)	
Brake pedal full stroke	128 mm (5.04 in)	
Adjust Brake pedal full stroke	128 mm(5.04 in)	
Brake pedal free play	3~8 mm(0.11~0.31 in)	
Stop lamp switch outer case to pedal stopper clearance	1~2 mm (0.04 ~ 0.08 in)	
Booster push rod to master cylinder piston clearance	0 (at 500 mmHg vacuum)	
Parking brake lever stroke when lever assembly is pulled with 196N (20Kgf, 44lb force)	8 clicks	
Front disc brake pad thickness	11 mm (0.43 in)	3 ~ 4 mm (0.12 ~ 0.16 in)
Front disc thickness	26 mm (1.024 in) : 2.4 L 28 mm (1.1 in) : 3.3 L	24.4 mm (0.961 in) : 2.4 L 26.4 mm (1.04 in) : 3.3 L
Front disc runout		Max.0.04 mm (0.002 in)
Front disc thickness variation		Max.0.005 mm (0.0002 in)
Rear disc brake pad thickness	10 mm (0.394 in) : 2.4 L 15 mm (0.59 in) : 3.3 L	3 mm (0.12 in)
Rear disc brake disc thickness	10 mm (0.394 in)	8.4 mm (0.33 in)
Rear disc runout		Max.0.05mm (0.002 in)
Rear disc thickness variation		Max.0.01 mm (0.0004 in)

TIGHTENING TORQUE

	Nm	Kgf·m	lb-ft
Master cylinder to booster mounting nut	7.84~11.76	0.8~1.2	5.9~8.9
Brake booster mounting nut	12.74~15.68	1.3~1.6	9.6~11.8
Bleeder screw	6.86~12.74	0.7~1.3	5.2~9.6
Brake tube nut, brake hose	1372~16.66 (M10) 18.62~22.54 (M12)	1.4~1.7 (M10) 1.9~2.3 (M12)	10.326~12.54 (M10) 14.01~16.964 (M12)
Caliper assembly to knuckle	78.4~9.8	8~10	59.0~73.8
Brake hose to front caliper	24.5~29.4	2.5~3	18.4~22.1
Brake hub flange nut	196~254.8	20~26	147.5~191.8
Push rod locking nut	15.68~21.56	1.6~2.2	11.8~16.2
Caliper guide rod bolt	21.56~31.36	2.2~3.2	16.2~23.6
Stop lamp switch mounting nut	7.84~9.8	0.8~1	5.9~7.38

TIGHTENING TORQUE (ABS)

Item	Nm	kgf·m	lb-ft
Active wheel speed sensor mounting bolt on the brake plate	7.84~8.82	0.8~0.9	5.9~6.54
Hydraulic & electronic control unit mounting bolt	13.72~17.64	1.4~1.8	10.326~13.276
Hydraulic & electronic control unit mounting bracket bolt	16.66~25.48	1.7~2.6	12.54~19.177
Brake tubes nut	13.72~16.66	1.4~1.7	10.326~12.54
Air bleeder screw	6.86~12.74	0.7~1.3	5~9.6

TIGHTENING TORQUE (ESC)

Item	Nm	kgf·m	lb-ft

Yaw rate & lateral acceleration sensor Nut	4.9~7.84	0.5~0.8	3.69~5.9
Brake tube nut	13.72~16.66 (M10) 18.62~22.54(M12)	1.4~1.7 (M10) 1.9~2.3(M12)	10.326~12.54 (M10) 14.01~16.964 (M12)

Brake System > Brake System > Description and Operation

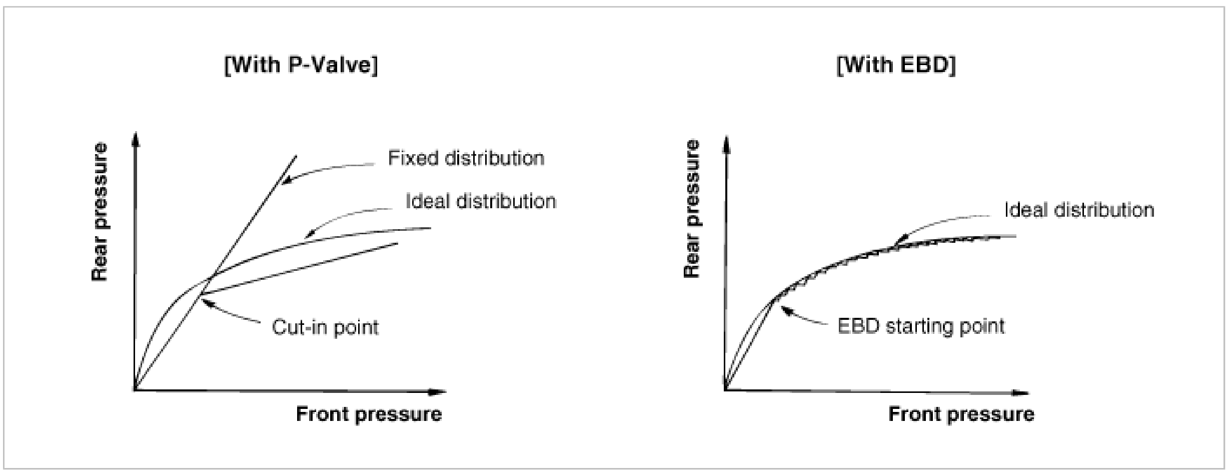
DESCRIPTION

The EBD system (Electronic Brake force Distribution) as a sub-system of the ABS system is to control the effective adhesion utilization by the rear wheels.
It further utilizes the efficiency of highly developed ABS equipment by controlling the slip of the rear wheels in the partial braking range.
The brake force is moved even closer to the optimum and controlled electronically, thus dispensing with the need for the proportioning valve.
The proportioning valve, because of a mechanical device, has limitations to achieve an ideal brake force distribution tothe rear wheels as well as to carry out the flexible brake force distribution proportioning to the vehicle load or weight increasing. And in the event of malfunctioning, driver cannot notice whether it fails or not.
EBD controlled by the ABS Control Module, calculates the slip ratio of each wheel at all times and controls the brake pressure of the rear wheels not to exceed that of the front wheels.
If the EBD fails, the EBD warning lamp (Parking brake lamp) lights up.

ADVANTAGES

- Function improvement of the base-brake system.
- Compensation for the different friction coefficients.
- Elimination of the proportioning valve.
- Failure recognition by the warning lamp.

Comparison between Proportioning valve and EBD



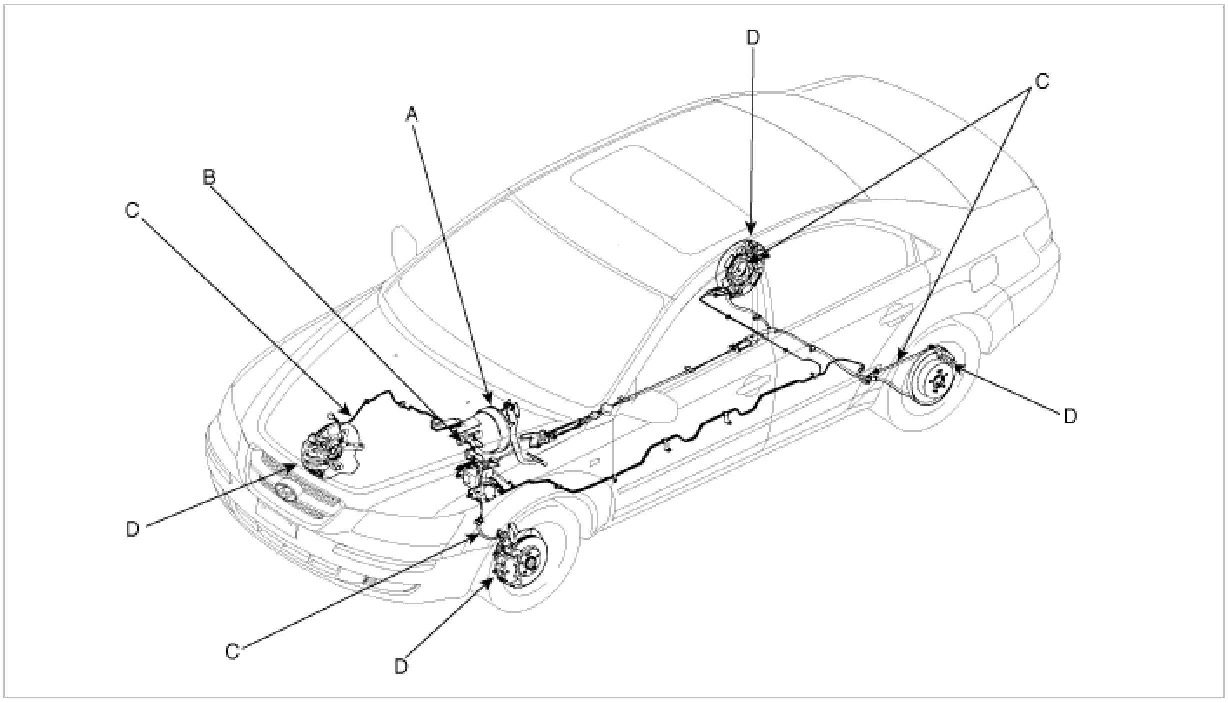
Brake System > Brake System > Repair procedures

Operation and Leakage Check

Check all of the following items:

Component	Procedure
Brake Booster (A)	Check brake operation by applying the brakes during a test drive. If the brakes do not work properly, check the brake booster. Replace the brake booster as an assembly if it does not work properly or if there are signs of leakage.
Piston cup and pressure cup inspection (B)	• Check brake operation by applying the brakes. Look for damage or signs of fluid leakage. Replace the master cylinder as an assembly if the pedal does not work properly or if there is damage or signs of fluid leakage. • Check for a difference in brake pedal stroke between quick and slow brake applications. Replace the master cylinder if there is a difference in pedal stroke.
Brake hoses (C)	Look for damage or signs of fluid leakage. Replace the brake hose with a new one if it is damaged or leaking.

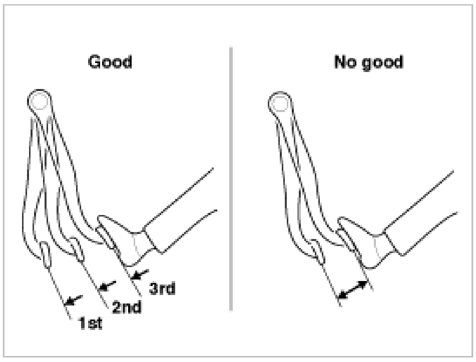
Caliper piston seal and piston boots (D)	Check brake operation by applying the brakes. Look for damage or signs of fluid leakage. If the pedal does not work properly, the brakes drag, or there is damage or signs of fluid leakage, disassemble and inspect the brake caliper. Replace the boots and seals with new ones whenever thebrake caliper is disassembled.



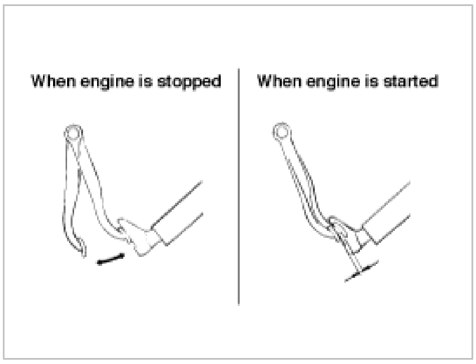
BRAKE BOOSTER OPERATING TEST

For simple checking of the brake booster operation, carry out the following tests

1. Run the engine for one or two minutes, and then stop it. If the pedal depresses fully the first time but gradually becomes higher when depressed succeeding times, the booster is operating properly, if the pedal height remains unchanged, thebooster is defective.

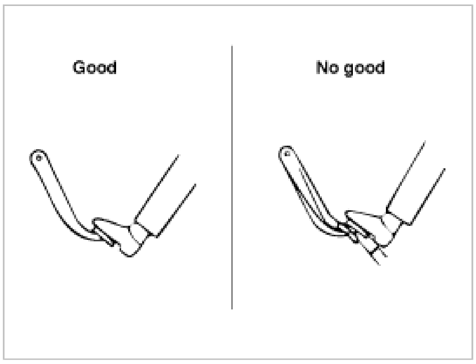


2. With the engine stopped, step on the brake pedal several times.
Then step on the brake pedal and start the engine. If the pedal moves downward slightly, the booster is in good condition. If there is no change, the booster is defective.



3. With the engine running, step on the brake pedal and then stop the engine.
Hold the pedal depressed for 30 seconds. If the pedal height does not change, the booster is in good condition, if the pedal

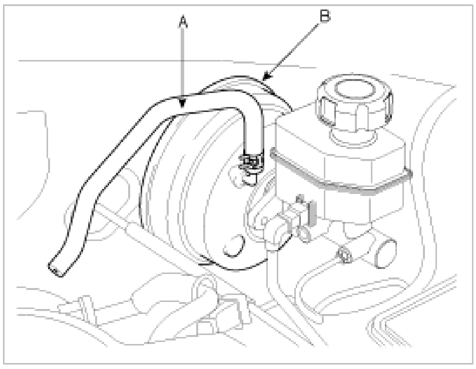
rises, the booster is defective.
If the above three tests are okay, the booster performance can be determined as good.
Even if one of the above three tests is not okay, check the check valve, vacuum hose and booster for defect.



VACUUM HOSE (CHECK VALVE)

INSPECTION

1. Disconnect the brake booster vacuum hose (check valve built in) (A) at the booster (B).
2. Start the engine and let it idle. There should be vacuum available. If no vacuum is available, the check valve is not working properly. Replace the brake booster vacuum hose and check valve and retest.

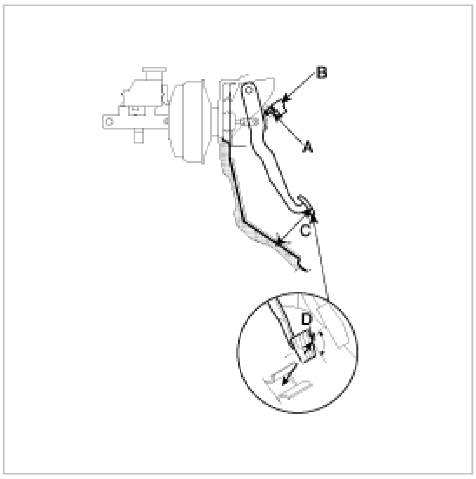


BRAKE PEDAL BRAKE SWITCH ADJUSTMENT

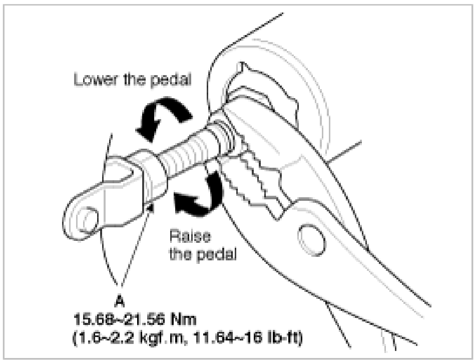
PEDAL HEIGHET

1. Disconnect the brake switch connector, loosen the brake switch locknut (A), and brake off the brake switch (B) until it is no longer touching the brake pedal.
2. Lift up the carpet. At the insulator cutout, measure the pedal height (C) from the middle of the left-side center of the pedal pad (D).

Standard pedal height(with carpet removed): 184.5mm(7.26 in.)

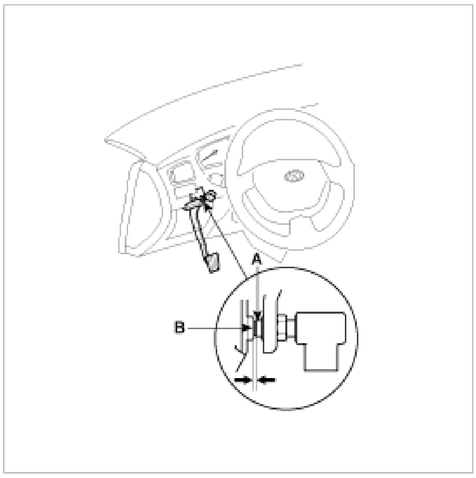


3. Loosen the pushrod locknut (A), and screw the pushrod in or out with pliers until the standard pedal height from the floor is reached. After adjustment, tighten the locknut firmly. Do not adjust the pedal height with the pushrod depressed.



BRAKE SWITCH CLEARANCE

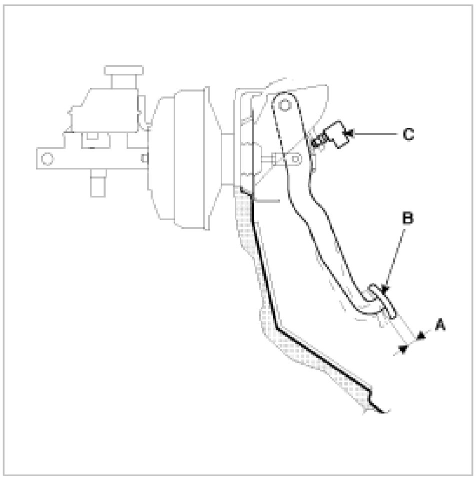
Screw in the brake switch until its plunger is fully depressed (threded end (A) touching the pad (B) on the pedal arm) then brake off the switch 3/4 turn to make 1 ~ 2 mm (0.04 ~ 0.08 in.) of clearance between the brake switch connector. Make sure that the brake lights go off when the pedal is released.



PEDAL FREE PLAY

1. With the engine off, inspect the pedal free play (A) on the pedal pad (B) by pushing the pedal by hand.

   Free play: 3 ~ 8 mm (0.12 ~ 0.31 in.)

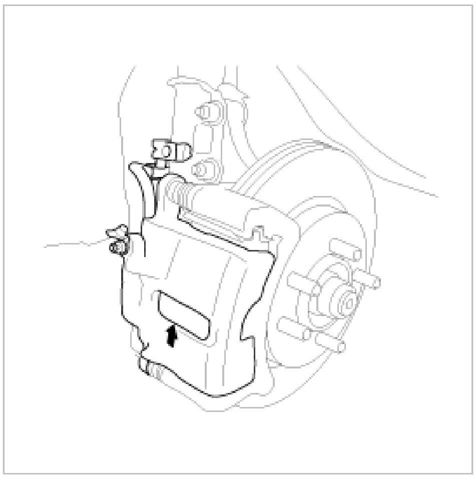


2. If the pedal free play is out of specification, adjust the brake switch (C). If the pedal free play is insufficient, it may result in brake drag.

INSPECTION OF FRONT DISC BRAKE PAD

1. Check the brake pad thickness through the caliper body inspection hole.

   Pad thickness
   Standard value : 11.0 mm (0.43 in.)
   Service limit : 3 ~ 4 mm (0.12 ~ 0.16 in.)



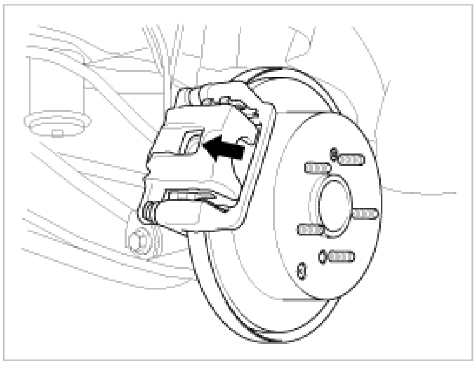
CAUTION

- If the pad lining thickness is out of specilfication, left and right pads must be replaced as a complete set.
- When the thickness difference between the left pad and right pad is large, check the sliding condition of the piston and the guide rod.

INSPECTION OF REAR DISC BRAKE PAD

1. Check the rear disk brake pad thickness through the caliper body inspection hole.

Pad thickness
Standard value : 10.0 mm (0.39 in.)
Service limit : 3.0 mm (0.12 in.)

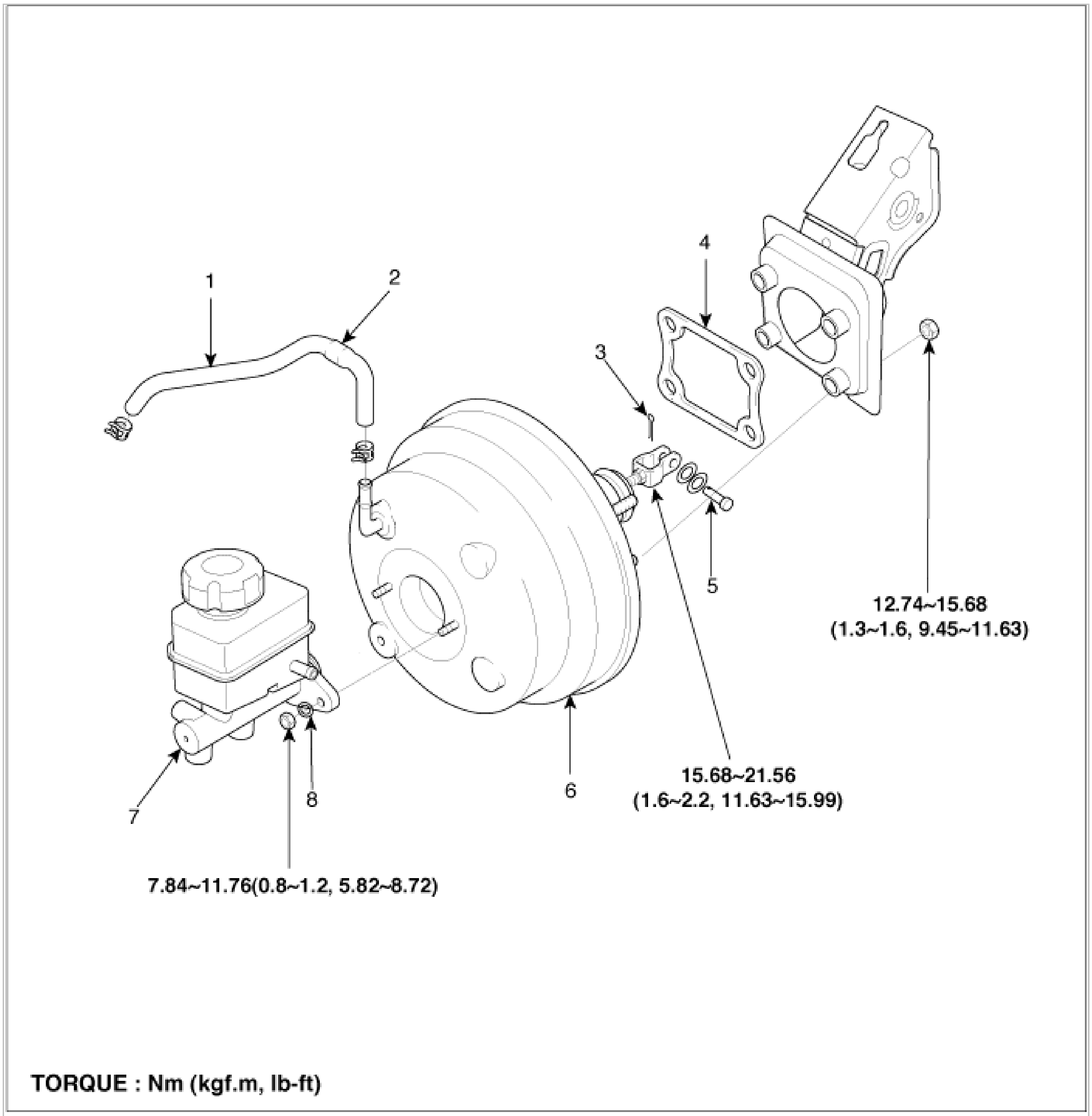


CAUTION

- If the pad thickness is out of specification, left and right pads must be replaced as a complete set.
- When the thickness difference between the left pad and right pad is large, check the sliding condition of the piston and the guide rod.

Brake System > Brake System > Brake Booster > Components and Components Location

COMPONENTS

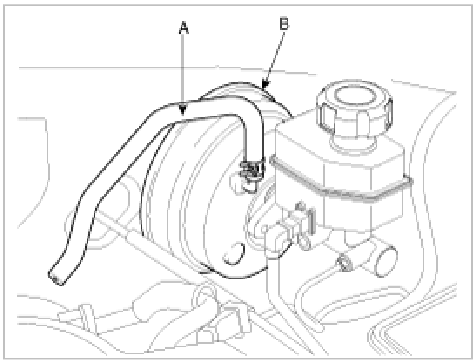


1. Vacuum hose	5. Clevis pin
2. Check valve	6. Brake booster
3. Snap pin	7. Master cylinder
4. Seal	8. Washer

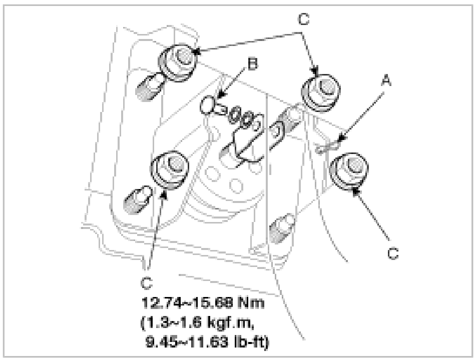
Brake System > Brake System > Brake Booster > Repair procedures

Removal

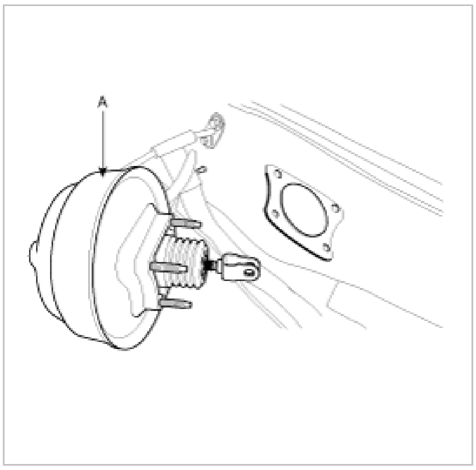
1. Remove the master cylinder.
2. Disconnect the vacuum hose (A) from the brake booster (B).



3. Remove the snap pin (A) and clevis pin (B).



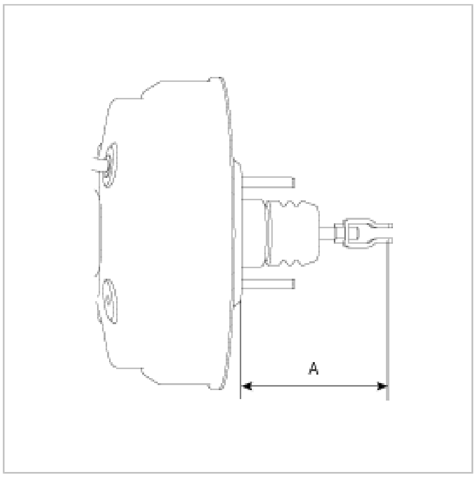
4. Remove the four booster mounting nuts (C).
5. Remove the brake booster (A).



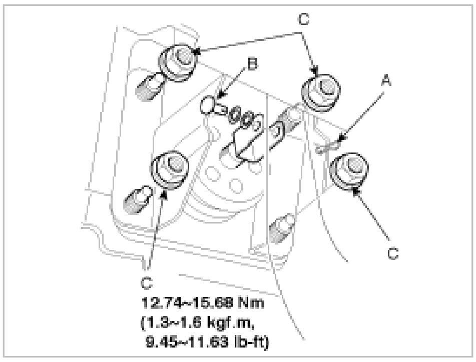
INSTALLATION

1. Adjust push rod length of the booster, and then install the seal on the booster assembly.

Standard length (A): 108± 0.5 mm (4.25 ± 0.019 in.)



2. Insert the booster and tighten the nuts (C).



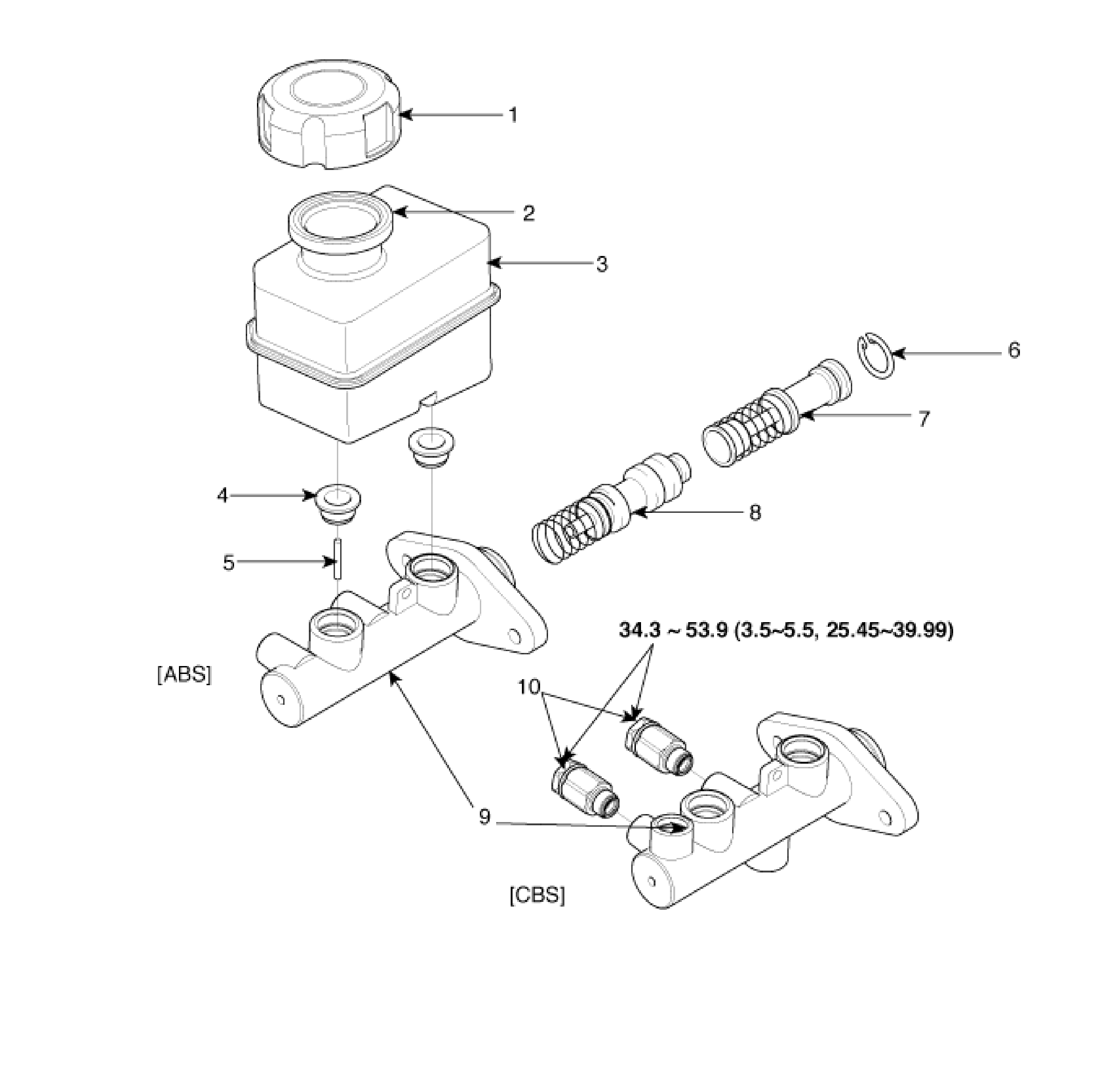
3. Connect the booster push rod and brake pedal with a pin (B) and install a snap clevis pin (A) to the clevis pin (B).

> **CAUTION**
>
> Grease the pin before installing the snap pin.
> Always use a new snap pin.

4. Install the master cylinder.
5. Connect the vacuum hose to the brake booster.
6. After filling the brake reservoir with brake fluid, bleed the system.
7. Check for fluid leakage.
8. Check and adjust the brake pedal for proper operation.

Brake System > Brake System > Master Cylinder > Components and Components Location

COMPONENTS



1. Reservoir cap	6. Retainer
2. Brake fluid filter	7. Primary piston assembly
3. Reservoir	8. Secondary piston assembly
4. Grommet	9. Master cylinder body
5. Cylinder pin	10. Proportioning valve

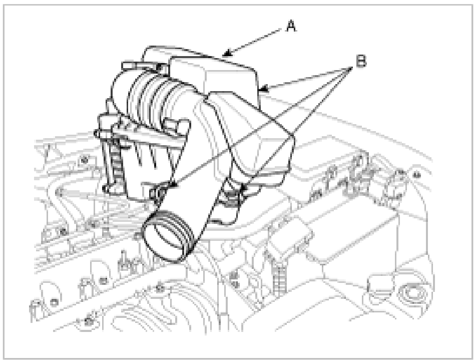
Brake System > Brake System > Master Cylinder > Repair procedures

REMOVAL

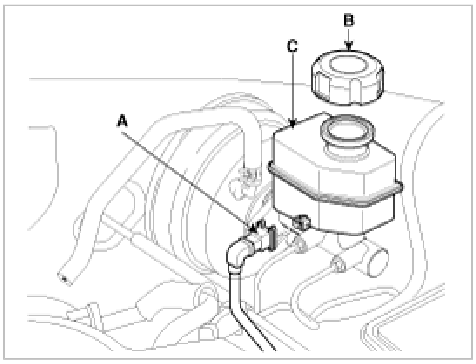
NOTE

Do not spill brake fluid on the vehicle; it may damage the paint; if brake fluid does contact the paint, wash it off immediately with water.

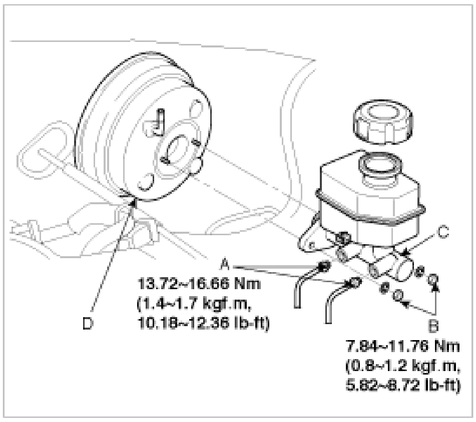
1. Remove air cleaner mounting bolts (B) from the air cleaner mounting bracket and air cleaner body (A).



2. Disconnect the brake fluid level switch connector (A), and remove the reservoir cap (B).



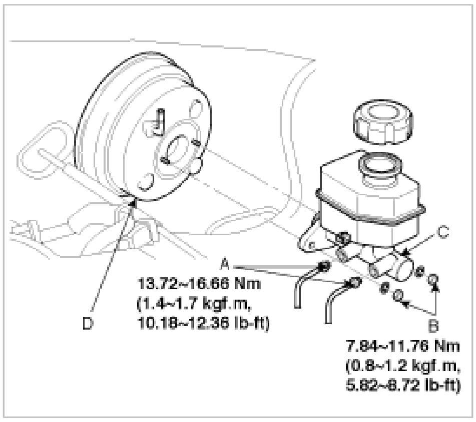
3. Remove the brake fluid from the master cylinder reservoir (C) with a syringe.
4. Disconnect the brake lines (A) from the master cylinder. To prevent spills, cover the hose joints with rags or shop towels.



5. Remove the master cylinder mounting nuts (B) and washers.
6. Remove the master cylinder(C) from the brake booster (D). Be careful not to bend or damage the brake lines when removing the master cylinder.

INSTALLATION

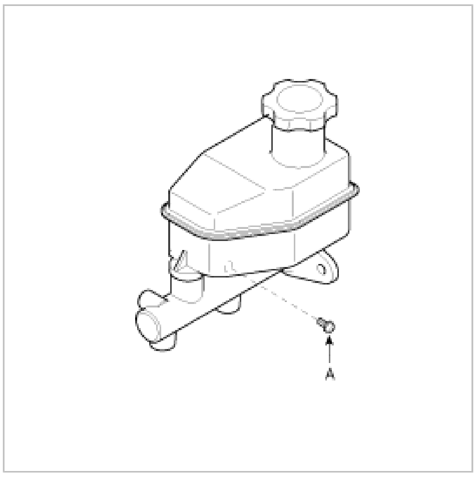
1. Install the master cylinder on the brake booster with 2 nuts.
2. Connect 2 brake tubes and the brake fluid level sensor connector.



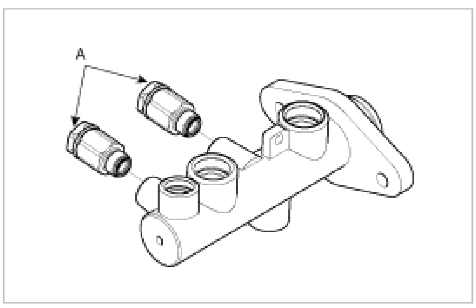
3. Fill the brake reservoir with the brake fluid and bleed the brake system.

DISASSEMBLY

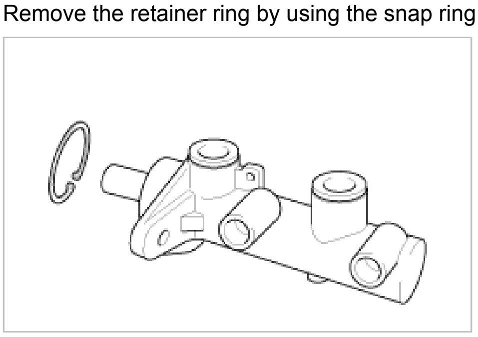
1. Remove the reservoir cap and drain the brake fluid into a suitable container.
2. Remove the fluid level sensor.
3. Remove the reservoir from the master cylinder, after remove mounting screw (A).



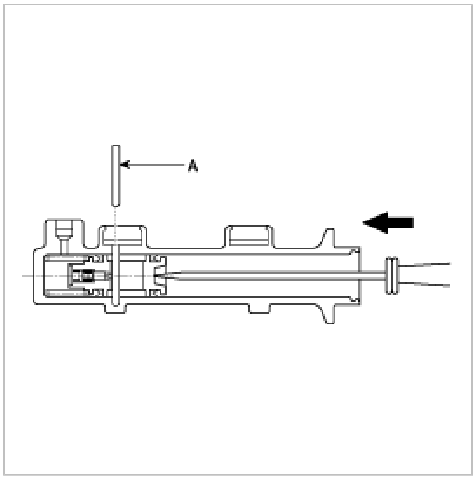
4. Remove the proportioning valves (A) - CBS only.



5. Remove the retainer ring by using the snap ring pliers then remove the primary piston assembly.



6. Remove the pin with the secondary piston pushed completely using a screwdriver. Remove the secondary piston assembly.



NOTE

Do not disassemble the primary and secondary piston assembly.

INSPECTION

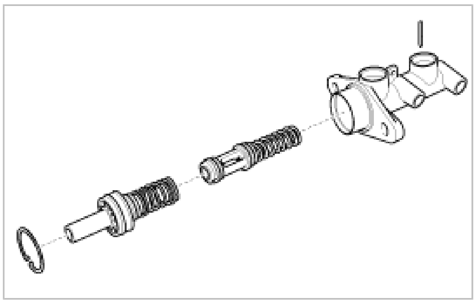
1. Check the master cylinder bore for rust or scratching.
2. Check the master cylinder for wear or damage. If necessary, clean or replace the cylinder.

CAUTION

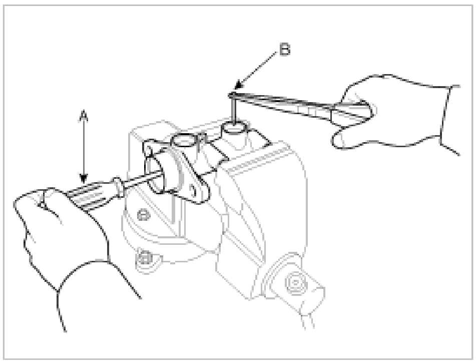
- If the cylinder bore is damaged, replace the master cylinder assembly.
- Wash the contaminated parts in alcohol.

REASSEMBLY

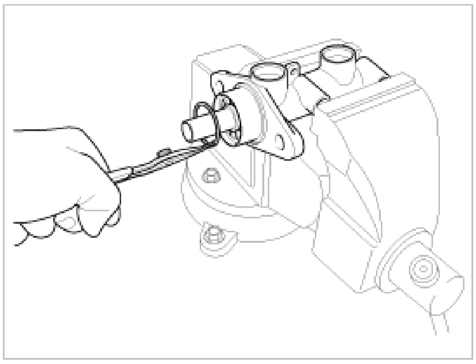
1. Apply genuine brake fluid to the rubber parts of the cylinder kit and grommets.
2. Carefully insert the springs and pistons in the proper direction.



3. Press the piston with a screwdriver(A) and install the cylinder pin(B).



4. Press the piston with a screwdriver and install the retainer ring.



5. Mount two grommets.
6. Install the reservoir on the cylinder.

Brake System > Brake System > Proportioning Valve > Description and Operation

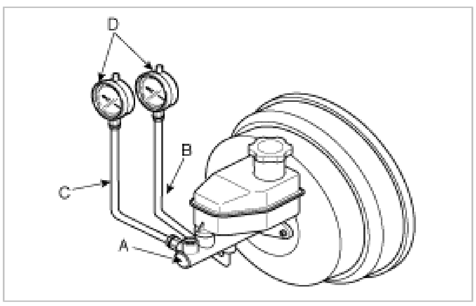
DESCRIPTION

Do not disassemble the proportioning valve. The proportioning valve makes the ideal distribution of fluid pressure to the front and rear brakes to prevent the brakes from skidding in the event of rear wheel lock up and to obtain a higher brake efficiency within the range of service brake application.

Brake System > Brake System > Proportioning Valve > Repair procedures

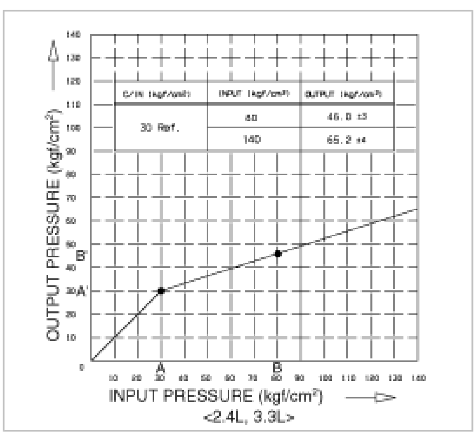
INSPECTION

1. Remove the front brake tube (B) and rear brake tube (C) from the master cylinder (A).
2. Connect two pressure gauges (D); one to the output valve of the front (B) and rear (C) brake.



> **NOTE**
>
> Be sure to bleed the system after connecting the pressure gauges.

3. With the brake applied, measure the front pressure and the rear pressure.
   If the measured pressures are within the specified range as illustrated, the proportioning valve is good.



4. Reconnect the brake lines in their original positions and bleed the system.

> **NOTE**

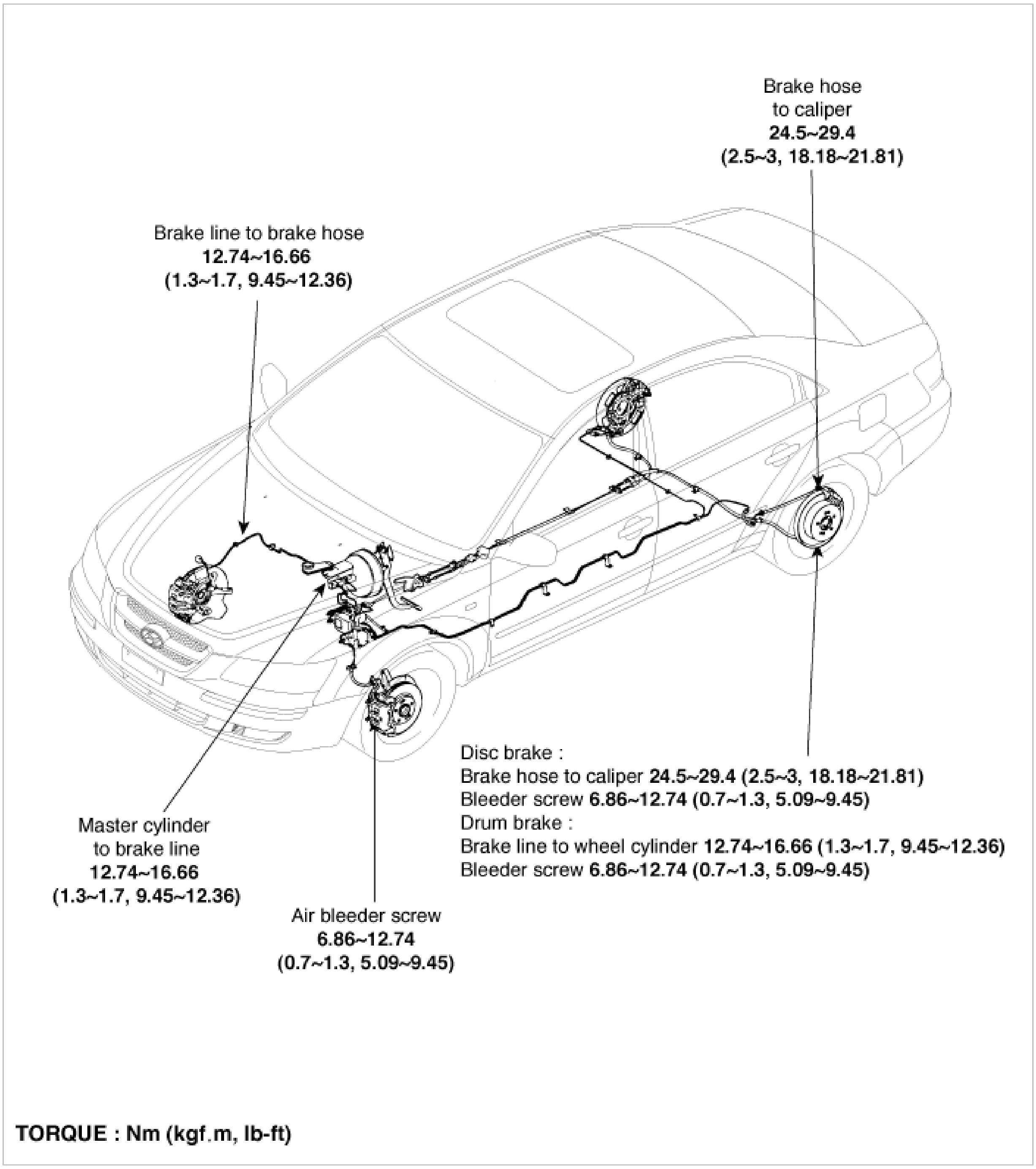
This table shows characteristics of the proportioning valve as the pressure increases.

<2.4L, 3.3L>

Input Pressure	Output Pressure
A : 30 kg/cm²	A' : 30 kg/cm²
B : 80 kg/cm²	B' : 46 kg/cm²

Brake System > Brake System > Brake Line > Components and Components Location

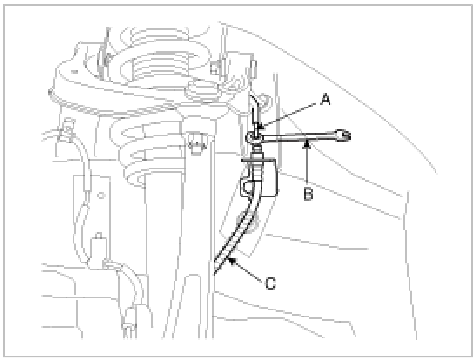
COMPONENT



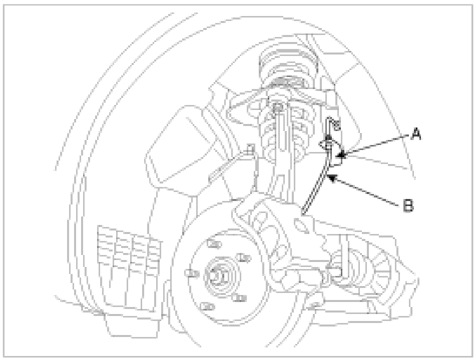
Brake System > Brake System > Brake Line > Repair procedures

REMOVAL

1. Disconnect the brake hose(C) from the brake line(A) using a flare-nut wrench(B).



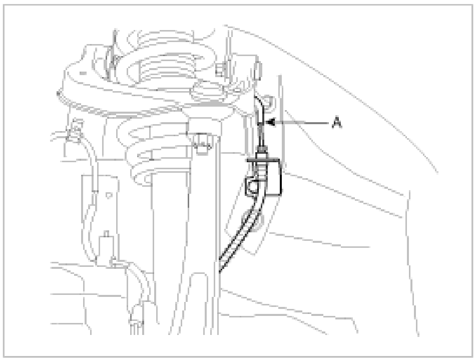
2. Remove the bracket mounting bolt(A), and then remove the brake hose(B).



3. Remove the connector bolt from the caliper, and disconnect the brake hose from the caliper.

INSTALLATION

1. Install a brake hose on the caliper with tightening brake hose bolt.
2. Install the bracket and the brake hose mounting bolt.



3. Connect the brake hose(A) to the brake line.
4. After installing the brake hose, bleed the brake system.

INSPECTION

- Check the brake tubes for cracks, crimps and corrosion.
- Check the brake hoses for cracks, damaged and oil leakage.
- Check the brake tube flare nuts for damage and oil leakage.

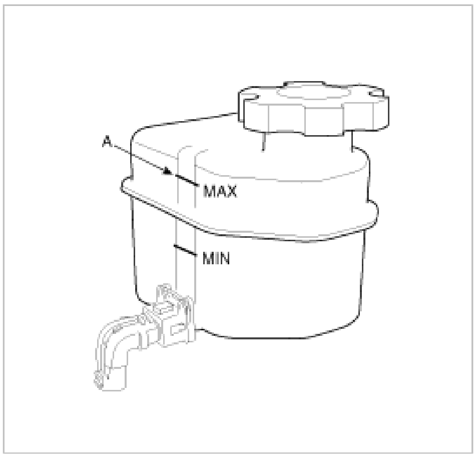
BRAKE SYSTEM BLEEDING

NOTE

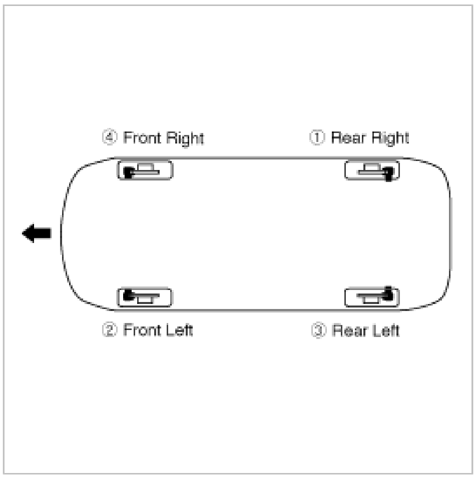
- Do not reuse the drained fluid.
- Always use Genuine DOT3 or DOT 4 Brake Fluid. Using a non-Genuine DOT or 4 brake fluid can cause corrosion and decrease the life of the system.
- Make sure no dirt of other foreign matter is allowed to contaminate the brake fluid.
- Do not spill brake fluid on the vehicle, it may damage the paint; if brake fluid does contact the paint, wash it off

immediately with water.
- The reservoir on the master cylinder must be at the MAX (upper) level mark at the start of bleeding procedure and checked after bleeding each brake caliper. Add fluid as required.

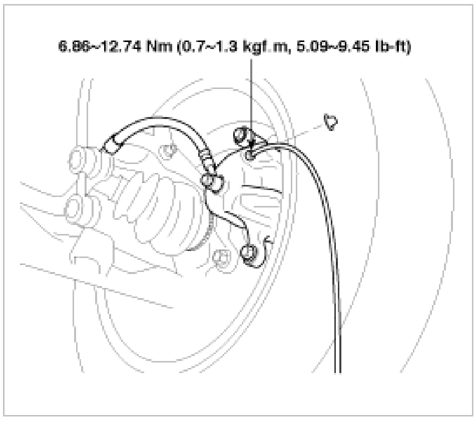
1. Make sure the brake fluid in the reservoir is at the MAX (upper) level line (A).



2. Have someone slowly pump the brake pedal several times, then apply pressure.
3. Lossen the right-rear brake bleed screw to allow air to escape from the system. Then tighten the bleed screw securely.
4. Repeat the procedure for wheel in the sequence shown below unit air bubbles no longer appear in the fluid.
5. Refill the master cylinder reservoir to MAX(upper) level line.

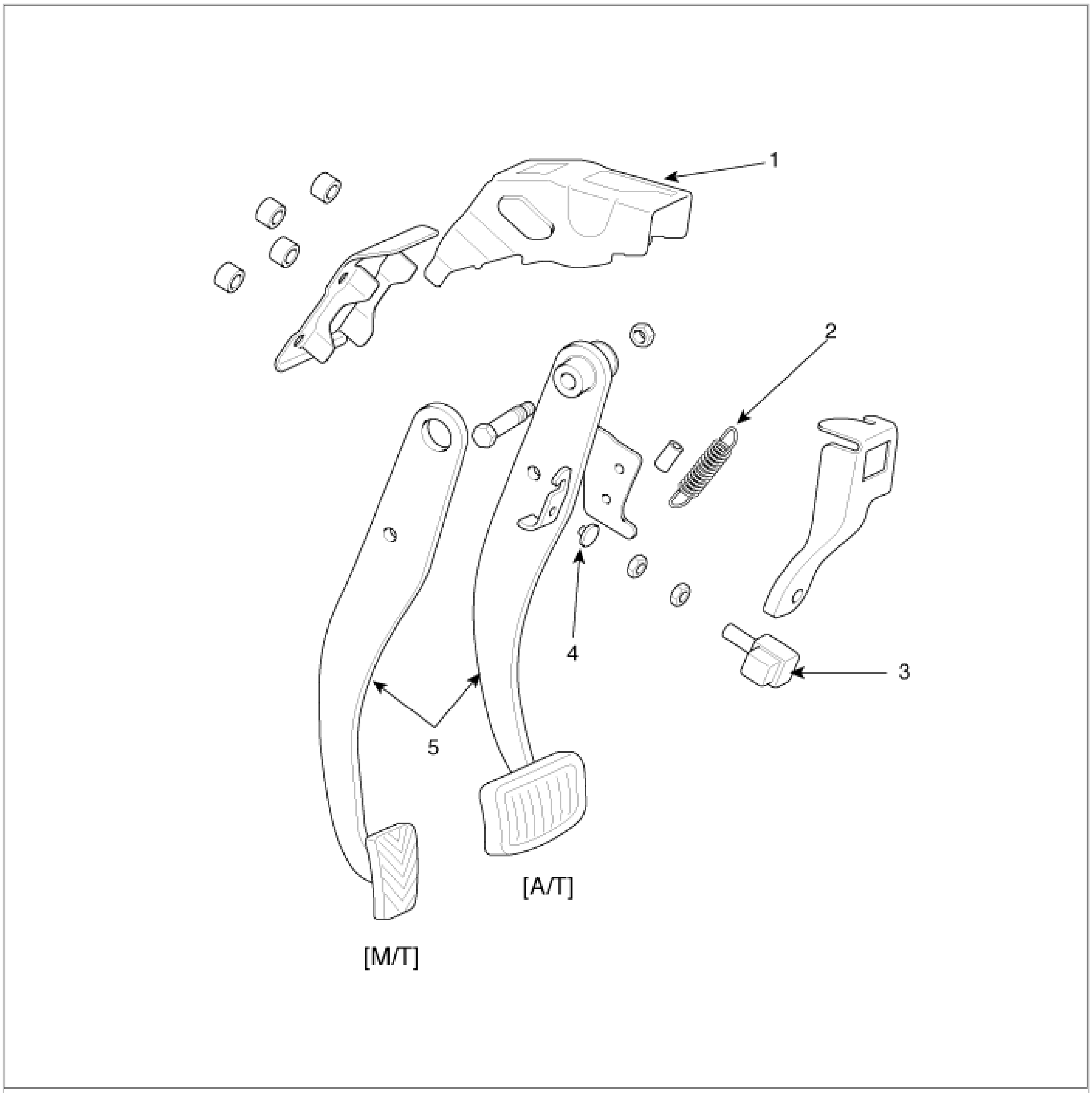


FRONT DISC BRAKE



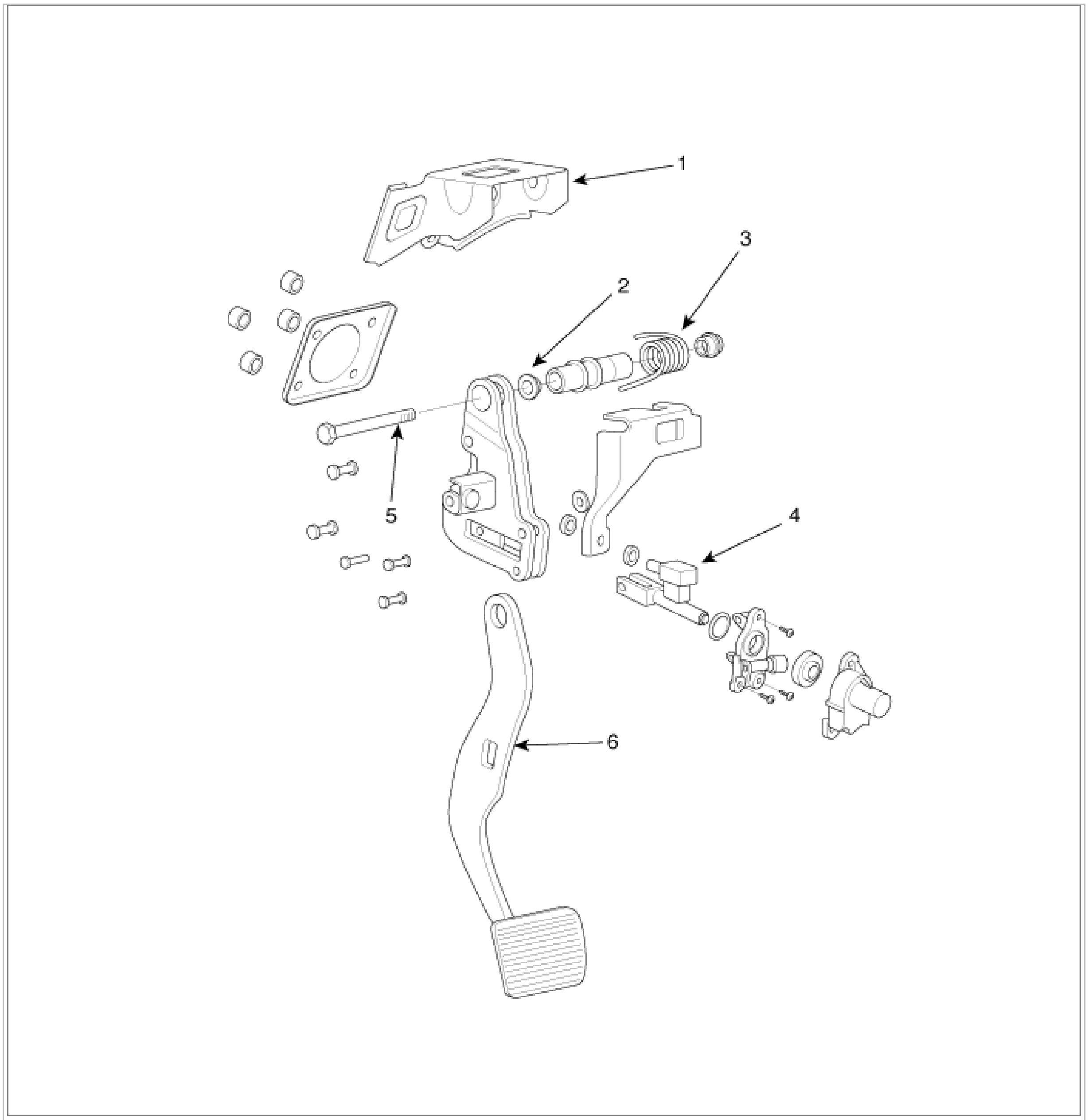
Brake System > Brake System > Brake Pedal > Components and Components Location

COMPONENTS



1. Member assembly bracket
2. Return spring
3. Stop lamp switch
4. Bushing
5. Brake pedal

COMPONENTS (ADJUSTABLE PEDAL)



1. Member assembly bracket
2. Bushing
3. Return spring
4. Stop lamp switch
5. Shaft bolt
6. Brake pedal

Brake System > Brake System > Brake Pedal > Repair procedures

REMOVAL

1. Remove the lower crash pad.(Refer to BD-"crash pad")
2. Pull down steering column shaft after removing 4 bolts.
3. Remove the stop lamp switch connector (A).
4. Remove the shift lock cable (A/T).

5. Remove the pin and snap pin.
6. Loosen the brake pedal member assembly mounting nuts and then remove the brake pedal assembly.

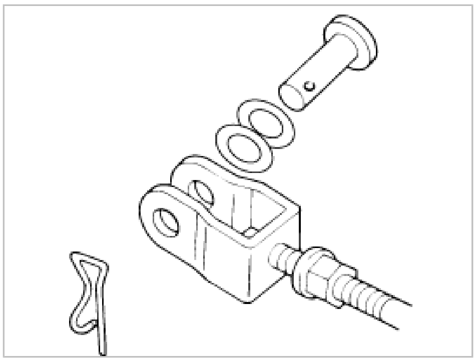
INSTALLATION

1. Installation is the reverse of removal.

> CAUTION
>
> Coat the inner surface of the bushings with the specified grease.

Specified grease : SAE J310

2. Before inserting the pin, apply the specified grease to the joint pin.



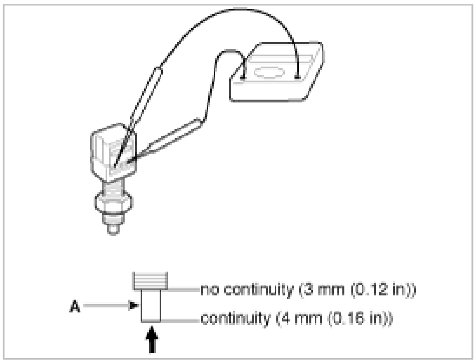
3. Install the snap pin.
4. Install the nuts with specified torque, when installing the brake pedal.

TORQUE : Nm(kgf·m,lb-ft); 12.74~15.68(1.3~1.6, 9.45~11.63)

5. Adjust the brake pedal height and free play.
6. Install the stop lamp switch.

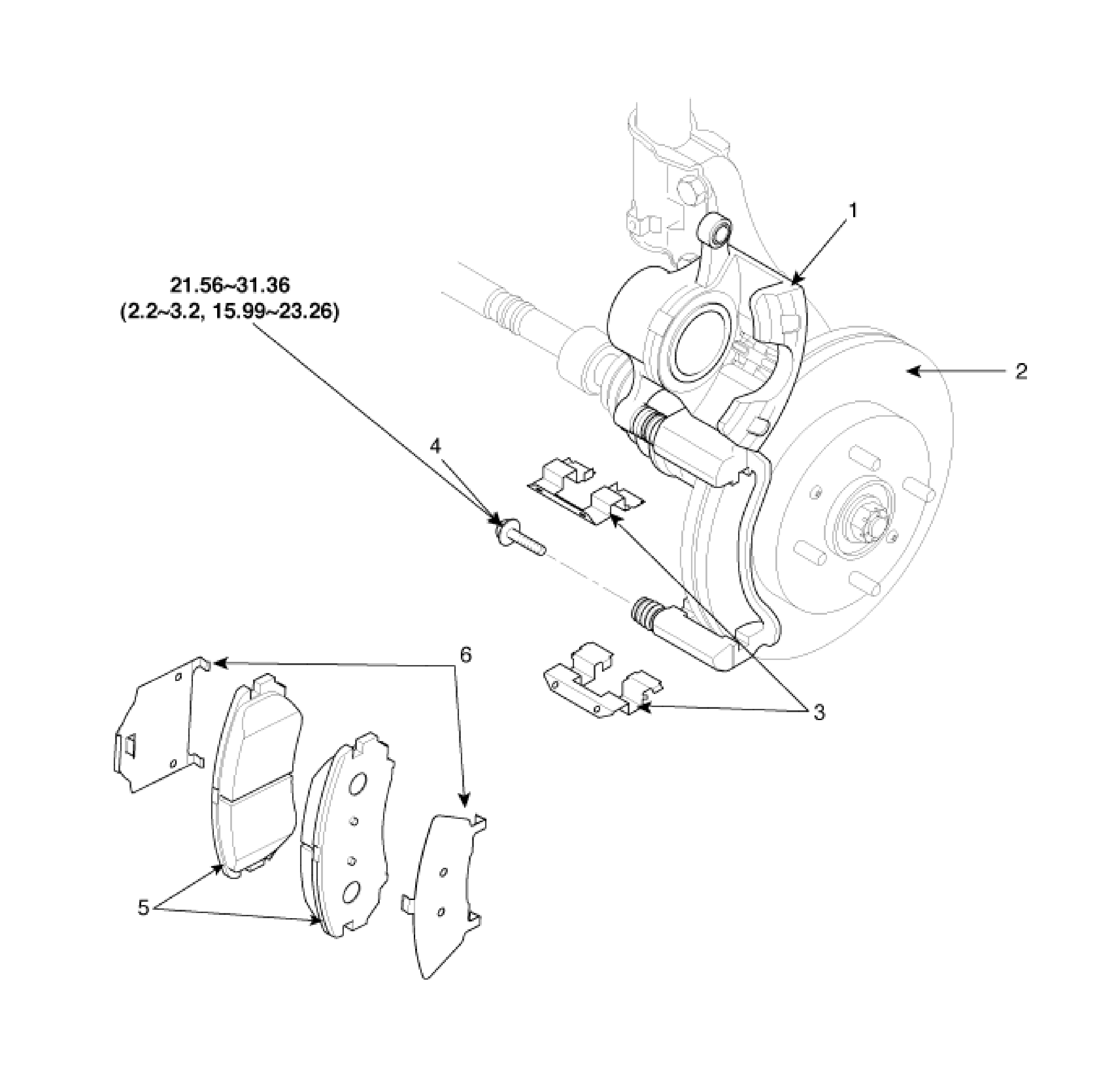
INSPECTION

1. Check the bushing for wear.
2. Check the brake pedal for bending or twisting.
3. Check the brake pedal return spring for damage.
4. Check the stop lamp switch.
   (1) Connect a circuit tester to the connector of stop lamp switch, and check whether or not there is continuity when the plunger of the stop lamp switch is pushed in and when it is released.
   (2) The stop lamp switch is in good condition if there is no continuity when plunger(A) is pushed.



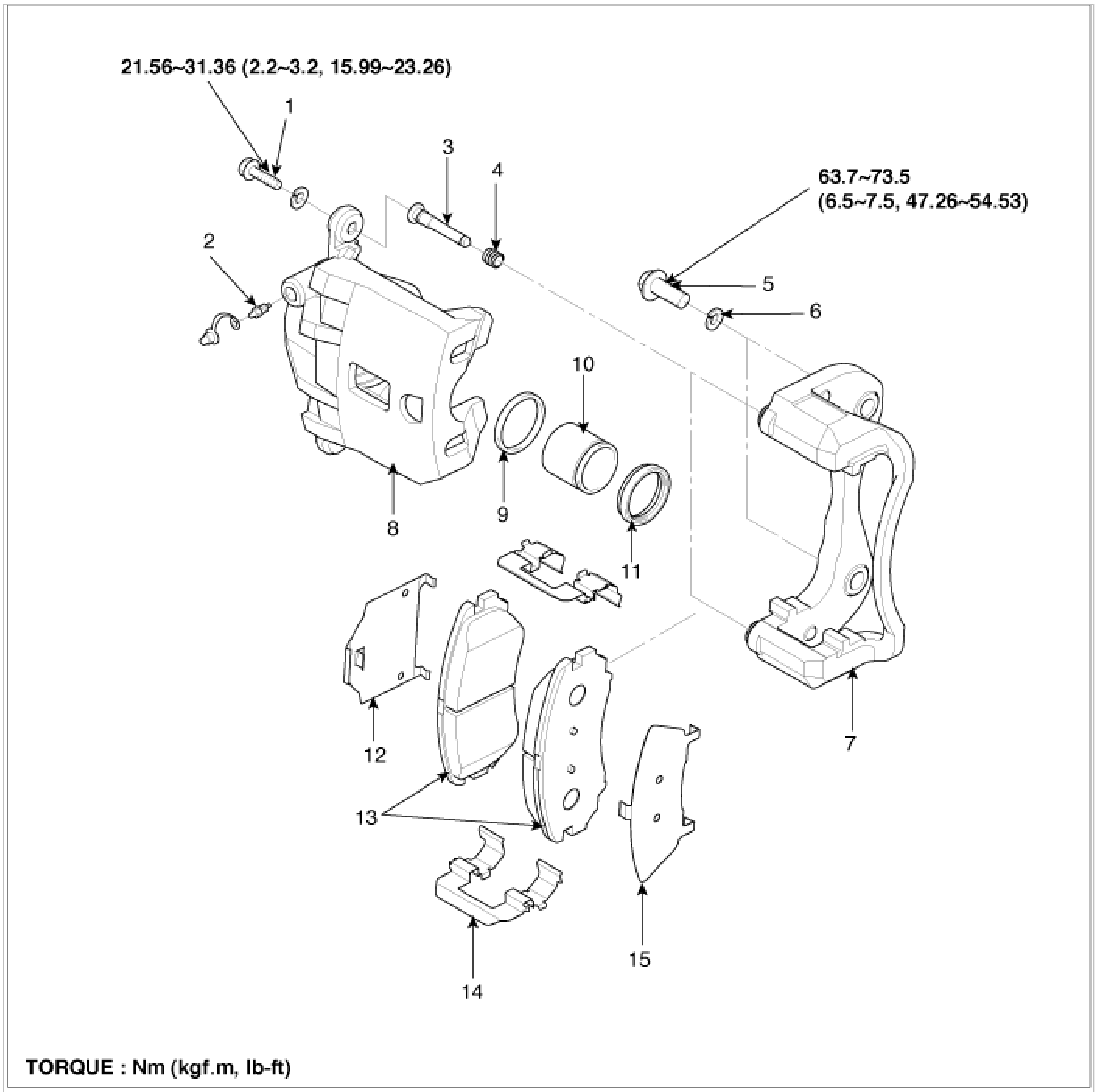
Brake System > Brake System > Front Disc Brake > Components and Components Location

COMPONENTS



TORQUE: Nm (kgf.m, lb-ft)

1. Brake caliper
2. Brake disc
3. Pad retainers
4. Guide rod bolt
5. Brake pads
6. Brake pad shims



1. Guide rod bolt	6. Washer	11. Piston boot
2. Bleeder screw	7. Caliper bracket	12. Inner shim
3. Guide rod	8. Caliper body	13. Brake pad
4. Boot	9. Piston seal	14. Pad retainer
5. Caliper mounting bolt	10. Piston	15. Outer shim

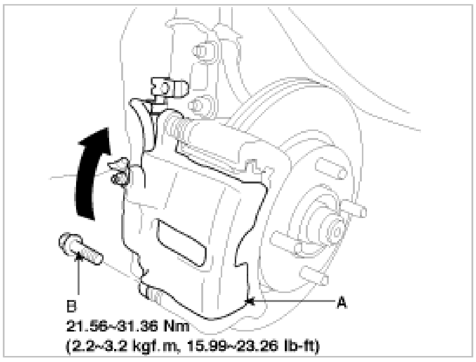
Brake System > Brake System > Front Disc Brake > Repair procedures

REMOVAL

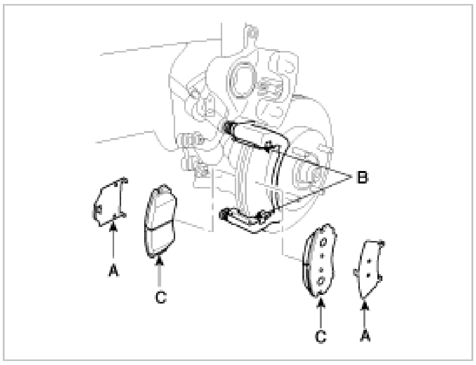
CAUTION

Frequent inhalation of brake pad dust, regardless of material composition, could be hazardous to your health.
- Avoid breathing dust particles.
- Never use on air hose or brush to clean brake assemblies.

1. Lossen the front wheel nuts slightly. Raise the front of the vehicle, and make sure it is securely supported. Remove the front wheels.
2. Remove the guide rod bolt(B), After raise the caliper assembly(A), support it with a wire.

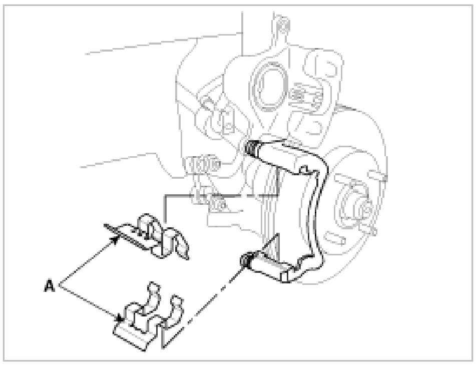


3. Remove pad shim(A), pad retainer(B) and pad assembly(C) in the caliper bracket.

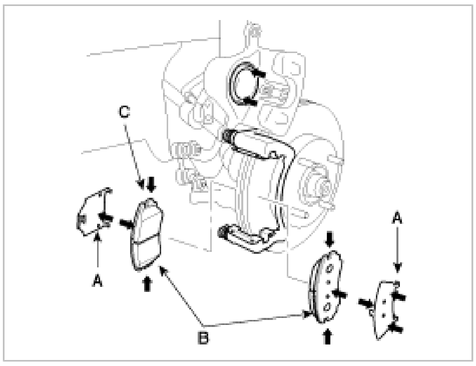


INSTALLATION

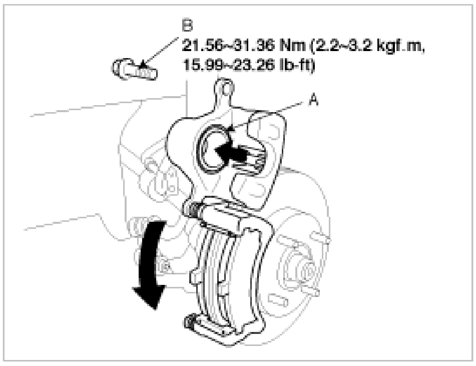
1. Install the pad retainers (A) on the caliper bracket.



2. Check the foreign material at the pad shims (A) and the back of the pads (B).
   Contaminated brake discs or pads reduce stopping ability. Keep grease off the discs and pads.

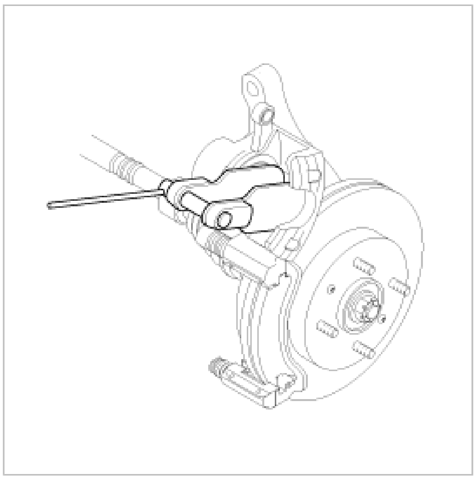


3. Install the brake pads (B) and pad shims (A) correctly. Install the pad with the wear indicator (C) on the inside.
   If you are reusing the pads, always reinstall the brake pads in their original positions to prevent a momentary loss of braking efficiency.
4. Push in the piston (A) so that the caliper will fit over the pads. Make sure that the piston boot is in position to prevent damaging it when pivoting the caliper down.
5. Pivot the caliper down into position. Being careful not to damage the pin boot, install the guide rod bolt (B) and torque it to proper specification.



NOTE

Insert the piston in the cylinder using the special tool (09581-11000).



6. Depress the brake pedal several times to make sure the brakes work, then test-drive.

NOTE

Engagement of the brake may require a greater pedal stroke immediately after the brake pads have been replaced as a set.Several applications of the brake will restore the normal pedal stroke.
Be sure to do this before driving the vehicle.

7. After installation, check for leaks at hose and line joints or connections, and retighten if necessary.

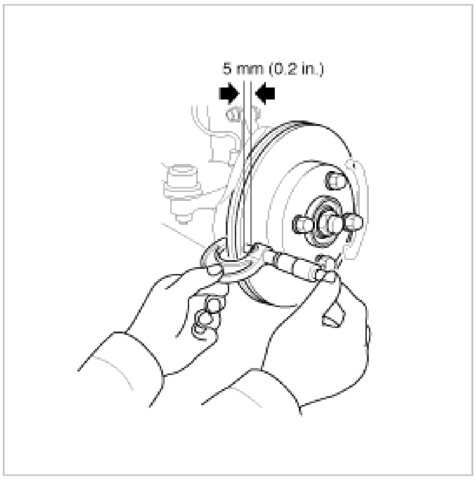
INSPECTION

FRONT BRAKE DISC THICKNESS CHECK

1. Remove all rust and contramination from the surface, and measure the disc thickness at 12 points, at least, of same distance (5mm) front the brake disc outer circle.

Front brake disc thickness
Standard value :
26.0 mm(1.024 in) - 2.4 L
28.0 mm(1.10 in) - 3.3 L
Limit :
24.4 mm(0.961 in) - 2.4 L
26.4 mm(1.04 in) - 3.3 L

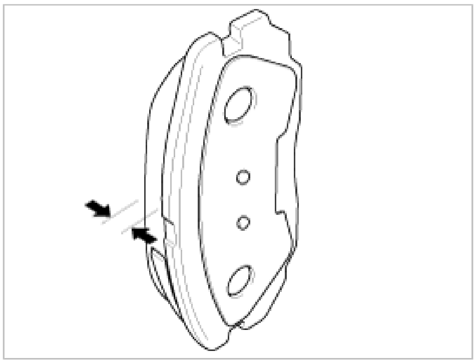
2. Thickness variation should not exceed 0.005mm (0.0002 in) (circumference) and 0.01 mm (0.0004 in)(radius) at any directions.
3. If wear exceeds the limit, replace the discs and pad assembly left and right of the vehicle.



FRONT BRAKE PAD CHECK

1. Check the pad wear. Measure the pad thickness and replace it, if it is less than the specified value.

Pad thickness
Standard value : 11 mm (0.43 in.)
Service limit : 3 ~ 4 mm (0.12 ~ 0.16 in.)



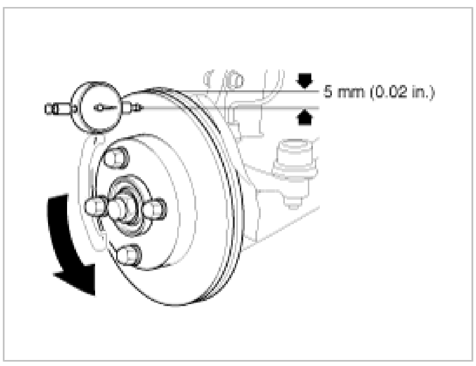
2. Check that grease is applied, to sliding contact points and the pad and backing metal for damage.

FRONT BRAKE DISC RUN OUT CHECK

1. Place a dial gauge about 5mm (0.2 in.) from the outer circumference of the brake disc, and measure the run out of the disc.

Brake disc run out
Limit : 0.04 mm (0.0016 in.) or less (new one)

2. If the run out of the brake disc exceeds the limit specification, replace the disc, and then measure the run out again.
3. If the run out does not exceed the limit specification, install the brake disc after turning it 180° and then check the run out of the brake disc again.
4. If the run out cannot be corrected by changing the position of the brake disc, replace the brake disc.



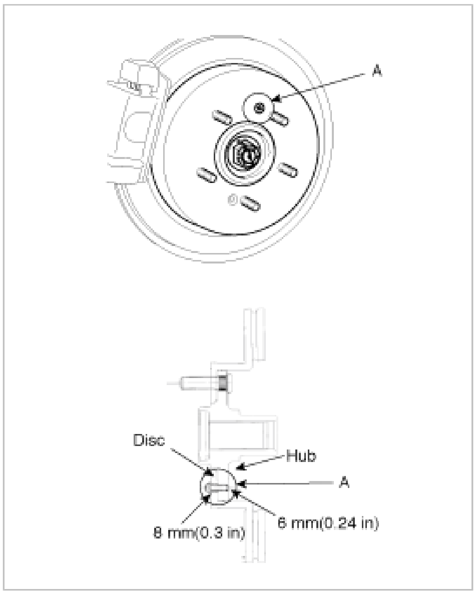
Seizing of Front brake disc

1. Remove the brake disc from hub using an M8 screw(A) if the brake disc has been seized with the hub due to corrosion or

overheating.

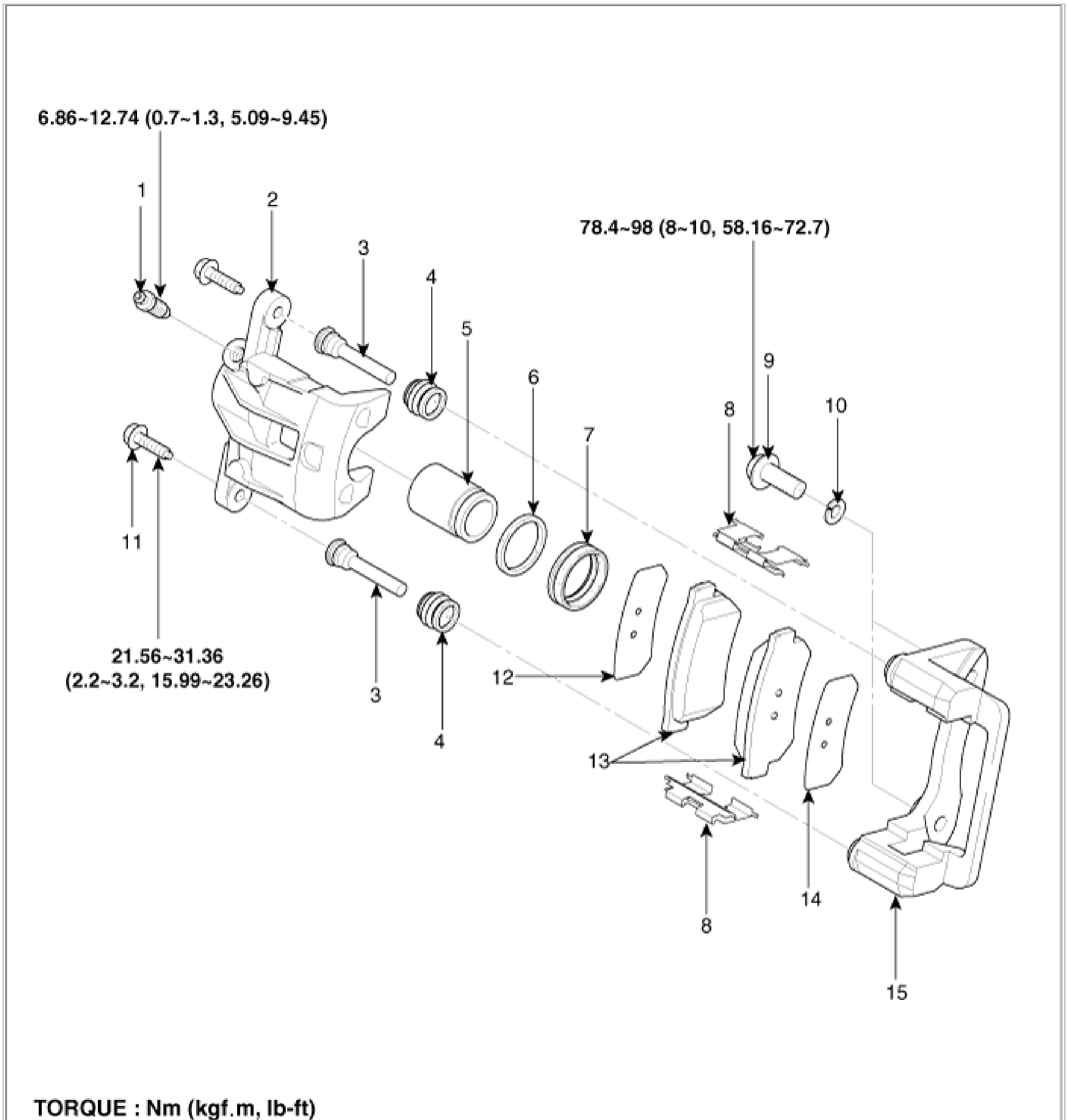
NOTE

Be careful not to use a hammer. The disc can be damaged if you remove the disc from the hub by hammering.



Brake System > Brake System > Rear Disc Brake > Components and Components Location

COMPONENTS

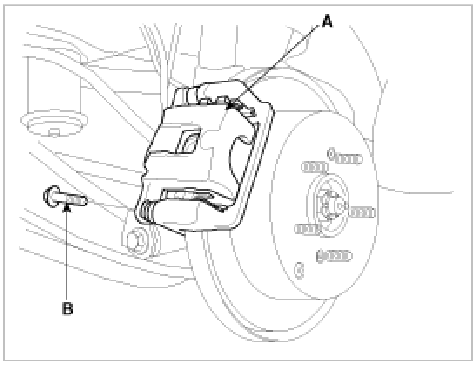


1. Bleeder screw	6. Piston seal	11. Guide rod bolt
2. Caliper body	7. Piston boot	12. Inner shim
3. Guide rod	8. Pad retainer	13. Brake Pad
4. Boot	9. Caliper mounting bolt	14. Outer shim
5. Piston	10. Washer	15. Caliper bracket

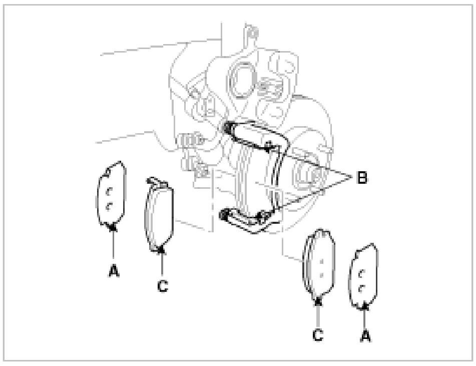
Brake System > Brake System > Rear Disc Brake > Repair procedures

REMOVAL

1. Raise the rear of the vehicle and make sure it is securely supported. Remove the rear wheel.
2. Remove the guide rod bolt(B), After raising the caliper assembly(A), support it with a wire.

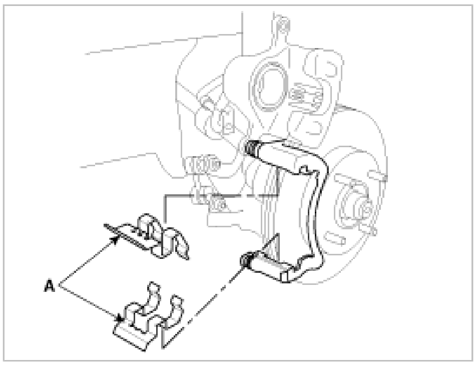


3. Remove pad shim(A), pad retainer(B) and pad assembly(C) in the caliper bracket.

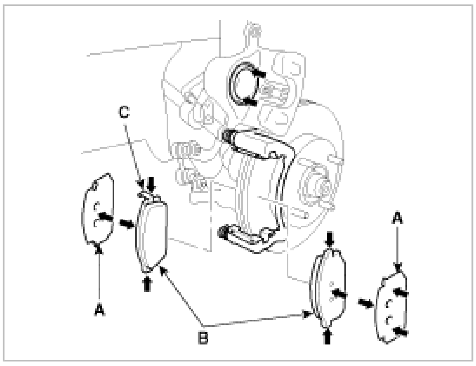


INSTALLATION

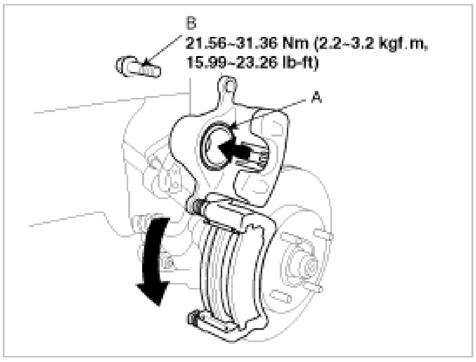
1. Install the pad retainers(A) on the caliper bracket.



2. Check for foreign material between the pad shim (A) and the back of the pads (B).

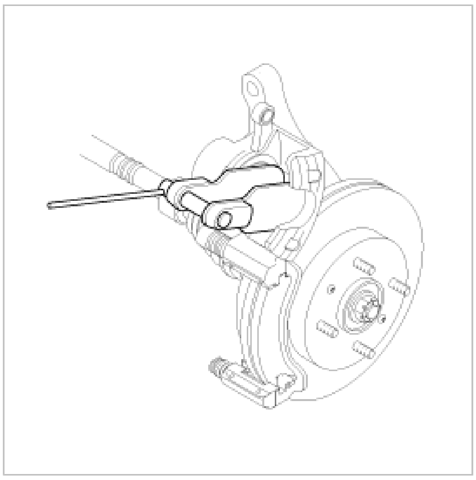


3. Contaminated brake discs or pads reduce stopping ability. Keep grease off the discs and pads.
4. Install the brake pads (B) and pad shims (A) correctly. Install the pad with the wear indicator (C) on the inside.
   If you are reusing the pads, always reinstall the brake pads in their original position to prevent a momentary loss of braking efficiency.
5. Push in the piston (A) so that the caliper will fit over the pads. Make sure that the piston boot is in position to prevent damaging it when pivoting the caliper down.
6. Pivot caliper down into position. Being careful not to damage the pin boot, install the guide rod bolt (B) and torque it to proper specification



NOTE

Insert the piston in the cylinder using the special tool(09581-11000).



7. Depress the brake pedal several time to make sure the brakes work, then test-drive.

NOTE

Engagement of the brake may require a greater pedal stroke immediately after the brake pads have been replaced as a set. Several applications of the brake will restore the normal pedal stroke.

8. After installaion, check for leaks at hose and line joints or connections, and retighten if necessary.

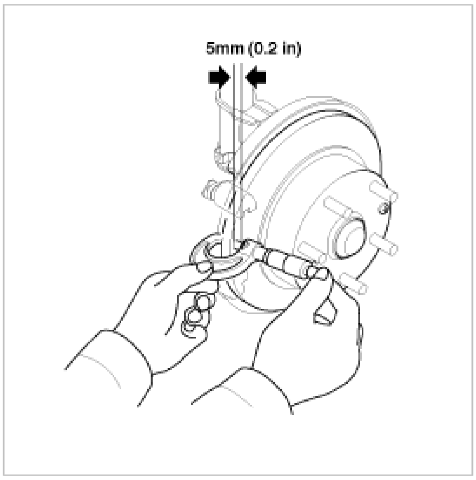
INSPECTION

REAR BRAKE DISC THICKNESS CHECK

1. Remove all rust and contamination from the disc surface, and then measure the disc thickness at 8 points, al least, of the same distance (5 mm(0.12 in)) from the brake disk outer circle.

   Rear brake disc thickness
   Standard value : 10.0 mm (0.39 in)
   Limit : 8.4 mm (0.33 in)

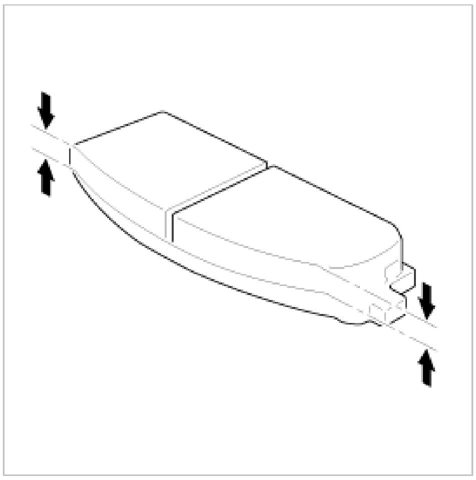
2. Thickness variation should not exceed 0.01 mm(0.0004 in) (circumference) and 0.01 mm(0.0004 in) (radius) at any directions.
3. If wear exceeds the limit, replace the discs and pad assembly for left and right of the vehicle.



REAR BRAKE PAD CHECK

1. Check the pad wear. Measure the pad thickness and replace it, if it is less than the specified value.

Pad thickness
Standard value :
10.0 mm (0.39 in) - 2.4 L
15.0 mm (0.59 in) - 3.3 L
Service limit : 3.0 mm (0.12 in)

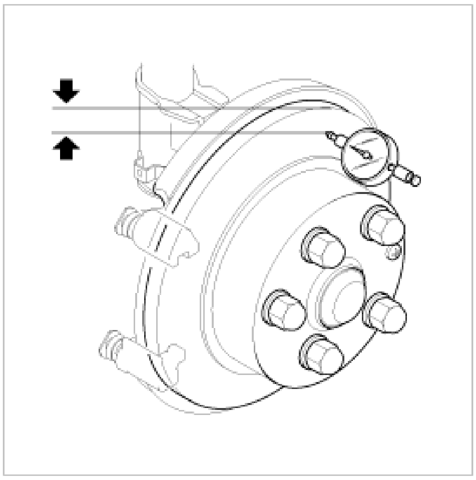


2. Check that grease is applied, and the pad and backing metal for damage.

REAR BRAKE DISC RUN OUT CHECK

1. Place a dial gauge about 5 mm (0.2 in) from the outer circumference of the brake disc, and measure the run out of the disc.

Brake disc run out
Limit : 0.05 mm (0.002 in) or less (new one)

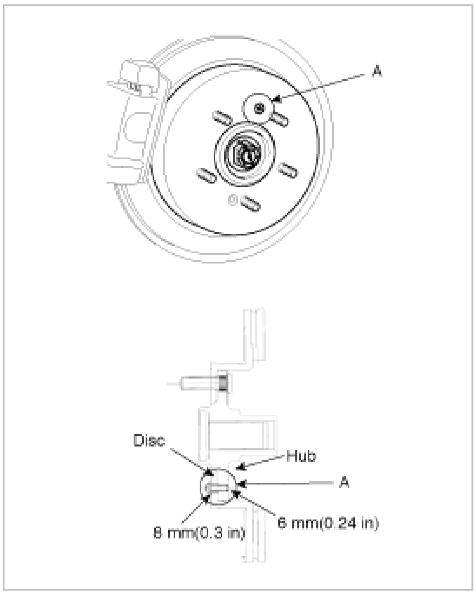


2. If the run out of the brake disc exceeds the limit specification, replace the disc, and then measure the run out again.
3. If the run out does not exceed the limit specification, install the brake disc after turning it 180° and then check the run out of the brake disc again.
4. If the run out cannot be corrected by changing the position of the brake disc, replace the brake disc.

Seizing of Rear brake disc

1. Remove the brake disc from hub using an M8 screw(A) if the brake disc has been seized with the hub due to corrosion or overheating.

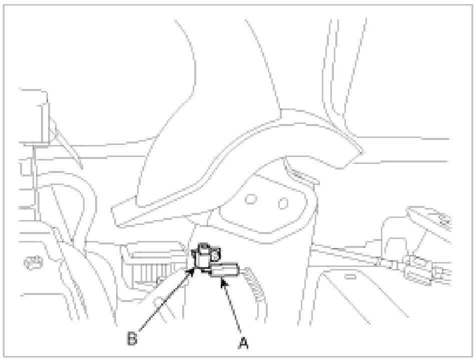
> NOTE
>
> Be careful not to use a hammer. The disc can be damaged if you remove the disc from the hub by hammering.



Brake System > Parking Brake System > Parking Brake Switch > Repair procedures

INSPECTION

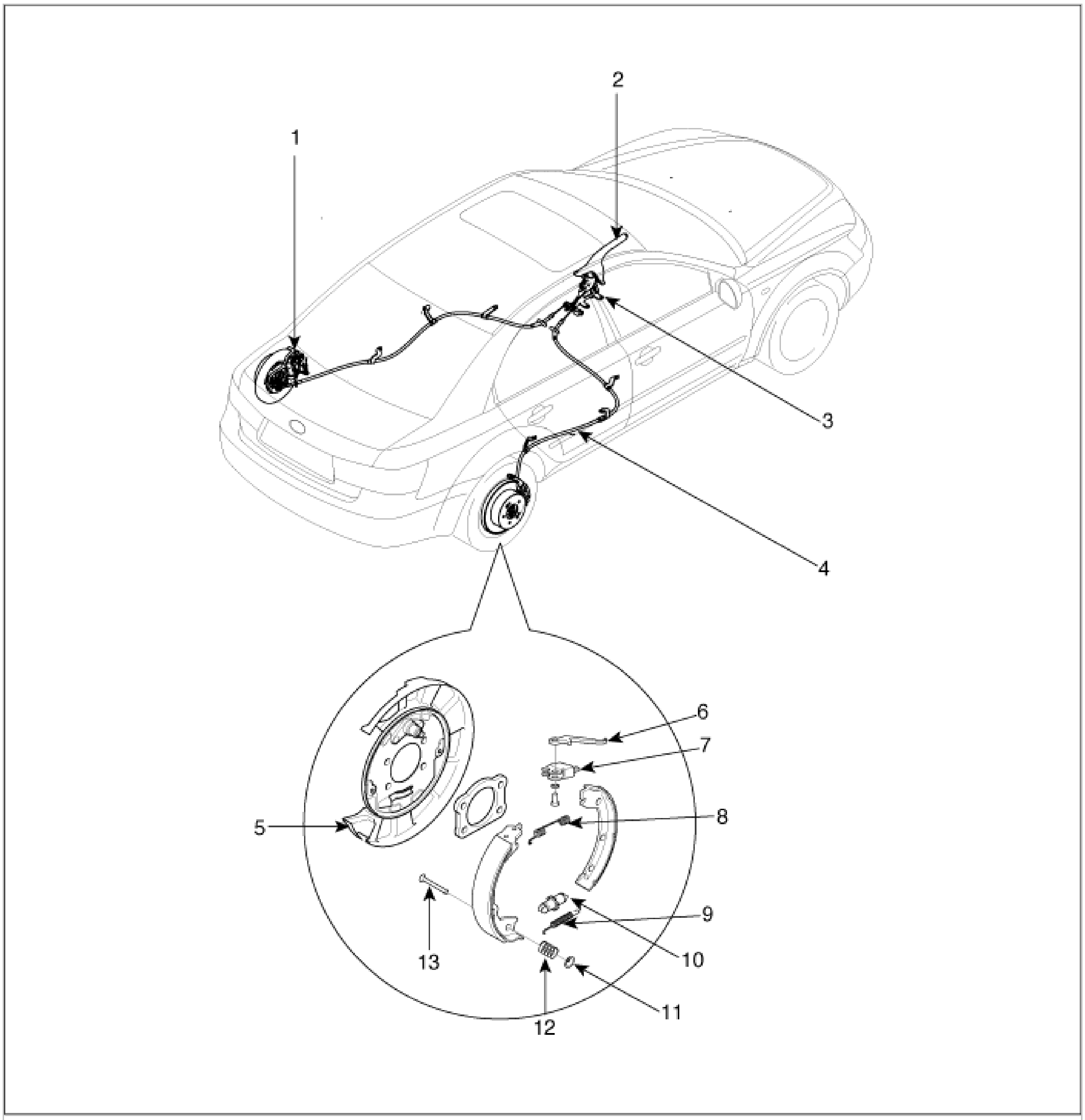
1. Remove the floor console and the connector(B) from the switch(A).



2. Inspect the continuity between (-) terminal and the ground.
   A. When the brake lever is pulled, there should be the continuity between them.
   B. When the brake lever is released, there should be no continuity between them.

Brake System > Parking Brake System > Parking Brake Assembly > Components and Components Location

COMPONENTS



1. Rear brake caliper	6. Operating lever	11. Cup washer
2. Parking brake lever	7. Strut	12. Shoe hold down spring
3. Parking brake switch	8. Upper spring	13. Shoe hold down pin
4. Parking brake cable	9. Lower spring	
5. Backing plate	10. Adjuster	

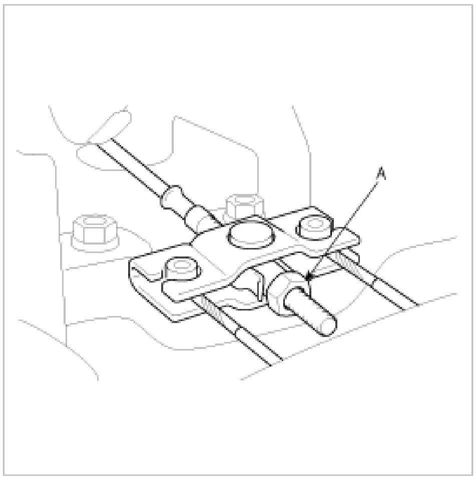
Brake System > Parking Brake System > Parking Brake Assembly > Repair procedures

REMOVAL

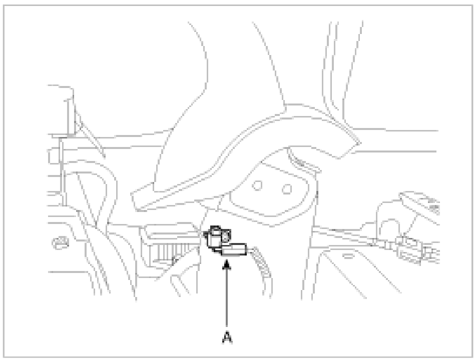
NOTE

The parking brake cables must not be bent or distorted.
This will lead to stiff operation and premature failure.

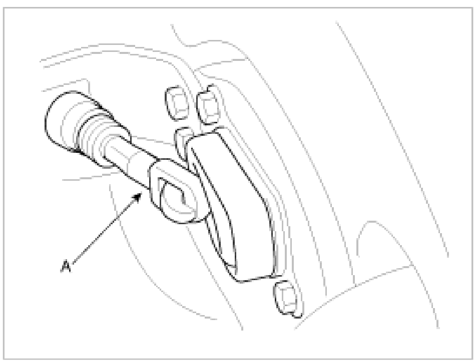
1. Remove the floor console.
2. Loosen the adjusting nut (A) and remove the parking brake cables.



3. Disconnect the connector(A) of the parking brake switch connector.



4. Remove the bolts and parking brake lever assembly(A).
5. Remove the wheel and tire.
6. Remove the brake disc and the brake shoe (Refer to the rear disc brake).
7. Remove the parking brake hook(A).



8. Remove the parking brake cable assembly.

INSTALLATION

1. Install the removed parts in the reverse order of removal.
2. Apply the specified grease to each sliding parts of the ratchet plate or the ratchet pawl.

Specified grease :
Multi purpose grease SAE J310, NLGI No.2

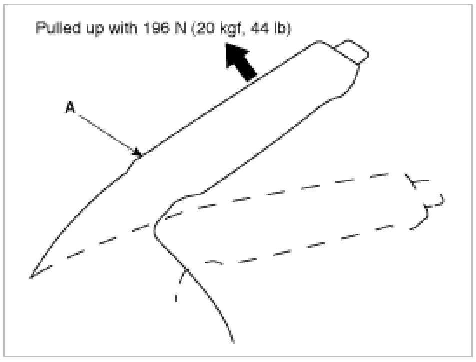
3. After installing the parking brake cable adjuster, adjust the parking brake lever stroke (Refer to the parking brake check and adjustment).

Parking brake check and adjustment

INSPECTION

1. Pull the parking brake lever (A) with 196 N (20 kgf, 44 lbf) force to fully apply the parking brake. The parking brake lever should be locked within the specified number of clicks.

Lever locked clicks : 8



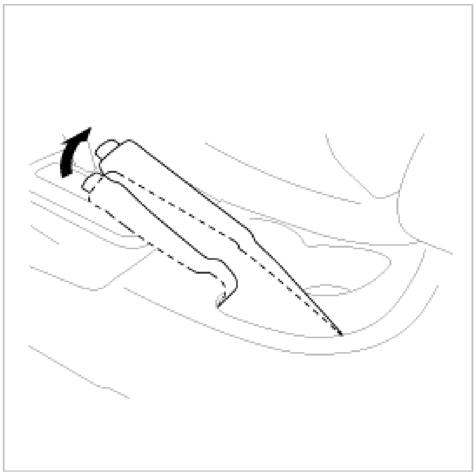
2. Adjust the parking brake if the lever clicks are out of specification.

ADJUSTMENT

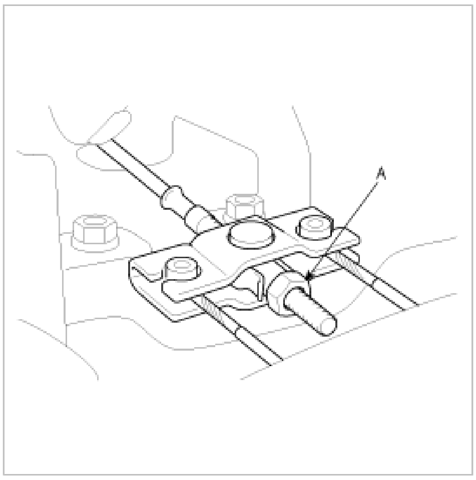
NOTE

After rear brake caliper servicing, loosen the parking brake adjusting nut, start the engine and depress the brake pedal several times to set the self-adjusting brake before adjusting the parking brake.

1. Block the front wheels, then raise the rear of the vehicle and make sure it is securely supported.
2. Pull the parking brake lever up one click.



3. Remove the floor console.
4. Tighten the adjusting nut (A) until the parking brakes are dragged slightly when the rear wheels are turned.



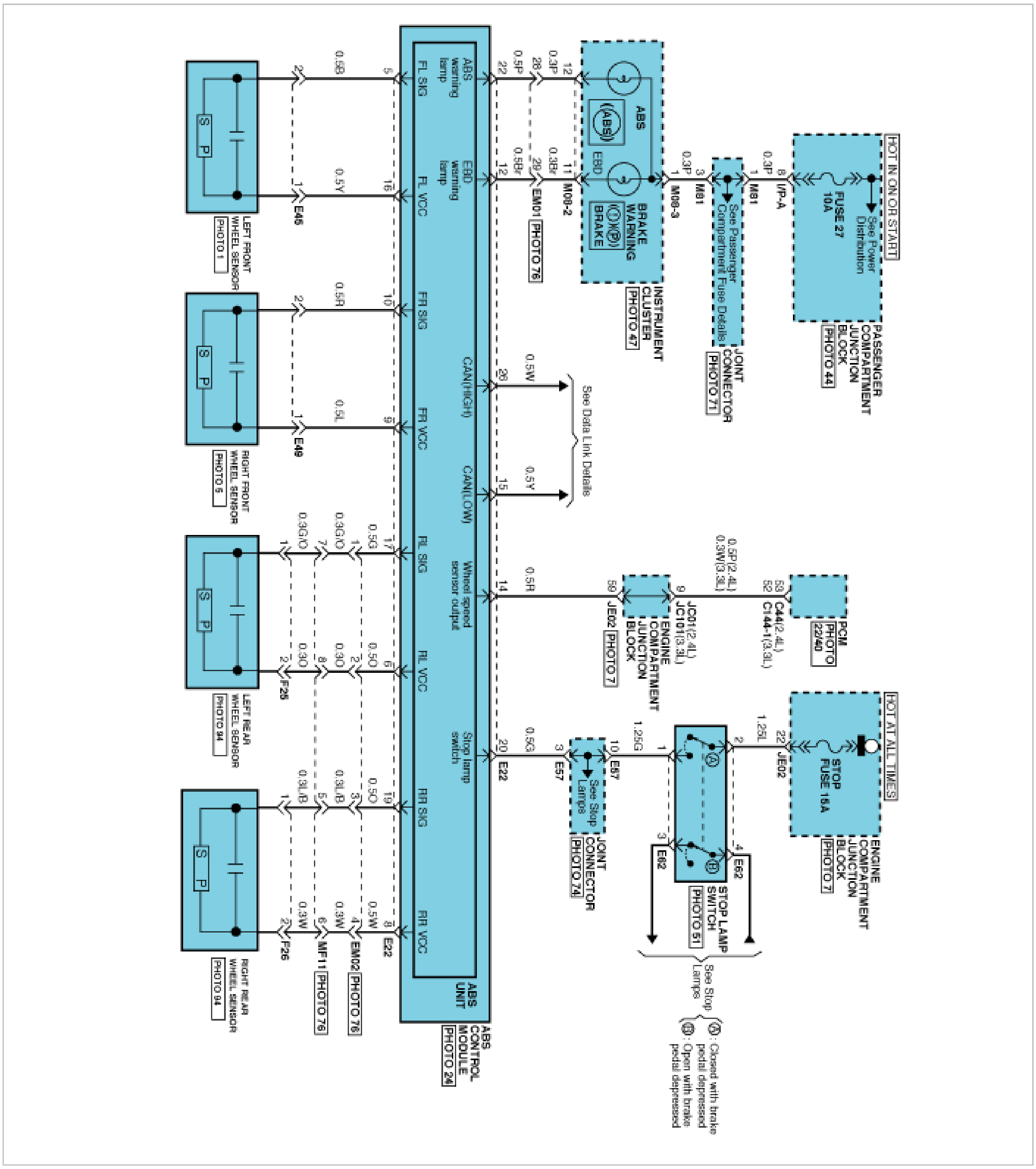
5. Release the parking brake lever completely, and check if parking brakes are not dragged when the rear wheels are turned.

Readjust if necessary.

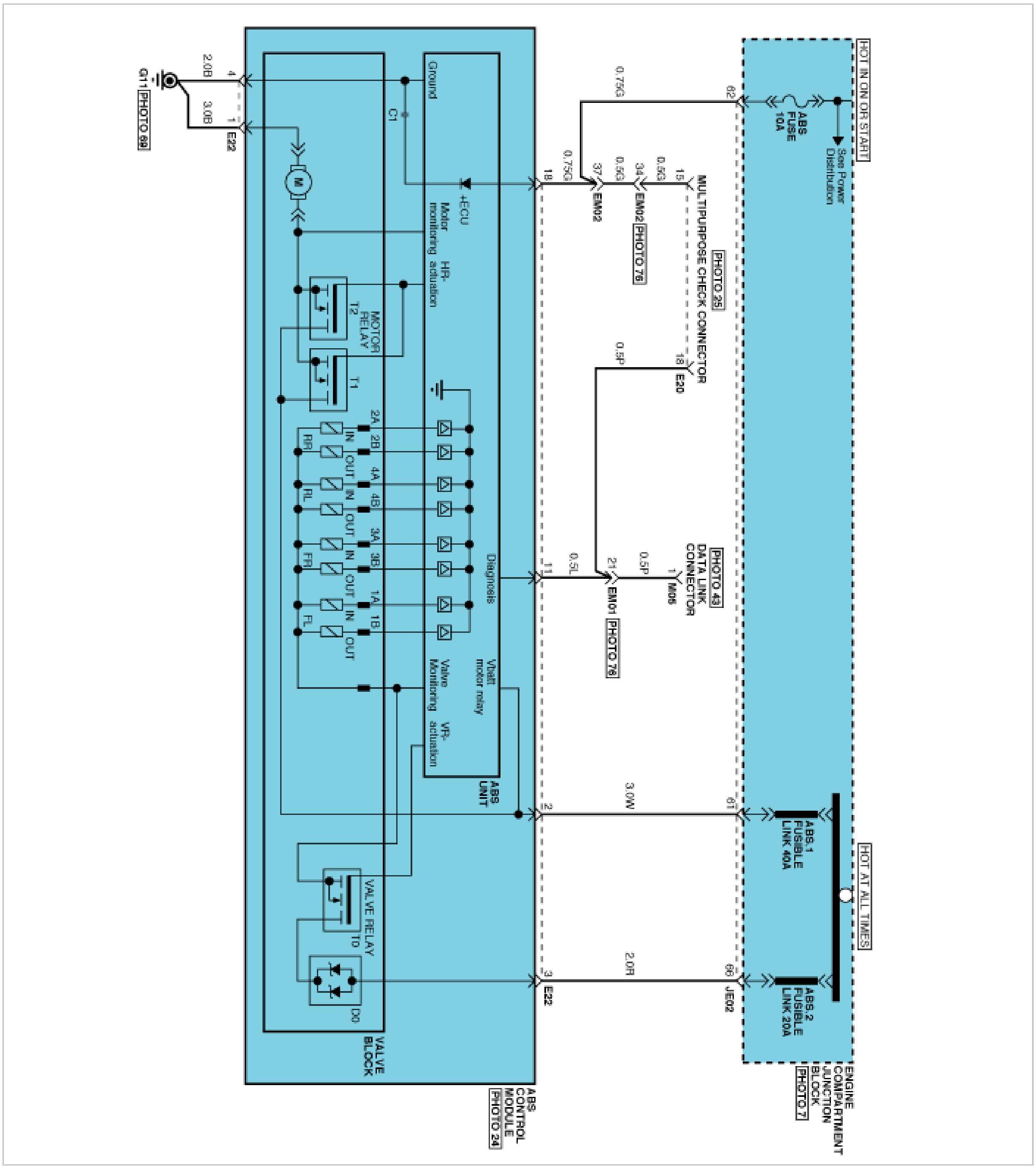
6. Make sure that the parking brakes are fully applied when the parking brake lever is pulled up completly.
7. Reinstall the floor console.

Brake System > ABS(Anti-Lock Brake System) > Schematic Diagrams

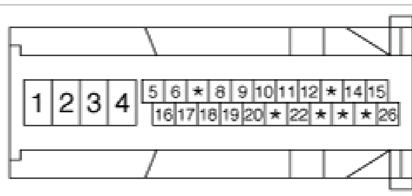
ABS CIRCUIT DIAGRAM(1)



ABS CIRCUIT DIAGRAM(2)



ECU CONNECTOR INPUT/OUTPUT(ABS)



Wire No.	Designation	Current		max.permissible wire resistance R_L (mΩ)	min.leakage resistance R_P (kΩ)
		max	min		
1	Ground for recirculation pump	20~39 A	10 A	10	
4	Ground for solenoid valves and ECU	5~15 A	2.5 A	10	
2	Voltage supply for pump motor	20~39 A	10 A	10	200

3	Voltage supply for solenoid valves	5~15 A	2 A	10	200
18	Voltage for hybrid ECU	1 A	500 mA	60	200
5,10,17,19	signal wheel speed sensor FL, FR, RL,RR	6 mA	16 mA	250	200 to ground 1.5M to bat
16,9,6,8	Voltage supply for the active wheel speed sensor FL,FR, RL, RR	6 mA	16 mA	250	200 to ground 1.5M to bat
14,24	wheel speed sensor output (FR, RL)	20 mA	10 mA	250	200
11	Diagnostic wire K	6 mA	3 mA	250	200
22	ABS-warning lamp actuation	30 mA	5 mA	250	200
12	EBD-warning lamp actuation	30 mA	5 mA	250	200
20	brake light switch	10 mA	5 mA	250	200
15	CAN Low	30 mA	20 mA	250	200
26	CAN High	30 mA	20 mA	250	200

ABS HECU CONNECTOR

Connector terminal		Specification	Condition
Number	Description		
1	Ground for recirculation pump	Current range: Min.10A Max.20~39A	Always
4	Ground for solenoid valves and ECU	Current range: Min.2.5A Max.5~15A	Always
2	Voltage supply for pump motor	Battery voltage	Always
3	Voltage supply for solenoid valves		
16	Voltage supply for the active wheel speed sensor FL,FR, RL, RR	Battery voltage	IG ON
9			
6			
8			
5	signal wheel speed sensor FL, FR, RL,RR	Voltage(High) : 0.89~1.26 V Voltage (Low) : 0.44~0.63 V	On driving
10			
17			
19			
11	Diagnostic wire K	Voltage (High) ≥ 0.8 * IG ON Voltage (Low) ≤ 0.2 * IG ON	On HI-SCAN communication
18	Voltage for hybrid ECU	Battery voltage	KEY ON/OFF
20	Brake light switch	Voltage (High) ≥ 0.8 * IG ON Voltage (Low) ≤ 0.3 * IG ON	BRAKE ON/OFF

SENSOR OUTPUT ON Hi-SCAN(ABS)

	Description	Abbreviation	Unit	Remarks
1	Vehicle speed sensor	VEH. SPD	Km/h	
2	Battery voltage	BATT. VOL	V	
3	FL Wheel speed sensor	FL WHEEL	Km/h	
4	FR Wheel speed sensor	FR WHEEL	Km/h	
5	RL Wheel speed sensor	RL WHEEL	Km/h	
6	RR Wheel speed sensor	RR WHEEL	Km/h	
7	ABS Warning lamp	ABS LAMP	-	
8	EBD Warning lamp	EBD LAMP	-	

9	Brake Lamp	B/LAMP	-	
10	Pump relay state	PUMP RLY	-	
11	Valve relay state	VALVE RLY	-	
12	Motor	MOTOR	-	
13	Front Left valve(IN)	FL INLET	-	
14	Front Right valve (IN)	FR INLET	-	
15	Rear Left valve (IN)	RL INLET	-	
16	Rear Right valve (IN)	RR INLET	-	
17	Front Left valve (OUT)	FL OUTLET	-	
18	Front Right valve (OUT)	FR OUTLET	-	
19	Rear Left valve(OUT)	RL OUTLET	-	
20	Rear Right valve (OUT)	RR OUTLET	-	

Brake System > ABS(Anti-Lock Brake System) > Description and Operation

DESCRIPTION

This specification applies to HCU(Hydraulic Control Unit) and ECU(Electronic Control Unit) of the HECU.(Hydraulic and Electronic Control Unit)
This specification is for the wiring design and installation of ABS/TCS/ESC ECU.
This unit has the functions as follows.

- Input of signal from Pressure sensor, Steering angle sensor, Yaw & Lateral G sensor, the wheel speed sensors attached to each wheel.
- Control of braking force / traction force/ yaw moment.
- Failsafe function.
- Self diagnosis function.
- Interface with the external diagnosis tester.

Installation position : engine compartment

- Brake tube length from Master cylinder port to HECU inlet port should be max. 1m
- The position should not be close to the engine block and not lower than the wheel.

OPERATION

The ECU shall be put into operation by switching on the operating voltage (IGN).
On completion of the initialization phase, the ECU shall be ready for operation.
In the operating condition, the ECU shall be ready, within the specified limits (voltage and temperature), to process the signals offered by the various sensors and switches in accordance with the control algorithm defined by the software and to control the hydraulic and electrical actuators.

Wheel Sensor signal processing

The ECU shall receive wheel speed signal from the four active wheel sensors.
The wheel signals are converted to voltage signal by the signal conditioning circuit after receiving current signal from active wheel sensors and given as input to the MCU.

Solenoid Valve Control

When one side of the valve coil is connected to the positive voltage that is provided through the valve relay and the other side is connected to the ground by the semiconductor circuit, the solenoid valve goes into operation.
The electrical function of the coils are always monitored by the valve test pulse under normal operation conditions.

Voltage limits

- Overvoltage
  When overvoltage is detected(above 16V), the ECU switches off the valve relay and shuts down the system.
  When voltage is returned to operating range, the system goes back to the normal condition after the initialization phase.
- Undervoltage
  In the event of undervoltage(below 10V), ABS control shall be inhibited and the warning lamp shall be turned on.
  When voltage is returned to operating range, the warning lamp is switched off and ECU returns to normal operating mode.

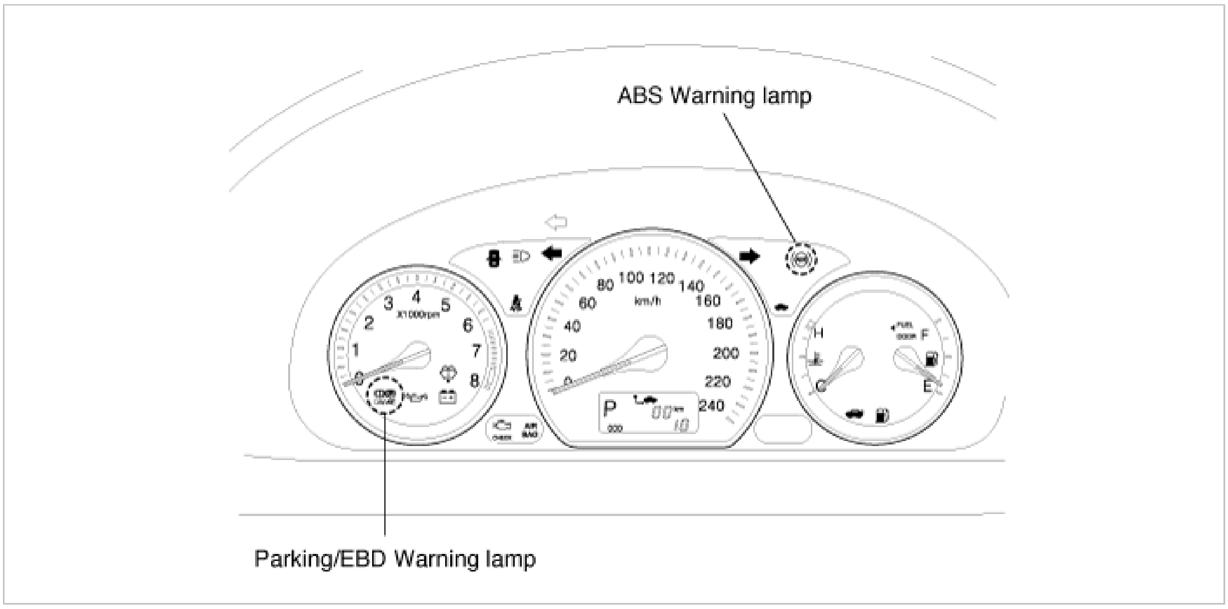
Pump Motor Checking

The ECU performs a pump motor test at a speed of 15km/h once after IGN is switched on.

Diagnostic Interface

Failures detected by the ECU are encoded on the ECU, stored in a EEPROM and read out by diagnostic equipment when the ignition switch is turned on.
The diagnosis interface can also be used for testing the ECU during production of the ECU and for actuating the HCU in the test line of manufactories (Air-bleeding line or Roll and Brake Test line).

Warning Lamp module

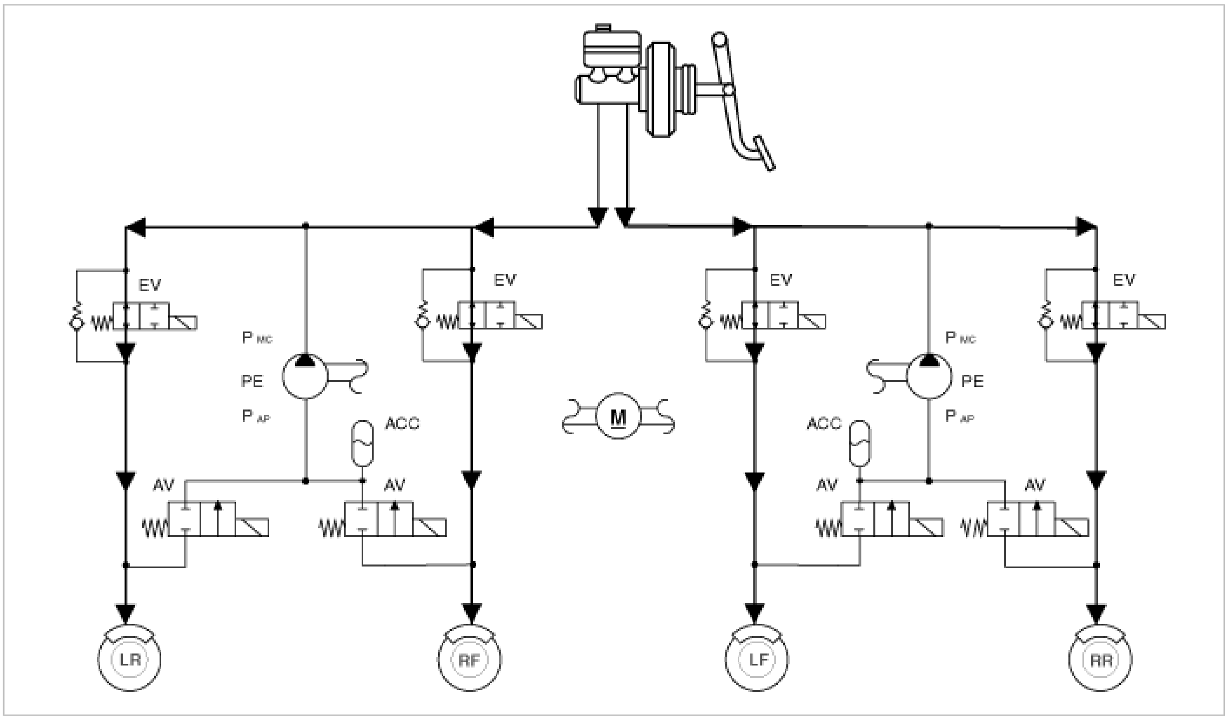


1. ABS WARNING LAMP MODULE
   The active ABS warning lamp module indicates the selftest and failure status of the ABS.The ABS warning lamp shall be on:
   A. During the initialization phase after IGN ON. (continuously 3 seconds).
   B. In the event of inhibition of ABS functions by failure.
   C. During diagnostic mode.
   D. When the ECU Connector is seperated from ECU.
2. PARKING/EBD WARNING LAMP MODULE
   The active EBD warning lamp module indicates the selftest and failure status of the EBD.However, in case the Parking Brake Switch is turned on, the EBD warning lamp is always turned on regardless of EBD functions.The EBD warning lamp shall be on:
   A. During the initialization phase after IGN ON. (continuously 3 seconds).
   B. When the Parking Brake Switch is ON or brake fluid level is low.
   C. When the EBD function is out of order.
   D. During diagnostic mode.
   E. When the ECU Connector is seperated from ECU.

ABS CONTROL

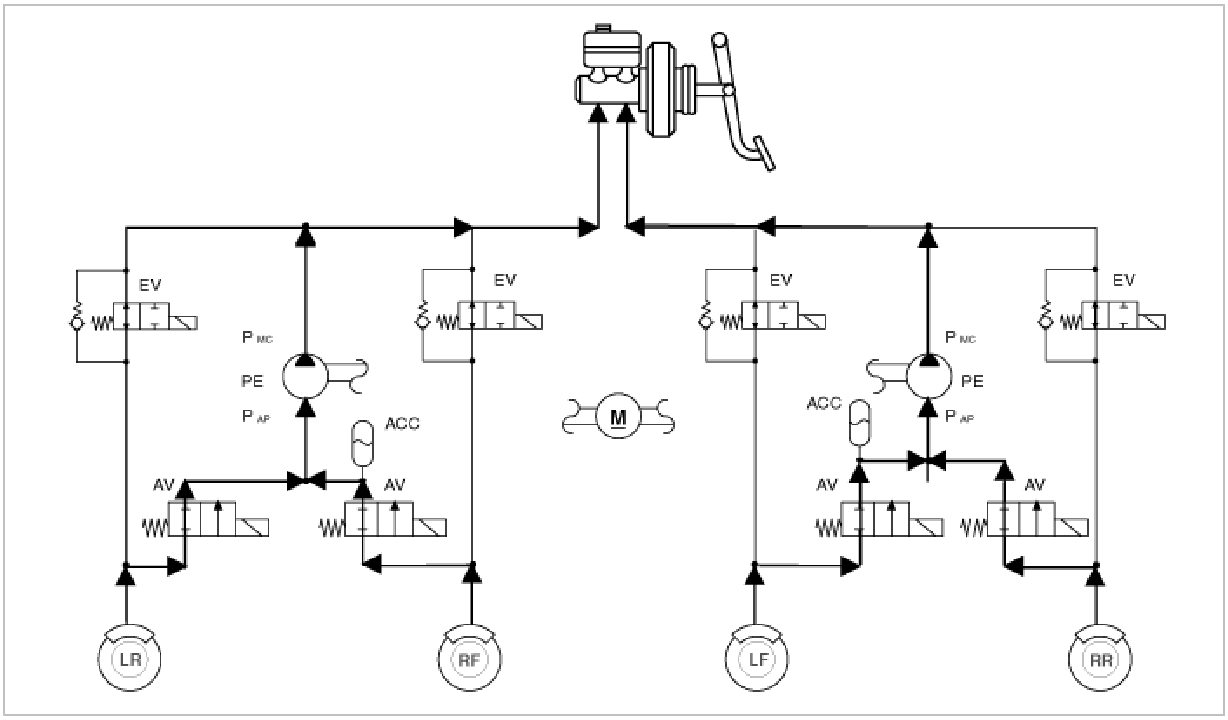
1. NORMAL BRAKING without ABS

	Inlet valve(EV)	Outlet valve(AV)	Pump motor
Operation	Open	Close	OFF



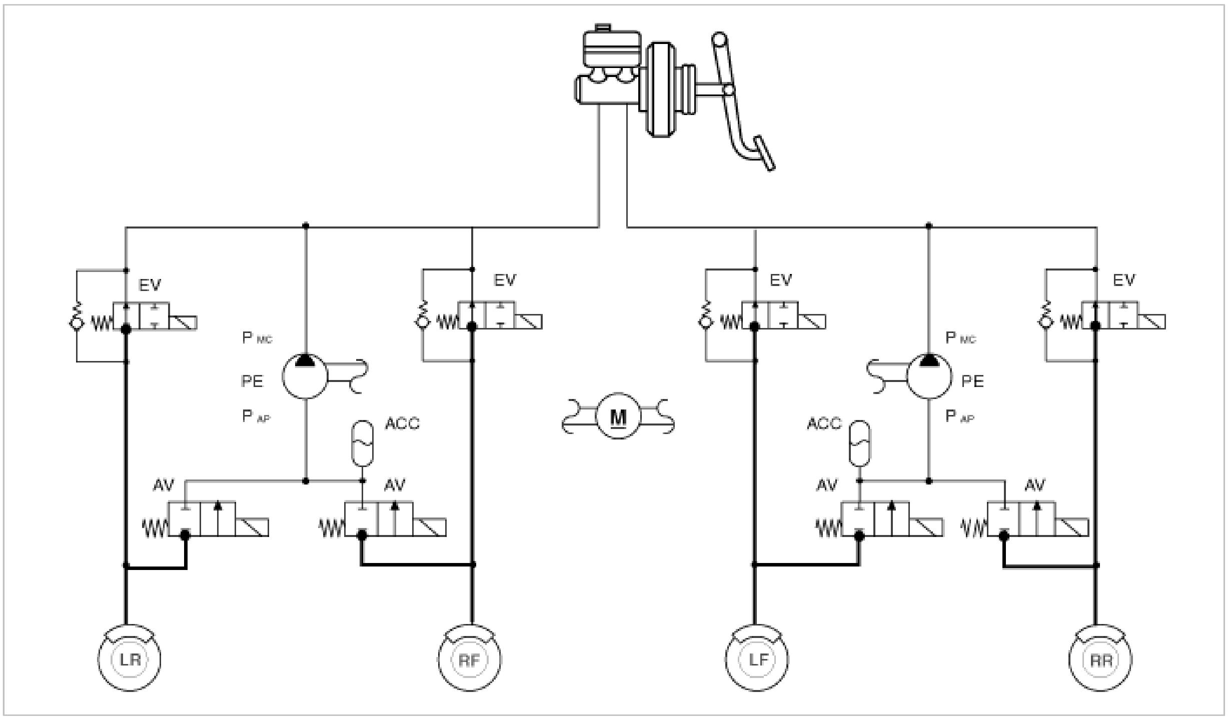
2. DECREASE MODE

	Inlet valve(EV)	Outlet valve(AV)	Pump motor
Operation	Close	Open	ON(Motor speed control)



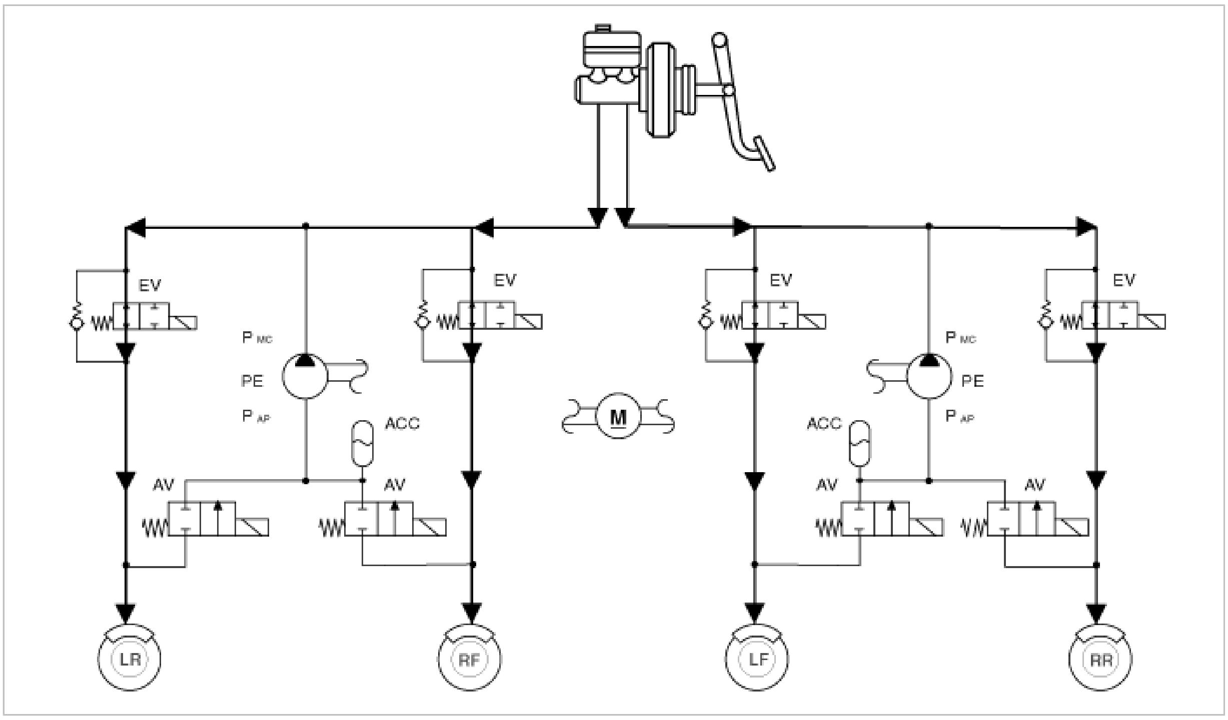
3. HOLD MODE

	Inlet valve(EV)	Outlet valve(AV)	Pump motor
Operation	Close	Close	OFF



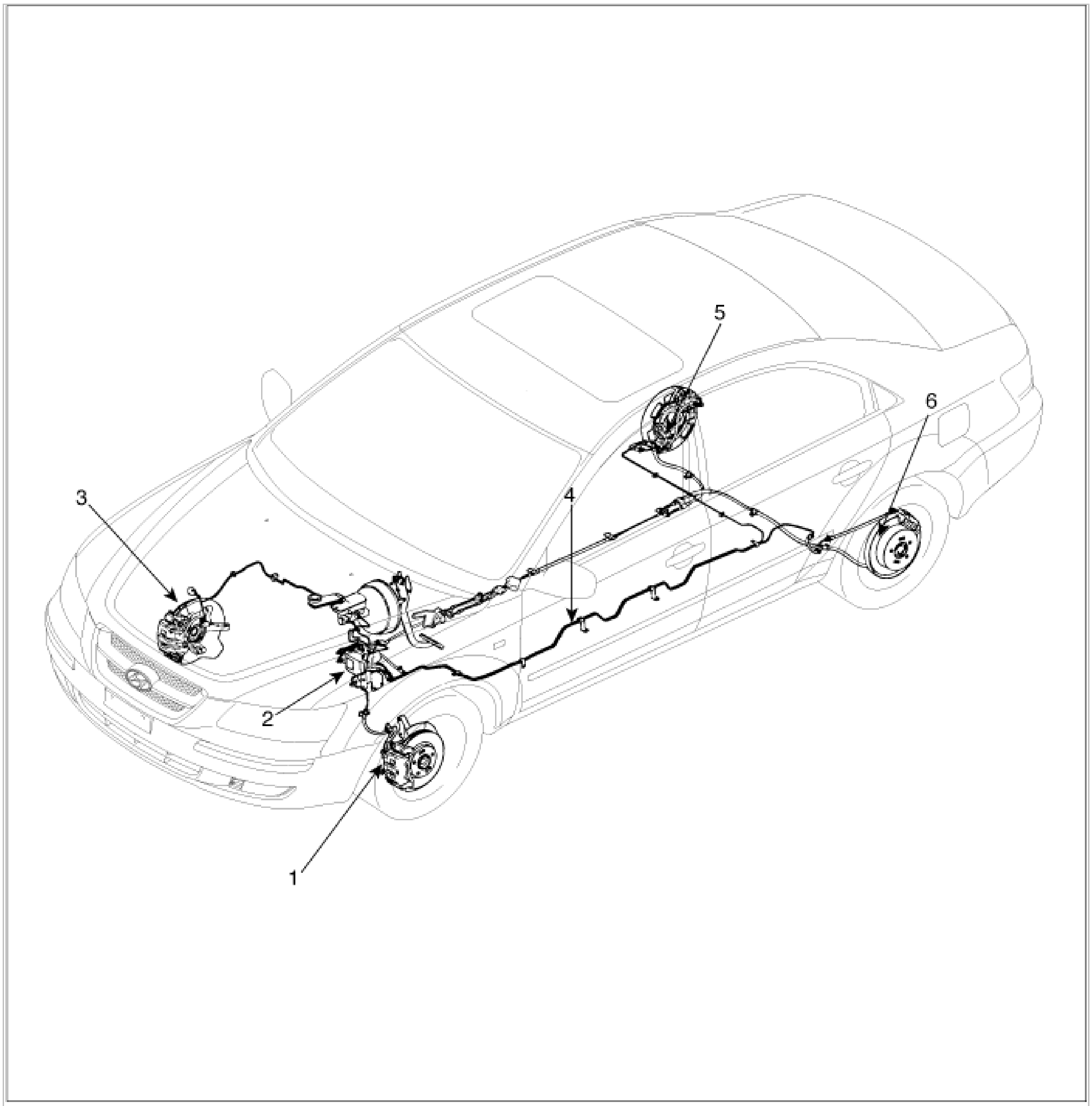
4. INCREASE MODE

	Inlet valve(EV)	Outlet valve(AV)	Pump motor
Operation	Open	Close	OFF



Brake System > ABS(Anti-Lock Brake System) > Components and Components Location

COMPONENTS

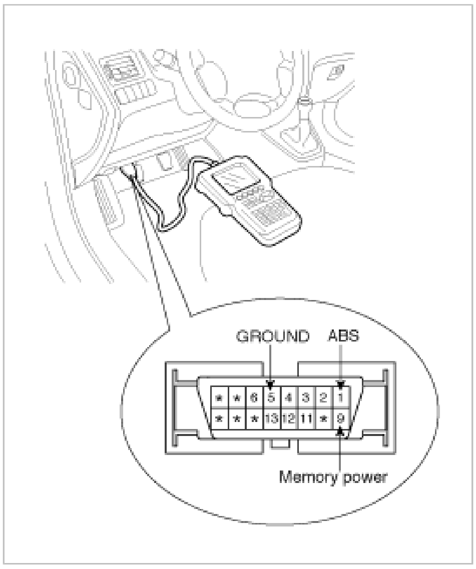


1. Front left wheel speed sensor
2. ABS control module(HECU)
3. Front right wheel speed sensor
4. Hydrauric line
5. Rear right wheel speed sensor
6. Rear left wheel speed sensor

Brake System > ABS(Anti-Lock Brake System) > Troubleshooting

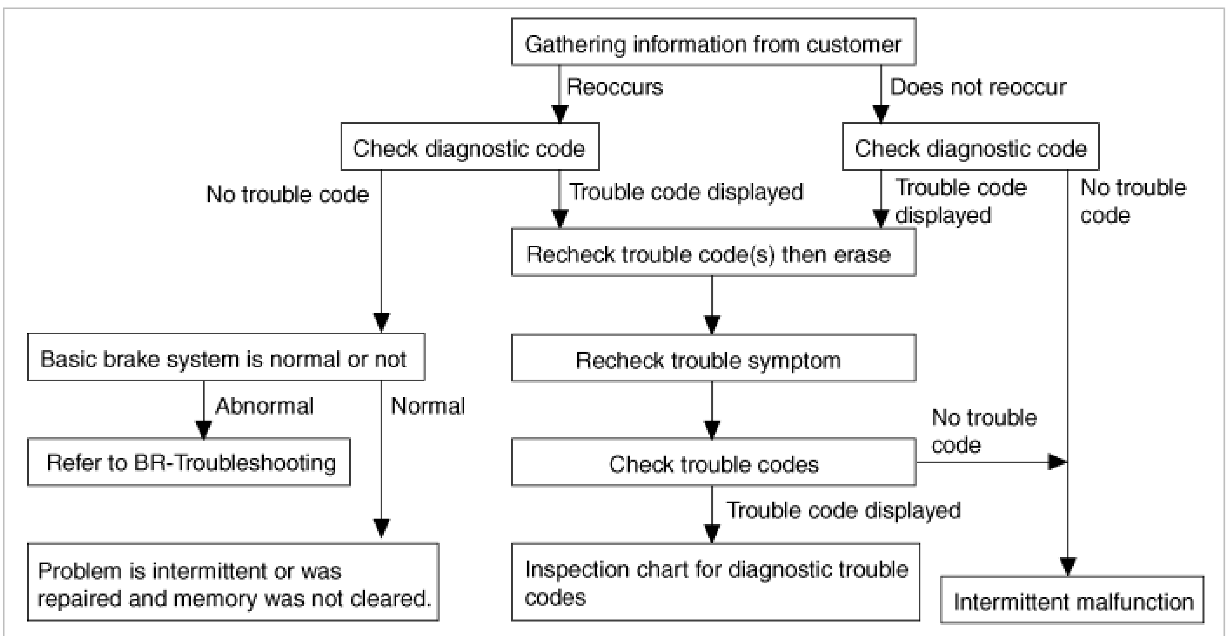
HI-SCAN (PRO) CHECK

1. Turn the ignition switch OFF.
2. Connector the Hi-scan(pro) to the 16P data link connector located the driver's side kick panel.



3. Turn the ignition switch ON.
4. Check for diagnostic trouble using the Hi-scan(pro)
5. After completion trouble of the repair or correction of the problem, erase the stored fault codes the clear key on the Hi-scan (pro).
6. Disconnect the Hi-scan(pro) from the 16P data link connector.

STANDARD FLOW OF DIAGNOSTIC TROUBLESHOOTING



*** Using the customer problem analysis check sheet for reference, ask the customer as much detail as possible about the problem.**

NOTES WITH REGARD TO DIAGNOSIS

The phenomena listed in the following table are not abnormal.

Phenomenon	Explanation
System check sound	When starting the engine, a thudding sound can sometimes be heard coming from inside the engine compartment. This is because the system operation check is being performed.
ABS operation sound	1. Sound of the motor inside the ABS hydraulic unit operation (whine). 2. Sound is generated along with vibration of the brake pedal (scraping). 3. When ABS operates, sound is generated from the vehicle chassis due to repeated brake application and release (Thump : suspension; squeak: tires)

ABS operation (Long braking distance)	For road surfaces such as snow-covered and gravel roads, the braking distance for vehicles with ABS can sometimes be longer than that for other vehicles. Accordingly, advise the customer to drive safely on such roads by lowering the vehicle speed.
Diagnosis detection conditions can vary depending on the diagnosis code. When checking the trouble symptom after the diagnosis code has been erased, ensure that the requirements listed in "Comment" are met.	

ABS CHECK SHEET

ABS Check Sheet

Inspector's Name ________

Customer's Name		**Registration No.**	
		Registration Year	/ /
		VIN.	
Date Vehicle Brought In	/ /	**Odometer**	Km Miles

Date the Problem First Occurred	/ /
Frequency of Occurence of Problem	☐ Continuous ☐ Intermittent (times a day)

Symptoms	☐ ABS does not operate.		
	☐ ABS does not operate efficiently.		☐ Intermittent (times a day)
	ABS Warning Light Abnormal	☐ Remains ON	☐ Does not light up

Diagnostic Trouble Code Check	**1st Time**	☐ Normal Code	☐ Malfunction Code (Code)
	2nd Time	☐ Normal Code	☐ Malfunction Code (Code)

PROBLEM SYMPTOMS TABLE

Symptom	Suspect Area	See page
ABS does not operate.	Only when 1. -4. are all normal and the problem is still occurring, replace the HECU. 1. Check the DTC reconfirming that the normal code is output. 2. Power source circuit. 3. Speed sensor circuit. 4. Check the hydraulic circuit for leakage.	BR - 75
ABS does not operate intermittently.	Only when 1. -4. are all normal and the problem is still occurring, replace the ABS actuator assembly. 1. Check the DTC reconfirming that the normal code is output. 2. Wheel speed sensor circuit. 3. Stop lamp switch circuit.	BR - 77

	4. Check the hydraulic circuit for leakage.	
Communication with Hi-scan (pro) is not possible. (Communication with any system is not possible)	1. Power source circuit 2. Diagnosis line	BR - 79
Communication with Hi-scan (pro) is not possible. (Communication with ABS only is not possible)	1. Power source circuit 2. Diagnosis line 3. HECU	BR - 80
When ignition key is turned ON (engine OFF), the ABS warning lamp does not light up.	1. ABS warning lamp circuit 2. HECU	BR - 81
Even after the engine is started, the ABS warning lamp remains ON.	1. ABS warning lamp circuit 2. HECU	BR - 82

CAUTION

During ABS operation, the brake pedal may vibrate or may not be able to be depressed. Such phenomena are due to intermittent changes in hydraulic pressure inside the brake line to prevent the wheels from locking and is not an abnormality.

ABS Does Not Operate

DETECTING CONDITION

Trouble Symptoms	Possible Cause
Brake operation varies depending on driving conditions and road surface conditions, so diagnosis can be difficult.However if a normal DTC is displayed, check the following probable cause. When the problem is still occurring, replace the ABS control module.	- Faulty power source circuit - Faulty wheel speed sensor circuit - Faulty hydraulic circuit for leakage - Faulty HECU

INSPECTION PROCEDURES

DTC INSPECTION

1. Connect the Hi-Scan (pro) with the data link connector and turn the ignition switch ON.
2. Verify that the normal code is output.
   Is the normal code output?

   NO

   ▸ Check the power source circuit.

   YES

   ▸ Erase the DTC and recheck using Hi-Scan (pro).

CHECK THE POWER SOURCE CIRCUIT.

1. Disconnect the connector from the ABS control module.
2. Turn the ignition switch ON, measure the voltage between terminal 18 of the ABS control module harness side connector and body ground.

   Specification: approximately B+

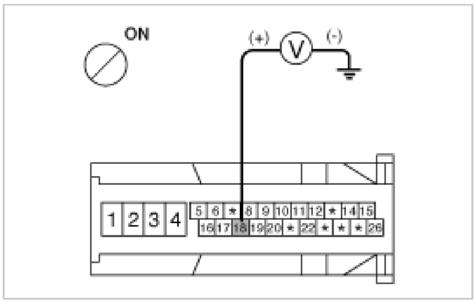
   Is the voltage within specification?

   YES

   ▸ Check the ground circuit.

   NO

   ▸ Check the harness or connector between the fuse (10A) in the engine compartment junction block and the ABS control module. Repair if necessary.



CHECK THE GROUND CIRCUIT.

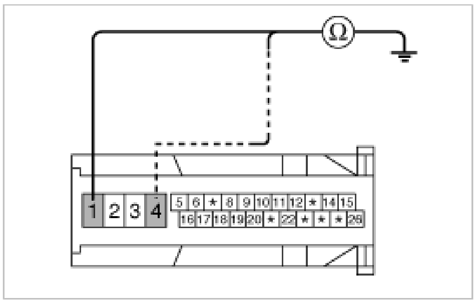
1. Disconnect the connector from the ABS control module.
2. Check for continuity between terminals 1,4 of the ABS control module harness side connector and ground point.
   Is there continuity?

YES

▸ Check the wheel speed sensor circuit.

NO

▸ Repair an open in the wire and ground point.



CHECK THE WHEEL SPEED SENSOR CIRCUIT.

Refer to the DTC troubleshooting procedures.
Is it normal?

YES

▸ Check the hydraulic circuit for leakage.

NO

▸ Repair or replace the wheel speed sensor.

CHECK THE HYDRAULIC CIRCUIT FOR LEAKAGE.

Refer to the hydraulic lines.
Inspect leakage of the hydraulic lines.
Is it normal?

YES

▸ The problem is still occurring, replace the ABS control module.

NO

▸ Repair the hydraulic lines for leakage.

ABS Does Not Operate Intermittently.

DETECTING CONDITION

Trouble Symptoms	Possible Cause
Brake operation varies depending on driving conditions and road surface conditions, so diagnosis can be difficult.However if a normal DTC is displayed, check the following probable cause. When the problem is still occurring, replace the ABS control module.	- Faulty power source circuit - Faulty wheel speed sensor circuit - Faulty hydraulic circuit for leakage - Faulty HECU

INSPECTION PROCEDURES

DTC INSPECTION

1. Connect the Hi-Scan (pro) with the data link connector and turn the ignition switch ON.
2. Verify that the normal code is output.

Is the normal code output?

NO

▸ Check the wheel speed sensor circuit.

YES

▸ Erase the DTC and recheck using Hi-Scan (pro).

CHECK THE WHEEL SPEED SENSOR CIRCUIT.

Refer to the DTC troubleshooting procedures.
Is it normal?

YES

▸ Check the stop lamp switch circuit.

NO

▸ Repair or replace the wheel speed sensor.

CHECK THE STOP LAMP SWITCH CIRCUIT.

1. Check that stop lamp lights up when brake pedal is depressed and turns off when brake pedal is released.
2. Measure the voltage between terminal 20 of the ABS control module harness side connector and body ground when brake pedal is depressed.

Specification: approximately B+

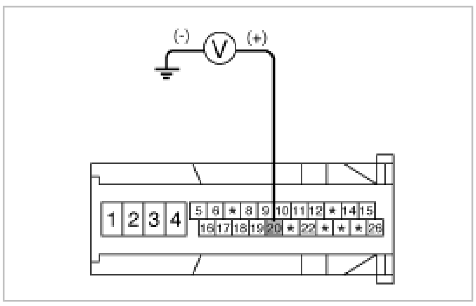
Is the voltage within specification?

YES

▸ Check the hydraulic circuit for leakage.

NO

▸ Repair the stop lamp switch. Repair an open in the wire between the ABS control module and the stop lamp switch.



CHECK THE HYDRAULIC CIRCUIT FOR LEAKAGE.

Refer to the hydraulic lines.
Inspect leakage of the hydraulic lines.
Is it normal?

YES

▸ The problem is still occurring, replace the ABS control module.

NO

▸ Repair the hydraulic lines for leakage.

Communication With Hi-Scan (pro) Is Not Possible. (Communication With Any System Is Not Possible)

DETECTING CONDITION

Trouble Symptoms	Possible Cause
Possible defect in the power supply system (including ground) for the diagnosis line.	- An open in the wire - Poor ground - Faulty power source circuit

INSPECTION PROCEDURES

CHECK THE POWER SUPPLY CIRCUIT FOR THE DIAGNOSIS

Measure the voltage between terminal 9 of the data link connector and body ground.

Specification: approximately B+

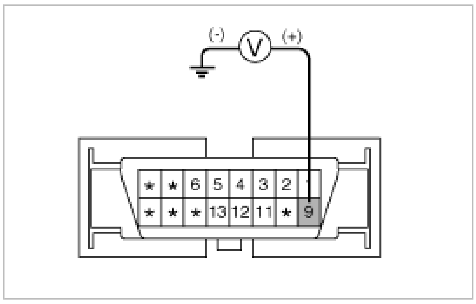
Is voltage within specification?

YES

▸ Check the ground circuit for the diagnosis.

NO

▸ Repair an open in the wire. Check and replace fuse (15A) from the engine compartment junction block.

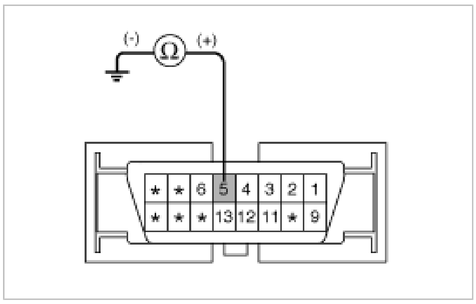


CHECK THE GROUND CIRCUIT FOR THE DIAGNOSIS

Check for continuity between terminal 5 of the data link connector and body ground.
Is there continuity?

NO

▸ Repair an open in the wire between terminal 5 of the data link connector and ground point.



Communication With Hi-Scan (pro) Is Not Possible. (Communication With ABS Only Is Not Possible)

DETECTING CONDITION

Trouble Symptoms	Possible Cause
When communication with Hi-Scan (pro) is not possible, the cause may be probably an open in the HECU power circuit or an open in the diagnosis output circuit.	- An open in the wire - Faulty HECU - Faulty power source circuit

INSPECTION PROCEDURES

CHECK FOR CONTINUITY IN THE DIAGNOSIS LINE

1. Disconnect the connector from the ABS control module.
2. Check for continuity between terminals 11 of the ABS control module connector and 1 of the data link connector.
   Is there continuity?

   YES

   ▸ Check the power source of ABS control module.

   NO

   ▸ Repair an open in the wire.

CHECK THE POWER SOURCE OF ABS CONTROL MODULE

1. Disconnect the connector from the ABS control module.
2. Turn the ignition switch ON, measure the voltage between terminal 18 of the ABS control module harness side connector and body ground.

   Specification: approximately B+

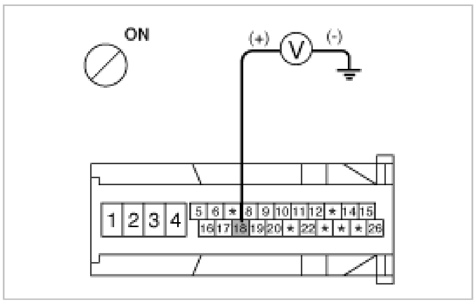
   Is voltage within specification?

YES

▸ Check for poor ground.

NO

▸ Check the harness or connector between the fuse (10A) in the engine compartment junction block and the ABS control module.Repair if necessary.



CHECK FOR POOR GROUND

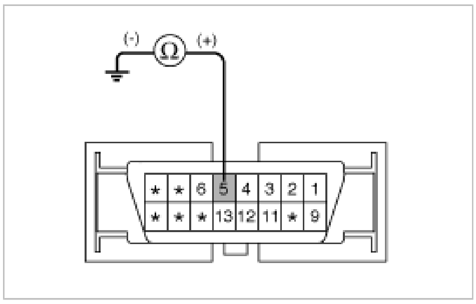
Check for continuity between terminal 5 of the data link connector and ground point.

YES

▸ Replace the ABS control module and recheck.

NO

▸ Repair an open in the wire or poor ground.



When Ignition Key Is Turned ON (Engine OFF), The ABS Warning Lamp Does Not Light Up.

DETECTING CONDITION

Trouble Symptoms	Possible Cause
When current flows in the HECU the ABS warning lamp turns from ON to OFF as the initial check.Therefore if the lamp does not light up, the cause may be an open in the lamp power supply circuit, a blown bulb, an open in the both circuits between the ABS warning lamp and the HECU, and the faulty HECU.	- Faulty ABS warning lamp bulb - Blown No.2 fuse (10A) in the engine compartment junction block - Faulty ABS warning lamp module - Faulty HECU

INSPECTION PROCEDURES

PROBLEM VERIFICATION

Disconnect the connector from the ABS control module and turn the ignition switch ON.
Does the ABS warning lamp light up?

YES

▸ It is normal. Recheck the ABS control module.

NO

▸ Check the power source for the ABS warning lamp.

CHECK THE POWER SOURCE FOR THE ABS WARNING LAMP

1. Disconnect the instrument cluster connector and turn the ignition switch ON.
2. Measure the voltage between terminal 5 of the cluster harness side connector and body ground.

Specification: approximately B+

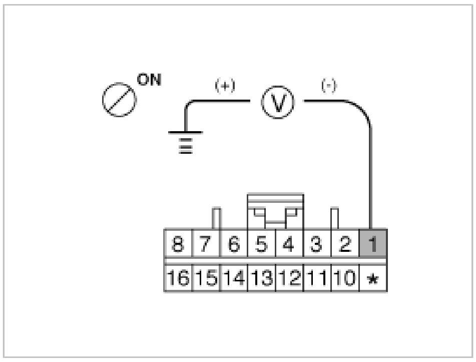
Is voltage within specification?

YES

▸ Repair bulb or instrument cluster assembly.

NO

▸ Check for blown fuse.



CHECK FOR BLOWN FUSE

Check continuity of fuse (10A) from the engine compartment junction block.
Is there continuity?

YES

▸ Repair an open in the wire between ABS fuse and 1 of cluster connector.

NO

▸ Replace the blown fuse.

Even After The Engine Is Started, The ABS Warning Lamp Remains ON.

DETECTING CONDITION

Trouble Symptoms	Possible Cause
If the HECU detects trouble, it lights the ABS warning lamp while at the same time prohibiting ABS control. At this time, the HECU records a DTC in memory.Even though the normal code is output, the ABS warning lamp remains ON, then the cause may be probably an open or short in the ABS warning lamp circuit.	- An open in the wire - Faulty instrument cluster assembly - Faulty ABS warning lamp module - Faulty HECU

INSPECTION PROCEDURES

CHECK DTC OUTPUT.

1. Connect the Hi-Scan (pro) to the 16P data link connector located behind the driver's side kick panel.
2. Check the DTC output using Hi-Scan (pro).
   Is DTC output?

   YES

   ▸ Repair circuit indicated by code output.

   NO

   ▸ Check instrument cluster.

CHECK INSTRUMENT CLUSTER

Disconnect the cluster connector and turn the ignition switch ON.
Does the ABS warning lamp remains ON?

YES

▸ Replace the instrument cluster.

NO

▸ Check for open the wire.

CHECK FOR OPEN IN THE WIRE

Check for continuity in the wire between cluster and ABS control module.
Is there continuity?

YES

▸ Replace the ABS control module and recheck.

NO

▸ Repair an open in the wire between cluster and ABS control module.

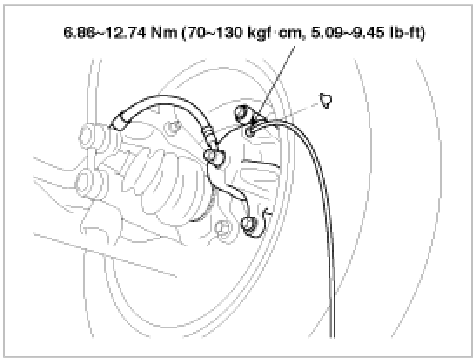
BLEEDING OF BRAKE SYSTEM

1. Remove the reservoir cap and fill the brake reservoir with brake fluid.

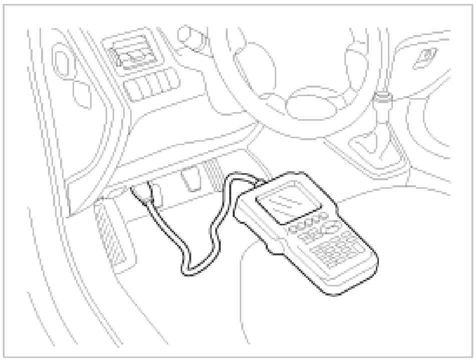
> **CAUTION**
>
> If there is any brake fluid on any painted surface, wash it off immediately.

> **NOTE**
>
> When pressure bleeding, do not depress the brake pedal.
> Recommended fluid........ DOT3 or DOT4

2. Connect a clear plastic tube to the wheel cylinder bleeder plug and insert the other end of the tube into a half filled clear plastic bottle.



3. Connect the hi-scan (pro) to the data link connector located underneath the dash panel.



4. Select and operate according to the instructions on the hi-scan (Pro) screen.

> **CAUTION**
>
> You must obey the maximum operating time of the ABS motor with the hi-scan (Pro) to prevent the motor pump from burning.

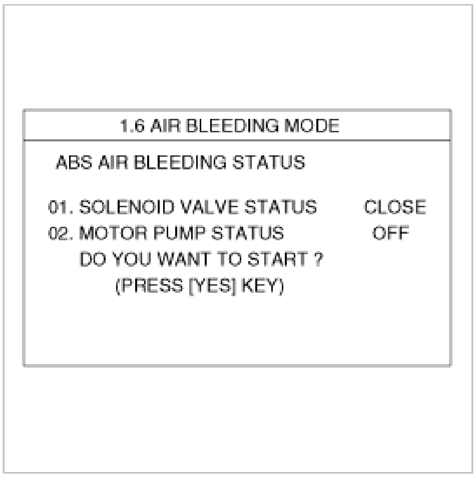
(1) Select hyundai vehicle diagnosis.

(2) Select vehicle name.

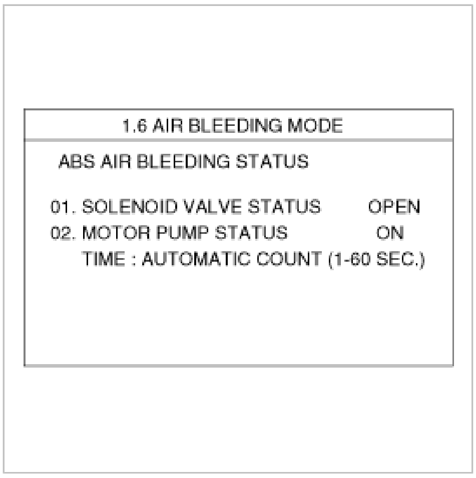
(3) Select Anti-Lock Brake system.

(4) Select air bleeding mode.

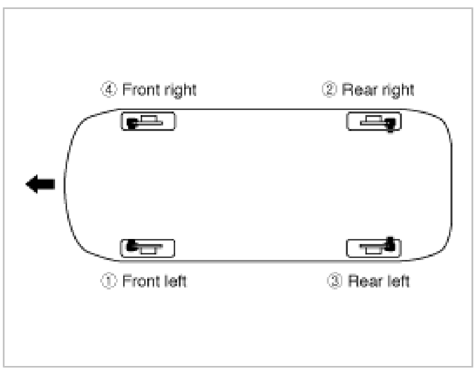
(5) Press "YES" to operate motor pump and solenoid valve.



(6) Wait 60 sec. before operating the air bleeding. (If not, you may damage the motor.)



5. Pump the brake pedal several times, and then loosen the bleeder screw until fluid starts to run out without bubbles. Then close the bleeder screw.
6. Repeat step 5 until there are no more bubbles in the fluid for each wheel.



7. Tighten the bleeder screw.

Bleed screw tightening torque:
6.86~12.74 Nm (70 ~130 kgf·cm, 5.09 ~ 9.45 lb-ft)

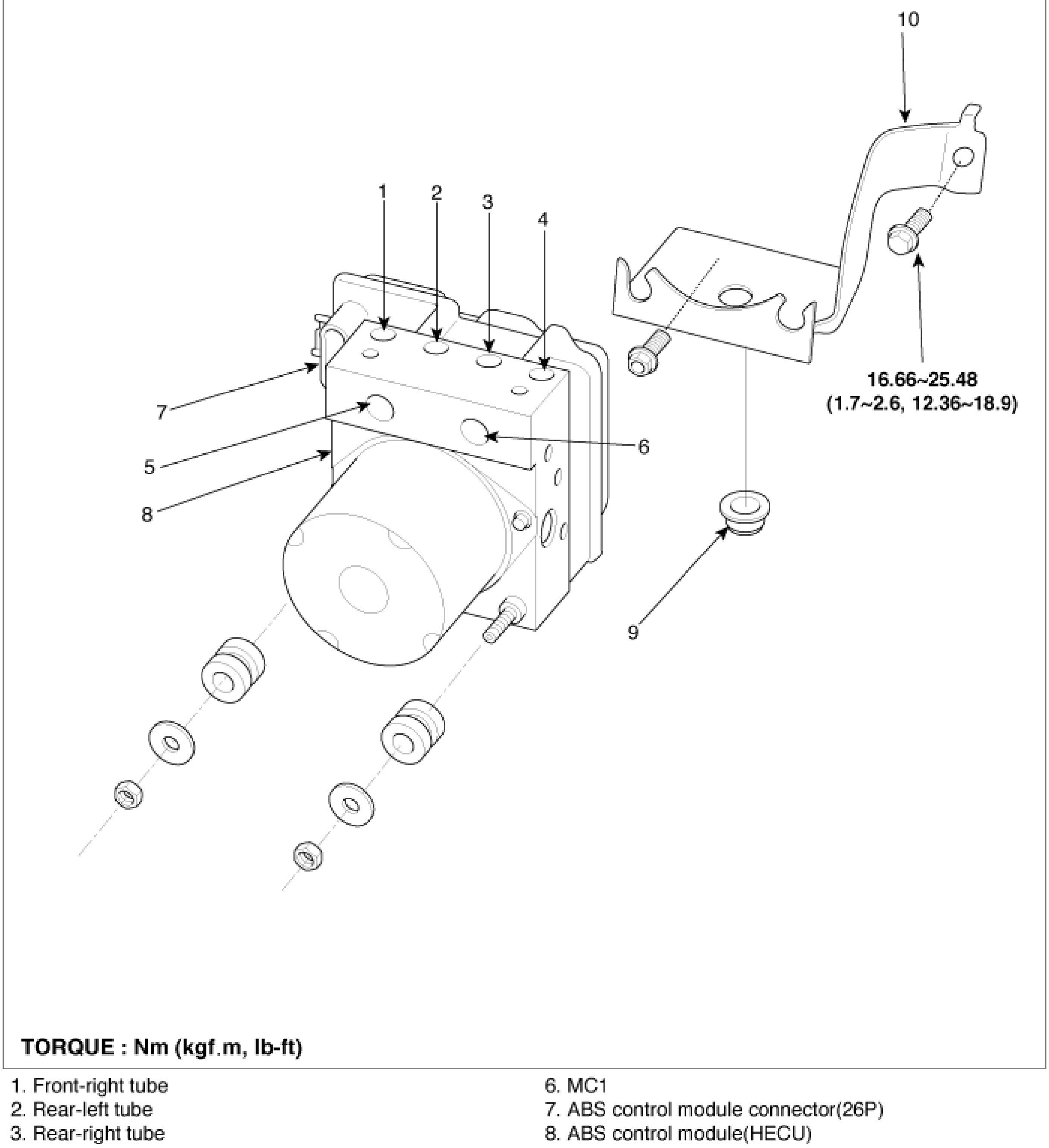
DIAGNOSTIC TROUBLE CODE CHART(DTC)

DTC	DESCRIPTION	WARNING LAMP			REMARK	SEE PAGE
		ABS	EBD	ESC		
C1101	BATTERY VOLTAGE HIGH	O	O	O		
C1102	BATTERY VOLTAGE LOW	O		O		
C1200	FL WHEEL SPEED SENSOR- OPEN/SHORT	O		O		

C1201	FL WHEEL SENSOR- RANGE/ PERFORMANCE	O		O		
C1202	FL WHEEL WHEEL SPEED SENSOR-NO SIGNAL	O		O		
C1203	FR WHEEL SENSOR- OPEN/SHORT	O		O		
C1204	FR WHEEL SENSOR- RANGE/ PERFORMANCE	O		O		
C1205	FR WHEEL SPEED SENSOR-NO SIGNAL	O		O		
C1206	RL WHEEL SENSOR- OPEN/SHORT	O		O		
C1207	RL WHEEL SENSOR- RANGE/ PERFORMANCE	O		O		
C1208	RL WHEEL SPEED SENSOR-NO SIGNAL	O		O		
C1209	RR WHEEL SENSOR- OPEN/SHORT	O		O		
C1210	RR WHEEL SENSOR- RANGE/ PERFORMANCE	O		O		
C1211	RR WHEEL SPEED SENSOR-NO SIGNAL	O		O		
C1213	WHEEL SPEED FREQUENCY ERROR	O		O		
C1235	PRESSURE SENSOR-ELECTRICAL			O	ESC	
C1237	PRESSURE SENSOR-SIGNAL FAULT			O	ESC	
C1260	STEERING ANGLE SENSOR-SIGNAL			O	ESC	
C1261	STEERING ANGLE SENSOR IS NOT CALIBRATED			O	ESC	
C1282	YAW RATE & LATERAL G SENSOR-ELECTRICAL			O	ESC	
C1283	YAW RATE & LATERAL G SENSOR-SIGNAL			O	ESC	
C1503	ESC SWIRCH ERROR			O	ESC	
C1513	BRAKE LIGHT SWITCH MAL.			O		
C1604	ECU HARDWARE ERROR	O	O	O		
C1605	CAN CONTROL HARDWARE ERROR			O	ESC	
C1611	CAN TIME OUT-ECM			O	ESC	
C1612	CAN TIME OUT-TCU			O	ESC	
C1616	CAN BUS OFF			O	ESC	
C1623	CAN TIMEOUT STEERING ANGLE SENSOR			O	ESC	
C1625	CAN TIME OUT-ESC			O	ESC	
C1626	IMPLAUSIBLE CONTROL	O		O	ESC	
C1702	VARIANT CODING	O	O	O	ESC	
C2112	VALVE RELAY MAL.	O	O	O		
C2308	FL INLET VALVE MAL.	O	O	O		
C2312	FL OUTLET VALVE MAL.	O	O	O		
C2316	FR INLET VALVE MAL.	O	O	O		
C2320	FR OUTLET VALVE MAL.	O	O	O		
C2324	RL INLET VALVE MAL.	O	O	O		
C2328	RL OUTLET VALVE MAL.	O	O	O		
C2332	RR INLET VALVE MAL.	O	O	O		
C2336	RR OUTLET VALVE MAL.	O	O	O		
C2366	TC VALVE PRIMARY(USV1) ERROR	O	O	O	ESC	
C2370	TC VALVE SECONDARY (USV2) ERROR	O	O	O	ESC	
C2372	ESC VALVE 1(HSV1) ERROR	O	O	O	ESC	
C2374	ESC VALVE 2 (HSV2) ERROR	O	O	O	ESC	
C2402	MOTOR-ELECTRICAL	O	O	O		

Brake System > ABS(Anti-Lock Brake System) > ABS Control Module > Components and Components Location

COMPONENTS



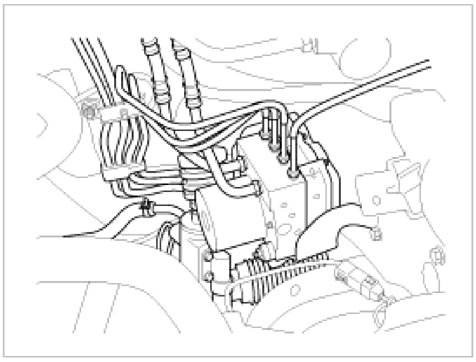
TORQUE : Nm (kgf.m, lb-ft)

1. Front-right tube
2. Rear-left tube
3. Rear-right tube
4. Front-left tube
5. MC2
6. MC1
7. ABS control module connector(26P)
8. ABS control module(HECU)
9. Damper
10. Bracket

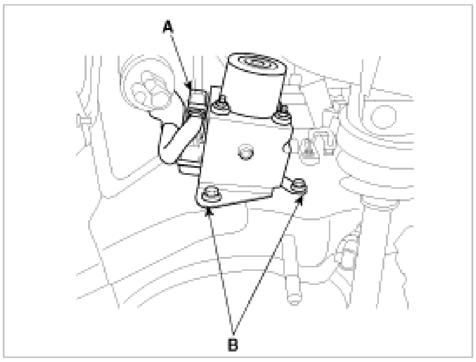
Brake System > ABS(Anti-Lock Brake System) > ABS Control Module > Repair procedures

REMOVAL

1. Disconnect the brake tube from the HECU by unlocking the nuts counterclockwise with a spanner.



2. Lift up the vehicle.
3. Disconnect the connector(A) from the HECU.



4. Remove the two HECU brake mounting bolts(B) , and then disassemble the HECU with the bracket.

> CAUTION
>
> 1. Never attempt to disassemble the HECU.
> 2. The HECU must be transported and stored in
> 3. Never shock to the HECU.

5. Remove the two HECU mounting nuts and washer, and then remove the bracket.

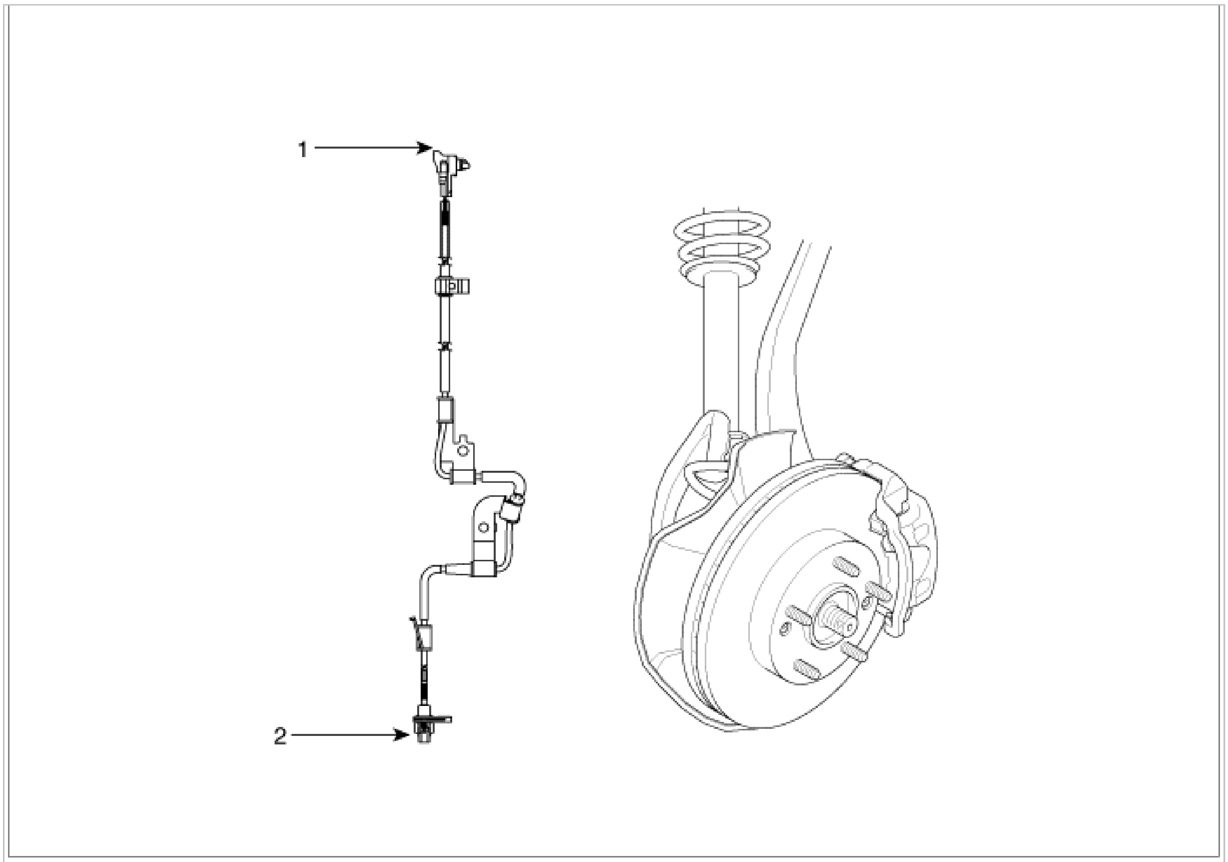
INSTALLATION

1. Installation is the reverse of removal.
2. Tighten the HECU mounting bolts and brake tube nuts to the specified torque.

Tighterning torque
HECU mounting nut :
5.88~9.8 Nm (0.6~1 kgf·m, 4.36~7.27 lb-ft)
HECU bracket mounting bolt:
16.66~25.48 Nm (1.7~2.6 kgf·m, 12.36~18.9 lb-ft)

Brake System > ABS(Anti-Lock Brake System) > Front Wheel Speed Sensor > Components and Components Location

COMPONENTS

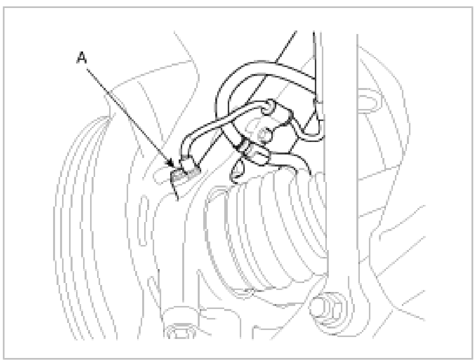


1. Front wheel speed sensor connector
2. Front wheel speed sensor

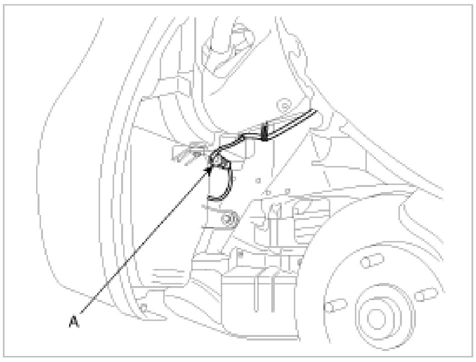
Brake System > ABS(Anti-Lock Brake System) > Front Wheel Speed Sensor > Repair procedures

REMOVAL

1. Remove the front wheel speed sensor mounting bolt(A).



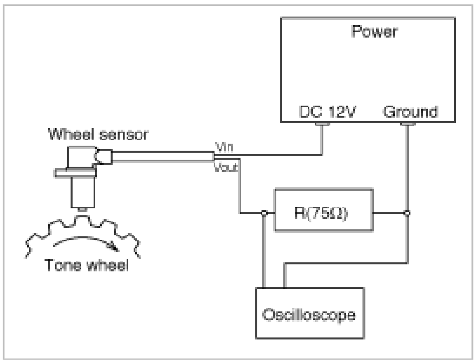
2. Remove the front wheel guard.
3. Remove the front wheel speed sensor after disconnecting the wheel speed sensor connector(A).



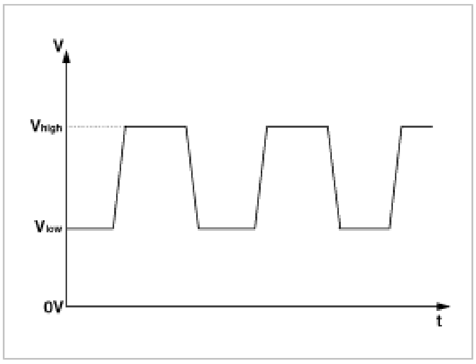
INSPECTION

1. Measure the output voltage between the terminal of the wheel speed sensor and the body ground.

> CAUTION
>
> In order to protect the wheel speed sensor, when measuring output voltage, a 75Ω resistor must be used as shown.



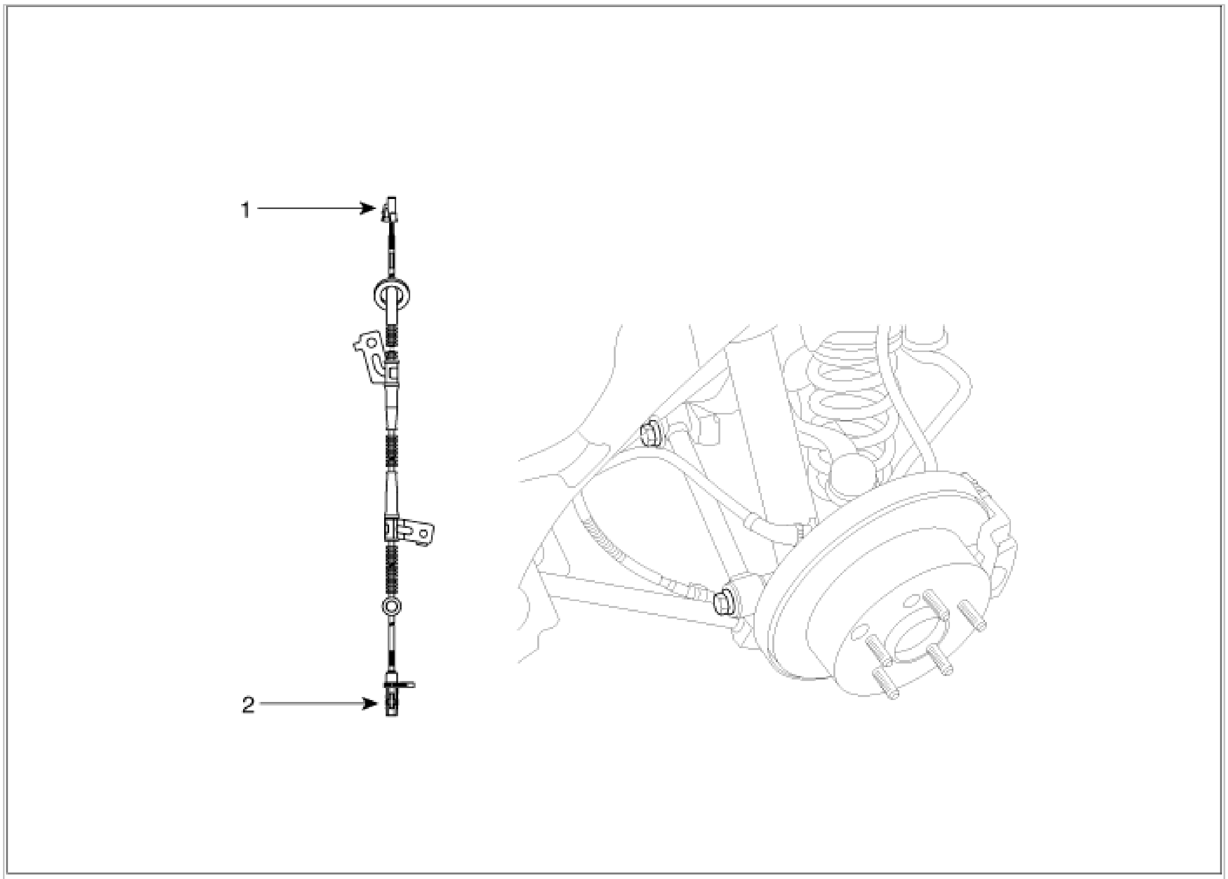
2. Compare the change of the output voltage of the wheel speed sensor to the normal change of the output voltage as shown below.



A. V_low : 0.44 V ~ 0.63 V
B. V_high : 0.885 V ~ 1.26 V
C. Frequency range : 1~2,500 Hz

Brake System > ABS(Anti-Lock Brake System) > Rear Wheel Speed Sensor > Components and Components Location

COMPONENTS

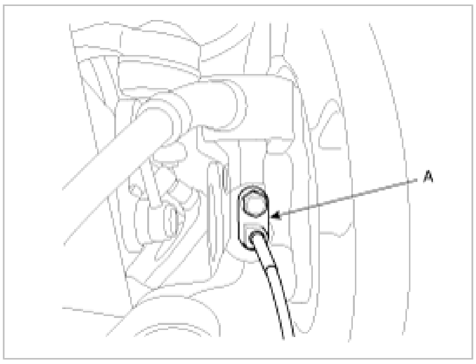


1. Rear wheel speed sensor connector
2. Rear wheel speed sensor

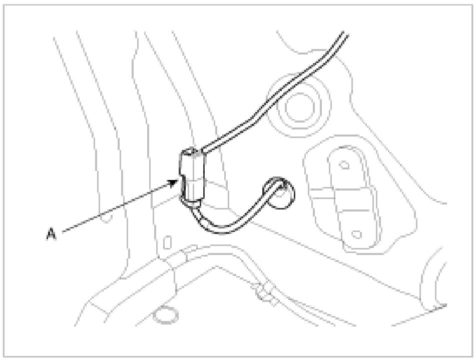
Brake System > ABS(Anti-Lock Brake System) > Rear Wheel Speed Sensor > Repair procedures

REMOVAL

1. Remove the rear wheel speed sensor mounting bolt(A).



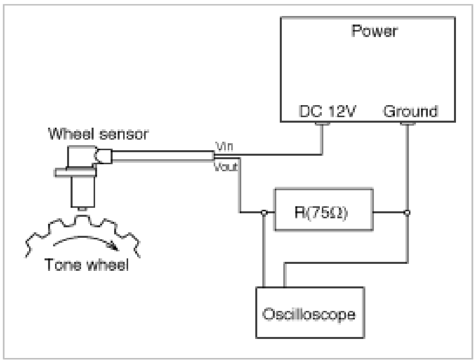
2. Remove the rear seat side pad then disconnect the rear wheel speed sensor connector(A).



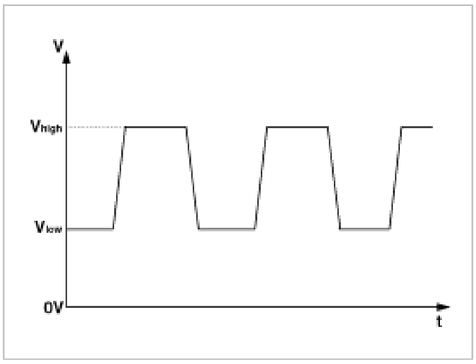
INSPECTION

1. Measure the output voltage between the terminal of the wheel speed sensor and the body ground.

> **CAUTION**
>
> In order to protect the wheel speed sensor, when measuring output voltage, a 75Ω resistor must be used as shown.



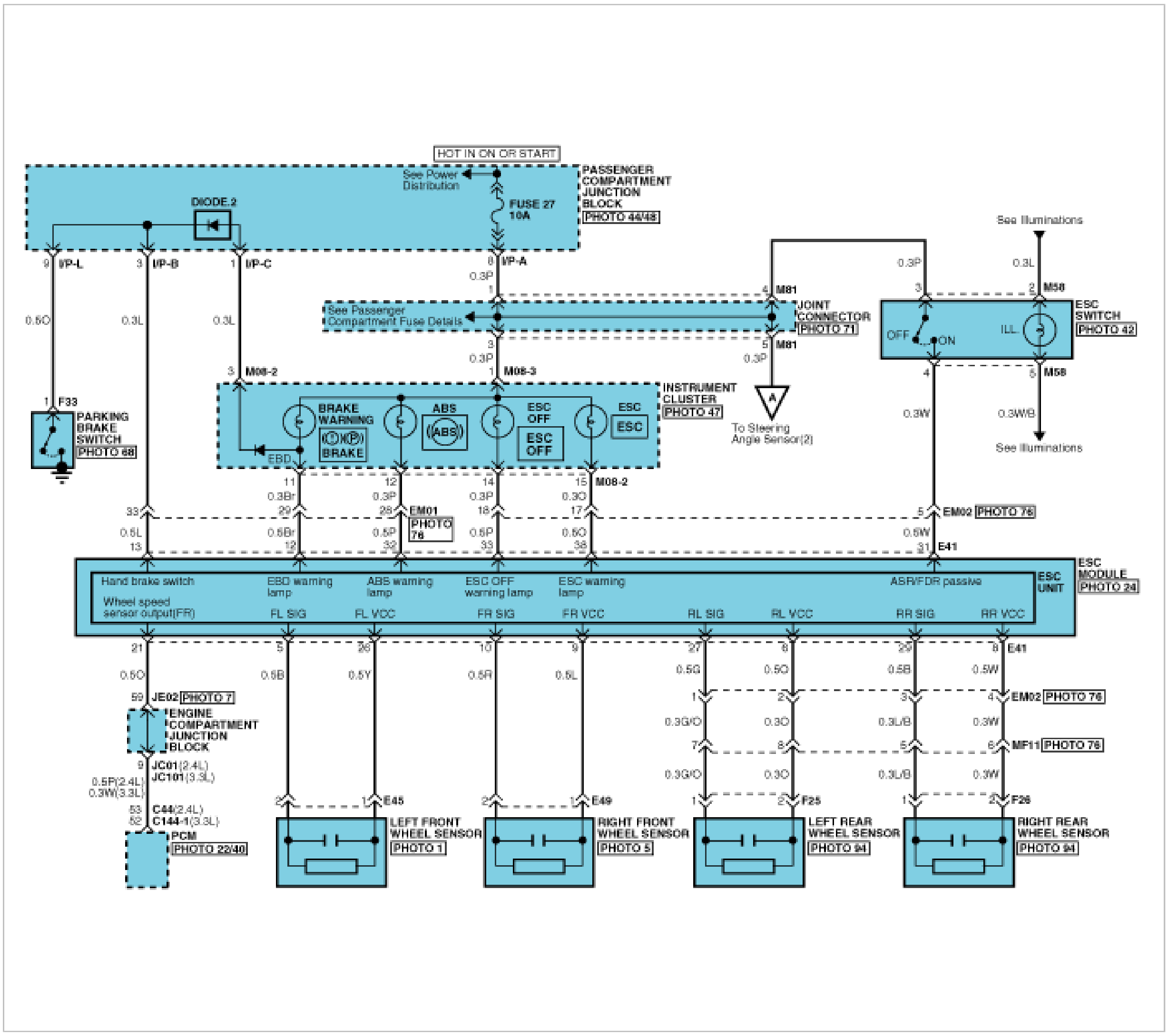
2. Compare the change of the output voltage of the wheel speed sensor to the normal change of the output voltage as shown below.



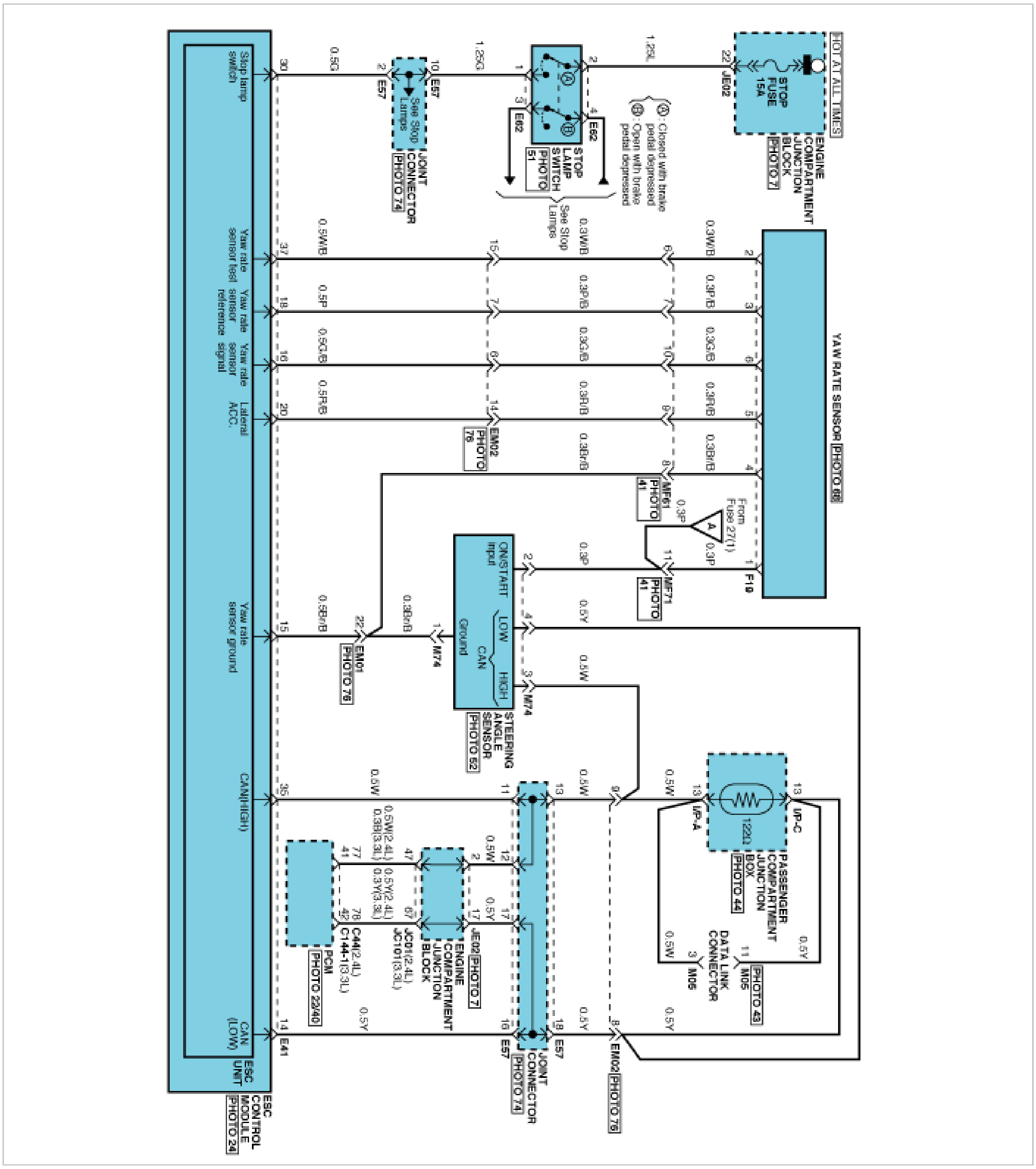
A. V_low : 0.44 V ~ 0.63 V
B. V_high : 0.885 V ~ 1.26 V
C. Frequency range : 1~2,500 Hz

Brake System > ESP(Electronic Stability Program) System > Schematic Diagrams

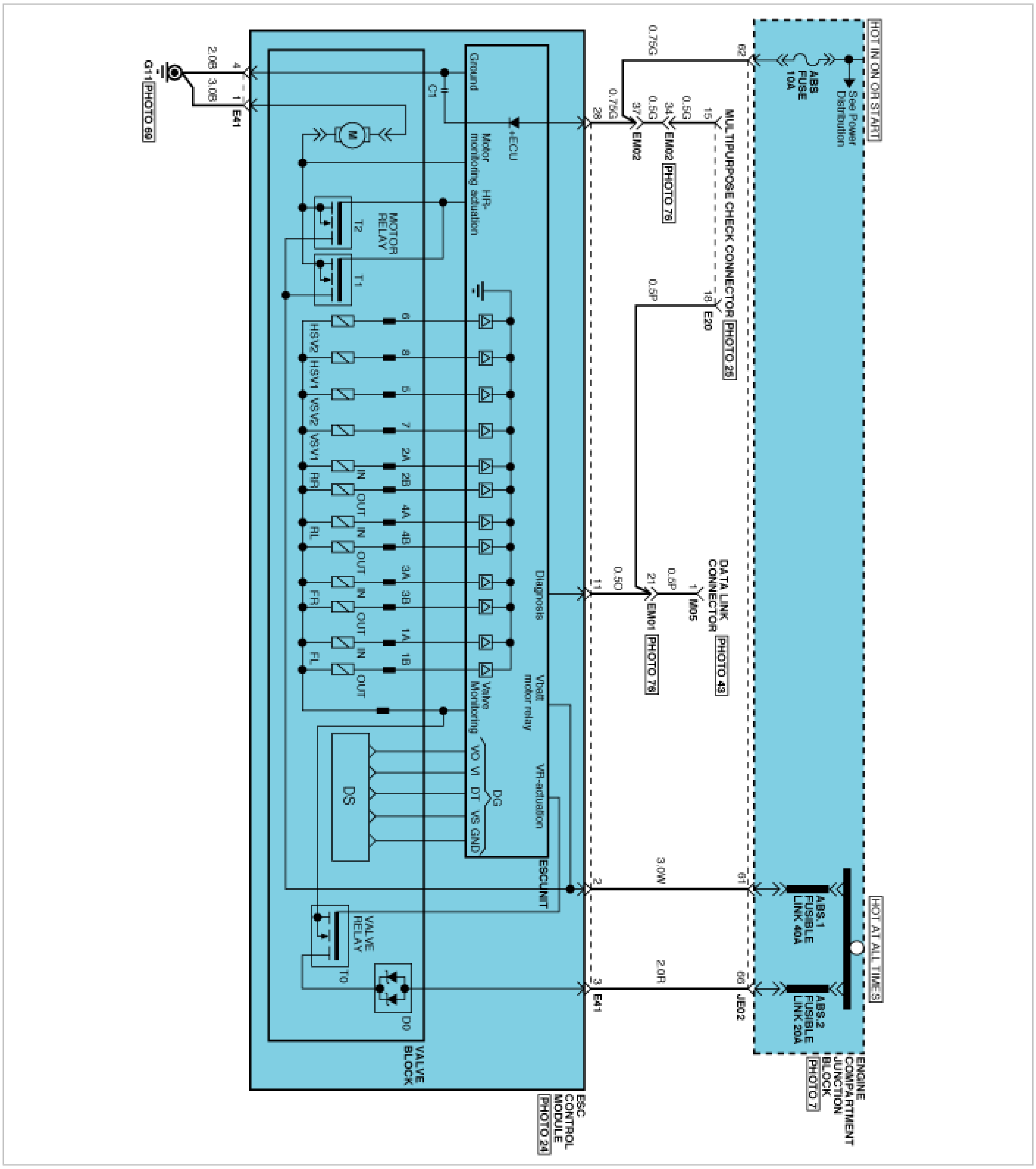
ESP circuit DIAGRAM(1)



ESP circuit DIAGRAM(2)

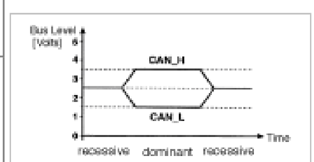


ESP circuit DIAGRAM(3)



ESP HECU CONNECTOR INPUT / OUTPUT

Connector Terminal		Signal name	Specifications	Conditions
No	Description			
1	Ground(Pump)	GND	Current range : Min-10 A Max-20 ~ 39 A	Always
4	Ground(Valve,ECU)	GND	Current range : Min-2.5 A Max-5 ~ 15 A	Always
2	Supply voltage(Pump)	Vb MOTOR	Battery voltage	Always
3	Supply voltage(Valve)	Vb VALVE		
26	Wheel sensor voltage (FL)	WP FL	Battery voltage	IG ON
9	Wheel sensor voltage (FR)	WP FR		

6	Wheel sensor voltage (RL)	WP RL		
8	Wheel sensor voltage (RR)	WP RR		
5	Wheel sensor signal(FL)	WS FL	Voltage(High) : 0.89~1.26 V Voltage(Low) : 0.44~0.63 V	RUNNING
10	Wheel sensor signal (FR)	WS FR		
27	Wheel sensor signal(RL)	WS RL		
29	Wheel sensor signal (RR)	WS RR		
11	Diagnosis Input/oupput	DIAG'K'	Voltage(High) : 0.8 * IG ON more Voltage(Low) : 0.2 * IG ON lower	HI-SCAN Communication
28	Ignition	IG.KEY	Battery voltage	KEY ON/OFF
31	ESC Passive switch	ESC Passive switch	Voltage(High) : 0.6 * IG ON more Voltage(Low) : 0.4 * IG ON lower	Switch ON/OFF
13	Hand brake switch	Hand brake switch	Voltage(High) : 0.7 * IG ON more Voltage(Low) : 0.3 * IG ON lower	Switch ON/OFF
37	Yaw Rate Sensor Test	Yaw Rate Sensor Test	Voltage(High) : 4.1 V more Voltage(Low) : 1 V lower	IG ON
18	Yaw Rate Sensor Reference	Yaw Rate Sensor Reference	2.464 V ~ 2.536 V	IG ON
16	Yaw Rate Sensor Signal	Yaw Rate Sensor Signal	Offset voltage :2.5 V range : 0.35 V ~ 4.65 V (-100 ~ 100 °/s)	IG ON
20	Acceleration Sensor Signal	Acceleration Sensor Signal	Offset voltage :2.5 V range : 0.35 V ~ 4.65 V (-1.8 g ~ 1.8 g)	IG ON
15	Yaw Rate Sensor Ground	Yaw Rate Sensor Ground	GND LEVEL	Always
35	CAN High	CAN High	not communication:2.5 ± 0.5 V communication : 	IG ON
14	CAN Low	CAN Low		
30	BRAKE LIGHT SWITCH	BRAKE LIGHT SWITCH	voltage(High) : 4.5V more voltage(Low) : 2V lower	BRAKE ON/OFF

NF ABS/ESC SENSOR OUTPUT LIST

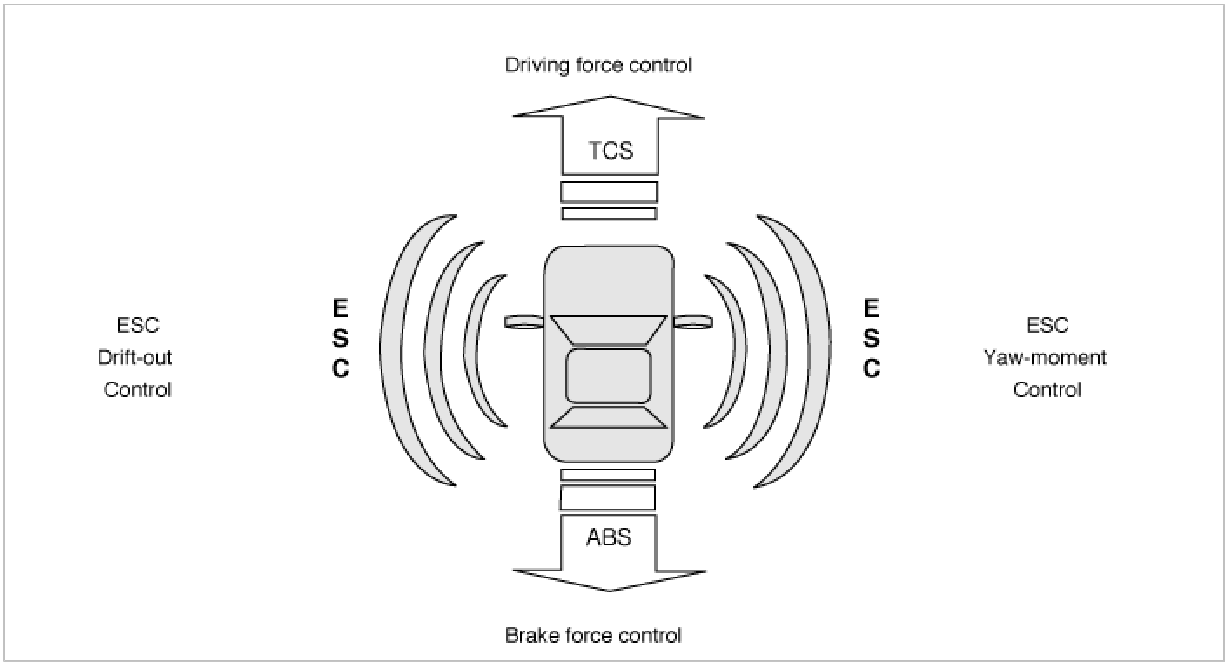
	DISPLAY(Hi-DS Scanner)	Abbreviation	Unit	Remarks
1	ENGINE SPEED	ENG. SPD	RPM	ESC ONLY
2	VEHICLE SPEED	VEH. SPD	Km/h	
3	THROTTLE P. SNESOR	TP. SNSR	%	ESC ONLY
4	SHIFT LEVER POSITION	SHIFT POSI.	-	ESC ONLY
5	BATTERY VOLTAGE	BATT. VOL	V	
6	WHEEL SPEED SNSR-FL	FL WHEEL	Km/h	
7	WHEEL SPEED SNSR-FR	FR WHEEL	Km/h	
8	WHEEL SPEED SNSR-RL	RL WHEEL	Km/h	
9	WHEEL SPEED SNSR-RR	RR WHEEL	Km/h	
10	ABS WARNING LAMP	ABS LAMP	-	
11	EBD WARNING LAMP	EBD LAMP	-	

12	ESC FUNCTION LAMP	ESC LAMP	-	ESC ONLY
13	ESC OFF LAMP	ESC OFF	-	ESC ONLY
14	ESC OFF SWITCH	ESC SW	-	ESC ONLY
15	BRAKE LAMP SWITCH	B/LAMP	-	
16	PUMP RELAY STATE	PUMP RLY	-	
17	VALVE RELAY STATE	VALVE RLY	-	
18	MOTOR	MOTOR	-	
19	FL VALVE (IN)	FL INLET	-	
20	FR VALVE (IN)	FR INLET	-	
21	RL VALVE (IN)	RL INLET	-	
22	RR VALVE (IN)	RR INLET	-	
23	FL VALVE (OUT)	FL OUTLET	-	
24	FR VALVE (OUT)	FR OUTLET	-	
25	RL VALVE (OUT)	RL OUTLET	-	
26	RR VALVE (OUT)	RR OUTLET	-	
27	TCS VALVE(USV)1	USV1	-	ESC ONLY
28	TCS VALVE(USV)1	USV2	-	ESC ONLY
29	ESC VALVE(HSV1)	HSV1	-	ESC ONLY
30	ESC VALVE(HSV2)	HSV2	-	ESC ONLY
31	STEERING ANGLE SNSR	SAS	deg	-780 ~ 779.9 °(ESC ONLY)
32	YAW RATE SNSR-LATERAL	LATERAL	g	-1.8 ~ 1.8 G(ESC ONLY)
33	YAW RATE SNSR-YAW	YAW	deg/S	-100 ~ 100 deg/s(ESC ONLY)
34	PRESSURE SENSOR	PRES. SNSR	bar	-42.5 ~ 425 bar(ESC ONLY)
35	PARKING BRAKE SIGNAL	P/BRAKE	-	ESC ONLY
37	SAS CALIBRATED	SAS CALI.	-	ESC ONLY
38	YAW RATE SENSOR TEST PASSED	YAW TEST	-	ESC ONLY

Brake System > ESP(Electronic Stability Program) System > Description and Operation

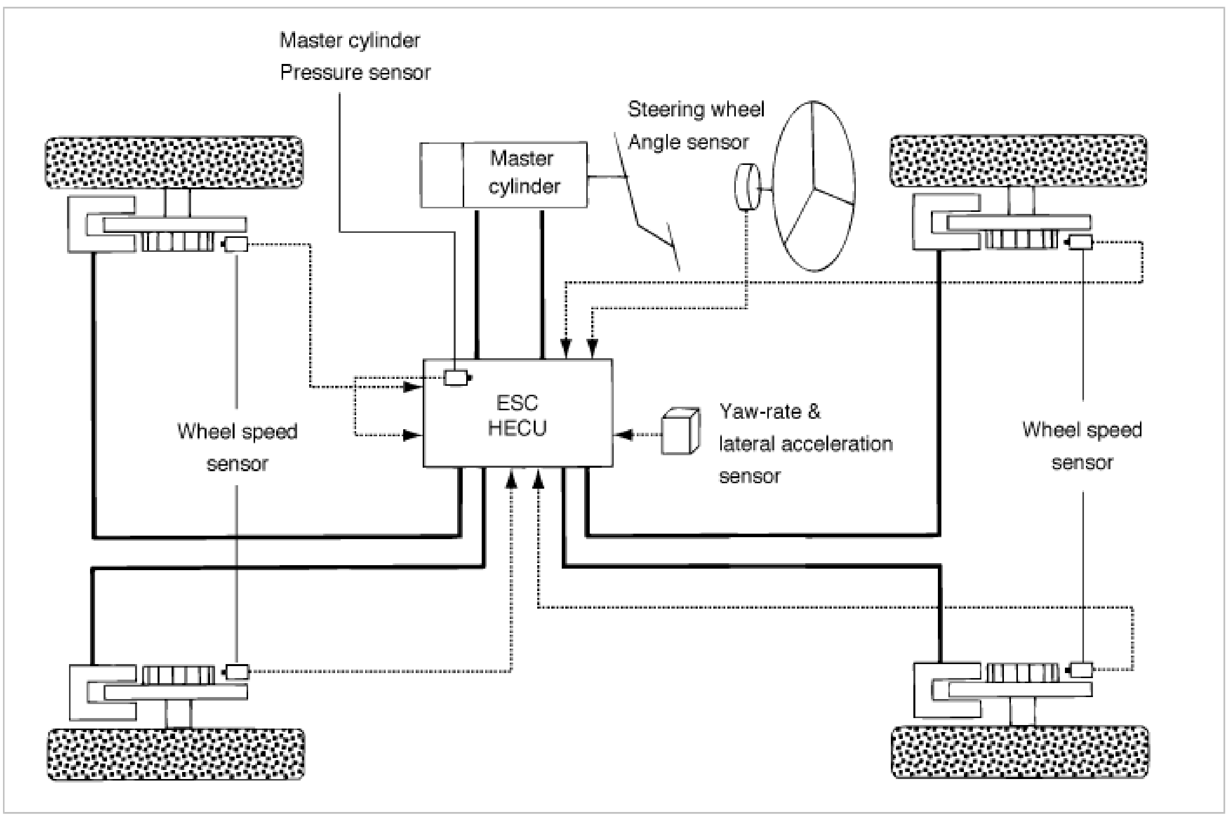
description of ESC

Optimum driving safety now has a name : ESC, the Electronic Stability Control.
ESC recognizes critical driving conditions, such as panic reactions in dangerous situations, and stabilizes the vehicle by wheel-individual braking and engine control intervention with no needfor actuating the brake or the gas pedal.
ESC adds a further function known as Active Yaw Control (AYC) to the ABS, TCS, EBD and ESC functions. Whereas the ABS/TCS function controls wheel slip during braking and acceleration and, thus, mainly intervenes in the longitudinal dynamics of the vehicle, active yaw control stabilizes the vehicle about its vertical axis.
This is achieved by wheel individual brake intervention and adaptation of the momentary engine torque with no need for any action to be taken by the driver.
ESC essentially consists of three assemblies : the sensors, the electronic control unit and the actuators.
Of course, the stability control feature works under all driving and operating conditions. Under certain driving conditions, the ABS/TCS function can be activated simultaneously with the ESC function in response to a command by the driver.
In the event of a failure of the stability control function, the basic safety function, ABS, is still maintained.



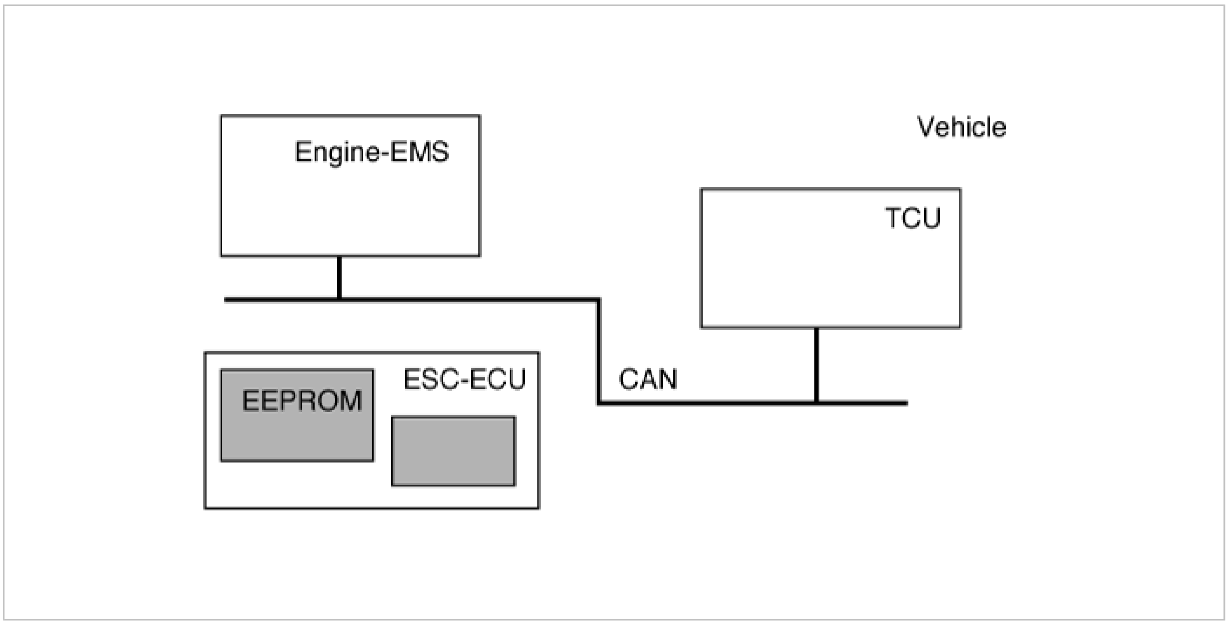
DESCRIPTION OF ESP CONTROL

ESP system includes ABS/EBD, TCS and AYC function.
ABS/EBD function The ECU changes the active sensor signal (current shift) coming from the four wheel sensors to the square wave.By using the input of above signals, the ECU calculates the vehicle speed and the acceleration & deceleration of the four wheels.And, the ECU judges whether the ABS/EBD should be actuated or not.
TCS function prevents the wheel slip of drive direction by adding the brake pressure and engine torque reduction via CAN communication.TCS function uses the wheel speed sensor signal to determine the wheel slip as far as ABS function.
AYC function prevents unstable maneuver of the vehicle. To determine the vehicle maneuver, AYC function uses the maneuver sensor signals(Yaw Rate Sensor, Lateral Acceleration Sensor, Steering Wheel Angle Sensor).If vehicle maneuver is unstable (Over Steer or Under Steer), AYC function applies the brake pressure on certain wheel, and send engine torque reduction signal by CAN.
After the key-on, the ECU continually diagnoses the system failure. (self-diagnosis)If the system failure is detected, the ECU informs driver of the system failure through the BRAKE/ABS/ESC warning lamp. (fail-safe warning)



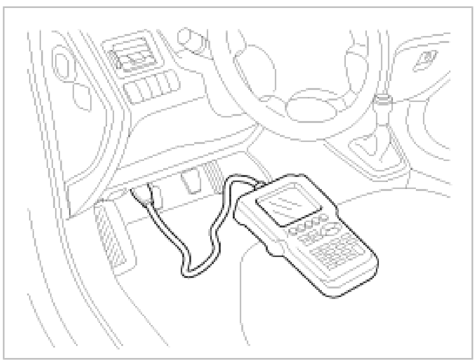
VARIANT CODING

A hardware difference of ECU does not exist according to the specification of the vehicle, but a software changes according to deference of vehicle parameter. The ESC stores variant code (data of engine, displacement volume , T/M) at the ECU memory. Since then an ESC uses the stored data.

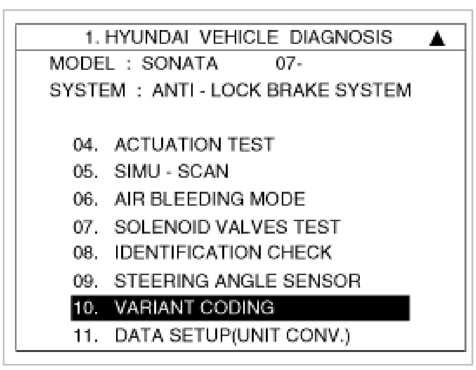


***PROCEDURE**

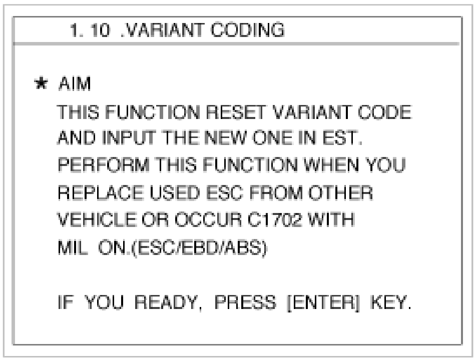
1. Install a EMS/TCU/ESC normally.
2. Connect the hi-scan (pro) to the data link connector located underneath the dash panel.



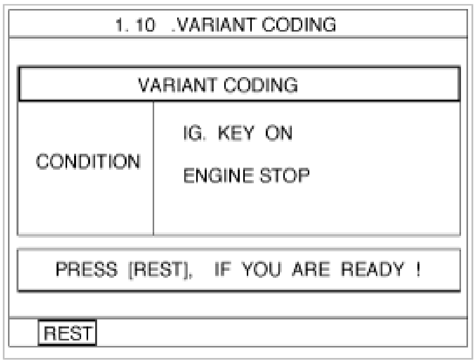
3. Select vehicle name.
4. Select ANTI-LOCK BRAKE SYSTEM.
5. Select the variant coding.



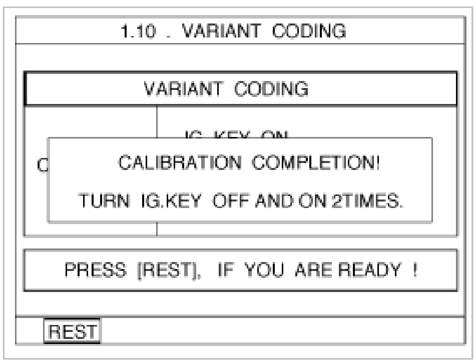
6. Follow the next procedure according to the comment .



7. Confirm the condition , and then push the "REST".



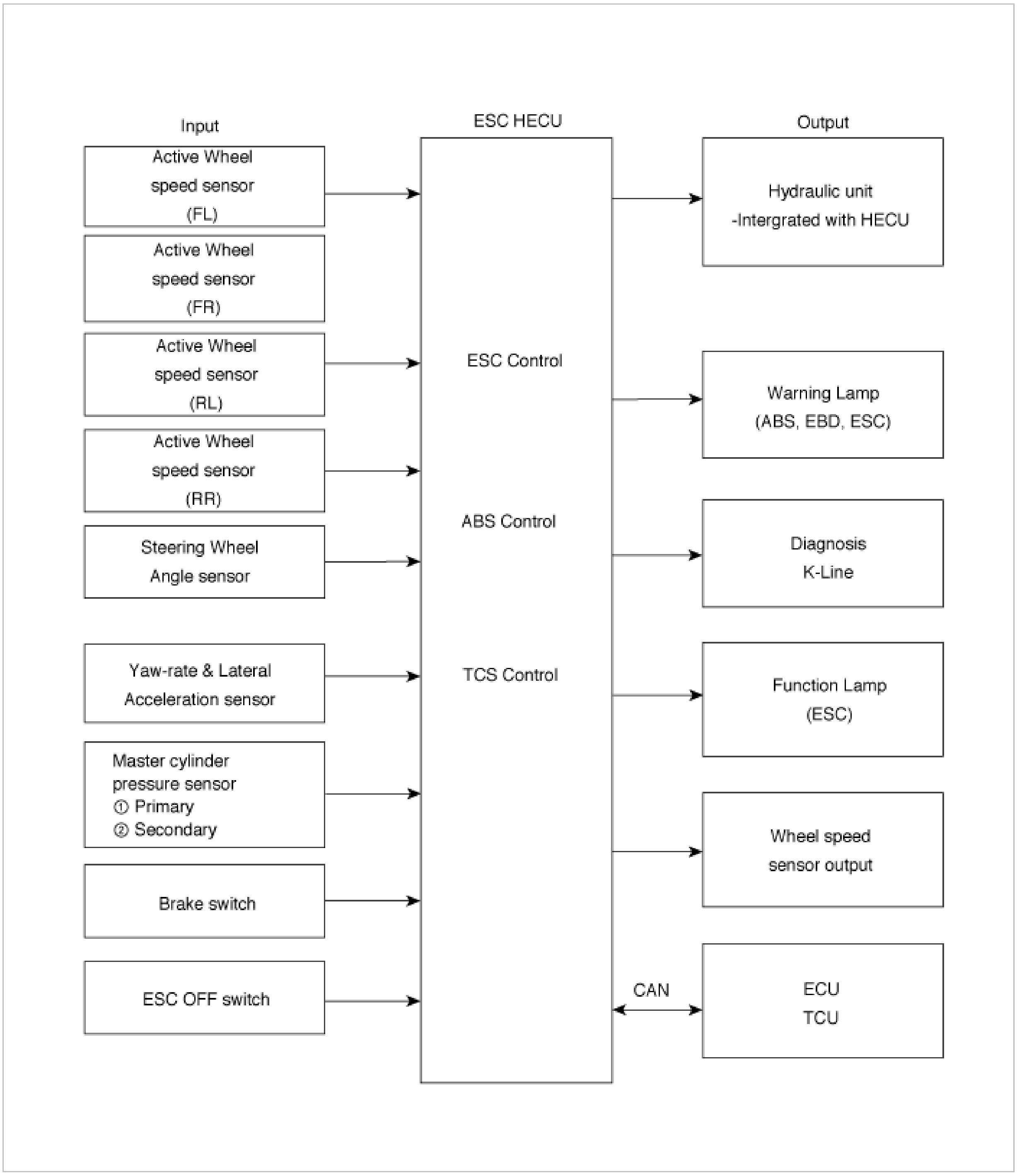
8. If the procedure is finished , the below screen is displayed .



9. IGN off.
10. IGN on.
11. The variant coding is completed.

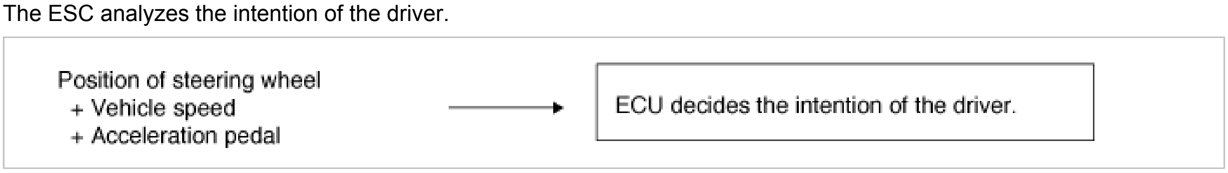
> CAUTION
>
> If the warning lamp(ESC, EBD, ABS) is lighted up, follow the "Variant coding" again.

INPUT AND OUTPUT DIAGRAM

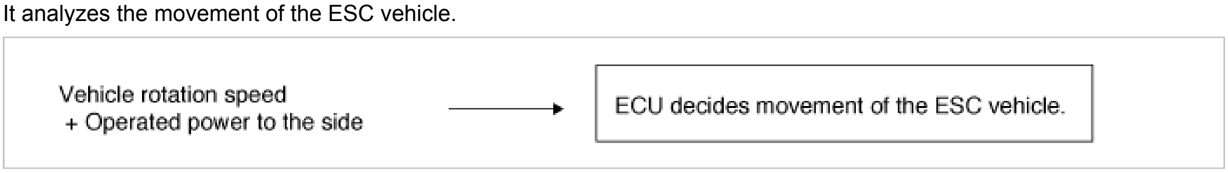


ESC OPERATION MODE

1. STEP 1
   The ESC analyzes the intention of the driver.



2. STEP 2
   It analyzes the movement of the ESC vehicle.

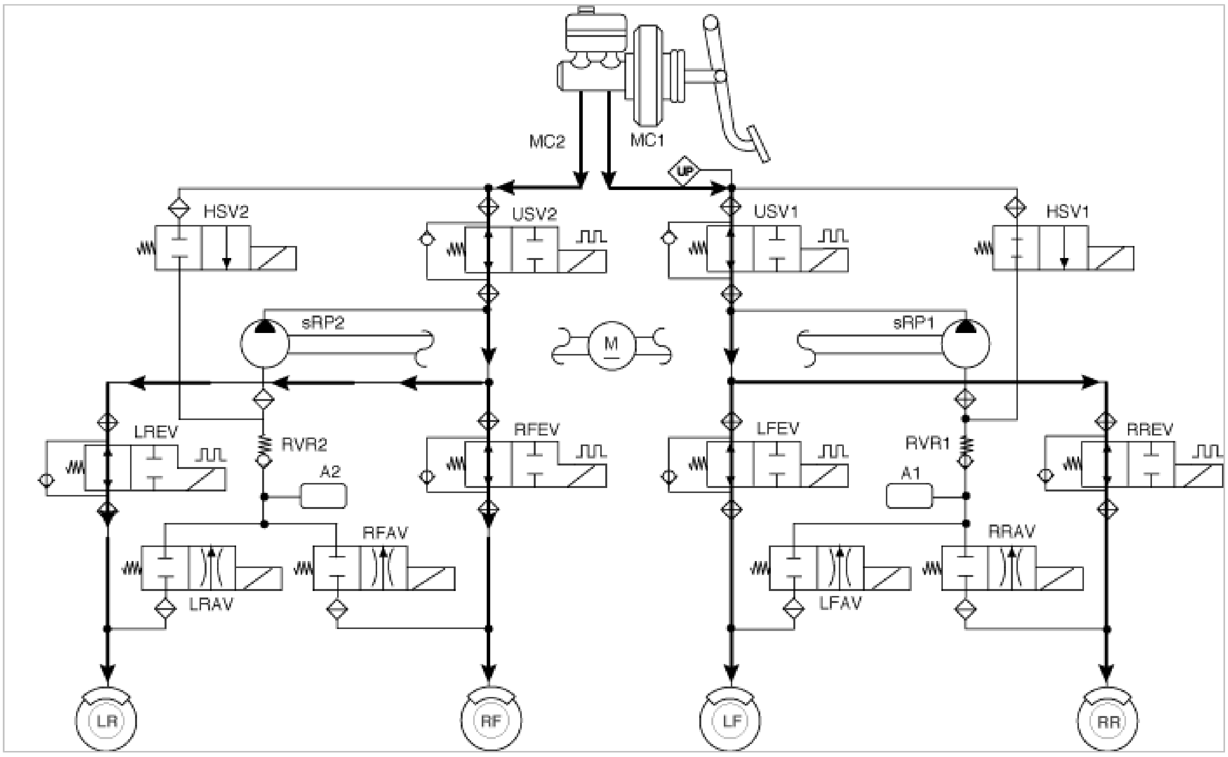


3. STEP 3
   It controls a vehicle posture control through the ESC braking power.
   A. The ECU calculates the needed countermeasure.
   B. The hydraulic unit controls Independently the braking power of each wheel.
   C. The ESC adjusts engine output through an engine and communication line to be connected.

ESC OPERATION MODE

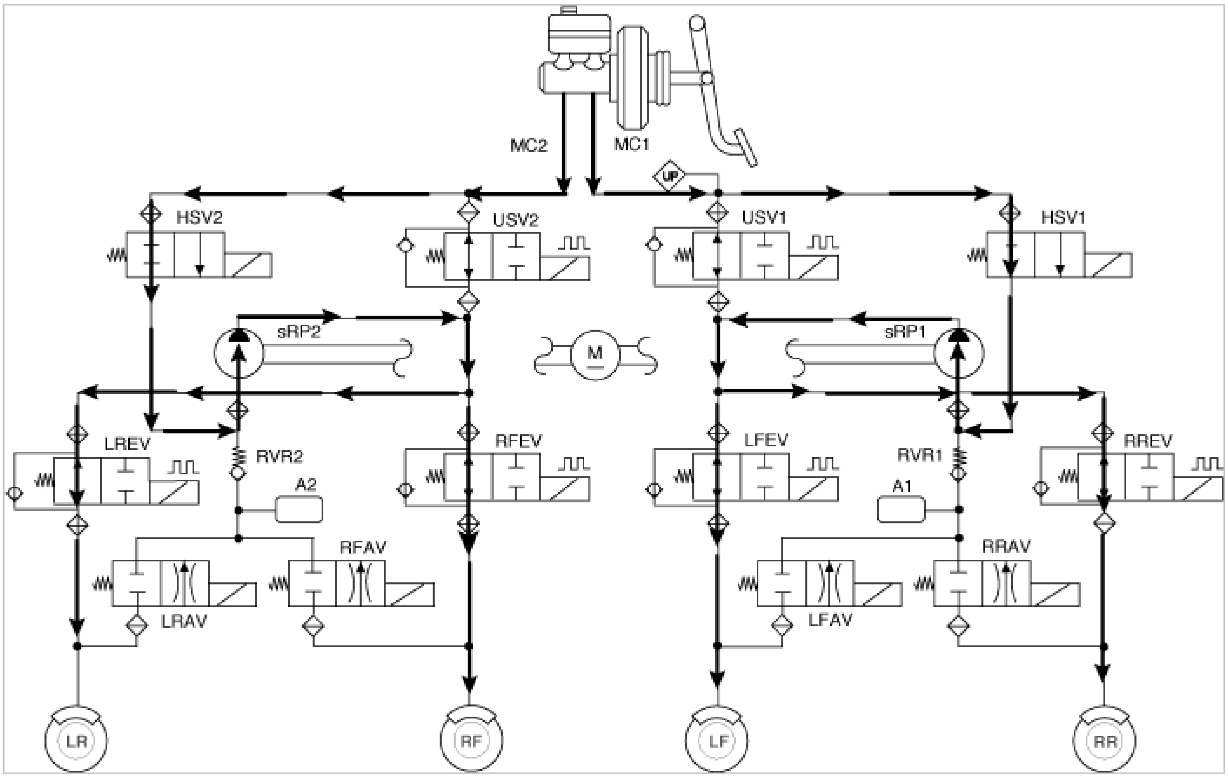
1. ESC Non-operation-Normal braking.

	Inlet valve(EV)	Outlet valve(AV)	Pilot valve(USV)	High pressure switch valve(HSV)	Pump motor
Normal braking	Open	Close	Open	Close	OFF



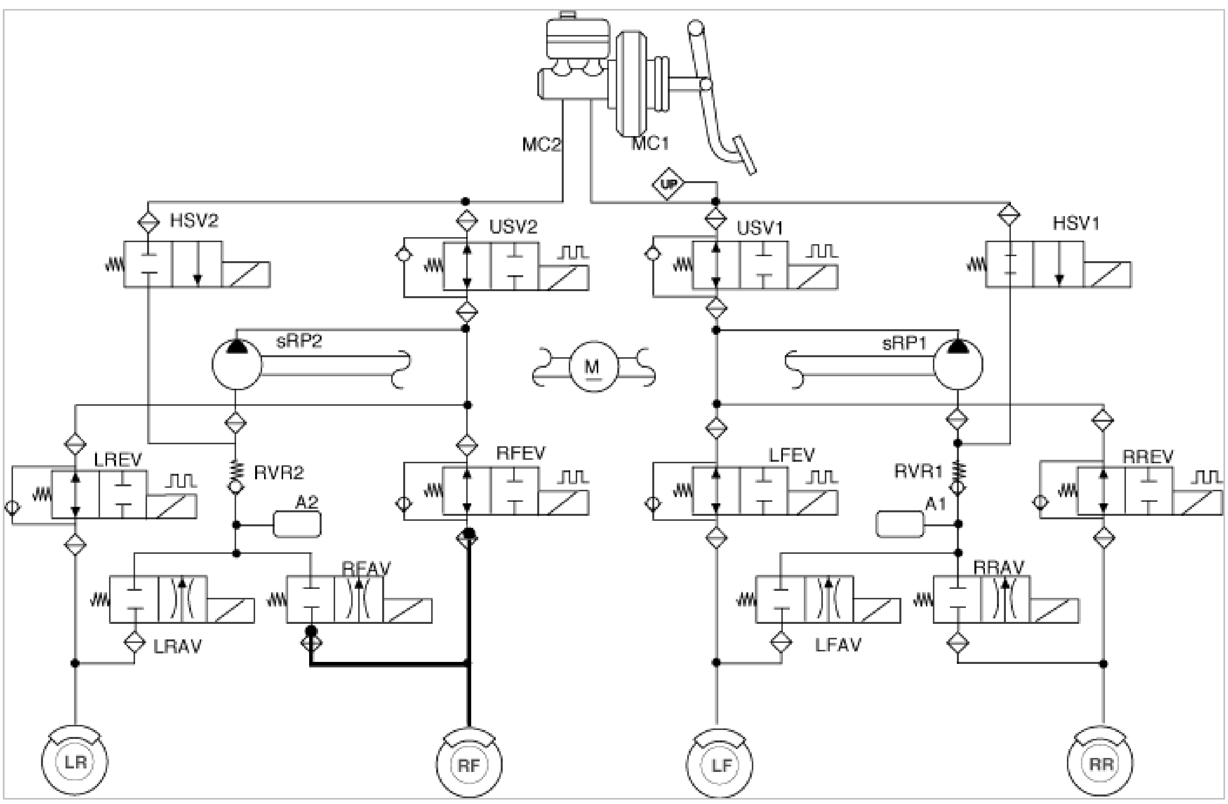
2. ESC INCREASE MODE

	Inlet valve(EV)	Outlet valve(AV)	Pilot valve(USV)	High pressure switch valve(HSV)	Pump motor
Normal braking	Open	Close	Close(Partial)	Open	ON(Motor speed control)



3. ESC HOLD MODE (FR is only controlled.)

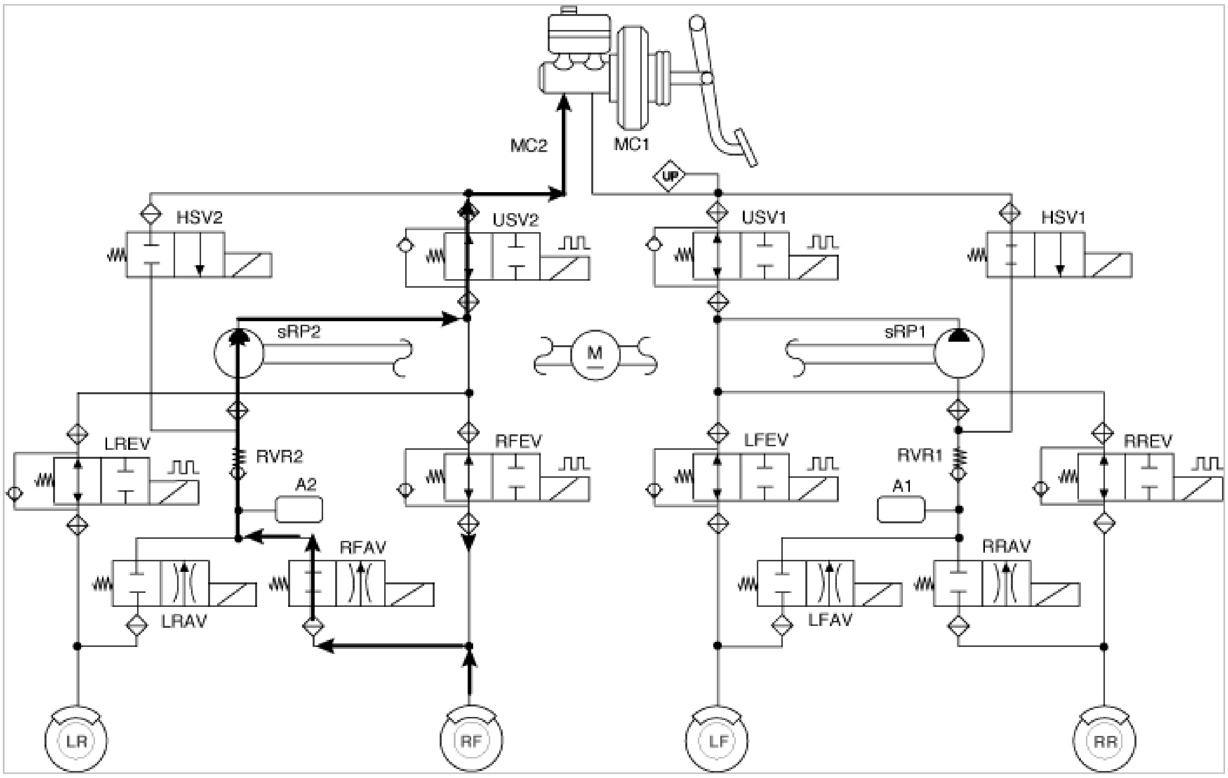
	Inlet valve(EV)	Outlet valve(AV)	Pilot valve(USV)	High pressure switch valve(HSV)	Pump motor
Normal braking	Close	Close	Close(Partial)	Open	ON(Motor speed low control)



4. ESC DECREASE MODE (FR is only controlled)

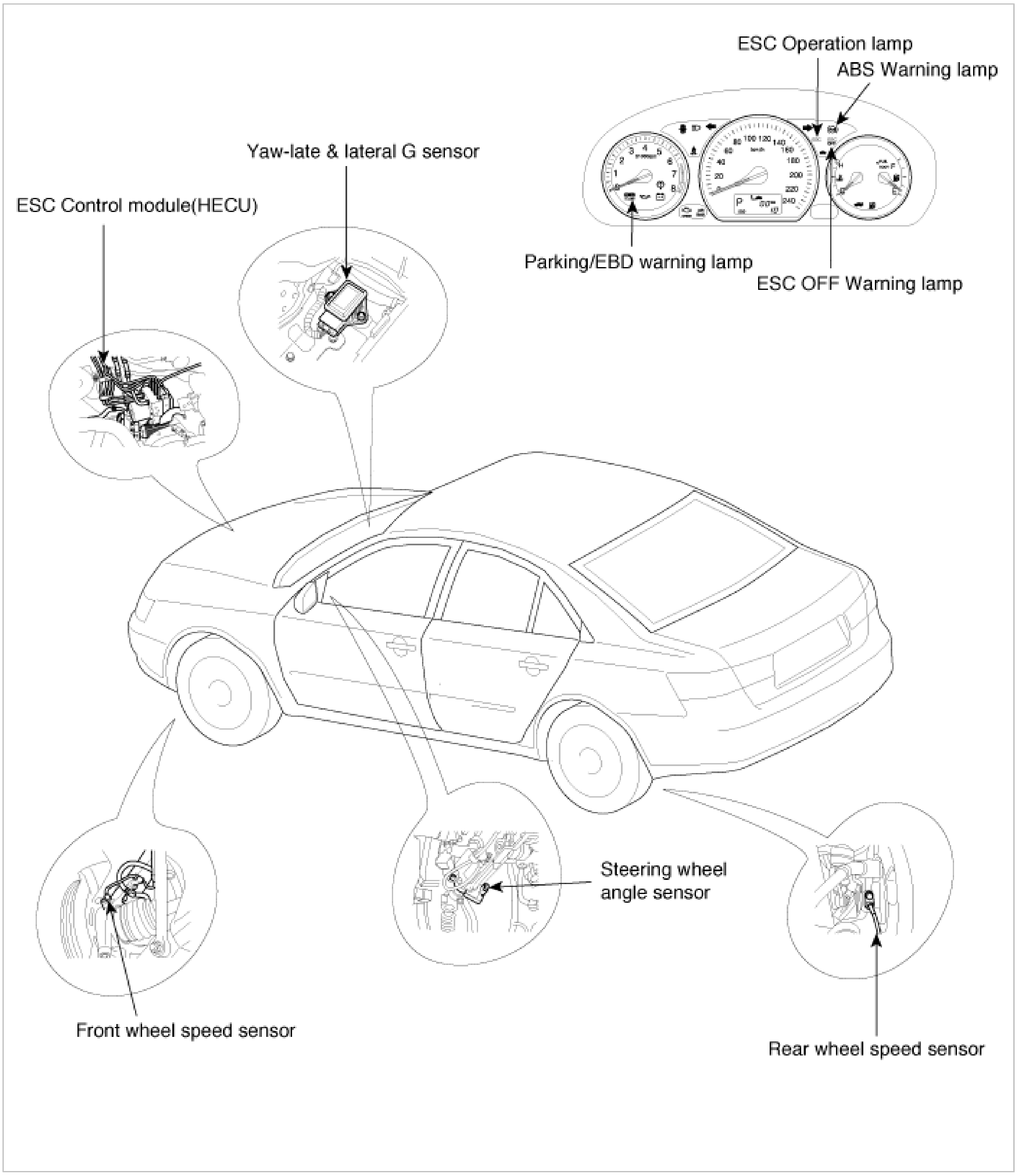
	Inlet valve(EV)	Outlet valve(AV)	Pilot valve(USV)	High pressure switch valve(HSV)	Pump motor

Normal braking	Close	Open	Close(Partial)	Open	ON(Motor speed low control)



Brake System > ESP(Electronic Stability Program) System > Components and Components Location

COMPONENTS



Brake System > ESP(Electronic Stability Program) System > Troubleshooting

FAILURE DIAGNOSIS

1. In principle, ESC and TCS controls are prohibited in case of ABS failure.
2. When ESC or TCS fails, only the failed system control is prohibited.
3. However, when the solenoid valve relay should be turned off in case of ESC failure, refer to the ABS fail-safe.
4. Information on ABS fail-safe is identical to the fail-safe in systems where ESC is not installed.

MEMORY OF FAIL CODE

1. It keeps the code as far as the backup lamp power is connected. (O)
2. It keeps the code as far as the HCU power is on. (X)

FAILURE CHECKUP

1. Initial checkup is performed immediately after the HECU power on.

2. Valve relay checkup is performed immediately after the IG2 ON.
3. It executes the checkup all the time while the IG2 power is on.
4. Initial checkup is made in the following cases.
   (1) When the failure is not detected now
   (2) When ABS and ESC are not in control.
   (3) Initial checkup is not made after ECU power on.
   (4) If the vehicle speed is over 5 mph(8 km/h) when the brake lamp switch is off.
   (5) When the vehicle speed is over 24.8 mph(40 km/h).
5. Though, it keeps on checkup even if the brake lamp switch is on.
6. When performing ABS or ESC control before the initial checkup, stop the initial checkup and wait for the HECU power input again.
7. Judge failure in the following cases.
   (1) When the power is normal.
   (2) From the point in which the vehicle speed reaches 4.9 mph(8 km/h) after HECU power on.

COUNTERMEASURES IN FAIL

1. Turn the system down and perform the following actions and wait for HECU power OFF.
2. Turn the valve relay off.
3. Stop the control during the operation and do not execute any until the normal condition recovers.

WARNING LAMP ON

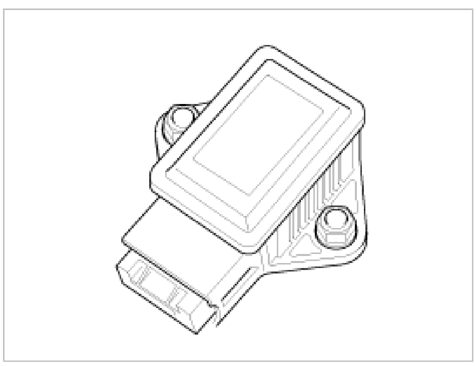
1. ABS warning lamp turns on when ABS is fail.
2. ESC operation lamp turns on when ESC is fail.

When power voltage and valve relay voltage are abnormal, input/output related failure judgment is not made.

Brake System > ESP(Electronic Stability Program) System > Yaw-rate Sensor > Description and Operation

DESCRIPTION

1. The yaw-rate & lateral G sensor is applied for the ESC system.
2. The yaw-rate is the angular velocity, when a vehicle turns a corner, and the lateral G is the acceleration to move a vehicle out of the way when cornering.
3. The sensor is located in the crash pad lower floor on vehicle.

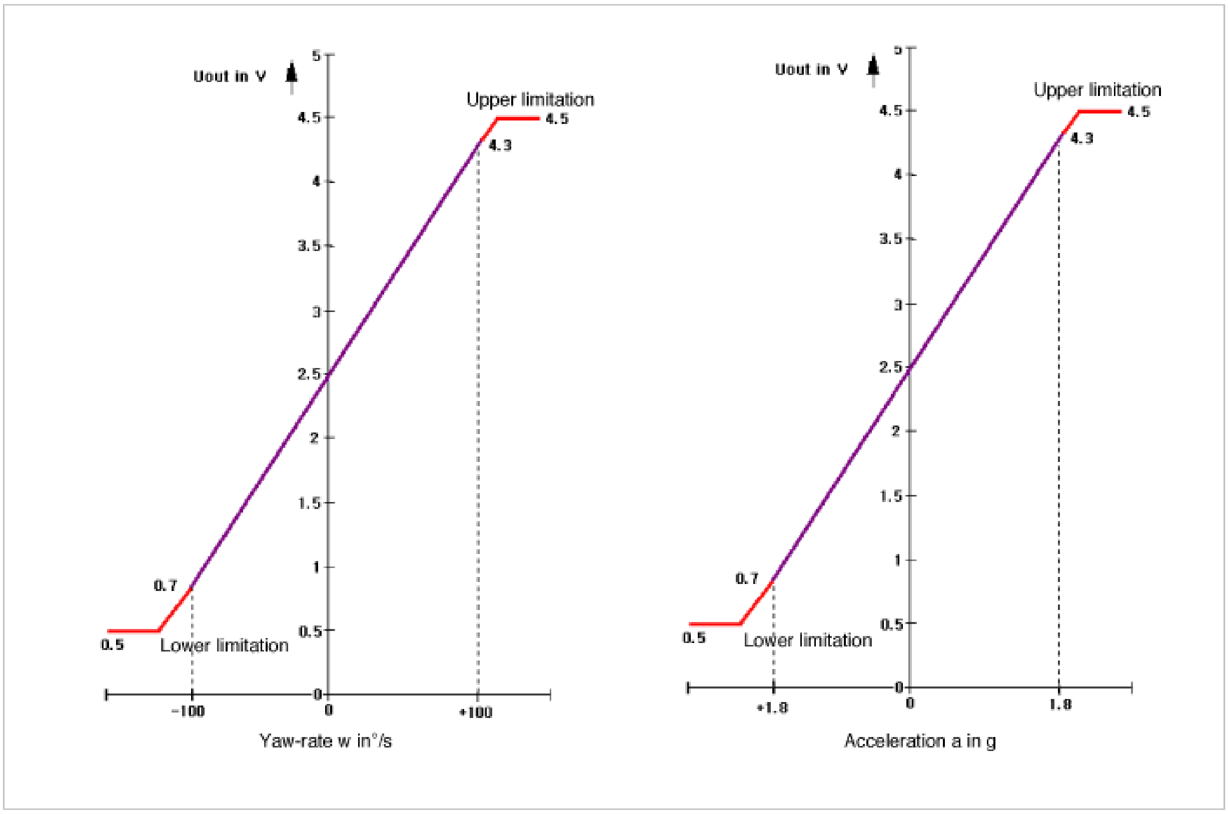


SPECIFICATION

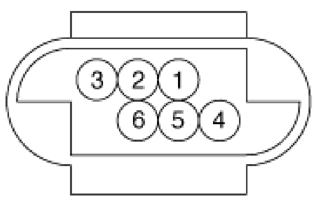
DESCRIPTION			SPECIFICATION	REMARK
Nominal supply voltage			11.5 ~ 12.5 V	
Supply voltage range			8 ~ 16 V	
Supply current			Max. 120 mA	Typ. 75 mA
Reference Voltage Output			2.464 ~ 2.536 V	Typ. 2.5 V
Operating temperature range			-40 ~ 85°C	
Yaw-late sensor	Measurement	+w direction, left turn	Min.100 °/s	Typ. 111 °/S

	range	-w direction, right turn	Min.100 °/s	Typ. 111 °/S
	Non-linearity		-1 ~ 1 %	
	Offset (within life,within operating temperature)		3.75 °/S	
	Upper cut-off frequency		Min. 45 Hz	Typ. 60 Hz
Lateral G sensor	Measurement range	+y direction, left turn	Min.1.8 g	Typ. 2 g
		-y direction, right turn	Min. -1.8 g	Typ. 2 g
	Non-linearity		-4 ~ 4 %	
	Offset (within life,within operating temperature)		-0.09 ~ 0.09 g	
	Upper cut-off frequency		Min. 20 Hz	Typ. 40 Hz

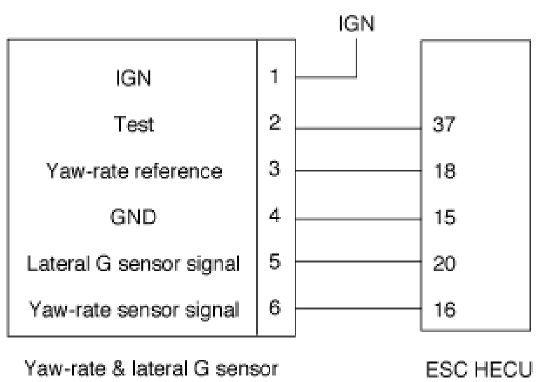
OUTPUT CHARACTERISTIC



CIRCUIT DIAGRAM (YAW-RATE & LATERAL G SENSOR)



[Yaw-rate & lateral G sensor connector]



Brake System > ESP(Electronic Stability Program) System > ESP OFF Switch > Description and

Operation

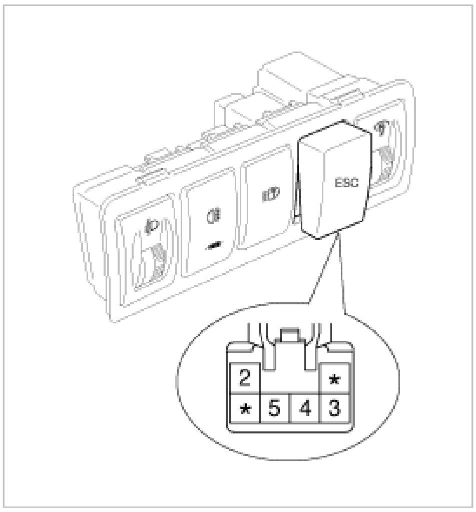
DESCRIPTION

1. The ESC OFF switch is for the user to turn off the ESC system.
2. The ESC OFF lamp is on when ESC OFF switch is engaged.

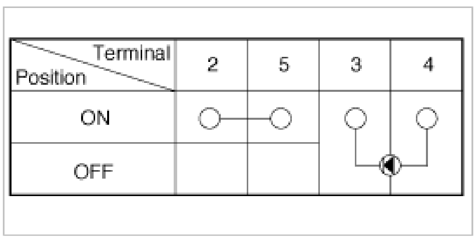
Brake System > ESP(Electronic Stability Program) System > ESP OFF Switch > Repair procedures

INSPECTION

1. Remove the ESC OFF switch from the switch panel on the crashpad of the driver's side.



2. Check the continuity between the switch terminals as the ESC OFF switch is engaged.



Position \ Terminal	2	5	3	4
ON	○	○	○	○
OFF				

Brake System > ESP(Electronic Stability Program) System > Steering Angle Position Sensor > Description and Operation

DESCRIPTION

GENERAL DATA

The steering angle speed sensor detects the angle of the steering wheel in order to which direction a user chooses.The sensor is detached on the MFS(Mutil-Function Switch) under the steering wheel.

MEASUREING PRINCIPLE

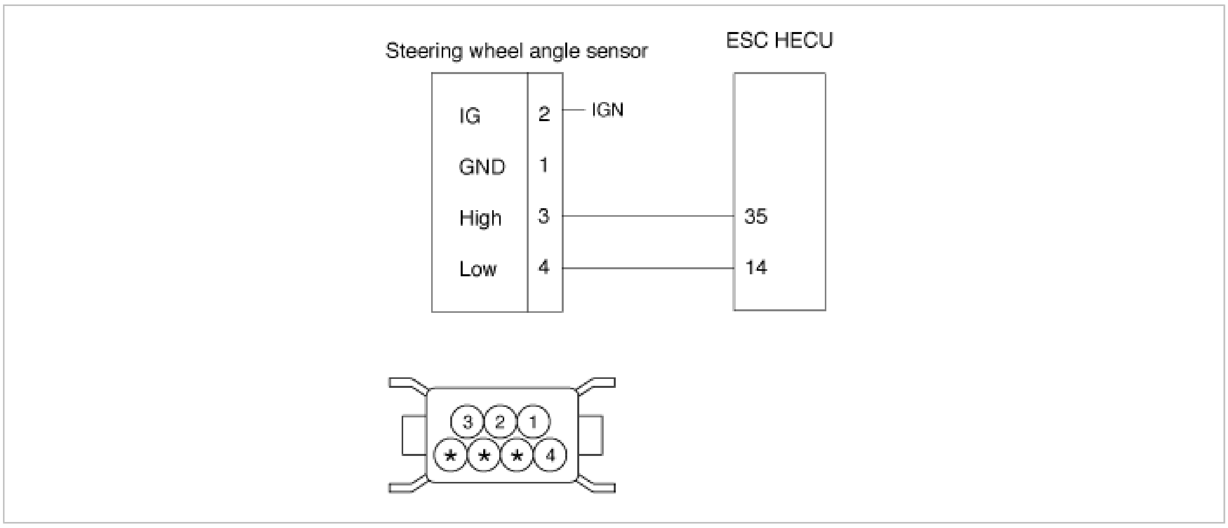
A non contact, analog angle sensor carrying out absolute measuring by the use of the Anisotropic-Magneto-Resistive effect (AMR).Measuring of the absolute angle by means of a toothed measuring gear with magnetic properties in combination with different ratios. Corresponding AMR elements that change their electrical resistance according to the magnetic field direction detect the angle position of the measuring gears.A micro-controller decodes the measured voltage signals after A/D converting with the help of a mathematical function. Output of the digital angle value and velocity via CAN-interface.

SPECIFICATION

DESCRIPTION	SPECIFICATION
Operating voltage	8~16 V
Operating temperature	-40 ~ 85 °C
Current consumption	Max.150 mA
Steering angle velocity	Max. ±2000 °/sec

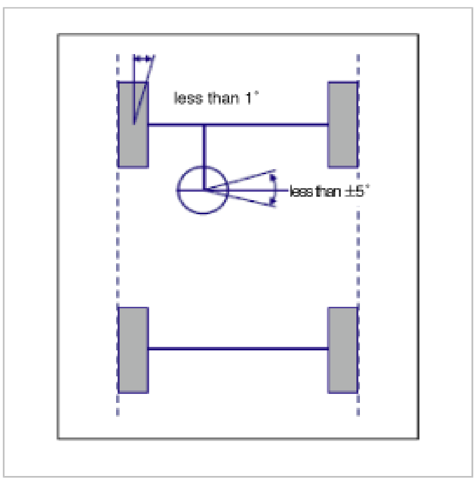
Connection delay time		t < 200 ms
Reverse voltage		-13.5 V
Measuring range	Angle	-780 ° ~ 779 °
	Angular velocity	0~ 1016 °/s
Nonlinearity angle		-2.5 ° ~ +2.5 °
Hysteresis angle		0 ° ~ 5 °
Rotational friction torque measuring		10 °/s

CIRCUIT DIAGRAM(STEERING WHEEL SPEED ANGLE SENSOR)



STEERING ANGLE SENSOR (SAS) calibration

1. PURPOSE OF calibration
   A. On vehicle control, an ESC analyzes the intention of the driver.
   B. An ESC recognizes a steering angle which a driver rotates through the steering angle sensor.
   C. A steering angle sensor used in ESC8 adjusts 0° setting of steering wheel through K-line or CAN communication.
2. STEERING ANGLE SENSOR (SAS) CALIBRATION METHOD

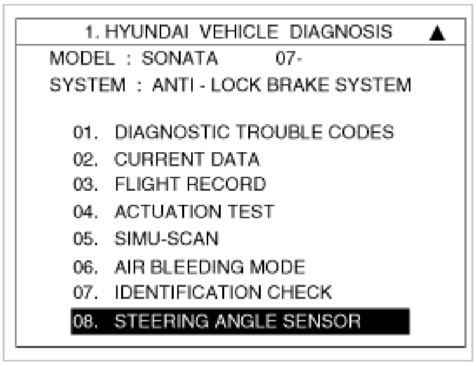


(1) Align the wheel to the straight line. (steering wheel < ± 5°)
ex) Perform the wheel alignment first.
Align the wheel to the straight line.
A driver moves the vehicle to the front and back about 5 meters twice or three times.

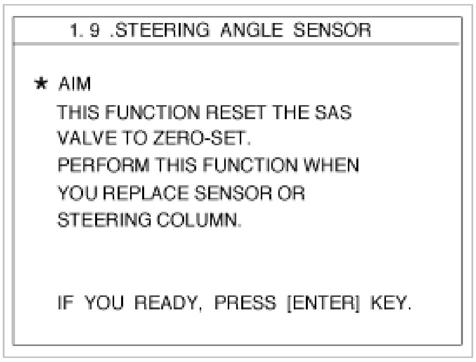
(2) Connect Hi-scan to the vehicle.

(3) Select Brake system.

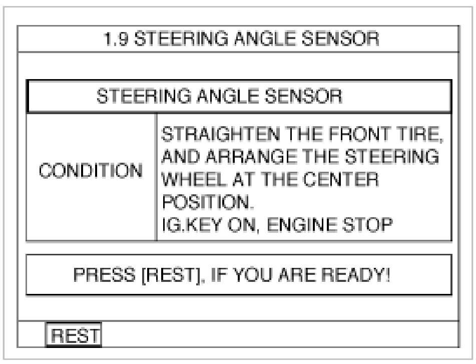
(4) Select Steering angle sensor(SAS) calibration.



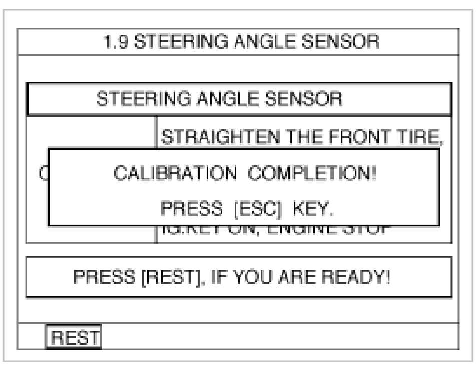
(5) Perform the Steering angle sensor(SAS) calibration.



(6) Perform the procedure continuously.



(7) The procedure is finished. Push the "ESC" key.



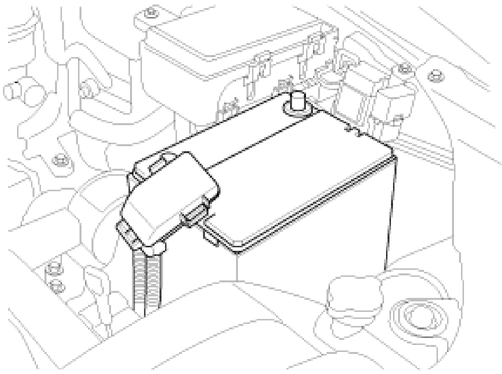
(8) Scanner OFF.

(9) Remove the scanner from the vehicle.

(10) Confirm the Steering angle sensor(SAS) calibration as driving the vehicle.(turn left once, turn right once)

Brake System > Troubleshooting > C1101

COMPONENT LOCATION



GENERAL DESCRIPTION

The ABS ECU(Electronic Control Unit) checks the battery voltage to determine, as a safety issue, whether the ABS system can operate normally or not. The normal battery voltage range is essential for controlling the ABS system as intended.

DTC DESCRIPTION

The ABS ECU monitors battery voltage by reading the value of voltage.

1. When the voltage is higher than the expected normal value, this code is set, and the ABS/EBD/TCS/ESC functions are prohibited. If the voltage recovers, to within normal operating ranges, then the controller returns to normal operation as well.
2. When the voltage is lower than the expected normal value, this code is set. The ABS/TCS/ESC functions are prohibited and the EBD function is allowed on LOW VOLTAGE CONDITION 1, the ABS/EBD/TCS/ESC functions are prohibited on UNDER VOLTAGE CONDITION.
3. If the voltage recovers, to within normal operating ranges, then the controller returns to normal operations as well.

DTC DETECTING CONDITION

<table>
<tr><th>Item</th><th colspan="2">Detecting Condition</th><th>Possible cause</th></tr>
<tr><td>DTC Strategy</td><td colspan="2">Battery Voltage Monitoring</td><td rowspan="6">• Poor connection in power supply circuit (IGN+)
• Faulty Alternator
• Faulty HECU</td></tr>
<tr><td rowspan="2">Enable Conditions</td><td>C1101</td><td>High voltage problem will be monitored if filtered Ignition Voltage is > 16.8 V.
It will be reset if filtered Ignition Voltage < 16.7 V.</td></tr>
<tr><td>C1102</td><td>1. Ignition Voltage is monitored for a level of filtered Ignition Voltage < 9.3 V outside control, or a level of filtered Ignition Voltage < 9.2 V during control.
2. Hard under voltage due to low voltage glitches is detected if unfiltered Ignition Voltage < = 8.2 V for t >= 20 ms.
3. A hard under voltage problem will be detected if the filtered UZ < 7.7 V. The system remains in this condition until filtered UZ > 7.8 V.

NOTE
All under voltage failures will only be saved in EEPROM if vehicle speed is > 6 km/h(3 MPH). This prevents false failure entries due to a bad battery at ignition on.</td></tr>
<tr><td>Monitoring period</td><td colspan="2">Continuous.
Under voltage faults are only entered in the EEPROM if the vehicle speed is v > 6 km/h (3 MPH).
Over voltage faults will be always stored.</td></tr>
<tr><td>Effect</td><td colspan="2">The proper function of valves and return pump is not guaranteed.</td></tr>
<tr><td>Fail Safe</td><td colspan="2">• System down. The ABS/EBD/TCS/ESC functions are inhibited.
- The valve relay and all solenoids are prevented from being switched on.
• The ABS/EBD/ESC warning lamps are activated.</td></tr>
</table>

SPECIFICATION

Voltage : 9.3 ≤ V ≤ 16.8 V

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Go to the next step.

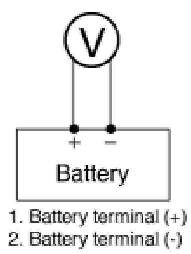
POWER SUPPLY CIRCUIT INSPECTION

1. ALTERNATOR OUTPUT VOLTAGE INSPECTION

(1) Engine "ON".

(2) Measure voltage between the battery terminal(+) and the battery terminal(-).

Specification : Approx. 14.4 ± 0.3 V (20 °C)



Voltage regulator ambient temperature(°C)	Regulating voltage
-30	14.1 ~ 15.2
20	14.1 ~ 14.7
120	13.3 ~ 14.7

Is the measured voltage within specifications?

YES

▸ Go to "Power Circuit Inspection" procedure.

NO

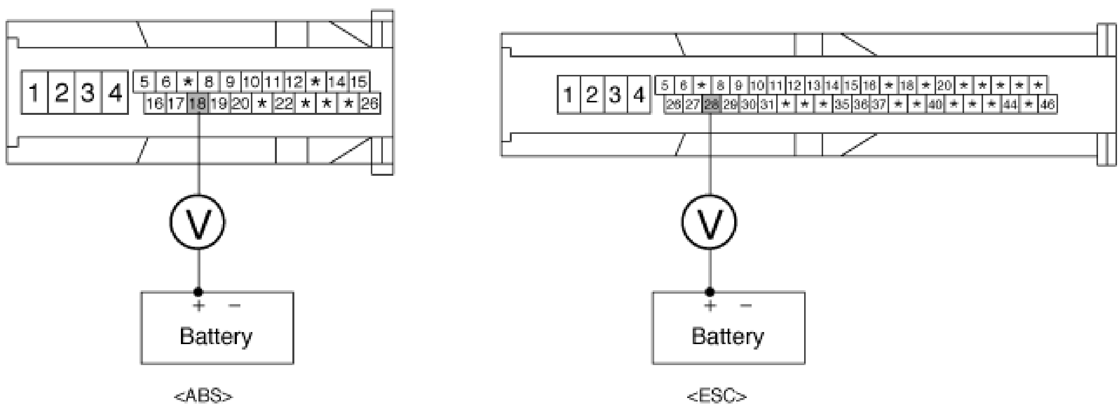
▸ Check for damaged harness and poor connection between alternator and battery. If OK , repair or replace alternator and then go to "Verification of vehicle Repair" procedure.

2. POWER CIRCUIT INSPECTION

(1) Engine "ON".

(2) Measure voltage between the battery terminal(+) and terminal "18(28:ESC)" of the HECU harness connector.

Specification : Approx. below 0.2 V



Is the measured voltage within specifications?

YES

▸Go to "Ground Circuit Inspection" procedure.

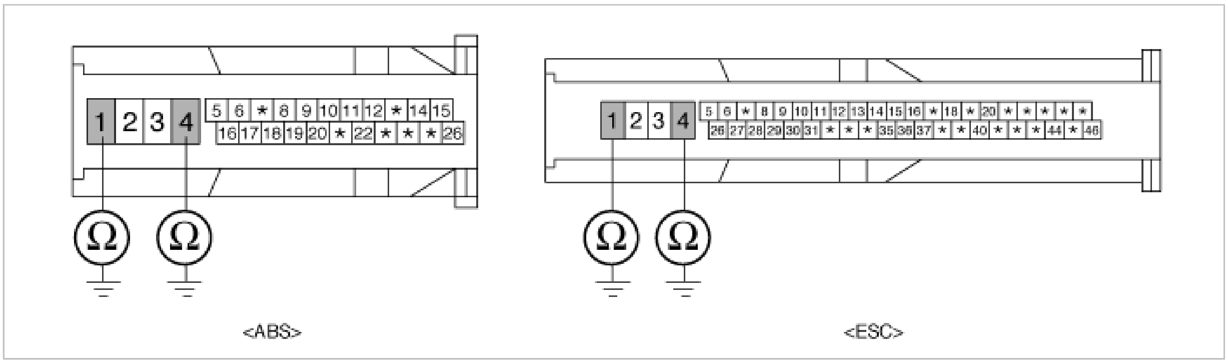
NO

▸ Check for damaged harness and poor connection between the battery terminal(+) and terminal "18(28:ESC)" of the HECU harness connector. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect HECU connector.
3. Measure resistance between terminal "1,4" of the HECU harness connector and chassis ground.

Specification : Approx. below 1 Ω



Is the measured resistance within specifications?

NO

▸ Check for damaged harness and poor connection between terminal "1,4" of the HECU harness connector and chassis ground. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

YES

▸ Go to "Component Inspection" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
   Does warning lamp remain On?

YES

▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Fault is intermittent caused by poor connection in power harness (IGN+), faulty Alternator and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.
   Are any DTCs present?

YES

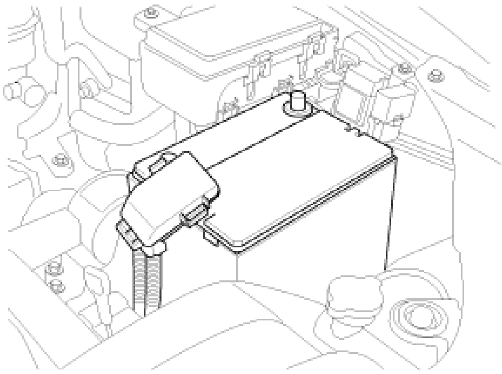
▸ Go to the applicable troubleshooting procedure.

NO

▸ A system performs normally at this time.

Brake System > Troubleshooting > C1102

COMPONENT LOCATION



GENERAL DESCRIPTION

The ABS ECU(Electronic Control Unit) checks the battery voltage to determine, as a safety issue, whether the ABS system can operate normally or not. The normal battery voltage range is essential for controlling the ABS system as intended.

DTC DESCRIPTION

The ABS ECU monitors battery voltage by reading the value of voltage.

1. When the voltage is higher than the expected normal value, this code is set, and the ABS/EBD/TCS/ESP functions are prohibited. If the voltage recovers, to within normal operating ranges, then the controller returns to normal operation as well.
2. When the voltage is lower than the expected normal value, this code is set. The ABS/TCS/ESP functions are prohibited and the EBD function is allowed on LOW VOLTAGE CONDITION 1, the ABS/EBD/TCS/ESP functions are prohibited on UNDER VOLTAGE CONDITION.
3. If the voltage recovers, to within normal operating ranges, then the controller returns to normal operations as well.

DTC DETECTING CONDITION

<table>
<tr><th>Item</th><th colspan="2">Detecting Condition</th><th>Possible cause</th></tr>
<tr><td>DTC Strategy</td><td colspan="2">Battery Voltage Monitoring</td><td rowspan="6">• Poor connection in power supply circuit (IGN+)
• Faulty Alternator
• Faulty HECU</td></tr>
<tr><td rowspan="2">Enable Conditions</td><td>C1101</td><td>High voltage problem will be monitored if filtered Ignition Voltage is > 16.8 V.
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<tr><td>C1102</td><td>1. Ignition Voltage is monitored for a level of filtered Ignition Voltage < 9.3V outside control, or a level of filtered Ignition Voltage < 9.2 V during control.
2. Hard under voltage due to low voltage glitches is detected if unfiltered Ignition Voltage < = 8.2 V for t >= 20 ms.
3. A hard under voltage problem will be detected if the filtered UZ < 7.7 V. The system remains in this condition until filtered UZ > 7.8 V.

NOTE
All under voltage failures will only be saved in EEPROM if vehicle speed is > 6km/h(3 MPH). This prevents false failure entries due to a bad battery at ignition on.</td></tr>
<tr><td>Monitoring period</td><td colspan="2">Continuous.
Under voltage faults are only entered in the EEPROM if the vehicle speed is v > 6 km/h (3 MPH).
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<tr><td>Fail Safe</td><td colspan="2">• System down. The ABS/EBD/TCS/ESP functions are inhibited.
- The valve relay and all solenoids are prevented from being switched on.
• The ABS/EBD/ESP warning lamps are activated.</td></tr>
</table>

SPECIFICATION

Voltage : 9.3 ≤ V ≤ 16.8 V

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

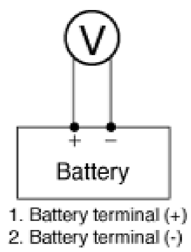
NO

▸ Go to the next step.

POWER SUPPLY CIRCUIT INSPECTION

1. ALTERNATOR OUTPUT VOLTAGE INSPECTION
   (1) Engine "ON".
   (2) Measure voltage between the battery terminal(+) and the battery terminal(-).

   Specification : Approx. 14.4 ± 0.3 V (20 °C)



Voltage regulator ambient temperature(°C)	Regulating voltage
-30	14.1 ~ 15.2
20	14.1 ~ 14.7
120	13.3 ~ 14.7

Is the measured voltage within specifications?

YES

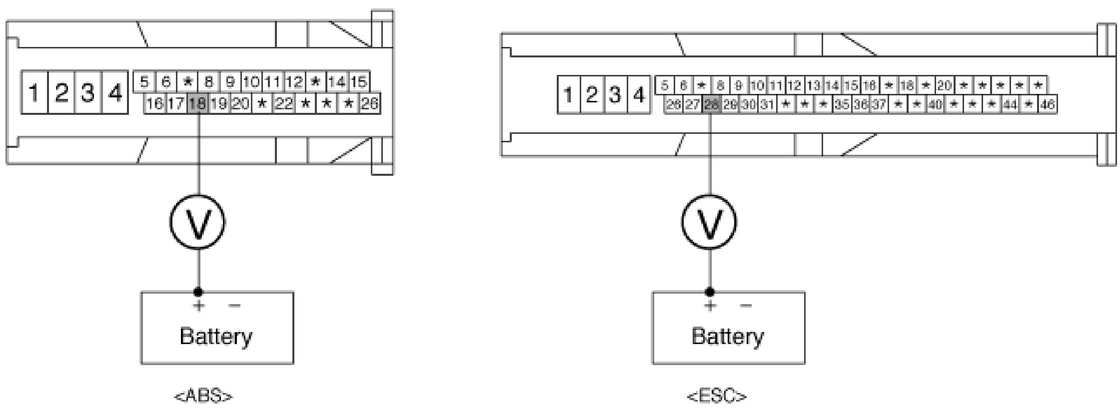
▸ Go to "Power Circuit Inspection" procedure.

NO

▸ Check for damaged harness and poor connection between alternator and battery. If OK , repair or replace alternator and then go to "Verification of vehicle Repair" procedure.

2. POWER CIRCUIT INSPECTION
   (1) Engine "ON".
   (2) Measure voltage between the battery terminal(+) and terminal "18(28:ESP)" of the HECU harness connector.

   Specification : Approx. below 0.2 V



Is the measured voltage within specifications?

YES

▸Go to "Ground Circuit Inspection" procedure.

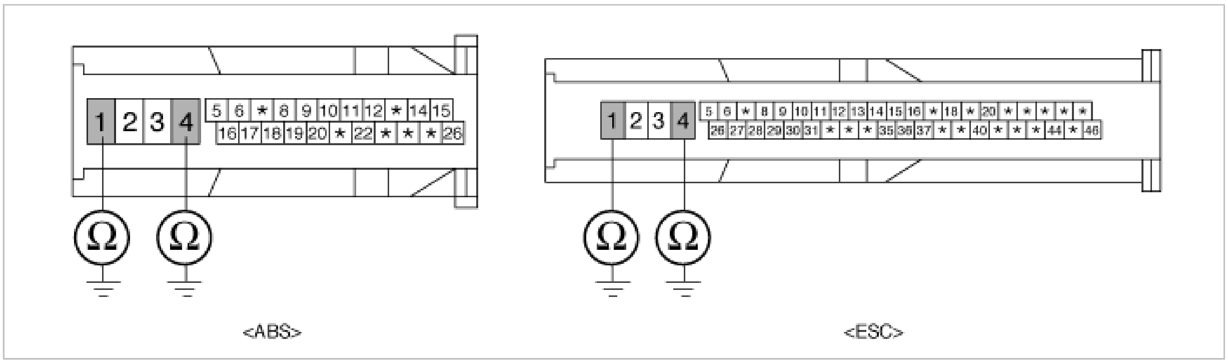
NO

▸ Check for damaged harness and poor connection between the battery terminal(+) and terminal "18(28:ESP)" of the HECU harness connector. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect HECU connector.
3. Measure resistance between terminal "1,4" of the HECU harness connector and chassis ground.

Specification : Approx. below 1 Ω



Is the measured resistance within specifications?

NO

▸ Check for damaged harness and poor connection between terminal "1,4" of the HECU harness connector and chassis ground. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

YES

▸ Go to "Component Inspection" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
   Does warning lamp remain On?

YES

▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Fault is intermittent caused by poor connection in power harness (IGN+), faulty Alternator and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.
   Are any DTCs present?

YES

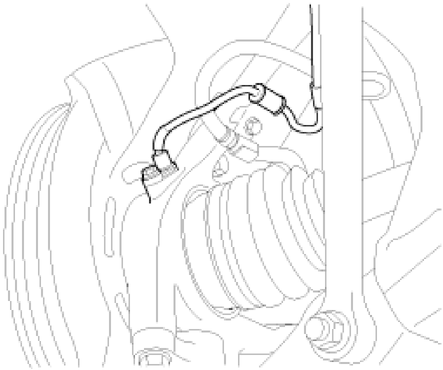
▸ Go to the applicable troubleshooting procedure.

NO

▸ A system performs normally at this time.

Brake System > Troubleshooting > C1200

COMPONENT LOCATION



GENERAL DESCRIPTION

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is an active hall-sensor type and good at temperature and noise charicteristic. Digital wave is produced as tone wheel rotate according as hall sensor principle. Frequency of duty wave is changed in proportion to rotation of tone wheel and HECU calculate vehicle speed by this frequency.

DTC DESCRIPTION

The ABS ECU monitors the wheel speed sensor circuit continuously. If the sensor signal current is continuously out of the specified range for 200msec, then the HECU determines that the circuit is open/short, and sets this code. Warning lamp is turned OFF if the detected fault is not more than when the IG KEY is turned to ON again, and wheel speeds are more than 10 Km/h(6 MPH).

DTC DETECTING CONDITION

Item	Detecting Condition		Possible cause
DTC Strategy	Current Monitoring		• Open or short of Wheel speed sensor circuit • Faulty Wheel speed sensor • Faulty HECU
CASE 1	Monitoring period	Once after power up.	
	Enable Conditions	Wheel speed sensor test starts immediate after power. Especially shorts between WSS(Wheel speed sensor) lines and shorts to UZ(ECU voltage supply) can be detected by switching single WSS channels in sequence. After end of test only the channels with no fault are switched on.	
CASE 2	Monitoring period	Continuous	
	Enable Conditions	The sensor circuitry has two current levels I = 7 mA and I= 14mA. If the sensor line is broken, shorted to ground or shorted to supply voltage a faulty current level will be detected.WSS line faults are detected, if the fault condition exists uninterrupted for t >= 200 ms.	
Effect	No correct WSS Signal can be generated. Control of the corresponding wheel is no longer possible. If a sensor fault occurs on a front wheel, pressure is increased; on a rear wheel, pressure is decreased (until switch off).		

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

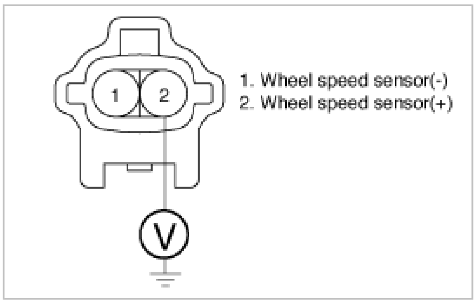
NO

▸ Go to the next step.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal "2" of the wheel speed sensor harness connector and chassis ground.

Specification : approx. B+



Is the measured voltage within specifications?

YES

▸ Go to "Signal Circuit Inspection" procedure.

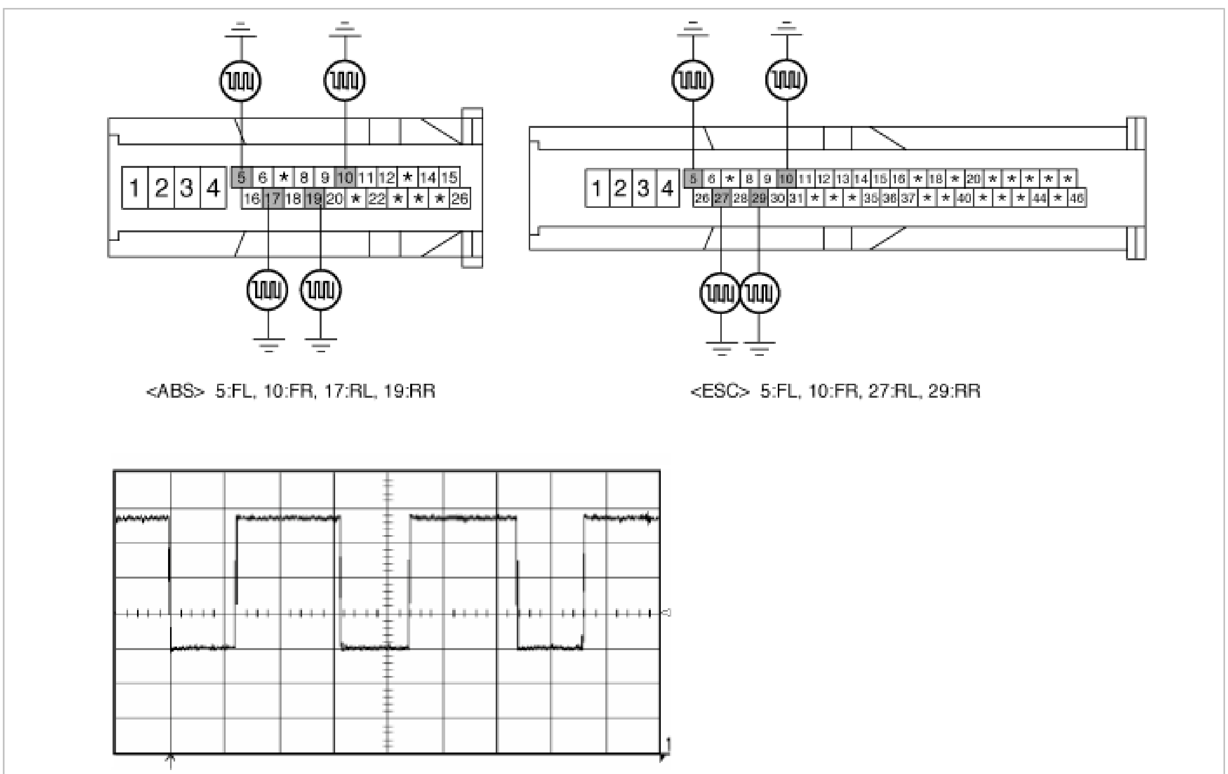
NO

▸ Check for open or short to GND in wheel speed sensor harness between terminal "16(ESC:26),9,6,8" of the HECU harness connector and terminal "2" of the Wheel speed sensor harness connector. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. By turning the wheel with hand.
3. Measure voltage between terminal "5,10,17(ESC:27),19(ESC:29)" of the HECU harness connector and chassis ground.

Specification : High : 0.89 ~ 1.26 V , Low : 0.44 ~ 0.63 V



<wave form>

Is the measured voltage within specifications?

YES

▶Go to "Component Inspection" procedure.

NO

▶ Check for open or short to GND in wheel speed sensor harness between terminal "1" of the wheel speed sensor harness connector and terminal "5,10,17(ESC:27),19(ESC:29)" of the HECU harness connector. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 10km/h or more(6mph or more).
   Does warning lamp remain On?

YES

▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected,replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Fault is intermittent caused by open or short of wheel speed sensor harness, faulty wheel speed sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.(Start and drive vehicle in gear and maintain vehicle speed is approx. 10 km/h or more(6 mph or more))
   Are any DTCs present?

YES

▶ Go to the applicable troubleshooting procedure.

NO

▶ A system performs normally at this time.

Brake System > Troubleshooting > C1201

COMPONENT LOCATION

GENERAL DESCRIPTION

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is an active hall-sensor type and good at temperature and noise charicteristic. Digital wave is produced as tone wheel rotate according as hall sensor principle. Frequency of duty wave is changed in proportion to rotation of tone wheel and HECU calculate vehicle speed by this frequency.

DTC DESCRIPTION

The ABS ECU monitors the wheel speed sensor signal continuously. This code is set if an abnormal speed change ratio is detected while the vehicle speed is 10~80 Km/h(6~50 MPH). Warning lamp is turned OFF if the detected fault is not more than when the IG KEY is turned to ON again, and wheel speeds are more than 12 Km/h(7MPH).

DTC DETECTING CONDITION

Item	Detecting Condition		Possible cause
DTC Strategy	Current Monitoring		• mproper installation of wheel speed sensor • Abnormal Rotor and wheel bearing • Faulty Wheel speed sensor • Faulty HECU
CASE 1	Monitoring period	The monitoring is active from 10 km/h to 80km/h(6~50 MPH) and if no ABS-control is active at a front wheel and a rear wheel.	
	Enable Conditions	Every time, if a gap in the wheel speed sensor signal occurs cyclically with one wheel rotation, a fault counter is increased by one. If the fault counter exceeds its limit of 10, a wheel specific fault is stored in the EEPROM.	
CASE 2	Monitoring period	Continuous if V_Vehicle > 12 m/s	
	EnableConditions	No wheel speed signals within 10 ms to 20 ms at a vehicle speed> 12 m/s (43.2 km/h, 27MPH). If the dynamic sensor monitor responses, the failures will be stored into failure memory immediately after a waiting period of 60ms.	
Effect	Due to faulty wheel speed information the control of the corresponding wheel is no longer possible. reaction of the controller: If a sensor fault occurs on a front wheel, pressure is increased; on a rear wheel, pressure is decreased.		

MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC)
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 40 km/h or more(24 mph or more) Monitor the "Wheel speed sensor" parameter on the Scantool.

Specification : Approx. 12 km/h or more(7 mph or more)

Is it normal?

YES

▸ Fault is intermittent caused by faulty wheel speed sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Repair or replace as necessary and then go to "Component Inspection" procedure.

NO

(1) Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure.

(2) Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure.

(3) Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 12 km/h or more(7 mph or more).
   Does warning lamp remain On?

YES

▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Fault is intermittent caused by open or short of wheel speed sensor harness, faulty wheel speed sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.(Start and drive vehicle in gear and maintain vehicle speed is approx. 12 km/h or more(7 mph or more))
   Are any DTCs present ?

YES

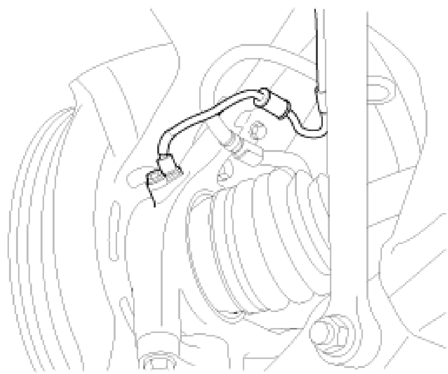
▸ Go to the applicable troubleshooting procedure.

NO

▸ A system performs normally at this time.

Brake System > Troubleshooting > C1202

COMPONENT LOCATION



GENERAL DESCRIPTION

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is an active hall-sensor type and good at temperature and noise charicteristic. Digital wave is produced as tone wheel rotate according as hall sensor principle. Frequency of duty wave is changed in proportion to rotation of tone wheel and HECU calculate vehicle speed by this frequency.

DTC DESCRIPTION

The ABS ECU monitors the wheel speed sensor signal continuously. This code is set when the sensor air gap is out of specified range or when No wheel speed signals within 10 ms to 20 ms at a vehicle speed > 43.2 km/h(26 MPH) . Warning lamp is turned OFF if the detected fault is not more than when the IG KEY is turned to ON again, and wheel speeds are more than 12 Km/h (7MPH)

DTC DETECTING CONDITION

Item	Detecting Condition		Possible cause
DTC Strategy	Signal monitoring		
CASE 1	Monitoring period	Continuous except no under voltage is detected.	
	Enable Conditions	The test detects a failure if one (or two) wheel are at Vmin(2.75 km/h ;1.7 MPH) and the other wheels are above 12 km/h for longer than 1s.A fault could also be set during driving, if the vehicle accelerates 18 km/h after a particular wheel speed gets to vmin(2.75 km/h ;1.7 MPH) and stays there. This monitoring	

		could only detect singular faults.	
CASE 2	Monitoring period	Continuous except no under voltage is detected.	
	Enable Conditions	No wheel speed signals within 10 ms to 20 ms at a vehicle speed > 12 m/s (43,2 km/h). If the dynamic sensor monitor responses, the failures will be stored into failure memory immediately after a waiting period of 60 ms.	
CASE 3	Monitoring period	• The main monitor (λ5) needs additional information of the ESC-sensors and is active for a velocity > 20 km/h(12 MPH) and no under voltage(9.2 V) is detected. • The backup monitor (λ6) manages with the wheel speeds alone.	• Improper installation of wheel speed sensor • Abnormal Rotor and wheel bearing • Faulty Wheel speed sensor • Faulty HECU
	Enable Conditions	• The main monitor (λ5): If the maximum difference of wheel speeds related to maximum wheel speed exceeds 5% a wheel specific wheel speed sensor fault is set. - the above conditions apply for 20s for 1 defective WSS. - the above conditions apply for 40s for 2 defective WSS. • The backup monitor (λ6):If the velocity is higher than 50 km/h(31 MPH), the deviation between the fastest and the slowest wheel must exceeds 6% related to the fastest wheel. If the velocity is below 50 km/h(31 MPH), the deviation must exceed an absolute value of 3 km/h(1.8 MPH) . - detection filter time : normally 20s	
Effect	Due to faulty wheel speed information the control of the corresponding wheel is no longer possible. reaction of the controller: If a sensor fault occurs on a front wheel, pressure is increased; on a rear wheel, pressure is decreased		

MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 50km/h or more(31mph or more) Monitor the "Wheel speed sensor" parameter on the Scantool.

Specification : Approx. 50 km/h or more(31 mph or more)

Is it normal?

YES

▸ Fault is intermittent caused by faulty wheel speed sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Repair or replace as necessary and then go to "Component Inspection" procedure.

NO

(1) Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure.

(2) Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure.

(3) Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 50 km/h or more(31 mph or more).
   Does warning lamp remain On?

YES

▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Fault is intermittent caused by open or short of wheel speed sensor harness, faulty wheel speed sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.(Start and drive vehicle in gear and maintain vehicle speed is approx. 50km/h or more(31mph or more)).
   Are any DTCs present ?

   YES

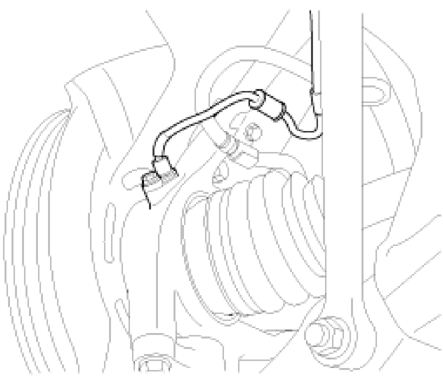
   ▸ Go to the applicable troubleshooting procedure.

   NO

   ▸ A system performs normally at this time.

Brake System > Troubleshooting > C1203

COMPONENT LOCATION



GENERAL DESCRIPTION

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is an active hall-sensor type and good at temperature and noise charicteristic. Digital wave is produced as tone wheel rotate according as hall sensor principle. Frequency of duty wave is changed in proportion to rotation of tone wheel and HECU calculate vehicle speed by this frequency.

DTC DESCRIPTION

The ABS ECU monitors the wheel speed sensor circuit continuously. If the sensor signal current is continuously out of the specified range for 200 msec, then the HECU determines that the circuit is open/short, and sets this code. Warning lamp is turned OFF if the detected fault is not more than when the IG KEY is turned to ON again, and wheel speeds are more than 10 Km/h(6 MPH).

DTC DETECTING CONDITION

Item	Detecting Condition		Possible cause
DTC Strategy	Current Monitoring		
CASE 1	Monitoring period	Once after power up.	
		Wheel speed sensor test starts immediate after power. Especially shorts between WSS(Wheel speed sensor) lines and	

	Enable Conditions	shorts to UZ(ECU voltage supply) can be detected by switching single WSS channels in sequence. After end of test only the channels with no fault are switched on.	
CASE 2	Monitoring period	Continuous	• Open or short of Wheel speed sensor circuit • Faulty Wheel speed sensor • Faulty HECU
	Enable Conditions	The sensor circuitry has two current levels I = 7 mA and I= 14 mA. If the sensor line is broken, shorted to ground or shorted to supply voltage a faulty current level will be detected.WSS line faults are detected, if the fault condition exists uninterrupted for t >= 200 ms.	
Effect	No correct WSS Signal can be generated. Control of the corresponding wheel is no longer possible. If a sensor fault occurs on a front wheel, pressure is increased; on a rear wheel, pressure is decreased (until switch off).		

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

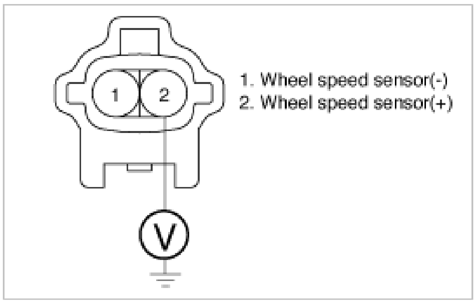
NO

▸ Go to the next step.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal "2" of the wheel speed sensor harness connector and chassis ground.

Specification : approx. B+



Is the measured voltage within specifications?

YES

▸ Go to "Signal Circuit Inspection" procedure.

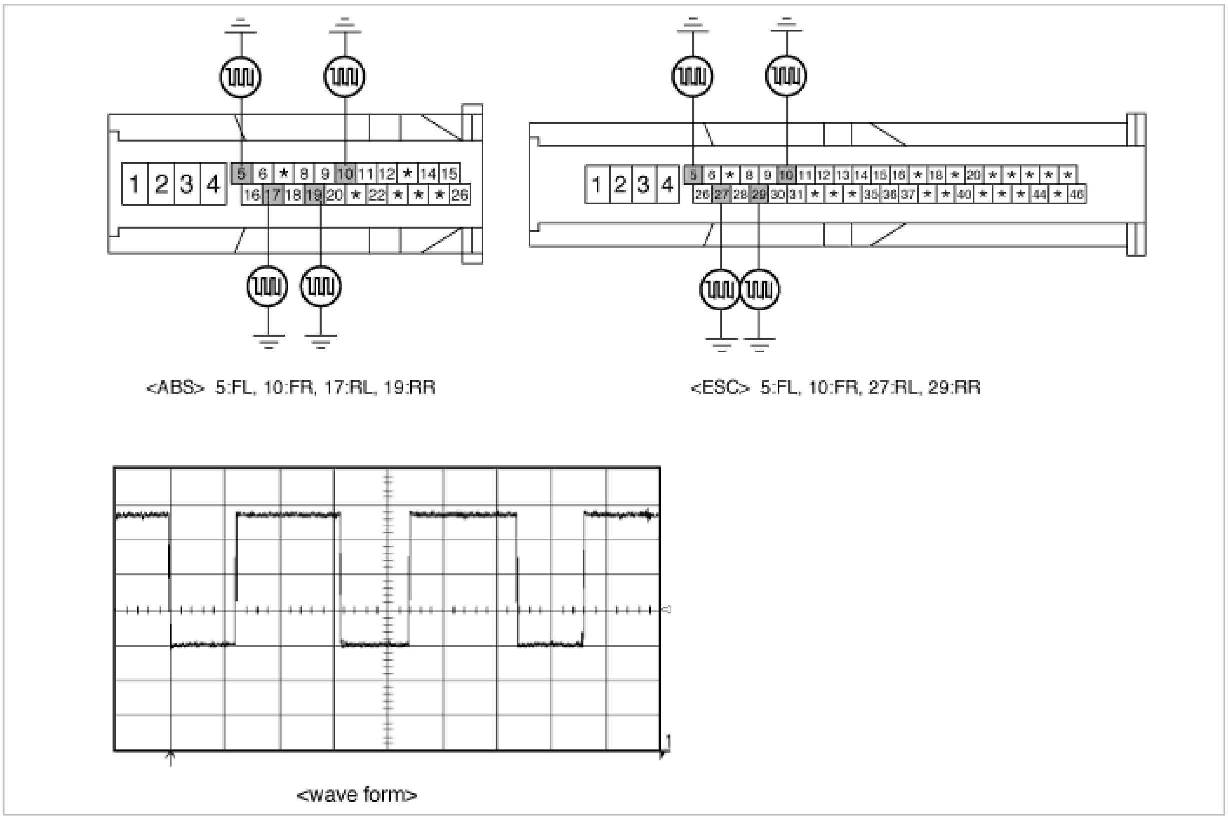
NO

▸ Check for open or short to GND in wheel speed sensor harness between terminal "16(ESP:26),9,6,8" of the HECU harness connector and terminal "2" of the Wheel speed sensor harness connector. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. By turning the wheel with hand.
3. Measure voltage between terminal "5,10,17(ESP:27),19(ESP:29)" of the HECU harness connector and chassis ground.

Specification : High : 0.89 ~ 1.26 V , Low : 0.44 ~ 0.63 V



Is the measured voltage within specifications?

YES

▸Go to "Component Inspection" procedure.

NO

▸ Check for open or short to GND in wheel speed sensor harness between terminal "1" of the wheel speed sensor harness connector and terminal "5,10,17(ESP:27),19(ESP:29)" of the HECU harness connector. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 10km/h or more(6mph or more).
   Does warning lamp remain On?

YES

▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected,replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Fault is intermittent caused by open or short of wheel speed sensor harness, faulty wheel speed sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.(Start and drive vehicle in gear and maintain vehicle speed is approx. 10 km/h or more(6 mph or more))
   Are any DTCs present?

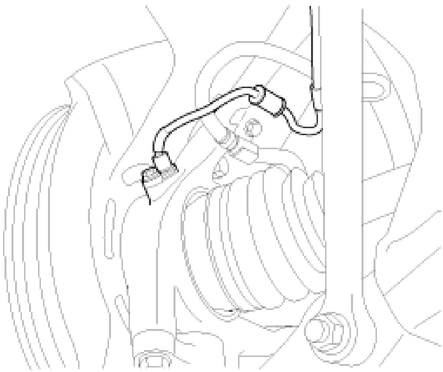
YES

▸ Go to the applicable troubleshooting procedure.

NO

▸ A system performs normally at this time.

COMPONENT LOCATION



GENERAL DESCRIPTION

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is an active hall-sensor type and good at temperature and noise charicteristic. Digital wave is produced as tone wheel rotate according as hall sensor principle. Frequency of duty wave is changed in proportion to rotation of tone wheel and HECU calculate vehicle speed by this frequency.

DTC DESCRIPTION

The ABS ECU monitors the wheel speed sensor signal continuously. This code is set if an abnormal speed change ratio is detected while the vehicle speed is 10~80 Km/h(6~50 MPH). Warning lamp is turned OFF if the detected fault is not more than when the IG KEY is turned to ON again, and wheel speeds are more than 12 Km/h(7MPH).

DTC DETECTING CONDITION

Item	Detecting Condition		Possible cause
DTC Strategy	Current Monitoring		• mproper installation of wheel speed sensor • Abnormal Rotor and wheel bearing • Faulty Wheel speed sensor • Faulty HECU
CASE 1	Monitoring period	The monitoring is active from 10 km/h to 80km/h(6~50 MPH) and if no ABS-control is active at a front wheel and a rear wheel.	
	Enable Conditions	Every time, if a gap in the wheel speed sensor signal occurs cyclically with one wheel rotation, a fault counter is increased by one. If the fault counter exceeds its limit of 10, a wheel specific fault is stored in the EEPROM.	
CASE 2	Monitoring period	Continuous if V_Vehicle > 12 m/s	
	EnableConditions	No wheel speed signals within 10 ms to 20 ms at a vehicle speed> 12 m/s (43.2 km/h, 27MPH). If the dynamic sensor monitor responses, the failures will be stored into failure memory immediately after a waiting period of 60ms.	
Effect	Due to faulty wheel speed information the control of the corresponding wheel is no longer possible. reaction of the controller: If a sensor fault occurs on a front wheel, pressure is increased; on a rear wheel, pressure is decreased.		

MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC)
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 40 km/h or more(24 mph or more) Monitor the "Wheel

speed sensor" parameter on the Scantool.

Specification : Approx. 12 km/h or more(7 mph or more)

Is it normal?

YES

▸ Fault is intermittent caused by faulty wheel speed sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Repair or replace as necessary and then go to "Component Inspection" procedure.

NO

(1) Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure.

(2) Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure.

(3) Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 12 km/h or more(7 mph or more).
   Does warning lamp remain On?

YES

▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Fault is intermittent caused by open or short of wheel speed sensor harness, faulty wheel speed sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.(Start and drive vehicle in gear and maintain vehicle speed is approx. 12 km/h or more(7 mph or more))
   Are any DTCs present ?

YES

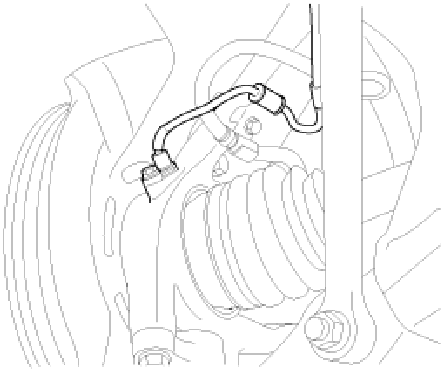
▸ Go to the applicable troubleshooting procedure.

NO

▸ A system performs normally at this time.

Brake System > Troubleshooting > C1205

COMPONENT LOCATION



GENERAL DESCRIPTION

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is an active hall-sensor type and good at temperature and noise charicteristic. Digital wave is produced as tone wheel rotate according as hall sensor principle. Frequency of duty wave is changed in proportion to rotation of tone wheel and HECU calculate vehicle speed by this frequency.

DTC DESCRIPTION

The ABS ECU monitors the wheel speed sensor signal continuously. This code is set when the sensor air gap is out of specified range or when No wheel speed signals within 10 ms to 20 ms at a vehicle speed > 43.2 km/h(26 MPH) . Warning lamp is turned OFF if the detected fault is not more than when the IG KEY is turned to ON again, and wheel speeds are more than 12 Km/h (7MPH)

DTC DETECTING CONDITION

<table>
<tr><th>Item</th><th colspan="2">Detecting Condition</th><th>Possible cause</th></tr>
<tr><td>DTC Strategy</td><td colspan="2">Signal monitoring</td><td rowspan="8">• Improper installation of wheel speed sensor
• Abnormal Rotor and wheel bearing
• Faulty Wheel speed sensor
• Faulty HECU</td></tr>
<tr><td rowspan="2">CASE 1</td><td>Monitoring period</td><td>Continuous except no under voltage is detected.</td></tr>
<tr><td>Enable Conditions</td><td>The test detects a failure if one (or two) wheel are at Vmin(2.75 km/h ;1.7 MPH) and the other wheels are above 12 km/h for longer than 1s.A fault could also be set during driving, if the vehicle accelerates 18 km/h after a particular wheel speed gets to vmin(2.75 km/h ;1.7 MPH) and stays there. This monitoring could only detect singular faults.</td></tr>
<tr><td rowspan="2">CASE 2</td><td>Monitoring period</td><td>Continuous except no under voltage is detected.</td></tr>
<tr><td>Enable Conditions</td><td>No wheel speed signals within 10 ms to 20 ms at a vehicle speed > 12 m/s (43,2 km/h). If the dynamic sensor monitor responses, the failures will be stored into failure memory immediately after a waiting period of 60 ms.</td></tr>
<tr><td rowspan="2">CASE 3</td><td>Monitoring period</td><td>• The main monitor (λ5) needs additional information of the ESP-sensors and is active for a velocity > 20 km/h(12 MPH) and no under voltage(9.2 V) is detected.
• The backup monitor (λ6) manages with the wheel speeds alone.</td></tr>
<tr><td>Enable Conditions</td><td>• The main monitor (λ5): If the maximum difference of wheel speeds related to maximum wheel speed exceeds 5% a wheel specific wheel speed sensor fault is set.
- the above conditions apply for 20s for 1 defective WSS.
- the above conditions apply for 40s for 2 defective WSS.
• The backup monitor (λ6):If the velocity is higher than 50 km/h(31 MPH), the deviation between the fastest and the slowest wheel must exceeds 6% related to the fastest wheel. If the velocity is below 50 km/h(31 MPH), the deviation must exceed an absolute value of 3 km/h(1.8 MPH) .
- detection filter time : normally 20s</td></tr>
<tr><td>Effect</td><td colspan="2">Due to faulty wheel speed information the control of the corresponding wheel is no longer possible.
reaction of the controller: If a sensor fault occurs on a front wheel, pressure is increased; on a rear wheel, pressure is decreased</td></tr>
</table>

MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).

2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 50km/h or more(31mph or more) Monitor the "Wheel speed sensor" parameter on the Scantool.

Specification : Approx. 50 km/h or more(31 mph or more)

Is it normal?

YES

▸ Fault is intermittent caused by faulty wheel speed sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Repair or replace as necessary and then go to "Component Inspection" procedure.

NO

(1) Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure.

(2) Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure.

(3) Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 50 km/h or more(31 mph or more).
   Does warning lamp remain On?

YES

▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Fault is intermittent caused by open or short of wheel speed sensor harness, faulty wheel speed sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.(Start and drive vehicle in gear and maintain vehicle speed is approx. 50km/h or more(31mph or more)).
   Are any DTCs present ?

YES

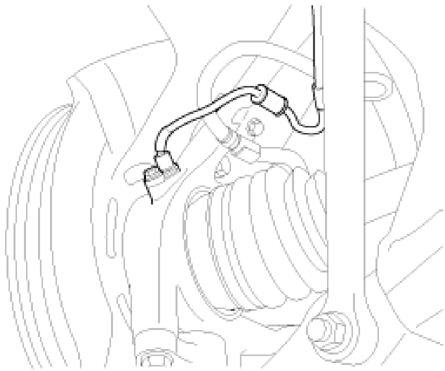
▸ Go to the applicable troubleshooting procedure.

NO

▸ A system performs normally at this time.

Brake System > Troubleshooting > C1206

COMPONENT LOCATION



GENERAL DESCRIPTION

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is an active hall-sensor type and good at temperature and noise charicteristic. Digital wave is produced as tone wheel rotate according as hall sensor principle. Frequency of duty wave is changed in proportion to rotation of tone wheel and HECU calculate vehicle speed by this frequency.

DTC DESCRIPTION

The ABS ECU monitors the wheel speed sensor circuit continuously. If the sensor signal current is continuously out of the specified range for 200msec, then the HECU determines that the circuit is open/short, and sets this code. Warning lamp is turned OFF if the detected fault is not more than when the IG KEY is turned to ON again, and wheel speeds are more than 10 Km/h(6 MPH).

DTC DETECTING CONDITION

Item	Detecting Condition		Possible cause
DTC Strategy	Current Monitoring		• Open or short of Wheel speed sensor circuit • Faulty Wheel speed sensor • Faulty HECU
CASE 1	Monitoring period	Once after power up.	
	Enable Conditions	Wheel speed sensor test starts immediate after power. Especially shorts between WSS(Wheel speed sensor) lines and shorts to UZ(ECU voltage supply) can be detected by switching single WSS channels in sequence. After end of test only the channels with no fault are switched on.	
CASE 2	Monitoring period	Continuous	
	Enable Conditions	The sensor circuitry has two current levels I = 7 mA and I= 14mA. If the sensor line is broken, shorted to ground or shorted to supply voltage a faulty current level will be detected.WSS line faults are detected, if the fault condition exists uninterrupted for t >= 200 ms.	
Effect	No correct WSS Signal can be generated. Control of the corresponding wheel is no longer possible. If a sensor fault occurs on a front wheel, pressure is increased; on a rear wheel, pressure is decreased (until switch off).		

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

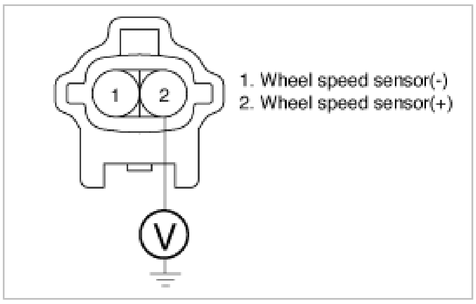
NO

▸ Go to the next step.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal "2" of the wheel speed sensor harness connector and chassis ground.

Specification : approx. B+



Is the measured voltage within specifications?

YES

▸ Go to "Signal Circuit Inspection" procedure.

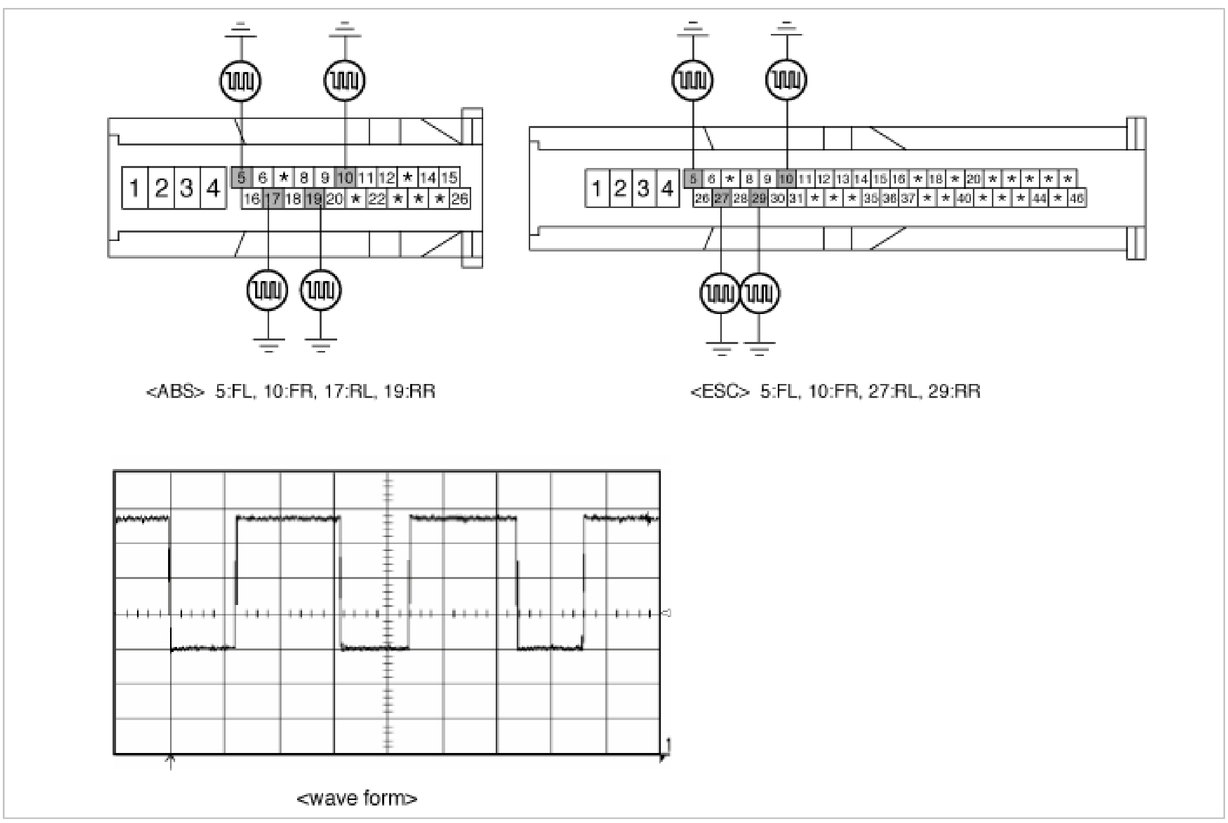
NO

▸ Check for open or short to GND in wheel speed sensor harness between terminal "16(ESP:26),9,6,8" of the HECU harness connector and terminal "2" of the Wheel speed sensor harness connector. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. By turning the wheel with hand.
3. Measure voltage between terminal "5,10,17(ESP:27),19(ESP:29)" of the HECU harness connector and chassis ground.

Specification : High : 0.89 ~ 1.26 V , Low : 0.44 ~ 0.63 V



Is the measured voltage within specifications?

YES

▸Go to "Component Inspection" procedure.

NO

▸ Check for open or short to GND in wheel speed sensor harness between terminal "1" of the wheel speed sensor harness connector and terminal "5,10,17(ESP:27),19(ESP:29)" of the HECU harness connector. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 10km/h or more(6mph or more).
   Does warning lamp remain On?

YES

▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected,replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Fault is intermittent caused by open or short of wheel speed sensor harness, faulty wheel speed sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.(Start and drive vehicle in gear and maintain vehicle speed is approx. 10 km/h or more(6 mph or more))
   Are any DTCs present?

YES

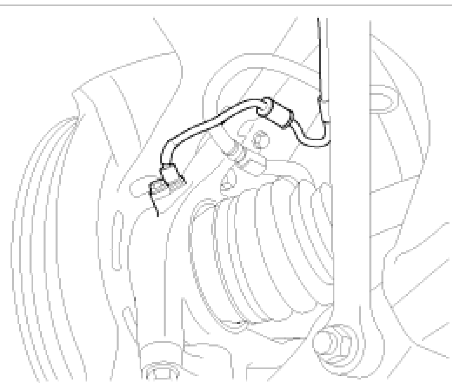
▸ Go to the applicable troubleshooting procedure.

NO

▸ A system performs normally at this time.

Brake System > Troubleshooting > C1207

COMPONENT LOCATION



GENERAL DESCRIPTION

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is an active hall-sensor type and good at temperature and noise charicteristic. Digital wave is produced as tone wheel rotate according as hall sensor principle. Frequency of duty wave is changed in proportion to rotation of tone wheel and HECU calculate vehicle speed by this frequency.

DTC DESCRIPTION

The ABS ECU monitors the wheel speed sensor signal continuously. This code is set if an abnormal speed change ratio is detected while the vehicle speed is 10~80 Km/h(6~50 MPH). Warning lamp is turned OFF if the detected fault is not more than when the IG KEY is turned to ON again, and wheel speeds are more than 12 Km/h(7MPH).

DTC DETECTING CONDITION

Item	Detecting Condition		Possible cause
DTC Strategy	Current Monitoring		• mproper installation of wheel speed sensor • Abnormal Rotor and wheel bearing • Faulty Wheel speed sensor • Faulty HECU
CASE 1	Monitoring period	The monitoring is active from 10 km/h to 80km/h(6~50 MPH) and if no ABS-control is active at a front wheel and a rear wheel.	
	Enable Conditions	Every time, if a gap in the wheel speed sensor signal occurs cyclically with one wheel rotation, a fault counter is increased by one. If the fault counter exceeds its limit of 10, a wheel specific fault is stored in the EEPROM.	
CASE 2	Monitoring period	Continuous if V_Vehicle > 12 m/s	
	EnableConditions	No wheel speed signals within 10 ms to 20 ms at a vehicle speed> 12 m/s (43.2 km/h, 27MPH). If the dynamic sensor monitor responses, the failures will be stored into failure memory immediately after a waiting period of 60ms.	
Effect	Due to faulty wheel speed information the control of the corresponding wheel is no longer possible. reaction of the controller: If a sensor fault occurs on a front wheel, pressure is increased; on a rear wheel, pressure is decreased.		

MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC)
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 40 km/h or more(24 mph or more) Monitor the "Wheel speed sensor" parameter on the Scantool.

   Specification : Approx. 12 km/h or more(7 mph or more)

   Is it normal?

   YES

   ▶ Fault is intermittent caused by faulty wheel speed sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Repair or replace as necessary and then go to "Component Inspection" procedure.

   NO

   (1) Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure.

   (2) Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure.

   (3) Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 12 km/h or more(7 mph or more).
   Does warning lamp remain On?

   YES

   ▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Fault is intermittent caused by open or short of wheel speed sensor harness, faulty wheel speed sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.(Start and drive vehicle in gear and maintain vehicle speed is approx. 12 km/h or more(7 mph or more))
   Are any DTCs present ?

YES

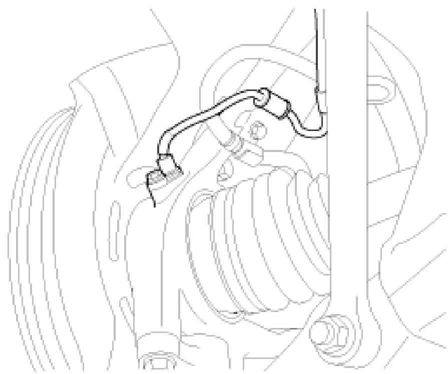
▸ Go to the applicable troubleshooting procedure.

NO

▸ A system performs normally at this time.

Brake System > Troubleshooting > C1208

COMPONENT LOCATION



GENERAL DESCRIPTION

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is an active hall-sensor type and good at temperature and noise charicteristic. Digital wave is produced as tone wheel rotate according as hall sensor principle. Frequency of duty wave is changed in proportion to rotation of tone wheel and HECU calculate vehicle speed by this frequency.

DTC DESCRIPTION

The ABS ECU monitors the wheel speed sensor signal continuously. This code is set when the sensor air gap is out of specified range or when No wheel speed signals within 10 ms to 20 ms at a vehicle speed > 43.2 km/h(26 MPH) . Warning lamp is turned OFF if the detected fault is not more than when the IG KEY is turned to ON again, and wheel speeds are more than 12 Km/h (7MPH)

DTC DETECTING CONDITION

Item	Detecting Condition		Possible cause
DTC Strategy	Signal monitoring		
CASE 1	Monitoring period	Continuous except no under voltage is detected.	
	Enable Conditions	The test detects a failure if one (or two) wheel are at Vmin(2.75 km/h ;1.7 MPH) and the other wheels are above 12 km/h for longer than 1s.A fault could also be set during driving, if the vehicle accelerates 18 km/h after a particular wheel speed gets to vmin(2.75 km/h ;1.7 MPH) and stays there. This monitoring	

		could only detect singular faults.	
CASE 2	Monitoring period	Continuous except no under voltage is detected.	
	Enable Conditions	No wheel speed signals within 10 ms to 20 ms at a vehicle speed > 12 m/s (43,2 km/h). If the dynamic sensor monitor responses, the failures will be stored into failure memory immediately after a waiting period of 60 ms.	
CASE 3	Monitoring period	• The main monitor (λ5) needs additional information of the ESP-sensors and is active for a velocity > 20 km/h(12 MPH) and no under voltage(9.2 V) is detected. • The backup monitor (λ6) manages with the wheel speeds alone.	• Improper installation of wheel speed sensor • Abnormal Rotor and wheel bearing • Faulty Wheel speed sensor • Faulty HECU
	Enable Conditions	• The main monitor (λ5): If the maximum difference of wheel speeds related to maximum wheel speed exceeds 5% a wheel specific wheel speed sensor fault is set. - the above conditions apply for 20s for 1 defective WSS. - the above conditions apply for 40s for 2 defective WSS. • The backup monitor (λ6):If the velocity is higher than 50 km/h(31 MPH), the deviation between the fastest and the slowest wheel must exceeds 6% related to the fastest wheel. If the velocity is below 50 km/h(31 MPH), the deviation must exceed an absolute value of 3 km/h(1.8 MPH) . - detection filter time : normally 20s	
Effect	Due to faulty wheel speed information the control of the corresponding wheel is no longer possible. reaction of the controller: If a sensor fault occurs on a front wheel, pressure is increased; on a rear wheel, pressure is decreased		

MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 50km/h or more(31mph or more) Monitor the "Wheel speed sensor" parameter on the Scantool.

   Specification : Approx. 50 km/h or more(31 mph or more)

   Is it normal?

   YES

   ▸ Fault is intermittent caused by faulty wheel speed sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Repair or replace as necessary and then go to "Component Inspection" procedure.

   NO

   (1) Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure.

   (2) Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure.

   (3) Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 50 km/h or more(31 mph or more).
   Does warning lamp remain On?

YES

▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Fault is intermittent caused by open or short of wheel speed sensor harness, faulty wheel speed sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.(Start and drive vehicle in gear and maintain vehicle speed is approx. 50km/h or more(31mph or more)).
   Are any DTCs present ?

YES

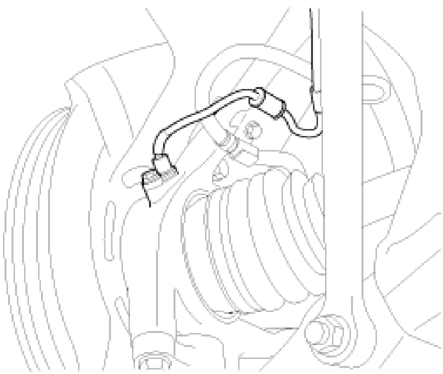
▸ Go to the applicable troubleshooting procedure.

NO

▸ A system performs normally at this time.

Brake System > Troubleshooting > C1209

COMPONENT LOCATION



GENERAL DESCRIPTION

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is an active hall-sensor type and good at temperature and noise charicteristic. Digital wave is produced as tone wheel rotate according as hall sensor principle. Frequency of duty wave is changed in proportion to rotation of tone wheel and HECU calculate vehicle speed by this frequency.

DTC DESCRIPTION

The ABS ECU monitors the wheel speed sensor circuit continuously. If the sensor signal current is continuously out of the specified range for 200msec, then the HECU determines that the circuit is open/short, and sets this code. Warning lamp is turned OFF if the detected fault is not more than when the IG KEY is turned to ON again, and wheel speeds are more than 10 Km/h(6 MPH).

DTC DETECTING CONDITION

Item	Detecting Condition		Possible cause
DTC Strategy	Current Monitoring		
CASE 1	Monitoring period	Once after power up.	
		Wheel speed sensor test starts immediate after power. Especially shorts between WSS(Wheel speed sensor) lines and	

	Enable Conditions	shorts to UZ(ECU voltage supply) can be detected by switching single WSS channels in sequence. After end of test only the channels with no fault are switched on.	• Open or short of Wheel speed sensor circuit • Faulty Wheel speed sensor • Faulty HECU
CASE 2	Monitoring period	Continuous	
	Enable Conditions	The sensor circuitry has two current levels I = 7 mA and I= 14mA. If the sensor line is broken, shorted to ground or shorted to supply voltage a faulty current level will be detected.WSS line faults are detected, if the fault condition exists uninterrupted for t >= 200 ms.	
Effect	No correct WSS Signal can be generated. Control of the corresponding wheel is no longer possible. If a sensor fault occurs on a front wheel, pressure is increased; on a rear wheel, pressure is decreased (until switch off).		

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

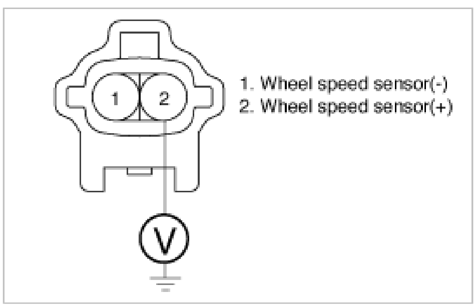
NO

▸ Go to the next step.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal "2" of the wheel speed sensor harness connector and chassis ground.

Specification : approx. B+



Is the measured voltage within specifications?

YES

▸ Go to "Signal Circuit Inspection" procedure.

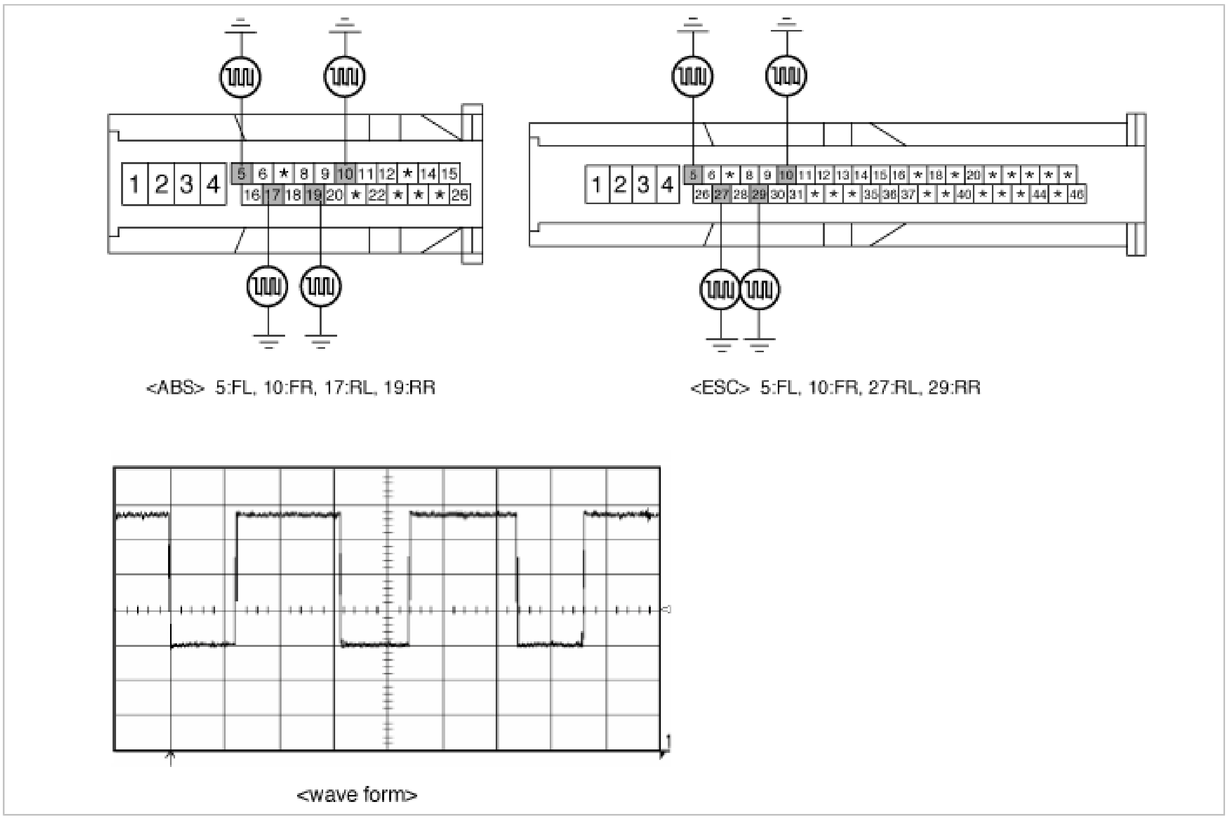
NO

▸ Check for open or short to GND in wheel speed sensor harness between terminal "16(ESP:26),9,6,8" of the HECU harness connector and terminal "2" of the Wheel speed sensor harness connector. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. By turning the wheel with hand.
3. Measure voltage between terminal "5,10,17(ESP:27),19(ESP:29)" of the HECU harness connector and chassis ground.

Specification : High : 0.89 ~ 1.26 V , Low : 0.44 ~ 0.63 V



Is the measured voltage within specifications?

YES

▸Go to "Component Inspection" procedure.

NO

▸ Check for open or short to GND in wheel speed sensor harness between terminal "1" of the wheel speed sensor harness connector and terminal "5,10,17(ESP:27),19(ESP:29)" of the HECU harness connector. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 10km/h or more(6mph or more).
   Does warning lamp remain On?

YES

▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected,replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Fault is intermittent caused by open or short of wheel speed sensor harness, faulty wheel speed sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.(Start and drive vehicle in gear and maintain vehicle speed is approx. 10 km/h or more(6 mph or more))
   Are any DTCs present?

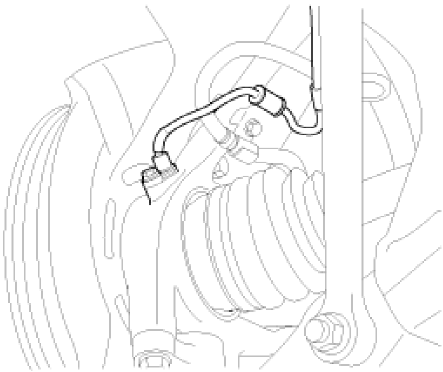
YES

▸ Go to the applicable troubleshooting procedure.

NO

▸ A system performs normally at this time.

COMPONENT LOCATION



GENERAL DESCRIPTION

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is an active hall-sensor type and good at temperature and noise charicteristic. Digital wave is produced as tone wheel rotate according as hall sensor principle. Frequency of duty wave is changed in proportion to rotation of tone wheel and HECU calculate vehicle speed by this frequency.

DTC DESCRIPTION

The ABS ECU monitors the wheel speed sensor signal continuously. This code is set if an abnormal speed change ratio is detected while the vehicle speed is 10~80 Km/h(6~50 MPH). Warning lamp is turned OFF if the detected fault is not more than when the IG KEY is turned to ON again, and wheel speeds are more than 12 Km/h(7MPH).

DTC DETECTING CONDITION

<table>
<tr><th>Item</th><th colspan="2">Detecting Condition</th><th>Possible cause</th></tr>
<tr><td>DTC Strategy</td><td colspan="2">Current Monitoring</td><td rowspan="6">• mproper installation of wheel speed sensor
• Abnormal Rotor and wheel bearing
• Faulty Wheel speed sensor
• Faulty HECU</td></tr>
<tr><td rowspan="2">CASE 1</td><td>Monitoring period</td><td>The monitoring is active from 10 km/h to 80km/h(6~50 MPH) and if no ABS-control is active at a front wheel and a rear wheel.</td></tr>
<tr><td>Enable Conditions</td><td>Every time, if a gap in the wheel speed sensor signal occurs cyclically with one wheel rotation, a fault counter is increased by one.
If the fault counter exceeds its limit of 10, a wheel specific fault is stored in the EEPROM.</td></tr>
<tr><td rowspan="2">CASE 2</td><td>Monitoring period</td><td>Continuous if V_Vehicle > 12 m/s</td></tr>
<tr><td>EnableConditions</td><td>No wheel speed signals within 10 ms to 20 ms at a vehicle speed> 12 m/s (43.2 km/h, 27MPH). If the dynamic sensor monitor responses, the failures will be stored into failure memory immediately after a waiting period of 60ms.</td></tr>
<tr><td>Effect</td><td colspan="2">Due to faulty wheel speed information the control of the corresponding wheel is no longer possible.
reaction of the controller: If a sensor fault occurs on a front wheel, pressure is increased; on a rear wheel, pressure is decreased.</td></tr>
</table>

MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC)
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 40 km/h or more(24 mph or more) Monitor the "Wheel

speed sensor" parameter on the Scantool.

Specification : Approx. 12 km/h or more(7 mph or more)

Is it normal?

YES

▸ Fault is intermittent caused by faulty wheel speed sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Repair or replace as necessary and then go to "Component Inspection" procedure.

NO

(1) Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure.

(2) Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure.

(3) Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 12 km/h or more(7 mph or more).
   Does warning lamp remain On?

YES

▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Fault is intermittent caused by open or short of wheel speed sensor harness, faulty wheel speed sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.(Start and drive vehicle in gear and maintain vehicle speed is approx. 12 km/h or more(7 mph or more))
   Are any DTCs present ?

YES

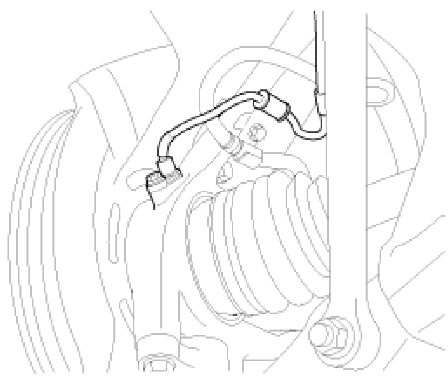
▸ Go to the applicable troubleshooting procedure.

NO

▸ A system performs normally at this time.

Brake System > Troubleshooting > C1211

COMPONENT LOCATION



GENERAL DESCRIPTION

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is an active hall-sensor type and good at temperature and noise charicteristic. Digital wave is produced as tone wheel rotate according as hall sensor principle. Frequency of duty wave is changed in proportion to rotation of tone wheel and HECU calculate vehicle speed by this frequency.

DTC DESCRIPTION

The ABS ECU monitors the wheel speed sensor signal continuously. This code is set when the sensor air gap is out of specified range or when No wheel speed signals within 10 ms to 20 ms at a vehicle speed > 43.2 km/h(26 MPH) . Warning lamp is turned OFF if the detected fault is not more than when the IG KEY is turned to ON again, and wheel speeds are more than 12 Km/h (7MPH)

DTC DETECTING CONDITION

Item	Detecting Condition		Possible cause
DTC Strategy	Signal monitoring		• Improper installation of wheel speed sensor • Abnormal Rotor and wheel bearing • Faulty Wheel speed sensor • Faulty HECU
CASE 1	Monitoring period	Continuous except no under voltage is detected.	
	Enable Conditions	The test detects a failure if one (or two) wheel are at Vmin(2.75 km/h ;1.7 MPH) and the other wheels are above 12 km/h for longer than 1s.A fault could also be set during driving, if the vehicle accelerates 18 km/h after a particular wheel speed gets to vmin(2.75 km/h ;1.7 MPH) and stays there. This monitoring could only detect singular faults.	
CASE 2	Monitoring period	Continuous except no under voltage is detected.	
	Enable Conditions	No wheel speed signals within 10 ms to 20 ms at a vehicle speed > 12 m/s (43,2 km/h). If the dynamic sensor monitor responses, the failures will be stored into failure memory immediately after a waiting period of 60 ms.	
CASE 3	Monitoring period	• The main monitor (λ5) needs additional information of the ESP-sensors and is active for a velocity > 20 km/h(12 MPH) and no under voltage(9.2 V) is detected. • The backup monitor (λ6) manages with the wheel speeds alone.	
	Enable Conditions	• The main monitor (λ5): If the maximum difference of wheel speeds related to maximum wheel speed exceeds 5% a wheel specific wheel speed sensor fault is set. - the above conditions apply for 20s for 1 defective WSS. - the above conditions apply for 40s for 2 defective WSS. • The backup monitor (λ6):If the velocity is higher than 50 km/h(31 MPH), the deviation between the fastest and the slowest wheel must exceeds 6% related to the fastest wheel. If the velocity is below 50 km/h(31 MPH), the deviation must exceed an absolute value of 3 km/h(1.8 MPH) . - detection filter time : normally 20s	
Effect	Due to faulty wheel speed information the control of the corresponding wheel is no longer possible. reaction of the controller: If a sensor fault occurs on a front wheel, pressure is increased; on a rear wheel, pressure is decreased		

MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).

2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 50km/h or more(31mph or more) Monitor the "Wheel speed sensor" parameter on the Scantool.

Specification : Approx. 50 km/h or more(31 mph or more)

Is it normal?

YES

▸ Fault is intermittent caused by faulty wheel speed sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Repair or replace as necessary and then go to "Component Inspection" procedure.

NO

(1) Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure.

(2) Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure.

(3) Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 50 km/h or more(31 mph or more).
   Does warning lamp remain On?

YES

▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Fault is intermittent caused by open or short of wheel speed sensor harness, faulty wheel speed sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.(Start and drive vehicle in gear and maintain vehicle speed is approx. 50km/h or more(31mph or more)).
   Are any DTCs present ?

YES

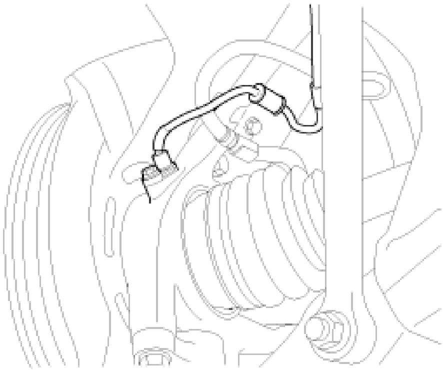
▸ Go to the applicable troubleshooting procedure.

NO

▸ A system performs normally at this time.

Brake System > Troubleshooting > C1213

COMPONENT LOCATION



GENERAL DESCRIPTION

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is an active hall-sensor type and good at temperature and noise charicteristic. Digital wave is produced as tone wheel rotate according as hall sensor principle. Frequency of duty wave is changed in proportion to rotation of tone wheel and HECU calculate vehicle speed by this frequency.

DTC DESCRIPTION

The ABS ECU monitors the wheel speed sensor signal continuously. The monitoring reports a failure if the ABS target slip breaks out.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	Signal monitoring	• Improper installation of wheel speed sensor • Abnormal Rotor and wheel bearing • Faulty Wheel speed sensor • Faulty HECU
Enable Conditions	The monitoring reports a failure if the ABS target slip is exceeded for a time period >= 10 s at one or more wheels. If the driver brakes or the velocity is lower than 50 km/h(31 MPH) the detection time is enlarged to 60s.	
Monitoring period	Continuous	
Effect	Reduced function of the ESC system.	

MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 10 km/h or more(6 mph or more). Monitor the "Wheel speed sensor" parameter on the Scantool.

Specification : Approx.10 km/h or more(6 mph or more)

Is it normal?

YES

▸ Fault is intermittent caused by faulty wheel speed sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Repair or replace as necessary and then go to "Component Inspection" procedure.

NO

(1) Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure.

(2) Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure.

(3) Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 10 km/h or more(6 mph or more).
   Does warning lamp remain On?

   YES

   ▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Fault is intermittent caused by open or short of wheel speed sensor harness, faulty wheel speed sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.(Start and drive vehicle in gear and maintain vehicle speed is approx. 10 km/h or more(6 mph or more))
   Are any DTCs present?

   YES

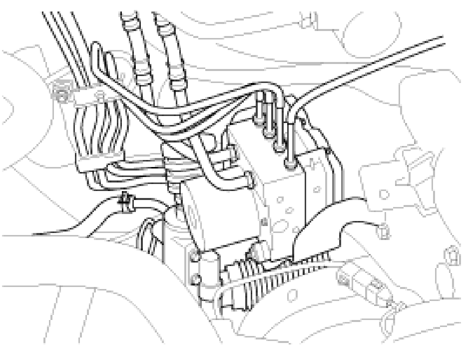
   ▸ Go to the applicable troubleshooting procedure.

   NO

   ▸ System performing to specification at this time.

Brake System > Troubleshooting > C1235

COMPONENT LOCATION



GENERAL DESCRIPTION

The pressure sensor senses the brake oil pressure to judge driver's brake intention when ESC is operating.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible cause
DTC Strategy		Signal monitoring	
		1. Sensor supply voltage is continuous monitored (except power on). A sensor supply failure is detected if Sensor Supply Voltage > 5.3 V OR Sensor Supply Voltage < 4.7 V for t ≥ 60 ms. 2. Pressure signal 1 (DSO: original pressure value) is continuous monitored (except power on). Line faults like open, short to GND or short to UZ are detected. A Fault is	

<table>
<tr><td rowspan="2">C1235</td><td>Enable Conditions</td><td>set if the DSO signal is U DSO > 4.7 V OR U DSO < 0.3 V for a time t >= 100 ms.
3. Pressure signal 2 (DSI: inverted pressure value) is continuous monitored (except power on). Line faults like open, short to GND or short to UZ are detected. A Fault is set if the DSI signal isU DSI > 4.7 V OR U DSI < 0.3 V for a time t >= 100 ms.
4. Plausibility of DSO and DSI pressure lines are continuous monitored.Internal DS5 faults (amplification-, bridge-, analog-digital converter malfunction, etc.) are detected if DSO+DSI < 4.5 V OR DSO+DSI > 5.5 V is present longer than t >= 100 ms .
5. POS(Power On Selftest) detects internal sensor malfunctions. sensor element, amplification, etc.) The test phase is divided in two 60 ms parts. DSO signal must be <0.5 V for 30 ms. In phase 2 DSO signal must be between 1.9 V and 3.1V for also 30 ms then the POS Test is passed. The test phase is divided in two 60 ms parts. DSO and DSI signal must be < 0.5 V for 30 ms. In phase 2 DSO and DSI signal must be between 1.9 V and 3.1 V for also 30 ms then the POS Test is passed.</td><td rowspan="5">• Faulty HECU</td></tr>
<tr><td>Monitoring period</td><td>1~4 : Continuous
5 : Once during Power Up</td></tr>
<tr><td rowspan="2">C1237</td><td>Enable Conditions</td><td>1. The DS(Pressure sensor)-offset value must be in the range of 15 bar. A failure is detected if this range is exceeded.
2. There are three monitoring which have different thresholds concerning the allowed pressure and the detection time.
1) Plausibility 1 :
For redundancy reasons an additional hardware-BLS-signal is created by the pressure sensor signal.
If the pressure sensor is compensated, the threshold for generating the hardware-BLS or signal is 10 bar.
If the pressure sensor is not compensated, the threshold is increased by 15 bar.
If this signal is set without any hardware-BLS-signals being set, and if no pump is operated during that time, a fault is set after the braking.
2) Plausibility 2 :
If the pressure signal is higher than 30 bar and not both of the hardware-BLS are set, a fault is stored after 2s.
3) Plausibility 3:
If the pressure signal is higher than 80 bar and not both of the hardware-BLS are set, a fault is stored after 1s.</td></tr>
<tr><td>Monitoring period</td><td>1. After DS-initialization, no under voltage, no pumps are running and no BLS-signal is set.
2. Continuous in the normal operating voltage range.</td></tr>
<tr><td colspan="2">Effect</td><td>No Pressure Signal available.</td></tr>
</table>

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
   Does warning lamp remain On?

YES

▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.
   Are any DTCs present?

YES

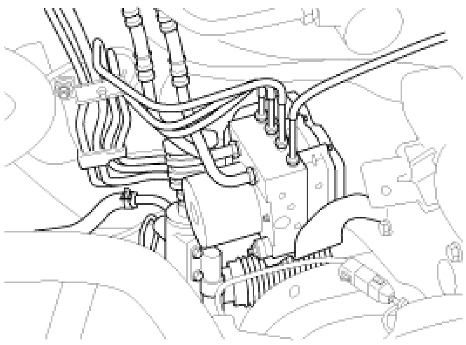
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Brake System > Troubleshooting > C1237

COMPONENT LOCATION



GENERAL DESCRIPTION

The pressure sensor senses the brake oil pressure to judge driver's brake intention when ESP is operating.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible cause
DTC Strategy		Signal monitoring	
C1235	Enable Conditions	1. Sensor supply voltage is continuous monitored (except power on). A sensor supply failure is detected if Sensor Supply Voltage > 5.3 V OR Sensor Supply Voltage < 4.7 V for t ≥ 60 ms. 2. Pressure signal 1 (DSO: original pressure value) is continuous monitored (except power on). Line faults like open, short to GND or short to UZ are detected. A Fault is set if the DSO signal is U DSO > 4.7 V OR U DSO < 0.3 V for a time t >= 100 ms. 3. Pressure signal 2 (DSI: inverted pressure value) is continuous monitored (except power on). Line faults like open, short to GND or short to UZ are detected. A Fault is set if the DSI signal isU DSI > 4.7 V OR U DSI < 0.3 V for a time t >= 100 ms. 4. Plausibility of DSO and DSI pressure lines are continuous monitored.Internal DS5 faults (amplification-, bridge-, analog-digital converter malfunction, etc.) are detected if DSO+DSI < 4.5 V OR DSO+DSI > 5.5 V is present longer than t >= 100 ms . 5. POS(Power On Selftest) detects internal sensor	

		malfunctions. sensor element, amplification, etc.) The test phase is divided in two 60 ms parts. DSO signal must be <0.5 V for 30 ms. In phase 2 DSO signal must be between 1.9 V and 3.1V for also 30 ms then the POS Test is passed. The test phase is divided in two 60 ms parts. DSO and DSI signal must be < 0.5 V for 30 ms. In phase 2 DSO and DSI signal must be between 1.9 V and 3.1 V for also 30 ms then the POS Test is passed.	
	Monitoring period	1~4 : Continuous 5 : Once during Power Up	
C1237	Enable Conditions	1. The DS(Pressure sensor)-offset value must be in the range of 15 bar. A failure is detected if this range is exceeded. 2. There are three monitoring which have different thresholds concerning the allowed pressure and the detection time. 1) Plausibility 1 : For redundancy reasons an additional hardware-BLS-signal is created by the pressure sensor signal. If the pressure sensor is compensated, the threshold for generating the hardware-BLS or signal is 10 bar. If the pressure sensor is not compensated, the threshold is increased by 15 bar. If this signal is set without any hardware-BLS-signals being set, and if no pump is operated during that time, a fault is set after the braking. 2) Plausibility 2 : If the pressure signal is higher than 30 bar and not both of the hardware-BLS are set, a fault is stored after 2s. 3) Plausibility 3: If the pressure signal is higher than 80 bar and not both of the hardware-BLS are set, a fault is stored after 1s.	• Faulty HECU
	Monitoring period	1. After DS-initialization, no under voltage, no pumps are running and no BLS-signal is set. 2. Continuous in the normal operating voltage range.	
Effect		No Pressure Signal available.	

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
   Does warning lamp remain On?

   YES

   ▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.
   Are any DTCs present?

   YES

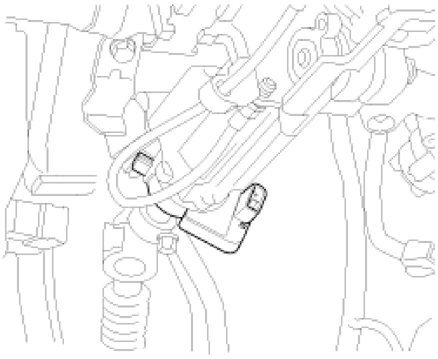
   ▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Brake System > Troubleshooting > C1260

COMPONENT LOCATION



DTC DESCRIPTION

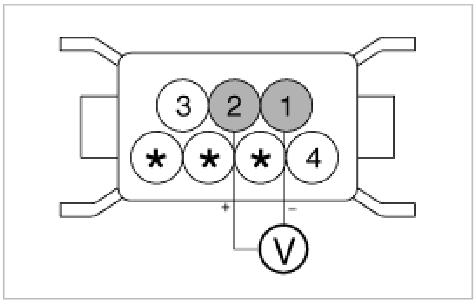
The Steering wheel angle sensor determines the direction of the rotation.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	Signal monitoring	• Faulty steering wheel sensor
Enable Conditions	1. LWS(steering angle sensor) offset monitoring : If the offset value exceeds a threshold of approximately 15 deg a LWS-fault is determined. 2. LWS Gradient monitoring : - signal gradient (steering angle velocity) from one 20 ms-cycle to another is higher than 40° or - change of this gradient (steering angle acceleration) is higher than 15° 3. LWS range monitoring : If value is higher than possible range for more than 300 ms a fault is determined. 4. LWS Plausibility monitoring : Dependent on the driving conditions failures in size of [10 + 60 m/s / FZREF(reference speed] deg at steering angle are recognized within 400 .. 4800 ms . 5. LWS Constant Signal Monitoring : If there is no change in the signal, but a right AND left cornering has been recognized, a fault is determined. (lateral acceleration > 2 m/s^2 in combination with a yaw rate > 6 °/s in both directions). 6. LWS Wrong Sign Monitoring : If the signals don't fit and forwards driving is detected, a fault is determined. 7. LWS Message counter monitoring : If the message counter shows an increase higher than 3 or lower than 1 in one 20 ms-cyle, a fault is stored after 160 ms.	
Monitoring period	1. Continuous during driving. 2. no under voltage and at least one LWS-message was sent in the current 20 ms-cycle. 3. After initialization and no under voltage detected. 4. Continuous during driving. 5. Initialization once in every ignition cycle. 6,7. Continuous during driving.	
Effect	Reduced controller function caused by faulty LWS signal.	

POWER SUPPLY CIRCUIT INSPECTION

1. Measure the voltage between terminal 1 and 2 of the steering angle sensor connector.



Is the voltage within 8~16V?

YES

▸ Clear the DTC, and then drive a vehicle over 40 Km/h(24 MPH) .If ESC warning lamp is turned on, replace the steering wheel sensor. Then go to "Verification of Vehicle Repair" procedure.

NO

▸ Check harness and connector between the HECU and the steering angle sensor. If NG ,replace the steering wheel sensor.

COMPONENT INSPECTION

1. CHECK INSTALLATION OF STEERING ANGLE SENSOR
   Check if the steering angle sensor is properly installed.
   Is the installation proper?

YES

▸ Check power of steering angle sensor.

NO

▸ Reinstall the steering angle sensor properly.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and practice the steering angle sensor calibration.(See page BR-161).
2. Select "Diagnostic Trouble Codes(DTCs)" mode.
3. Using a scantool, Clear DTC.
4. Operate the vehicle within DTC Detecting Condition in General Information.
   Are any DTCs present?

YES

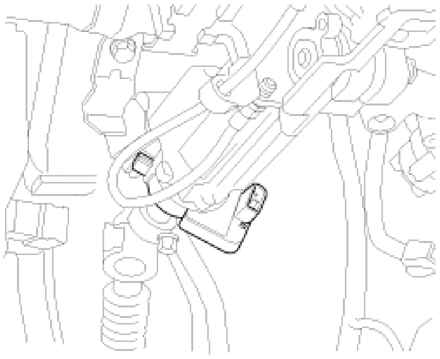
▸ Go to the applicable troubleshooting procedure.

NO

▸ A system performs normally at this time.

Brake System > Troubleshooting > C1261

COMPONENT LOCATION



DTC DESCRIPTION

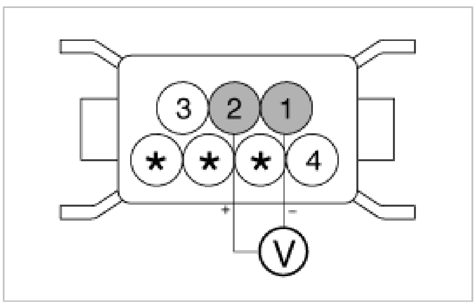
The Steering wheel angle sensor determines the direction of the rotation.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	Signal monitoring	• Faulty steering wheel sensor
Enable Conditions	1. LWS(steering angle sensor) offset monitoring : If the offset value exceeds a threshold of approximately 15 deg a LWS-fault is determined. 2. LWS Gradient monitoring : - signal gradient (steering angle velocity) from one 20 ms-cycle to another is higher than 40° or - change of this gradient (steering angle acceleration) is higher than 15° 3. LWS range monitoring : If value is higher than possible range for more than 300 ms a fault is determined. 4. LWS Plausibility monitoring : Dependent on the driving conditions failures in size of [10 + 60 m/s / FZREF(reference speed] deg at steering angle are recognized within 400 .. 4800 ms . 5. LWS Constant Signal Monitoring : If there is no change in the signal, but a right AND left cornering has been recognized, a fault is determined. (lateral acceleration > 2 m/s² in combination with a yaw rate > 6 °/s in both directions). 6. LWS Wrong Sign Monitoring : If the signals don't fit and forwards driving is detected, a fault is determined. 7. LWS Message counter monitoring : If the message counter shows an increase higher than 3 or lower than 1 in one 20 ms-cyle, a fault is stored after 160 ms.	
Monitoring period	1. Continuous during driving. 2. no under voltage and at least one LWS-message was sent in the current 20 ms-cycle. 3. After initialization and no under voltage detected. 4. Continuous during driving. 5. Initialization once in every ignition cycle. 6,7. Continuous during driving.	
Effect	Reduced controller function caused by faulty LWS signal.	

POWER SUPPLY CIRCUIT INSPECTION

1. Measure the voltage between terminal 1 and 2 of the steering angle sensor connector.



Is the voltage within 8~16 V?

YES

▸ Clear the DTC, and then drive a vehicle over 40 Km/h(24 MPH) .If ESP warning lamp is turned on, replace the steering wheel sensor. Then go to "Verification of Vehicle Repair" procedure.

NO

▸ Check harness and connector between the HECU and the steering angle sensor. If NG ,replace the steering wheel sensor.

COMPONENT INSPECTION

1. CHECK INSTALLATION OF STEERING ANGLE SENSOR
   Check if the steering angle sensor is properly installed.
   Is the installation proper?

YES

▸ Check power of steering angle sensor.

NO

▸ Reinstall the steering angle sensor properly.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and practice the steering angle sensor calibration.(See page BR-161).
2. Select "Diagnostic Trouble Codes(DTCs)" mode.
3. Using a scantool, Clear DTC.
4. Operate the vehicle within DTC Detecting Condition in General Information.
   Are any DTCs present?

YES

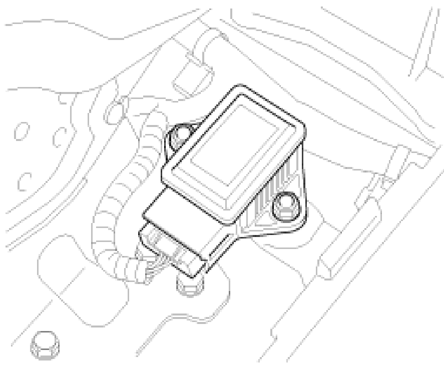
▸ Go to the applicable troubleshooting procedure.

NO

▸ A system performs normally at this time.

Brake System > Troubleshooting > C1282

COMPONENT LOCATION



GENERAL DESCRIPTION

The yaw-rate & Lateral G sensor are used for the stability of a vehicle. The yaw-rate is used to measure angular velocity while the Lateral G is to measure the force that moves the vehicle away from the center, when a vehicle is cornering.

DTC DESCRIPTION

This code sets when there is an open or short in the circuit of the yaw-rate & lateral G sensor.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	Signal monitoring	• Open or short of Yaw Rate & Lateral G sensor circuit • Faulty Yaw Rate & Lateral G sensor • Faulty HECU
Enable Conditions	1. The AY(Acceleration Sensor) sensor voltage is monitored for a is out of range value. A line fault is detected if AY < 0.3 V OR AY > 4.7 V for a time t >= 100 ms.. 2. Open line, short to GND and short to UZ are detected. The DRS sensor voltage is monitored for a is out of range value. A line fault is detected, if - DRSS < 0.225 V OR DRSS > 4.774 V for a time t >= 100 ms. - DRSR < 2.1 V OR DRSR > 2.9 V for a time t > 200 ms. ※DRSS (Yaw sensor reference), DRS(yaw sensor), DRSR(Yaw sensor signal)	
Monitoring period	Continuous	
Effect	Reduced controller function caused by faulty DRS and AY signal.	

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

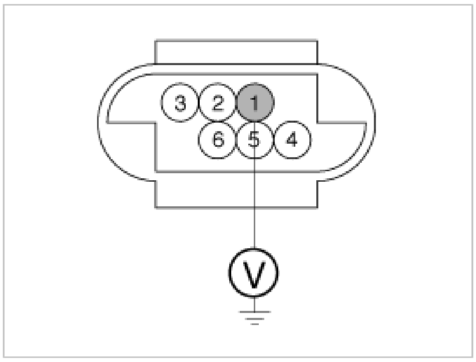
NO

▸ Go to the next step.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal "1" of the Yaw Rate & Lateral G sensor harness connector and chassis ground.

Specification : approx. B+



Is the measured voltage within specifications?

YES

▸ Go to "Ground Circuit Inspection" procedure.

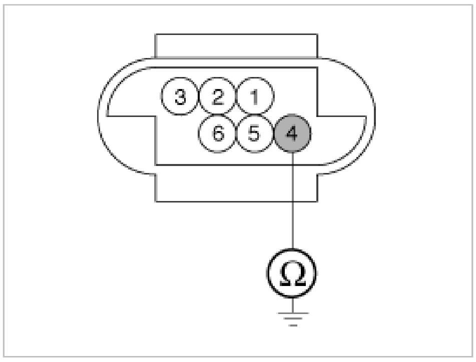
NO

▸ Check for open or short to GND in the Yaw Rate & Lateral G sensor harness between terminal "3" of the Yaw Rate & Lateral G sensor harness connector and terminal "16,20" of the HECU harness connector. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect Yaw Rate & Lateral G sensor connector
3. Measure resistance between terminal "4" of the Yaw Rate & Lateral G sensor harness connector and chassis ground.

Specification : Approx. below 1 Ω



Is the measured resistance within specifications?

YES

▸ Go to "Signal Circuit Inspection" procedure.

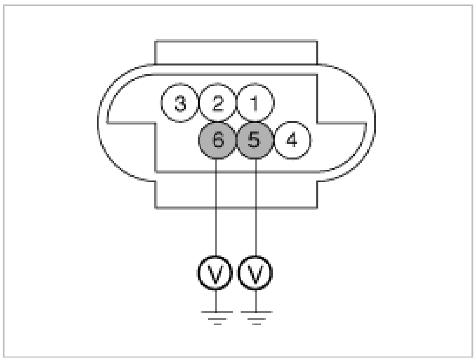
NO

▸ Check for open or short in the Yaw Rate & Lateral G sensor harness between terminal "4" of the Yaw Rate & Lateral G sensor harness connector and terminal "15" of the HECU harness connector. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Ignition "ON".
2. Measure voltage between terminal "5, 6" of the Yaw Rate & Lateral G sensor harness connector and chassis ground.

Specification : Approx. 2.5 V



Is the measured voltage within specifications?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Check for open or short in the Yaw Rate & Lateral G sensor harness between terminal "5, 6" of the Yaw Rate & Lateral G sensor harness connector and terminal "16, 20" of the HECU harness connector. Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
   Does warning lamp remain On?

YES

▸ Substitute with a known-good Yaw Rate & Lateral G sensor and check for proper operation. If problem is corrected, replace Yaw Rate & Lateral G sensor and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Fault is intermittent caused by open or short of Yaw Rate & Lateral G sensor harness and/or faulty Yaw Rate & Lateral G sensor or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.
   Are any DTCs present?

YES

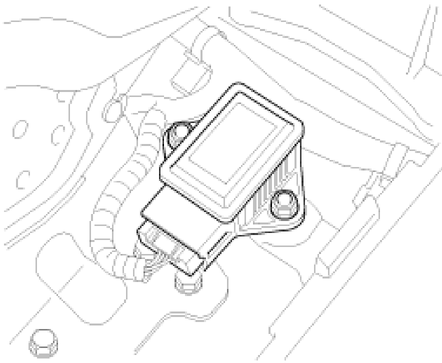
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Brake System > Troubleshooting > C1283

COMPONENT LOCATION



GENERAL DESCRIPTION

The yaw-rate & Lateral G sensor are used for the stability of a vehicle. The yaw-rate is used to measure angular velocity while the Lateral G is to measure the force that moves the vehicle away from the center, when a vehicle is cornering.

DTC DESCRIPTION

This code sets when there is an open or short in the circuit of the yaw-rate & lateral G sensor.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	Signal monitoring	• Faulty Lateral Acceleration Sensor • Faulty Yaw Rate Sensor • Faulty HECU
EnableConditions	This test detects internal AY(Acceleration sensor) sensor malfunctions. 1. During the POS measure window (t = 100 ms) the AY signal must be for at least t = 60 ms between 0.2 V < AY < 0.8 V 2. If during stable vehicle behavior an AY-Failure larger than approximately 2.5 m/s occurs, the ESP controller will disregard the AY sensor information so that a false ESP intervention is prevented. A fault is recognized after 1.6 s during model validity. 3. If the offset value exceeds a threshold of approximately 2.25 m/s^2 an AY fault is determined. 4. During standstill the plausible range of |AY| is below 7 m/s^2. If the filtered value of |AY| is larger than 7 m/s^2 for more than 400 m/s a fault is set. 5. If the lateral acceleration is higher than 15 m/s^2 for more than 800 ms a suspected failure bit is set. After 1,6 s a fault is detected. 6. Standstill compensation: Failure threshold 5.25 °/s.Fast compensation (during driving if no standstill compensation could be completed): Failure threshold is 7,5 °/s.Long-term ("normal") compensation (during driving after succeeded standstill or fast offset compensation): Failure threshold is 7,5 °/s. 7. The fault criteria is approx. 25 % sensitivity failure. 8. If the measured yaw rate deviates more than 2.5 °/s plus a dynamicthreshold from the reference yaw rate during model validity, a failure isrecognized after 1.6 s. The dynamic threshold is between 2.5 °/s and more than 5 °/s. A typical value is 3 °/s. 9. The measured yaw rate and the model yaw rates, calculated from theWSS and LWS are compared. If the signals doesn.t fit and forward driving is recognized, a fault is determined. 10. In case of a YRS-failure, the YRS will send an abnormal yaw rate signal.	
Monitoring period	1. Once after power up and no low voltage. 2,3,8. Continuous during stable driving. 4. Continuous during standstill. 5. Continuous, if no under voltage is detected. 6. Continuous, dependent on driving situation. 7. During stable cornering after completed offset compensation. 9. After every standstill 10. Continuous	

Effect	Reduced controller function caused by faulty DRS(yaw sensor) signal.	

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

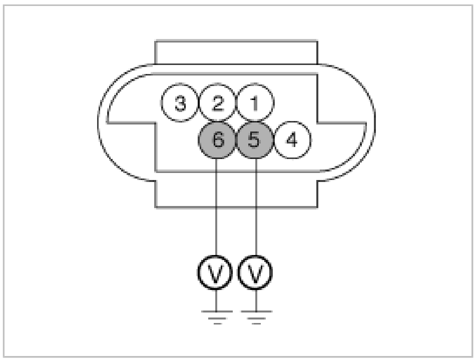
NO

▸ Go to the next step.

SIGNAL CIRCUIT INSPECTION

1. Ignition "ON".
2. Measure voltage between terminal "5, 6" of the Yaw Rate & Lateral G sensor harness connector and chassis ground.

Specification : Approx. 2.5 V



Is the measured voltage within specifications?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Check for open or short in the Yaw Rate & Lateral G sensor harness between terminal "5, 6" of the Yaw Rate & Lateral G sensor harness connector and terminal "16, 20" of the HECU harness connector. Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 20 km/h or more(12 mph or more)
   Does warning lamp remain On?

YES

▸ Substitute with a known-good Yaw Rate & Lateral G sensor and check for proper operation. If problem is corrected, replace Yaw Rate & Lateral G sensor and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Fault is intermittent caused by open or short of Yaw Rate & Lateral G sensor harness and/or faulty Yaw Rate & Lateral G sensor or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.(Start and drive vehicle in gear and maintain vehicle speed is approx. 20 km/h or more(12 mph or more))

Are any DTCs present?

YES

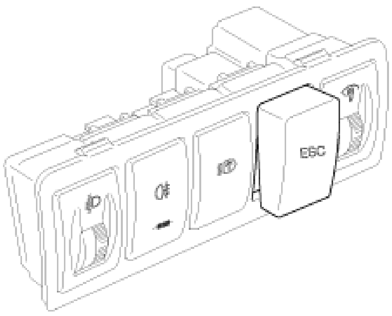
▸ Go to the applicable troubleshooting procedure.

NO

▸ A system performs normally at this time.

Brake System > Troubleshooting > C1503

COMPONENT LOCATION



GENERAL DESCRIPTION

Driver can inhibit the ESC control by ESC switch. When switch signal send into HECU, ESC warning lamp go ON and ESC control is stopped and if next switch signal is inputted again, ESC control is ready. This function is used for sporty driving or vehicle inspection.

DTC DESCRIPTION

Trouble code is set when the condition that the level of ESC switch is high is continued for 60sec.When the ESC switch failure is set there is no signal in the warning lamp and HECU inhibit the ESC control and allow the ABS/EBD control.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	Short circuit monitoring	• Open or short ESC switch
Enable Conditions	Trouble code is set when the condition that the level of ESC switch is high is continued for 60 sec.	
Monitoring period	Continuous	

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

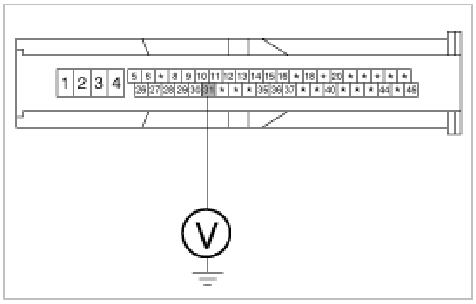
NO

▸ Go to the next step.

SIGNAL CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF" & ESC Switch"ON".
2. Measure voltage between terminal "31" of the HECU harness connector and chassis ground.

Specification : Approx B+



Is the measured voltage within specifications?

YES

▸ Fault is intermittent caused by open or short in ESC switch line, faulty ESC switch or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

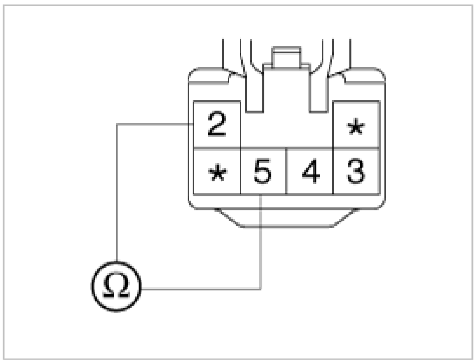
NO

▸ Check for damaged harness and poor connection in the power harness between the battery terminal(+) and the terminal "31" of the HECU harness connector . Check for open or blown 10A fuse referring to "Circuit Diagram" . Repair as necessary and then go to "Verification of vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Disconnect ESC switch connector.
3. Press the ESC switch.
4. Measure resistance between terminal "2" of the ESC switch harness connector and terminal "5" of the ESC switch harness connector.

Specification : Approx below 1 Ω



Is the measured resistance within specifications?

YES

▸ Fault is intermittent caused by faulty ESC switch or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

NO

▸ Substitute with a known-good ESC switch and check for proper operation. If problem is corrected, replace ESC switch and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.
   Are any DTCs present?

YES

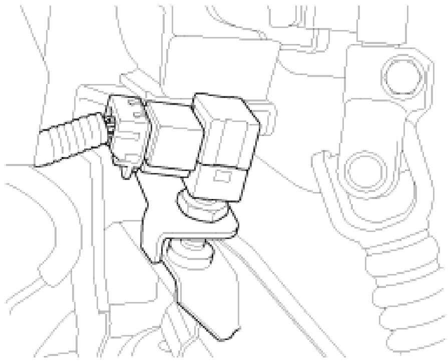
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Brake System > Troubleshooting > C1513

COMPONENT LOCATION



GENERAL DESCRIPTION

The brake light switch indicates brake pedal status to the ABS control unit. The switch is turned on when brake is depressed. The brake light switch is a normally-open contact which runs to battery voltage when active (brake depressed). When passive (brake not depressed), the cable is grounded via the break light bulbs.

DTC DESCRIPTION

The brake light signal is a reference to judge driver's will for braking. ABS ECU monitor open circuit of brake light switch for normal ABS control.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	Open circuit monitoring	• Open circuit in brake switch line • Faulty brake light switch • Faulty input stage in HECU
Enable Conditions	If the BLS-signals is high for 60 s, while the gas pedal is stepped, with vehicle speed > 3 m/s, offset compensated pVor < 5 bar and no control is active, a fault is set.	
Monitoring period	Continuous, if no under voltage is detected.	
Effect	Reduced function caused by a faulty brake light switch.	

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

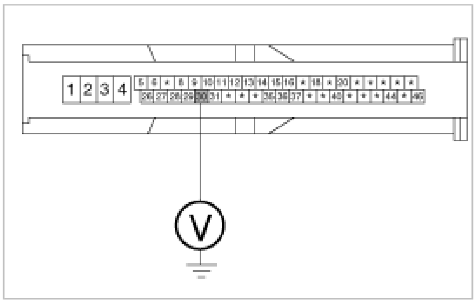
NO

▸ Go to the next step.

SIGNAL CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Press the brake pedal.
3. Measure voltage between the terminal "30" of the HECU harness connector and chassis ground.

Specification : Brake Light Switch - Approx. B+



Is the measured voltage within specifications?

YES

▸ Fault is intermittent caused by open harness in brake lamp switch and brake switch line, faulty brake lamp switch was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

NO

▸ Check for damaged harness and poor connection in the power harness between the battery terminal(+) and the terminal "30" of the HECU harness connector . Check for open or blown 15A STOP fuse. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

COMPONENT INSPECTION

1. Connect a ohmmeter to the connector of brake light switch, and check whether or not there is continuity when the plunger of the brake light switch is pushed in and when it is released.
   The switch is in good condition if there is no continuity when the plunger is pushed.
2. Is there no continuity when the plunger is pushed?

YES

▸ Fault is intermittent caused by open harness in brake light switch line, faulty brake lamp switch or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

NO

▸ Substitute with a known-good brake lamp switch and check for proper operation. If problem is corrected, replace brake lamp switch and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.
   Are any DTCs present?

YES

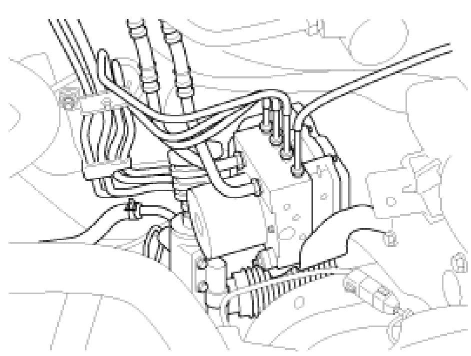
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Brake System > Troubleshooting > C1604

COMPONENT LOCATION



GENERAL DESCRIPTION

The HECU is composed of a ECU (Electronic Control Unit) and a HCU(Hydraulic Control Unit) , so the HECU hardware includes all solenoid valves inside the unit as well as the ECU.

DTC DESCRIPTION

The HECU monitors the operation of the IC components such as memory, register, A/D converter and so on. The HECU sets this code when the EEPROM data read by the master processor is different than prior data writed, or when the master/slave processor detects abnormal operation in RAM, Status Register, Interrupt, Timer, A/D converter or cycle time.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	Internal monitoring	• Faulty HECU
EnableConditions	1. Internal control unit failures of the Micro controller and peripheral integrated circuits will be continuous monitored for proper function. 2. After EEPROM-values have been read from EEPROM, the values are monitored for corrupt data. Failure is set if: 1) Checksum not correct or 2) PSW-EEPROM-Handler reported unknown failure during EEPROM-value reading. 3. Evaluate EEPROM reading sequence. If EEPROM reading sequence take longer then 3 s, a failure is set.	
Monitoring period	1.Continuos 2,3.directly after ignition on, during reading of EEPROM-values.	
Effect	No control is available.	

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
   Does warning lamp remain On?

   YES

   ▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.
   Are any DTCs present?

   YES

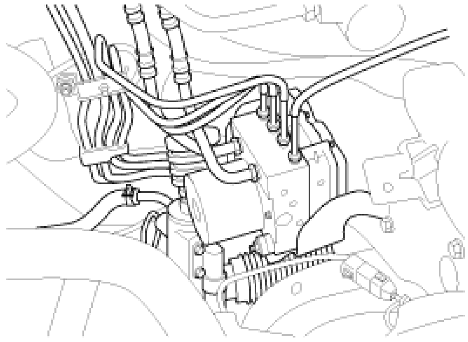
   ▸ Go to the applicable troubleshooting procedure.

   NO

   ▸ System performing to specification at this time.

Brake System > Troubleshooting > C1605

COMPONENT LOCATION



GENERAL DESCRIPTION

The CAN is for sending and receiving the information for TCS(ESC) control, between the HECU and EMS/TCU.

DTC DESCRIPTION

This code shows in case that there is an error on the CAN hardware. In this case, replace the HECU and check.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	CAN RAM monitoring	• Faulty HECU
Enable Conditions	1. Monitoring whether the initialization software has write access to the configuration registers of the CAN-controller module.Faults are detected immediately. 2. Monitoring includes line short to ground, line short to supply voltage and mutual line short. Line interruptions are detected by CAN message monitor.After detecting a BUSOFF failure the transmission is reinitialized. A BUSOFF fault is established if re-initialization is tried for 15 times in sequence without success.	
Monitoring period	1. immediate during start up. 2. Continuous	
Effect	1. CAN-Controller is not initialized correctly. Possibly no reception or transmission of messages. 2. CAN messages can not be processed. BLS is not controlled.	

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
   Does warning lamp remain On?

   YES

   ▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Fault is intermittent caused by short harness in CAN line and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.

3. Operate the vehicle within DTC Detecting Condition in General Information.
   Are any DTCs present?

   YES

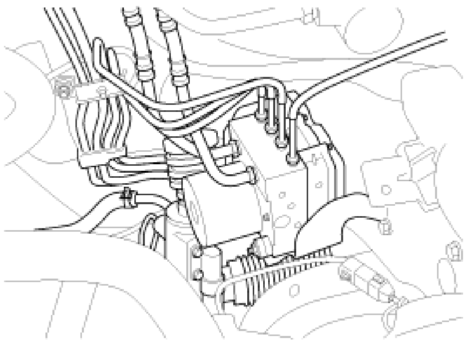
   ▸ Go to the applicable troubleshooting procedure.

   NO

   ▸ System performing to specification at this time.

Brake System > Troubleshooting > C1611

COMPONENT LOCATION



GENERAL DESCRIPTION

The CAN is for sending and receiving the information for TCS(ESC) control, between the HECU and EMS/TCU.

DTC DESCRIPTION

This code shows in case that there is an error on the CAN hardware. In this case, replace the HECU and check.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	CAN RAM monitoring	• Faulty HECU • Faulty ECM • Faulty TCU • Faulty Steering angle sensor
Enable Conditions	1. Purpose is to monitor if received message was not received by CAN controller of ABS8/ESC8 ECU.Faults are detected after filtering. Filtering has to be customized. 2. Purpose is to monitor if transmitted message has the expected data length.Actually the monitoring is reduced the check for too short messages.A message with oversized data length causes no fault. Faults are detected immediate.	
Monitoring period	Continuous	
Effect	1. CAN messages are not correct erceived. 2. CAN messages are not according to what was expected at compile time of the software.	

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
   Does warning lamp remain On?

   YES

   ▸ Substitute with a known-good ECM(C1611)[TCU(C1612)/Steering angle sensor(C1623)] and check for proper operation. If problem is corrected, replace ECM(C1611)[TCU(C1612)/Steering angle sensor(C1623)] and then go to "Verification of Vehicle Repair" procedure. If NG, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Fault is intermittent caused by faulty ECM(C1611)[TCU(C1612)/Steering angle sensor(C1623)] and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.
   Are any DTCs present?

YES

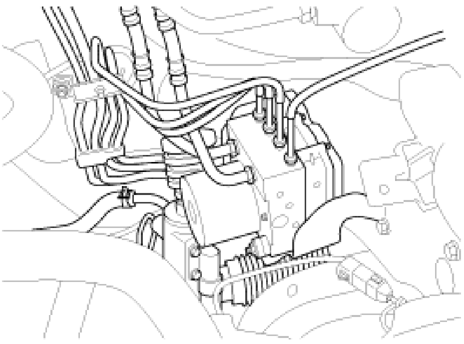
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Brake System > Troubleshooting > C1612

COMPONENT LOCATION



GENERAL DESCRIPTION

The CAN is for sending and receiving the information for TCS(ESP) control, between the HECU and EMS/TCU.

DTC DESCRIPTION

This code shows in case that there is an error on the CAN hardware. In this case, replace the HECU and check.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	CAN RAM monitoring	• Faulty HECU • Faulty ECM • Faulty TCU • Faulty Steering angle sensor
Enable Conditions	1. Purpose is to monitor if received message was not received by CAN controller of ABS8/ESC8 ECU.Faults are detected after filtering. Filtering has to be customized. 2. Purpose is to monitor if transmitted message has the expected data length.Actually the monitoring is reduced the check for too short messages.A message with oversized data length causes no fault. Faults are detected immediate.	
Monitoring period	Continuous	
Effect	1. CAN messages are not correct erceived. 2. CAN messages are not according to what was expected at compile time of the software.	

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
   Does warning lamp remain On?

YES

▸ Substitute with a known-good ECM(C1611)[TCU(C1612)/Steering angle sensor(C1623)] and check for proper operation. If problem is corrected, replace ECM(C1611)[TCU(C1612)/Steering angle sensor(C1623)] and then go to "Verification of Vehicle Repair" procedure. If NG, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Fault is intermittent caused by faulty ECM(C1611)[TCU(C1612)/Steering angle sensor(C1623)] and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.
   Are any DTCs present?

YES

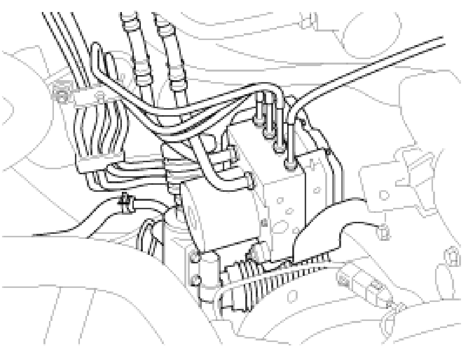
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Brake System > Troubleshooting > C1616

COMPONENT LOCATION



GENERAL DESCRIPTION

The CAN is for sending and receiving the information for TCS(ESC) control, between the HECU and EMS/TCU.

DTC DESCRIPTION

The HECU checks the CAN communication lines for normal TCS control, and sets this code if CAN BUS OFF status is detected for more than 100 ms.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	Open or short circuit monitoring	• Open or short circuit in CAN line
Enable Conditions	Monitoring includes line short to ground, line short to supply voltage and mutual line short. Line interruptions are detected by CAN message monitor. After detecting a BUSOFF failure the transmission is reinitialized. A BUSOFF fault is established if re-initialization is tried for 15 times in sequence without success.	

Monitoring period	Continuous	
Effect	CAN messages can not be processed. BLS(Brake light switch) is not controlled.	

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

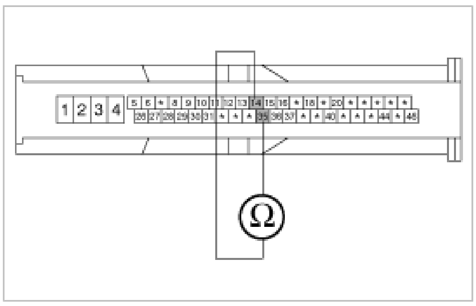
NO

▸ Go to the next step.

SIGNAL CIRCUIT INSPECTION

1. Ignition "OFF".
2. Measure resistance between terminal "35" of the HECU harness connector and terminal "14" of the HECU harness connector.

Specification : Approx. 60 Ω



Is the measured resistance within specifications?

YES

▸ Fault is intermittent caused by open or short in CAN signal harnessor was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

NO

▸ Check for open or short in CAN signal harness between terminal "35" of the HECU harness connector and terminal "14" of the HECU harness connector. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.
   Are any DTCs present?

YES

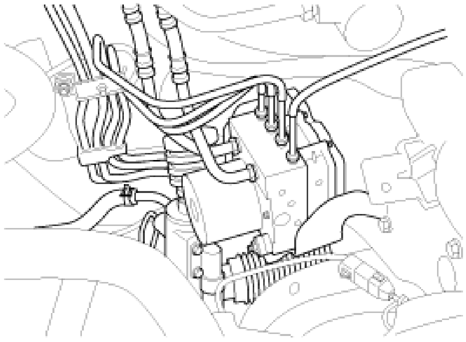
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Brake System > Troubleshooting > C1623

COMPONENT LOCATION



GENERAL DESCRIPTION

The CAN is for sending and receiving the information for TCS(ESP) control, between the HECU and EMS/TCU.

DTC DESCRIPTION

This code shows in case that there is an error on the CAN hardware. In this case, replace the HECU and check.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	CAN RAM monitoring	• Faulty HECU • Faulty ECM • Faulty TCU • Faulty Steering angle sensor
Enable Conditions	1. Purpose is to monitor if received message was not received by CAN controller of ABS8/ESP8 ECU.Faults are detected after filtering. Filtering has to be customized. 2. Purpose is to monitor if received message has the expected data length.Actually the monitoring is reduced the check for too short messages.A message with oversized data length causes no fault. Faults are detected immediate.	
Monitoring period	Continuous	
Effect	1. CAN messages are not correct received. 2. CAN messages are not according to what was expected at compile time of the software.	

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
   Does warning lamp remain On?

   YES

   ▸ Substitute with a known-good ECM(C1611)[TCU(C1612)/Steering angle sensor(C1623)] and check for proper operation. If problem is corrected, replace ECM(C1611)[TCU(C1612)/Steering angle sensor(C1623)] and then go to "Verification of Vehicle Repair" procedure. If NG, replace HECU and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Fault is intermittent caused by faulty ECM(C1611)[TCU(C1612)/Steering angle sensor(C1623)] and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.
   Are any DTCs present?

YES

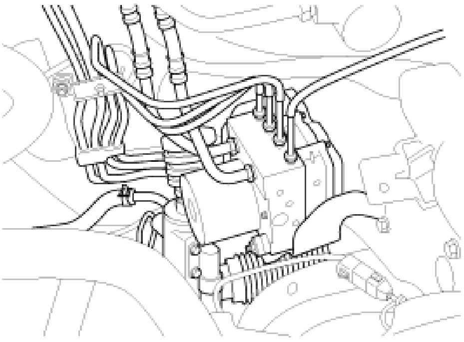
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Brake System > Troubleshooting > C1625

COMPONENT LOCATION



GENERAL DESCRIPTION

The CAN is for sending and receiving the information for TCS(ESC) control, between the HECU and EMS/TCU.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	Open or short circuit monitoring	• Open or short circuit in CAN line • Faulty HECU
Enable Conditions	Purpose is to monitor if transmitted message was not transmitted on time by the CAN controller of ABS8/ESC8 ECU. Faults are detected after filtering.	
Monitoring period	Continuous	
Effect	CAN messages are not transmitted on time.	

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Go to the next step.

SIGNAL CIRCUIT INSPECTION

1. Check for open or short in CAN signal harness between terminal "35" of the HECU harness connector and PCM harness connector.
2. Check for open or short in CAN signal harness between terminal "14" of the HECU harness connector and PCM harness connector.
   Is it normal?

YES

▸ Replace the HECU. Then go to "Verification of vehicle Repair" procedure.

NO

▸ Repair or replace harness and connector.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.
   Are any DTCs present?

   YES

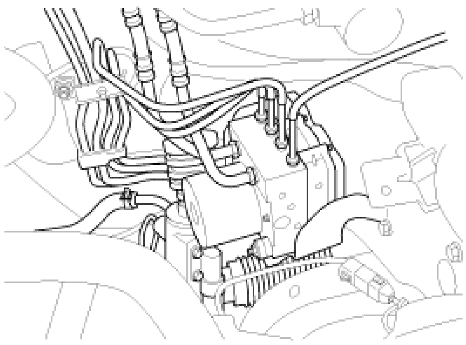
   ▸ Go to the applicable troubleshooting procedure.

   NO

   ▸ System performing to specification at this time.

Brake System > Troubleshooting > C1626

COMPONENT LOCATION



DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	Internal error	• Faulty HECU
Enable Conditions	1. Under normal conditions, the inlet valves of all four wheels are not closed during control for longer than 1.28 s. If the controller requests pressure-hold or pressure-decrease for longer than 1.28 s, a fault is stored. 2. The monitoring reports a failure if continuous ESC control occurs for a time period >= 10 s. A continuous ESC control for longer than 10 s is not possible under normal conditions.	
Monitoring period	1. Continuous 2. detected under voltage and a fault is not already detected.	
Effect	1. Reduced function as all wheel valves will remain in pressure build-up position. 2. Reduced function of the ESC system, no more ESC, no more ABS.	

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
   Does warning lamp remain On?

   YES

   ▸ Replace the HECU. Then go to "Verification of vehicle Repair" procedure.

   NO

▸ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.
   Are any DTCs present?

YES

▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Brake System > Troubleshooting > C1702

GENERAL DESCRIPTION

A hardware difference of ECU does not exist according to the specification of the vehicle, but a software changes according to deference of vehicle parameter. The ESC stores variant code (data of engine, displacement volume , T/M) at the ECU memory. Since then a ESC uses the stored data.

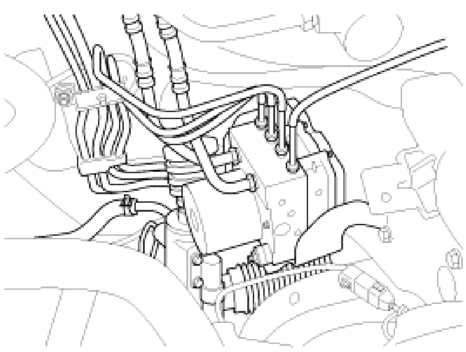
COMPONENT INSPECTION

*Variant Coding (See page BR - 142)

1. Install a EMS/TCU/ESC normally.
2. Connect a scanner to the vehicle.
3. IGN On
4. Scanner On
5. Select a brake mode.
6. Push the Variant Coding button.
7. Scanner Off
8. IGN Off
9. Remove the scanner.
10. IGN On
11. Finish the Variant Coding.

Brake System > Troubleshooting > C2112

COMPONENT LOCATION



GENERAL DESCRIPTION

The ABS ECU supplies battery power to all solenoid valves by way of a valve relay which is controlled by the Electronic Control UNIT(ECU). The valve relay and all solenoid valves are installed inside the HECU (Hydraulic and Electronic Control Unit).

DTC DESCRIPTION

ABS ECU monitors voltage of the valve relay to check if ABS ECU can perform ABS control normally. When the valve relay is switched to ON, the HECU will set this code if the solenoid drive voltage is below permissible voltage ranges for a period of time. When the valve relay is switched to OFF, the HECU sets this code if the solenoid drive voltage is over the permissible voltage range for a period of time.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	Battery Voltage Monitoring	• Open or short of power supply circuit • Faulty HECU • Faulty of the valve relay fuse(20 A)
Enable Conditions	1. Watchdog and VR(valve relay) function is tested during startup.FSA test(Fail Save Circuit test) detects if the VR/Enable remains in off position when it is turned on and vice versa. Reason could be short to GND or UZ(ECU voltage supply), interrupted lines or a defective output stage etc. 2. A Fault is detected if UVR(valve relay voltage) < 0.8 * UZ for a time t > 500 ms. 3. This test evaluates the function of the VR (valve relay) periodically. The VR is switched off and back on. VR malfunction and UVR short to UZ or UBVR (supply solenoid valves) and medium or high ohmic short of UVR (or a valve) to UZ, UBVR(supply solenoid valves) or GND are detected.	
Monitoring period	1.Once during startup. 2,3.Continuous	
Effect	No valve actuation possible.	

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

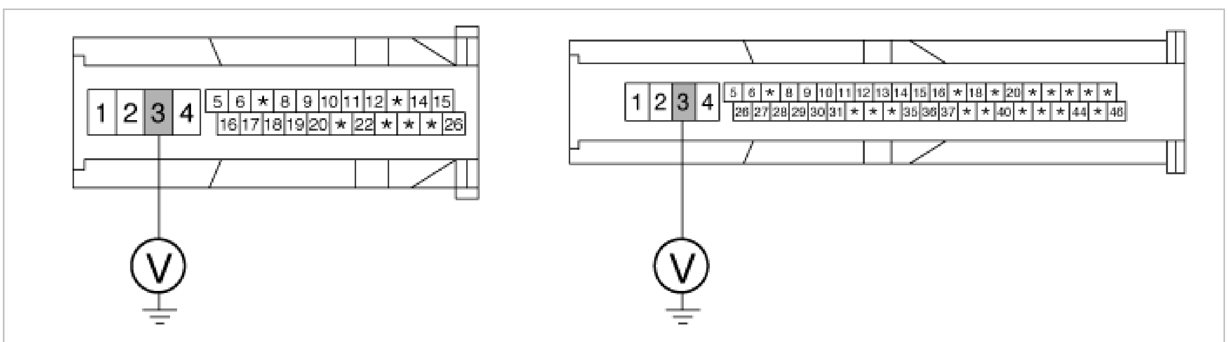
NO

▸ Go to the next step.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "OFF"
2. Disconnect HECU connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal "3" of the HECU harness connector and chassis ground.

Specification :Approx. B+



<ABS> <ESC>

Is the measured voltage within specifications?

YES

▸ Go to "Ground Circuit Inspection" procedure.

NO

▸ Check for open or short in power harness between battery terminal(+) and terminal "3" of the HECU harness connector. Check for open or blown 20A fuse . Repair as necessary and then go to "Verification of vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect HECU connector.
3. Measure resistance between terminal "4" of the HECU harness connector and chassis ground.

Specification :Approx.below 1 Ω

Is the measured resistance within specifications?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Check for damaged harness and poor connection between terminal "4" of the HECU harness connector and chassis ground. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
   Does warning lamp remain On?

YES

▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Fault is intermittent caused by open or short of power harness and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.
   Are any DTCs present?

YES

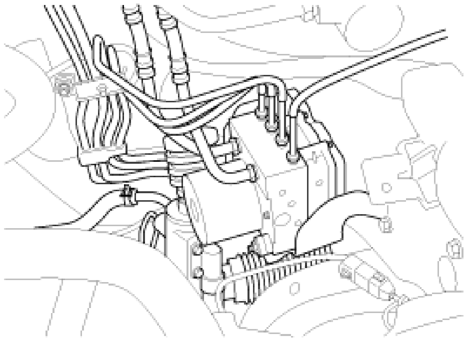
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Brake System > Troubleshooting > C2308

COMPONENT LOCATION



GENERAL DESCRIPTION

The ABS HECU is composed of an ECU (Electronic Control Unit) and a HCU(Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydraulic pressure supplied to a wheel cylinder.

DTC DESCRIPTION

The HECU monitors the operation of the valves by checking the drive circuit of the solenoid valves, and then sets this code when the unexpcted drive voltage is detected. For example, the HECU sets the DTC if an unexpected high drive voltage is detected when the valve relay is switched to OFF.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	Battery Voltage Monitoring	• Faulty HECU
Enable Conditions	1. The electrical feedback signal does not match the actuation signal for the corresponding valve: Actuation Signal != Feedback Signal Fault filter time is t = 30 ms (for current controlled valves and under voltage conditions: t =80 ms) 2. Cyclic Valve and Relay Test (CVRT): • A Fault is found if UVR(Valve relay voltage) is not within 0.1 * UZ(Ignition voltage) < UVR < 0.8 * UZ • A Fault is found if UVR is not UVR < 0.2 * UZ and the Valve Feedback is not act. Valve = = FALSE, not act. Valve = = TRUE At least VR is switched on again. 3. The valve and pump motor test detects electrical actuation malfunction of ABS valves. The test actuates all valves in series (to detect short cuts or shunts between the valve lines). Faults are detected by monitoring the valve response signals.	
Monitoring period	1. Continuous 2. CVRT is executed immediately after power on and then periodic every t =20 s. The Test is canceled if any control/valve actuation takes place or if the Vehicle is in motion and the BLS is on. 3. The Valve and Pump motor Test is performed once after ignition on if vehicle speed is >= 15 km/h(9 MPH).	
Effect	Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.	

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more)
   Does warning lamp remain On?

   YES

   ▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.

2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more))
   Are any DTCs present?

   YES

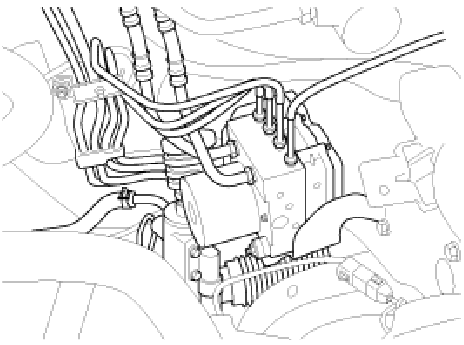
   ▸ Go to the applicable troubleshooting procedure.

   NO

   ▸ System performing to specification at this time.

Brake System > Troubleshooting > C2312

COMPONENT LOCATION



GENERAL DESCRIPTION

The ABS HECU is composed of an ECU (Electronic Control Unit) and a HCU(Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydraulic pressure supplied to a wheel cylinder.

DTC DESCRIPTION

The HECU monitors the operation of the valves by checking the drive circuit of the solenoid valves, and then sets this code when the unexpcted drive voltage is detected. For example, the HECU sets the DTC if an unexpected high drive voltage is detected when the valve relay is switched to OFF.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	Battery Voltage Monitoring	
Enable Conditions	1. The electrical feedback signal does not match the actuation signal for the corresponding valve: Actuation Signal != Feedback Signal Fault filter time is t = 30 ms (for current controlled valves and under voltage conditions: t =80 ms) 2. Cyclic Valve and Relay Test (CVRT): • A Fault is found if UVR(Valve relay voltage) is not within 0.1 * UZ(Ignition voltage) < UVR < 0.8 * UZ • A Fault is found if UVR is not UVR < 0.2 * UZ and the Valve Feedback is not act. Valve = = FALSE, not act. Valve = = TRUE At least VR is switched on again. 3. The valve and pump motor test detects electrical actuation malfunction of ABS valves. The test actuates all valves in series (to detect short cuts or shunts between the valve lines). Faults are detected by monitoring the valve response signals.	• Faulty HECU
	1. Continuous 2. CVRT is executed immediately after power on and then periodic every t =20 s.	

Monitoring period	The Test is canceled if any control/valve actuation takes place or if the Vehicle is in motion and the BLS is on. 3. The Valve and Pump motor Test is performed once after ignition on if vehicle speed is >= 15 km/h(9 MPH).	
Effect	Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.	

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more)
   Does warning lamp remain On?

   YES

   ▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more))
   Are any DTCs present?

   YES

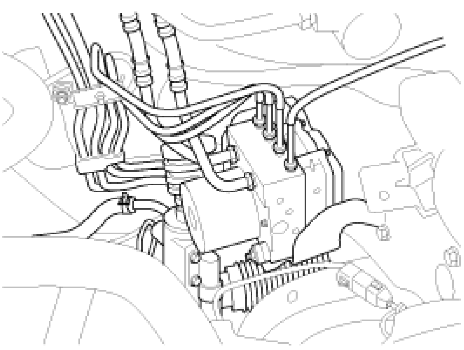
   ▸ Go to the applicable troubleshooting procedure.

   NO

   ▸ System performing to specification at this time.

Brake System > Troubleshooting > C2316

COMPONENT LOCATION



GENERAL DESCRIPTION

The ABS HECU is composed of an ECU (Electronic Control Unit) and a HCU(Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydraulic pressure supplied to a wheel cylinder.

DTC DESCRIPTION

The HECU monitors the operation of the valves by checking the drive circuit of the solenoid valves, and then sets this code when the unexpcted drive voltage is detected. For example, the HECU sets the DTC if an unexpected high drive voltage is detected when the valve relay is switched to OFF.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	Battery Voltage Monitoring	• Faulty HECU
Enable Conditions	1. The electrical feedback signal does not match the actuation signal for the corresponding valve: Actuation Signal != Feedback Signal Fault filter time is t = 30 ms (for current controlled valves and under voltage conditions: t =80 ms) 2. Cyclic Valve and Relay Test (CVRT): • A Fault is found if UVR(Valve relay voltage) is not within 0.1 * UZ(Ignition voltage) < UVR < 0.8 * UZ • A Fault is found if UVR is not UVR < 0.2 * UZ and the Valve Feedback is not act. Valve = = FALSE, not act. Valve = = TRUE At least VR is switched on again. 3. The valve and pump motor test detects electrical actuation malfunction of ABS valves. The test actuates all valves in series (to detect short cuts or shunts between the valve lines). Faults are detected by monitoring the valve response signals.	
Monitoring period	1. Continuous 2. CVRT is executed immediately after power on and then periodic every t =20 s. The Test is canceled if any control/valve actuation takes place or if the Vehicle is in motion and the BLS is on. 3. The Valve and Pump motor Test is performed once after ignition on if vehicle speed is >= 15 km/h(9 MPH).	
Effect	Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.	

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more)
   Does warning lamp remain On?

   YES

   ▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more))
   Are any DTCs present?

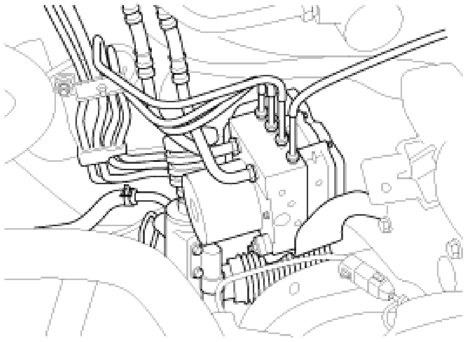
   YES

   ▸ Go to the applicable troubleshooting procedure.

   NO

   ▸ System performing to specification at this time.

COMPONENT LOCATION



GENERAL DESCRIPTION

The ABS HECU is composed of an ECU (Electronic Control Unit) and a HCU(Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydraulic pressure supplied to a wheel cylinder.

DTC DESCRIPTION

The HECU monitors the operation of the valves by checking the drive circuit of the solenoid valves, and then sets this code when the unexpcted drive voltage is detected. For example, the HECU sets the DTC if an unexpected high drive voltage is detected when the valve relay is switched to OFF.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	Battery Voltage Monitoring	• Faulty HECU
Enable Conditions	1. The electrical feedback signal does not match the actuation signal for the corresponding valve: Actuation Signal != Feedback Signal Fault filter time is t = 30 ms (for current controlled valves and under voltage conditions: t =80 ms) 2. Cyclic Valve and Relay Test (CVRT): • A Fault is found if UVR(Valve relay voltage) is not within 0.1 * UZ(Ignition voltage) < UVR < 0.8 * UZ • A Fault is found if UVR is not UVR < 0.2 * UZ and the Valve Feedback is not act. Valve = = FALSE, not act. Valve = = TRUE At least VR is switched on again. 3. The valve and pump motor test detects electrical actuation malfunction of ABS valves. The test actuates all valves in series (to detect short cuts or shunts between the valve lines). Faults are detected by monitoring the valve response signals.	
Monitoring period	1. Continuous 2. CVRT is executed immediately after power on and then periodic every t =20 s. The Test is canceled if any control/valve actuation takes place or if the Vehicle is in motion and the BLS is on. 3. The Valve and Pump motor Test is performed once after ignition on if vehicle speed is >= 15 km/h(9 MPH).	
Effect	Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.	

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more)
   Does warning lamp remain On?

   YES

   ▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more))
   Are any DTCs present?

   YES

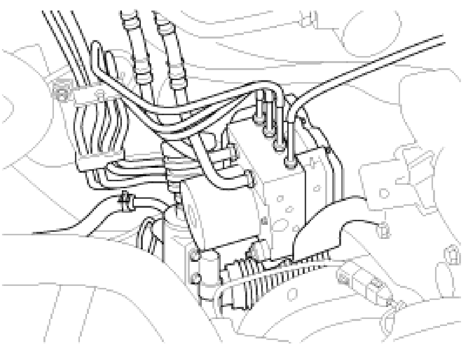
   ▸ Go to the applicable troubleshooting procedure.

   NO

   ▸ System performing to specification at this time.

Brake System > Troubleshooting > C2324

COMPONENT LOCATION



GENERAL DESCRIPTION

The ABS HECU is composed of an ECU (Electronic Control Unit) and a HCU(Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydraulic pressure supplied to a wheel cylinder.

DTC DESCRIPTION

The HECU monitors the operation of the valves by checking the drive circuit of the solenoid valves, and then sets this code when the unexpcted drive voltage is detected. For example, the HECU sets the DTC if an unexpected high drive voltage is detected when the valve relay is switched to OFF.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	Battery Voltage Monitoring	

Enable Conditions	1. The electrical feedback signal does not match the actuation signal for the corresponding valve: Actuation Signal != Feedback Signal Fault filter time is t = 30 ms (for current controlled valves and under voltage conditions: t =80 ms) 2. Cyclic Valve and Relay Test (CVRT): • A Fault is found if UVR(Valve relay voltage) is not within 0.1 * UZ(Ignition voltage) < UVR < 0.8 * UZ • A Fault is found if UVR is not UVR < 0.2 * UZ and the Valve Feedback is not act. Valve = = FALSE, not act. Valve = = TRUE At least VR is switched on again. 3. The valve and pump motor test detects electrical actuation malfunction of ABS valves. The test actuates all valves in series (to detect short cuts or shunts between the valve lines). Faults are detected by monitoring the valve response signals.	• Faulty HECU
Monitoring period	1. Continuous 2. CVRT is executed immediately after power on and then periodic every t =20 s. The Test is canceled if any control/valve actuation takes place or if the Vehicle is in motion and the BLS is on. 3. The Valve and Pump motor Test is performed once after ignition on if vehicle speed is >= 15 km/h(9 MPH).	
Effect	Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.	

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more)
   Does warning lamp remain On?

   YES

   ▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more))
   Are any DTCs present?

   YES

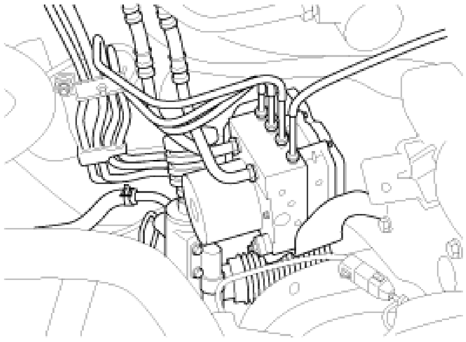
   ▸ Go to the applicable troubleshooting procedure.

   NO

   ▸ System performing to specification at this time.

Brake System > Troubleshooting > C2328

COMPONENT LOCATION



GENERAL DESCRIPTION

The ABS HECU is composed of an ECU (Electronic Control Unit) and a HCU(Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydraulic pressure supplied to a wheel cylinder.

DTC DESCRIPTION

The HECU monitors the operation of the valves by checking the drive circuit of the solenoid valves, and then sets this code when the unexpcted drive voltage is detected. For example, the HECU sets the DTC if an unexpected high drive voltage is detected when the valve relay is switched to OFF.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	Battery Voltage Monitoring	• Faulty HECU
Enable Conditions	1. The electrical feedback signal does not match the actuation signal for the corresponding valve: Actuation Signal != Feedback Signal Fault filter time is t = 30 ms (for current controlled valves and under voltage conditions: t =80 ms) 2. Cyclic Valve and Relay Test (CVRT): • A Fault is found if UVR(Valve relay voltage) is not within 0.1 * UZ(Ignition voltage) < UVR < 0.8 * UZ • A Fault is found if UVR is not UVR < 0.2 * UZ and the Valve Feedback is not act. Valve = = FALSE, not act. Valve = = TRUE At least VR is switched on again. 3. The valve and pump motor test detects electrical actuation malfunction of ABS valves. The test actuates all valves in series (to detect short cuts or shunts between the valve lines). Faults are detected by monitoring the valve response signals.	
Monitoring period	1. Continuous 2. CVRT is executed immediately after power on and then periodic every t =20 s. The Test is canceled if any control/valve actuation takes place or if the Vehicle is in motion and the BLS is on. 3. The Valve and Pump motor Test is performed once after ignition on if vehicle speed is >= 15 km/h(9 MPH).	
Effect	Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.	

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more)

Does warning lamp remain On?

YES

▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more))
   Are any DTCs present?

YES

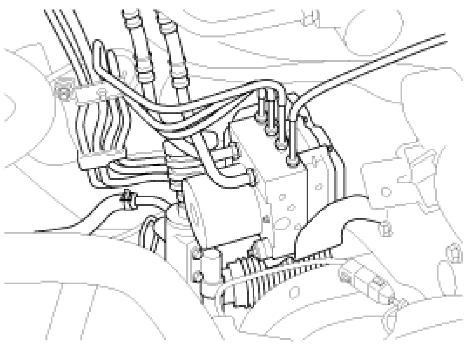
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Brake System > Troubleshooting > C2332

COMPONENT LOCATION



GENERAL DESCRIPTION

The ABS HECU is composed of an ECU (Electronic Control Unit) and a HCU(Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydraulic pressure supplied to a wheel cylinder.

DTC DESCRIPTION

The HECU monitors the operation of the valves by checking the drive circuit of the solenoid valves, and then sets this code when the unexpcted drive voltage is detected. For example, the HECU sets the DTC if an unexpected high drive voltage is detected when the valve relay is switched to OFF.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	Battery Voltage Monitoring	
	1. The electrical feedback signal does not match the actuation signal for the corresponding valve: Actuation Signal != Feedback Signal Fault filter time is t = 30 ms (for current controlled valves and under voltage conditions: t =80 ms) 2. Cyclic Valve and Relay Test (CVRT):	

Enable Conditions	• A Fault is found if UVR(Valve relay voltage) is not within 0.1 * UZ(Ignition voltage) < UVR < 0.8 * UZ • A Fault is found if UVR is not UVR < 0.2 * UZ and the Valve Feedback is not act. Valve = = FALSE, not act. Valve = = TRUE At least VR is switched on again. 3. The valve and pump motor test detects electrical actuation malfunction of ABS valves. The test actuates all valves in series (to detect short cuts or shunts between the valve lines). Faults are detected by monitoring the valve response signals.	• Faulty HECU
Monitoring period	1. Continuous 2. CVRT is executed immediately after power on and then periodic every t =20 s. The Test is canceled if any control/valve actuation takes place or if the Vehicle is in motion and the BLS is on. 3. The Valve and Pump motor Test is performed once after ignition on if vehicle speed is >= 15 km/h(9 MPH).	
Effect	Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.	

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more)
   Does warning lamp remain On?

   YES

   ▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more))
   Are any DTCs present?

   YES

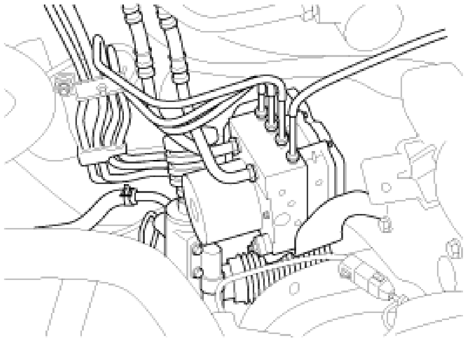
   ▸ Go to the applicable troubleshooting procedure.

   NO

   ▸ System performing to specification at this time.

Brake System > Troubleshooting > C2336

COMPONENT LOCATION



GENERAL DESCRIPTION

The ABS HECU is composed of an ECU (Electronic Control Unit) and a HCU(Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydraulic pressure supplied to a wheel cylinder.

DTC DESCRIPTION

The HECU monitors the operation of the valves by checking the drive circuit of the solenoid valves, and then sets this code when the unexpcted drive voltage is detected. For example, the HECU sets the DTC if an unexpected high drive voltage is detected when the valve relay is switched to OFF.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	Battery Voltage Monitoring	• Faulty HECU
Enable Conditions	1. The electrical feedback signal does not match the actuation signal for the corresponding valve: Actuation Signal != Feedback Signal Fault filter time is t = 30 ms (for current controlled valves and under voltage conditions: t =80 ms) 2. Cyclic Valve and Relay Test (CVRT): • A Fault is found if UVR(Valve relay voltage) is not within 0.1 * UZ(Ignition voltage) < UVR < 0.8 * UZ • A Fault is found if UVR is not UVR < 0.2 * UZ and the Valve Feedback is not act. Valve = = FALSE, not act. Valve = = TRUE At least VR is switched on again. 3. The valve and pump motor test detects electrical actuation malfunction of ABS valves. The test actuates all valves in series (to detect short cuts or shunts between the valve lines). Faults are detected by monitoring the valve response signals.	
Monitoring period	1. Continuous 2. CVRT is executed immediately after power on and then periodic every t =20 s. The Test is canceled if any control/valve actuation takes place or if the Vehicle is in motion and the BLS is on. 3. The Valve and Pump motor Test is performed once after ignition on if vehicle speed is >= 15 km/h(9 MPH).	
Effect	Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.	

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more)

Does warning lamp remain On?

YES

▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more))
   Are any DTCs present?

YES

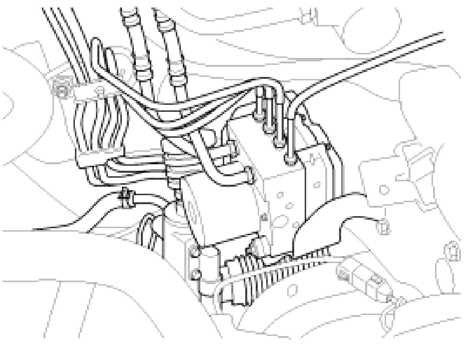
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Brake System > Troubleshooting > C2366

COMPONENT LOCATION



GENERAL DESCRIPTION

The ESC HECU is composed of an ECU (Electronic Control Unit) and a HCU(Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS/ESC is activated. Solenoid valves function is to increase, decrease or maintain the hydraulic pressure supplied to a wheel cylinder.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	Battery Voltage Monitoring	• Faulty HECU
Enable Conditions	The valve and pump motor test detects electrical actuation malfunction of USV and HSV valves. The test actuates all valves in series (to detect shorts or shunts between the valve lines). Faults are detected by monitoring the valve response signals.	
Monitoring period	The USV Test is performed once after ignition on at standstill if the BLS is off and at vehicle speed is v >= 15 km/h(9MPH) if the BLS is on.	
Effect	Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.	

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more)
   Does warning lamp remain On?

   YES

   ▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more))
   Are any DTCs present?

   YES

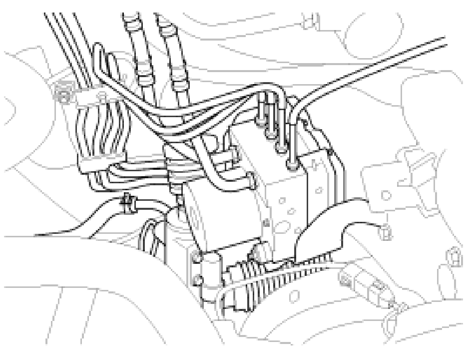
   ▸ Go to the applicable troubleshooting procedure.

   NO

   ▸ System performing to specification at this time.

Brake System > Troubleshooting > C2370

COMPONENT LOCATION



GENERAL DESCRIPTION

The ESP HECU is composed of an ECU (Electronic Control Unit) and a HCU(Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS/ESP is activated. Solenoid valves function is to increase, decrease or maintain the hydraulic pressure supplied to a wheel cylinder.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	Battery Voltage Monitoring	• Faulty HECU
Enable Conditions	The valve and pump motor test detects electrical actuation malfunction of USV and HSV valves. The test actuates all valves in series (to detect shorts or shunts between the valve lines). Faults are detected by monitoring the valve response signals.	
	The USV Test is performed once after ignition on at standstill if the BLS is off and	

Monitoring period	at vehicle speed is v > 15 km/h(9 MPH) if the BLS is on.	
Effect	Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.	

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more)
   Does warning lamp remain On?

   YES

   ▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more))
   Are any DTCs present?

   YES

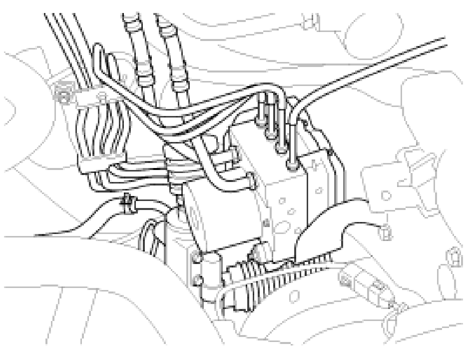
   ▸ Go to the applicable troubleshooting procedure.

   NO

   ▸ System performing to specification at this time.

Brake System > Troubleshooting > C2372

COMPONENT LOCATION



GENERAL DESCRIPTION

The ESP HECU is composed of an ECU (Electronic Control Unit) and a HCU(Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS/ESP is activated. Solenoid valves function is to increase, decrease or maintain the hydraulic pressure supplied to a wheel cylinder.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	Battery Voltage Monitoring	

Enable Conditions	The valve and pump motor test detects electrical actuation malfunction of USV and HSV valves. The test actuates all valves in series (to detect shorts or shunts between the valve lines). Faults are detected by monitoring the valve response signals.	• Faulty HECU
Monitoring period	The USV Test is performed once after ignition on at standstill if the BLS is off and at vehicle speed is v > 15 km/h(9 MPH) if the BLS is on.	
Effect	Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.	

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more)
   Does warning lamp remain On?

YES

▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more))
   Are any DTCs present?

YES

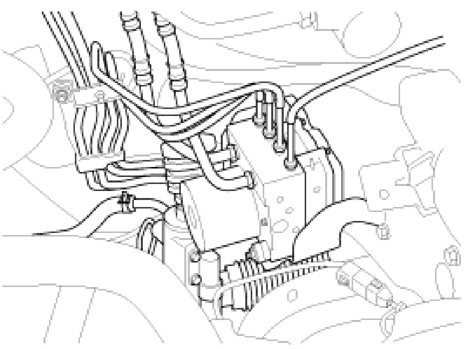
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Brake System > Troubleshooting > C2374

COMPONENT LOCATION



GENERAL DESCRIPTION

The ESP HECU is composed of an ECU (Electronic Control Unit) and a HCU(Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS/ESP is activated. Solenoid valves function is to increase, decrease or maintain the hydraulic pressure supplied to a wheel cylinder.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	Battery Voltage Monitoring	• Faulty HECU
Enable Conditions	The valve and pump motor test detects electrical actuation malfunction of USV and HSV valves. The test actuates all valves in series (to detect shorts or shunts between the valve lines). Faults are detected by monitoring the valve response signals.	
Monitoring period	The USV Test is performed once after ignition on at standstill if the BLS is off and at vehicle speed is v > = 15 km/h(9 MPH) if the BLS is on.	
Effect	Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.	

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more)
   Does warning lamp remain On?

   YES

   ▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more))
   Are any DTCs present?

   YES

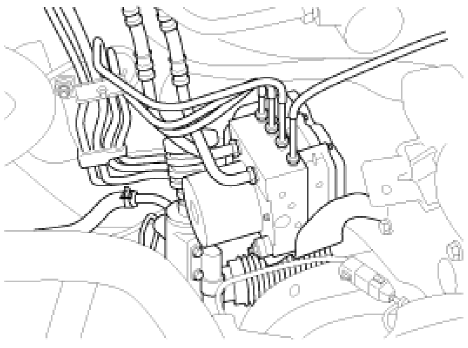
   ▸ Go to the applicable troubleshooting procedure.

   NO

   ▸ System performing to specification at this time.

Brake System > Troubleshooting > C2402

COMPONENT LOCATION



GENERAL DESCRIPTION

The ABS ECU supplies battery power to the electric motor by way of a motor relay which is controlled by the Electronic Control Unit(ECU). The electric motor pump supplies hydraulic pressure to all wheel brake calipers by operating the piston inside the pump.

DTC DESCRIPTION

The ABS/ESC ECU monitors the pump motor relay or fuse open, open or short in motor or motor lock and then sets this code if a malfunction is detected.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	Battery Voltage Monitoring	• Open or short of power supply circuit • Faulty HECU • Faulty of the pump motor fuse(40A)
Enable Conditions	1. A failure is detected if the voltage UM (Pump motor voltage) > 2.0 V for a time t >= 1 s. 2. A failure is detected if the voltage UM (Pump motor voltage) < (UZ(battery voltage) - 4.0 V) for a time t >= 100 ms. 3. After the end of the actuation of the motor relay has, the pump motor is still in motion and is generating a Voltage during it.s slowdown. The generated UM is monitored for a certain time on high level. The time depends on the supply voltage and is in the range of t = 30 ms to t = 125 ms.If the slow down condition isn.t met, the pump is activated again (see actuation times below) and the slowdown time is measured again. This is repeated for maximum n = 3 times. If, after the last pump activation, the pump motor slowdown time is still to short, a failure is detected.Actuation times: 1st actuation: 200 ms 2nd actuation: 1000 ms 3rd actuation: 3000 ms	
Monitoring period	1. Stop monitor is active if the pump is off i.e. not actuation and no Slowdown. 2. The monitor is active if the pump is switched on . 3. Monitor is always active in the transition "pump on -> pump off".	
Effect	1. The return pump does not work correct. 2. Pressure decrease (outlet valve) is no longer possible (wheels block). 3. Pressure decrease (outlet valve) is no longer possible (wheels lock).	

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   ▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

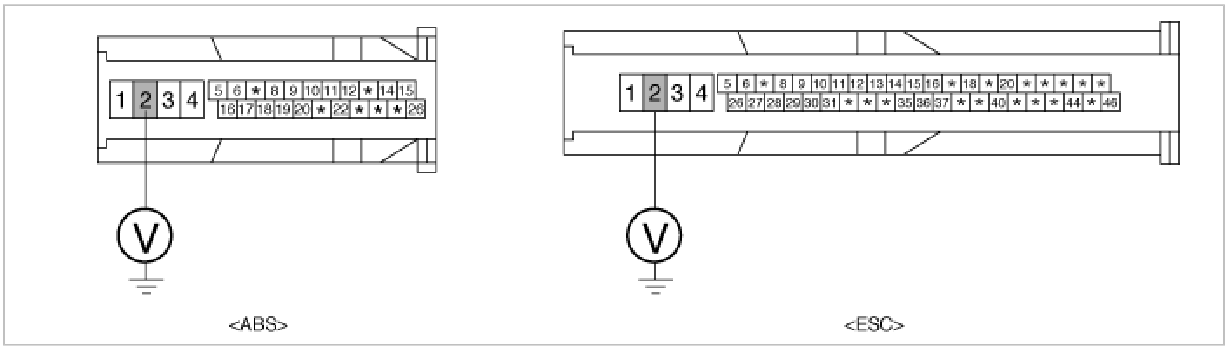
   NO

   ▶ Go to the next step.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "OFF"
2. Disconnect HECU connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal "2" of the HECU harness connector and chassis ground.

   Specification :Approx. B+



Is the measured voltage within specifications?

YES

▸ Go to "Ground Circuit Inspection" procedure.

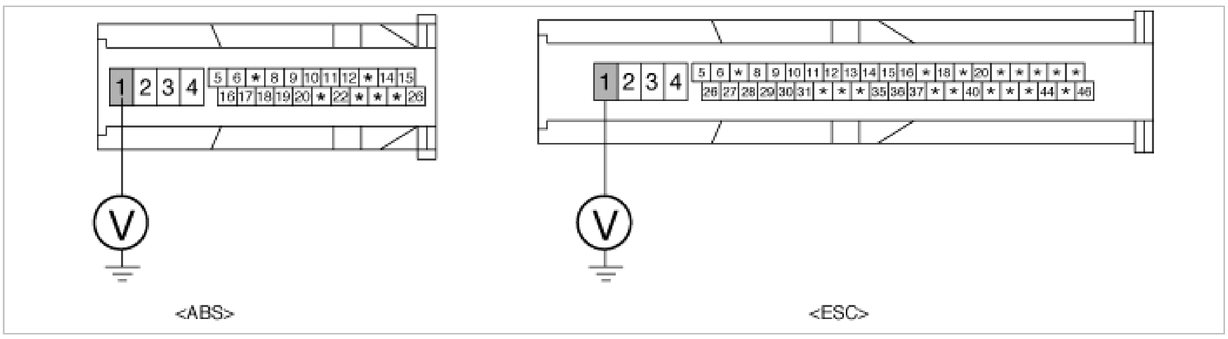
NO

▸ Check for open or short in power harness between battery terminal(+) and terminal "2" of the HECU harness connector. Check for open or blown 40A fuse . Repair as necessary and then go to "Verification of vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect HECU connector.
3. Measure resistance between terminal "1" of the HECU harness connector and chassis ground.

Specification :Approx.below 1 Ω



Is the measured resistance within specifications?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Check for damaged harness and poor connection between terminal "1" of the HECU harness connector and chassis ground. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more)
   Does warning lamp remain On?

YES

▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.

2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more))
   Are any DTCs present?

   YES

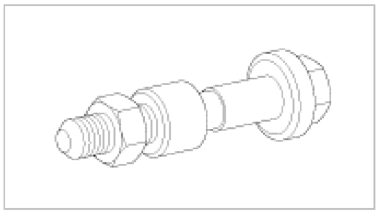
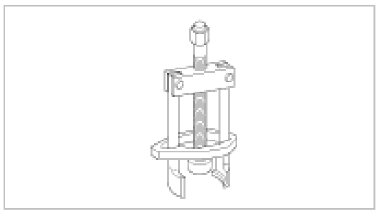
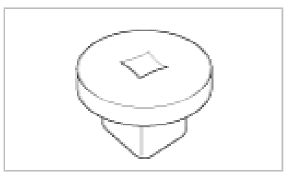
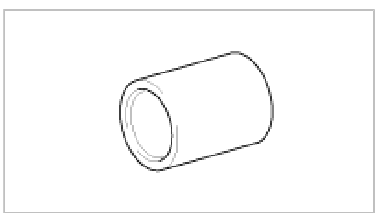
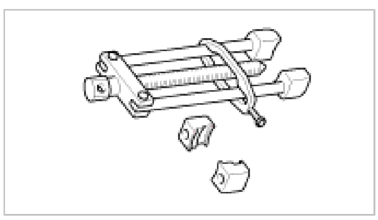
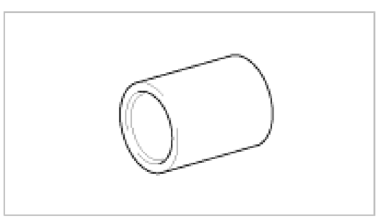
   ▸ Go to the applicable troubleshooting procedure.

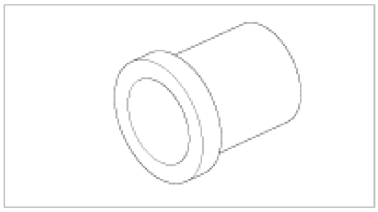
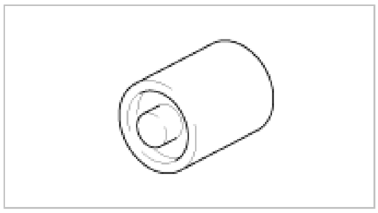
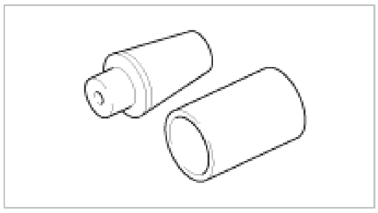
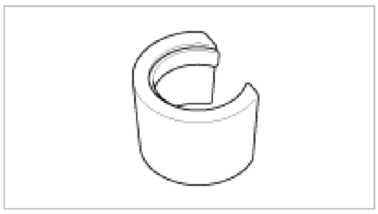
   NO

   ▸ System performing to specification at this time.

Driveshaft and axle > General Information > Special Service Tools

SPECIAL TOOLS

Tool (Number and Name)	Illustration	Use
09568-4A000 Ball joint remover		Removal of the front lower arm and tie rod end ball joint
09517-21500 Front hub remover and installer		Measurement of wheel bearing preload
09432-11000 Bearing and gear puller		Removal of the bearing inner race from the front hub
09532-11600 Preload socket		Measurement of the wheel bearing preload (use with torque wrench)
09216-21100 Mount bushing remover and installer		• Removal of the center bearing • Press-fitting of the front wheel bearing outer race (Use with 09495-33100, 09216-21600)
09495-33000 Mainshaft bearing puller		Removal of the tone wheel
09216-21600 Mount bushing remover and installer		Removal of the wheel bearing outer race
09545-21100 Ball joint dust cover installer		Press-fitting of the front hub to the knuckle

		
09545-34100 Lower arm bushing remover and installer		Removal of the bearing inner race from the front hub
09453-33000B Snap ring installer		Removal and installation of the rear axle carrier bushing (Use with 09552-38200)
09216-22100 Mount bushing removerand installation base		Removal of the wheel bearing outer race (Use with 09216-21600)

Driveshaft and axle > General Information > Troubleshooting

TROUBLESHOOTING

Symptom Pos	sible cause	Remedy
Vehicle pulls to one side	Scoring of driveshaft ball joint Wear, rattle or scoring of wheel bearing Defective front suspension and steering	Replace Replace Adjust or replace
Vibration	Wear, damage or bending of driveshaft Driveshaft rattle and worn hub splines Wear, rattle or scratching of wheel bearing	Replace Replace Replace
Shimmy I	mproper wheel balance Bent wheel Defective front suspension and steering	Adjust or replace Replace Adjust or replace
Excessive noise	Wear, damage or bending of driveshaft Driveshaft rattle and worn hub splines Driveshaft rattle and worn side gear splines Wear, rattle or galling of wheel bearing Loose hub nut Defective front suspension and steering	Replace Replace Replace Replace Adjust or replace Adjust or replace
Bent cage	Cage damaged by improper handling or tool usage	Replace bearing
Galling	Metal smears on roller end due to overheating, incorrect lubricant or overloading	Replace bearing Check seals, check for proper lubrication
Cracked inner race	Race cracked due to improper fit, cocking or poor bearing seats	Replace bearing
Etching	Bearing surfaces appear gray or grayish black	Replace bearing

	in color accompanied by material etched away usually at roller spacing	Check seals, check for proper lubrication
Brinelling Surface	indentations on race surface caused by rollers being under impact loading or vibration while the bearing is not rotating	Replace bearing
Heat discoloration	Heat discoloration is dark blue resulting from overload or no lubricant (Yellow or brown color is normal)	Replace bearing Check seals and other parts
Fatigue spalling	Flaking of surface metal resulting from fatigue	Replace bearing Clean all related parts

Driveshaft and axle > General Information > Specifications

SPECIFICATIONS

Items			Joint type		Max. permissible angle	
			Inner side	**Outer side**	**Inner side**	**Outer side**
Drive shaft	ASAN (KOREA)	2.4 M/T	TJ	BJ	23°	45°
		2.4 A/T	TJ	BJ	23°	45°
		3.3A/T SF	J	BJ	23°	45°
	ALLABAMA (USA)	2.4 M/T	[LH]TG [RH]TP	RJ	[LH]23° [RH]23.16°	45°
		2.4 A/T	[LH]TG [RH]TP	RJ	[LH]23° [RH]23.16°	45°
		3.3A/T TG		RJ	23°	45°
Center bearing	[3.3L] ASAN (KOREA)	Type	Radial ball bearing			
		Dimension (O.D X I.D.) mm (in)	Ø 62 X Ø 30 (Ø 2.44 X Ø 1.18)			
	[3.3L] ALLABAMA (USA)	Type	Radial ball bearing			
		Dimension (O.D X I.D.) mm (in)	Ø 62 X Ø 30 (Ø 2.44 X Ø 1.18)			
Wheel bearing		Type	Double row angular contact ball bearing			
		Dimension (O.D X I.D.) mm (in)	Ø 84 X Ø 45 (Ø 3.3 X Ø 1.77)			
		Starting torque	28N (0.18 kgf·m, 16 lbf·in) or less			
Hub end play			0.008 mm (0.0003 in) or less			

-BJ : Birfield Joint (ASAN)
-TJ : Tripod Joint (ASAN)
-RJ : Rzeppa Joint (ALABAMA)
-SFJ : Shudderless Free ring Joint (ASAN)
-TP : Tripod Joint (ALABAMA)
-TG : Tri Glide Joint (ALABAMA)

TIGHTNING TORQUE

Item	N·m	kgf·m	lb-ft

Inner shaft cover	8.8~13.7	0.9~1.4	6.5~10
Inner shaft bearing bracket	39~49	4~5	28.9~36
Drive shaft castle nut	200~280	20~28	148~207
Brake caliper to knuckle	50~60	5~6	36~44
Lower arm and ball joint	100~120	10~12	74~88
Wheel nut	90~110	9~11	66~81
Shock absorber lower mounting bolt	140~160	14~16	101~118
Stabilizer link mounting nut 100~	120	10~12	74~88
Tie rod end self locking nut	24~34	2.4~3.4	18~25
Rear upper arm to carrier self locking nut	80~90	8~9	59~66
Lower arm ball joint self locking nut	75~90	7.5~9	54.2~66
Rear axle mounting bolt	60~70	6~7	44~52
Front Upper arm to knuckle self locking nut	35~45	3.5~4.5	26~33

CAUTION

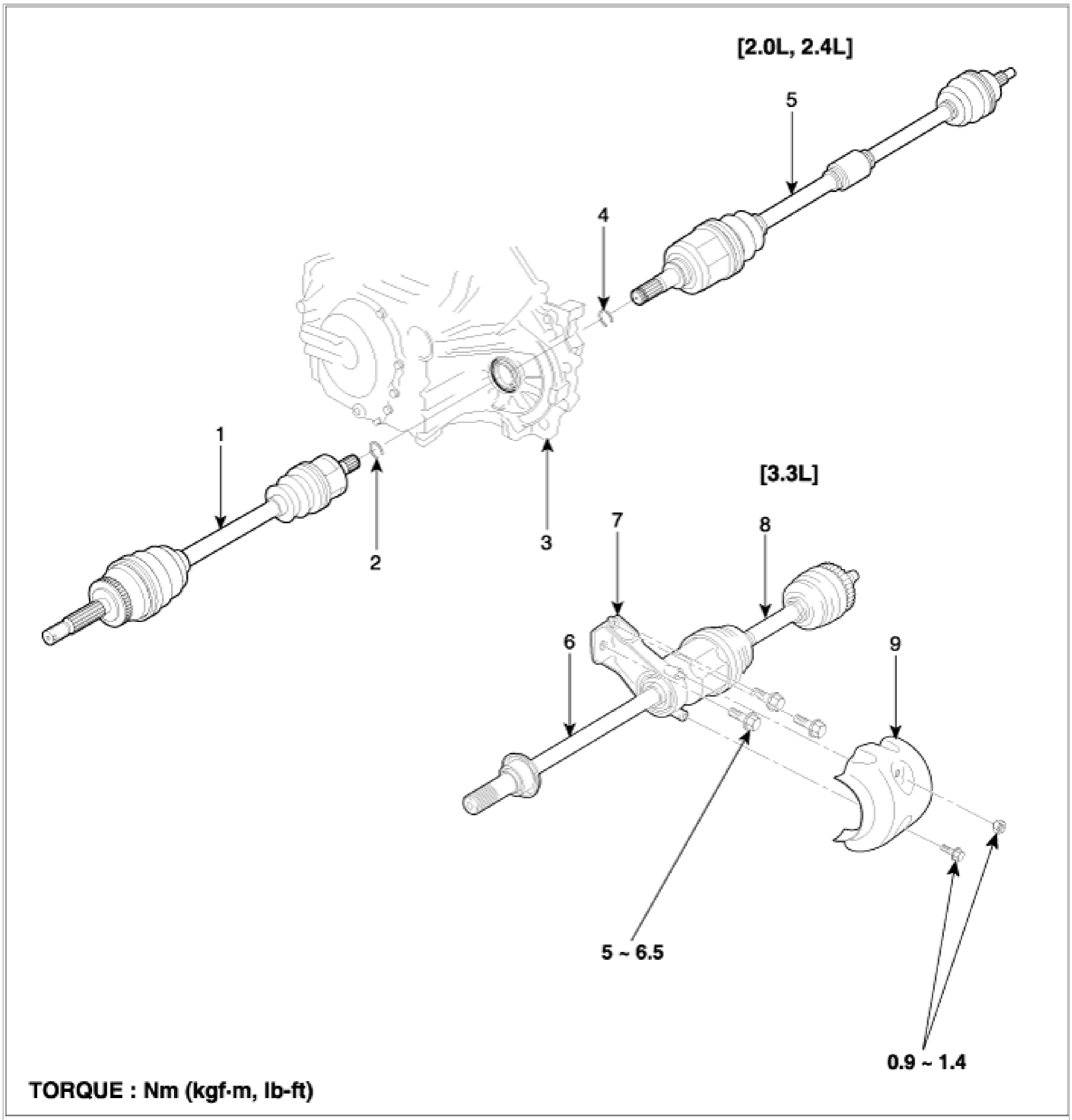
Replace self-locking nuts with new ones after removal.

LUBRICANTS

Items			Specified lubricants	Quantity
ASAN (KOREA)	[2.4L]	BJ	CENTOPLEX 278M/136K	JOINT : 85 ± 5g, BOOT : 70 ± 5g
		TJ	MX-13KT	JOINT : 60 ± 5g, BOOT : 60 ± 5g
	[3.3L]	BJ	CENTOPLEX 278M/136K	JOINT : 140 ± 5g, BOOT : 60 ± 5g
		SFJ	MX-13KT	JOINT : 100 ± 5g, BOOT : 45 ± 5g
ALLABAMA (USA)	[2.4L]	RJ	DELPHI 5389	JOINT : 80 ± 5g, BOOT : 70 ± 5g
		TG	DELPHI 5476	JOINT :100 ± 5g, BOOT : 120 ± 5g
		TP	DELPHI 5389	JOINT : 110 ± 5, gBOOT : 130 ± 5g
	[3.3L]	RJ	DELPHI 5389	JOINT : 80 ± 5g, BOOT : 70 ± 5g
		TG	DELPHI 5476	JOINT :100 ± 5g, BOOT : 120 ± 5g

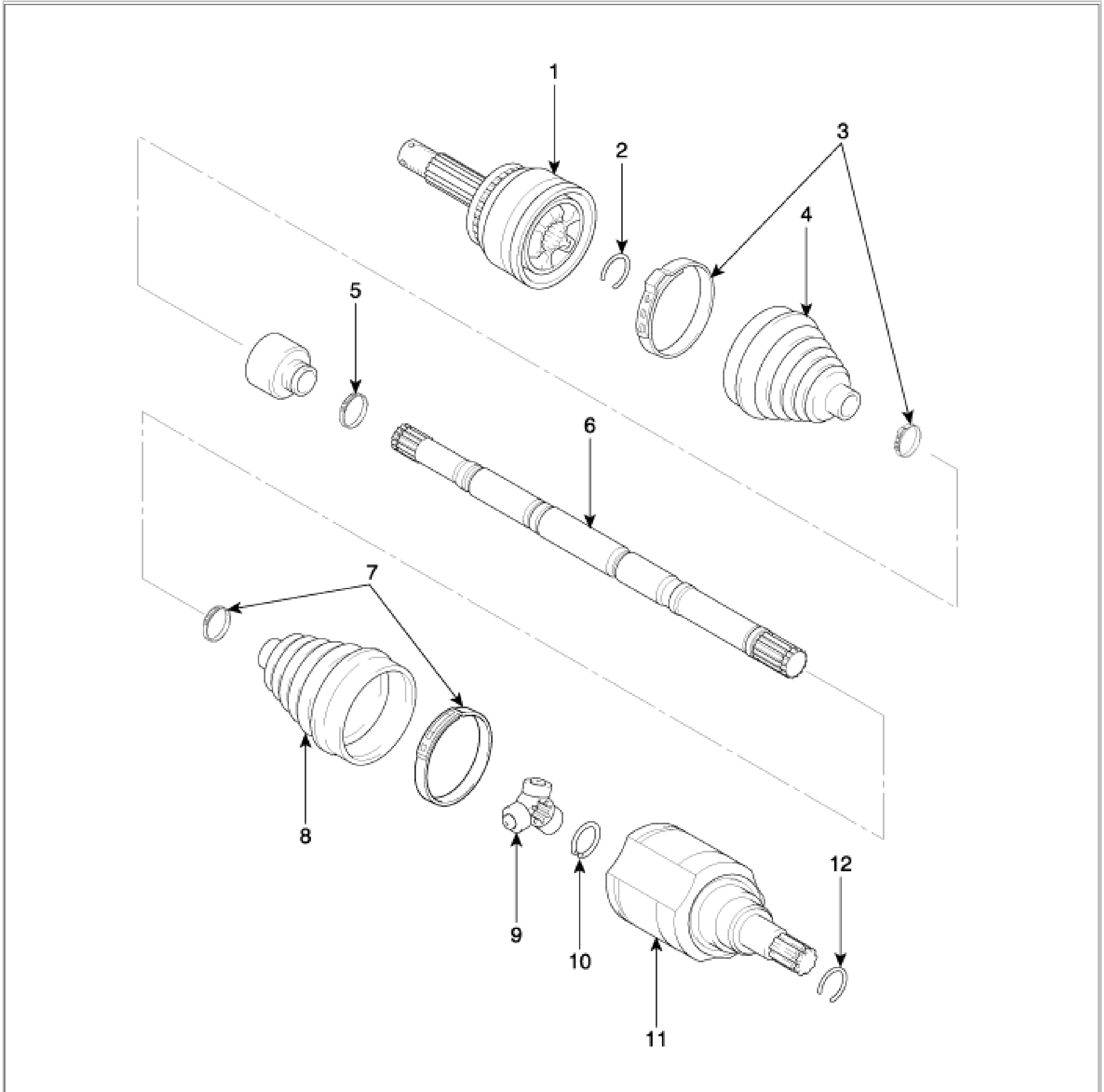
Driveshaft and axle > Driveshaft Assembly > Front Driveshaft > Components and Components Location

COMPONENTS



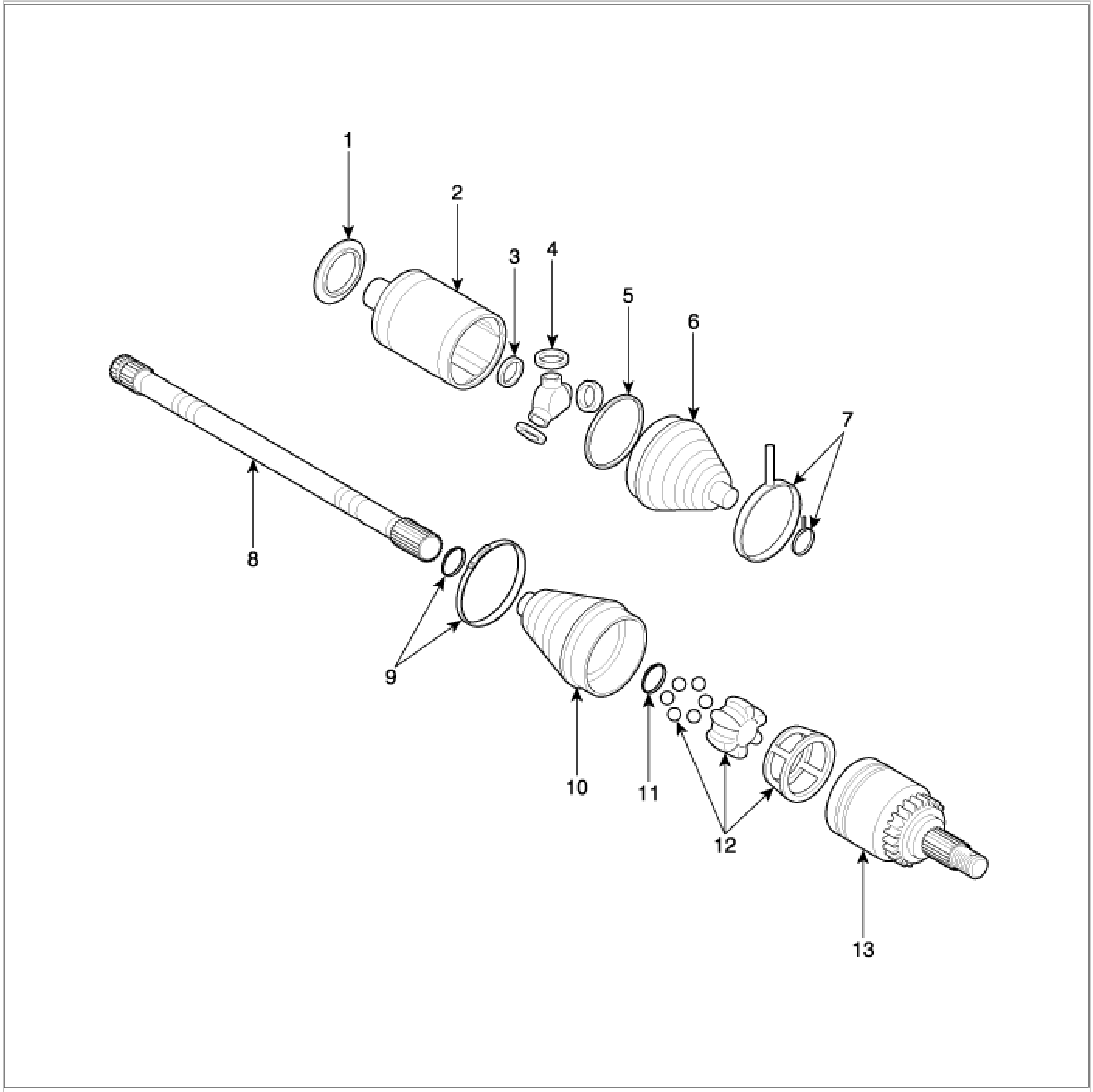
1. Driveshaft (LH)
2. Circlip
3. Transaxle
4. Circlip
5. Driveshaft (RH) [2.0L, 2.4L]
6. Inner shaft
7. Inner shaft bracket mounting
8. Driveshaft (RH) [3.3L]
9. Inner shaft cover

COMPONENTS



1. BJ assembly	7. TJ boot bands
2. Clip	8. TJ boot
3. BJ boot bands	9. Spider assembly
4. BJ boot	10. Clip
5. Dynamic damper bands	11. TJ case
6. Shaft	12. Clip

COMPONENTS

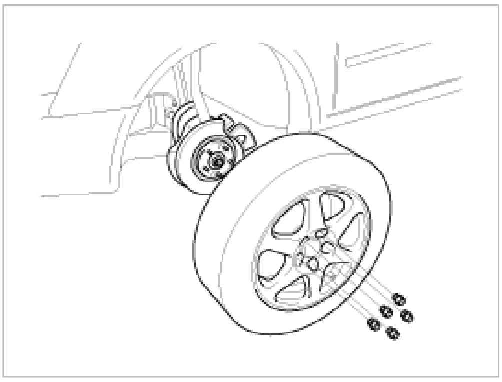


1. Dust cover	6. SFJ boot	11. Snap ring
2. SFJ assembly	7. SFJ boot band	12. BJ inner race and ball
3. Snap ring	8. Driveshaft (RH)	13. BJ assembly
4. Spider assembly	9. BJ boot band	
5. Circle pin	10. BJ boot	

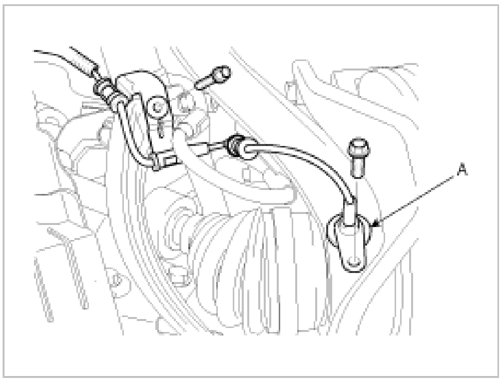
Driveshaft and axle > Driveshaft Assembly > Front Driveshaft > Repair procedures

REMOVAL

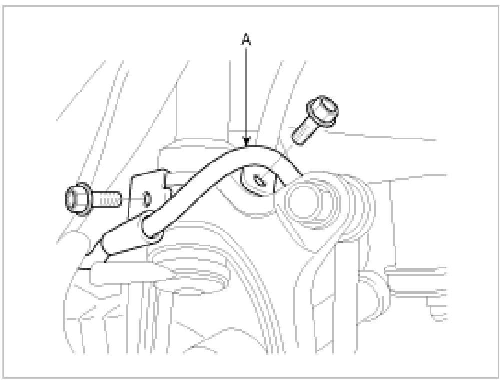
1. Remove the wheel and tire.



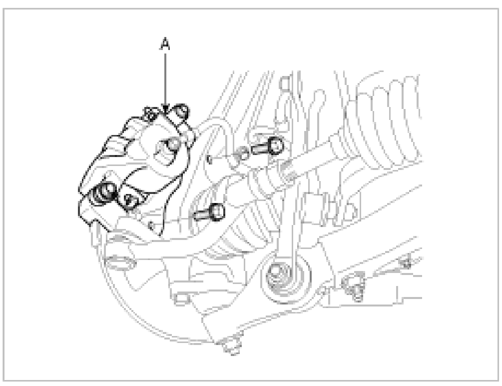
2. Disconnect the wheel speed sensor(A) from the knuckle.

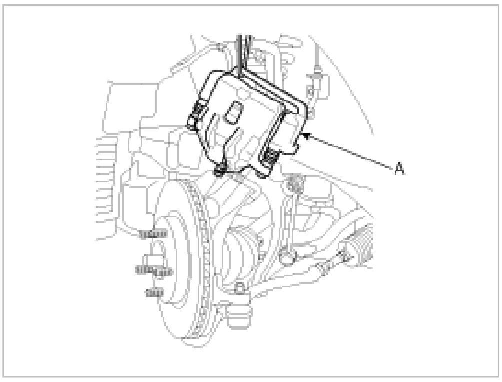


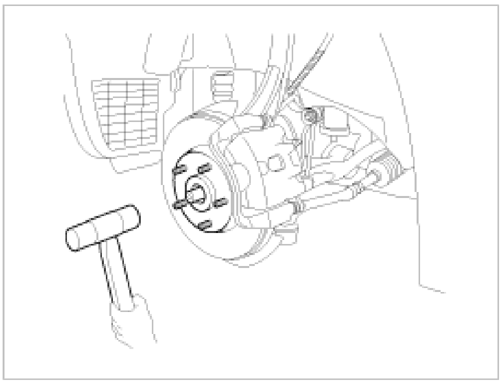
3. Disconnect the brake hose(A) from the knuckle.



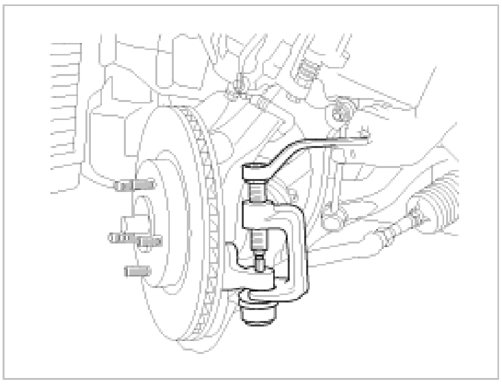
4. Remove the caliper assembly(A) and suspend it with wire.



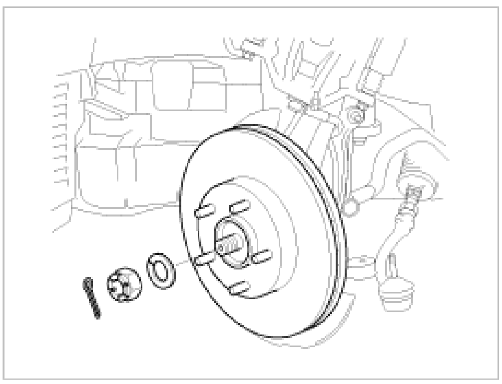




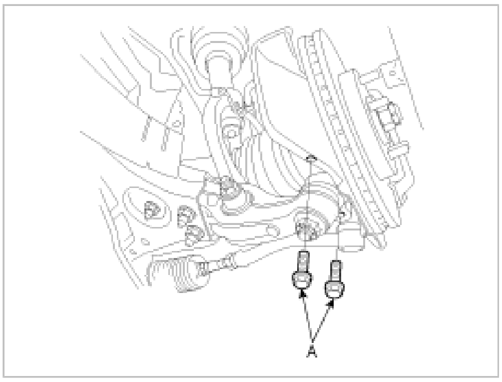
5. Using the special tool (09568-4A000), disconnect the tie rod end from the knuckle.



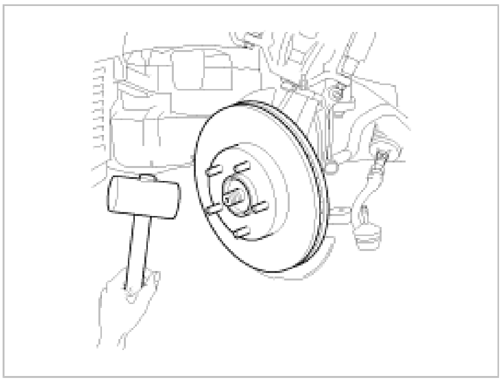
6. Remove the spilt pin and driveshaft castle nut and washer from the front hub.



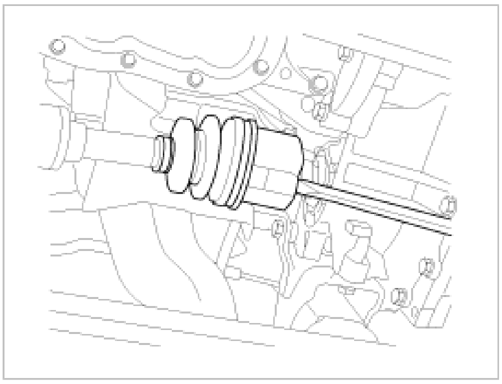
7. Remove the 2 bolts(A) and disconnect the ball joint from the knuckle.



8. Using a plastic hammer, disconnect the driveshaft from the axle hub.

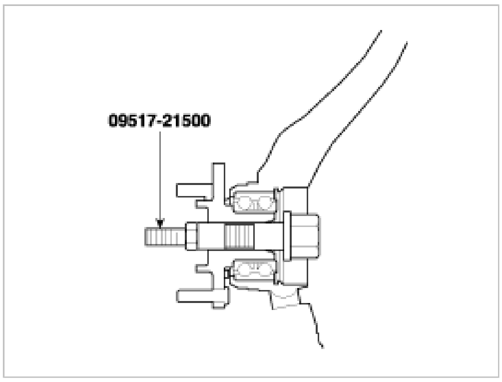


9. Removing the driveshaft from the transaxle by using a pry bar as shown below.



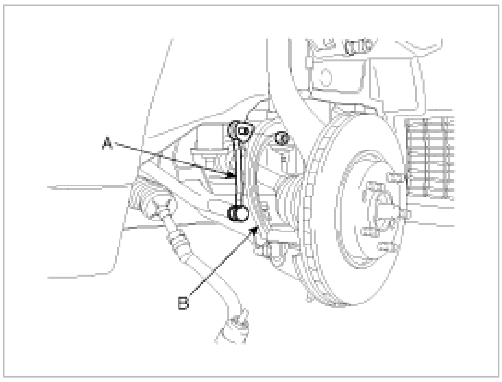
CAUTION

- Use a pry bar so you do not damage the joint.
- If you pull the driveshaft by excessive force, components inside the joint can be displaced causing the boot to be torn and the bearing to be damaged.
- Plug the transaxle case opening with an oil seal cap in order to avoid contamination.
- Support the driveshaft properly.
- Replace the retainer ring each time the driveshaft is removed from the transaxle case.
- While loosening the driveshaft nut, do not allow vehicle weight to be concentrated on the wheel bearing. If the vehicle moves, hold the wheel bearing using the special tool.

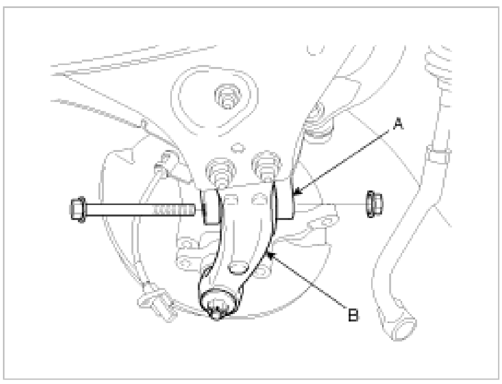


[RH3.3]

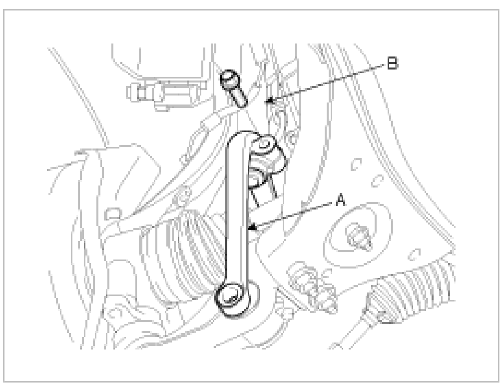
A. Remove the stabilzer link(A) from the fork(B).



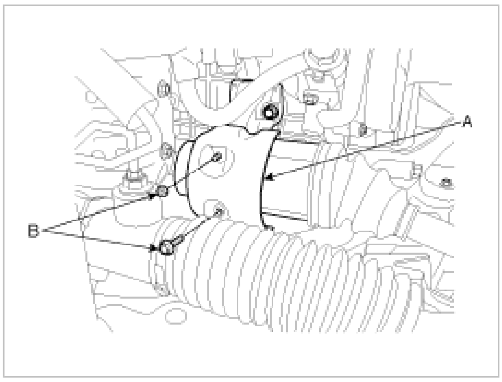
B. Remove the fork(A) from the front lower arm(B).



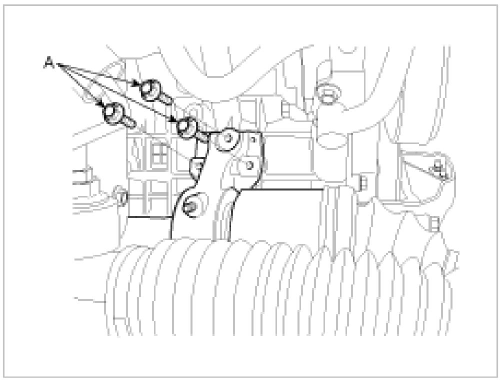
C. Remove the fork(A) from the front strut assembly(B).



D. Remove the inner shaft cover(A) from the inner shaft bracket(B).



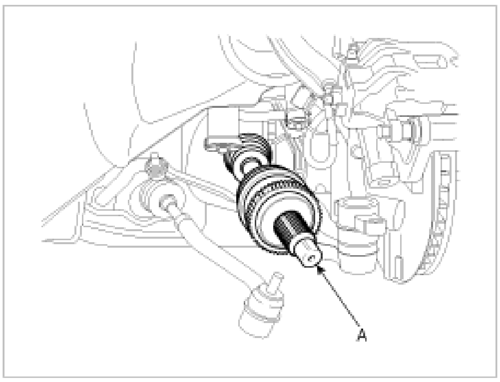
E. Remove the inner shaft bracket mounting bolt(A).



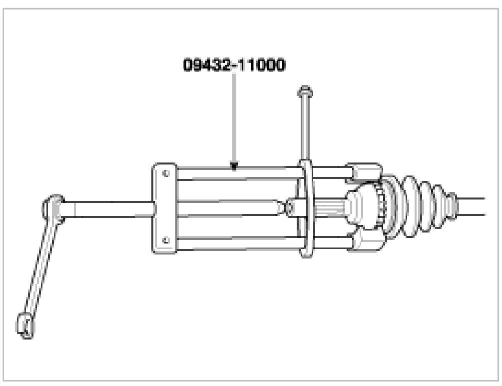
F. Remove the front driveshaft assembly(A) with the inner shaft from the transaxle.

CAUTION

Do not try to disconnect the inner shaft from the driveshaft. Because they can not be disconnected once assembled.
Do not reuse the driveshaft which is disassembled from the innershaft.



10. Using the special tool (09432-11000), remove the tone wheel.

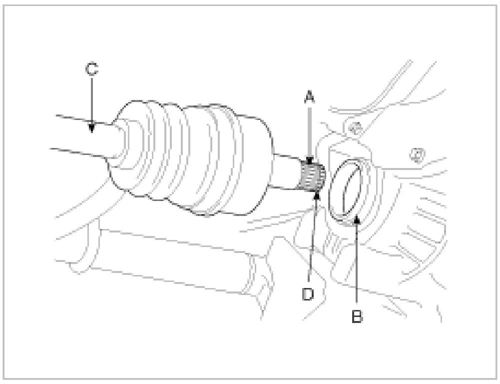


INSTALLATION

CAUTION

Replace the circlip with new ones after removal.

1. Apply gear oil on the drive shaft spliness(A) and the contacting surface of differential case oil seal(B).
2. Before installing the drive shaft(C), set the opening side of the clip(D) facing downward.



3. After installation, check if the drive shaft cannot be removed.
4. Install the drive shaft into the knuckle.

CAUTION

Be careful not to damage the boot.

5. Install the knuckle in the lower arm assembly.

Tightening Torque Nm(kgf·m, lb-ft) :
100~120 (10~12, 74~88)

6. Install the tie rod end in the knuckle.

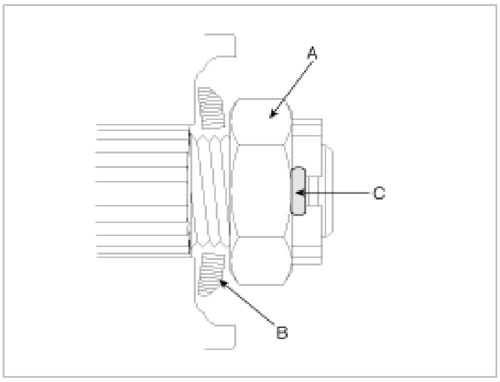
Tightening Torque Nm(kgf·m, lb-ft) :
24~34 (2.4~3.4, 18~25)

7. Install the wheel speed sensor in the knuckle.

Tightening Torque Nm(kgf·m, lb-ft) :
8~10 (0.8~1, 5.8~7.2)

8. After installing the washer(B) with convex surface outward, install the lock nut(A) and the spilt pin(C)

Tightening Torque Nm(kgf·m, lb-ft) :
200~280 (20~28, 148~207)

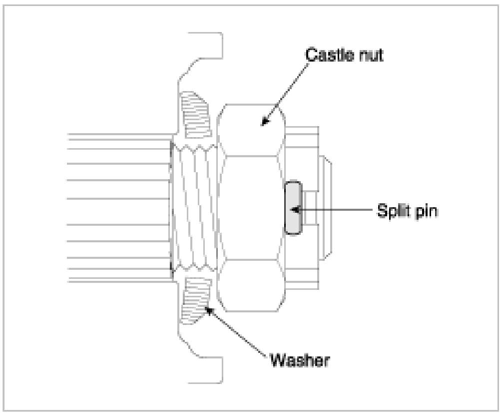


9. Install the wheel and tire.

INSTALLATION

1. Tighten the components with the tightening torque.

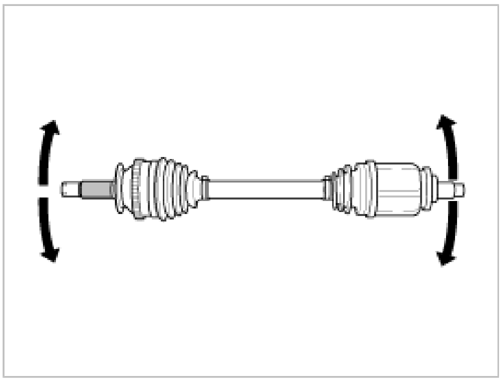
Item T	orque (kg·m)
Driveshaft nut	20 ~ 28
Lower arm and ball joint	10 ~ 12
Shock absorber lower mounting bolts	14 ~ 16
Tie rod end and knuckle	2.4 ~ 3.4



2. Replace the retainer ring every time the driveshaft is removed from the transaxle case.
3. Install the washer on driveshaft and tighten the nut as illustrated.
4. Install the split pin.

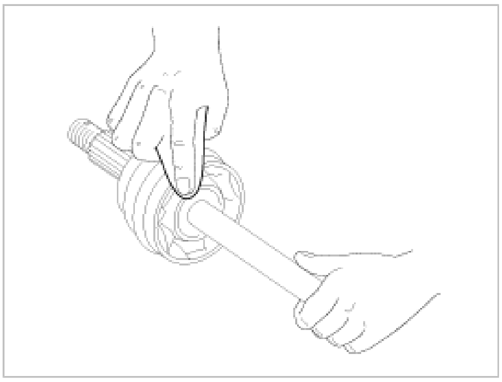
INSPECTION

1. Check the driveshaft boots for damage and deterioration.
2. Check the splines for wear and damage.
3. Check the ball joints for wear and operating condition.



INSPECTION

1. Check the driveshaft spline part for wear.
2. Check for entry of water and foreign material into boot.
3. Check the spider ring for revolution and wear.
4. Check the SFJ case inside wear and rust.

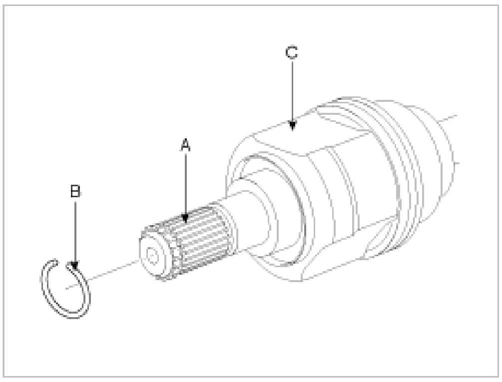


DISASSEMBLY

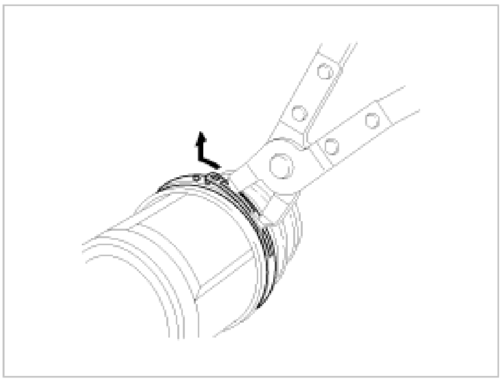
NOTE

- Do not disassemble the BJ assembly.
- Special grease must be applied to the drive shaft joint. Do not substitute with another type of grease.
- The boot band should be replaced with a new one.

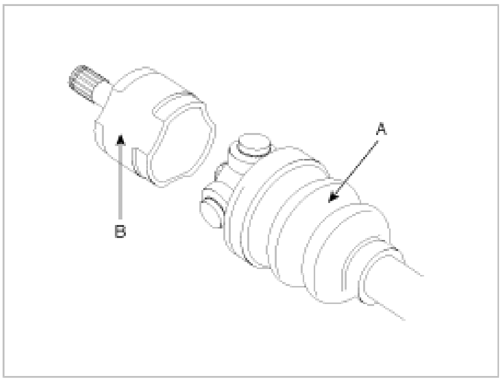
1. Remove the clip(B) from drive shaft splines(A) of the transaxle side TJ case(C).



2. Remove both boot bands from the transaxle side TJ case.

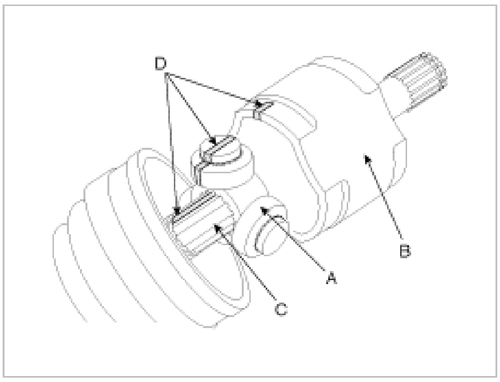


3. Pull out the boot from the transaxle side joint(TJ).
4. When separating the joint and boot(A), remove the grease from the TJ case(B).

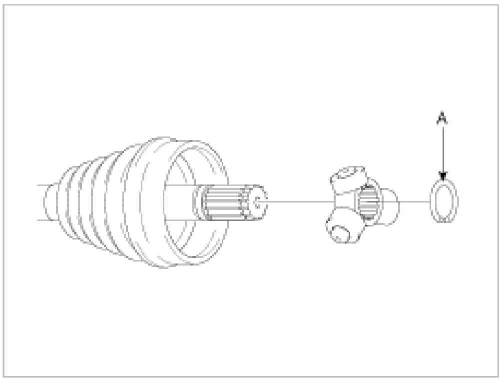


CAUTION

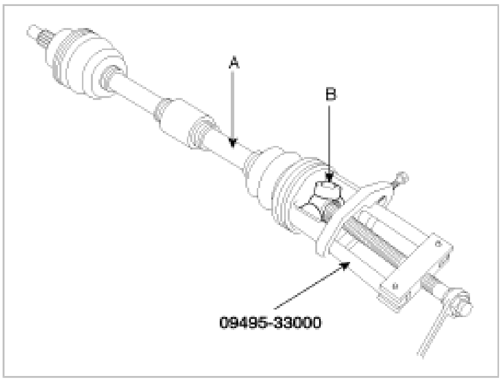
- Be careful not to damage the boot.
- Make alignment marks on spider roller assembly(A), TJ case(B), and shaft splines(C) to aid reassembly.



5. Using a plier or flat-tipped (-) screwdriver, remove the snap ring(A).



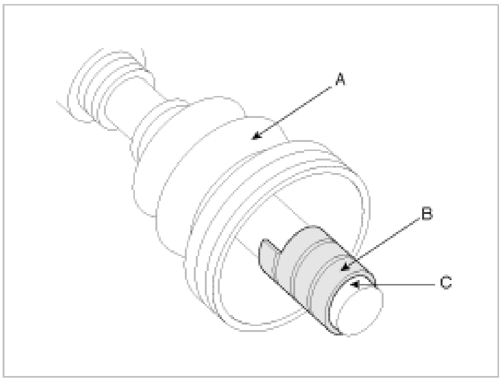
6. Remove the spider assembly(B) from drive shaft(A) by using the Special Tool(09495-33000).



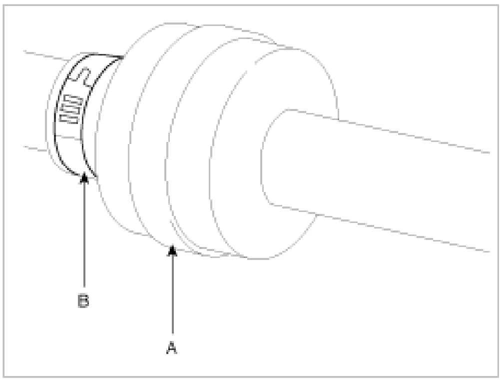
7. Clean the spider assembly.
8. Remove the boot(A), of the transaxle side joint(TJ).

CAUTION

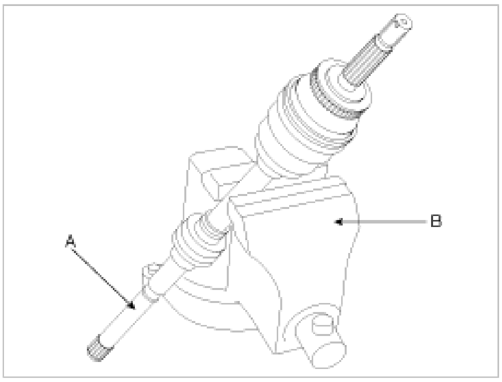
Wrap tape(B) around the driveshaft splines(C) to protect the boot(A).



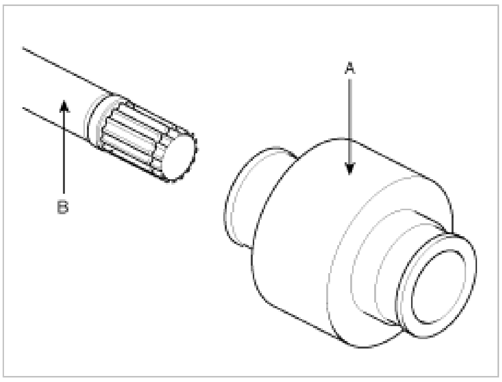
9. Remove both side of bands(B,C) of the dynamic damper(A).



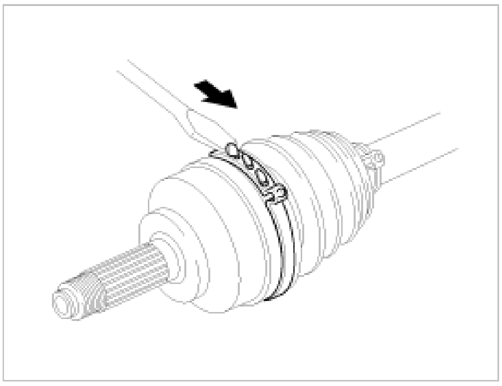
10. Fix the drive shaft(A) with a vice(B) as illustrated.



11. Apply soapy water to the shaft to prevent being damaged between the shaft spline and the dynamic damper when the dynamic damper is removed.
12. Separate dynamic damper(A) from the shaft(B) carefully.



13. Remove both bands on the side of wheel.



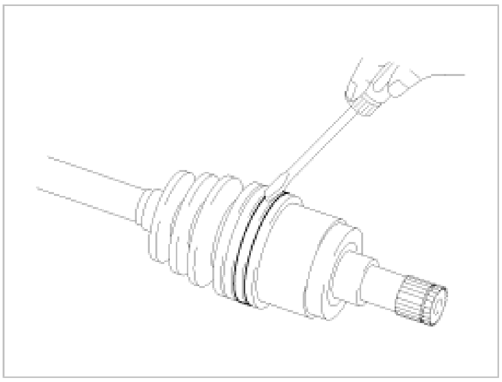
14. Pull out the joint(BJ) boot on the side of wheel into the transaxle direction.
    Be carefull not to damage the boot.

DISASSEMBLY

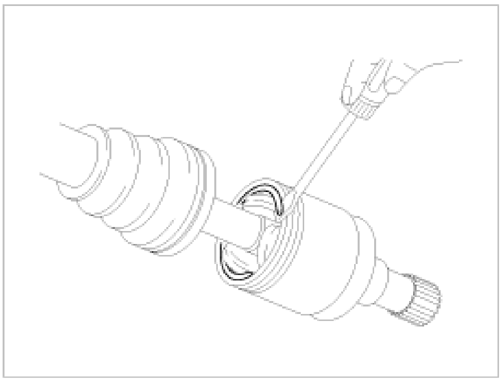
> **NOTE**
>
> - Do not disassemble the BJ assembly.
> - The Driveshaft joint uses special grease. Do not subtitute with another type of grease.
> - The Boot band should be replaced with a new one.

1. Remove the SFJ boot band and pull the boot from SFJ outer race.

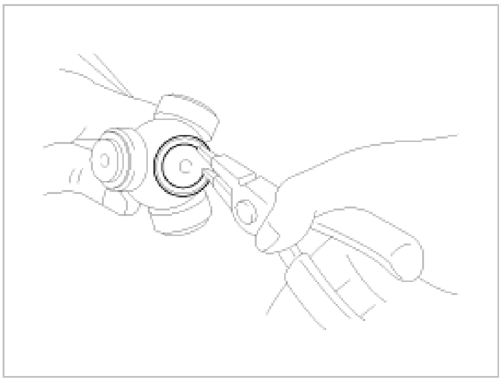
> **NOTE**
>
> Be careful not to damage it.



2. Remove the circlip using a screwdriver.
   (ASAN) KOREA



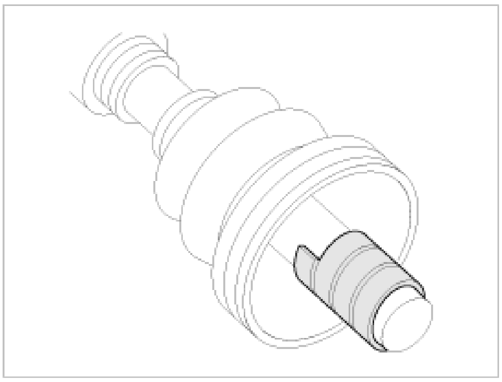
3. Remove the driveshaft from SFJ outer race.



4. Remove the snap ring and disassemble the spider assembly from the shaft.
5. Clean the spider assembly.
6. Remove the BJ boot band and removal of the SFJ boot and the BJ boot.

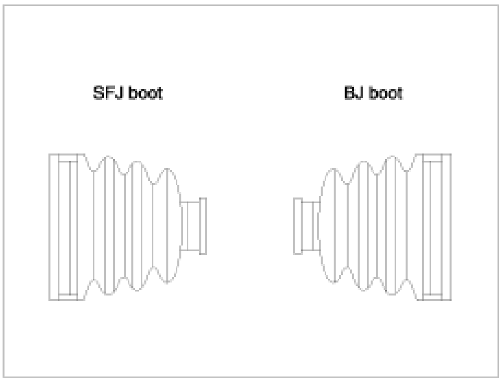
CAUTION

If the boot is reused, wrap a tape around the driveshaft splines to protect the boot.



REASSEMBLY

1. Wrap a tape around the driveshaft spline(SFJ side) to avoid boot damage.



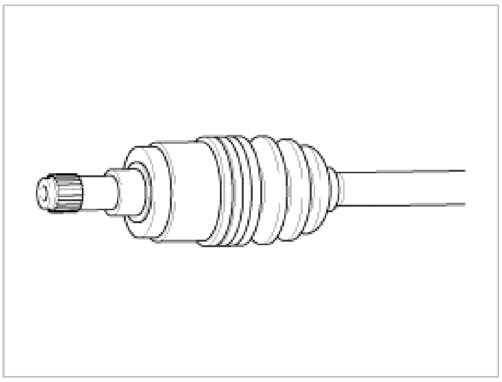
2. Apply specified grease at the driveshaft and install the boot.

Item 3.3		L
Grease filling quantity	BJ boot	Joint 140g ± 5g, Boot 60g ± 5g
	SFJ boot	Joint 100g ± 5g, Boot 45g ± 5g

3. Add the specified grease in the amount wiped away at the of inspection.
4. Tighten the boot band.

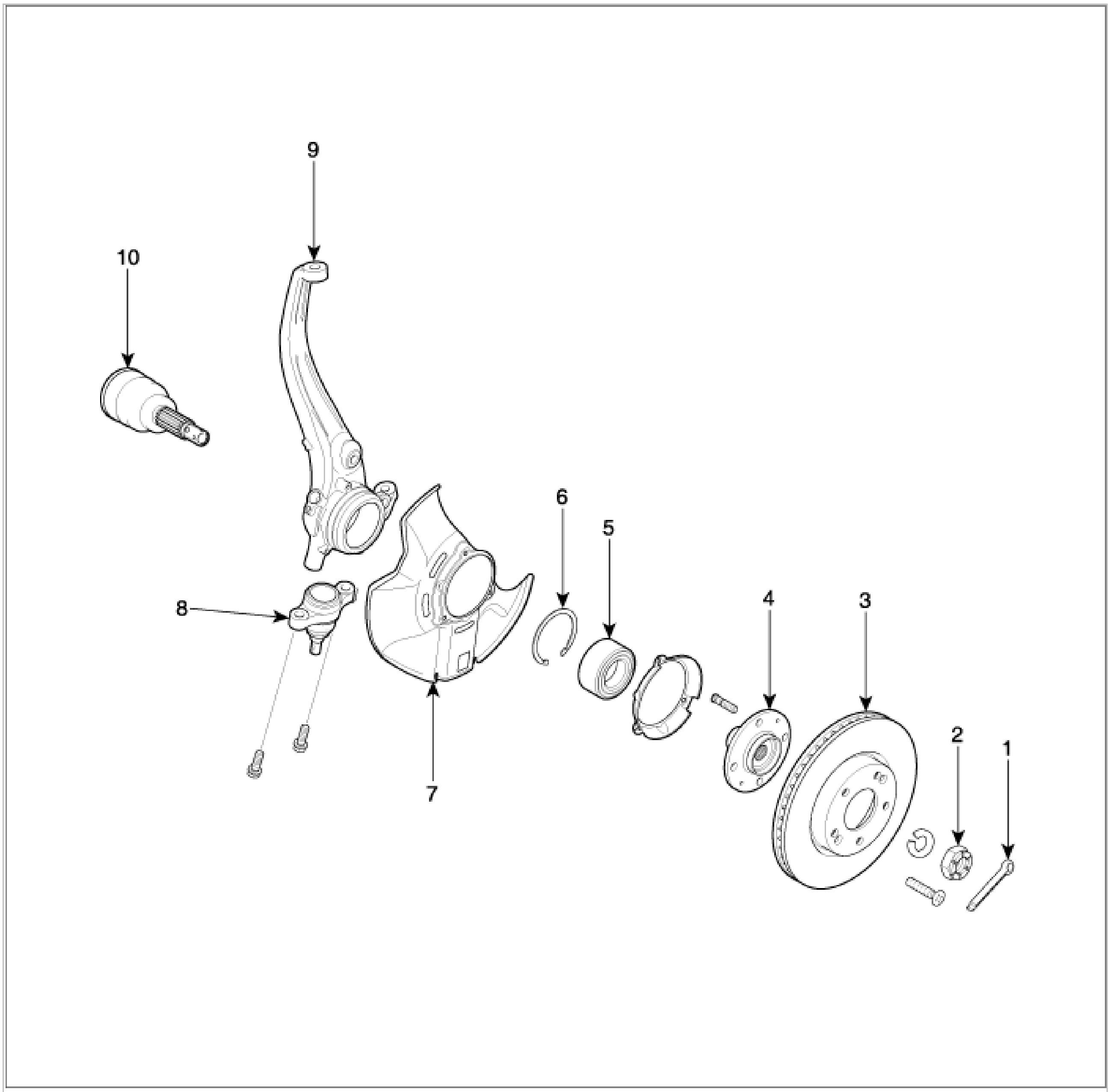
CAUTION

Adjust the distance between boot bands within the specification range when tightening the boot band to adjust air in the boot.



Driveshaft and axle > Front Axle Assembly > Front Hub / Axle > Components and Components Location

COMPONENTS

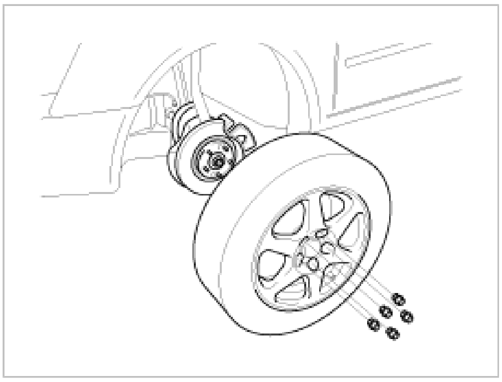


1. Split pin
2. Driveshaft nut
3. Brake disc
4. Hub
5. Wheel bearing
6. Snap ring
7. Dust cover
8. Lower arm ball joint
9. Knuckle
10. Driveshaft

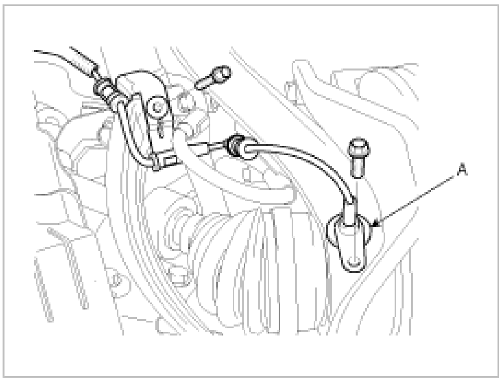
Driveshaft and axle > Front Axle Assembly > Front Hub / Axle > Repair procedures

REMOVAL

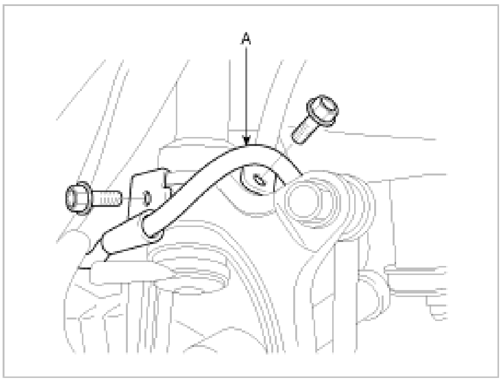
1. Remove the wheel and tire.



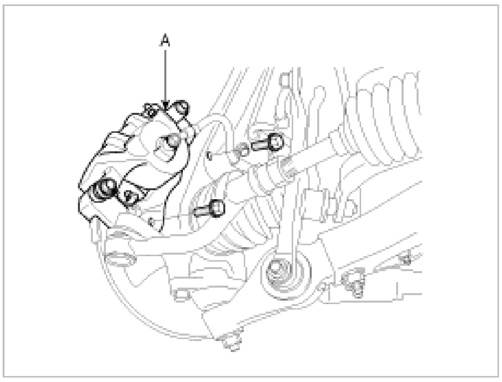
2. Disconnect the wheel speed sensor(A) from the knuckle.

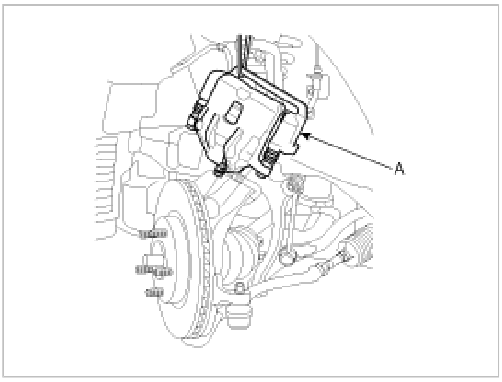


3. Disconnect the brake hose(A) from the knuckle.

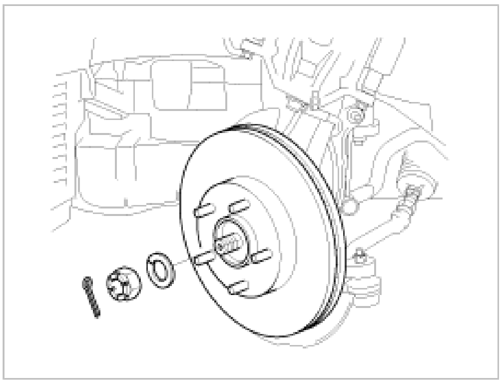


4. Remove the caliper assembly(A) and suspend it with wire.

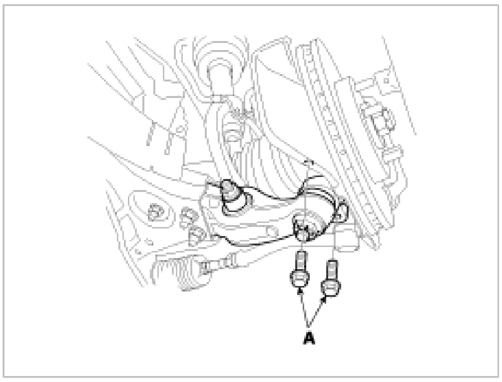




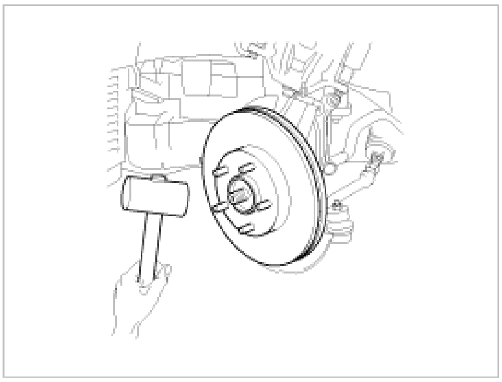
5. Remove the split pin and driveshaft castle nut from the front hub.



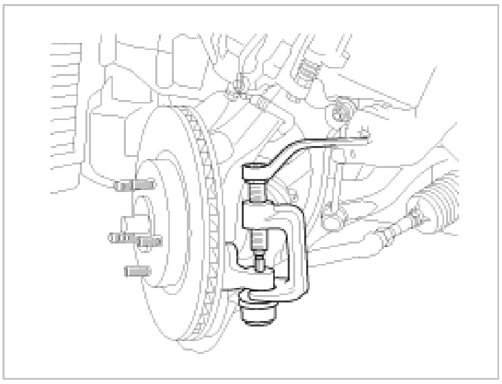
6. Remove the 2 bolts(A) and disconnect the ball joint from the knuckle.



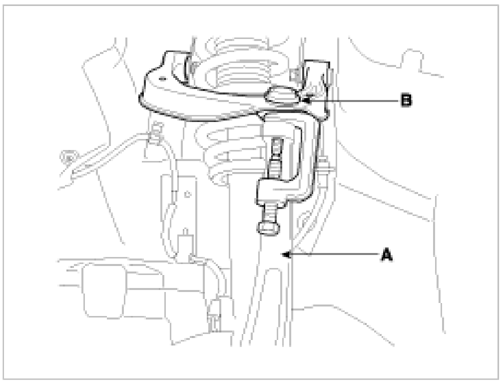
7. Using a plastic hammer, disconnect the driveshaft from the axle hub.



8. Using the special tool (09568-4A000), disconnect the tie rod end from the knuckle.



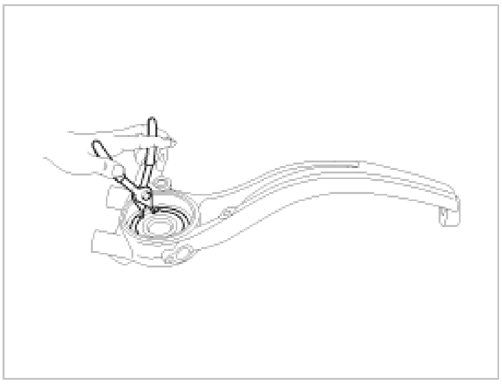
9. Loosen the upper armmounting nut but do not remove it.
10. Using the special tool (09568-4A000), disconnect the upper arm from the knuckle.



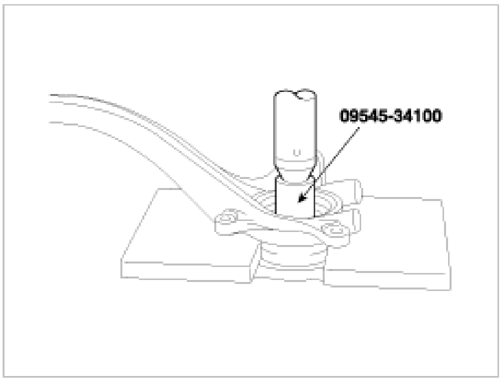
11. Remove the front axle and knuckle together.
12. Installation is the reverse of removal.

DISASSEMBLY

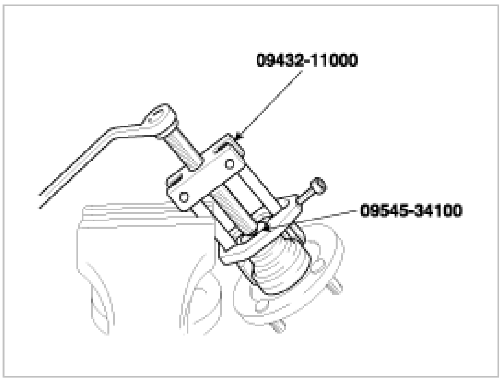
1. Remove the brake disc from the hub.
2. Remove the snap ring.



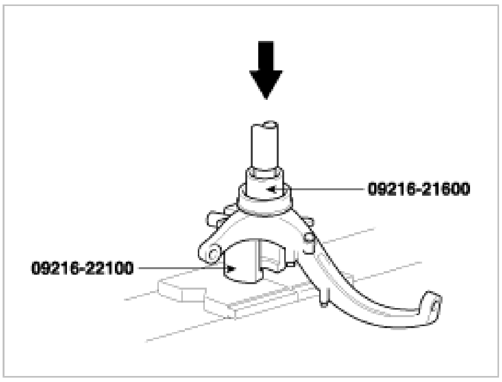
3. Using the special tool (09545-34100), disconnect the hub from the knuckle.



4. Using the special tools (09432-11000, 09545-34100), remove the wheel bearing inner race from the hub.



5. Using the special tools (09216-21600, 09216-22100), remove the wheel bearing outer race from the knuckle.



INSPECTION

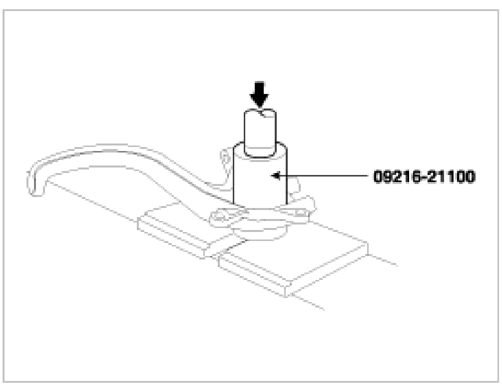
1. Check the hub for cracks and splines for wear.
2. Check the snap ring for cracks or damage.
3. Check the knuckle inner surface for scoring and cracks.

REASSEMBLY

1. Apply a thin coat of multi-purpose grease to the knuckle and bearing contact surface.
2. Using the special tool (09216-21100), press-in the bearing to the knuckle.

NOTE

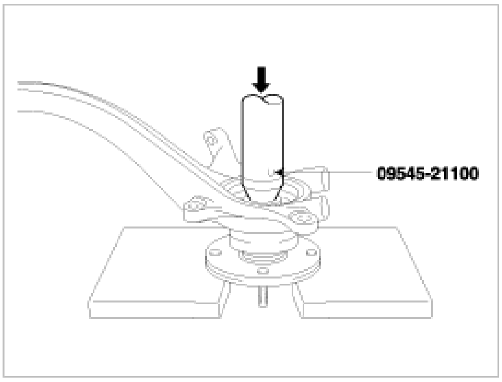
- Do not press against the inner race of the wheel bearing because that can cause damage to the bearing assembly.
- Always use a new bearing assembly.



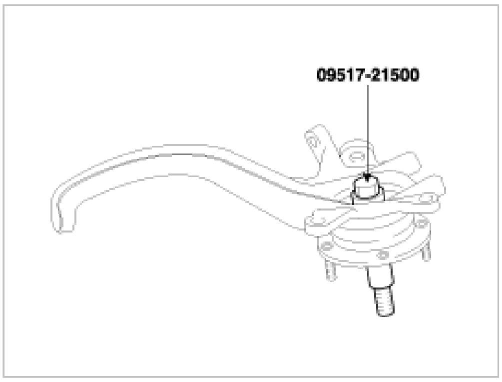
3. Install the snap ring into the groove of the knuckle.
4. Using the special tool (09545-21100), press the hub on to the knuckle.

NOTE

Do not press against the outer race of the wheel bearing because that can cause damage to the bearing assembly.

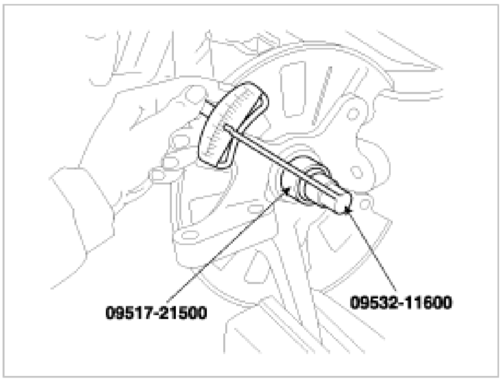


5. Tighten the hub to the knuckle to 200 Nm (20 kgf·m, 148 lb-ft) with the special tool (09517-21500).



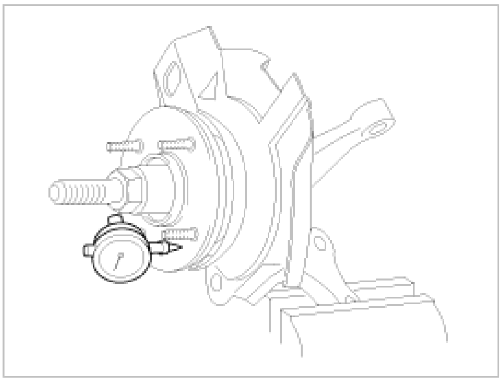
6. Rotate the hub to seat the bearing.
7. Measure the wheel bearing starting torque.

Standard value
Starting torque : 1.8 Nm (0.18 kgf·m, 16 lb-ft) or less



Fix a dial gauge and measure the hub end play. Check that it is within the standard value.

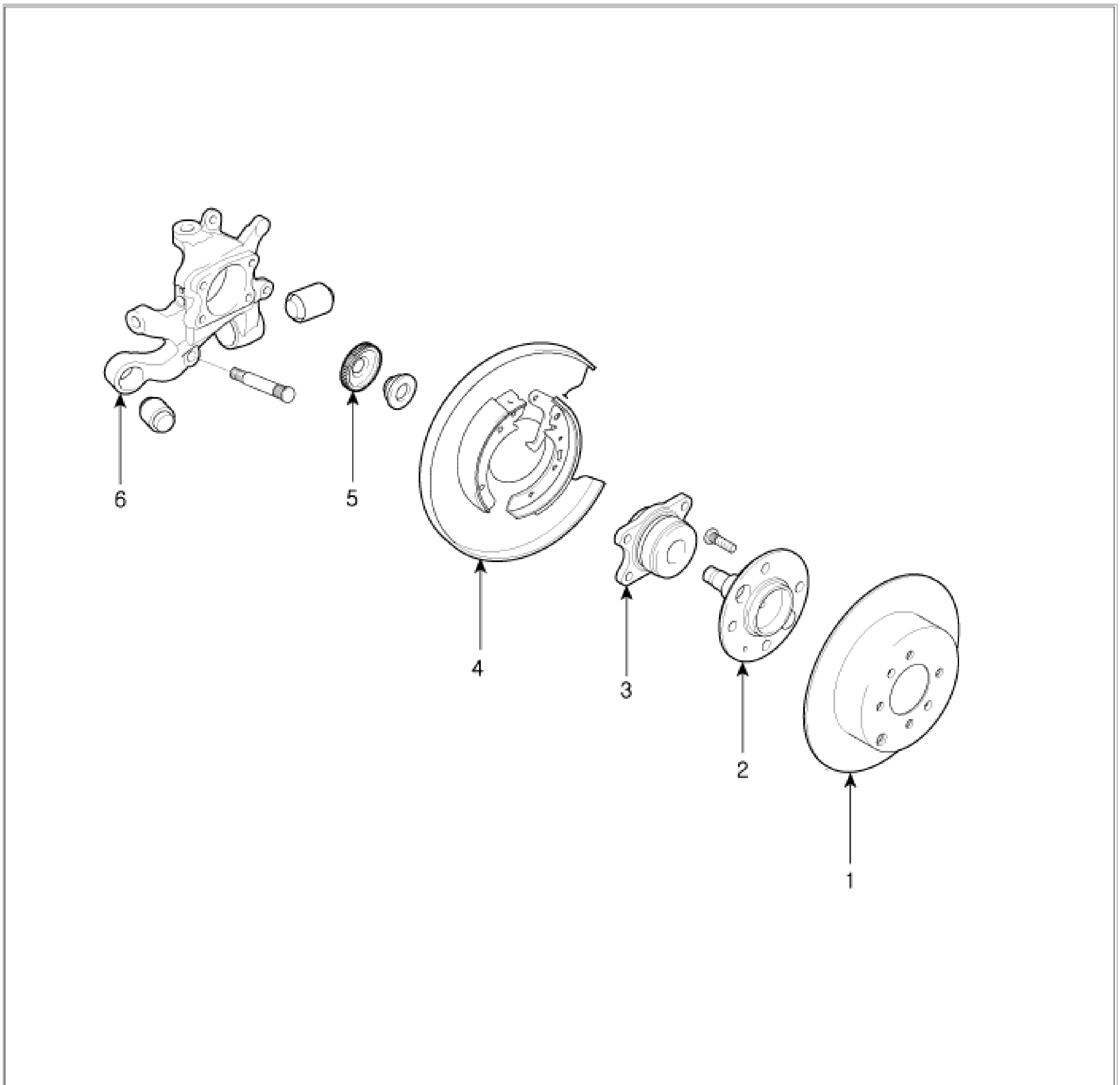
Standard value
Hub end play : 0.008 mm (0.0003 in) or less



8. Remove the special tool.
9. Install the disc to the hub.

Driveshaft and axle > Rear Axle Assembly > Rear Hub / Axle > Components and Components Location

COMPONENTS

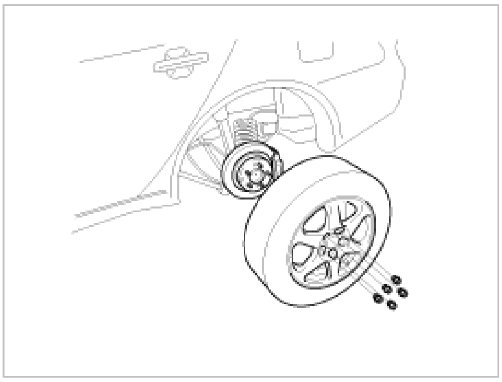


1. Brake disc	4. Brake assembly
2. Hub	5. Tone wheel (ABS System)
3. Hub bearing	6. Carrier assembly

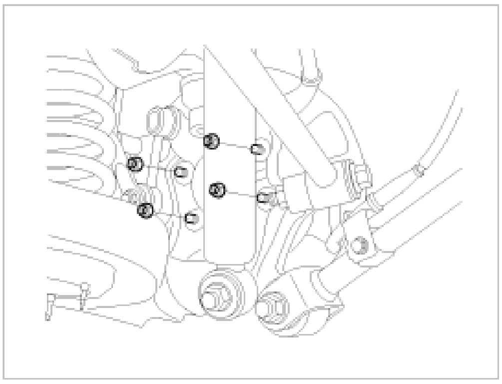
Driveshaft and axle > Rear Axle Assembly > Rear Hub / Axle > Repair procedures

REMOVAL

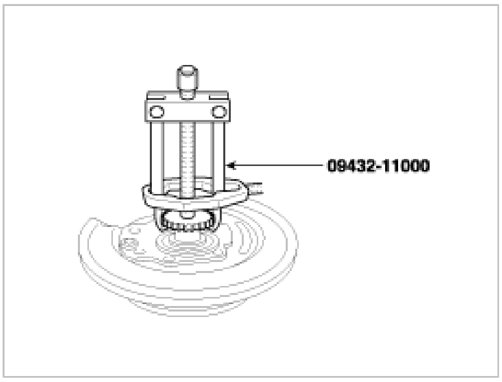
1. Release the parking brake.
2. Remove the wheel and tire.



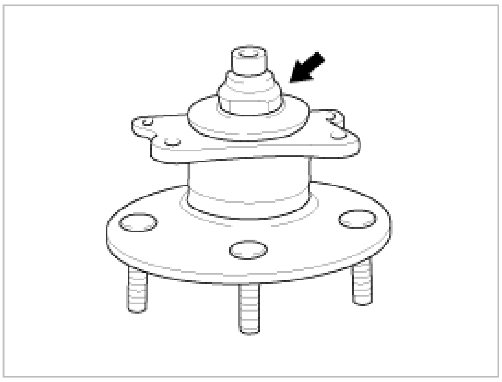
3. Remove the ABS sensor from the carrier.
4. Remove the caliper assembly from the carrier and suspend it with wire.
5. Remove the brake disc.
6. Remove the rear axle hub mounting bolts (4).



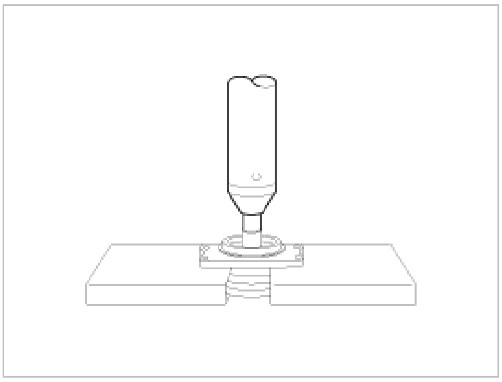
7. Using the special tool (09432-11000), remove the tone wheel.



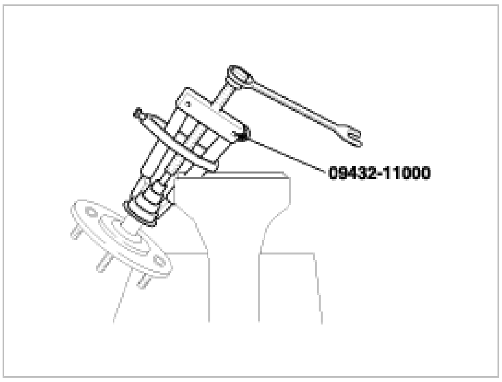
8. Remove the carrier assembly.
9. After unstaking the flange nut, remove the nut.



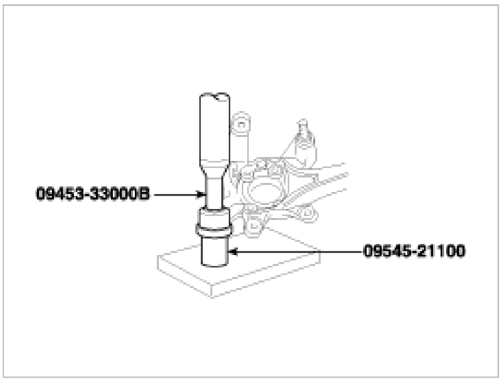
10. While supporting the flange area of the bearing outer race, press out the rear axle hub.



11. Using the special tool (09432-11000), remove the bearing inner race from the axle hub.

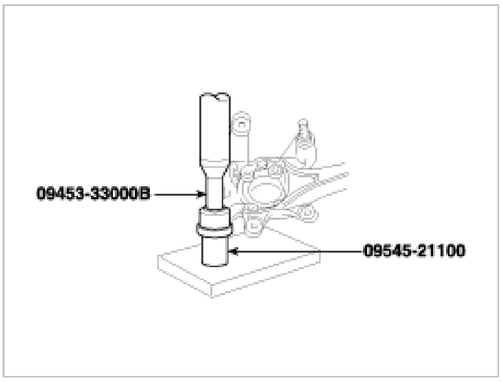


12. Using the special tools (09453-33000B, 09545-21100), remove the 2 bushings from the carrier.

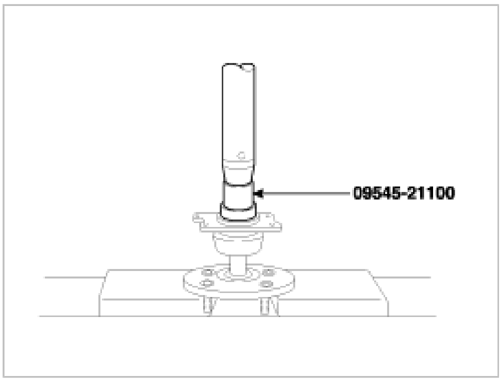


INSTALLATION

1. Using the special tools (09453-33000B, 09545-21100) press-in the 2 bushings to the carrier.



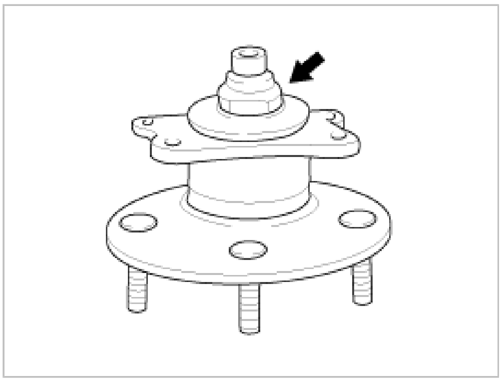
2. Apply a thin coat of multi-purpose grease to the hub and bearing contact surface.
3. Using the special tool (09545-21100), press-in the bearing to the hub.



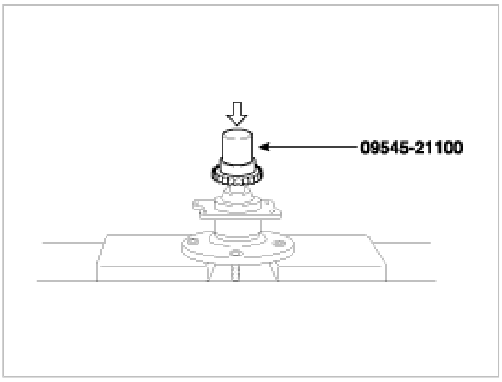
NOTE

- Do not press against the outer race of the bearing because that can cause the damage to the bearing assembly.
- Always use a new bearing assembly.

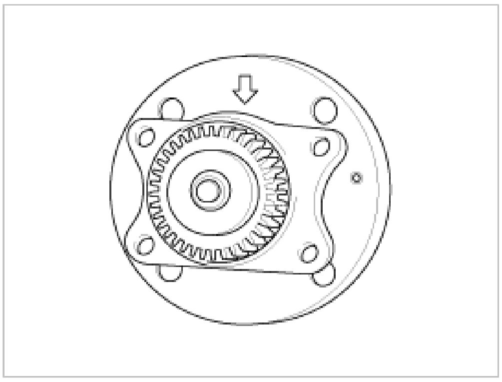
4. After tightening the flange nut, stake the nut to meet the concave portion of the spindle.



5. Using the special tool (09221-21000), press-in the tone wheel.

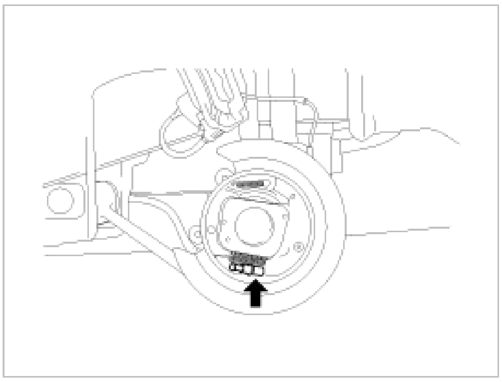


6. Fix the hub and bearing assembly to the brake backing plate so that the rounded area of the bearing outer race is placed facing upward.

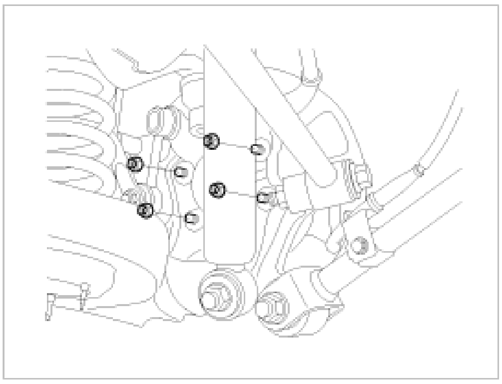


NOTE

If it is difficult to fix, adjust the parking brake adjusting nut in clockwise direction to enlarge the space between the shoe and lining assembly.

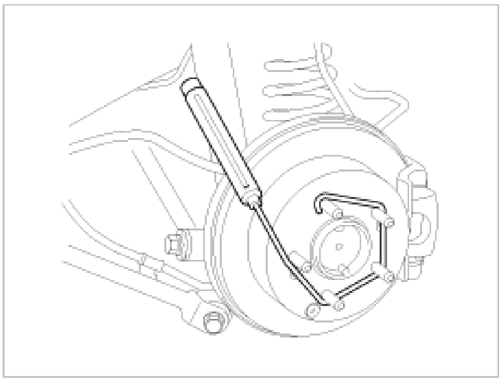


7. Tighten the 4 bolts to the specified torque.



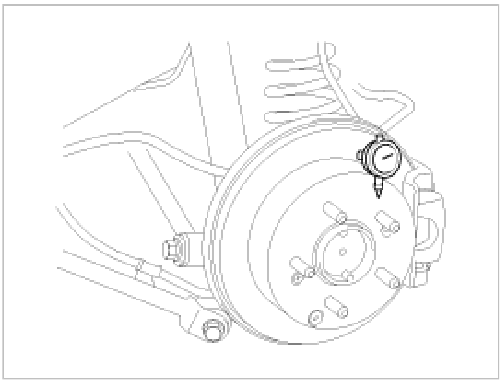
8. Rotate the hub to seat the bearing.
9. Using a spring balance, measure the wheel bearing starting torque.

Standard value
Starting torque : 1.76 Nm (0.18 kgf·m, 15.6 lb-in) or less



10. Fix a dial gauge andmeasure the hub end play. Check that it is within the standard value.

Standard value
Hub end play : 0.008 mm (0.0003 in) or less

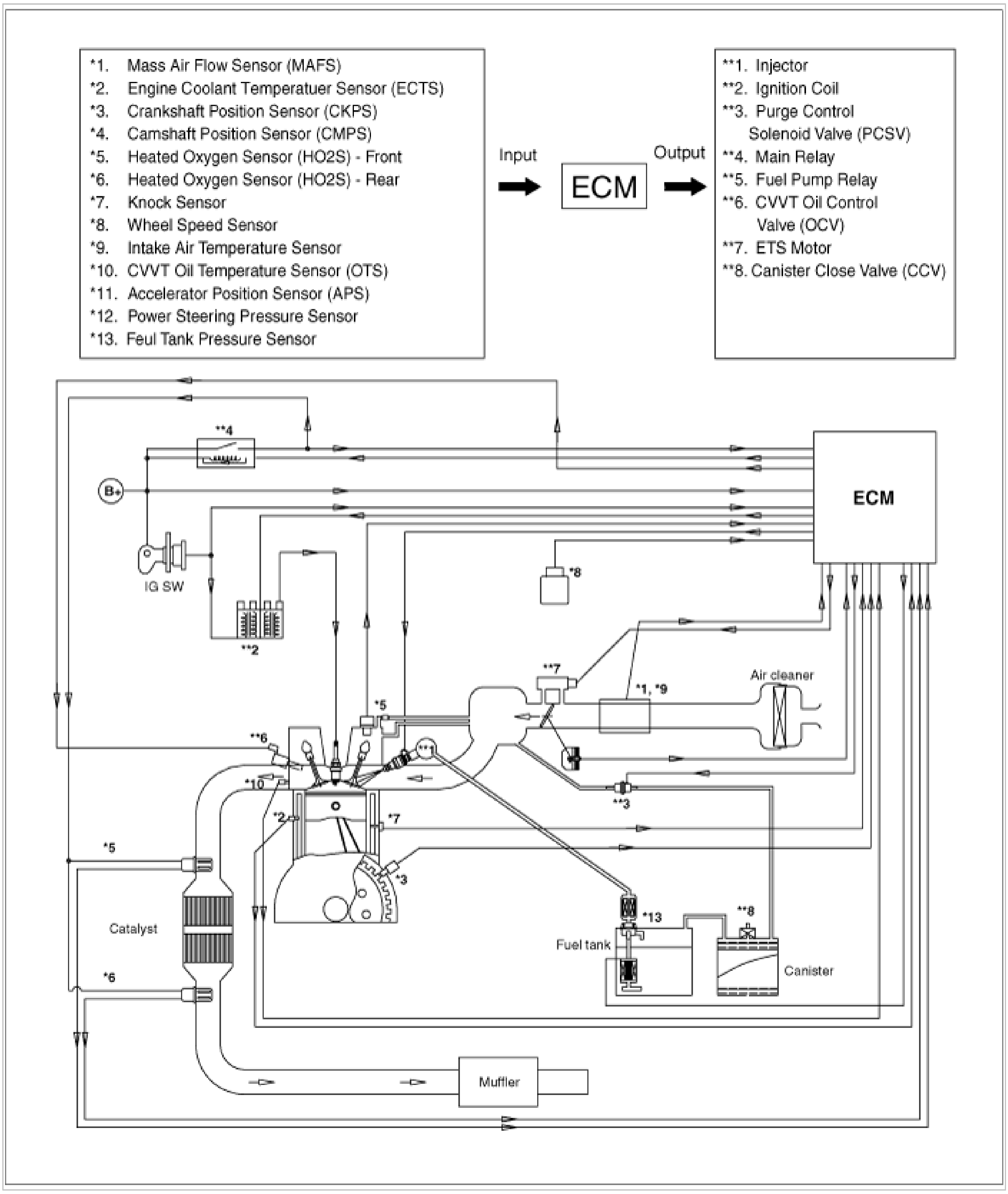


INSPECTION

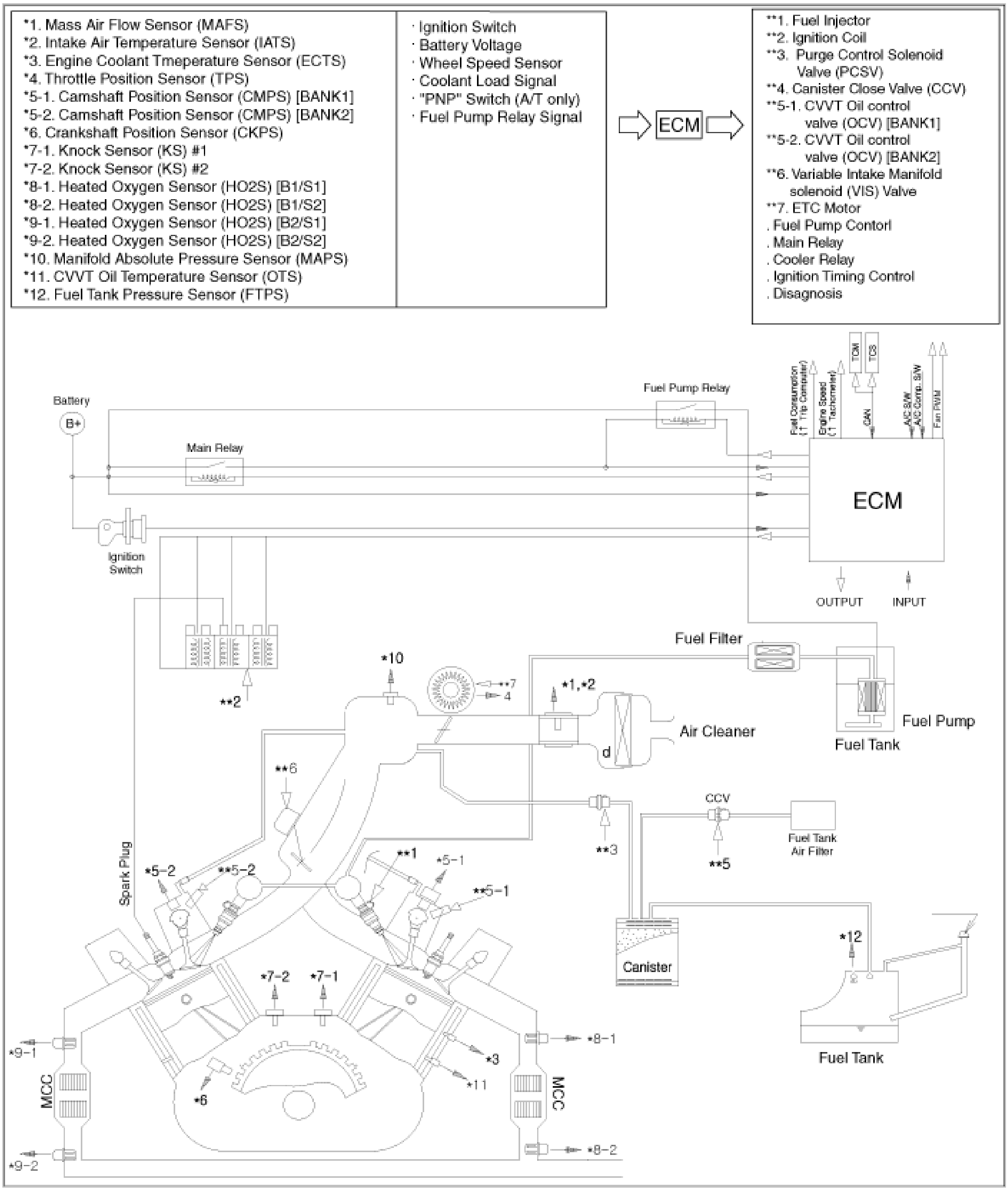
1. Check the rear hub bearing for wear or damage.
2. Check the rear tone wheel for chipped teeth.
3. Check the hub inner surface for scoring.
4. Check the carrier for crack.

SCHEMATIC DIAGRAM

[2.4 DOHC]



[3.3 V6]



Emission Control System > General Information > General Information

SPECIFICATIONS

Item Spec	ification	
Purge Control Solenoid Valve (PCSV)	Type	Duty Control type
	Resistance (Ω)	19 ~ 22 at 20 °C (68 °F)
Canister Close Valve (CCV)	TYPE	ON/OFF
	Resistance	19.8 ~ 21.8 at 20°C (68°F)

TIGHTENING TORQUE

Item N·m		kg·cm	lbf·ft
Positive Crankcase Ventilation Valve	8 ~ 12	80 ~ 120	6 ~ 8
Purge Control Solenoid Valve (PCSV)	9.7 ~ 11.77	100 ~ 120	7.23 ~ 8.68
Canister	16.7 ~ 25.5	170.3 ~ 260	12.3 ~ 18.8

TROUBLESHOOTING

Symptom Suspect	area	Remedy
Engine will not start or hard to start	Vacuum hose disconnected or damaged	Repair or replace
	Malfunction of the EVAP. Canister Purge Solenoid Valve	Repair or replace
Rough idle or engine stalls	Vacuum hose disconnected or damaged	Repair or replace
	Malfunction of the PCV valve	Replace
	Malfunction of the evaporative emission canister purge system	Check the system; if there is a problem, check related components parts
Excessive oil consumption	Positive crankcase ventilation line clogged	Check positive crankcase ventilation system

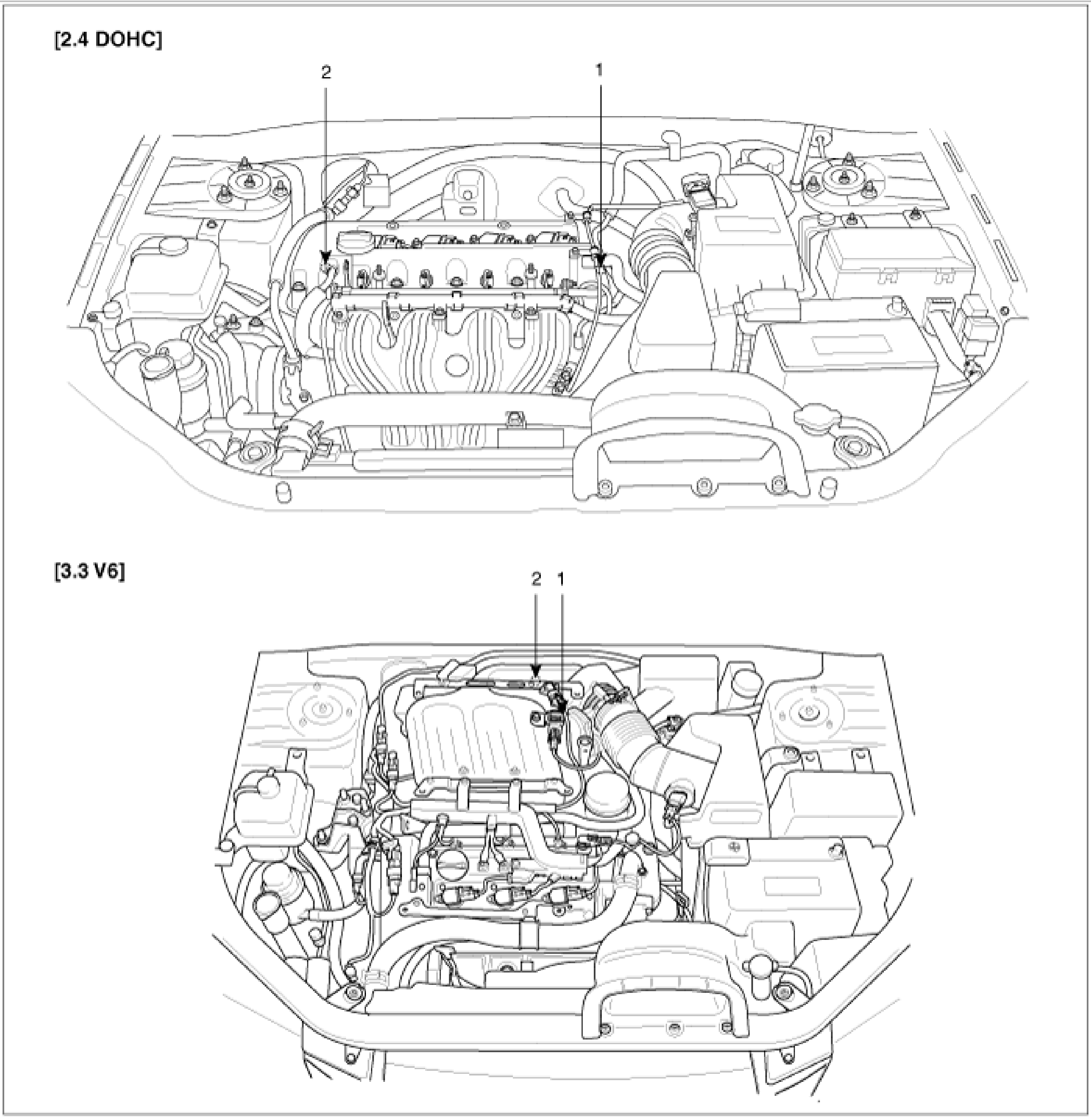
COMPONENTS

Components F	unction	Remarks
Crankcase Emission System - Positive Crankcase Ventilation (PCV) valve	HC reduction	Variable flow rate type
Evaporative Emission System - Evaporative emission canister - Purge Control Solenoid Valve (PCSV)	HC reduction HC reduction	Duty control solenoid valve
Exhaust Emission System - MFI system (air-fuel mixture control device) - Three-way catalytic converter	CO, HC, NOx reduction CO, HC, NOx reduction	Heated oxygen sensor feedback type Monolithic type

MFI : Multiport Fuel Injection
EVAP : Evaporative Emission

Emission Control System > General Information > Components and Components Location

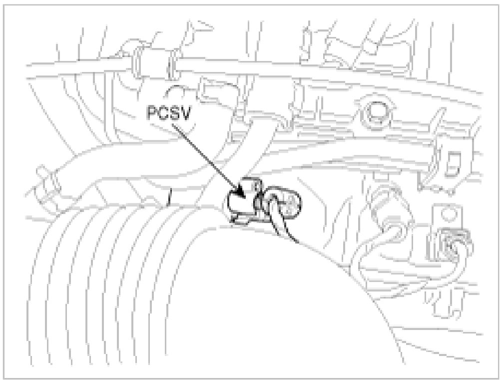
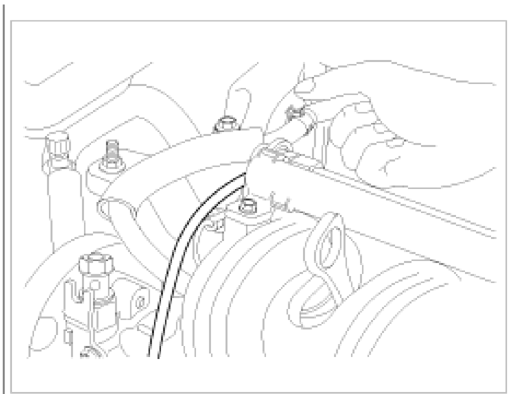
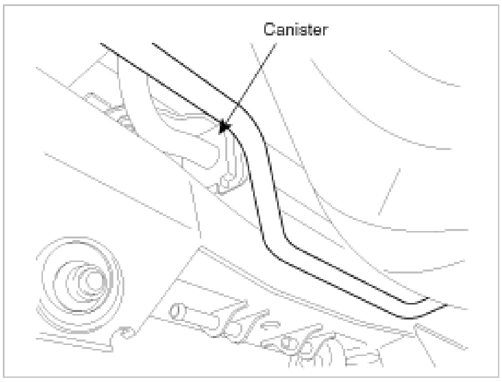
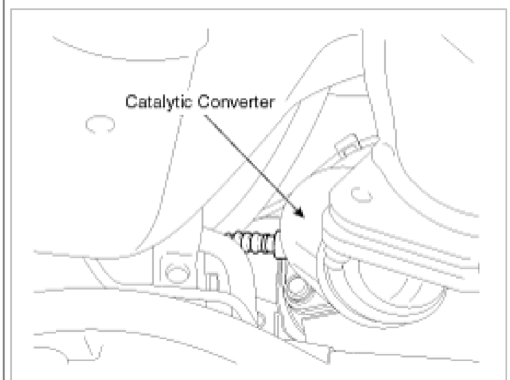
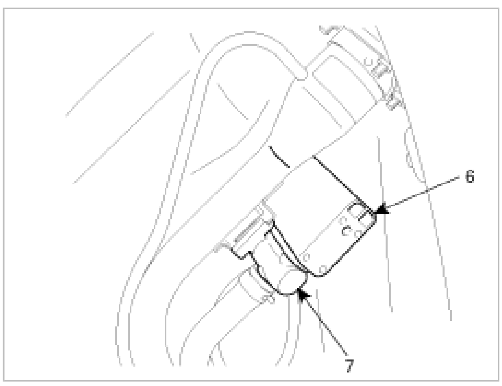
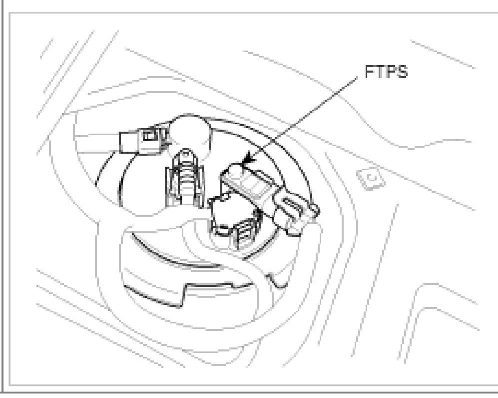
COMPONENTS LOCATION



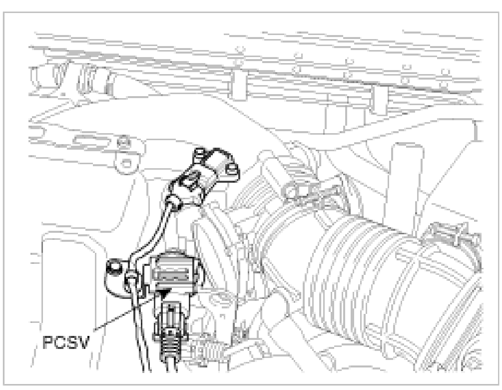
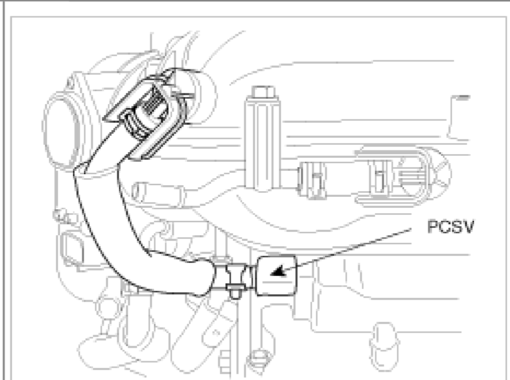
1. Purge Control Solenoid Valve (PCSV)
2. PCV Valve
3. Canister
4. Catalytic Converter (Bank 1)
5. Catalytic Converter (Bank 2)
6. Fuel Tank Air Filter
7. Canister Close Valve (CCV)
8. Fuel Tank Pressure Sensor (FTPS)

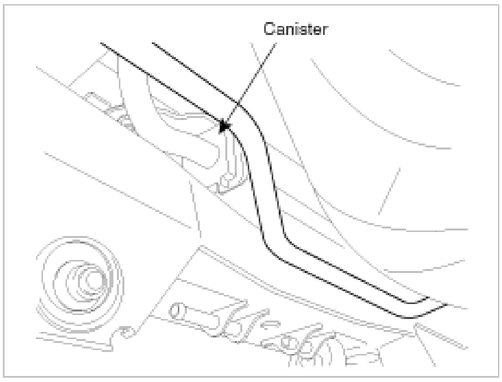
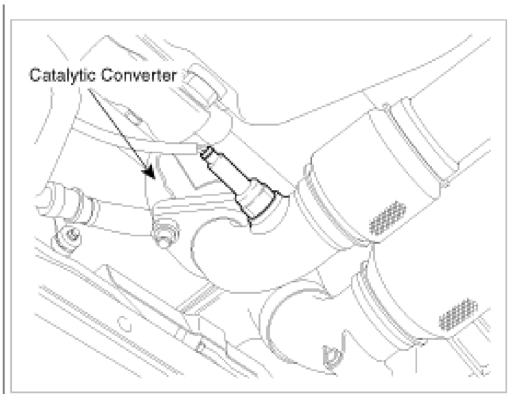
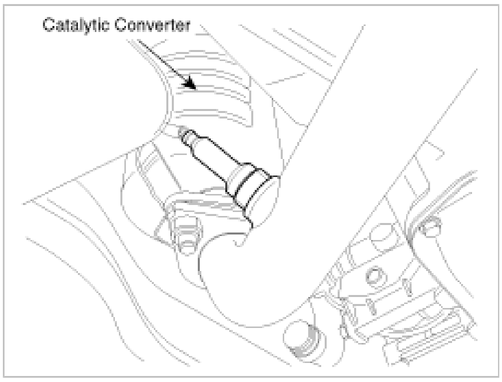
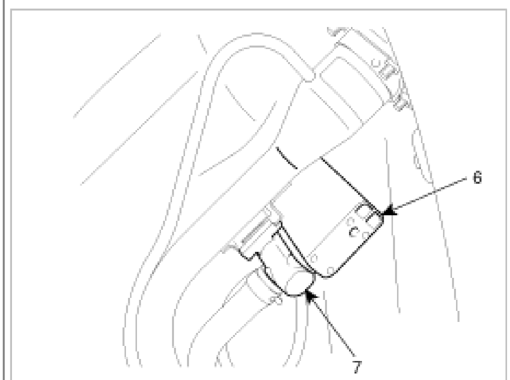
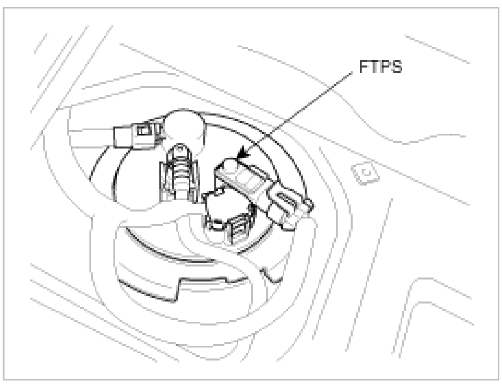
[2.4 DOHC]

1	Purge Control Solenoid Valve (PCSV)	2	Positive Crankcase Ventilation (PCV) Valve

			
3	Canister	4	Catalytic Converter
			
6	Canister Air Filter	8	Fuel Tank Pressure Sensor (FTPS)
7	Canister Close Valve (CCV)		
			

[3.3 V6]

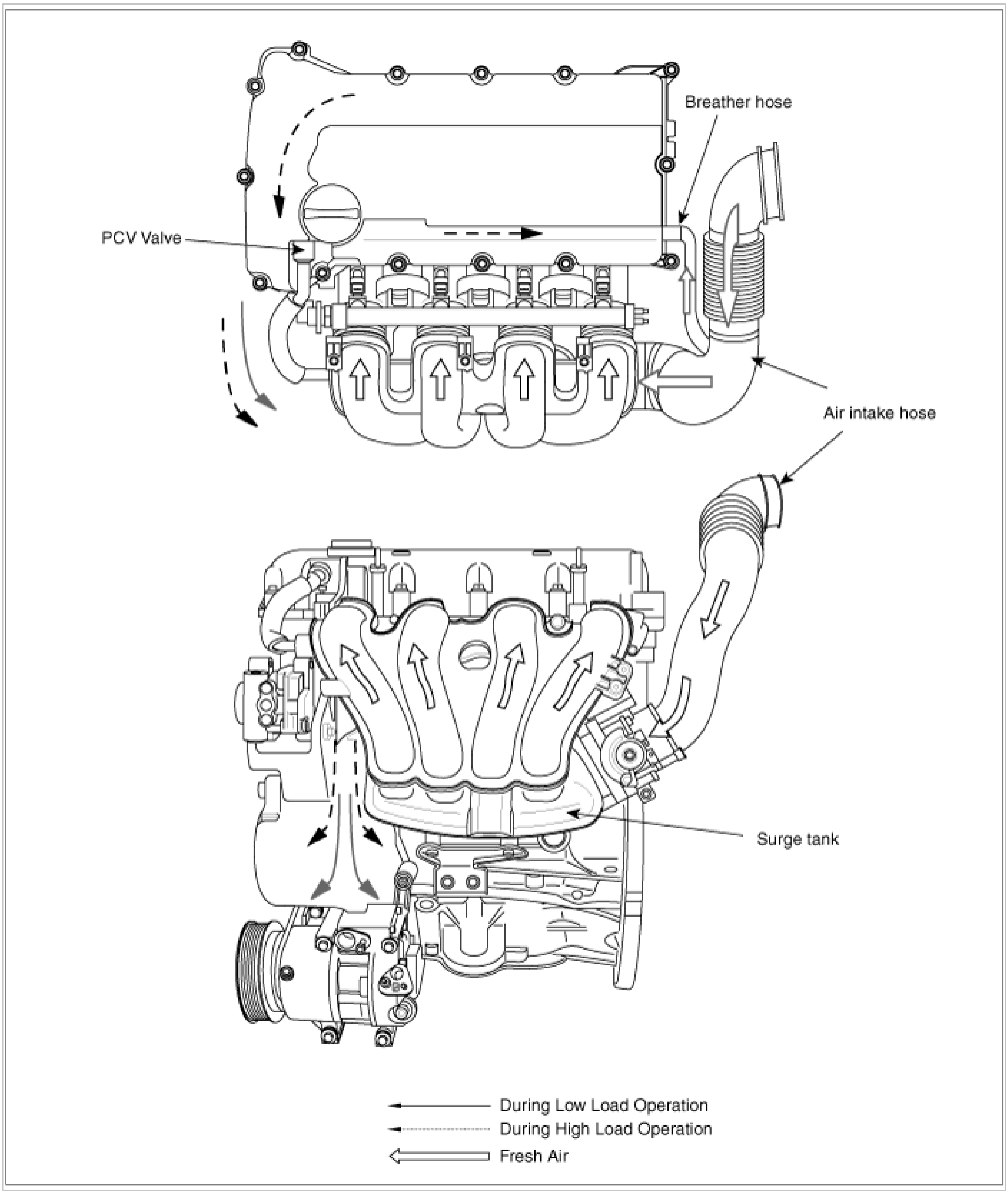
1	Purge Control Solenoid Valve (PCSV)	2	Positive Crankcase Ventilation (PCV) Valve
			
3	Canister	4	Catalytic Converter (Bank 1)

			
5	Catalytic Converter (Bank 2)	6	Canister Air Filter
		7	Canister Close Valve (CCV)
			
8	Fuel Tank Pressure Sensor (FTPS)		
			

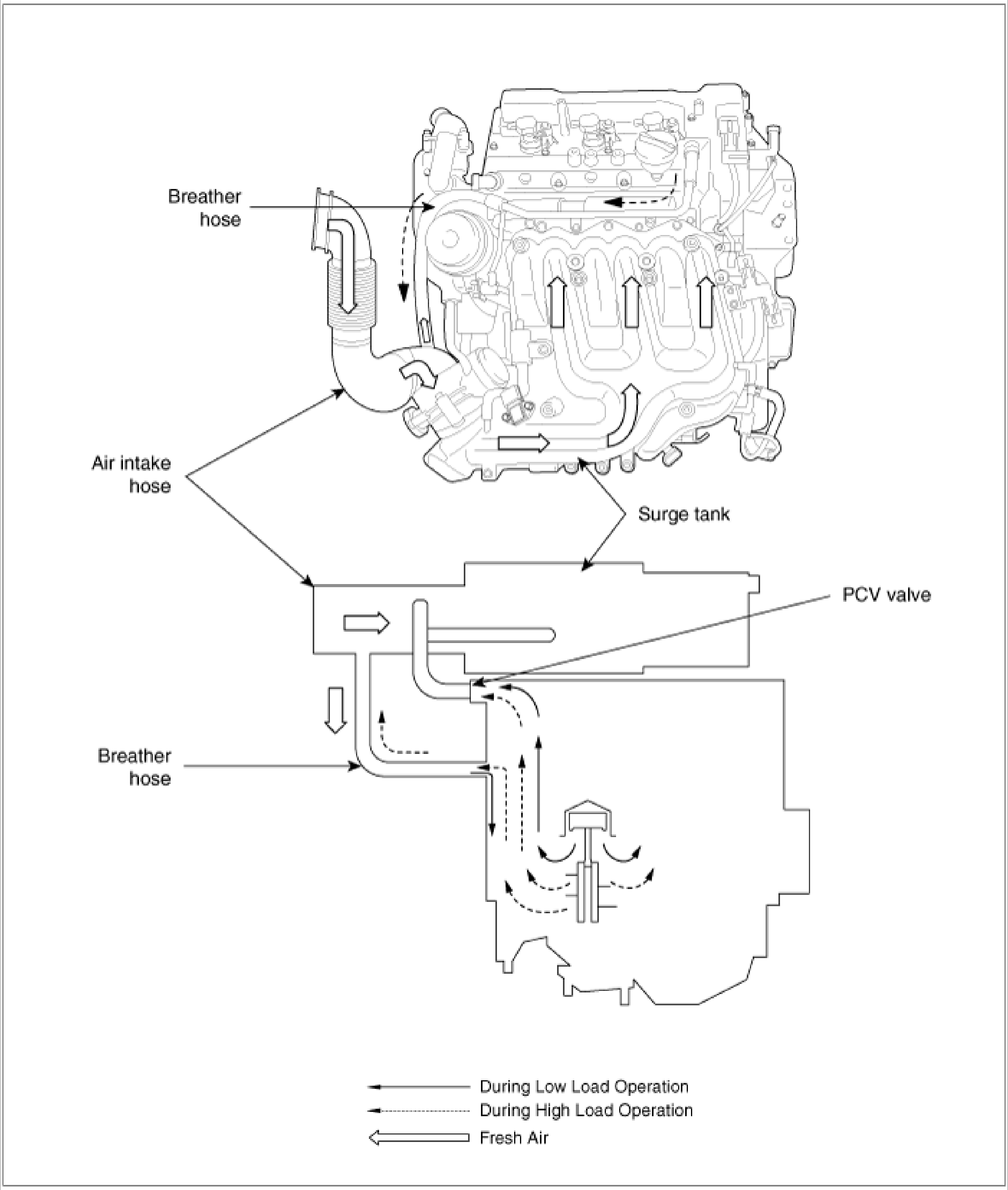
Emission Control System > Crankcase Emission Control System > Components and Components Location

COMPONENTS LOCATION

[2.4 DOHC]


Breather hose
PCV Valve
Air intake hose
Surge tank
During Low Load Operation
During High Load Operation
Fresh Air

[3.3 V6]



Emission Control System > Crankcase Emission Control System > Positive Crankcase Ventilation (PCV) Valve > Description and Operation

OPERATION

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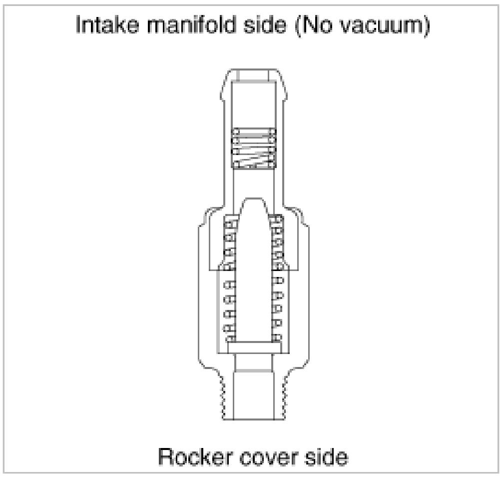
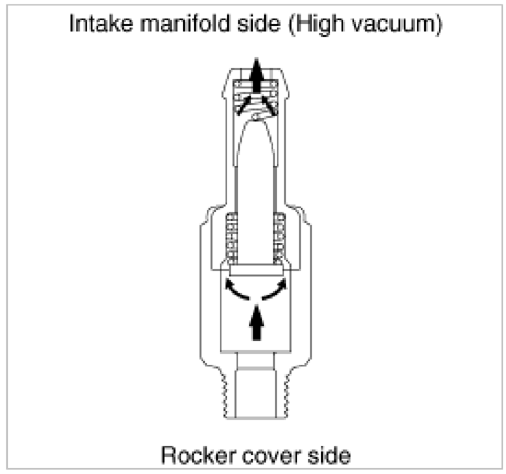
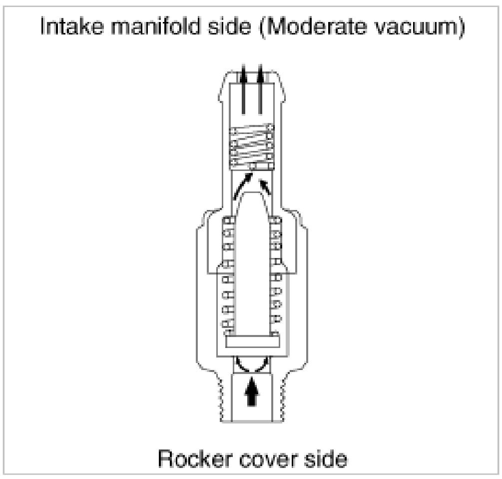
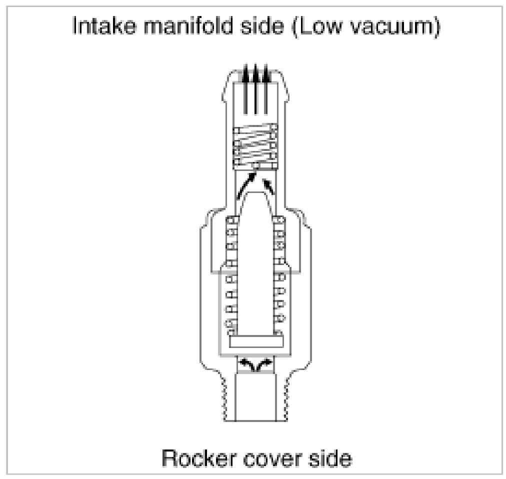
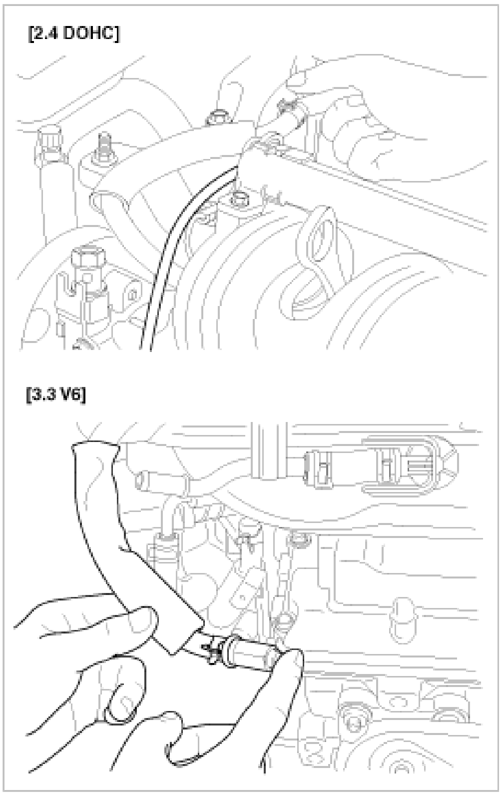
<tr><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td>Engine condition</td><td>Not running</td><td>Engine condition</td><td>Idling or decelerating</td></tr>
<tr><td>PCV valve</td><td>Not operating</td><td>PCV valve</td><td>Fully operating</td></tr>
<tr><td>Vacuum passage</td><td>Restricted</td><td>Vacuum passage</td><td>Small</td></tr>
<tr><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td>Engine condition</td><td>Normal operation</td><td>Engine condition</td><td>Accelerating and high load</td></tr>
<tr><td>PCV valve</td><td>Properly operating</td><td>PCV valve</td><td>Slightly operating</td></tr>
<tr><td>Vacuum passage</td><td>Large</td><td>Vacuum passage</td><td>Very large</td></tr>
</table>

Emission Control System > Crankcase Emission Control System > Positive Crankcase Ventilation (PCV) Valve > Repair procedures

REMOVAL

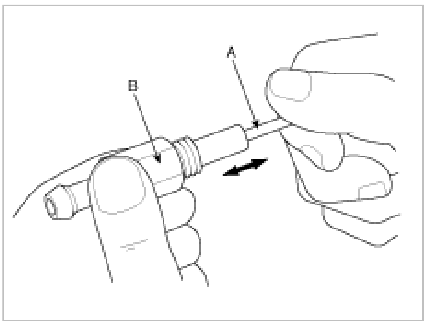
1. Disconnect the ventilation hose from the positive crankcase ventilation (PCV) valve. Remove the PCV valve from the rocker cover and reconnect it to the ventilation hose.
2. Run the engine at idle and put a finger on the open end of the PCV valve and make sure that intake manifold vacuum can be felt.

> NOTE
>
> The plunger inside the PCV valve will move back and forth.



INSPECTION

1. Remove the PCV valve.
2. Insert a thin stick(A) into the PCV valve(B) from the threaded side to check that the plunger moves.
3. If the plunger does not move, the PCV valve is clogged. Clean it or replace.



INSTALLATION

Install the PCV valve and tighten to the specified torque.

PCV valve : 0.8~1.2 kgf·m

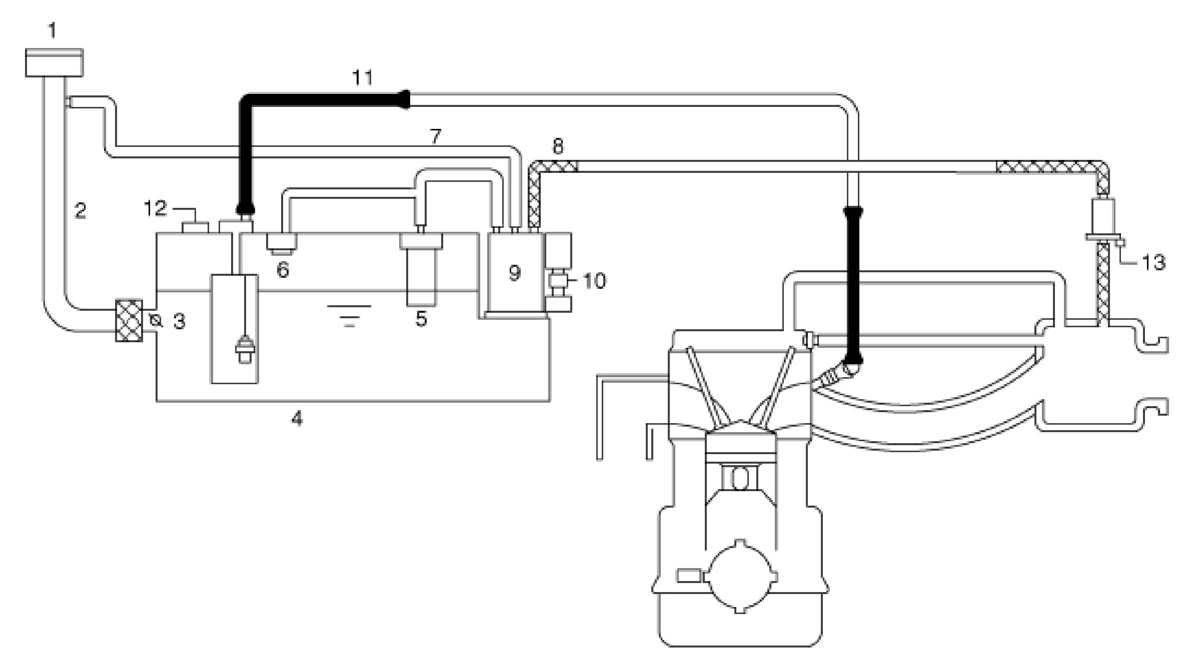
Emission Control System > Evaporative Emission Control System > Description and Operation

DESCRIPTION

This system consists of a fill vent valve, fuel shut-off valve, fuel cut valve (for roll over), two way valve (pressure/vacuum relief), fuel liquid/vapor separator which is installed beside the filler pipe, charcoal canister which is mounted under the rear floor LH side member and protector, tubes and miscellaneous connections.
While refueling, ambient air is drawn into the filler pipe so as not to emit fuel vapors in the air. The fuel vapor in the tank is then forced to flow into the canister via the fill vent valve. The fuel liquid/vapor separator isolates liquid fuel and passes the pure vapor to the charcoal canister.
While the engine is operating, the trapped vapor in the canister is drawn into the intake manifold and then into the engine

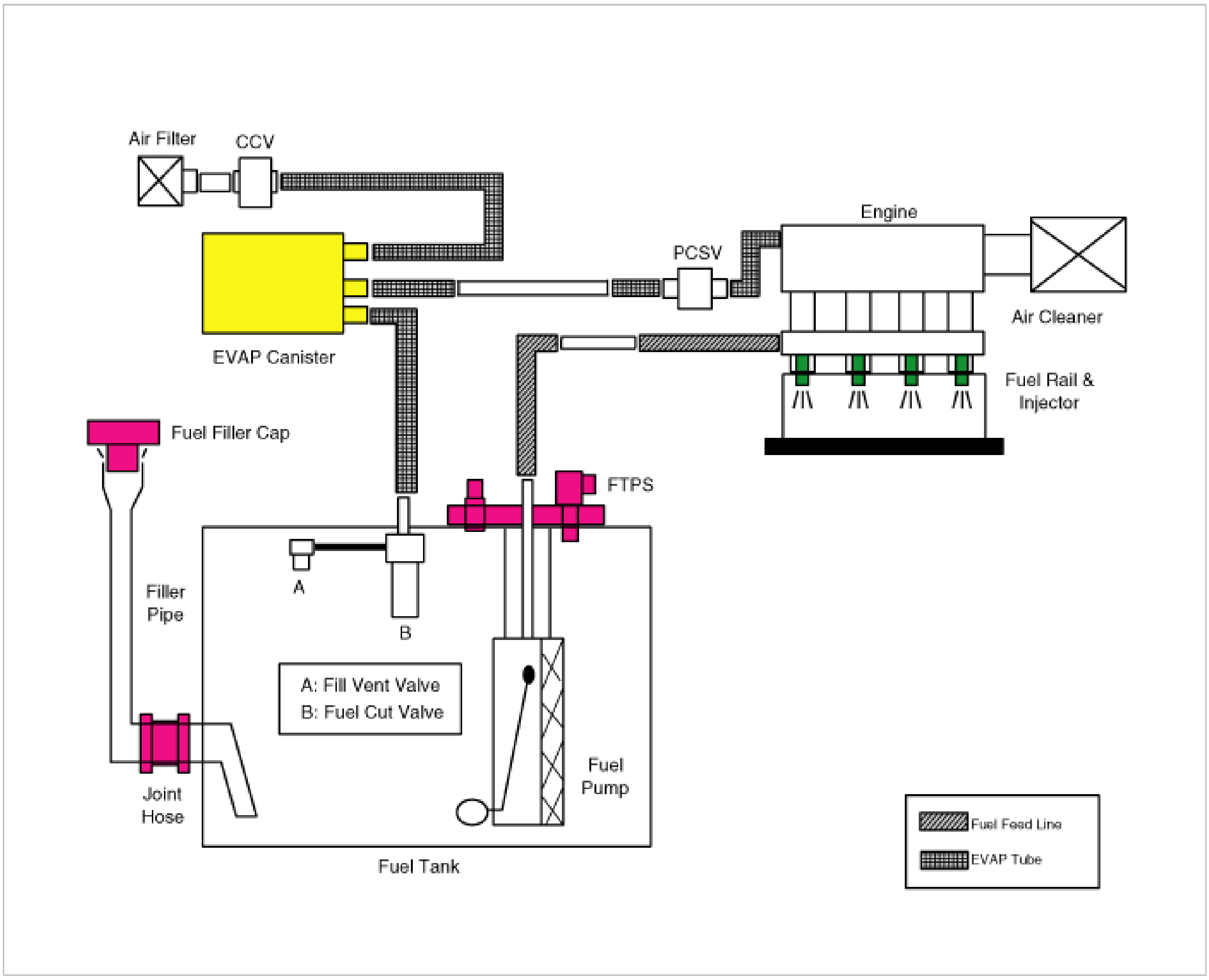
combustion chamber. According to this purge process, the charcoal canister is purged and recovers its absorbing capability.

COMPONENTS

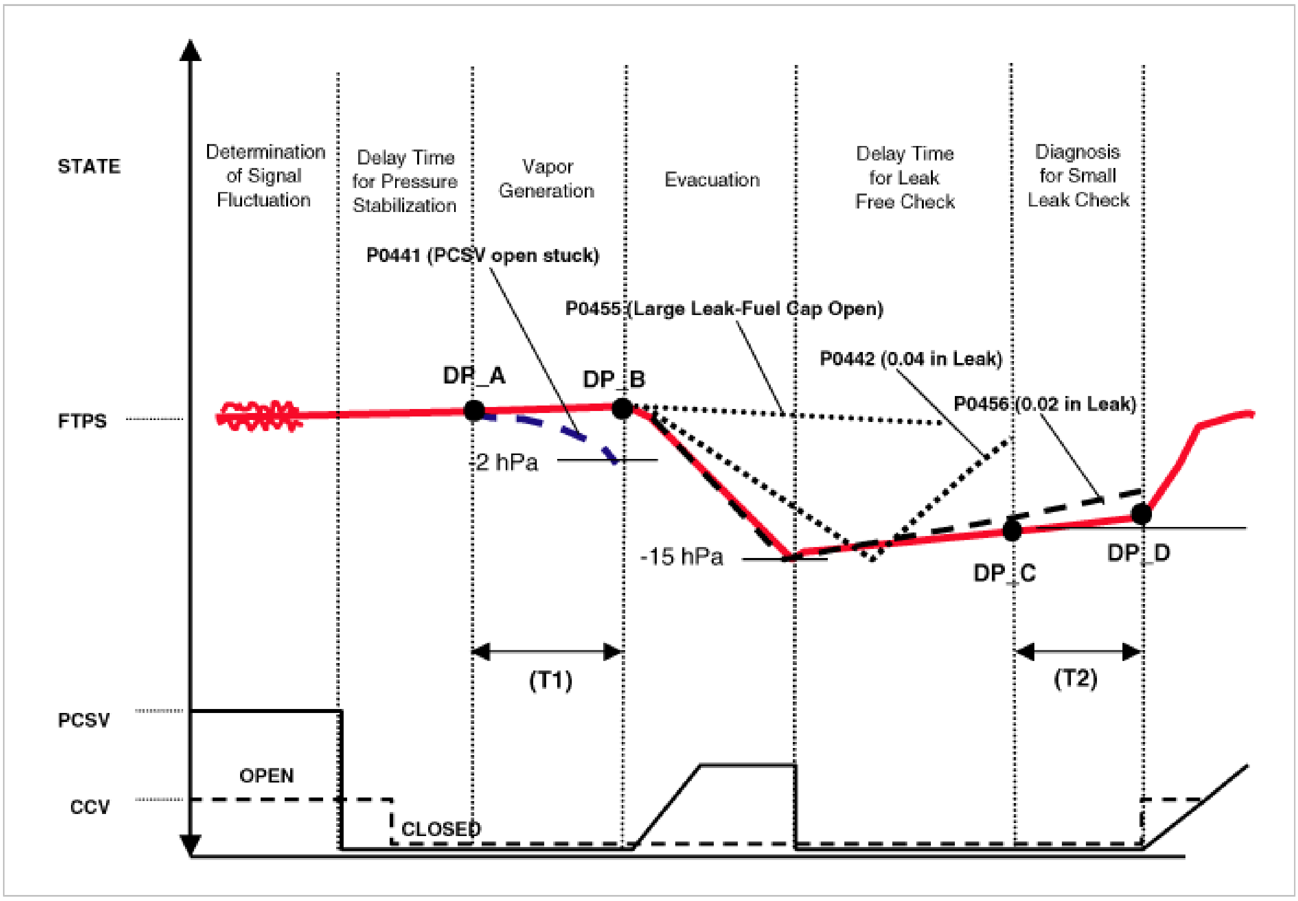


1. Filler cap	8. EVAP. Hose
2. Fuel filler pipe	9. Canister
3. Check valve	10. Canister Close Valve (CCV)
4. Fuel tank	11. Fuel feed line
5. ORVR control valve	12. Fuel Tank Pressure Sensor (FTPS)
6. Vapor valve	13. Purge Control Solenoid Valve (PCSV)
7. EVAP. Hose	

DESCRIPTION



EVAP. SYSTEM MONITORING



Emission Control System > Evaporative Emission Control System > Repair procedures

INSPECTION

1. Disconnect the vacuum hose from the throttle body, and connect a vacuum pump to the vacuum hose.
2. Check the following points when the engine is cold [engine coolant temperature 60°C(140°F) or below] and when it is warm [engine coolant temperature 80°C(176°F) or higher].

WHEN ENGINE IS COLD

Engine operating condition	Applied vacuum	Result
Idling	50 kPa (7.3 psi)	Vacuum is held
3,000 rpm		

WHEN ENGINE IS WARM

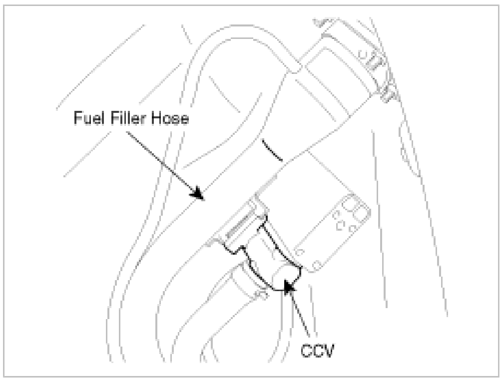
Engine operating condition	Applied vacuum	Result
Idling	50 kPa (7.3 psi)	Vacuum is held
Within 3 minutes after engine start at 3,000 rpm	Try to apply vacuum	Vacuum is released
After 3 minutes have passed after engine start at 3,000 rpm	50 kPa (7.3 psi)	Vacuum will be held momentarily, after which, it will be released

Emission Control System > Evaporative Emission Control System > Canister > Description and Operation

DESCRIPTION

The evaporative emission control system prevents hydrocarbon (HC) vapors from the fuel tank from escaping into the atmosphere where they could form photochemical smog. Gasoline vapors are collected in the charcoal canister. The

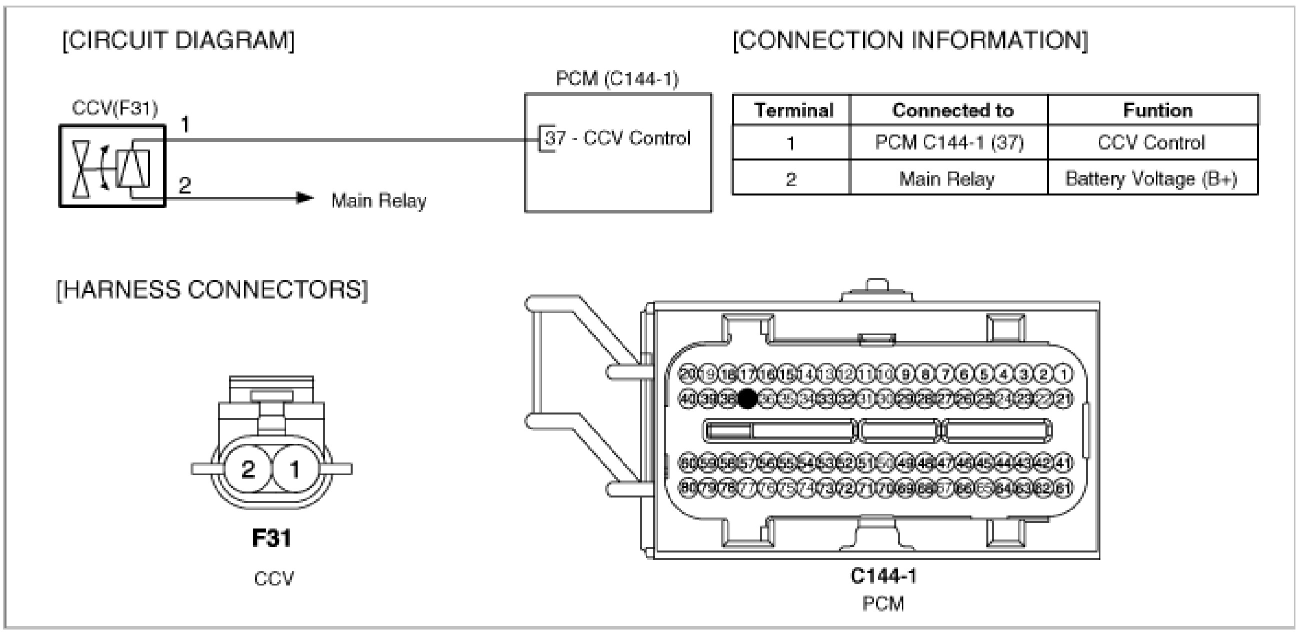
Canister Close Valve (CCV) closes off the air inlet into the canister for leak detection of the evaporative emission system. The CCV also prevents fuel vapors from escaping from the canister. When the engine purges the HC vapors from the canister, the clean air comes into the canister through the canister air-filter and the CCV.



SPECIFICATION

Item Spec	ification
Coil Resistance (Ω)	19.8 ~ 21.8Ω at 20°C (68°F)

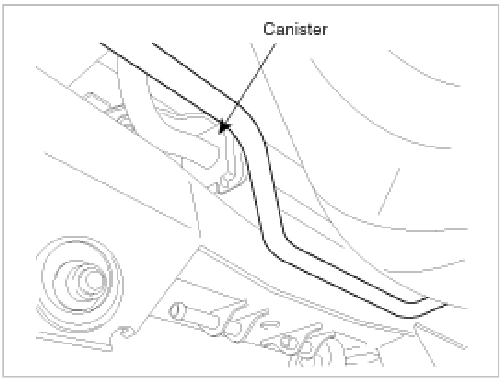
SCHEMATIC DIAGRAM



Emission Control System > Evaporative Emission Control System > Canister > Repair procedures

REMOVAL

1. Remove the fuel tank. (Refer to "Fuel System" group)
2. Disconnect hoses connecting to the canister.
3. Unfasten two mounting bolts and remove the canister.



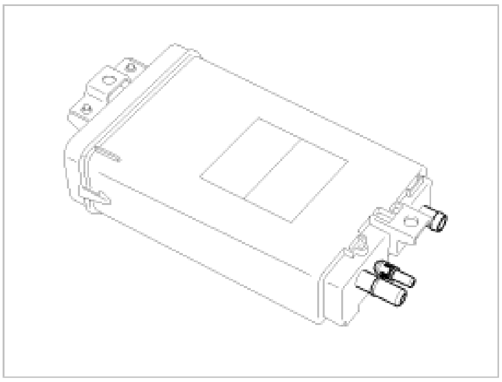
INSTALLATION

Installation is in reverse order of removal.

Torque : 1.7 ~ 2.6kgf·m (16.7 ~ 25.5N·m, 12.3 ~ 18.8lbf·ft)

INSPECTION

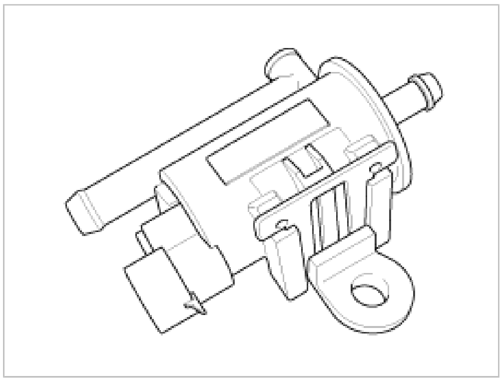
1. Lock for loose connections, sharp bends or damage to the fuel vapor lines.
2. Look for distortion, cracks or fuel damage.
3. After removing the canister, inspect for cracks or damage.



Emission Control System > Evaporative Emission Control System > Purge Control Solenoid Valve (PCSV) > Description and Operation

DESCRIPTION

Purge Control Solenoid Valve (PCSV) is installed on the surge tank and controls the passage between the canister and the intake manifold. It is a solenoid valve and is open when the PCM grounds the valve control line. When the passage is open (PCSV ON), fuel stored in the canister is transferred to the intake manifold.



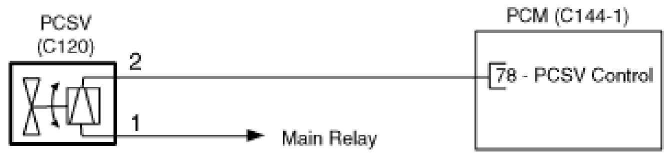
SPECIFICATION

Item	Specification

Coil Resistance (Ω)	19.0 ~ 22.0Ω at 20°C (68°F)

SCHEMATIC DIAGRAM

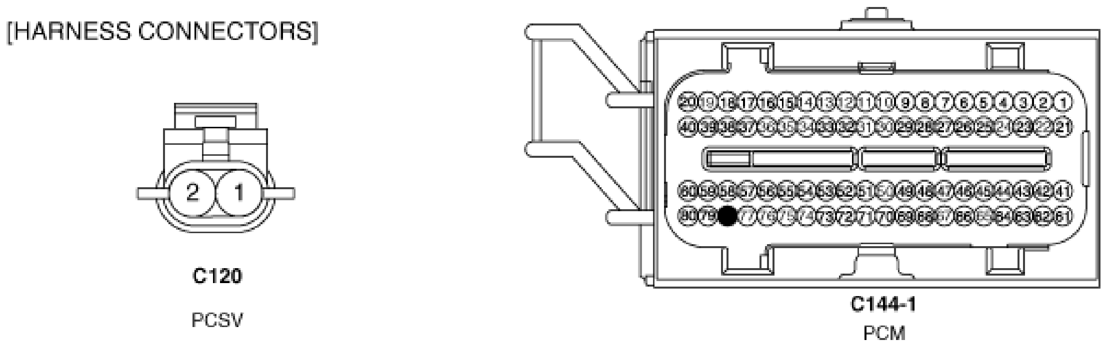
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-1 (78)	PCSV Control

[HARNESS CONNECTORS]



Emission Control System > Evaporative Emission Control System > Purge Control Solenoid Valve (PCSV) > Repair procedures

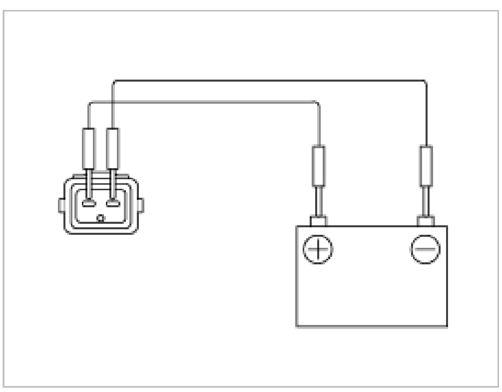
INSPECTION

NOTE

When disconnecting the vacuum hose, make an identification mark on it so that it can be reconnected to its original position.

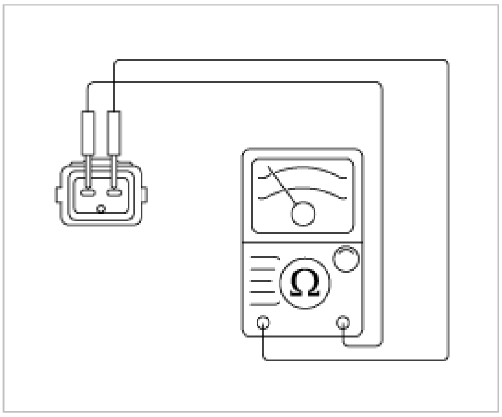
1. Disconnect the vacuum hose from the solenoid valve.
2. Detach the harness connector.
3. Connect a vacuum pump to the nipple to which the red-striped vacuum hose was connected.
4. Apply vacuum and check when voltage is applied to the PCSV and when the voltage is discontinued.

Battery voltage	Normal condition
When applied	Vacuum is released
When discontinued	Vacuum is maintained



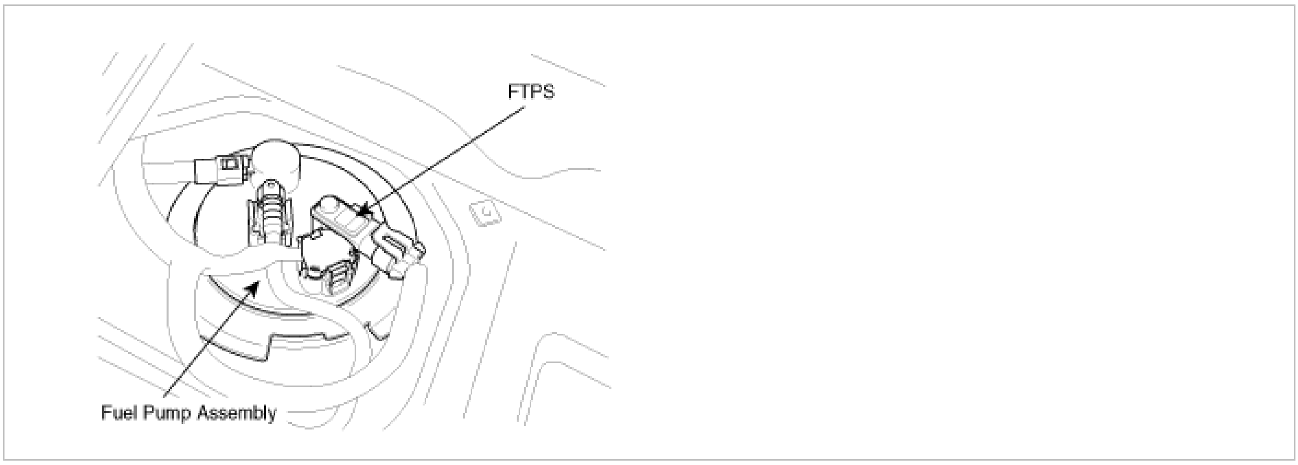
5. Measure the resistance between the terminals of the solenoid valve.

PCSV coil resistance(Ω) :
19 ~ 22Ω at 20°C (68°F)



Emission Control System > Evaporative Emission Control System > Fuel Tank Pressure Sensor (FTPS) > Description and Operation

DESCRIPTION

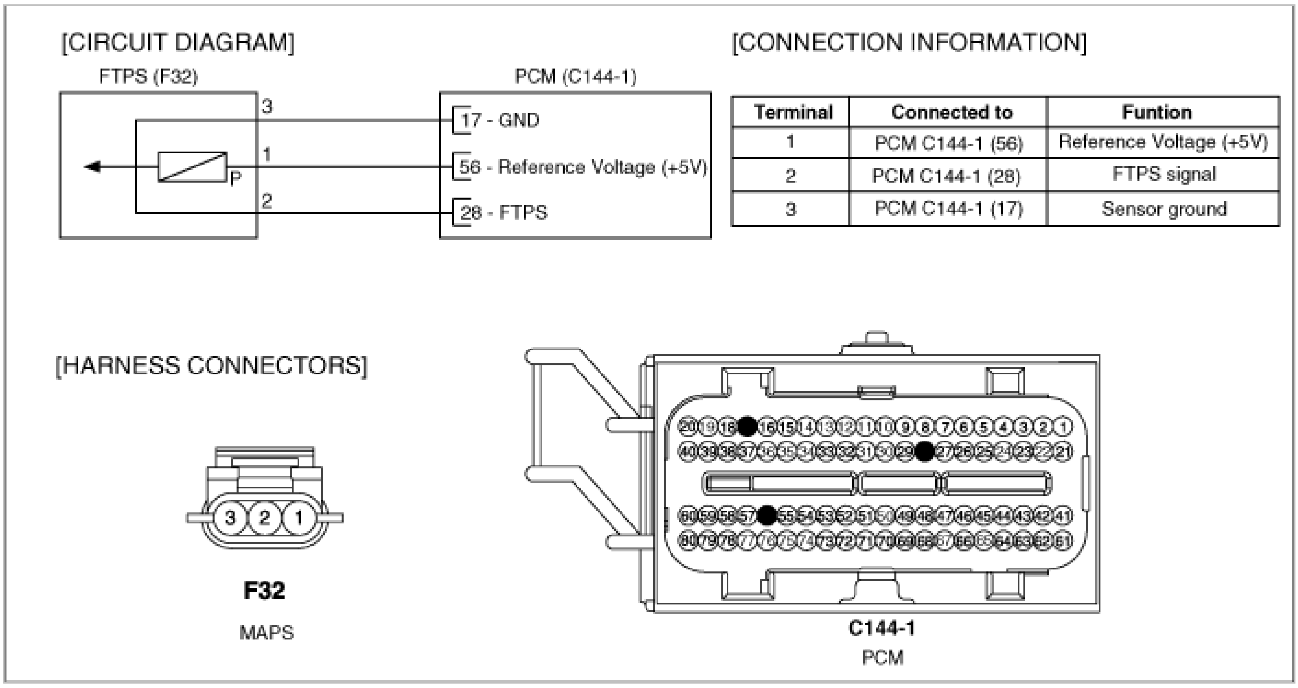


The evaporative emission control system prevents hydrocarbon vapors from escaping from the fuel tank into the atmosphere where they could form photochemical smog. Gasoline vapors are collected in the charcoal canister. The Fuel Tank Pressure Sensor (FTPS) is installed on fuel pump assembly and is an integral part of the evaporative monitoring system. The PCM monitors the FTPS signal to detect vacuum decay and excess vacuum. The FTPS measures the difference between the air pressure inside the fuel tank and outside air pressure to check the purge control solenoid valve operation and for leak detection in the evaporative emission control system by monitoring pressure and vacuum levels in the fuel tank during the purge control solenoid valve operating cycles.

SPECIFICATION

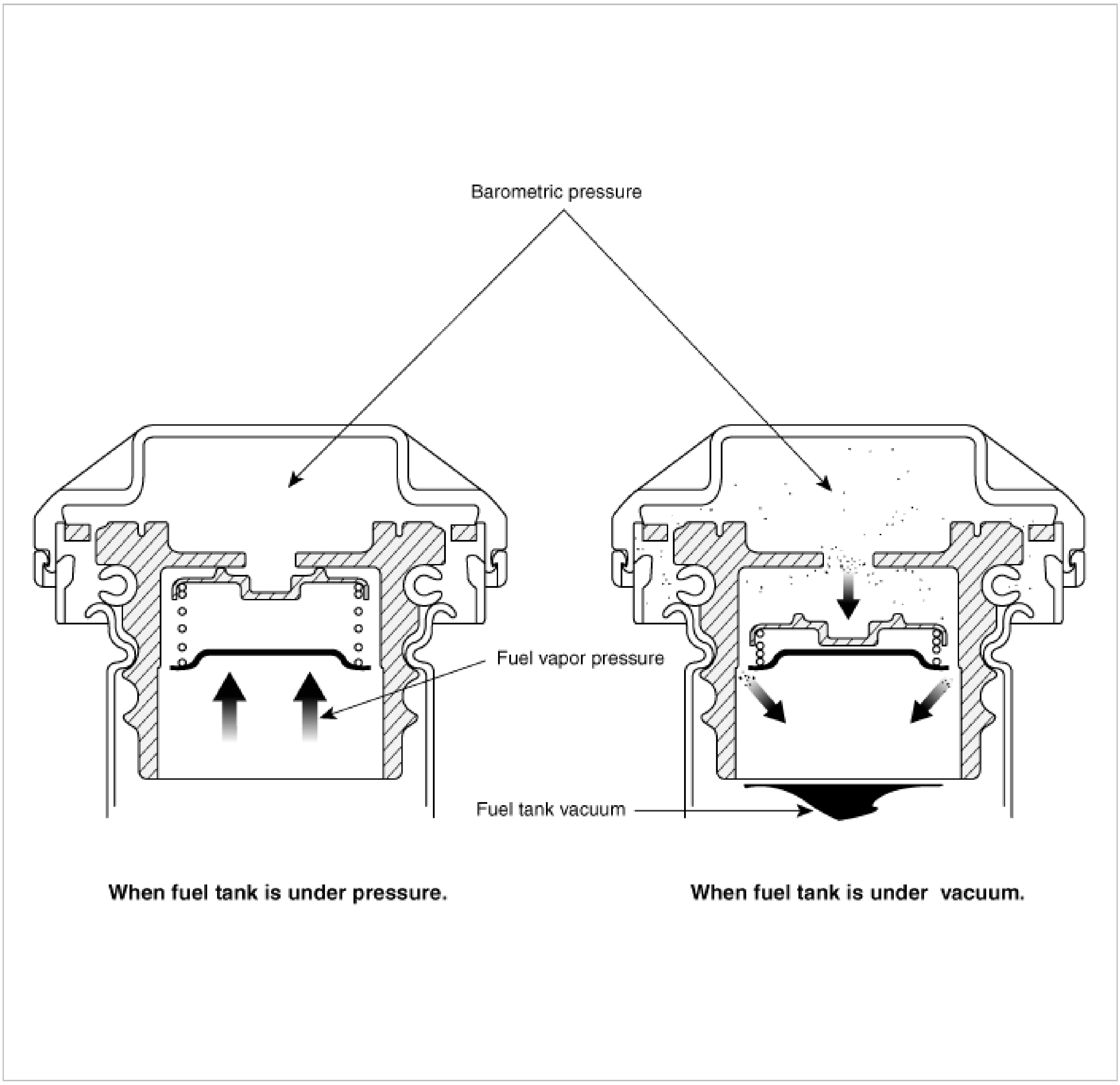
Pressure (kPa)	Output Voltage (V)
-3.75 kPa	4.5 V
0 kPa	1.5 V
1.25 kPa	0.5 V

SCHEMATIC DIAGRAM



Emission Control System > Evaporative Emission Control System > Fuel Filler Cap > Description and Operation

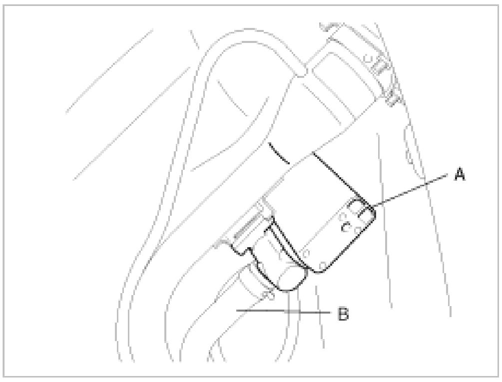
DESCRIPTION



Emission Control System > Evaporative Emission Control System > Fuel Tank Air Filter > Repair procedures

REPLACE

1. Remove the rear left wheel house.
   (Refer to "BD" group)
2. Disconnect the canister close valve wiring connector and the vapor hose to canister (B).



3. Remove the fuel tank air filter(A).
4. Install a new fuel tank air filter.

Emission Control System > Exhaust Emission Control System > Description and Operation

DESCRIPTION

Modifications to the combustion chamber, intake manifold, camshaft and ignition system form the basic control system. These items have been integrated into a highly effective system which controls exhaust emissions while maintaining good driveability and fuel economy.

AIR/FUEL MIXTURE CONTROL SYSTEM [MULTIPORT FUEL INJECTION (MFI) SYSTEM]

This in turn allows the engine to produce exhaust gases of the proper composition to permit the use of a three way catalyst. The three way catalyst is designed to convert the three pollutants (1) hydrocarbons (HC), (2) carbon monoxide (CO), and (3) oxides of nitrogen (NOx) into harmless substances. There are two operating modes in the MFI system.

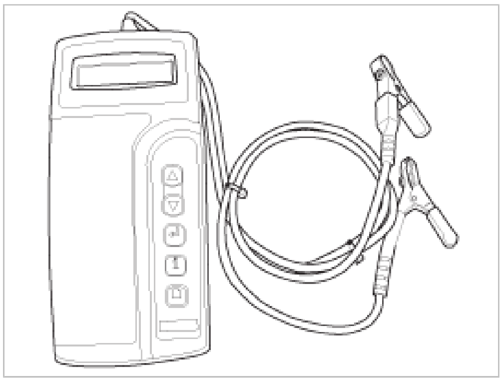
1. Open Loop air/fuel ratio is controlled by information programmed into the ECM.
2. Closed Loop air/fuel ratio is adjusted by the ECM based on information supplied by the oxygen sensor.

THE MICRO 570 ANALYZER

The MICRO 570 Analyzer provides the ability to test the charging and starting systems, including the battery, starter and alternator.

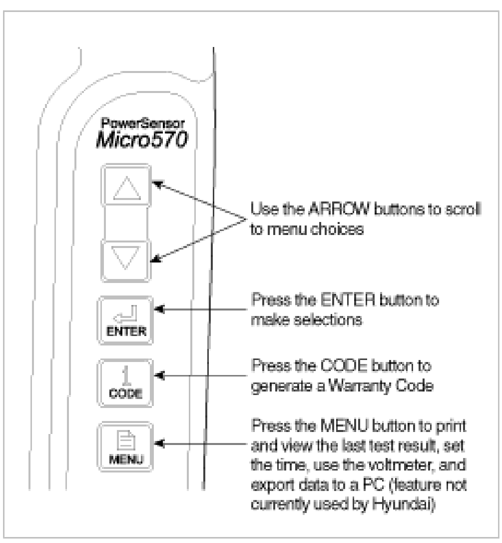
CAUTION

Because of the possibility of personal injury, always use extreme caution and appropriate eye protection when working with batteries.



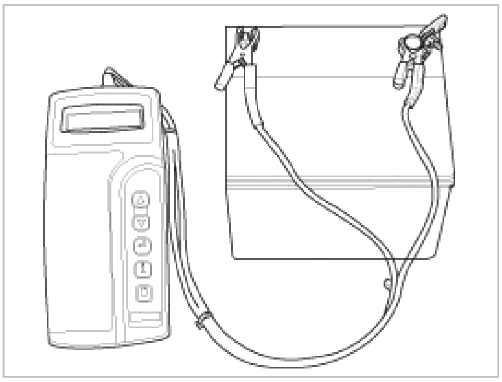
KEYPAD

The MICRO570 button on the key pad provides the following functions :



BATTERY TEST PROCEDURE

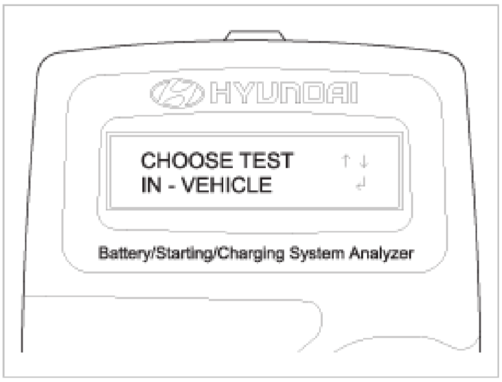
1. Connect the tester to the battery.
   A. Red clamp to battery positive (+) terminal.
   B. Black clamp to battery negative (-) terminal.



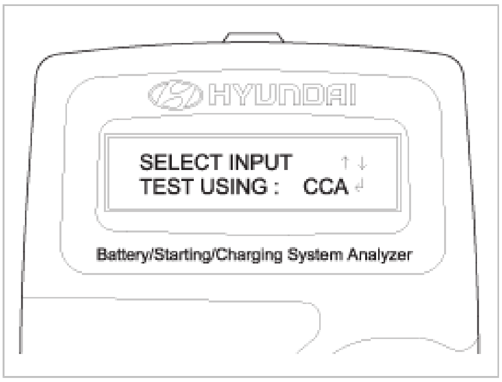
CAUTION

Connect clamps securely. If "CHECK CONNECTION" message is displayed on the screen, reconnect clamps securely.

2. The tester will ask if the battery is connected "IN A VEHICLE" or "OUT OF A VEHICLE". Make your selection by pressing the arrow buttons; then press ENTER.



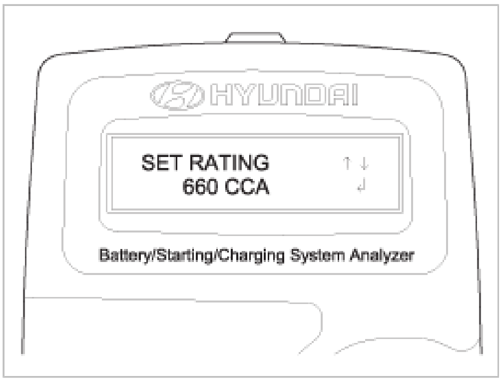
3. Choose either CCA or CCP and press the ENTER button.



NOTE

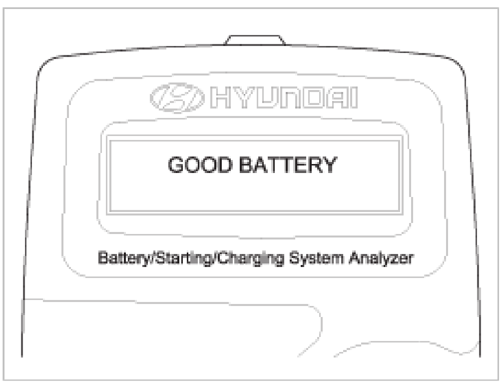
- CCA : Cold cranking amps, is an SAE specification for cranking batteries at -18°C (0°F).
- CCP : Cold cranking amps, is an SAE specification for korean manufacturer's for cranking batteries at -18°C (0°F).

4. Set the CCA value displayed on the screen to the CCA value marked on the battery label by pressing up and down buttons and press ENTER.



> **NOTE**
>
> The battery ratings(CCA) displayed on the tester must be identical to the ratings marked on battery label.

5. The tester (Micro570) displays battery test results including voltage and battery ratings.
   A relevant action must be given according to the test results by referring to the battery test results as shown in the table below.



> **NOTE**
>
> The battery ratings (CCA) displayed on the tester must be identical to the ratings marked on battery label.

6. To conduct starter test, continuously, press ENTER.

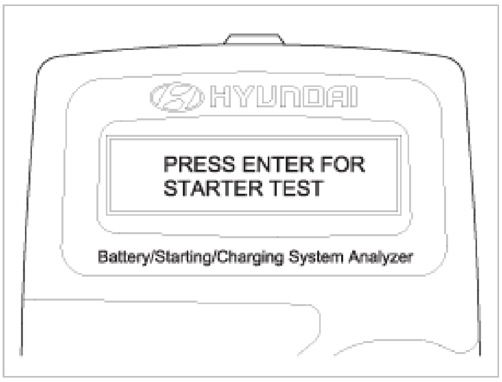
BATTERY TEST RESULTS

RESULT ON PRINTER	REMEDY
Good battery	No action is required
Good recharge	Battery is in a good state Recharge the battery and use
Charge & Retest	Battery is not charged properly => Charge and test the battery again (Failure to charge the battery fully may read incorrect measurement value)
Replace battery	=> Replace battery and recheck the charging system. (Improper connection between battery and vehicle cables may cause "REPLACE BATTERY", retest the battery after removing cables and connecting the tester to the battery terminal directly prior to replacing the battery)
Bad cell-replace	=> Charge and retest the battery. And then, test results may cause "REPLACE BATTERY", replace battery and recheck the charging system

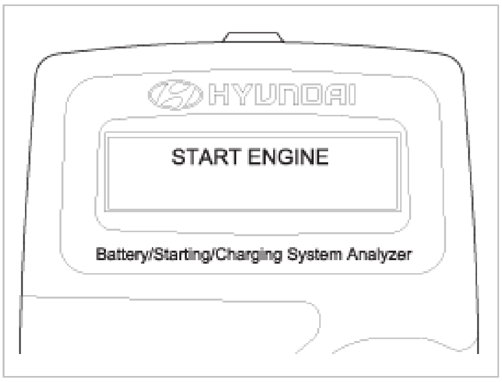
> **WARNING**
>
> Whenever filing a claim for battery, the print out of the battery test results must be attached.

STARTER TEST PROCEDURE

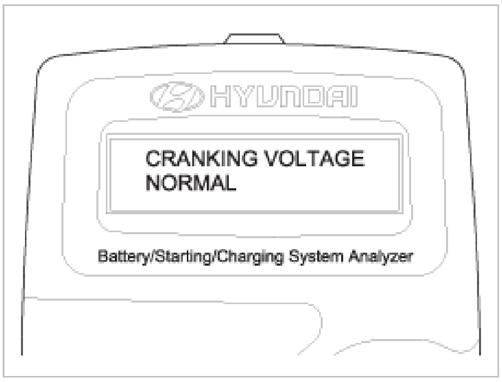
1. After the battery test, press ENTER immediately for the starter test.



2. After pressing ENTER key, start the engine.



3. Cranking voltage and starter test results will be displayed on the screen.
   Take a relevant action according to the test results by referring to the starter test results as given below.



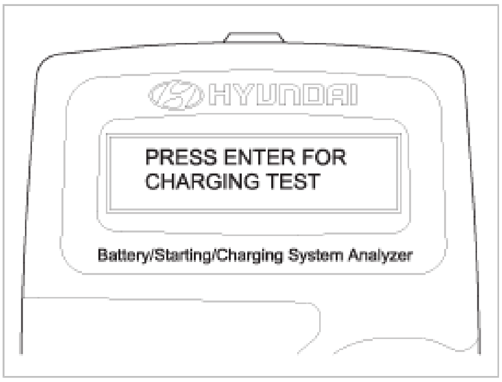
4. To continue charging system test, press ENTER.

STARTER TEST RESULTS

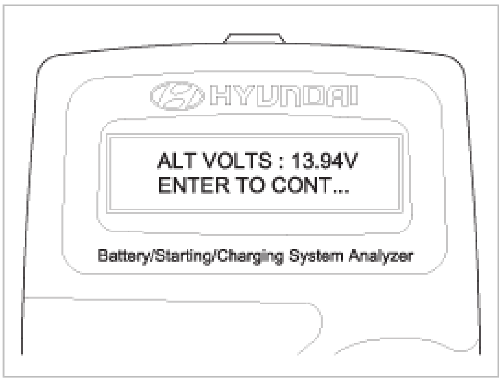
RESULT ON PRINTER	REMEDY
Cranking voltage normal	System shows a normal starter draw
Cranking voltage low	Cranking voltage is lower than normal level => Check starter
Charge battery	The state of battery charge is too low to test => Charge the battery and retest
Replace battery	=> Replace battery => If the vehicle is not started though the battery condition of "Good and fully charged" is displayed. => Check wiring for open circuit, battery cable connection, starter and repair or replace as necessary. => If the engine does crank, check fuel system.

CHARGING SYSTEM TEST PROCEDURE

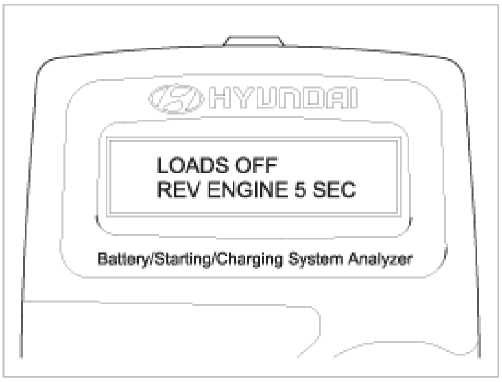
1. Press ENTER to begin charging system test.



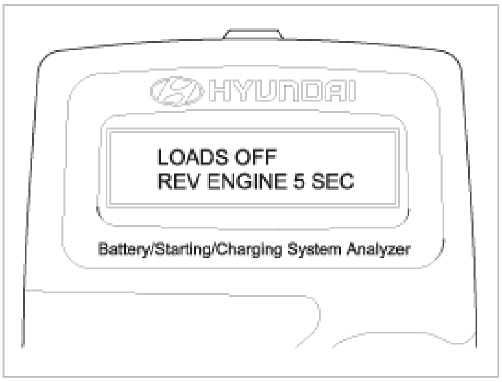
2. ENTER button is pressed, the tester displays the actual voltage of alternator.
   Press ENTER to test the charging system.



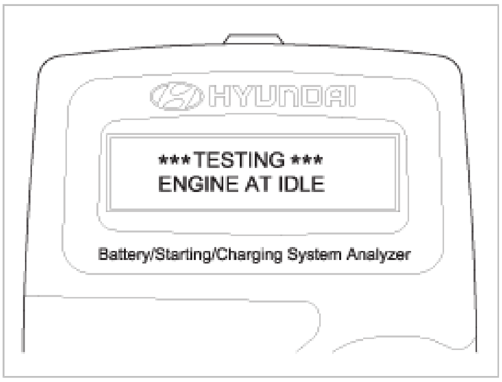
3. Turn off all electrical load and rev engine for 5 seconds by pressing the accelerator pedal.



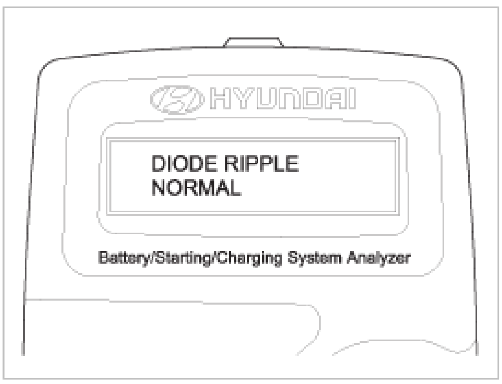
4. Press ENTER.



5. The MICRO 570 analyzer charging system output at idle for comparison to other readings.



6. Take a relevant action according to the test results by referring to the table below after shutting off the engine and disconnect the tester clamps from the battery.

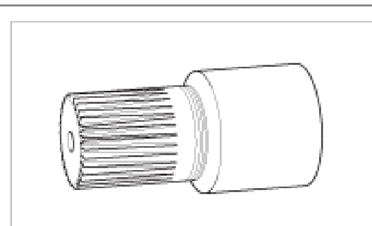


CHARGING SYSTEM TEST RESULTS

RESULT ON PRINTER	REMEDY
Charging system normal/Diode ripple normal	Charging system is normal
No charging voltage	Alternator does not supply charging current to battery => Check belts, connection between alternator and battery Replace belts or cable or alternator as necessary
Low charging voltage	Alternator does not supply charging current to battery and electrical load to system fully => Check belts and alternator and replace as necessary
High charging voltage	The voltage from alternator to battery is higher than normal limit during voltage regulating. => Check connection and ground and replace regulator as necessary => Check electrolyte level in the battery
Excess ripple detected	One or more diodes in the alternator is not functioning properly => Check alternator mounting and belts and replace as necessary

Engine Electrical System > General Information > Special Service Tools

SPECIAL SERVICE TOOL

Tool (Number and name)	Illustration	Use
Alternator pulley remover wrench		Removal and installation of alternator pulley

Engine Electrical System > General Information > Troubleshooting

TROUBLE SHOOTING

IGNITION SYSTEM

Symptom	Suspect area	Remedy
Engine will not start or is hard to start (Cranks OK)	Ignition lock switch Ignition coil Spark plugs Ignition wiring disconnected or broken	Inspect ignition lock switch, or replace as required Inspect ignition coil, or replace as required Inspect spark plugs, or replace as required Repair wiring, or replace as required
Rough idle or stalls	Ignition wiring Ignition coil	Repair wiring, or replace as required Inspect ignition coil, or replace as required
Engine hesitates/poor acceleration	Spark plugs and spark plug cables Ignition wiring	Inspect spark plugs / cable, or replace as required Repair wiring, or replace as required
Poor mileage	Spark plugs and spark plug cables	Inspect spark plugs / cable, or replace as required

CHARGING SYSTEM

Symptom	Suspect area	Remedy
Charging warning indicator does not light with ignition switch "ON" and engine off.	Fuse blown Light burned out Wiring connection loose Electronic voltage regulator	Check fuses Replace light Tighten loose connection Replace voltage regulator
Charging warning indicator does not go out with engine running. (Battery requires frequent recharging)	Drive belt loose or worn Battery cable loose, corroded or worn Electronic voltage regulator or alternator Wiring	Adjust belt tension or replace belt Inspect cable connection, repair or replace cable Replace voltage regulator or alternator Repair or replace wiring
Overcharge	Electronic voltage regulator Voltage sensing wire	Replace voltage regulator Repair or replace wiring
Discharge	Drive belt loose or worn Wiring connection loose or short circuit Electronic voltage regulator or alternator Poor grounding Worn battery	Adjust belt tension or replace belt Inspect wiring connection, repair or replace wiring Replace voltage regulator or alternator Inspect ground or repair Replace battery

STARTING SYSTEM

Symptom	Suspect area	Remedy
Engine will not crank	Battery charge low Battery cables loose, corroded or worn out Transaxle range switch (Vehicle with automatic transaxle only) Fuse blown Starter motor faulty Ignition switch faulty	Charge or replace battery Repair or replace cables Refer to TR group-automatic transaxle Replace fuse Replace Replace
Engine cranks slowly	Battery charge low Battery cables loose, corroded or worn out Starter motor faulty	Charge or replace battery Repair or replace cables Replace
Starter keeps running	Starter motor Ignition switch	Replace Replace
Starter spins but engine will not crank	Short in wiring Pinion gear teeth broken or starter motor Ring gear teeth broken	Repair wiring Replace Replace fly wheel or torque converter

Engine Electrical System > General Information > Specifications

SPECIFICATION

IGNITION SYSTEM

Items			Specification
Ignition coil	Primary resistance		0.62 ± 10 % (Ω)
	Secondary resistance		7.0 ± 15 % (kΩ)
Spark plugs	Unleaded	NGK	IFR5G-11 (3.3L)
		DENSO	SK16PR-A11 (2.4L)
		Gap	1.0 ~ 1.1 mm (0.0394 ~ 0.0433 in.)

STARTING SYSTEM

Items			Specification	
			2.4L	3.3L
Starter	Rated voltage		12 V, 1.2 kW	12 V, 1.4 kW
	No. of pinion teeth		8	8
	No-load characteristics	Voltage	11.5 V	11.5 V
		Ampere	90A, MAX	85A, MAX
		Speed	2,600 rpm, MIN	2,600 rpm, MIN

CHARGING SYSTEM

Items		Specification	
		2.4L	3.3L
Alternator	Type	Battery voltage sensing	←
	Rate voltage	13.5 V, 110A	13.5V, 130A
	Speed in use	1,000 ~ 18,000 rpm	←
	Voltage regulator	IC regulator built-in type	←
	Regulator setting voltage	14.55 ± 0.2 V	14.2 ~ 14.8V
	Temperature compensation	-3.5 ± 1 mV / °C	-4 ± 4 mV / °C
Battery	Type	MF 68AH	←
	Cold cranking amperage [at -18°C(-0.4°F)]	600 A	←
	Reserve capacity	110 min	←
	Specific gravity [at 20°C(68°F)]	1.280 ± 0.01	←

NOTE

- COLD CRANKING AMPERAGE is the amperage a battery can deliver for 30 seconds and maintain a terminal voltage of 7.2V or greater at a specified temperature.
- RESERVE CAPACITY RATING is amount of time a battery can deliver 25A and maintain a minimum terminal voltage of 10.5V at 26.7°C(80.1°F).

AUTO CRUISE CONTROL SYSTEM

Items	Specification
Setting error	Within ± 1.5Km/h on level road

Vehicle speed memory variation	No variation
Setting time	0.1sec max
Resuming time	0.1sec max.
Minimum operating speed	40 ± 2Km/h
Cancel speed range	15 ± 2Km/h
Maximum memorized speed	160 ± 2Km/h
Pulling force	127N(13Kgf)
Main switch serial resistance value	3.9kΩ ± 1%
Command switch serial resistance value	SET switch : 220Ω ± 1%
	RESUME switch : 910Ω ± 1%

Engine Electrical System > Ignition System > Description and Operation

DESCRITION

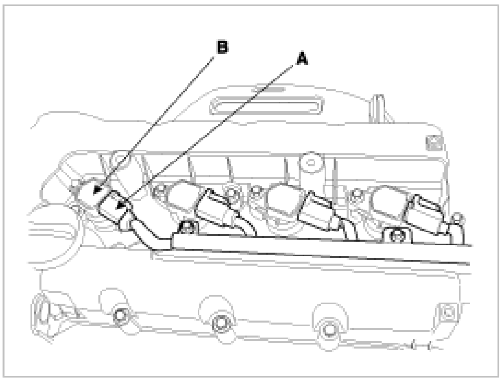
Ignition timing is controlled by the electronic control ignition timing system. The standard reference ignition timing data for the engine operating conditions are preprogrammed in the memory of the ECM (Engine Control Module).
The engine operating conditions (speed, load, warm-up condition, etc.) are detected by the various sensors. Based on these sensor signals and the ignition timing data, signals to interrupt the primary current are sent to the ECM. The ignition coil is activated, and timing is controlled.

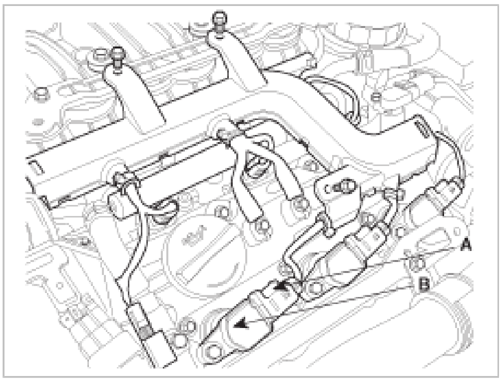
Engine Electrical System > Ignition System > Repair procedures

REMOVAL

IGNITION COIL

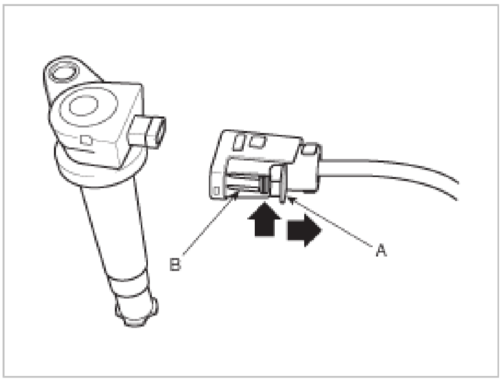
1. Remove the engine cover.
2. Disconnect the ignition coil connector(A).





NOTE

When removing the ignition coil connector, pull the lock pin(A) and push the clip(B).

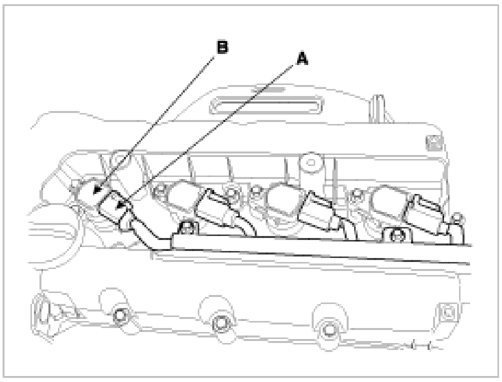


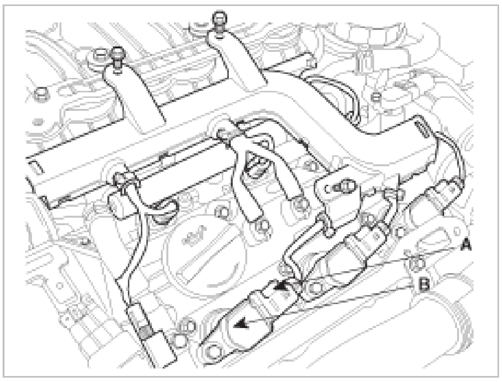
3. Remove the ignition coil (B).
4. Installation is the reverse of removal.

ON-VEHICLE INSPECTION

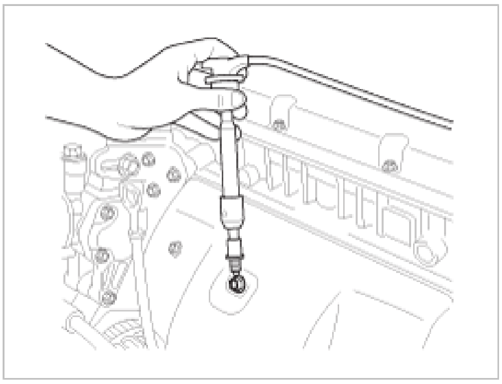
SPARK TEST

1. Remove the ignition coil connector(A).



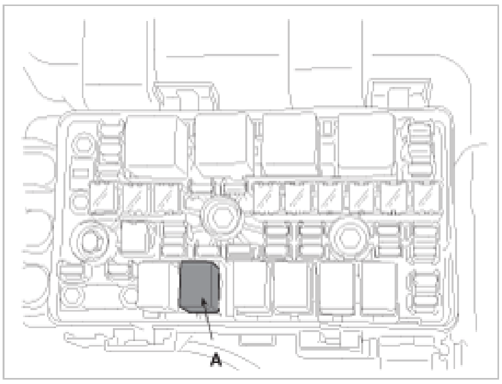


2. Remove the ignition coil(B).
3. Using a spark plug socket, remove the spark plug.
4. Install the spark plug to the ignition coil.
5. Ground the spark plug to the engine.

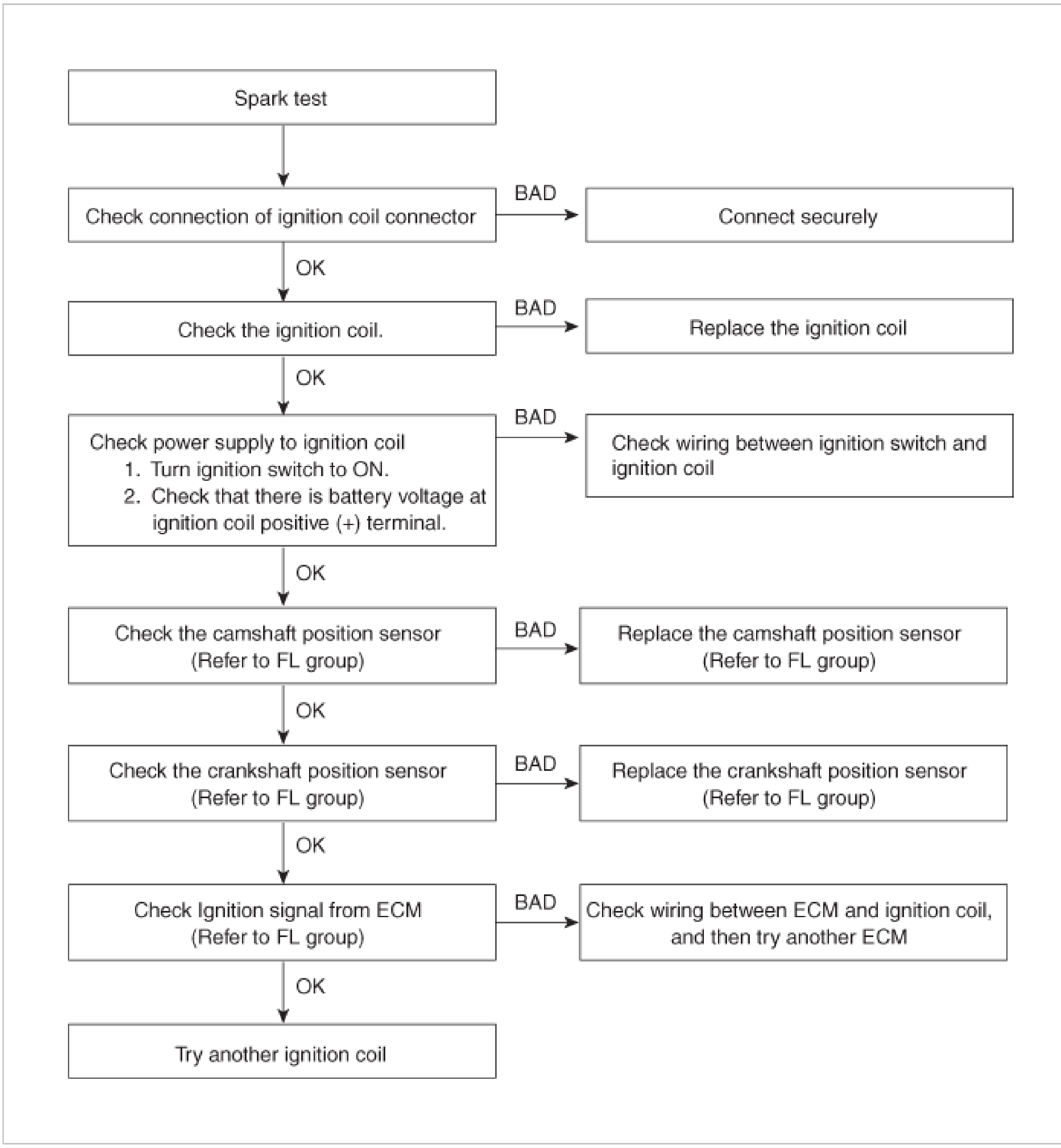


6. Check if spark occurs while engine is being cranked.

> NOTE
>
> To prevent fuel being injected from injectors while the engine is being cranked, remove the fuel pump(A) relay from the fuse box.
> Crank the engine for no more than 5 ~ 10 seconds.

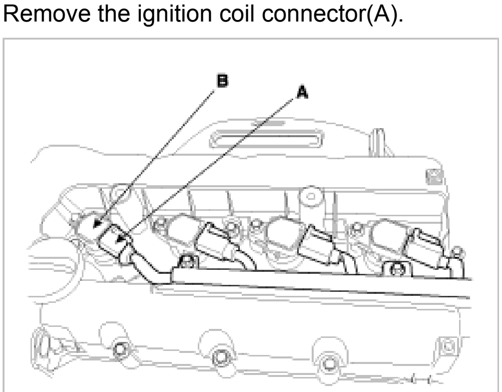


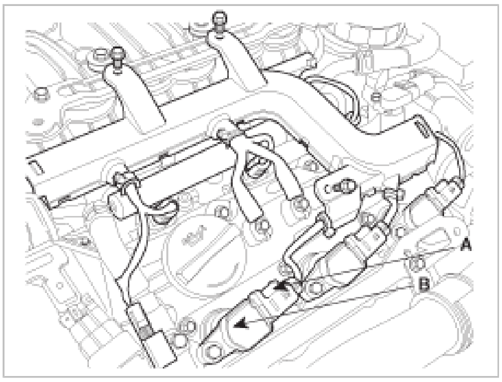
7. Inspect all the spark plugs.
8. Using a spark plug socket, install the spark plug.
9. Install the ignition coil.
10. Reconnect the ignition coil connector.



INSPECT SPARK PLUG

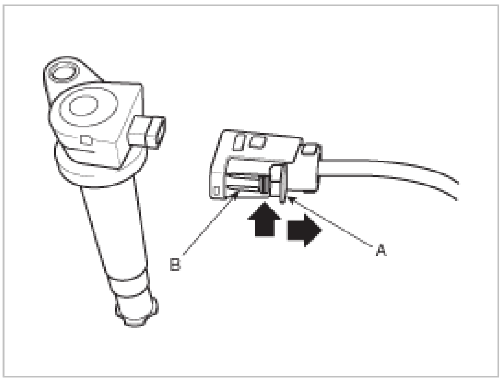
1. Remove the ignition coil connector(A).





NOTE

When removing the ignition coil connector, pull the lock pin(A) and push the clip(B).

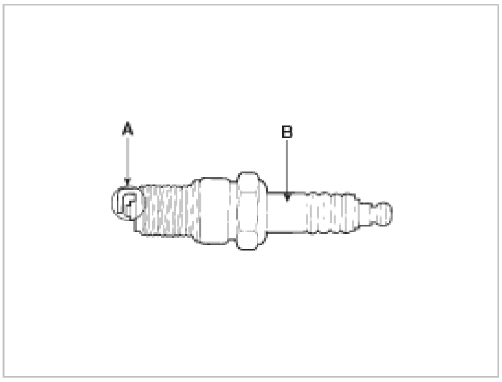


2. Remove the ignition coil(B).
3. Using a spark plug socket, remove the spark plug.

CAUTION

Be careful that no contaminates enter through the spark plug holes.

4. Inspect the electrodes (A) and ceramic insulator (B).

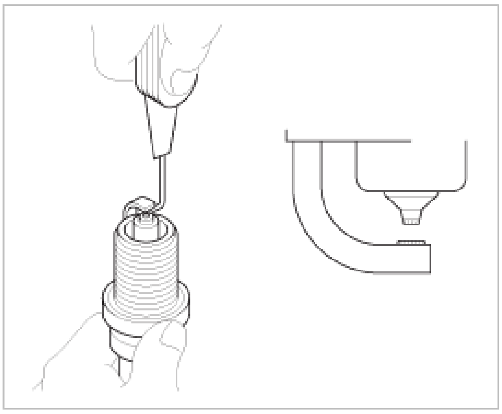


INSPECTION OF ELECTRODES

Condition	Dark deposits	White deposits
Description	- Fuel mixture too rich - Low air intake	- Fuel mixture too lean - Advanced ignition timing - Insufficient plug tightening torque

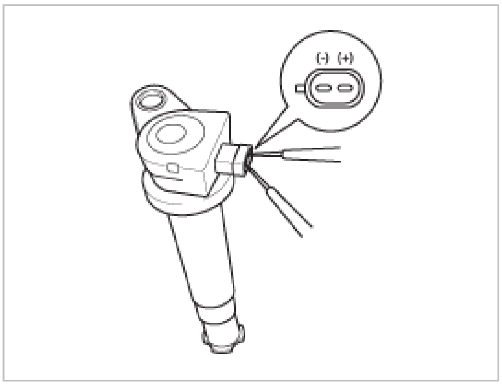
5. Check the electrode gap (A).

Standard :
Unleaded : 1.0 ~ 1.1 mm (0.0394 ~ 0.0433 in.)



INSPECT IGNITION COIL

1. Measure the primary coil resistance between terminals (+) and (-).

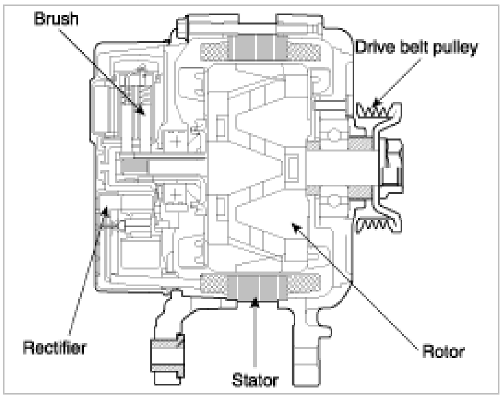


Standard value: 0.62Ω ± 10%

Engine Electrical System > Charging System > Description and Operation

DESCRIPTION

The charging system includes a battery, an alternator with a built-in regulator, and the charging indicator light and wire.
The Alternator has built-in diodes, each rectifying AC current to DC current.
Therefore, DC current appears at alternator "B" terminal.
In addition, the charging voltage of this alternator is regulated by the battery voltage detection system.
The main components of the alternator are the rotor, stator, rectifier, capacitor brushes, bearings and V-ribbed belt pulley.
The brush holder contains a built-in electronic voltage regulator.



Engine Electrical System > Charging System > Repair procedures

ON-VEHICLE INSPECTION

CAUTION

- Check that the battery cables are connected to the correct terminals.
- Disconnect the battery cables when the battery is given a quick charge.
- Never disconnect the battery while the engine is running.

CHECK THE BATTERY TERMINALS AND FUSES

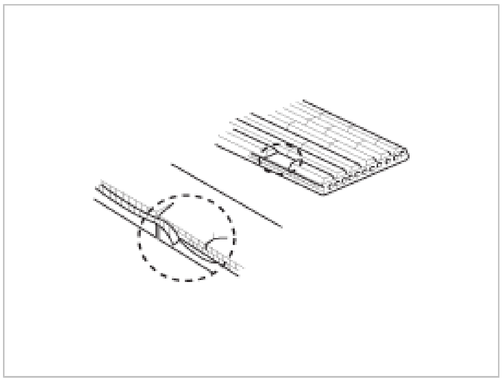
1. Check that the battery terminals are not loose or corroded.
2. Check the fuses for continuity.

INSPECT DRIVE BELT

Visually check the belt for excessive wear, frayed cords etc.
If any defect has been found, replace the drive belt.

NOTE

Cracks on the rib side of a belt are considered acceptable. If the belt has chunks missing from the ribs, it should be replaced.



VISUALLY CHECK ALTERNATOR WIRING AND LISTEN FOR ABNORMAL NOISES

1. Check that the wiring is in good condition.
2. Check that there is no abnormal noise from the alternator while the engine is running.

CHECK DISCHARGE WARNING LIGHT CIRCUIT

1. Warm up the engine and then turn it off.
2. Turn off all accessories.
3. Turn the ignition switch "ON". Check that the discharge warning light is lit.
4. Start the engine. Check that the light is lit.
   If the light does not go off as specified, troubleshoot the discharge light circuit.

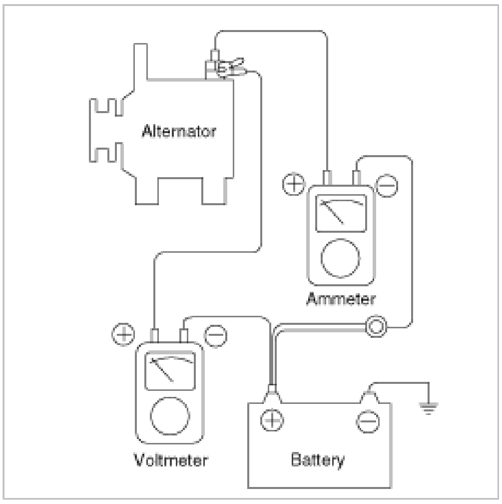
INSPECT CHARGING SYSTEM

VOLTAGE ;DROP ;TEST ;OF ;ALTERNATOR ;OUTPUT ;WIRE

This test determines whether or not the wiring between the alternator "B" terminal and the battery (+) terminal is good by the voltage drop method.

PREPARATION

1. Turn the ignition switch to "OFF".
2. Disconnect the output wire from the alternator "B" terminal. Connect the (+) lead wire of ammeter to the "B" terminal of alternator and the (-) lead wire of ammeter to the output wire. Connect the (+) lead wire of voltmeter to the "B" terminal of alternator and the (-) lead wire of voltmeter to the (+) terminal of battery.



TEST

1. Start the engine.
2. Turn on the headlamps and blower motor, and set the engine speed until the ammeter indicates 20A.
   And then, read the voltmeter at this time.

RESULT

1. The voltmeter may indicate the standard value.

   Standard value: 0.2V max

2. If the value of the voltmeter is higher than expected (above 0.2V max.), poor wiring is suspected. In this case check the wiring from the alternator "B" terminal to the battery (+) terminal. Check for loose connections, color change due to an over-heated harness, etc. Correct them before testing again.
3. Upon completion of the test, set the engine speed at idle.
   Turn off the headlamps, blower motor and the ignition switch.

OUTPUT CURRENT TEST

This test determines whether or not the alternator gives an output current that is equivalent to the normal output.

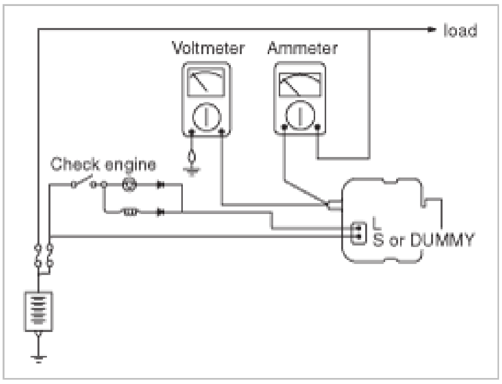
PREPARATION

1. Prior to the test, check the following items and correct as necessary.
   Check the battery installed in the vehicle to ensure that it is in good condition. The battery checking method is described in the section "Battery".
   The battery that is used to test the output current should be one that has been partially discharged. With a fully charged battery, the test may not be conducted correctly due to an insufficient load.
   Check the tension of the alternator drive belt. The belt tension check method is described in the section "Inspect drive belt".
2. Turn off the ignition switch.
3. Disconnect the battery ground cable.
4. Disconnect the alternator output wire from the alternator "B" terminal.
5. Connect a DC ammeter (0 to 150A) in series between the "B" terminal and the disconnected output wire. Be sure to connect the (-) lead wire of the ammeter to the disconnected output wire.

   NOTE

   Tighten each connection securely, as a heavy current will flow. Do not rely on clips.

6. Connect a voltmeter (0 to 20V) between the "B" terminal and ground. Connect the (+) lead wire to the alternator "B" terminal and (-) lead wire to a good ground.
7. Attach an engine tachometer and connect the battery ground cable.
8. Leave the engine hood open.



TEST

1. Check to see that the voltmeter reads as the same value as the battery voltage. If the voltmeter reads 0V, and the open circuit in the wire between alternator "B" terminal and battery (-) terminal or poor grounding is suspected.
2. Start the engine and turn on the headlamps.
3. Set the headlamps to high beam and the heater blower switch to HIGH, quickly increase the engine speed to 2,500 rpm and read the maximum output current value indicated by the ammeter.

> NOTE
>
> After the engine start up, the charging current quickly drops.
> Therefore, the above operation must be done quickly to read the maximum current value correctly.

RESULT

1. The ammeter reading must be higher than the limit value. If it is lower but the alternator output wire is in good condition, remove the alternator from the vehicle and test it.

   Limit value : 50% of the rate voltage

> NOTE
>
> - The nominal output current value is shown on the nameplate affixed to the alternator body.
> - The output current value changes with the electrical load and the temperature of the alternator itself.
>   Therefore, the nominal output current may not be obtained. If such is the case, keep the headlamps on the cause discharge of the battery, or use the lights of another vehicle to increase the electrical load.
>   The nominal output current may not be obtained if the temperature of the alternator itself or ambient temperature is too high.
>   In such a case, reduce the temperature before testing again.

2. Upon completion of the output current test, lower the engine speed to idle and turn off the ignition switch.
3. Disconnect the battery ground cable.
4. Remove the ammeter and voltmeter and the engine tachometer.
5. Connect the alternator output wire to the alternator "B" terminal.
6. Connect the battery ground cable.

REGULATED VOLTAGE TEST

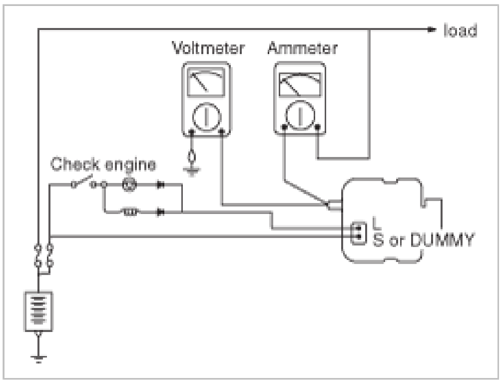
The purpose of this test is to check that the electronic voltage regulator controls voltage correctly.

PREPARATION

1. Prior to the test, check the following items and correct if necessary.
   Check that the battery installed on the vehicle is fully charged. The battery checking method is described in the section "Battery".
   Check the alternator drive belt tension. The belt tension check method is described in the section "Inspect drive belt".
2. Turn ignition switch to "OFF".
3. Disconnect the battery ground cable.
4. Connect a digital voltmeter between the "B" terminal of the alternator and ground. Connect the (+) lead of the voltmeter

to the "B" terminal of the alternator. Connect the (-) lead to good ground or the battery (-) terminal.

5. Disconnect the alternator output wire from the alternator "B" terminal.
6. Connect a DC ammeter (0 to 150A) in series between the "B" terminal and the disconnected output wire. Connect the (-) lead wire of the ammeter to the disconnected output wire.
7. Attach the engine tachometer and connect the battery ground cable.



TEST

1. Turn on the ignition switch and check to see that the voltmeter indicates the following value.

   Voltage: Battery voltage

   If it reads 0V, there is an open circuit in the wire between the alternator "B" terminal and the battery and the battery (-) terminal.
2. Start the engine. Keep all lights and accessories off.
3. Run the engine at a speed of about 2,500 rpm and read the voltmeter when the alternator output current drops to 10A or less

RESULT

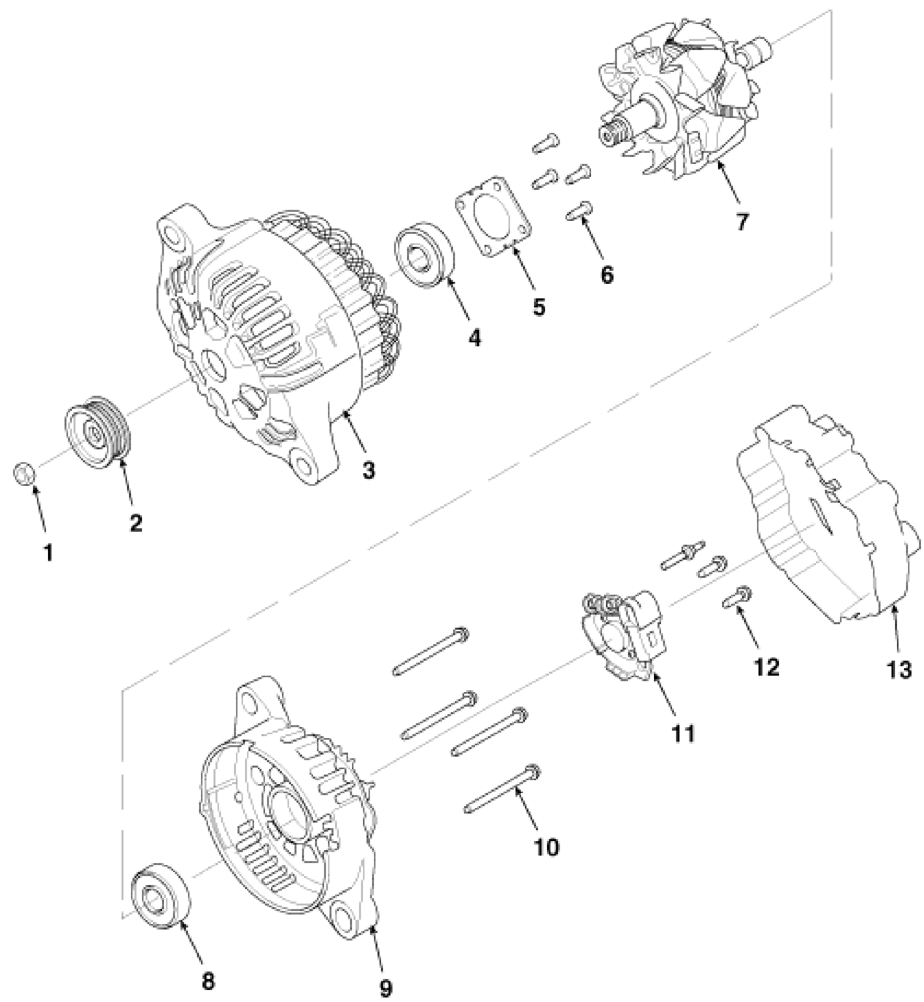
1. If the voltmeter reading agrees with the value listed in the regulating voltage table below, the voltage regulator is functioning correctly. If the reading is other than the standard value, the voltage regulator or the alternator is faulty.
   REGULATING VOLTAGE TABLE

Voltage regulator ambient temperature °C (°F)	Regulating voltage (V)
-30 (-22) 25 (77) 135 (275)	14.2 ~ 15.3 14.2 ~ 14.8 13.3 ~ 14.8

2. Upon completion of the test, reduce the engine speed to idle, and turn off the ignition switch.
3. Disconnect the battery ground cable.
4. Remove the voltmeter and ammeter and the engine tachometer.
5. Connect the alternator output wire to the alternator "B" terminal.
6. Connect the battery ground cable.

Engine Electrical System > Charging System > Alternator > Components and Components Location

COMPONENT

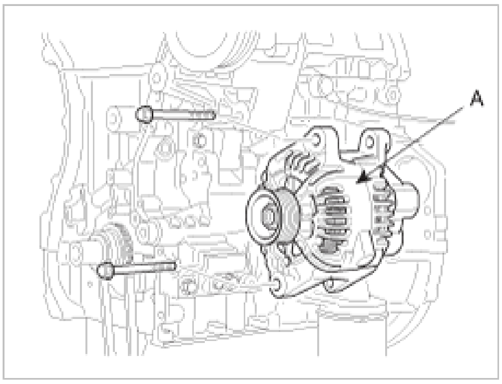


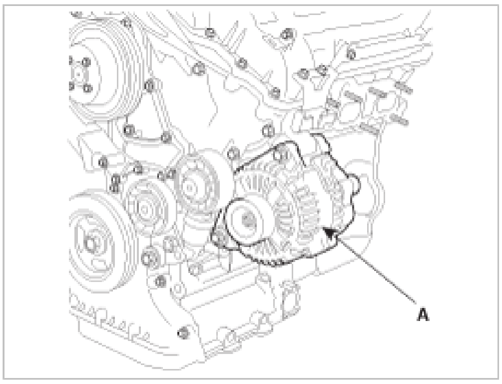
1. Nut	8. Rear bearing
2. Pulley	9. Rear bracket
3. Front bracket	10. Through bolt
4. Front bearing	11. Brush holder assembly
5. Bearing cover	12. Brush holder bolt
6. Bearing cover bolt	13. Rear cover
7. Rotor coil	

Engine Electrical System > Charging System > Alternator > Repair procedures

REMOVAL

1. Disconnect the battery negative terminal first, then the positive terminal.
2. Disconnect the alternator connector, and remove the cable from alternator "B" terminal.
3. Remove the drive belt.
4. Pull out the through bolt and then remove the alternator(A).

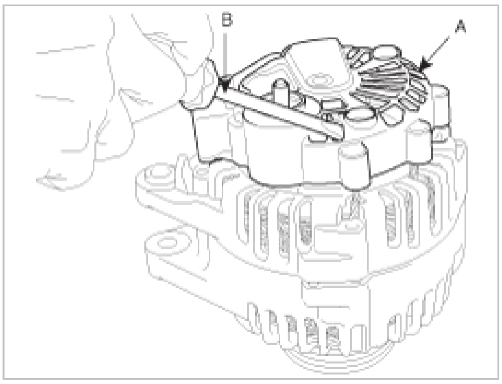




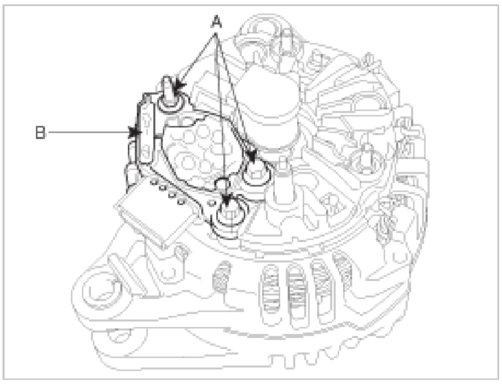
5. Installation is the reverse of removal.

DISASSEMBLY

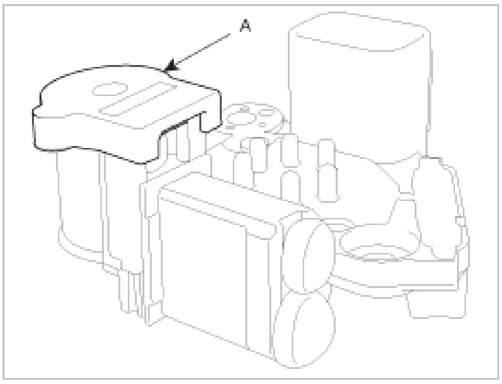
1. Remove the alternator cover(A) using a screw driver(B).



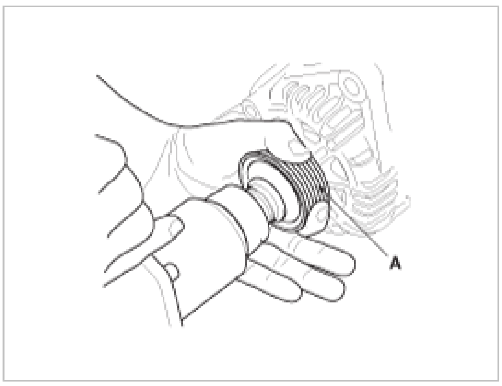
2. Loosen the mounting bolts(A) and disconnect the brush holder assembly(B).



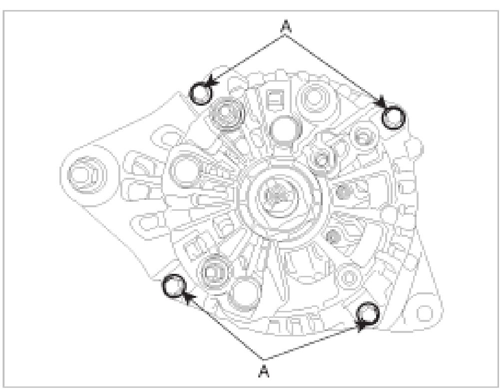
3. Remove the slip ring guide(A).



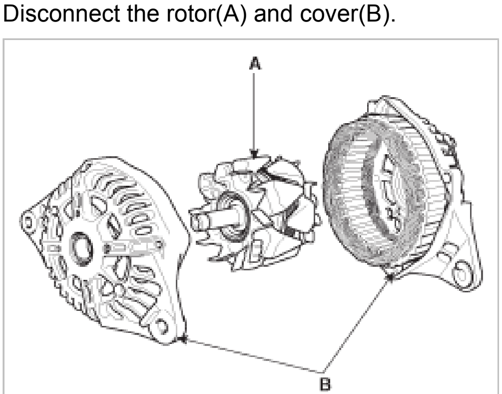
4. Remove the nut, pulley(A) and spacer.



5. Loosen the 4 through bolts(A).



6. Disconnect the rotor(A) and cover(B).

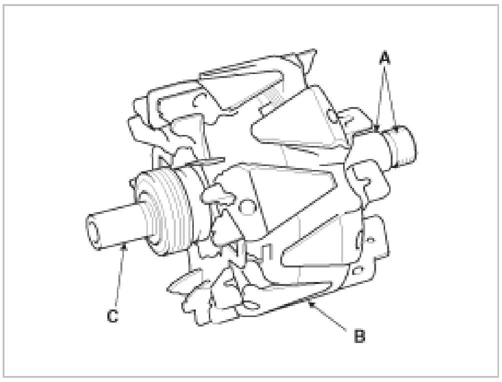


7. Reassembly is the reverse order of disassembly.

INSPECTION

INSPECT ROTOR

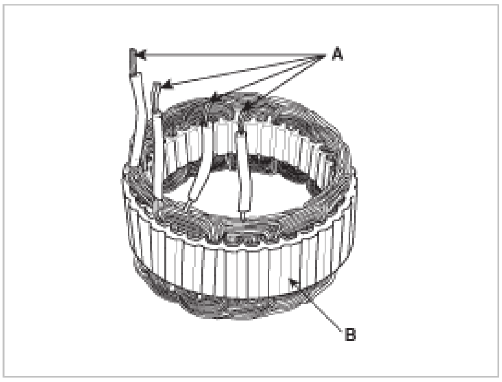
1. Check that there is continuity between the slip rings (A).



2. Check that there is no continuity between the slip rings and the rotor (B) or rotor shaft (C).
3. If the rotor fails either continuity check, replace the alternator.

INSPECT STATOR

1. Check that there is continuity between each pair of leads (A).

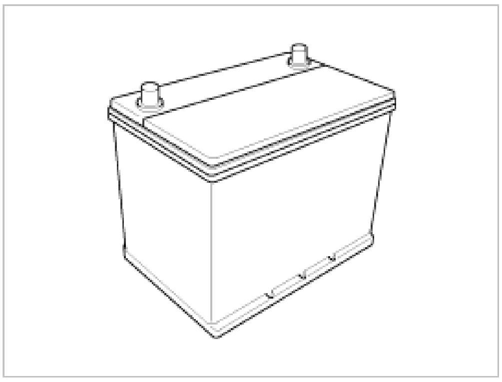


2. Check that there is no continuity between each lead and the coil core.
3. If the coil fails either continuity check, replace the alternator.

Engine Electrical System > Charging System > Battery > Description and Operation

DESCRIPTION

1. The maintenance-free battery is, as the name implies, totally maintenance free and has no removable battery cell caps.
2. Water never needs to be added to the maintenance-free battery.
3. The battery is completely sealed, except for small vent holes in the cover.

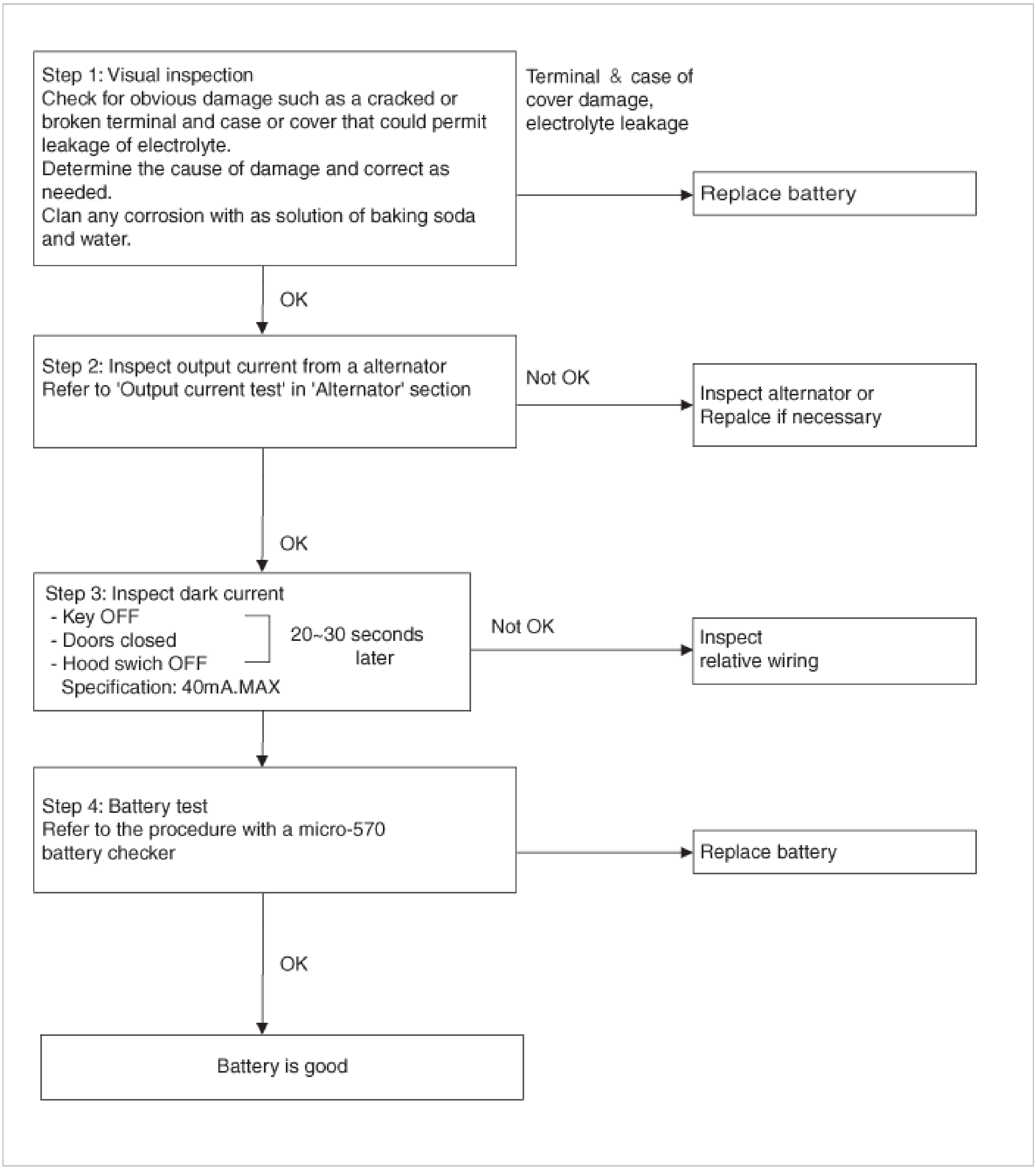


Engine Electrical System > Charging System > Battery > Repair procedures

INSPECTION

BATTERY DIAGNOSTIC TEST (1)

CHECKING FLOW



LOAD TEST

1. Perform the following steps to complete the load test procedure for maintenance free batteries.
2. Connect the load tester clamps to the terminals and proceed with the test as follow:
   (1) If the battery has been on charge, remove the surface charge by connecting a 300ampere load for 15 seconds.
   (2) Connect the voltmeter and apply the specified load.
   (3) Read the voltage after the load has been applied for 15 seconds.
   (4) Disconnect the load.
   (5) Compare the voltage reading with the minimum and replace the battery if battery test voltage is below that shown in the voltage table.

Voltage	Temperature
9.6V	20°C (68.0°F) and above

9.5V	16°C (60.8°F)
9.4V	10°C (50.0°F)
9.3V	4°C (39.2°F)
9.1V	-1°C (30.2°F)
8.9V	-7°C (19.4°F)
8.7V	-12°C (10.4°F)
8.5V	-18°C (-0.4°F)

NOTE

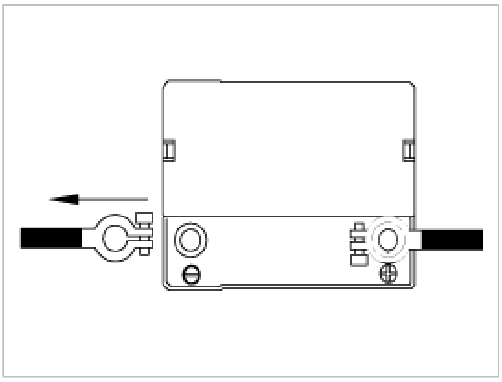
- If the voltage is greater than shown in the table, the battery is good.
- If the voltage is less than shown in the table, replace the battery.

BATTERY DIAGNOSTIC TEST (2)

1. Make sure the ignition switch and all accessories are in the OFF position.
2. Disconnect the battery cables (negative first).
3. Remove the battery from the vehicle.

CAUTION

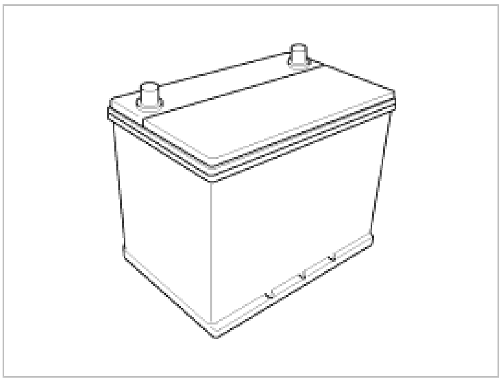
Care should be taken in the event the battery case is cracked or leaking, to protect your skin from the electrolyte. Heavy rubber gloves (not the household type) should be wore when removing the battery.



4. Inspect the battery tray for damage caused by the loss of electrolyte. If acid damage is present, it will be necessary to clean the area with a solution of clean warm water and baking soda. Scrub the area with a stiff brush and wipe off with a cloth moistened with baking soda and water.
5. Clean the top of the battery with the same solution as described above.
6. Inspect the battery case and cover for cracks. If cracks are present, the battery must be replaced.
7. Clean the battery posts with a suitable battery post tool.
8. Clean the inside surface of the terminal clamps with a suitable battery cleaning tool. Replace damaged or frayed cables and broken terminal clamps.
9. Install the battery in the vehicle.
10. Connect the cable terminals to the battery post, making sure tops of the terminals are flush with the tops of the posts.
11. Tighten the terminal nuts securely.
12. Coat all connections with light mineral grease after tightening.

CAUTION

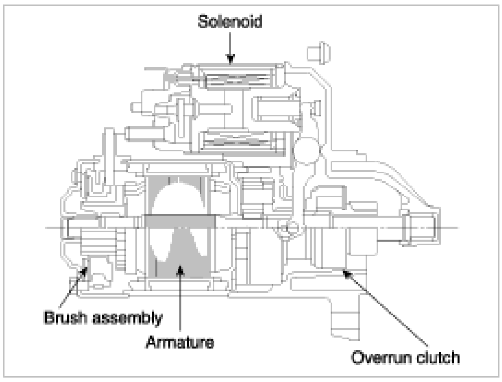
When batteries are being charged, an explosive gas forms beneath the cover of each cell. Do not smoke near batteries being charged or which have recently been charged. Do not break live circuit at the terminals of batteries being charged.
A spark will occur when the circuit is broken. Keep open flames away from battery.



Engine Electrical System > Starting System > Description and Operation

DESCRIPTION

The starting system includes the battery, starter, solenoid switch, ignition switch, inhibitor switch (A/T), ignition lock switch, connection wires and the battery cable.
When the ignition key is turned to the start position, current flows and energizes the starter motor's solenoid coil.
The solenoid plunger and clutch shift lever are activated, and the clutch pinion engages the ring gear.
The contacts close and the starter motor cranks. In order to prevent damage caused by excessive rotation of the starter armature when the engine starts, the clutch pinion gear overruns.



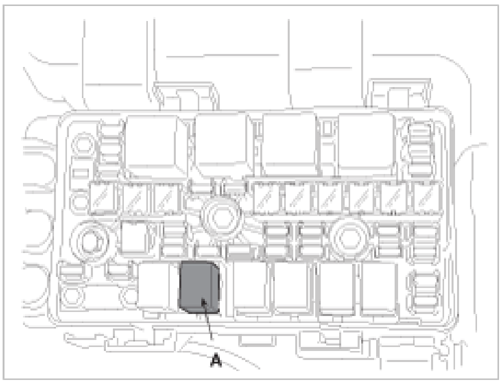
Engine Electrical System > Starting System > Repair procedures

STARTER CIRCUIT TROUBLESHOOTING

NOTE

The battery must be in good condition and fully charged.

1. Remove the fuel pump relay(A) from the fuse box.



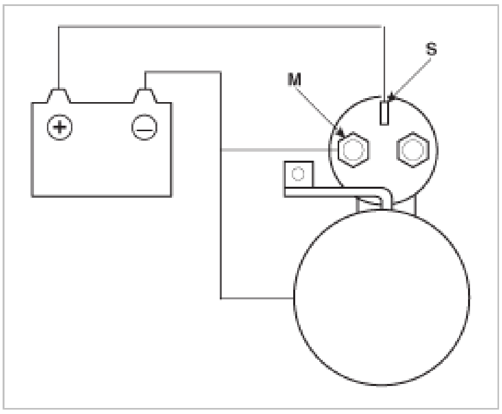
2. With the shift lever in N or P (A/T) or clutch pedal pressed (M/T), turn the ignition switch to "START"
   If the starter normally cranks the engine, starting system is OK. If the starter will not crank the engine at all, go to next step.
   If it won't disengage from the ring gear when you release key, check for the following until you find the cause.

A. Solenoid plunger and switch malfunction.
B. Dirty pinion gear or damaged overrunning clutch.

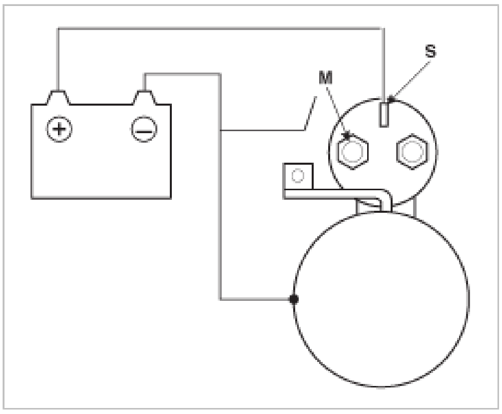
3. Check the battery condition. Check electrical connections at the battery, battery negative cable connected to the body, engine ground cables, and the starter for looseness and corrosion. Then try starting the engine again.
   If the starter cranks normally the engine, repairing the loose connection repaired the problem. The starting system is now OK.
   If the starter still does not crank the engine, go to next step.
4. Disconnect the connector from the S-terminal of solenoid. Connect a jumper wire from the B-terminal of solenoid to the S-terminal of solenoid.
   If the starter cranks the engine, go to next step.
   If the starter still does not crank the engine, remove the starter, and repair or replace as necessary.
5. Check the following items in the order listed until you find the open circuit.
   A. Check the wire and connectors between the driver's under-dash fuse/relay box and the ignition switch, and between the driver's under-dash fuse/relay box and the starter.
   B. Check the ignition switch (Refer to BE group - ignition system)
   C. Check the transaxle range switch connector or ignition lock switch connector.
   D. Inspect the starter relay.

STARTER SOLENOID TEST

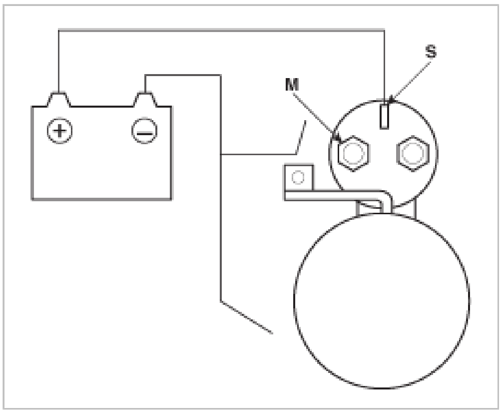
1. Disconnect the field coil wire from the M-terminal of solenoid switch.
2. Connect the battery as shown. If the starter pinion pops out, it is working properly. To avoid damaging the starter, do not leave the battery connected for more than 10 seconds.



3. Disconnect the battery from the M terminal.
   If the pinion does not retract, the hold-in coil is working properly. To avoid damaging the starter, do not leave the battery connected for more than 10 seconds.

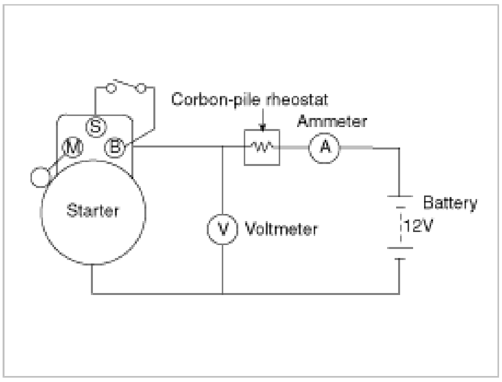


4. Disconnect the battery also from the body. If the pinion retracts immediately, it is working properly. To avoid damaging the starter, do not leave the battery connected for more than 10 seconds.



FREE RUNNING TEST

1. Place the starter motor in a vise equipped with soft jaws and connect a fully-charged 12-volt battery to starter motor as follows.
2. Connect a test ammeter (100-ampere scale) and carbon pile rheostats as shown in the illustration.
3. Connect a voltmeter (15-volt scale) across starter motor.

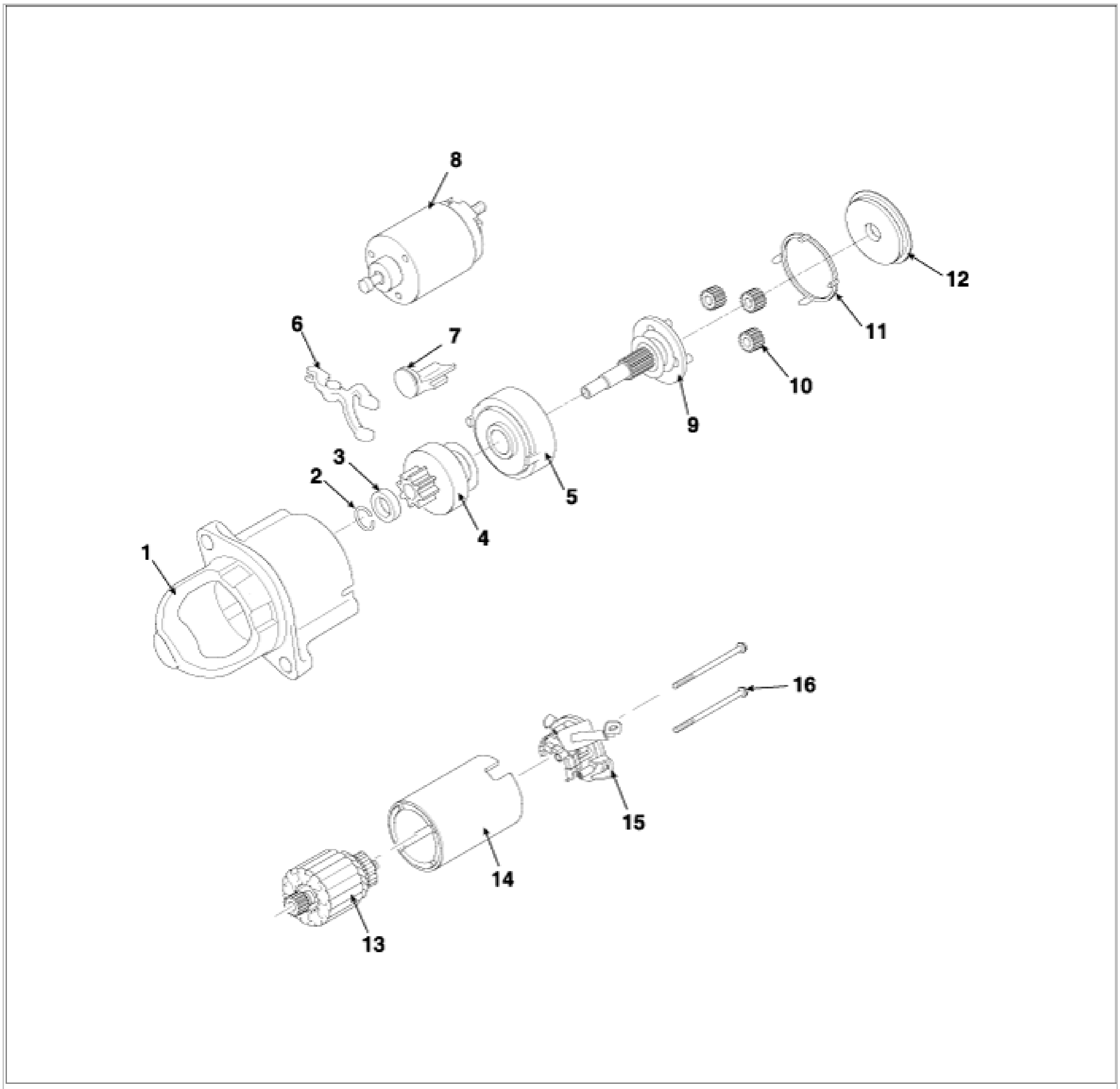


4. Rotate carbon pile to the off position.
5. Connect the battery cable from battery's negative post to the starter motor body.
6. Adjust until battery voltage shown on the voltmeter reads 11volts.
7. Confirm that the maximum amperage is within the specifications and that the starter motor turns smoothly and freely.

Current : 90A max (2.4L), 85A MAX (3.3L)
Speed : 2,600 rpm

Engine Electrical System > Starting System > Starter > Components and Components Location

COMPONENT



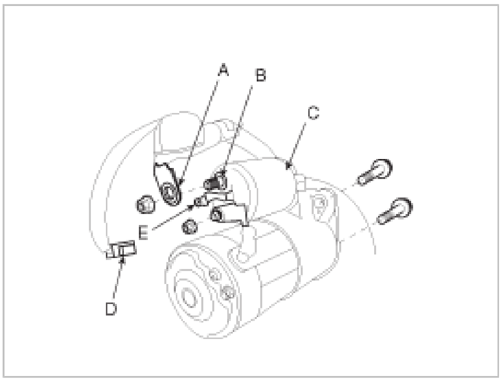
1. Front bracket
2. Stop ring
3. Stopper
4. Overrun clutch assembly
5. Internal gear assembly
6. Lever
7. Lever packing
8. Magnet switch assembly
9. Planet shaft assembly
10. Planetary gear assembly
11. Packing
12. Shield
13. Armature assembly
14. Yoke assembly
15. Brush holder assembly
16. Through bolt

Engine Electrical System > Starting System > Starter > Repair procedures

STARTER

REMOVAL

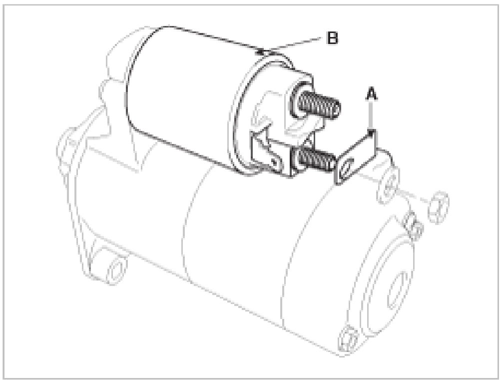
1. Disconnect the battery negative cable.
2. Disconnect the starter cable (A) from the B terminal (B) on the solenoid (C), then disconnect the connector (D) from the S terminal (E).



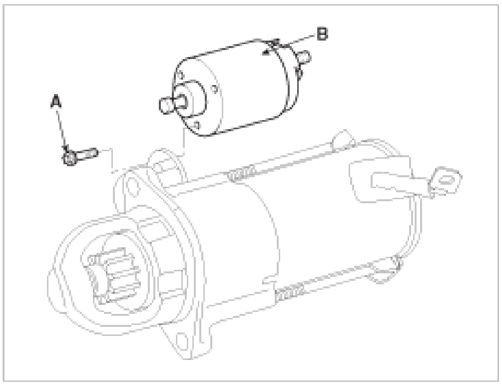
3. Remove the 2 bolts holding the starter, then remove the starter.
4. Installation is the reverse of removal.
5. Connect the battery negative cable to the battery.

DISASSEMBLY

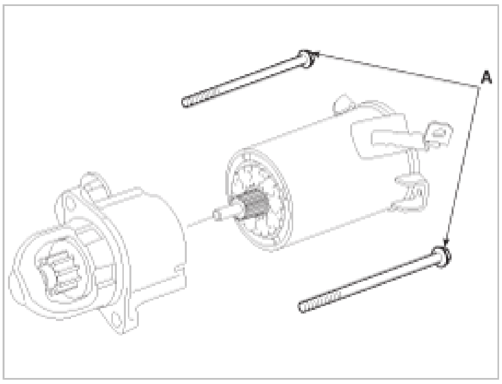
1. Disconnect the M-terminal (A) on the magnet switch assembly (B).



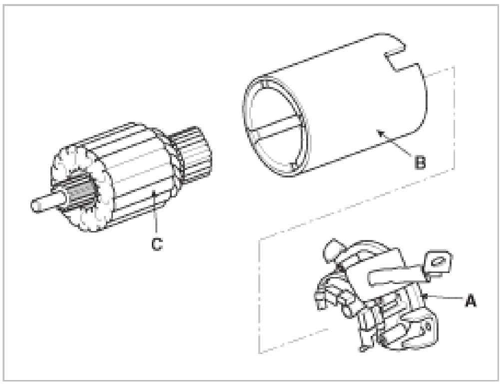
2. After loosening the 3 screws (A), detach the magnet switch assembly (B).



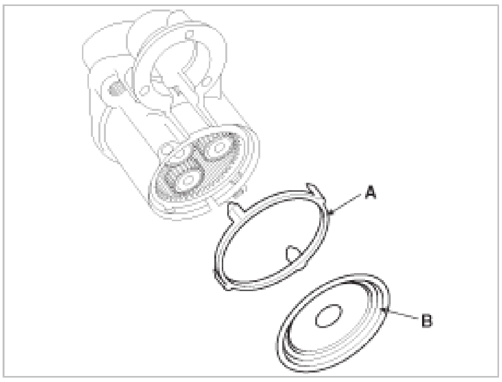
3. Loosen the through bolts (A).



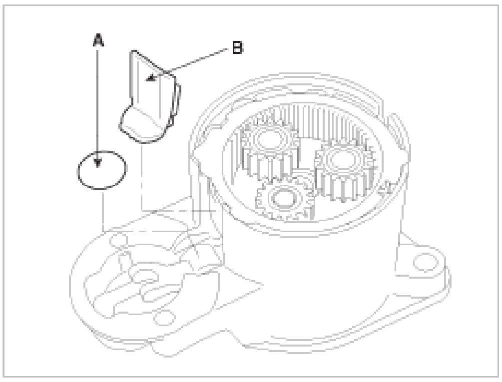
4. Remove the brush holder assembly (A), yoke (b) and armature (C).



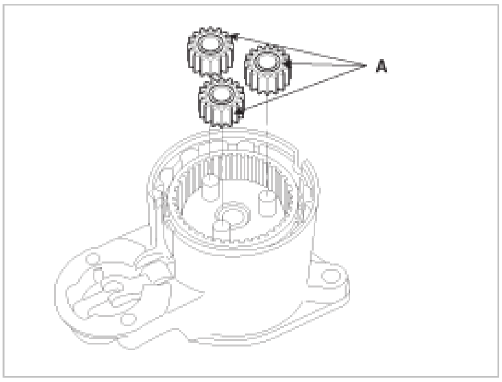
5. Remove the shield (A) and packing (B).



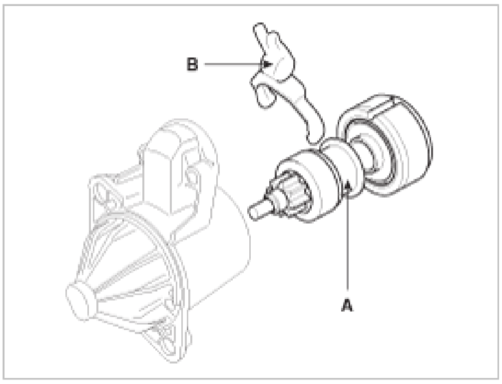
6. Remove the lever plate (A) and lever packing (B).



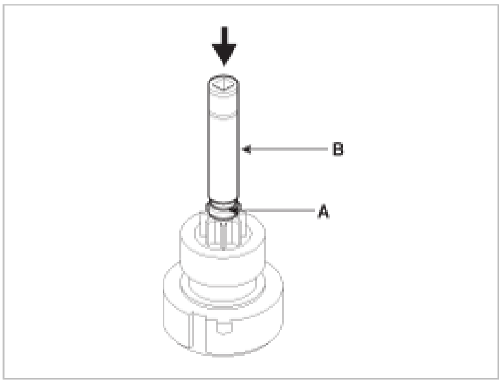
7. Disconnect the planet gear (A).



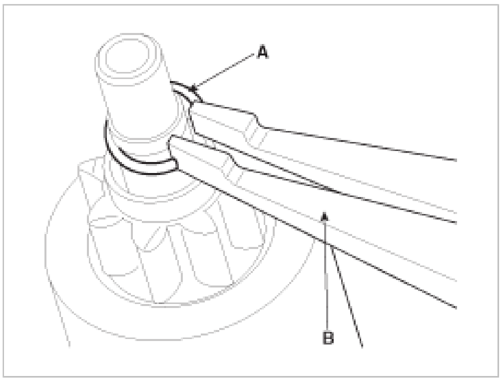
8. Disconnect the planet shaft assembly (A) and lever (B).



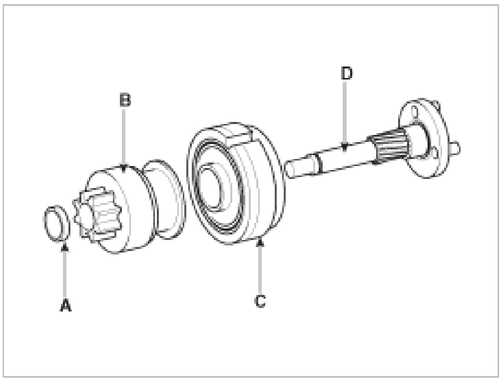
9. Press the stop ring (A) using a socket (B).



10. After removing the stopper (A) using stopper pliers (B).



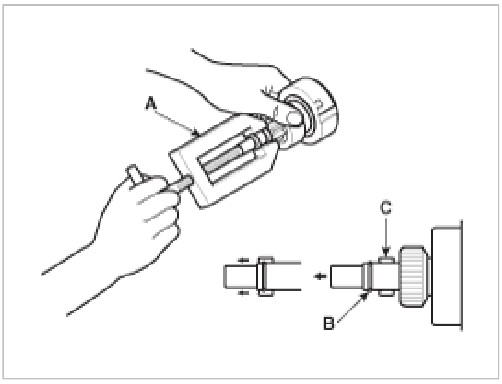
11. Disconnect the stop ring (A), overrunning clutch (B), internal gear (C) and planet shaft (D).



12. Reassembly is the reverse of disassembly.

NOTE

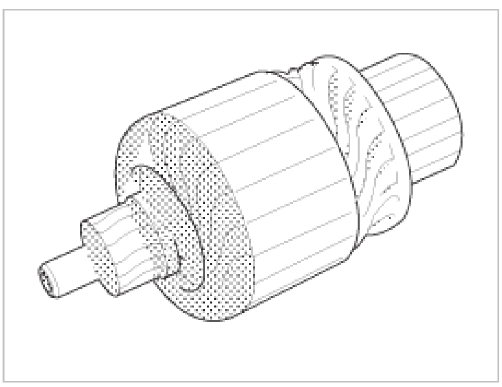
Using a suitable pulling tool (A), pull the overrunning clutch stop ring (B) over the stopper (C).



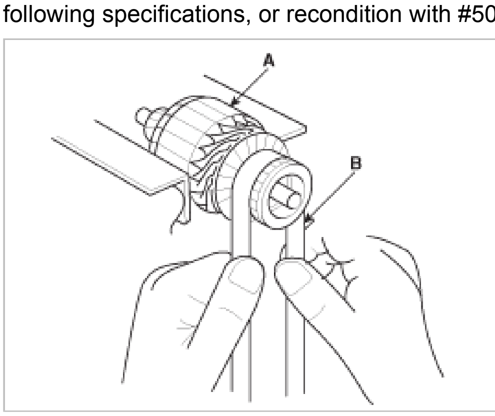
INSPECTION

ARMATURE INSPECTION AND TEST

1. Remove the starter.
2. Disassemble the starter as shown at the beginning of this procedure.
3. Inspect the armature for wear or damage from contact with the permanent magnet. If there is wear or damage, replace the armature.

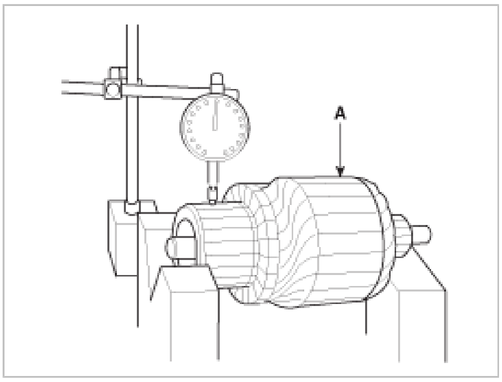


4. Check the commutator (A) surface. If the surface is dirty or burnt, resurface with emery cloth or a lathe within the following specifications, or recondition with #500 or #600 sandpaper (B).



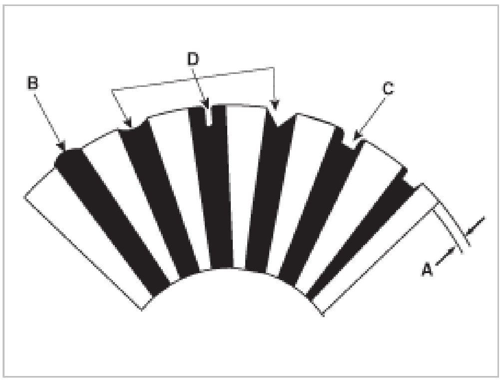
5. Measure the commutator (A) runout.
   A. If the commutator runout is within the service limit, check the commutator for carbon dust or brass chips between the segments.
   B. If the commutator run out is not within the service limit, replace the armature.

Commutator runout
Standard (New): 0.02mm (0.0008in.) max
Service limit: 0.05mm (0.0020in.)

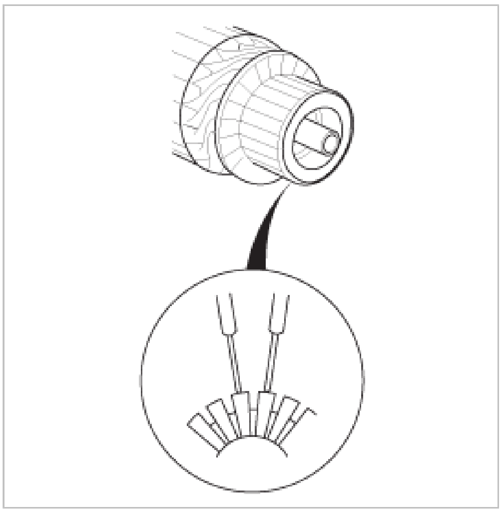


6. Check the mica depth (A). If the mica is too high (B), undercut the mica with a hacksaw blade to the proper depth. Cut away all the mica (C) between the commutator segments. The undercut should not be too shallow, too narrow, or v-shaped (D).

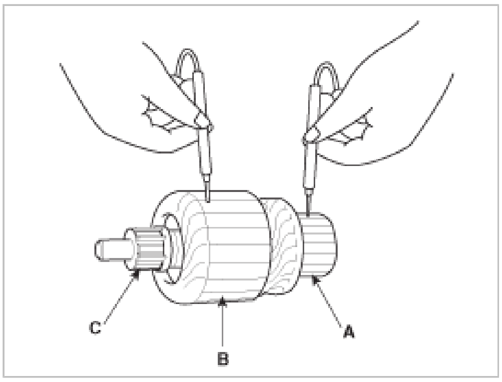
Commutator mica depth
Standard (New) : 0.5 mm (0.0197 in.)
Limit : 0.2mm (0.0079 in.)



7. Check for continuity between the segments of the commutator. If an open circuit exists between any segments, replace the armature.

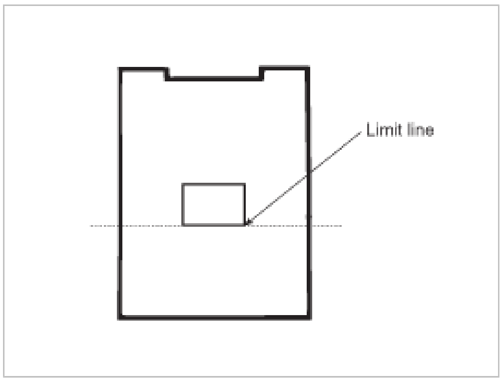


8. Check with an ohmmeter that no continuity exists between the commutator (A) and armature coil core (B), and between the commutator and armature shaft (C). If continuity exists, replace the armature.



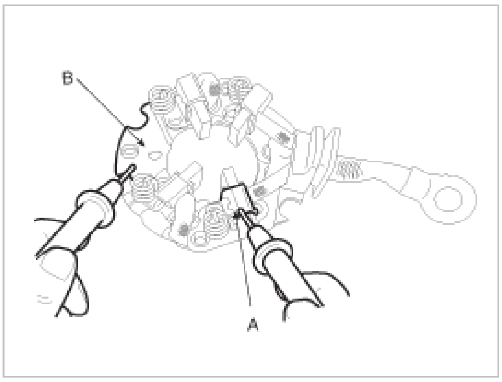
INSPECT STARTER BRUSH

Brushes that are worm out, or oil-soaked, should be replaced.

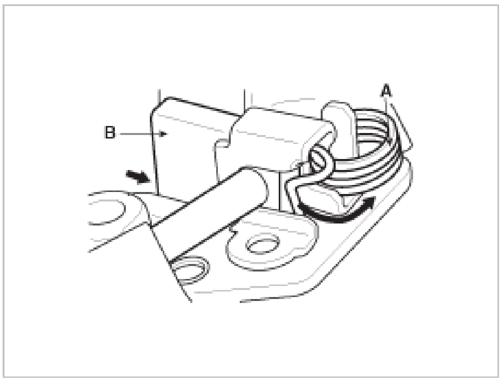


STARTER BRUSH HOLDER TEST

1. Check that there is no continuity between the (+) brush holder (A) and (-) brush holder (B). If there is no continuity, replace the brush holder assembly.



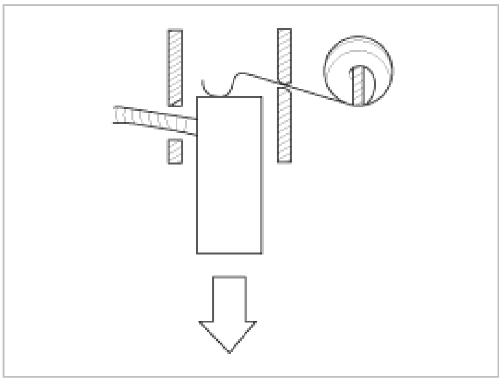
2. Pry back each brush spring (A) with a screwdriver, then position the brush (B) about halfway out of its holder, and release the spring to hold it there.



3. Install the armature in the housing, and install the brush holder. Next, pry back each brush spring again, and push the brush down until it seats against the commutator, then release the spring against the end of the brush.

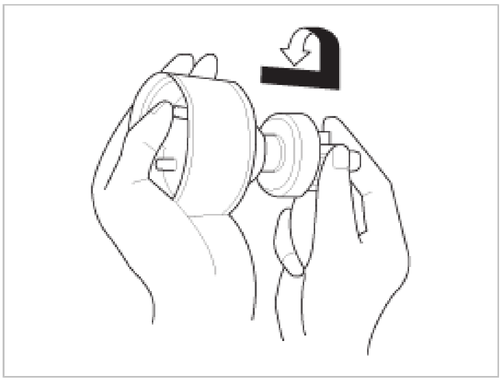
NOTE

To seat new brushes, slip a strip of #500 or #600 sandpaper, with the grit side up, between the commutator and each brush, and smoothly rotate the armature. The contact surface of the brushes will be sanded to the same contour as the commutator.



INSPECT OVERRUNNING CLUTCH

1. Slide the overrunning clutch along the shaft.
   Replace it if does not slide smoothly.
2. Rotate the overrunning clutch both ways.
   Does it lock in one direction and rotate smoothly in reverse? If it does not lock in either direction or it locks in both directions, replace it.



3. If the starter drive gear is worn or damaged, replace the overrunning clutch assembly. (the gear is not available separately).
   Check the condition of the flywheel or torque converter ring gear if the starter drive gear teeth are damaged.

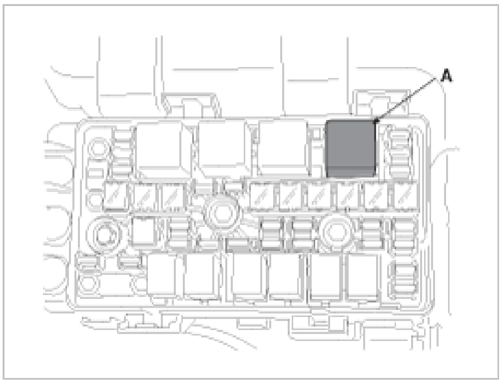
CLEANING

1. Do not immerse parts in cleaning solvent. Immersing the yoke assembly and/or armature will damage the insulation. Wipe these parts with a cloth only.
2. Do not immerse the drive unit in cleaning solvent. The overrun clutch is pre-lubricated at the factory and solvent will wash lubrication from the clutch.
3. The drive unit may be cleaned with a brush moistened with cleaning solvent and wiped dry with a cloth.

Engine Electrical System > Starting System > Starter Relay > Repair procedures

INSPECTION

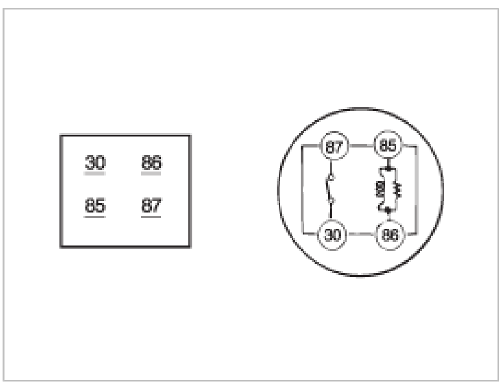
1. Remove the fuse box cover.
2. Remove the starter relay (A).



3. Using an ohmmeter, check that there is continuity between each terminal.

Terminal	Continuity
30 - 87	NO
85 - 86	YES

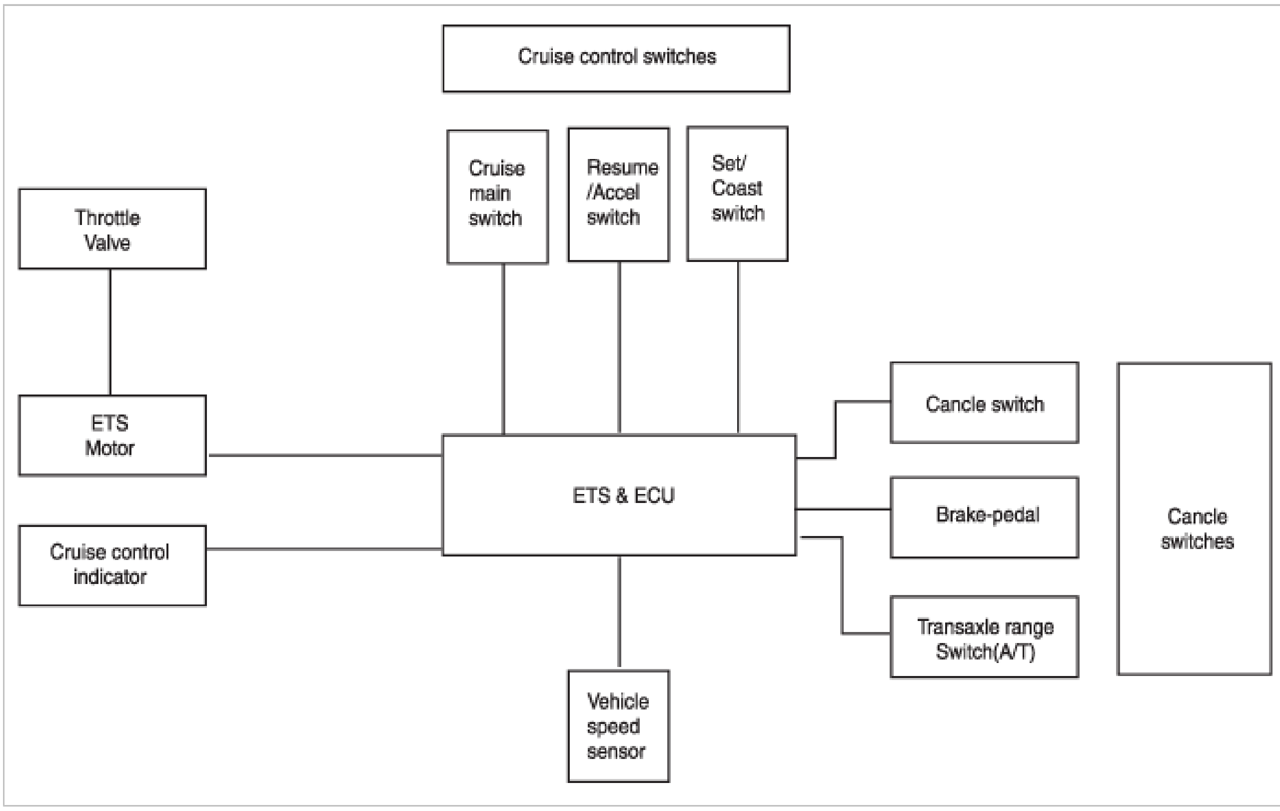
4. Apply 12V to terminal 85 and ground to terminal 86.
   Check for continuity between terminals 30 and 87.



5. If there is no continuity, replace the starter relay.
6. Install the starter relay.
7. Install the fuse box cover.

Engine Electrical System > Cruise Control System > Description and Operation

SYSTEM BLOCK DIAGRAM



COMPONENT PARTS AND FUNCTION OUTLINE

Component part		Function
Vehicle-speed sensor		Converts vehicle speed to pulse.
Engine control module (ECM)		Receives signals from sensor and control switches;
Cruise control indicator		Illuminate when CRUISE main switch is ON (Built into cluster)
Cruise Control switches	CRUISE main switch	Switch for automatic speed control power supply.
	Resume/Accel switch	Controls automatic speed control functions by Resume/Accel switch (Set/Coast switch)
	Set/Coast switch	
Cancel switch	Cancel switch	Sends cancel signals to ECM
	Brake-pedal switch	
	Transaxle range switch (A/T) Clutch switch (M/T)	
ETS motor		Regulates the throttle valve to the set opening by ECM.

* ETS : Electronic Throttle System

CRUISE CONTROL

Cruise control system is engaged by "ON. OFF" main switch located on right of steering wheel column. System has the capability to cruise, coast, resume speed, and accelerate, and raise "tap-up" or lower "tap-down" set speed.
It also has a safety interrupt, engaged upon depressing brake or shifting select lever.
ECM is a speed control system that maintains a required vehicle speed at normal driving conditions.
The main components of cruise control system are mode control switches, transaxle range switch, brake switch, vehicle speed sensor, ECM and ETS motor that connect throttle body.
ECM contains a low speed limit which will prevent system engagement below a minimum speed of 40km/h (25mph).
The operation of the controller is controlled by mode control switches located on steering wheel.
Transaxle range switch and brake switch are provided to disengage the cruise control system. The switches are on brake pedal bracket and transaxle. When the brake pedal is depressed or select lever shifted, the cruise control system is electrically disengaged and the throttle is returned to the idle position.

Cruise main switch

Cruise control system is engaged by pressing "ON. OFF" push button. Releasing "ON.OFF" push button release throttle, clears cruise memory speed, and puts vehicle in a non-cruise mode.

Coast/Set switch

COAST.SET switch located on right of steering wheel column has two positions - "Normal" and "Depressed". The set position - With COAST.SET switch depressed and then released the cruise speed will be set at the speed the vehicle was going when COAST.SET switch was released. The coast position - With COAST.SET switch fully depressed, driver can lower cruise speed. To decrease cruise speed, COAST.SET switch is held in, disengaging cruise control system. When vehicle has slowed to required cruise speed, releasing COAST.SET switch will re-engage speed at new selected speed. The tap down - To lower vehicle speed, cruise must be engaged and operating. Tap down is done by quickly pressing and releasing COAST.SET switch. Do not hold COAST.SET switch in depressed position.

Tap down is a function in which cruise speed car be decreased by 1mph (1.6km/h)

Resume/Accel switch

RES.ACCEL switch located on right of steering wheel column has two positions - "Normal" and "Depressed".

The resume position - With RES.ACCEL switch depressed and then release, this switch also returns cruise control operation to last speed (Which is temporarily disengaged by Cancel switch or Brake pedal), setting when momentarily operating RES.ACCEL switch by constant acceleration.

The accel position - With RES.ACCEL switch depressed and held in, disengaging cruise control system, when vehicle has accelerated to required cruise speed, releasing RES.ACCEL switch will re-engage speed at new selected speed.

The tap up - To increase vehicle speed, the cruise must be engaged and operating.

Tap up is done by quickly pressing and releasing RES.ACCEL switch less than 0.5 second. Do not hold RES.ACCEL switch in depressed position. Tap up is a function in which cruise speed can be increased by 1mph (1.6km/h).

Cancel switch

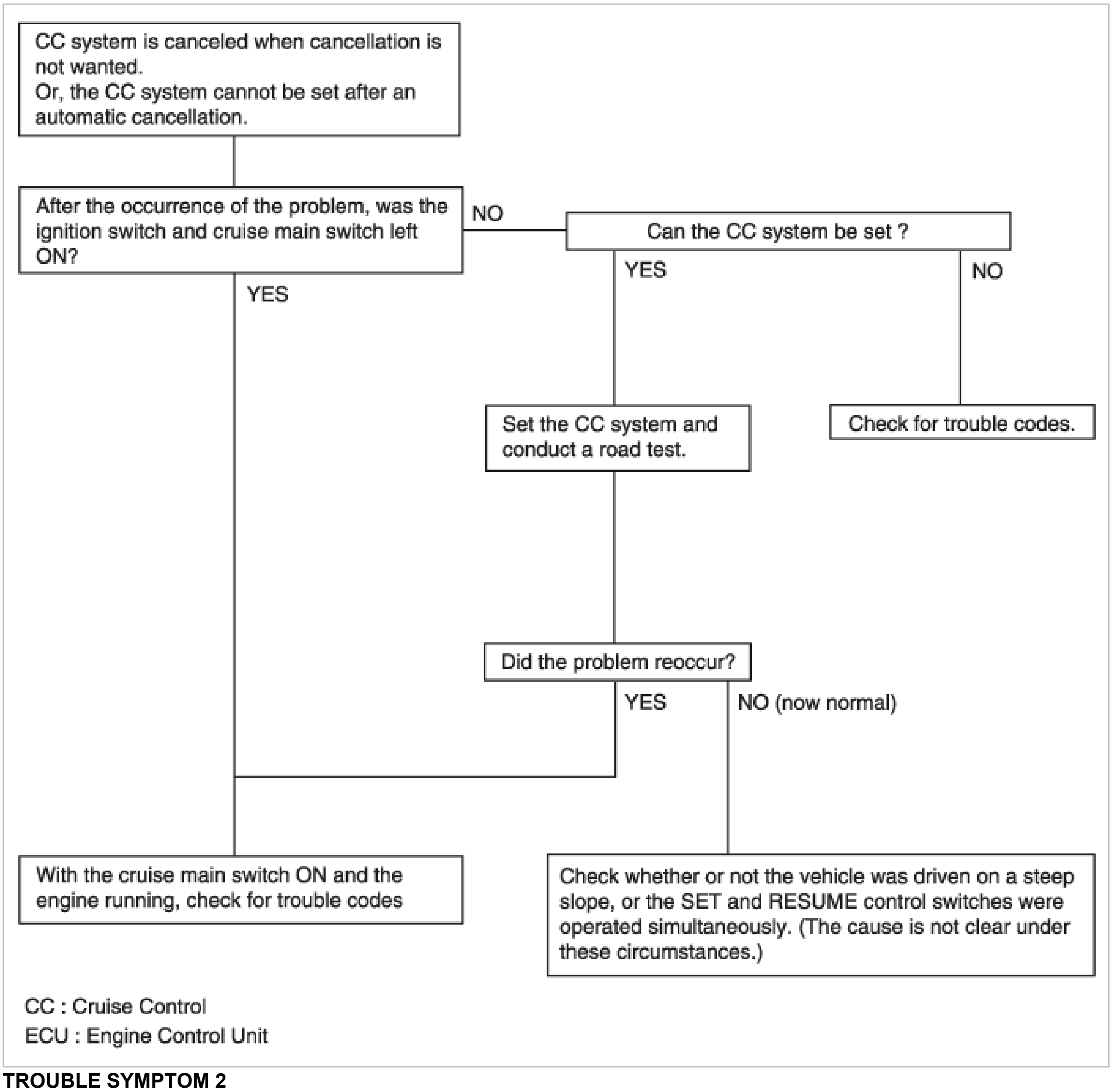
Cruise control system is temporarily disengaged by pressing "CANCEL" switch.

Cruise speed canceled by this switch will be recovered by RES.ACCEL switch

Engine Electrical System > Cruise Control System > Troubleshooting

TROUBLE SYMPTOM CHARTS

TROUBLE SYMPTOM 1



TROUBLE SYMPTOM 2

Trouble symptom	Probable cause	Remedy
The set vehicle speed varies greatly upward or downward "Surging" (repeated alternating acceleration and deceleration) occurs after setting	Malfunction of the vehicle speed sensor circuit	Repair the vehicle speed sensor system, or replace the part
	Malfunction of ECM	Replace the ECM

TROUBLE SYMPTOM 3

Trouble symptom	Probable cause	Remedy
The CC system is not canceled when the brake pedal is depressed	Damaged or disconnected wiring of the brake pedal switch	Repair the harness or replace the brake pedal switch
	Malfunction of the ECM	Replace the ECM

TROUBLE SYMPTOM 4

Trouble symptom	Probable cause	Remedy
The CC system is not canceled when	Damaged or disconnected wiring of inhibitor switch input circuit	Repair the harness or repair or replace

the shift lever is moved to the "N" position (It is canceled, however, when the brake pedal is depressed	Improper adjustment of inhibitor switch	the inhibitor switch
	Malfunction of the ECM	Replace the ECM

TROUBLE SYMPTOM 5

Trouble symptom	Probable cause	Remedy
Cannot decelerate (coast) by using the SET switch	Temporary damaged or disconnected wiring of SET switch input circuit	Repair the harness or replace the SET switch
	Malfunction of the ECM	Replace the ECM

TROUBLE SYMPTOM 6

Trouble symptom	Probable cause	Remedy
Cannot accelerate or resume speed by using the RESUME switch	Damaged or disconnected wiring, or short circuit, or RESUME switch input circuit	Repair the harness or replace the RESUME switch
	Malfunction of the ECM	Replace the ECM

TROUBLE SYMPTOM 7

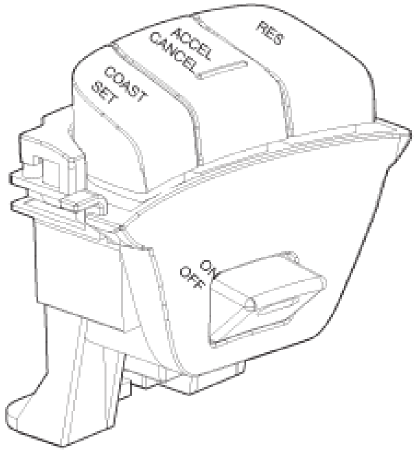
Trouble symptom	Probable cause	Remedy
CC system can be set while driving at a vehicle speed of less than 40km/h (25mph), or there is no automatic cancellation at that speed	Malfunction of the vehicle-speed sensor circuit	Repair the vehicle speed sensor system, or replace the part
	Malfunction of the ECM	Replace the ECM

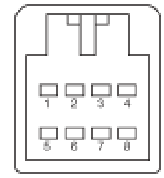
TROUBLE SYMPTOM 8

Trouble symptom	Probable cause	Remedy
The cruise main switch indicator lamp does not illuminate (But CC system is normal)	Damaged or disconnected bulb of cruise main switch indicator lamp	Repair the harness or replace the part.
	Harness damaged or disconnected	

Engine Electrical System > Cruise Control System > Cruise Control Switch > Schematic Diagrams

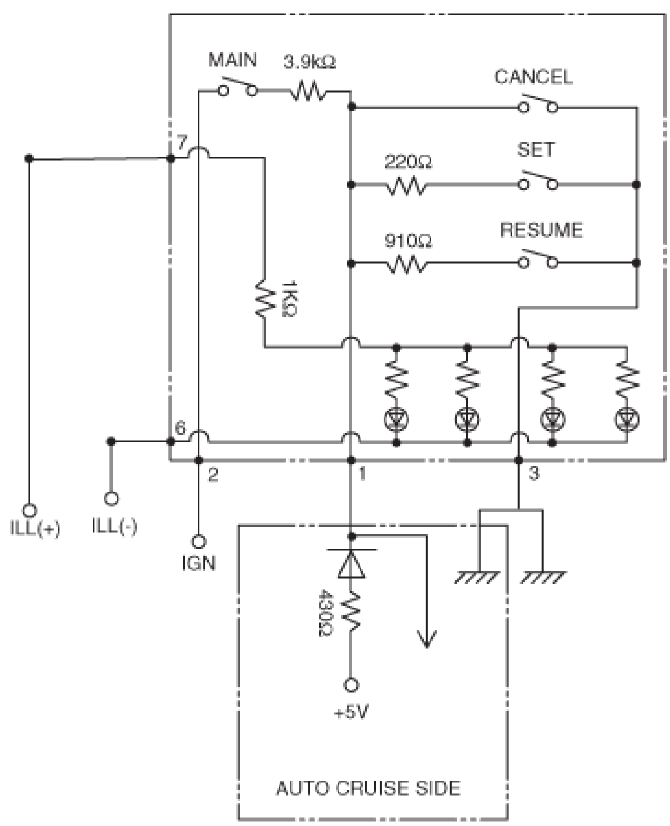
CIRCUIT DIAGRAM





CONNECTOR

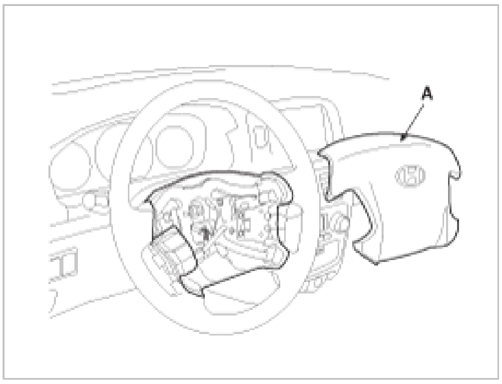
NO	CONNECTOR
1	CRUSIE SW(SIG IN)
2	CRUSIE MAIN SW(IGN)
3	CRUSIE SW(SIG OUT)
4	–
5	–
6	ILL(-)
7	ILL(+)



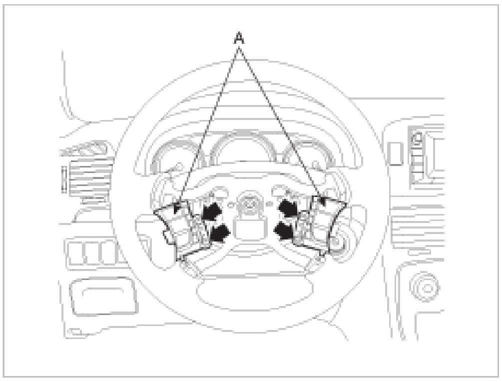
Engine Electrical System > Cruise Control System > Cruise Control Switch > Repair procedures

REMOVAL

1. Disconnect the battery (-) terminal.
2. Remove the driver side air bag module(A). (Refer to RT GR.)



3. Disconnect the cruise control switch connector and then remove the cruise control switch(A) with two screws.

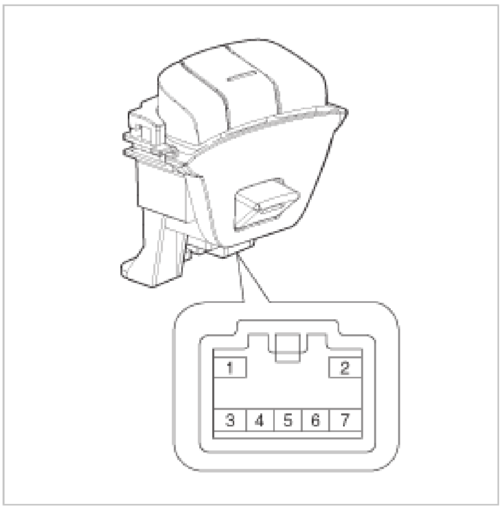


4. Installation is the reverse of removal.

INSPECTION

MEASURING RESISTANCE

1. Disconnect the cruise control switch connector from the control switch.



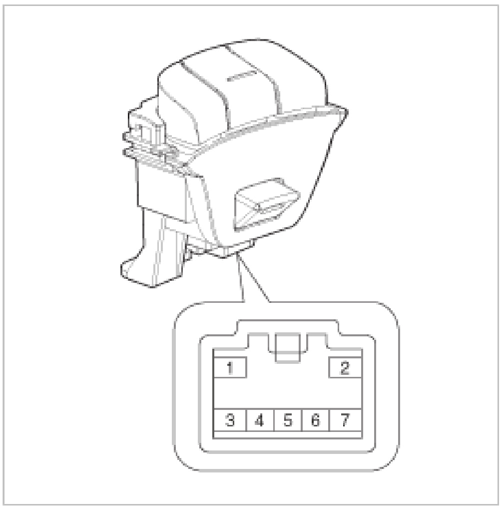
2. Measure resistance between terminals on the control switch when each function switch is ON (switch is depressed).

Function switch	Terminal	Resistance
Cruise Main	RH 1-2	3.9kΩ ± 1%
Cancel	RH 1-3	0Ω ± 1%
Set/Coast	RH 1-3	220Ω ± 1%
Resume/Accel	RH 1-3	910Ω ± 1%

3. If not within specification, replace switch.

MEASURING VOLTAGE

1. Connect the cruise control switch connector to the control switch.



2. Measure voltage between terminals on the harness side connector when each function switch is ON (switch is depressed).

Function switch	Terminal	Voltage
Cruise Main	RH 1-2	-
Cancel	RH 1-3	0.0V ± 0.22V
Set/Coast	RH 1-3	1.5V ± 0.22V
Resume/Accel	RH 1-3	3.0V ± 0.22V

3. If not within specification, replace switch.

Engine Mechanical System > General Information > General Information

SPECIFICATIONS

Description Sp	ecifications	Limit
General		
Type	In-line, Double Overhead Camshaft	
Number of cylinder	4	
Bore	88mm (3.464in)	
Stroke	97mm (3.819in.)	
Total displacement	2359cc (143.90cu.in.)	
Compression ratio	10.5	
Firing order	1-3-4-2	
Valve timing		
Intake valve		
Opens (ATDC)	11°	
Closes (ABDC)	67°	
Exhaust		
Opens (BBDC)	34°	
Closes (ATDC)	10°	
Valve		
Valve length		
Intake	113.18mm (4.4559in.)	112.93mm (4.4460in)
Exhaust	105.89mm (4.1689in.)	105.74mm (4.1629in)
Stem O.D.		
Intake	5.465 ~ 5.480mm (0.2151 ~ 0.2157in.)	
Exhaust	5.458 ~ 5.470mm (0.2149 ~ 0.2153in.)	
Face angle	45.25° ~ 45.75°	
Margin		
Intake	1.02mm (0.0401in.)	
Exhaust	1.09mm (0.0429in.)	
Valve stem to valve guide clearance		
Intake	0.020 ~ 0.047mm (0.00078 ~ 0.00185in.)	0.07mm (0.00275in.)
Exhaust	0.030 ~ 0.054mm (0.00118 ~ 0.00212in.)	0.09mm (0.00354in.)
Valve guide		
Length		
Intake	43.8 ~ 44.2mm (1.7244 ~ 1.7401in.)	
Exhaust	43.8 ~ 44.2mm (1.7244 ~ 1.7401in.)	
Valve seat		
Width of seat contact		
Intake	1.16 ~ 1.46mm (0.0457 ~ 0.0575in.)	
Exhaust	1.35 ~ 1.65mm (0.0531 ~ 0.0649in.)	
Seat angle	44.75° ~ 45.10°	
Valve spring		
Free length	47.44mm (1.8677in.)	
Load	19.0 ± 0.6kg/35.0mm (41.88 ± 1.32lb/1.3779in.) 39.8 ± 1.2kg/26.0mm (87.74 ± 2.64lb/1.0236in.)	
Squarences	1.5° MAX.	
Valve clearance		
Cold (20°C[68°F])		
Intake	0.17 ~ 0.23mm (0.0067 ~ 0.0090in.)	0.10 ~ 0.30mm (0.0039 ~ 0.0118in.)
Exhaust	0.27 ~ 0.33mm (0.0106 ~ 0.0129in,)	0.20 ~ 0.40mm (0.0078 ~ 0.0157in.)
Cylinder head		
Flatness of gasket surface	Max. 0.05mm (0.0019in.)	

Flatness of manifold mounting surface Oversize rework dimensions of	Max. 0.10mm (0.0039in.)	
Cylinder block Cylinder bore Out-of-round and taper of cylinder bore Clearance with piston (To set limits to new parts)	 88.00 ~ 88.03mm (3.4645 ~ 3.4657in.) Less than 0.05mm (0.0019in.) 0.02 ~ 0.04mm (0.0008 ~ 0.0016in.)	
Piston O.D (To set limits to new parts) Ring groove width No.1 No.2 Oil ring Service oversize	 87.97 ~ 88.00mm (3.4634 ~ 3.4645in.) 1.22 ~ 1.24mm (0.0480 ~ 0.0488in.) 1.22 ~ 1.24mm (0.0480 ~ 0.0488in.) 2.01 ~ 2.03mm (0.0791 ~ 0.0799in.) 0.25, 0.50mm (0.010, 0.020in.) oversize	 1.26mm (0.0496in.) 1.26mm (0.0496in.) 2.05mm (0.0807in.)
Piston ring Side clearance No.1 No.2 Oil ring End gap No.1 No.2 Oil ring side rail Service oversize	 0.03 ~ 0.07mm (0.0012 ~ 0.0027in.) 0.03 ~ 0.07mm (0.0012 ~ 0.0027in.) 0.06 ~ 0.15mm (0.0024 ~ 0.0059in.) 0.15 ~ 0.30mm (0.0059 ~ 0.0118in.) 0.30 ~ 0.45mm (0.0118 ~ 0.0177in.) 0.20 ~ 0.70mm (0.0078 ~ 0.0275in.) 0.25, 0.50mm(0.010, 0.020in.) oversize	 0.1mm (0.004in.) 0.1mm (0.004in.) 0.2mm (0.008in.) 0.6mm (0.0236in.) 0.7mm (0.0275in.) 0.8mm (0.0315in.)
Connecting rod Bend Twist Connecting rod big end to crankshaft side clearance	0.05mm (0.0020in.) or less 0.1mm (0.004in.) or less 0.100 ~ 0.250mm (0.0039 ~ 0.010in.)	0.35mm (0.0138in.)
Connecting rod bearing Oil clearance (To seat limits to new parts)	0.028 ~ 0.046mm (0.0011 ~ 0.0018in.)	0.05mm (0.0019in.)
Camshaft Cam height Intake Exhaust Journal O.D. Intake Exhaust Bearing oil clearance Intake Exhaust End play	 43.80mm (1.7244in.) 45.00mm (1.7716in.) No.1 : 30mm (1.1811in.) No.2,3,4,5 : 24mm (0.9449in.) No.1 : 40mm (1.5748in.) No.2,3,4,5 : 24mm (0.9449in.) No.1 : 0.020 ~ 0.057mm (0.00078 ~ 0.00224in.) No.2,3,4,5 : 0.045 ~ 0.082mm (0.00177 ~ 0.00323in.) No.1,2,3,4,5 : 0.045 ~ 0.082mm (0.00177 ~ 0.00323in.) 0.1 ~ 0.22mm (0.0039 ~ 0.0086in.)	 0.09mm (0.0035in.) 0.12mm (0.0047in.) 0.12mm (0.0047in.) 0.24mm (0.0094in.)
Crankshaft Pin O.D. Journal O.D. End play	 47.954 ~ 47.972mm (1.8879 ~ 1.8886in.) 51.942 ~ 51.960mm (2.0449 ~ 2.0456in.) 0.07 ~ 0.25mm (0.0027 ~ 0.0098in.)	
Crankshaft bearing Oil clearance	 0.026 ~ 0.048mm (0.0010 ~ 0.0019in.)	
Cooling method	Water-cooled, pressurized. Forced circulation with electrical fan	
Radiator Type	 Pressurized corrugated fin type	

Radiator cap Main valve opening pressure Vacuum valve opening pressure	 83 ~ 110kpa (12 ~ 16psi, 0.83 ~ 1.1kg/cm²) -7kpa (-100psi, -0.07kg/cm²) or less	
Thermostat Type Valve opening temperature Full-opening temperature	 Wax pellet type with jiggle valve 82°C (177°F) 95°C (201°F)	
Coolant pump	Centrifugal type impeller	
Drive belt Type	 V-ribbed belt	
Engine coolant temperature sensor Type Resistance	 Heat-sensitive thermistor type 2.31 ~ 2.59KΩ at 20°C (68°F)	
Air cleaner Type Element	 Dry type Unwoven cloth type	
Exhaust pipe Muffler Suspension system	 Expansion resonance type Rubber hangers	

SERVICE STANDRDS

Standard value	
Antifreeze	Maxture ratio of anti-freeze in coolant
ETHYLENE GLYCOL BASE FOR ALUMINUM	50%

TIGHTENING TORQUE

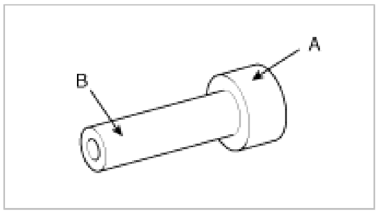
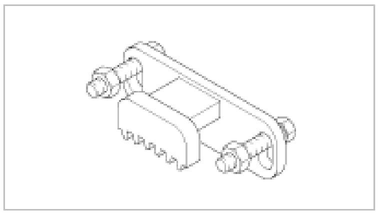
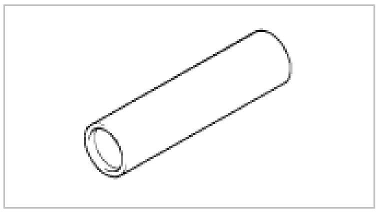
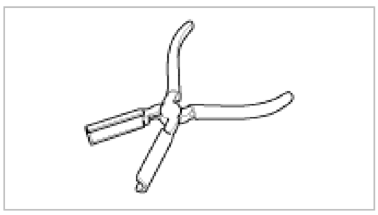
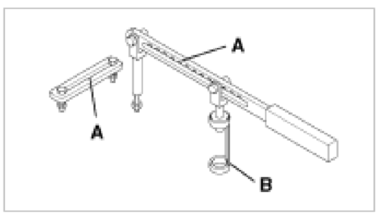
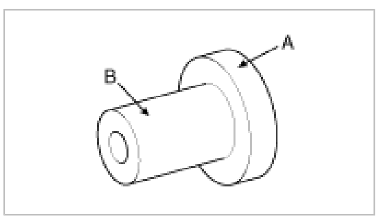
Item	Quantity	N.m	kgf.m	lbf.ft
Ladder frame bolt (M8 x 55)	4	23.52 ~ 27.44	2.4 ~ 2.8	17.35 ~ 20.24
Ladder frame bolt (M8 x 103)	6	23.52 ~ 27.44	2.4 ~ 2.8	17.35 ~ 20.24
Balance shaft module bolt	4	16.66 + 60° + 60°	1.7 + 60° + 60°	12.29 + 60° + 60°
Timing chain cover bolt (M8)	6	18.62 ~ 22.54	1.9 ~ 2.3	13.74 ~ 16.63
Timing chain cover bolt (M6)	7	7.84 ~ 9.8	0.8 ~ 1.0	5.78 ~ 7.23
Oil pan bolt (M6 x 10)	16	9.8 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.67
Oil pan bolt (M8 x 103)	2	26.46 ~ 30.38	2.7 ~ 3.1	19.52 ~ 22.41
Engine support bracket bolt (M10 x 40)	1	39.2 ~ 44.1	4.0 ~ 4.5	28.92 ~ 32.53
Engine support bracket bolt (M10 x 45)	2	39.2 ~ 44.1	4.0 ~ 4.5	28.92 ~ 32.53
Engine support bracket bolt (M8 x 30)	1	19.6 ~ 24.5	2.0 ~ 2.5	14.46 ~ 18.07
Camshaft bearing cap bolt (M6)	16	10.78 ~ 12.74	1.1 ~ 1.3	7.95 ~ 9.39
Camshaft bearing cap bolt (M8)	4	27.44 ~ 31.36	2.8 ~ 3.2	20.24 ~ 23.14
Cylinder head bolt	10	(32.4~36.3) + (90~95°) + (90~95°)	(3.3~3.7) + (90~95°) + (90~95°)	(23.9~26.8) + (90~95°) + (90~95°)
Engine hanger bolt	2	19.6 ~ 26.46	2.0 ~ 2.7	14.46 ~ 19.52
Cylinder head cover bolt	18	7.84 ~ 9.8	0.8 ~ 1.0	5.78 ~ 7.23
Crankshaft pulley bolt	1	166.6 ~ 176.4	17 ~ 18	122.9 ~ 130.13
Flywheel bolt	7	117.6 ~ 127.4	12 ~ 13	86.75 ~ 93.98
Drive plate bolt	7	117.6 ~ 127.4	12 ~ 13	86.75 ~ 93.98
Timing chain tensioner bolt	2	9.8 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.67

Timing chain tensioner arm bolt	1	9.8 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.67
Timing chain guide bolt	3	9.8 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.67
OCV bolt	1	9.8 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.67
CVVT & camshaft sprocket bolt	1	53.9 ~ 63.7	5.5 ~ 6.5	39.7 ~ 47.0
Balance shaft chain tensioner arm bolt	1	9.8 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.67
Balance shaft chain guide bolt	2	9.8 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.67
Balance shaft chain tensioner bolt	2	9.8 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.67
Water pump bolt	5	19.6 ~ 26.46	2.0 ~ 2.7	14.46 ~ 19.52
A/C bracket bolt	4	19.6 ~ 23.52	2.0 ~ 2.4	14.46 ~ 17.35
P/S bracket bolt	2	44.1 ~ 53.9	4.5 ~ 5.5	32.53 ~ 39.70
Tensioner & idler bracket bolt	7	39.2 ~ 44.1	4.0 ~ 4.5	28.92 ~ 32.53
Water temp. control bolt	2	14.7 ~ 21.56	1.5 ~ 2.2	10.84 ~ 15.90
Water temp. control nut	1	19.6 ~ 26.46	2.0 ~ 2.7	14.46 ~ 19.52
Water inlet pipe bolt	2	19.6 ~ 26.46	2.0 ~ 2.7	14.46 ~ 19.52
Oil level gauge assembly bolt	1	7.84 ~ 11.76	0.8 ~ 1.2	5.78 ~ 8.67
Ignition coil bolt	4	3.92 ~ 5.88	0.4 ~ 0.6	2.89 ~ 4.34
Intake manifold bolt	3	18.62 ~ 27.44	1.9 ~ 2.8	13.73 ~ 20.24
Intake manifold nut	2	18.62 ~ 27.44	1.9 ~ 2.8	13.73 ~ 20.24
Intake manifold stay bolt	4	18.62 ~ 27.44	1.9 ~ 2.8	13.73 ~ 20.24
Exhaust manifold heat protector bolt	4	18.62 ~ 27.44	1.9 ~ 2.8	13.73 ~ 20.24
Exhaust manifold nut	7	39.2 ~ 44.1	4.0 ~ 4.5	28.92 ~ 32.53
Exhaust manifold stay bolt (M8)	2	18.62 ~ 27.44	1.9 ~ 2.8	13.74 ~ 20.24
Exhaust manifold stay bolt (M10)	1	51.94 ~ 57.82	5.4 ~ 5.9	38.3 ~ 42.6
Front muffler bolt	2	39.2 ~ 58.8	4.0 ~ 6.0	28.92 ~ 43.37
Engine cover nut	2	3.92 ~ 5.88	0.4 ~ 0.6	2.89 ~ 4.34
Engine cover mounting bracket bolt	2	7.84 ~ 11.76	0.8 ~ 1.2	5.78 ~ 8.67
Crankshaft position sensor bolt	1	3.92 ~ 5.88	0.4 ~ 0.6	2.89 ~ 4.34
Oxygen sensor	1	39.2 ~ 49.0	4.0 ~ 5.0	28.9 ~ 36.1
Knock sensor	1	16.66 ~ 25.48	1.7 ~ 2.6	12.29 ~ 18.79
Oil temperature sensor	1	19.6 ~ 39.2	2.0 ~ 4.0	14.46 ~ 28.92
Camshaft position sensor	1	3.92 ~ 5.88	0.4 ~ 0.6	2.89 ~ 4.34
Oil pressure switch	1	7.84 ~ 11.76	0.8 ~ 1.2	5.78 ~ 8.67
Main bearing cap bolt	10	14.7 + (27.5~31.4) + (120~125°)	1.5 + (2.8~3.2) + (120~125°)	10.8 + (20.3~23.1) + (120~125°)
Oil filter	1	11.76 ~ 15.68	1.2 ~ 1.6	8.67 ~ 11.57
Connecting rod bearing cap bolt	8	(17.7~21.6) + (88~92°)	(1.8~2.2) + (88~92°)	(13.0~15.9) + (88~92°)

Engine Mechanical System > General Information > Special Service Tools

SPECIAL TOOLS

Tool (Number and name)	Illustration	Use
Crankshaft front oil seal installer		Installation of the front oil seal

(09214-3K000) (09231-H1100)		A : 09214-3K000 B : 09231-H1100
Flywheel stopper (09231-3K000)		Removal and installation of the flywheel and crankshaft pulley.
Torque angle adapter (09221-4A000)		Installtion of bolts & nuts needing an angular method
Valve stem seal installer (09222-4A000)		Installation of the valve stem seal
Valve stem seal installer (09222-29000)		Removal of the valve stem seal
Valve spring compressor & holder (09222-3K000) (09222-3K100)		Removal and installation of the intake or exhaust valve A : 09222-3K000 B : 09222-3K100 (holder)
Crankshaft rear oil seal installer (09214-3K100) (09231-H1100)		Installation of the crankshaft rear oil seal A : 09214-3K100 B : 09231-H1100

Engine Mechanical System > General Information > Troubleshooting

TROUBLESHOOTING

Symption	Suspect area	Remedy (See page)
Engine misfire with abnormal internal lower engine noises.	Worn crankshaft bearings Loose or improperly engine filwheel	Replace the crankshaft and bearings as required. Repair or replace the flywheel as required.

	Worn piston rings (Oil consumption may or may not cause the engine to misfire.)	Inspect the cylinder for a loss of compression. Repair or replace as required.
	Worn crankshaft thrust bearings	Replace the crankshaft and bearings as required
Engine misfire with abnormal valve train noise.	Stuck valves. (Carbon buidup on the valve stem)	Repair or replace as required
	Excessive worn or mis-aligned timing chain	Replace the timing chain and sprocket as required.
	Worn camshaft lobes.	Replace the camshaft and valve lifters.
Engine misfire with coolant consumption	• Faulty cylinder head gasket and/or cranking or other damage to the cylinder head and engine block cooling system. • Coolant consumption may or may not cause the engine to overheat.	• Inspect the cylinder head and engine block for damage to the coolant passages and/or a faulty head gasket. • Repair or replace as required.
Engine misfire with excessive oil consumption	Worn valves, guides and/or valve stem oil seals.	Repair or replace as required.
	Worn piston rings. (Oil consumption may or may not cause the engine to misfire)	• Inspect the cylinder for a loss of compression. • Repair or replace as required.
Engine noise on start-up, but only lasting a few seconds.	Incorrect oil viscosity	• Drain the oil. • Install the correct viscosity oil.
	Worn crankshaft thrust bearing.	• Inspect the thrust bearing and crankshaft. • Repair or replace as required.
Upper engine noise, regardless of engine speed.	Low oil pressure	Repair or repalce as required.
	Broken valve spring.	Replace the valve spring.
	Worn or dirty valve lifters.	Replace the valve lifters.
	Stetched or broken timing chain and/or damaged sprocket teeth.	Replace the timing chain and sprockets.
	Worn timing chain tensioner, if applicable.	Replace the timing chain tensioner as required.
	Worn camshaft lobes.	• Inspect the camshaft lobes. • Replace the timing camshaft and valve lifters as required.
	Worn valve guides or valve stems.	Inspect the valves and valve guides, then repair as required.
	Stuck valves. (Carbon on the valve stem or valve seat may cause the valve to stay open.	Inspect the valves and valve guides, then repair as required.
	Worn drive belt, idler, tensioner and bearing.	Replace as required
Lower engine noise, regardless of engine speed	Low oil pressure	Repair or required.
	Loose or damaged flywheel.	Repair or replace the flywheel.
	Damaged oil pan, contacting the oil pump screen.	• Inspect the oil pan. • Inspect the oil pump screen. • Repair or replace as required.
	Oil pump screen loose, damaged or restircted.	• Inspect the oil pump screen. • Repair or replace as required.
	Excessive piston-to-cylinder bore clearance.	• Inspect the piston, piston pin and cylinder bore. • Repair as required.
	Excessive piston pin-to-piston clearance	• Inspect the piston, piston pin and the

		connecting rod. • Repair or replace as required.
	Excessive connecting rod bearing clearance	Inspect the following components and repair as required. • The connecting rod bearings. • The connecting rods. • The crankshaft pin journals.
	Excessive crankshaft bearing clearance	Inspect the following components, and repair as required. • The crankshaft bearings. • The crankshaft main journals. • The cylinder block
	Incorrect piston, piston pin and connecting rod installation	• Verify the piston pins and connecting rods are installed correctly. • Repair as required.
Engine noise under load	Low oil pressure	Repair or replace as required.
	Excessive connecting rod bearing clearance	Inspect the following components and repair as required : • The connecting rod bearings. • The connecting rods. • The crankshaft
	Excessive crankshaft bearing clearance	Inspect the following components, and repair as required. • The crankshaft bearings. • The crankshaft main journals. • The cylinder block.
Engine will not crank-crankshaft will not rotate	Hydraulically locked cylinder • Coolant/antifreeze in cylinder. • Oil in cylinder. • Fuel in cylinder	1. Remove spark plugs and check for fluid. 2. Inspect for broken head gasket. 3. Inspect for cracked engine block or cylinder head. 4. Inspect for a sticking fuel injector and/or leaking fuel regulator.
	Broken timing chain and/or timing chain and/or timing chain gears.	1. Inspect timing chain and gears. 2. Repair as required.
	Material in cylinder • Broken valve • Piston material • Foreign material	1. Inspect cylinder for damaged components and/or foreign materials. 2. Repair or replace as required.
	Seized crankshaft or connecting rod bearings.	1. Inspect crankshaft and connecting rod bearing. 2. Repair as required.
	Bent or broken connecting rod.	1. Inspect connecing rods. 2. Repair as required.
	Broken crankshaft	1. Inspect crankshaft. 2. Repair as required.

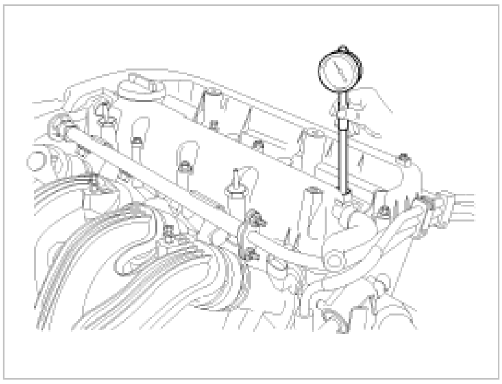
Engine Mechanical System > General Information > Repair procedures

COMPRESSION

NOTE

If the there is lack of power, excessive oil consumption or poor fuel economy, measure the compression pressure.

1. Warm up and stop engine.
   Allow the engine to warm up to normal operating temperature.
2. Remove ignition coils. (See EE group - ignition)
3. Remove spark plugs.
   Using a 16mm plug wrench, remove the 4 spark plugs.
4. Check cylinder compression pressure.
   A. Insert a compression gauge into the spark plug hole.



   B. Fully open the throttle.
   C. While cranking the engine, measure the compression pressure.

   NOTE

   Always use a fully charged battery to obtain engine speed of 200 rpm or more.

   D. Repeat steps (a) through (c) for each cylinder.

   NOTE

   This measurement must be done in as short a time as possible.

   Compression pressure :
   1,283kPa (13.0kgf/cm², 185psi)
   Minimum pressure :
   1,135kPa (11.5kgf/cm², 164psi)
   Difference between each cylinder :
   100kPa (1.0kgf/cm², 15psi) or less

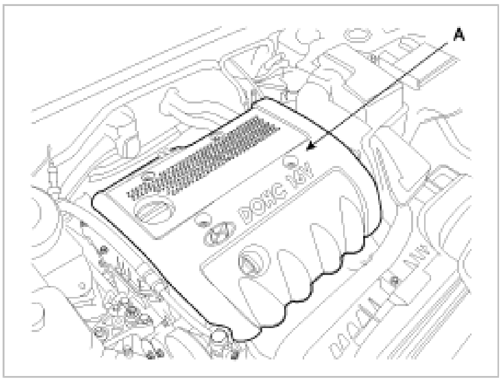
   E. If the cylinder compression in 1 or more cylinders is low, pour a small amount of engine oil into the cylinder through the spark plug hole and repeat steps (a) through (c) for cylinders with low compression.
      - If adding oil helps the compression, it is likely that the piston rings and/or cylinder bore are worn or damaged.
      - If pressure stays low, a valve may be sticking or seating is improper, or there may be leakage past the gasket.
5. Reinstall spark plugs.
6. Install ignition coils. (See EE group - ignition)

VALVE CLEARANCE INSPECTION AND ADJUSTMENT

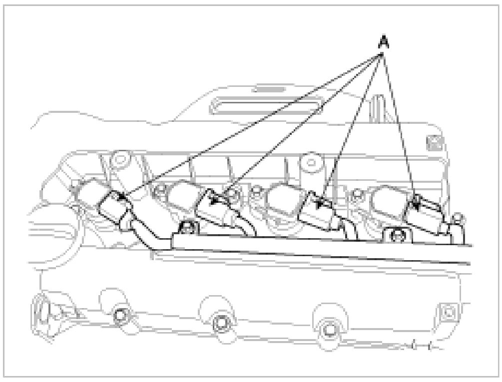
NOTE

Inspect and adjust the valve clearance when the engine is cold (Engine coolant temperature : 20°C) and cylinder head is installed on the cylinder block.

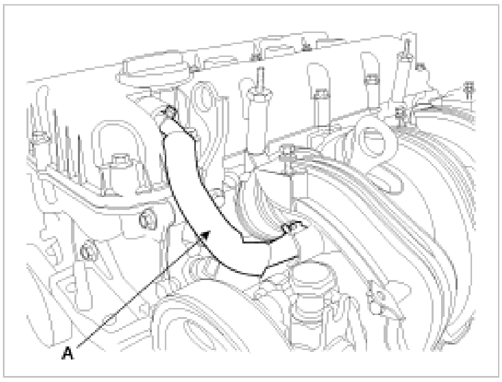
1. Remove the engine cover(A).



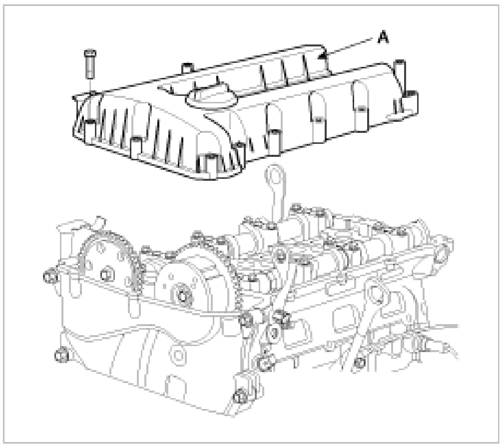
2. Remove the cylinder head cover.
   A. Disconnect the ignition coil connect(A) and remove the ignition coil.



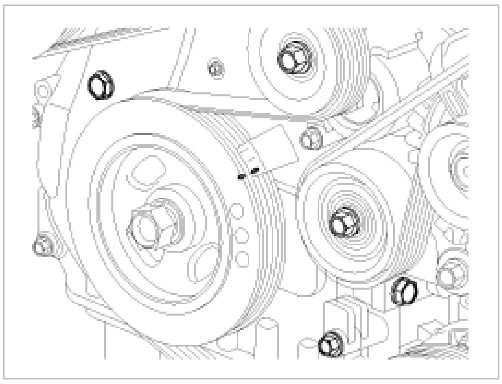
   B. Disconnect the P.C.V hose(A) and the breather hose from the cylinder head cover.



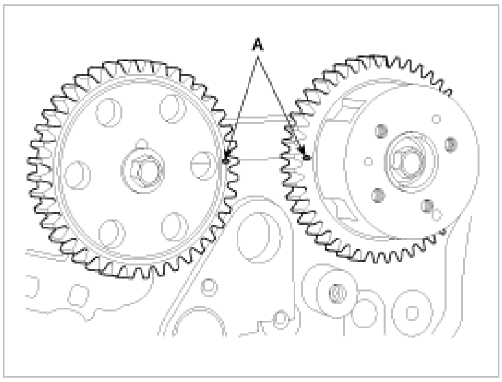
   C. Loosen the cylinder head cover bolts and then remove the cover(A) and gasket.



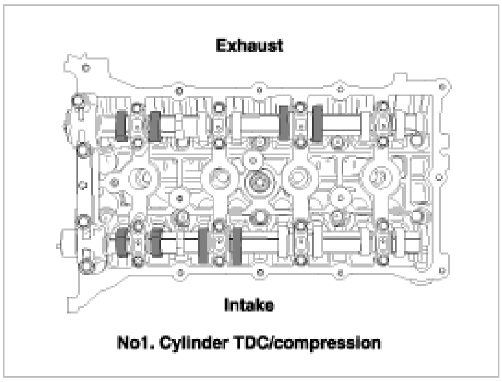
3. Set No.1 cylinder to TDC/compression.
   A. Turn the crankshaft pulley and align its groove with the timing mark "T" of the lower timing chain cover.



B. Check that the mark(A) of the camshaft timing sprockets are in straight line on the cylinder head surface as shown in the illustration.
   If not, turn the crankshaft one revolution (360°)



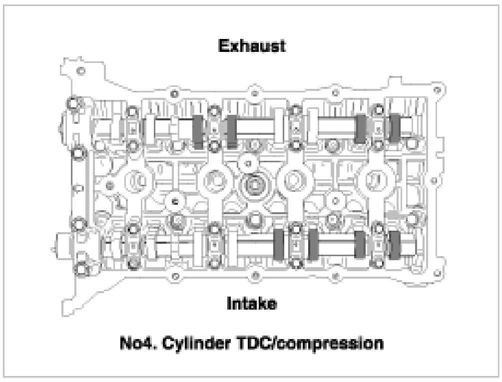
4. Inspect the valve clearance.
   A. Check only the valve indicated as shown. [No. 1 cylinder : TDC/Compression] measure the valve clearance.



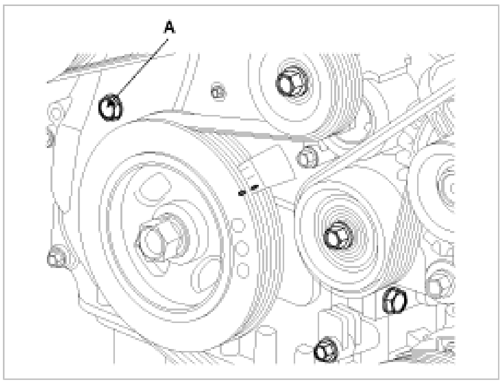
·Using a thickness gauge, measure the clearance between the tappet and the base circle of camshaft.
·Record the out-of-specification valve clearance measurements. They will be used later to determine the required replaement adjusing tappet.

Valve clearance
Specification
Engine coolant temperature : 20°C [68°F]
Limit
Intake : 0.10 ~ 0.30mm (0.0039 ~ 0.0118in.)
Exhaust : 0.20 ~ 0.40mm (0.0079 ~ 0.0157in.)

B. Turn the crankshaft pulley one revolution (360°) and align the groove with timing mark "T" of the lower timing chain cover.
C. Check only valves indicated as shown. [NO. 4 cylinder : TDC/compression]. Measure the valve clearance.



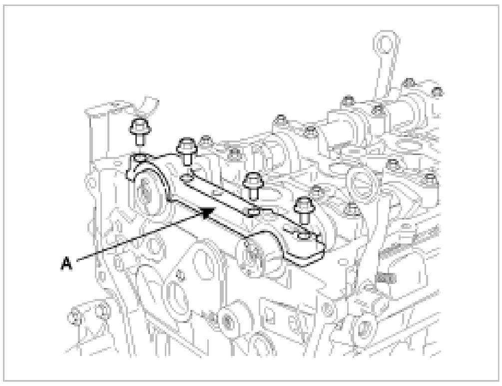
5. Adjust the intake and exhaust valve clearance.
   A. Set the No.1 cylinder to the TDC/compression.
   B. Marks on the timing chain and camshaft timing sprockets.
   C. Remove the service hole bolt(A) of the timing chain cover.



CAUTION

The bolt must not be reused once it has been assembled.

   D. Insert a thin rod in the service hole of the timing chain cover and release the ratchet.
   E. Remove the front camshaft bearing cap(A).



   F. Remove the exhaust camshaft sprocket.
   G. Remove the exhaust camshaft bearing cap and exhaust camshaft.
   H. Remove the intake camshaft bearing cap and intake camshaft.

CAUTION

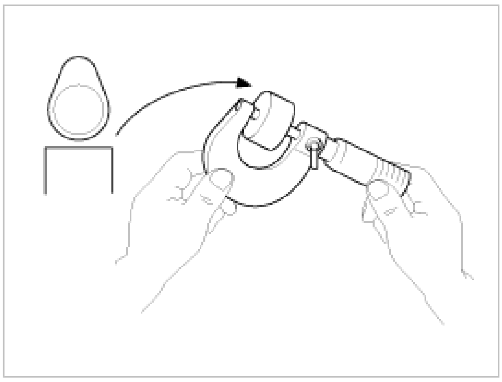
When disconnecting the timing chain from the camshaft timing sprocket, hold the timing chain.

   I. Tie a timing chain with a string.

CAUTION

Be careful not to drop anything inside timing chain cover.

   J. Measure the thickness of the removed tappet using a micrometer.



K. Calculate the thickness of a new tappet so that the valve clearance comes within the specificified value.

Valve clearance (Engine coolant temperature : 20°C)
T : Thickness of removed tappet
A : Measured valve clearance
N : Thickness of new tappet
Intake : N = T + [A - 0.20mm(0.0079in.)]
Exhaust : N = T + [A-0.30mm (0.0118in.)]

L. Select a new tappet with a thickness as close as possible to the caculated value.

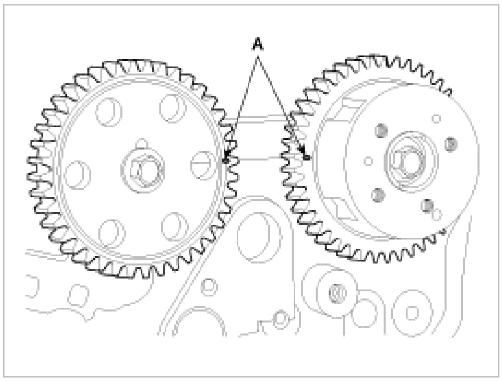
NOTE

Shims are available in 47size increments of 0.015mm (0.0006in.) from 3.00mm (0.118in.) to 3.690mm (0.1452in.)

M. Place a new tappet on the cylinder head.
N. Hold the timing chain, and place the intake camshaft and timing sprocket assembly.
O. Align the matchmarks on the timing chain and camshaft timing sprocket.
P. Install the intake and exhaust camshaft.
Q. Install the front bearing cap.
R. Install the sevice hole bolt.

Tightening torque
12 ~ 15N.m (1.2 ~ 1.5kgf.m, 8.8 ~ 11.0lbf.ft)

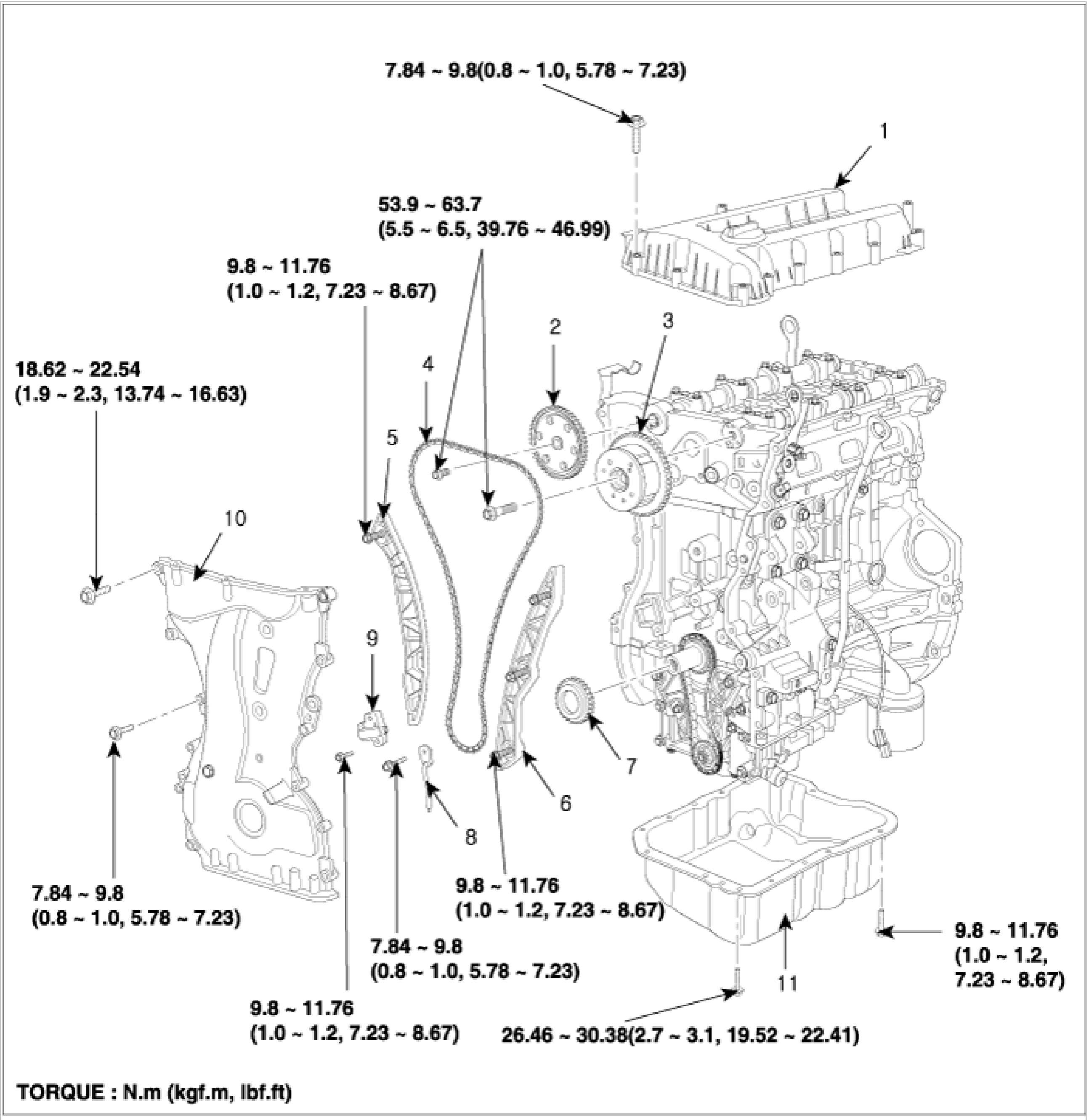
S. Turn the crankshaft two turns in the operating direction(clockwise) and realign crankshaft sprocket and camshaft sprocket timing marks.



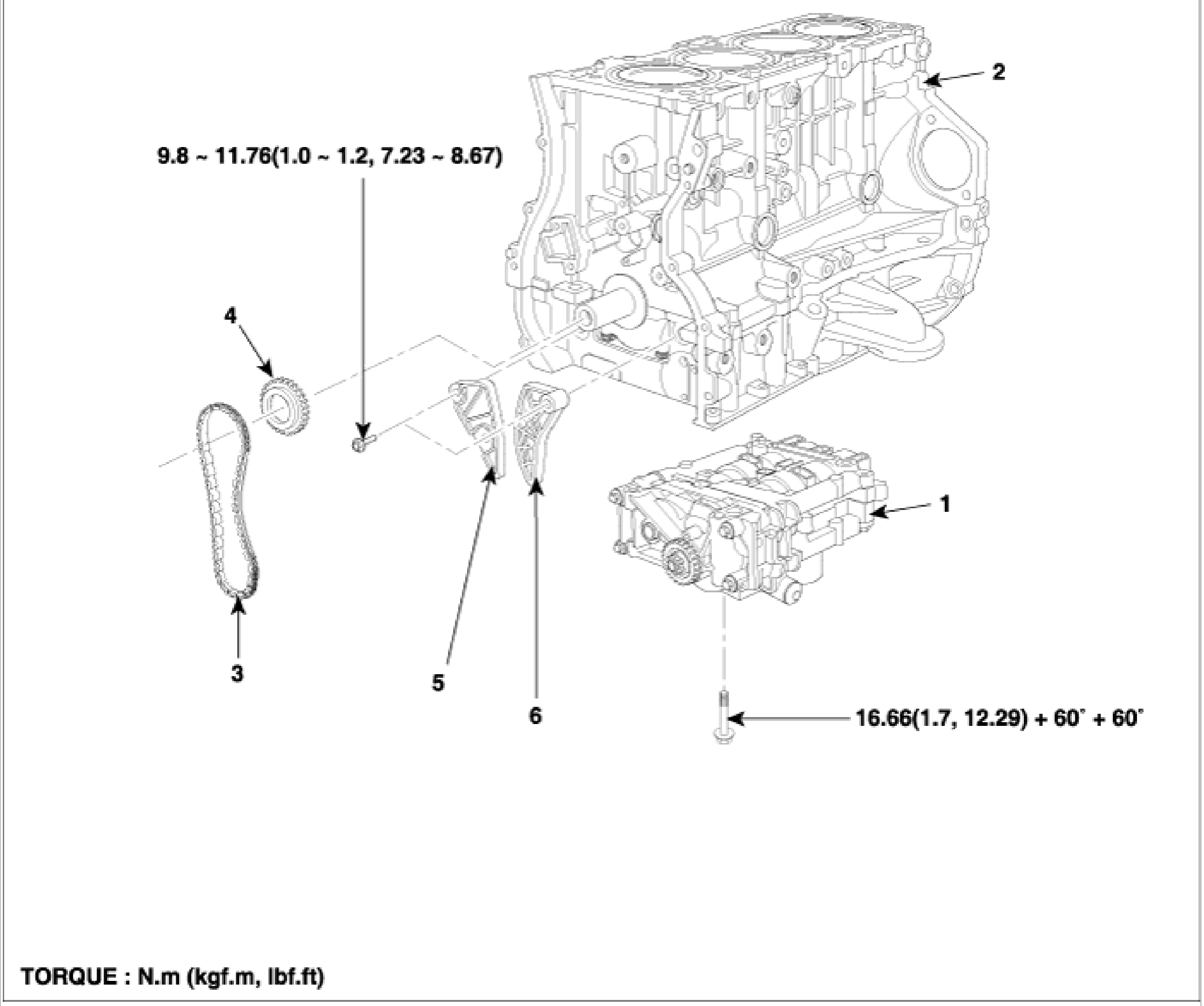
T. Recheck the valve clearance.

Valve clearance (Engine coolant temperature : 20°C)
[Specification]
Intake : 0.17 ~ 0.23mm (0.0067 ~ 0.0090in.)
Exhaust : 0.27 ~ 0.33mm (0.0106 ~ 0.0129in.)

COMPONENT



1. Cylinder head cover
2. Exhaust camshaft sprocket
3. CVVT assembly
4. Timing chain
5. Timing chain tensioner arm
6. Timing chain guide
7. Crankshafe sprocket
8. Oil jet
9. Timing chain tensioner
10. Timing chain cover
11. Oil pan



1. Balance shaft module
2. Cylinder block
3. Balance shaft chain
4. Balance shaft chain sprocket
5. Balance shaft chain guide
6. Balance shaft chain tensioner arm

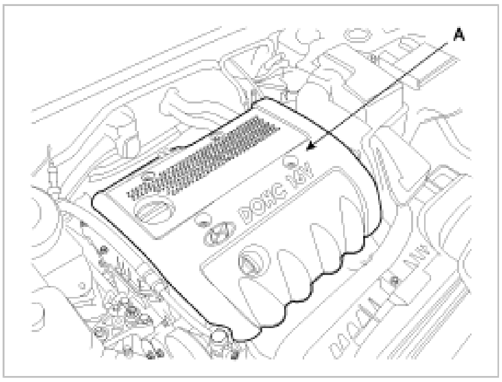
Engine Mechanical System > Timing System > Repair procedures

REMOVAL

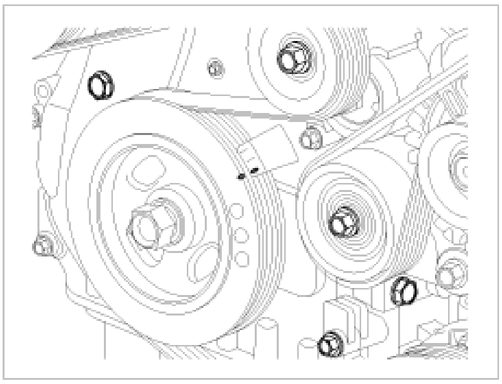
Engine removal is not required for this procedure.

Timing chain

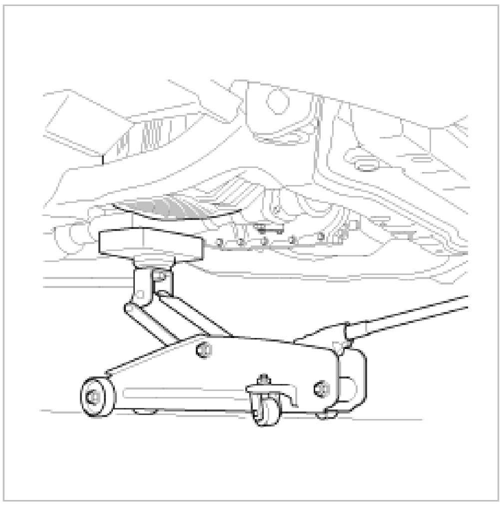
1. Remove the engine cover(A).



2. Remove RH front wheel.
3. Remove RH side cover.
4. Set No.1 cylinder to TDC/compression

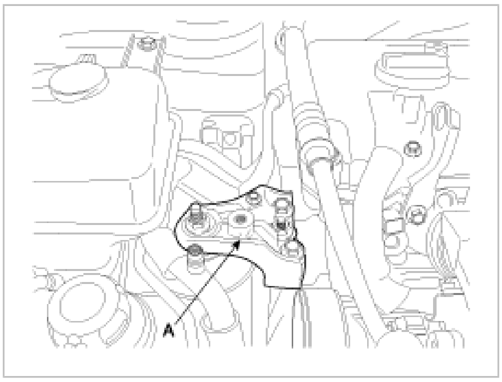


5. Remove the engine mount bracket.
   (1) Set the jack to the engine oil pan.

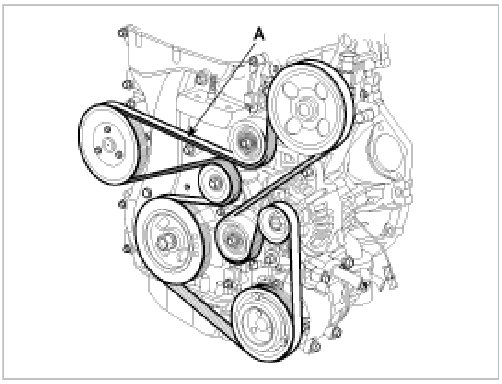


> **NOTE**
>
> Place wooden block between the jack and engine oil pan.

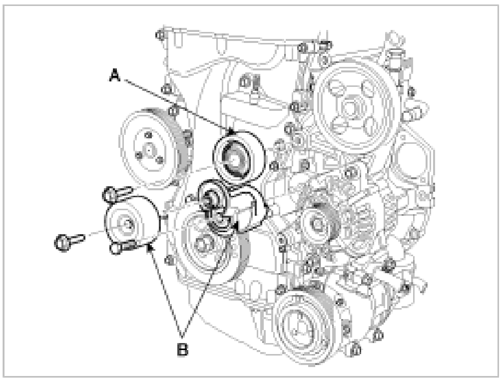
   (2) Remove the 2bolts, 2nuts and engine mount bracket(A).



6. Temporarily loosen the water pump pulley bolts.
7. Remove drive belt(A).



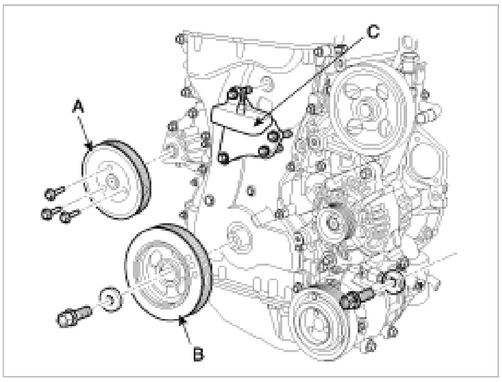
8. Remove the idler pulley(A).



9. Remove the drive belt tensioner pulley and tensioner(B).

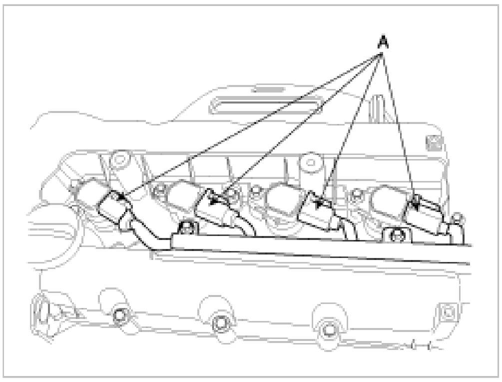
> NOTE
>
> Tensioner pulley bolt is left - handed screw.

10. Remove the water pump pulley(A).

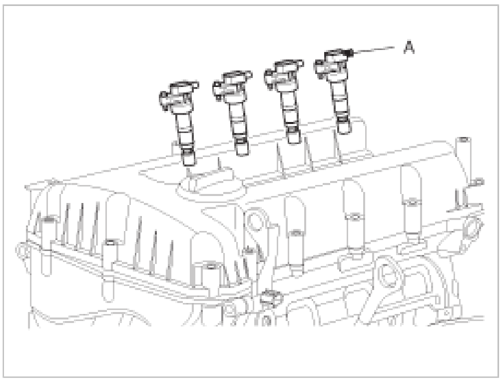


11. Remove the crankshaft pulley(B).

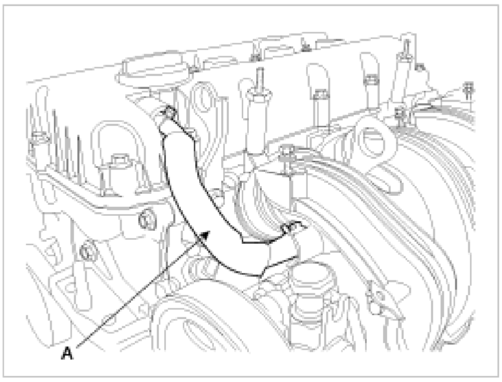
12. Remove the engine support bracket(C).
13. Disconnect the ignition coil connector(A).



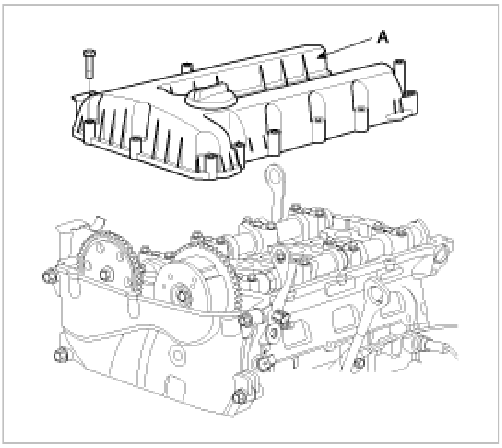
14. Remove the ignition coil(A).



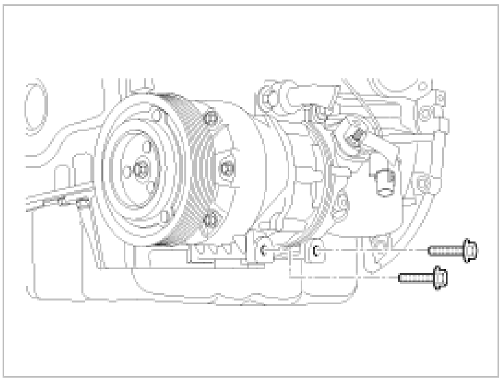
15. Remove the PCV hose(A) and breather hose from the cylinder head cover.



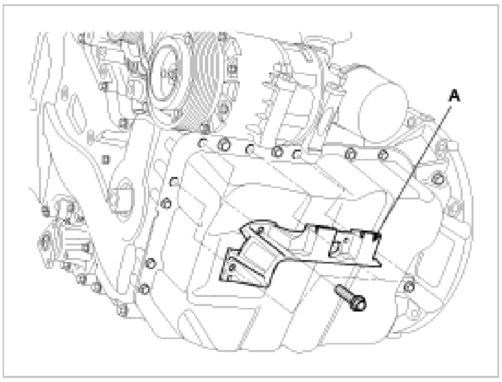
16. Loosen the cylinder head cover bolts and then remove the cylinder head cover(A) and gasket.



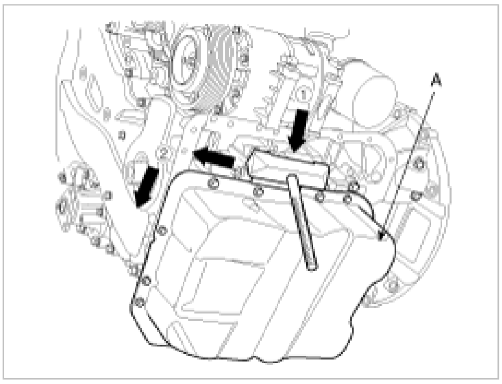
17. Remove the compressor lower bolts.



18. Remove the compressor bracket(A).

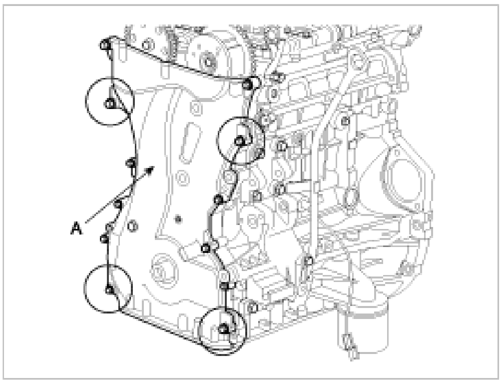


19. Drain the engine oil.
20. Remove the oil pan.



> **CAUTION**
>
> - Insert the SST between the oil pan and the ladder frame by tapping it with a plastic hammer in the direction of ① arrow.
> - After tapping the SST with a plastic hammer along the direction of ② arrow around more than 2/3 edge of the oil pan, remove it from the ladder frame.
> - Do not turn over the SST abruptly without tapping. It be result in damage of the SST.
>
> Be careful not to damage the contact surfaces of cylinder block and oil pan.

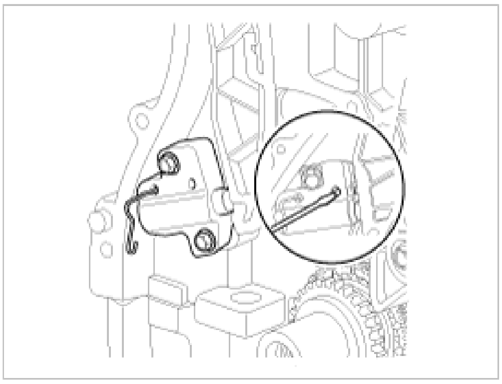
21. Remove the timing chain cover(A) by prying the portions between the cylinder head and cylinder block with a screwdriver.



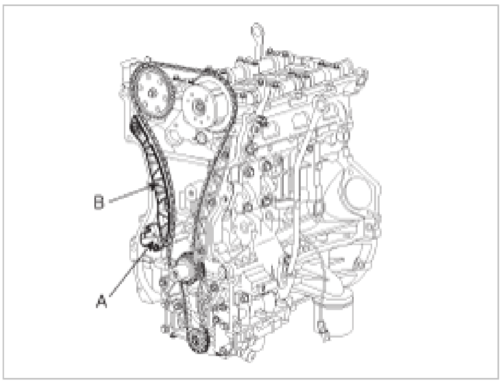
CAUTION

Be careful not to damage the contact surfaces of cylinder block, cylinder head and timing chain cover.

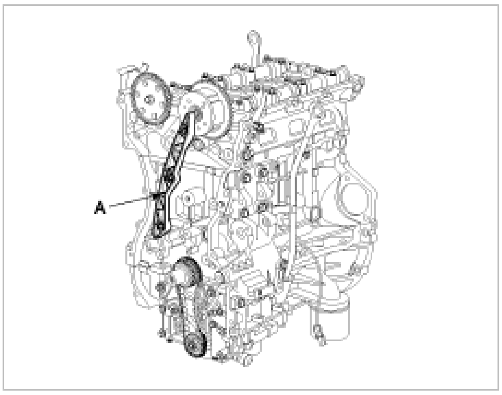
22. The key of crankshaft should be aligned with the mating face of main bearing cap. As a result of this, the piston of No.1 cylinder is placed at the top dead center on compression stroke.
23. Install a set pin after compressing the timing chain tensioner.



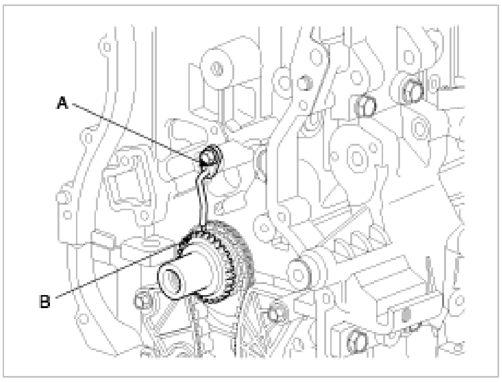
24. Remove the timing chain tensioner(A).



25. Remove the timing chain tensioner arm(B).
26. Remove the timing chain.
27. Remove the timing chain guide(A).

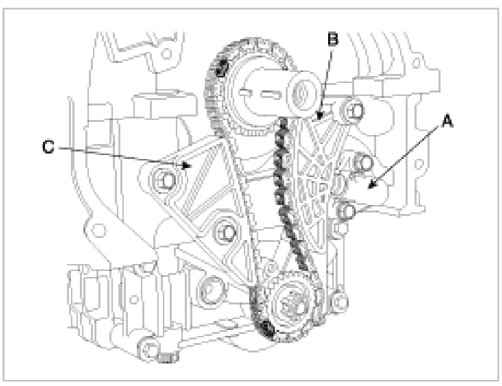


28. Remove the timing chain oil jet(A).
29. Remove the crankshaft chain sprocket(B).

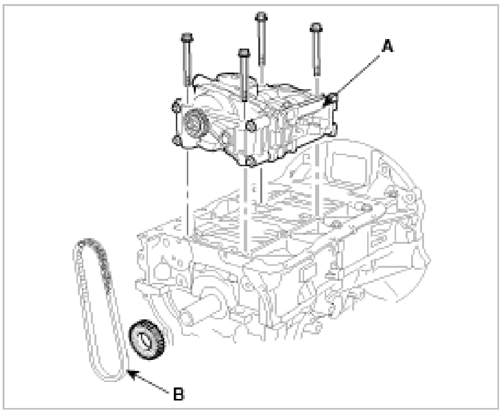


Balance shaft chain

1. Remove the timing chain.
2. Install a set pin after compressing the balance shaft chain tensioner.
3. Remove the balance shaft chain tensioner(A).



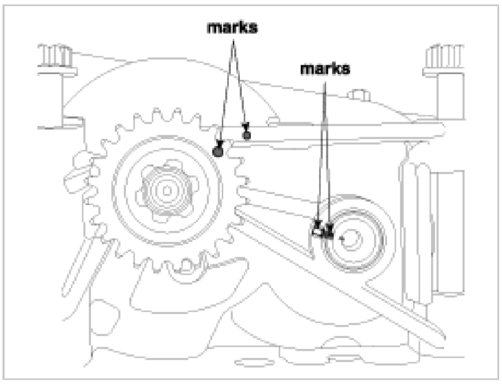
4. Remove the balance shaft chain tensioner arm(B).
5. Remove the balance shaft chain guide(C).
6. Remove the balance shaft module(A) and balance shaft chain(B).



INSTALLATION

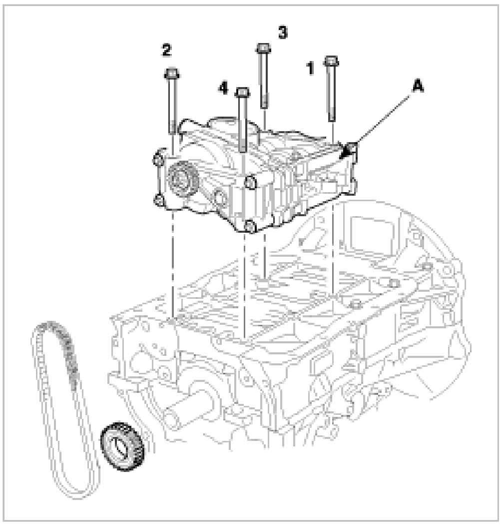
Balance shaft chain

1. The key of crankshaft should be aligned with the mating face of main bearing cap. As a result of this, the piston of No.1 cylinder is placed at the top dead center on compression stroke.
2. Confirm the balance shaft module timing mark.
   Timing marks to be visually aligned with centers of adjacent cast timing notches.



3. Install balance shaft module that the timing mark of balance shaft module sprocket should be matched with the timing mark (color link) of balance shaft chain.

Tightening torque
16.66N.m(1.7kgf.m, 12.3lbf.ft) + 60° + 60°



4. Install the balance shaft chain guide(C).

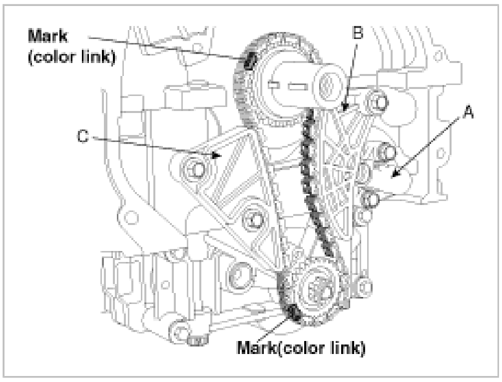
Tightening torque
9.8 ~ 11.76N.m(1.0 ~ 1.2kgf.m, 7.23 ~ 8.67lbf.ft)

5. Install the balance shaft tensioner arm(B).

Tightening torque
9.8 ~ 11.76N.m(1.0 ~ 1.2kgf.m, 7.23 ~ 8.67lbf.ft)

6. Install the balance shaft tensioner(A) and remove the set pin.

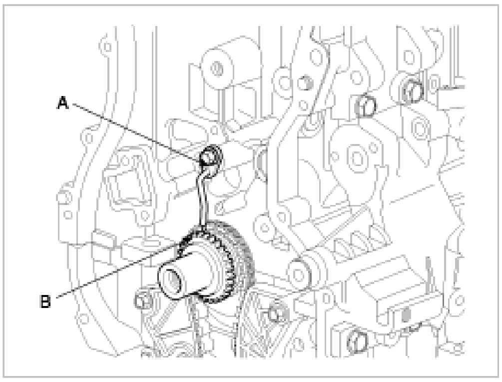
Tightening torque
9.8 ~ 11.76N.m(1.0 ~ 1.2kgf.m, 7.23 ~ 8.67lbf.ft)



7. Confirm the timing marks.

Timing chain

1. Install crankshaft chain sprocket(B).

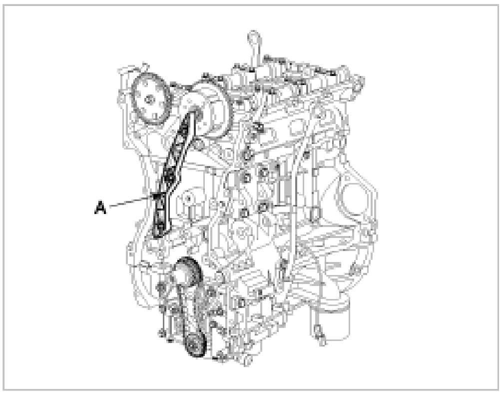


2. Install timing chain oil jet(A).

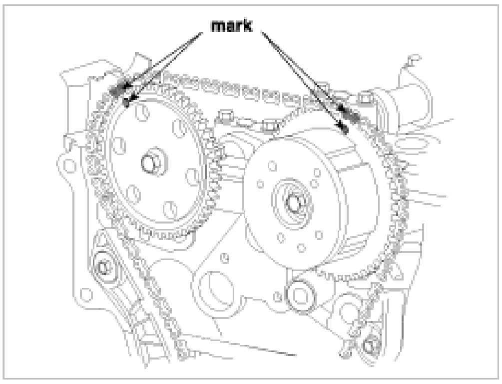
Tightening torque
7.84 ~ 9.8N.m(0.8 ~ 1.0kgf.m, 5.78 ~ 7.23lbf.ft)

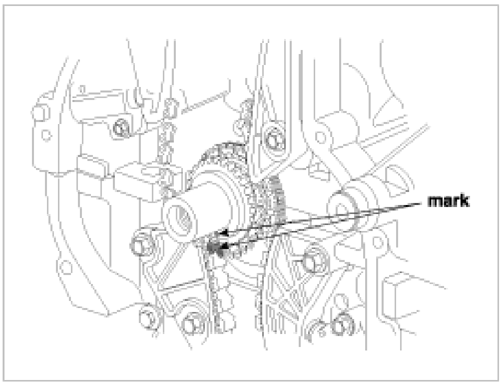
3. Set crankshaft that the key of crankshaft should be aligned with the mating surface of main bearing cap. Put the intake, exhaust camshaft assembly that the TDC mark of intake sprocket and exhast sprocket should be aligned with the top surface of cylinder head. As a result of this, place the piston on No.1 cylinder at the top dead center on compression stroke.
4. install timing chain guide(A).

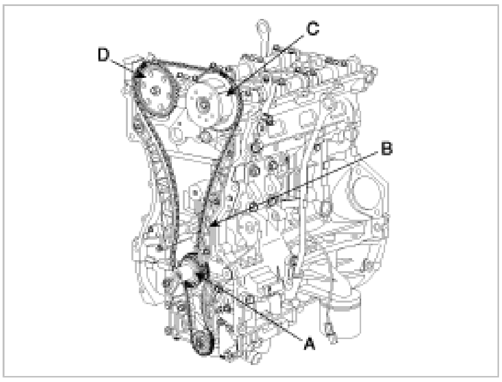
Tightening torque
9.8 ~ 11.6N.m(1.0 ~ 1.2kgf.m, 7.23 ~ 8.67lbf.ft)



5. Install timing chain.
   To install the timing chain with no slack between each shaft (cam, crank), follow the below procedure.
   Crankshaft sprocket(A) → Timing chain guide(B) → Intake camshaft sprocket(C) → Exhaust camshaft sprocket(D).
   The timing mark of each sprockets should be matched with timing mark (color link) of timing chain at installing timing chain.





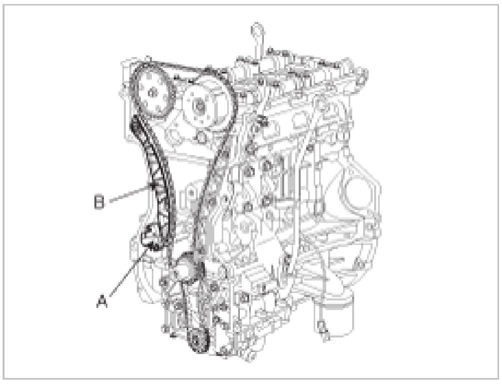


6. Install timing chain tensioner arm(B).

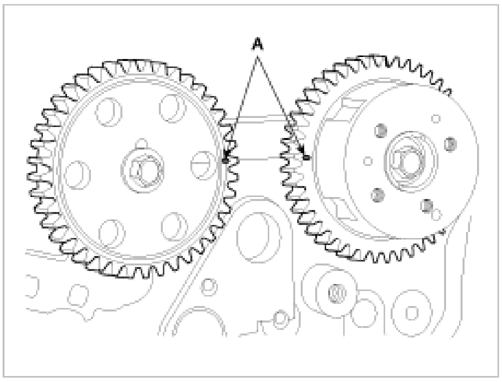
   Tightening torque
   9.8 ~ 11.76N.m(1.0 ~ 1.2kgf.m, 7.23 ~ 8.67lbf.ft)

7. Install timing chain auto tensioner(A) and remove set pin.

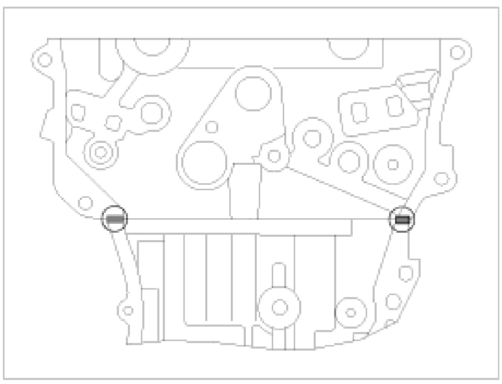
Tightening torque
9.8 ~ 11.76N.m(1.0 ~ 1.2kgf.m, 7.23 ~ 8.67lbf.ft)



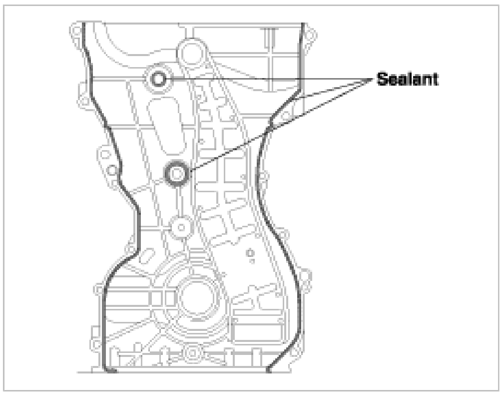
8. After rotating crankshaft 2 revolutions in regular direction (clockwise viewed from front), confirm the timing mark.



9. Install timing chain cover.
   A. The sealant locations on chain cover and on counter parts (cylinder head, cylinder block, and ladder frame) must be free of engine oil and ETC.
   B. Before assembling the timing chain cover, the liquid sealant Loctite 5900 should be applied on the gap between cylinder head and cylinder block.
      The part must be assembled within 5 minutes after sealant was applied.
      Bead width : 2.5mm(0.1in.)

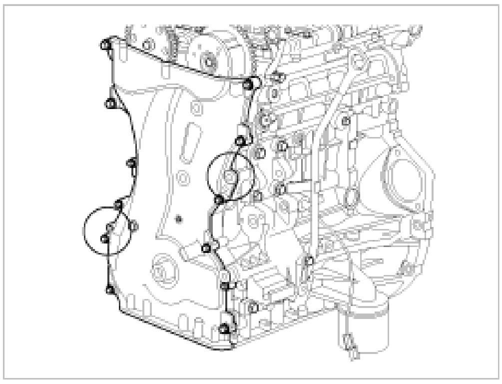


   C. After applying liquid sealant Loctite 5900 on timing chain cover.
      The part must be assembled within 5 minutes after sealant was applied.
      Selant should be applied without discontinuity.
      Bead width : 2.5mm(0.1in.)



D. The dowel pins on the cylinder block and holes on the timing chain cover should be used as a reference in order to assemble the timing chain cover to be in exact position.

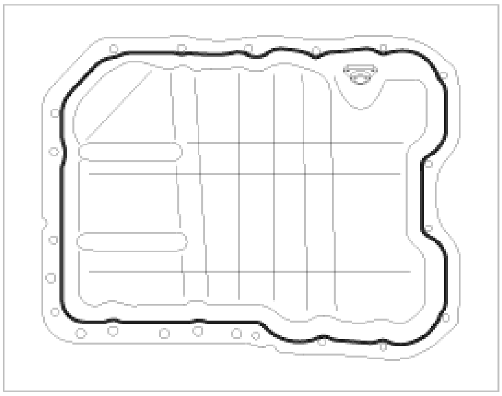
Tightening torque
M6 : 7.84 ~ 9.8N.m(0.8 ~ 1.0kgf.m, 5.78 ~ 7.23lbf.ft)
M8 : 18.62 ~ 22.54N.m(1.9 ~ 2.3kgf.m, 13.74 ~ 16.63lbf.ft)



E. The firing and/or blow out test should not be performed within 30 minutes after the timing chain cover was assembled.

10. Install timing chain cover oil seal
    (1) Apply engine oil to a new oil seal lip.
    (2) Using SST(09214-3K000, 09231-H1100) and a hammer, tap in the oil seal.
11. Install oil pan.
    A. Using a gasket scraper, remove all the old packing material from the gasket surfaces.
    B. Before assebling the oil pan, the liquid sealant Loctite 5900 should be applied on oil pan.
    The part must be assembled within 5 minutes after the sealant was applied.

Sealant : Loctite 5900 or equivalent(MS 721-40A)

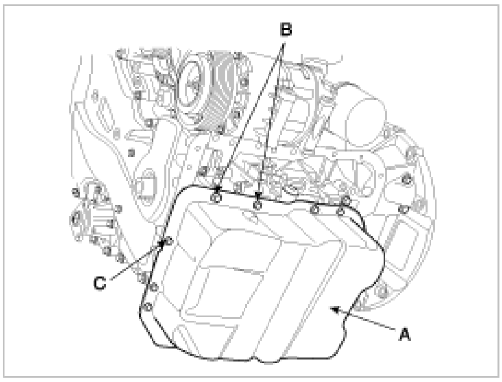


CAUTION

• When applying sealant gasket, sealant must not be protruded into the inside of oil pan.
• To prevent leakage of oil, apply sealant gasket ot the inner threads of the bolt holes.

C. Install oil pan(A).
   Uniformly tighten the bolts in several passes.

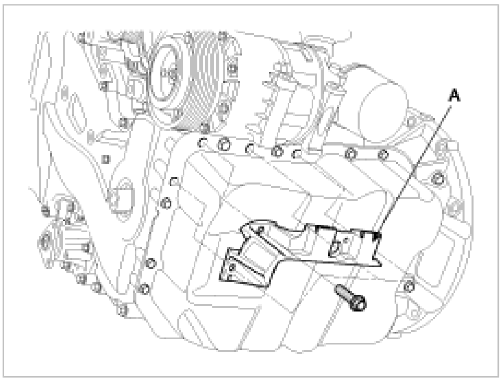
   Tightening torque
   M8(B) : 26.46 ~ 30.38N.m(2.7 ~ 3.1kgf.m, 19.52 ~ 22.41lbf.ft)
   M6(C) : 9.8 ~ 11.76N.m(1.0 ~ 1.2kgf.m, 7.23 ~ 8.67lbf.ft)



D. After assembly, wait at least 30 minutes before filling the engine with oil.

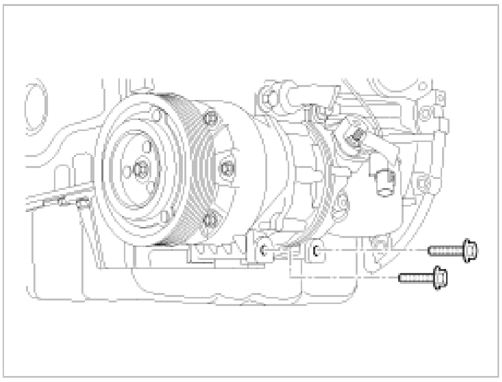
12. Install air compressor bracket(A).

Tightening torque
19.6 ~ 23.52N.m(2.0 ~ 2.4kgf.m, 14.46 ~ 17.35lbf.ft)



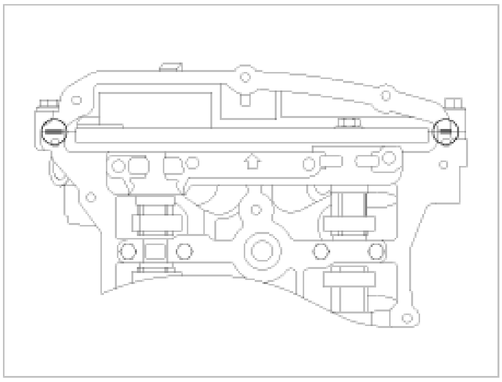
13. Install air compressor bolt

Tightening torque
19.6 ~ 24.5N.m(2.0 ~ 2.5kgf.m, 14.46 ~ 18.07lbf.ft)



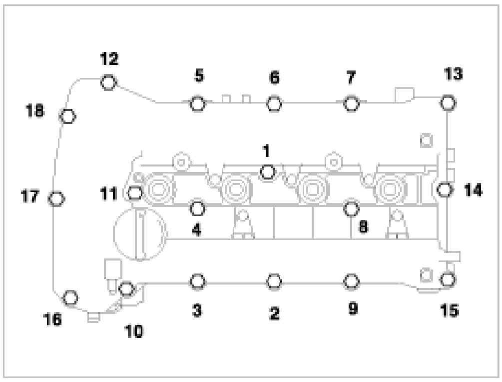
14. Install cylinder head cover.
   A. The hardening sealant located on the upper area between timing chain cover and cylinder head should be removed before assembling cylinder head cover.

B. After applying sealant, it should be assembled within 5 minutes.
Bead width : 2.5mm(0.1in.)



C. The firing and/or blow out test should not be performed within 30 minutes after the cylinder head cover was assembled.
D. Install the cylinder head coer bolts as following method.

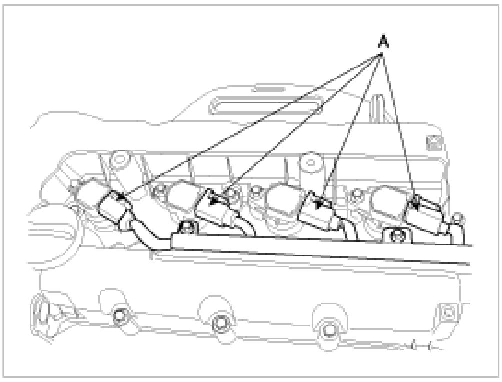
Tightening torque
1st step : 3.92 ~ 5.88N.m(0.4 ~ 0.6kgf.m, 2.89 ~ 4.34lbf.ft)
2st step : 7.84 ~ 9.8N.m(0.8 ~ 1.0kgf.m, 5.78 ~ 7.23lbf.ft)



CAUTION

Do not reuse cylinder head cover gasket.

15. Install ignition coil (See EE group-ignition)
16. Connect ignition coil connector(A).



17. Install engine support bracket(C).

Tightening torque
M10 : 39.2 ~ 44.1N.m(4.0 ~ 4.5kgf.m, 28.92 ~ 32.53lbf.ft)
M8 : 19.6 ~ 24.5N.m(2.0 ~ 2.5kgf.m, 14.46 ~ 18.07lbf.ft)

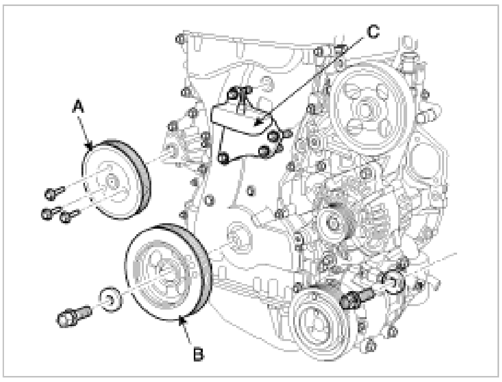
---

18. Using SST(09231-3K000), install crankshaft pulley(B).

Tightening torque
166.6 ~ 176.4N.m(17 ~ 18kgf.m, 122.9 ~ 130.13lbf.ft)

19. Install water pump pulley(A).

Tightening torque
7.84 ~ 9.8N.m(0.8 ~ 1.0kgf.m, 5.78 ~ 7.23lbf.ft)

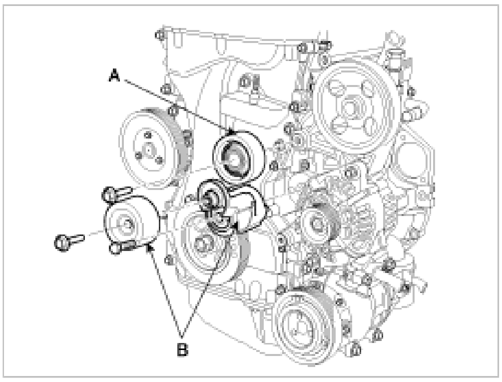


20. Install drive belt tensioner(B) and tensioner pulley.

Tightening torque
53.9 ~ 63.7N.m(5.5 ~ 6.5kgf.m, 39.7 ~ 47.0lbf.ft)

21. Install idler pulley(A)

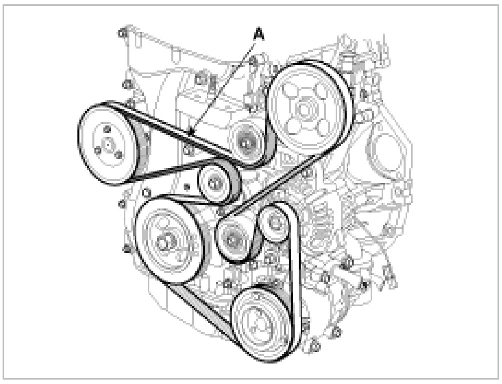
Tightening torque
53.9 ~ 63.7N.m(5.5 ~ 6.5kgf.m, 39.7 ~ 47.0lbf.ft)



NOTE

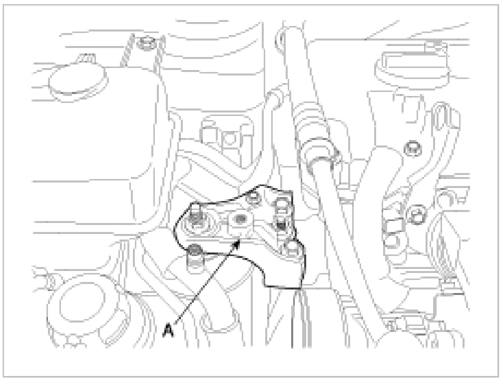
Tensioner pulley bolt is left-handed screw.

22. Install drive belt(A)
Crankshaft pulley → A/C pulley → alternator pulley → idler pulley → P/C pump pulley → idler pulley → water pump pulley → tensioner pulley.
Rotate auto tensioner arm in the counter - clockwise moving auto tensioner pulley bolt with wrench.
After putting belt on auto tensioner pulley, release the auto tensioner pulley slowly.



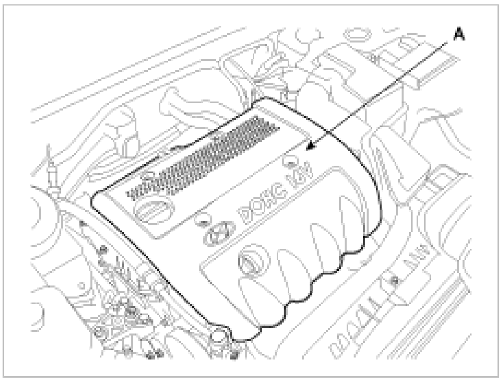
23. Install engine mounting bracket(A).

Tightening torque
63.7 ~ 83.3N.m(6.5 ~ 8.5kgf.m, 47.0 ~ 61.4lbf.ft)



24. Install RH side cover.
25. Install RH front wheel.
26. Install engine cover(A).

Tightening torque
3.92 ~ 5.88N.m(40 ~ 60kgf.cm, 2.89 ~ 4.34lbf.ft)



INSPECTION

SPOCKETS, CHAIN TENSIONER, CHAIN GUIDE, CHAIN TENSIONER ARM

1. Check the camshaft sprocket and crankshaft sprocket for abnormal wear, cracks, or damage. Replace as necessary.
2. Inspect the tensioner arm and chain guide for abnormal wear, cracks, or damage.
   Replace as necessary.
3. Check that the tensioner piston moves smoothly when the ratchet pawl is released with thin rod.

BELT, IDLER, BELT TENSIONER, PULLEY

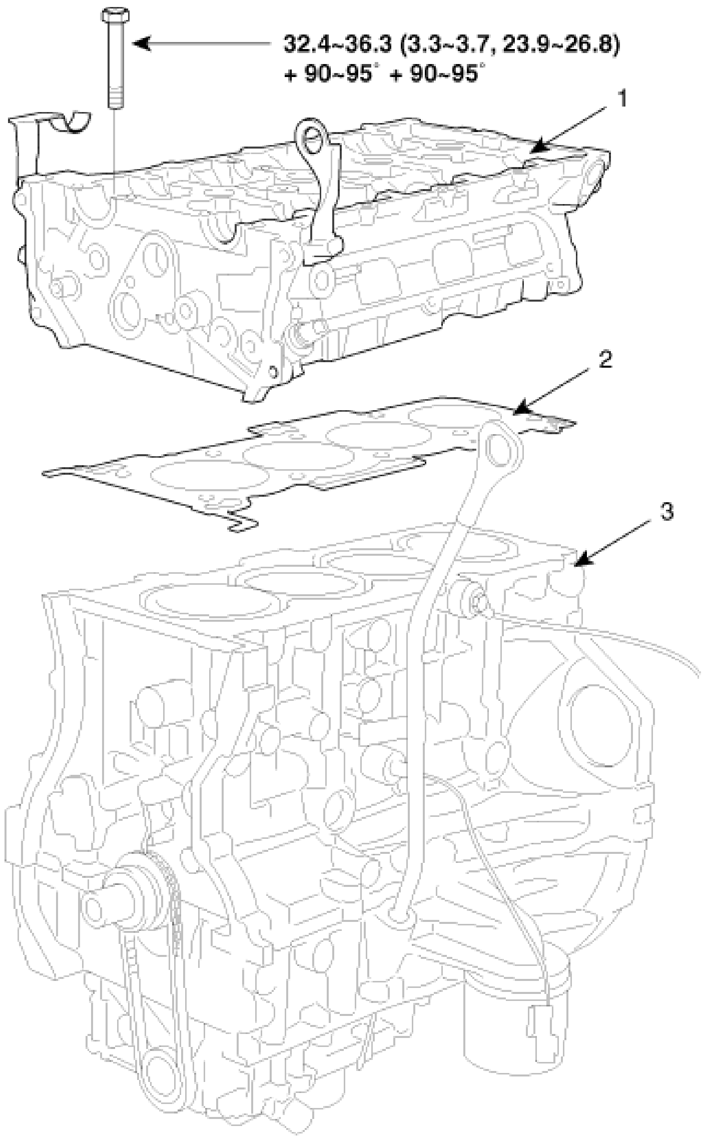
1. Check the belt for oil or dust deposits.
   Replace, if necessary.
   Small deposits should be wiped away with a dry cloth or paper. Do not clean with solvent.
2. When the engine is overhauled or belt tension adjusted, check the belt carefully. If any of the following flaws are evident, replace the belt.

> NOTE
>
> • Do not bend, twist or turn the timing belt inside out.
> • Do not allow the timing belt to come into contact with oil, water and steam.

3. Inspect the idler for easy and smooth rotation and check for play or noise.

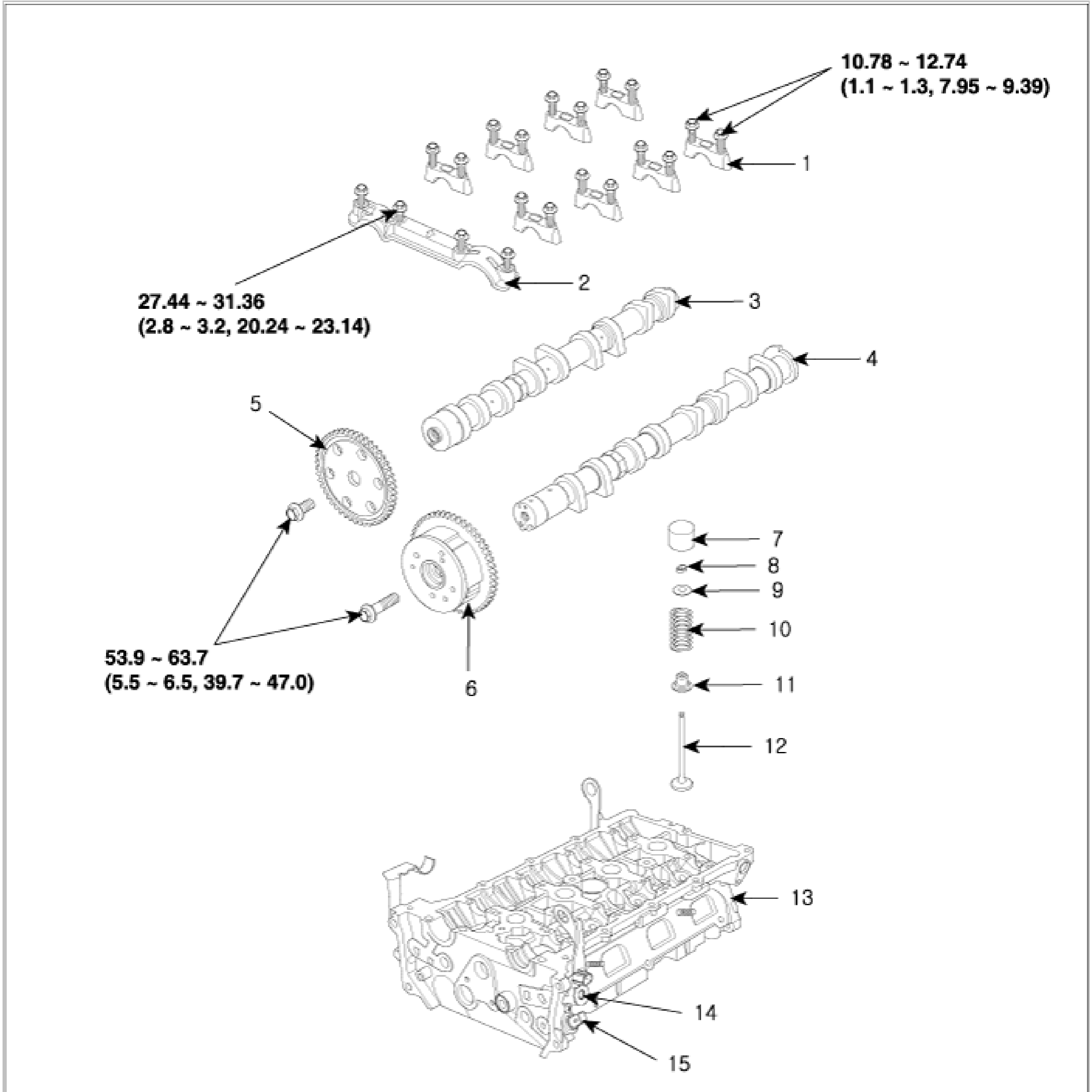
Engine Mechanical System > Cylinder Head Assembly > Components and Components Location

COMPONENTS



TORQUE : N.m (kgf.m, lbf.ft)

1. Cylinder head
2. Cylinder head gasket
3. Cylinder block



1. Camshaft bearing cap
2. Camshaft front bearing cap
3. Exhaust camshaft
4. Intake camshaft
5. Exhaust camshaft sprocket
6. CVVT assembly
7. MLA
8. Retainer lock
9. Retainer
10. Valve spring
11. Valve stem seal
12. Valve
13. Cylinder head
14. OCV
15. OTS

Engine Mechanical System > Cylinder Head Assembly > Repair procedures

REMOVAL

Engine removal is not required for this procedure.

CAUTION

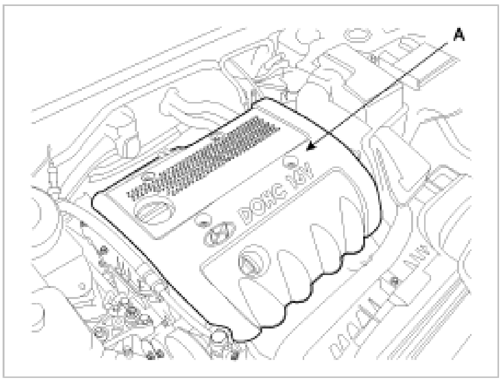
- Use fender covers to avoid damaging painted surfaces.
- To avoid damaging the cylinder head, wait until the engine coolant temperature drops below normal temperature before removing it.
- When handling a metal gasket, take care not to fold the gasket or damage the contact surface of the gasket.

• To avoid damage, unplug the wiring connectors carefully while holding the connector portion.

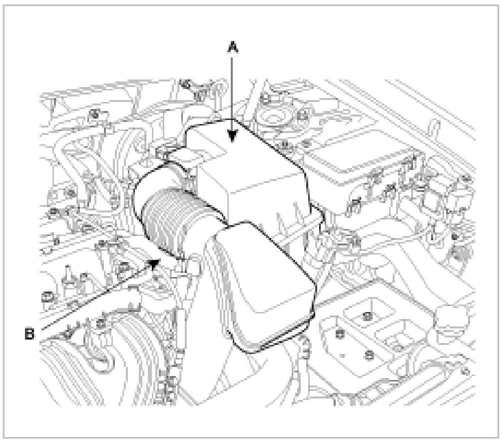
NOTE

• Mark all wiring and hoses to avoid misconnection.
• Turn the crankshaft pulley so that the No. 1 piston is at top dead center.

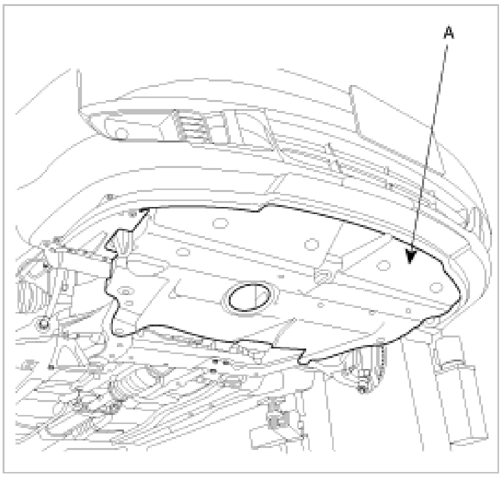
1. Disconnect the negative terminal from the battery.
2. Remove engine cover(A).



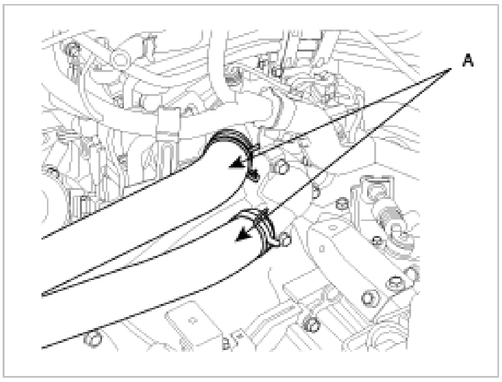
3. Remove air duct.
4. Remove the intake air hose and air cleaner assembly.
   (1) Disconnect the AFS connector.
   (2) Disconnect the breather hose(B) from air cleaner hose.
   (3) Disconnect the ECM connector. (See FL group)
   (4) Remove the intake air hose and air cleaner assembly(A).



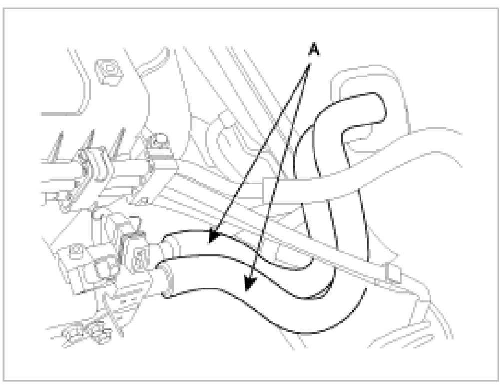
5. Remove front wheels.
6. Remove under cover(A).



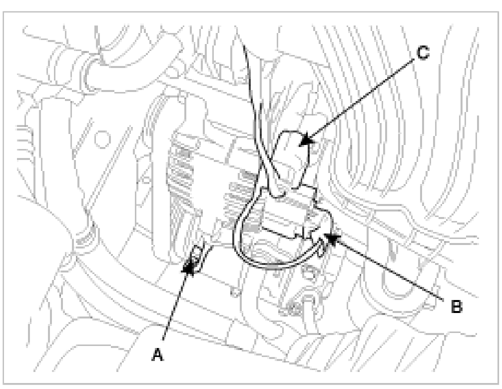
7. Drain the engine coolant.
   Remove the radiator cap to speed draining.
8. Remove the upper and lower radiator hose(A).



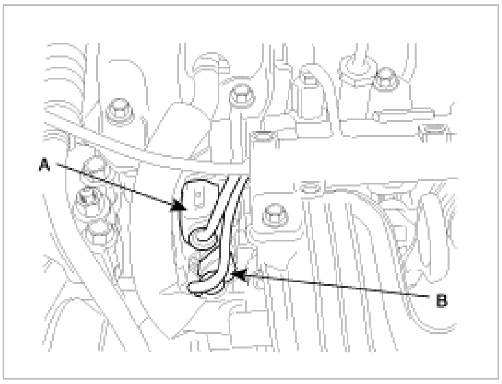
9. Remove the heater hoses(A).



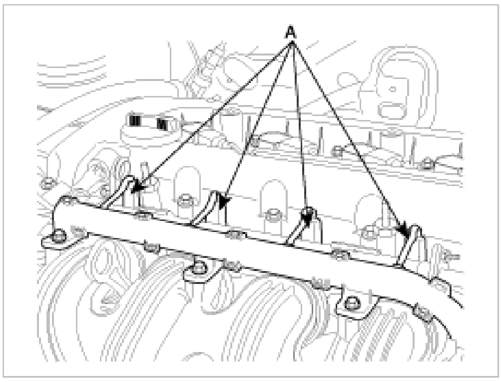
10. Disconnect A/C switch(A), alternator connector(B), and oil pressure switch(C).



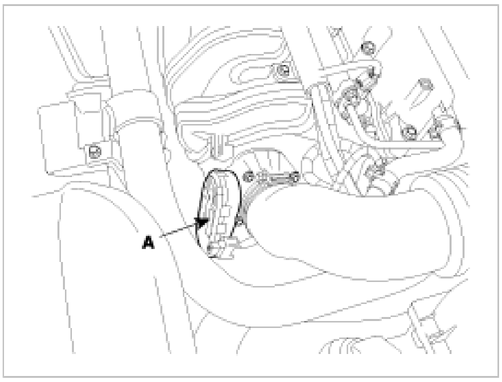
11. Disconnect OCV connector(A) and OTS connector(B).



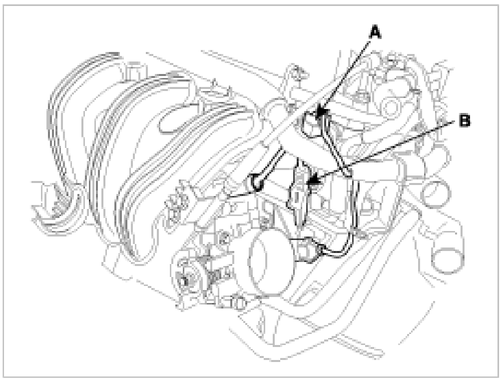
12. Disconnect injector connectors(A).



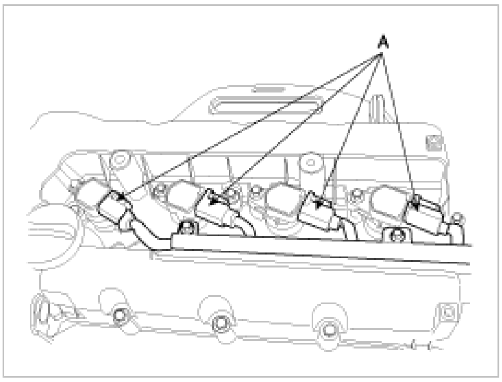
13. Disconnect ETS connector(A)



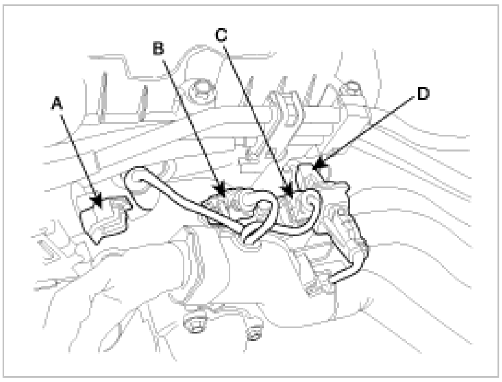
14. Disconnect CMP connector(A), and knock sensor connector(B).



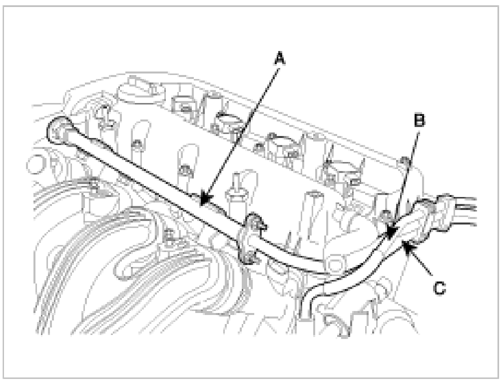
15. Disconnect ignition coil connectors(A).



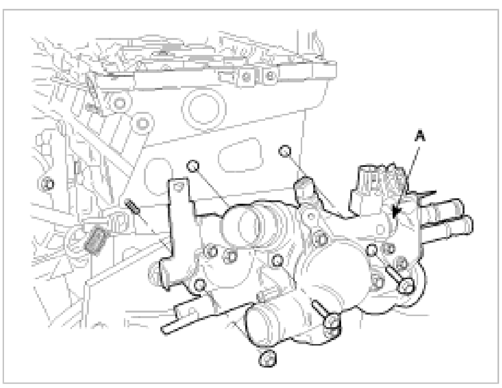
16. Disconnect PCSV connector(A), WTS connector(B), condenser connector(C), and CKP sensor connector(D).



17. Remove delivery pipe(A), brake vacuum hose(B), and PCSV hose(C).



18. Remove water temp control assembly(A).

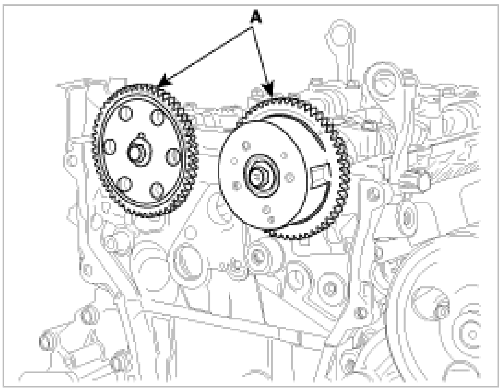


19. Remove intake manifold.

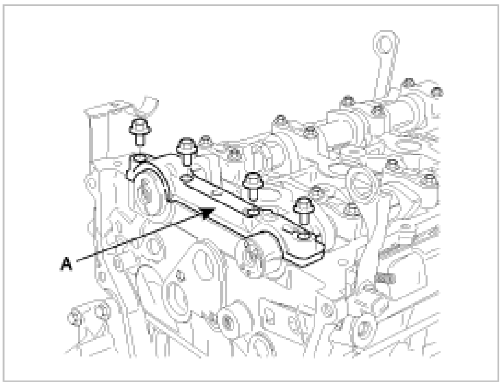
20. Remove exhaust manifold.

21. Remove timing chain.

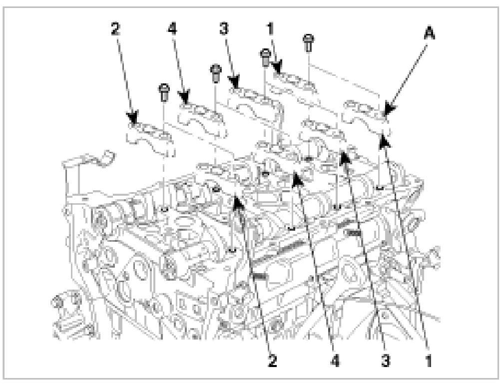
22. Remove CVVT assembly and camshaft sprocket(A).



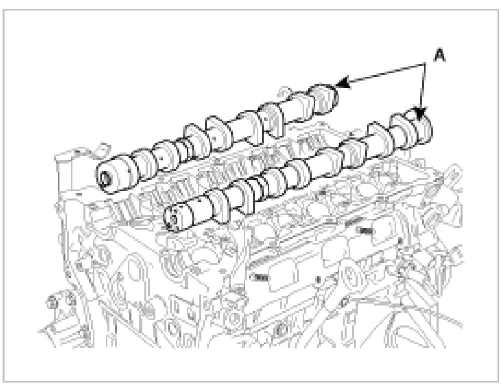
23. Remove camshaft.
    (1) Remove front camshaft bearing cap(A).



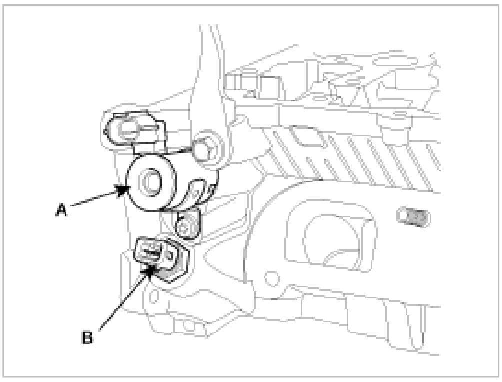
    (2) Remove camshaft bearing cap(A), in the sequence shown.



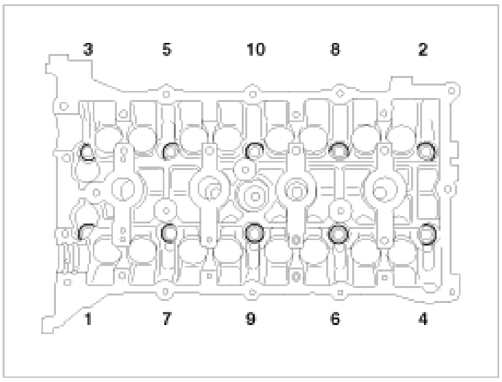
    (3) Remove camshafts(A)



24. Remove OCV(A) and OTS(B).



25. Remove the cylinder head bolts, then remove the cylinder head.
   (1) Using triple square wrench, uniformly loosen and remove the 10 cylinder head bolts, in several passes, in the sequence shown. Remove the 10 cylinder head bolts and plate washers.



> **CAUTION**
>
> Head warpage or cracking could result from removing bolts in an incorrect order.

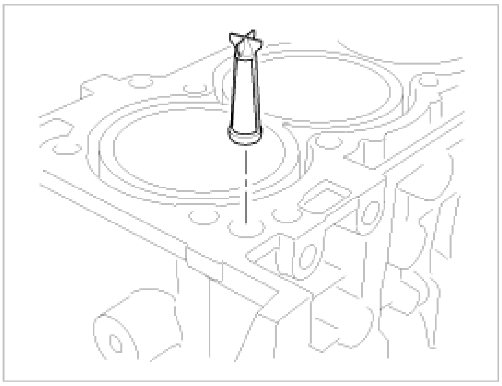
   (2) Lift the cylinder head from the dowels on the cylinder block and place the cylinder head on wooden blocks on a bench.

> **CAUTION**
>
> Be careful not to damage the contact surfaces of the cylinder head and cylinder block.

INSTALLATION

> **NOTE**
>
> - Thoroughly clean all parts to be assembled.
> - Always use a new head and manifold gasket.
> - The cylinder head gasket is a metal gasket. Take care not to bend it.
> - Rotate the crankshaft, set the No.1 piston at TDC.

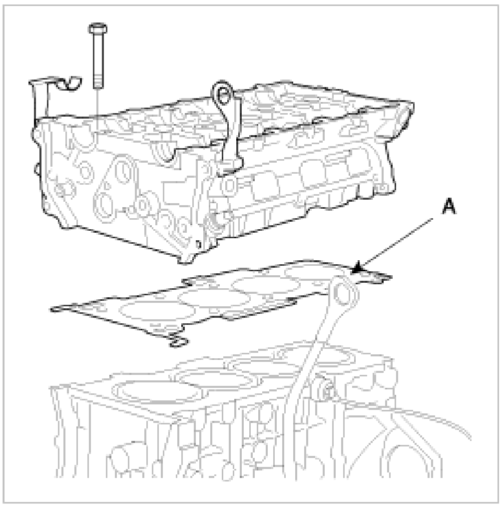
1. Install OCV filter.



NOTE

Keep clean te OCV filter.

2. Install the cylinder head gasket(A) on the cylinder block.



NOTE

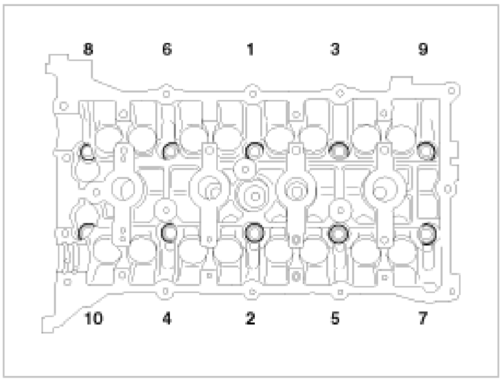
Be careful of the installation direction.

3. Place the cylinder head carefully in order not to damage the gasket with the bottom part of the end.
4. Install cylinder head bolts.
   (1) Apply a light coat if engine oil on the threads and under the heads of the cylinder head bolts.
   (2) Using wrench, install and tighten the 10 cylinder head bolts and plate washers, in several passes, in the sequence shown.

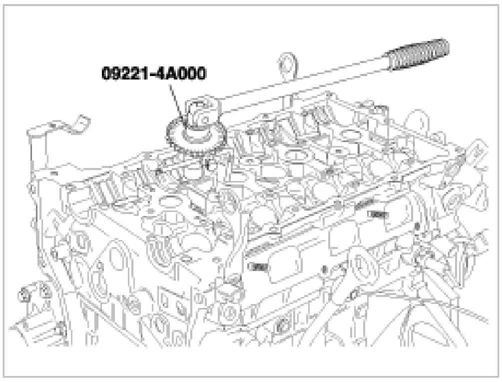
Tightening torque
32.4~36.3Nm (3.3~3.7kgf.m, 23.9~26.8lb-ft) + (90~95°) + (90~95°)

NOTE

Always use new cylinder head bolt.

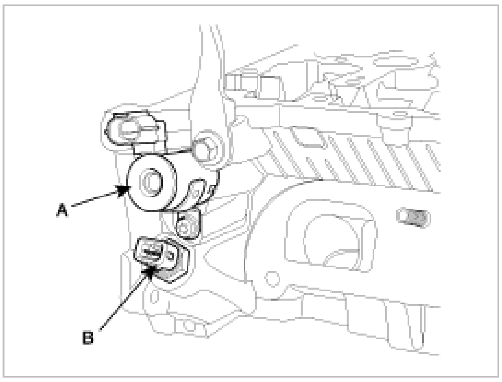


Using SST(09221-4A000), install cylinder head bolts.



5. Install OCV(A) and OTS (B).

Tightening torque
OCV : 9.8 ~ 11.76Nm(1.0 ~ 1.2kgf.m, 7.23 ~ 8.67lbf.ft)
OTS : 19.6 ~ 23.52Nm(2.0 ~ 2.4kgf.m, 14.46 ~ 17.35lbf.ft)

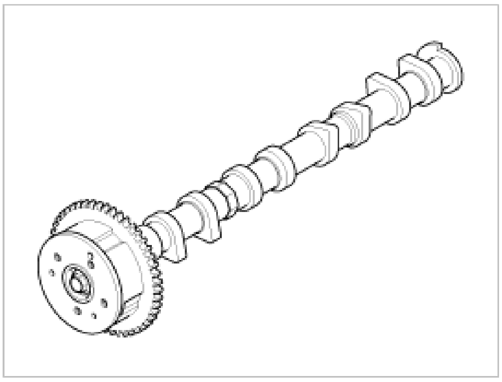


CAUTION

- Do not reuse the OCV when dropped.
- Keep clean the OCV.
- Do not hold the OCV sleeve during servicing.
- When the OCV is installed on the engine, do not move the engine with holding the OCV yoke.

6. Install the CVVT and camshaft sprocket.

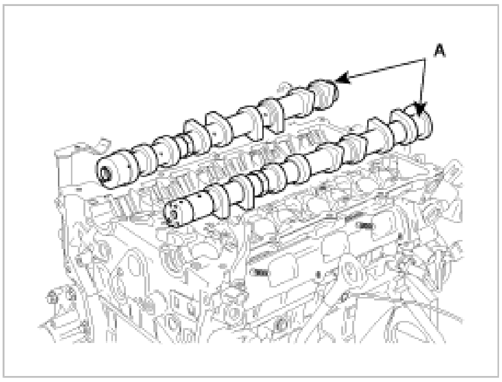
Tightening torque
53.9 ~ 63.7Nm(5.5 ~ 6.5 kgf.m, 39.7 ~ 47.0lbf.ft)



NOTE

Hold the hexagonal head wrench portion of the camshaft with a vise, and install the bolt and CVVT assembly.

7. Install camshafts (A).

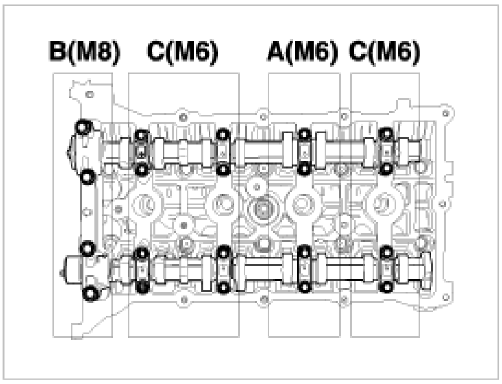


NOTE

Apply a light coat of engine oil on camshaft journals.

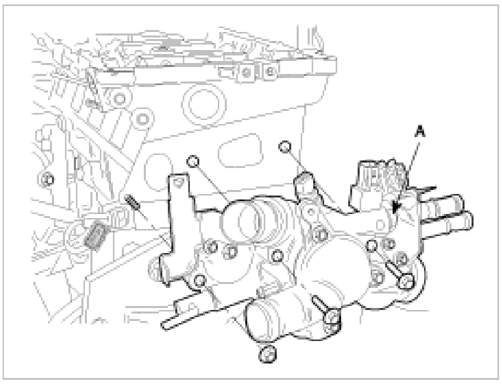
8. Install camshaft bearing caps in their proper locations.
   Tightening order.
   Group A → Group B → Group C.

   Tightening torque
   M6 : 10.78 ~ 12.74Nm(1.1 ~ 1.3kgf.m, 7.95 ~ 9.39lbf.ft)
   M8 : 27.44 ~ 31.36Nm(2.8 ~ 3.2kgf.m, 20.24 ~ 23.14 lbf.ft)



9. Install timing chain.
10. Check and adjust valve clearance.
11. Install the exhaust manifold.
12. Install the intake manifold.
13. Install water temp control assembly (A).

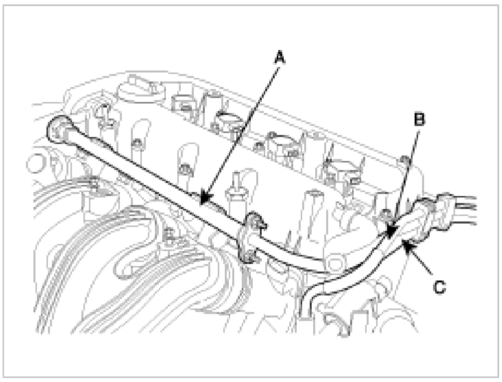
    Tightening torque
    Bolt : 14.7 ~ 21.56Nm(1.5 ~ 2.2kgf.m, 10.84 ~ 15.90lbf.ft)
    Nut : 19.6 ~ 26.46Nm(2.0 ~ 2.7kgf.m, 14.46 ~ 19.52lbf.ft)



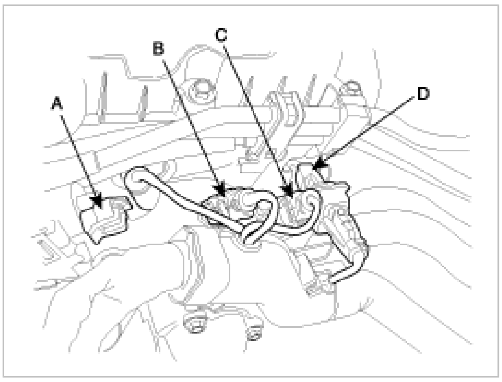
NOTE

- Assemble water temp control assembly and water inlet pipe to water pump assembly before nuts for assembling of water inlet pipe to be tightened.
- Insert after wetting O-ring or inner surface of thermostat housing.
- Always use a new O-ring.

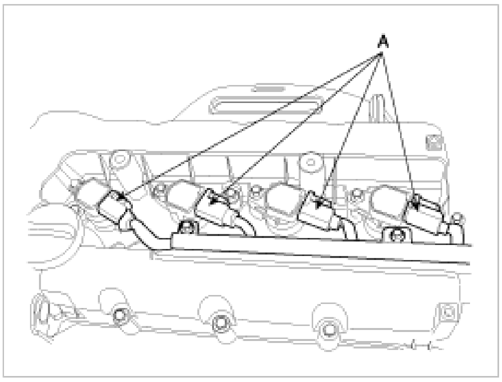
14. Install delivery pipe (A), brake hose(B), and PCSV hose (C).



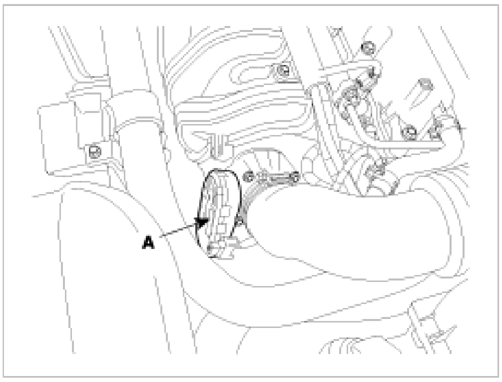
15. Connect PCSV connector (A), WTS connector (B), condenser connector (C), and CKP sensor connector (D).



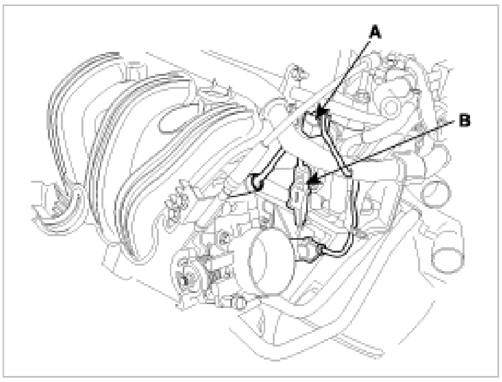
16. Install ignition coil connector (A).



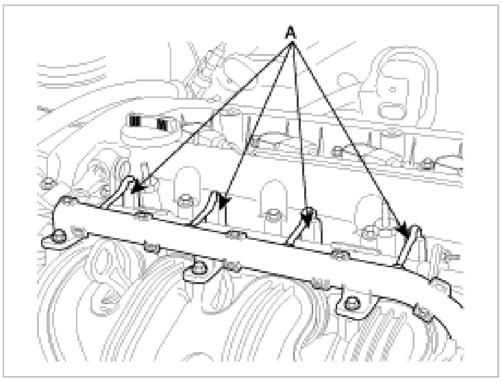
17. Connect ETS connector(A)



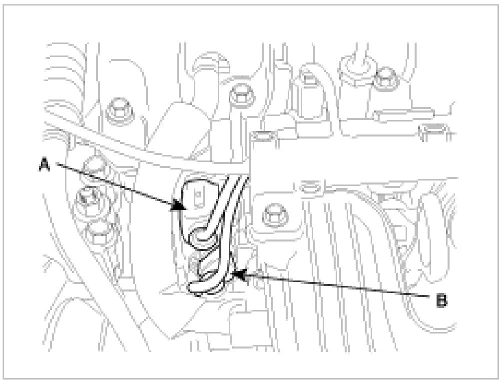
18. Connect CMP connector (A), and knock sensor connector (B).



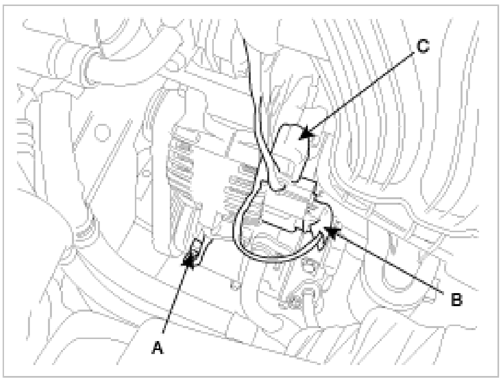
19. Connect injector connectors (A).



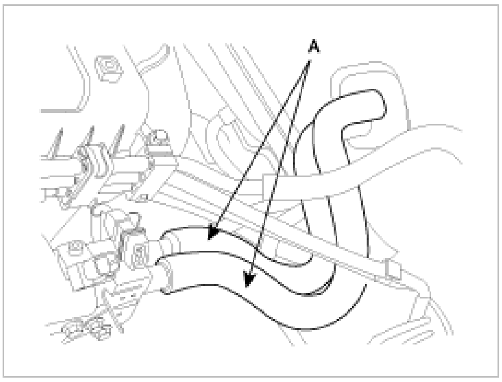
20. Connect OCV connector (A) and OTS connector (B).



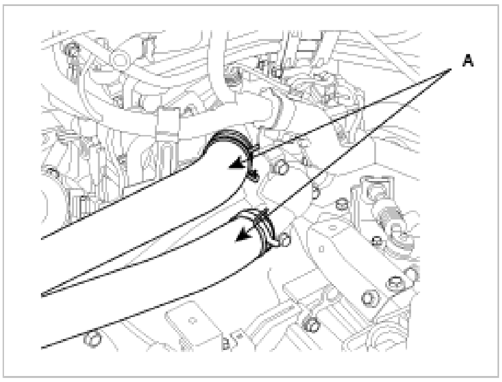
21. Connect A/C switch (A), alternator connect (B), and oil pressure switch (C).



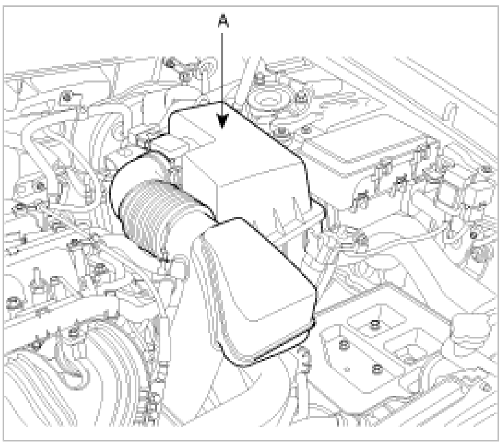
22. Install heater hoses(A).



23. Install the upper radiator hose and lower radiator hose(A).



24. Install the intake air hose and air cleaner assembly.



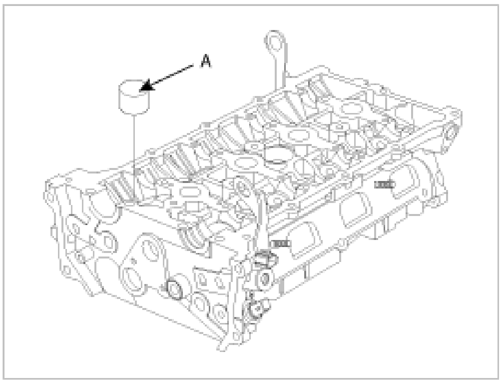
25. Install the engine cover.
26. Connect the negative terminal to the battery.
27. Filll with engine coolant.
28. Start the engine and check for leaks.
29. Recheck engine coolant level and oil level.

DISASSEMBLY

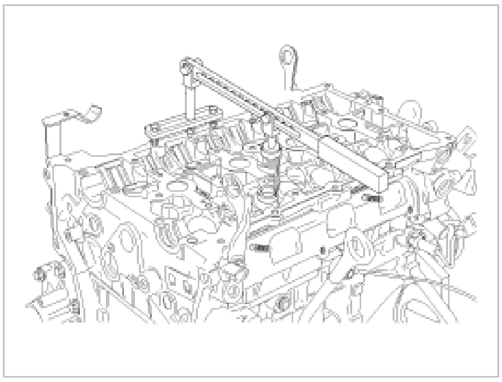
NOTE

Identify MLA(Mechanical Lash Adjuster), valves, valve springs as they are removed so that each item can be reinstalled in its original position.

1. Remove MLAs(A).



2. Remove valves.
   (1) Using SST(09222-3K000, 09222-3K100), compress the valve spring and remove retainer lock.

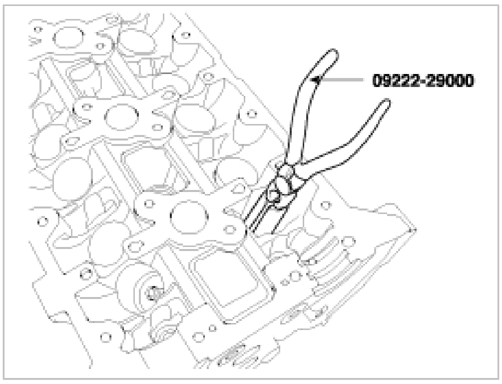


   (2) Remove the spring retainer.

   (3) Remove the valve spring.

   (4) Remove the valve.

   (5) Using SST(09222-29000) remove the valve stem seal.

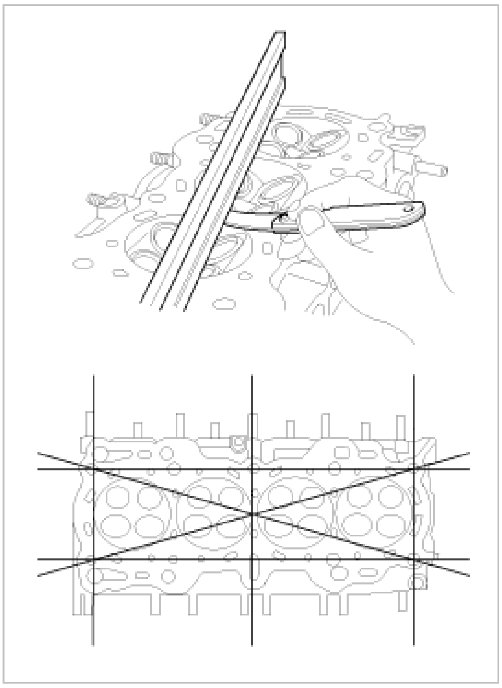


INSPECTION

CYLINDER HEAD

1. Inspect for flatness.
   Using a precision straight edge and feeler gauge, measure the surface the contacting the cylinder block and the manifolds for warpage.

Flatness of cylinder head gasket surface
Standard : Less than 0.05mm(0.002in.)

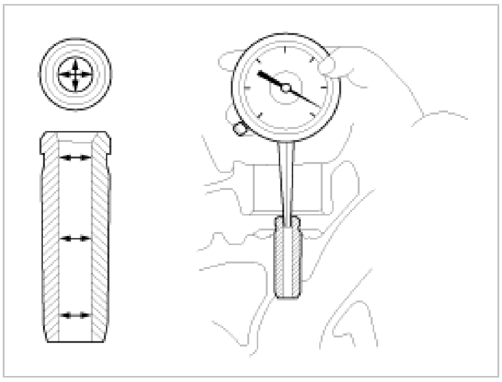


2. Inspect for cracks.
   Check the combustion chamber, intake ports, exhaust ports and cylinder block surface for cracks. If cracked, replace the cylinder head.

VALVE AND VALVE SPRING

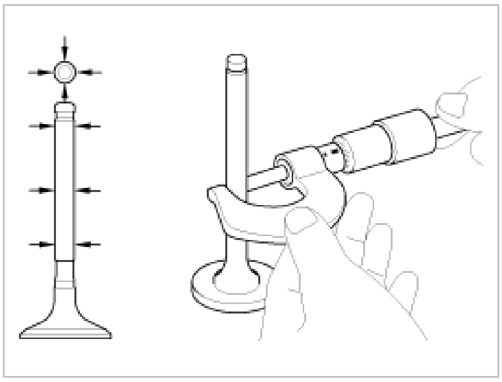
1. Inspect valve stems and valve guides.
   (1) Using a caliper gauge, measure the inside diameter of the valve guide.

Valve guid I.D.
Intake / Exhaust : 5.500 ~ 5.512mm (0.216 ~ 0.217in.)



   (2) Using a micrometer, measure the diameter of the valve stem.

Valve stem O.D.
Intake : 5.465 ~ 5.480mm (0.2151 ~ 0.2157in.)
Exhaust : 5.458 ~ 5.470mm (0.2149 ~ 0.2153in.)



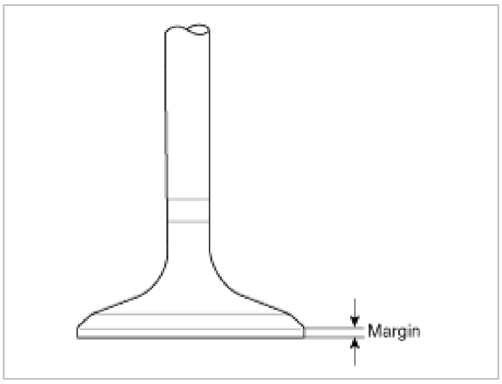
(3) Subtract the valve stem diameter measurement from the valve guide inside diameter measurement.

Valve stem-to-guide clearance
[Standard]
Intake : 0.020 ~ 0.047mm (0.0008 ~ 0.0018in.)
Exhaust : 0.030 ~ 0.054mm (0.0012 ~ 0.0021in.)
[Limit]
Intake : 0.07mm (0.0027in.)
Exhaust : 0.09mm (0.0035in.)

If the clearance is greater than maximum, replace the valve and valve guide.

2. Inspect valves.
   (1) Check the valve is ground to the correct valve face angle.
   (2) Check that the surface of the valve for wear.
   If the valve face is worn, replace the valve.
   (3) Check the valve head margin thickness.
   If the margin thickness is less than minimum, replace the valve.

Margin
[Standard]
Intake : 1.02mm(0.0401in.)
Exhaust : 1.09mm(0.0429in.)

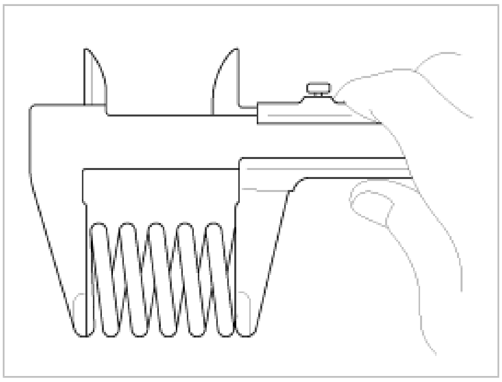


   (4) Check the surface of the valve stem tip for wear.
   If the valve stem tip is worn, replace the valve.

3. Inspect valve seats
   Check the valve seat for evidence of overheating and improper contact with the valve face.
   Replace the seat if necessary.
   Before reconditioning the seat, check the valve guide for wear. If the valve guide is worn, replace it, then recondition the seat. Recondition the valve seat with a valve seat grinder or cutter. The valve seat contact width should be within specifications and centered on the valve face.

4. Inspect valve springs.
   (1) Using a steel square, measure the out-of-square of the valve spring.
   (2) Using a vernier calipers, measure the free length of the valve spring.

Valve spring
[Standard]
Free height : 47.44mm (1.8677in.)
Out-of-square : 1.5°



If the free length is not as specified, replace the valve spring.

MLA

1. Inspect MLA.
   Using a micrometer, measure the MLA outside diameter.

   MLA O.D.
   Intake/Exhaust : 31.964 ~ 31.980mm(1.2584 ~ 1.2590in.)

2. Using a caliper gauge, measure MLA tappet bore inner diameter of cylinder head.

   Tappet bore I.D.
   Intake/Exhaust : 32.000 ~ 32.025mm(1.2598 ~ 1.2608in.)

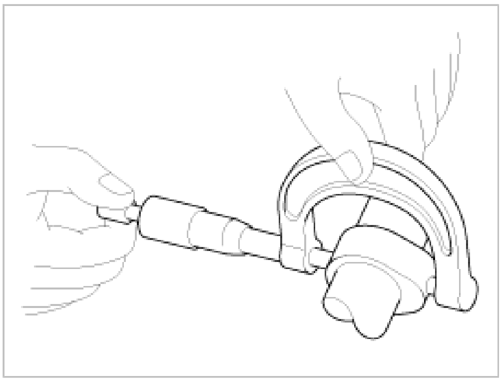
3. Subtract MLA outside diameter measurement from tappet bore inside diameter measurement.

   MLA to tappet bore clearance
   [Standard]
   Intake/Exhaust : 0.020 ~ 0.061mm(0.0008 ~ 0.0024in.)
   [Limit]
   Intake/Exhaust : 0.07mm(0.0027in.)

CAMSHAFT

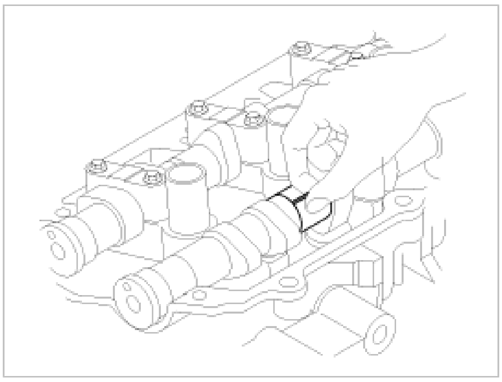
1. Inspect cam lobes.
   Using a micrometer, measure the cam lobe height.

   Cam height
   [Standard value]
   Intake : 43.70 ~ 43.90mm (1.7204 ~ 1.7283in.)
   Exhaust : 44.90 ~ 45.10mm (1.7677 ~ 1.7756in.)



If the cam lobe height is less than standard, replace the camshaft.

2. Inspect camshaft journal clearance.
   (1) Clean the bearing caps and camshaft journals.
   (2) Place the camshafts on the cylinder head.
   (3) Lay a strip of plastigage across each of the camshaft journal.



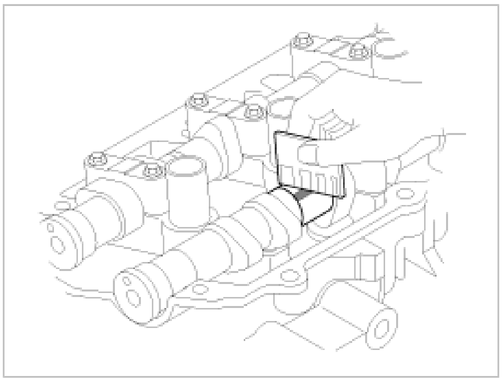
   (4) Install the bearing caps.

CAUTION

Do not turn the camshaft.

   (5) Remove the bearing caps.
   (6) Measure the plastigage at its widest point.

Bearing oil clearance
[Standard value]
Intake
No.1 journal : 0.02 ~ 0.057mm (0.0008 ~ 0.0022in.)
No.2,3,4,5, journal : 0.045 ~ 0.082mm (0.0018 ~ 0.0032in.)
Exhaust : 0.045 ~ 0.082mm (0.0018 ~ 0.0032in.)
[Limit] :
Intake
No.1 journal : 0.09mm (0.0035in.)
No.2,3,4,5 journal : 0.12mm (0.0047in.)
Exhaust : 0.12mm (0.0047in.)



If the oil clearance is greater than maximum, replace the camshaft. If necessary, replace cylinder head.

(7) Completely remove the plastigage.

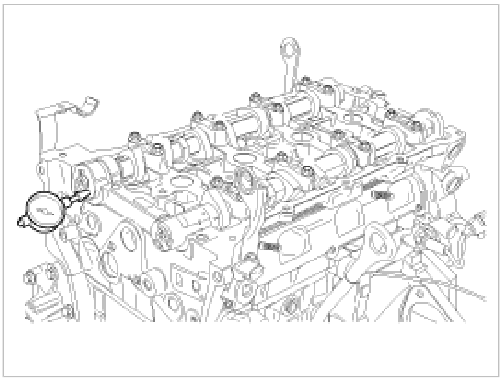
(8) Remove the camshafts.

3. Inspect camshaft end play.

(1) Install the camshafts.

(2) Using a dial indicator, measure the end play while moving the camshaft back and forth.

Camshaft end play
[Standard value] : 0.10 ~ 0.22mm(0.004 ~ 0.0087in.)
[Limit] : 0.24mm (0.0094in.)



If the end play is greater than maximum, replace the camshaft. If necessary, replace cylinder head.

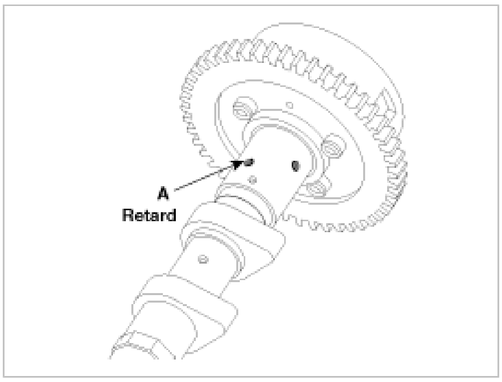
(3) Remove the camshafts.

CVVT ASSEMBLY

1. Inspect CVVT assembly.

(1) Check that the CVVT assembly will not turn.

(2) Apply vinyl tape to the retard hole except the one indicated by the arrow in the illustration.

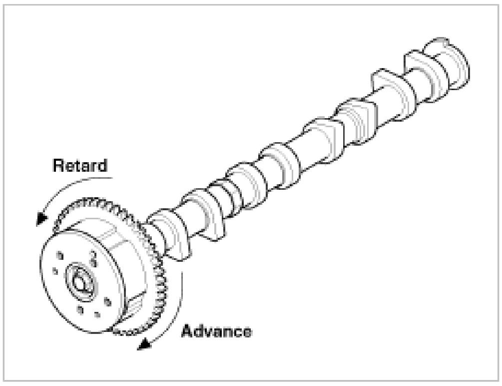


(3) Wind tape around the tip of the air gun and apply air of approx. 150kpa(1.5kgf/cm², 21psi) to the port of the camshaft.
(Perform this order to release the lock pin for the maximum delay angle locking.)

NOTE

When the oil splashes, wipe it off with a shop rag and the likes.

(4) Under the condition of (3), turn the CVVT assembly to the advance angle side (the arrow marked direction in the illustration) with your hand.
Depending on the air pressure, the CVVT assembly will turn to the advance side without applying force by hand. Also, under the condition that the pressure can be hardly applied because of the air leakage from the port, there may be the case that the lock pin could be hardly released.



(5) Except the position where the lock pin meets at the maximum delay angle, let the CVVT assembly turn back and forth and check the movable range and that there is no disturbance.

Standard: Movable smoothly in the range about 22.5°

(6) Turn the CVVT assembly with your hand and lock it at the maximum delay angle position (counter clockwise).

REASSEMBLY

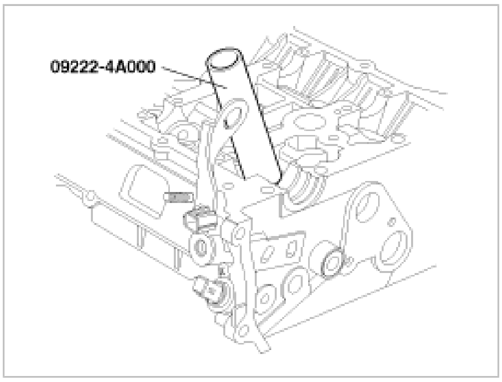
NOTE

Thoroughly clean all parts to be assembled.
Before installing the parts, apply fresh engine oil to all sliding and rotating surfaces.
Replace oil seals with new ones.

1. Install valves.
   (1) Using SST(09222-4A000), push in a new oil seal.

NOTE

Do not reuse old valve stem seals.
Incorrect installation of the seal could result in oil leakage past the valve guides.

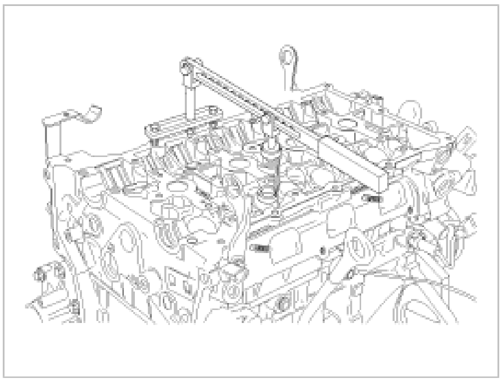


   (2) Install the valve, valve spring and spring retainer.

NOTE

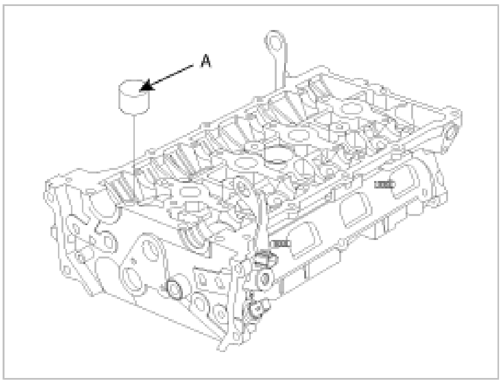
Place valve springs so that the side coated with enamel faces toward the valve spring retainer and then installs the retainer.

(3) Using the SST(09222-3K000, 09222-3K100), compress the spring and install the retainer locks. After installing the valves, ensure that the retainer locks are correctly in place before releasing the valve spring compressor.



(4) Lightly tap the end of each valve stem two or three times with the wooden handle of a hammer to ensure proper seating of the valve and retainer lock.

2. Install MLAs.
Check that the MLA rotates smoothly by hand.



NOTE

MLA can be reinstalled in its original position.

Engine Mechanical System > Engine And Transaxle Assembly > Repair procedures

REMOVAL

CAUTION

- Use fender covers to avoid damaging painted surfaces.
- To avoid damage, unplug the wiring connectors carefully while holding the connector portion.

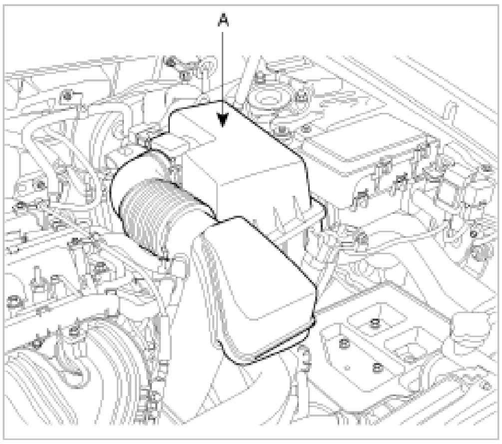
NOTE

- Mark all wiring and hoses to avoid misconnection.
- Inspection the timing belt before removing the cylinder head.
- Turn the crankshaft pulley so that the No.1 piston is at top dead center.

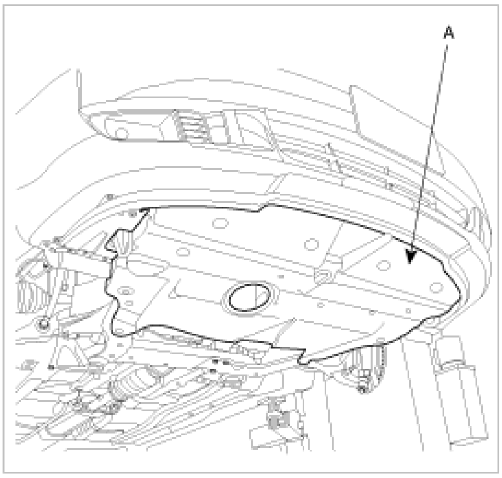
1. Disconnect the neagative terminal from the battery.
2. Remove the engine cover.
3. Remove the air duct.
4. Remove the intake air hose and air cleaner assembly.
   (1) Disconnect the AFS connector.
   (2) Disconnect the breather hose from air cleaner hose.

(3) Disconnect the ECM connector. (See FL group)

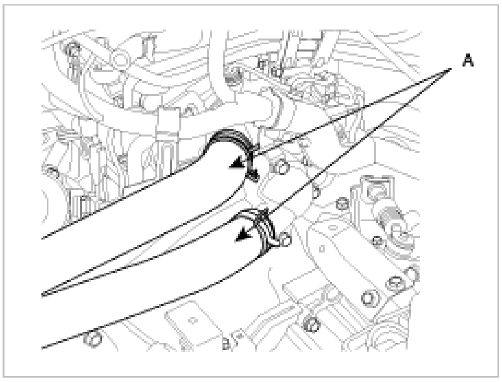
(4) Remove the intake air hose and air cleaner(A).



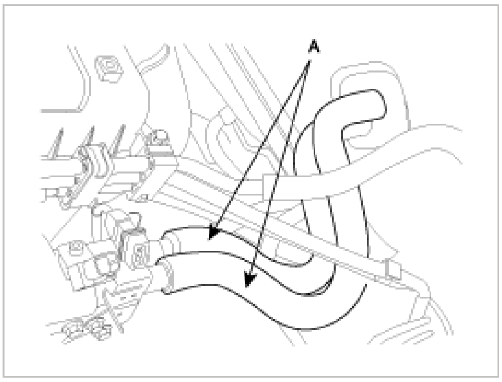
5. Remove front wheels.
6. Remove under cover(A).



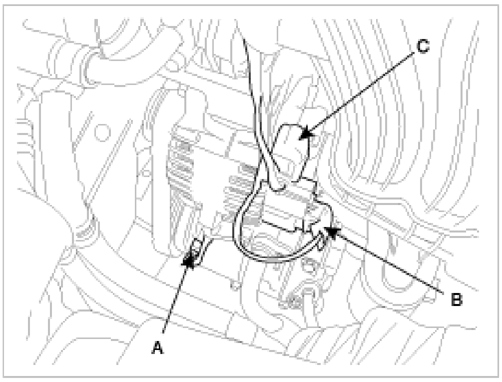
7. Drain the engine coolant.
   Remove the radiator cap to speed draining.
8. Remove the upper radiator hose and lower radiator hose(A).



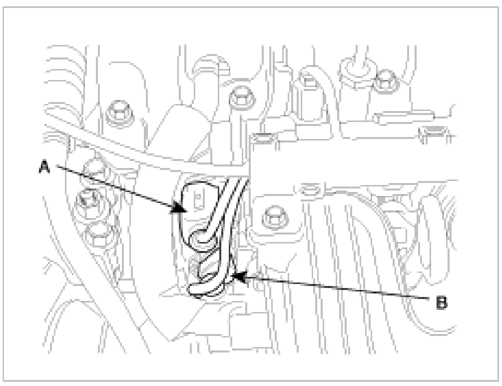
9. Remove the heater hoses(A).



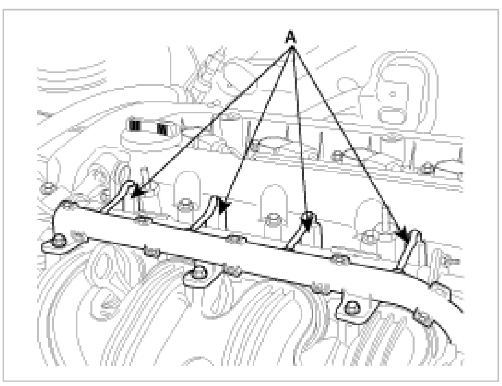
10. Disconnect A/C switch(A), alternator connector(B) and pressure switch(C).



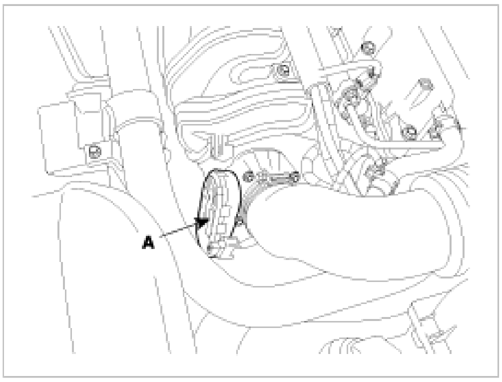
11. Disconnect OCV connector(A) and OTS connector(B).



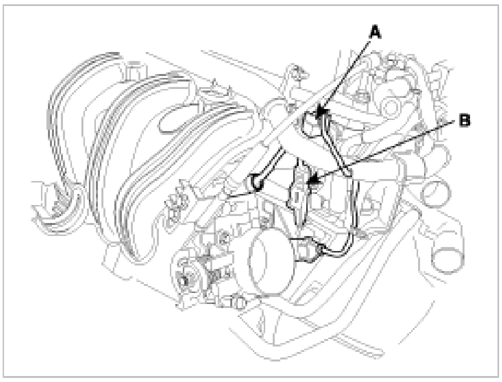
12. Disconnect injector connectors(A).



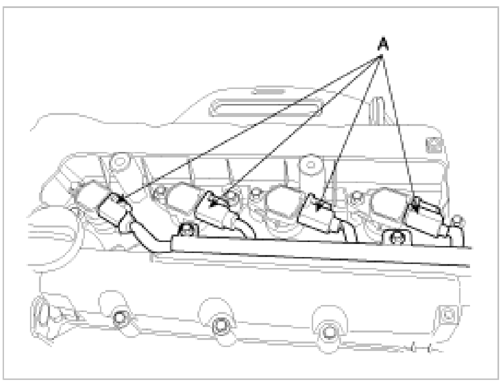
13. Disconnect ETS connector(A)



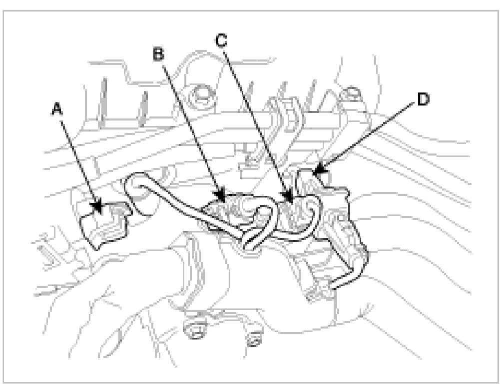
14. Disconnect CMP connector(A), and knock sensor connector(B).



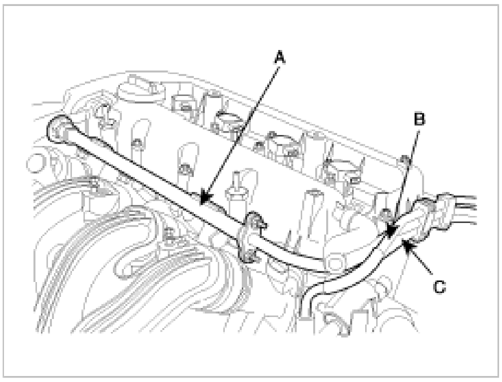
15. Disconnect ignition coil connectors(A).



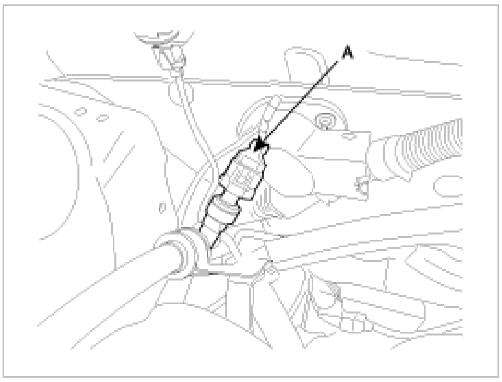
16. Disconnect PCSV connector(A), WTS connector(B), condenser connector(C), and CKP sensor connector(D).



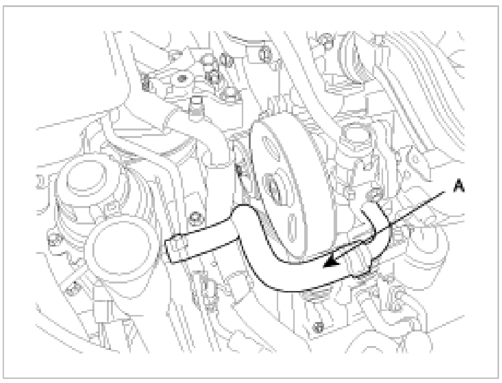
17. Remove delivery pipe(A), brake vacuum hose(B), and PCSV hose(C).



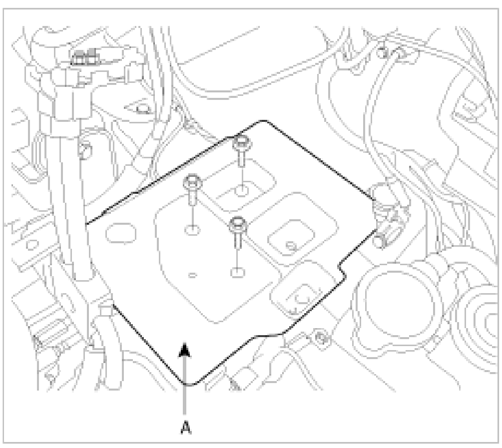
18. Disconnect P/S pump oil pressure switch connector(A).



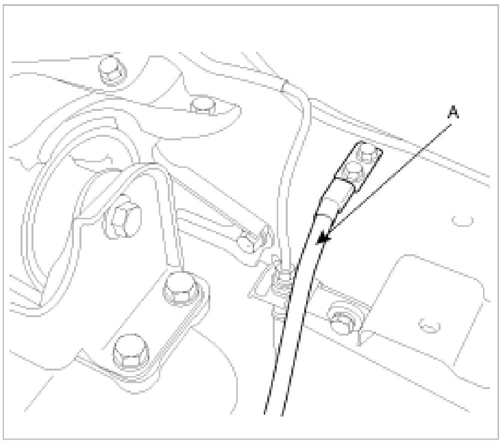
19. Remove P/S pump hose(A).



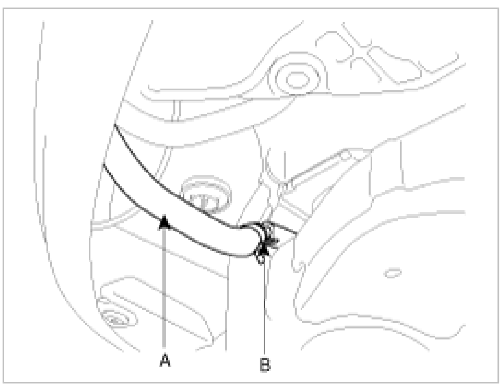
20. Remove the battery body bracket.(A).



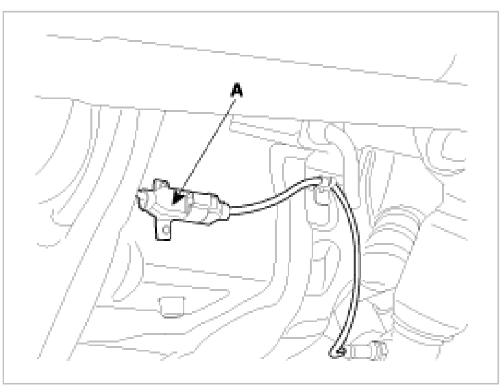
21. Disconnect the ground cable from the transaxle.



22. Disconnect the transaxle wire harness connector. (A/T).
    A. Disconnect the inhibitor switch connector.
    B. Disconnect the transaxle range connector.
    C. Disconnect the input shaft speed connector.
    D. Disconnect the output shaft speed connector.
    E. Disconnect the vehicle speed sensor connector.
    F. Remove control cable transaxle range switch.
23. Drain transaxle oil.
24. Disconnect EPS connector. (See ST group)
25. Remove lower arm ball joint. (SeeDS group)
26. Remove tile rod end ball joint. (See DS group)
27. Remove stabilizer link. (See SS group)
28. Remove power steering return hose(A) and drain power steering oil.

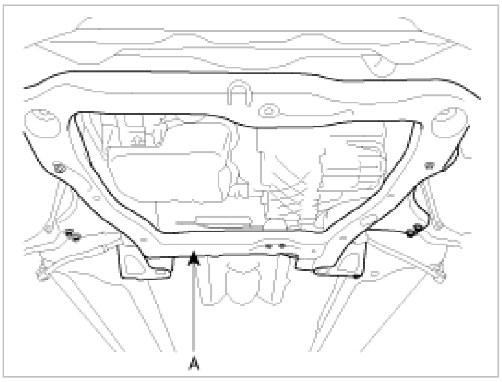


29. Remove front roll stopper mounting bolt.
30. Remove rear roll stopper mounting bolt.
31. Remove steering u-joint mounting (See ST group)
32. Disconnect oxygen sensor connetor(A).

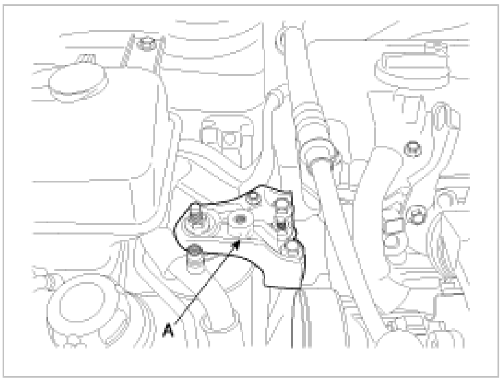


33. Remove front exhaust pipe.

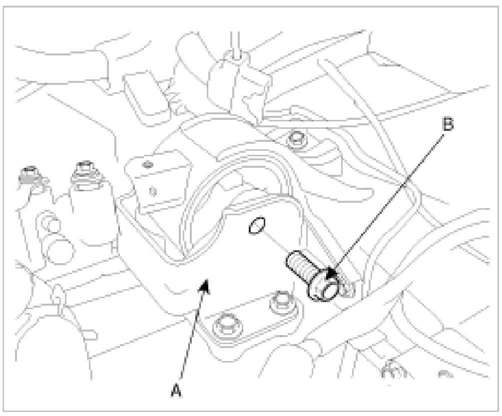
34. Install jack and remove sub-frame(A).



35. Remove drive shaft from transaxle.
36. Install jack for supporting engine and transaxle assembly.
37. Remove the engine mounting bracket(A).



38. Remove the transaxle mounting bracket(A).



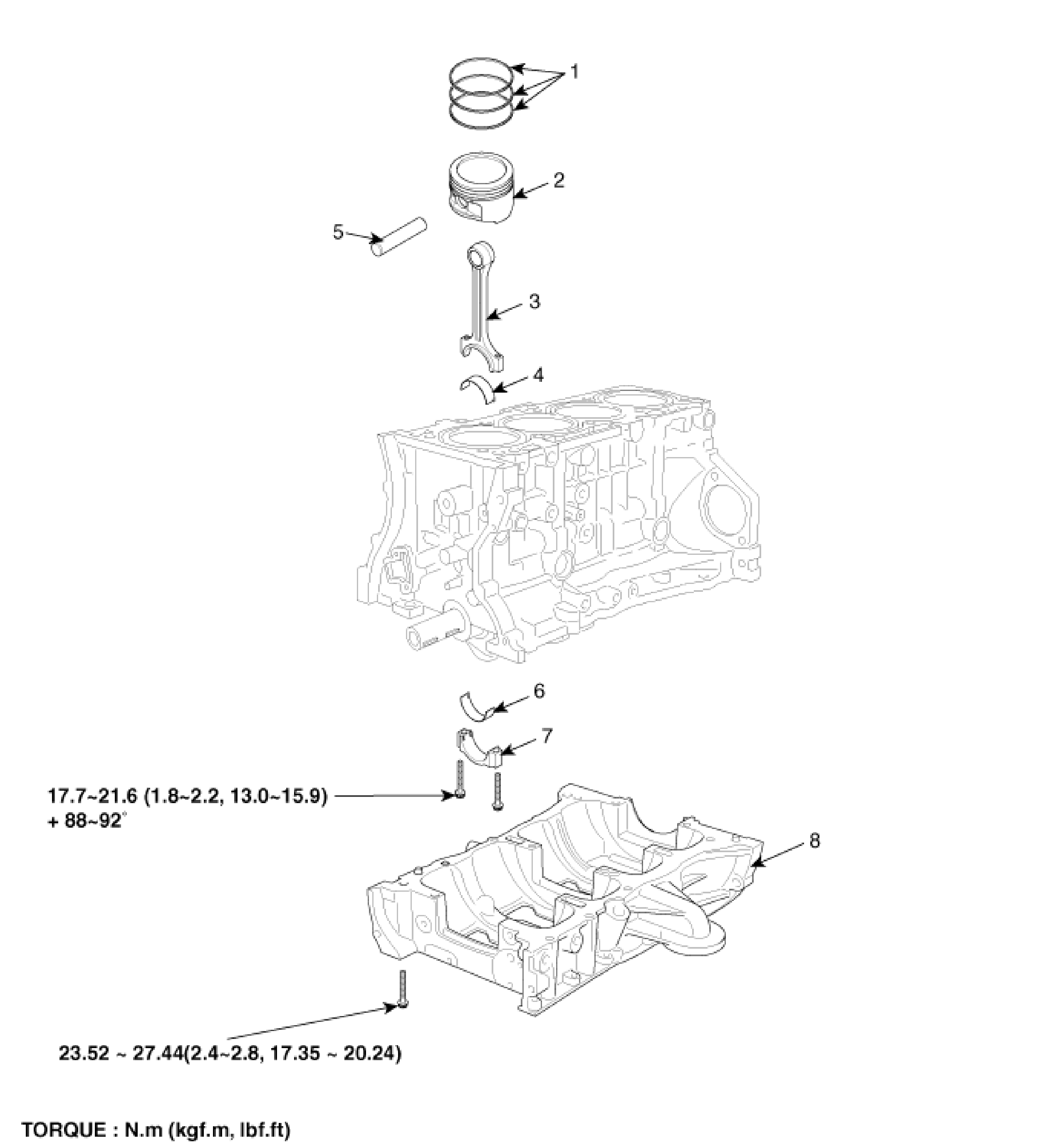
39. Jack up the vehicle.

INSTALLATION

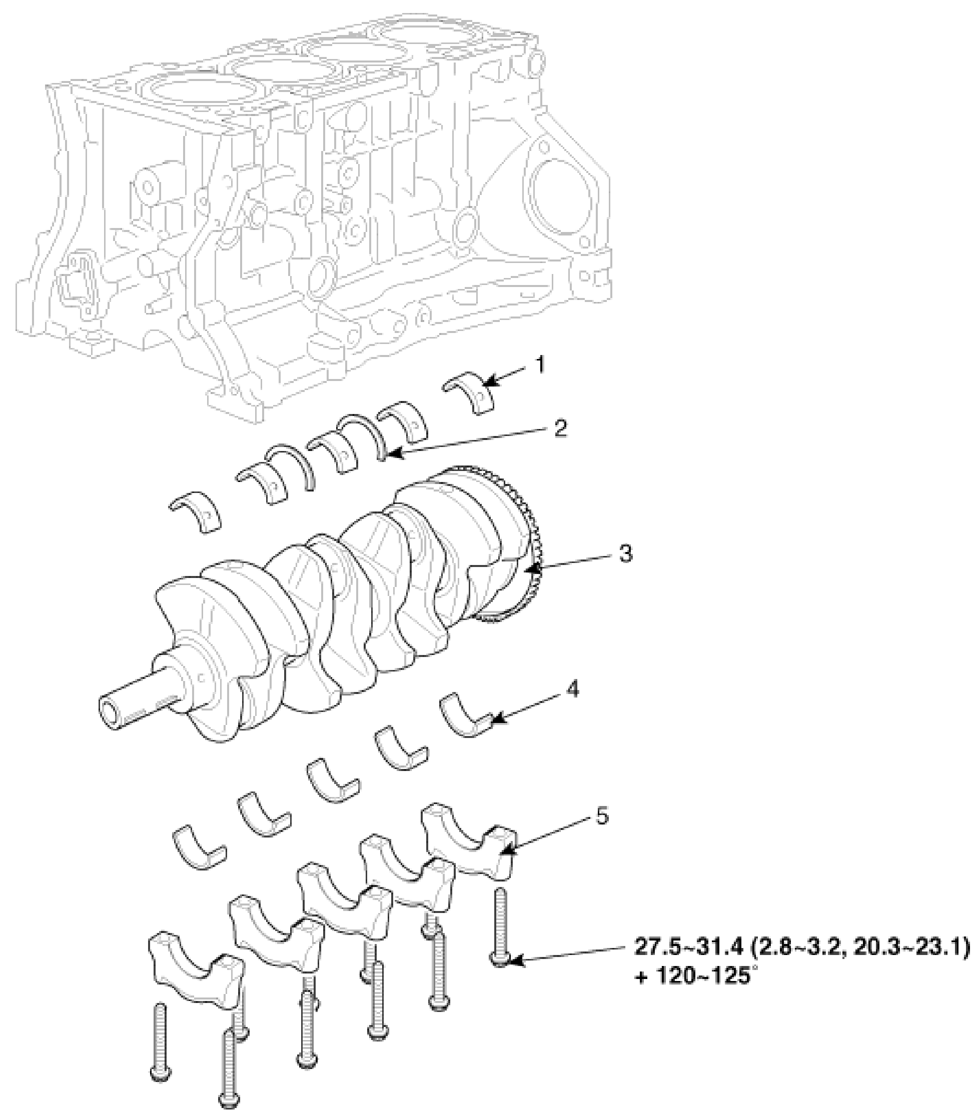
Perform the following :

- Adjust the shift cable.
- Refill the engine with engine oil.
- Refill the transaxle with fluid.
- Refill the radiator with engine coolant.
- Bleed air from the cooling system with the heater valve open.
- Clean the battery posts and cable terminals with sandpaper assemble them, then apply grease to prevent corrosion.
- Inspect for fuel leakage.
  After assembling the fuel line, turn on the ignition switch (do not operate the starter) so that the fuel pump runs for approximately two seconds and fuel line pressureizes.
  Repeat this operation two or three times, then check for fuel leakage at any point in the fuel line.

COMPONENTS



1. Piston ring
2. Piston
3. Connecting rod
4. Connecting rod upper bearing
5. Piston pin
6. Connecting rod lower bearing
7. Connecting rod bearing cap
8. Ladder frame

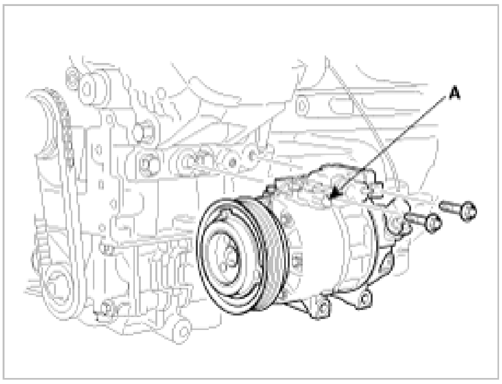


1. Crankshaft upper bearing
2. Thrust bearing
3. Crankshaft
4. Crankshaft lower bearing
5. Main bearing cap

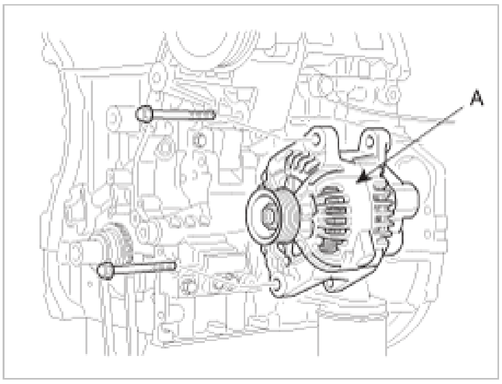
Engine Mechanical System > Cylinder Block > Repair procedures

DISASSEMBLY

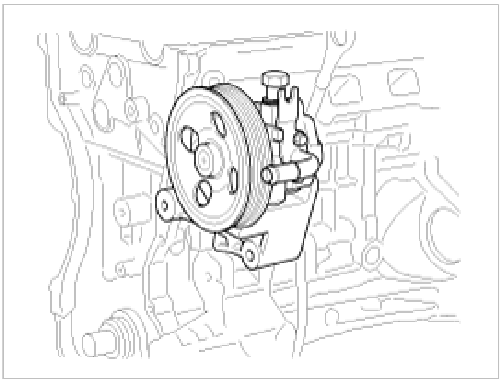
1. M/T : remove flywheel.
2. A/T : remove drive plate.
3. Install engine to engine stand for disassembly.
4. Remove timing chain.
5. Remove cylinder head.
6. Remove A/C compressor(A) from engine. (See HA group)



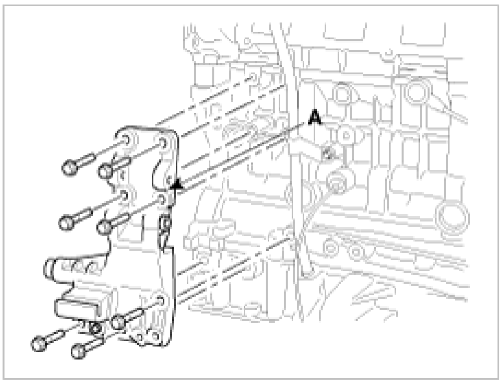
7. Remove alternator(A) from engine. (See EE group)



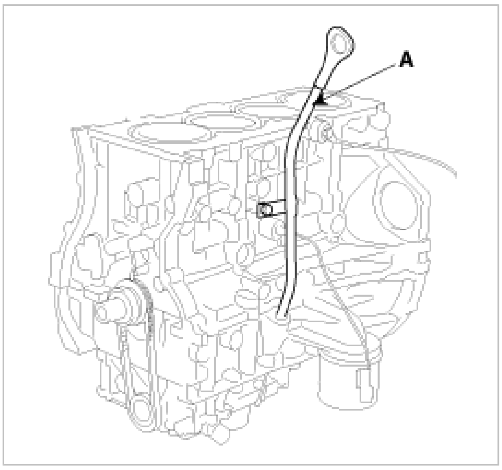
8. Remove power steering pump and bracket. (See ST group)



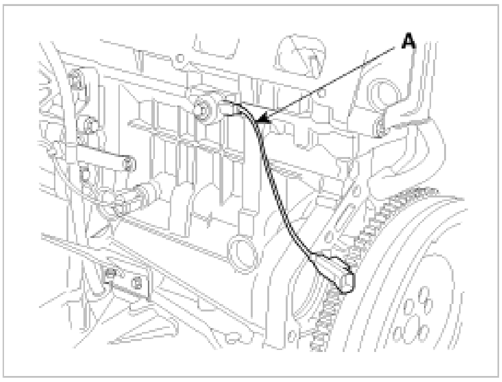
9. Remove tensioner assembly integrated bracket(A).



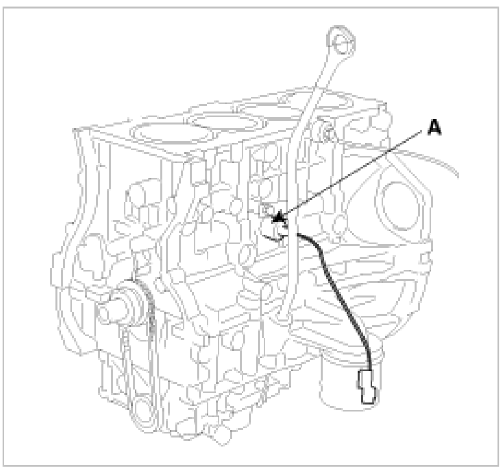
10. Remove oil level gauge assembly(A).



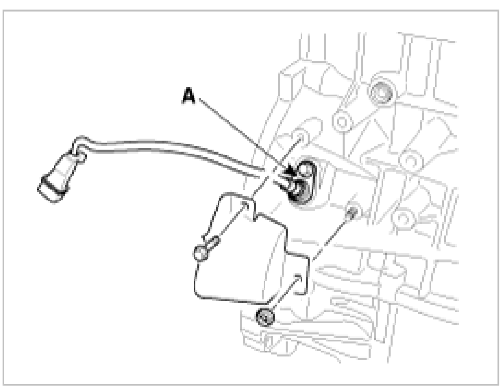
11. Remove knock sensor(A).



12. Remove oil pressure sensor(A).

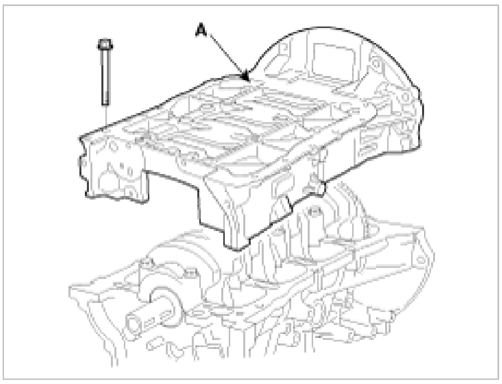


13. Remove CKP sensor(A).



14. Remove water pump.
15. Remove balance shaft module.

16. Remove ladder frame(A).



17. Check the connecting rod end play.
18. Remove the connecting rod caps and check oil clearance.
19. Remove piston and connecting rod assemblies.
    (1) Using a ridge reamer, remove all the carbon from the top of the cylinder.
    (2) Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.

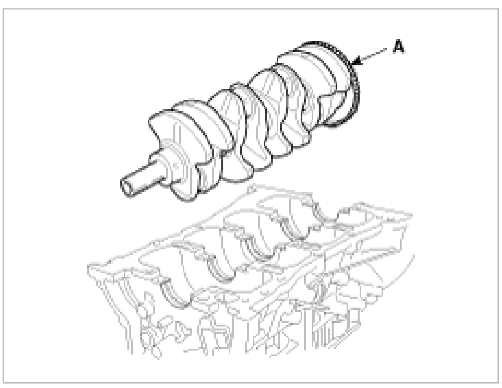
NOTE

• Keep the bearings, connecting rod and cap together.
• Arrange the piston and connecting rod assemblies in the correct order.

20. Remove crankshaft bearing cap and check oil clearance.
21. Check the crankshaft end play.
22. Lift the crankshaft(A) out of the engine, being careful not to damage journals.

NOTE

Arrange the main bearings and thrust bearings in the correct order.



23. Check fit between piston and piston pin.
    Try to move the piston back and forth on the piston pin. If any movement is felt, replace the piston and pin as a set.
24. Remove piston rings.
    (1) Using a piston ring expender, remove the 2 compression rings.
    (2) Remove 2 side rails and the spacer by hand.

NOTE

Arrange the piston rings in the correct order only.

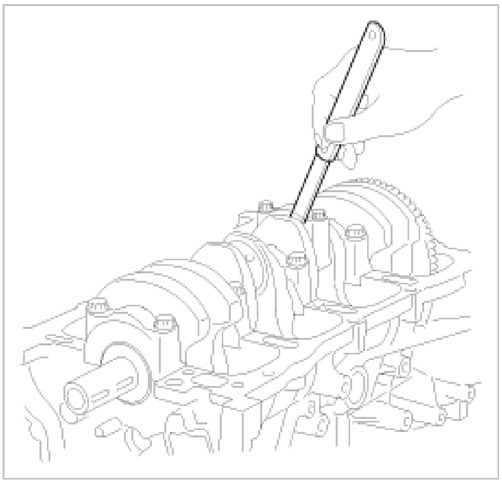
25. Disconnect connecting rod from piston.

INSPECTION

CONNECTING ROD AND CRANKSHAFT

1. Check the connecting rod end play.
   Using a feeler gauge, measure the end play while moving the connecting rod back and forth.

   Standard end play : 0.1~ 0.25mm(0.004 ~ 0.010in.)
   Maximum end play : 0.35mm(0.0138in.)

   A. If out-of-tolerance, install a new connecting rod.
   B. If still out-of-tolerance, replace the crankshaft.

2. Check the connecting road bearing oil clearance.
   (1) Check the matchmarks on the connecting rod and cap are aligned to ensure correct reassembly.
   (2) Remove 2 connecting rod cap bolts.
   (3) Remove the connecting rod cap and bearing half.
   (4) Clean the crank pin and bearing.
   (5) Place plastigage across the crank pin.
   (6) Reinstall the bearing half and cap, and torque the bolts.

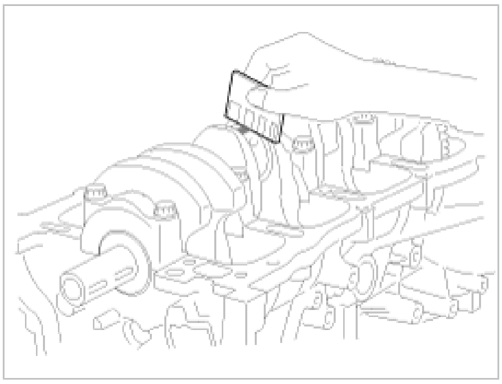
   Tightening torque
   17.7~21.6Nm (1.8~2.2kgf.m, 13.0~15.9lb-ft) + 88~92°

   NOTE

   Do not turn the crankshaft.

   (7) Remove 2 bolts, connecting rod cap and bearing half.
   (8) Measure the plastigage at its widest point.

   Standard oil clearance
   0.028 ~ 0.046mm(0.0011 ~ 0.0018in.)

   (9) If the plastigage measures too wide or too narrow, remove the upper half of the bearing, install a new, complete bearing with the same color mark (select the color as shown in the next column), and recheck the clearance.

CAUTION

Do not file, shim, or scrape the bearings or the caps to adjust clearance.

(10) If the plastigage shows the clearance is still incorrect, try the next larger or smaller bearing (the color listed above or below that one), and check clearance again.

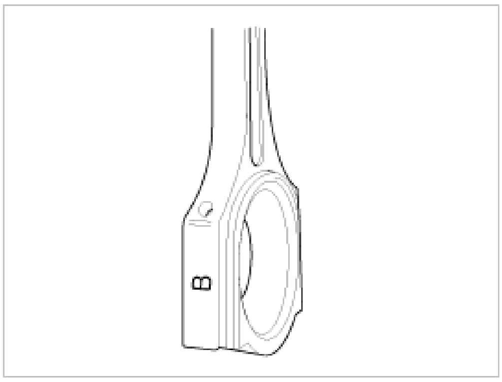
NOTE

If the proper clearance cannot be obtained by using the appropriate larger or smaller bearings, replace the crankshaft and start over.

CAUTION

If the marks are indecipherable because of an accumulation of dirt and dust, do not scrub them with a wire brush or scraper. Clean them only with solvent or detergent.

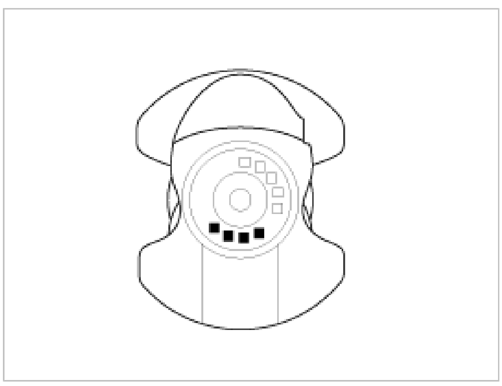
Connecting rod mark location



Discrimination of connecting rod

CLASS MA	RK	INSIDE DIAMETER
a	A	51.000 ~ 51.006mm (2.0079 ~ 2.0081in.)
b	B	51.006 ~ 51.012mm (2.0081 ~ 2.0083in.)
c	C	51.012 ~ 51.018mm (2.0083 ~ 2.0085in.)

Crankshaft pin mark location Discrimination of crankshaft

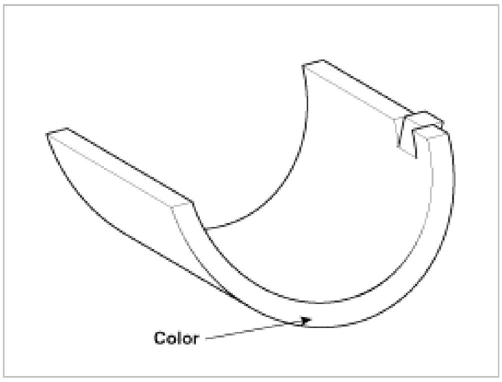


Discrimination of crankshaft

CLASS	MARK	OUTSIDE DIAMETER OF PIN
I	1	47.966 ~ 47.972mm (1.8884 ~ 1.8886in.)
II	2	47.960 ~ 47.966mm

		(1.8881 ~ 1.8884in.)
III	3	47.954 ~ 47.960mm (1.8879 ~ 1.8881in.)

Place of identification mark (Connecting rod bearing) Discrimination of connecting rod bearing



Discrimination of connecting rod bearing

CLASS	MARK	THICKNESS OF BEARING
AA	BLUE	1.514 ~ 1.517mm (0.0596 ~ 0.0597in.)
A	BLACK	1.511 ~ 1.514mm (0.0595 ~ 0.0596in.)
B	NONE	1.508 ~ 1.511mm (0.0594 ~ 0.0595in.)
C	GREEN	1.505 ~ 1.508mm (0.0593 ~ 0.0594in.)
D	YELLOW	1.502 ~ 1.505mm (0.0591 ~ 0.0593in)

(11) Selection

CRANKSHAFT INDENTIFICATION MARK	CONNECTING ROD IDENTIFICATION MARK	ASSEMBING CLASSIFICATION OF BEARING
I (1)	a (A)	D (YELLOW)
	b (B)	C (GREEN)
	c (C)	B (NONE)
II (2)	a (A)	C (GREEN)
	b (B)	B (NONE)
	c (C)	A (BLACK)
III (3)	a (A)	B (NONE)
	b (B)	A (BLACK)
	c (C)	AA (BLUE)

3. Check the crankshaft bearing oil clearance.
   (1) To check main bearing-to-journal oil clearance, remove the main caps and bearing halves.
   (2) Clean each main journal and bearing half with a clean shop tower.
   (3) Place one strip of plastigage across each main journal.
   (4) Reinstall the bearings and caps, then torque the bolts.

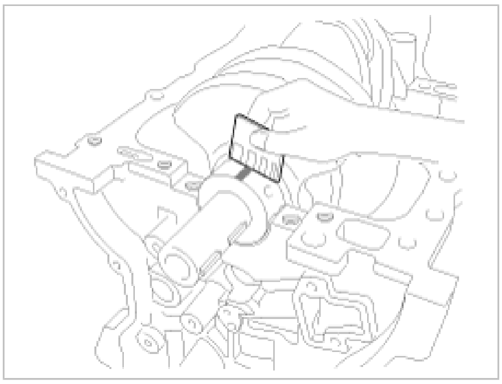
Tightening torque
14.7Nm (1.5kgf.m, 10.8lb-ft) + 27.5~31.4Nm (2.8~3.2kgf.m, 20.3~23.1lb-ft) + 120~125°

NOTE

Do not turn the crankshaft.

(5) Remove the cap and bearing again, and measure the widest part of the plastigage.

Standard oil clearance
0.026 ~ 0.048mm (0.0010 ~ 0.0019in.)



(6) If the plastigage measures too wide or too narrow, remove the upper half of the bearing, install a new, complete bearing with the same color mark (select the color as shown in the next column), and recheck the clearance.

CAUTION

Do not file, shim, or scrape the bearings or the caps to adjust clearance.

(7) If the plastigage shows the clearance is still incorrect, try the next larger or smaller bearing (the color listed above or below that one), and check clearance again.

NOTE

If the proper clearance cannot be obtained by using the appropriate larger or smaller bearings, replace the crankshaft and start over.

CAUTION

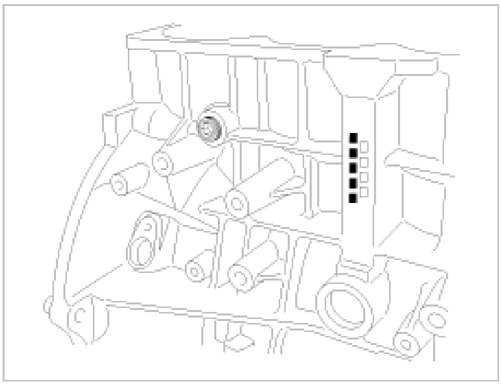
If the marks are indecipherable because of an accumulation of dirt and dust, do not scrub them with a wire brush or scraper. Clean them only with solvent or detergent.

Connecting rods

1. When reinstalling, make sure that cylinder numbers put on the connecting rod and cap at disassembly match. When a new connecting rod is installed, make sure that the notches for holding the bearing in place are on the same side.
2. Replace the connecting rod if it is damaged on the thrust faces at either end. Also if step wear or a severely rough surface of the inside diameter of the small end is apparent, the rod must be replaced as well.
3. Using a connecting rod aligning tool, check the rod for bend and twist. If the measured value is close to the repair limit, correct the rod by a press. Any connecting rod that has been severely bent or distorted should be replaced.

Allowable bend of connecting rod :
0.05mm / 100mm (0.0020 in./3.94 in.) or less
Allowable twist of connecting rod :
0.1mm / 100mm (0.0039 in./3.94 in.) or less

Crankshaft bore mark location
Letters have been stamped on the block as a mark for the size of each of the 5 main journal bores.
Use them, and the numbers or bar stamped on the crank (marks for main journal size), to choose the correct bearings.



Discrimination of cylinder block

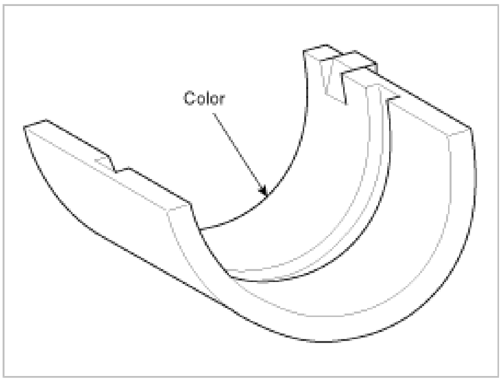
CLASS MA	RK	INSIDE DIAMETER
a	A	56.000 ~ 56.006mm (2.2047 ~ 2.2049in.)
b	B	56.006 ~ 56.012mm (2.2049 ~ 2.2052in.)
c	C	56.012 ~ 56.018mm (2.2052 ~ 2.2054in.)

Crankshaft journal mark location Discrimination of crankshaft

Discrimination of crankshaft

CLASS	MARK	OUTSIDE DIAMETER OF JOURNAL
I	1	51.954 ~ 51.960mm (2.0454 ~ 2.0456in.)
II	2	51.948 ~ 51.954mm (2.0452 ~ 2.0454.)
III	3	51.942 ~ 51.948mm (2.0449 ~ 2.0452in.)

Place of identification mark (Crankshaft bearing) Discrimination of crankshaft bearing



Discrimination of crankshaft bearing

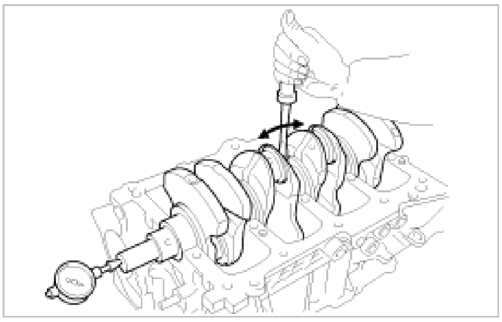
CLASS	MARK	THICKNESS OF BEARING
AA	BLUE	2.026 ~ 2.029mm (0.0797 ~ 0.0798in.)
A	BLACK	2.023 ~ 2.026mm (0.0796 ~ 0.0797in.)
B	NONE	2.020 ~ 2.023mm (0.0795 ~ 0.0796in.)
C	GREEN	2.017 ~ 2.020mm (0.0794 ~ 0.795in.)
D	YELLOW	2.014 ~ 2.017mm (0.0793 ~ 0.0794in.)

Selection

CRANKSHAFT IDENTIFICATION MARK	CRANKSHAFT BORE IDENTIFICATION MARK	ASSEMBLING CLASSIFICATION OF BEARING
I (1)	a (A)	D (YELLOW)
	b (B)	C (GREEN)
	c (C)	B (NONE)
II (2)	a (A)	C (GREEN)
	b (B)	B (NONE)
	c (C)	A (BLACK)
III (3)	a (A)	B (NONE)
	b (B)	A (BLACK)
	c (C)	AA (BLUE)

4. Check crankshaft end play.
   Using a dial indicator, measure the thrust clearance while prying the crankshaft back and forth with a screwdriver.

Standard end play
0.07 ~ 0.25mm (0.0027 ~ 0.0098in.)
Limit : 0.30mm (0.0118in.)

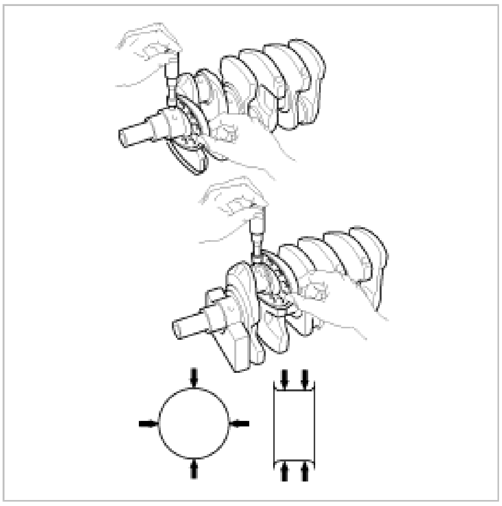


If the end play is greater than maximum, replace the thrust bearings as a set.

Thrust bearing thickness
1.925 ~ 1.965mm(0.0758 ~ 0.07736in.)

5. Inspect main journals and crank pins
   Using a micrometer, measure the diameter of each main journal and crank pin.

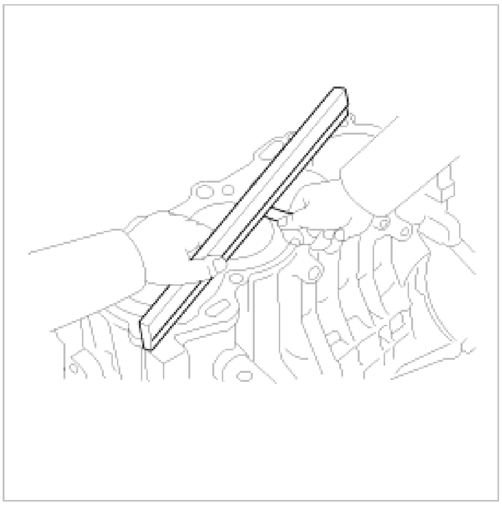
Main journal diameter : 51.942 ~ 51.960mm (2.0449 ~ 2.0456in.)
Crank pin diameter : 47.954 ~ 47.972mm (1.8879 ~ 1.8886in.)



CYLINDER BLOCK

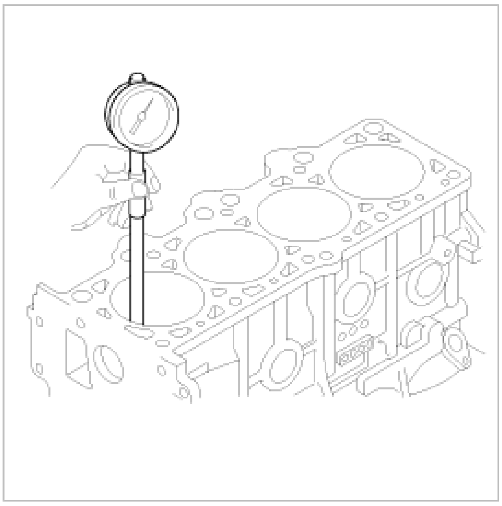
1. Remove gasket material.
   Using a gasket scraper, remove all the gasket material from the top surface of the cylinder block.
2. Clean cylinder block
   Using a soft brush and solvent, thoroughly clean the cylinder block.
3. Inspect top surface of cylinder block for flatness.
   Using a precision straight edge and feeler gauge, measure the surface contacting the cylinder head gasket for warpage.

Flatness of cylinder block gasket surface
Standard : Less than 0.05mm(0.0020 in.)



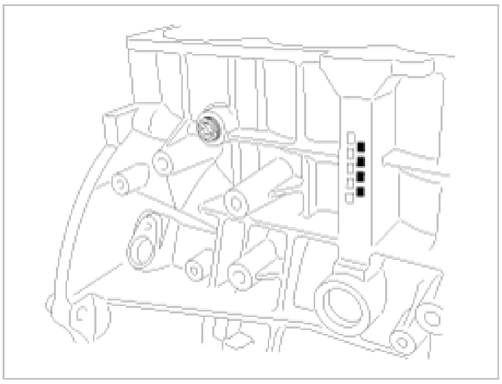
4. Inspect cylinder bore diameter
   Visually check the cylinder for vertical scratchs.
   If deep scratches are present, replace the cylinder block.
5. Inspect cylinder bore diameter
   Using a cylinder bore gauge, measure the cylinder bore diameter at position in the thrust and axial directions.

Standard diameter
88.00 ~ 88.03mm (3.4645 ~ 3.4657in.)



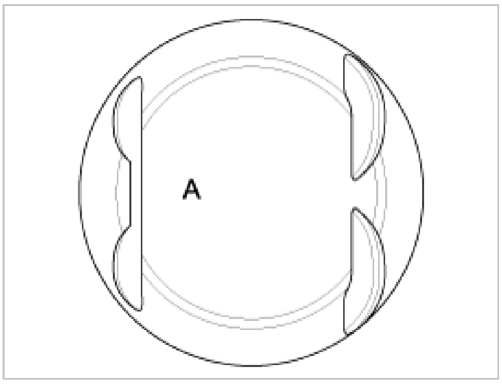
> NOTE
>
> Measure position(from the bottom of the cylinder block)
> : 110.7mm(4.3582in.)/160mm(6.2992in.)/210mm(8.2677in.)

6. Check the cylinder bore size code on the cylinder block.



Class	Cylinder bore inner diameter	Size code
A	88.00 ~ 88.01mm (3.4645~ 3.4649in.)	A
B	88.01 ~ 88.02mm (3.4649~ 3.4653in.)	B
C	88.02 ~ 88.03mm (3.4653~ 3.4657in.)	C

7. Check the piston size code on the piston top face.



> NOTE

Stamp the grade mark of basic diameter with rubber stamp.

Class	Piston outer diameter	Size code
A	87.97 ~ 87.98mm (3.4633 ~ 3.4637in.)	A
B	87.98 ~ 87.99mm (3.4637 ~ 3.4641in.)	None
C	87.99 ~ 88.00mm (3.4641 ~ 3.4645in.)	C

8. Select the piston related to cylinder bore class.

Clearance : 0.02 ~ 0.04mm (0.00078 ~ 0.00157in.)

PISTON AND RINGS

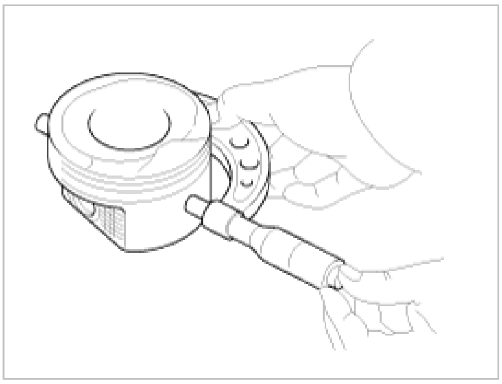
1. Clean piston
   (1) Using a gasket scraper, remove the carbon from the piston top.
   (2) Using a groove cleaning tool or broken ring, clean the piston ring grooves.
   (3) Using solvent and a brush, thoroughly clean the piston.

   NOTE

   Do not use a wire brush.

2. The standard measurement of the piston outside diameter is taken 47 mm (1.85 in.) from the top land of the piston.

Standard diameter
87.97 ~ 88.00mm (3.4633~ 3.4645in.)



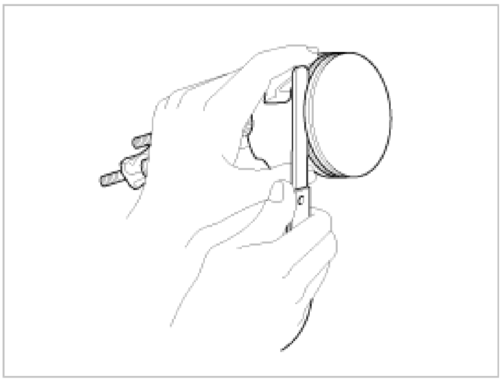
3. Calculate the difference between the cylinder bore diameter and the piston diameter.

Piston-to-cylinder clearance
0.02 ~ 0.04mm(0.0008 ~ 0.0016in.)

4. Inspect the piston ring side clearance.
   Using a feeler gauge, measure the clearance between new piston ring and the wall of the ring groove.

Piston ring side clearance
Standard
No.1 : 0.03 ~ 0.07mm (0.0012 ~ 0.0027in.)
No.2 : 0.03 ~ 0.07mm (0.0012 ~ 0.0027in.)
Oil ring : 0.06 ~ 0.15mm (0.0024 ~ 0.0059in.)
Limit
No.1 : 0.1mm (0.004in.)

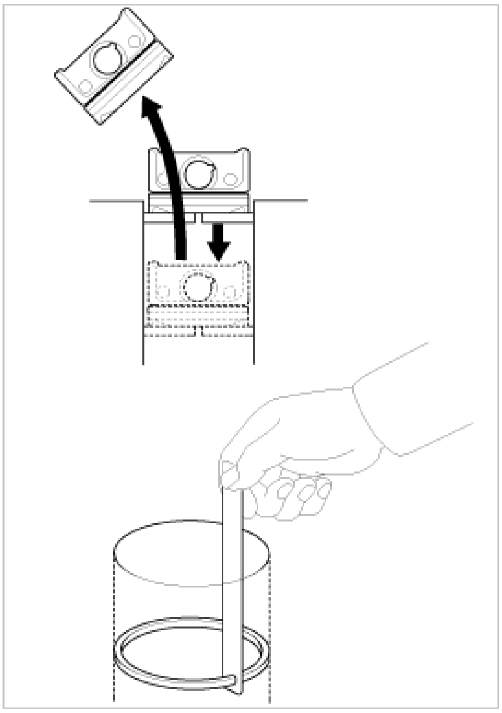
No.2 : 0.1mm (0.004in.)
Oil ring : 0.2mm (0.008in.)



If the clearance is greater than maximum, replace the piston.

5. Inspect piston ring end gap.
   To measure the piston ring end gap, insert a piston ring into the cylinder bore. Position the ring at right angles to the cylinder wall by gently pressing it down with a piston. Measure the gap with a feeler gauge. If the gap exceeds the service limit, replace the piston ring. If the gap is too large, recheck the cylinder bore diameter against the wear limits. If the bore is over the service limit, the cylinder block must be replaced.

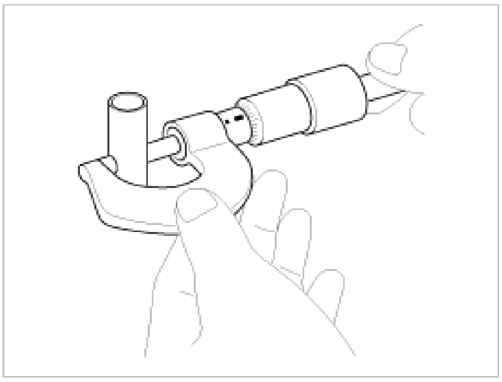
Piston ring end gap
Standard
No.1 : 0.15 ~ 0.30mm (0.0059 ~ 0.0118in.)
No.2 : 0.30 ~ 0.45m (0.0118 ~ 0.0177in.)
Oil ring : 0.20 ~ 0.70mm (0.0079 ~ 0.0275in.)
Limit
No.1 : 0.6mm (0.0236in.)
No.2 : 0.7mm (0.0275in.)
Oil ring : 0.8mm (0.0315in.)



PISTON PINS

1. Measure the diameter of the piston pin.

Piston pin diameter
21.001 ~ 21.006mm (0.8268 ~ 0.8270in.)



2. Measure the piston pin-to-piston clearance.

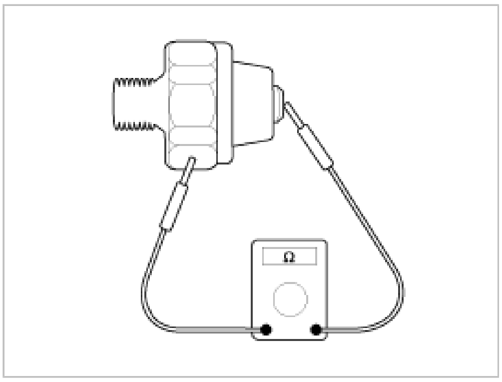
Piston pin-to-piston clearance
0.01 ~ 0.02mm (0.0004 ~ 0.0008in.)

3. Check the difference between the piston pin diameter and the connecting rod small end diameter.

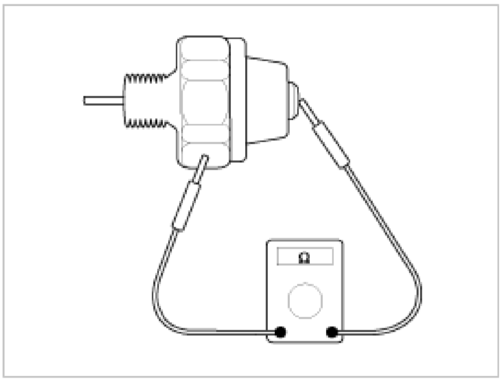
Piston pin-to-connecting rod interference
0.016 ~ 0.032mm (0.00063 ~ 0.00126in.)

OIL PRESSURE SWITCh

1. Check the continuity between the terminal and the body with an ohmmeter.
   If there is no continuity, replace the oil pressure switch.



2. Check the continuity between the terminal and the body when the fine wire is pushed. If there is continuity even when the fine wire is pushed, replace the switch.
3. If there is no continuity when a 50kpa (7psi) is applied throgh the oil hole, the switch is operaing properly.
   Check for air leakage. If air leaks, the diaphragm is broken. Replace it.

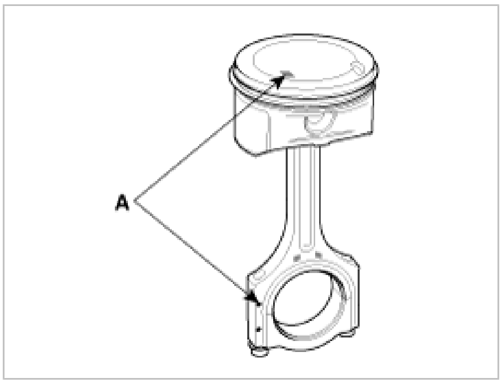


REASSEMBLY

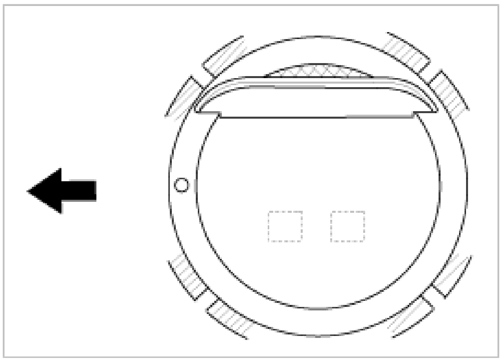
NOTE

• Thoroughly clean all parts to assembled.
• Before installing the parts, apply fresh engine oil to all sliding and rotating surfaces.
• Replace all gaskets, O-rings and oil seals with new parts.

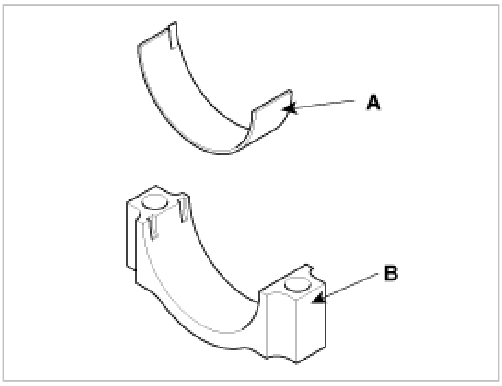
1. Assemble piston and connecting rod.
   (1) Use a hydraulic press for installation.
   (2) The piston front mark and the connecting rod front mark must face the timing belt side of the engine.



2. Install piston rings.
   (1) Install the oil ring spacer and 2 side rails by hand.
   (2) Using a piston ring expander, install the 2 compression rings with the code mark facing upward.
   (3) Position the piston rings so that the ring ends are as shown.



3. Install connecting rod bearings.
   (1) Align the bearing claw with the groove of the connecting rod or connecting rod cap.
   (2) Install the bearings(A) in the connecting rod and connecting rod cap(B).

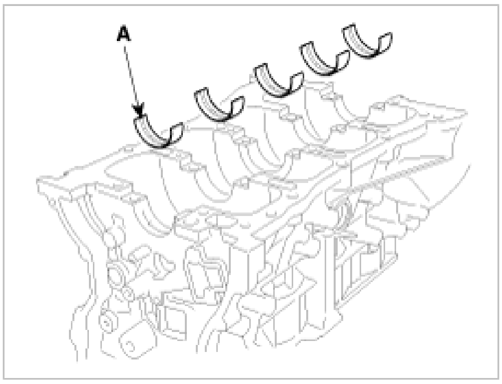


4. Install main bearings.

NOTE

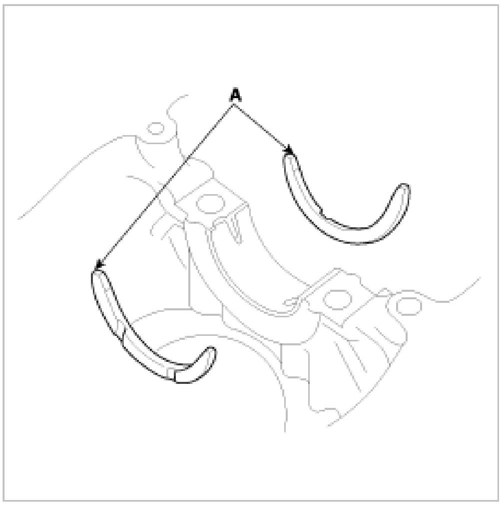
Upper bearings have an oil groove of oil holes; Lower bearings do not.

   (1) Align the bearing claw with the claw groove of the cylinder block, push in the 5 upper bearings(A).



(2) Align the bearing claw with the claw groove of the main bearing cap, and push in the 5 lower bearings.

5. Install thrust bearings.
   Install the 2 thrust bearings(A) under the No.3 journal position of the cylinder block with the oil grooves facing outward.



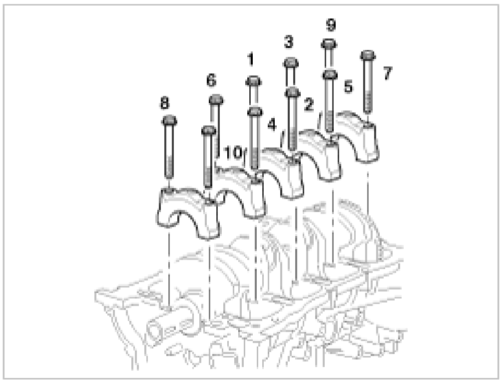
6. Place crankshaft on the cylinder block.
7. Place main bearing caps on cylinder block.
8. Install main bearing cap bolts.

> NOTE
>
> • The main bearing cap bolts are tightened in 2 progressive steps.
> • If any of the bearing cap bolts in broken or deformed, replace it.
> • Always use new main bearing cap bolt.

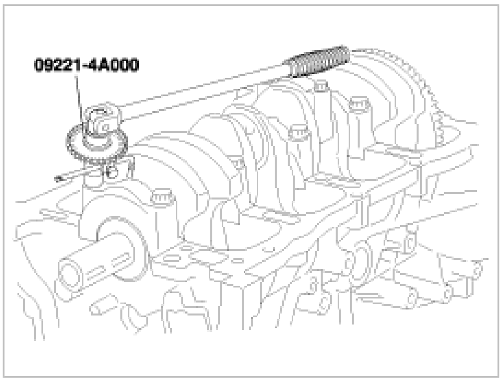
(1) Apply a light coat of engine oil on the threads and under the bearing cap bolts.

(2) Install and uniformly tighten the 10 bearing cap bolts(A), in several passes, in the sequence shown.

Tightening torque:
14.7Nm (1.5kgf.m, 10.8lb-ft) + 27.5~31.4Nm (2.8~3.2kgf.m, 20.3~23.1lb-ft) + 120~125°



(3) Retighten the bearing cap bolts by 120~125° in the numerical order shown.
Using SST(09221-4A000), install main bearing cap bolts.



(4) Check that the crankshaft turns smoothly.

9. Check crankshaft end play.
10. Install piston and connecting rod assemblies.

> **NOTE**
> Before installing the pistons, apply a coat of engine oil to the ring grooves and cylinder bores.

(1) Remove the connecting rod caps, and slip short sections of rubber hose over the threaded ends of the connecting rod bolts.

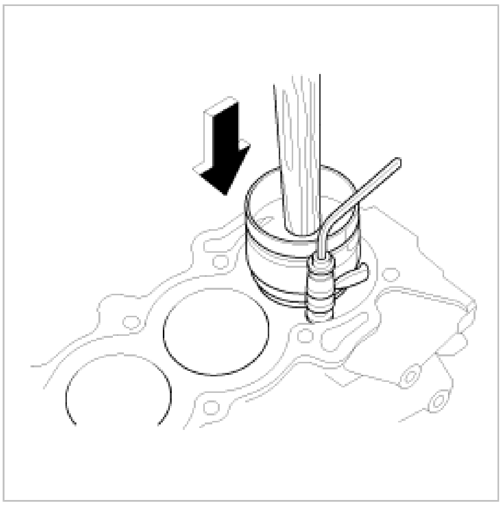
(2) Install the ring compressor, check that the bearing is securely in place, then position the piston in the cylinder, and tap it in using the wooden handle of a hammer.

(3) Stop after the ring compressor pops free, and check the connecting rod-to-check journal alignment before pushing the piston into place.

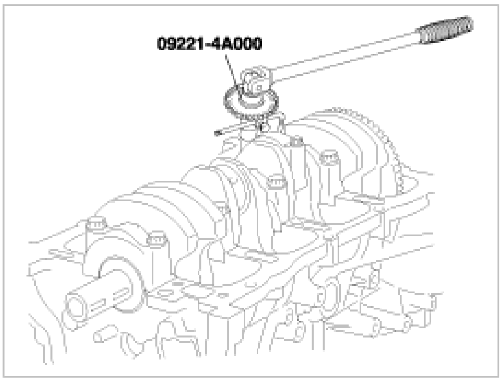
(4) Apply engine oil to the bolt threads. Install the rod caps with bearings, and torque the bolts.

Tightening torque
17.7~21.6Nm (1.8~2.2kgf.m, 13.0~15.9lb-ft) + 88~92°

> **NOTE**
> Maintain downward force on the ring compressor to prevent the rings from expanding before entering the cylinder bore.

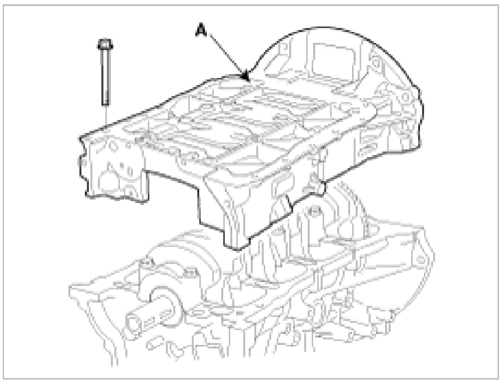


(5) Using SST(09221-4A000), install connecting rod bolts.



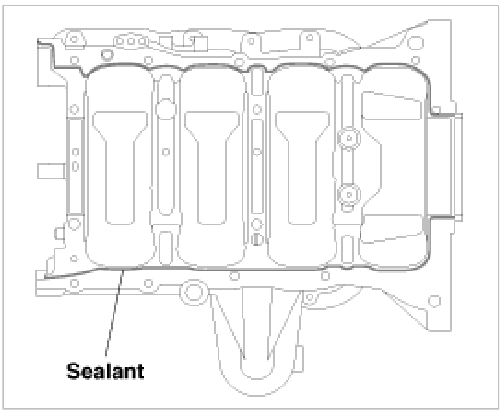
11. Install ladder frame(A) with 10 bolts.

Tightening torque
23.52 ~ 27.44Nm (2.4 ~ 2.8kgf.m, 17.35 ~ 20.24lbf.ft)



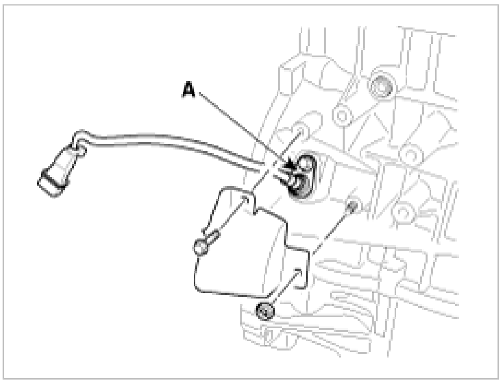
NOTE

- Be assembling ladder frame, the liquid sealant Loctite 5900 should be applied ladder frame.
- The part must be assembled within 5 minutes after sealant was applied.
- Apply sealant to the inner threads of the bolt holes.



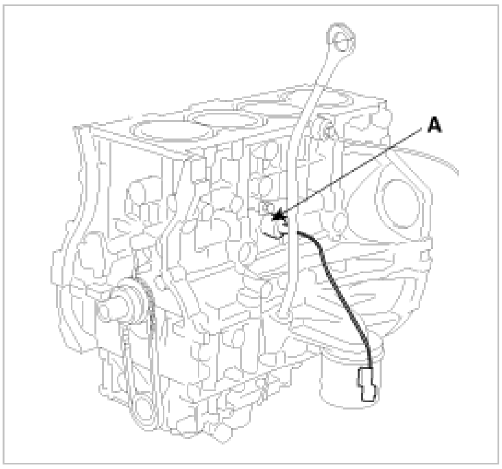
12. Install rear oil seal.
    (1) Apply engine oil to a new oil seal lip.
    (2) Using SST(09231-H1100, 09214-3K100) and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.
13. Install balance shaft module.
14. Install water pump.
15. Install CKP sensor(A) and sensor cover.

Tightening torque
3.92 ~ 5.88Nm (0.4 ~ 0.6kgf.m, 2.89 ~ 4.34lbf.ft)



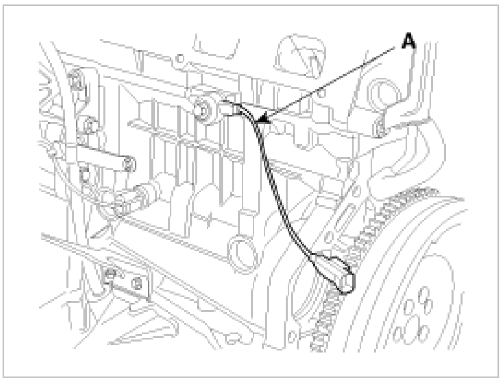
16. Install oil pressure sensor.
    (1) Apply adhesive to 2 or 3 threads.
        Adhesive : MS 721-39(B) or equivalent.
    (2) Install the oil pressure sensor (A).

Tightening torque
7.84 ~ 11.76Nm (0.8 ~ 1.2kgf.m, 5.78 ~ 8.67lbf.ft)



17. Install knock sensor(A).

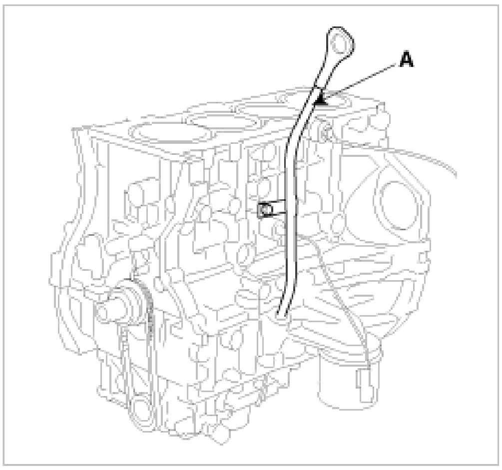
Tightening torque
16.66 ~ 25.48Nm (1.7 ~ 2.6kgf.m, 12.29 ~ 18.78lbf.ft)



18. Install oil level gauge assembly.
    (1) Install a new O-ring on the oil level gauge.
    (2) Apply engine oil on the O-ring.
    (3) Install the oil level gauge assembly(A) with the bolt.

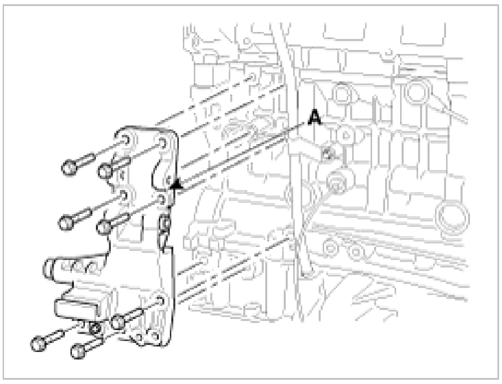
Tightening torque

7.84 ~ 11.76Nm (0.8 ~ 1.2kgf.m, 5.78 ~ 8.67lbf.ft)



19. Install tensioner assembly integrated bracket(A).

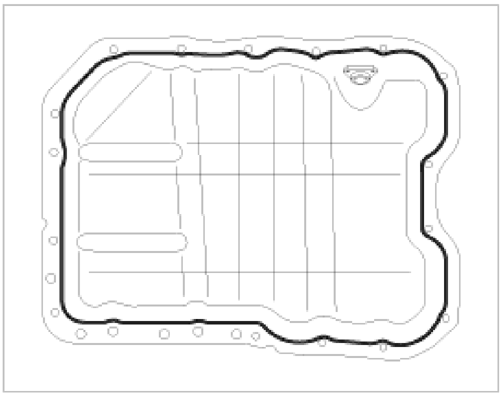
Tightening torque
39.2 ~ 44.1Nm (4.0 ~ 4.5kgf.m, 28.92 ~ 32.53lbf.ft)



20. Install power steering pomp bracket and power steering pump. (See ST group)
21. Install alternator. (See EE group)
22. Install A/C compressor. (See HA group)
23. Install cylinder head.
24. Install timing chain.
25. Install oil pan.
    (1) Using a razor blade and gasket scraper, remove all the old packing material from the gasket surfaces.

    > NOTE
    >
    > Check that the mating surfaces are clean and dry before applying liquid gasket.

    (2) Apply liquid gasket as an even bead, centered between the edges of the mating surface.
    Use liquid gasket LOCTITE5900 or equivalent(MS721-40A).

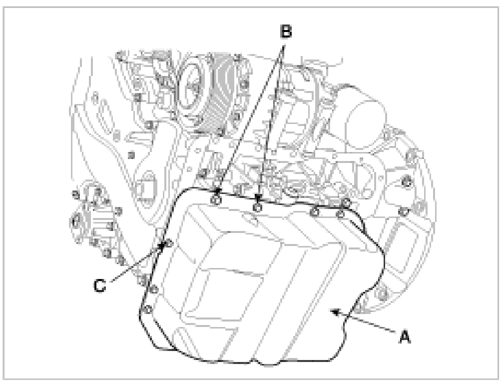


NOTE

- To prevent leakage of oil, apply liquid gasket to the inner threads of the bolt holes.
- Do not install the parts if five minutes or more have elapsed since applying the liquid gasket. Instead, reapply liquid gasket after removing the residue.
- After assembly, wait at least 30 minutes before filling the engine with oil.

(3) Install the oil pan(A).
Uniformly tighten the bolts in several passes.

Tightening torque
M8(B) : 26.46 ~ 30.38Nm (2.7 ~ 3.1kgf.m, 19.52 ~ 22.41lbf.ft)
M6(C) : 9.8 ~ 11.76Nm (1.0 ~ 1.2kgf.m, 7.23 ~ 8.67lbf.ft)



26. Remove engine stand.
27. A/T : Install drive plate.

Tightening torque
117.6 ~ 127.4Nm (12 ~ 13kgf.m, 86.75 ~ 93.98lbf.ft)

28. M/T : Install flywheel.

Tightening torque
117.6 ~ 127.4Nm (12 ~ 13kgf.m, 86.75 ~ 93.98lbf.ft)

NOTE

- Always use new flywheel(drive plate) bolts.
- Install and uniformly tighten the 7 bolts, in several passes.

Engine Mechanical System > Cooling System > Description and Operation

Engine Coolant Refilling and Bleeding

WARNING

Never remove the radiator cap when the engine is hot. Serious scalding could be caused by hot fluid under high pressure escaping from the radiator.

CAUTION

When pouring engine coolant, be sure to shut the relay box lid and not to let coolant spill on the electrical parts or the paint. If any coolant spills, rinse it off immediately.

1. Make sure the engine and radiator are cool to the touch.
2. Remove radiator cap.
3. Loosen the drain plug, and drain the coolant.
4. Tighten the radiator drain plug securely.
5. Remove, drain and reinstall the reservoir. Fill the tank halfway to the MAX mark with water, then up to the MAX mark with antifreeze.
6. Fill fluid mixture with coolant and water(4 : 6) slowly through the radiator cap. Push the upper/lower hoses of the radiator so as bleed air easily.

   NOTE

   - Use only genuine antifreese/coolant.
   - For best corrosion protection, the coolant concentration must be maintained year-round at 50% minimum. Coolant concentrations less than 50% may not provide sufficient protection against corrosion or freezing.
   - Coolant concentrations greater then 60% will impair cooling efficiency and are not recommended.

   CAUTION

   - Do not mix different brands of antifreeze/coolants.
   - Do not use additional rust inhibitors or anti-rust products; they may not be compatible with the coolant.

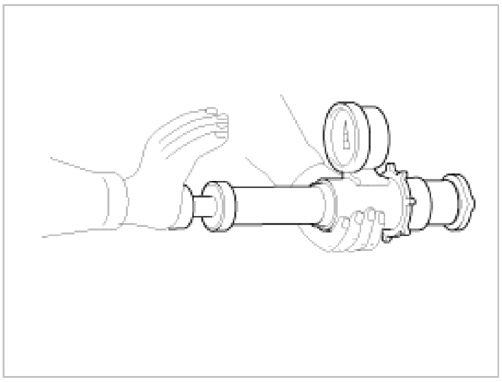
7. Start the engine and run coolant circulates.
   When the cooling fan operates and coolant curculates, refill coolant through the radiator cap.
8. Repeat 7 until the cooling fan 3 ~ 5times and bleed air sufficiently out of the cooling system.
9. Install the radiator cap and fill the reservoir tank to the "MAX" line with coolant.
10. Run the vehicle under idle until the cooling fan operates 2 ~ 3 times.
11. Stop the engine and wait coolant gets cool.
12. Repeat 6 to 11 until the coolant level doesn't fall any more, bleed air out of the cooling system.

    NOTE

    As it is to bleed air out to the cooling system and refill coolant when coolant gets cool completely, recheck the coolant level in the reservoir tank for 2 ~ 3 days after replacing coolant.

Cap Testing

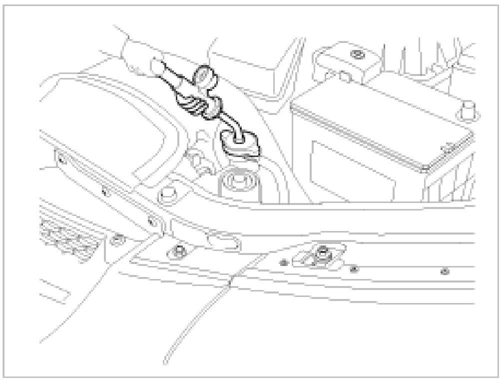
1. Remove the radiator cap, wet its seal with engine coolant, then install it no pressure tester.



2. Apply a pressure of 93 ~ 123kPa (0.95 ~ 1.25kgf/cm², 14 ~ 19psi)
3. Check for a drop in pressure.
4. If the pressure drops, replace the cap.

Testing

1. Wait until engine is cool, then carefully remove the radiator cap and fill the radiator with engine coolant, then install it on the pressure tester.

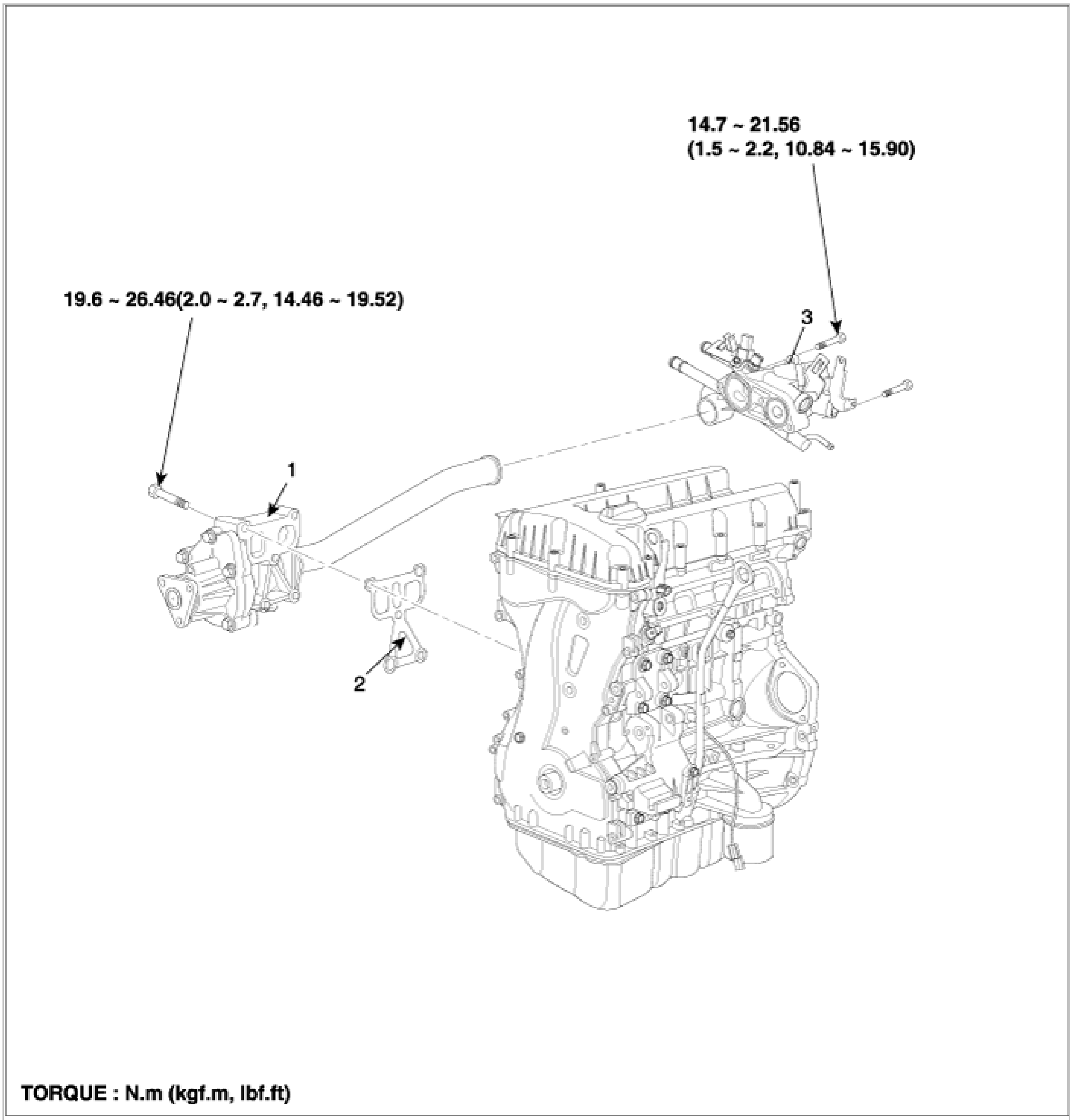


2. Apply a pressure tester to the radiator and apply a pressure of 93 ~ 123kPa (0.95 ~ 1.25kgf/cm² 14 ~ 18psi).
3. Inspect for engine coolant leaks and a drop in pressure.
4. Remove the tester and reinstall the radiator cap.

> NOTE
>
> Check for engine oil in the coolant and/or coolant in the engine oil.

Engine Mechanical System > Cooling System > Components and Components Location

COMPONENT



1. Water pump
2. Water pump gasket
3. Water temp control assembly

Engine Mechanical System > Cooling System > Repair procedures

REMOVAL

WATER PUMP

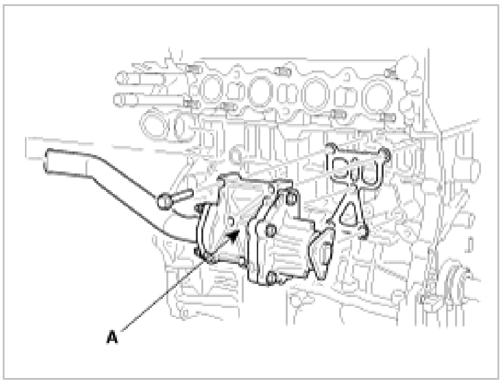
1. Drain the engine coolant.

> WARNING
>
> System is under high pressure when the engine is hot. To avoid danger of releasing scalding engine coolant, remove the cap only when the engine is cool.

2. Remove drive belt.
3. Remove exhaust manifold.
4. Remove the water pump.

(1) Remove the 4 bolts and pump pulley.

(2) Remove the water pump(B) and gasket.

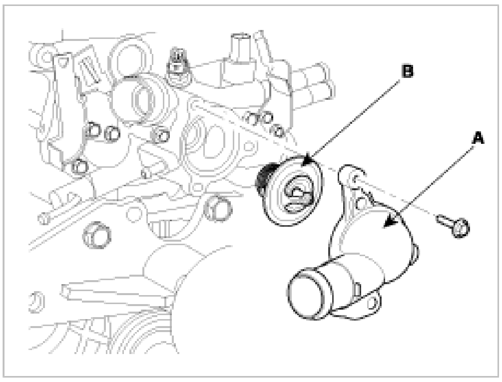


5. Remove water inlet pipe nut.

THERMOSTAT

> NOTE
>
> Removal of the thermostat would have an adverse effect, causing a lowering of cooling efficiency. Do not remove the thermostat, even if the engine tends to overheat.

1. Drain engine coolant so its level is below thermostat.
2. Remove water inlet(A) and thermostat(B).



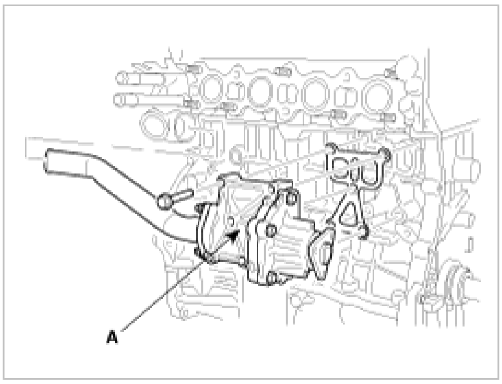
INSTALLATION

WATER PUMP

1. Install the water pump.

(1) Install the water pump(A) and a new gasket with the 5 bolts.

Tightening torque
19.6 ~ 26.46Nm (2.0 ~ 2.7kgf.m, 14.46 ~ 19.52lbf.ft)



(2) Install the 4 bolts and pump pulley.

2. Install water inlet pipe nut.

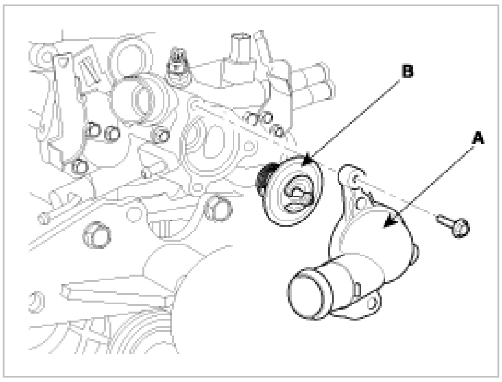
Tightening torque
19.6 ~ 26.46Nm (2.0 ~ 2.7kgf.m, 14.46 ~ 19.52lbf.ft)

3. Install exhaust manifold.
4. Install drive belt.
5. Fill with engine coolant.
6. Start engine and check for leaks.
7. Recheck engine coolant level.

THERMOSTAT

1. Place thermostat in thermostat housing.
   (1) Install the thermostat with the jiggle valve upward.

   (2) Install a new thermostat(B).



2. Install water inlet(A).

Tightening torque
14.7 ~ 21.56Nm (1.5 ~ 2.2kgf.m, 10.84 ~ 15.90lbf.ft)

3. Fill with engine coolant.
4. Start engine and check for leaks.

INSPECTION

WATER PUMP

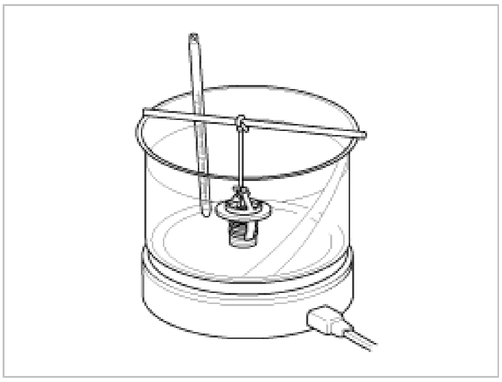
1. Check each part for cracks, damage or wear, and replace the coolant pump assembly if necessary.
2. Check the bearing for damage, abnormal noise and sluggish rotation, and replace the coolant pump assembly if necessary.
3. Check for coolant leakage. If coolant leaks from hole, the seal is defective. Replace the coolant pump assembly

NOTE

A small amount of "weeping" from the bleed hole is normal.

THERMOSTAT

1. Immerse the thermostat in water and gradually heat the water.



2. Check the valve opening temperature.

Valve opening temperature : 82°C (177°F)
Full opening temperature : 95°C (205°F)

If the valve opening temperature is not as specified, replace the thermostat.

3. Check the valve lift.

Valve lift : 8mm (0.3in.) or more at 95°C (205°F)

If the valve lift is not as specified, replace the thermostat.

Engine Mechanical System > Lubrication System > Description and Operation

OIL AND FILTER

CAUTION

- Prolonged and repeated contact with mineral oil will result in the removal of natural fats from the skin, leading to dryness, irritation and dermatitis. In addition, used engine oil contains potentially harmful contaminants which may cause skin cancer.
- Exercise caution in order to minimize the length and frequency of contact of your skin to used oil. Wear protective clothing and gloves. Wash your skin thoroughly with soap and water, or use water-less hand cleaner, to remove any used engine oil. Do not use gasoline, thinners, or solvents.
- In order to preserve the environment, used oil and used oil filter must be disposed of only at designated disposal sites.

1. Drain engine oil.
   A. Remove the oil filter cap.
   B. Remove the oil drain plug, and drain the oil into a container.
2. Replace oil filter.
   A. Remove the oil filter.
   B. Check and clean the oil filter installation surface.
   C. Check the part number of the new oil filter is as same as old one.
   D. Apply clean engine oil to the gasket of a new oil filter.
   E. Lightly screw the oil filter into place, and tighten it until the gasket contacts the seat.

   Tightening torque
   11.76 ~ 15.68Nm (1.2 ~ 1.6kgf.m, 8.67 ~ 11.57lbf.ft)

3. Refill with engine oil filter.
   A. Clean and install the oil drain plug with a new gasket.

   Tightening torque
   34.3 ~ 44.1N.m (3.5 ~ 4.5kgf.m, 25.3 ~ 32.5lb-ft)

   B. Fill with fresh engine oil

Capacity
Drain and refill
W/Oil filter change : 4.0l (4.23U.S.qts, 3.52lmp qts)
W/O Oil filter change : 3.7l (3.90U.S.qts, 3.26lmp qts)

C. Install the oil filter cap.

4. Start engine and check for oil leaks.
5. Recheck engine oil level.

INSPECTION

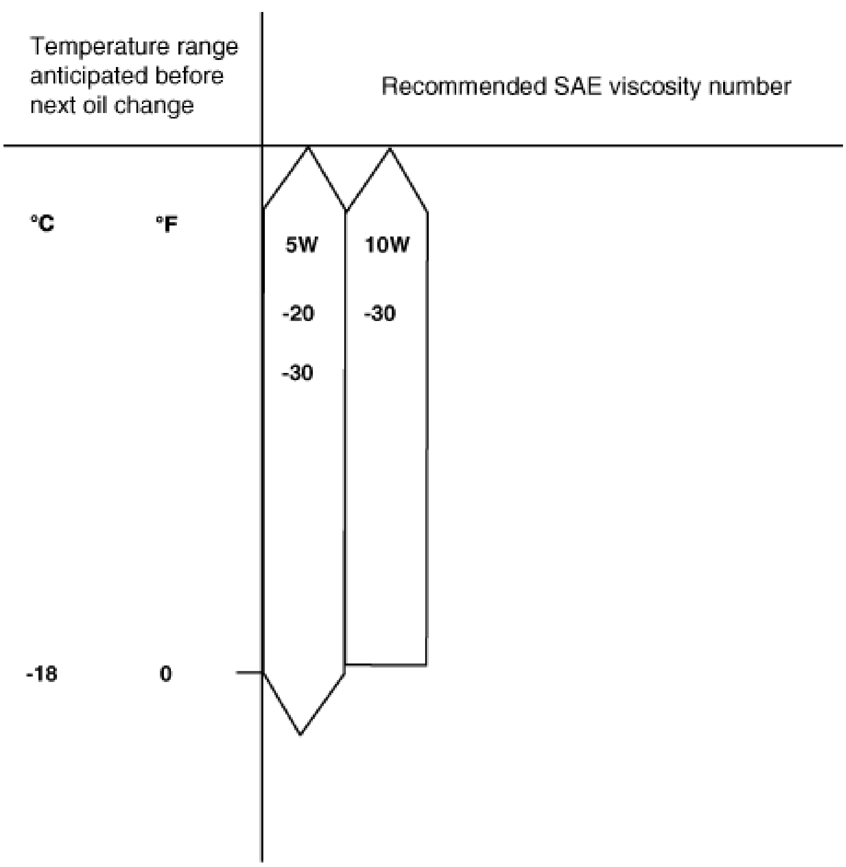
1. Check engine oil quality
   Check the oil for deterioration, entry of water, discoloring or thinning.
   If the quality is visibly poor, replace the oil.
2. Check engine oil level.
   After warming up the engine and then 5 minutes after the engine stop, oil level should be between the "L" and "F" marks on the dipstick.
   If low, check for leakage and add oil up to the "F" mark.

NOTE

Do not fill with engine oil above the "F" mark.

SELECTION OF ENGINE OIL

Recommended SAE viscosity grades : 5W-20
If 5W-20 engine oil is not available, secondary recommended engine oil can be used for corresponding temperature range.



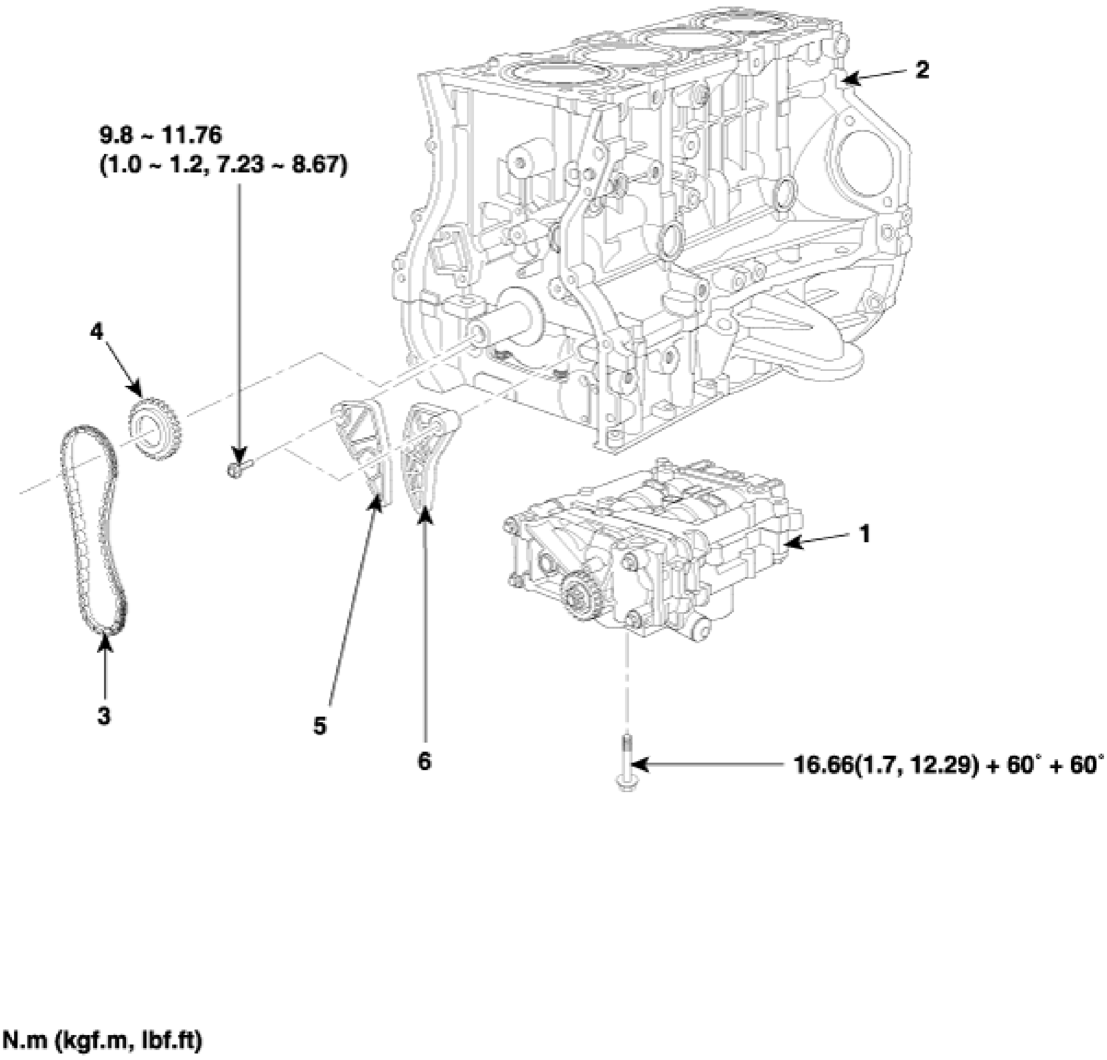
NOTE

For best performance and maximum protection of all types of operation, select only those lubricants whitch :
- Satisfy the requirement of the API classification.
- Have proper SAE grade number for expected ambient temperature range.

Lubricants that do not have both an SAE grade number and API service classification on the container should not be used.

Engine Mechanical System > Lubrication System > Components and Components Location

COMPONENT

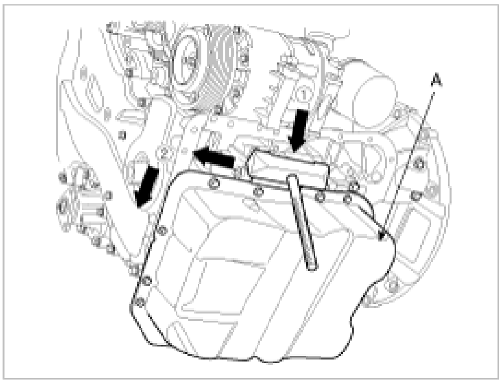


1. Balance shaft module
2. Cylinder block
3. Balance shaft chain
4. Balance shaft chain sprocket
5. Balance shaft chain guide
6. Balance shaft chain tensioner arm

Engine Mechanical System > Lubrication System > Repair procedures

REMOVAL

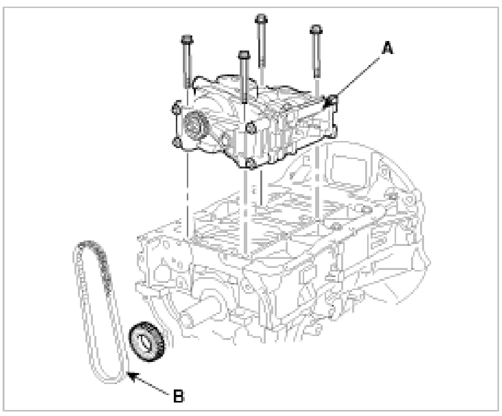
1. Drain engine oil.
2. Remove the drive belt.
3. Turn the crankshaft and align the white groove on the crankshaft pulley with the pointer on the lower cover.
4. Remove the oil pan.



CAUTION

- Insert the SST between the oil pan and the ladder frame by tapping it with a plastic hammer in the direction of ① arrow.
- After tapping the SST with a plastic hammer along the direction of ② arrow around more than 2/3 edge of the oil pan, remove it from the ladder frame.
- Do not turn over the SST abruptly without tapping. It be result in damage of the SST.

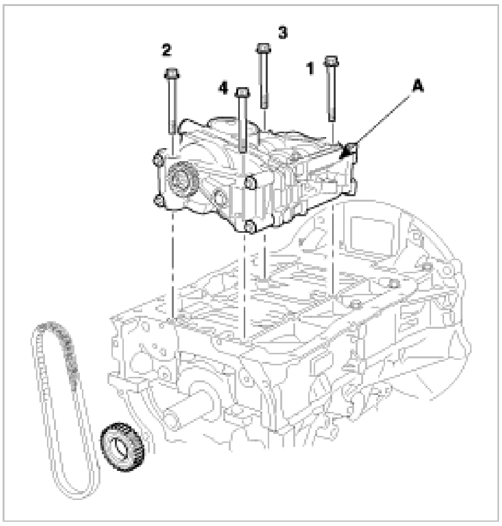
5. Remove the timing chain.
6. Remove balance shaft chain(B) and balance shaft module(A).



INSTALLATION

1. Install balance shaft chain.
2. Confirm the balance shaft module timing mark. Timing marks to be visually aligned with centers of adjacent cast timing notches.
3. Install balance shaft module that the timing mark of balance shaft module sprocket should be matched with the timing mark (color link) of balance shaft chain.

Tightenig torque
16.66Nm (1.7kgf.m, 12.3lbf.ft) + 60°+ 60°

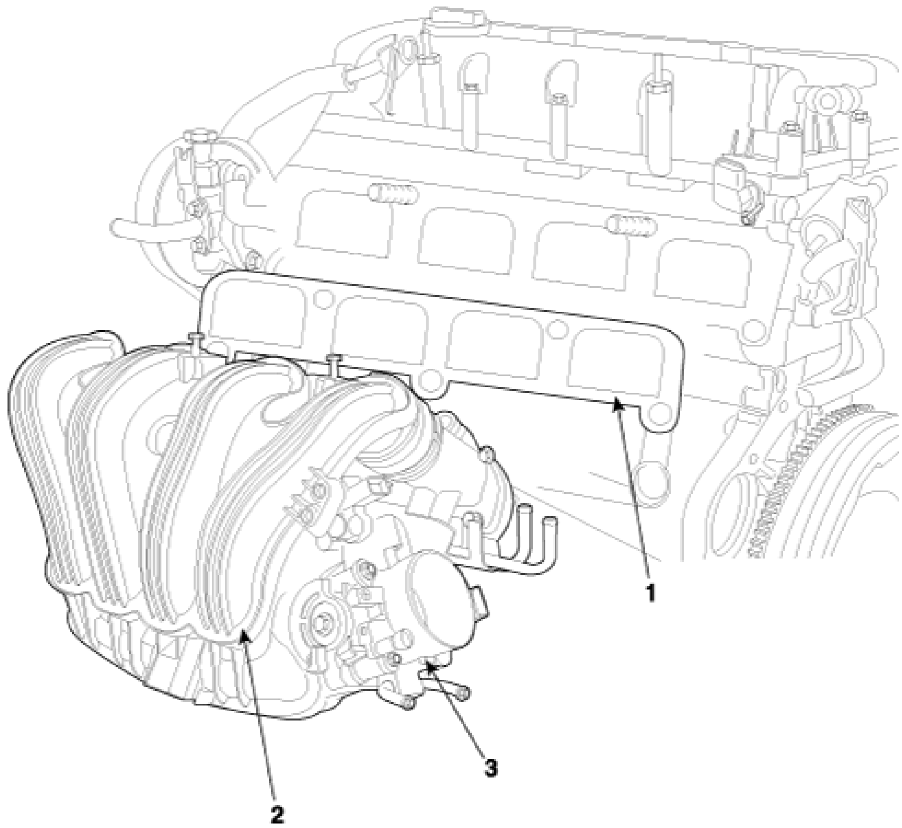


4. Install timing chain.
5. Install oil pan.
6. Fill with engine oil.
7. Start engine and check for leaks.

Engine Mechanical System > Intake And Exhaust System > Components and Components Location

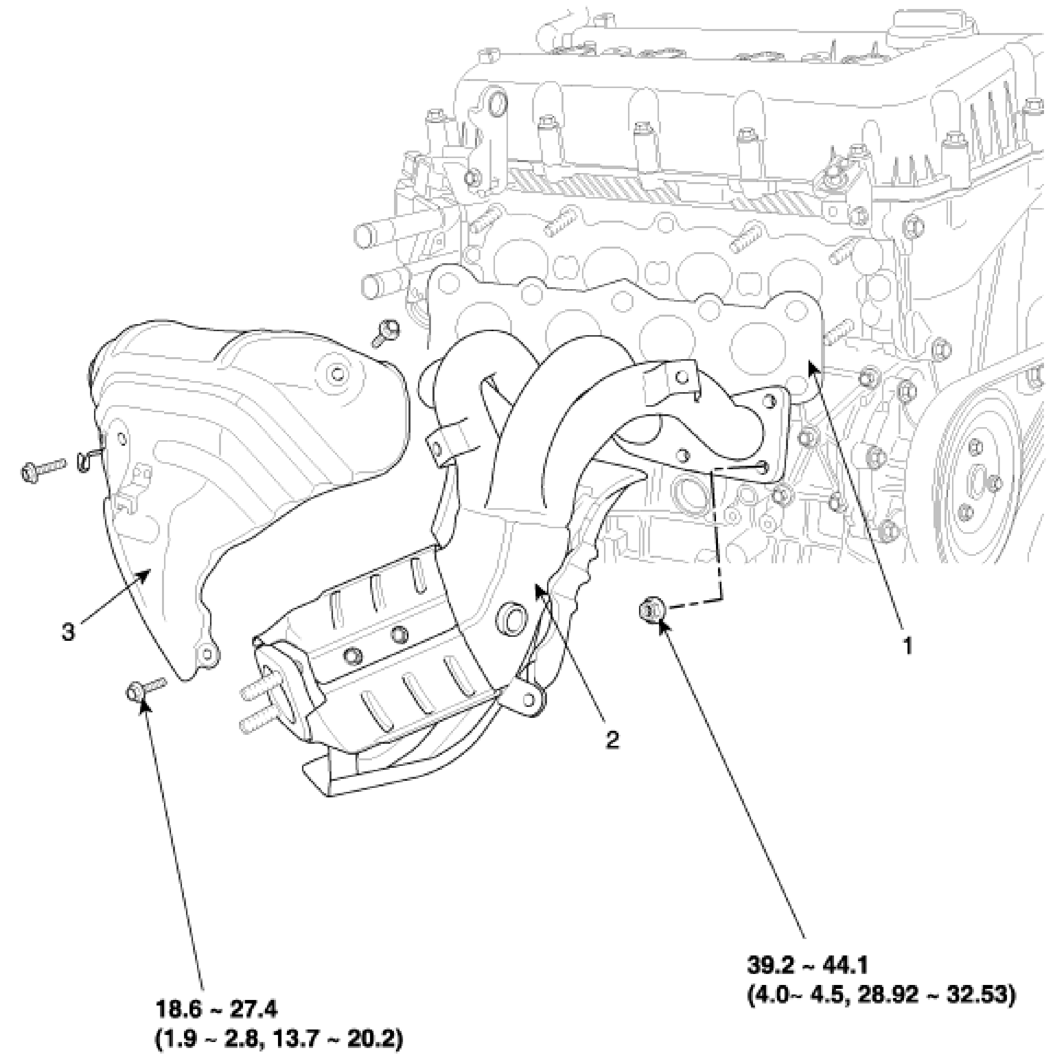
COMPONENT

INTAKE MANIFOLD



1. Intake manifold gasket
2. Intake manifold assembly
3. Throttle body

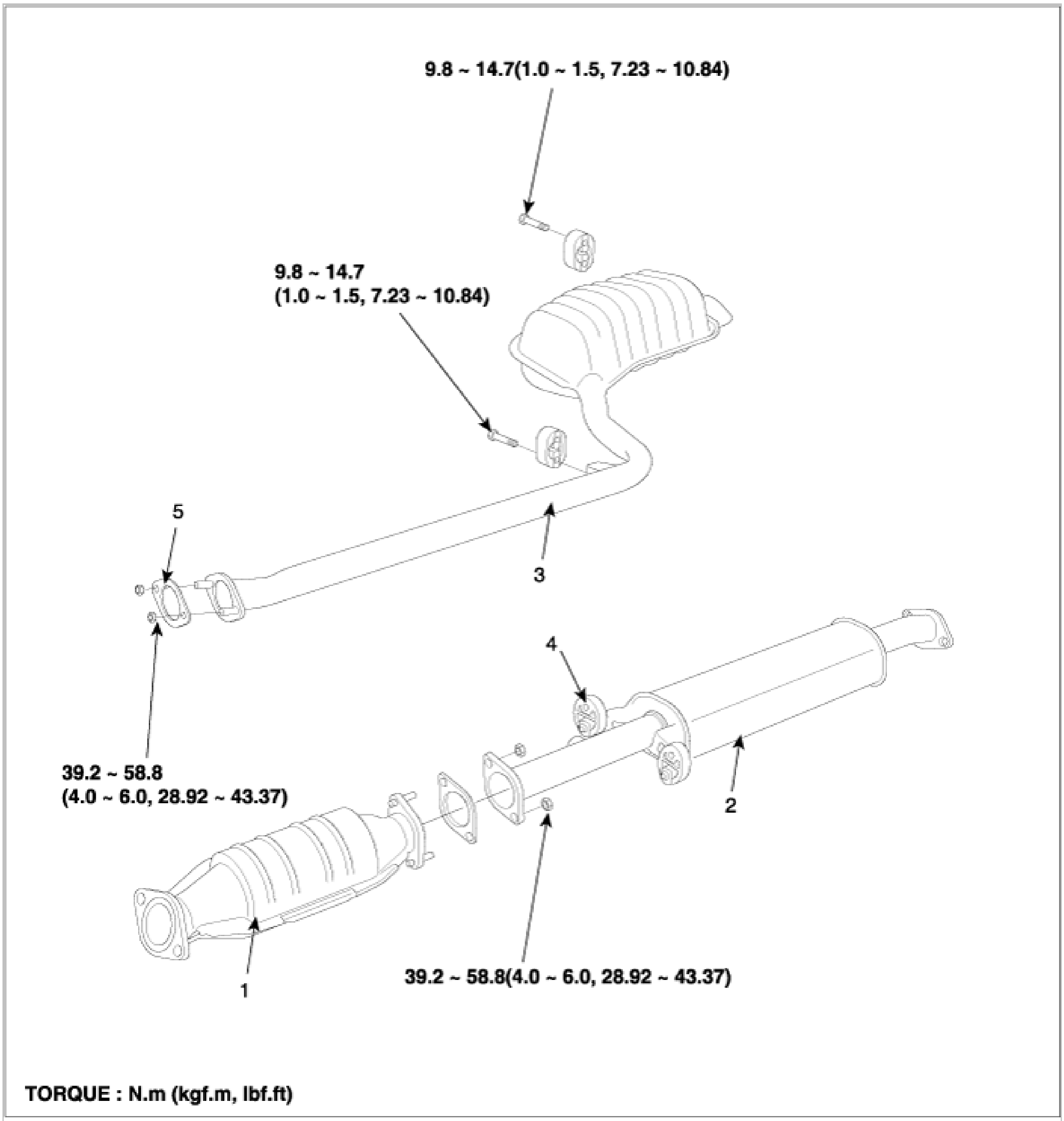
EXHAUST MANIFOLD



TORQUE : Nm (kgf.m, lbf.ft)

1. Exhaust manifold gasket
2. Exhaust manifold
3. Heat protector

MUFFLER



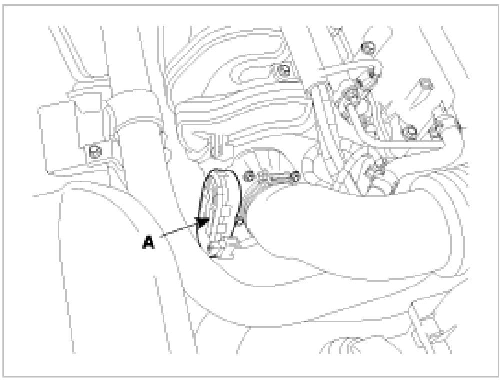
1. Catalytic converter
2. Center muffler
3. Main muffler
4. Rnbber hanger
5. Gasket

Engine Mechanical System > Intake And Exhaust System > Repair procedures

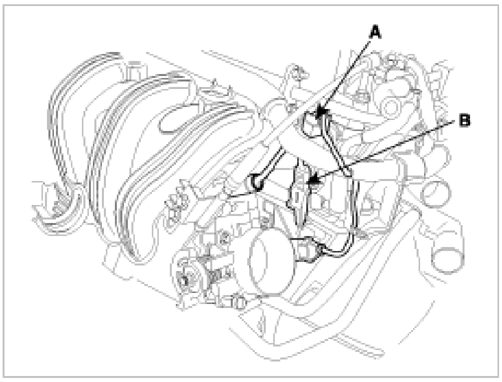
REMOVAL

INTAKE MANIFOLD

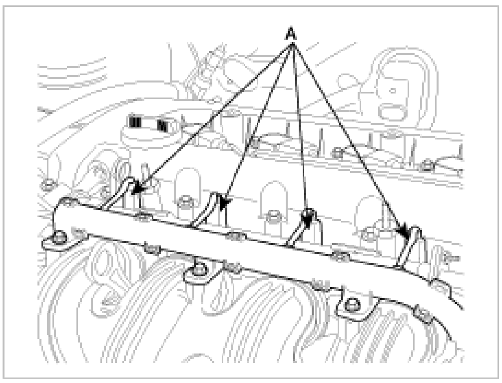
1. Remove the engine cover.
2. Disconnect ETS connector(A)



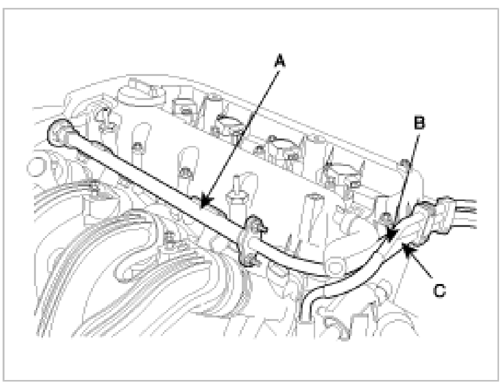
3. Disconnect CMP connector(A), and knock sensor connector(B).



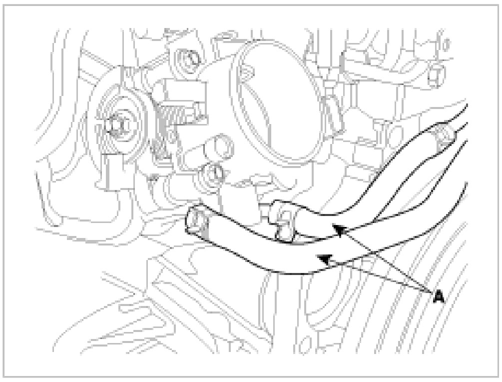
4. Disconnect injector connector(A).



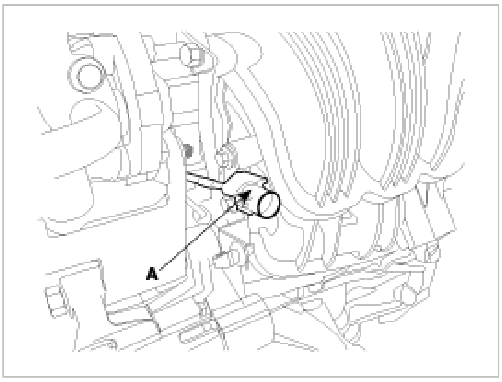
5. Remove the delivery pipe(A), brake vacuum hose(B), and PCSV hose(C).



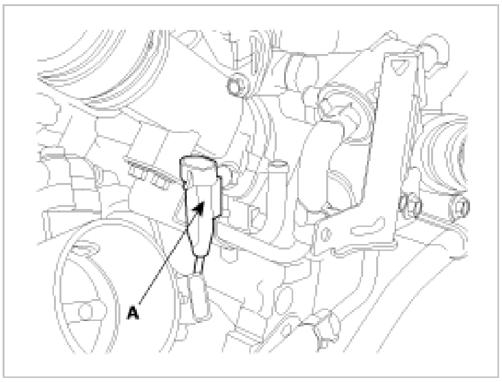
6. Remove coolant hose(A) from throttle body.



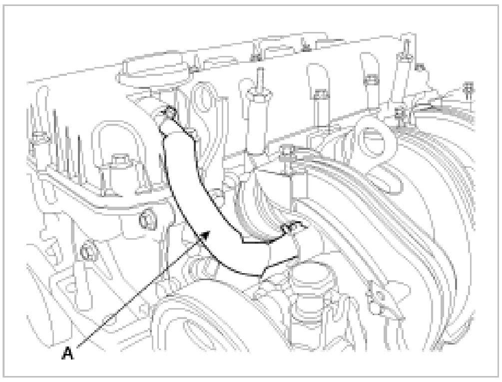
7. Remove oil pressure switch connector(A) from bracket.



8. Remove knock sensor connector(A) from bracket.

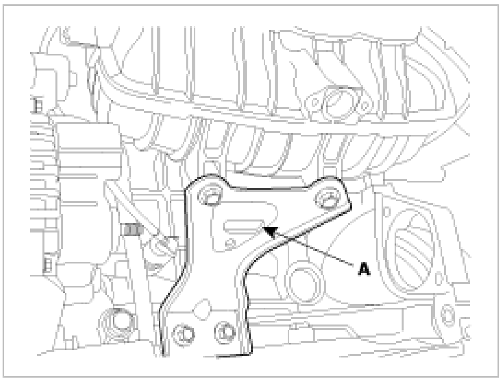


9. Remove PCV hose(A).

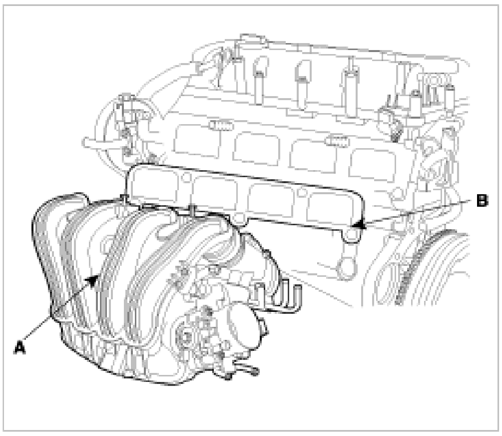


10. Remove oil level gauge.

11. Remove intake manifold stay(A).

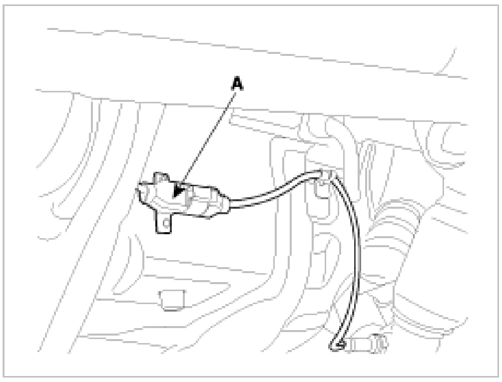


12. Remove intake manifold(A) and gasket(B).

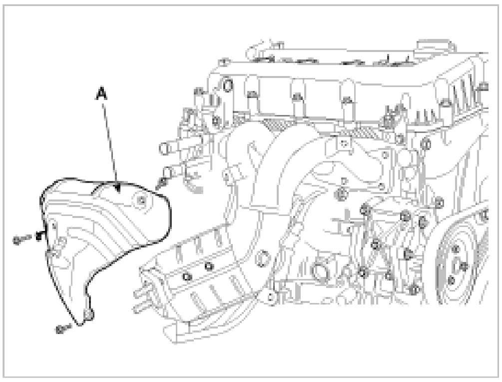


Exhaust manifold

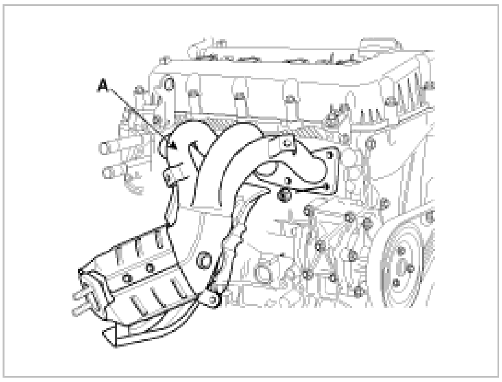
1. Remove the oxygen sensor connector.



2. Remove the front muffler.
3. Remove the heat protector(A).



4. Remove exhaust manifold stay bolt.
5. Remove exhaust manifold(A) and gasket.



INSTALLATION

EXHAUST MANIFOLD

1. Install new gasket and exhaust manifold.

Tightening torque
39.2 ~ 44.1N.m(4.0 ~ 4.5kgf.m, 28.92 ~ 32.53lbf.ft)

2. Install exhaust manifold stay bolt.

Tightening torque
51.94 ~ 57.82N.m(5.4 ~ 5.9kgf.m, 38.3 ~ 42.6lbf.ft)

3. Install heat protector.

Tightening torque
18.6 ~ 27.44N.m(1.9 ~ 2.8kgf.m, 13.7 ~ 20.2lbf.ft)

4. Install front muffler.

Tightening torque
39.2 ~ 58.8N.m(4.0 ~ 6.0kgf.m, 28.92 ~ 43.37lbf.ft)

5. Connect oxygen sensor connector.

INTAKE MANIFOLD

1. Install intake manifold.

Tightening torque
18.62 ~ 27.44N.m(1.9 ~ 2.8kgf.m, 13.7 ~ 20.2lbf.ft)

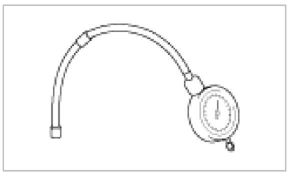
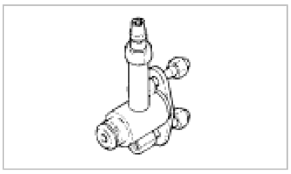
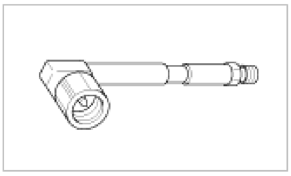
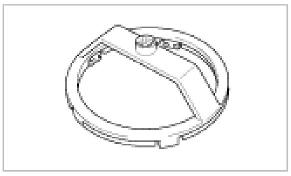
2. Install intake manifold stay.

Tightening torque
18.6 ~ 27.44N.m(1.9 ~ 2.8kgf.m, 13.7 ~ 20.2lbf.ft)

3. Install oil level gauge
4. Install PCV hose
5. Install air cleaner assembly.
6. Install engine cover.

Fuel System > General Information > Special Service Tools

SPECIAL SERVICE TOOLS

Tool (Number and name)	Illustration	Application
09353-24100 Fuel Pressure Gauge		Measuring the fuel line pressure
09353-38000 Fuel Pressure Gauge Adapter		Connection between the delivery pipe and fuel feed line
09353-24000 Fuel Pressure Gauge Connector		Connection between Fuel Pressure Gauge (09353-24100) and Fuel Pressure Gauge Adapter (09353-38000)
09310-3K000 Fuel Pump Locking Ring Wrench		Removing the fuel Pump assembly

Fuel System > General Information > Troubleshooting

BASIC TROUBLESHOOTING

BASIC TROUBLESHOOTING GUIDE

1	**Bring Vehicle to Workshop**

2	**Analyze Customer's Problem**
•	Ask the customer about the conditions and environment relative to the issue (Use CUSTOMER PROBLEM ANALYSIS SHEET).

3	**Verify Symptom, and then Check DTC and Freeze Frame Data**
•	Connect Hi-Scan (Pro) to Diagnostic Link Connector (DLC).
•	Record the DTC and freeze frame data.
	NOTE *To erase DTC and freeze frame data, refer to Step 5.*

4	**Confirm the Inspection Procedure for the System or Part**
•	Using the SYMPTOM TROUBLESHOOTING GUIDE CHART, choose the correct inspection procedure for the system or part to be checked.

5	**Erase the DTC and Freeze Frame Data**
	WARNING **NEVER erase DTC and freeze frame data before completing Step 2 MIL/DTC in "CUSTOMER PROBLEM ANALYSIS SHEET".**

6	**Inspect Vehicle Visually**
•	Go to Step 11, if you recognize the problem.

7	**Recreate (Simulate) Symptoms of the DTC**
•	Try to recreate or simulate the symptoms and conditions of the malfunction as described by customer.
•	If DTC(s) is/are displayed, simulate the condition according to troubleshooting procedure for the DTC.

8	**Confirm Symptoms of Problem**
•	If DTC(s) is/are not displayed, go to Step 9.
•	If DTC(s) is/are displayed, go to Step 11.

9	**Recreate (Simulate) Symptom**
•	Try to recreate or simulate the condition of the malfunction as described by the customer.

10	**Check the DTC**
•	If DTC(s) does(do) not occur, refer to INTERMITTENT PROBLEM PROCEDURE in BASIC INSPECTION PROCEDURE.
•	If DTC(s) occur(s), go to Step 11.

11	**Perform troubleshooting procedure for DTC**

12	**Adjust or repair the vehicle**

13	**Confirmation test**

14	**END**

CUSTOMER PROBLEM ANALYSIS SHEET

1. VEHICLE INFORMATION

(I) VIN:
(II) Production Date:
(III) Odometer Reading: (miles)

2. SYMPTOMS

□ Unable to start	□ Engine does not turn over □ Incomplete combustion □ Initial combustion does not occur
□ Difficult to start	□ Engine turns over slowly □ Other_________________
□ Poor idling	□ Rough idling □ Incorrect idling □ Unstable idling (High: ______ rpm, Low: ______rpm)

	□ Other ____________________________
□ Engine stall	□ Soon after starting □ After accelerator pedal depressed □ After accelerator pedal released □ During A/C ON □ Shifting from N to D-range □ Other ______________________________________
□ Others	□ Poor driving (Surge) □ Knocking □ Poor fuel economy □ Back fire □ After fire □ Other _______________________

3. ENVIRONMENT

Problem frequency	□ Constant □ Sometimes (______________) □ Once only □ Other ___________________________________
Weather	□ Fine □ Cloudy □ Rainy □ Snowy □ Other _______________
Outdoor temperature	Approx. _____ °C/°F
Place	□ Highway □ Suburbs □ Inner City □ Uphill □ Downhill □ Rough road □ Other ____________________________
Engine temperature	□ Cold □ Warming up □ After warming up □ Any temperature
Engine operation	□ Starting □ Just after starting (____ min) □ Idling □ Racing □ Driving □ Constant speed □ Acceleration □ Deceleration □ A/C switch ON/OFF □ Other _________________________

4. MIL/DTC

MIL (Malfunction Indicator Lamp)		□ Remains ON □ Sometimes lights up □ Does not light
DTC	Normal check (Pre-check)	□ Normal □ DTC (________________________________) □ Freeze Frame Data
	Check mode	□ Normal □ DTC (________________________________) □ Freeze Frame Data

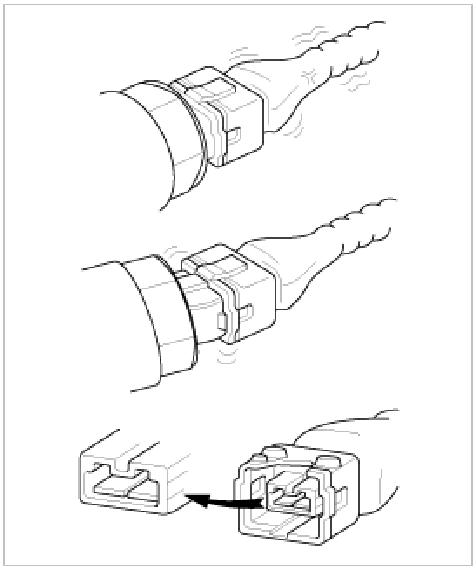
BASIC INSPECTION PROCEDURE

The measured resistance at high temperature after vehicle running may be high or low. So all resistance must be measured at ambient temperature (20°C, 68°F), unless there is any notice.

> **NOTE**
>
> The measured resistance in except for ambient temperature (20°C, 68°F) is reference value.

Sometimes the most difficult case in troubleshooting is when a problem symptom occurs but does not occur again during testing. An example would be if a problem appears only when the vehicle is cold but has not appeared when warm. In this case, the technician should thoroughly make out a "CUSTOMER PROBLEM ANALYSIS SHEET" and recreate (simulate) the environment and condition which occurred when the vehicle was having the issue.

1. Clear Diagnostic Trouble Code (DTC).
2. Inspect connector connection, and check terminal for poor connections, loose wires, bent, broken or corroded pins, and then verify that the connectors are always securely fastened.



3. Slightly shake the connector and wiring harness vertically and horizontally.
4. Repair or replace the component that has a problem.
5. Verify that the problem has disappeared with the road test.

● SIMULATING VIBRATION

1) Sensors and Actuators
 : Slightly vibrate sensors, actuators or relays with finger.

WARNING
Strong vibration may break sensors, actuators or relays

2) Connectors and Harness
 : Lightly shake the connector and wiring harness vertically and then horizontally.

● SIMULATING HEAT

1) Heat components suspected of causing the malfunction with a hair dryer or other heat sourre.

WARNING
• DO NOT heat components to the point where they may be damaged. • DO NOT heat the ECM directly.

● SIMULATING WATER SPRINKLING

1) Sprinkle water onto vehicle to simulate a rainy day or a high humidity condition.

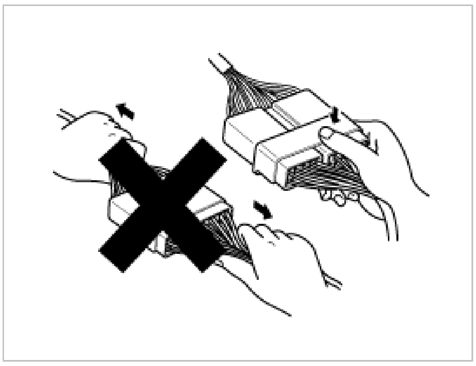
WARNING
DO NOT sprinkle water directly into the engine compartment or electronic components.

● SIMULATING ELECTRICAL LOAD

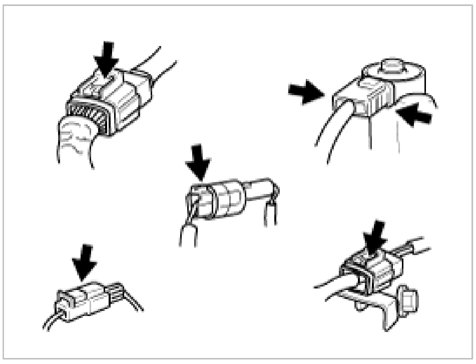
1) Turn on all electrical systems to simulate excessive electrical loads (Radios, fans, lights, etc.).

CONNECTOR INSPECTION PROCEDURE

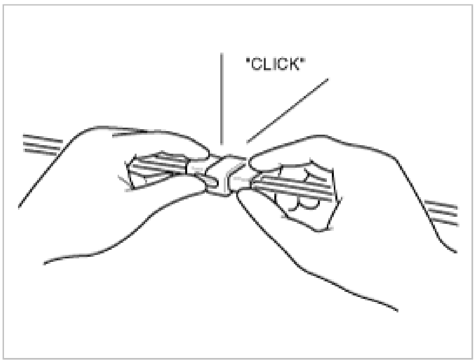
1. Handling of Connector
   A. Never pull on the wiring harness when disconnecting connectors.



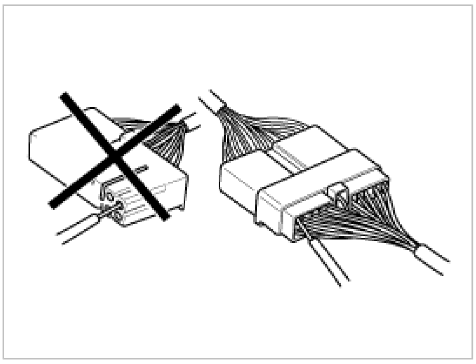
   B. When removing the connector with a lock, press or pull locking lever.



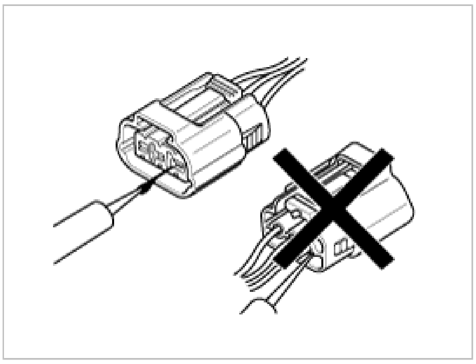
C. Listen for a click when locking connectors. This sound indicates that they are securely locked.



D. When a tester is used to check for continuity, or to measure voltage, always insert tester probe from wire harness side.



E. Check waterproof connector terminals from the connector side. Waterproof connectors cannot be accessed from harness side.



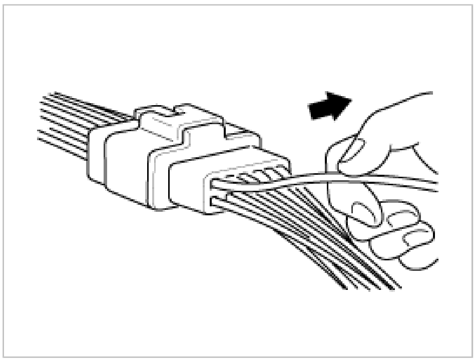
NOTE

- Use a fine wire to prevent damage to the terminal.
- Do not damage the terminal when inserting the tester lead.

2. Checking Point for Connector
   A. While the connector is connected:
      Hold the connector, check connecting condition and locking efficiency.
   B. When the connector is disconnected:
      Check missed terminal, crimped terminal or broken core wire by slightly pulling the wire harness.
      Visually check for rust, contamination, deformation and bend.

C. Check terminal tightening condition:
Insert a spare male terminal into a female terminal, and then check terminal tightening conditions.

D. Pull lightly on individual wires to ensure that each wire is secured in the terminal.



3. Repair Method of Connector Terminal
    A. Clean the contact points using air gun and/or shop rag.

    > NOTE
    > Never use sand paper when polishing the contact points, otherwise the contact point may be damaged.

    B. In case of abnormal contact pressure, replace the female terminal.

WIRE HARNESS INSPECTION PROCEDURE

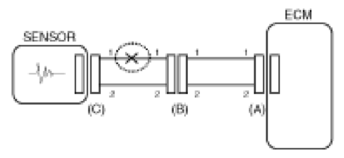
1. Before removing the wire harness, check the wire harness position and crimping in order to restore it correctly.
2. Check whether the wire harness is twisted, pulled or loosened.
3. Check whether the temperature of the wire harness is abnormally high.
4. Check whether the wire harness is rotating, moving or vibrating against the sharp edge of a part.
5. Check the connection between the wire harness and any installed part.
6. If the covering of wire harness is damaged; secure, repair or replace the harness.

ELECTRICAL CIRCUIT INSPECTION PROCEDURE

1. Procedures for Open Circuit
    A. Continuity Check
    B. Voltage Check

    If an open circuit occurs (as seen in [FIG. 1]), it can be found by performing Step 2 (Continuity Check Method) or Step 3 (Voltage Check Method) as shown below.

FIG 1



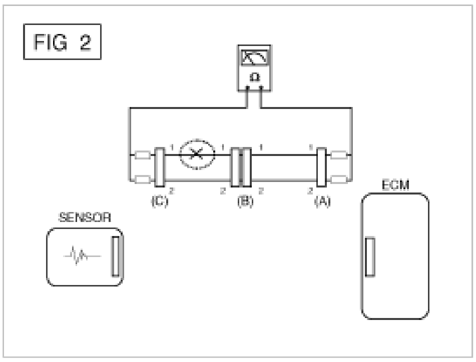
2. Continuity Check Method

    > NOTE
    > When measuring for resistance, lightly shake the wire harness above and below or from side to side.

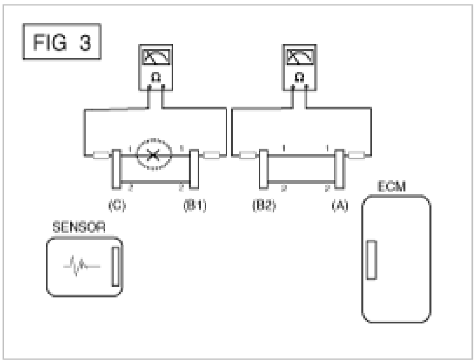
Specification (Resistance)
1Ω or less → Normal Circuit
1MΩ or Higher → Open Circuit

A. Disconnect connectors (A), (C) and measure resistance between connector (A) and (C) as shown in [FIG. 2].
In [FIG.2.] the measured resistance of line 1 and 2 is higher than 1MΩ and below 1 Ω respectively. Specifically the open

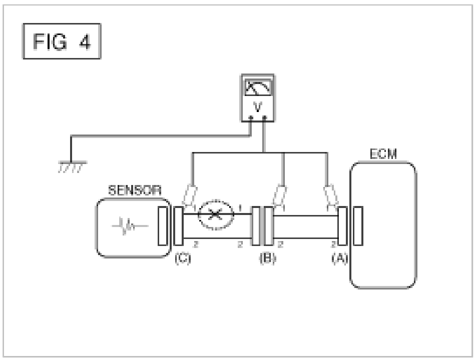
circuit is line 1 (Line 2 is normal). To find exact break point, check sub line of line 1 as described in next step.



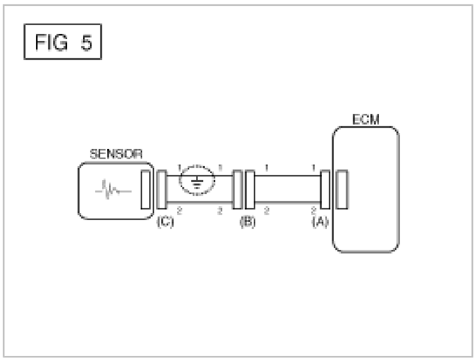
B. Disconnect connector (B), and measure for resistance between connector (C) and (B1) and between (B2) and (A) as shown in [FIG. 3].
In this case the measured resistance between connector (C) and (B1) is higher than 1MΩ and the open circuit is between terminal 1 of connector (C) and terminal 1 of connector (B1).



3. Voltage Check Method
   A. With each connector still connected, measure the voltage between the chassis ground and terminal 1 of each connectors (A), (B) and (C) as shown in [FIG. 4].
   The measured voltage of each connector is 5V, 5V and 0V respectively. So the open circuit is between connector (C) and (B).



4. Test Method for Short to Ground Circuit
   A. Continuity Check with Chassis Ground
   If short to ground circuit occurs as shown in [FIG. 5], the broken point can be found by performing below Step 2 (Continuity Check Method with Chassis Ground) as shown below.



5. Continuity Check Method (with Chassis Ground)

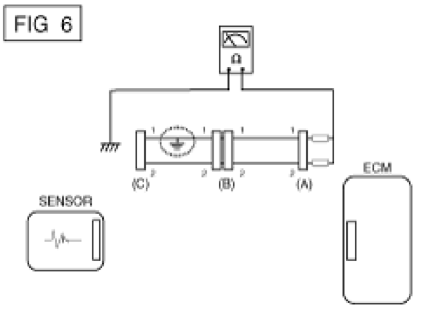
NOTE

Lightly shake the wire harness above and below, or from side to side when measuring the resistance.

Specification (Resistance)
1Ω or less → Short to Ground Circuit
1MΩ or Higher → Normal Circuit

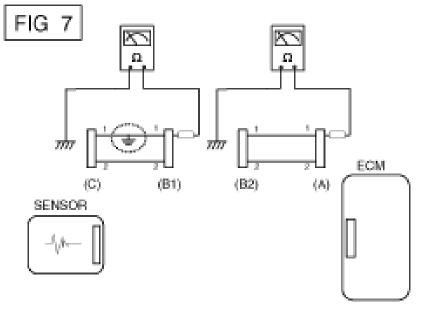
A. Disconnect connectors (A), (C) and measure for resistance between connector (A) and Chassis Ground as shown in [FIG. 6].
   The measured resistance of line 1 and 2 in this example is below 1 Ω and higher than 1MΩ respectively. Specifically the short to ground circuit is line 1 (Line 2 is normal). To find exact broken point, check the sub line of line 1 as described in the following step.

FIG 6



B. Disconnect connector (B), and measure the resistance between connector (A) and chassis ground, and between (B1) and chassis ground as shown in [FIG. 7].
   The measured resistance between connector (B1) and chassis ground is 1Ω or less. The short to ground circuit is between terminal 1 of connector (C) and terminal 1 of connector (B1).

FIG 7



SYMPTOM TROUBLESHOOTING GUIDE CHART

MAIN SYMPTOM	DIAGNOSTIC PROCEDURE	ALSO CHECK FOR
Unable to start (Engine does not turn over)	1. Test the battery 2. Test the starter 3. Inhibitor switch (A/T) or clutch start switch (M/T)	
Unable to start (Incomplete combustion)	1. Test the battery 2. Check the fuel pressure 3. Check the ignition circuit 4. Troubleshooting the immobilizer system (In case of immobilizer lamp ON)	• DTC • Low compression • Intake air leaks • Slipped or broken timing belt • Contaminated fuel
Difficult to start	1. Test the battery 2. Check the fuel pressure 3. Check the ECT sensor and circuit (Check DTC) 4. Check the ignition circuit	• DTC • Low compression • Intake air leaks • Contaminated fuel • Weak ignition spark
	1. Check the fuel pressure 2. Check the Injector	• DTC

Poor idling (Rough, unstable or incorrect Idle)	3. Check the long term fuel trim and short term fuel trim (Refer to CUSTOMER DATASTREAM) 4. Check the idle speed control circuit (Check DTC) 5. Inspect and test the Throttle Body 6. Check the ECT sensor and circuit (Check DTC)	• Low compression • Intake air leaks • Contaminated fuel • Weak ignition spark
Engine stall	1. Test the Battery 2. Check the fuel pressure 3. Check the idle speed control circuit (Check DTC) 4. Check the ignition circuit 5. Check the CKPS Circuit (Check DTC)	• DTC • Intake air leaks • Contaminated fuel • Weak ignition spark
Poor driving (Surge)	1. Check the fuel pressure 2. Inspect and test Throttle Body 3. Check the ignition circuit 4. Check the ECT Sensor and Circuit (Check DTC) 5. Test the exhaust system for a possible restriction 6. Check the long term fuel trim and short term fuel trim (Refer to CUSTOMER DATASTREAM)	• DTC • Low compression • Intake air leaks • Contaminated fuel • Weak ignition spark
Knocking	1. Check the fuel pressure 2. Inspect the engine coolant 3. Inspect the radiator and the electric cooling fan 4. Check the spark plugs	• DTC • Contaminated fuel
Poor fuel economy	1. Check customer's driving habits • Is A/C on full time or the defroster mode on? • Are tires at correct pressure? • Is excessively heavy load being carried? • Is acceleration too much, too often? 2. Check the fuel pressure 3. Check the injector 4. Test the exhaust system for a possible restriction 5. Check the ECT sensor and circuit	• DTC • Low compression • Intake air leaks • Contaminated fuel • Weak ignition spark
Hard to refuel (Overflow during refueling)	1. Test the canister close valve 2. Inspect the fuel filler hose/pipe • Pinched, kinked or blocked? • Filler hose is torn 3. Inspect the fuel tank vapor vent hose between the EVAP. canister and air filter 4. Check the EVAP. canister	• Malfunctioning gas station filling nozzle (If this problem occurs at a specific gas station during refueling)

Fuel System > General Information > Specifications

SPECIFICATION

FUEL DELIVERY SYSTEM

Items	Specification	
Fuel Tank	Capacity	67ℓit. (17.7 U.S.gaℓ., 14.7 Imp. gaℓ.)
Fuel Filter (built in Fuel Pump assembly)	Type	High pressure type
Fuel Pressure Regulator (built in Fuel Pump assembly)	Regulated Fuel Pressure	375 ~ 385 kPa(3.82 ~ 3.92 kgf/cm², 54.3 ~ 55.8 psi)
Fuel Pump	Type	Electrical, in-tank type
	Driven by	Electric motor

SENSOR

MASS AIR FLOW SENSOR (MAFS)

▷ Type: Hot-film type

▷ Specification

Air Flow (kg/h)	Frequency (Hz)
12.6 kg/h	2,617Hz
18.0 kg/h	2,958Hz
23.4 kg/h	3,241Hz
32.4 kg/h	3,653Hz
43.2 kg/h	4,024Hz
57.6 kg/h	4,399Hz
72.0 kg/h	4,704Hz
108.0 kg/h	5,329Hz
144.0 kg/h	5,897Hz
198.0 kg/h	6,553Hz
270.0 kg/h	7,240Hz
360.0 kg/h	7,957Hz
486.0 kg/h	8,738Hz
666.0 kg/h	9,644Hz
900.0 kg/h	10,590Hz

INTAKE AIR TEMPERATURE SENSOR (IATS)
▷ Type: Thermistor type
▷ Specification

Temperature		Resistance (kΩ)
°C	°F	
-40	-40	100.87kΩ
-20	-4	28.58kΩ
0	32	9.40kΩ
10	50	5.66kΩ
20	68	3.51kΩ
40	104	1.47kΩ
60	140	0.67kΩ
80	176	0.33kΩ

MANIFOLD ABSOLUTE PRESSURE SENSOR (MAPS)
▷ Type: Piezo-resistive pressure type
▷ Specification

Pressure (kPa)	Output Voltage (V)
20.0kPa	0.79V
46.66kPa	1.84V
101.32kPa	4.00V

ENGINE COOLANT TEMPERATURE SENSOR (ECTS)
▷ Type: Thermistor type
▷ Specification

Temperature		Resistance (kΩ)
°C	°F	
-40	-40	48.14kΩ
-20	-4	14.13 ~ 16.83kΩ
0	32	5.79kΩ
20	68	2.31 ~ 2.59kΩ

40	104	1.15kΩ
60	140	0.59kΩ
80	176	0.32kΩ

THROTTLE POSITION SENSOR (TPS)
▷ Type: Variable resistor type
▷ Specification (When reference voltage = 5.0V)

Throttle Angle (°)	Output Voltage(V)	
	TPS1	TPS2
0°	0V	5.0V
10°	0.5V	4.5V
20°	0.9V	4.1V
30°	1.4V	3.6V
40°	1.8V	3.2V
50°	2.3V	2.7V
60°	2.7V	2.3V
70°	3.2V	1.8V
80°	3.6V	1.4V
90°	4.1V	0.9V
100°	4.5V	0.5V
110°	5.0V	0V

Item	Sensor Resistance (kΩ)
TPS1	4.0 ~ 6.0kΩ at 20°C (68°F)
TPS2	2.72 ~ 4.08kΩ at 20°C (68°F)

ACCELERATOR POSITION SENSOR (APS)
▷ Type: Variable resistor type
▷ Specification (When reference voltage = 5.0V)

Accelerator Position	Output Voltage (V)	
	APS1	APS2
C.T	0.7 ~ 0.8V	0.29 ~ 0.46V
W.O.T	3.85 ~ 4.35V	1.93 ~ 2.18V

Item	Sensor Resistance (kΩ)
APS1	0.7 ~ 1.3kΩ at 20°C (68°F)
APS2	1.4 ~ 2.6kΩ at 20°C (68°F)

HEATED OXYGEN SENSOR (HO2S)
▷ Type: Zirconia (ZrO_2) type
▷ Specification

A/F Ratio	Output Voltage (V)
RICH	0.75 ~ 1.00V
LEAN	0 ~ 0.12V

Item	Resistance (Ω)
Sensor Heater	8.1 ~ 11.1Ω at 21°C (69.8°F)

CAMSHAFT POSITION SENSOR (CMPS)
▷ Type: Hall effect type

▷ Specification

Item	Specification
Output Voltage (V)	High: 5.0V
	Low: 0.7V
Air Gap (mm)	0.5 ~ 1.5mm

CRANKSHAFT POSITION SENSOR (CKPS)
▷ Type: Magnetic field sensitive type
▷ Specification

Item	Specification
Coil Resistance (Ω)	630 ~ 770Ω at 20°C (68°F)
Air Gap (mm)	0.5 ~ 1.5mm

KNOCK SENSOR (KS)
▷ Type: Piezo-electricity type
▷ Specification

Item	Specification
Capacitance (pF)	1,480 ~ 2,220pF

CVVT OIL TEMPERATURE SENSOR (OTS)
▷ Type: Thermistor type
▷ Specification

Temperature		Resistance (kΩ)
°C	°F	
-20	-4	16.52kΩ
20	68	2.45kΩ
80	176	0.29kΩ

FUEL TANK PRESSURE SENSOR (FTPS)
▷ Type: Piezo-Resistivity type
▷ Specification

Pressure (kPa)	Output Voltage (V)
-3.75 kPa	4.5 V
0 kPa	1.5 V
1.25 kPa	0.5 V

ACTUATORS

INJECTOR
▷ Number: 6
▷ Specification

Item	Specification
Coil Resistance (Ω)	11.4 ~ 12.6Ω at 20°C (68°F)

PURGE CONTROL SOLENOID VALVE (PCSV)
▷ Type: Duty control type
▷ Specification

Item	Specification
Coil Resistance (Ω)	19.0 ~ 22.0Ω at 20°C (68°F)

VARIABLE INTAKE SOLENOID (VIS) VALVE
▷ Specification

Item	Specification

Coil Resistance (Ω)	30.0 ~ 35.0Ω [22°C (71.6°F)]

CVVT OIL CONTROL VALVE (OCV)

▷ Specification

Item	Specification
Coil Resistance (Ω)	6.7 ~ 7.7Ω at 20°C (68°F)

ETC MOTOR

▷ Specification

Item	Specification
Coil Resistance (Ω)	1.275 ~ 1.725Ω at 20°C (68°F)

IGNITION COIL

▷ Type: Stick type

▷ Specification

Item	Specification
1st Coil Resistance (Ω)	0.62Ω±10% at 20°C (68°F)
2nd Coil Resistance (kΩ)	7.0kΩ±15% at 20°C (68°F)

CANISTER CLOSE VALVE (CCV)

▷ Type: ON/OFF control type

▷ Specification

Item	Specification
Coil Resistance (Ω)	19.8 ~ 21.8 at 20°C (68°F)

SERVICE STANDARD

<table>
<tr><td>Ignition Timing</td><td colspan="3">BTDC 10° ± 5°</td></tr>
<tr><td rowspan="4">Idle Speed</td><td rowspan="2">A/CON OFF</td><td>Neutral,N,P-range</td><td rowspan="4">620 ± 100 rpm</td></tr>
<tr><td>D-range</td></tr>
<tr><td rowspan="2">A/CON ON</td><td>Neutral,N,P-range</td></tr>
<tr><td>D-range</td></tr>
</table>

TIGHTENING TORQUES

ENGINE CONTROL SYSTEM

Item	Kgf·m	N·m	lbf·ft
PCM installation bolts	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
Heated oxygen sensor (Bank 1 / Sensor 1) installation	5.0 ~ 6.0	49.1 ~ 58.9	36.2 ~ 43.4
Heated oxygen sensor (Bank 1 / Sensor 2) installation	5.0 ~ 6.0	49.1 ~ 58.9	36.2 ~ 43.4
Heated oxygen sensor (Bank 2 / Sensor 1) installation	5.0 ~ 6.0	49.1 ~ 58.9	36.2 ~ 43.4
Heated oxygen sensor (Bank 2 / Sensor 2) installation	5.0 ~ 6.0	49.1 ~ 58.9	36.2 ~ 43.4
Engine coolant temperature sensor installation	2.0 ~ 4.0	19.6 ~ 39.2	14.5 ~ 28.9
Manifold absolute pressure sensor installation bolt	0.9 ~ 1.2	8.8 ~ 11.8	6.5 ~ 8.7
Camshaft position sensor [Bank 1] installation bolt	0.7 ~ 1.0	6.9 ~ 9.8	5.1 ~ 7.2
Camshaft position sensor [Bank 2] installation bolt	0.7 ~ 1.0	6.9 ~ 9.8	5.1 ~ 7.2
Crankshaft position sensor installation	0.8 ~ 1.2	7.8 ~ 11.8	5.8 ~ 8.7
Knock sensor #1,2 installation	1.6 ~ 2.4	15.7 ~ 23.5	11.6 ~ 17.4
ETC module installation bolt (on throttle body)	0.7 ~ 1.1	6.9 ~ 10.8	5.1 ~ 8.0

ETC module installation bolt (on ETC stay)	1.6 ~ 2.6	15.7 ~ 25.5	11.6 ~ 18.8
CVVT Oil temperature sensor installation	2.0 ~ 4.0	19.6 ~ 39.2	14.5 ~ 28.9
CVVT Oil control valve [Bank 1] installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
CVVT Oil control valve [Bank 2] installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
Vacuum valve (Variable intake actuator) installation bolts	0.9 ~ 1.2	8.8 ~ 11.8	6.5 ~ 8.7
Ignition coil condenser installation bolt	0.7 ~ 1.1	6.9 ~ 10.8	5.1 ~ 8.0
Ignition coil installation bolt	0.4 ~ 0.6	3.9 ~ 5.9	2.9 ~ 4.3

FUEL DELIVERY SYSTEM

Item	Kgf·m	N·m	lbf·ft
Fuel Tank band mounting nuts	3.5 ~ 5.5	34.3 ~ 53.9	25.3 ~ 39.8
Accelerator pedal bolt	1.3 ~ 1.6	12.8 ~ 15.7	9.4 ~ 11.6
Delivery pipe installation bolts	0.9 ~ 1.2	8.8 ~ 11.8	6.5 ~ 8.7

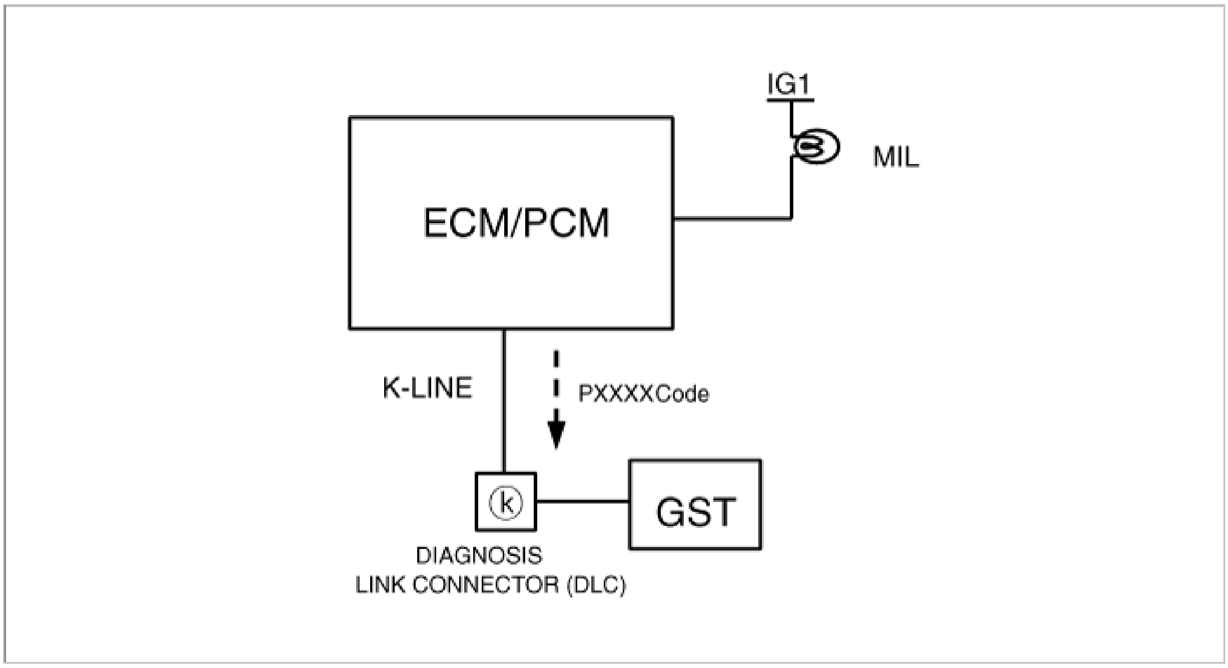
Fuel System > Engine Control System > Description and Operation

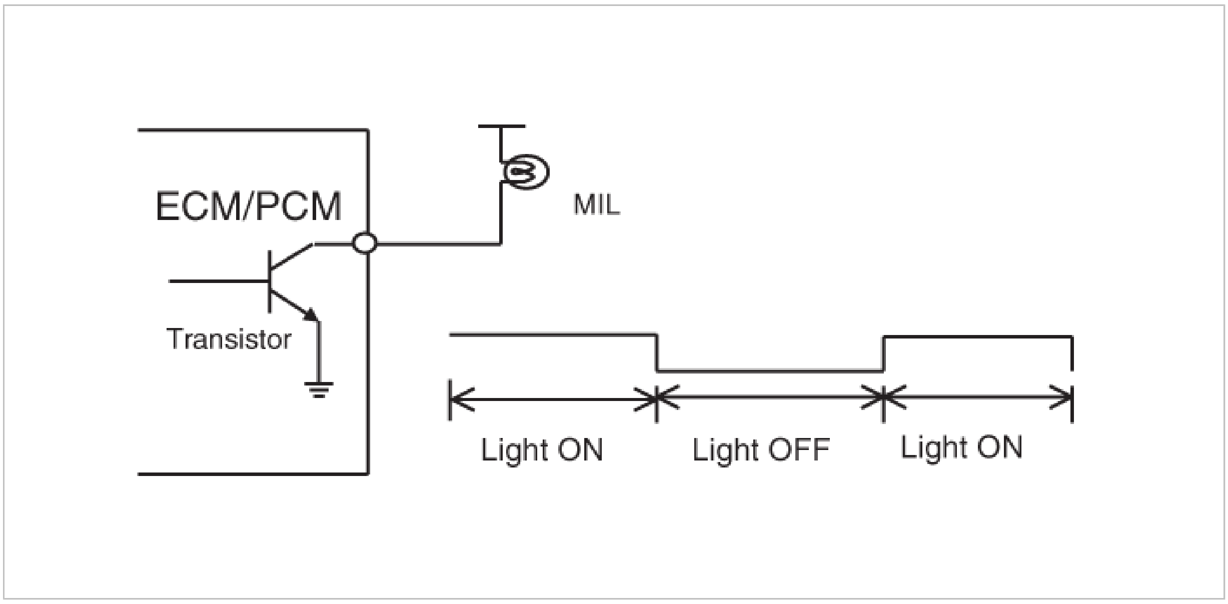
OBD-II REVIEW

1. OVERVIEW

The California Air Resources Board (CARB) began regulation of On Board Diagnostics (OBD) for vehicles sold in california beginning with the 1988 model year. The first phase, OBD-I, required monitoring of the fuel metering system, Exhust Gas Recirculation (EGR) system and additional emission related components. The Malfunction Indicator Lamp (MIL) was required to light and alert the driver of the fault and the need for repair of the emission control system. Associated with the MIL was a fault code or Diagnostic Trouble Code (DTC) idenfying the specific area of the fault.
The OBD system was proposed by CARB to improve air quality by identifying vehicle exceeding emission standards. Passage of the Federal Clean Air Act Amendments in 1990 has also prompted the Environmental Protection Agency (EPA) to develop On Board Diagnostic requirements. CARB OBD-II regulations were followed until 1999 when the federal regulations were used.
The OBD-II system meets government regulations by monitoring the emission control system. When a system or component exceeds emission threshold or a component operates outside tolerance, a DTC will be stored and the MIL illuminated.
The diagnostic executive is a computer program in the Engine Control Module (ECM) or PowertrainControl Module (PCM) that coordinates the OBD-II self-monitoring system. This program controls all the monitors and interactions, DTC and MIL operation, freeze frame data and scan tool interface.
Freeze frame data describes stored engine conditions, such as state of the engine, state of fuel control, spark, RPM, load and warm status at the point the first fault is detected. Previously stored conditions will be replaced only if a fuel or misfire fault is detected. This data is accessible with the scan tool to assist in repairing the vehicle.
The center of the OBD-II system is a microprocessor called the Engine Control Module (ECM) or Powertrain Control Module (PCM).
The ECM or PCM receives input from sensors and other electronic components (switches, relays, and others) based on information received and programmed into its memory (keep alive random access memory, and others), the ECM or PCM generates output signals to control various relays, solenoids and actuators.

2. CONFIGURATION OF HARDWARE AND RELATED TERMS





The Malfunction Indicator Lamp (MIL) is connected between ECM or PCM-terminal Malfunction Indicator Lamp and battery supply (open collector amplifier).
In most cars, the MIL will be installed in the instrument panel. The lamp amplifier can not be damaged by a short circuit.
Lamps with a power dissipation much greater than total dissipation of the MIL and lamp in the tester may cause a fault indication.
▹ At ignition ON and engine revolution (RPM)< MIN. RPM, the MIL is switched ON for an optical check by the driver.
When the ECM or PCM detects a malfunction related emission during the first driving cycle, the DTC and engine data are stored in the freeze frame memory. The MIL is illuminated only when the ECM or PCM detects the same malfunction related the DTC in two consecutive driving cycles.
● Misfire and Fuel System Malfunctions:
For misfire or fuel system malfunctions, the MIL may be eliminated if the same fault does not reoccur during monitoring in three subsequent sequential driving cycles in which conditions are similar to those under which the malfunction was first detected.
● All Other Malfunctions:
For all other faults, the MIL may be extinguished after three subsequent sequential driving cycles during which the monitoring system responsible for illuminating the MIL functions without detecting the malfunction and if no other malfunction has been identified that would independently illuminate the MIL according to the requirements outlined above.
The diagnostic system may erase a fault code if the same fault is not re-registered in at least 40 engine warm-up cycles, and the MIL is not illuminated for that fault code.

- Bidirectional line
- K-Line is defined as the line which provides information in a serial digital form from ECM or PCM to the diagnostic tester. K-Line is used bidirectionally, in which case it may carry commands or data from the diagnostic tester to the ECM or PCM. K-Line is also used to initialize the serial communication.

A driving cycle consists of engine start up, and engine shut off.

A warm-up cycle means sufficient vehicle operation such that the engine coolant temperature has risen by at least 40 degrees Fahrenheit from engine starting and reaches a minimum has risen by at least 40 degrees Fahrenheit from engine starting and reaches a minimum temperature of at least 160 degrees Fahrenheit.
A trip means vehicle operation (following an engine-off period) of duration and driving mode such that all components and systems are monitored at least once by the diagnostic system except catalyst efficiency or evaporative system monitoring when a steady-speed check is used, subject to the limitation that the manufacturer-defined trip monitoring conditions shall all be encountered at least once during the first engine start portion of the applicable FTP cycle.

- Diagnostic Trouble Code (SAE J2012)
- DTCs used in OBD-II vehicles will begin with a letter and are followed by four numbers.

The letter of the beginning of the DTC identifies the function of the monitored device that has failed. A "P" indicates a powertrain device, "C" indicates a chassis device. "B" is for body device and "U" indicates a network or data link code. The first number indicates if the code is generic (common to all manufacturers) or if it is manufacturer specific. A "0" & "2" indicates generic, "1" indicates manufacturer-specific. The second number indicates the system that is affected with a number between 1 and 7.
The following is a list showing what numbers are assigned to each system.

1) Fuel and air metering
2) Fuel and air metering(injector circuit malfunction only)
3) Ignition system or misfire
4) Auxiliary emission controls
5) Vehicle speed controls and idle control system
6) Computer output circuits
7) Transmission

The last two numbers of the DTC indicates the component or section of the system where the fault is located.
When a freeze frame event is triggered by an emission related DTC, the ECM or PCM stores various vehicle information as it existed the moment the fault ocurred. The DTC number along with the engine data can be useful in aiding a technician in locating the cause of the fault. Once the data from the 1st driving cycle DTC ocurrence is stored in the freeze frame memory, it will remain there even when the fault ocurrs again (2nd driving cycle) and the MIL is illuminated.

- Freeze Frame List
  1) Calculated Load Value
  2) Engine RPM
  3) Fuel Trim
  4) Fuel Pressure (if available)
  5) Vehicle Speed (if available)
  6) Coolant Temperature
  7) Intake Manifold Pressure (if available)
  8) Closed-or Open-loop operation
  9) Fault code

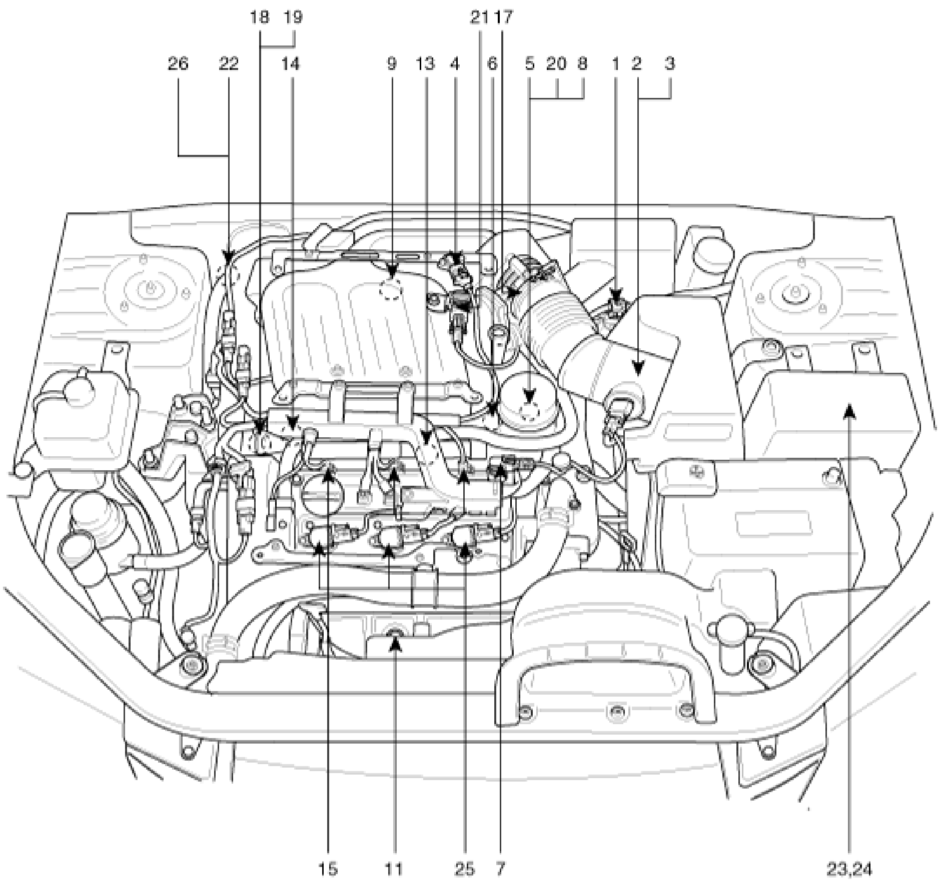
3. OBD-II SYSTEM READINESS TESTS

The catalyst efficiency monitor is a self-test strategy within the ECM or PCM that uses the downstream Heated Oxygen Sensor (HO2S) to determine when a catalyst has fallen below the minimum level of effectiveness in its ability to control exhaust emission.
Misfire is defined as the lack of proper combustion in the cylinder due to the absence of spark, poor fuel metering, or poor compression. Any combustion that does not occur within the cylinder at the proper time is also a misfire. The misfire detection monitor detects fuel, ignition or mechanically induced misfires. The intent is to protect the catalyst from permanent damage and to alert the customer of an emission failure or an inspection maintenance failure by illuminating the MIL . When a misfire is detected, special software called freeze frame data is enabled. The freeze frame data captures the operational state of the vehicle when a fault is detected from misfire detection monitor strategy.
The fuel system monitor is a self-test strategy within the ECM or PCM that monitors the adaptive fuel table The fuel control system uses the adaptive fuel table to compensate for normal variability of the fuel system components caused by wear or aging. During normal vehicle operation, if the fuel system appears biased lean or rich, the adaptive value table will shift the fuel delivery calculations to remove bias.
The cooling system monitoring is a self-test strategy within the ECM or PCM that monitors ECTS (Engine Coolant Temperature Sensor) and thermostat about circuit continuity, output range, rationality faults.
OBD-II regulations require monitoring of the upstream Heated O2 Sensor (H2OS) to detect if the deterioration of the sensor has exceeded thresholds. An additional HO2S is located downstream of the Warm-Up Three Way Catalytic Converter (WU-TWC) to determine the efficiency of the catalyst.
Although the downstream H2OS is similar to the type used for fuel control, it functions differently. The downstream HO2S is monitored to determine if a voltage is generated. That voltage is compared to a calibrated acceptable range.
The EVAP. monitoring is a self-test strategy within the ECM or PCM that tests the integrity of the EVAP. system. The complete evaporative system detects a leak or leaks that cumulatively are greater than or equal to a leak caused by a 0.040 inch and 0.020 inch diameter orifice.
The A/C system monitoring is a self-test strategy within the ECM or PCM that monitors malfunction of all A/C system component at A/C ON.
The comprehensive components monitoring is a self-test strategy within the ECM or PCM that detects fault of any electronic powertrain components or system that provides input to the ECM or PCM and is not exclusively an input to any other OBD-II

monitor.

Fuel System > Engine Control System > Components and Components Location

COMPONENT LOCATION



1. PCM (Powertrain Control Module)
2. Mass Air Flow Sensor (MAFS)
3. Intake Air Temperature Sensor (IATS)
4. Manifold Absolute Pressure Sensor (MAPS)
5. Engine Coolant Temperature Sensor (ECTS)
6. Camshaft Position Sensor (CMPS) [Bank 1]
7. Camshaft Position Sensor (CMPS) [Bank 2]
8. Crankshaft Position Sensor (CKPS)
9. Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 1]
10. Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 2]
11. Heated Oxygen Sensor (HO2S) [Bank 2 / Sensor 1]
12. Heated Oxygen Sensor (HO2S) [Bank 2 / Sensor 2]
13. Knock Sensor (KS) #1
14. Knock Sensor (KS) #2
15. Injector
16. Accelerator Position Sensor (APS)
17. ETC Module [Throttle Position Sensor (TPS) + ETC Motor]
18. CVVT Oil Control Valve (OCV) [Bank 1]
19. CVVT Oil Control Valve (OCV) [Bank 2]
20. CVVT Oil Temperature Sensor (OTS)
21. Purge Control Solenoid Valve (PCSV)
22. Variable Intake Solenoid (VIS) Valve
23. Fuel Pump Relay
24. Main Relay
25. Ignition Coil
26. Power Steering Pressure Sensor (PSPS)
27. Wheel Speed Sensor (WSS)
28. Fuel Tank Pressure Sensor (FTPS)
29. Canister Close Valve (CCV)

1. PCM (Powertrain Control Module)	2. Mass Air Flow Sensor (MAFS) 3. Intake Air Temperature Sensor (IATS)

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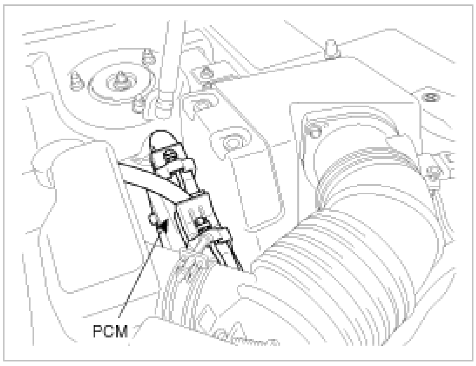
<td>
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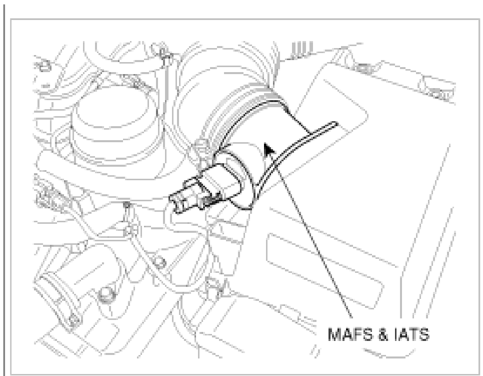
<td>
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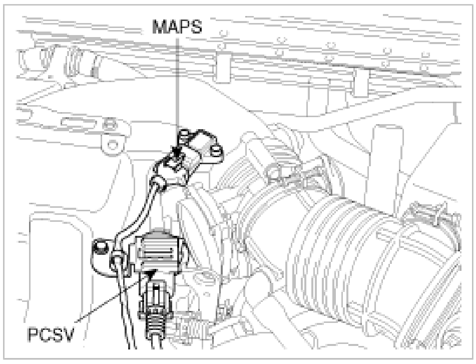
<td>
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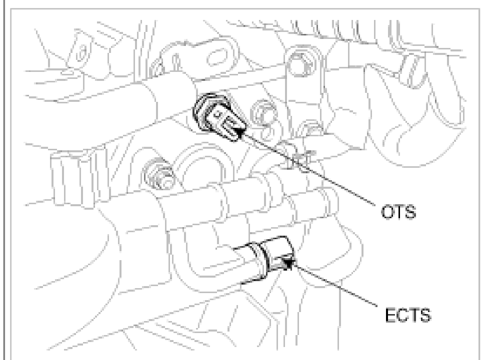
<td>
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<td>6. Camshaft Position Sensor (CMPS) [Bank 1]</td>
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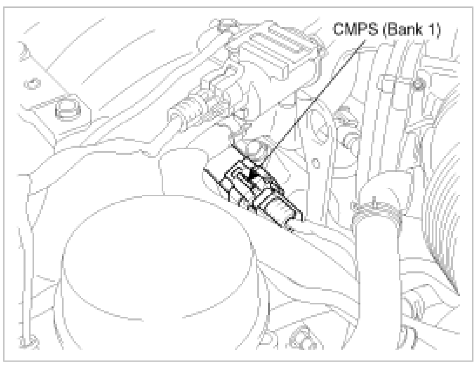
<td>
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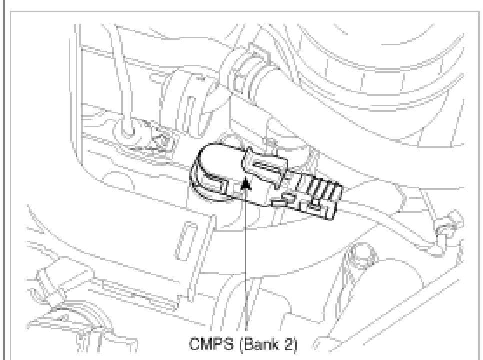
<td>
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<td>8. Crankshaft Position Sensor (CKPS)</td>
<td>9. Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 1]</td>
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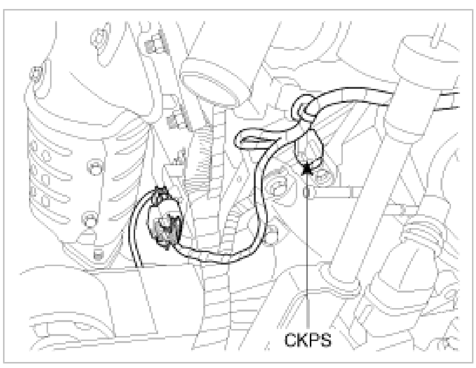
<td>
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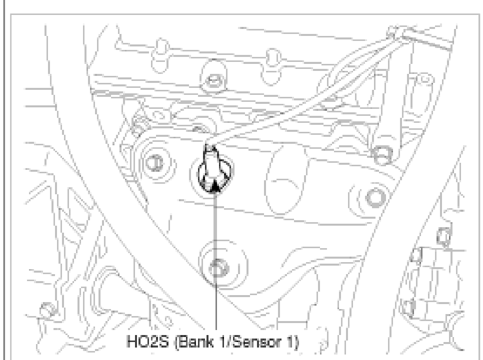
<td>
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<td>10. Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 2]</td>
<td>11. Heated Oxygen Sensor (HO2S) [Bank 2 / Sensor 1]</td>
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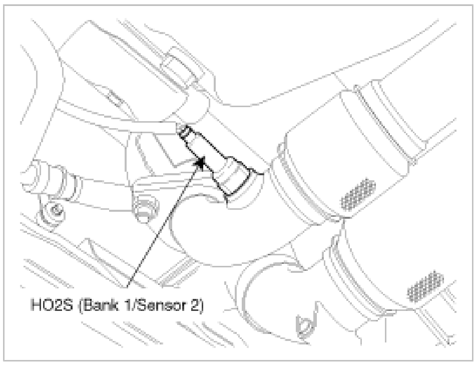
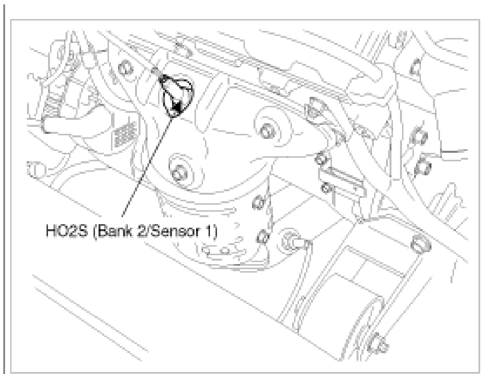
<tr><td>
</td><td>
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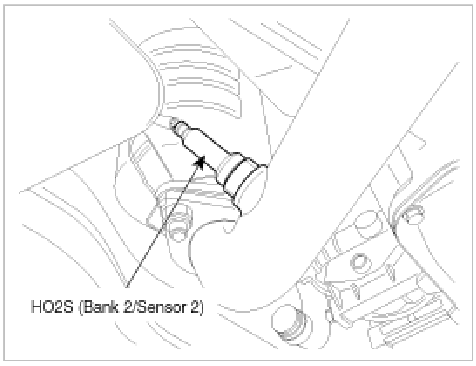
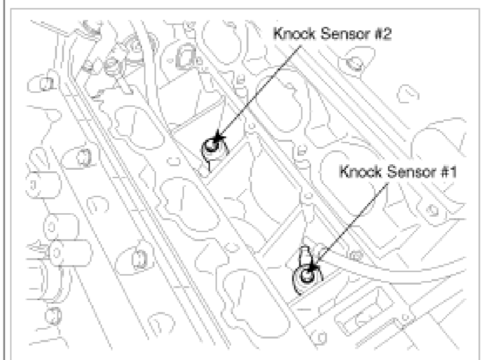
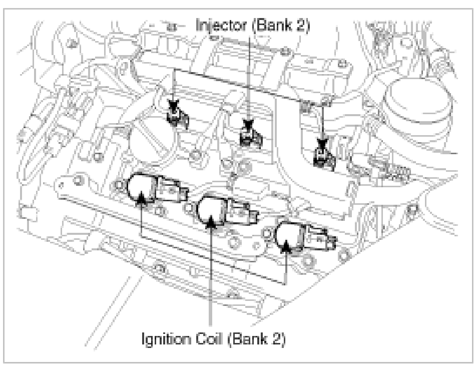
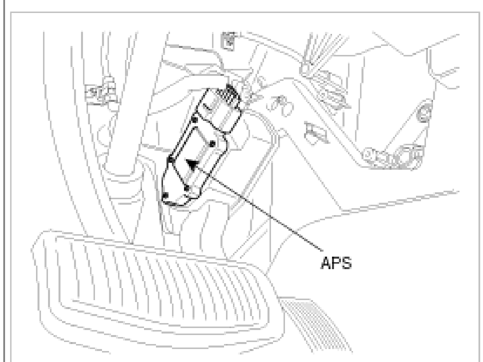
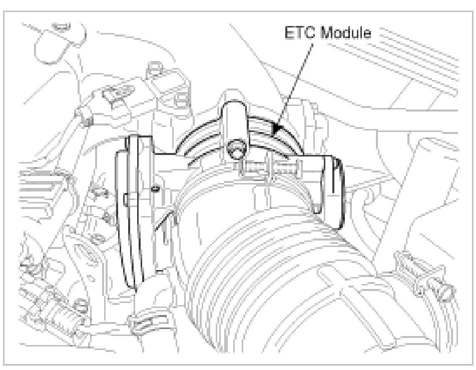
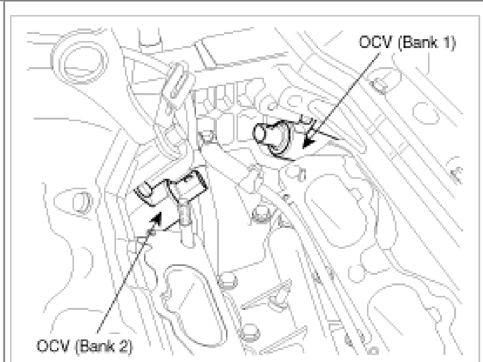
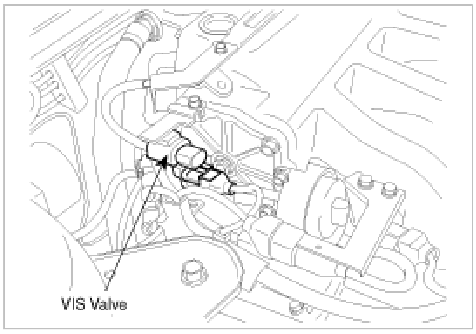
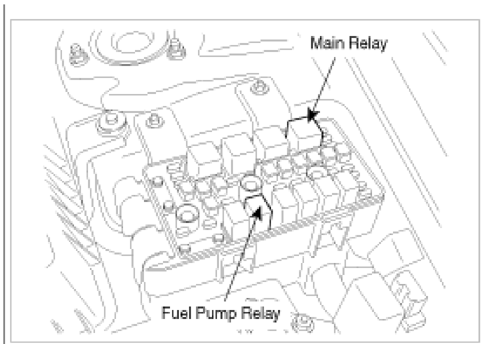
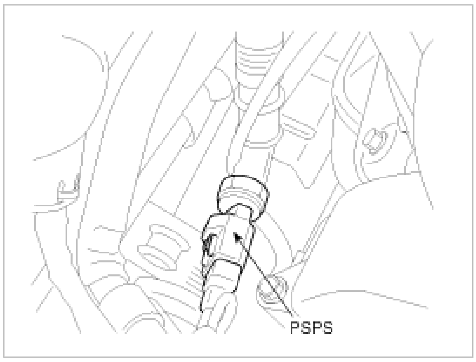
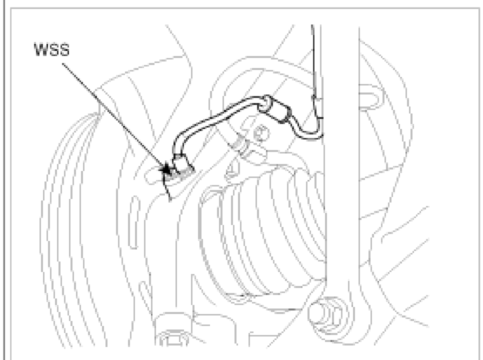
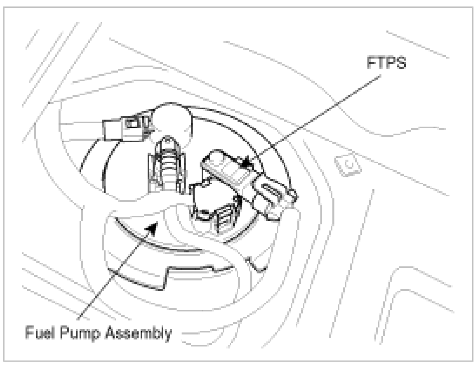
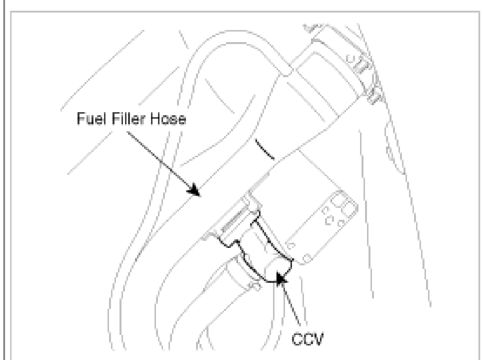
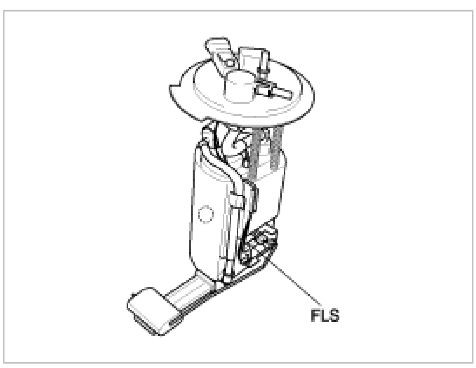
<tr><td>12. Heated Oxygen Sensor (HO2S) [Bank 2 / Sensor 2]</td><td>13. Knock Sensor (KS) #1
14. Knock Sensor (KS) #2</td></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td>15. Injector
25. Ignition Coil</td><td>16. Accelerator Position Sensor (APS)</td></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td>17. ETC Module [Throttle Position Sensor (TPS) + ETC Motor]</td><td>18. CVVT Oil Control Valve (OCV) [Bank 1]
19. CVVT Oil Control Valve (OCV) [Bank 2]</td></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td>22. Variable Intake Solenoid (VIS) Valve</td><td>23. Fuel Pump Relay
24. Main Relay</td></tr>
<tr><td></td><td></td></tr>
</table>

	
26. Power Steering Pressure Sensor (PSPS)	27. Wheel Speed Sensor (WSS)
	
28. Fuel Tank Pressure Sensor (FTPS)	29. Canister Close Valve (CCV)
	
30. Fuel Level Sensor (FLS)	
	

Fuel System > Engine Control System > Troubleshooting

INSPECTION CHART FOR DIAGNOSTIC TROUBLE CODES (DTC)

DTC	Description	MIL	PAGE
P0011	"A" Camshaft Position-Timing Over-Advanced or System Performance (Bank 1)	●	
P0012	"A" Camshaft Position-Timing Over-Retarded (Bank 1)	●	

P0016	Crankshaft Position-Camshaft Position Correlation (Bank 1 / Sensor A)	●	
P0018	Crankshaft Position-Camshaft Position Correlation (Bank 2 / Sensor A)	●	
P0021	"A" Camshaft Position-Timing Over-Advanced or System Performance (Bank 2)	●	
P0022	"A" Camshaft Position-Timing Over-Retarded (Bank 2)	●	
P0026	Intake Valve Control Solenoid Circuit Range/Performance (Bank 1)	●	
P0028	Intake Valve Control Solenoid Circuit Range/Performance (Bank 2)	●	
P0031	HO2S Heater Circuit low (Bank 1 / Sensor 1)	●	
P0032	HO2S Heater Circuit high (Bank 1 / Sensor 1)	●	
P0037	HO2S Heater Circuit low (Bank 1 / Sensor 2)	●	
P0038	HO2S Heater Circuit high (Bank 1 / Sensor 2)	●	
P0051	HO2S Heater Circuit low (Bank 2 / Sensor 1)	●	
P0052	HO2S Heater Circuit high (Bank 2 / Sensor 1)	●	
P0057	HO2S Heater Circuit low (Bank 2 / Sensor 2)	●	
P0058	HO2S Heater Circuit high (Bank 2 / Sensor 2)	●	
P0076	Intake Valve Control Solenoid Circuit Low (Bank 1)	●	
P0077	Intake Valve Control Solenoid Circuit High (Bank 1)	●	
P0082	Intake Valve Control Solenoid Circuit Low (Bank 2)	●	
P0083	Intake Valve Control Solenoid Circuit High (Bank 2)	●	
P0101	Mass or Volume Air Flow Circuit Range/Performance	●	
P0102	Mass or Volume Air Flow Circuit Low Input	●	
P0103	Mass or Volume Air Flow Circuit high Input	●	
P0106	Manifold Absolute Pressure/Barometric Pressure Circuit Range/Performance	●	
P0107	Manifold Absolute Pressure/Barometric Pressure Circuit Low Input	●	
P0108	Manifold Absolute Pressure/Barometric Pressure Circuit High Input	●	
P0110	Intake Air Temperature Sensor 1 Circuit	●	
P0111	Intake Air Temperature Sensor 1 Circuit Range/Performance	●	
P0112	Intake Air Temperature Sensor 1 Circuit Low Input	●	
P0113	Intake Air Temperature Sensor 1 Circuit High Input	●	
P0115	Engine Coolant Temperature Circuit	●	
P0117	Engine Coolant Temperature Circuit Low Input	●	
P0118	Engine Coolant Temperature Circuit High Input	●	
P0122	Throttle/Pedal Position Sensor/Switch "A" Circuit Low Input	●	
P0123	Throttle/Pedal Position Sensor/Switch "A" Circuit High Input	●	
P0125	Insufficient Coolant Temperature for Closed Loop Fuel Control	●	
P0128	Coolant Thermostat (Coolant Temp. below Thermostat Regulating Temp.)	●	
P0131	HO2S Circuit Low Voltage (Bank 1 / Sensor 1)	●	
P0132	HO2S Circuit High Voltage (Bank 1 / Sensor 1)	●	
P0133	HO2S Circuit Slow Response (Bank 1 / Sensor 1)	●	
P0134	HO2S Circuit No Activity Detected (Bank 1 / Sensor 1)	●	
P0135	HO2S Heater Circuit (Bank 1 / Sensor 1)	●	
P0137	HO2S Circuit Low Voltage (Bank 1 / Sensor 2)	●	
P0138	HO2S Circuit High Voltage (Bank 1 / Sensor 2)	●	
P0139	HO2S Circuit Slow Response (Bank 1 / Sensor 2)	●	
P0140	HO2S Circuit No Activity Detected (Bank 1 / Sensor 2)	●	
P0141	HO2S Heater Circuit (Bank 1 / Sensor 2)	●	
P0151	HO2S Circuit Low Voltage (Bank 2 / Sensor 1)	●	

P0152	HO2S Circuit High Voltage (Bank 2 / Sensor 1)	●	
P0153	HO2S Circuit Slow Response (Bank 2 / Sensor 1)	●	
P0154	HO2S Circuit No Activity Detected (Bank 2 / Sensor 1)	●	
P0155	HO2S Heater Circuit (Bank 2 / Sensor 1)	●	
P0157	HO2S Circuit Low Voltage (Bank 2 / Sensor 2)	●	
P0158	HO2S Circuit High Voltage (Bank 2 / Sensor 2)	●	
P0159	HO2S Circuit Slow Response (Bank 2 / Sensor 2)	●	
P0160	HO2S Circuit No Activity Detected (Bank 2 / Sensor 2)	●	
P0161	HO2S Heater Circuit (Bank 2 / Sensor 2)	●	
P0171	System Too Lean (Bank 1)	●	
P0172	System Too Rich (Bank 1)	●	
P0174	System Too Lean (Bank 2)	●	
P0175	System Too Rich (Bank 2)	●	
P0196	Engine Oil Temp. Sensor Range / Performance	●	
P0197	Engine Oil Temp. Sensor Low Input	●	
P0198	Engine Oil Temp. Sensor High Input	●	
P0217	Engine Coolant Over Temperature Condition	●	
P0222	Throttle/Pedal Position Sensor/Switch "B" Circuit Low Input	●	
P0223	Throttle/Pedal Position Sensor/Switch "B" Circuit High Input	●	
P0230	Fuel Pump Primary Circuit	▲	
P0261	Cylinder 1-Injector Circuit Low	●	
P0262	Cylinder 1-Injector Circuit High	●	
P0264	Cylinder 2-Injector Circuit Low	●	
P0265	Cylinder 2-Injector Circuit High	●	
P0267	Cylinder 3-Injector Circuit Low	●	
P0268	Cylinder 3-Injector Circuit High	●	
P0270	Cylinder 4-Injector Circuit Low	●	
P0271	Cylinder 4-Injector Circuit High	●	
P0273	Cylinder 5-Injector Circuit Low	●	
P0274	Cylinder 5-Injector Circuit High	●	
P0276	Cylinder 6-Injector Circuit Low	●	
P0277	Cylinder 6-Injector Circuit High	●	
P0300	Random/Multiple Cylinder Misfire Detected	●	
P0301	Cylinder 1-Misfire detected	●	
P0302	Cylinder 2-Misfire detected	●	
P0303	Cylinder 3-Misfire detected	●	
P0304	Cylinder 4-Misfire detected	●	
P0305	Cylinder 5-Misfire detected	●	
P0306	Cylinder 6-Misfire detected	●	
P0315	Segment Time Acquisition Incorrect	▲	
P0325	Knock Sensor 1 Circuit	●	
P0326	Knock Sensor 1 Circuit Range/Performance (Bank 1)	●	
P0330	Knock Sensor 2 Circuit	●	
P0331	Knock Sensor 2 Circuit Range/Performance (Bank 2)	●	
P0335	Crankshaft Position Sensor A Circuit	●	
P0336	Crankshaft Position Sensor A Circuit Range/Performance	●	

P0340	Camshaft Position Sensor A Circuit Malfunction (Bank 1 or Signal Sensor)	●	
P0341	Camshaft Position Sensor A Circuit Range/Performance (Bank 1 or Single Sensor)	●	
P0346	Camshaft Position Sensor A Circuit Range/Performance (Bank 2)	●	
P0351	Ignition Coil 'A' Primary / Secondary Circuit	●	
P0352	Ignition Coil 'B' Primary / Secondary Circuit	●	
P0353	Ignition Coil 'C' Primary / Secondary Circuit	●	
P0354	Ignition Coil 'D' Primary / Secondary Circuit	●	
P0355	Ignition Coil 'E' Primary / Secondary Circuit	●	
P0356	Ignition Coil 'F' Primary / Secondary Circuit	●	
P0420	Catalyst System Efficiency below Threshold (Bank 1)	●	
P0430	Catalyst System Efficiency below Threshold (Bank 2)	●	
P0441	Evap. Emission System Incorrect Purge Flow	●	
P0442	Evap. Emission System-Leak detected (Small leak)	●	
P0444	Evap. Emission System-Purge Ctrl. Valve Circuit Open	●	
P0445	Evap. Emission System-Purge Ctrl. Valve Circuit Shorted	●	
P0447	Evap. Emission System-Vent Control Circuit Open	●	
P0448	Evap. Emission System-Vent Control Circuit Shorted	●	
P0451	Evap. Emission System-Pressure Sensor Range / Performance	●	
P0452	Evap. Emission System-Pressure Sensor Low Input	●	
P0453	Evap. Emission System-Pressure Sensor High Input	●	
P0454	Evap. Emission System-Pressure Sensor Intermittent	●	
P0455	Evap. Emission System-Leak detected (Large leak)	●	
P0456	Evap. Emission System-Leak detected (Very small leak)	●	
P0461	Fuel Level Sensor "A" Circuit Range/Performance	●	
P0462	Fuel Level Sensor "A" Circuit Low Input	●	
P0463	Fuel Level Sensor "A" Circuit High Input	●	
P0464	Fuel Level Sensor "A" Circuit Intermittent	●	
P0480	Fan 1 Control Circuit Malfunction	●	
P0501	Vehicle Speed Sensor A Range/Performance	●	
P0504	Brake Switch "A"/"B" Correlation	●	
P0506	Idle Air Control System-RPM lower than expected	●	
P0507	Idle Air Control System-RPM higher than expected	●	
P0532	A/C Refrigerant Pressure Sensor "A" Circuit Low Input	▲	
P0533	A/C Refrigerant Pressure Sensor "A" Circuit High Input	▲	
P0552	Power Steering Pressure Sensor/Switch Circuit Low Input	●	
P0553	Power Steering Pressure Sensor/Switch Circuit High Input	●	
P0562	System Voltage Low	●	
P0563	System Voltage High	●	
P0571	Brake Switch "A" Circuit	●	
P0601	EEPROM-Check sum Error	●	
P0602	EEPROM-Programming Error	●	
P0604	Internal Control Module Random Access Memory (RAM) Error	●	
P0606	ECM/PCM Processor(ECM-SELF TEST Failed)	●/▲	
P061B	Internal Control Module Torque Calculation Performance	●	
P0630	VIN not Programmed or Incompactible-ECM/PCM	●	
P0638	Throttle Actuator Control Range/Performance	●	

P0641	Sensor Reference Voltage "A" Circuit Open	●	
P0646	A/C Clutch Relay Control Circuit Low	▲	
P0647	A/C Clutch Relay Control Circuit High	▲	
P0650	Malfunction Indicator Lamp(MIL) Control Circuit	▲	
P0651	Sensor Reference Voltage "B" Circuit Open	●	
P0660	Intake Manifold Tuning Valve Control Circuit/Open (Bank 1)	●	
P0685	ECM/PCM Power Relay Control Circuit /Open	▲	
P1106	Manifold Absolute Pressure Sensor Circuit Short - Intermittent High Input	▲	
P1107	Manifold Absolute Pressure Sensor Circuit Short - Intermittent Low Input	▲	
P1111	Intake Air Temperature Sensor Circuit Short - Intermittent High Input	▲	
P1112	Intake Air Temperature Sensor Circuit Short - Intermittent Low Input	▲	
P1114	Engine Coolant Temperature Sensor Circuit - Intermittent Low Input	▲	
P1115	Engine Coolant Temperature Sensor Circuit - Intermittent High Input	▲	
P1295	ETC (Electronic Throttle Control) System Malfunction - Power Management	●	
P1523	ETC (Electronic Throttle Control) System Malfunction - Throttle Valve Stuck	▲	
P161B	PCM Internal Error - Torque Calculating	●	
P2104	ETC (Electronic Throttle Control) System Malfunction - Forced Idle	●	
P2105	ETC (Electronic Throttle Control) System Malfunction - Forced Engine Shutdown	●	
P2106	ETC (Electronic Throttle Control) System Malfunction - Forced Limited Power	●	
P2122	Throttle/Pedal Position Sensor/Switch "D" Circuit Low Input	●	
P2123	Throttle/Pedal Position Sensor/Switch "D" Circuit High Input	●	
P2127	Throttle/Pedal Position Sensor/Switch "E" Circuit Low Input	●	
P2128	Throttle/Pedal Position Sensor/Switch "E" Circuit High Input	●	
P2135	Throttle/Pedal Position Sensor/Switch "A" / "B" Voltage Correlation	●	
P2138	Throttle/Pedal Position Sensor/Switch "D" / "E" Voltage Correlation	●	
P2173	ETC (Electronic Throttle Control) System Malfunction - High Air flow Detected.	●	
P2187	System Too Lean at Idle (←Additive) (Bank 1)	●	
P2188	System Too Rich at Idle (Bank 1)	●	
P2189	System Too Lean at Idle (←Additive) (Bank 2)	●	
P2190	System Too Rich at Idle (Bank 2)	●	
P2195	HO2S Signal Stuck Lean (Bank 1 / Sensor 1)	●	
P2196	HO2S Signal Stuck Rich (Bank 1 / Sensor 1)	●	
P2197	HO2S Signal Stuck Lean (Bank 2 / Sensor 1)	●	
P2198	HO2S Signal Stuck Rich (Bank 2 / Sensor 1)	●	
P2270	HO2S Signal Stuck Lean (Bank 1 / Sensor 2)	●	
P2271	HO2S Signal Stuck Rich (Bank 1 / Sensor 2)	●	
P2272	HO2S Signal Stuck Lean (Bank 2 / Sensor 2)	●	
P2273	HO2S Signal Stuck Rich (Bank 2 / Sensor 2)	●	
P2422	Evap. Emission System-Canister Clogging	●	
P2610	ECM/PCM Internal Engine Off Timer Performance	●	
P2A00	02 Sensor Not Ready (Bank 1 / Sensor 1)	●	
P2A03	02 Sensor Not Ready (Bank 1 / Sensor 2)	●	
U0001	CAN Communication Malfunction	●	

NOTE

● : MIL ON & MEMORY
▲ : MIL OFF & MEMORY

Fuel System > Engine Control System > Power train Control Module (PCM) > Repair procedures

PCM PROBLEM INSPECTION PROCEDURE

1. TEST PCM GROUND CIRCUIT: Measure resistance between PCM and chassis ground using the backside of PCM harness connector as PCM side check point. If the problem is found, repair it.

   Specification (Resistance): 1Ω or less

2. TEST PCM CONNECTOR: Disconnect the PCM connector and visually check the ground terminals on PCM side and harness side for bent pins or poor contact pressure. If the problem is found, repair it.
3. If problem is not found in Step 1 and 2, the PCM could be faulty. If so, replace the PCM with a new one, and then check the vehicle again. If the vehicle operates normally then the problem was likely with the PCM.
4. RE-TEST THE ORIGINAL PCM : Install the original PCM (may be broken) into a known-good vehicle and check the vehicle. If the problem occurs again, replace the original PCM with a new one. If problem does not occur, this is intermittent problem (Refer to INTERMITTENT PROBLEM PROCEDURE in BASIC INSPECTION PROCEDURE).

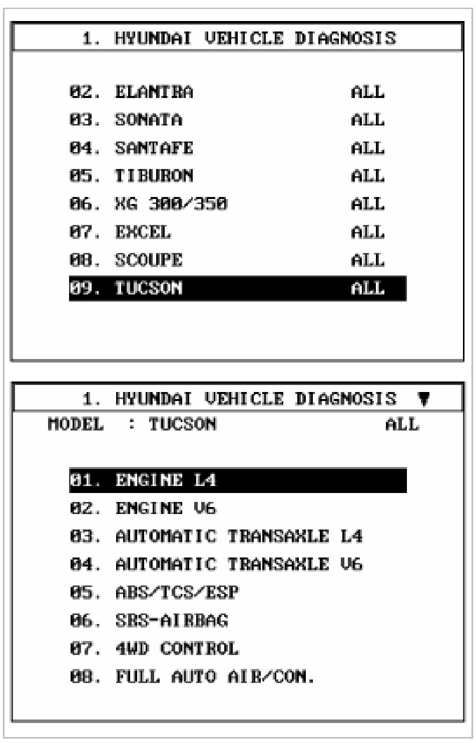
VIN PROGRAMMING PROCEDURE

VIN (Vehicle Identification Number) is a number that has the vehicle's information (Maker, Vehicle Type, Vehicle Line/Series, Body Type, Engine Type, Transmission Type, Model Year, Plant Location and so forth. For more information, please refer to the group "GI" in this SERVICE MANUAL). When replacing an PCM, the VIN must be programmed in the PCM. If there is no VIN in PCM memory, the fault code (DTC P0630) is set.

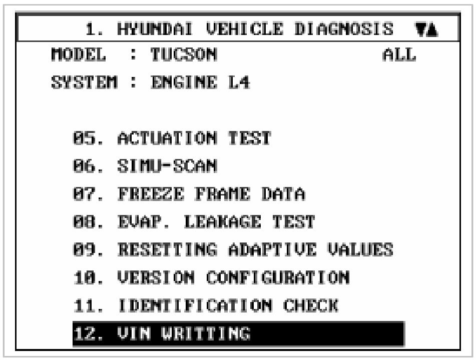
CAUTION

The programmed VIN cannot be changed. When writing the VIN, confirm the VIN carefully

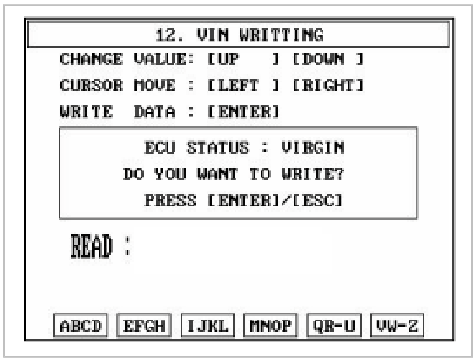
1. Select "Vehicle" and "Engine" (For example, TUCSON 2.0L L4).



2. Select "VIN WRITING".



3. Check the PCM status.



NOTE

- VIRGIN: VIN is not programmed
- LEARNT: VIN has been already programmed

Is the PCM status "VIRGIN"?

YES

▸ Go to next step 4.

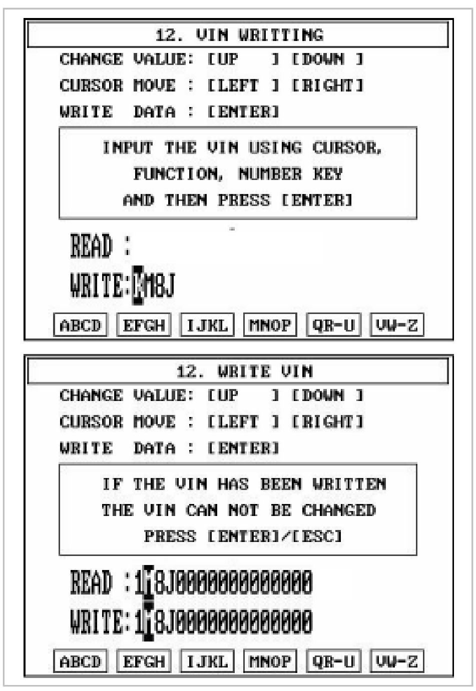
NO

▸ END

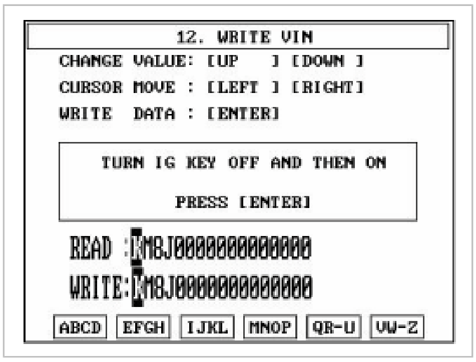
4. Write the VIN with cursor, function and number keys.

WARNING

Before pressing the "ENTER" key, confirm the VIN again because the programmed VIN cannot be changed.



5. After verifying the written VIN, press the "ENTER" key.
6. Turn the ignition switch OFF, and then turn ON.

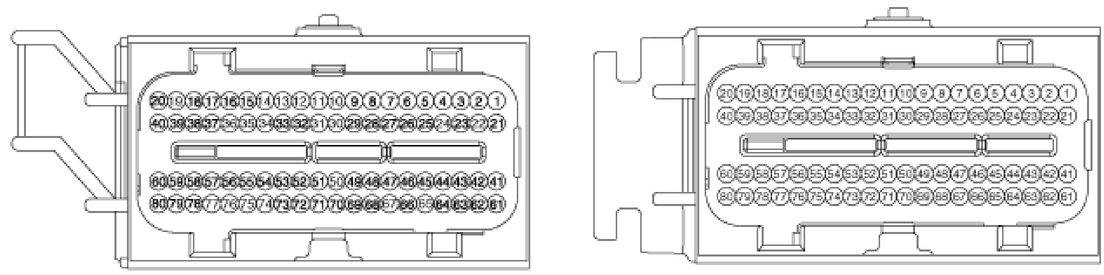


7. Verify the programmed VIN in the PCM memory.

Fuel System > Engine Control System > Power train Control Module (PCM) > Specifications

POWERTRAIN CONTROL MODULE (PCM)

1. PCM HARNESS CONNECTOR



CONNECTOR [C144-1] CONNECTOR [C144-2]

2. PCM TERMINAL FUNCTION

CONNECTOR [C144-1]

PinNo.	Description	Connected to
1	2nd CAN [High]	Multi-Purpose Check Connector
2	2nd CAN [Low]	Multi-Purpose Check Connector
3	For Autotransaxle Control	
4	For Autotransaxle Control	
5	For Autotransaxle Control	
6	For Autotransaxle Control	
7	For Autotransaxle Control	
8	For Autotransaxle Control	
9	Clutch Switch signal input	Cruise Clutch Pedal Position Switch
10	For Autotransaxle Control	
11	For Autotransaxle Control	
12	-	
13	For Autotransaxle Control	
14	-	
15	Alternator load signal input	Alternator
16	Cruise Switch ground	Cruise Switch
17	Fuel Tank Pressure Sensor ground	Fuel Tank Pressure Sensor (FTPS)
18	Air conditioner switch "ON" signal input	Air Conditioner Switch
19	-	

20	For Autotransaxle Control	
21	Brake switch signal input	Brake Switch
22	For Autotransaxle Control	
23	Brake lamp signal input	Brake Lamp
24	For Autotransaxle Control	
25	Cruise Switch signal input	Cruise Switch
26	Air conditioner thermal switch signal input	Air Conditioner Thermal Switch
27	Diagnostic Data Line (K-Line)	Data Link Connector (DLC)
28	Fuel Tank Pressure Sensor signal input	Fuel Tank Pressure Sensor (FTPS)
29	Fuel level signal input	Fuel Sender (in Fuel Pump Assembly)
30	-	
31	-	
32	Air Conditioner Pressure Sensor signal input	Air Conditioner Pressure Sensor
33	Sensor ground	Air Conditioner Pressure Sensor, Power Steering Pressure Sensor (PSPS)
34	-	
35	For Autotransaxle Control	
36	-	
37	Canister Close Valve control output	Canister Close Valve (CCV)
38	Battery voltage supply after main relay	Main Relay
39	Battery voltage supply after main relay	Main Relay
40	Battery voltage supply after main relay	Main Relay
41	CAN [High]	ABS Control Module, ESP Control Module
42	CAN [Low]	ABS Control Module, ESP Control Module
43	Main Relay control output	Main Relay
44	Intake Air Temperature Sensor signal input	Intake Air Temperature Sensor (IATS)
45	Immobilizer communication line	Immobilizer
46	Power Steering Pressure Sensor signal input	Power Steering Pressure Sensor (PSPS)
47	Mass Air Flow Sensor signal input	Mass Air Flow Sensor (MAFS)
48	Accelerator Position Sensor #2 ground	Accelerator Position Sensor (APS) #2
49	Accelerator Position Sensor #2 signal input	Accelerator Position Sensor (APS) #2
50	For Autotransaxle Control	
51	Cruise "SET" lamp control output	(Cruise "SET" Lamp)
52	Vehicle speed signal input	ABS Control Module, ESP Control Module [With ABS/ESP]
53	Intake Air Temperature Sensor ground	Intake Air Temperature Sensor (IATS)
54	Accelerator Position Sensor #1 signal input	Accelerator Position Sensor (APS) #1
55	Accelerator Position Sensor #1 ground	Accelerator Position Sensor (APS) #1
56	Fuel Tank Pressure Sensor sensor power supply	Fuel Tank Pressure Sensor (FTPS)
57	Accelerator Position Sensor #2 power supply	Accelerator Position Sensor (APS) #2
58	Sensor Power Supply (+5V)	Air Conditioner Pressure Sensor, Power Steering Pressure Sensor (PSPS)
59	Accelerator Position Sensor #1 power supply	Accelerator Position Sensor (APS) #1
60	For Autotransaxle Control	
61	Engine speed signal output	Cluster (Tachometer)
62	Fuel consumption signal output	Trip Computer
63	Malfunction Indicator Lamp (MIL) control output	Cluster (Malfunction Indicator Lamp)

64	Air Conditioner Compressor Relay control output	Air Conditioner Compressor Relay
65	For Autotransaxle Control	
66	Cooling Fan control output (PWM)	Cooling Fan Control Module
67	For Autotransaxle Control	
68	Throttle Position Sensor signal (PWM) output	ABS Control Module, ESP Control Module
69	Cruise "MAIN" lamp control output	Cruise "MAIN" Lamp
70	Fuel Pump Relay control output	Fuel Pump Relay
71	Variable Intake Solenoid Valve control output	Variable Intake Solenoid (VIS) Valve
72	Immobilizer lamp control output	Immobilizer Lamp
73	For Autotransaxle Control	
74	For Autotransaxle Control	
75	For Autotransaxle Control	
76	For Autotransaxle Control	
77	For Autotransaxle Control	
78	Purge Control Solenoid Valve control output	Purge Control Solenoid Valve (PCSV)
79	Wheel Speed Sensor [Low] signal input	Wheel Speed Sensor (WSS)[Without ABS/ESP]
80	Wheel Speed Sensor [High] signal input	Wheel Speed Sensor (WSS)[Without ABS/ESP]

CONNECTOR [C144-2]

PinNo.	Description	Connected to
1	ETC Motor [-] control output	ETC Motor (in ETC Module)
2	ETC Motor [+] control output	ETC Motor (in ETC Module)
3	For Autotransaxle Control	
4	CVVT Oil Temperature Sensor signal input	CVVT Oil Temperature Sensor (OTS)
5	-	
6	For Autotransaxle Control	
7	Engine Coolant Temperature Sensor signal input	Engine Coolant Temperature Sensor (ECTS)
8	Manifold Absolute Pressure Sensor signal input	Manifold Absolute Pressure Sensor (MAPS)
9	For Autotransaxle Control	
10	For Autotransaxle Control	
11	Manifold Absolute Pressure Sensor power supply	Manifold Absolute Pressure Sensor (MAPS)
12	Battery voltage supply after ignition switch	Ignition Switch
13	Throttle Position Sensor #2 power supply	Throttle Position Sensor (TPS) #2
14	Throttle Position Sensor #1 ground	Throttle Position Sensor (TPS) #1
15	Camshaft Position Sensor [Bank 2] power supply	Camshaft Position Sensor (CMPS) [Bank 2]
16	Throttle Position Sensor #1 power supply	Throttle Position Sensor (TPS) #1
17	Camshaft Position Sensor [Bank 2] ground	Camshaft Position Sensor (CMPS) [Bank 2]
18	Camshaft Position Sensor [Bank 1] ground	Camshaft Position Sensor (CMPS) [Bank 1]
19	Ignition Coil (Cylinder #6) control output	Ignition Coil (Cylinder #6)
20	-	
21	Crankshaft Position Sensor [High] signal input	Crankshaft Position Sensor (CKPS)
22	For Autotransaxle Control	
23	Sensor Shield	Crankshaft Position Sensor (CKPS), Knock Sensor (KS) #1,2
24	Camshaft Position Sensor [Bank 2] signal input	Camshaft Position Sensor (CMPS) [Bank 2]
25	Camshaft Position Sensor [Bank 1] signal input	Camshaft Position Sensor (CMPS) [Bank 1]

26	-	
27	-	
28	Heated Oxygen Sensor [Bank 2 / Sensor 1] ground	Heated Oxygen Sensor (HO2S) [Bank 2 / Sensor 1]
29	Heated Oxygen Sensor [Bank 2 / Sensor 2] ground	Heated Oxygen Sensor (HO2S) [Bank 2 / Sensor 2]
30	Heated Oxygen Sensor [Bank 1 / Sensor 1] ground	Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 1]
31	Heated Oxygen Sensor [Bank 1 / Sensor 2] ground	Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 2]
32	Camshaft Position Sensor [Bank 1] power supply	Camshaft Position Sensor (CMPS) [Bank 1]
33	Engine Coolant Temperature Sensor ground	Engine Coolant Temperature Sensor (ECTS)
34	Sensor ground	Manifold Absolute Pressure Sensor (MAPS), CVVT Oil Temperature Sensor (OTS)
35	Power ground	Chassis Ground
36	Power ground	Chassis Ground
37	Power ground	Chassis Ground
38	Power ground	Chassis Ground
39	Power ground	Chassis Ground
40	Ignition Coil (Cylinder #4) control output	Ignition Coil (Cylinder #4)
41	Crankshaft Position Sensor [Low] signal input	Crankshaft Position Sensor (CKPS)
42	For Autotransaxle Control	
43	For Autotransaxle Control	
44	For Autotransaxle Control	
45	For Autotransaxle Control	
46	-	
47	-	
48	Throttle Position Sensor #1 signal input	Throttle Position Sensor (TPS) #1
49	Heated Oxygen Sensor [Bank 1 / Sensor 1] signal input	Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 1]
50	Heated Oxygen Sensor [Bank 1 / Sensor 2] signal input	Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 2]
51	Heated Oxygen Sensor [Bank 2 / Sensor 1] signal input	Heated Oxygen Sensor (HO2S) [Bank 2 / Sensor 1]
52	Heated Oxygen Sensor [Bank 2 / Sensor 2] signal input	Heated Oxygen Sensor (HO2S) [Bank 2 / Sensor 2]
53	Knock Sensor (KS) #2 [High] signal input	Knock Sensor (KS) #2 [High]
54	Knock Sensor (KS) #2 [Low] signal input	Knock Sensor (KS) #2 [Low]
55	Knock Sensor (KS) #1 [Low] signal input	Knock Sensor (KS) #1 [Low]
56	Knock Sensor (KS) #1 [High] signal input	Knock Sensor (KS) #1 [High]
57	Throttle Position Sensor #2 signal input	Throttle Position Sensor (TPS) #2
58	Throttle Position Sensor #2 ground	Throttle Position Sensor (TPS) #2
59	For Autotransaxle Control	
60	Ignition Coil (Cylinder #2) control output	Ignition Coil (Cylinder #2)
61	CVVT Oil Control Valve [Bank 2] control output	CVVT Oil Control Valve (OCV) [Bank 2]
62	CVVT Oil Control Valve [Bank 1] control output	CVVT Oil Control Valve (OCV) [Bank 1]
63	Injector (Cylinder #2) control output	Injector (Cylinder #2)
64	Injector (Cylinder #3) control output	Injector (Cylinder #3)
65	-	
66	-	
67	Heated Oxygen Sensor [Bank 2 / Sensor 1] Heater control output	Heated Oxygen Sensor (HO2S) [Bank 2 / Sensor 1]
68	Injector (Cylinder #4) control output	Injector (Cylinder #4)
69	Injector (Cylinder #5) control output	Injector (Cylinder #5)

70	Heated Oxygen Sensor [Bank 1 / Sensor 1] Heater control output	Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 1]
71	Injector (Cylinder #6) control output	Injector (Cylinder #6)
72	Injector (Cylinder #1) control output	Injector (Cylinder #1)
73	Heated Oxygen Sensor [Bank 2 / Sensor 2] Heater control output	Heated Oxygen Sensor (HO2S) [Bank 2 / Sensor 2]
74	Heated Oxygen Sensor [Bank 1 / Sensor 2] Heater control output	Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 2]
75	For Autotransaxle Control	
76	Battery Power	Battery
77	Ignition Coil (Cylinder #3) control output	Ignition Coil (Cylinder #3)
78	Ignition Coil (Cylinder #5) control output	Ignition Coil (Cylinder #5)
79	Ignition Coil (Cylinder #1) control output	Ignition Coil (Cylinder #1)
80	-	

3. PCM TERMINAL INPUT/OUTPUT SIGNAL
CONNECTOR [C144-1]

PinNo.	Description	Condition	Type	Level	Test Result
1	2nd CAN [High]	Idle	DC	2.0 ~ 3.0V	2.5V
2	2nd CAN [Low]	Idle	DC	2.0 ~ 3.0V	2.5V
3	For Autotransaxle Control				
4	For Autotransaxle Control				
5	For Autotransaxle Control				
6	For Autotransaxle Control				
7	For Autotransaxle Control				
8	For Autotransaxle Control				
9	Clutch Switch signal input				
10	For Autotransaxle Control				
11	For Autotransaxle Control				
12	-				
13	For Autotransaxle Control				
14	-				
15	Alternator load signal input	Idle	PULSE	High: Battery Voltage	13.6V
				Low: Max. 1.5V	0V
				140 ~ 190Hz	160Hz
16	Cruise Switch ground				
17	Fuel Tank Pressure Sensor ground	Idle	DC	Max. 50mV	30mV
18	Air conditioner switch "ON" signal input	A/CON Relay OFF	DC	Battery Voltage	9.1V
		A/CON Relay ON		Max. 1.0V	0.1V
19	-				
20	For Autotransaxle Control				

21	Brake switch signal input	Brake pedal releasing	DC	Battery Voltage	12.7V
		Brake pedal pressing		Max. 0.5V	0.03V
22	For Autotransaxle Control				
23	Brake lamp signal input	Brake pedal releasing	DC	Max. 0.5V	0V
		Brake pedal pressing		Battery Voltage	13.0V
24	For Autotransaxle Control				
25	Cruise Switch signal input				
26	Air conditioner thermal switch signal input	A/CON OFF	DC	Max. 1.0V	0V
		A/CON ON		Battery Voltage	11.9V
27	Diagnostic Data Line (K-Line)	When transmitting	PULSE	High: Min. Vbatt * 80%	11.3V
				Low: Max. Vbatt * 20%	0.14V
		When receiving		High: Min. Vbatt * 70%	11.3V
				Low: Max. Vbatt * 30%	0.32V
28	Fuel Tank Pressure Sensor signal input				
29	Fuel level signal input				
30	-				
31	-				
32	Air Conditioner Pressure Sensor signal input	A/CON OFF	DC	0 ~ 5.0V	
		A/CON ON			1.85 ~ 2.2V
33	Sensor ground	Idle	DC	Max. 50mV	40mV
34	-				
35	For Autotransaxle Control				
36	-				
37	Canister Close Valve control output				
38	Battery voltage supply after main relay	IG OFF	DC	Max. 1.0V	0V
		IG ON		Battery Voltage	12.1V
39	Battery voltage supply after main relay	IG OFF	DC	Max. 1.0V	0V
		IG ON		Battery Voltage	12.1V
40	Battery voltage supply after main relay	IG OFF	DC	Max. 1.0V	0V
		IG ON		Battery Voltage	12.1V
41	CAN [High]	RECESSIVE	PULSE	2.0 ~ 3.0V	3.85V
		DOMINANT		2.75~4.5V	2.5V
42	CAN [Low]	RECESSIVE	PULSE	2.0 ~ 3.0V	2.55V

		DOMINANT		2.75~4.5V	1.34V
43	Main Relay control output	Relay ON	DC	Battery Voltage	12.3V
		Relay OFF		Max. 1.0V	0.87V
44	Intake Air Temperature Sensor signal input	Idle	Analog	0 ~ 5.0V	1.86V
45	Immobilizer communication line				
46	Power Steering Pressure Sensor signal input	Neutral	Analog	0 ~ 5.0V	0.89V
		Full-Turn			4.16V
47	Mass Air Flow Sensor signal input	Idle	PULSE	High: Vref	5.04V
				Low: Max. 0.5V	0.27V
				Idle: 3.0KHz	
		3,000 rpm		High: Vref	5.04V
				Low: Max. 0.5V	0.27V
				3000rpm: 4.5 kHz	
48	Accelerator Position Sensor #2 ground	Idle	DC	Max. 50mV	35mV
49	Accelerator Position Sensor #2 signal input	C.T	Analog	0.3 ~ 0.9V	0.4V
		W.O.T		1.5 ~ 3.0V	2.1V
50	For Autotransaxle Control				
51	Cruise "SET" lamp control output				
52	Vehicle speed signal input	Vehicle running	PULSE	High: Min. 5.0V	12.6V
				Low: Max. 1.0V	0.2V
53	Intake Air Temperature Sensor ground	Idle	DC	Max. 50mV	34mV
54	Accelerator Position Sensor #1 signal input	C.T	Analog	0.3 ~ 0.9V	0.77V
		W.O.T		4.0 ~ 4.8V	4.23V
55	Accelerator Position Sensor #1 ground	Idle	DC	Max. 50mV	36mV
56	Fuel Tank Pressure Sensor sensor supply				
57	Accelerator Position Sensor #2 power supply	IG OFF	DC	Max. 0.5V	0V
		IG ON		4.9 ~ 5.1V	5.08V
58	Sensor Power Supply (+5V)	IG OFF	DC	Max. 0.5V	0V
		IG ON		4.9 ~ 5.1V	5.08V
59	Accelerator Position Sensor #1 power supply	IG OFF	DC	Max. 0.5V	0V
		IG ON		4.9 ~ 5.1V	5.08V
60	For Autotransaxle Control				
61	Engine speed signal output	Idle	PULSE	High: Battery Voltage	13.0V
				Low: Max. 0.5V	0V
				20~26Hz	35Hz
				High: Battery	12.8V

62	Fuel consumption signal output	Idle	PULSE	Voltage or Vref	
				Low: Max. 0.5V	0V
63	Malfunction Indicator Lamp (MIL) control output	MIL OFF	DC	High: Battery Voltage	4.24V
		MIL ON		Low: Max. 2.0V	0V
64	Air Conditioner Compressor Relay control output	A/CON OFF	DC	Battery Voltage	13.0V
		A/CON ON		Max. 1.0V	0.14V
65	For Autotransaxle Control				
66	Cooling Fan control output (PWM)	A/CON ON	PULSE	High: Vref	12.3V
				Low: 0 ~ 0.5 V	0V
					300Hz
67	For Autotransaxle Control				
68	Throttle Position Sensor signal (PWM) output	Idle	PULSE	High: Battery Voltage	12.3V
				Low: 0 ~ 0.5 V	0V
					100Hz
69	Cruise "CRUISE" lamp control output				
70	Fuel Pump Relay control output	Relay OFF	DC	Battery Voltage	12.5V
		Relay ON		Max. 1.0V	0.09V
71	Variable Intake Solenoid Valve control output	Active	DC	Max. 1.0V	0.1V
		Inactive		Battery Voltage	12.4V
72	Immobilizer lamp control output				
73	For Autotransaxle Control				
74	For Autotransaxle Control				
75	For Autotransaxle Control				
76	For Autotransaxle Control				
77	For Autotransaxle Control				
78	Purge Control Solenoid Valve control output	Inactive Active	PULSE	High: Battery Voltage	13.2V
				Low: Max. 1.0V	0.08V
					16Hz
79	Wheel Speed Sensor [Low] signal input				
80	Wheel Speed Sensor [High] signal input				

CONNECTOR [C144-2]

PinNo.	Description	Condition	Type	Level	Test Result
				High: Battery	13.3V

				Voltage	
1	ETC Motor [-] control output	Idle	PULSE	Low: Max. 1.0V	0.3V
					3.14KHz
2	ETC Motor [+] control output	Idle	PULSE	High: Battery Voltage	13.3V
				Low: Max. 1.0V	0.4V
					3.14KHz
3	For Autotransaxle Control				
4	CVVT Oil Temperature Sensor signal input	Idle	Analog	0.5 ~ 4.5V	1.68V
5	-				
6	For Autotransaxle Control				
7	Engine Coolant Temperature Sensor signal input	Idle	Analog	0.5 ~ 4.5V	0.47V
8	Manifold Absolute Pressure Sensor signal input	IG ON	Analog	3.9 ~ 4.1V	4.01V
		Idle		0.8 ~ 1.6V	1.59V
9	For Autotransaxle Control				
10	For Autotransaxle Control				
11	Manifold Absolute Pressure Sensor power supply	IG OFF	DC	Max. 0.5V	0V
		IG ON		4.9 ~ 5.1V	5.08V
12	Battery voltage supply after ignition switch	IG OFF	DC	Max. 0.5V	0V
		IG ON		Battery Voltage	12.2V
13	Throttle Position Sensor #2 power supply	IG OFF	DC	Max. 0.5V	0V
		IG ON		4.9 ~ 5.1V	5.05V
14	Throttle Position Sensor #1 ground	Idle	DC	Max. 50mV	30mV
15	Camshaft Position Sensor [Bank 2] power supply	IG OFF	DC	Max. 0.5V	0V
		IG ON		4.9 ~ 5.1V	5.06V
16	Throttle Position Sensor #1 power supply	IG OFF	DC	Max. 0.5V	0V
		IG ON		4.9 ~ 5.1V	5.06V
17	Camshaft Position Sensor [Bank 2] ground	Idle	DC	Max. 50mV	30mV
18	Camshaft Position Sensor [Bank 1] ground	Idle	DC	Max. 50mV	30mV
19	Ignition Coil (Cylinder #6) control output	Idle	PULSE	1st: 300~400V	272V
				ON: Max. 2V	1.2V
					5.8Hz
20	-				
21	Crankshaft Position Sensor [High] signal input	Idle	Sine Wave	Vp_p: Min.1.0V	8V
					700Hz
22	For Autotransaxle Control				
23	Sensor Shield	Idle	DC	Max. 50mV	32mV
				High: Vref	5.08V

24	Camshaft Position Sensor [Bank 2] signal input	Idle	PULSE	Low: Max. 0.5V	0.06V
					40Hz
25	Camshaft Position Sensor [Bank 1] signal input	Idle	PULSE	High: Vref	5.08V
				Low: Max. 0.5V	0.06V
					40Hz
26	-				
27	-				
28	Heated Oxygen Sensor [Bank 2 / Sensor 1] ground	Idle	DC	Max. 50mV	27mV
29	Heated Oxygen Sensor [Bank 2 / Sensor 2] ground	Idle	DC	Max. 50mV	27mV
30	Heated Oxygen Sensor [Bank 1 / Sensor 1] ground	Idle	DC	Max. 50mV	26V
31	Heated Oxygen Sensor [Bank 1 / Sensor 2] ground	Idle	DC	Max. 50mV	27mV
32	Camshaft Position Sensor [Bank 1] power supply	IG OFF	DC	Max. 0.5V	0V
		IG ON		4.9 ~ 5.1V	5.06V
33	Engine Coolant Temperature Sensor ground	Idle	DC	Max. 50mV	13mV
34	Sensor ground	Idle	DC	Max. 50mV	13mV
35	Power ground	Idle	DC	Max. 50mV	0mV
36	Power ground	Idle	DC	Max. 50mV	0mV
37	Power ground	Idle	DC	Max. 50mV	0mV
38	Power ground	Idle	DC	Max. 50mV	2mV
39	Power ground	Idle	DC	Max. 50mV	2mV
40	Ignition Coil (Cylinder #4) control output	Idle	PULSE	1st: 300~400V	263V
				ON: Max. 2V	1.4V
					5.8Hz
41	Crankshaft Position Sensor [Low] signal input	Idle	Sine Wave	Vp_p: Min.1.0V	8V
					700Hz
42	For Autotransaxle Control				
43	For Autotransaxle Control				
44	For Autotransaxle Control				
45	For Autotransaxle Control				
46	-				
47	-				
48	Throttle Position Sensor #1 signal input	C.T	Analog	0.25 ~ 0.9V	
		W.O.T		Min. 4.0V	
				Rich: 0.6 ~	

49	Heated Oxygen Sensor [Bank 1 / Sensor 1] signal input	Engine Running	DC	1.0V	0.95V
				Lean: 0 ~ 0.4V	0.13V
50	Heated Oxygen Sensor [Bank 1 / Sensor 2] signal input	Engine Running	DC	Rich: 0.6 ~ 1.0V	0.88V
				Lean: 0 ~ 0.4V	0.21V
51	Heated Oxygen Sensor [Bank 2 / Sensor 1] signal input	Engine Running	DC	Rich: 0.6 ~ 1.0V	0.91V
				Lean: 0 ~ 0.4V	0.18V
52	Heated Oxygen Sensor [Bank 2 / Sensor 2] signal input	Engine Running	DC	Rich: 0.6 ~ 1.0V	0.89V
				Lean: 0 ~ 0.4V	0.22V
53	Knock Sensor (KS) #2 [High] signal input	Knocking	Variable Frequency	-0.3 ~ 0.3 V	1.7V
		Normal		0 V	
54	Knock Sensor (KS) #2 [Low] signal input	Knocking	Variable Frequency	-0.3 ~ 0.3 V	1.7V
		Normal		0 V	
55	Knock Sensor (KS) #1 [Low] signal input	Knocking	Variable Frequency	-0.3 ~ 0.3 V	1.7V\
		Normal		0 V	
56	Knock Sensor (KS) #1 [High] signal input	Knocking	Variable Frequency	-0.3 ~ 0.3 V	1.7V
		Normal		0 V	
57	Throttle Position Sensor #2 signal input	C.T	Analog	Min. 4.0V	
		W.O.T		0.25 ~ 0.9V	
58	Throttle Position Sensor #2 ground	Idle	DC	Max. 50mV	17mV
59	For Autotransaxle Control				
60	Ignition Coil (Cylinder #2) control output	Idle	PULSE	1st: 300~400V	266V
				ON: Max. 2V	1.3V
					5.8Hz
61	CVVT Oil Control Valve [Bank 2] control output	Idle	PULSE	Battery Voltage	14.5V
				Max. 1.0V	0.1V
				Duty variance when operating the accelerator	128Hz
62	CVVT Oil Control Valve [Bank 1] control output	Idle	PULSE	Battery Voltage	14.3V
				Max. 1.0V	0.1V
				Duty variance when	

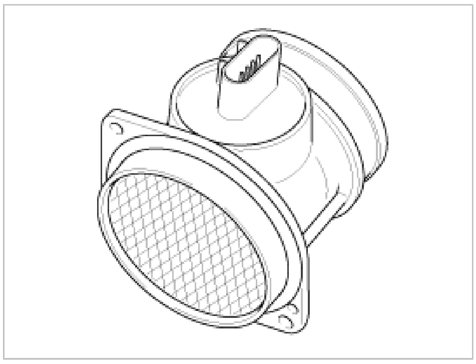
				operating the accelerator	128Hz
63	Injector (Cylinder #2) control output	Idle	PULSE	High: Battery Voltage	13.8V
				Low: Max. 1.0V	0.13V
				Vpeak: Max. 80V	57.5V
					5.8Hz
64	Injector (Cylinder #3) control output	Idle	PULSE	High: Battery Voltage	13.8V
				Low: Max. 1.0V	0.13V
				Vpeak: Max. 80V	56.8V
					5.8Hz
65	-				
66	-				
67	Heated Oxygen Sensor [Bank 2 / Sensor 1] Heater control output	Engine Running	PULSE	High: Battery Voltage	13.8V
				Low: Max. 1.0V	0.17V
					16Hz
68	Injector (Cylinder #4) control output	Idle	PULSE	High: Battery Voltage	13.8V
				Low: Max. 1.0V	0.13V
				Vpeak: Max. 80V	56.8V
					5.8Hz
69	Injector (Cylinder #5) control output	Idle	PULSE	High: Battery Voltage	13.7V
				Low: Max. 1.0V	0.13V
				Vpeak: Max. 80V	56.8V
					5.8Hz
70	Heated Oxygen Sensor [Bank 1 / Sensor 1] Heater control output	Engine Running	PULSE	High: Battery Voltage	13.8V
				Low: Max. 1.0V	0.17V
					16Hz
71	Injector (Cylinder #6) control output	Idle	PULSE	High: Battery Voltage	13.8V
				Low: Max. 1.0V	0.13V

				Vpeak: Max. 80V	56.8V
					5.8Hz
72	Injector (Cylinder #1) control output	Idle	PULSE	High: Battery Voltage	13.8V
				Low: Max. 1.0V	0.13V
				Vpeak: Max. 80V	56.8V
					5.8Hz
73	Heated Oxygen Sensor [Bank 2 / Sensor 2] Heater control output	Engine Running	PULSE	High: Battery Voltage	13.9V
				Low: Max. 1.0V	0.19V
					16Hz
74	Heated Oxygen Sensor [Bank 1 / Sensor 2] Heater control output	Engine Running	PULSE	High: Battery Voltage	13.9V
				Low: Max. 1.0V	0.18V
					16Hz
75	For Autotransaxle Control				
76	Battery Power	Always	DC	Battery Voltage	13.0V
77	Ignition Coil (Cylinder #3) control output	Idle	PULSE	1st: 300~400V	266V
				ON: Max. 2V	1.4V
					5.8Hz
78	Ignition Coil (Cylinder #5) control output	Idle	PULSE	1st: 300~400V	267V
				ON: Max. 2V	1.4V
					5.8Hz
79	Ignition Coil (Cylinder #1) control output	Idle	PULSE	1st: 300~400V	268V
				ON: Max. 2V	1.4V
					5.8Hz
80	-				

Fuel System > Engine Control System > Mass Air Flow Sensor (MAFS) > Description and Operation

DESCRIPTION

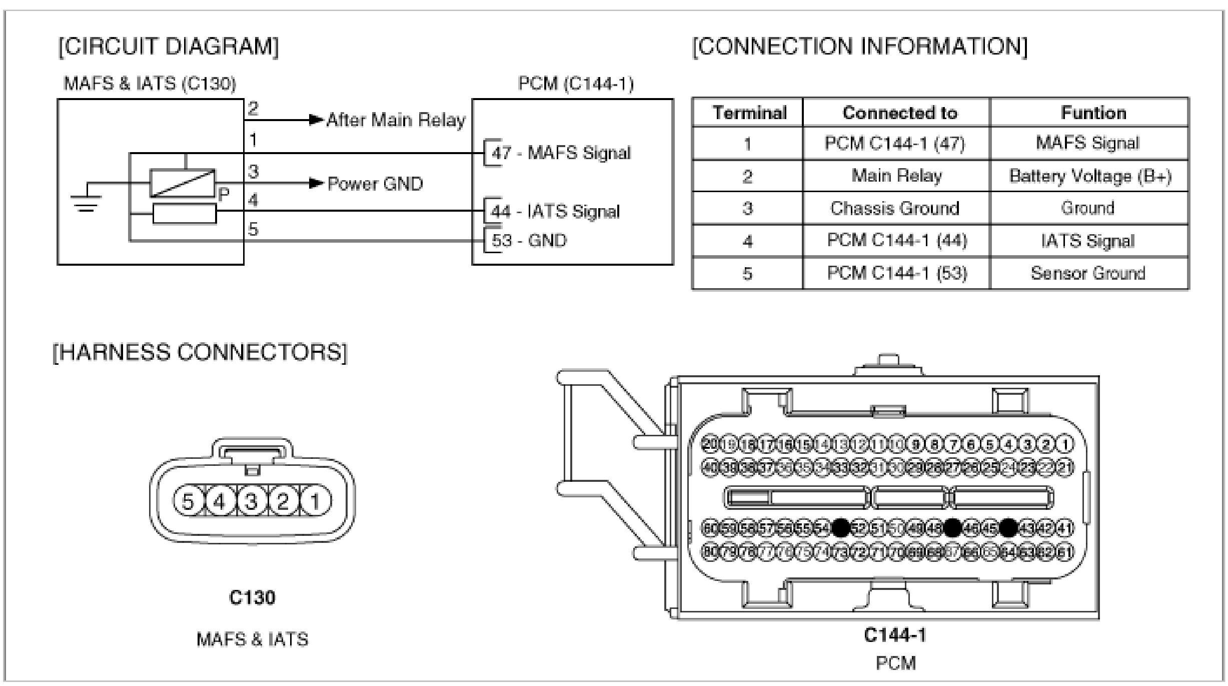
Mass Air Flow Sensor (MAFS) is a hot-film type sensor and is located in between the air cleaner and the throttle body. It consists of a tube, a sensor assembly and honey cell and detects intake air quantity flowing into the intake manifold. While the intake air coming out of the air cleaner flows by the honey cell, it becomes laminar flow, and then it passes the hot-film. At this time, heat transfer is generated by convection and this sensor loses its energy. This sensor detects the mass air flow by using the energy loss and transfers the information to the PCM by frequency. The PCM calculates fuel quantity and ignition timing.



SPECIFICATION

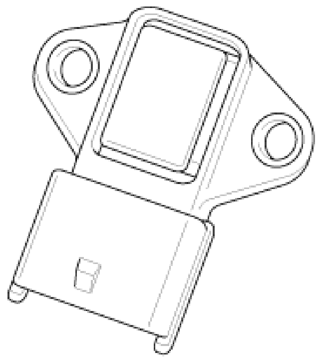
Air Flow (kg/h)	Output Frequency (Hz)
12.6 kg/h	2,617Hz
18.0 kg/h	2,958Hz
23.4 kg/h	3,241Hz
32.4 kg/h	3,653Hz
43.2 kg/h	4,024Hz
57.6 kg/h	4,399Hz
72.0 kg/h	4,704Hz
108.0 kg/h	5,329Hz
144.0 kg/h	5,897Hz
198.0 kg/h	6,553Hz
270.0 kg/h	7,240Hz
360.0 kg/h	7,957Hz
486.0 kg/h	8,738Hz
666.0 kg/h	9,644Hz
900.0 kg/h	10,590Hz

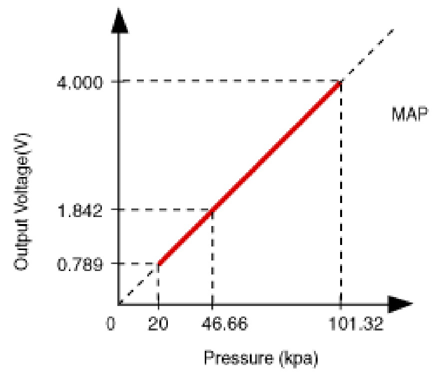
SCHEMATIC DIAGRAM



Fuel System > Engine Control System > Manifold Absolute Pressure Sensor (MAPS) > Description and Operation

DESCRIPTION

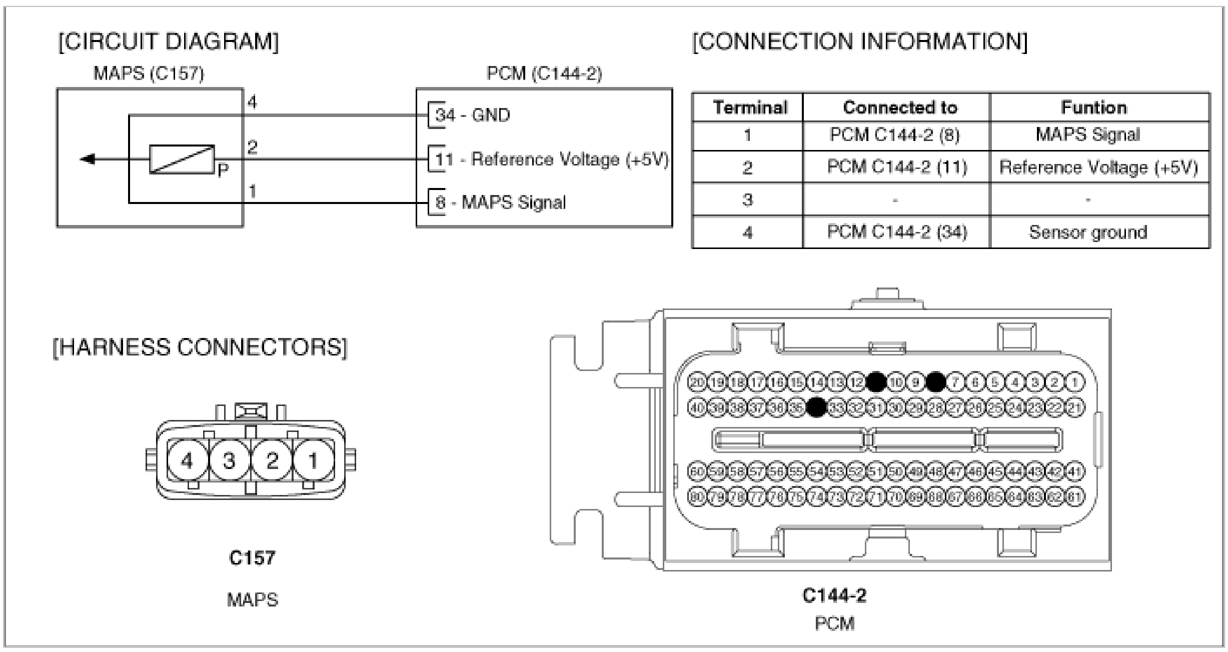




Manifold Absolute Pressure Sensor (MAPS) is speed-density type sensor and is installed on the surge tank. This MAPS senses absolute pressure in surge tank and transfers this analog signal proportional to the pressure to the PCM. The PCM calculates the intake air quantity and engine speed based on this signal. This MAPS consists of piezo-electric element and hybrid IC that amplifies the element output signal. The element is silicon diaphragm type and adapts pressure sensitive variable resistor effect of semi-conductor. 100% vacuum and the manifold pressure applies to both sides of it respectively. That is, this sensor outputs the silicon variation proportional to pressure change by voltage.

SPECIFICATION

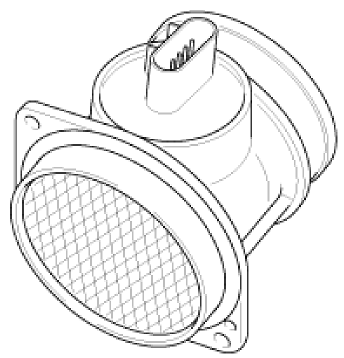
Pressure(kPa)	Output Voltage (V)
20.0kPa	0.79V
46.66kPa	1.84V
101.32kPa	4.00V

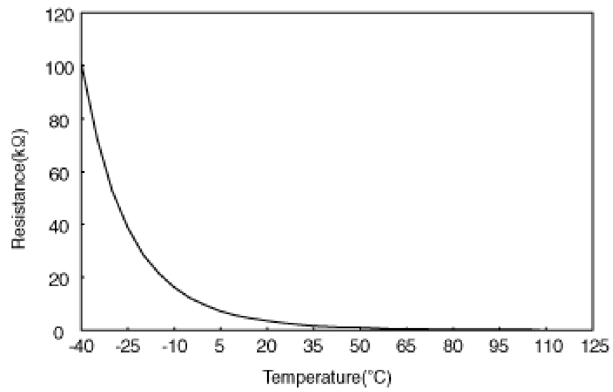


Terminal	Connected to	Funtion
1	PCM C144-2 (8)	MAPS Signal
2	PCM C144-2 (11)	Reference Voltage (+5V)
3	-	-
4	PCM C144-2 (34)	Sensor ground

Fuel System > Engine Control System > Intake Air Temperature Sensor (IATS) > Description and Operation

DESCRIPTION





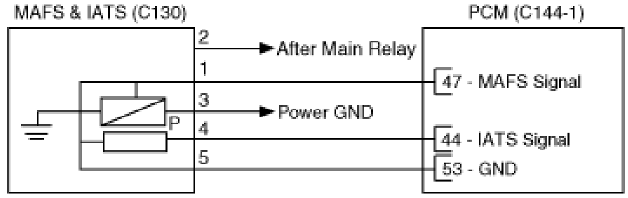
Intake Air Temperature Sensor (IATS) is installed inside the Mass Air Flow Sensor (MAFS) and detects the intake air temperature. To calculate precise air quantity, correction of the air temperature is needed because air density varies according to the temperature. So the PCM uses not only MAFS signal but also IATS signal. This sensor has a Negative Temperature Coefficient (NTC) and its resistance is in inverse proportion to the temperature.

SPECIFICATION

Temperature		Resistance (kΩ)
°C	°F	
-40	-40	100.87kΩ
-20	-4	28.58kΩ
0	32	9.40kΩ
10	50	5.66kΩ
20	68	3.51kΩ
40	104	1.47kΩ
60	140	0.67kΩ
80	176	0.33kΩ

SCHEMATIC DIAGRAM

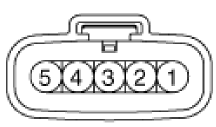
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

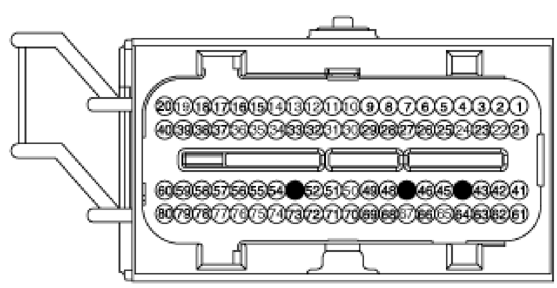
Terminal	Connected to	Funtion
1	PCM C144-1 (47)	MAFS Signal
2	Main Relay	Battery Voltage (B+)
3	Chassis Ground	Ground
4	PCM C144-1 (44)	IATS Signal
5	PCM C144-1 (53)	Sensor Ground

[HARNESS CONNECTORS]



C130

MAFS & IATS



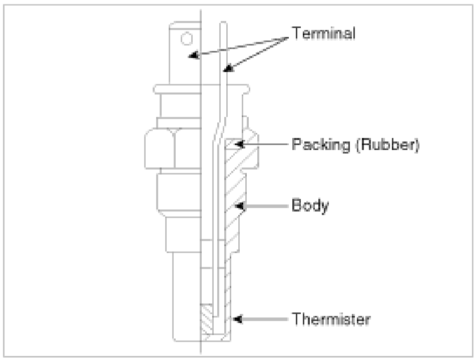
C144-1

PCM

Fuel System > Engine Control System > Engine Coolant Temperature Sensor (ECTS) > Description and Operation

DESCRIPTION

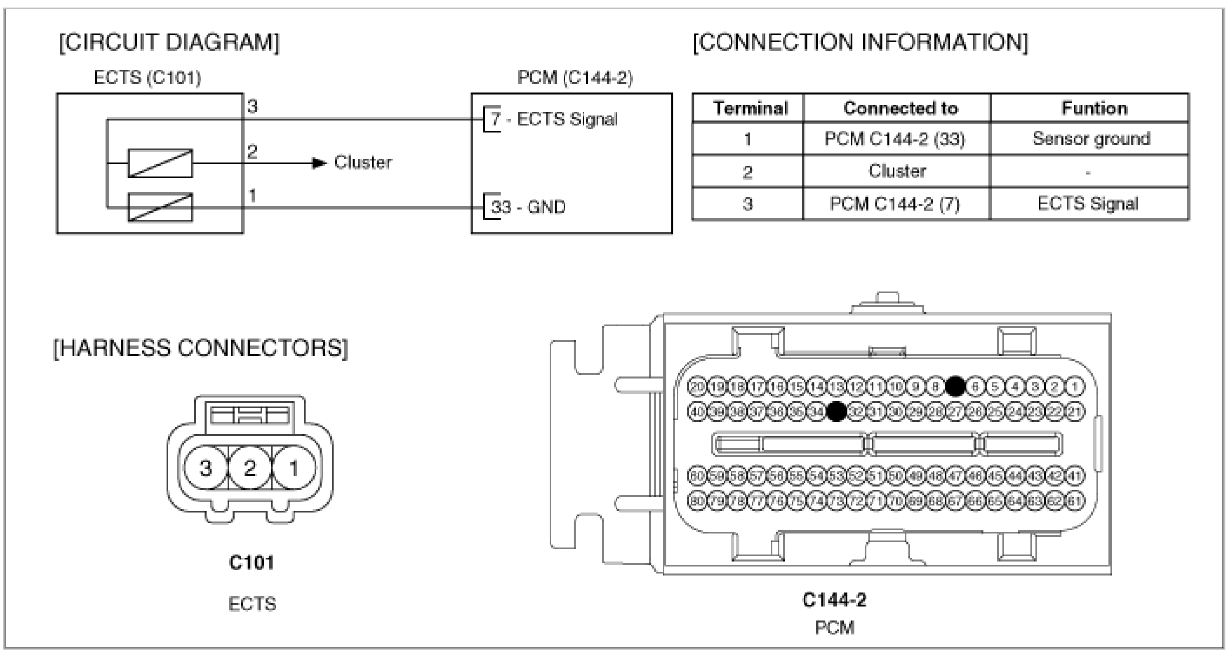
Engine Coolant Temperature Sensor (ECTS) is located in the engine coolant passage of the cylinder head for detecting the engine coolant temperature. The ECTS uses a thermistor whose resistance changes with the temperature. The electrical resistance of the ECTS decreases as the temperature increases, and increases as the temperature decreases. The reference 5 V in the PCM is supplied to the ECTS via a resistor in the PCM.That is, the resistor in the PCM and the thermistor in the ECTS are connected in series. When the resistance value of the thermistor in the ECTS changes according to the engine coolant temperature, the output voltage also changes. During cold engine operation the PCM increases the fuel injection duration and controls the ignition timing using the information of engine coolant temperature to avoid engine stalling and improve drivability.



SPECIFICATION

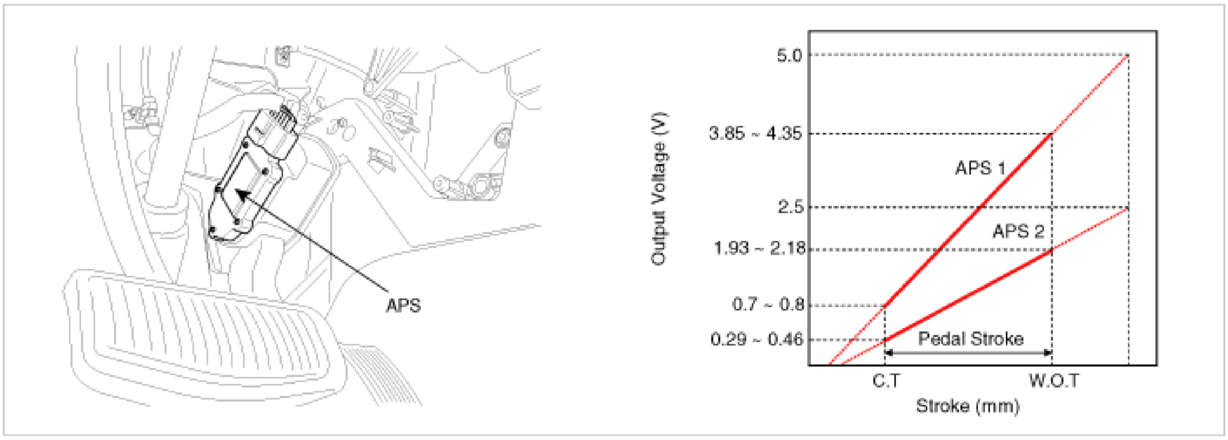
Temperature		Resistance(kΩ)
°C	°F	
-40	-40	48.14kΩ
-20	-4	14.13 ~ 16.83kΩ
0	32	5.79kΩ
20	68	2.31 ~ 2.59kΩ
40	104	1.15kΩ
60	140	0.59kΩ
80	176	0.32kΩ

SCHEMATIC DIAGRAM



Fuel System > Engine Control System > Accelerator Position Sensor (APS) > Description and Operation

DESCRIPTION



Accelerator Position Sensor (APS) is installed on the accelerator pedal module and detects the rotation angle of the accelerator pedal. The APS is one of the most important sensors in engine control system, so it consists of the two sensors which adapt individual sensor power and ground line. The second sensor monitors the first sensor and its output voltage is half of the first one. If the ratio of the sensor 1 and 2 is out of the range (approximately 1/2), the diagnostic system judges that it is abnormal.

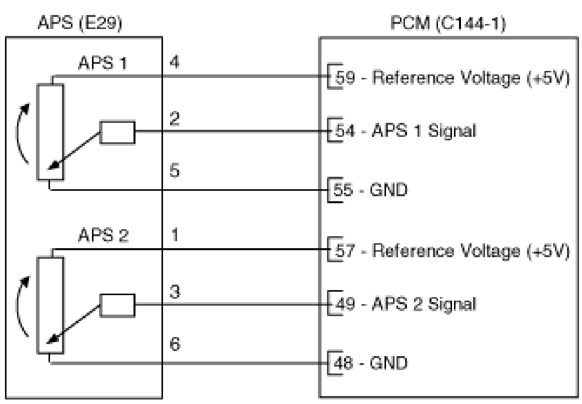
SPECIFICATION

Pedal Position	Output Voltage (V) [Vref = 5.0V]	
	APS1	APS2
C.T	0.7 ~ 0.8V	0.29 ~ 0.46V
W.O.T	3.85 ~ 4.35V	1.93 ~ 2.18V

Item	Sensor Resistance
APS1	0.7 ~ 1.3kΩ at 20°C (68°F)
APS2	1.4 ~ 2.6kΩ at 20°C (68°F)

SCHEMATIC DIAGRAM

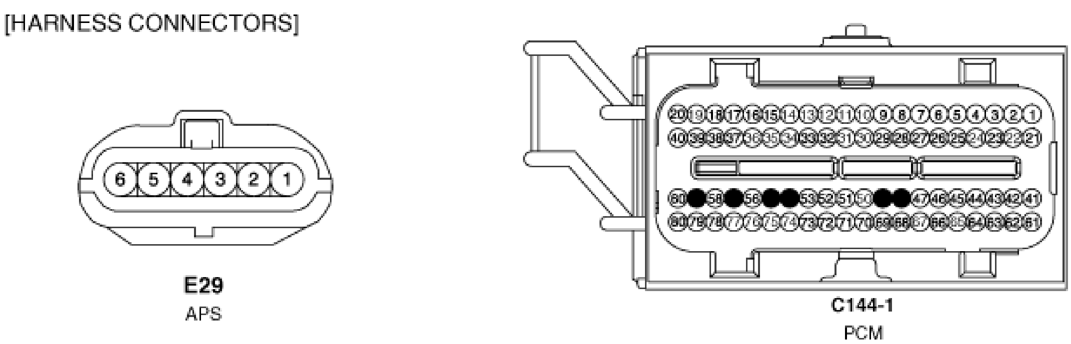
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Funtion
1	PCM C144-1 (57)	APS 2 Reference Voltage (+5V)
2	PCM C144-1 (54)	APS 1 Signal
3	PCM C144-1 (49)	APS 2 Signal
4	PCM C144-1 (59)	APS 1 Reference Voltage (+5V)
5	PCM C144-1 (55)	APS 1 Ground
6	PCM C144-1 (48)	APS 2 Ground

[HARNESS CONNECTORS]

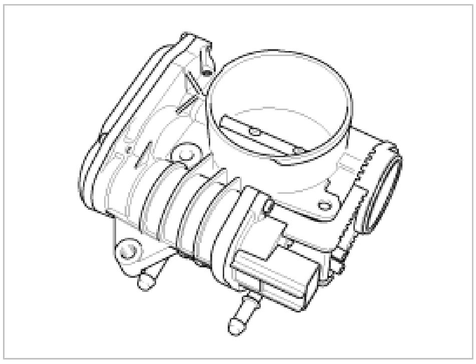


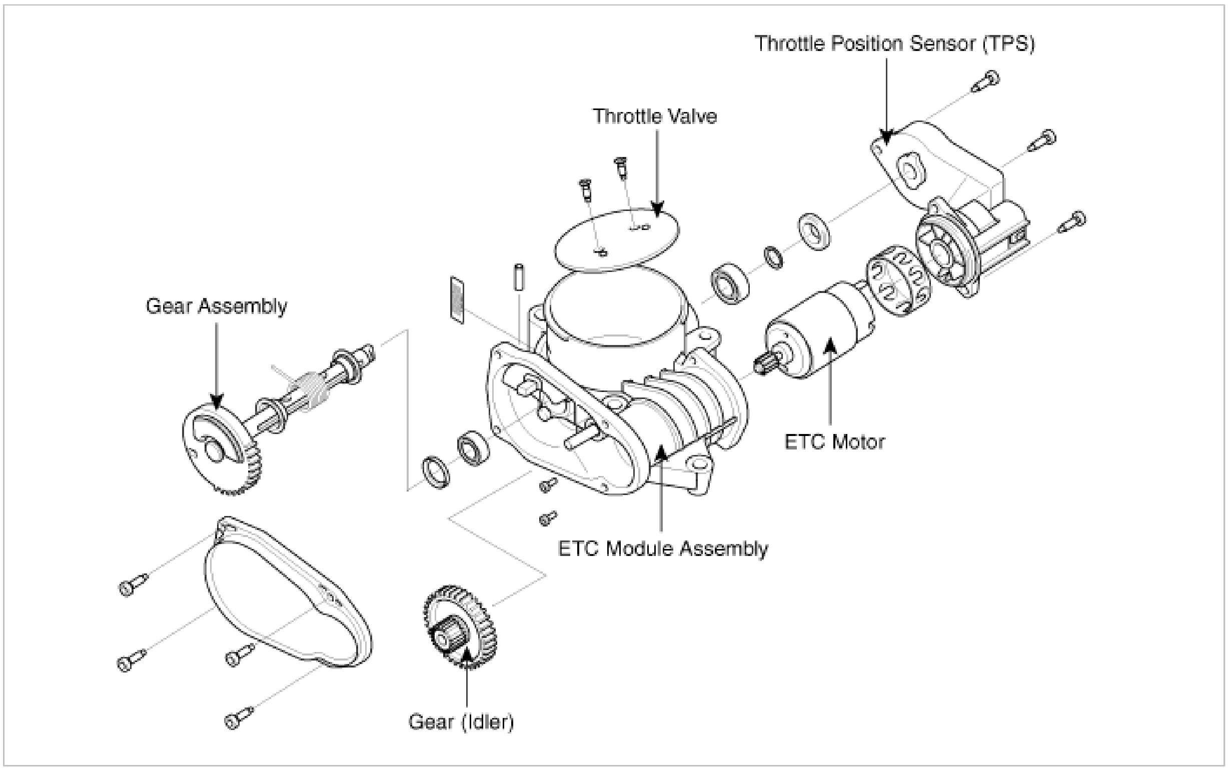
Fuel System > Engine Control System > ETC (Electric Throttle control) System > Description

and Operation

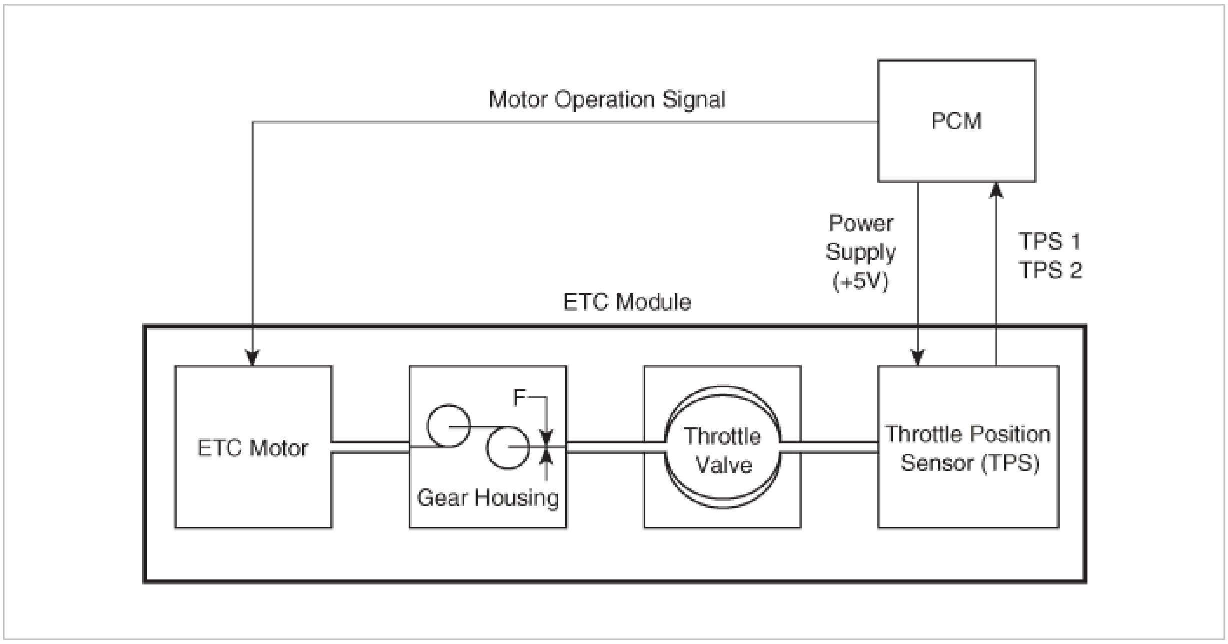
DESCRIPTION

ETC (Electronic Throttle Control) system is electronically controlled throttle device which controls the throttle valve. It consists of ETC motor, throttle body and throttle position sensor (TPS). A mechanical throttle control system receives a driver's intention via a wire cable between the accelerator and the throttle valve, while this ETC system does the signal from the Accelerator Position Sensor (APS) installed on the accelerator pedal. After the PCM receives the APS signal and calculates the throttle opening angle, it activates the throttle valve by using the ETC motor. Additionally, it can materialize cruise control function without any special devices.





COMPONENTS

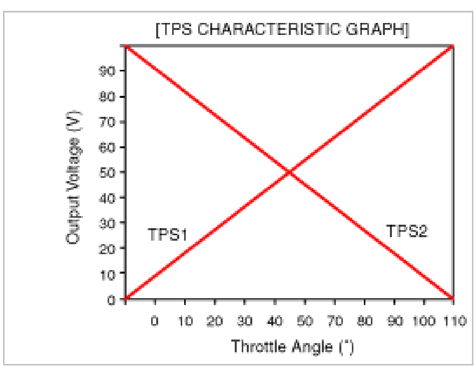


SPECIFICATION

[THROTTLE POSITION SENSOR]

Throttle Angle(°)	Output Voltage(V) [Vref = 5.0V]	
	TPS1	TPS2
0°	0V	5.0V
10°	0.5V	4.5V
20°	0.9V	4.1V
30°	1.4V	3.6V
40°	1.8V	3.2V
50°	2.3V	2.7V
60°	2.7V	2.3V
70°	3.2V	1.8V
80°	3.6V	1.4V
90°	4.1V	0.9V
100°	4.5V	0.5V
110°	5.0V	0V

Item	Sensor Resistance
TPS1	4.0 ~ 6.0kΩ at 20°C (68°F)
TPS2	2.72 ~ 4.08kΩ at 20°C (68°F)



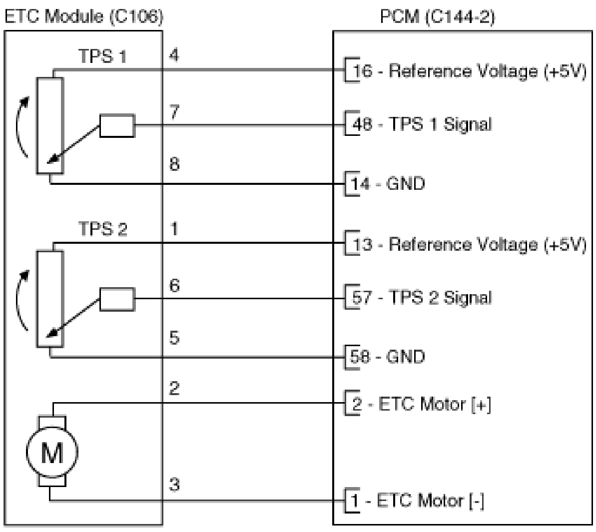
[ETC MOTOR]

Item	Sensor Resistance

Coil Resistance (Ω)	1.275 ~ 1.725Ω at 20°C (68°F)

SCHEMATIC DIAGRAM

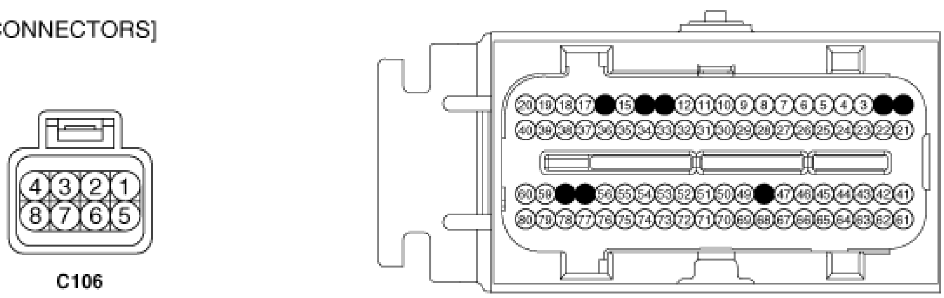
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Funtion
1	PCM C144-2 (13)	TPS 2 Reference Voltage (+5V)
2	PCM C144-2 (2)	ETC Motor [+] Control
3	PCM C144-2 (1)	ETC Motor [-] Control
4	PCM C144-2 (16)	TPS 1 Reference Voltage (+5V)
5	PCM C144-2 (58)	TPS 2 Ground
6	PCM C144-2 (57)	TPS 2 Signal
7	PCM C144-2 (48)	TPS 1 Signal
8	PCM C144-2 (14)	TPS 1 Ground

[HARNESS CONNECTORS]



C106

ETC MODULE

C144-2

PCM

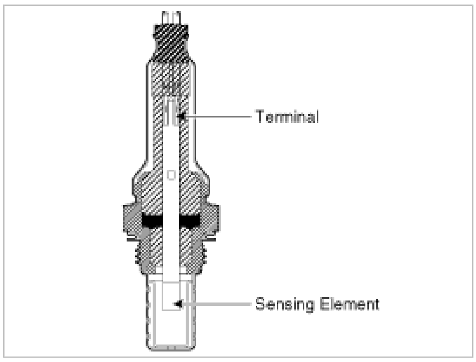
FAIL-SAFE MODE

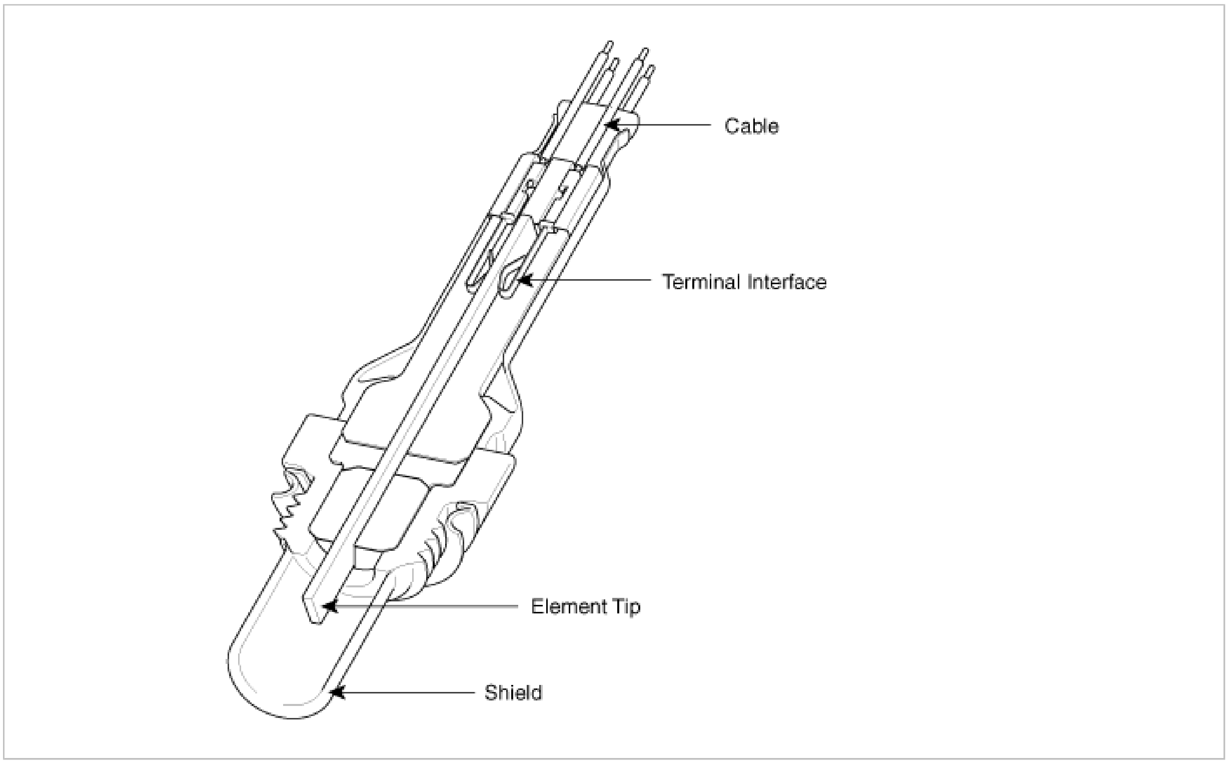
Mode	Description	Symptom	Possible Cause
MODE 1	FORCED ENGINE SHUTDOWN	Engine stop	• ETC system can't proceed reliable algorithm procedure - Fatal PCM internal programming error - Faulty intake system or throttle body
MODE 2	FORCED IDLE & POWER MANAGEMENT	Forced idle state controlled by fuel quantity regulation and ignition timing adjustment	• ETC system can't control engine power via throttle device • Disabled throttle control or broken throttle position information
MODE 3	FORCED IDLE	Forced idle state and no response for accelerator activation	• No information about the accelerator position - Broken APS 1 and 2, faulty A/D converter or internal controller
MODE 4	LIMIT PERFORMANCE & POWER MANAGEMENT	Engine power is determined by accelerator position and idle power requirement (Limited vehicle running)	• ETC system can't securely control engine power
MODE 5	LIMIT PERFORMANCE	1. Engine power varies with accelerator position, but driver perceives lack of engine power. 2. MIL ON (Normal vehicle running)	• Not reliable accelerator position signal or bad maximum power generation - Faulty APS, ignition voltage or internal controller
MODE 6	NORMAL	Normal	

Fuel System > Engine Control System > Heated Oxygen Sensor (HO2S) > Description and Operation

DESCRIPTION

Heated Oxygen Sensor (HO2S) consists of zirconium and alumina and is installed on upstream and downstream of the Manifold Catalyst Converter (MCC). After it compares oxygen consistency of the atmosphere with the exhaust gas, it transfers the oxygen consistency of the exhaust gas to the PCM. When A/F ratio is rich or lean, it generates approximately 1V or 0V respectively. In order that this sensor normally operates, the temperature of the sensor tip is higher than 370°C (698°F). So it has a heater which is controlled by the PCM duty signal. When the exhaust gas temperature is lower than the specified value, the heater warms the sensor tip.



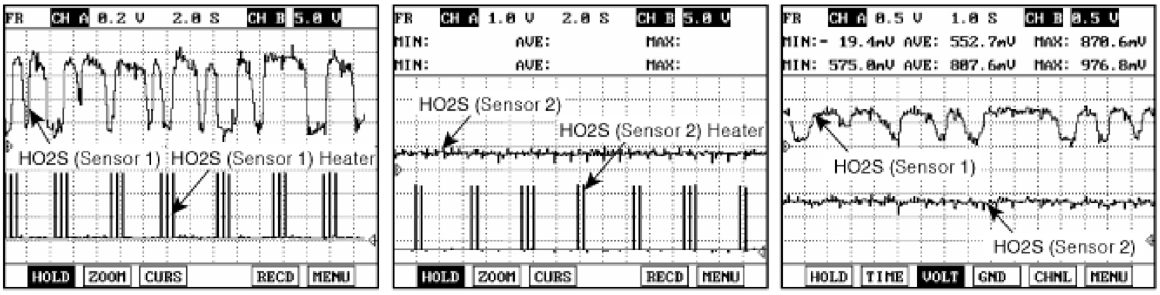


SPECIFICATION

A/F Ratio	Output Voltage (V)
RICH	0.75 ~ 1.00V
LEAN	0 ~ 0.12V

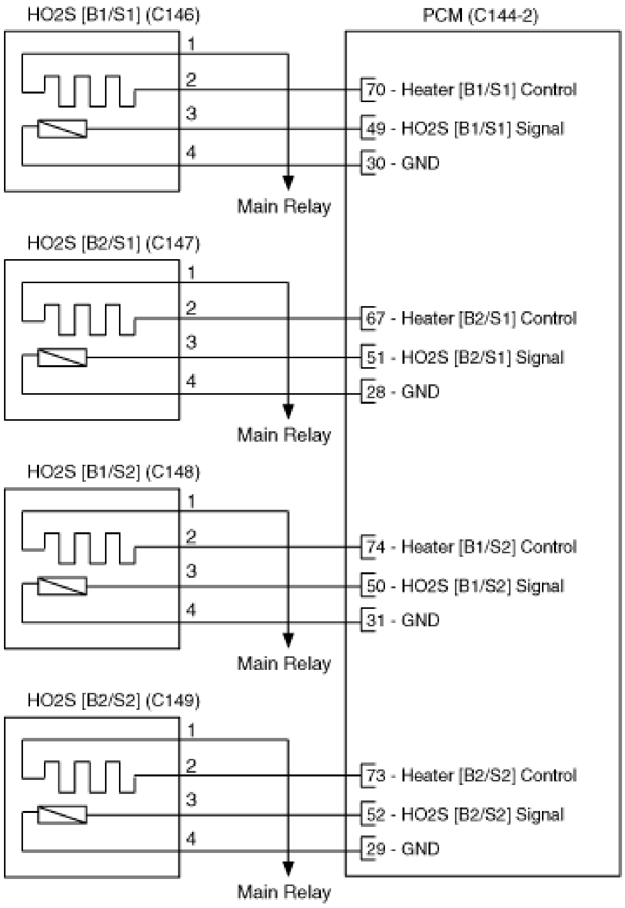
Item	Specification
Heater Resistance (Ω)	8.1 ~ 11.1Ω at 21°C (69.8°F)

WAVEFORM



SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

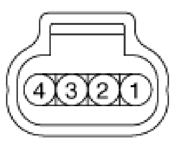
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

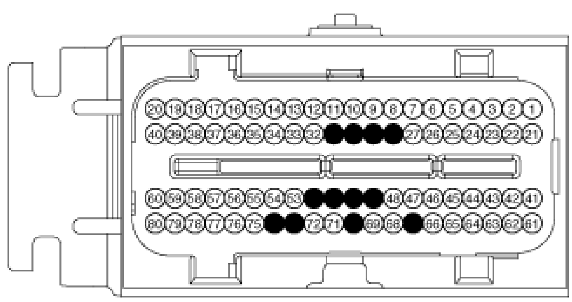
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C144-2

PCM

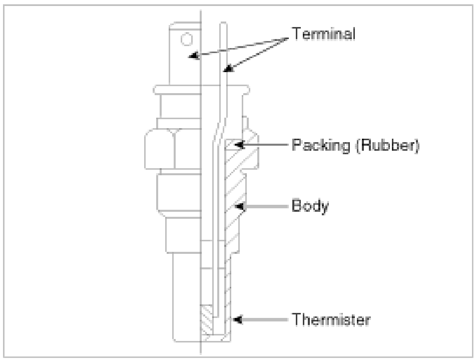
Fuel System > Engine Control System > CVVT Oil Temperature Sensor (OTS) > Description and Operation

DESCRIPTION

Continuously Variable Valve Timing (CVVT) system controls valve overlap by forcibly activating the camshaft and adjusts EGR

(Exhaust Gas Recirculation) amount. It decreases exhaust gas (NOx, HC) and improves fuel economy, idle state, torque in low speed and power in high speed. This system uses engine oil pressure and consists of the two CVVT Oil Control Valves (OCV) in each bank which supplies oil to cam phaser according to PWM (Pulse With Modulator) signal of the PCM, a CVVT Oil Temperature Sensor (OTS) which detects the oil temperature and a cam phaser which is installed on the end of the camshaft and converts camshaft phase. The oil getting out of the CVVT oil control valve flows into the cam phaser and rotates the rotor inside camphaser. At this time, the camshaft rotates with the rotor and the cam phase is changed.

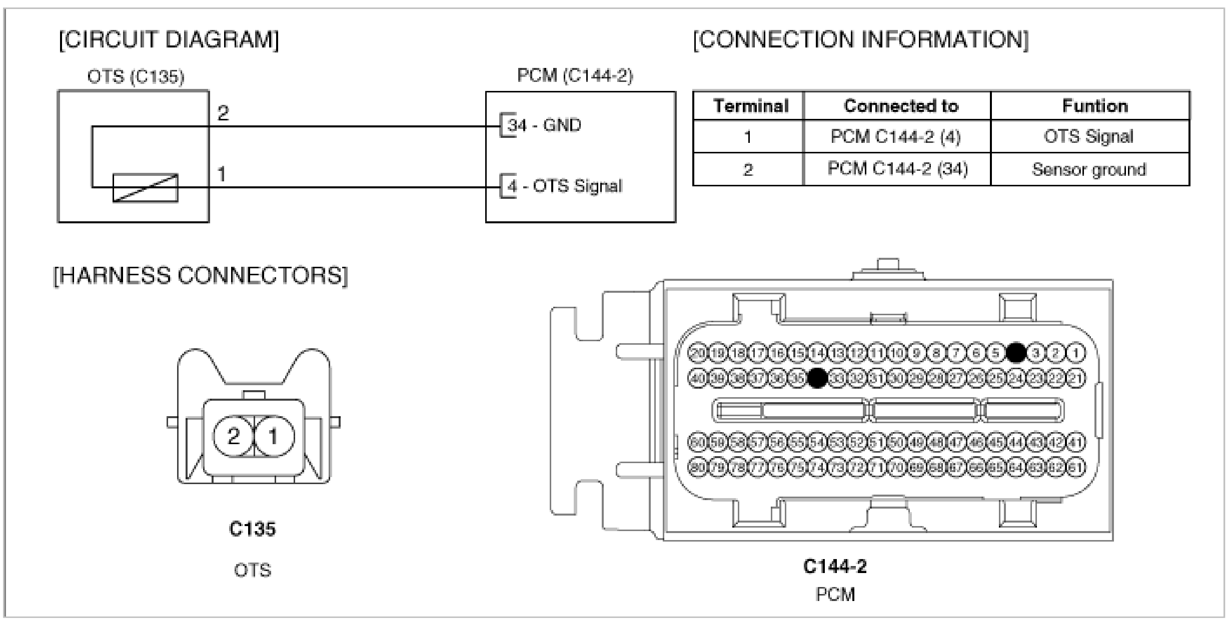
1. When camshaft rotates engine rotation-wise: Intake-Advance / Exhaust-Retard
2. When camshaft rotates counter engine rotation-wise: Intake- Retard / Exhaust- Advance



SPECIFICATION

Temperature		Resistance(kΩ)
°C	°F	
-20	-4	16.52kΩ
20	32	2.45kΩ
80	176	0.29kΩ

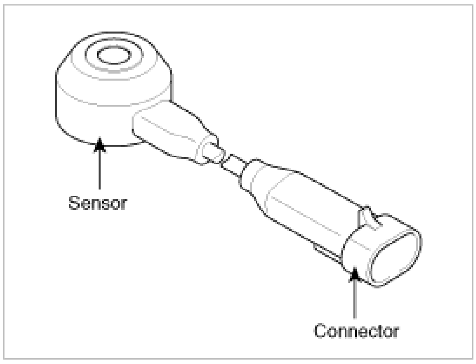
SCHEMATIC DIAGRAM

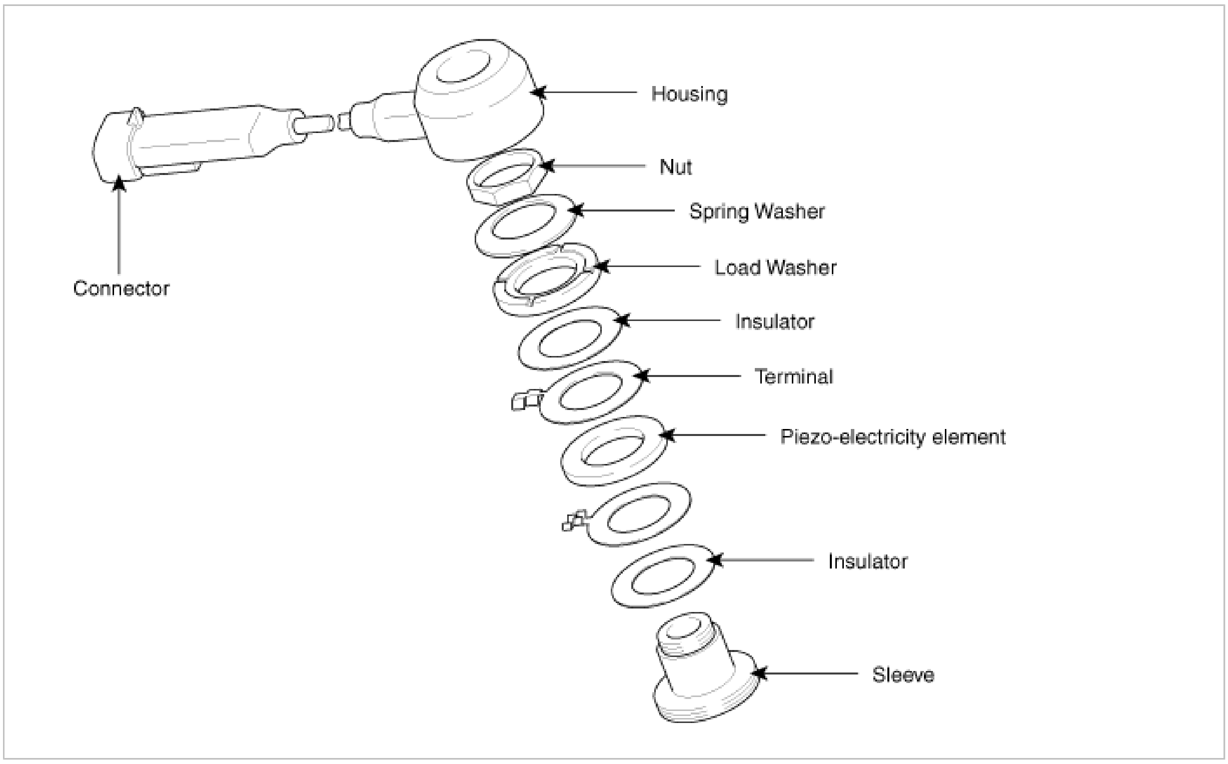


Fuel System > Engine Control System > Knock Sensor (KS) > Description and Operation

DESCRIPTION

Knocking is a phenomenon characterized by undesirable vibration and noise and can cause engine damage. Knock Sensor (KS) senses engine knocking and the two sensors are installed inside the V-valley of the cylinder block. When knocking occurs, the vibration from the cylinder block is applied as pressure to the piezoelectric element. At this time, this sensor transfers the voltage signal higher than the specified value to the PCM and the PCM retards the ignition timing. If the knocking disappears after retarding the ignition timing, the PCM will advance the ignition timing. This sequential control can improve engine power, torque and fuel economy.

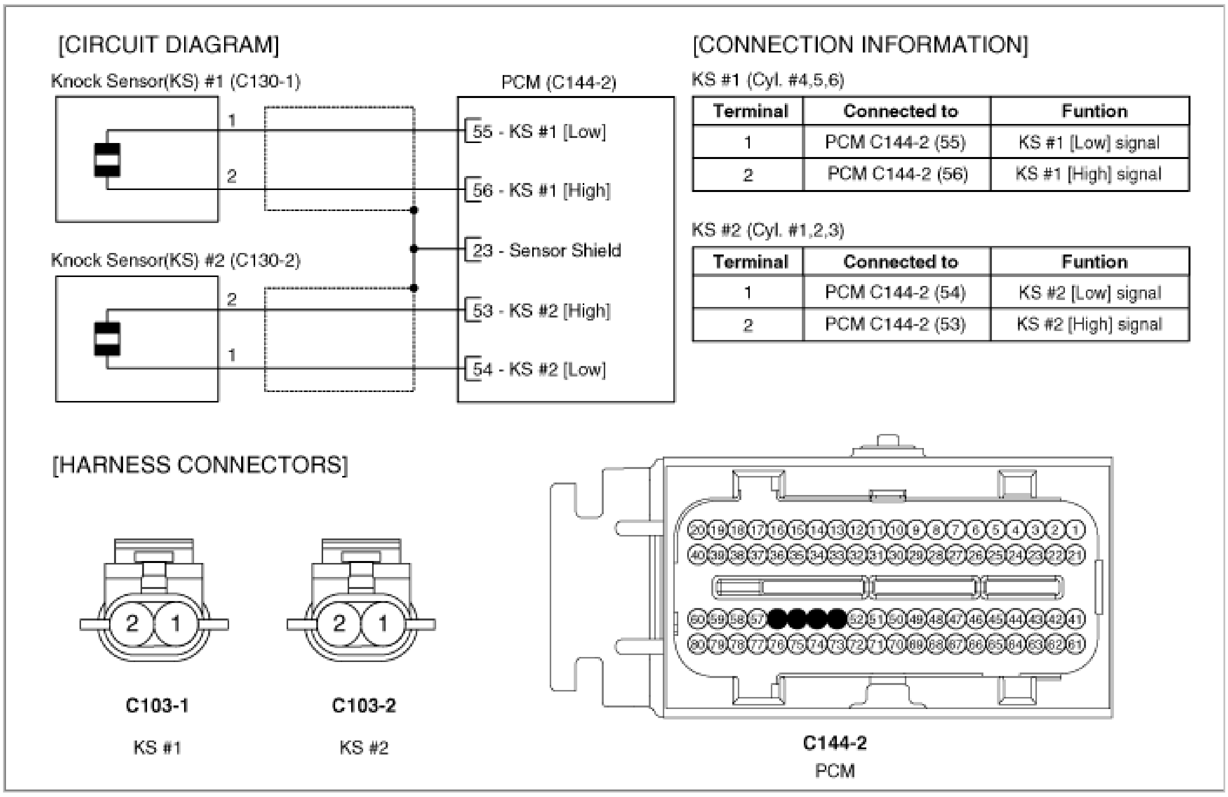




SPECIFICATION

Item	Specification
Capacitance (pF)	1,480 ~ 2,220pF

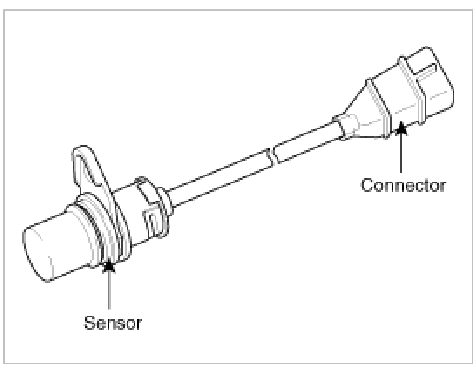
SCHEMATIC DIAGRAM



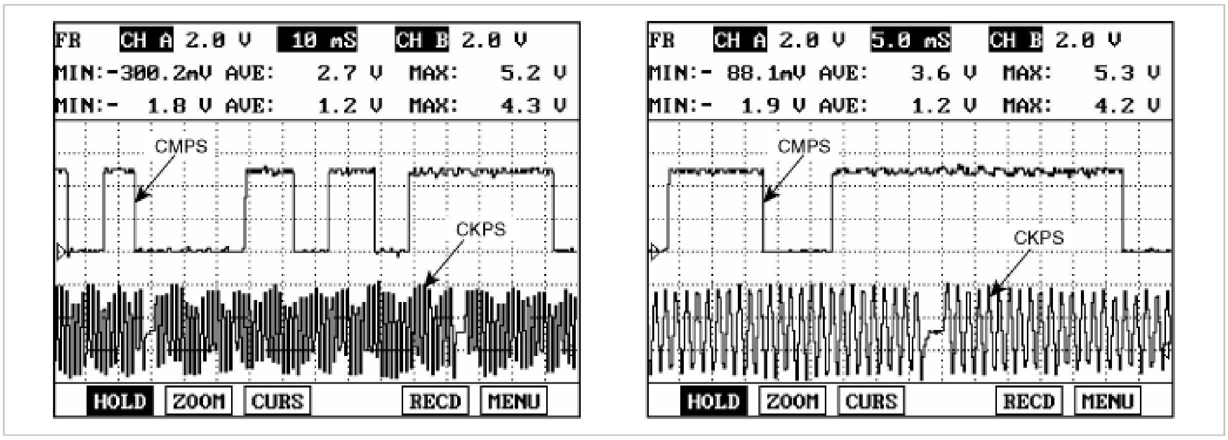
Fuel System > Engine Control System > Crankshaft Position Sensor (CKPS) > Description and Operation

DESCRIPTION

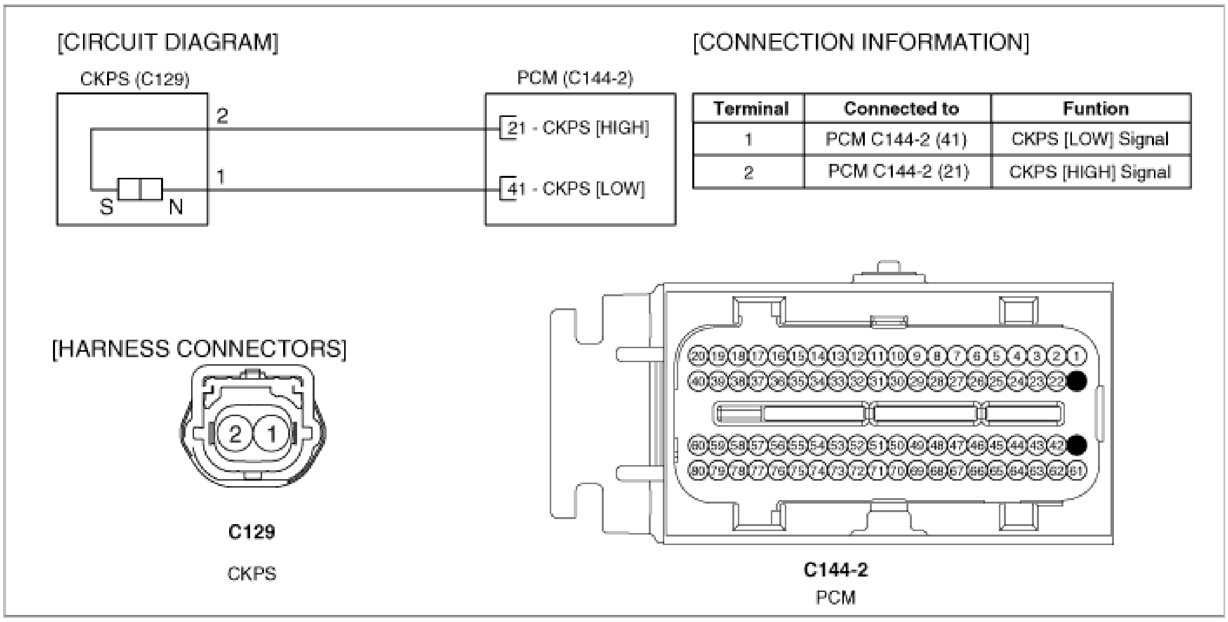
Crankshaft Position Sensor (CKPS) detects the crankshaft position and is one of the most important sensors of the engine control system. If there is no CKPS signal input, fuel is not supplied and the main relay does not operate. That is, vehicle can't run without CKPS signal. This sensor is installed on transaxle housing and generates alternating current by magnetic flux field which is made by the sensor and the target wheel when engine runs. The magnetic flux increases when the protrusion of the target wheel is getting near to the sensor and does not change in the most close position. When the protrusion becomes estranged from the sensor, magnetic flux disappears and alternating current is generated. The target wheel consists of 58 slots and 2 missing slots on 360 CA (Crank Angle).



WAVEFORM



SCHEMATIC DIAGRAM

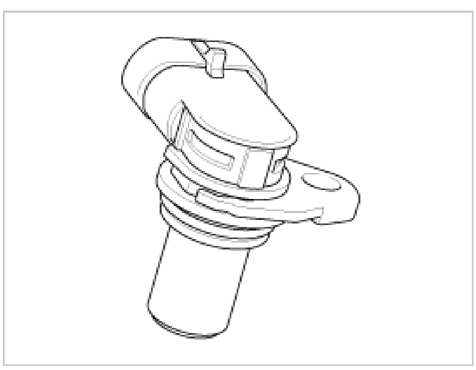


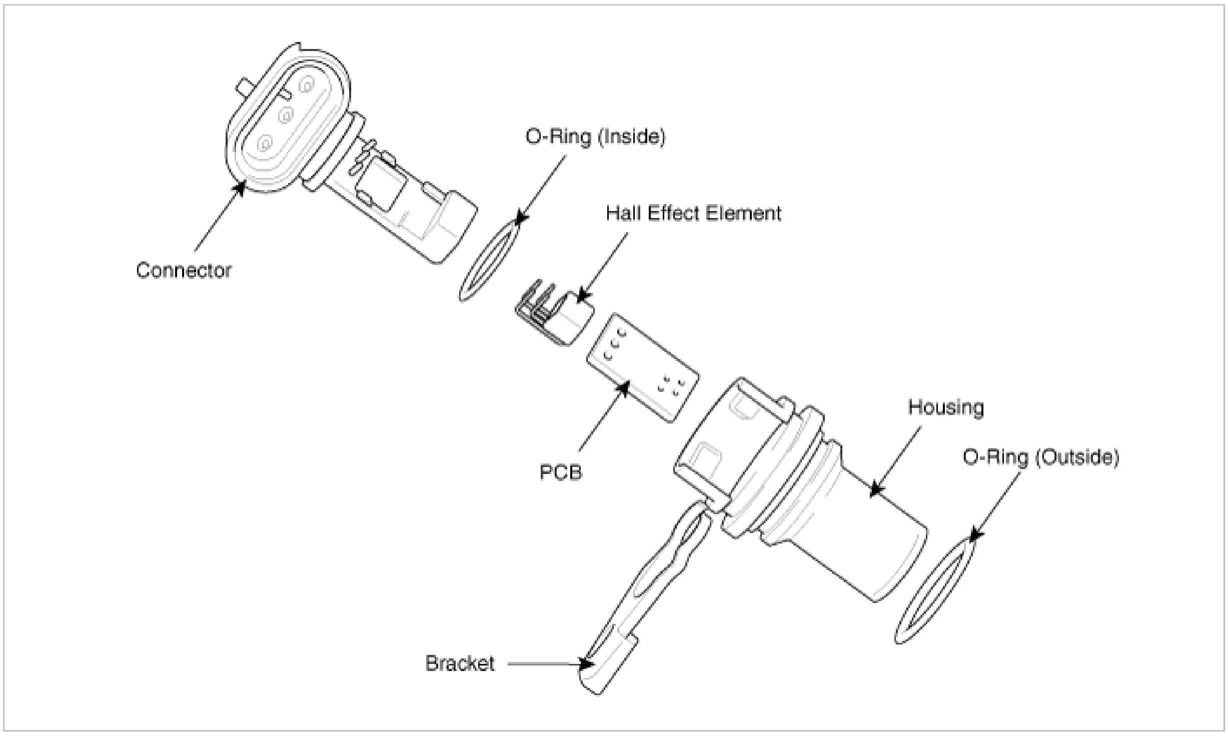
Terminal	Connected to	Funtion
1	PCM C144-2 (41)	CKPS [LOW] Signal
2	PCM C144-2 (21)	CKPS [HIGH] Signal

Fuel System > Engine Control System > Camshaft Position Sensor (CMPS) > Description and Operation

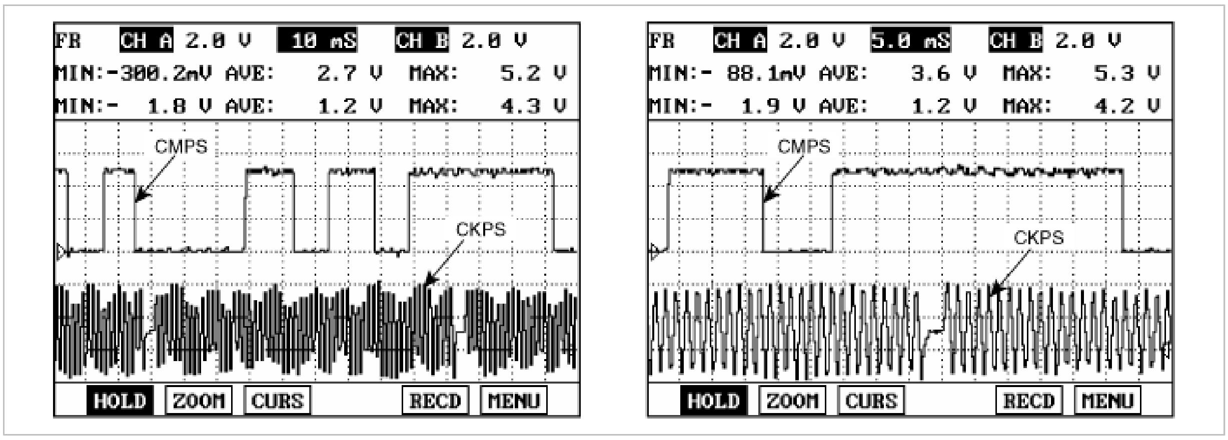
DESCRIPTION

Camshaft Position Sensor (CMPS) is a hall sensor and detects the camshaft position by using a hall element. It is related with Crankshaft Position Sensor (CKPS) and detects the piston position of each cylinder which the CKPS can't detect. The two CMPS are installed on engine head cover of bank 1 and 2 and uses a target wheel installed on the camshaft. This sensor has a hall-effect IC which output voltage changes when magnetic field is made on the IC with current flow. So the sequential injection of the 6 cylinders is impossible without CMPS signal.



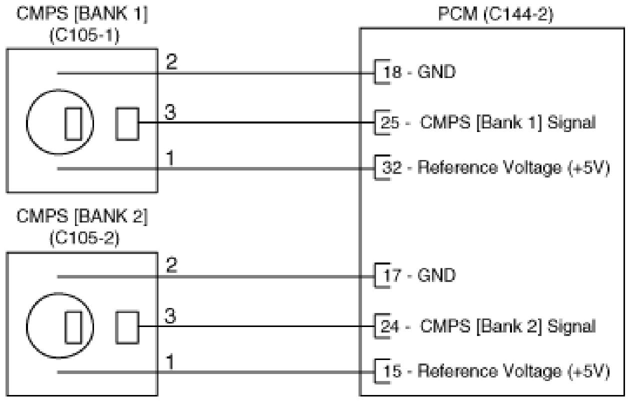


WAVEFORM



SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

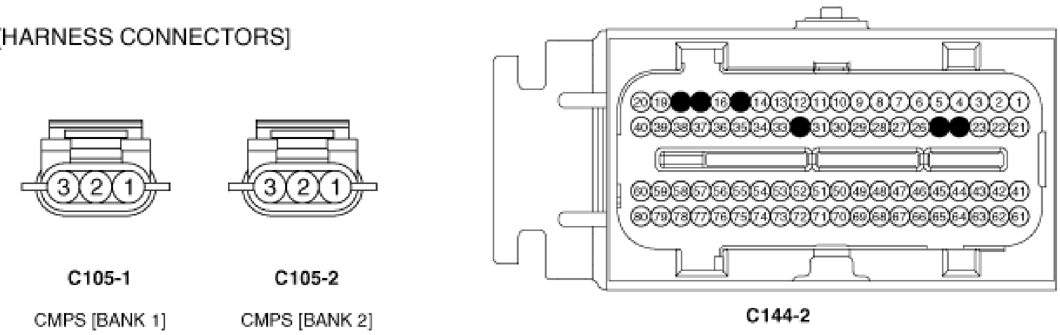
CMPS [BANK 1]

Terminal	Connected to	Funtion
1	PCM C144-2 (32)	Reference Voltage (+5V)
2	PCM C144-2 (18)	Sensor ground
3	PCM C144-2 (25)	CMPS [Bank 1] control

CMPS [BANK 2]

Terminal	Connected to	Funtion
1	PCM C144-2 (15)	Reference Voltage (+5V)
2	PCM C144-2 (17)	Sensor ground
3	PCM C144-2 (24)	CMPS [Bank 2] control

[HARNESS CONNECTORS]

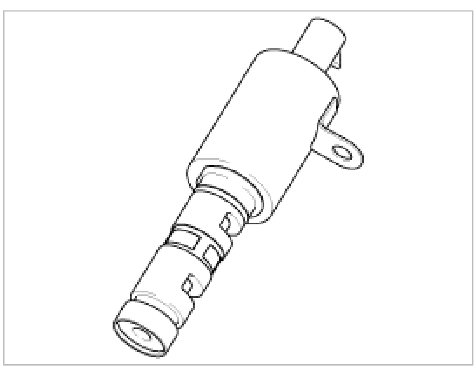


Fuel System > Engine Control System > CVVT Oil Control Valve (OCV) > Description and Operation

DESCRIPTION

Continuously Variable Valve Timing (CVVT) system controls valve overlap with forcibly activating the camshaft and adjusts EGR (Exhaust Gas Recirculation) amount. It decreases exhaust gas (NOx, HC) and improves fuel economy, idle state, torque in low speed and power in high speed. This system uses engine oil pressure and consists of the two CVVT Oil Control Valve (OCV) in each bank which supplies oil to cam phaser according to PWM (Pulse With Modulator) signal of the PCM, a CVVT Oil Temperature Sensor (OTS) which detects the oil temperature and a cam phaser which is installed on the end of the camshaft and converts camshaft phase. The oil getting out of the CVVT oil control valve flows into the cam phaser and rotates the rotor inside cam phaser. At this time, the camshaft rotates with the rotor and the cam phase is changed.

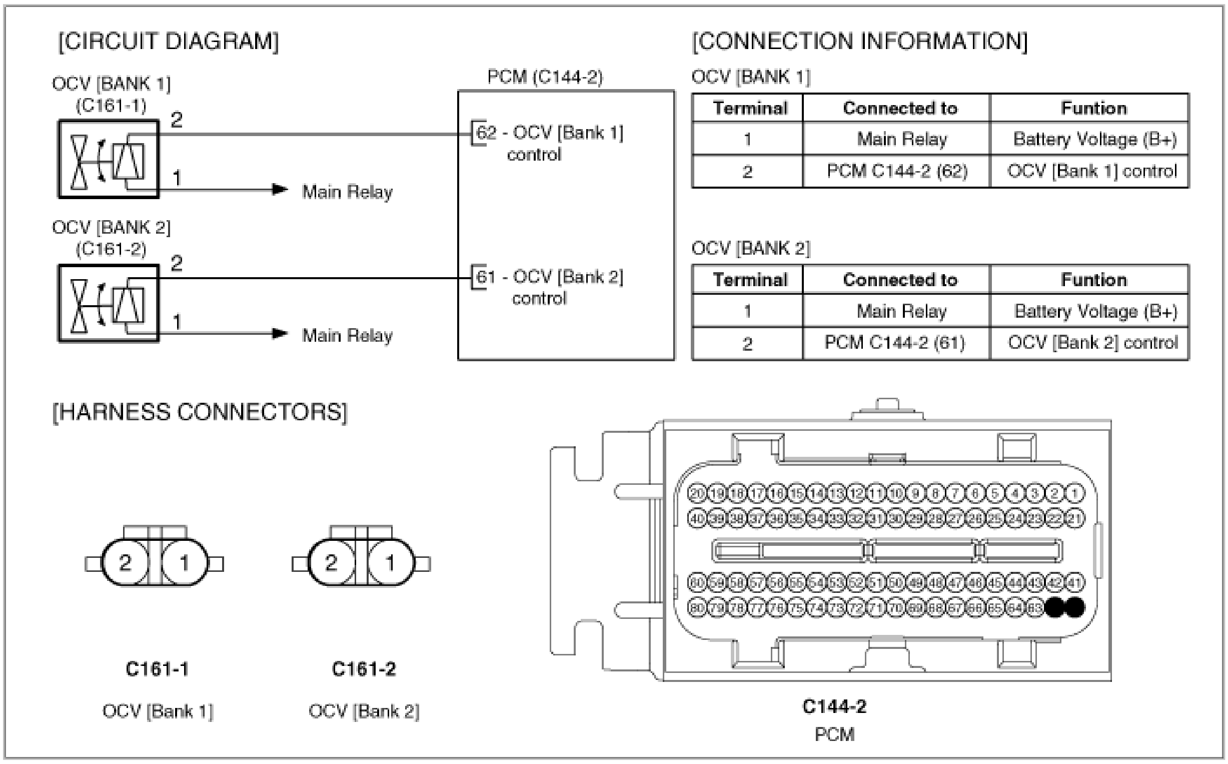
1. When camshaft rotates engine rotation-wise: Intake-Advance / Exhaust-Retard
2. When camshaft rotates counter engine rotation-wise: Intake- Retard / Exhaust- Advance



SPECIFICATION

Item	Specification
Coil Resistance (Ω)	6.7 ~ 7.7Ω at 20°C (68°F)

SCHEMATIC DIAGRAM



Fuel System > Engine Control System > CVVT Oil Control Valve (OCV) > Repair procedures

INSTALLATION

CAUTION

If the OCVs are installed incorrectly, the vehicle may be damaged.
So when installing them, be careful its connector color (Components and harness side).

[Bank and its color]

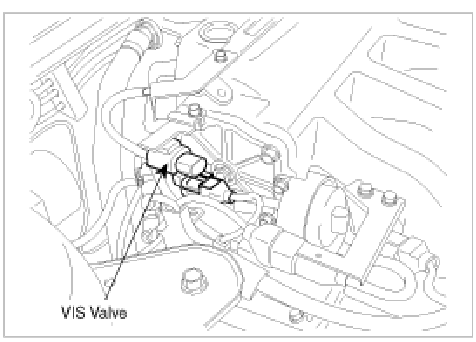
Bank	Component side	Harness side
Bank 1 (RH)	Grey	Grey
Bank 2 (LH)	Black	Black

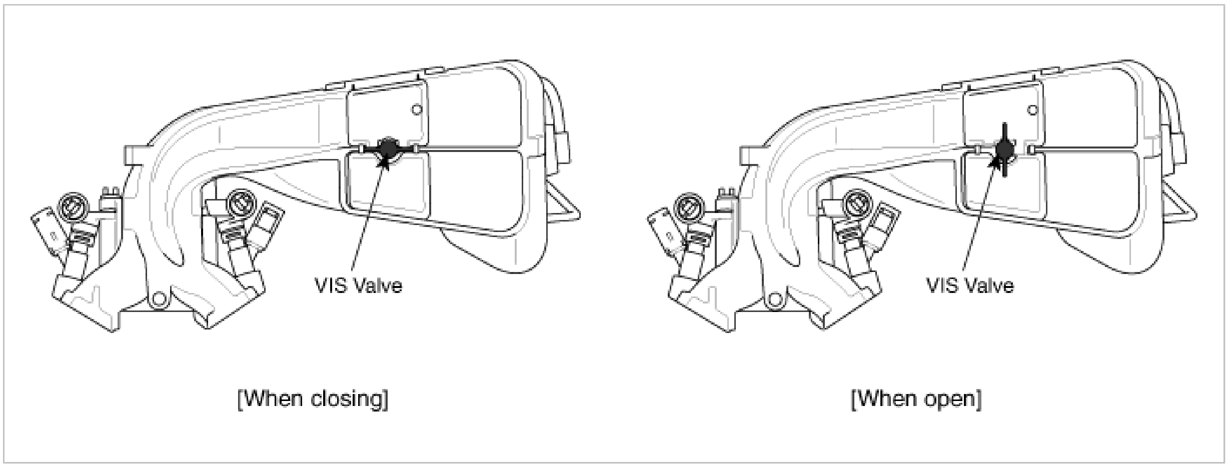
Fuel System > Engine Control System > Variable Intake Solenoid (VIS) Valve > Description and Operation

DESCRIPTION

Variable Intake Solenoid (VIS) Valve is installed on the intake manifold and isolates or not the one bank from the other banks to improve the intake efficiency.

1. Low/Middle Speed: VIS Valve Close → Resonation Effect → Improving Intake Efficiency
2. High Speed: VIS Valve Open → Improving Intake Inertia Effect → Improving Intake Efficiency

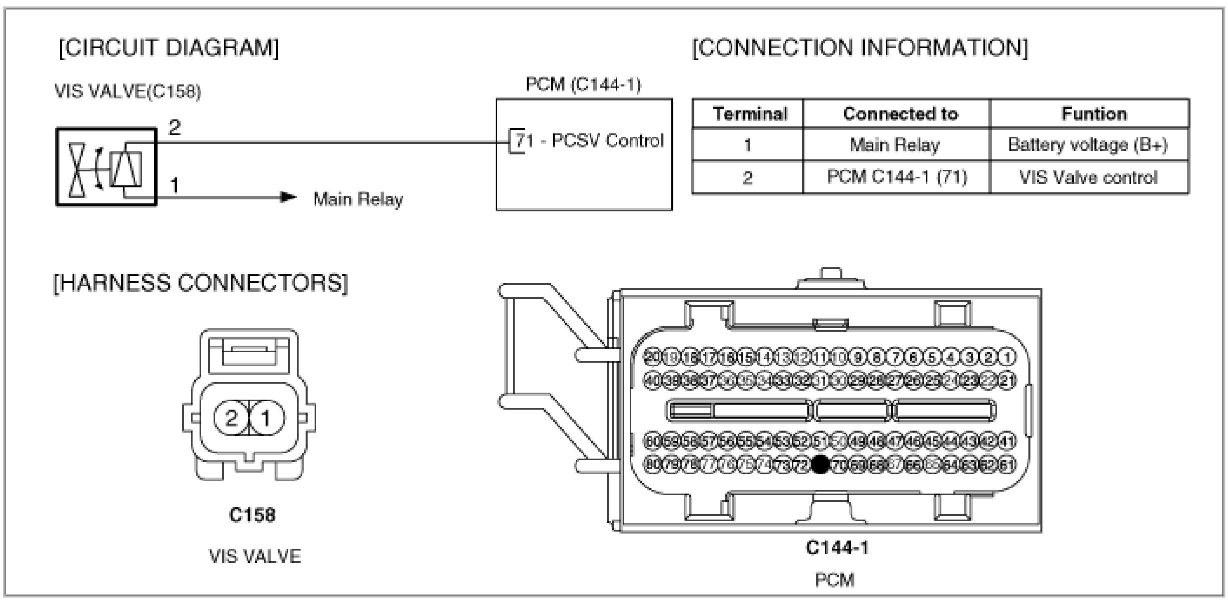




SPECIFICATION

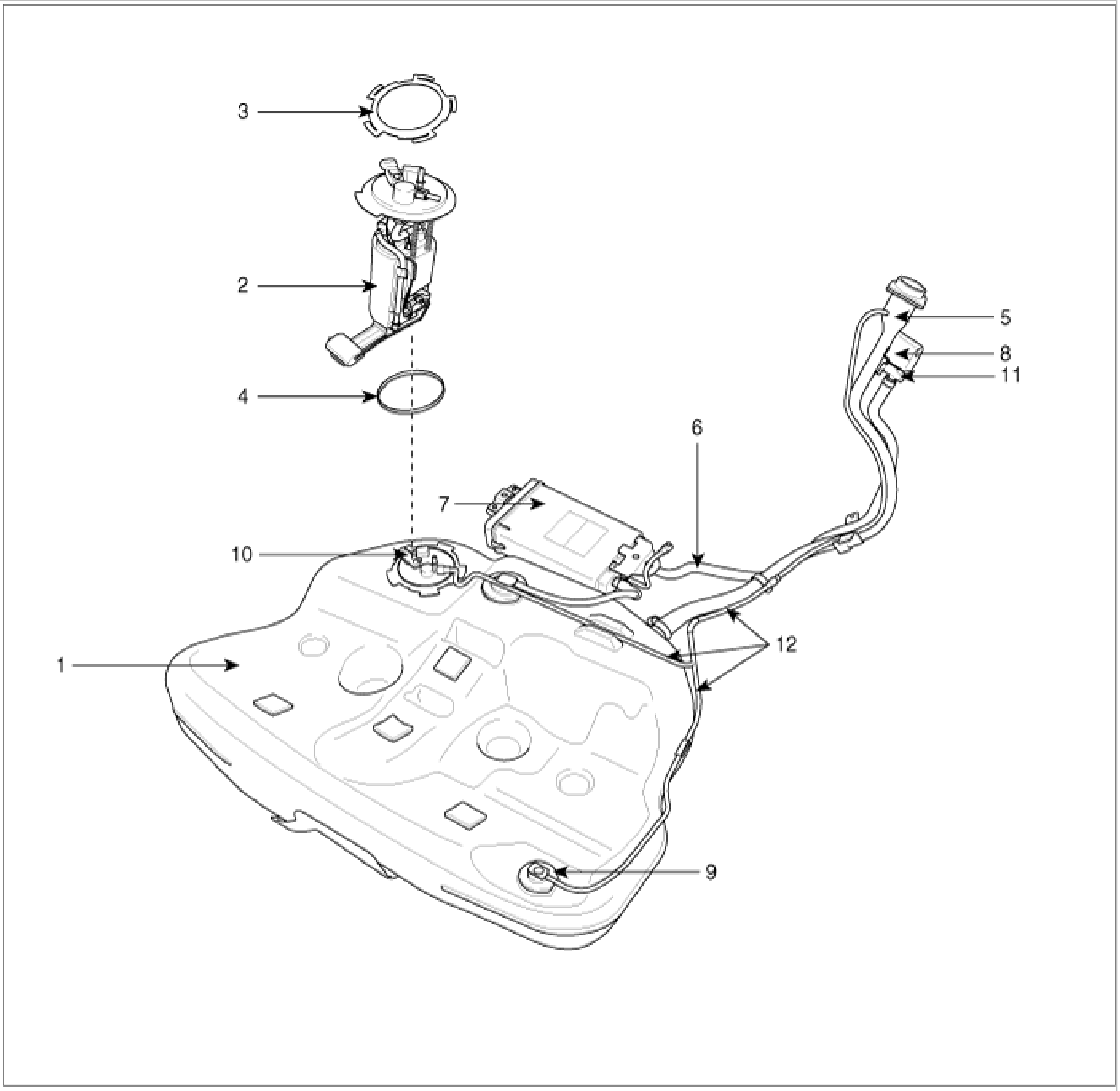
Item	Specification
Coil Resistance (Ω)	30.0 ~ 35.0 Ω at 22°C (71.6°F)

SCHEMATIC DIAGRAM



Fuel System > Fuel Delivery System > Components and Components Location

COMPONENTS



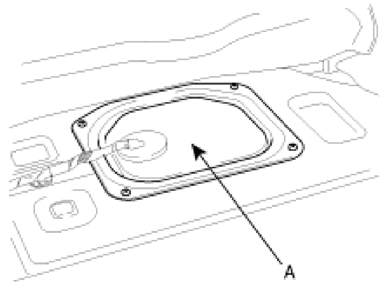
1. Fuel Tank
2. Fuel Pump (including Fuel Filter & Fuel Pressure Regulator)
3. Locking Ring-Fuel Pump
4. Packing-Fuel Pump Plate
5. Fuel Filler Neck Assembly
6. Hose (Canister ↔ Fuel Tank Filter)
7. Canister
8. Fuel Tank Air Filter
9. Fuel Cut Valve
10. Fuel Tank Pressure Sensor (FTPS)
11. Canister Close Valve (CCV)
12. Recirculation Line

Fuel System > Fuel Delivery System > Repair procedures

FUEL PRESSURE TEST

1. PREPARING

1. Open the service cover (A) in trunk.

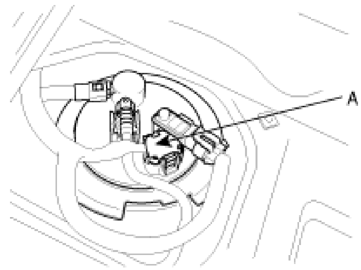


2. RELEASE THE INTERNAL PRESSURE

1. Disconnect the fuel pump connector(A).
2. Start the engine and wait until fuel in fuel line is exhausted.
3. After the engine stalls, turn the ignition switch to OFF position and disconnect the negative (-) terminal from the battery.

NOTE

Be sure to reduce the fuel pressure before disconnecting the fuel feed hose, otherwise fuel will spill out.



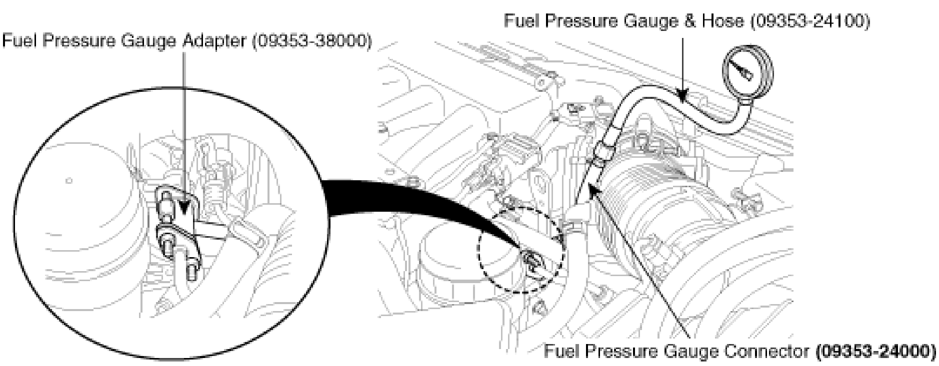
3. INSTALL THE SPECIAL SERVICE TOOL (SST) FOR MEASURING THE FUEL PRESSURE

1. Disconnect the fuel feed hose from the delivery pipe.

CAUTION

Cover the hose connection with a shop towel to prevent splashing of fuel caused by residual pressure in the fuel line.

2. Install the Fuel Pressure Gauge Adapter (09353-38000) between the delivery pipe and the fuel feed hose.
3. Connect the Fuel Pressure Gauge Connector (09353-24000) to the Fuel Pressure Gauge Adapter (09353-38000).
4. Connect the Fuel Pressure Gauge and Hose (09353-24100) to Fuel Pressure Gauge Connector (09353-24000).
5. Connect the fuel feed hose to the Fuel Pressure Gauge Adapter (09353-38000).



4. INSPECT FUEL LEAKAGE ON CONNECTION

1. Connect the battery negative (-) terminal.
2. Apply battery voltage to the fuel pump terminal and activate the fuel pump. With fuel pressure applied, check that there is no fuel leakage from the fuel pressure gauge or connection part.

5. FUEL PRESURE TEST

1. Disconnect the negative (-) terminal from the battery.
2. Connect the fuel pump connector.
3. Connect the battery negative (-) terminal.
4. Start the engine and measure the fuel pressure at idle.

Standard Value: 374 ~ 384 kpa (3.82 ~ 3.92 kgf/㎠, 54.3 ~ 55.8 psi)

- If the measured fuel pressure differs from the standard value, perform the necessary repairs using the table below.

Condition	Probable Cause	Suspected Area
Fuel Pressure too low	Clogged fuel filter	Fuel filter
	Fuel leak on the fuel-pressure regulator that is assembled on fuel pump because of poor seating of the fuel-pressure regulator.	Fuel Pressure Regulator
Fuel Pressure too High	Sticking fuel pressure regulator	Fuel Pressure Regulator

5. Stop the engine and check for a change in the fuel pressure gauge reading.

After engine stops, the gauge reading should hold for about 5 minutes

- Observing the declination of the fuel pressure when the gauge reading drops and perform the necessary repairs using the table below.

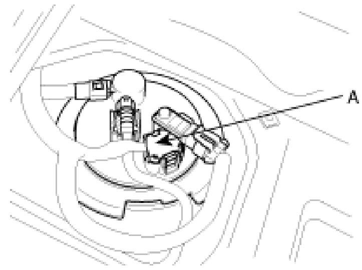
Condition	Probable Cause	Supected Area
Fuel pressure drops slowly after engine is stopped	Injector leak	Injector
Fuel pressure drops immediately after engine is stopped	The check valve within the fuel pump is open	Fuel Pump

6. RELEASE THE INTERNAL PRESSURE

1. Disconnect the fuel pump connector(A).
2. Start the engine and wait until fuel in fuel line is exhausted.
3. After the engine stalls, turn the ignition switch to OFF position and disconnect the negative (-) terminal from the battery.

NOTE

Be sure to reduce the fuel pressure before disconnecting the fuel feed hose, otherwise fuel will spill out.



7. REMOVE THE SPECIAL SERVICE TOOL (SST) AND CONNECT THE FUEL LINE

1. Disconnect the Fuel Pressure Gauge and Hose (09353-24100) from the Fuel Pressure Gauge Connector (09353-24000).
2. Disconnect the Fuel Pressure Gauge Connector (09353-24000) from the Fuel Pressure Gauge Adapter (09353-38000).
3. Disconnect the fuel feed hose from the Fuel Pressure Gauge Adapter (09353-38000).
4. Disconnect the Fuel Pressure Gauge Adapter (09353-38000) from the delivery pipe.

CAUTION

Cover the hose connection with a shop towel to prevent splashing of fuel caused by residual pressure in the fuel line.

5. Connect the fuel feed hose to the delivery pipe.

8. INSPECT FUEL LEAKAGE ON CONNECTION

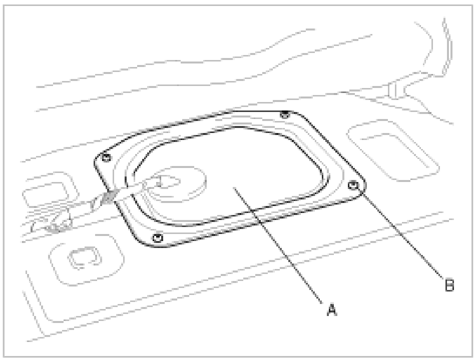
1. Connect the battery negative (-) terminal.
2. Apply battery voltage to the fuel pump terminal and activate the fuel pump. With fuel pressure applied, check that there is no fuel leakage from the fuel pressure gauge or connection part.
3. If the vehicle is normal, connect the fuel pump connector.

Fuel System > Fuel Delivery System > Fuel Tank > Repair procedures

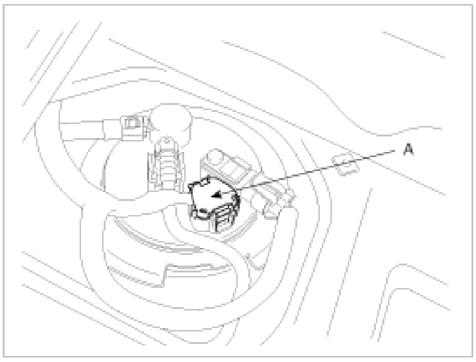
REMOVAL

1. Preparation

(1) Open the Service Cover (A) by unscrewing the bolts (B).



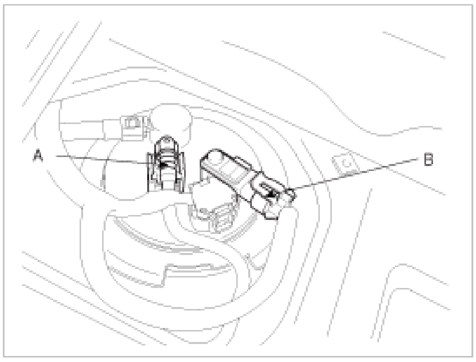
(2) Disconnect the Fuel Pump Connector (A).



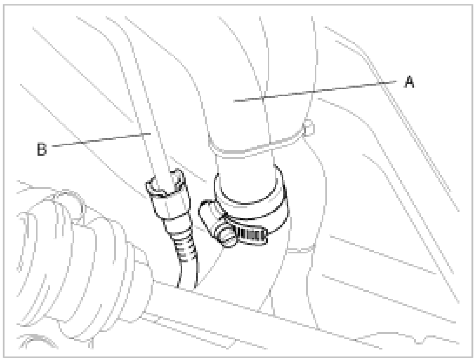
(3) Start the engine and wait until fuel in fuel line is exhausted.

(4) After the engine stalls, turn the ignition switch to OFF position.

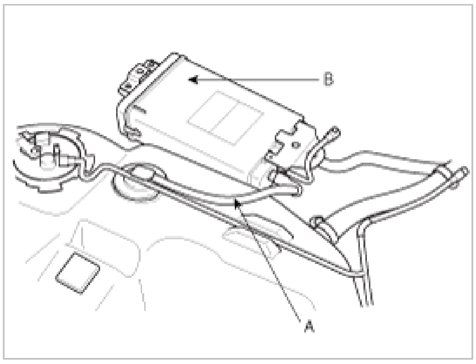
2. Disconnect the Fuel Feed Line (A) and Fuel Tank Pressure Sensor connector (B).



3. Lift the vehicle and support the fuel tank with a jack.
4. Remove the main and center muffler (Refer to the group "EM" in this SHOP MANUAL).
5. Disconnect the Fuel Filler Hose (A) and Recirculation Line (B).



6. Disconnect the Canister Hose (A) from the Canister (B).



7. Remove the fuel tank band mounting bolts (2), and then remove the Fuel Tank from the vehicle.

INSTALLATION

Install the Fuel Tank according to the reverse order of REMOVAL procedure.

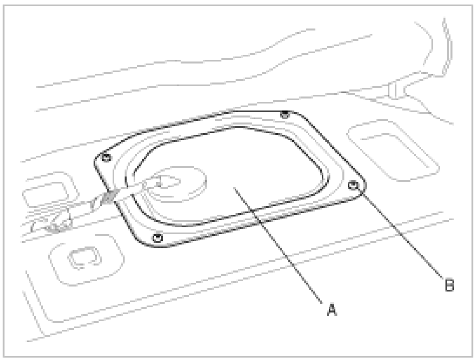
Fuel Tank Band Tightening Torques: 34.3 ~ 53.9 N·m (3.5 ~ 5.5 kgf·m, 25.3 ~ 39.8 lbf·ft)

Fuel System > Fuel Delivery System > Fuel Pump > Repair procedures

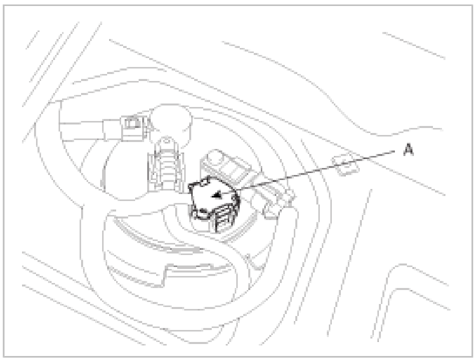
REMOVAL

1. Preparation

(1) Open the Service Cover (A) with unscrewing the bolts (B).



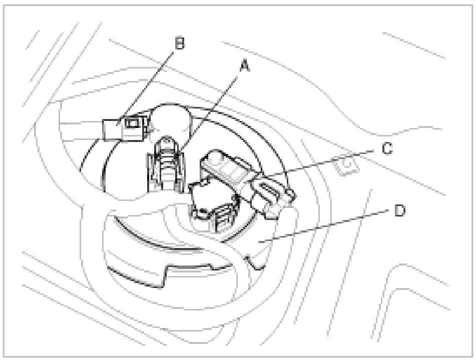
(2) Disconnect the Fuel Pump Connector (A).



(3) Start the engine and wait until fuel in fuel line is exhausted.

(4) After the engine stalls, turn the ignition switch to OFF position.

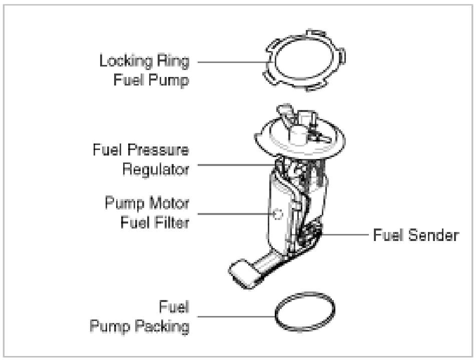
2. Disconnect the Fuel Feed Line (A), Recirculation Line (B) and Fuel Tank Pressure Sensor connector (C).



3. Unfasten the Fuel Pump Locking Ring (D) with the Special Service Tool (Refer to "SPECIAL SERVICE TOOL").

> **CAUTION**
>
> Be careful NOT TO damage the surface of the fuel rank.

4. Remove the Fuel Pump assembly from the Fuel Tank.



INSTALLATION

Install the Fuel Pump according to the reverse order of REMOVAL procedure.

NOTE

Replace the Fuel Pump Locking Ring and Fuel Pump Plate Packing with a new one when installing the fuel pump again.

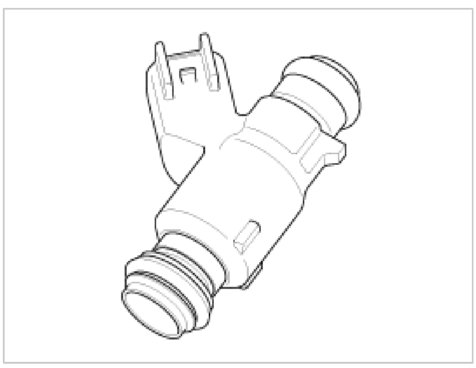
Fuel System > Fuel Delivery System > Injector > Description and Operation

DESCRIPTION

Based on information from various sensors, the PCM measures the fuel injection amount. The fuel injector is a solenoid-operated valve and the fuel injection amount is controlled by length of time that the fuel injector is held open. The PCM controls each injector by grounding the control circuit. When the PCM energizes the injector by grounding the control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the PCM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should be peak for a moment.

CAUTION

If an injector connector is disconnected for more than 46 seconds while the engine runs, the PCM will determine that the cylinder is misfired and cut fuel supply. So be careful not to exceed 46 seconds. But the engine runs normally in 10 seconds after turning the ignition key off.

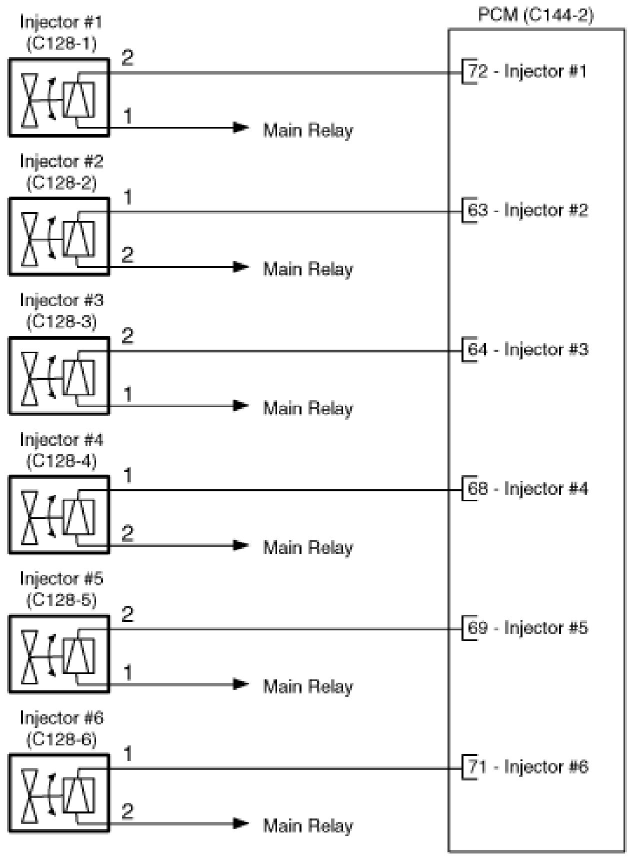


SPECIFICATION

Item	Specification
Coil Resistance (Ω)	11.4 ~ 12.6Ω at 20°C (68°F)

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Injector #1

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (72)	Injector #1 control

Injector #2

Terminal	Connected to	Funtion
1	PCM C144-2 (63)	Injector #2 control
2	Main Relay	Battery Voltage (B+)

Injector #3

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (64)	Injector #3 control

Injector #4

Terminal	Connected to	Funtion
1	PCM C144-2 (68)	Injector #4 control
2	Main Relay	Battery Voltage (B+)

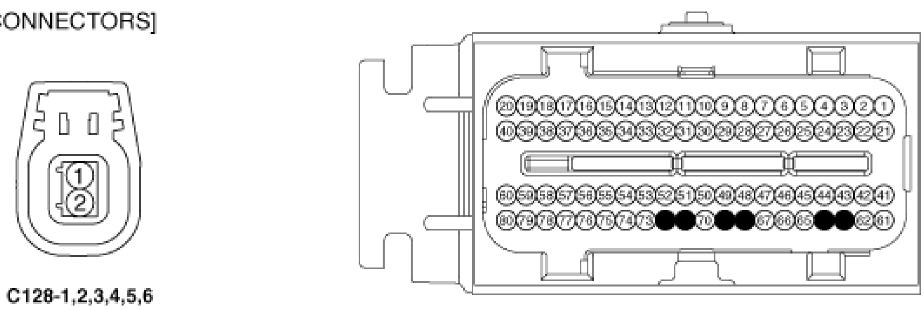
Injector #5

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (69)	Injector #5 control

Injector #6

Terminal	Connected to	Funtion
1	PCM C144-2 (71)	Injector #6 control
2	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTORS]



C128-1,2,3,4,5,6

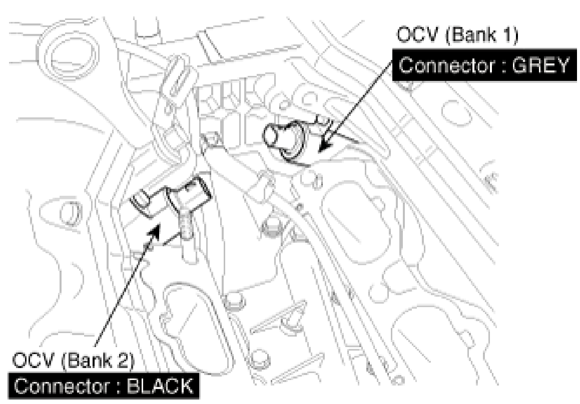
Injector #1,2,3,4,5,6

C144-2

PCM

Fuel System > Troubleshooting > P0011

COMPONENT LOCATION



GENERAL DESCRIPTION

Different from the existing fixed cam phase angle type, CVVT(Continuously Variable Valve Timing) is the device which varies cam phase angle continuously to be optimum. And with engine oil pressure, it operates. CVVT consists of OCV(Oil Control Valve) and cam phaser. OCV, mounted on cylinder head, controlls the amount and direction of oil delivered to cam phaser by oil valve which is connected to a solenoid. Cam phaser, rotating cam phaser rotor with pressure and amount of oil produced by OCV, rotates cam shaft forcefully for or against the rotating direction and finally, cam shaft phase changes. With the appliance of CVVT, engine power,fuel efficiency and the quality of exhause gas are improved.

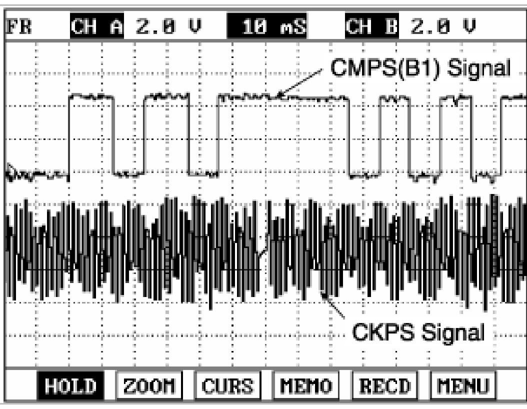
DTC DESCRIPTION

This diagnostic monitors the phasing response rate and determines whether the response rate is fast enough. A state machine is used to capture the response rate.The measured results are then compared to an allowable threshold. The threshold is a function of the oil temperature and the requested desired rate. Test of the phaser response rate requires an engine speed or engine load change.
PCM detects CAM phasing average rate while cam offset is available. If the CAM phasing rate is failure in 12 times out of 15 CAM phasing test PCM determines that a fault exists and a DTC is stored.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Determines if the phaser is moving at an expected rate	• Excessive phasing system leakage • Binding Oil Pressure (ex. Blockage in OCV filter) • Faulty PCM
Enable Conditions	• Cam Offset is available	
Threshold value	• Cam phasing average rate is out of threshold programmed in PCM	
Diagnosis Time	• Continuous (12 tests failure for 15 cam edge tests)	
MIL On Condition	• 2 driving cycles	

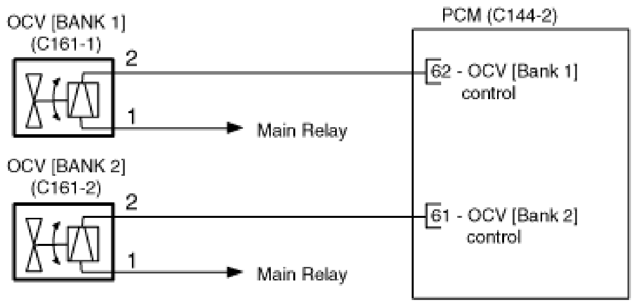
SIGNAL WAVEFORM AND DATA



This example shows a typical Crankshaft Position Sensor(CKPS) and Camshaft Position Sensor(CMPS) waveform at idle.
If the Cam Phasing is generated by PCM the offset of cam target wheel tooth varies against 58X reference tooth of CKPS.
Cam phasing can be detected from offset variation.

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

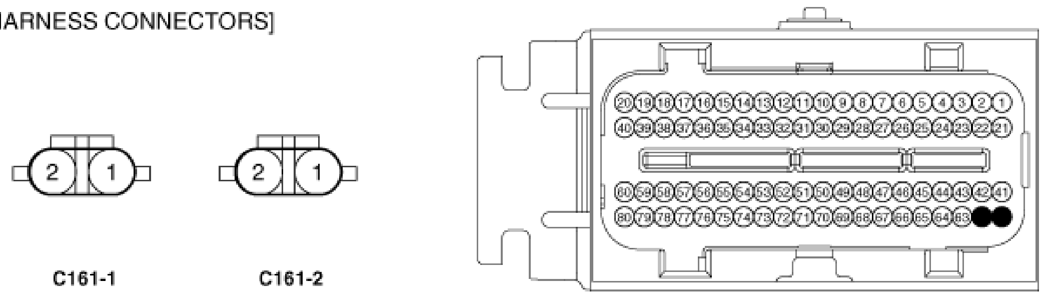
OCV [BANK 1]

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (62)	OCV [Bank 1] control

OCV [BANK 2]

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (61)	OCV [Bank 2] control

[HARNESS CONNECTORS]



C161-1

OCV [Bank 1]

C161-2

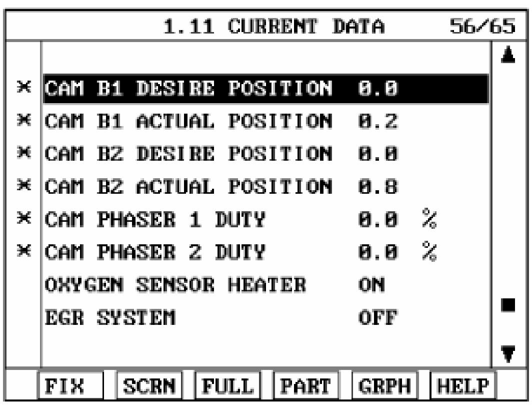
OCV [Bank 2]

C144-2

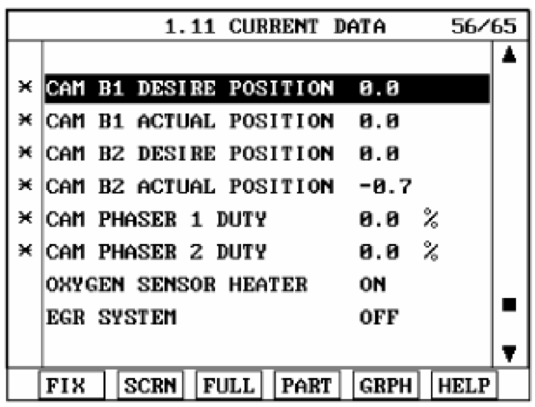
PCM

MONITOR SCANTOOL DATA

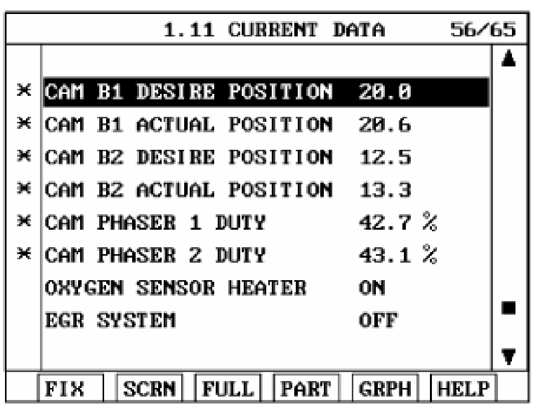
1. Connect scantool and ENG "ON".
2. Monitor "CMPS(B1)" on the service data.



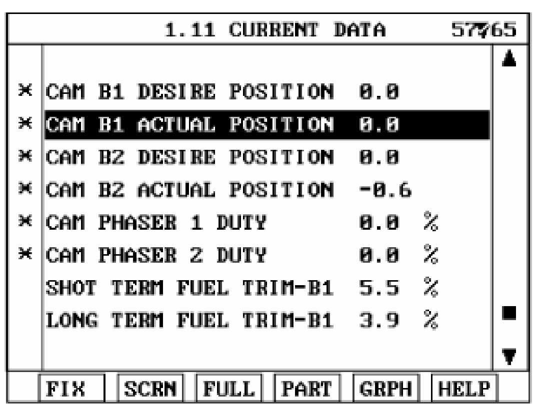
Normal data - idle



Open circuit - idle



Normal at accelleration



Open at accelleration

3. Are the "CMPS(B1)" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Go to "System Inspection" procedure.

SYSTEM INSPECTION

1. Visual Inspection
   (1) Check oil level is O.K.

   (2) Check oil level is contaminated.

   (3) Check that any oil leakage or blockage is occurred on the parts related to CVVT.

   (4) Has a problem been found ?

   YES

   ▸ Repair or replace as necessary and then, go to " Verification of Vehicle Repair" procedure.

   NO

   ▸ Go to "Component Inspection" procedure.

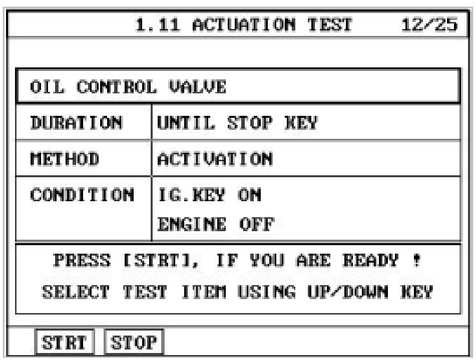
COMPONENT INSPECTION

1. Check OCV
   (1) connect scantool and IG "ON"

   (2) Select "OCV" on the Actuation Test

   (3) Activates "OCV" by pressing "STRT(F1)" key
   (should hear a faint click from Oil Control solenoid Valve)

   (4) Repeat this procedure 4 or 5 times to ensure intake valve control solenoid reliability



   (5) Has a problem been found ?

   YES

   ▸ Substitute with a known - good CVVT and check for proper operation. If the problem is corrected, replace CVVT and go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Substitute with a known - good OCV and check for proper operation. If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

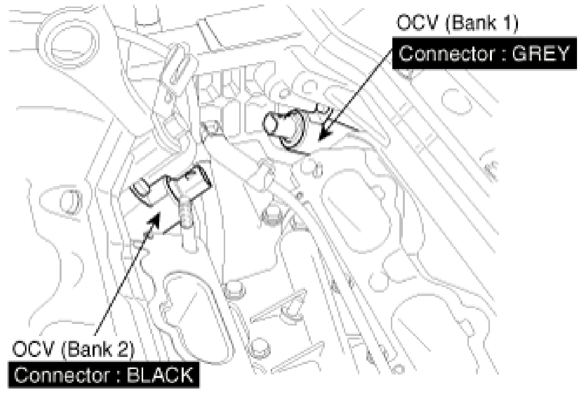
YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

COMPONENT LOCATION



GENERAL DESCRIPTION

Different from the existing fixed cam phase angle type, CVVT(Continuously Variable Valve Timing) is the device which varies cam phase angle continuously to be optimum. And with engine oil pressure, it operates. CVVT consists of OCV(Oil Control Valve) and cam phaser. OCV, mounted on cylinder head, controlls the amount and direction of oil delivered to cam phaser by oil valve which is connected to a solenoid. Cam phaser, rotating cam phaser rotor with pressure and amount of oil produced by OCV, rotates cam shaft forcefully for or against the rotating direction and finally, cam shaft phase changes. With the appliance of CVVT, engine power,fuel efficiency and the quality of exhause gas are improved.

DTC DESCRIPTION

Figure1. illustrates the method for detecting unresolved phasing steady-state error.
The figure shows two cases, case 1 to the left of the dashed line, and case 2 to the right of the dashed line. In case 1,the duty cycle command is considered high, or above a calibration threshold memorized in PCM. This should cause the cam phaser to move toward the maximum position, but the position remains at a medium level. The range of positions considered 'medium' is defined by calibrations.
In case 2, the duty cycle command is considered low, or below a calibration threshold memorized in PCM. This should cause the cam phaser to move toward the minimum position, but the position remains at a medium level.
Each of these cases is a phaser position error failure. Each case is also considered to be due to a phaser seizure. When either case is detected, a timing counter begins to increment. If the counter exceeds a calibration threshold memorized in PCM, the failure criteria is TRUE.
Another similar diagnostic test is performed to check steady-state error. In this test, no consideration is given to the duty cycle command versus phaser position. This test is only a check of the phasing position error. It is a test of the phaser control logic. If there has been integral windup in the PID control,this test will detect it. In the test, if the phaser error is greater than a calibration threshold memorized in PCM,a timing counter increments. If the counter exceeds the calibration threshold memorized in PCM,the failure criteria is TRUE.

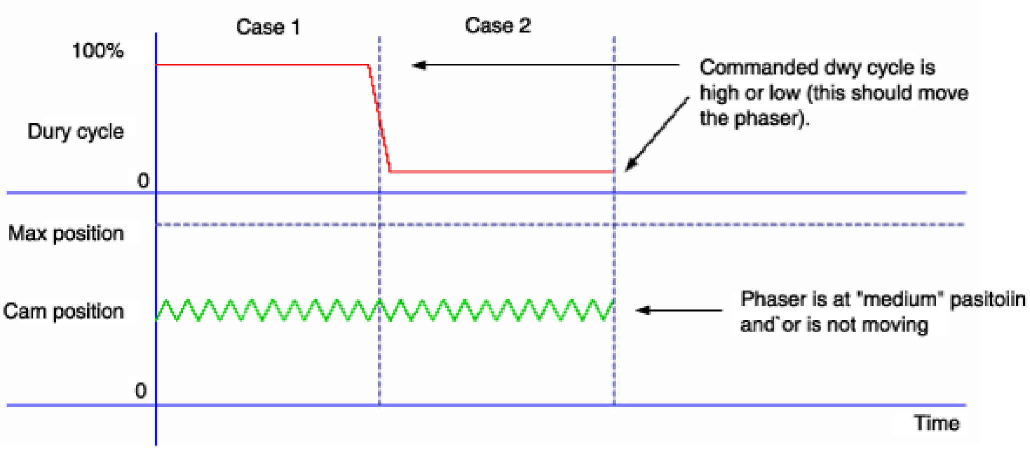


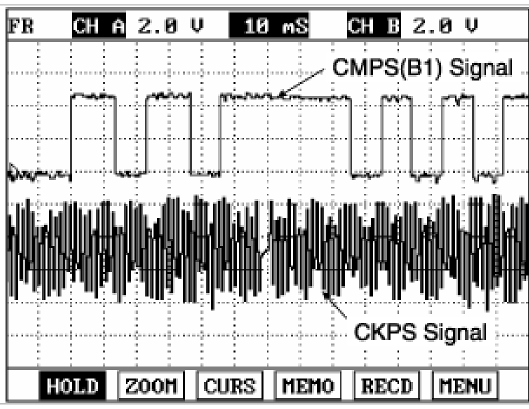
Fig. 1

PCM monitors CAM phaser error while both cam offset is available and cam velocity is below 15CAD/s .If the CAM phaser does not move although PCM commands OCV duty cycle PCM determines that a faultexists and a DTC is stored.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible cause
DTC Strategy		• Determines if the phaser is stuck or has steady-state error	• Engine Oil • OCV • CVVT stuck • PCM
Enable Conditions		• Offsets available • Cam velocity below threshold< 15 CAD/s	
Thresh old value	Case 1	• 5 CAD < Cam position< 50 CAD • Duty Cycle >90% • Duty Cycle< 10% • Timing Counter >80	
	Case 2	• Cam Position error >4 CAD • Timing Counter >80	
Diagnosis Time		• Continuous (More than 0.75sec. Test failure for every 90sec tests)	
MIL On Condition		• 2 Driving Cycles	

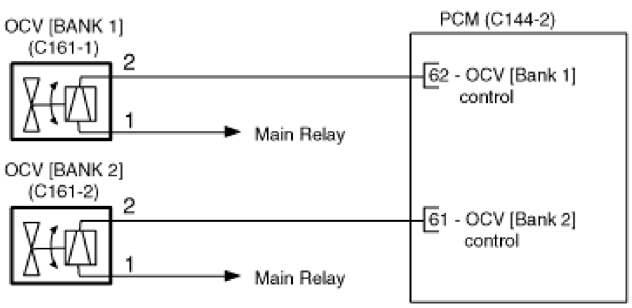
SIGNAL WAVEFORM AND DATA



This example shows a typical Crankshaft Position Sensor(CKPS) and Camshaft Position Sensor(CMPS) waveform at idle.
If the Cam Phasing is generated by PCM the offset of cam target wheel tooth varies against 58X reference tooth of CKPS.
Cam phasing can be detected from offset variation.

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

OCV [BANK 1]

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (62)	OCV [Bank 1] control

OCV [BANK 2]

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (61)	OCV [Bank 2] control

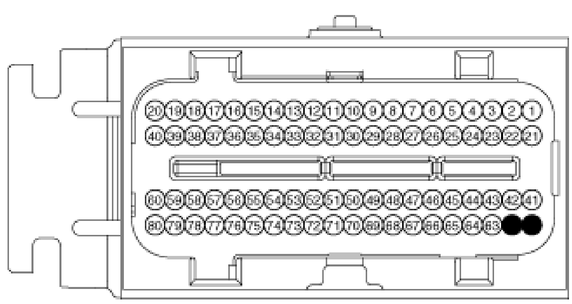
[HARNESS CONNECTORS]

C161-1

OCV [Bank 1]

C161-2

OCV [Bank 2]

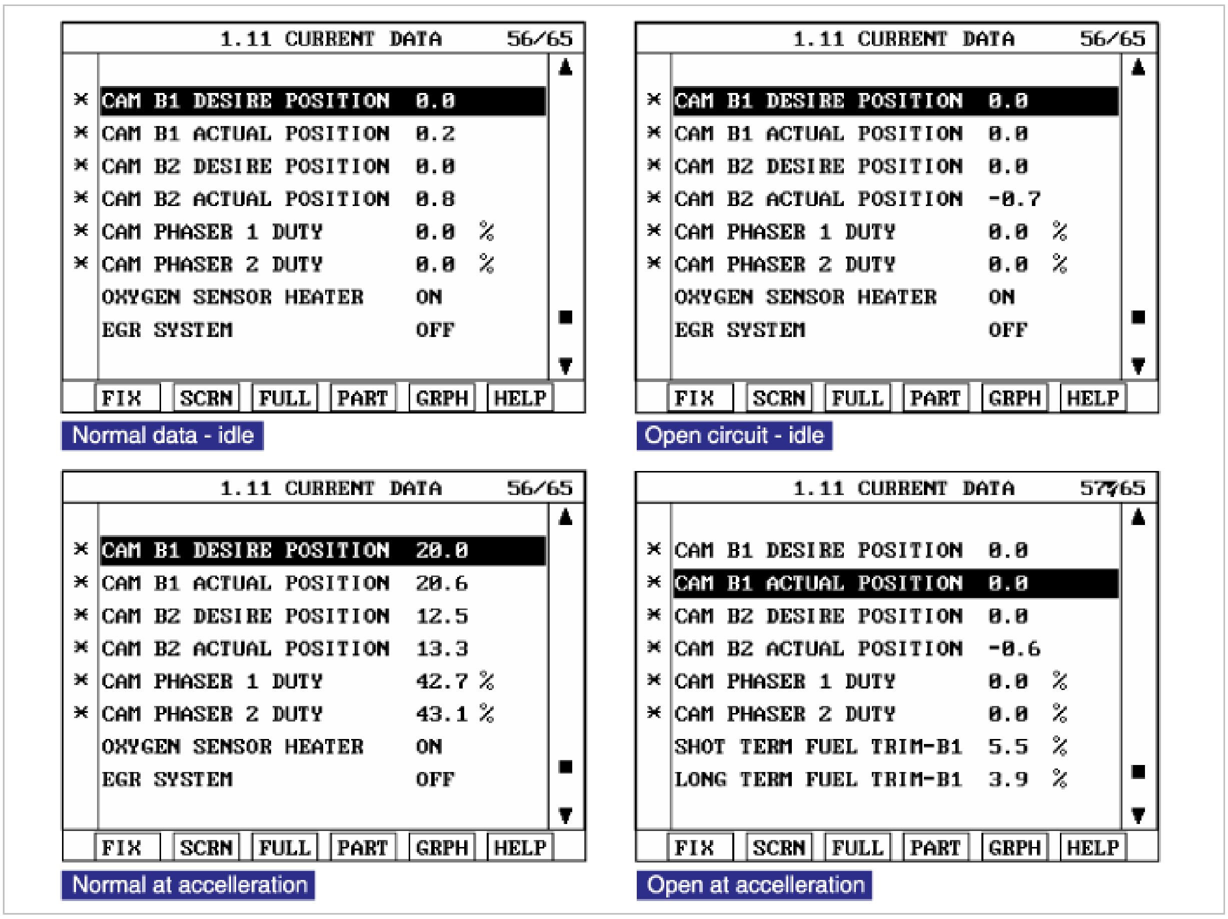


C144-2

PCM

MONITOR SCANTOOL DATA

1. connect scantool and ENG "ON"
2. Monitor "CMPS(B1)" on the service date.



Normal data - idle

Open circuit - idle

Normal at accelleration

Open at accelleration

3. Are the "CMPS(B1)" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Go to "System Inspection" procedure.

SYSTEM INSPECTION

1. Visual Inspection
   (1) Check oil level is O.K.
   (2) Check oil level is contaminated.
   (3) Has a problem been found ?

   YES

   ▸ Repair or replace as necessary and then, go to " Verification of Vehicle Repair" procedure.

   NO

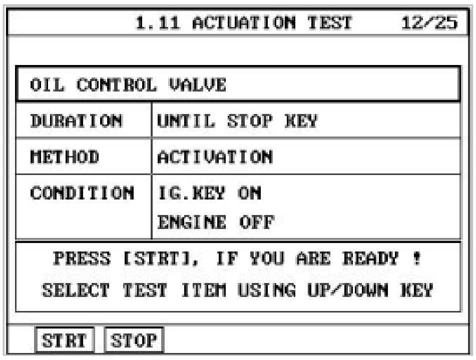
   ▸ Go to "Component Inspection" procedure.

COMPONENT INSPECTION

1. Check OCV
   (1) connect scantool and IG "ON"
   (2) Select "OCV" on the Actuation Test
   (3) Activates "OCV" by pressing "STRT(F1)" key

(should hear a faint click from Oil Control solenoid Valve)

(4) Repeat this procedure 4 or 5 times to ensure intake valve control solenoid reliability



1.11 ACTUATION TEST 12/25	
OIL CONTROL VALVE	
DURATION	UNTIL STOP KEY
METHOD	ACTIVATION
CONDITION	IG.KEY ON ENGINE OFF
PRESS [STRT], IF YOU ARE READY ! SELECT TEST ITEM USING UP/DOWN KEY	
STRT STOP	

(5) Has a problem been found ?

YES

▸ Substitute with a known - good CVVT and check for proper operation. If the problem is corrected, replace CVVT and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good OCV and check for proper operation. If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

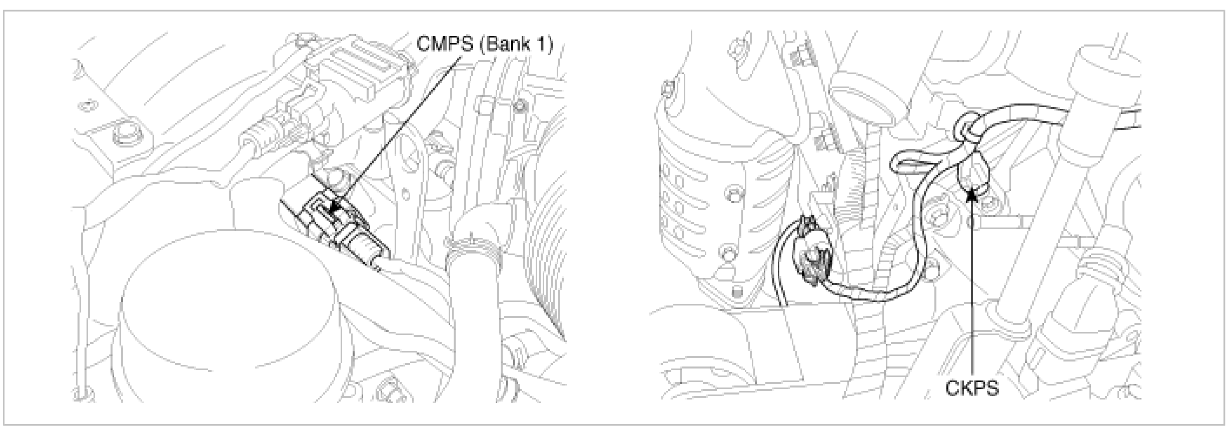
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0016

COMPONENT LOCATION



GENERAL DESCRIPTION

Different from the existing fixed cam phase angle type, CVVT(Continuously Variable Valve Timing) is the device which varies cam phase angle continuously to be optimum. And with engine oil pressure, it operates. CVVT consists of OCV(Oil Control Valve) and cam phaser. OCV, mounted on cylinder head, controlls the amount and direction of oil delivered to cam phaser by oil valve which is connected to a solenoid. Cam phaser, rotating cam phaser rotor with pressure and amount of oil produced by OCV, rotates cam shaft forcefully for or against the rotating direction and finally, cam shaft phase changes. With the appliance of CVVT, engine power,fuel efficiency and the quality of exhause gas are improved.

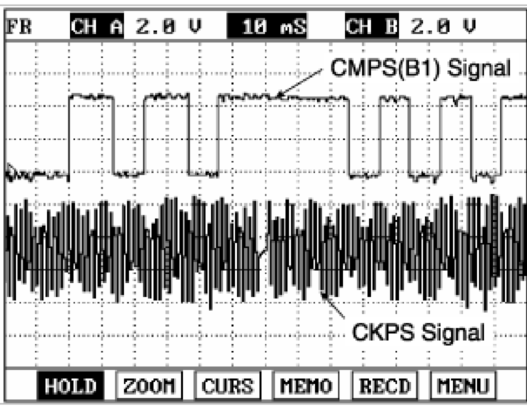
DTC DESCRIPTION

Tooth offsets are learned, updated, stored and initialized. For a given cam target wheel and systemcalibration, the tooth offsets should maintain relatively steady values. If the values of tooth offsets areobserved to drift outside of an established range, then a failure is present in the hardware or electronicsystem for measuring cam phasing.
This diagnosis is to verify that learned tooth offsets are within an acceptable range.
PCM monitors tooth offset while no active faults is present.If the tooth offsets is out of threshold more than 20 offset learning for 36 offset learning PCM determines that a faultexists and a DTC is stored.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible cause
DTC Strategy		• Determines if CAM target is aligned correctly to crank	• CKPS, CMPS • CVVT • Timing Misalignment • PCM
Enable Conditions		• No active faults	
Thresh old value	Case 1	• Real Offset Value< Min. Cam Offset array ratio (Refer to specificaton as below)	
	Case 2	• Real Offset Value >Min. Cam Offset array ratio (Refer to specificaton as below)	
Diagnosis Time		• Continuous (More than 20 offset learning failure for 36 offset learning)	
MIL On Condition		• 2 driving Cycles	

SIGNAL WAVEFORM AND DATA



This example shows a typical Crankshaft Position Sensor(CKPS) and Camshaft Position Sensor(CMPS) waveform at idle.
If the Cam Phasing is generated by PCM the offset of cam target wheel tooth varies against 58X reference tooth of CKPS. Cam phasing can be detected from offset variation.

SPECIFICATION

Min	Cylinder number	1	2	3	4	5	6
	Cam Offset Ratio	0.15	0.37	0.25	0.13	0.3	0.24
Max	Cylinder number	1	2	3	4	5	6
	Cam Offset Ratio	0.3	0.51	0.4	0.28	0.46	0.4

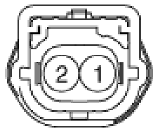
SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]

[CONNECTION INFORMATION]

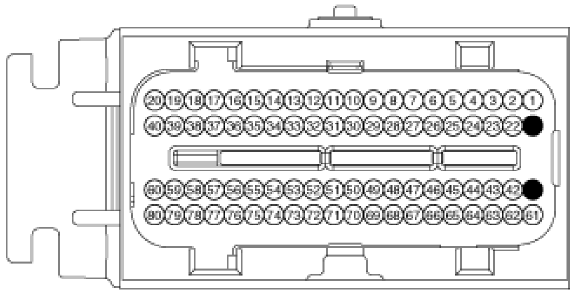
Terminal	Connected to	Funtion
1	PCM C144-2 (41)	CKPS [LOW] Signal
2	PCM C144-2 (21)	CKPS [HIGH] Signal

[HARNESS CONNECTORS]



C129

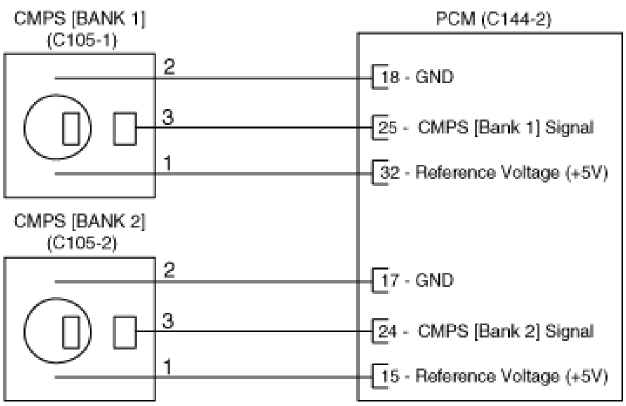
CKPS



C144-2

PCM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

CMPS [BANK 1]

Terminal	Connected to	Funtion
1	PCM C144-2 (32)	Reference Voltage (+5V)
2	PCM C144-2 (18)	Sensor ground
3	PCM C144-2 (25)	CMPS [Bank 1] control

CMPS [BANK 2]

Terminal	Connected to	Funtion
1	PCM C144-2 (15)	Reference Voltage (+5V)
2	PCM C144-2 (17)	Sensor ground
3	PCM C144-2 (24)	CMPS [Bank 2] control

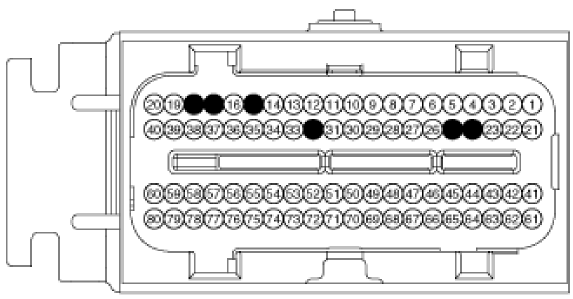
[HARNESS CONNECTORS]

C105-1

CMPS [BANK 1]

C105-2

CMPS [BANK 2]

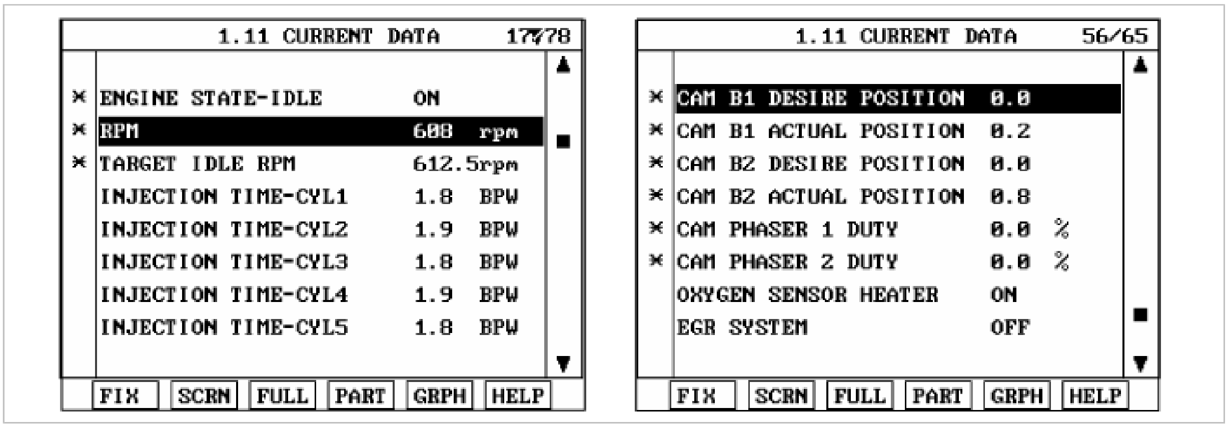


C144-2

PCM

MONITOR SCANTOOL DATA

1. Connect scantool and warm -up the engine until normal operating temperature.
2. Monitor "CAM, Engine speed" on service data.



3. Are the "CMPS(B1) & Engine RPM" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Go to "Terminaal and connector inpection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

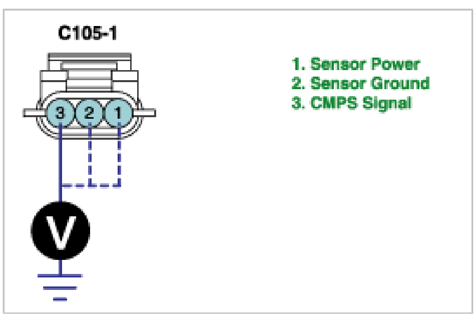
NO

▸ Go to "Terminal and connector inspection" procedure.

SYSTEM INSPECTION

1. Check CMPS
   (1) IG "OFF" & Disconnect CMPS connector.
   (2) IG "ON" & Measure voltage between terminal 1,2 & 3 of CMPS harness connector and chassis ground.

Specification :
Terminal 1. approx. 5V
Terminal 2. approx. below 1V
Terminal 3. approx. 5V



(3) Is the measured voltage within specification ?

YES

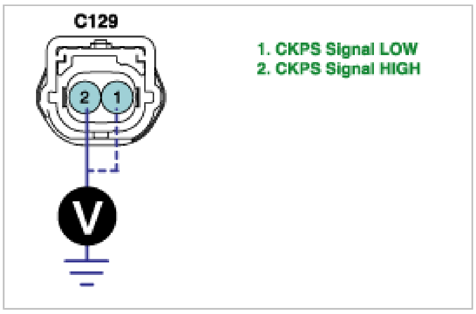
▸ Go to Check "CKPS" as follow.

NO

▸ Repair or replace as necessary and then go to " Verification of Vehicle Repair" procedure.

2. Check CKPS
   (1) IG "OFF" and disconnect CKPS connector.
   (2) IG "ON" & Measure voltage between terminal 1 & 2 of CKPS harness connecotor and chassis ground.

Specification : Approximately 1.4V



   (3) Is the measured voltage within specification ?

YES

▸ Go to "component Inspection" procedure.

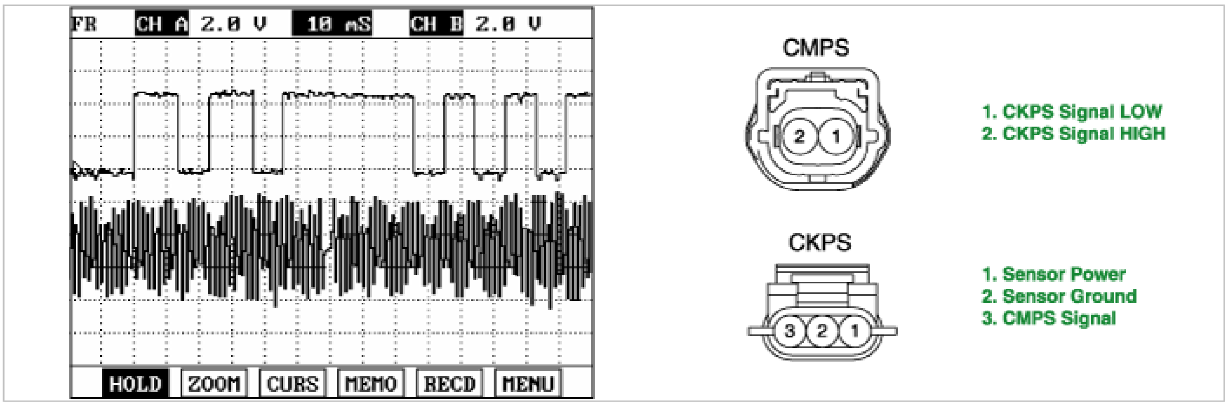
NO

▸ Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. CMPS, CKPS Inspection
   (1) IG "OFF" and connect scantool.
   (2) ENG "ON" and Measure signal waveform at terminal 3 of CMPS.
   (3) Measure signal waveform at terminal 1 or 2 of CKPS.

Specification :



   (4) Is the measured signal waveform O.K ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

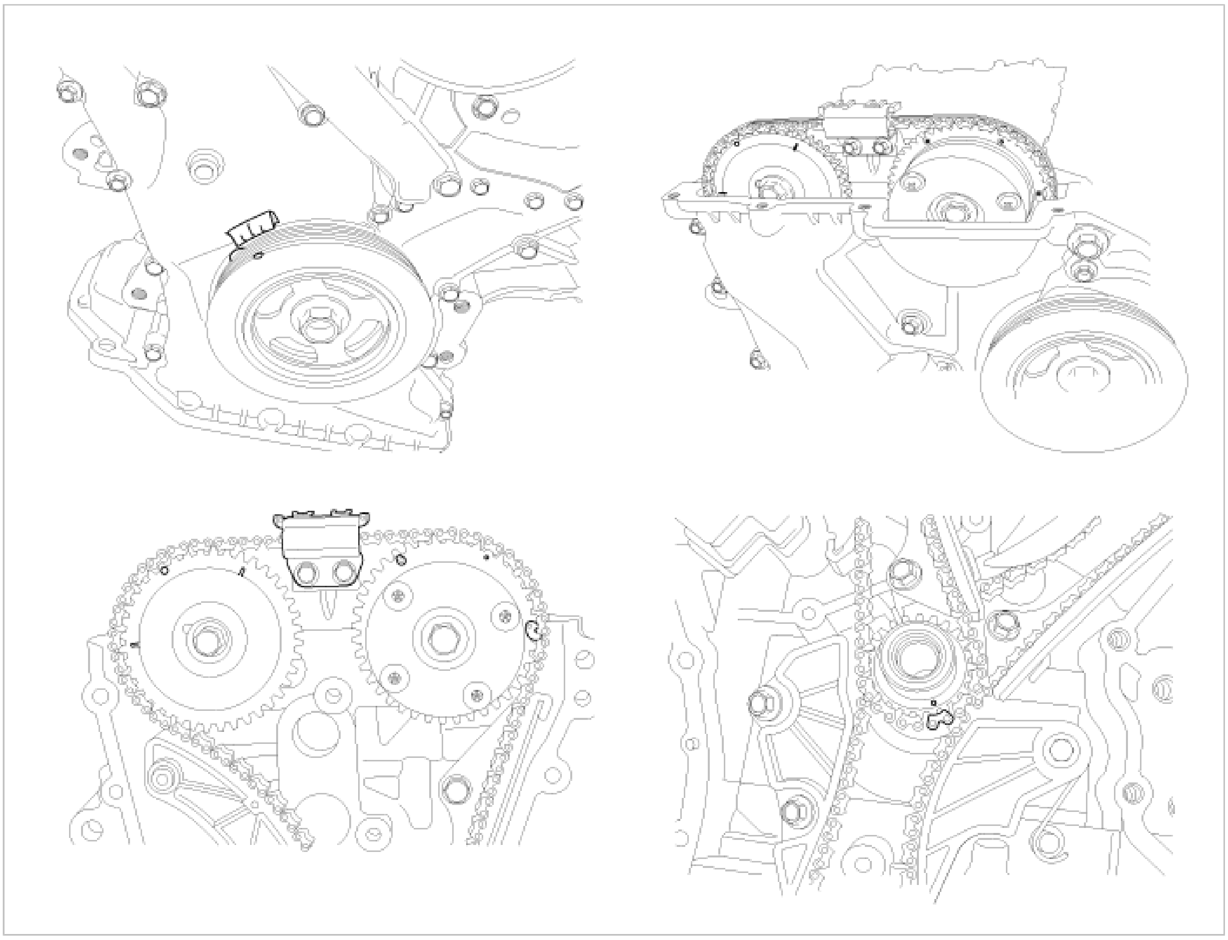
> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

NO

▸ Go to "Timing Mark Inspection" procedure as follow.

2. Timing Mark Inspection.
   (1) IG "OFF" and check the timing mark is correctly aligned.

Reference :



(2) Is the timing mark correctly aligned ?

YES

▸ Substitute with a known - good CVVT and check for proper operation. If the problem is corrected, replace CVVT and go to "Verification of Vehicle Repair" procedure.

(3) ▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

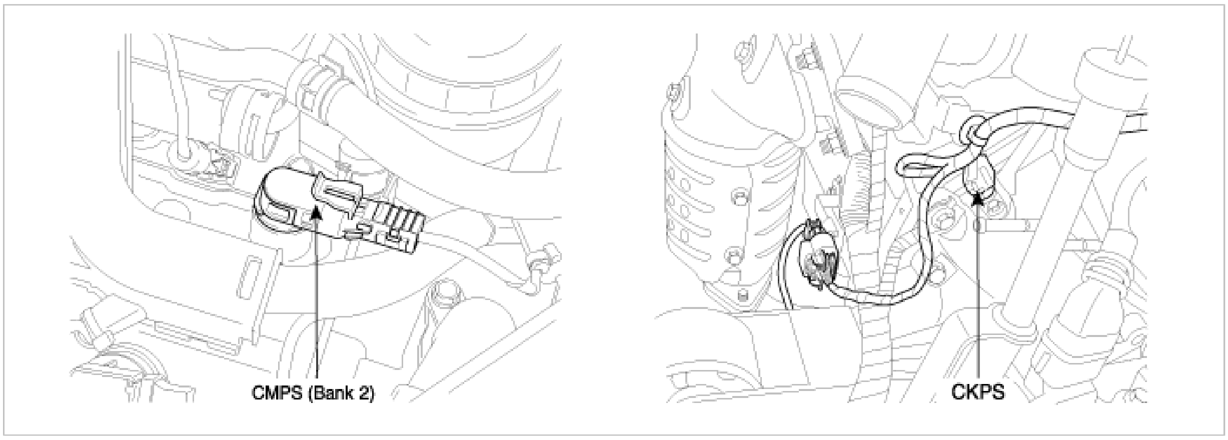
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0018

COMPONENT LOCATION



GENERAL DESCRIPTION

Different from the existing fixed cam phase angle type, CVVT(Continuously Variable Valve Timing) is the device which varies cam phase angle continuously to be optimum. And with engine oil pressure, it operates. CVVT consists of OCV(Oil Control Valve) and cam phaser. OCV, mounted on cylinder head, controlls the amount and direction of oil delivered to cam phaser by oil valve which is connected to a solenoid. Cam phaser, rotating cam phaser rotor with pressure and amount of oil produced by OCV, rotates cam shaft forcefully for or against the rotating direction and finally, cam shaft phase changes. With the appliance of CVVT, engine power,fuel efficiency and the quality of exhause gas are improved.

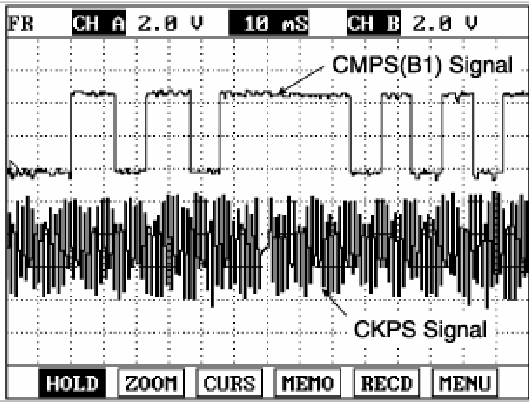
DTC DESCRIPTION

Tooth offsets are learned, updated, stored and initialized. For a given cam target wheel and systemcalibration, the tooth offsets should maintain relatively steady values. If the values of tooth offsets areobserved to drift outside of an established range, then a failure is present in the hardware or electronicsystem for measuring cam phasing.
This diagnosis is to verify that learned tooth offsets are within an acceptable range.
PCM monitors tooth offset while no active faults is present.If the tooth offsets is out of threshold more than 20 offset learning for 36 offset learning PCM determines that a faultexists and a DTC is stored.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible cause
DTC Strategy		• Determines if CAM(B2) target is aligned correctly to crank	• CKPS, CMPS(B2) • CVVT • Timing Misalignment • PCM
Enable Conditions		• No active faults	
Thresh old value	Case 1	• Real Offset Value< Min. Cam Offset array ratio (Refer to specificaton as below)	
	Case 2	• Real Offset Value >Min. Cam Offset array ratio (Refer to specificaton as below)	
Diagnosis Time		• Continuous (More than 20 offset learning failure for 36 offset learning)	
MIL On Condition		• 2 driving Cycles	

SIGNAL WAVEFORM AND DATA



This example shows a typical Crankshaft Position Sensor(CKPS) and Camshaft Position Sensor(CMPS) waveform at idle.
If the Cam Phasing is generated by PCM the offset of cam target wheel tooth varies against 58X reference tooth of CKPS.
Cam phasing can be detected from offset variation.

SPECIFICATION

Min	Cylinder number	1	2	3	4	5	6
	Cam Offset Ratio	0.15	0.37	0.25	0.13	0.3	0.24
Max	Cylinder number	1	2	3	4	5	6
	Cam Offset Ratio	0.3	0.51	0.4	0.28	0.46	0.4

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]

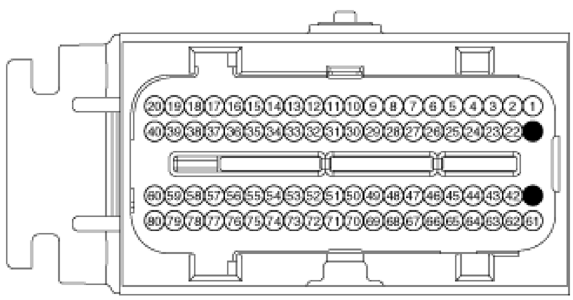
[CONNECTION INFORMATION]

Terminal	Connected to	Funtion
1	PCM C144-2 (41)	CKPS [LOW] Signal
2	PCM C144-2 (21)	CKPS [HIGH] Signal

[HARNESS CONNECTORS]

C129

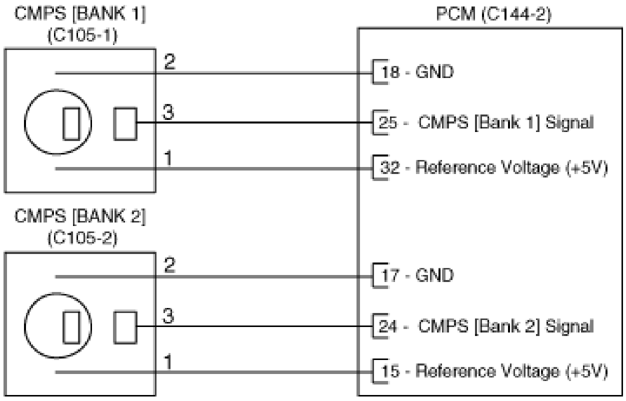
CKPS



C144-2

PCM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

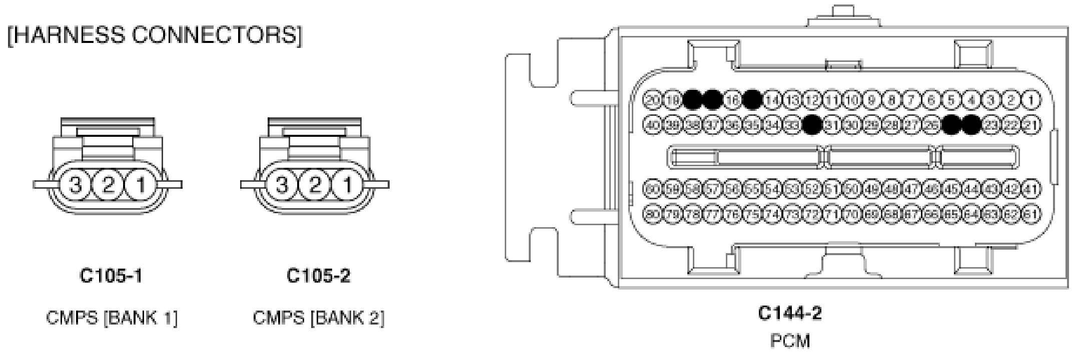
CMPS [BANK 1]

Terminal	Connected to	Funtion
1	PCM C144-2 (32)	Reference Voltage (+5V)
2	PCM C144-2 (18)	Sensor ground
3	PCM C144-2 (25)	CMPS [Bank 1] control

CMPS [BANK 2]

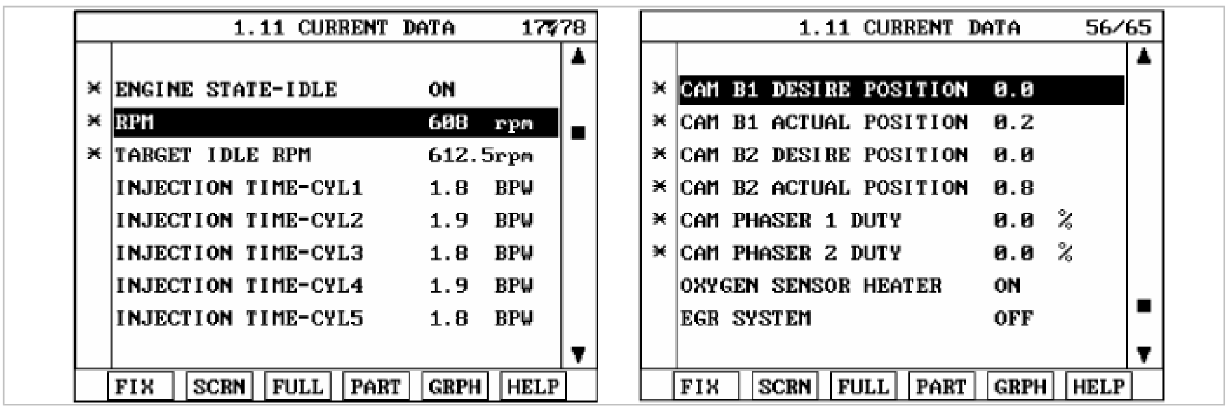
Terminal	Connected to	Funtion
1	PCM C144-2 (15)	Reference Voltage (+5V)
2	PCM C144-2 (17)	Sensor ground
3	PCM C144-2 (24)	CMPS [Bank 2] control

[HARNESS CONNECTORS]



MONITOR SCANTOOL DATA

1. Connect scantool and warm -up the engine until normal operating temperature.
2. Monitor "CAM, Engine speed" on service data.



3. Are the "CMPS(B2) & Engine RPM" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Go to "Terminaal and connector inpection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

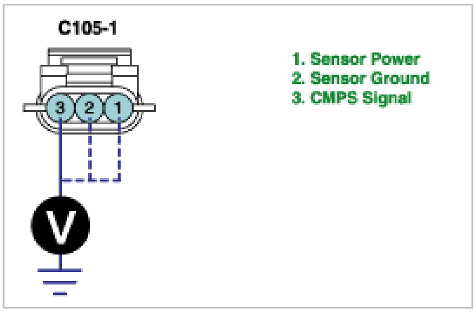
NO

▸ Go to " System Inspection " procedure.

SYSTEM INSPECTION

1. Check CMPS
   (1) IG "OFF" & Disconnect CMPS connector.
   (2) IG "ON" & Measure voltage between terminal 1,2 & 3 of CMPS(B2) harness connector and chassis ground.

Specification :
Terminal 1. approx. 5V
Terminal 2. approx. below 1V
Terminal 3. approx. 5V



(3) Is the measured voltage within specification ?

YES

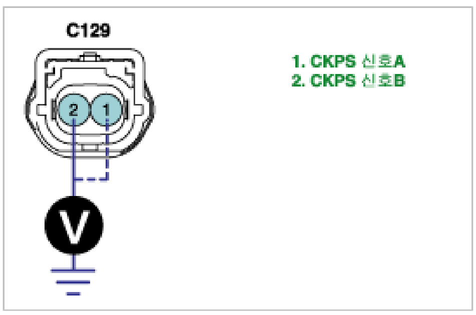
▸ Go to Check "CKPS" as follow.

NO

▸ Repair or replace as necessary and then go to " Verification of Vehicle Repair" procedure.

2. Check CKPS
   (1) IG "OFF" and disconnect CKPS connector.
   (2) IG "ON" & Measure voltage between terminal 1 & 2 of CKPS harness connecotor and chassis ground.

Specification : Approximately 1.4V



(3) Is the measured voltage within specification ?

YES

▸Go to "component Inspection" procedure.

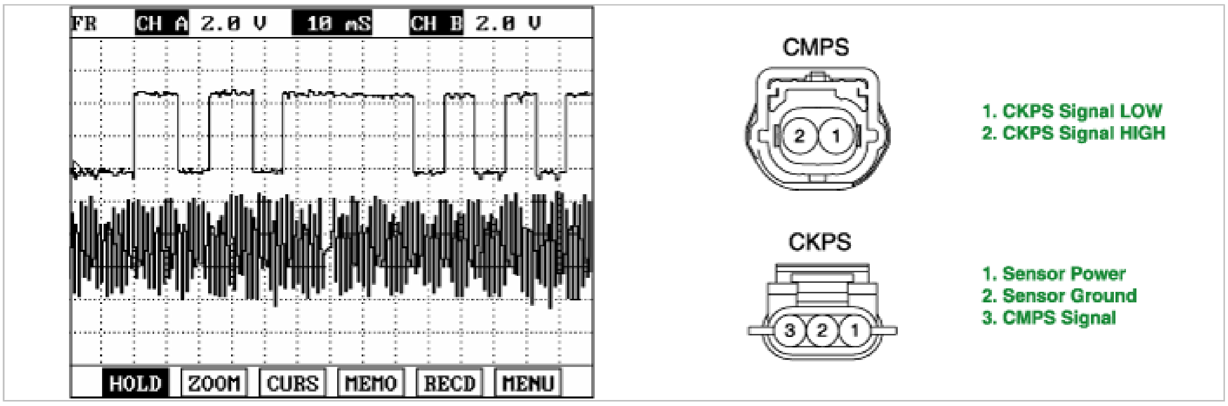
NO

▸Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. CMPS, CKPS Inspection
   (1) IG "OFF" and connect scantool.
   (2) ENG "ON" and Measure signal waveform at terminal 3 of CMPS.
   (3) Measure signal waveform at terminal 1 or 2 of CKPS.

Specification :



(4) Is the measured signal waveform O.K ?

YES

▶ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

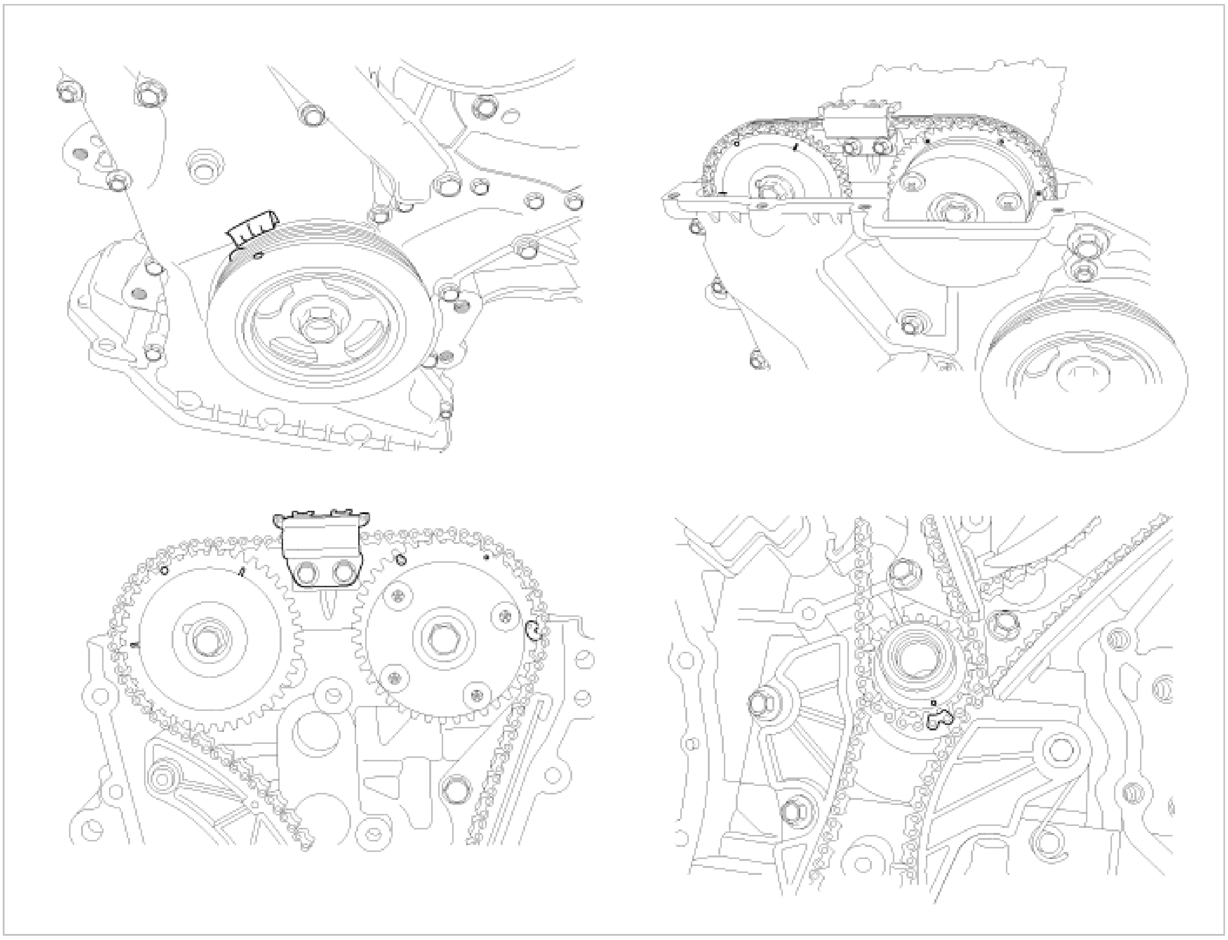
NO

▶ Go to "Timing Mark Inspection" procedure as follow.

2. Timing Mark Inspection

(1) IG "OFF" and check the timing mark is correctly aligned.

Refernce :



(2) Is the timing mark correctly aligned ?

YES

▸ Substitute with a known - good CVVT and check for proper operation. If the problem is corrected, replace CVVT and go to "Verification of Vehicle Repair" procedure.

NO

▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

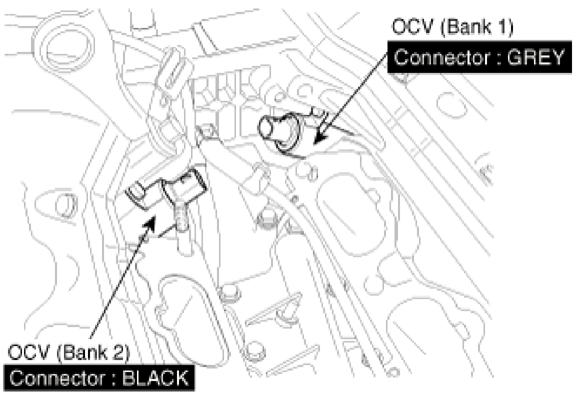
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0021

COMPONENT LOCATION



GENERAL DESCRIPTION

Different from the existing fixed cam phase angle type, CVVT(Continuously Variable Valve Timing) is the device which varies cam phase angle continuously to be optimum. And with engine oil pressure, it operates. CVVT consists of OCV(Oil Control Valve) and cam phaser. OCV, mounted on cylinder head, controlls the amount and direction of oil delivered to cam phaser by oil valve which is connected to a solenoid. Cam phaser, rotating cam phaser rotor with pressure and amount of oil produced by OCV, rotates cam shaft forcefully for or against the rotating direction and finally, cam shaft phase changes. With the appliance of CVVT, engine power,fuel efficiency and the quality of exhause gas are improved.

DTC DESCRIPTION

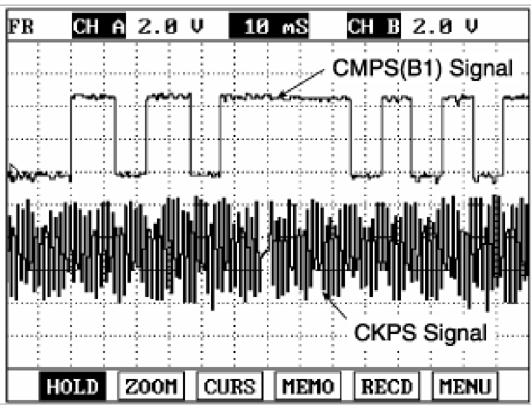
This diagnostic monitors the phasing response rate and determines whether the response rate is fast enough. A state machine is used to capture the response rate.The measured results are then compared to an allowable threshold. The threshold is a function of the oil temperature and the requested desired rate. Test of the phaser response rate requires an engine speed or engine load change.
PCM detects CAM phasing average rate while cam offset is available. If the CAM phasing rate is failure in 12 times out of 15 CAM phasing test PCM determines that a fault exists and a DTC is stored.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Determines if the phaser is moving at an expected rate	

Enable Conditions	• Cam Offset is available	• Excessive phasing system leakage • Binding Oil Pressure (ex. Blockage in OCV filter) • Faulty PCM
Threshold value	• Cam phasing average rate is out of threshold programmed in PCM	
Diagnosis Time	• Continuous (12 tests failure for 15 cam edge tests)	
MIL On Condition	• 2 driving cycles	

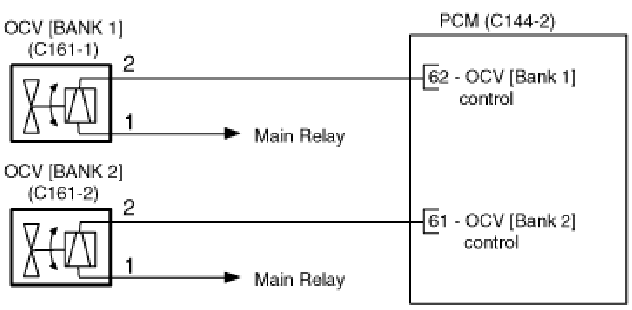
SIGNAL WAVEFORM AND DATA



This example shows a typical Crankshaft Position Sensor(CKPS) and Camshaft Position Sensor(CMPS) waveform at idle.
If the Cam Phasing is generated by PCM the offset of cam target wheel tooth varies against 58X reference tooth of CKPS.
Cam phasing can be detected from offset variation.

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

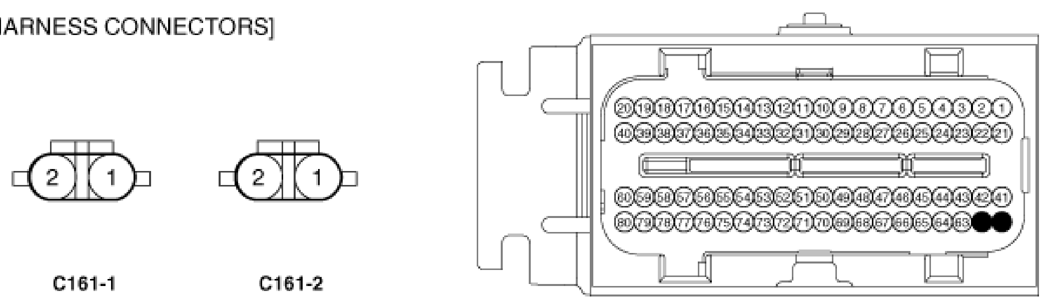
OCV [BANK 1]

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (62)	OCV [Bank 1] control

OCV [BANK 2]

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (61)	OCV [Bank 2] control

[HARNESS CONNECTORS]



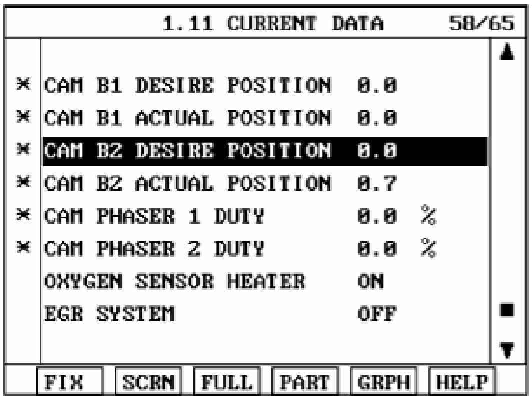
C161-1
OCV [Bank 1]

C161-2
OCV [Bank 2]

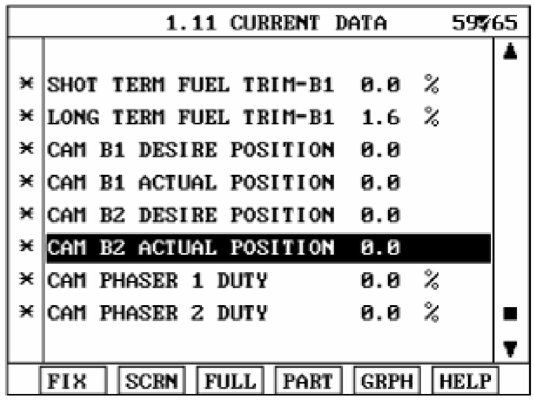
C144-2
PCM

MONITOR SCANTOOL DATA

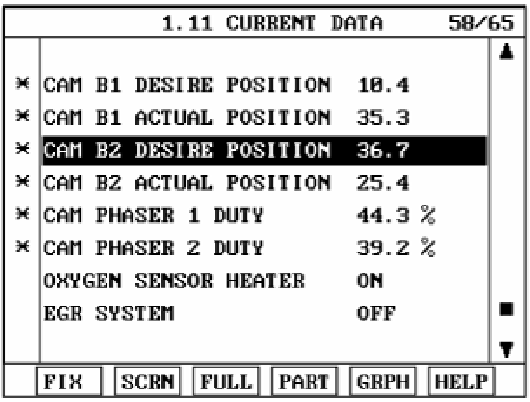
1. connect scantool and ENG "ON"
2. Monitor "CMPS(B2)" on the service data.



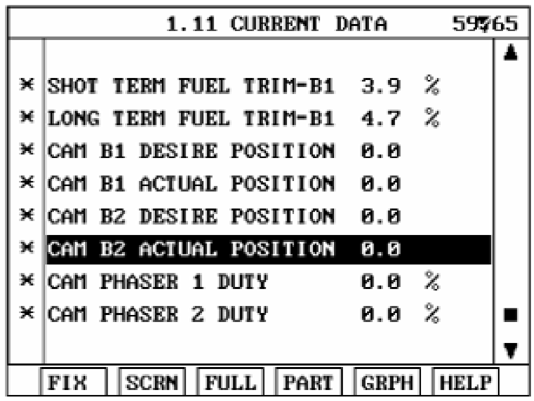
Normal data - idle



Open at idle



Open at accelleration



Open at acceleration

3. Are the "CMPS(B2)" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection,bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and goto "Verification of Vehicle Repair" procedure.

NO

▸ Go to "System Inspection" procedure.

SYSTEM INSPECTION

1. Visual Inspection
   (1) Check oil level is O.K.
   (2) Check oil level is contaminated.
   (3) Check that any oil leakage or blockage is occurred on the parts related to CVVT.
   (4) Has a problem been found ?

   YES

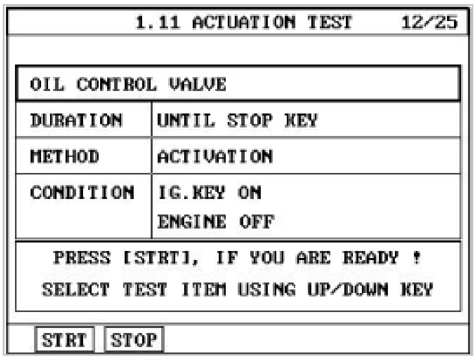
   ▸ Repair or replace as necessary and then, go to " Verification of Vehicle Repair" procedure.

   NO

   ▸ Go to "Component Inspection" procedure.

COMPONENT INSPECTION

1. Check OCV
   (1) connect scantool and IG "ON"
   (2) Select "OCV" on the Actuation Test
   (3) Activates "OCV" by pressing "STRT(F1)" key
   (should hear a faint click from Oil Control solenoid Valve)
   (4) Repeat this procedure 4 or 5 times to ensure intake valve control solenoid reliability



1.11 ACTUATION TEST 12/25	
OIL CONTROL VALVE	
DURATION	UNTIL STOP KEY
METHOD	ACTIVATION
CONDITION	IG.KEY ON ENGINE OFF
PRESS [STRT], IF YOU ARE READY ! SELECT TEST ITEM USING UP/DOWN KEY	
STRT STOP	

(5) Has a problem been found ?

YES

▸ Substitute with a known - good CVVT and check for proper operation. If the problem is corrected, replace CVVT and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good OCV and check for proper operation. If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

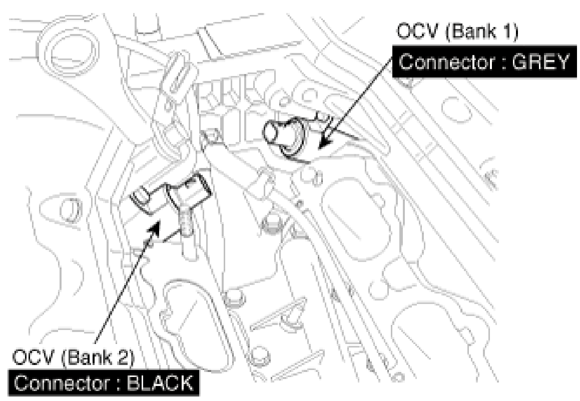
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0022

COMPONENT LOCATION



GENERAL DESCRIPTION

Different from the existing fixed cam phase angle type, CVVT(Continuously Variable Valve Timing) is the device which varies cam phase angle continuously to be optimum. And with engine oil pressure, it operates. CVVT consists of OCV(Oil Control Valve) and cam phaser. OCV, mounted on cylinder head, controlls the amount and direction of oil delivered to cam phaser by oil valve which is connected to a solenoid. Cam phaser, rotating cam phaser rotor with pressure and amount of oil produced by OCV, rotates cam shaft forcefully for or against the rotating direction and finally, cam shaft phase changes. With the appliance of CVVT, engine power,fuel efficiency and the quality of exhause gas are improved.

DTC DESCRIPTION

Figure1. illustrates the method for detecting unresolved phasing steady-state error.
The figure shows two cases, case 1 to the left of the dashed line, and case 2 to the right of the dashed line. In case 1,the duty cycle command is considered high, or above a calibration threshold memorized in PCM. This should cause the cam phaser to move toward the maximum position, but the position remains at a medium level. The range of positions considered ‘medium’ is defined by calibrations.
In case 2, the duty cycle command is considered low, or below a calibration threshold memorized in PCM. This should cause the cam phaser to move toward the minimum position, but the position remains at a medium level.
Each of these cases is a phaser position error failure. Each case is also considered to be due to a phaser seizure. When either case is detected, a timing counter begins to increment. If the counter exceeds a calibration threshold memorized in PCM, the failure criteria is TRUE.
Another similar diagnostic test is performed to check steady-state error. In this test, no consideration is given to the duty cycle command versus phaser position. This test is only a check of the phasing position error. It is a test of the phaser control logic. If there has been integral windup in the PID control,this test will detect it. In the test, if the phaser error is greater than a calibration threshold memorized in PCM,a timing counter increments. If the counter exceeds the calibration threshold memorized in PCM,the failure criteria is TRUE.

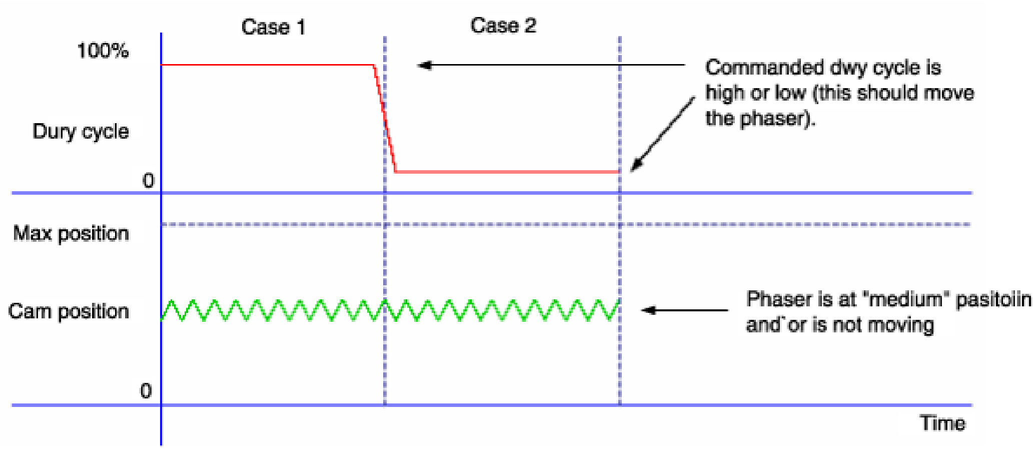


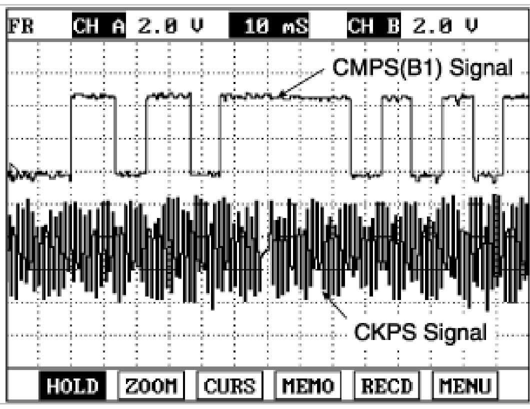
Fig. 1

PCM monitors CAM phaser error while both cam offset is available and cam velocity is below 15CAD/s .If the CAM phaser does not move although PCM commands OCV duty cycle PCM determines that a faultexists and a DTC is stored.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible cause
DTC Strategy		• Determines if the phaser is stuck or has steady-state error	• Engine Oil • OCV • CVVT stuck • PCM
Enable Conditions		• Offsets available • Cam velocity below threshold< 15 CAD/s	
Thresh old value	Case 1	• 5 CAD < Cam position< 50 CAD • Duty Cycle >90% • Duty Cycle< 10% • Timing Counter >80	
	Case 2	• Cam Position error >4 CAD • Timing Counter >80	
Diagnosis Time		• Continuous (More than 0.75sec. Test failure for every 90sec tests)	
MIL On Condition		• 2 Driving Cycles	

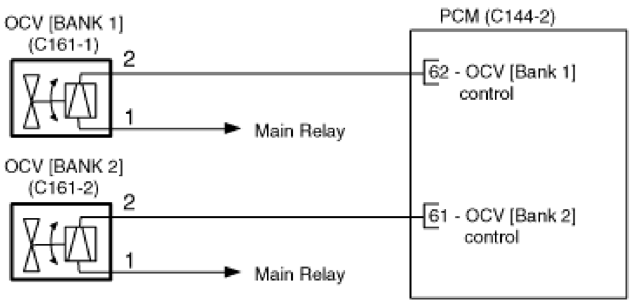
SIGNAL WAVEFORM AND DATA



This example shows a typical Crankshaft Position Sensor(CKPS) and Camshaft Position Sensor(CMPS) waveform at idle. If the Cam Phasing is generated by PCM the offset of cam target wheel tooth varies against 58X reference tooth of CKPS. Cam phasing can be detected from offset variation.

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

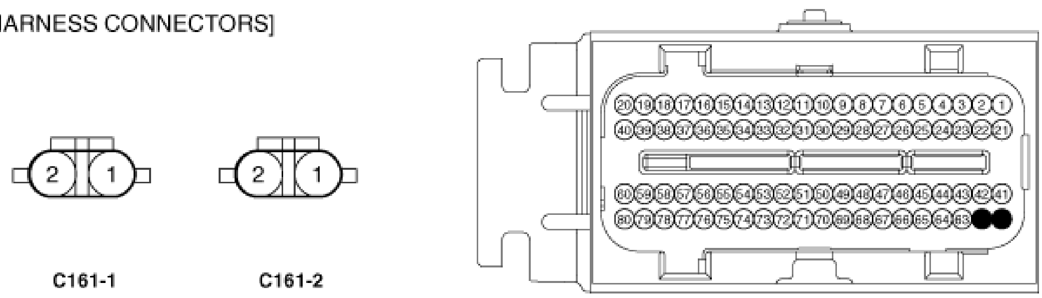
OCV [BANK 1]

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (62)	OCV [Bank 1] control

OCV [BANK 2]

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (61)	OCV [Bank 2] control

[HARNESS CONNECTORS]



C161-1

OCV [Bank 1]

C161-2

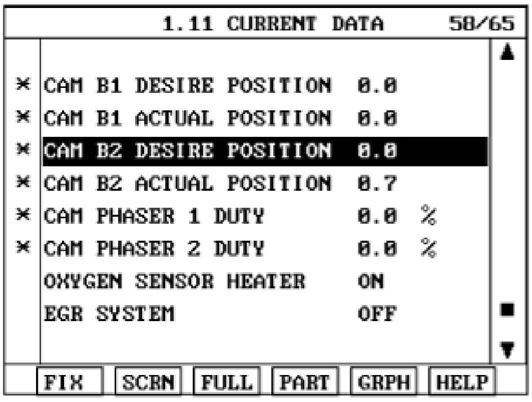
OCV [Bank 2]

C144-2

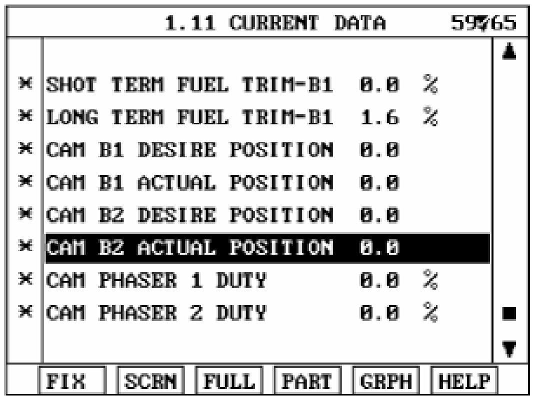
PCM

MONITOR SCANTOOL DATA

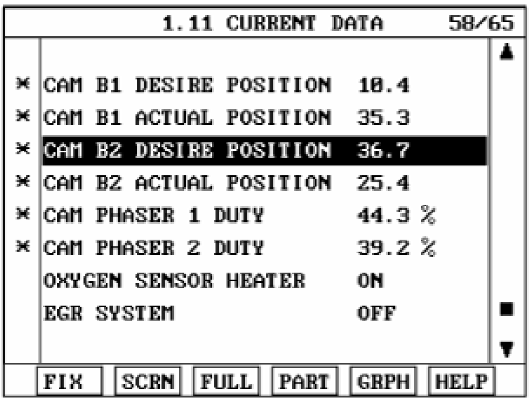
1. connect scantool and ENG "ON"
2. Monitor "CMPS(B2)" on the service data.



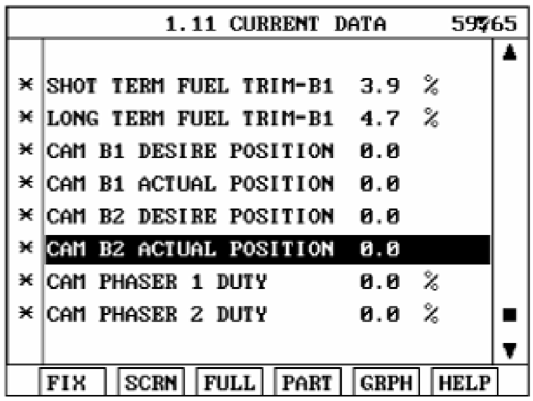
Normal data - idle



Open at idle



Open at accelleration



Open at acceleration

3. Are the "CMPS(B2)" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection,bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and goto "Verification of Vehicle Repair" procedure.

NO

▸ Go to "System Inspection" procedure.

SYSTEM INSPECTION

1. Visual Inspection
   (1) Check oil level is O.K.

   (2) Check oil level is contaminated.

   (3) Has a problem been found ?

   YES

   ▸ Repair or replace as necessary and then, go to " Verification of Vehicle Repair" procedure.

   NO

   ▸ Go to "Component Inspection" procedure.

COMPONENT INSPECTION

1. Check OCV
   (1) connect scantool and IG "ON"

   (2) Select "OCV" on the Actuation Test

   (3) Activates "OCV" by pressing "STRT(F1)" key
   (should hear a faint click from Oil Control solenoid Valve)

   (4) Repeat this procedure 4 or 5 times to ensure intake valve control solenoid reliability

1.11 ACTUATION TEST 12/25	
OIL CONTROL VALVE	
DURATION	UNTIL STOP KEY
METHOD	ACTIVATION
CONDITION	IG.KEY ON ENGINE OFF
PRESS [STRT], IF YOU ARE READY ! SELECT TEST ITEM USING UP/DOWN KEY	
STRT STOP	

(5) Has a problem been found ?

YES

▸ Substitute with a known - good CVVT and check for proper operation. If the problem is corrected, replace CVVT and go to "Verification of Vehicle Repair" procedure.

NO

(6) ▸ Substitute with a known - good OCV and check for proper operation. If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

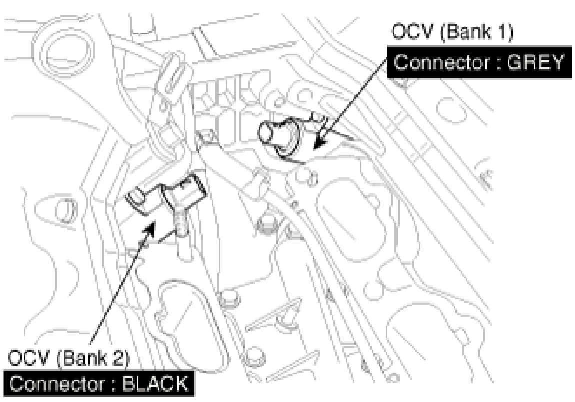
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0026

COMPONENT LOCATION

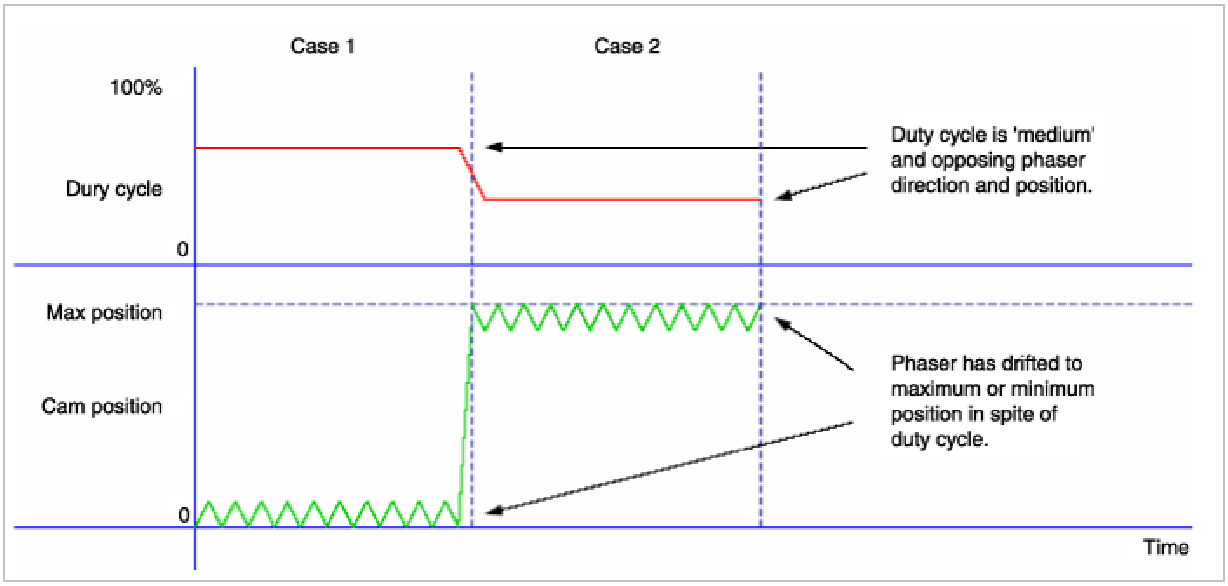


GENERAL DESCRIPTION

Different from the existing fixed cam phase angle type, CVVT(Continuously Variable Valve Timing) is the device which varies cam phase angle continuously to be optimum. And with engine oil pressure, it operates. CVVT consists of OCV(Oil Control Valve) and cam phaser. OCV, mounted on cylinder head, controlls the amount and direction of oil delivered to cam phaser by oil valve which is connected to a solenoid. Cam phaser, rotating cam phaser rotor with pressure and amount of oil produced by OCV, rotates cam shaft forcefully for or against the rotating direction and finally, cam shaft phase changes. With the appliance of CVVT, engine power,fuel efficiency and the quality of exhause gas are improved.

DTC DESCRIPTION

Small particles in the engine oil may cause the oil control valve to bind or otherwise get stuck atcertain spool positions. A test is used in this diagnostic to detect a stuck valve spool. A cleaningfunction is then used to try and free the spool. If unsuccessful, the diagnostic test is failed.
Figure 1. illustrates the principle of the valve stuck diagnostic test. As in the phaser error diagnosticillustration, there are two cases shown in the figure. The case on the left shows a case where the dutycycle is above a calibration threshold, yet the phaser position is near the minimum position. Undernormal operation, such a duty cycle command would move the phaser toward its maximum position.The case on the right shows the opposite situation. The duty cycle command is below a threshold, yetthe phaser position is near its maximum.



In the diagnostic test logic, duty cycle is not used. There are two reasons: 1) duty cycle is theparameter most closely related to result of the test, and should not be used in the test, and 2) it isdifficult to establish thresholds for duty cycle because of the variation of such thresholds. Instead ofduty cycle, position error is used. This indicates clearly the expected duty cycle behavior and allowsthresholds to be established without consideration for temperature, voltage and pressure conditions aswell as the strength or lack of strength in the gain calibration.
PCM monitors OCV stuck while cam offset is available and Valve cleaning is not in progress .If the PCM detects that CAM position angle is over 20 CAD(Crank Angle Degree) than expected cam positionthat PCM controls the OCV while cam position is in designated crank angle degree, PCM determines that a faultexists and a DTC is stored.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible cause
DTC Strategy		• Determines if oil control valve is stuck	• Oil Pressure Loss • OCV seizure • PCM
Enable Conditions		• Valve cleaning not in progress • Offsets available	
Thresh old value	Case 1	• Cam position > 50 CAD • Cam position Error > 20 CAD • Timing counter >56 count	
	Case 2	• Cam position< 5 CAD • Cam position Error > 20 CAD • Timing counter >56 count	
Diagnosis Time		• Continuous (More than 0.75sec failure for every 56.25 sec. tests)	
MIL On Condition		• 2 driving Cycle	

SIGNAL WAVEFORM AND DATA

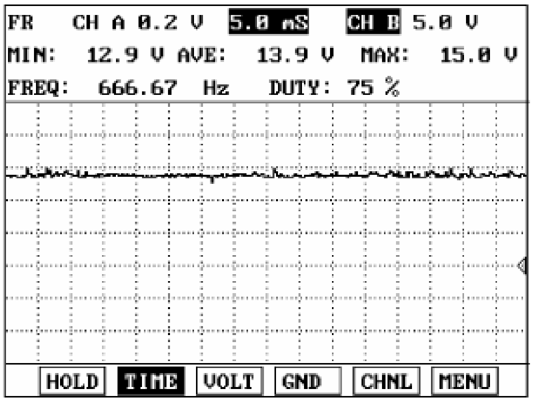


Fig. 1

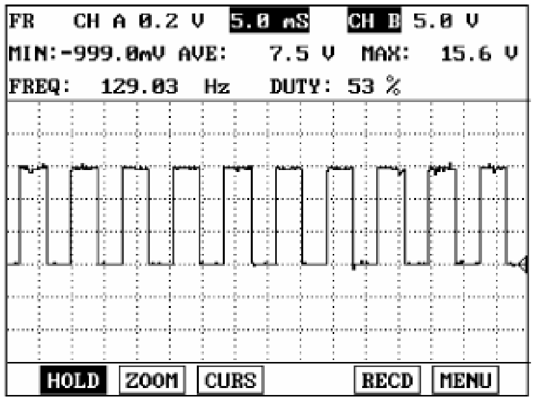


Fig. 2

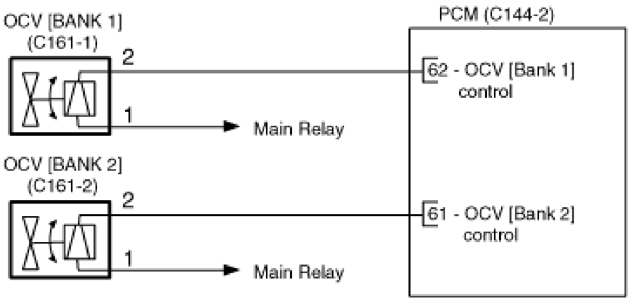
Fig. 1 : Idle - normal Condition
Fig. 2 : Acceleration

SPECIFICATION

Resistance (Ω)	6.7 ~ 7.7

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

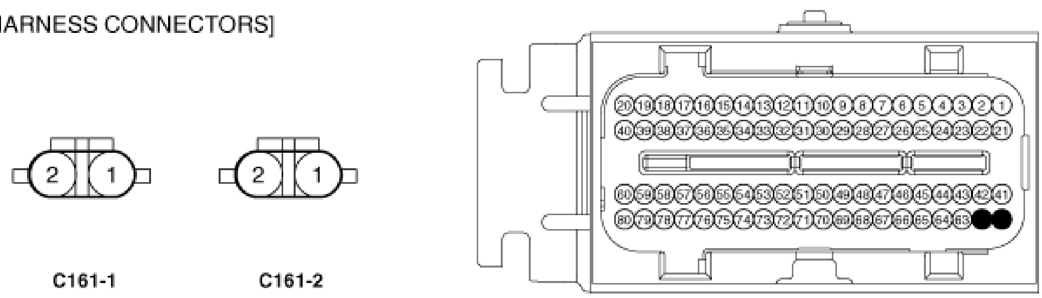
OCV [BANK 1]

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (62)	OCV [Bank 1] control

OCV [BANK 2]

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (61)	OCV [Bank 2] control

[HARNESS CONNECTORS]



C161-1

OCV [Bank 1]

C161-2

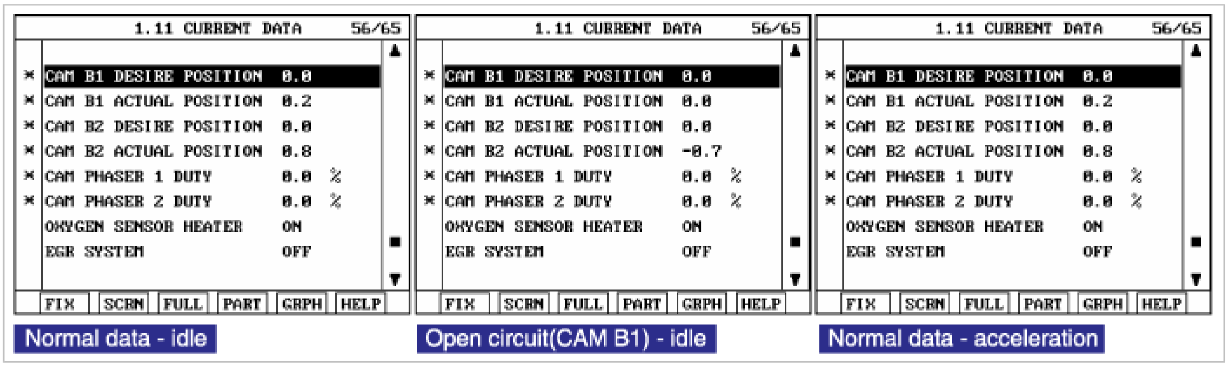
OCV [Bank 2]

C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "CAM(B1)" status on the service data.



4. Are the "CMP(B1)" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, ending, corrosion, contamination, deterioration, or damage. Repair or replace asnecessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

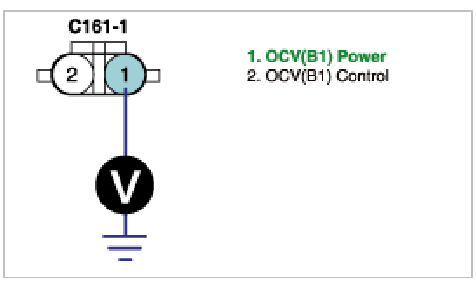
NO

▸ Go to " Power Circuit Inspection " as follow

POWER CIRCUIT INSPECTION

1. IG "OFF" and disconnect OCV connector.
2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 1 of OCV harness connector and chassis ground.

Specification : B+



4. Is the measured voltage within specification ?

YES

▸ Go to " Control Circuit Inspection " procedure.

NO

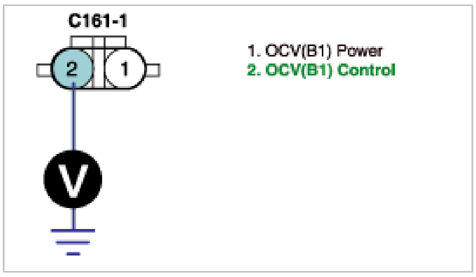
▸ Check that Fuse between Main Relay and OCV is open.
▸ Check open between main relay and OCV.
▸ Check short to ground between Main Relay and OCV.
▸ Repair or replace as necessay go to "Verification of Vehicle Repair " procedure.

CONTROL CIRCUIT INSPECTION

1. IG "OFF" and disconnect OCV connector.
2. IG "ON" & ENG "OFF".

3. Measure voltage between terminal 2 of OCV harness connector and chassis ground.

Specification : Approx. below 1V



4. Is the measured voltage within specification ?

YES

▸ Go to "System Inspection" procedure.

NO

▸ Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

SYSTEM INSPECTION

1. Visual Inspection
   (1) Check oil level is O.K.
   (2) Check oil level is contaminated.
   (3) Check that any oil leakage is occurred around OCV.
   (4) Has a problem been found ?

   YES

   ▸ Repair or replace as necessary and then, go to " Verification of Vehicle Repair" procedure.

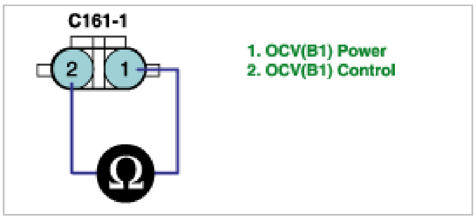
   NO

   ▸ Go to "Component Inspection" procedure

COMPONENT INSPECTION

1. OCV Inspection
   (1) IG "OFF" & Disconnect OCV connector.
   (2) Measure resistance between terminal 1 and 2 of OCV connector (Component Side)
   Specification :

Resistance (Ω)	6.7 ~ 7.7



   (3) Is the measured resistance within specification?

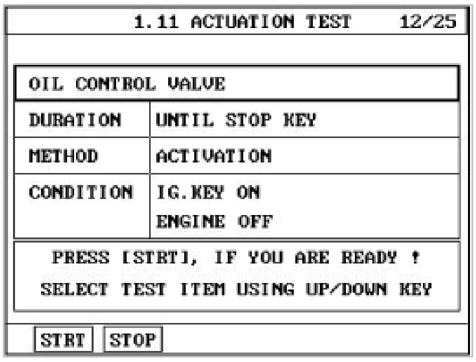
   YES

   ▸ Go to "Actuation Test" as follow.

   NO

   ▸ Substitute with a known - good OCV and check for proper operation. If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

2. Actuation Test
   (1) IG "OFF" and connect OCV connector
   (2) IG "ON" & ENG "OFF"
   (3) Check that click sound can be heard when actuation operates with scantool.



(4) Does the OCV operate corectly when actuation operates ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

NO

▸ Substitute with a known - good OCV and check for proper operation. If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

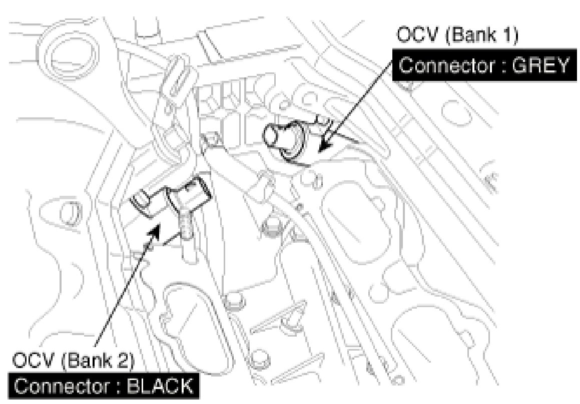
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0028

COMPONENT LOCATION



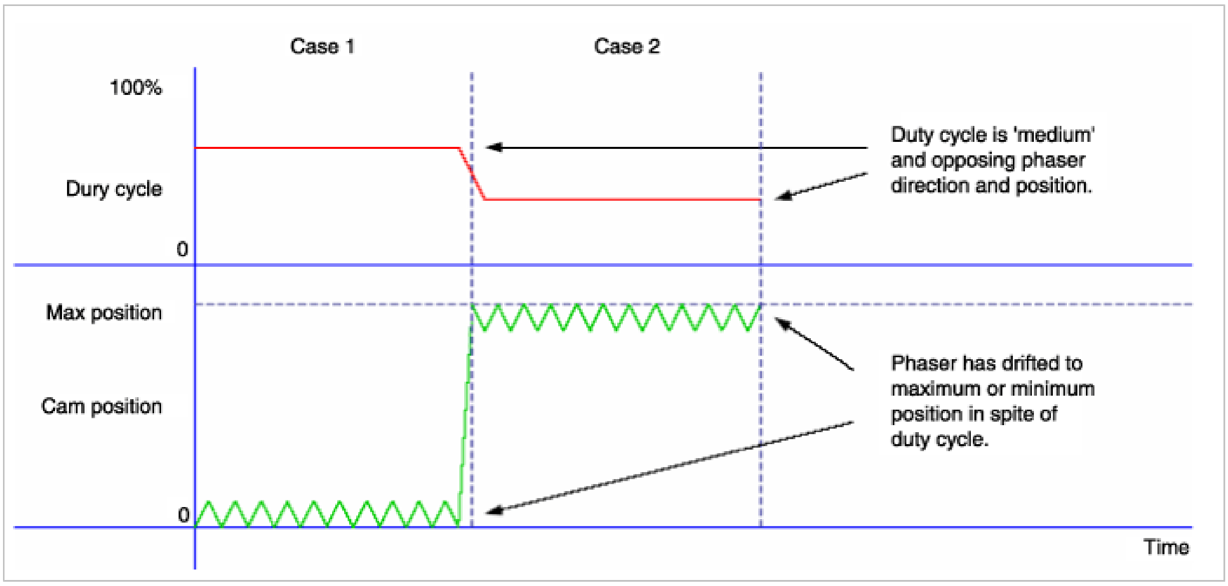
GENERAL DESCRIPTION

Different from the existing fixed cam phase angle type, CVVT(Continuously Variable Valve Timing) is the device which varies cam phase angle continuously to be optimum. And with engine oil pressure, it operates. CVVT consists of OCV(Oil Control Valve) and cam phaser. OCV, mounted on cylinder head, controlls the amount and direction of oil delivered to cam phaser by oil valve which is connected to a solenoid. Cam phaser, rotating cam phaser rotor with pressure and amount of oil produced by OCV, rotates cam shaft forcefully for or against the rotating direction and finally, cam shaft phase changes. With the appliance of CVVT, engine power,fuel efficiency and the quality of exhause gas are improved.

DTC DESCRIPTION

Small particles in the engine oil may cause the oil control valve to bind or otherwise get stuck atcertain spool positions. A test is used in this diagnostic to detect a stuck valve spool. A cleaningfunction is then used to try and free the spool. If unsuccessful, the diagnostic test is failed.

Figure 1. illustrates the principle of the valve stuck diagnostic test. As in the phaser error diagnosticillustration, there are two cases shown in the figure. The case on the left shows a case where the dutycycle is above a calibration threshold, yet the phaser position is near the minimum position. Undernormal operation, such a duty cycle command would move the phaser toward its maximum position.The case on the right shows the opposite situation. The duty cycle command is below a threshold, yetthe phaser position is near its maximum.



In the diagnostic test logic, duty cycle is not used. There are two reasons: 1) duty cycle is theparameter most closely related to result of the test, and should not be used in the test, and 2) it isdifficult to establish thresholds for duty cycle because of the variation of such thresholds. Instead ofduty cycle, position error is used. This indicates clearly the expected duty cycle behavior and allowsthresholds to be established without consideration for temperature, voltage and pressure conditions aswell as the strength or lack of strength in the gain calibration.

PCM monitors OCV stuck while cam offset is available and Valve cleaning is not in progress .If the PCM detects that CAM position angle is over 20 CAD(Crank Angle Degree) than expected cam positionthat PCM controls the OCV while cam position is in designated crank angle degree, PCM determines that a faultexists and a DTC is stored.

DTC DETECTING CONDITION

<table>
<tr><th colspan="2">Item</th><th>Detecting Condition</th><th>Possible cause</th></tr>
<tr><td colspan="2">DTC Strategy</td><td>• Determines if oil control valve is stuck</td><td rowspan="7">• Oil Pressure Loss
• OCV(B2) seizure
• PCM</td></tr>
<tr><td colspan="2">Enable Conditions</td><td>• Valve cleaning not in progress
• Offsets available</td></tr>
<tr><td rowspan="2">Thresh old value</td><td>Case 1</td><td>• Cam position > 50 CAD
• Cam position Error > 20 CAD
• Timing counter >56 count</td></tr>
<tr><td>Case 2</td><td>• Cam position< 5 CAD
• Cam position Error > 20 CAD
• Timing counter >56 count</td></tr>
<tr><td colspan="2">Diagnosis Time</td><td>• Continuous
(More than 0.75sec failure for every 56.25 sec. tests)</td></tr>
<tr><td colspan="2">MIL On Condition</td><td>• 2 driving Cycle</td></tr>
</table>

SIGNAL WAVEFORM AND DATA

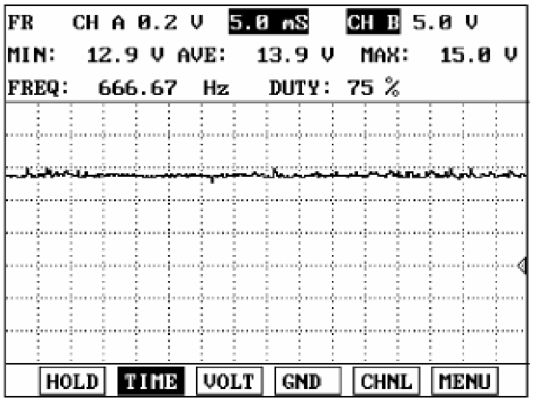


Fig. 1

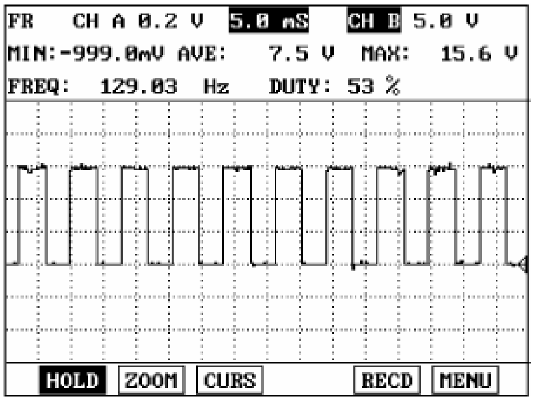


Fig. 2

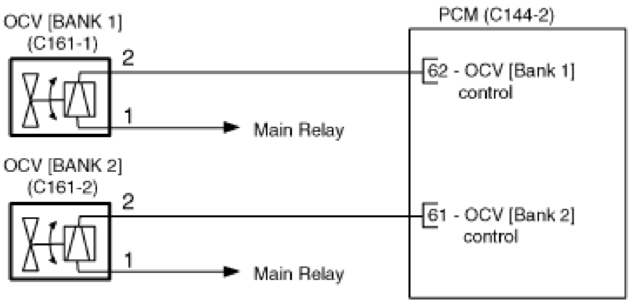
Fig. 1 : Idle - normal Condition
Fig. 2 : Acceleration

SPECIFICATION

Resistance (Ω)	6.7 ~ 7.7

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

OCV [BANK 1]

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (62)	OCV [Bank 1] control

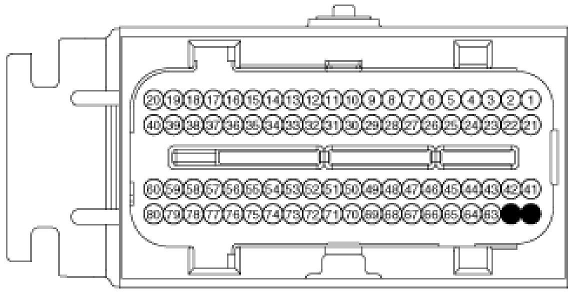
OCV [BANK 2]

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (61)	OCV [Bank 2] control

[HARNESS CONNECTORS]

C161-1
OCV [Bank 1]

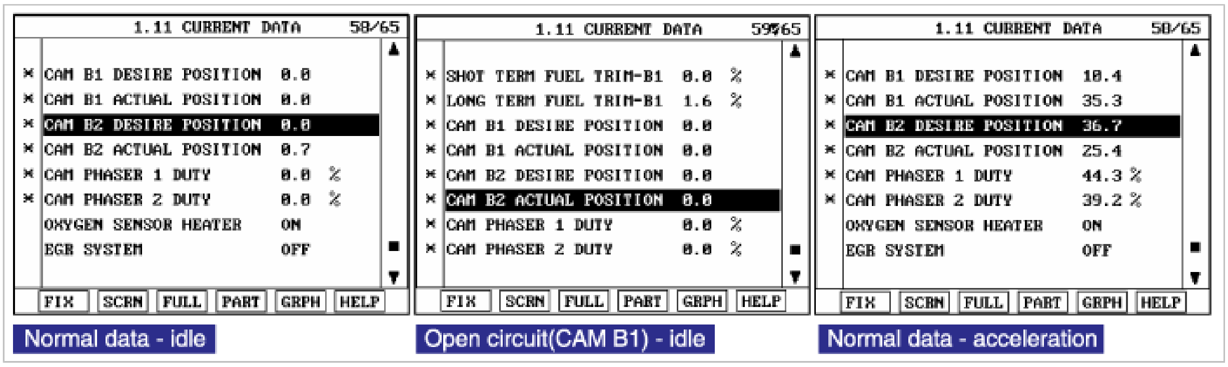
C161-2
OCV [Bank 2]



C144-2
PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "CAM(B2)" status on the service data.



Normal data - idle | Open circuit(CAM B1) - idle | Normal data - acceleration

4. Are the "CMP(B2)" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, ending, corrosion, contamination, deterioration, or damage. Repair or replace asnecessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

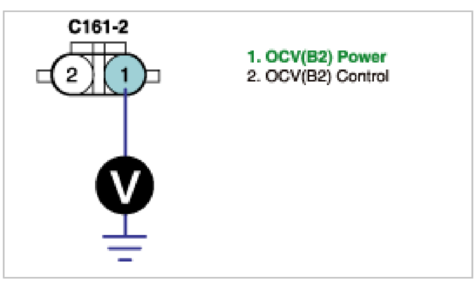
NO

▸ Go to " Power Circuit Inspection " as follow

POWER CIRCUIT INSPECTION

1. IG "OFF" and disconnect OCV connector.
2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 1 of OCV harness connector and chassis ground.

Specification : B+



4. Is the measured voltage within specification ?

YES

▸ Go to " Control Circuit Inspection " procedure.

NO

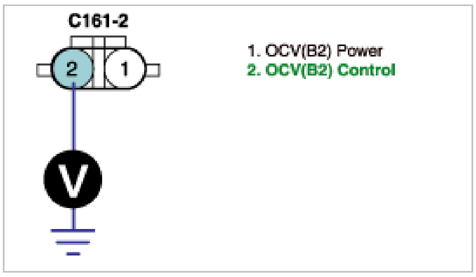
▸ Check that Fuse between Main Relay and OCV is open.
▸ Check open between main relay and OCV.
▸ Check short to ground between Main Relay and OCV.
▸ Repair or replace as necessay go to "Verification of Vehicle Repair " procedure.

CONTROL CIRCUIT INSPECTION

1. IG "OFF" and disconnect OCV connector.
2. IG "ON" & ENG "OFF".

3. Measure voltage between terminal 2 of OCV harness connector and chassis ground.

Specification : Approx. below 1V



4. Is the measured voltage within specification ?

YES

▸ Go to "System Inspection" procedure.

NO

▸ Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

SYSTEM INSPECTION

1. Visual Inspection
   (1) Check oil level is O.K.

   (2) Check oil level is contaminated.

   (3) Check that any oil leakage is occurred around OCV.

   (4) Has a problem been found ?

   YES

   ▸ Repair or replace as necessary and then, go to " Verification of Vehicle Repair" procedure.

   NO

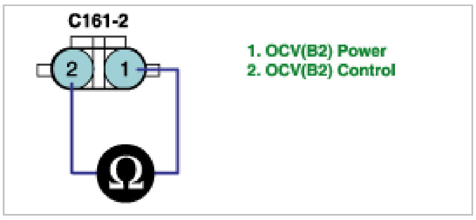
   ▸ Go to "Component Inspection" procedure

COMPONENT INSPECTION

1. OCV Inspection
   (1) IG "OFF" & Disconnect OCV connector.

   (2) Measure resistance between terminal 1 and 2 of OCV connector (Component Side)
   Specification :

Resistance (Ω)	6.7 ~ 7.7



   (3) Is the measured resistance within specification ?

   YES

   ▸ Go to "Actuation Test" as follow.

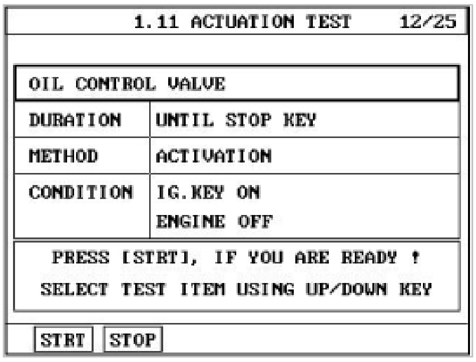
   NO

   ▸ Substitute with a known - good OCV and check for proper operation. If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

2. Actuation Test
   (1) IG "OFF" and connect OCV connector

   (2) IG "ON" & ENG "OFF"

   (3) Check that click sound can be heard when actuation operates with scantool.



(4) Does the OCV operate corectly when actuation operates ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

NO

Substitute with a known - good OCV and check for proper operation. If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

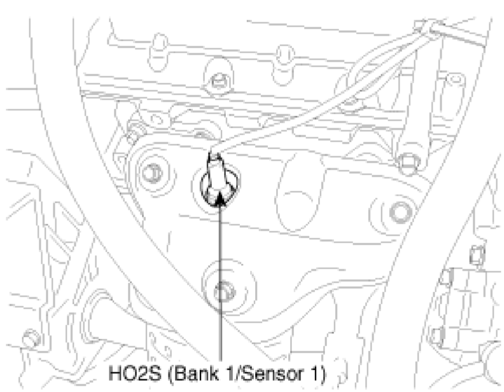
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0031

COMPONENT LOCATION



GENERAL DESCRIPTION

In order to control emissions of the CO, HC and NOx components of the exhaust gas, heated oxygen sensor (HO2S), mounted on the front side and rear side of catalytic converter, detects the oxygen content in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation.The HO2S requires a minimum temperature to operate properly and provide a closed loop fuel control system. The HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions.The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

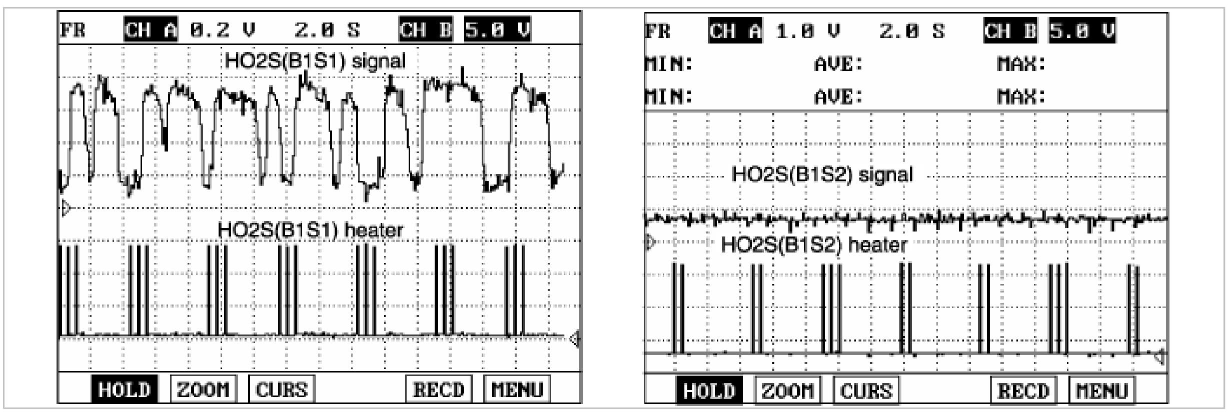
DTC DESCRIPTION

If the PCM detects heater output voltage is lower than threshold value for 5 seconds while enable condition is met PCM determines that a fault exists and a DTC is stored. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to ground or open circuit of O2 sensor heater circuit output	• Poor Connection • Open in Power Circuit • Open or short to ground in control circuit • HO2S(B1/S1) • PCM
Enable Conditions	• No disabling Faults Present • Engine Running • 11V ≤ Ignition Voltage ≤ 16V • Enable Time delay < 0.5sec	
Threshold value	• short to ground or open circuit	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA



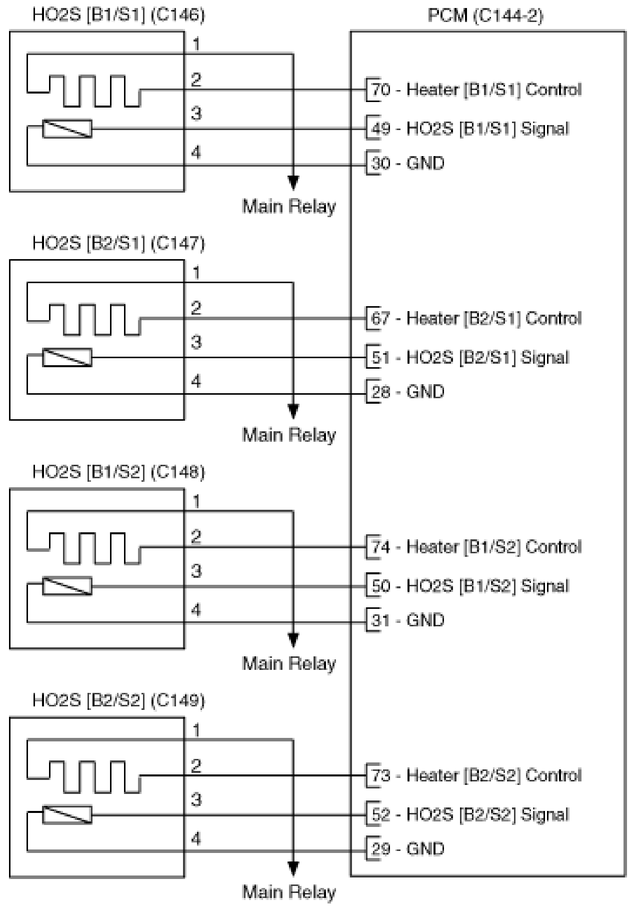
The HO2S requires a minimum temperature to provide a closed loop fuel control system. So the HO2S contains a heater element to reduce its warm-up time and ensure its performance during all driving conditions. The HO2S heater is controlled ON after engine start except for Cold condition and high speed accelleration. The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

SPECIFICATION

Heater	
Resistance (Ω)	9.6 ± 1.5

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

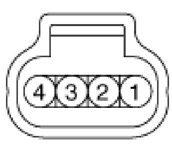
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

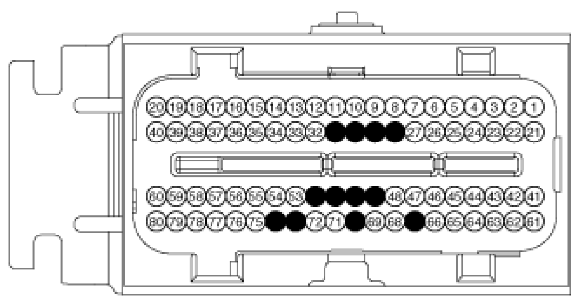
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]

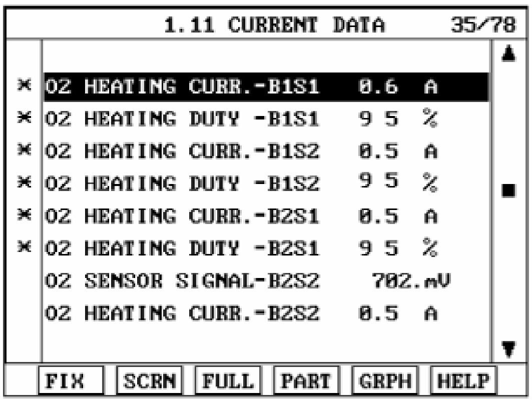


C144-2

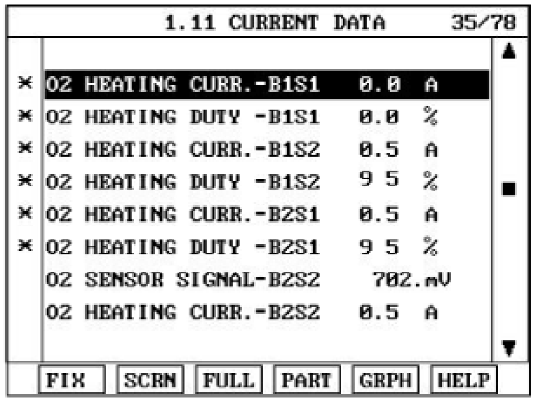
PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "HO2S(B1/S1)" status on the service data.



Normal data - idle



Open circuit(HO2S heater-B1S1)

4. Is the "HO2S Heater(B1/S1)" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

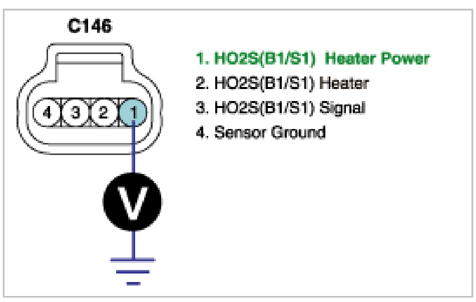
NO

▸ Go to " Power Circuit Inspection " procedure

POWER CIRCUIT INSPECTION

1. IG "OFF" & Disconnect HO2S(B1/S1) connector.
2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 1 of HO2S(B1/S1) harness connector and chassis ground.

Specification : B+



4. Is the measured voltage within specification ?

YES

▸ Go to HO2S(B1/S1) heater "Control Circuit Inspection" procedure.

NO

▸ Repair open or short to ground in HO2S(B1/S1) Heater power circuit then, go to "Verification of Vehicle Repair" procedure.

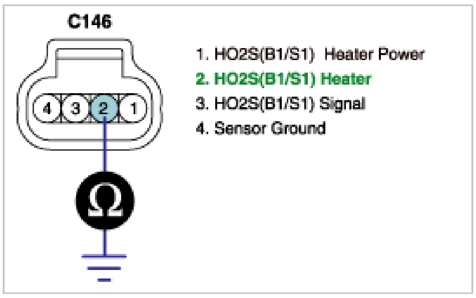
CONTROL CIRCUIT INSPECTION

1. Check short to ground in harness.

(1) IG "OFF" and disconnect HO2S(B1/S1) connector.

(2) Measure resistance between terminal 2 of HO2S(B1/S1) harness connector and chassis ground.

Specification : Infinite



(3) Is the measured resistance within specification ?

YES

▸ Go to HO2S(B1/S1) "Check Open in harness" as follows.

NO

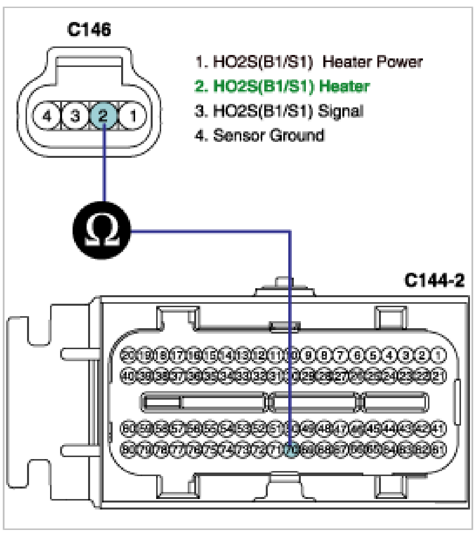
▸ Repair short to ground in HO2S (B1/S1) heater control circuit and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness

(1) IG "OFF" and disconnect HO2S(B1/S1) and PCM connector.

(2) Measure resistance between 2 of HO2S(B1/S1) harness connector and terminal 70 of PCM harness connector.

Specification : Approx. below 1Ω



(3) Is the measured resistance within specification ?

YES

▸ Go to HO2S(B1/S1) "Component Inspection" procedure.

NO

▸ Repair open in HO2S(B1/S1) heater control circuit and go to "Verifiction of Vehicle Repair" procedure.

COMPONENT INSPECTION

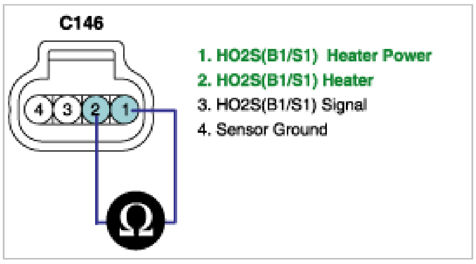
1. Check HO2S(B1/S1) Heater resistance.

(1) IG "OFF" and disconnect HO2S(B1/S1) connector.

(2) Measure resistance between terminal 1 and 2 of HO2S(B1/S1)connector (Component Side)

Specification :

Heater	
Resistance (Ω)	9.6 ± 1.5



(3) Is the measured resistance within specification ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

NO

▸ Substitute with a known - good HO2S(B1/S1) and check for proper operation. If the problem is corrected, replace HO2S (B1/S1) and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

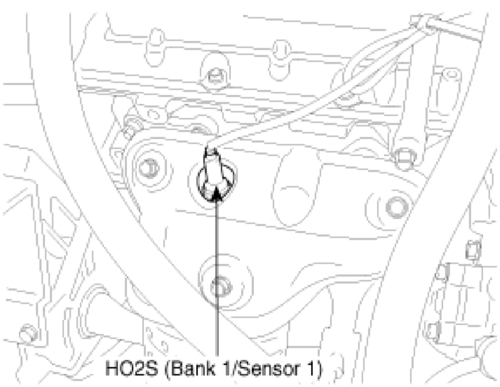
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0032

COMPONENT LOCATION



GENERAL DESCRIPTION

In order to control emissions of the CO, HC and NOx components of the exhaust gas, heated oxygen sensor (HO2S), mounted on the front side and rear side of catalytic converter, detects the oxygen content in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation.The HO2S requires a minimum temperature to operate properly and provide a closed loop fuel control system. The HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions.The

PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

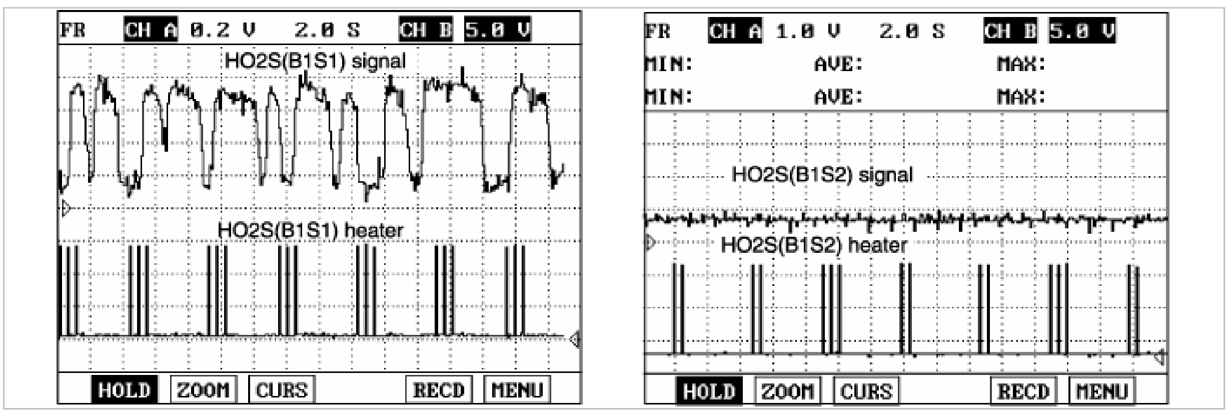
DTC DESCRIPTION

If the PCM detects heater output voltage is higher than threshold value for 5 seconds while enable condition is met PCM determines that a fault exists and a DTC is stored. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to battery O2 sensor heater circuit output	• Poor Connection • short to battery in control circuit • HO2S(B1/S1) • PCM
Enable Conditions	• No disabling Faults Present • Engine Running • 11V ≤ Ignition Voltage ≤ 16V • Enable Time delay < 0.5sec	
Threshold value	• short to battery	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA



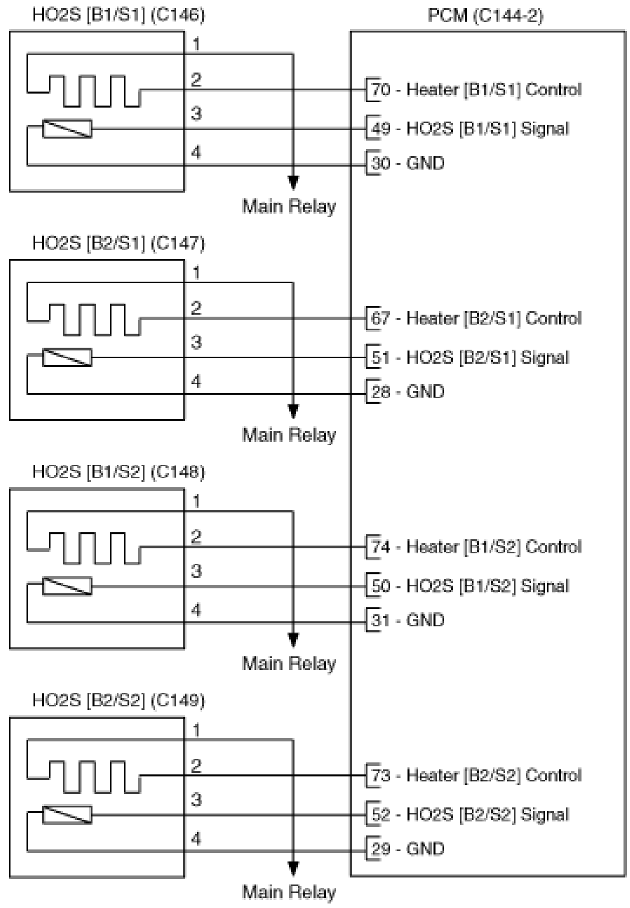
The HO2S requires a minimum temperature to provide a closed loop fuel control system. So the HO2S contains a heater element to reduce its warm-up time and ensure its performance during all driving conditions. The HO2S heater is controlled ON after engine start except for Cold condition and high speed accelleration. The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

SPECIFICATION

Heater	
Resistance (Ω)	9.6 ± 1.5

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

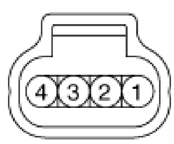
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

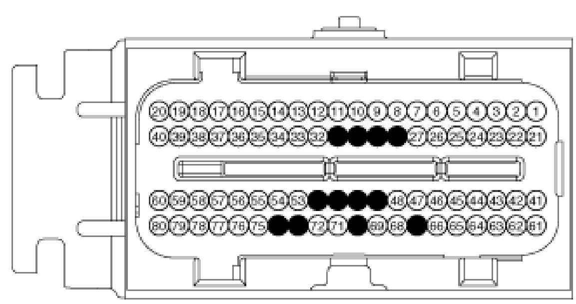
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

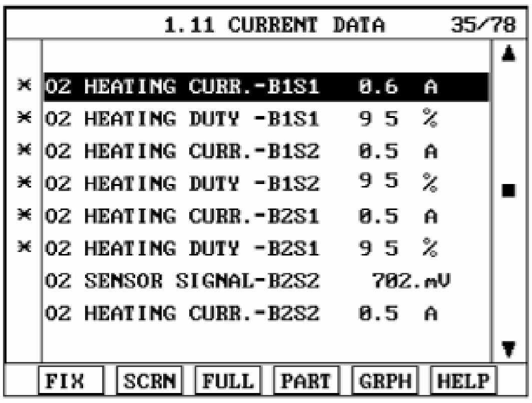
HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



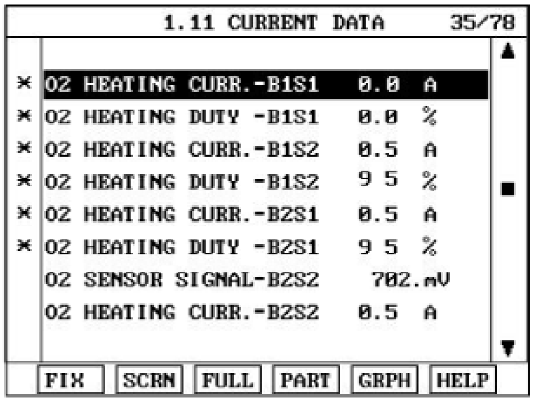
C144-2
PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "HO2S(B1/S1)" status on the service data.



Normal data - idle



Open circuit(HO2S heater-B1S1)

4. Is the "HO2S Heater(B1/S1)" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

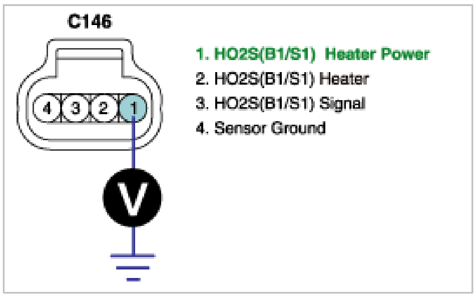
NO

▸ Go to " Power Circuit Inspection " procedure

POWER CIRCUIT INSPECTION

1. IG "OFF" & Disconnect HO2S(B1/S1) connector.
2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 1 of HO2S(B1/S1) harness connector and chassis ground.

Specification : B+



4. Is the measured voltage within specification ?

YES

▸ Go to HO2S(B1/S1) heater "Control Circuit Inspection" procedure.

NO

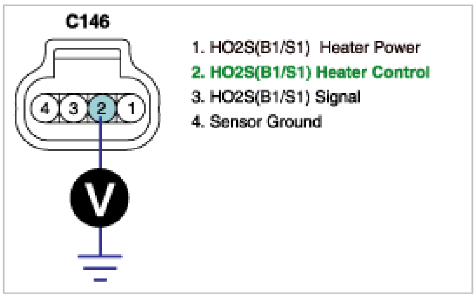
▸ Check output voltage from alternator then repair or replace as necessary. Go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. IG "OFF" & disconnect HO2S(B1/S1) connector.

2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 2 of HO2S(B1/S1) harness connector and chassis ground.

Specification : Approx. 0 V



4. Is the measured voltage within specification ?

YES

▸ Go to HO2S(B1/S1) "Component Inspection" procedure.

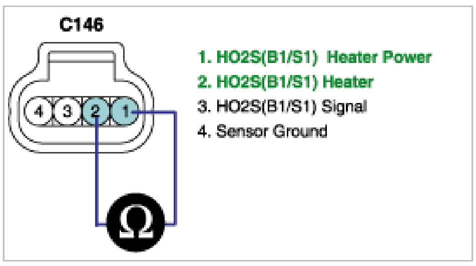
NO

▸ Repair short to battery in HO2S(B1/S1) Heater control circuit and go to "Verification of Vhicle Repair" procedure.

COMPONENT INSPECTION

1. Check HO2S(B1/S1) Heater resistance.
   (1) IG "OFF" and disconnect HO2S(B1/S1) connector.
   (2) Measure resistance between terminal 1 and 2 of HO2S(B1/S1)connector (Component Side)
   Specification :

Heater	
Resistance (Ω)	9.6 ± 1.5



   (3) Is the measured resistance within specification ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

NO

▸ Substitute with a known - good HO2S(B1/S1) and check for proper operation. If the problem is corrected, replace HO2S (B1/S1) and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.
1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "

5. Are any DTCs present ?

YES

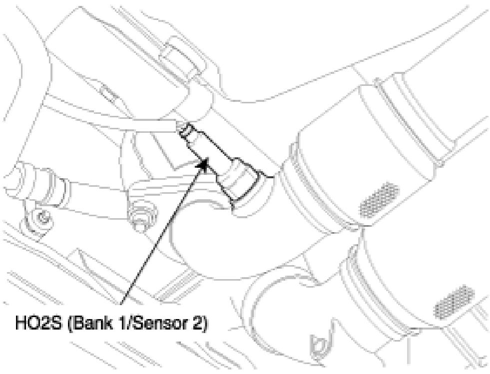
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0037

COMPONENT LOCATION



GENERAL DESCRIPTION

The rear heated oxygen sensor is mounted on the rear side of the Catalytic Converter which is able to detect the catalyst efficiency. The rear heated oxygen sensor (HO2S) produces a voltage between 0V and 1V. This rear heated oxygen sensor is used to estimate the oxygen storage capability. If a catalyst has good conversion properties, the oxygen fluctuations are smoothed by the oxygen storage capacity of the catalyst. If the conversion provided by the catalyst is low due to aging, poisoning or misfiring, then the oxygen fluctuations are similar to signals from the front oxygen sensor.

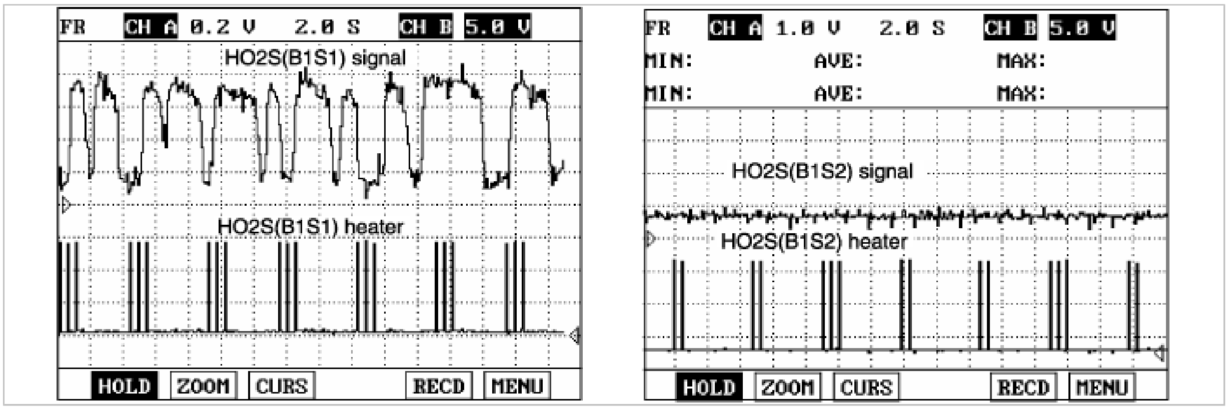
DTC DESCRIPTION

If the PCM detects heater output voltage is lower than threshold value for 5 seconds while enable condition is met PCM determines that a fault exists and a DTC is stored. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to ground or open circuit of O2 sensor heater circuit output	• Poor Connection • Open in Power Circuit • Open or short to ground in control circuit • HO2S(B1/S2) • PCM
Enable Conditions	• No disabling Faults Present • Engine Running • 11V ≤ Ignition Voltage ≤ 16V • Enable Time delay < 0.5sec	
Threshold value	• short to ground or open circuit	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA



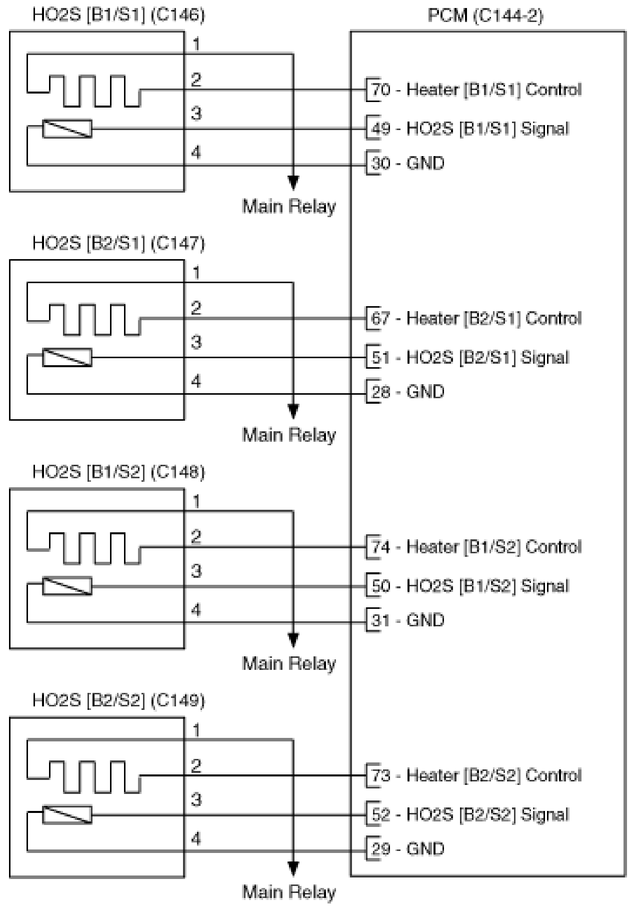
The HO2S requires a minimum temperature to provide a closed loop fuel control system. So the HO2S contains a heater element to reduce its warm-up time and ensure its performance during all driving conditions. The HO2S heater is controlled ON after engine start except for Cold condition and high speed accelleration. The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

SPECIFICATION

Heater	
Resistance (Ω)	9.6 ± 1.5

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

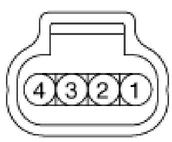
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

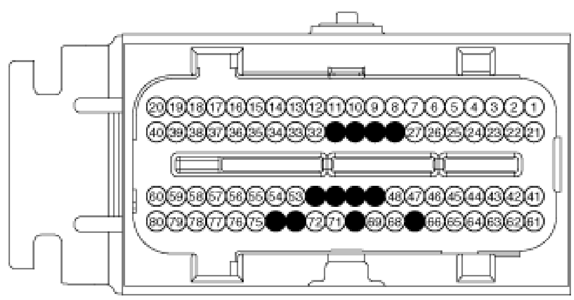
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]

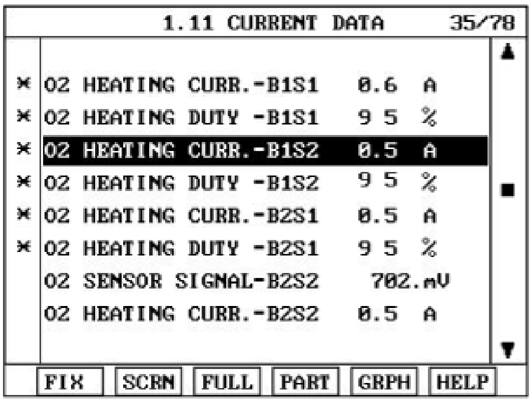


C144-2

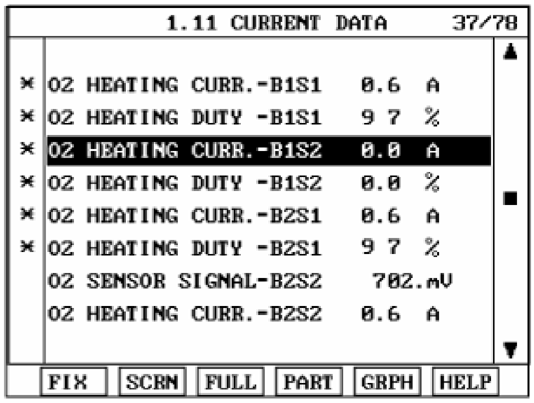
PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "HO2S(B1/S2)" status on the service data.



Normal data at idle



Open circuit(HO2S heater-B1S2)

4. Is the "HO2S Heater(B1/S2)" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

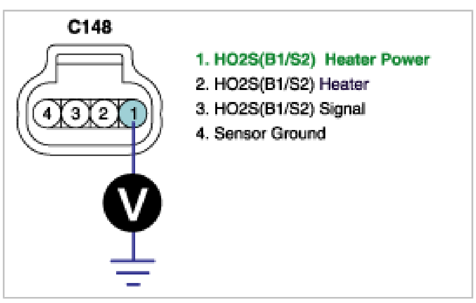
NO

▸ Go to " Power Circuit Inspection " procedure

POWER CIRCUIT INSPECTION

1. IG "OFF" & Disconnect HO2S(B1/S2) connector.
2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 1 of HO2S(B1/S2) harness connector and chassis ground.

Specification : B+



4. Is the measured voltage within specification ?

YES

▸ Go to HO2S(B1/S2) heater "Control Circuit Inspection" procedure.

NO

▸ Repair open or short to ground in HO2S(B1/S2) Heater power circuit then, go to "Verification of Vehicle Repair" procedure.

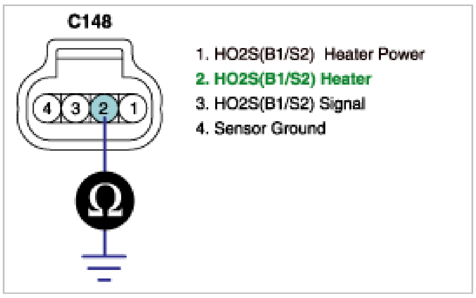
CONTROL CIRCUIT INSPECTION

1. Check short to ground in harness.

(1) IG "OFF" and disconnect HO2S(B1/S2) connector.

(2) Measure resistance between terminal 2 of HO2S(B1/S2) harness connector and chassis ground.

Specification : Infinite



(3) Is the measured resistance within specification ?

YES

▸ Go to HO2S(B1/S2) "Check Open in harness" as follows.

NO

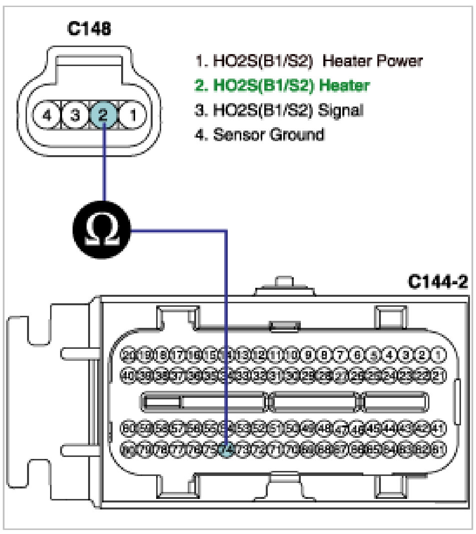
▸ Repair short to ground in HO2S (B1/S2) heater control circuit and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness

(1) IG "OFF" and disconnect HO2S(B1/S2) and PCM connector.

(2) Measure resistance between terminal 2 of HO2S(B1/S2) harness connector and terminal 74 of PCM harness connector.

Specification : Approx. below 1Ω



(3) Is the measured resistance within specification ?

YES

▸ Go to HO2S(B1/S2) "Component Inspection" procedure.

NO

▸ Repair open in HO2S(B1/S2) heater control circuit and go to "Verifiction of Vehicle Repair" procedure.

COMPONENT INSPECTION

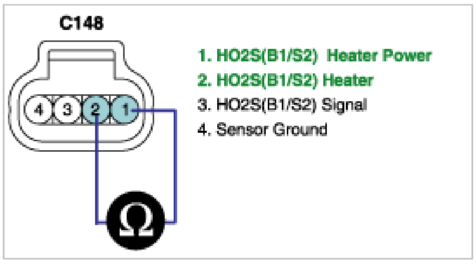
1. Check HO2S(B1/S2) Heater resistance

(1) IG "OFF" and disconnect HO2S(B1/S2) connector

(2) Measure resistance between terminal 1 and 2 of HO2S(B1/S2)(Component Side)

Specification :

Heater	
Resistance (Ω)	9.6 ± 1.5



(3) Is the measured resistance within specification ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

NO

▸ Substitute with a known - good HO2S(B1/S2) and check for proper operation. If the problem is corrected, replace HO2S (B1/S2) and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

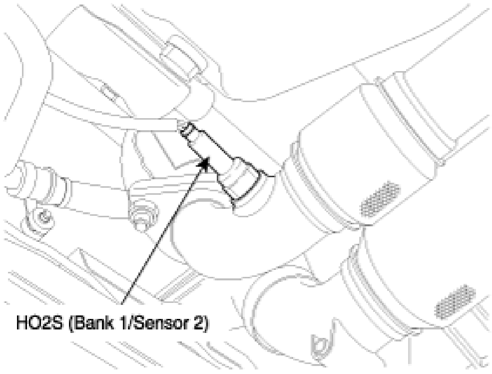
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0038

COMPONENT LOCATION



GENERAL DESCRIPTION

The rear heated oxygen sensor is mounted on the rear side of the Catalytic Converter which is able to detect the catalyst efficiency. The rear heated oxygen sensor (HO2S) produces a voltage between 0V and 1V. This rear heated oxygen sensor is used to estimate the oxygen storage capability. If a catalyst has good conversion properties, the oxygen fluctuations are smoothed by the oxygen storage capacity of the catalyst. If the conversion provided by the catalyst is low due to aging, poisoning or misfiring, then the oxygen fluctuations are similar to signals from the front oxygen sensor.

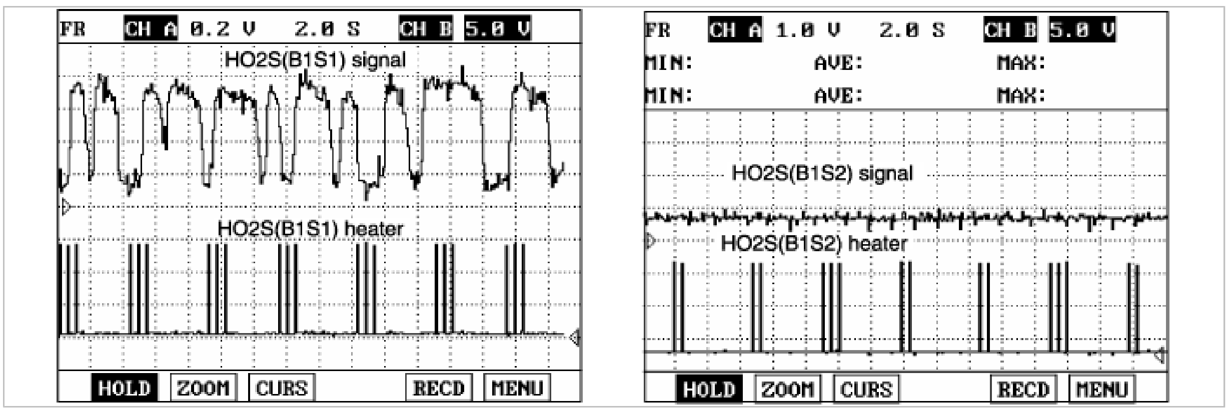
DTC DESCRIPTION

If the PCM detects heater output voltage is higher than threshold value for 5 seconds while enable condition is met PCM determines that a fault exists and a DTC is stored. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to ground or open circuit of O2 sensor heater circuit output	• Poor Connection • short to battery in control circuit • HO2S(B1/S2) • PCM
Enable Conditions	• No disabling Faults Present • Engine Running • 11V ≤ Ignition Voltage ≤ 16V • Enable Time delay < 0.5sec	
Threshold value	• short to battery	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA



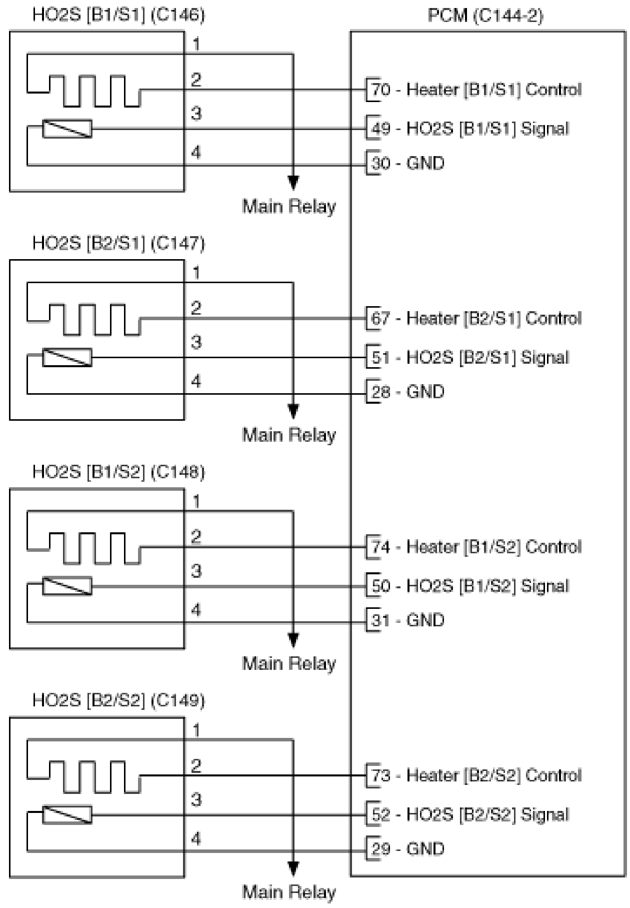
The HO2S requires a minimum temperature to provide a closed loop fuel control system. So the HO2S contains a heater element to reduce its warm-up time and ensure its performance during all driving conditions. The HO2S heater is controlled ON after engine start except for Cold condition and high speed accelleration. The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

SPECIFICATION

Heater	
Resistance (Ω)	9.6 ± 1.5

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

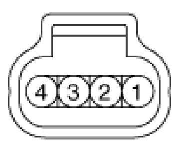
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

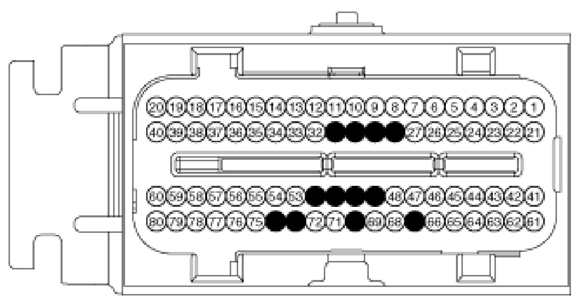
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]

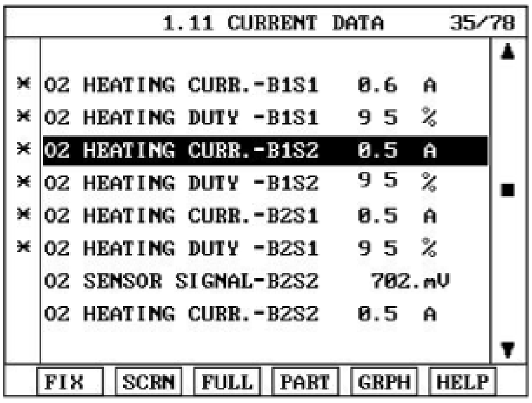


C144-2

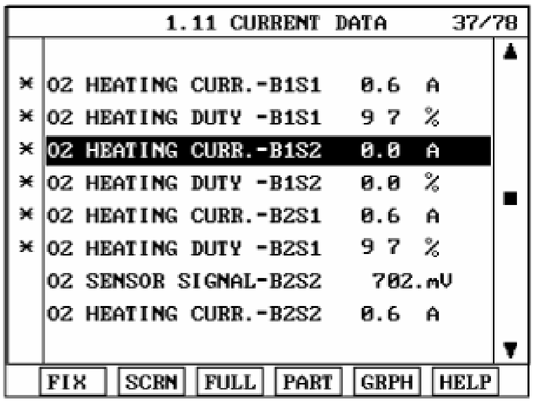
PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "HO2S(B1/S2)" status on the service data.



Normal data at idle



Open circuit(HO2S heater-B1S2)

4. Is the "HO2S Heater(B1/S2)" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

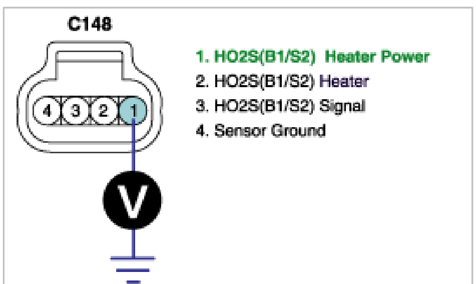
NO

▸ Go to " Power Circuit Inspection " procedure

POWER CIRCUIT INSPECTION

1. IG "OFF" & Disconnect HO2S(B1/S2) connector.
2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 1 of HO2S(B1/S2) harness connector and chassis ground.

Specification : B+



4. Is the measured voltage within specification ?

YES

▸ Go to HO2S(B1/S2) heater "Control Circuit Inspection" procedure.

NO

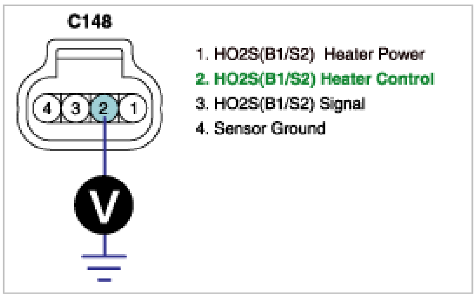
▸ Repair open or short to ground in HO2S(B1/S2) Heater power circuit then, go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. IG "OFF" & disconnect HO2S(B1/S2) connector.

2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 2 of HO2S(B1/S2) harness connector and chassis ground.

Specification : Approx. 0 V



4. Is the measured voltage within specification ?

YES

▸ Go to HO2S(B1/S2) "Component Inspection" procedure.

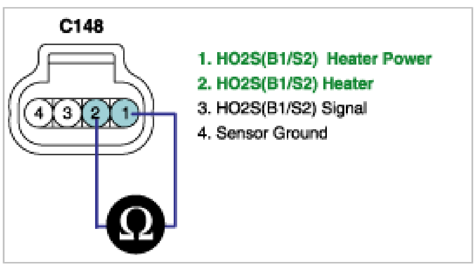
NO

▸ Repair short to battery in HO2S (B1/S2) heater control circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check HO2S(B1/S2) Heater resistance
   (1) IG "OFF" and disconnect HO2S(B1/S2) connector
   (2) Measure resistance between terminal 1 and 2 of HO2S(B1/S2)(Component Side)
   Specification :

Heater	
Resistance (Ω)	9.6 ± 1.5



   (3) Is the measured resistance within specification ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

NO

▸ Substitute with a known - good HO2S(B1/S2) and check for proper operation. If the problem is corrected, replace HO2S (B1/S2) and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "

5. Are any DTCs present ?

YES

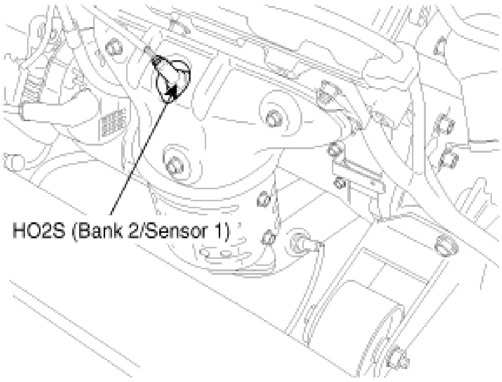
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0051

COMPONENT LOCATION



GENERAL DESCRIPTION

In order to control emissions of the CO, HC and NOx components of the exhaust gas, heated oxygen sensor (HO2S), mounted on the front side and rear side of catalytic converter, detects the oxygen content in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation.The HO2S requires a minimum temperature to operate properly and provide a closed loop fuel control system. The HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions.The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

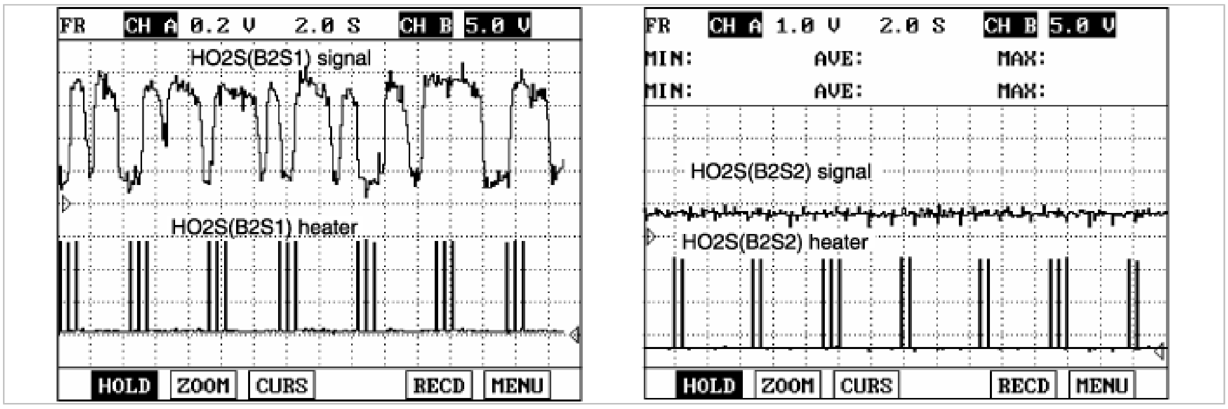
DTC DESCRIPTION

If the PCM detects heater output voltage is lower than threshold value for 5 seconds while enable condition is met PCM determines that a fault exists and a DTC is stored. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to ground or open circuit of O2 sensor heater circuit output	• Poor Connection • Open in Power Circuit • Open or short to ground in control circuit • HO2S(B2/S1) • PCM
Enable Conditions	• No disabling Faults Present • Engine Running • 11V ≤ Ignition Voltage ≤ 16V • Enable Time delay < 0.5sec	
Threshold value	• short to ground or open circuit	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA



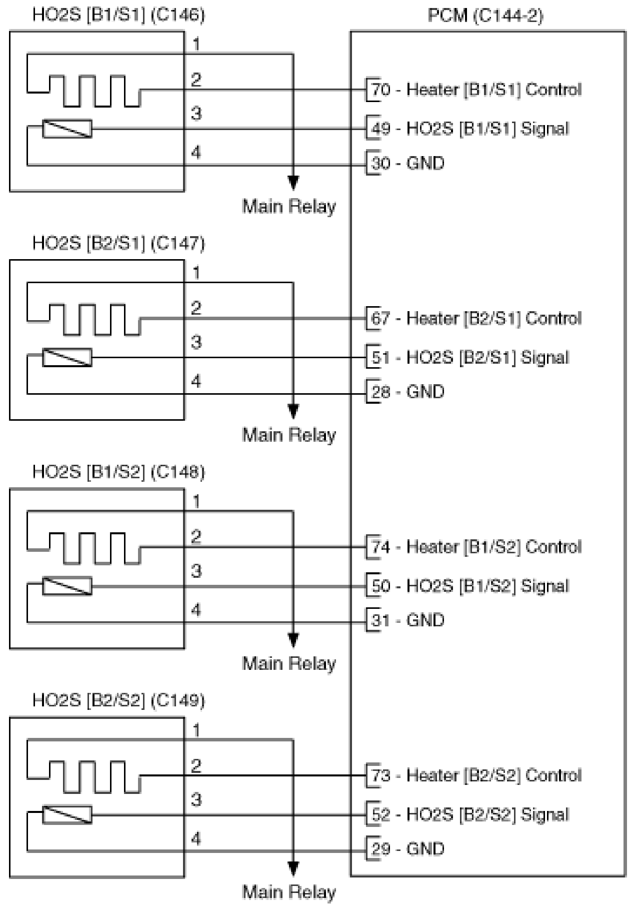
The HO2S requires a minimum temperature to provide a closed loop fuel control system. So the HO2S contains a heater element to reduce its warm-up time and ensure its performance during all driving conditions. The HO2S heater is controlled ON after engine start except for Cold condition and high speed accelleration. The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

SPECIFICATION

Heater	
Resistance (Ω)	9.6 ± 1.5

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

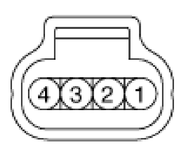
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

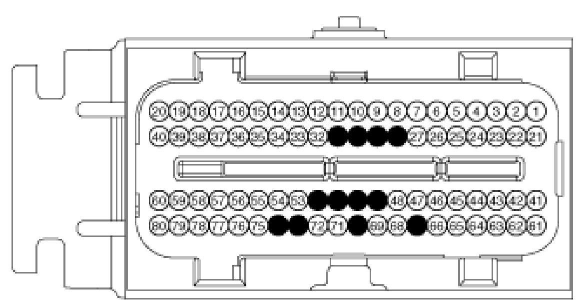
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]

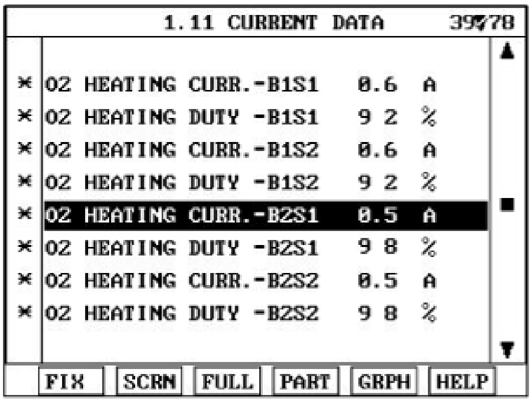


C144-2

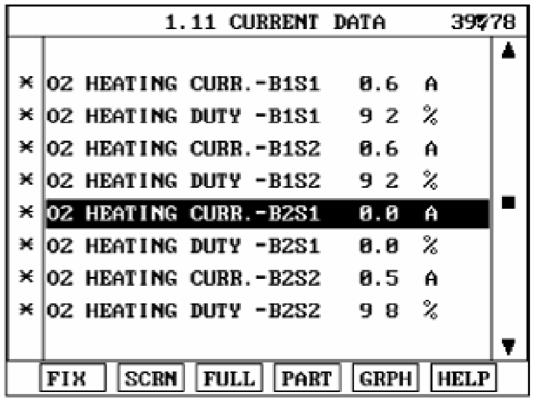
PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "HO2S(B2/S1)" status on the service data.



Normal data - idle



Open circuit(HO2S heater-B2S1)

4. Is the "HO2S Heater(B2/S1)" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

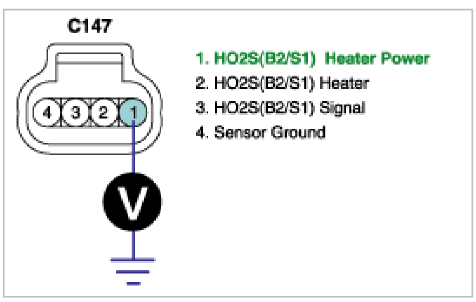
NO

▸ Go to " Power Circuit Inspection " as follows

POWER CIRCUIT INSPECTION

1. IG "OFF" & Disconnect HO2S(B2/S1) connector.
2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 1 of HO2S(B2/S1) harness connector and chassis ground.

Specification : B+



4. Is the measured voltage within specification ?

YES

▸ Go to HO2S(B2/S1) heater "Control Circuit Inspection" procedure.

NO

▸ Repair open or short to ground in HO2S(B2/S1) Heater power circuit then, go to "Verification of Vehicle Repair" procedure.

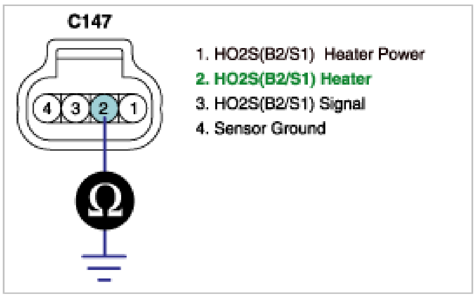
CONTROL CIRCUIT INSPECTION

1. Check short to ground in harness.

(1) IG "OFF" and disconnect HO2S(B2/S1) connector.

(2) Measure resistance between terminal 2 of HO2S(B2/S1) harness connector and chassis ground.

Specification : Infinite



(3) Is the measured resistance within specification ?

YES

▸ Go to HO2S(B2/S1) "Check Open in harness" as follows.

NO

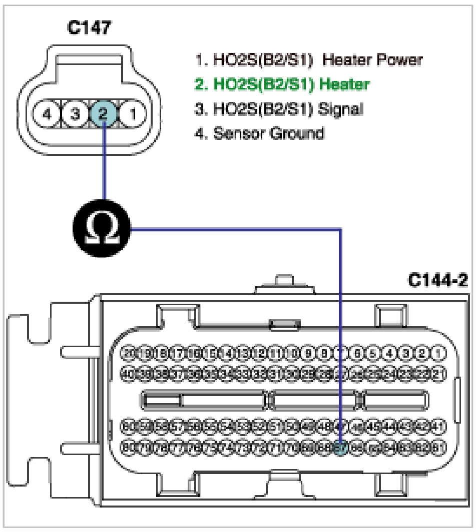
▸ Repair short to ground in HO2S (B2/S1) heater control circuit and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness

(1) IG "OFF" and disconnect HO2S(B2/S1) and PCM connector.

(2) Measure resistance between terminal 2 of HO2S(B2/S1) harness connector and terminal 67 of PCM harness connector.

Specification : Approx. below 1Ω



(3) Is the measured resistance within specification ?

YES

▸ Go to HO2S(B2/S1) "Component Inspection" procedure.

NO

▸ Repair open in HO2S(B2/S1) heater control circuit and go to "Verifiction of Vehicle Repair" procedure.

COMPONENT INSPECTION

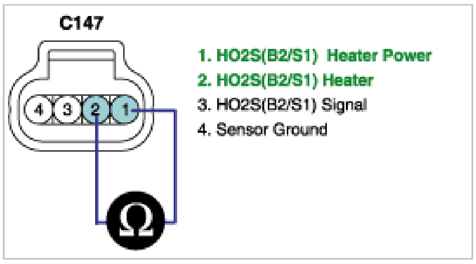
1. Check HO2S(B2/S1) Heater resistance

(1) IG "OFF" and disconnect HO2S(B2/S1) connector

(2) Measure resistance between terminal 1 and 2 of HO2S(B2/S1)(Component Side)

Specification :

Heater	
Resistance (Ω)	9.6 ± 1.5



(3) Is the measured resistance within specification ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

NO

▸ Substitute with a known - good HO2S(B2/S1) and check for proper operation. If the problem is corrected, replace HO2S (B2/S1) and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs.
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Monitor that all rediness test have been verified as " Complete ".
5. Are any DTCs present ?

YES

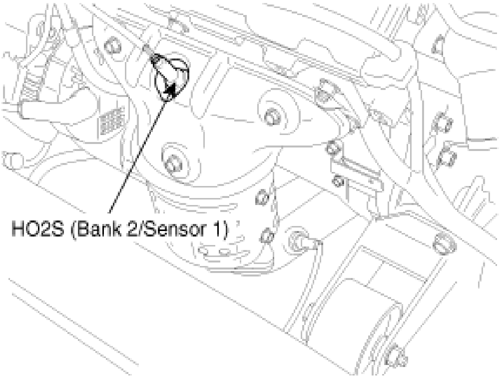
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0052

COMPONENT LOCATION



GENERAL DESCRIPTION

In order to control emissions of the CO, HC and NOx components of the exhaust gas, heated oxygen sensor (HO2S), mounted on the front side and rear side of catalytic converter, detects the oxygen content in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation.The HO2S requires a minimum temperature to operate properly and provide a closed loop fuel control system. The HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions.The

PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

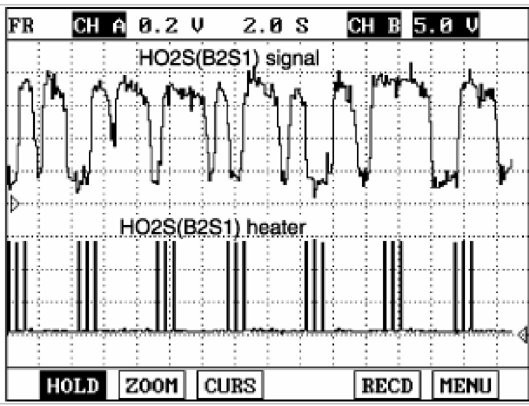
DTC DESCRIPTION

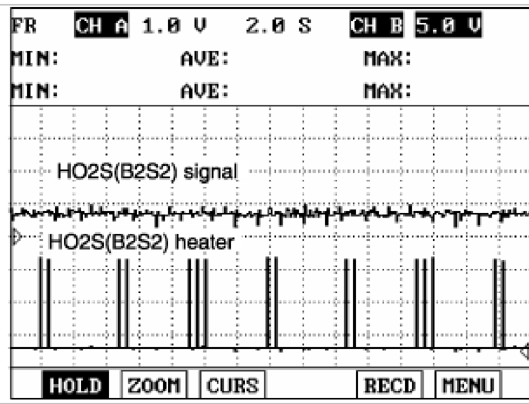
If the PCM detects heater output voltage is higher than threshold value for 5 seconds while enable condition is met PCM determines that a fault exists and a DTC is stored. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to ground or open circuit of O2 sensor heater circuit output	• Poor Connection • Open or short to battery in control circuit • HO2S(B2/S1) • PCM
Enable Conditions	• No disabling Faults Present • Engine Running • 11V ≤ Ignition Voltage ≤ 16V • Enable Time delay < 0.5sec	
Threshold value	• short to battery	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA





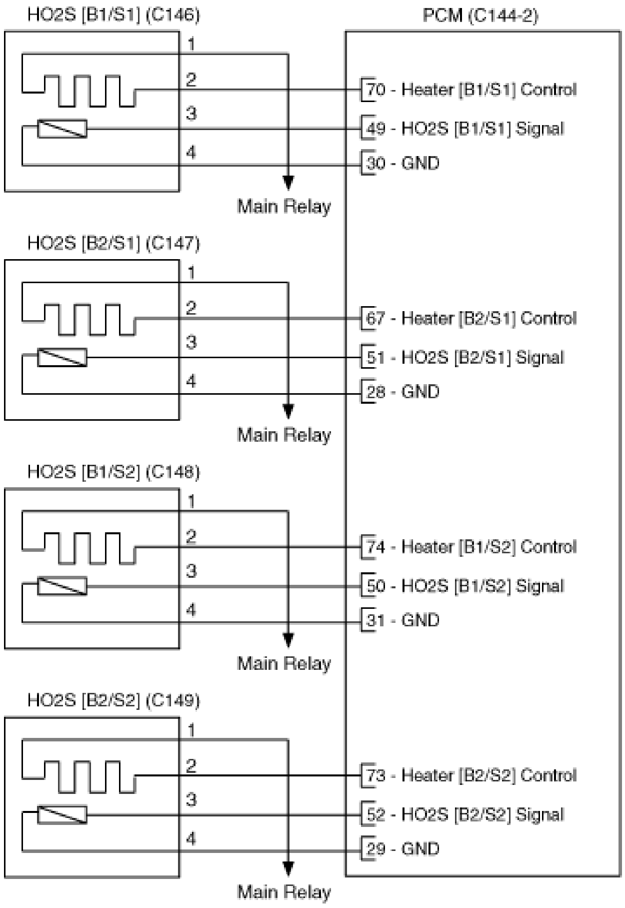
The HO2S requires a minimum temperature to provide a closed loop fuel control system. So the HO2S contains a heater element to reduce its warm-up time and ensure its performance during all driving conditions. The HO2S heater is controlled ON after engine start except for Cold condition and high speed accelleration. The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

SPECIFICATION

Heater	
Resistance (Ω)	9.6 ± 1.5

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

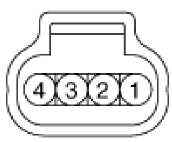
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

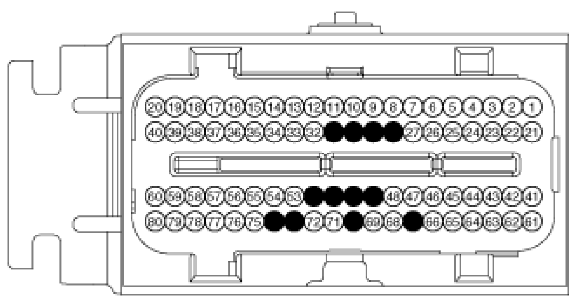
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]

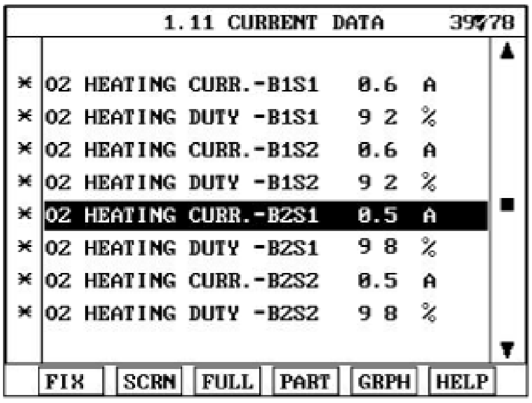


C144-2

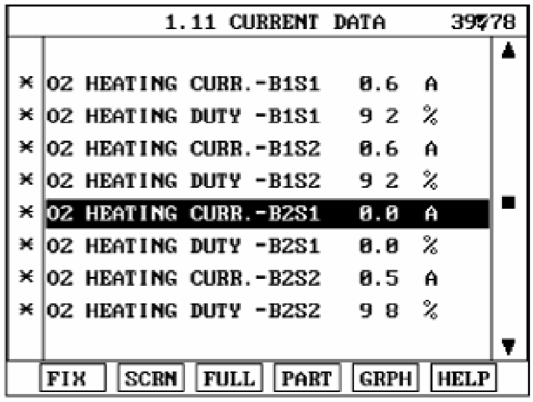
PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "HO2S(B2/S1)" status on the service data.



Normal data - idle



Open circuit(HO2S heater-B2S1)

4. Is the "HO2S Heater(B2/S1)" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

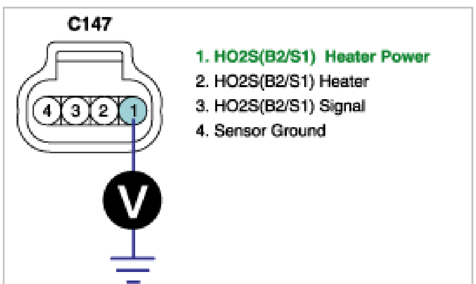
NO

▸ Go to " Power Circuit Inspection " as follows

POWER CIRCUIT INSPECTION

1. IG "OFF" & Disconnect HO2S(B2/S1) connector.
2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 1 of HO2S(B2/S1) harness connector and chassis ground.

Specification : B+



4. Is the measured voltage within specification ?

YES

▸ Go to HO2S(B2/S1) heater "Control Circuit Inspection" procedure.

NO

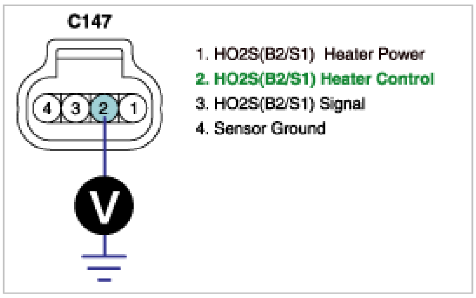
▸ Repair open or short to ground in HO2S(B2/S1) Heater power circuit then, go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. IG "OFF" & disconnect HO2S(B2/S1) connector.

2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 2 of HO2S(B2/S1) harness connector and chassis ground.

Specification : Approx. 0 V



4. Is the measured voltage within specification ?

YES

▸ Go to HO2S(B2/S1) "Component Inspection" procedure.

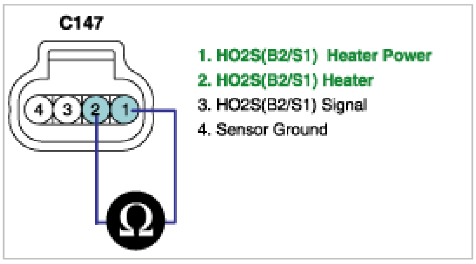
NO

▸ Repair short to battery in HO2S(B2/S1) Heater control circuit and go to "Verification of Vhicle Repair" procedure.

COMPONENT INSPECTION

1. Check HO2S(B2/S1) Heater resistance
   (1) IG "OFF" and disconnect HO2S(B2/S1) connector
   (2) Measure resistance between terminal 1 and 2 of HO2S(B2/S1)(Component Side)
   Specification :

Heater	
Resistance (Ω)	9.6 ± 1.5



   (3) Is the measured resistance within specification ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

NO

▸ Substitute with a known - good HO2S(B2/S1) and check for proper operation. If the problem is corrected, replace HO2S (B2/S1) and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.
1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "

5. Are any DTCs present ?

YES

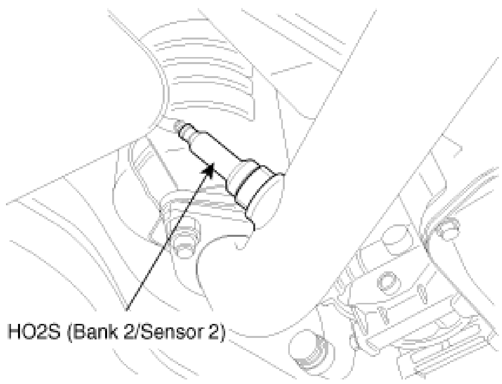
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0057

COMPONENT LOCATION



GENERAL DESCRIPTION

The rear heated oxygen sensor is mounted on the rear side of the Catalytic Converter which is able to detect the catalyst efficiency. The rear heated oxygen sensor (HO2S) produces a voltage between 0V and 1V. This rear heated oxygen sensor is used to estimate the oxygen storage capability. If a catalyst has good conversion properties, the oxygen fluctuations are smoothed by the oxygen storage capacity of the catalyst. If the conversion provided by the catalyst is low due to aging, poisoning or misfiring, then the oxygen fluctuations are similar to signals from the front oxygen sensor.

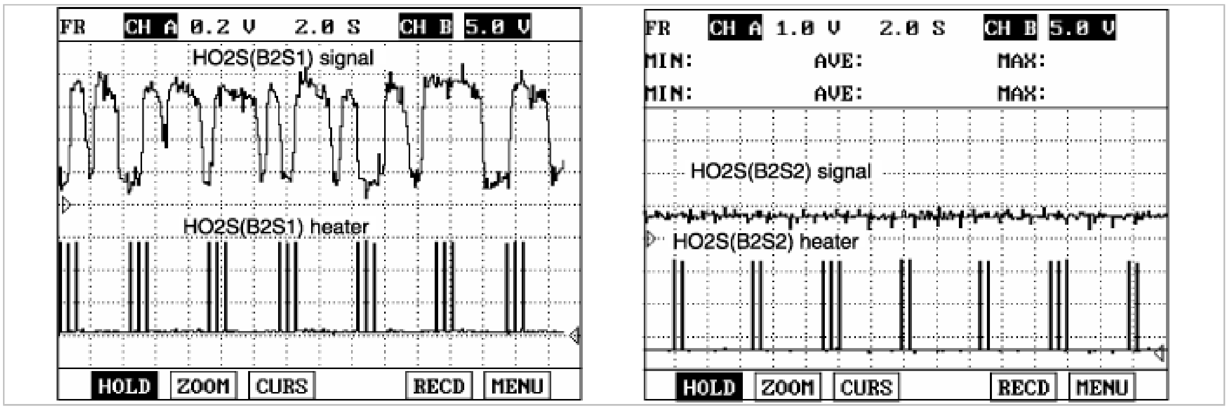
DTC DESCRIPTION

If the PCM detects heater output voltage is lower than threshold value for 5 seconds while enable condition is met PCM determines that a fault exists and a DTC is stored. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to ground or open circuit of O2 sensor heater circuit output	• Poor Connection • Open in Power Circuit • Open or short to ground in control circuit • HO2S(B2/S2) • PCM
Enable Conditions	• No disabling Faults Present • Engine Running • 11V ≤ Ignition Voltage ≤ 16V • Enable Time delay < 0.5sec	
Threshold value	• short to ground or open circuit	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA



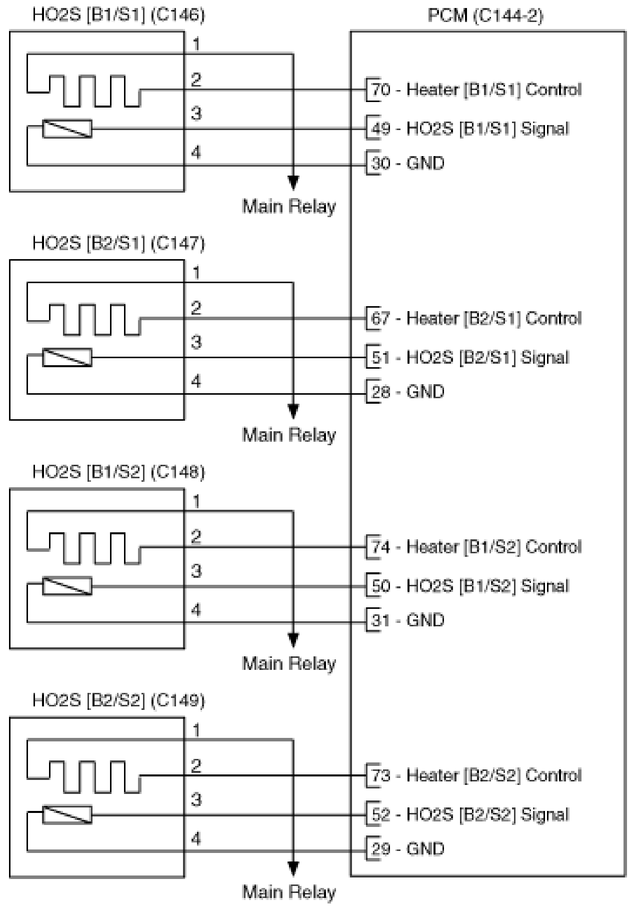
The HO2S requires a minimum temperature to provide a closed loop fuel control system. So the HO2S contains a heater element to reduce its warm-up time and ensure its performance during all driving conditions. The HO2S heater is controlled ON after engine start except for Cold condition and high speed accelleration. The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

SPECIFICATION

Heater	
Resistance (Ω)	9.6 ± 1.5

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

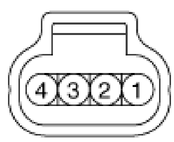
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

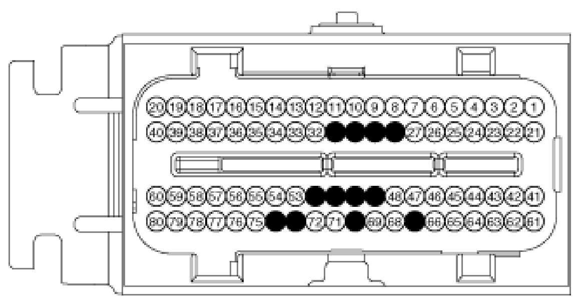
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

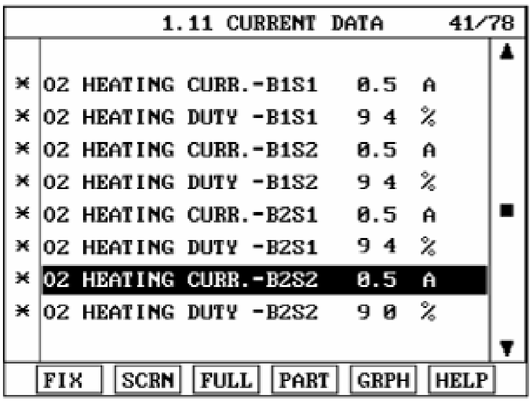
HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



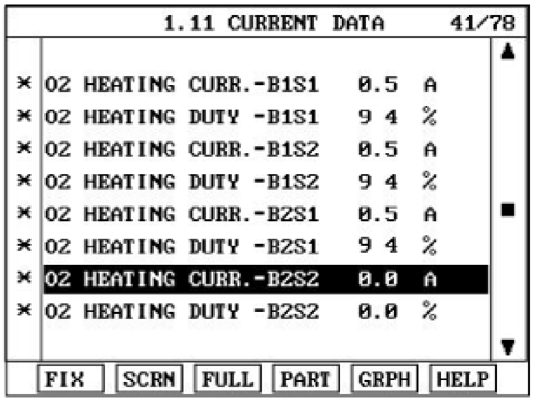
C144-2
PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "HO2S(B2/S2)" status on the service data.



Normal data - idle



Open circuit(HO2S heater-B2S2)

4. Is the "HO2S Heater(B2/S2)" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

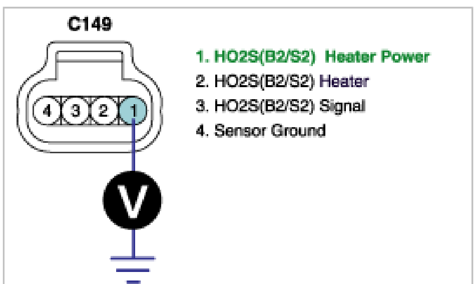
NO

▸ Go to " Power Circuit Inspection " procedure

POWER CIRCUIT INSPECTION

1. IG "OFF" & Disconnect HO2S(B2/S2) connector.
2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 1 of HO2S(B2/S2) harness connector and chassis ground.

Specification : B+



4. Is the measured voltage within specification ?

YES

▸ Go to HO2S(B2/S2) heater "Control Circuit Inspection" procedure.

NO

▸ Repair open or short to ground in HO2S(B2/S2) Heater power circuit then, go to "Verification of Vehicle Repair" procedure.

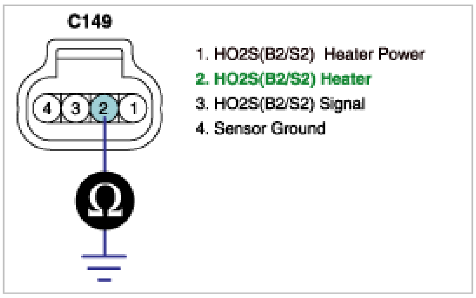
CONTROL CIRCUIT INSPECTION

1. Check short to ground in harness.

(1) IG "OFF" and disconnect HO2S(B2/S2) connector.

(2) Measure resistance between terminal 2 of HO2S(B2/S2) harness connector and chassis ground.

Specification : Infinite



(3) Is the measured resistance within specification ?

YES

▸ Go to HO2S(B2/S2) "Check Open in harness" as follows.

NO

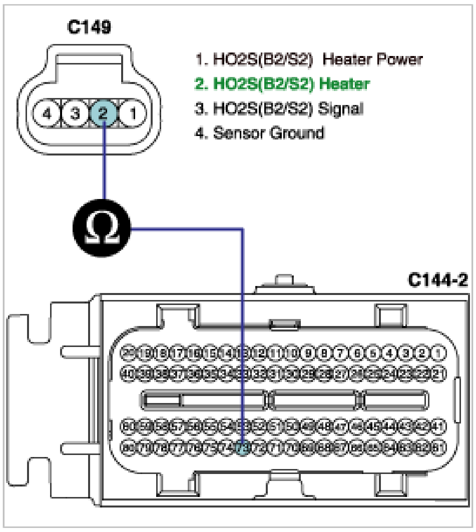
▸ Repair short to ground in HO2S (B2/S2) heater control circuit and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness

(1) IG "OFF" and disconnect HO2S(B2/S2) and PCM connector.

(2) Measure resistance between terminal 2 of HO2S(B2/S2) harness connector and terminal 73 of PCM harness connector.

Specification : Approx. below 1Ω



(3) Is the measured resistance within specification ?

YES

▸ Go to HO2S(B2/S2) "Component Inspection" procedure.

NO

▸ Repair open in HO2S(B2/S2) heater control circuit and go to "Verifiction of Vehicle Repair" procedure.

COMPONENT INSPECTION

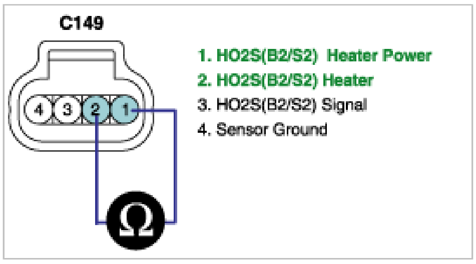
1. Check HO2S(B2/S2) Heater resistance

(1) IG "OFF" and disconnect HO2S(B2/S2) connector

(2) Measure resistance between terminal 1 and 2 of HO2S(B2/S2)(Component Side)

Specification :

Heater	
Resistance (Ω)	9.6 ± 1.5



(3) Is the measured resistance within specification ?

YES

▶ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

NO

▶ Substitute with a known - good HO2S(B2/S2) and check for proper operation. If the problem is corrected, replace HO2S (B2/S2) and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

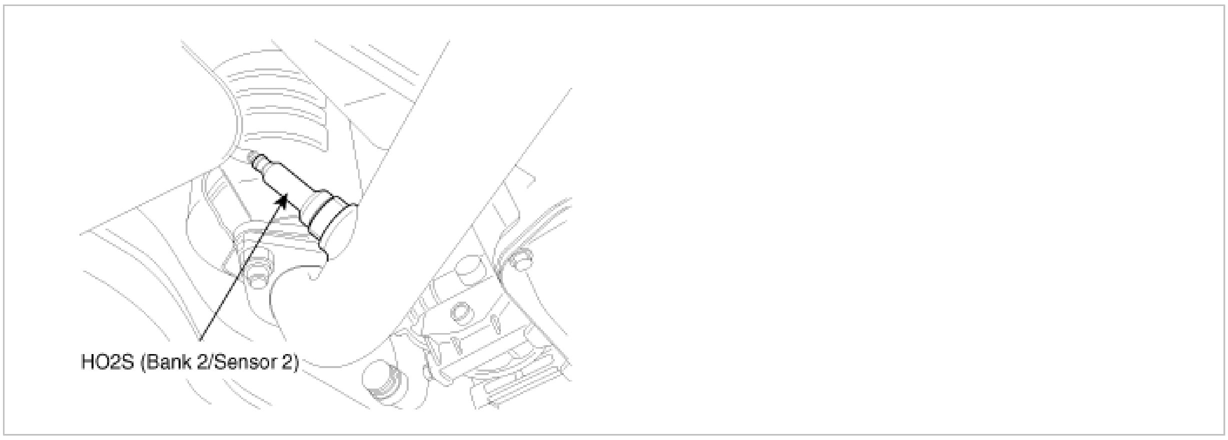
▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

Fuel System > Troubleshooting > P0058

COMPONENT LOCATION



GENERAL DESCRIPTION

The rear heated oxygen sensor is mounted on the rear side of the Catalytic Converter which is able to detect the catalyst efficiency. The rear heated oxygen sensor (HO2S) produces a voltage between 0V and 1V. This rear heated oxygen sensor is used to estimate the oxygen storage capability. If a catalyst has good conversion properties, the oxygen fluctuations are smoothed by the oxygen storage capacity of the catalyst. If the conversion provided by the catalyst is low due to aging, poisoning or misfiring, then the oxygen fluctuations are similar to signals from the front oxygen sensor.

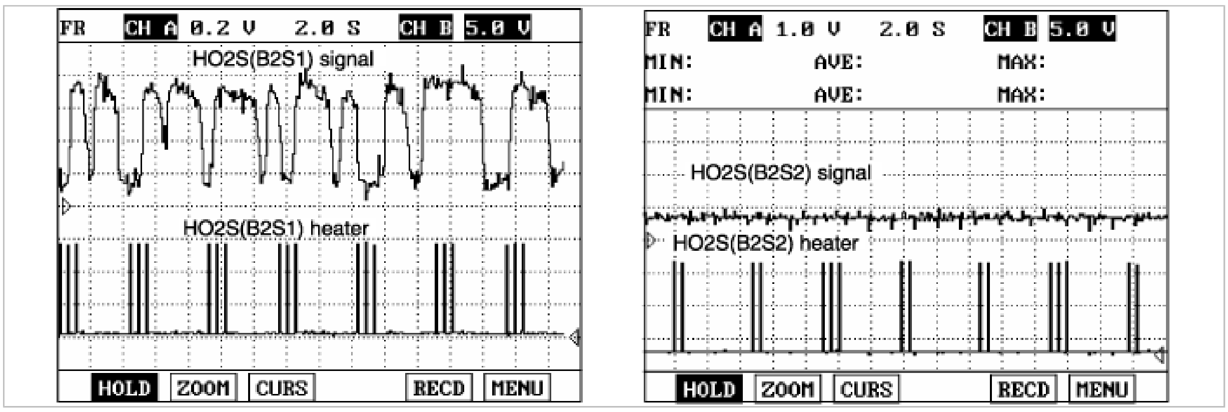
DTC DESCRIPTION

If the PCM detects heater output voltage is higher than threshold value for 5 seconds while enable condition is met PCM determines that a fault exists and a DTC is stored. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to ground or open circuit of O2 sensor heater circuit output	• Poor Connection • Open or short to battery in control circuit • HO2S(B2/S2) • PCM
Enable Conditions	• No disabling Faults Present • Engine Running • 11V ≤ Ignition Voltage ≤ 16V • Enable Time delay < 0.5sec	
Threshold value	• Short to battery	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA



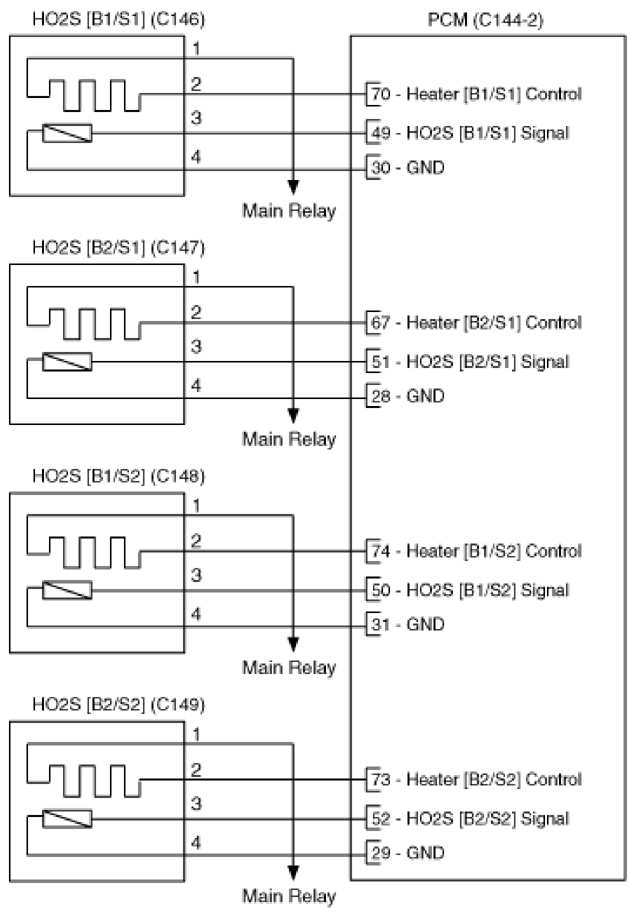
The HO2S requires a minimum temperature to provide a closed loop fuel control system. So the HO2S contains a heater element to reduce its warm-up time and ensure its performance during all driving conditions. The HO2S heater is controlled ON after engine start except for Cold condition and high speed accelleration. The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

SPECIFICATION

Heater	
Resistance (Ω)	9.6 ± 1.5

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

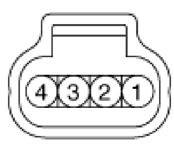
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

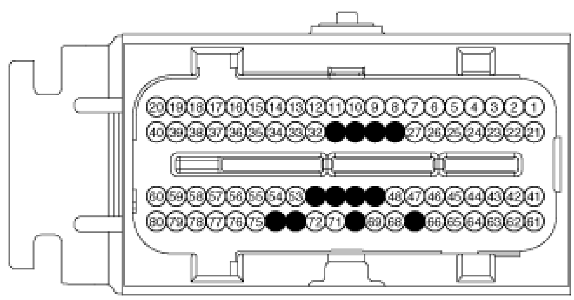
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]

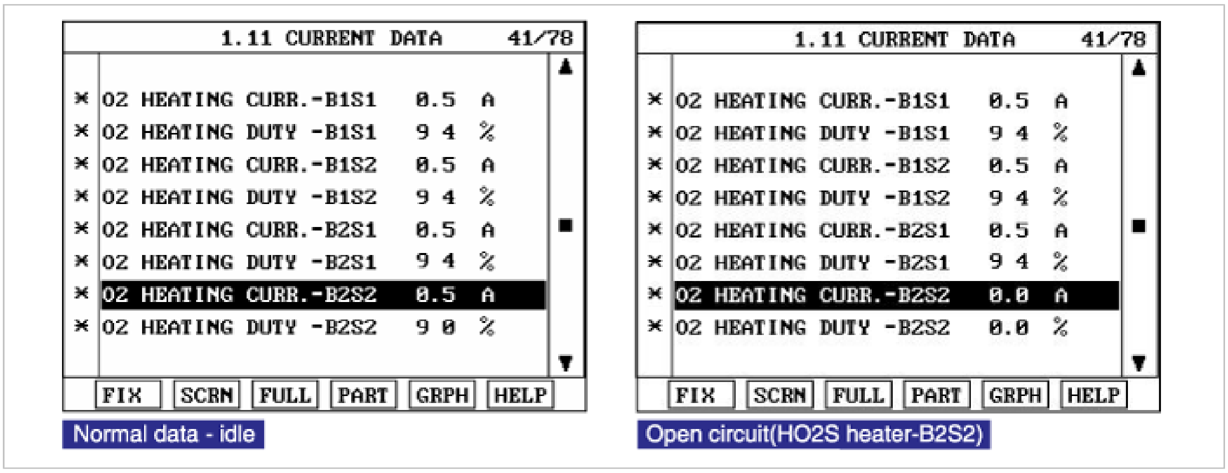


C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "HO2S(B2/S2)" status on the service data.



Normal data - idle

Open circuit(HO2S heater-B2S2)

4. Is the "HO2S Heater(B2/S2)" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

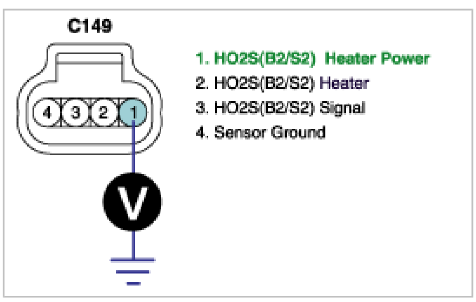
NO

▸ Go to " Power Circuit Inspection " procedure

POWER CIRCUIT INSPECTION

1. IG "OFF" & Disconnect HO2S(B2/S2) connector.
2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 1 of HO2S(B2/S2) harness connector and chassis ground.

Specification : B+



4. Is the measured voltage within specification ?

YES

▸ Go to HO2S(B2/S2) heater "Control Circuit Inspection" procedure.

NO

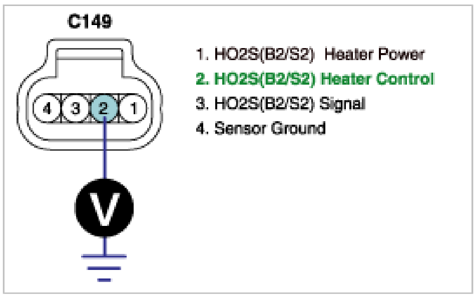
▸ Repair open or short to ground in HO2S(B2/S2) Heater power circuit then, go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. IG "OFF" & disconnect HO2S(B2/S2) connector.

2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 2 of HO2S(B2/S2) harness connector and chassis ground.

Specification : Approx. 0 V



4. Is the measured voltage within specification ?

YES

▸ Go to HO2S(B2/S2) "Component Inspection" procedure.

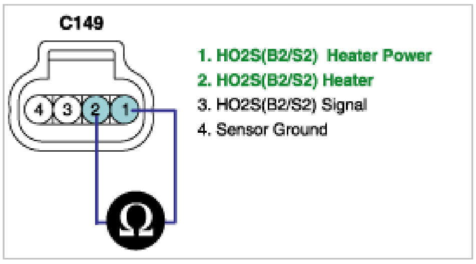
NO

▸ Repair short to battery in HO2S (B2/S2) heater control circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check HO2S(B2/S2) Heater resistance
   (1) IG "OFF" and disconnect HO2S(B2/S2) connector
   (2) Measure resistance between terminal 1 and 2 of HO2S(B2/S2)(Component Side)
   Specification :

Heater	
Resistance (Ω)	9.6 ± 1.5



   (3) Is the measured resistance within specification ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

NO

▸ Substitute with a known - good HO2S(B2/S2) and check for proper operation. If the problem is corrected, replace HO2S (B2/S2) and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.
1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "

5. Are any DTCs present ?

YES

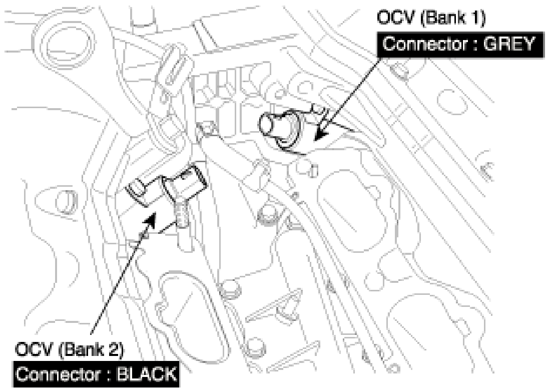
▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

Fuel System > Troubleshooting > P0076

COMPONENT LOCATION



GENERAL DESCRIPTION

PCM controls OCV(Oil Contol Valve) with PWM (Pulse Width Modulator) signal to change oil passages supplying oil to CVVT that makes CAM postion changes (advance or retard). OCV is integrated with oil filter and located at the nearest CVVT on the engine block.

The oil control valve is commanded by a pulse-width-modulated signal from the engine control unit. A duty cycle of zero commands the cam phaser to its default position. A duty cycle of 100% commands the phaser to its maximum phased position. When the phaser must be controlled to an intermediate position, the duty cycle is maintained in the region of the 'hold position'. This is a medium duty cycle, usually between 35% and 65%, depending on temperature and voltage conditions. As the cam phaser is advanced and retarded, its position is measured using a toothed wheel.

The wheel is attached to the camshaft, or to the cam phaser rotor. A sensor picks up the signal from the wheel and its output is read by the engine control unit. A cam signal is generated for each cam phaser on the engine. This requires a separate toothed wheel and cam sensor combination for each cam phaser. The cam signal and crankwheel signal are compared as the engine turns, and the phasing position is determined. The position is displayed in crank angle degrees, relative position from default. This position measurement is used as feedback for the position control software, which determines the required percent duty cycle commanded to the oil control valve.

DTC DESCRIPTION

When the enable condition is satisfied The PCM checks that high and low outputs (Voltage level) are observed when OCVs are commanded. When a OCV output failure is detected, the appropriate fail counter is incremented.

If the failure threshold is exceeded 5 seconds during one diagnostic test(10second), the test is failed and DTC is stored. MIL (Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to ground or open circuit of VCPD Bank 1 Intake circuit output	• Poor Connection • Open in Power Circuit • Open or short to ground in control circuit • OCV • PCM
Enable Conditions	• No disabling Faults Present • Engine Running • 11V ≤ Ignition Voltage ≤ 16V • Enable Time delay ≥ 0.5sec	
Threshold value	• Short to ground or open circuit	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA

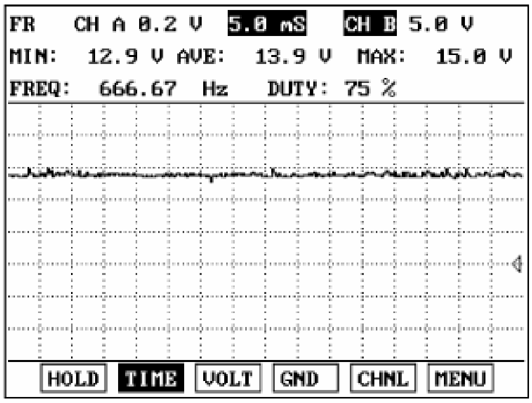


Fig. 1

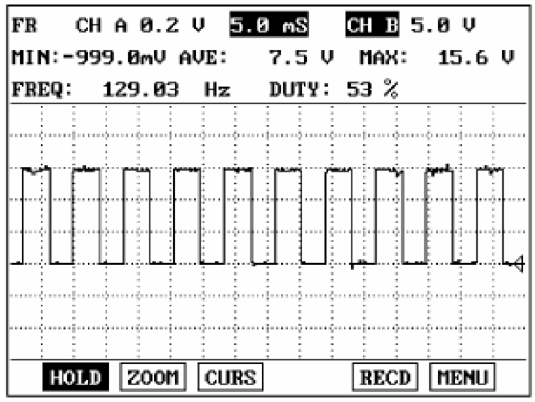


Fig. 2

Fig. 1 : Idle
Fig. 2 : Accelleration

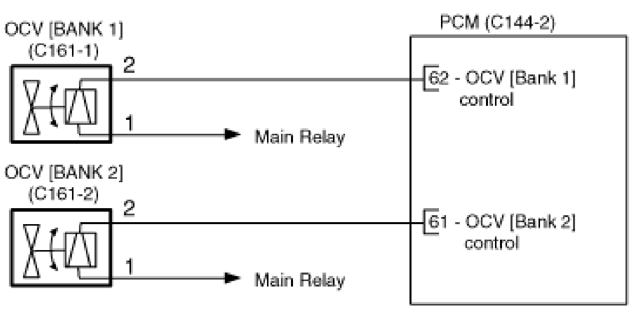
The oil control valve is commanded by a pulse-width-modulated signal from the engine control unit. A duty cycle of zero commands the cam phaser to its default position. A duty cycle of 100% commands the phaser to its maximum phased position. When the phaser must be controlled to an intermediate position, the duty cycle is maintained in the region of the ‘hold position’. This is a medium duty cycle, usually between 35% and 65%, depending on temperature and voltage conditions.

SPECIFICATION

Resistance (Ω)	6.7 ~ 7.7

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

OCV [BANK 1]

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (62)	OCV [Bank 1] control

OCV [BANK 2]

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (61)	OCV [Bank 2] control

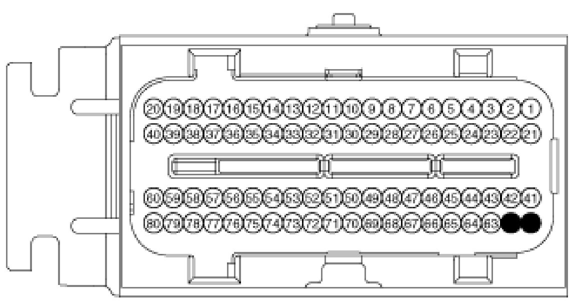
[HARNESS CONNECTORS]

C161-1

OCV [Bank 1]

C161-2

OCV [Bank 2]



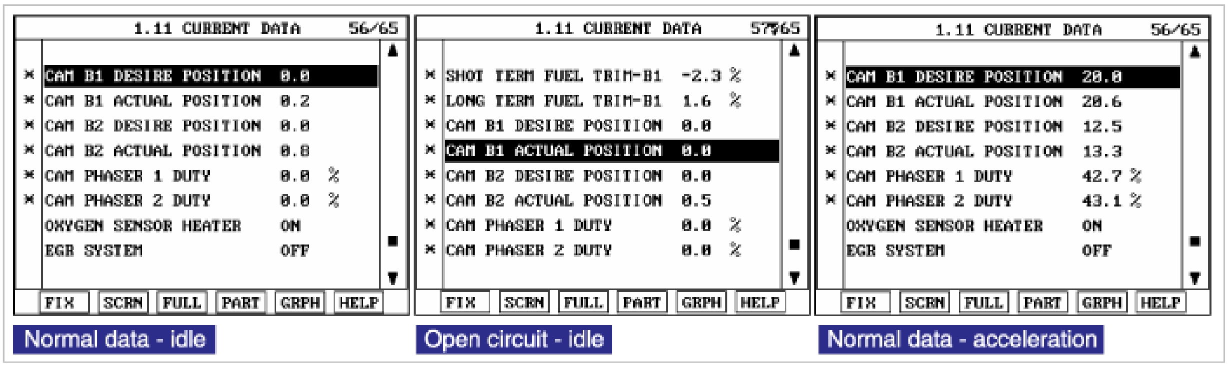
C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.

3. Monitor "Cam Duty1, Cam Desired Position and Cam Actual Position" on the service data.



4. Are the "CAM" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

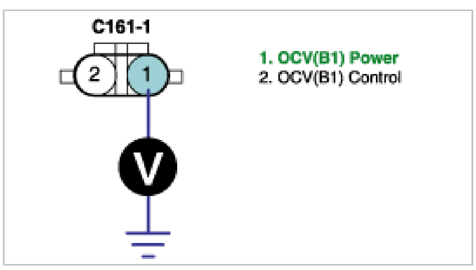
NO

▸ Go to " Power Circuit Inspection " procedure

POWER CIRCUIT INSPECTION

1. IG "OFF" & Disconnect OCV(B1) connector.
2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 1 of OCV(B1) harness connector and chassis ground.

Specification : B+



4. Is the measured voltage within specification ?

YES

▸ Go to "Control Circuit Inspection" procedure.

NO

▸ Check fuse between Main Relay and OCV is open or not installed.
▸ Check open in power circuit between Main Relay and OCV power circuit.
▸ Repair or repalce as necessary and then go to "Verification of Vehicle Repair" procedure.

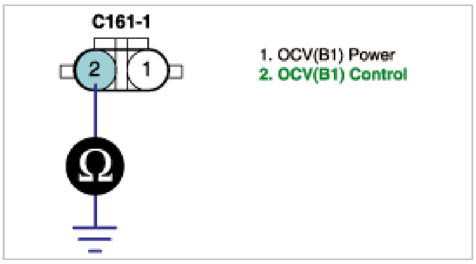
CONTROL CIRCUIT INSPECTION

1. Check short to ground in harness.
   (1) IG "OFF" and disconnect OCV connector.

(2) IG "ON" & ENG "OFF".

(3) Measure resistance between terminal 2 of OCV harness connector and chassis ground.

Specification : Infinite



(4) Is the measured resistance within specification ?

YES

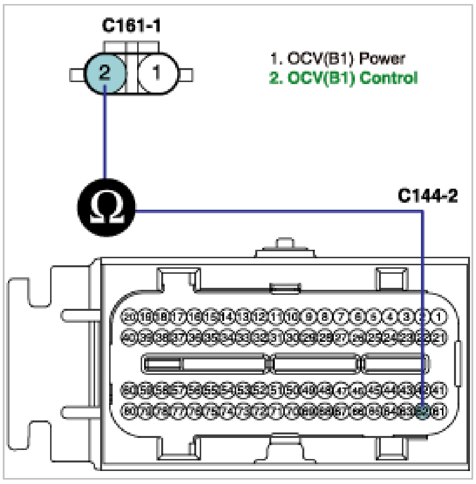
▸ Go to "Check open in harness" as follows

NO

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness
   (1) IG "OFF" and disconnect OCV and PCM connector.
   (2) Measure resistance between terminal 2 of OCV harness connector and terminal 62 of PCM harness connector.

Specification : Approx. below 1Ω



(3) Is the measured resistance within specification ?

YES

▸ Go to "Component Inspection" procedure.

NO

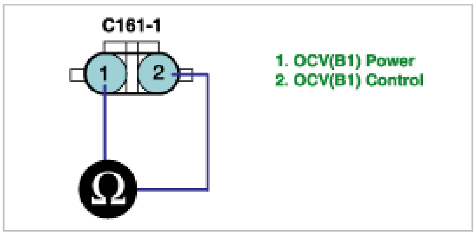
(4) ▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check OCV
   (1) IG "OFF" and disconnect OCV connector.
   (2) Measure resistance between terminal 1 and 2 of OCV. (Component Side)

Specification :

Resistance (Ω)	6.7 ~ 7.7



(3) Is the measured resistance within specification ?

YES

▸ Go to "OCV Actuation Test" as follows.

NO

▸ Substitute with a known - good OCV and check for proper operation. If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

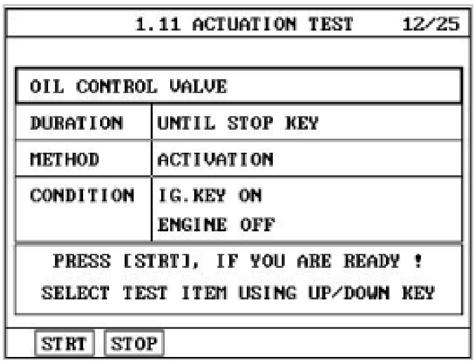
2. OCV Actuation Test

(1) Connect scantool and IG "ON".

(2) Select "OCV" on the Actuation Test.

(3) Activates "OCV" by pressing "STRT(F1)" key.
(should hear a faint click from Oil Control solenoid Valve)

(4) Repeat this procedure 4 or 5 times to ensure intake valve control solenoid reliability



(5) Does OCV generate clik sound during acutation test ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Substitute with a known - good OCV and check for proper operation. If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

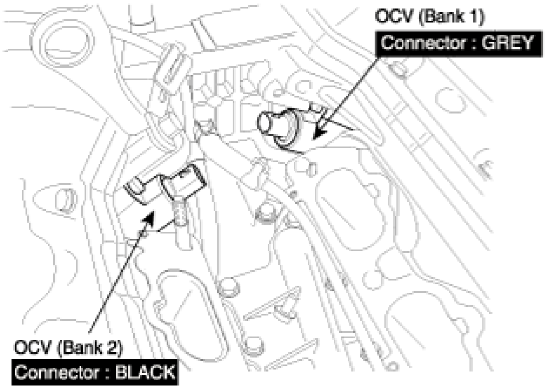
YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

COMPONENT LOCATION



GENERAL DESCRIPTION

PCM controls OCV(Oil Contol Valve) with PWM (Pulse Width Modulator) signal to change oil passages supplying oil to CVVT that makes CAM postion changes (advance or retard). OCV is integrated with oil filter and located at the nearest CVVT on the engine block.
The oil control valve is commanded by a pulse-width-modulated signal from the engine control unit. A duty cycle of zero commands the cam phaser to its default position. A duty cycle of 100% commands the phaser to its maximum phased position. When the phaser must be controlled to an intermediate position, the duty cycle is maintained in the region of the 'hold position'. This is a medium duty cycle, usually between 35% and 65%, depending on temperature and voltage conditions. As the cam phaser is advanced and retarded, its position is measured using a toothed wheel.
The wheel is attached to the camshaft, or to the cam phaser rotor. A sensor picks up the signal from the wheel and its output is read by the engine control unit. A cam signal is generated for each cam phaser on the engine. This requires a separate toothed wheel and cam sensor combination for each cam phaser. The cam signal and crankwheel signal are compared as the engine turns, and the phasing position is determined. The position is displayed in crank angle degrees, relative position from default. This position measurement is used as feedback for the position control software, which determines the required percent duty cycle commanded to the oil control valve.

DTC DESCRIPTION

When the enable condition is satisfied The PCM checks that high and low outputs (Voltage level) are observed when OCVs are commanded. When a OCV output failure is detected, the appropriate fail counter is incremented.
If the failure threshold is exceeded 5 seconds during one diagnostic test(10second),the test is failed and DTC is stored. MIL (Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to battery of VCPD Bank 1 Intake circuit output	• Poor Connection • Short to battery in Control Circuit • OCV • PCM
Enable Conditions	• No disabling Faults Present • Engine Running • 11V ≤ Ignition Voltage ≤ 16V • Enable Time delay ≥ 0.5sec	
Threshold value	• Short to battery	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA

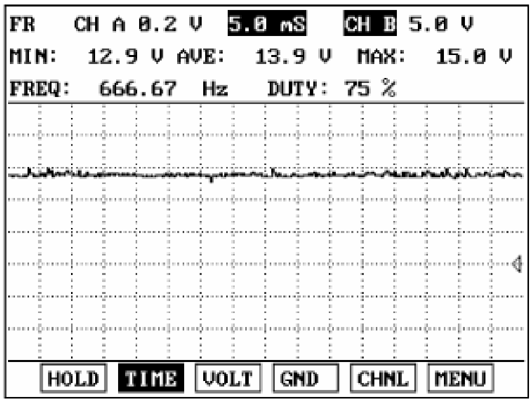


Fig. 1

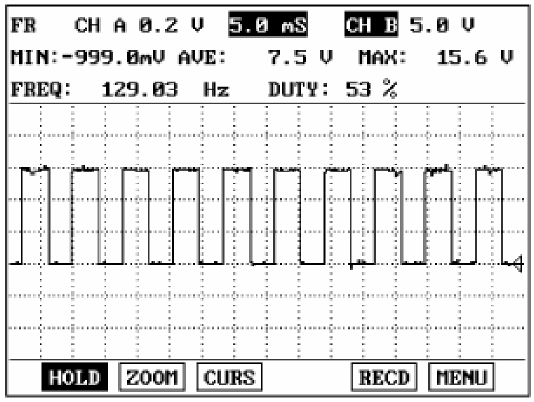


Fig. 2

Fig. 1 : Idle
Fig. 2 : Accelleration

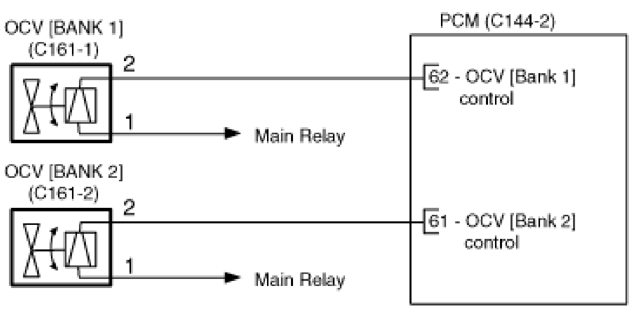
The oil control valve is commanded by a pulse-width-modulated signal from the engine control unit. A duty cycle of zero commands the cam phaser to its default position. A duty cycle of 100% commands the phaser to its maximum phased position. When the phaser must be controlled to an intermediate position, the duty cycle is maintained in the region of the 'hold position'. This is a medium duty cycle, usually between 35% and 65%, depending on temperature and voltage conditions.

SPECIFICATION

Resistance (Ω)	6.7 ~ 7.7

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

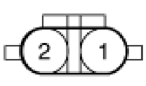
OCV [BANK 1]

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (62)	OCV [Bank 1] control

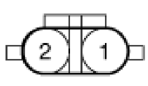
OCV [BANK 2]

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (61)	OCV [Bank 2] control

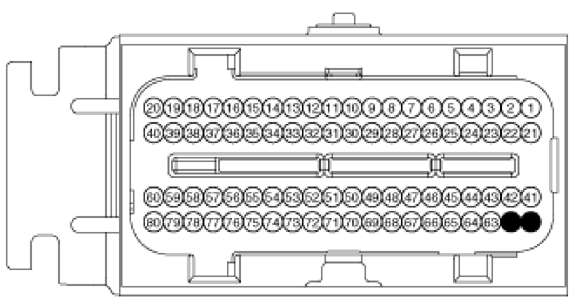
[HARNESS CONNECTORS]



C161-1
OCV [Bank 1]

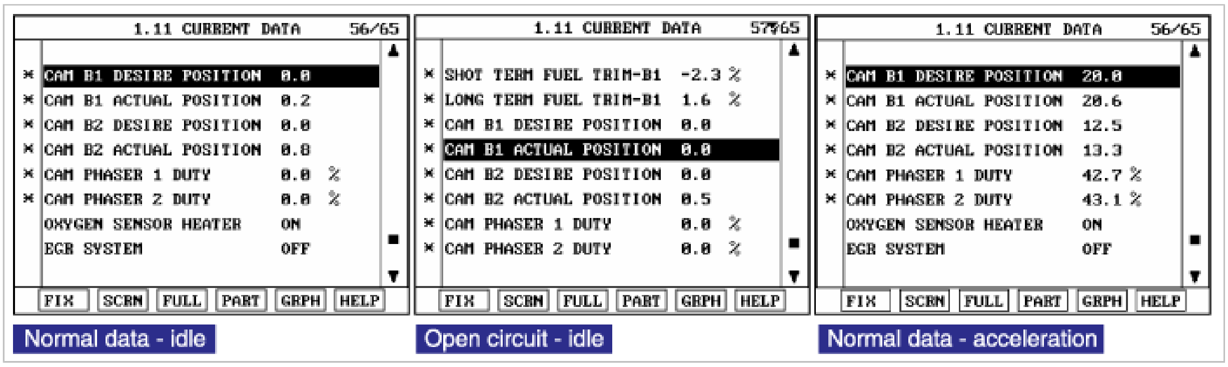


C161-2
OCV [Bank 2]


C144-2
PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "Cam Duty1, Cam Desired Position and Cam Actual Position" on the service data.



4. Are the "CAM" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

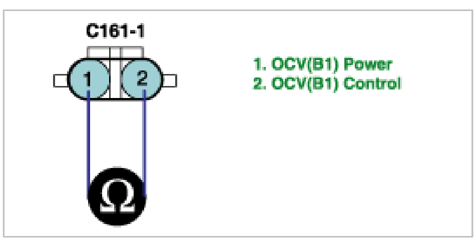
NO

▸ Go to " Control Circuit Inspection " procedure.

CONTROL CIRCUIT INSPECTION

1. IG "OFF" and Disconnect OCV connector.
2. Measure resistance between terminal 1 and 2 of OCV harness connector.

Specification : Infinite



3. Is the measured resistance within specification ?

YES

▸ Go to "Component Inspection" procedure.

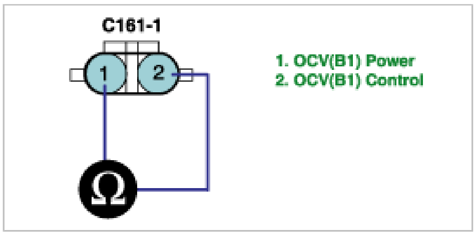
NO

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check OCV
   (1) IG "OFF" and disconnect OCV connector.
   (2) Measure resistance between terminal 1 and 2 of OCV. (Component Side)
   Specification :

Resistance (Ω)	6.7 ~ 7.7



(3) Is the measured resistance within specification ?

YES

▸ Go to "OCV Actuation Test" as follows.

NO

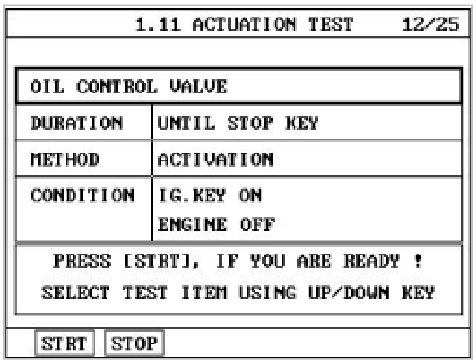
▸ Substitute with a known - good OCV and check for proper operation. If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

2. OCV Actuation Test
   (1) Connect scantool and IG "ON".

   (2) Select "OCV" on the Actuation Test.

   (3) Activates "OCV" by pressing "STRT(F1)" key.
   (should hear a faint click from Oil Control solenoid Valve)

   (4) Repeat this procedure 4 or 5 times to ensure intake valve control solenoid reliability



   (5) Does OCV generate clik sound during acutation test ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Substitute with a known - good OCV and check for proper operation. If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

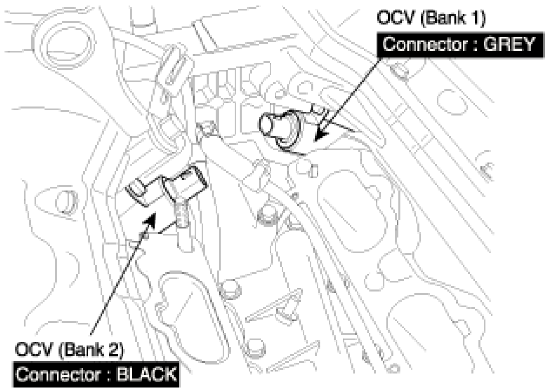
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0082

COMPONENT LOCATION



GENERAL DESCRIPTION

PCM controls OCV(Oil Contol Valve) with PWM (Pulse Width Modulator) signal to change oil passages supplying oil to CVVT that makes CAM postion changes (advance or retard). OCV is integrated with oil filter and located at the nearest CVVT on the engine block.
The oil control valve is commanded by a pulse-width-modulated signal from the engine control unit. A duty cycle of zero commands the cam phaser to its default position. A duty cycle of 100% commands the phaser to its maximum phased position. When the phaser must be controlled to an intermediate position, the duty cycle is maintained in the region of the ‘hold position’. This is a medium duty cycle, usually between 35% and 65%, depending on temperature and voltage conditions. As the cam phaser is advanced and retarded, its position is measured using a toothed wheel.
The wheel is attached to the camshaft, or to the cam phaser rotor. A sensor picks up the signal from the wheel and its output is read by the engine control unit. A cam signal is generated for each cam phaser on the engine. This requires a separate toothed wheel and cam sensor combination for each cam phaser. The cam signal and crankwheel signal are compared as the engine turns, and the phasing position is determined. The position is displayed in crank angle degrees, relative position from default. This position measurement is used as feedback for the position control software, which determines the required percent duty cycle commanded to the oil control valve.

DTC DESCRIPTION

When the enable condition is satisfied The PCM checks that high and low outputs (Voltage level) are observed when OCVs are commanded. When a OCV output failure is detected, the appropriate fail counter is incremented.
If the failure threshold is exceeded 5 seconds during one diagnostic test(10second), the test is failed and DTC is stored. MIL (Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to ground or open circuit of VCPD Bank 1 Intake circuit output	• Poor Connection • Open in Power circuit • Open or short to ground in Control Circuit • OCV • PCM
Enable Conditions	• No disabling Faults Present • Engine Running • 11V ≤ Ignition Voltage ≤ 16V • Enable Time delay ≥ 0.5sec	
Threshold value	• Short to ground or open circuit	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA

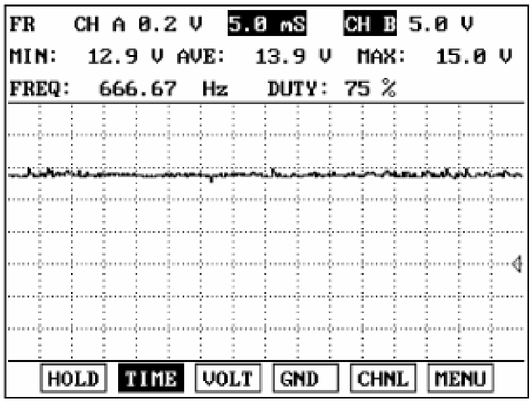


Fig. 1

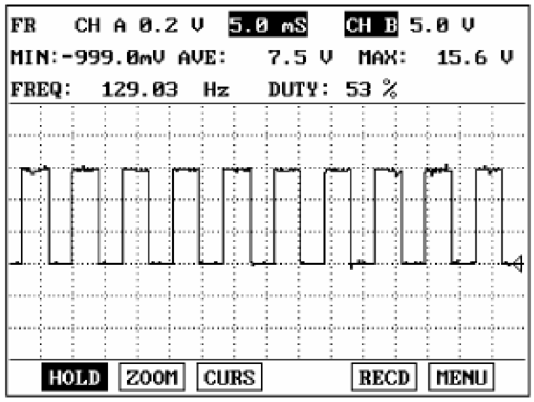


Fig. 2

Fig. 1 : Idle
Fig. 2 : Accelleration

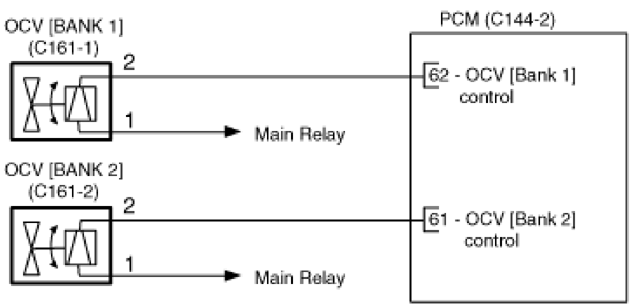
The oil control valve is commanded by a pulse-width-modulated signal from the engine control unit. A duty cycle of zero commands the cam phaser to its default position. A duty cycle of 100% commands the phaser to its maximum phased position. When the phaser must be controlled to an intermediate position, the duty cycle is maintained in the region of the 'hold position'. This is a medium duty cycle, usually between 35% and 65%, depending on temperature and voltage conditions.

SPECIFICATION

Resistance (Ω)	6.7 ~ 7.7

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

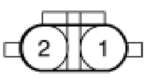
OCV [BANK 1]

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (62)	OCV [Bank 1] control

OCV [BANK 2]

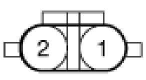
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (61)	OCV [Bank 2] control

[HARNESS CONNECTORS]



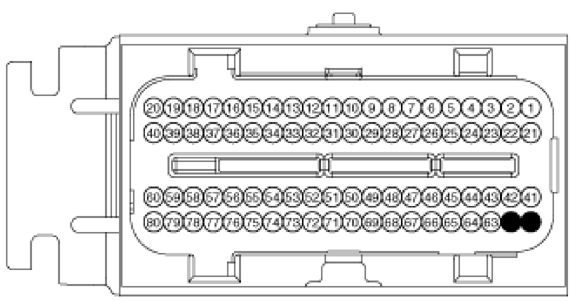
C161-1

OCV [Bank 1]



C161-2

OCV [Bank 2]



C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "Cam Duty2, Cam Desired Position(B2) and Cam Actual Position(B2)" on the service data.

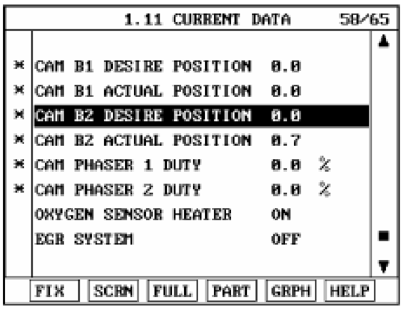


Fig.1

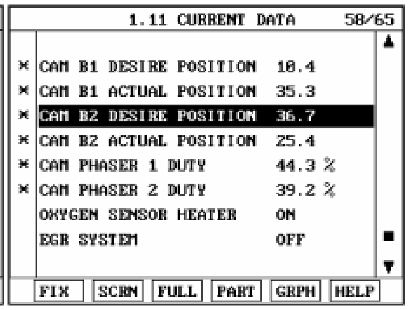


Fig.2

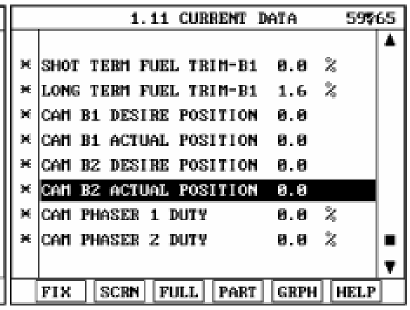


Fig.3

Fig. 1 : Normal at idle
Fig. 2 : Accelleration at idle
Fig. 3 : Open at idle

4. Are the "CAM" data displayed correctly ?

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▶ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure

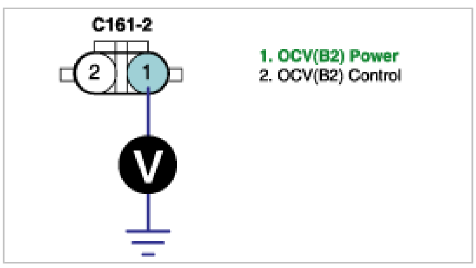
NO

▶ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. IG "OFF" & Disconnect OCV(B2) connector.
2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 1 of OCV(B2) harness connector and chassis ground.

Specification : B+



4. Is the measured voltage within specification ?

YES

▶ Go to "Control Circuit Inspection " procedure.

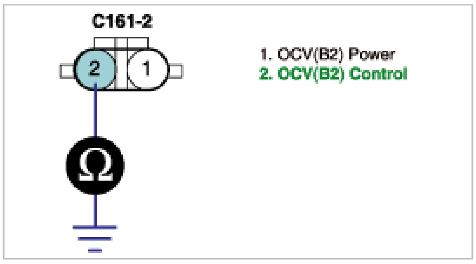
NO

▶ Check fuse between Main Relay and OCV is open or not installed.
▶ Check open in power circuit between Main Relay and OCV power circuit.
▶ Repair or repalce as necessary and then go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check short to ground in harness
   (1) IG "OFF" and disconnect OCV connector.
   (2) IG "ON" & ENG "OFF".
   (3) Measure resistance between terminal 2 of OCV harness connector and chassis ground.

Specification : Infinite



   (4) Is the measured resistance within specification ?

YES

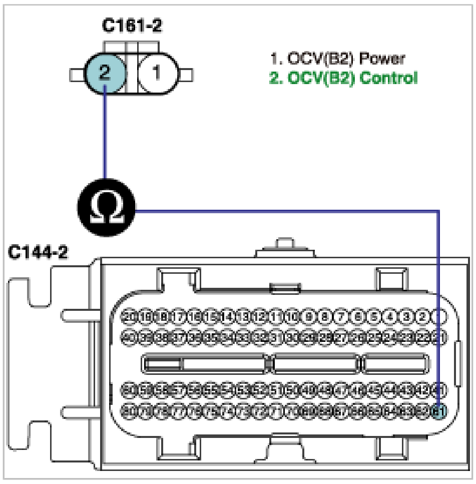
▸ Go to "Check open in harness" as follows

NO

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness
   (1) IG "OFF" and disconnect OCV and PCM connector.
   (2) Measure resistance between terminal 2 of OCV harness connector and terminal 61 of PCM harness connector.

Specification : Approx. below 1Ω



   (3) Is the measured resistance within specification ?

YES

▸ Go to "Component Inspection" procedure.

NO

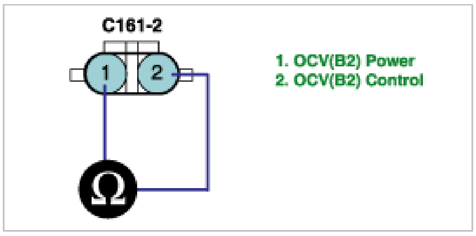
▸ Repair or replace as necessary and then go to " Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check OCV
   (1) IG "OFF" and disconnect OCV connector.
   (2) Measure resistance between terminal 1 and 2 of OCV. (Component Side)

Specification :

Resistance (Ω)	6.7 ~ 7.7



(3) Is the measured resistance within specification ?

YES

(4) ▸ Go to "OCV Actuation Test" as follows.

NO

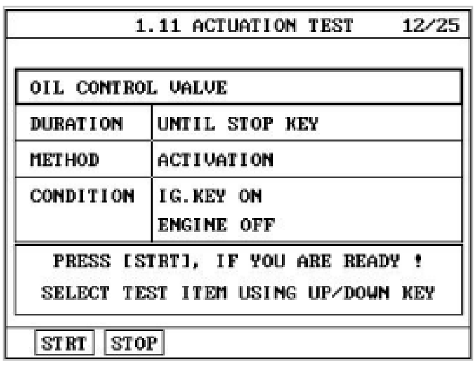
▸ Substitute with a known - good OCV and check for proper operation. If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

2. OCV Actuation Test
   (1) Connect scantool and IG "ON"

   (2) Select "OCV" on the Actuation Test

   (3) Activates "OCV" by pressing "STRT(F1)" key
   (should hear a faint click from Oil Control solenoid Valve)

   (4) Repeat this procedure 4 or 5 times to ensure intake valve control solenoid reliability



   (5) Does OCV generate clik sound during acutation test ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Substitute with a known - good OCV and check for proper operation. If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

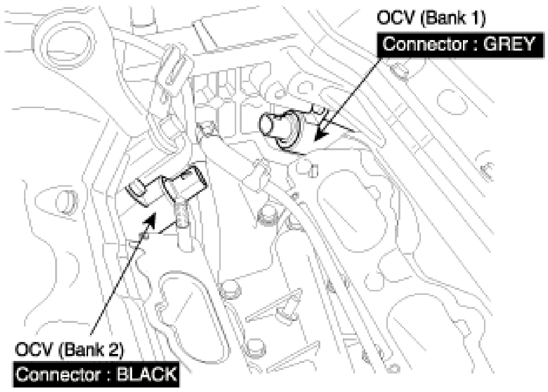
YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

COMPONENT LOCATION



GENERAL DESCRIPTION

PCM controls OCV(Oil Contol Valve) with PWM (Pulse Width Modulator) signal to change oil passages supplying oil to CVVT that makes CAM postion changes (advance or retard). OCV is integrated with oil filter and located at the nearest CVVT on the engine block.
The oil control valve is commanded by a pulse-width-modulated signal from the engine control unit. A duty cycle of zero commands the cam phaser to its default position. A duty cycle of 100% commands the phaser to its maximum phased position. When the phaser must be controlled to an intermediate position, the duty cycle is maintained in the region of the 'hold position'. This is a medium duty cycle, usually between 35% and 65%, depending on temperature and voltage conditions. As the cam phaser is advanced and retarded, its position is measured using a toothed wheel.
The wheel is attached to the camshaft, or to the cam phaser rotor. A sensor picks up the signal from the wheel and its output is read by the engine control unit. A cam signal is generated for each cam phaser on the engine. This requires a separate toothed wheel and cam sensor combination for each cam phaser. The cam signal and crankwheel signal are compared as the engine turns, and the phasing position is determined. The position is displayed in crank angle degrees, relative position from default. This position measurement is used as feedback for the position control software, which determines the required percent duty cycle commanded to the oil control valve.

DTC DESCRIPTION

When the enable condition is satisfied The PCM checks that high and low outputs (Voltage level) are observed when OCVs are commanded. When a OCV output failure is detected, the appropriate fail counter is incremented.
If the failure threshold is exceeded 5 seconds during one diagnostic test(10second), the test is failed and DTC is stored. MIL (Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to battery of VCPD Bank 1 Intake circuit output	• Poor Connection • Short to battery in Control Circuit • OCV • PCM
Enable Conditions	• No disabling Faults Present • Engine Running • 11V ≤ Ignition Voltage ≤ 16V • Enable Time delay ≥ 0.5sec	
Threshold value	• Short to battery	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA

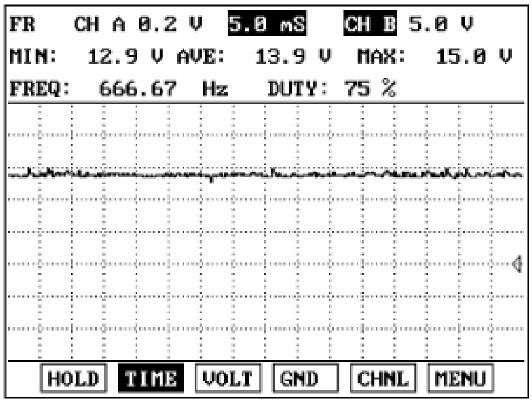


Fig. 1

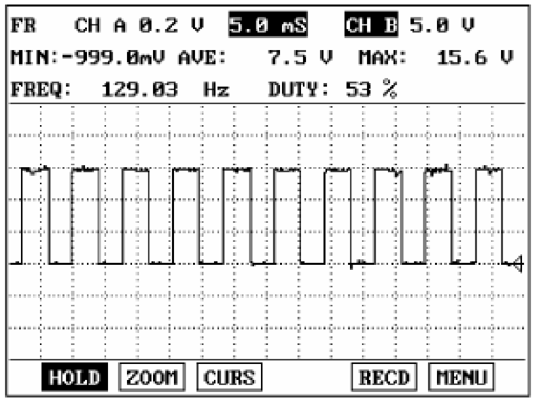


Fig. 2

Fig. 1 : Idle
Fig. 2 : Accelleration

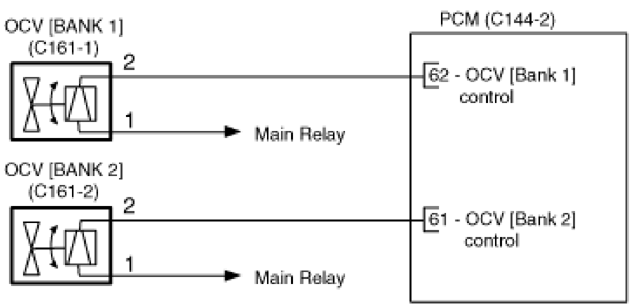
The oil control valve is commanded by a pulse-width-modulated signal from the engine control unit. A duty cycle of zero commands the cam phaser to its default position. A duty cycle of 100% commands the phaser to its maximum phased position. When the phaser must be controlled to an intermediate position, the duty cycle is maintained in the region of the ‘hold position’. This is a medium duty cycle, usually between 35% and 65%, depending on temperature and voltage conditions.

SPECIFICATION

Resistance (Ω)	6.7 ~ 7.7

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

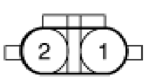
OCV [BANK 1]

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (62)	OCV [Bank 1] control

OCV [BANK 2]

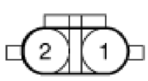
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (61)	OCV [Bank 2] control

[HARNESS CONNECTORS]



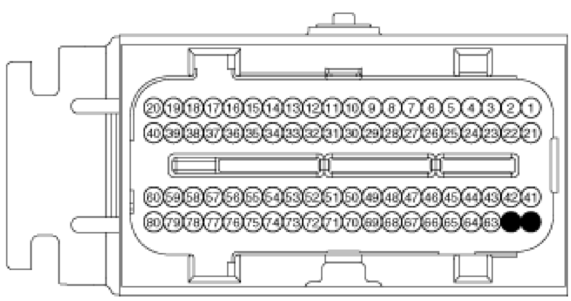
C161-1

OCV [Bank 1]



C161-2

OCV [Bank 2]



C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "Cam Duty2, Cam Desired Position(B2) and Cam Actual Position(B2)" on the service data.

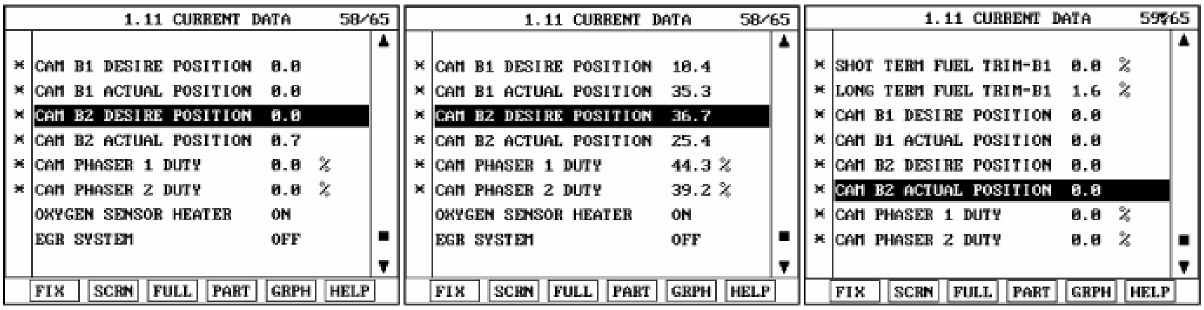


Fig.1 Fig.2 Fig.3

Fig. 1 : Normal at idle
Fig. 2 : Accelleration at idle
Fig. 3 : Open at idle

4. Are the "CAM" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

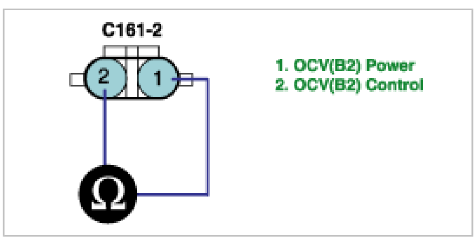
NO

▸ Go to " Control Circuit Inspection " procedure.

CONTROL CIRCUIT INSPECTION

1. IG "OFF" and Disconnect OCV connector.
2. Measure resistance between terminal 1 and 2 of OCV harness connector.

Specification : Infinite



3. Is the measured resistance within specification ?

YES

▸ Go to "Component Inspection" procedure.

NO

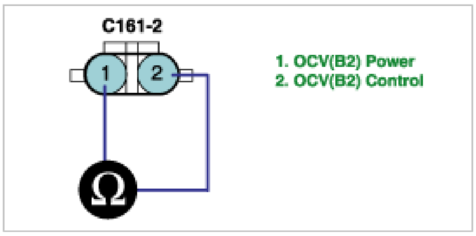
▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check OCV
   (1) IG "OFF" and disconnect OCV connector.
   (2) Measure resistance between terminal 1 and 2 of OCV. (Component Side)

Specification :

Resistance (Ω)	6.7 ~ 7.7



(3) Is the measured resistance within specification ?

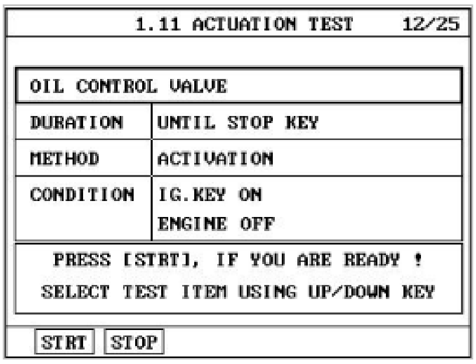
YES

(4) ▸ Go to "OCV Actuation Test" as follows.

NO

▸ Substitute with a known - good OCV and check for proper operation. If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

2. OCV Actuation Test
   (1) Connect scantool and IG "ON"
   (2) Select "OCV" on the Actuation Test
   (3) Activates "OCV" by pressing "STRT(F1)" key
   (should hear a faint click from Oil Control solenoid Valve)
   (4) Repeat this procedure 4 or 5 times to ensure intake valve control solenoid reliability



(5) Does OCV generate clik sound during acutation test ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Substitute with a known - good OCV and check for proper operation. If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

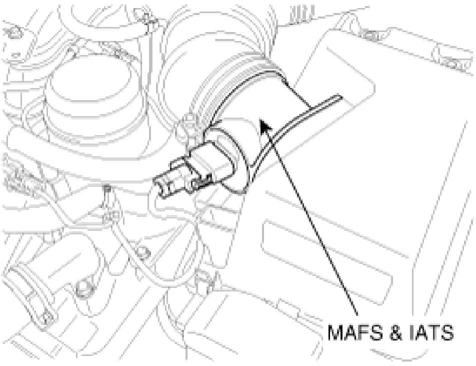
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0101

COMPONENT LOCATION



GENERAL DESCRIPTION

The Delphi MAF Sensor is an air mass flowmeter, which operates on the principle of hot film anemometry. A heated element is placed within the air stream, and maintained at a constant temperature above the air temperature. The amount of electrical power required to maintain the heated element at the proper temperature is a direct function of the flow rate of the air mass past the element. PCM uses this information to determine the injection duration and ignition timing for the desired air/fuel ratio.

DTC DESCRIPTION

The difference between values coming from the MAF Sensor and those are calculated is analyzed. This difference, or error, is then compared to high and low limit calibration values, which are functions of engine speed. PCM compares the difference between MAFS output and calculated flow rate value while enable condition is met.
If the acutal air flow is higher than Maximum threshold, or lower than Minimum threshold for more than 75 seconds failure for every 125 seconds test. PCM determines that a fault exists and a DTC is stored. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

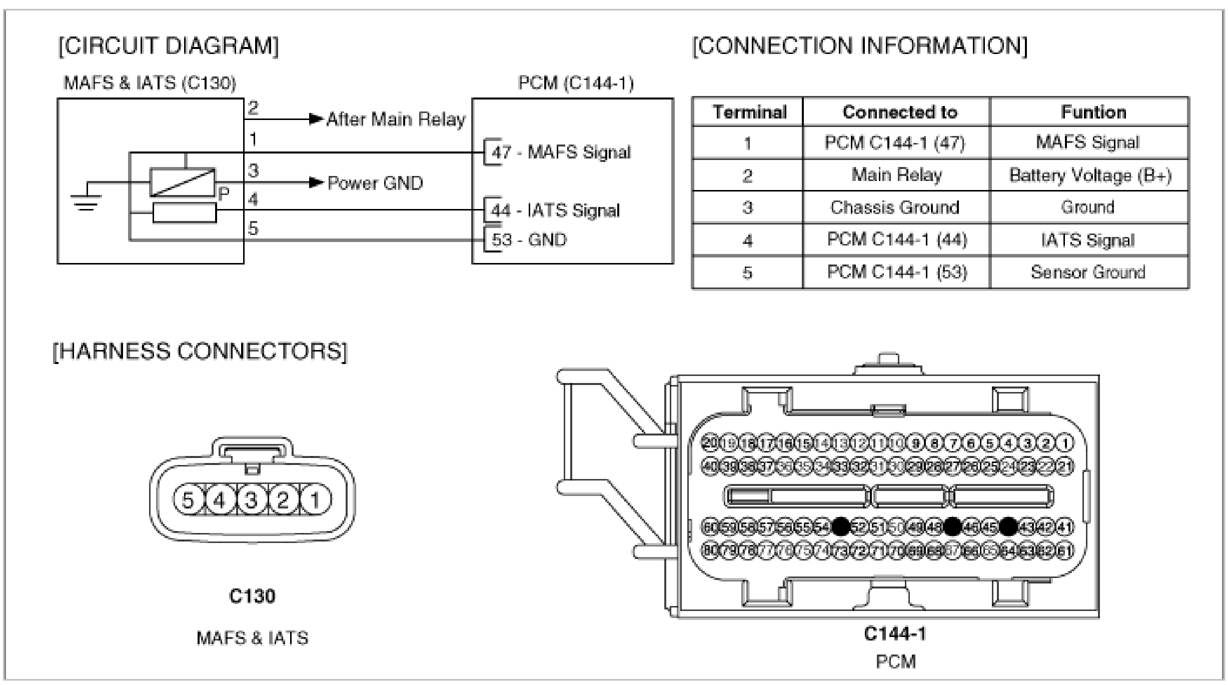
Item	Detecting Condition	Possible cause
DTC Strategy	• The MAF Rationality Diagnostic compares the difference between MAF Sensor output and calculated flow rate value to a calibration value	• Poor connection • Open or short in harness • Clogged air cleaner • MAFS • PCM
Enable Conditions	• Barometric Pressure enable conditions criteria met • Engine Coolant Temperature ≥ 60°C • 600rpm < Engine Speed < 3000rpm • Air Conditioning Clutch not transitioning • Torque Control is not Active • Traction Control is not Active • Brake switch is not active • Current Transmission Torque Converter Clutch State same as previous • Power Steering is not Cramped • Engine Speed difference ≤ 300rpm • TPS value difference ≤ 5% • MAP value difference ≤ 7 kPa • Idle Airflow difference ≤ 10% • VCPC changes ≤ 10% • MAP TPS Rationality High Power Condition Fail Criteria Not Met • MAP TPS Rationality Low Power Condition Fail Criteria Not	

		Met • MAP TPS Rationality Decel. Condition Fail Criteria Not Met • BARO Update Enable Criteria Met • Enable Timer ≥ 1.5s
Thresh old value	Case 1	• Acutal Air Mass Value < Positive Memorized Value
	Case 2	• Acutal Air Mass Value > Negative Memorized Value
Diagnosis Time		• Continuous (More than 75 seconds failure for every 125 seconds test)
MIL On Condition		• 2 Driving Cycles

SPECIFICATION

Air Flow (kg/h)	Frequency (Hz)
12.6 kg/h	2,617Hz
18.0 kg/h	2,958Hz
23.4 kg/h	3,241Hz
32.4 kg/h	3,653Hz
43.2 kg/h	4,024Hz
57.6 kg/h	4,399Hz
72.0 kg/h	4,704Hz
108.0 kg/h	5,329Hz
144.0 kg/h	5,897Hz
198.0 kg/h	6,553Hz
270.0 kg/h	7,240Hz
360.0 kg/h	7,957Hz
486.0 kg/h	8,738Hz
666.0 kg/h	9,644Hz
900.0 kg/h	10,590Hz

SCHEMATIC DIAGRAM



MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "Air Flow" status on the service data.

Specification :

Air Flow (kg/h)	Frequency (Hz)
12.6 kg/h	2,617Hz
18.0 kg/h	2,958Hz
23.4 kg/h	3,241Hz
32.4 kg/h	3,653Hz
43.2 kg/h	4,024Hz
57.6 kg/h	4,399Hz
72.0 kg/h	4,704Hz
108.0 kg/h	5,329Hz
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198.0 kg/h	6,553Hz
270.0 kg/h	7,240Hz
360.0 kg/h	7,957Hz
486.0 kg/h	8,738Hz
666.0 kg/h	9,644Hz
900.0 kg/h	10,590Hz

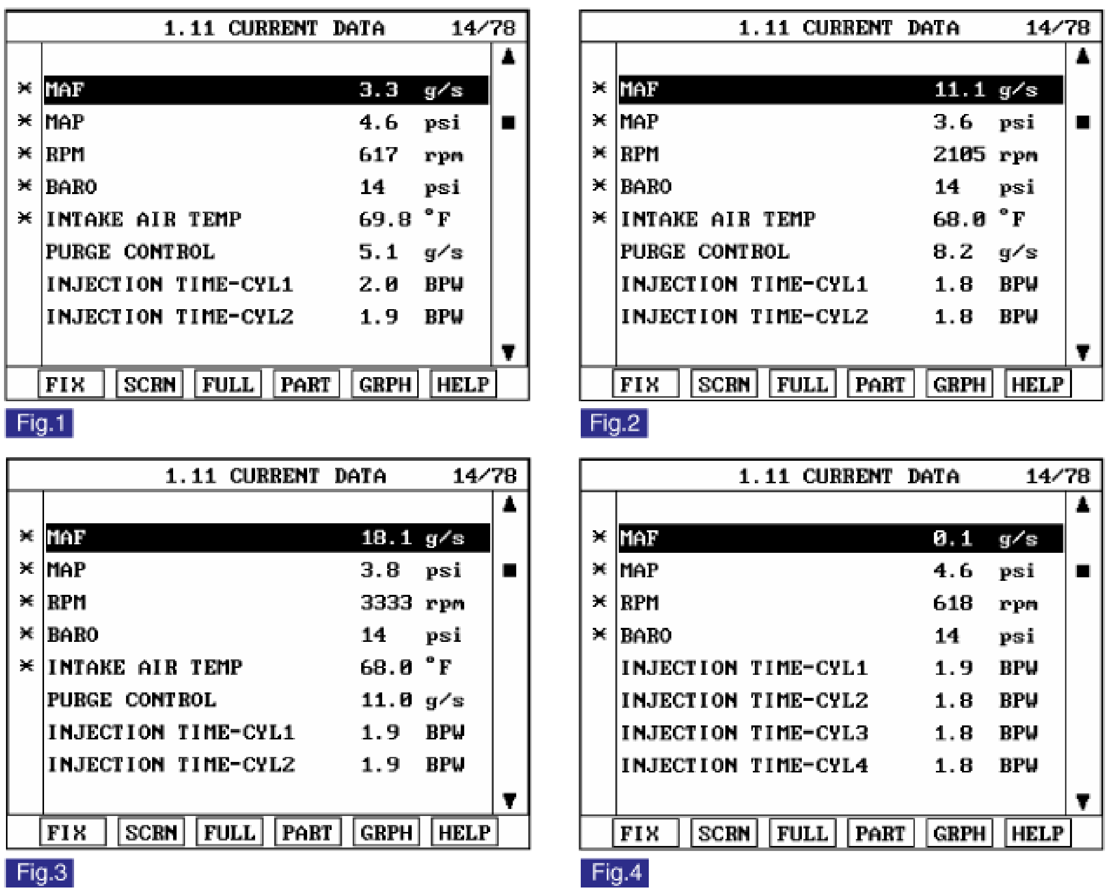


Fig.1: Idle
Fig.2: 2000 rpm
Fig.3: 3000 rpm
Fig.4: Open in signal harness

4. Are the "Air Flow" data displayed correctly ?

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▶ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure

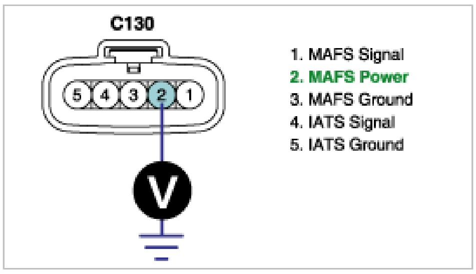
NO

▶ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. IG "OFF" and Disconnect MAFS connector.
2. IG "ON" & ENG "OFF"
3. Measure voltage between terminal 2 of MAFS harness connector and chassis ground

Specification : B+



4. Is the measured resistance within specification ?

YES

▶ Go to "Ground Circuit Inspection" proceudure.

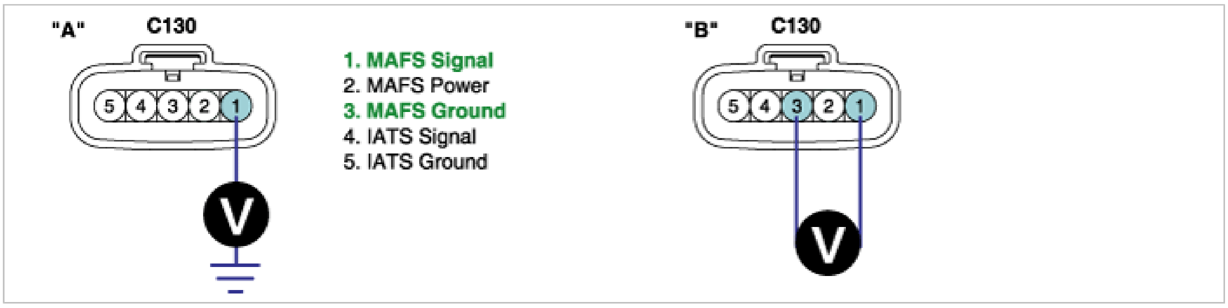
NO

▶ Check that fuse between MAFS and Main Relay is open or not installed.
▶ Check open in power circuit between MAFS and Main Relay.
▶ Go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF" and disconnect MAFS connector.
2. Measure voltage between terminal 1 of MAFS harness connector and chassis ground.
3. Measure voltage between terminal 1 and 3 of MAFS harness connector.

Specification : Voltage difference between Measurement "A" and "B" is below 200mV.



4. Is the measured voltage within specification ?

YES

▸ Go to "Signal Circuit Inspection" procedure.

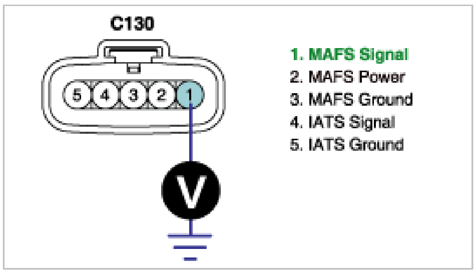
NO

▸ Repair contact resistance or open in harnesss and then go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. IG "OFF" and disconnect MAFS connector.
2. IG "ON' & ENG "OFF".
3. Measure voltage between terminal 1 of MAFS harness connector and chassis ground.

Specification : Approx. 5V



4. Is the measured voltage within specification ?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Visual Inspection
   (1) Check that MAFS is damaged, contaminated or deformed.
   (2) Check tha air cleaner is clogged.
   (3) Has a problem been found ?

   YES

   ▸ Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Go to "Check MAFS" as follows

2. Check MAFS
   (1) IG "OFF" and install a scantool
   (2) ENG "ON" and monitor "MAFS" data on the service data.
   (3) Monitor signal waveform at terminal 1 of MAFS with scantool.

   Specification :Signal waveform will be displayed as follows. (Be aware that the signal of MAFS is not voltage display but frequency display.)

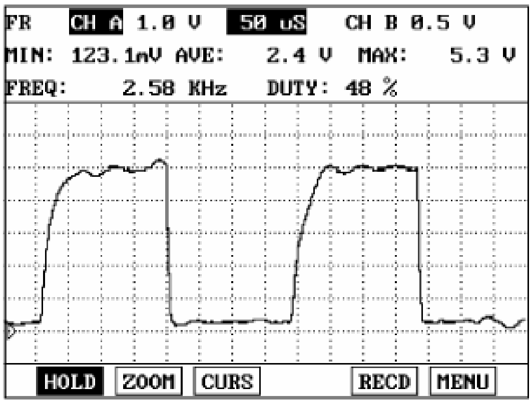


Fig. 1

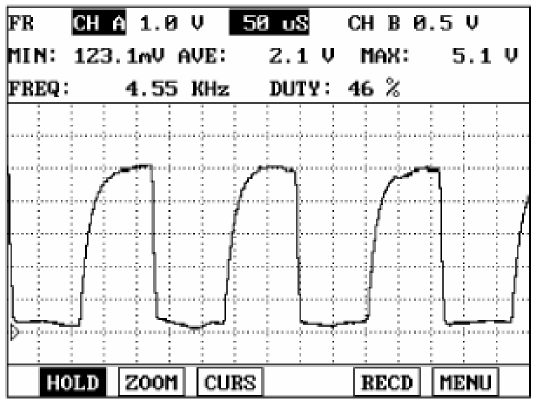


Fig. 2

Fig. 1 : Idle
Fig. 2 : Acceleration

(4) Are both service data and signalwave form dispayed correctly ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Substitute with a known - good MAFS and check for proper operation. If the problem is corrected, replace MAFS and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

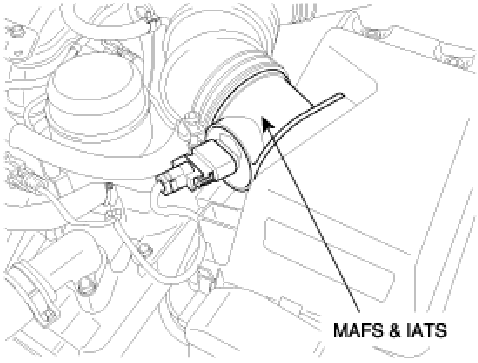
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0102

COMPONENT LOCATION



GENERAL DESCRIPTION

The Delphi MAF Sensor is an air mass flowmeter, which operates on the principle of hot film anemometry. A heated element is placed within the air stream, and maintained at a constant temperature above the air temperature. The amount of electrical power required to maintain the heated element at the proper temperature is a direct function of the flow rate of the air mass past the element. PCM uses this information to determine the injection duration and ignition timing for the desired air/fuel ratio.

DTC DESCRIPTION

The MAF Frequency Airmeter Circuit Diagnostic compares the airmeter input frequency to low and high limits. When the frequency is outside the allowable limits, the circuit is determined to be failed. When a MAF Sensor fails, it may cause the fuel control subsystem to deliver an incorrect quantity of fuel. The most probable failure modes of the MAF Sensor system are an open or short circuit, resulting in a low frequency code setting.
If PCM detects that output of MAFS is lower than 720Hz for more than 75 second failure during one dignostic test(125 second) while enable condition is met PCM determines that a fault exists and a DTC is stored.MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

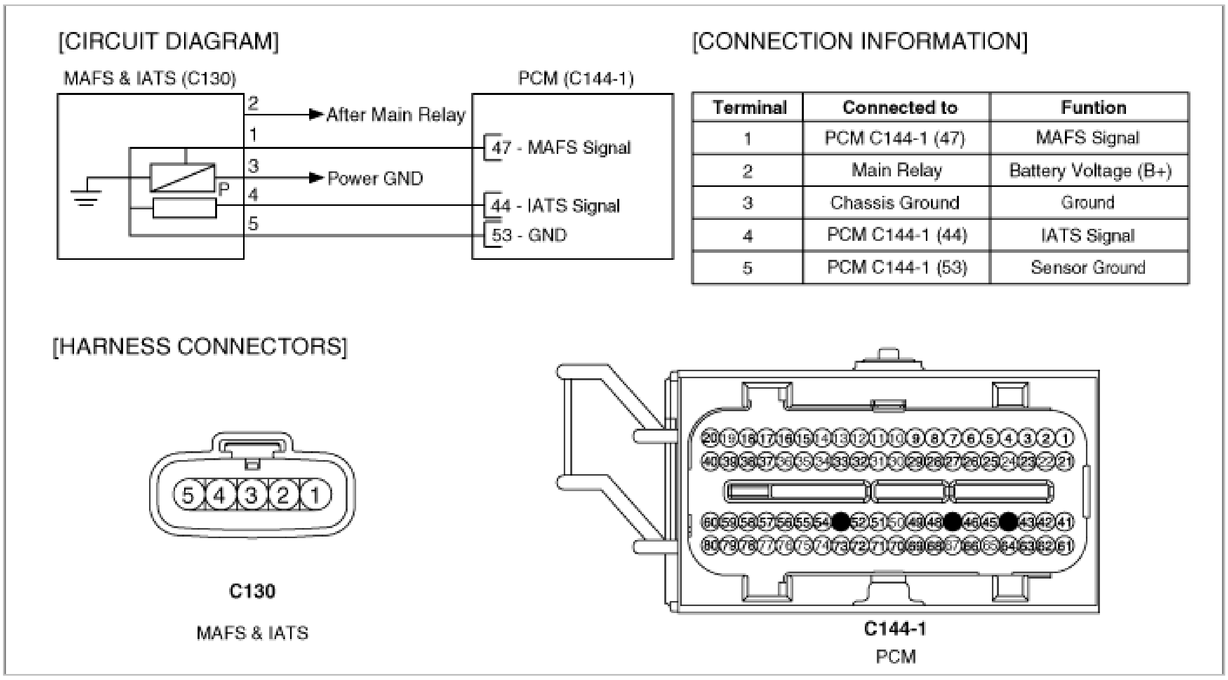
Item	Detecting Condition	Possible cause
DTC Strategy	• The MAF Frequency Airmeter Circuit Diagnostic compares the airmeter input frequency to a low limit	• Poor Connection • Open or short in harness • Clogged air cleaner • MAFS • PCM
Enable Conditions	• Engine Speed ≥ 500 rpm • Engine Running Time ≥ 5 second • Ignition Voltage ≥ 11V • Conditions met delay time ≥ 1 second	
Threshold value	• MAF frequency signal < 1000Hz	
Diagnosis Time	• Continuous (More than 75 second failure for every 125 second tests)	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION

Air Flow (kg/h)	Frequency (Hz)
12.6 kg/h	2,617Hz
18.0 kg/h	2,958Hz
23.4 kg/h	3,241Hz
32.4 kg/h	3,653Hz
43.2 kg/h	4,024Hz
57.6 kg/h	4,399Hz
72.0 kg/h	4,704Hz
108.0 kg/h	5,329Hz
144.0 kg/h	5,897Hz

198.0 kg/h	6,553Hz
270.0 kg/h	7,240Hz
360.0 kg/h	7,957Hz
486.0 kg/h	8,738Hz
666.0 kg/h	9,644Hz
900.0 kg/h	10,590Hz

SCHEMATIC DIAGRAM



MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "Air Flow" status on the service data.
   Specification :

Air Flow (kg/h)	Frequency (Hz)
12.6 kg/h	2,617Hz
18.0 kg/h	2,958Hz
23.4 kg/h	3,241Hz
32.4 kg/h	3,653Hz
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108.0 kg/h	5,329Hz
144.0 kg/h	5,897Hz
198.0 kg/h	6,553Hz
270.0 kg/h	7,240Hz
360.0 kg/h	7,957Hz
486.0 kg/h	8,738Hz
666.0 kg/h	9,644Hz

900.0 kg/h	10,590Hz

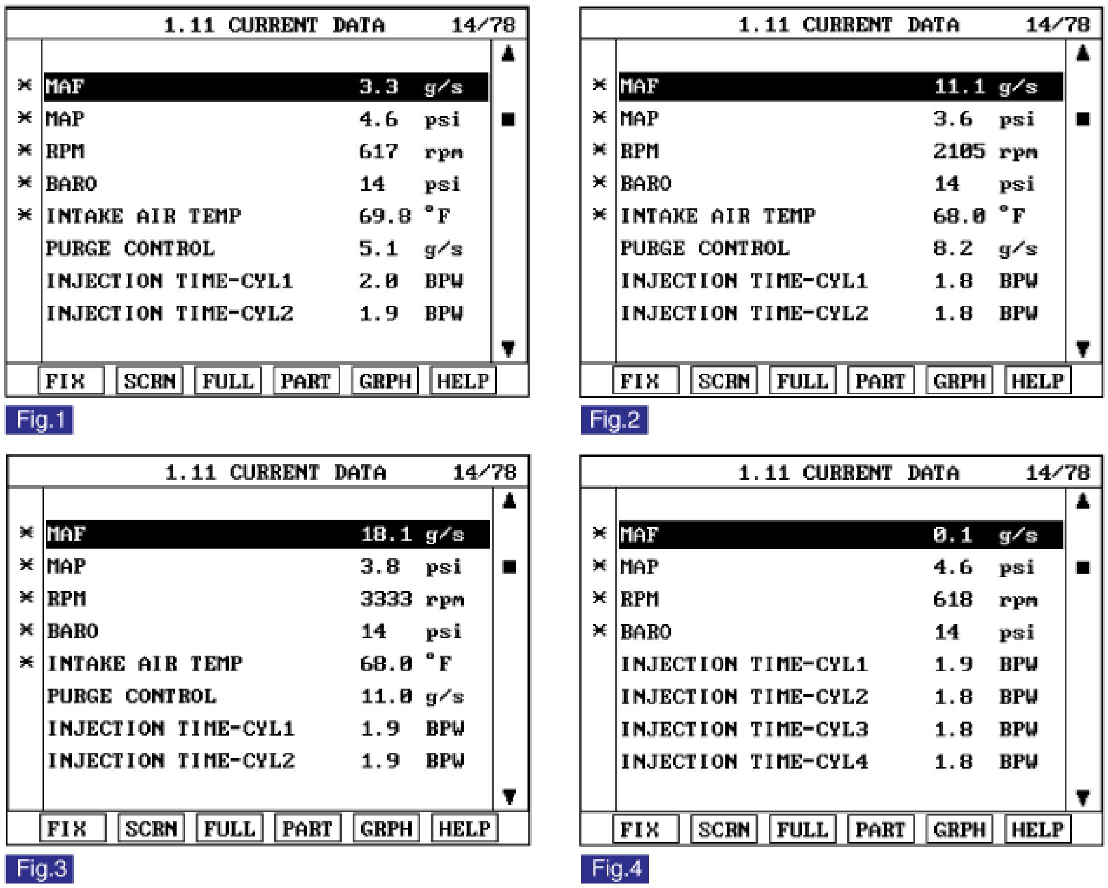


Fig.1: Idle
Fig.3: 3000 rpm

Fig.2: 2000 rpm
Fig.4: Open in signal harness

4. Are the "Air Flow" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

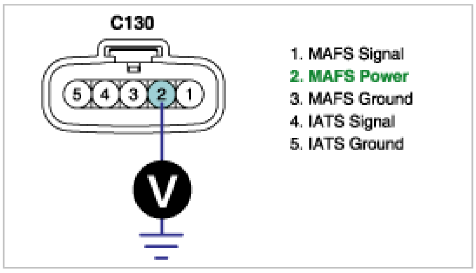
NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. IG "OFF" and Disconnect MAFS connector.
2. IG "ON" & ENG "OFF"
3. Measure voltage between terminal 2 of MAFS harness connector and chassis ground

Specification : B+



4. Is the measured voltage within specification ?

YES

▸ Go to "Signal Circuit Inspection" Procedure.

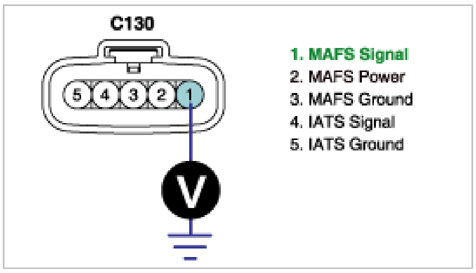
NO

▸ Check fuse between MAFS and main relay is open or not installed.
▸ Repair open in power harness between MAFS and main relay and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF" and disconnect MAFS connector.
   (2) IG "ON' & ENG "OFF".
   (3) Measure voltage between terminal 1 of MAFS harness connector and chassis ground.

Specification : Approx. 5V



   (4) Is the measured voltage within specification ?

YES

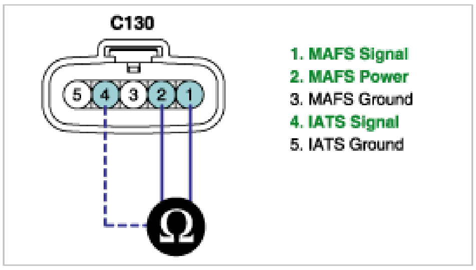
▸ Go to "Ground circuit inspection" procedure.

NO

▸ If the measured voltage is "0", go to "Check open in harness" as follows. If the measured voltage is over "5V", go to " Check short to battery in harness" as follows.

2. Check short to battery in harness
   (1) IG "OFF" and disconnect MAFS and PCM connector.
   (2) Measure resistance between terminal 1 and 2 of MAFS harness connector.
   (3) Measure resistance between terminal 1 and 4 of MAFS harness connector.

Specification : Infinite



   (4) Is the measured voltage within specification ?

YES

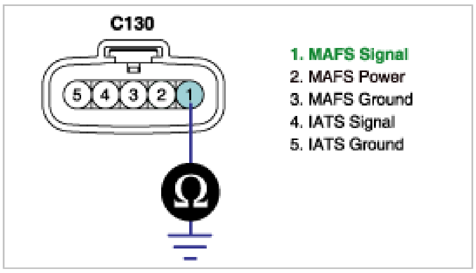
▸ Go to "Check short to ground in harness" as follows.

NO

▸ Repair short to battery in harness and go to "Verification of Vehicle Repair" procedure.

3. Check short to ground in harness
   (1) IG "OFF" and disconnect MAFS and PCM connector.
   (2) Measure resistance between terminal 1 of MAFS harness connector and chassis ground.

Specification : Infinite



   (3) Is the measured resistance within specification ?

YES

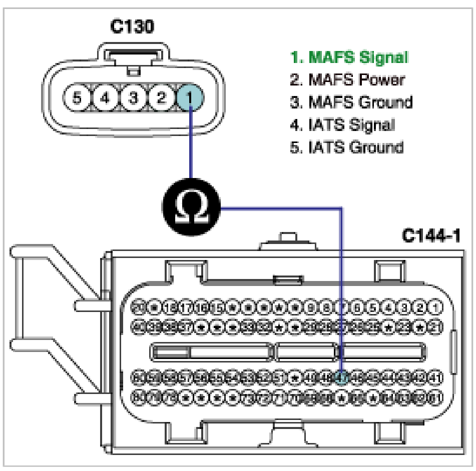
▸ Go to "Check open in harness" as follows.

NO

▸ epair short to ground in harness and go to "Verification of Vehicle Repair" procedure.

4. Check open in harness
   (1) IG "OFF" and disconnect MAFS and PCM connector.
   (2) Measure resistance between terminal 1 of MAFS harness connector and terminal 47 of PCM harness connector.

Specification : Approx. below 1Ω.



   (3) Is the measured resistance within specification ?

YES

▸ Go to "Ground circuit Inspection" procedure.

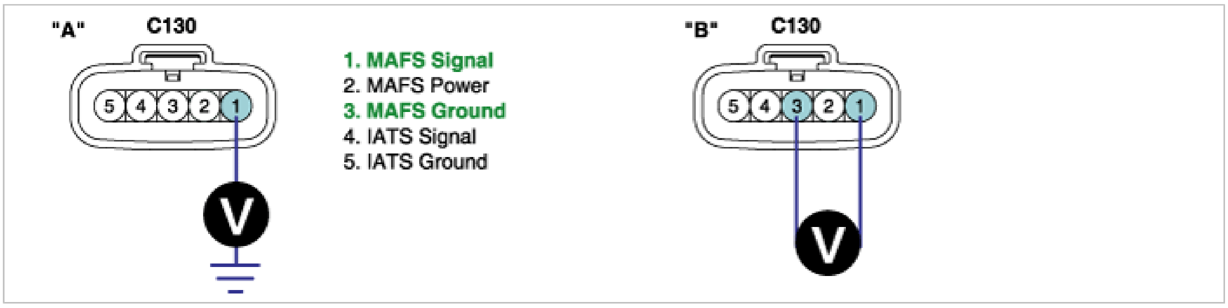
NO

▸ Repair open in harness and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF" and disconnect MAFS connector.
2. Measure voltage between terminal 1 of MAFS harness connector and chassis ground.
3. Measure voltage between terminal 1 and 3 of MAFS harness connector.

Specification : Voltage difference between Measurement "A" and "B" is below 200mV.



4. Is the measured voltage within specification ?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair contact resistance or open in harnesss and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Visual Inspection
   (1) Check that MAFS is damaged, contaminated or deformed.
   (2) Check tha air cleaner is clogged.
   (3) Has a problem been found ?

   YES

   ▸ Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Go to "Check MAFS" as follows

2. Check MAFS
   (1) IG "OFF" and install a scantool
   (2) ENG "ON" and monitor "MAFS" data on the service data.
   (3) Monitor signal waveform at terminal 1 of MAFS with scantool.

   Specification :Signal waveform will be displayed as follows. (Be aware that the signal of MAFS is not voltage display but frequency display.)

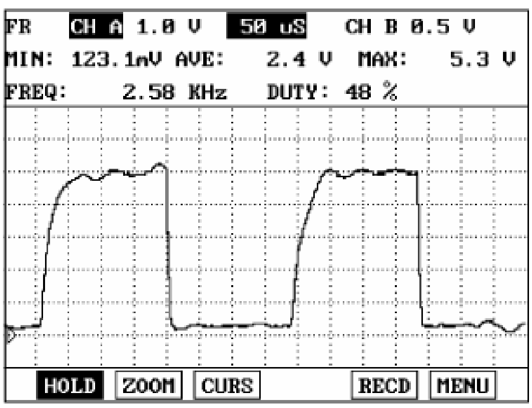


Fig. 1

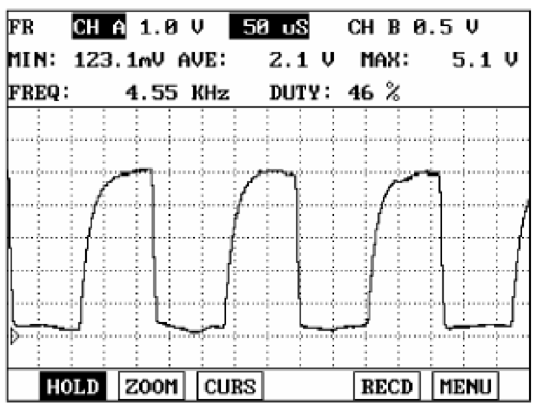


Fig. 2

Fig. 1 : Idle
Fig. 2 : Acceleration

   (4) Are both service data and signalwave form dispayed correctly ?

   YES

   ▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Substitute with a known - good MAFS and check for proper operation. If the problem is corrected, replace MAFS and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

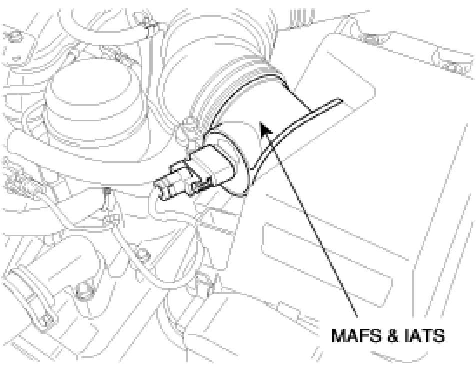
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0103

COMPONENT LOCATION



GENERAL DESCRIPTION

The Delphi MAF Sensor is an air mass flowmeter, which operates on the principle of hot filmanemometry. A heated element is placed within the air stream, and maintained at a constanttemperature above the air temperature. The amount of electrical power required to maintain theheated element at the proper temperature is a direct function of the flow rate of the air mass pastthe element. PCM uses this information to determine the injection duration and ignition timing for the desired air/fuel ratio.

DTC DESCRIPTION

The MAF Frequency Airmeter Circuit Diagnostic compares the airmeter input frequency to low and high limits. When the frequency is outside the allowable limits, the circuit is determined to be failed. When a MAF Sensor fails, it may cause the fuel control subsystem to deliver an incorrect quantity of fuel. The most probable failure modes of the MAF Sensor system are an open or short circuit, resulting in a low frequency code setting.
If PCM detects that output of MAFS is higher thatn 12000Hz for more than 75 second failure during 125 second dignostic test while enable condition is met PCM determines that a fault exists and a DTC is stored.MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• The MAF Frequency Airmeter Circuit Diagnostic compares the airmeter input frequency to a high limit	

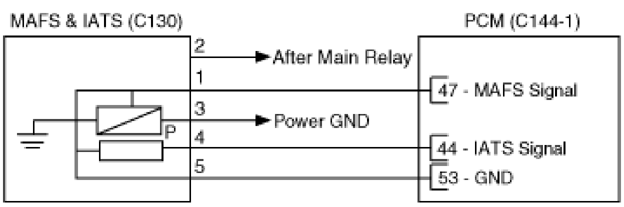
Enable Conditions	• Engine Speed ≥ 500 rpm • Engine Running Time ≥ 5 second • Ignition Voltage ≥ 11V • Conditions met delay time ≥ 1 second	• Noise • MAFS • PCM
Threshold value	• MAF frequency signal > 11900Hz	
Diagnosis Time	• Continuous (More than 75 second failure for every 125 second tests)	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION

Air Flow (kg/h)	Frequency (Hz)
12.6 kg/h	2,617Hz
18.0 kg/h	2,958Hz
23.4 kg/h	3,241Hz
32.4 kg/h	3,653Hz
43.2 kg/h	4,024Hz
57.6 kg/h	4,399Hz
72.0 kg/h	4,704Hz
108.0 kg/h	5,329Hz
144.0 kg/h	5,897Hz
198.0 kg/h	6,553Hz
270.0 kg/h	7,240Hz
360.0 kg/h	7,957Hz
486.0 kg/h	8,738Hz
666.0 kg/h	9,644Hz
900.0 kg/h	10,590Hz

SCHEMATIC DIAGRAM

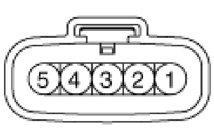
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

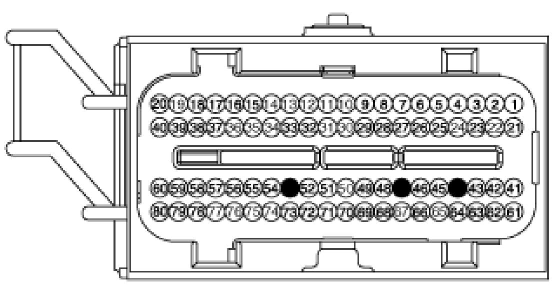
Terminal	Connected to	Funtion
1	PCM C144-1 (47)	MAFS Signal
2	Main Relay	Battery Voltage (B+)
3	Chassis Ground	Ground
4	PCM C144-1 (44)	IATS Signal
5	PCM C144-1 (53)	Sensor Ground

[HARNESS CONNECTORS]



C130

MAFS & IATS



C144-1

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "Air Flow" status on the service data.

Specification :

Air Flow (kg/h)	Frequency (Hz)
12.6 kg/h	2,617Hz
18.0 kg/h	2,958Hz
23.4 kg/h	3,241Hz
32.4 kg/h	3,653Hz
43.2 kg/h	4,024Hz
57.6 kg/h	4,399Hz
72.0 kg/h	4,704Hz
108.0 kg/h	5,329Hz
144.0 kg/h	5,897Hz
198.0 kg/h	6,553Hz
270.0 kg/h	7,240Hz
360.0 kg/h	7,957Hz
486.0 kg/h	8,738Hz
666.0 kg/h	9,644Hz
900.0 kg/h	10,590Hz

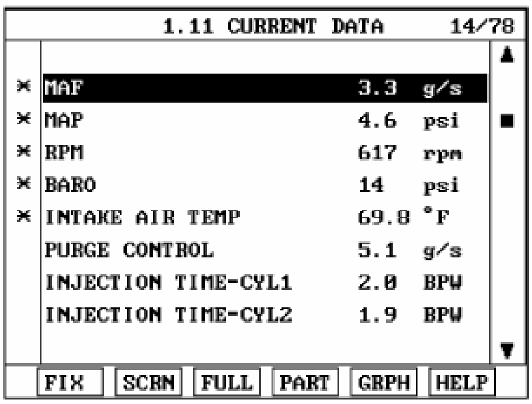


Fig.1

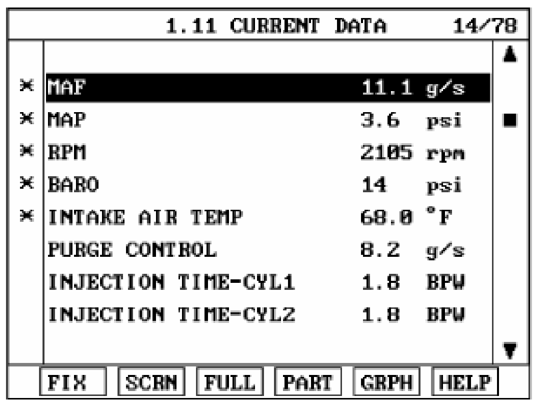


Fig.2

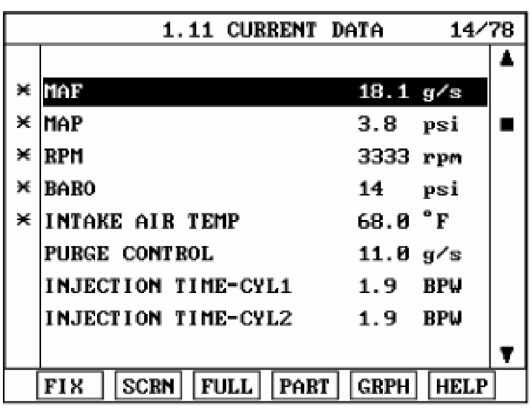


Fig.3

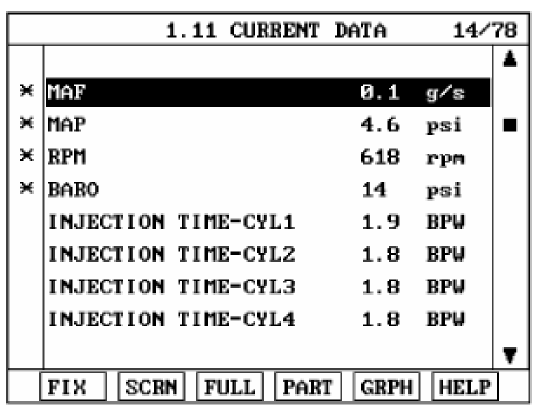


Fig.4

Fig.1: Idle
Fig.2: 2000 rpm
Fig.3: 3000 rpm
Fig.4: Open in signal harness

4. Are the "Air Flow" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure

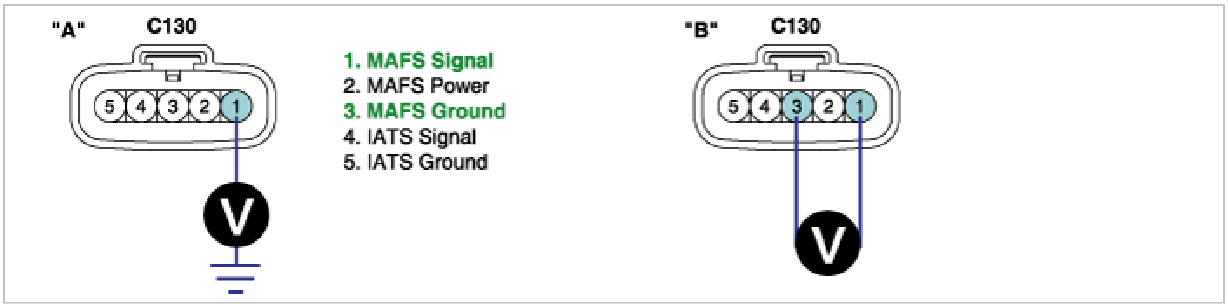
NO

▸ Go to "Ground Circuit Inspection" procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF"
2. Disconnector MAFS connector.
3. Measure the voltage between terminal 1 of MAFS harness connector.
4. Measure the voltage between terminal 1 and 3 of MAFS harness connector.

Specification : Voltage difference and "A" and B" is below 200mV



5. Is the measured voltage within the specification?

YES

▸ Go to "Component Inspection".

NO

▸ After repairing or replacing contact resistance in ground circuit and open in the MAFS circuit, go to "Verification and Vehicle Repair".

COMPONENT INSPECTION

1. Visual Inspection

(1) Check that MAFS is damaged, contaminated or deformed.

(2) Check tha air cleaner is clogged.

(3) Has a problem been found ?

YES

▸ Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Go to "Check MAFS" as follows

2. Check MAFS

(1) IG "OFF" and install a scantool

(2) ENG "ON" and monitor "MAFS" data on the service data.

(3) Monitor signal waveform at terminal 1 of MAFS with scantool.

Specification :Signal waveform will be displayed as follows. (Be aware that the signal of MAFS is not voltage display but frequency display.)

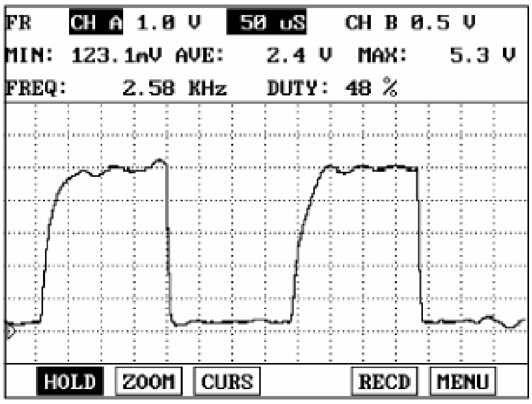


Fig. 1

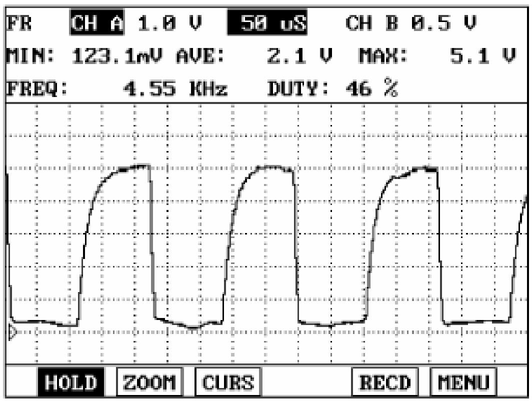


Fig. 2

Fig. 1 : Idle
Fig. 2 : Acceleration

(4) Are both service data and signalwave form dispayed correctly ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Substitute with a known - good MAFS and check for proper operation. If the problem is corrected, replace MAFS and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

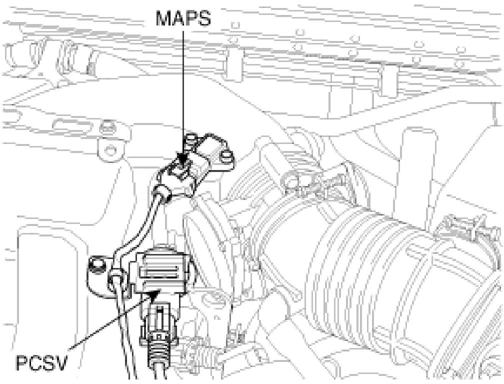
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0106

COMPONENT LOCATION



GENERAL DESCRIPTION

The amount of intake air flow must be inputted to PCM in order to determine the fuel injection quantity. To measure the pressure inside of intake manifold, MAFS is used at idle and MAPS is required at accelerating. MAPS(Manifold Absolute Pressure) calculates the amount of air indirectly as measuring the pressure inside of intake manifold. This mechanism is alsl called Speed-Density Type.MAPS transfers analog output signal which is proportional to the change of intake manifold pressure, then, with this signal and RPM, PCM calculates the amount of intake air flow. MAPS is mounted on surge tank to measure the pressure inside of intake manifold, and it consists of a piezo electric element and hybrid IC which amplifies output signal from the element. A piezo electric element is a sort of a diaphragm using piezo electric effect. One side of the diaphragm is surrounded with vacuum chamber while intake pressure is applied to the other side. Thus, signals are output by the transformation of diagphragm according to the change of pressure inside of intake manifold.

DTC DESCRIPTION

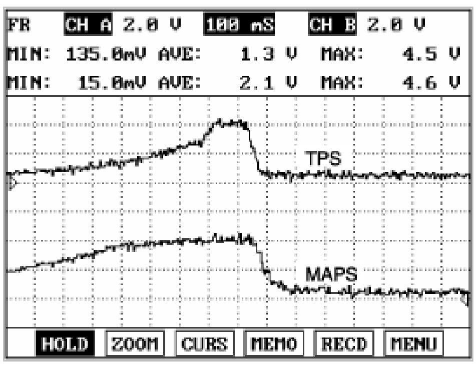
The MAP/TPS Rationality Diagnostic is comprised of two tests. A deceleration test is performedto provide a robust method for detection of an altitude compensated MAP value that is too high for the deceleration condition. The second test compares the altitude compensated MAP value to both high and low limits, dependent upon throttle position and engine speed. When the MAP value is out of the threshold range, the MAP/TPS system is determined to be failed.
When the MAP/TPS Rationality Diagnostic fails, the effects may cause the fuel control subsystem to deliver an incorrect quantity of fuel. The most probable failure modes of the MAP Sensor system are a skewed MAP or TPS sensor, resulting in a poor correlation between MAP and TPS
To ensure the vehicle is not performing in a transient maneuver, input signals and control parametersare monitored for stability for both the deceleration test and the power test. A large enough change inany of these stability parameters indicates that either the actual airflow rate or the calculated airflowrate may be misrepresented during the transient condition. Inclusion of this check for stability allowsbetter separation of passing and failing systems.
PCM compares the difference between MAPS output and calculated MAPS value while enable condition ismet. If the acutal MAP value is higher than Maximum threshold or lower than Minimum threshold for 15 secondfailure during one diagnostic test(32 second),PCM determines that a fault exists and a DTC is stored.MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible cause
DTC Strategy		• The MAP reading is compared to expected MAP high and low limits based on engine speed & Throttle Position	
	Case 1	**Decel Stable Conditions Criteria** • Engine State = Run • MAP_TPS_Rationality Fault is not present • Valid barometric pressure update • 1300rpm ≤ Engine speed ≤ 4500rpm • Idle Airflow Stable ≤ 4.9988% • -10°C< Coolant Temperature above minimum threshold	
		Power Stable Conditions Criteria • Engine State = Run • MAP_TPS_Rationality Fault is not present • Valid barometric pressure update • 1300rpm ≤ Engine speed ≤ 4000rpm	

Enable Conditions	Case 2	• HVAC Clutch not transitioning • Traction control not active • Torque fuel reduction not active • Brake Switch Not Activated • Coolant Temperature ≥ 60°C • TPS value difference ≤ 4.9988% • MAP value difference ≤ 5kPa • Idle Airflow Stable ≤ 4.9988% • Bank 1 VCPC ≤ 10 degree • Bank 2 VCPC ≤ 10 degree	• Poor connection • Open or short in harness • MAPS • PCM
	Case 3	**Decel Enable Conditions Criteria** • Decel Stable Conditions Present • Throttle position < 0.2991% • Vehicle Speed ≥ 30kph • The minimum consecutive time that the engine operating conditions must meet the enable criteria	
	Case 4	**Power Enable Conditions Criteria** • Power Stable Conditions Present • The minimum consecutive time that the engine operating conditions must meet the enable criteria > 3 second	
Threshold value	Case 1	**Power Test** • Altitude compensated MAP < Memorized min. MAP data • Altitude compensated MAP > Memorized max. MAP data	
	Case 2	**Decelleration Test** • Altitude compensated MAP < Memorized MAP data	
Diagnosis Time		• Continuous (More than 15 seconds failure for every 32 seconds test)	
MIL On Condition		• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA



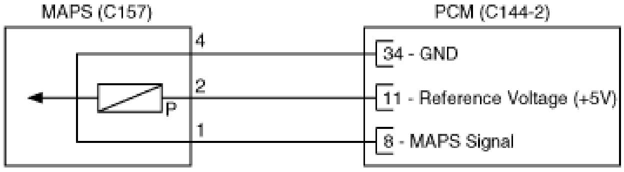
It is necessary that MAPS should be checked along with TPS. Because The MAP/TPS Rationality Diagnostic is comprised of two tests. A deceleration test is performed to provide a robust method for detection of an altitude compensated MAP value that is too high for the deceleration condition. The second test compares the altitude compensated MAP value to both high and low limits, dependent upon throttle position and engine speed. When the MAP value is out of the threshold range, the MAP/TPS system is determined to be failed.

SPECIFICATION

Pressure (kPa)	20	35	60	95	101.32
Voltage (V)	0.789	1.382	2.369	3.75	4
Tolerance (V)	± 0.045				

SCHEMATIC DIAGRAM

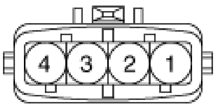
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

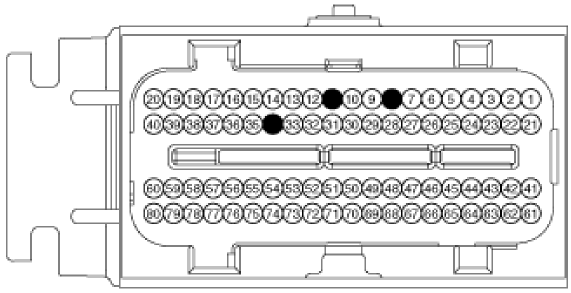
Terminal	Connected to	Funtion
1	PCM C144-2 (8)	MAPS Signal
2	PCM C144-2 (11)	Reference Voltage (+5V)
3	-	-
4	PCM C144-2 (34)	Sensor ground

[HARNESS CONNECTORS]



C157

MAPS



C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "MAPS" status on the service data.

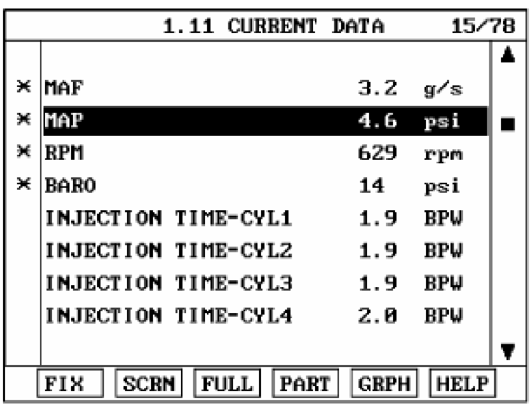


Fig. 1

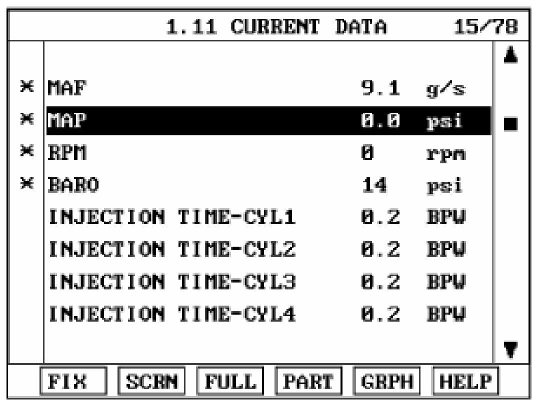


Fig. 2

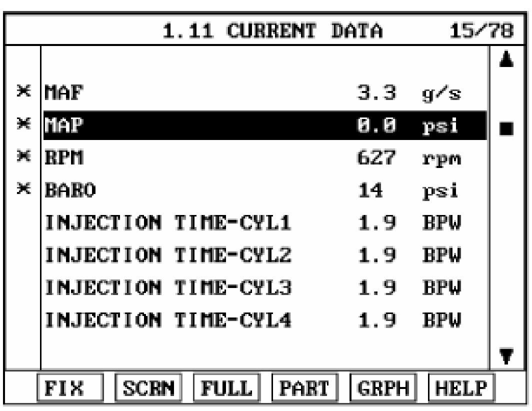


Fig. 3

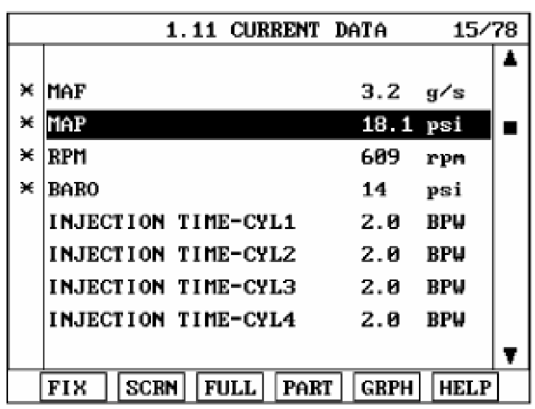


Fig. 4

Fig. 1 : Normal at idle
Fig. 2 : Open at idle
Fig. 3 : Short to ground at idle
Fig. 4 : Shrot to 5V at idle

4. Are the "MAPS" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

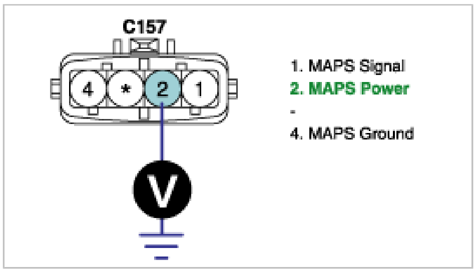
NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. IG "OFF" and disconnect MAPS connector.
2. IG "ON" & ENG "OFF"
3. Measure voltage between terminal 2 of MAPS harness connector and chassis ground.

Specification : Approx. 5V



4. Is the measured voltage within specification ?

YES

▸ Go to "Ground circuit inspection" procedure.

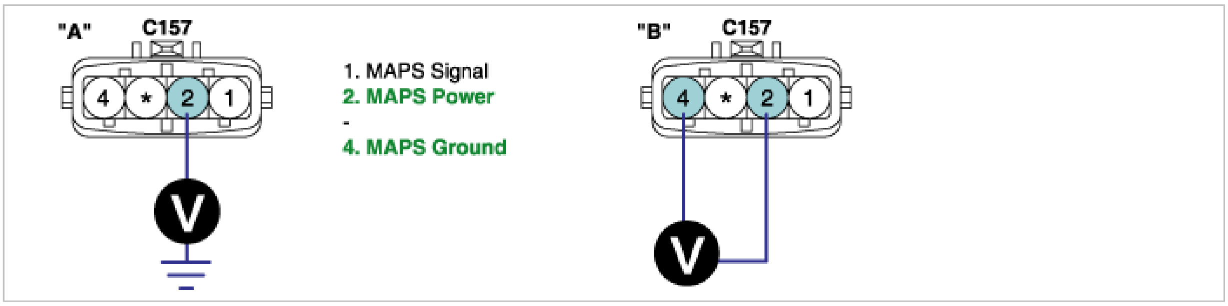
NO

▸ Repair open or short to ground in harness and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF" and disconnect MAPS connector.
2. Measure voltage between terminal 2 of MAPS harness connector and chassis ground.
3. Measure voltage between terminal 2 and 4 of MAPS harness connector.

Specification : Voltage difference between Measurement "A" and "B" is below 200mV.



4. Is the measured voltage within specification ?

YES

▸ Go to "Signal Circuit Inspection" procedure.

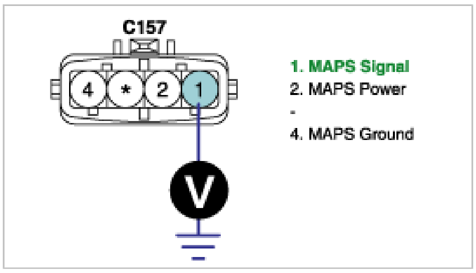
NO

▸ Repair contact reistance or open in harness and then go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF" and disconnect MAPS connector.
   (2) IG "ON" & ENG "OFF"
   (3) Measure voltage between terminal 1 of MAPS harness connector and chassis ground.

Specification : Approx. 0V



   (4) Is the measured voltage within specification ?

YES

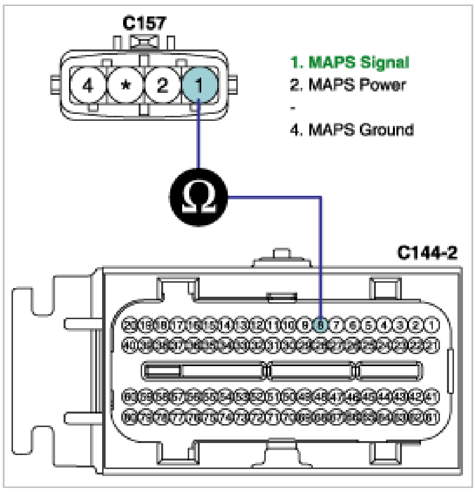
▸ Go to "Check open in harness" as follows.

NO

▸ Repair short to ground in harness and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness
   (1) IG "OFF" and disconnet MAPS and PCM connector.
   (2) Measure resistance between terminal 1 of MAPS harness connector and terminal 8 of PCM harness connector.

Specification : Approx. Below 1 Ω



   (3) Is the measured resistance within specification ?

YES

▸ Go to "Component Inspection" procedure.

NO

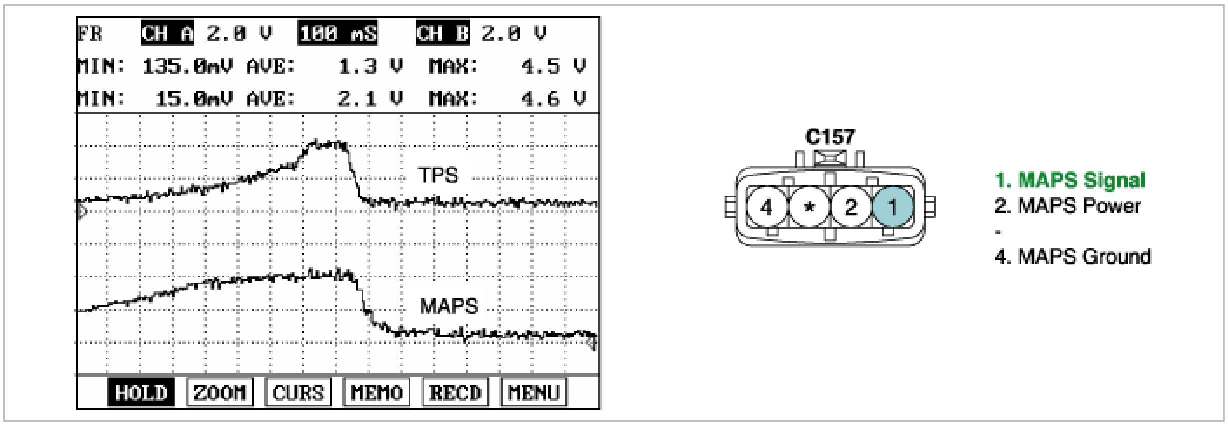
▸ Repair open in harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check MAPS Performance
   (1) IG "OFF" and install scatool.
   (2) Connect probe to MAPS and TPS to check signal waveform by using oscilloscope function.

(3) ENG "ON" and monitor signal waveform during accelleration and decelleration.
Specificaton :

Pressure (kPa)	20	35	60	95	101.32
Voltage (V)	0.789	1.382	2.369	3.75	4
Tolerance (V)	± 0.045				



(4) Is the measured signal waveform(MAP/TPS Rationality) O.K ?

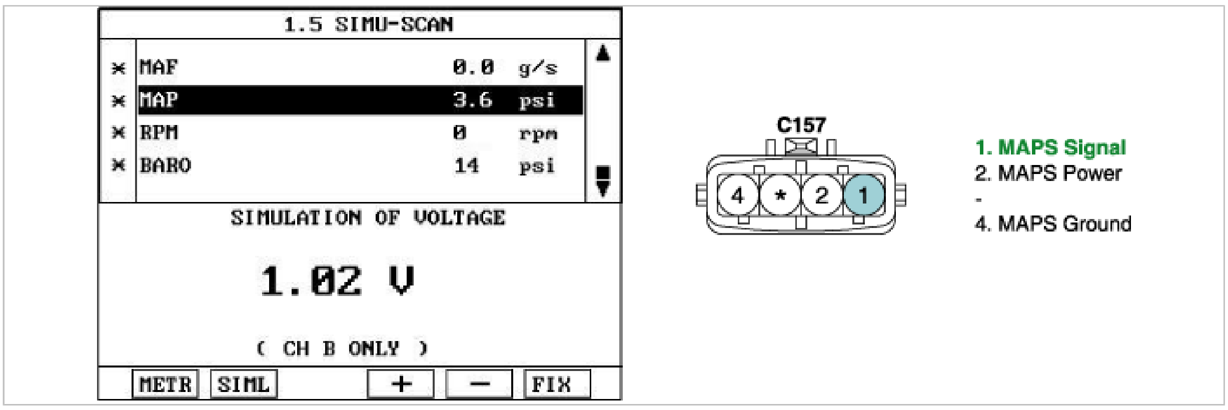
YES

▸ Go to "Check PCM" as follows.

NO

▸ Substitute with a known - good MAPS and check for proper operation. If the problem is corrected, replace MAPS and go to "Verification of Vehicle Repair" procedure.

2. Check PCM
   (1) IG "OFF" disconnect MAPS connector
   (2) Connect Scantool and IG "ON" & ENG "OFF"
   (3) Select simulation function on scantool.
   (4) Simulate voltage at terminal 1 of MAPS harness connector.



(5) Does the signal value of MAP sensor change according to simulation voltage ?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

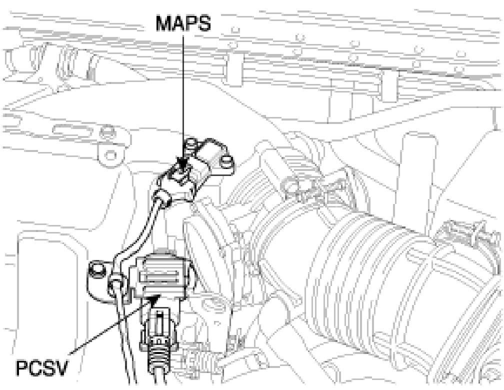
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0107

COMPONENT LOCATION



GENERAL DESCRIPTION

The amount of intake air flow must be inputted to PCM in order to determine the fuel injection quantity. To measure the pressure inside of intake manifold, MAFS is used at idle and MAPS is required at accelerating. MAPS(Manifold Absolute Pressure) calculates the amount of air indirectly as measuring the pressure inside of intake manifold. This mechanism is alsl called Speed-Density Type.
MAPS transfers analog output signal which is proportional to the change of intake manifold pressure, then, with this signal and RPM, PCM calculates the amount of intake air flow.
MAPS is mounted on surge tank to measure the pressure inside of intake manifold, and it consists of a piezo electric element and hybrid IC which amplifies output signal from the element. A piezo electric element is a sort of a diaphragm using piezo electric effect. One side of the diaphragm is surrounded with vacuum chamber while intake pressure is applied to the other side. Thus, signals are output by the transformation of diagphragm according to the change of pressure inside of intake manifold.

DTC DESCRIPTION

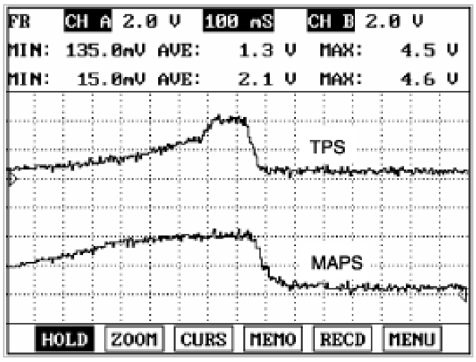
Checking output signals of MAPS every 5 sec. under detecting condition, if an output signal is below 0.25V for more than 2.5 sec., PCM sets P0107. Warning lamp turns on when the malfunction lasts till continuous 2 driving cycle.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible cause
DTC Strategy		• This code detects a continuous short to low or open in either the signal circuit or the MAP	• Connecting condition • Open or short to ground in power circuit • Open or short to ground in signal circuit • MAPS
Enable Conditions	Case 1	• No TPS Active Fault Present • Ignition Voltage ≥ 11V • Engine Speed ≤ 1000rpm • Throttle Position ≥ 0%	
	Case 2	• No TPS Active Fault Present • Ignition Voltage ≥ 11V • Engine Speed >1000rpm • Throttle Position ≥ 30%	

Threshold value	• MAP Signal < 0.25V	• PCM
Diagnosis Time	• Contineous (More than 2.5 seconds failure for every 5 seconds test)	
MIL On Condition	• 2 Driving Cycle	

SIGNAL WAVEFORM AND DATA

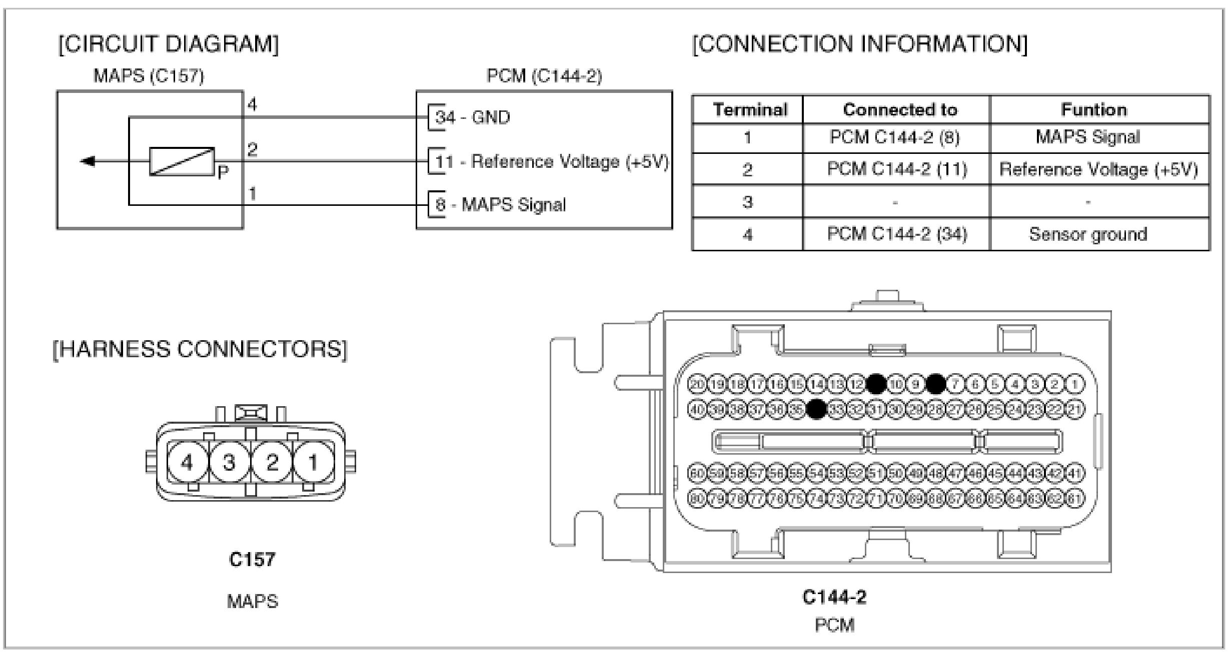


Comparing MAPS and TPS, The signals of MAPS and TPS increasess and decrease simultaneously.

SPECIFICATION

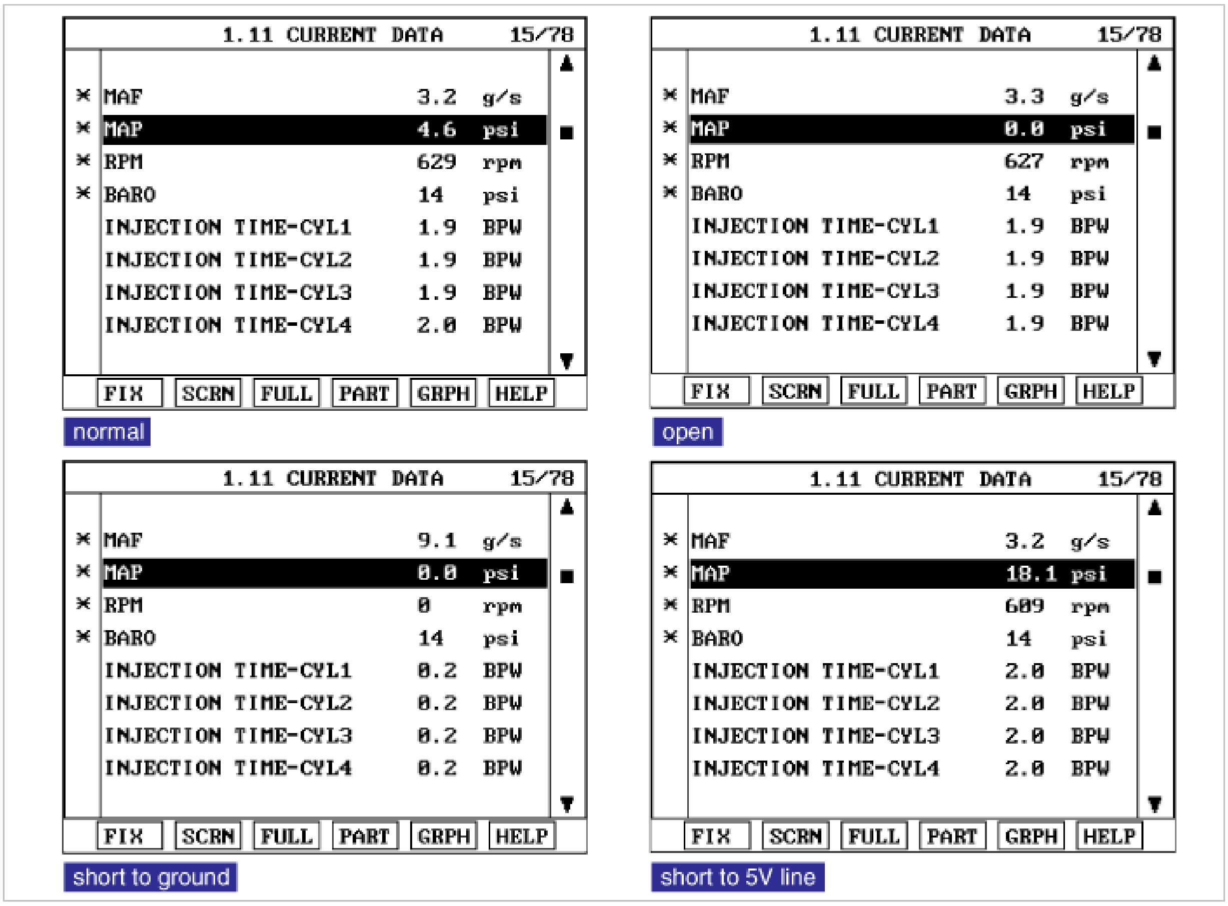
Pressure (kPa)	20	35	60	95	101.32
Voltage (V)	0.789	1.382	2.369	3.75	4
Tolerance (V)	± 0.045				

SCHEMATIC DIAGRAM



MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Cable (DLC)
2. Warm up engine to normal operating temperature
3. Monitor "MAPS" parameter on the scantool.



4. Is the current data displayed correctly ?

YES

▸ Fault is intermittently caused by poor contact in the sensor and/or PCM connector or non cleared PCM memory after repair. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace if necessary and go to "Verification of vehicle Repair" .

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure

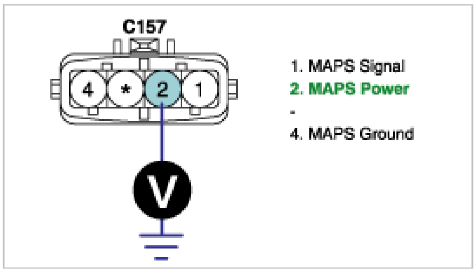
NO

▸ Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION

1. IG "OFF"
2. Disconnect MAPS connector.
3. IG "ON"
4. Measure the voltage between terminal 2 of MAPS harness connector and ground.

Specification : Approx. 5V



5. Is the measured voltage within specification ?

YES

▶ Go to "Signal Circuit Inspection" of MAPS.

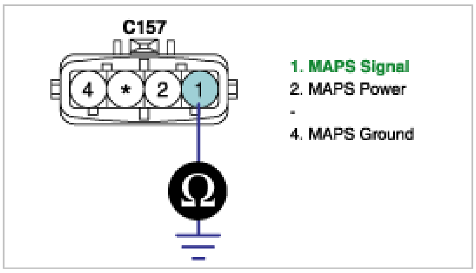
NO

▶ After repairing open or short to ground in circuits and go to "Verification of Vehicle Repair"

SIGNAL CIRCUIT INSPECTION

1. Check short to ground in harness.
   (1) IG "OFF"
   (2) Disconnect MAPS and PCM connector.
   (3) Measure the resistance between terminal 1 of MAPS harness connector and ground.

   Specification : Infinite



   (4) Is the measured resistance within the specification?

   YES

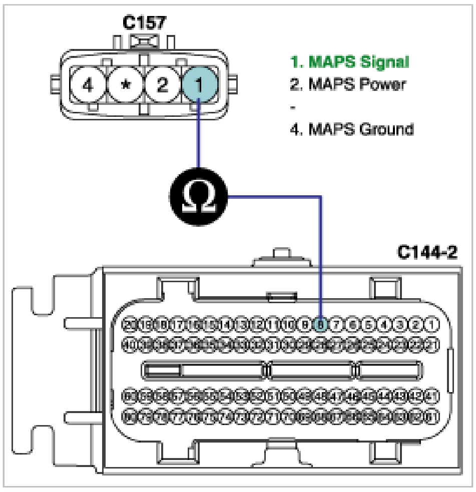
   ▶ Go to "Check open in the harness" procedure.

   NO

   ▶ After repairing short to ground in harness and go to "Verification of Vehicle Repair"

2. Check open in the harness
   (1) IG "OFF"
   (2) Disconnect MAPS and PCM connector.
   (3) Measure the resistance between terminal 1 of MAPS harness connector and terminal 8 of PCM harness connector

   Specification : Approx. below 1 Ω



(4) Is the measured resistance within the specification?

YES

▸ Go to "Component Inspection" procedure.

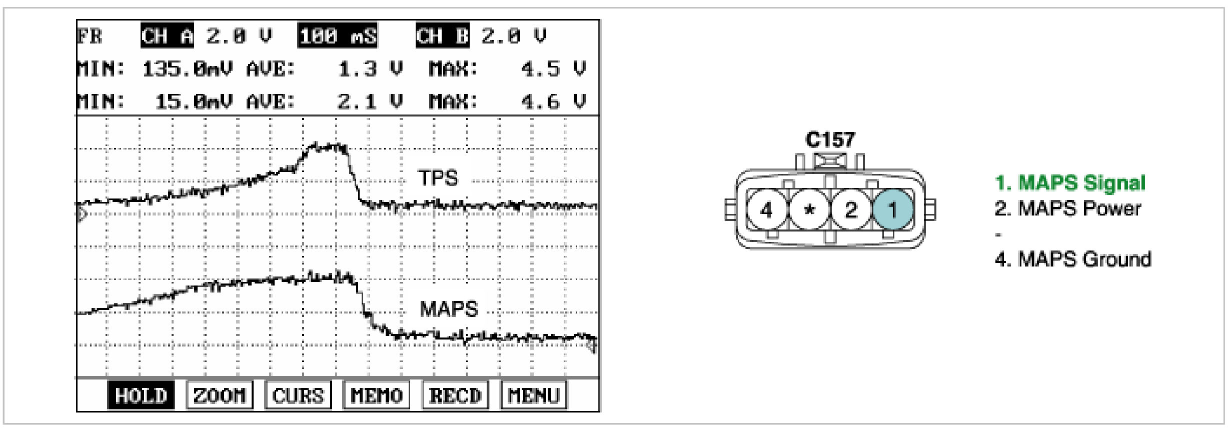
NO

▸ Repair open in the harness and go to "Verification of Vehicle Repair".

COMPONENT INSPECTION

1. MAPS performance test
   (1) IG "OFF"
   (2) Connect scantool to Data Link Connector(DLC) and selest "Oscilloscope" then, connect probes to output signal lines of MAPS and TPS.Turn engine "ON" and monitor the waveforms accelerating or decelerating
   (3) ENG "ON" and monitor signal waveform during accelleration and decelleration.
   Specificaton :

Pressure (kPa)	20	35	60	95	101.32
Voltage (V)	0.789	1.382	2.369	3.75	4
Tolerance (V)	± 0.045				



   (4) Is the waveform displayed correctly?(Compare the response time of TPS and MAPS)

YES

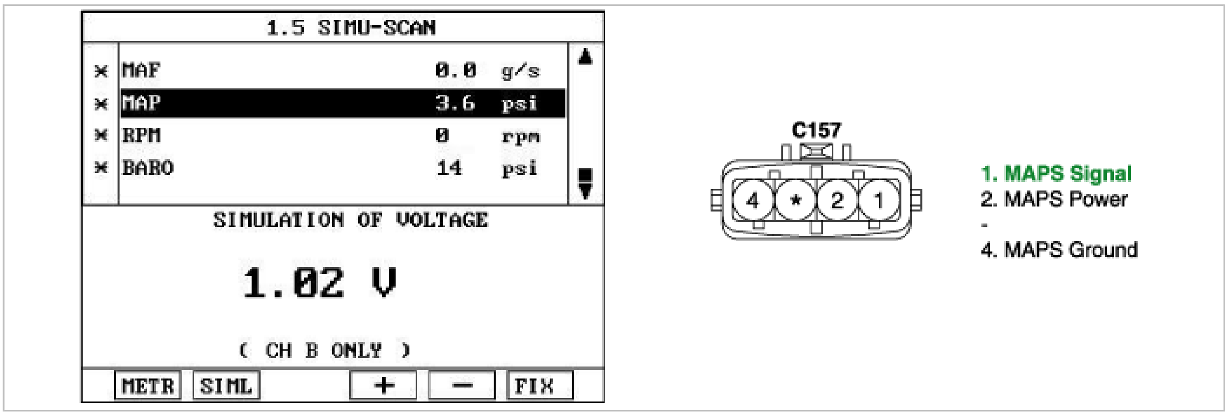
▸ Go to "Check PCM".

NO

▸ After replacing MAPS with new one, if it operates normally, replace MAPS and go to "Verification of Vehicle Repair".

2. Check PCM
   (1) IG "OFF" disconnect MAPS connector
   (2) Connect Scantool and IG "ON" & ENG "OFF"
   (3) Select simulation function on scantool.

(4) Simulate voltage at terminal 1 of MAPS harness connector.



(5) Does the output voltage response to the change of signal by simulation?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

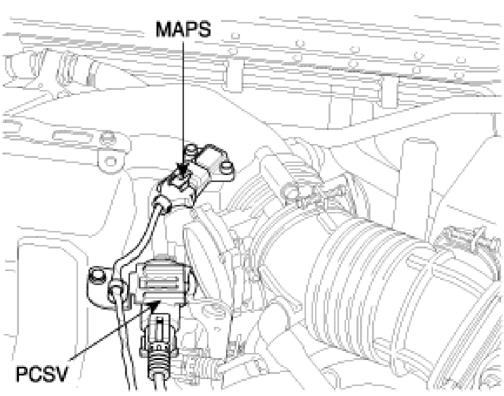
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0108

COMPONENT LOCATION



GENERAL DESCRIPTION

The amount of intake air flow must be inputted to PCM in order to determine the fuel injection quantity. To measure the pressure inside of intake manifold, MAFS is used at idle and MAPS is required at accelerating. MAPS(Manifold Absolute Pressure) calculates the amount of air indirectly as measuring the pressure inside of intake manifold. This mechanism is alsl called Speed-Density Type.
MAPS transfers analog output signal which is proportional to the change of intake manifold pressure, then, with this signal and RPM, PCM calculates the amount of intake air flow.
MAPS is mounted on surge tank to measure the pressure inside of intake manifold, and it consists of a piezo electric element and hybrid IC which amplifies output signal from the element. A piezo electric element is a sort of a diaphragm using piezo electric effect. One side of the diaphragm is surrounded with vacuum chamber while intake pressure is applied to the other side. Thus, signals are output by the transformation of diagphragm according to the change of pressure inside of intake manifold.

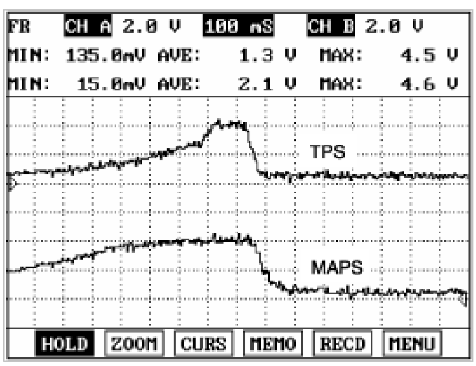
DTC DESCRIPTION

Checking output signals of MAPS every 5 sec. under detecting condition, if an output signal is above 4.5V for more than 2.5 sec., PCM sets P0108. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

<table>
<tr><th colspan="2">Item</th><th>Detecting Condition</th><th>Possible cause</th></tr>
<tr><td colspan="2">DTC Strategy</td><td>• This code detects a continuous short to high in either the signal circuit or the MAP sensor</td><td rowspan="7">• Connecting condition
• Short in Signal Circuit
• Open in Ground Circuit
• Faulty MAPS
• Faulty PCM</td></tr>
<tr><td rowspan="2">Enable Conditions</td><td>Case 1</td><td>• No TPS Active Fault Present
• Engine Running Time >10sec.
• Engine Speed ≤ 2500rpm
• Throttle Position ≤ 30%</td></tr>
<tr><td>Case 2</td><td>• No TPS Active Fault Present
• Engine Running Time >10sec.
• Engine Speed >2500rpm
• Throttle Position ≤ 40%</td></tr>
<tr><td colspan="2">Threshold value</td><td>• MAP Signal >4.5V</td></tr>
<tr><td colspan="2">Diagnosis Time</td><td>• Contineous
(More than 2.5 seconds failure for every 5 seconds test)</td></tr>
<tr><td colspan="2">MIL On Condition</td><td>• 2 Driving Cycle</td></tr>
</table>

SIGNAL WAVEFORM AND DATA



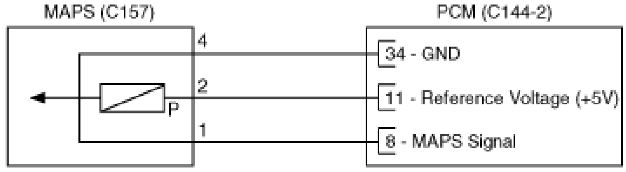
Comparing MAPS and TPS, The signals of MAPS and TPS increasess and decrease simultaneously.

SPECIFICATION

Pressure (kPa)	20	35	60	95	101.32
Voltage (V)	0.789	1.382	2.369	3.75	4
Tolerance (V)	± 0.045				

SCHEMATIC DIAGRAM

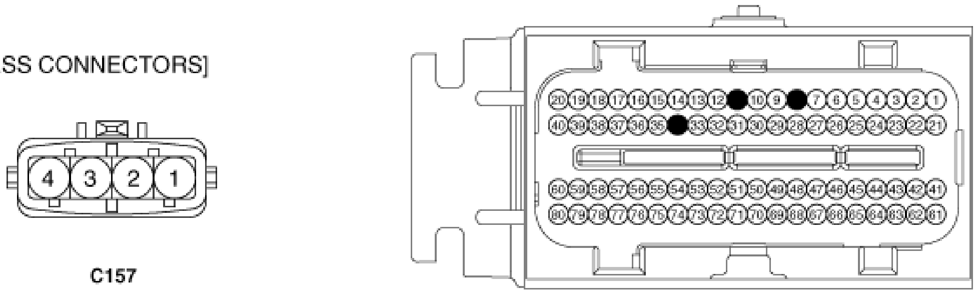
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Funtion
1	PCM C144-2 (8)	MAPS Signal
2	PCM C144-2 (11)	Reference Voltage (+5V)
3	-	-
4	PCM C144-2 (34)	Sensor ground

[HARNESS CONNECTORS]



C157

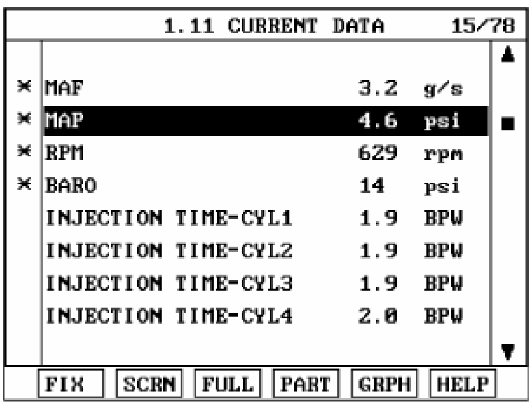
MAPS

C144-2

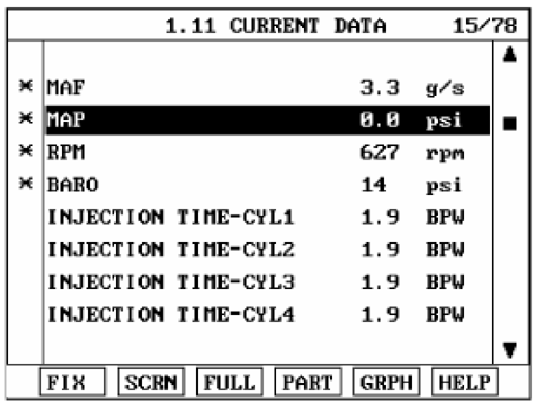
PCM

MONITOR SCANTOOL DATA

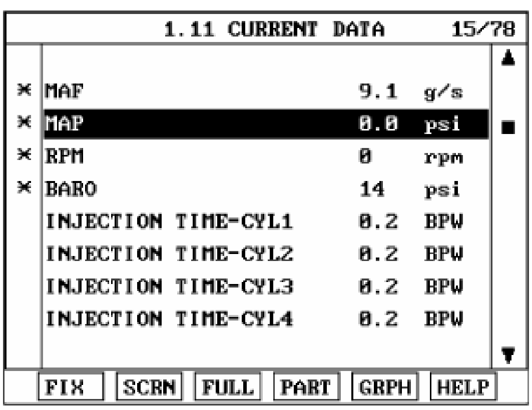
1. Connect scantool to Data Link Cable (DLC)
2. Warm up engine to normal operating temperature
3. Monitor "MAPS" parameter on the scantool.



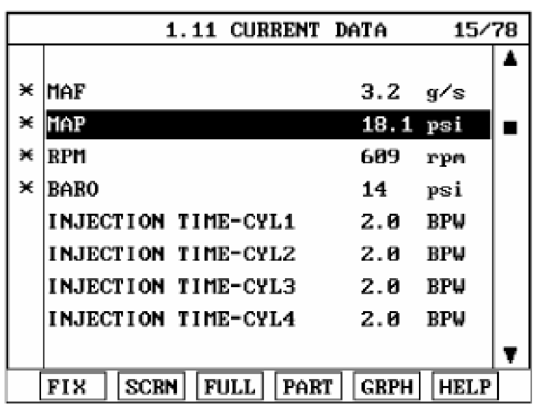
normal



open



short to ground



short to 5V line

4. Is the current data displayed correctly ?

YES

▸ Fault is intermittently caused by poor contact in the sensor and/or PCM connector or non cleared PCM memory after repair. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace if necessary and go to "Verification of vehicle Repair" .

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found ?

YES

▸ Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure

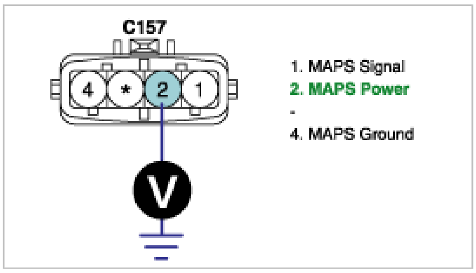
NO

▸ Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION

1. IG "OFF"
2. Disconnect MAPS connector
3. IG "ON"
4. Measure the voltage between terminal 2 of MAPS harness connector and ground.

Specification : Approx. 5V



5. Is the measured voltage within specification ?

YES

▸ Go to "Ground Circuit Inspection" procedure.

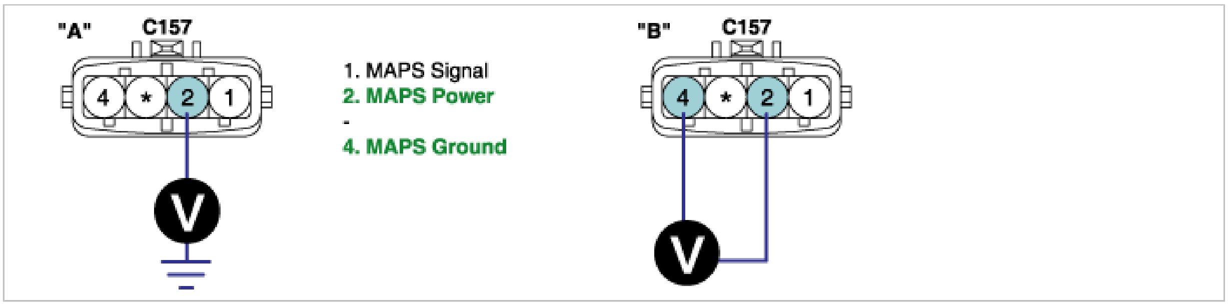
NO

▸ If the voltage is over 5.1V, check short to battery in harness.
▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF".
2. Disconnect MAPS connector.
3. IG "ON" & ENG "OFF"
4. Measure the voltage between terminal 2 of MAPS harness connector and chassis ground.
5. Measure the voltage between terminal 2 and 4 of MAPS harness connector.

Specification : "A" - "B" = : Approx. below 200mV



6. Is the measured voltage within specification ?

YES

▸ Go to "Signal Circuit Inspection" procedure.

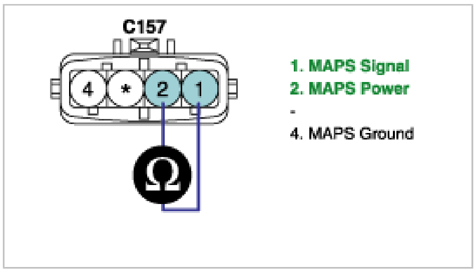
NO

▸ Repair contact reistance or open in harness and then go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. IG "OFF"
2. Disconnect MAPS and PCM connector.
3. Measure resistance between terminal 1 and 2 of MAPS harness connector.

Specification : Infinite



4. Is the measured resistance within specification ?

YES

▸ Go to "Component Inspection" procedure.

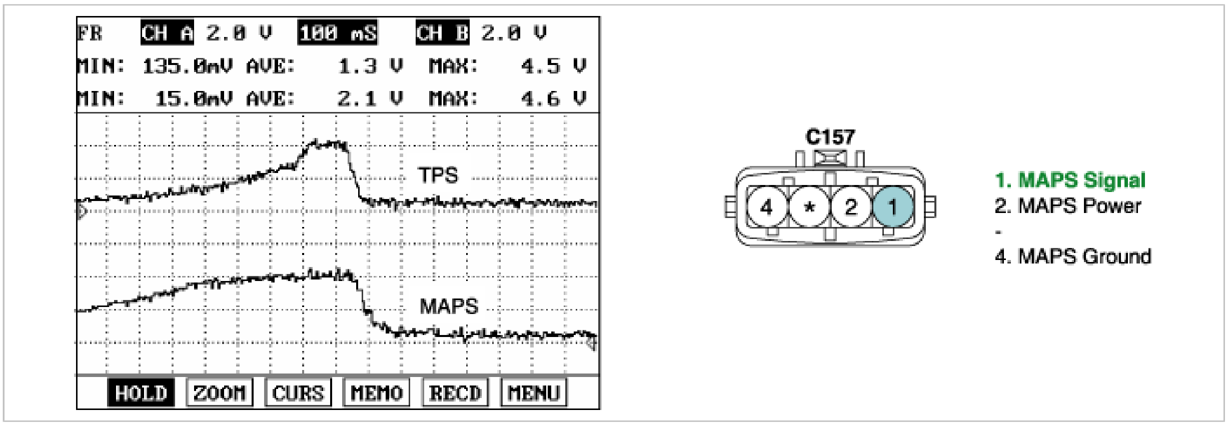
NO

▸ Repair contact reistance or open in harness and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. MAPS performance test
   (1) IG "OFF"
   (2) Connect scantool to Data Link Connector(DLC) and selest "Oscilloscope" then, connect probes to output signal lines of MAPS and TPS.Turn engine "ON" and monitor the waveforms accelerating or decelerating
   (3) ENG "ON" and monitor signal waveform during accelleration and decelleration.
   Specificaton :

Pressure (kPa)	20	35	60	95	101.32
Voltage (V)	0.789	1.382	2.369	3.75	4
Tolerance (V)	± 0.045				



   (4) Is the waveform displayed correctly?(Compare the response time of TPS and MAPS)

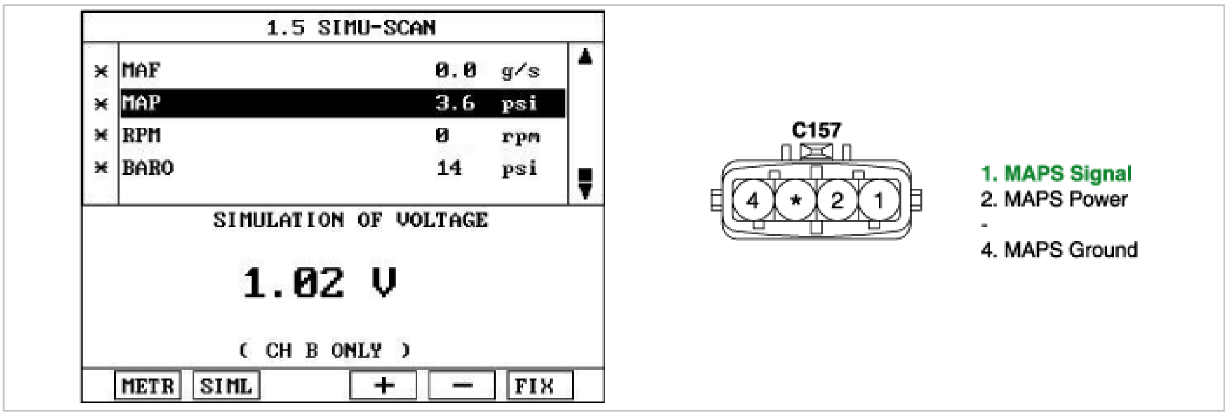
YES

▸ Go to "Check PCM".

NO

▸ After replacing MAPS with new one, if it operates normally, replace MAPS and go to "Verification of Vehicle Repair".

2. Check PCM
   (1) IG "OFF" disconnect MAPS connector
   (2) Connect Scantool and IG "ON" & ENG "OFF"
   (3) Select simulation function on scantool.
   (4) Simulate voltage at terminal 1 of MAPS harness connector.



   (5) Does the output voltage response to the change of signal by simulation?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

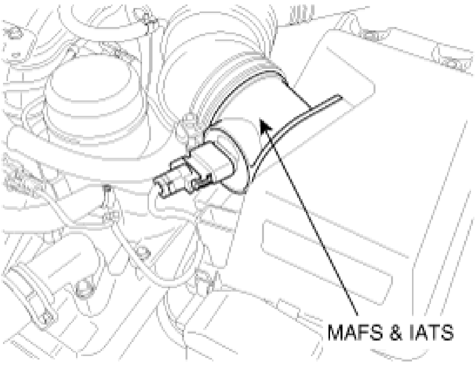
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0110

COMPONENT LOCATION



GENERAL DESCRIPTION

The Intake Air Temperature (IAT) sensor measures the temperature of engine intake air. The Intake Air Temperature (IAT) sensor is a thermistor (a variable resistor that changes along with outside air temperature) in series with a fixed resistor in the PCM. The PCM applies 5volts to the IAT sensor. The PCM monitors the voltage across the IAT sensor and converts it into a temperature reading. When the outside air temperature is cold the IAT sensor resistance is high, and when the outside air temperature is warm the IAT sensor resistance is low. Therefore, when the air temperature is cold the PCM will receive a high voltage input, and when the air temperature is warm the PCM will receive a low voltage input. The signal from IAT sensor is used for injection time correction (Cold post start correction), ignition angle correction(Air temperature correction) and idle speed correction(Air-density correction).

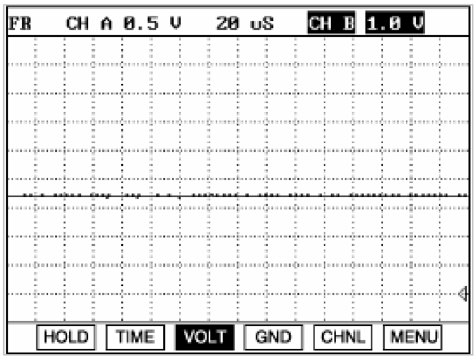
DTC DESCRIPTION

This test has two parts – the Stuck Start Test and the Stuck Drive test. The logic checks for movements in the IAT by comparing the min and max IAT values. If a sufficient difference is present, both parts of the test declare a PASS. Otherwise, the startup portion of the stuck test sets a “sensor stuck” flag and increments a counter while monitoring the min and max IAT. If the stuck condition persists, the counter eventually reaches its’ threshold and the startup test completes with the sensorstuck flag set.
If a PASS is not declared as mentioned above, the Drive portion of the stuck test also sets a “sensor stuck” flag and then checks for enough engine load to be present and if it is, it increments a counter. If the stuck condition persists and the engine continues to experience at least the minimum load, the counter eventually reaches its threshold indicating that enough engine heating as well as airflow introduction has taken place and sets a drive conditions complete flag. It then waits for the engine to return to idle. Once at idle, an idle counter is incremented until it reaches its threshold (as long as the stuck conditions persists). This completes the drive test and also the entire Stuck Test.
PCM monitors difference MAX. and MIN IATS in order to detect movement in IATS therough Start Test and Drive Test while enable condition is met. If PCM detects intake air temperature does not change PCM determines that a fault exists and a DTC is stored.
MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible cause
DTC Strategy	Case 1	• Start Test: Monitors the difference between max and min IAT in order to detect movement in IAT for a certain time.	• Poor connection • Open or short in harness • IATS • PCM
	Case 2	• Drive test: Performs the max and min delta check while driving under load for a length of time followed by an idle for a certain time.	
Enable Conditions		• Engine soaked time > 480min • Engine Running State • No disabling fault present • IAT stored previous trip • No IAT Tests pending	
Thresh old value	Case 1	• Max IAT - Min IAT ≤ 1°C • Start Test Counter ≥ 120	
	Case 2	• Max IAT - Min IAT ≤ 1°C • Idle Test Counter ≥ 120	
MIL On Condition		• 2 driving Cycles	

SIGNAL WAVEFORM AND DATA

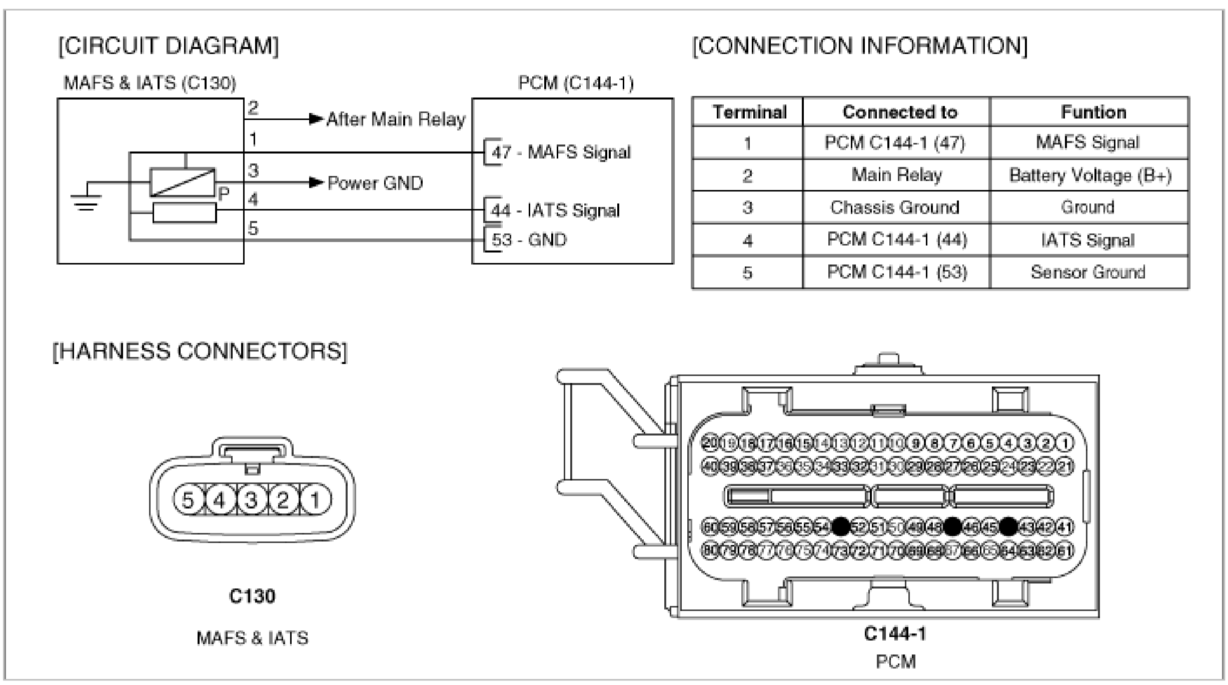


The output signals of IATS & ECTS change smoothly without any rapid changes. Those have almost same characteristic signal during the early period after start. It means that the temperatures of intake air and engine coolant are depended on the temperature of atmosphere. Meanwhile, during the warming up, the output signal of ECTS is going up increasingly. but, the output signal of IATS changes a little bit. even it may not change almost. It means that the heat of engine does not affect on the temperature of intake air.

SPECIFICATION

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	95.95 ~ 105.78	20(68)	3.42 ~ 3.61
-20(-4)	27.4 ~ 29.77	40(104)	1.43 ~ 1.5
0(32)	9.08 ~ 9.72	60(140)	0.66 ~ 0.69
10(50)	5.49 ~ 5.83	80(176)	0.33 ~ 0.34

SCHEMATIC DIAGRAM



Terminal	Connected to	Funtion
1	PCM C144-1 (47)	MAFS Signal
2	Main Relay	Battery Voltage (B+)
3	Chassis Ground	Ground
4	PCM C144-1 (44)	IATS Signal
5	PCM C144-1 (53)	Sensor Ground

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "IATS" item on the service data.

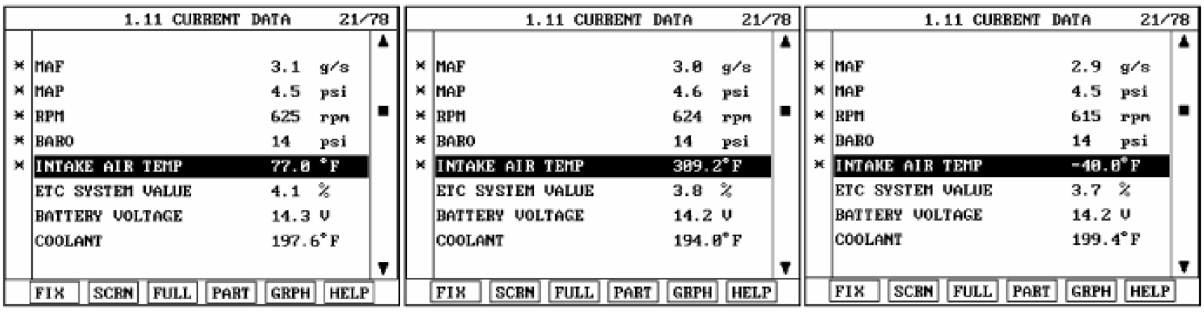


Fig. 1 Fig. 2 Fig. 3

Fig. 1 : Open at idle
Fig. 2 : Short to ground
Fig. 3 : Short to battery

4. Is the "IATS" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found ?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

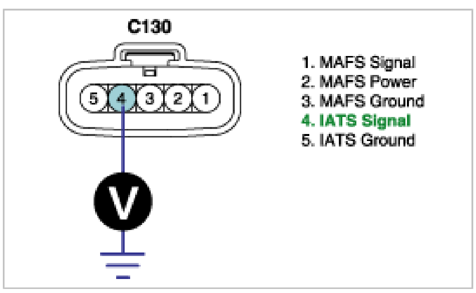
NO

▸ Go to " Signal Circuit Inspection " procedure.

SIGNAL CIRCUIT INSPECTION

1. IG "OFF" and disconnect IATS connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 4 of IATS harness connector and chassis ground.

Specification : Approx. 5V



4. Is the measured voltage within specification ?

YES

▸ Check short to battery in harness.
▸ If O.K, go to "Ground Circuit Inspection" procedure.
▸ If N.G, repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

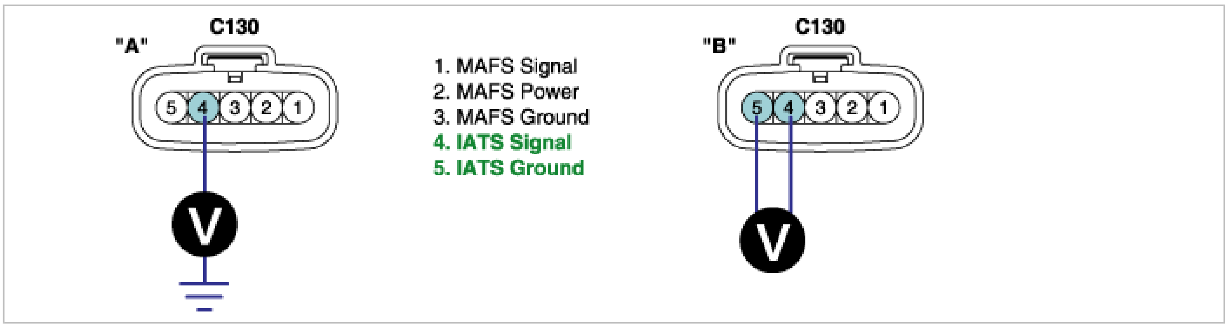
NO

▸ Repair open or short to ground in harness and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF" and disconnect IATS connector.
2. Measure voltage terminal 4 of IATS harness connector and chassis ground.
3. Measure voltage terminal 4 and 5 of IATS harness connector.

Specification : Voltage difference between measurement "A" and "B" is below 200mV.



4. Is the measured voltage within specification ?

YES

▸ Go to "Component Inspection" procedure.

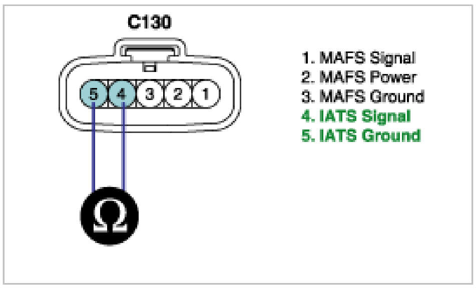
NO

▸ Repair contact resistance or open in harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check resistance of IATS
   (1) IG "OFF" and disconnect IATS connector.
   (2) Measure resistance between terminal 4 and 5 of IATS connector.(Component Side)
   Specificaton :

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	95.95 ~ 105.78	20(68)	3.42 ~ 3.61
-20(-4)	27.4 ~ 29.77	40(104)	1.43 ~ 1.5
0(32)	9.08 ~ 9.72	60(140)	0.66 ~ 0.69
10(50)	5.49 ~ 5.83	80(176)	0.33 ~ 0.34



   (3) Is the measured resistance within specification ?

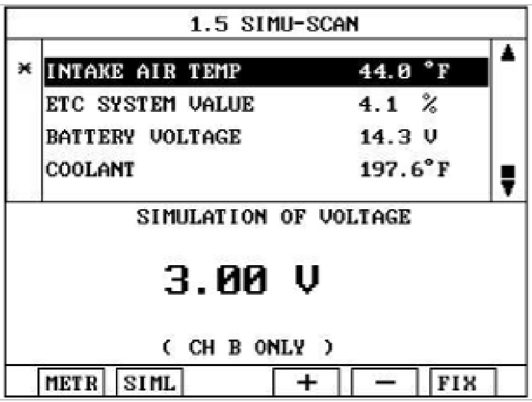
YES

▸ Go to "Check PCM" as follows.

NO

▸ Substitute with a known - good IATS and check for proper operation. If the problem is corrected, replace IATS and go to "Verification of Vehicle Repair" procedure.

2. Check PCM
   (1) IG "OFF" and connect scantool.
   (2) Disconnect IATS connector and connect probe to terminal 4 of IATS harness connector.
   (3) IG "ON" and ENG "OFF" and simulation Function on scantool.
   (4) Simulate voltage at terminal 4 of IATS harness connector.



(5) Does the signal value of IAT sensor change according to simulation voltage ?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

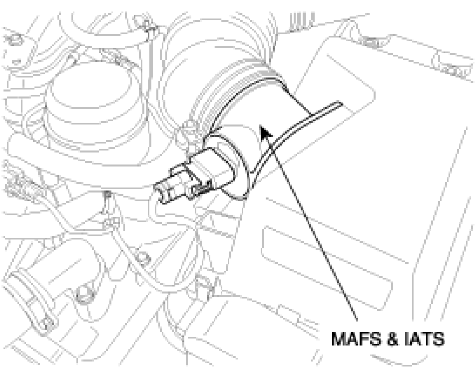
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0111

COMPONENT LOCATION



GENERAL DESCRIPTION

The Intake Air Temperature (IAT) sensor measures the temperature of engine intake air. The Intake Air Temperature (IAT) sensor is a thermistor (a variable resistor that changes along with outside air temperature) in series with a fixed resistor in the PCM. The

PCM applies 5volts to the IAT sensor. The PCM monitors the voltage across the IAT sensor and converts it into a temperature reading. When the outside air temperature is cold the IAT sensor resistance is high, and when the outside air temperature is warm the IAT sensor resistance is low. Therefore, when the air temperature is cold the PCM will receive a high voltage input, and when the air temperature is warm the PCM will receive a low voltage input. The signal from IAT sensor is used for injection time correction (Cold post start correction), ignition angle correction(Air temperature correction) and idle speed correction(Air-density correction).

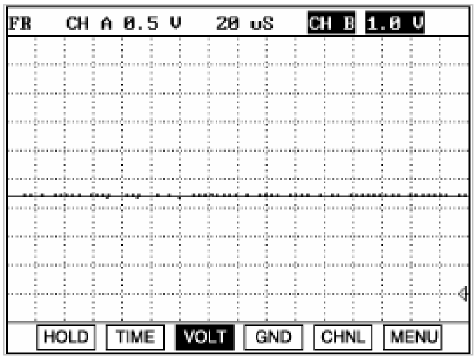
DTC DESCRIPTION

Determine if the IAT sensor reading is skewed high or low. As in the stuck test, the IAT sensor is exposed to conditions such as ample airflow introduction and engine heating that enhance the possibility of ambient temperature change. That helps the diagnostic in its' analysis
A skewed condition is suspected only if the IAT at startup differs from the coolant temperature by a minimum threshold on either the high or the low side. If it does not, the skew test declares a PASS.Otherwise, if IAT & ECT and the coolant temperature is greater than an allowed minimum, the Skew Low Test is executed. This test checks for enough engine load to be present and introduces a delay as long as the skewed condition persists. This allows sufficient airflow introduction and engine heating, and also allows time for the IAT reading to stabilize. If at any time during this delay the absolute difference between the startup and current IAT exceeds a maximum allowed value (drift check), no reporting is done and the test is disabled (case of vehicle being driven out of a heated garage in to a colder ambience, etc.). Otherwise, once the delay period is over, a fail counter isincremented and as it reaches its threshold, the low test completes and indicates a failure.On the other hand if a passing condition is not present and IAT & ECT, the Skew High Test is called. This test checks for enough engine load to be present and introduces a delay as long as the skewed condition persists. This allows sufficient airflow introduction and engine heating and also allows time for the IAT reading to stabilize. If at any time during this delay the absolute difference between the startup and current IAT exceeds a maximum allowed value (drift check), no reporting is done and the test is disabled (case of vehicle being driven out of an air conditioned garage into a warmer ambience, etc.). Once the delay period is over and the IAT is greater than a minimum threshold, a fail counter is incremented and as it reaches its threshold, the high test completes and indicates a failure. But if the IAT is less than this threshold, no reporting is done and test is disabled (again protection against case of vehicle being driven out of an air conditioned garage into a warmer ambience and setting a false MIL).
PCM monitors difference MAX. and MIN IATS in order to detect movement in IATS therough Start Test and Drive Test while enable condition is met. If PCM detects intake air temperature does not change PCM determines that a fault exists and a DTC is stored. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

DTC DETECTING CONDITION

Item		Detection condition	Possible cause
DTC Strategy	Case 1	• Skew Low Test: Monitors the difference between the startup coolant and IAT values	• Poor Connection • Open or short in harness • IATS • PCM
	Case 2	• Skew High Test: Monitors the difference between the startup IAT and coolant values	
EnableConditions	Case 1	• Engine soaked time ≥ 480min • Engine running state • No disabling faults present • IAT stored previous trip • IAT Skewed Test Not Complete • Startup Coolant Temperature >-20°C • Airflow >15 g/s • Vehicle speed >40kph	
	Case 2	• Engine soaked time ≥ 480min • Engine running state • No disabling faults present • IAT stored previous trip • IAT Skewed Test Not Complete • Airflow >15 g/s • Vehicle speed >40kph	
Thresh old value	Case 1	• Startup Coolant - Startup IAT ≥ 30°C	
	Case 2	• Startup IAT - Startup Coolant ≥ 20°C	
Diagnosis Time		• Continuous (More than 1.25 second failure)	
MIL On Condition		• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA



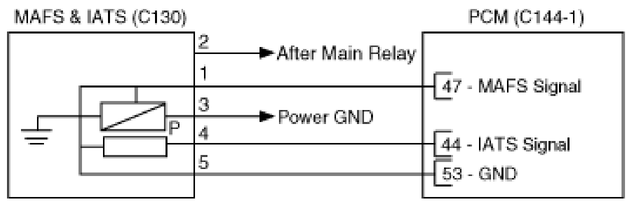
The output signals of IATS & ECTS change smoothly without any rapid changes. Those have almost same characteristic signal during the early period after start. It means that the temperatures of intake air and engine coolant are depended on the temperature of atmosphere. Meanwhile, during the warming up, the output signal of ECTS is going up increasingly. but, the output signal of IATS changes a little bit. even it may not change almost. It means that the heat of engine does not affect on the temperature of intake air.

SPECIFICATION

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	95.95 ~ 105.78	20(68)	3.42 ~ 3.61
-20(-4)	27.4 ~ 29.77	40(104)	1.43 ~ 1.5
0(32)	9.08 ~ 9.72	60(140)	0.66 ~ 0.69
10(50)	5.49 ~ 5.83	80(176)	0.33 ~ 0.34

SCHEMATIC DIAGRAM

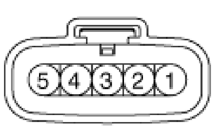
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

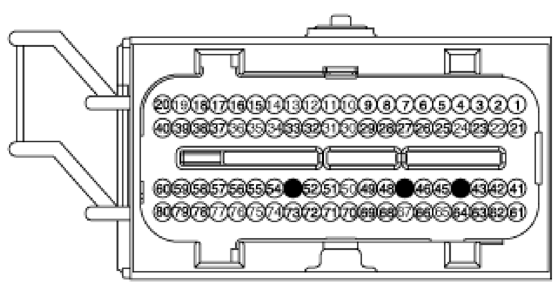
Terminal	Connected to	Funtion
1	PCM C144-1 (47)	MAFS Signal
2	Main Relay	Battery Voltage (B+)
3	Chassis Ground	Ground
4	PCM C144-1 (44)	IATS Signal
5	PCM C144-1 (53)	Sensor Ground

[HARNESS CONNECTORS]



C130

MAFS & IATS



C144-1

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "IATS" item on the service data.

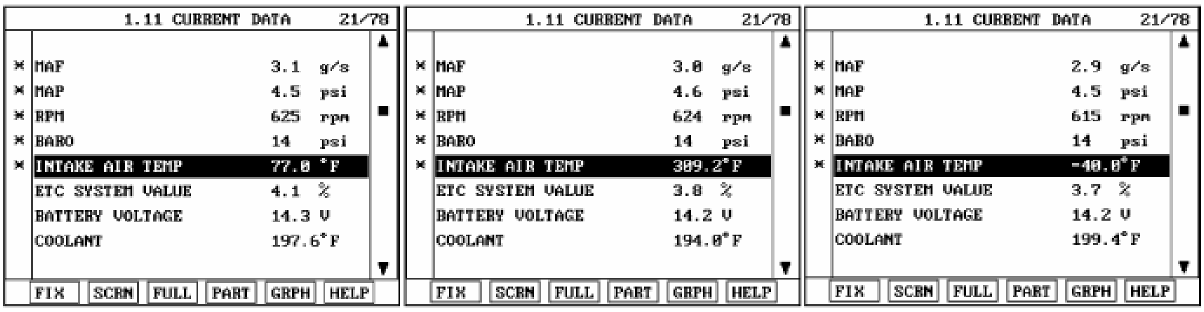


Fig. 1 Fig. 2 Fig. 3

Fig. 1 : Open at idle
Fig. 2 : Short to ground
Fig. 3 : Short to battery

4. Is the "IATS" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal & Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found ?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

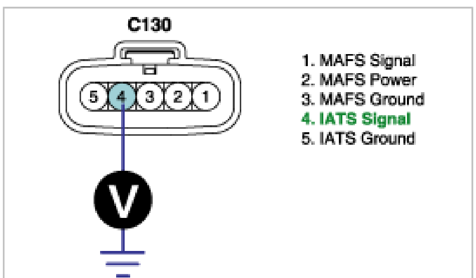
NO

▸ Go to "Terminaal and connector inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. IG "OFF" and disconnect IATS connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 4 of IATS harness connector and chassis ground.

Specification : Approx. 5V



4. Is the measured voltage within specification ?

YES

▸ Check short to battery in harness.
▸ If O.K, go to "Ground Circuit Inspection" procedure.
▸ If N.G, repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

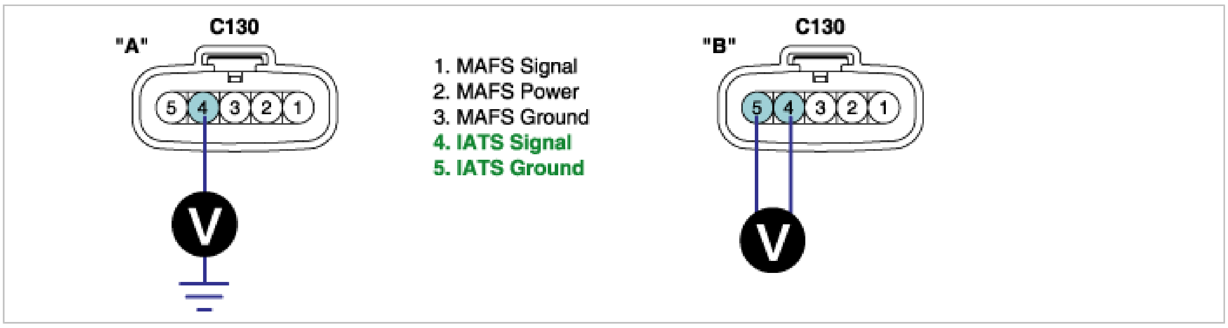
NO

▸ Repair open or short to ground in harness and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF" and disconnect IATS connector.
2. Measure voltage terminal 4 of IATS harness connector and chassis ground.
3. Measure voltage terminal 4 and 5 of IATS harness connector.

Specification : Voltage difference between measurement "A" and "B" is below 200mV.



4. Is the measured voltage within specification ?

YES

▸ Go to "Component Inspection" procedure.

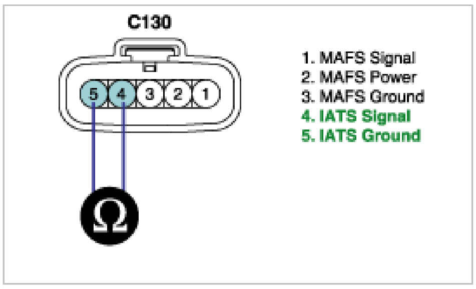
NO

▸ Repair contact resistance or open in harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check resistance of IATS
   (1) IG "OFF" and disconnect IATS connector.
   (2) Measure resistance between terminal 4 and 5 of IATS connector.(Component Side)
   Specificaton :

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	95.95 ~ 105.78	20(68)	3.42 ~ 3.61
-20(-4)	27.4 ~ 29.77	40(104)	1.43 ~ 1.5
0(32)	9.08 ~ 9.72	60(140)	0.66 ~ 0.69
10(50)	5.49 ~ 5.83	80(176)	0.33 ~ 0.34



   (3) Is the measured resistance within specification ?

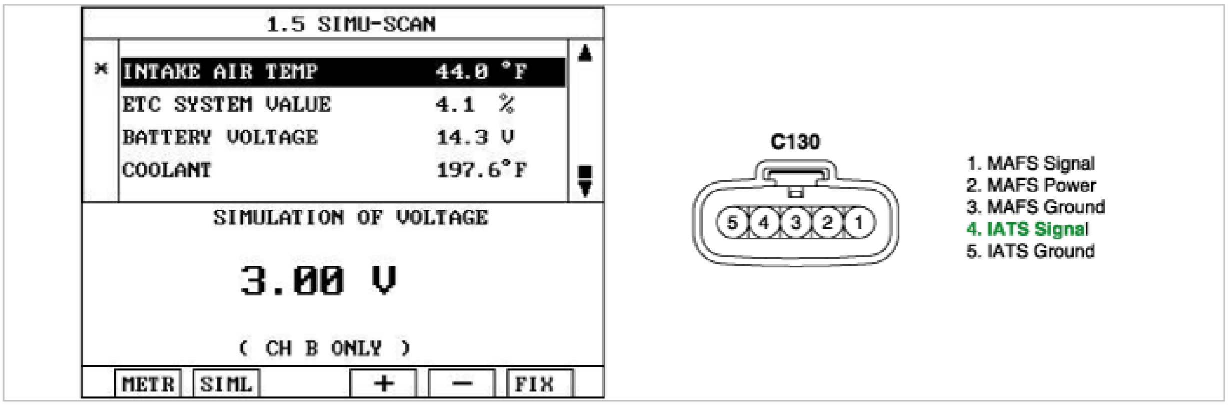
YES

▸ Go to "Check PCM" as follows.

NO

▸ Substitute with a known - good IATS and check for proper operation. If the problem is corrected, replace IATS and go to "Verification of Vehicle Repair" procedure.

2. Check PCM
   (1) IG "OFF" and connect scantool.
   (2) Disconnect IATS connector and connect probe to terminal 4 of IATS harness connector.
   (3) IG "ON" and ENG "OFF" and simulation Function on scantool.
   (4) Simulate voltage at terminal 4 of IATS harness connector.



(5) Does the signal value of IAT sensor change according to simulation voltage ?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

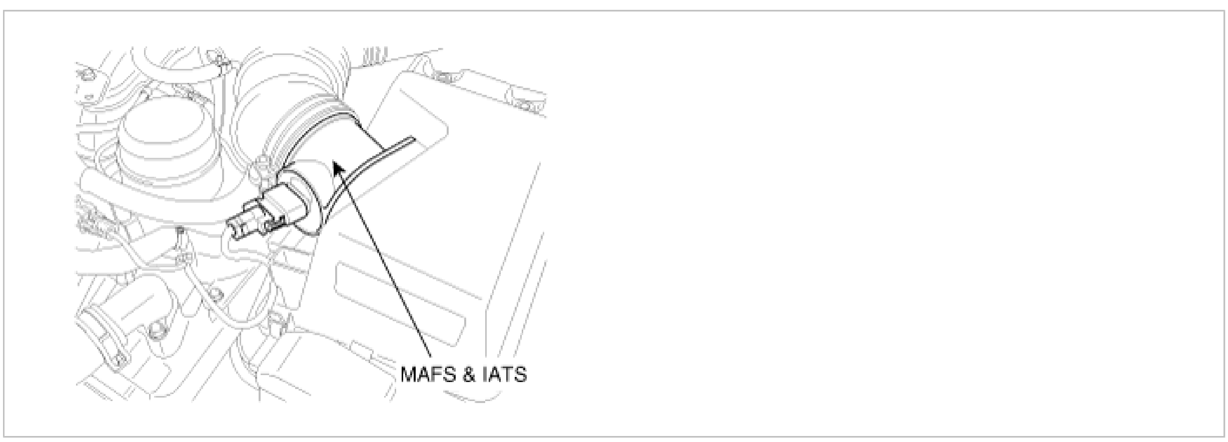
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0112

COMPONENT LOCATION



GENERAL DESCRIPTION

The Intake Air Temperature (IAT) sensor measures the temperature of engine intake air. The Intake Air Temperature (IAT) sensor is a thermistor (a variable resistor that changes along with outside air temperature) in series with a fixed resistor in the PCM. The PCM applies 5volts to the IAT sensor. The PCM monitors the voltage across the IAT sensor and converts it into a temperature reading. When the outside air temperature is cold the IAT sensor resistance is high, and when the outside air temperature is warm the IAT sensor resistance is low. Therefore, when the air temperature is cold the PCM will receive a high voltage input, and when the air temperature is warm the PCM will receive a low voltage input. The signal from IAT sensor is used for injection time correction (Cold post start correction), ignition angle correction(Air temperature correction) and idle speed correction(Air-density correction).

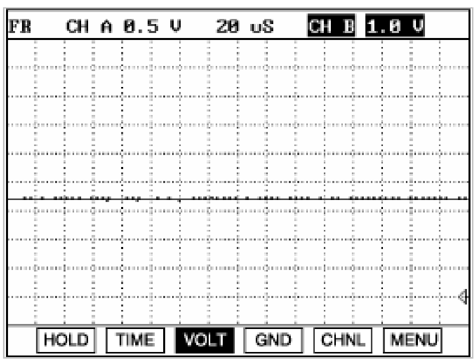
DTC DESCRIPTION

Checking output signals of IATS every 20 sec. under detecting condition, if an ouput signal is below 0.1V for more than 10 sec., PCM sets P0112. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible Cause
DTC Strategy		• This code detects a continuous short to ground in either the signal circuit or the sensor	• Poor connection • Short to ground in harness • IATS • PCM
EnableConditions	Case 1	• Engine running state • No Vehicle speed sensor fault • Vehicle speed >50kph(30mph)	
	Case 2	• Engine running time >120 sec. • Time from IG "OFF" to IG "ON" >360 min.	
Threshold value		• Intake air temperature sensor's voltage< 0.1V	
Diagnosis Time		• Continuous (More than 10 seconds failure for every 20 seconds test)	
MIL On Condition		• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA



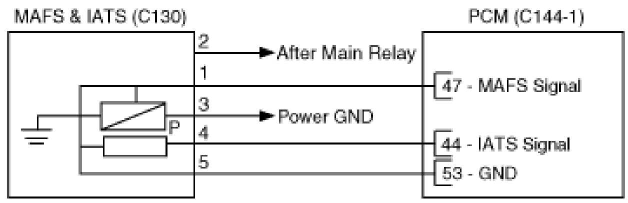
The output signals of IATS & ECTS change smoothly without any rapid changes. Those have almost same characteristic signal during the early period after start. It means that the temperatures of intake air and engine coolant are depended on the temperature of atmosphere. Meanwhile, during the warming up, the output signal of ECTS is going up increasingly. but, the output signal of IATS changes a little bit. even it may not change almost. It means that the heat of engine does not affect on the temperature of intake air.

SPECIFICATION

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	95.95 ~ 105.78	20(68)	3.42 ~ 3.61
-20(-4)	27.4 ~ 29.77	40(104)	1.43 ~ 1.5
0(32)	9.08 ~ 9.72	60(140)	0.66 ~ 0.69
10(50)	5.49 ~ 5.83	80(176)	0.33 ~ 0.34

SCHEMATIC DIAGRAM

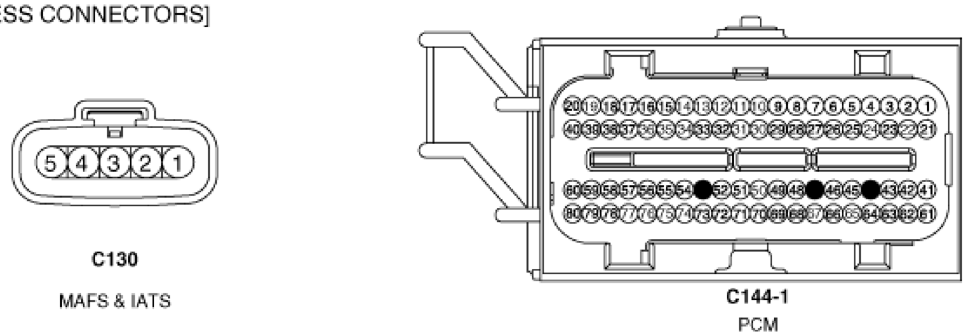
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Funtion
1	PCM C144-1 (47)	MAFS Signal
2	Main Relay	Battery Voltage (B+)
3	Chassis Ground	Ground
4	PCM C144-1 (44)	IATS Signal
5	PCM C144-1 (53)	Sensor Ground

[HARNESS CONNECTORS]



MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "IATS" item on the service data.

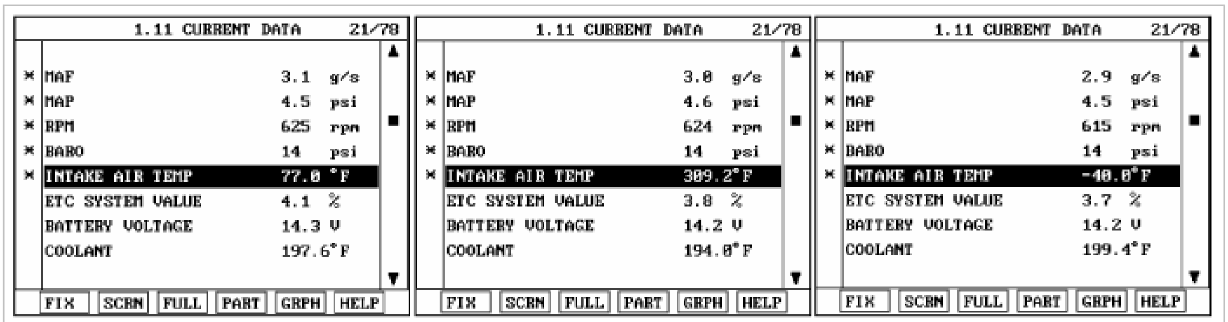


Fig. 1 Fig. 2 Fig. 3

Fig. 1 : Open at idle
Fig. 2 : Short to ground
Fig. 3 : Short to battery

4. Is the "IATS" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

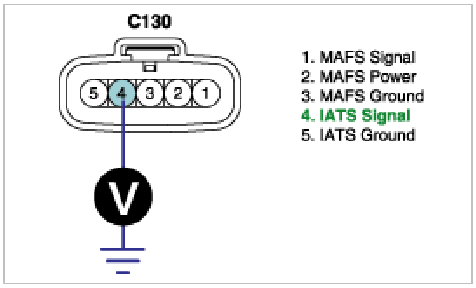
NO

▸ Go to " Signal Circuit Inspection " procedure.

SIGNAL CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF" and disconnect IATS connector.
   (2) IG "ON" and ENG "OFF"
   (3) Measure voltage between terminal 4 of IATS harness connector and chassis ground.

Specification : Approx. 5V



   (4) Is the measured voltage within specification ?

YES

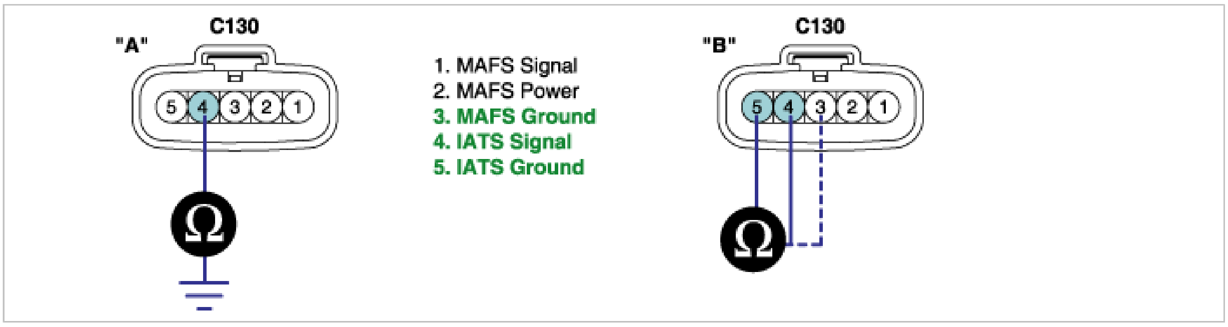
▸ Go to "Component Inspection" procedure.

NO

▸ Go to " Check short to ground in harness" procedure.

2. Check short to ground in harness
   (1) IG "OFF" and disconnect IATS connector and PCM connector.
   (2) Measure resistance between terminal 4 of IATS harness connector and chassis ground.
   (3) Measure resistance between terminals 4 and 5 of IATS harness connector.
   (4) Measure resistance between terminals 4 and 3 of IATS harness connector.

Specification : Infinite



   (5) Is the measured resistance within specification?

YES

▸ Go to "Component inspection" procedure.

NO

▸ Repair short to ground in harness and go to "Verification of Vehicle Repair" procedure.

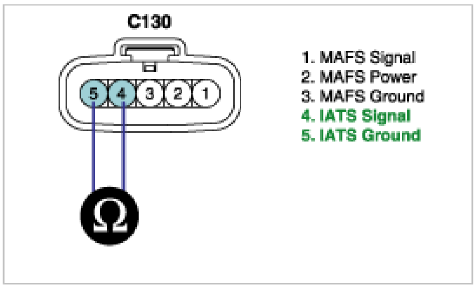
COMPONENT INSPECTION

1. Check IATS
   (1) IG "OFF" and disconnect IATS connector.
   (2) Measure resistance between teminals 4 and 5 of IATS connector.(Component side)

Specificaton :

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	95.95 ~ 105.78	20(68)	3.42 ~ 3.61

-20(-4)	27.4 ~ 29.77	40(104)	1.43 ~ 1.5
0(32)	9.08 ~ 9.72	60(140)	0.66 ~ 0.69
10(50)	5.49 ~ 5.83	80(176)	0.33 ~ 0.34



(3) Is the measured resistance within specification ?

YES

▸ Go to "Check PCM" as follows.

NO

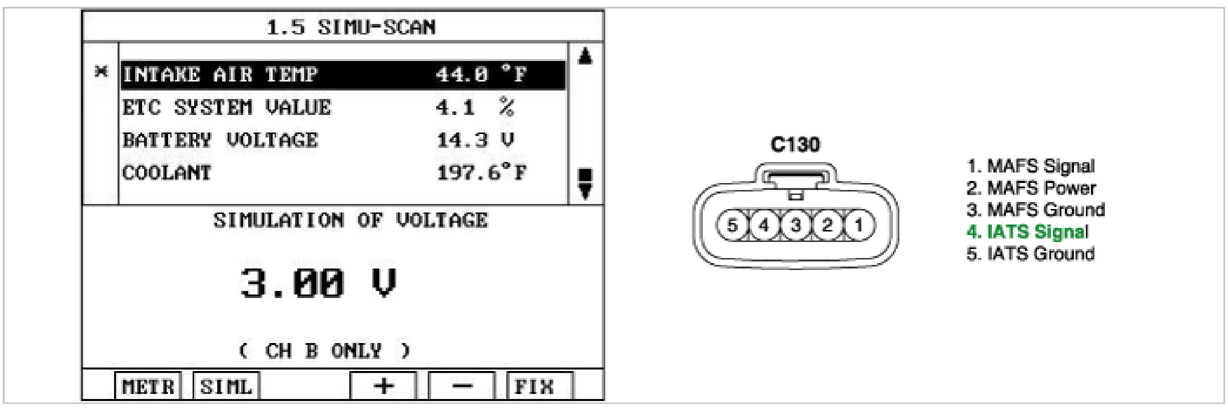
▸ Substitute with a known - good IATS and check for proper operation. If the problem is corrected, replace IATS and go to "Verification of Vehicle Repair" procedure.

2. Check PCM
   (1) IG "OFF" and connect scantool.

   (2) Disconnect IATS connector and connect probe to terminal 4 of IATS harness connector.

   (3) IG "ON" and ENG "OFF" and simulation Function on scantool.

   (4) Simulate voltage at terminal 4 of IATS harness connector.



(5) Does the signal value of IAT sensor change according to simulation voltage ?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "

5. Are any DTCs present ?

YES

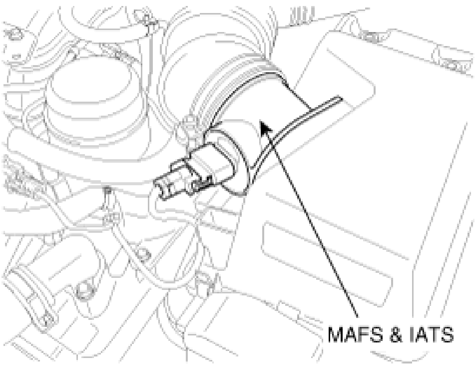
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0113

COMPONENT LOCATION



GENERAL DESCRIPTION

The Intake Air Temperature (IAT) sensor measures the temperature of engine intake air. The Intake Air Temperature (IAT) sensor is a thermistor (a variable resistor that changes along with outside air temperature) in series with a fixed resistor in the PCM. The PCM applies 5volts to the IAT sensor. The PCM monitors the voltage across the IAT sensor and converts it into a temperature reading. When the outside air temperature is cold the IAT sensor resistance is high, and when the outside air temperature is warm the IAT sensor resistance is low. Therefore, when the air temperature is cold the PCM will receive a high voltage input, and when the air temperature is warm the PCM will receive a low voltage input. The signal from IAT sensor is used for injection time correction (Cold post start correction), ignition angle correction(Air temperature correction) and idle speed correction(Air-density correction).

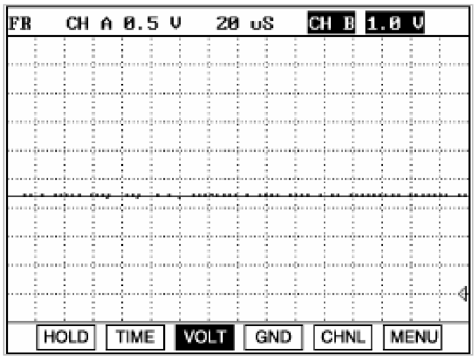
DTC DESCRIPTION

Checking output signals of IATS every 20 sec. under detecting condition, if an ouput signal is over 4.9V for more than 10 sec., PCM sets P0113. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• This code detects a continuous short to high in either the signal circuit or the sensor	• Poor connection • Open or short to battery in harness • Open in ground harness • IATS • PCM
Enable Conditions	• Engine running state • No Vehicle speed sensor fault • No ECTS fault • No MAFS fault • Intake airflow< 15 g/s • Vehicle speed< 25kph(9.3mph) • Engine coolant temperature >50°C(122°F)	
Threshold value	• Intake air temperature sensor's voltage >4.9V	
Diagnosis Time	• Continuous (More than 10 seconds failure for every 20 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA



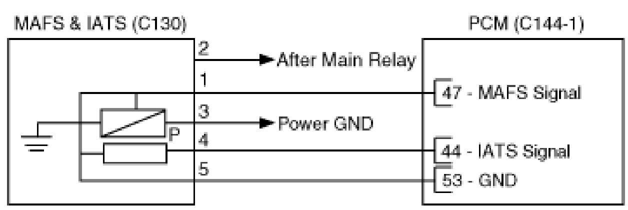
The output signals of IATS & ECTS change smoothly without any rapid changes. Those have almost same characteristic signal during the early period after start. It means that the temperatures of intake air and engine coolant are depended on the temperature of atmosphere. Meanwhile, during the warming up, the output signal of ECTS is going up increasingly. but, the output signal of IATS changes a little bit. even it may not change almost. It means that the heat of engine does not affect on the temperature of intake air.

SPECIFICATION

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	95.95 ~ 105.78	20(68)	3.42 ~ 3.61
-20(-4)	27.4 ~ 29.77	40(104)	1.43 ~ 1.5
0(32)	9.08 ~ 9.72	60(140)	0.66 ~ 0.69
10(50)	5.49 ~ 5.83	80(176)	0.33 ~ 0.34

SCHEMATIC DIAGRAM

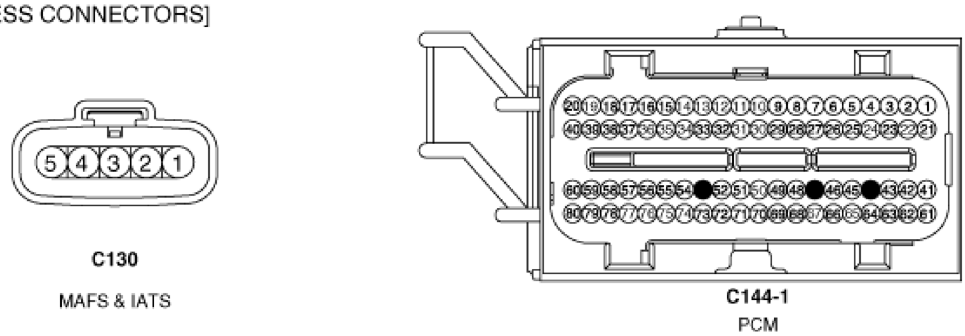
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Funtion
1	PCM C144-1 (47)	MAFS Signal
2	Main Relay	Battery Voltage (B+)
3	Chassis Ground	Ground
4	PCM C144-1 (44)	IATS Signal
5	PCM C144-1 (53)	Sensor Ground

[HARNESS CONNECTORS]



MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "IATS" item on the service data.

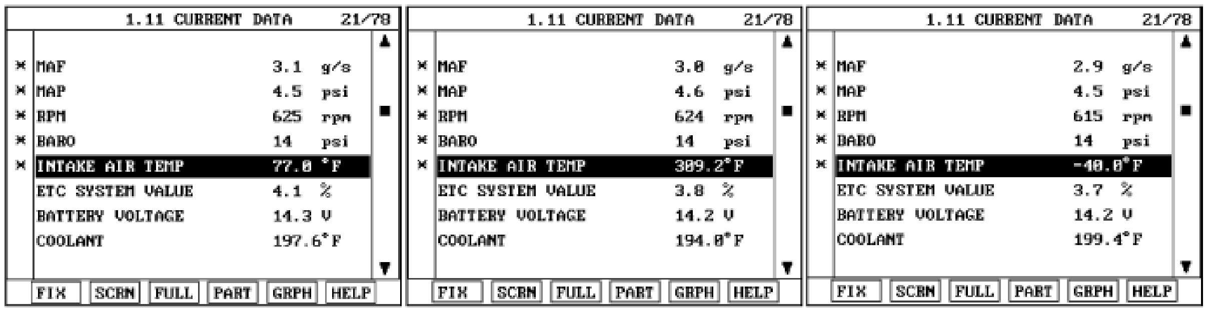


Fig. 1 Fig. 2 Fig. 3

Fig. 1 : Open at idle
Fig. 2 : Short to ground
Fig. 3 : Short to battery

4. Is the "IATS" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

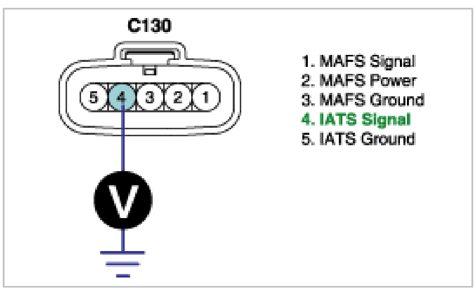
NO

▸ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF" and disconnect IATS connector.
   (2) IG "ON" and ENG "OFF"
   (3) Measure voltage between terminal 4 of IATS harness connector and chassis ground.

   Specification : Approx. 5V



   (4) Is the measured voltage within specification ?

   YES

   ▸ Go to "Ground Circuit Inspection" procedure.

   NO

   ▸ If the voltage is 0V, go to "Check open in harness" as follows. If the voltage is more than 5.1V, go to "Check short to battery in harness" as follows.

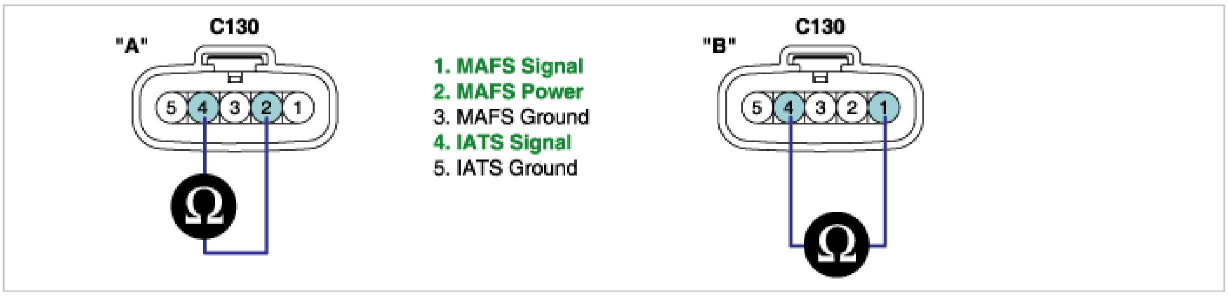
2. Check short to battery in harness

(1) IG "OFF" and disconnect IATS connector and PCM connector.

(2) Measure resistance between terminals 2 and 4 of IATS harness connector.

(3) Measure resistance between terminals 1 and 4 of IATS harness connector.

Specification : Infinite



(4) Is the measured resistance within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

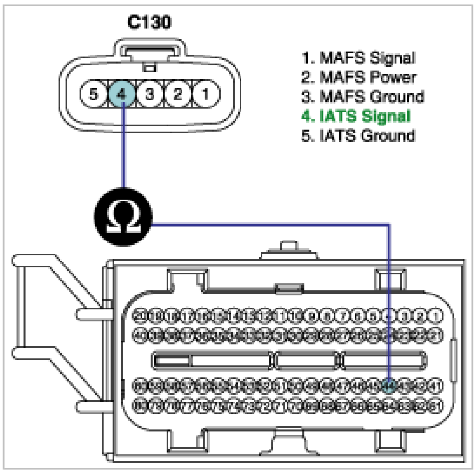
▸ Repair short to battery in harness and go to "Verification of Vehicle Repair" procedure.

3. Check open in harness

(1) IG "OFF" and disconnect IATS connector and PCM connctor.

(2) Measure resistance between terminal 4 of IATS harness connector and 44 of PCM harness connector.

Specification : below 1Ω



(3) Is the measured resistance within specification?

YES

▸ Go to "Ground Circuit Inspection" procedure.

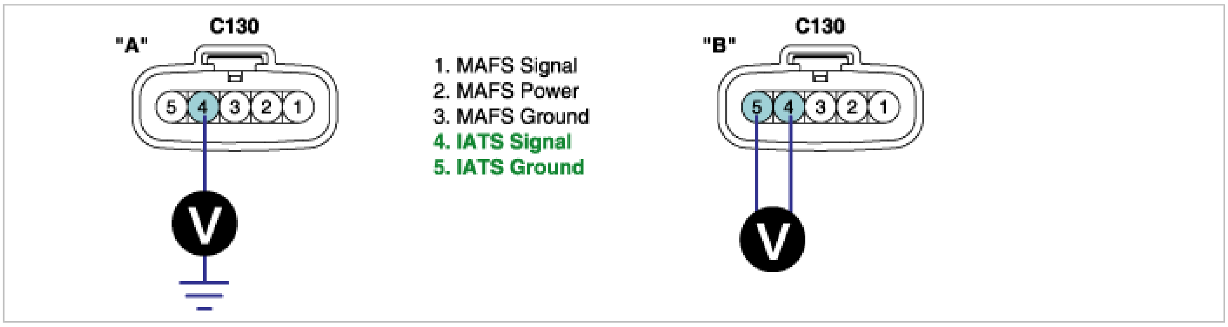
NO

▸ Repair open in harness and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF" and disconnect IATS connector.
2. Measure voltage between terminal 4 of IATS harness connector and chassis ground.
3. Measure voltage between terminals 4 and 5 of IATS harness connector.

Specification : Voltage difference between measurement "A" and "B" is below 200mV.



4. Is the measured voltage within specification ?

YES

▶ Go to "Component Inspection" procedure.

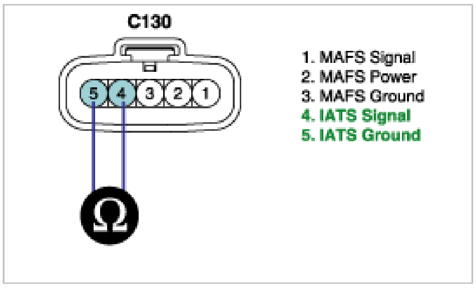
NO

▶ Repair contact resistance or open in harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check IATS
   (1) IG "OFF" and disconnect IATS connector.
   (2) Measure resistance between teminals 4 and 5 of IATS connector.(Component side)
   Specificaton :

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	95.95 ~ 105.78	20(68)	3.42 ~ 3.61
-20(-4)	27.4 ~ 29.77	40(104)	1.43 ~ 1.5
0(32)	9.08 ~ 9.72	60(140)	0.66 ~ 0.69
10(50)	5.49 ~ 5.83	80(176)	0.33 ~ 0.34



   (3) Is the measured resistance within specification ?

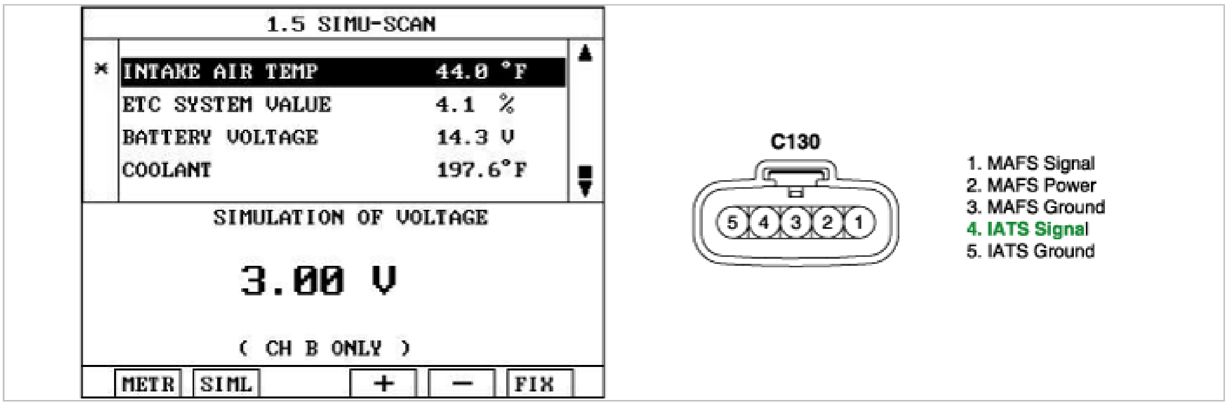
YES

▶ Go to "Check PCM" as follows.

NO

▶ Substitute with a known - good IATS and check for proper operation. If the problem is corrected, replace IATS and go to "Verification of Vehicle Repair" procedure.

2. Check PCM
   (1) IG "OFF" and connect scantool.
   (2) Disconnect IATS connector and connect probe to terminal 4 of IATS harness connector.
   (3) IG "ON" and ENG "OFF" and simulation Function on scantool.
   (4) Simulate voltage at terminal 4 of IATS harness connector.



(5) Does the signal value of IAT sensor change according to simulation voltage ?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

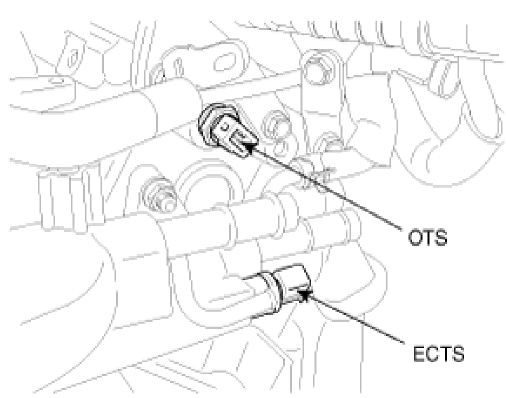
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0115

COMPONENT LOCATION



GENERAL DESCRIPTION

The Engine Coolant Temperature(ECT) Sensor measures the temperature of engine coolant. The Engine Coolant Temperature

(ECT) Sensor is located near the thermostat housing of the cylinder head. ECT Sensor is a thermistor (A Variable Resistor that Changes Along with ECT) in series with a fixed resistor in the Engine Control Module (PCM). The PCM applies 5 volts to the ECT sensor. The PCM monitors the voltage across the ECT sensor and converts it into a temperature reading. When the engine is cold the ECT sensor resistance is high, and when the engine is warm the ECT sensor resistance is low. Therefore, when the engine is cold the PCM will receive a high voltage input, and when the engine is warm the PCM will receive a low voltage input. The signal from ECT sensor is used for Injection, ignition timing, idle speed and cooling fan control.

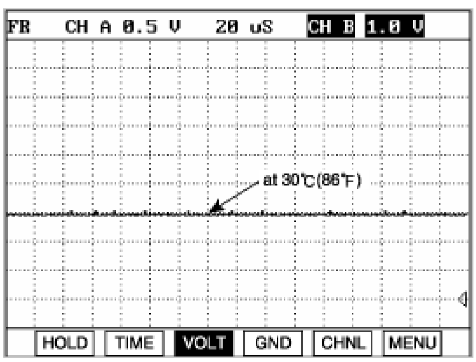
DTC DESCRIPTION

Failure mode is the coolant sensor output stuck. When this failure mode occurs, no change is observed in the ECT Sensor reading, even though the engine may be warming up from a cold start. It calculates the difference between the startup and current coolant temperatures and compares against the threshold. Insufficient change over this period of time indicates a failure.
PCM monitors difference between the startup and current coolant temperature and compares agaist the threshold while enable condition is met. If the PCM detects that the coolant temperature sensor signal change is less than 3°C for 120 second, PCM determines that a fault exists and a DTC is stored.
MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Rationality	• Poor connection • Low level of Engine Coolant • Improperly installed ECTS • Open or short in circuit • ECTS • PCM
Enable Conditions	• Engine Run state • Vehicle soak time >360min • No Disabling Faults Present	
Threshold value	• This code detects a coolant temp sensor that is stuck within an expected range of movement< 3 °C(37.4°F)	
Diagnosis Time	• Continuous (More than 120 seconds failure within 150 second test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA



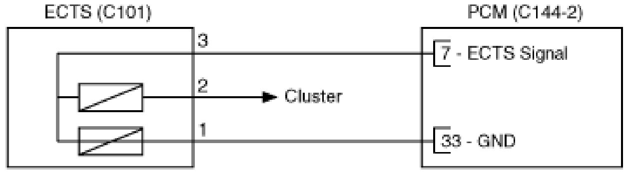
The output signals of IATS & ECTS change smoothly without any rapid changes. Those have almost same characteristic signal during the early period after start. It means that the temperatures of intake air and engine coolant are depended on the temperature of atmosphere. Meanwhile, during the warming up, the output signal of ECTS is going up increasingly. but, the output signal of IATS changes a little bit. even it may not change almost. It means that the heat of engine does not affect on the temperature of intake air.

SPECIFICATION

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59
0(32)	5.79	80(176)	0.32
20(68)	2.31 ~ 2.59		

SCHEMATIC DIAGRAM

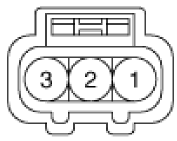
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

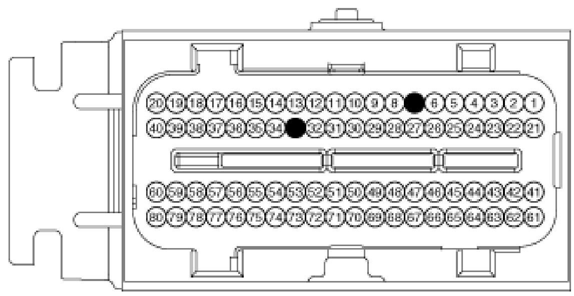
Terminal	Connected to	Funtion
1	PCM C144-2 (33)	Sensor ground
2	Cluster	-
3	PCM C144-2 (7)	ECTS Signal

[HARNESS CONNECTORS]



C101

ECTS



C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "Monitor "ECTS" status on the service data." item on the service data.

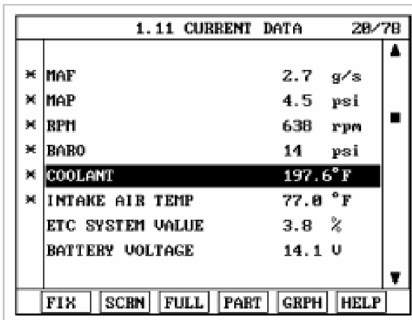


Fig. 1

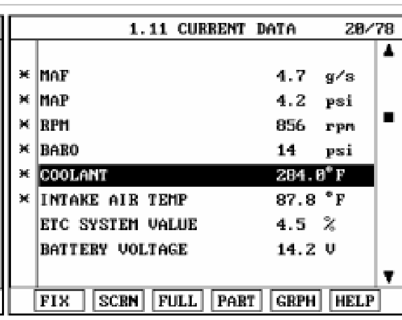


Fig. 2

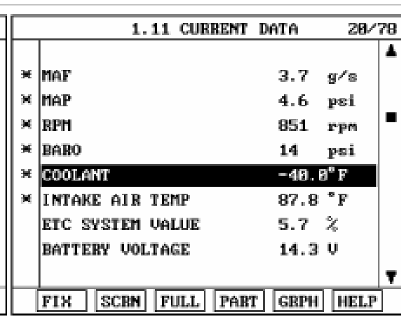


Fig. 3

Fig. 1 : Normal at Idle
Fig. 2 : Short to ground at idle
Fig. 3 : Open or short to battery at idle

4. Is the "ECTS" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

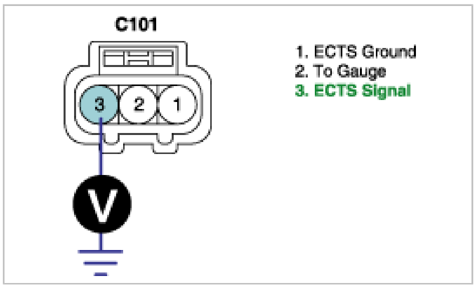
NO

▸ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. IG "OFF" and disconnect ECTS connector.
2. IG "ON" & ENG "OFF"
3. Measure voltage between terminal 3 of ECTS harness connector and chassis ground.

Specification : Approx. 5V



4. Is the measured voltage within specification ?

YES

▸ Go to "Ground Circuit Inspection" procedure.

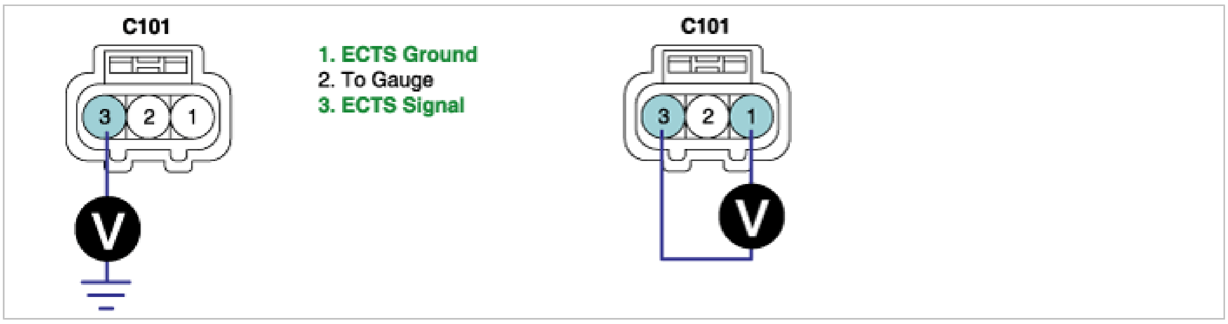
NO

▸ Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF" and disconnect ECTS connector.
2. Measure voltage between terminal 3 of ECTS harness connector and chassis ground.
3. Measure voltage between terminal 1 and 3 of ECTS harness connector.

Specification : Voltage difference between measurement "A" and "B" is below 200mV.



4. Is the measured voltage within specification ?

YES

▸ Go to "System Inspection" procedure.

NO

▸ Repair contact resistance and open in harness and go to "Verification of Vehicle Repair" procedure.

SYSTEM INSPECTION

1. Check Engine coolant level is O.K
2. Check that ECTS is correctly installed.
3. Has a problem been found ?

YES

▸ Repair or replace as necessary and then go to "Verification of Vehicle Repair"procedure.

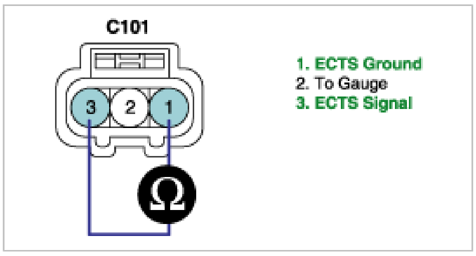
NO

▸ Go to "Component Inspection" procedure.

COMPONENT INSPECTION

1. Check resistance of ECTS
   (1) IG "OFF" and disconnect ECTS connector.
   (2) Measure resistance between terminal 1 and 3 of ECTS connector. (Component Side)
   Specificaton :

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59
0(32)	5.79	80(176)	0.32
20(68)	2.31 ~ 2.59		



   (3) Is the measured resistance within specification ?

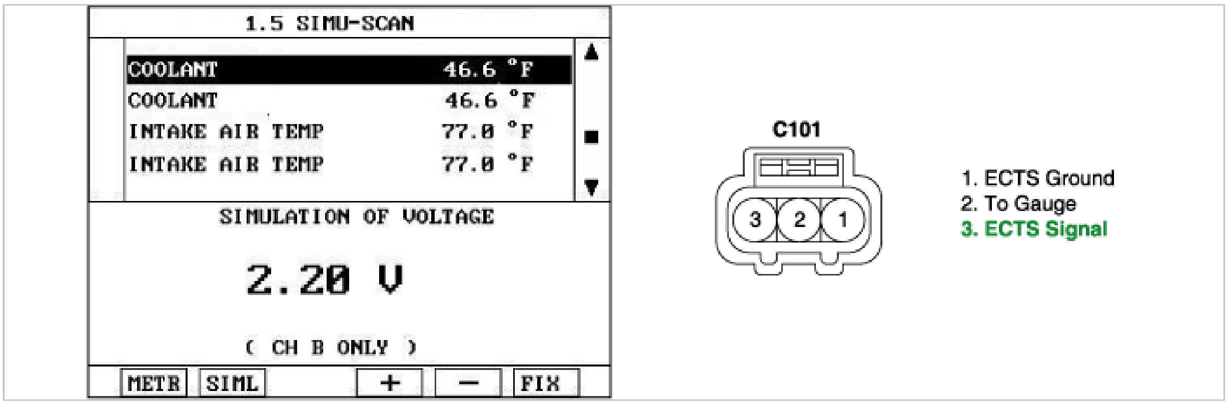
YES

▸ Go to "Check PCM" as follows.

NO

▸ Substitute with a known - good ECTS and check for proper operation. If the problem is corrected, replace ECTS and go to "Verification of Vehicle Repair" procedure.

2. Check PCM
   (1) IG "OFF" and connect scantool.
   (2) Connect probe to terminal 3 of ECTS harness connector.
   (3) IG "ON" and ENG "OFF" and simulation Function on scantool.
   (4) Simulate voltage at terminal 3 of ECTS harness connector.



   (5) Does the signal value of ECT sensor change according to simulation voltage ?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

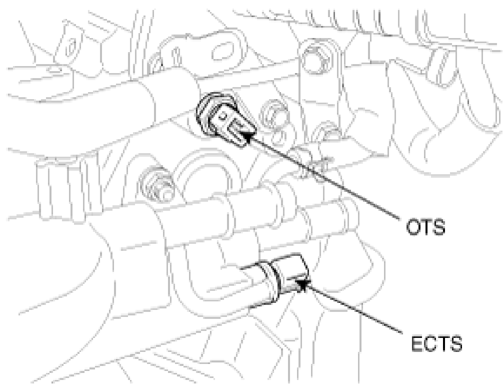
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0117

COMPONENT LOCATION



GENERAL DESCRIPTION

The Engine Coolant Temperature(ECT) Sensor measures the temperature of engine coolant. The Engine Coolant Temperature (ECT) Sensor is located near the thermostat housing of the cylinder head. ECT Sensor is a thermistor (A Variable Resistor that Changes Along with ECT) in series with a fixed resistor in the Engine Control Module (PCM). The PCM applies 5 volts to the ECT sensor. The PCM monitors the voltage across the ECT sensor and converts it into a temperature reading. When the engine is cold the ECT sensor resistance is high, and when the engine is warm the ECT sensor resistance is low. Therefore, when the engine is cold the PCM will receive a high voltage input, and when the engine is warm the PCM will receive a low voltage input. The signal from ECT sensor is used for Injection, ignition timing, idle speed and cooling fan control.

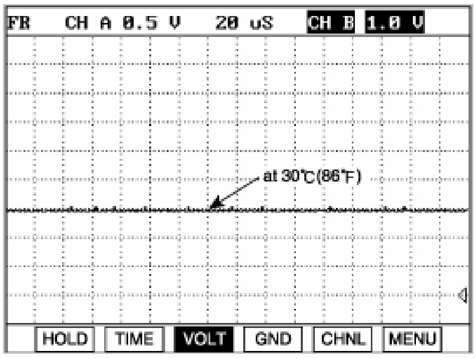
DTC DESCRIPTION

Checking output signals from ECTS every 20 sec. under detecting condition, if an output signal is below 0.1V for more than 10 sec., PCM sets P0117. Warning lamp turns on when the malfunction lasts till continuous 2 driving cycle. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible cause
DTC Strategy		• Signal low	• Poor connection • Short to ground in harness • ECTS • PCM
Enable Conditions	Case 1	• Time after start-up >120 sec.	
	Case 2	• Time from IG "OFF" to IG "ON" >360 min. • Engine running state	
Threshold value		• Engine coolant temperature sensor's voltage< 0.1V	
Diagnosis Time		• Contineous (More than 10 seconds failure for every 20 second test)	
MIL On Condition		• 2 Driving Cycle	

SIGNAL WAVEFORM AND DATA

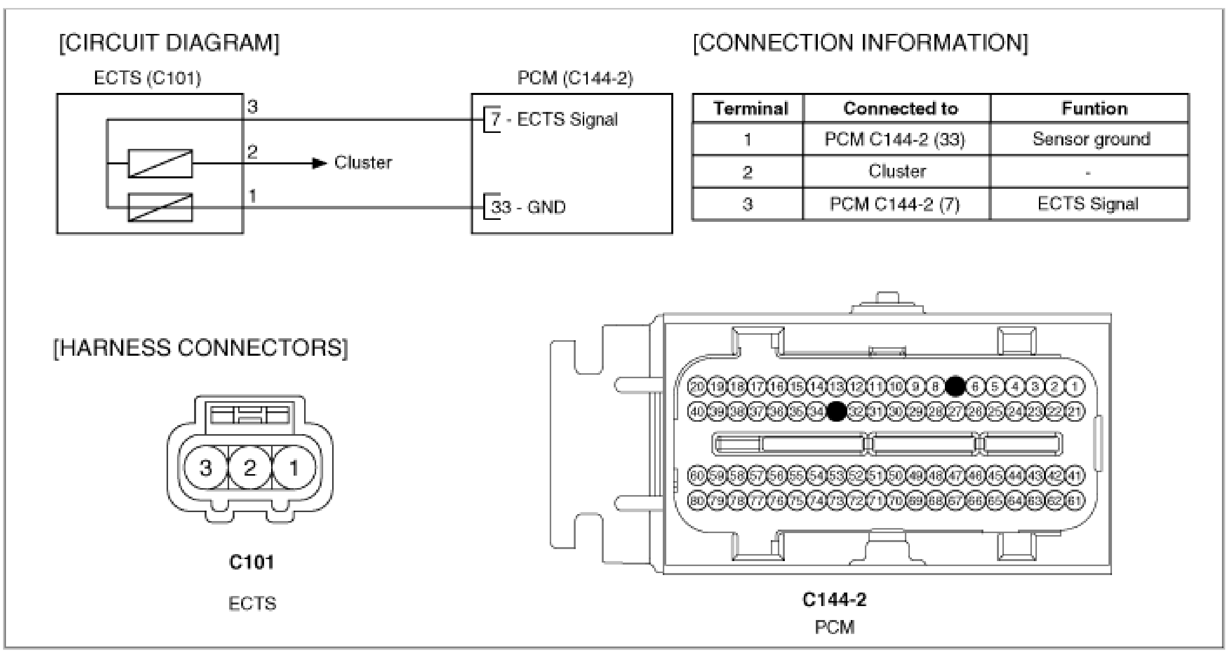


The output signals of IATS & ECTS change smoothly without any rapid changes. Those have almost same characteristic signal during the early period after start. It means that the temperatures of intake air and engine coolant are depended on the temperature of atmosphere. Meanwhile, during the warming up, the output signal of ECTS is going up increasingly. but, the output signal of IATS changes a little bit. even it may not change almost. It means that the heat of engine does not affect on the temperature of intake air.

SPECIFICATION

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59
0(32)	5.79	80(176)	0.32
20(68)	2.31 ~ 2.59		

SCHEMATIC DIAGRAM



MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "Monitor "ECTS" status on the service data." item on the service data.

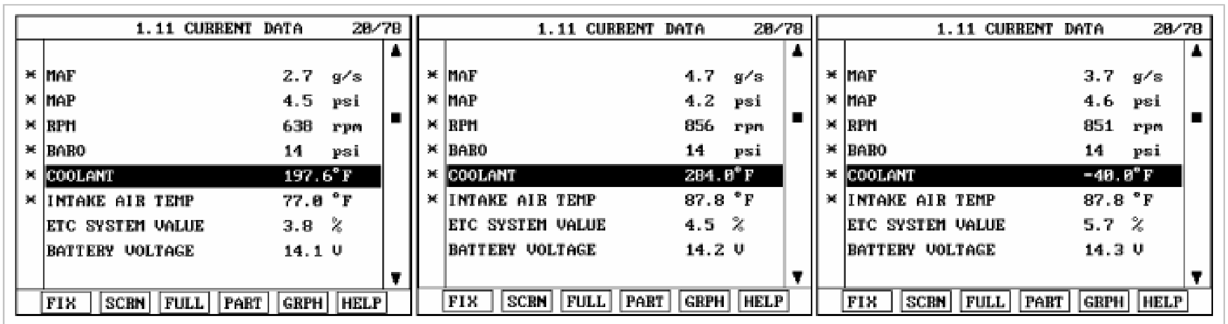


Fig. 1 Fig. 2 Fig. 3

Fig. 1 : Normal at Idle
Fig. 2 : Short to ground at idle
Fig. 3 : Open or short to battery at idle

4. Is the "ECTS" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal & Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminaal and connector inspection" procedure.

SIGNAL CIRCUIT INSPECTION

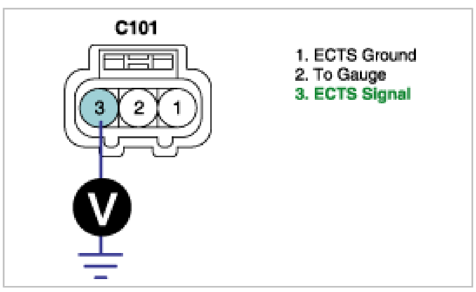
1. Check voltage

(1) IG "OFF" and disconnect ECTS connector.

(2) IG "ON" and ENG "OFF"

(3) Measure voltage between terminal 3 of ECTS harness connector and chassis ground.

Specification : Approx. 5V



(4) Is the measured voltage within specification ?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Go to "Check short to ground in harness" as follows.

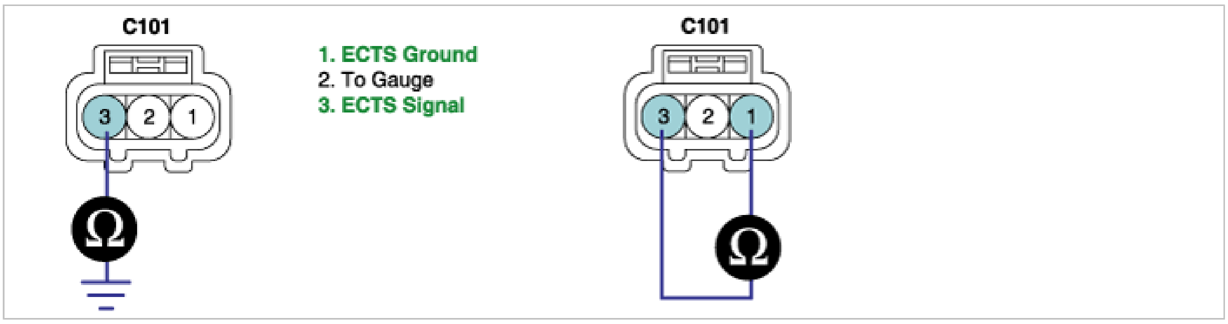
2. Check short to ground in harness

(1) IG "OFF" and disconnect ECTS connector and PCM connector.

(2) Measure resistance between terminal 3 of ECTS harness connector and chassis ground.

(3) Measure resistance between terminals 1 and 3 of ECTS harness connector.

Specification : Infinite



(4) Is the measured resistance within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check ECTS

(1) IG "OFF" and disconnect ECTS connector.

(2) Measure resistance between terminals 1 and 3 of ECTS connector.(Component side)

Specificaton :

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59
0(32)	5.79	80(176)	0.32
20(68)	2.31 ~ 2.59		

(3) Is the measured resistance within specification?

YES

▸ Go to "Check PCM" as follows.

NO

▸ Substitute with a known - good ECTS and check for proper operation. If the problem is corrected, replace ECTS and go to "Verification of Vehicle Repair" procedure.

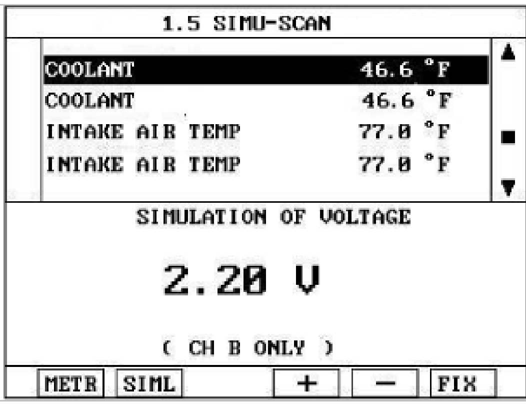
2. Check PCM

(1) IG "OFF" and connect scantool.

(2) Connect probe to terminal 3 of ECTS harness connector.

(3) IG "ON" and ENG "OFF" and simulation Function on scantool.

(4) Simulate voltage at terminal 3 of ECTS harness connector.



(5) Does the signal value of ECT sensor change according to simulation voltage ?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

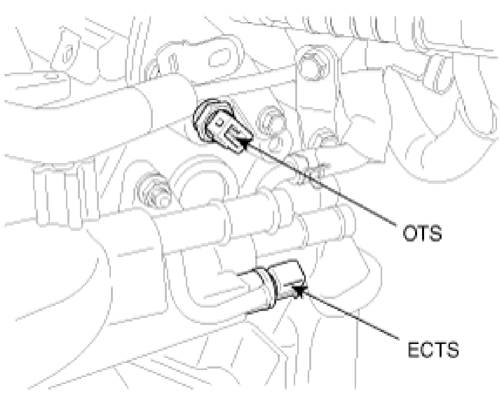
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0118

COMPONENT LOCATION



GENERAL DESCRIPTION

The Engine Coolant Temperature(ECT) Sensor measures the temperature of engine coolant. The Engine Coolant Temperature

(ECT) Sensor is located near the thermostat housing of the cylinder head. ECT Sensor is a thermistor (A Variable Resistor that Changes Along with ECT) in series with a fixed resistor in the Engine Control Module (PCM). The PCM applies 5 volts to the ECT sensor. The PCM monitors the voltage across the ECT sensor and converts it into a temperature reading. When the engine is cold the ECT sensor resistance is high, and when the engine is warm the ECT sensor resistance is low. Therefore, when the engine is cold the PCM will receive a high voltage input, and when the engine is warm the PCM will receive a low voltage input. The signal from ECT sensor is used for Injection, ignition timing, idle speed and cooling fan control.

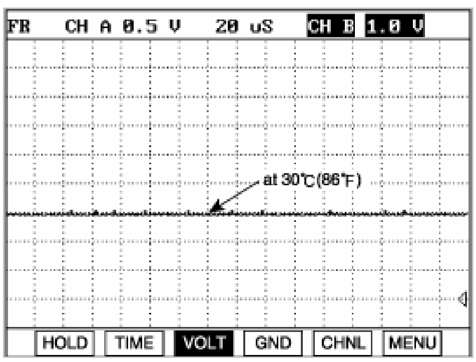
DTC DESCRIPTION

Checking output signals from ECTS every 20 sec. under detecting condition, if an output signal is above 4.9V for more than 10 sec., PCM sets P0118. Warning lamp turns on when the malfunction lasts till continuous 2 driving cycle. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible cause
DTC Strategy		• Open, Signal high	• Poor connection • Open or short to battery in signal harness • Open in ground harness • ECTS • PCM
Enable Conditions	Case 1	• Time after start-up >120 sec.	
	Case 2	• Time from IG "OFF" to IG "ON" > 360 min. • Intake air temperature ≥ -10°C(14°F) • Engine running state	
Threshold value		• Engine coolant temperature sensor's voltage >4.9V	
Diagnosis Time		• Contineous (More than 10 sec. failure for every 20 sec. test)	
MIL On Condition		• 2 Driving Cycle	

SIGNAL WAVEFORM AND DATA



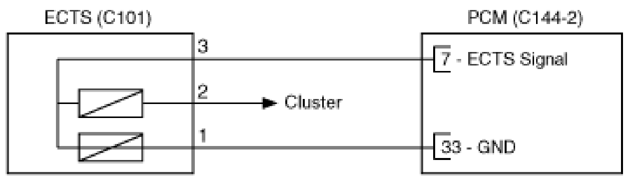
The output signals of IATS & ECTS change smoothly without any rapid changes. Those have almost same characteristic signal during the early period after start. It means that the temperatures of intake air and engine coolant are depended on the temperature of atmosphere. Meanwhile, during the warming up, the output signal of ECTS is going up increasingly. but, the output signal of IATS changes a little bit. even it may not change almost. It means that the heat of engine does not affect on the temperature of intake air.

SPECIFICATION

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59
0(32)	5.79	80(176)	0.32
20(68)	2.31 ~ 2.59		

SCHEMATIC DIAGRAM

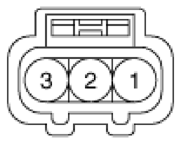
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

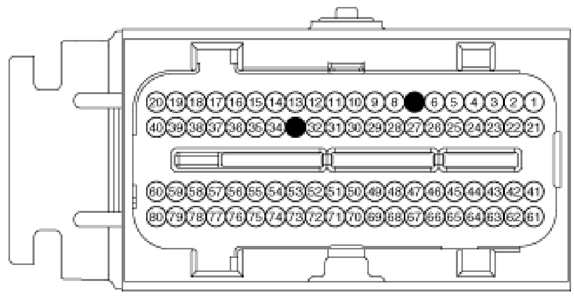
Terminal	Connected to	Funtion
1	PCM C144-2 (33)	Sensor ground
2	Cluster	-
3	PCM C144-2 (7)	ECTS Signal

[HARNESS CONNECTORS]



C101

ECTS



C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "Monitor "ECTS" status on the service data." item on the service data.

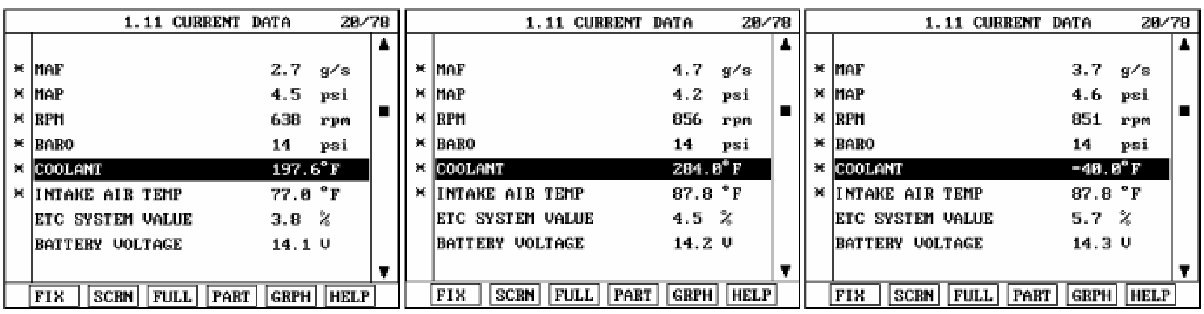


Fig. 1 Fig. 2 Fig. 3

Fig. 1 : Normal at Idle
Fig. 2 : Short to ground at idle
Fig. 3 : Open or short to battery at idle

4. Is the "ECTS" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Signal Circuit Inspection" procedure.

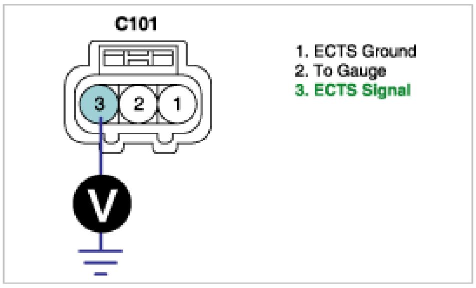
SIGNAL CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF" and disconnect ECTS connector.

   (2) IG "ON" and ENG "OFF"

   (3) Measure voltage between terminal 3 of ECTS harness connector and chassis ground.

   Specification : Approx. 5V



   (4) Is the measured voltage within specification ?

   YES

   ▸ Go to "Ground Circuit Inspection" procedure.

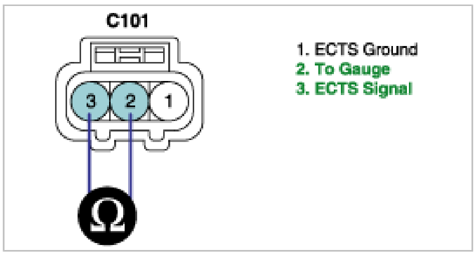
   NO

   ▸ If voltage is 0V, go to "Check open in harness" as follows. If it is more than 5.1V, go to "Check short to battery in harness" as follows

2. Check short to battery in harness
   (1) IG "OFF" and disconnect ECTS connector and PCM connector.

   (2) Measure resistance between terminals 2 and 3 of ECTS harness connector.

   Specification : Infinite



   (3) Is the measured resistance within specification?

   YES

   ▸ Go to "Component Inspection" procedure.

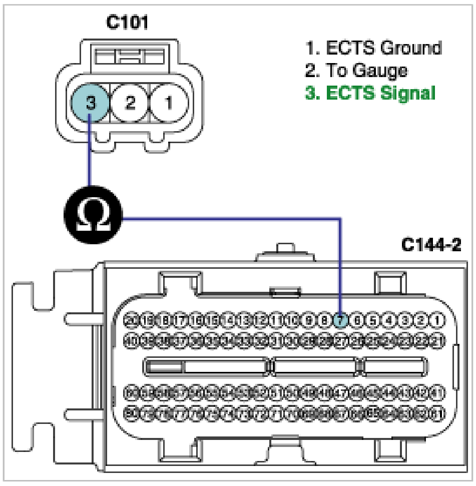
   NO

   ▸ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

3. Check open in harness
   (1) IG "OFF" and disconnect ECTS connector and PCM connector.

   (2) Measure resistance between terminal 3 of ECTS harness connector and terminal 7 of PCM harness connector.

   Specification : Below 1Ω



(3) Is the measured resistance within specification?

YES

▸ Go to "Ground Circuit Inspection" procedure.

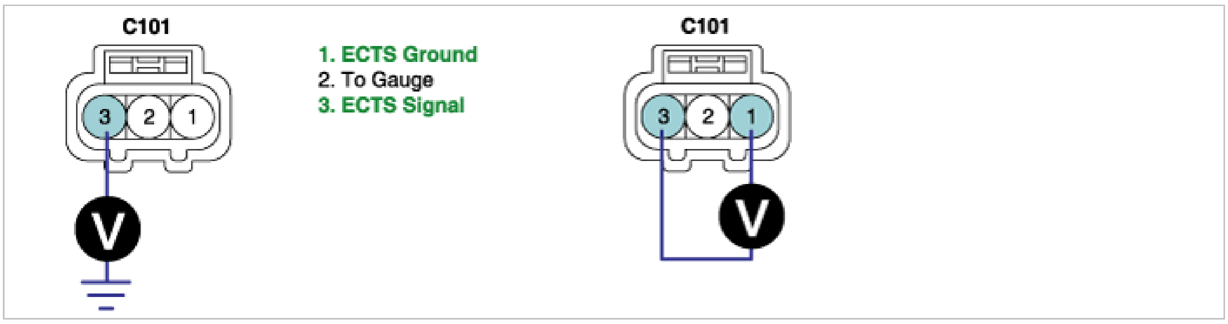
NO

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF" and disconnect ECTS connector.
2. Measure voltage between terminal 3 of ECTS harness connector and chassis ground.
3. Measure voltage between terminals 1 and 3 of ECTS harness connector.

Specification : Voltage difference between measurement "A" and "B" is below 200mV.



4. Is the measured voltage within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair open or contact resistance in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check ECTS
   (1) IG "OFF" and disconnect ECTS connector.
   (2) Measure resistance between terminals 1 and 3 of ECTS connector.(Component side)
   Specificaton :

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59
0(32)	5.79	80(176)	0.32
20(68)	2.31 ~ 2.59		

(3) Is the measured resistance within specification?

YES

▸ Go to "Check PCM" as follows.

NO

▸ Substitute with a known - good ECTS and check for proper operation. If the problem is corrected, replace ECTS and go to "Verification of Vehicle Repair" procedure.

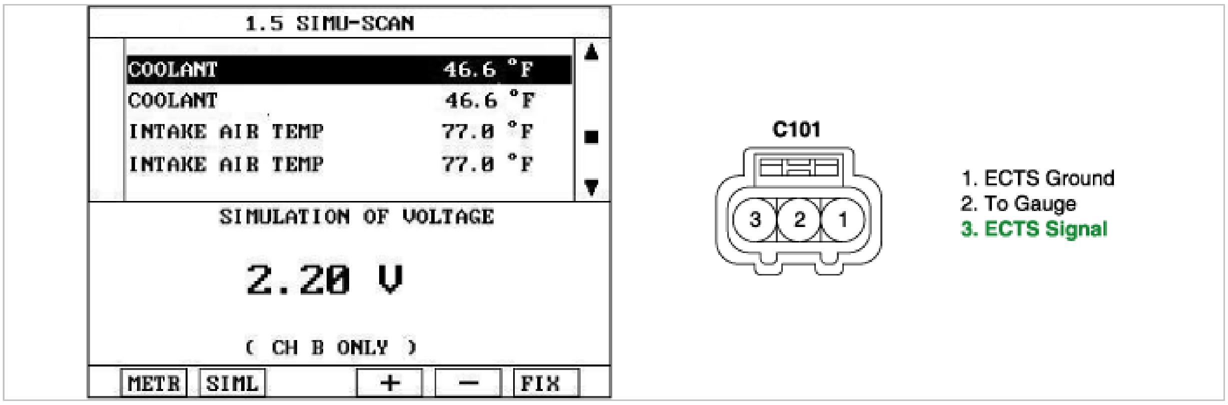
2. Check PCM

(1) IG "OFF" and connect scantool.

(2) Connect probe to terminal 3 of ECTS harness connector.

(3) IG "ON" and ENG "OFF" and simulation Function on scantool.

(4) Simulate voltage at terminal 3 of ECTS harness connector.



(5) Does the signal value of ECT sensor change according to simulation voltage ?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

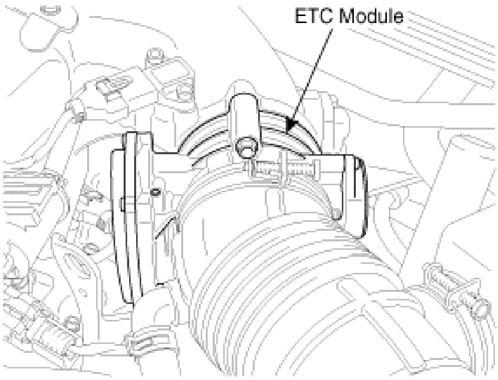
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0122

COMPONENT LOCATION



GENERAL DESCRIPTION

ETC(Electronic Throttle Control Valve) is the device controlling amount of air to engine acccording to driver's intension. Different from the existing mechanical throttle valve which is composed of accelerator pecal and connecting wire cable, ETC consists of a motor, a throttle body and a throttle position sensor. Receiving input signals from electronic accelerator pedal module, PCM lets ETC motor control throttle valve. With ETC, cruise control system works without any additional device.

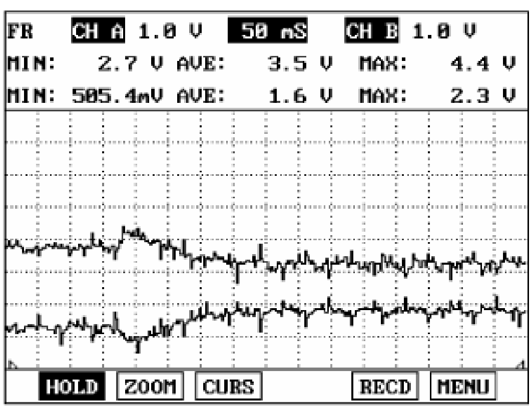
DTC DESCRIPTION

Checking output signals from TPS1 every 8.5 sec. under detecting condition, if an output signal is below 0.25V for more than 0.1 sec., PCM sets P0122. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

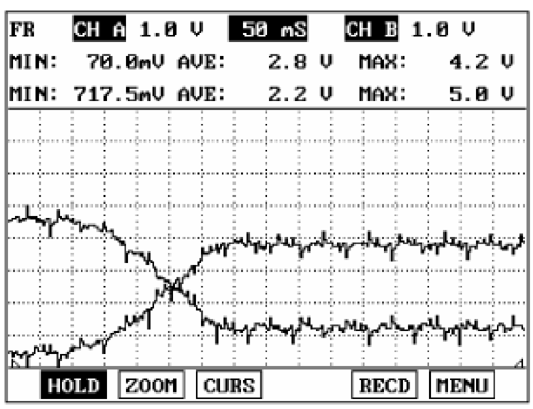
DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• signal low	• Poor connection • Open or short to ground in power harness • Short to ground in signal harness • TPS • PCM
Enable condition	• IG "ON	
threshold value	• The voltage of TPS< 0.25V	
diagnosis time	• Continuous (more than 0.1 sec. failure for every 8.5 sec.test)	
MIL ON condition	• 2 driving cycles	

SIGNAL WAVEFORM AND DATA



Hit the accelerator at IG ON



Open the throttle valve by force at IG ON

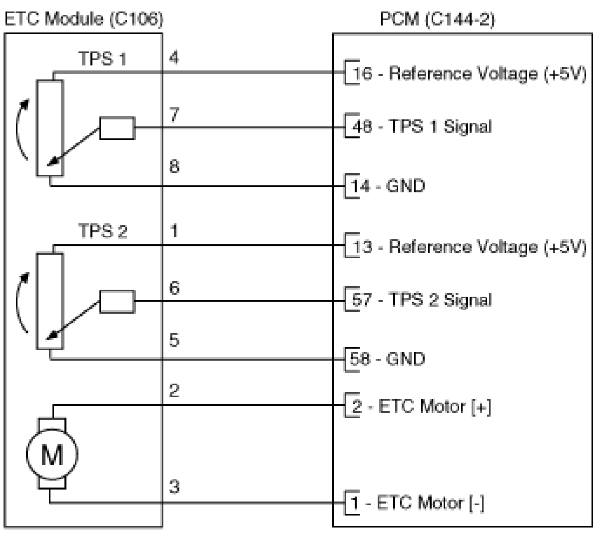
SPECIFICATION

Throttle opening (°)	Output voltage(V) [Vref=5.0]	
	TPS1	TPS2
0°	0.0V	5.0V

10°	0.5V	4.5V
20°	0.9V	4.1V
30°	1.4V	3.6V
40°	1.8V	3.2V
50°	2.3V	2.7V
60°	2.7V	2.3V
70°	3.2V	1.8V
80°	3.6V	1.4V
90°	4.1V	0.9V
100°	4.5V	0.5V
110°	5.0V	0.0V

SCHEMATIC DIAGRAM

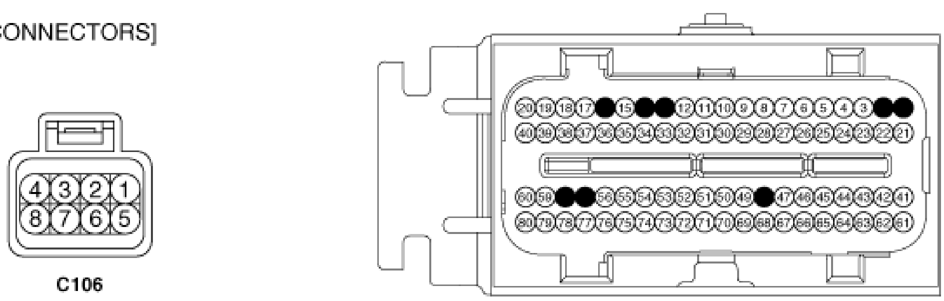
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Funtion
1	PCM C144-2 (13)	TPS 2 Reference Voltage (+5V)
2	PCM C144-2 (2)	ETC Motor [+] Control
3	PCM C144-2 (1)	ETC Motor [-] Control
4	PCM C144-2 (16)	TPS 1 Reference Voltage (+5V)
5	PCM C144-2 (58)	TPS 2 Ground
6	PCM C144-2 (57)	TPS 2 Signal
7	PCM C144-2 (48)	TPS 1 Signal
8	PCM C144-2 (14)	TPS 1 Ground

[HARNESS CONNECTORS]



C106

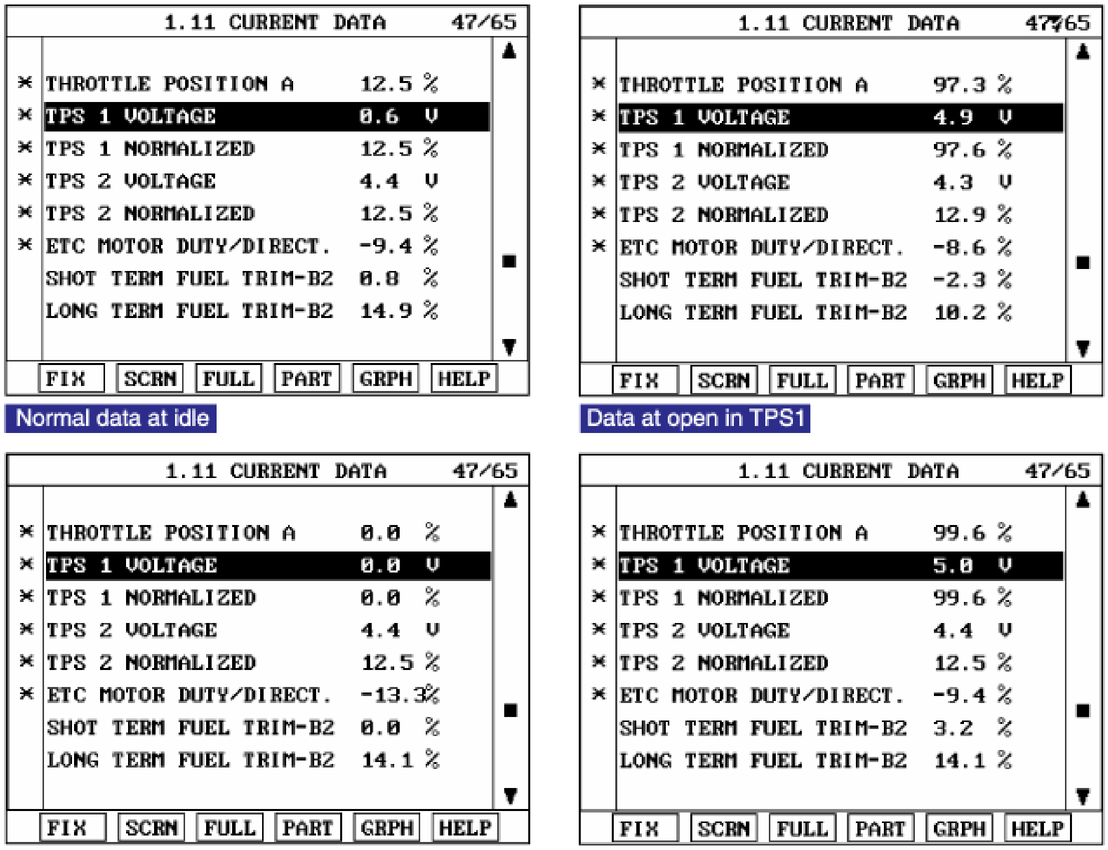
ETC MODULE

C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "TPS1" item on the service data.



Normal data at idle

Data at open in TPS1

Data at short to ground in TPS1

Data at short to battery in TPS1

CAUTION

※ Procedure of ETS Initialization

1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10 second)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

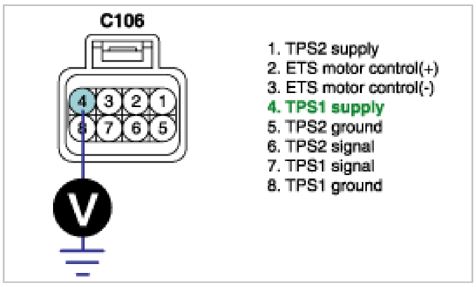
NO

▸ Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION

1. IG "OFF" and disconnect TPS connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 4 of TPS harness connector and chassis ground.

Specification : Approx. 5V



4. Is the measured voltage within specification ?

YES

▸ Go to "Signal circuit inspection" procedure.

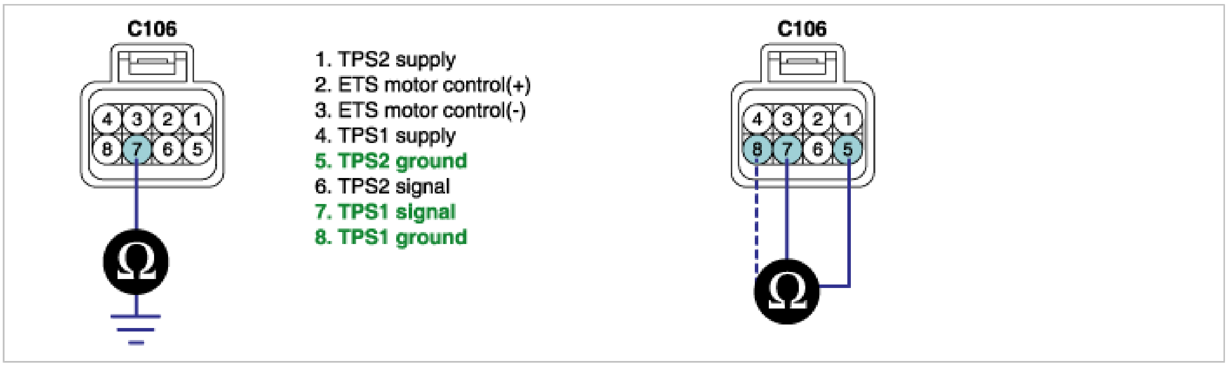
NO

▸ Repair open or short to ground in power harness, and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check short to ground in harness
   (1) IG "OFF" and disconnect TPS connector and PCM connector.
   (2) Measure resistance between terminal 7 of TPS harness connector and chassis ground.
   (3) Measure resistance between terminals 7 and 5(8) of TPS harness connector.

Specification : Infinite



(4) Is the measured resistance within specification?

YES

▸ Go to "Component Inspection" procedure.

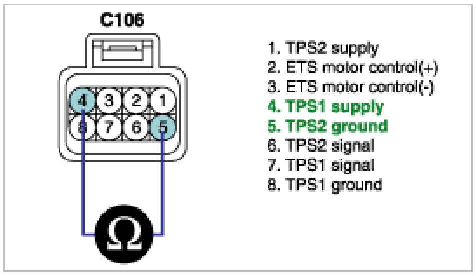
NO

▸ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check TPS
   (1) IG "OFF" and disconnect TPS connector.
   (2) Measure resistance between terminals 4 and 5 of TPS connector.(component side)

Specificaton : 4 ~ 6kΩ



(3) Is the measured resistance within specification?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good ECT motor & TPS and check for proper operation. If the problem is corrected, replace ECT motor & TPS and go to "Verification of Vehicle Repair" procedure.

CAUTION

Procedure of ETS Initialization

1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10sec.)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

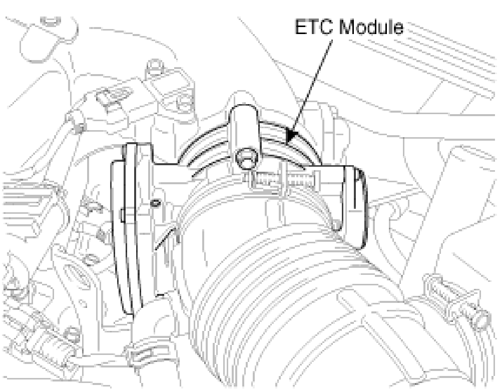
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0123

COMPONENT LOCATION



GENERAL DESCRIPTION

ETC(Electronic Throttle Control Valve) is the device controlling amount of air to engine acccording to driver's intension. Different from the existing mechanical throttle valve which is composed of accelerator pecal and connecting wire cable, ETC consists of a motor, a throttle body and a throttle position sensor. Receiving input signals from electronic accelerator pedal module, PCM lets

ETC motor control throttle valve. With ETC, cruise control system works without any additional device.

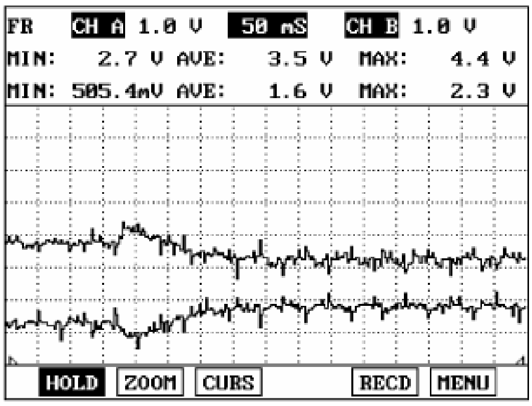
DTC DESCRIPTION

Checking output signals from TPS1 every 8.5 sec. under detecting condition, if an output signal is above 4.75V for more than 0.1 sec., PCM sets P0123. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

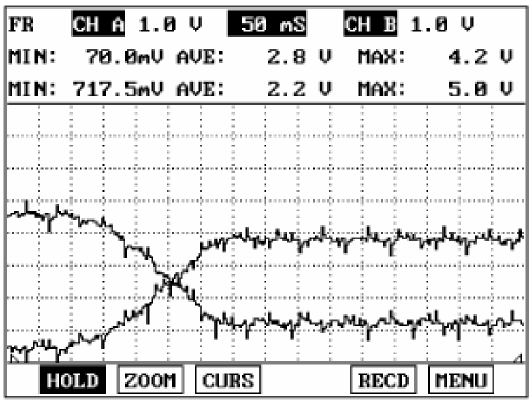
DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• signal low	• Poor connection • Open or short to battery in signal harness • Open in ground harness • TPS • PCM
Enable condition	• IG "ON	
threshold value	• The voltage of TPS >4.75V	
diagnosis time	• Continuous (more than 0.1 sec. failure for every 8.5 sec.test)	
MIL ON condition	• 2 driving cycles	

SIGNAL WAVEFORM AND DATA



Hit the accelerator at IG ON



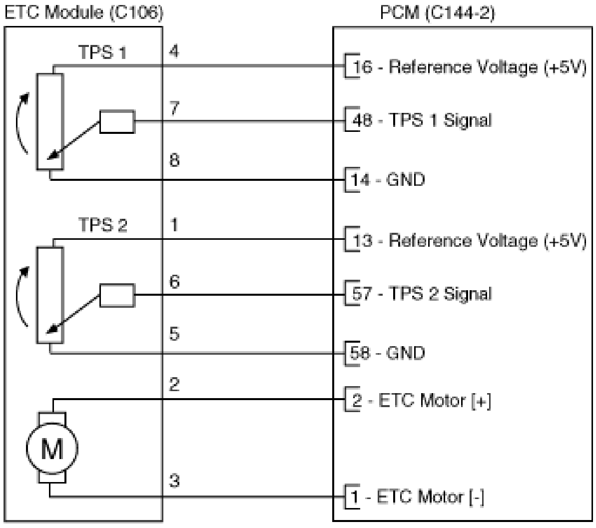
Open the throttle valve by force at IG ON

SPECIFICATION

Throttle opening (°)	Output voltage(V) [Vref=5.0]	
	TPS1	TPS2
0°	0.0V	5.0V
10°	0.5V	4.5V
20°	0.9V	4.1V
30°	1.4V	3.6V
40°	1.8V	3.2V
50°	2.3V	2.7V
60°	2.7V	2.3V
70°	3.2V	1.8V
80°	3.6V	1.4V
90°	4.1V	0.9V
100°	4.5V	0.5V
110°	5.0V	0.0V

SCHEMATIC DIAGRAM

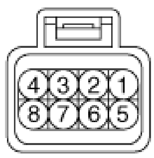
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

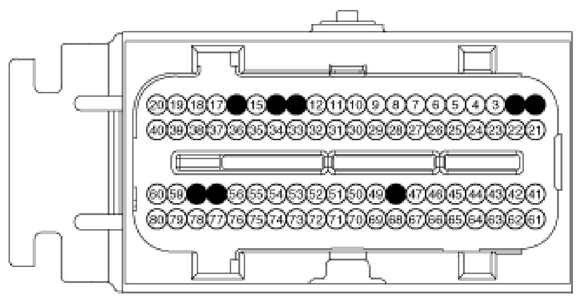
Terminal	Connected to	Funtion
1	PCM C144-2 (13)	TPS 2 Reference Voltage (+5V)
2	PCM C144-2 (2)	ETC Motor [+] Control
3	PCM C144-2 (1)	ETC Motor [-] Control
4	PCM C144-2 (16)	TPS 1 Reference Voltage (+5V)
5	PCM C144-2 (58)	TPS 2 Ground
6	PCM C144-2 (57)	TPS 2 Signal
7	PCM C144-2 (48)	TPS 1 Signal
8	PCM C144-2 (14)	TPS 1 Ground

[HARNESS CONNECTORS]



C106

ETC MODULE

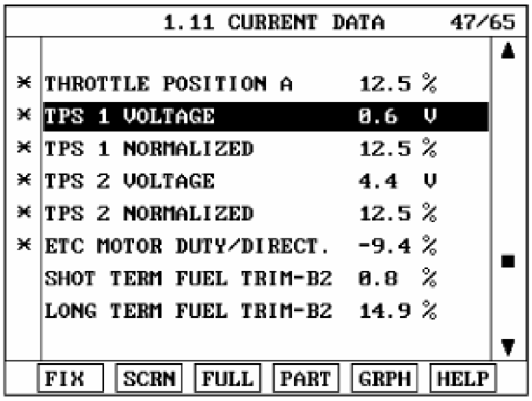


C144-2

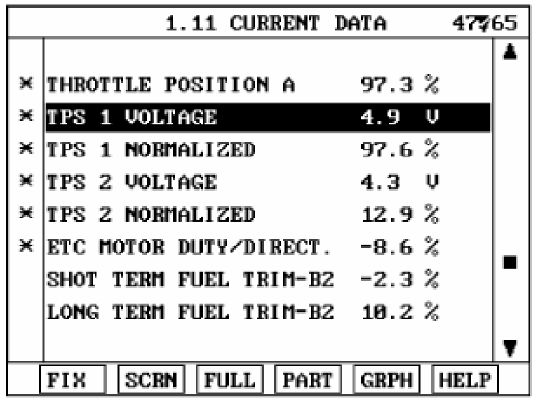
PCM

MONITOR SCANTOOL DATA

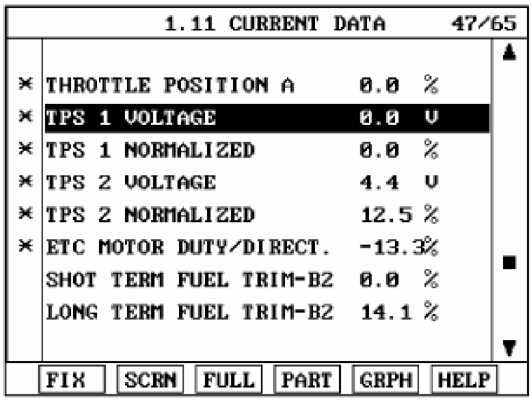
1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "TPS1" item on the service data.



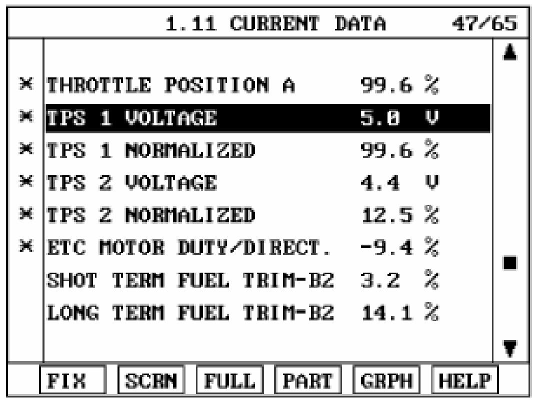
Normal data at idle



Data at open in TPS1



Data at short to ground in TPS1



Data at short to battery in TPS1

> **CAUTION**
>
> Procedure of ETS Initialization
> 1. Erase the trouble codes on PCM
> 2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10 second)
> 3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

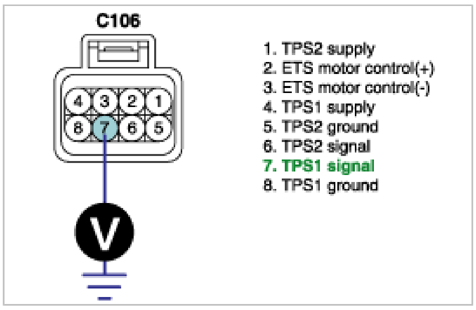
▸ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check voltgae
   (1) IG "OFF" and disconnect TPS connector.
   (2) IG "ON" and ENG "OFF"

(3) Measure voltage between terminal 7 of TPS harness connector and chassis ground.

Specification : Approx. 5V



(4) Is the measured voltage within specification?

YES

▸ Go to "Check open in harness" as follows.

NO

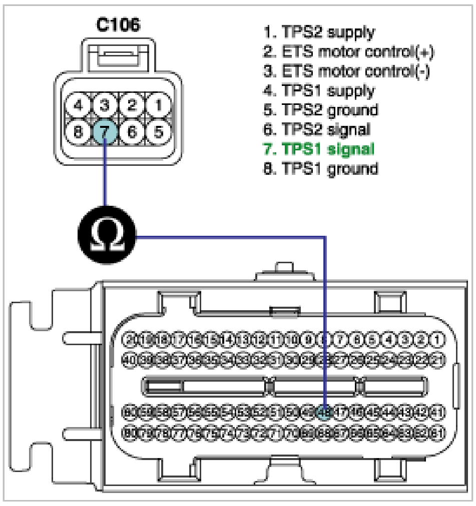
▸ Go to "Check short to battery in harness" as follows.

2. Check open in harness

(1) IG "OFF" and disconnect TPS connector and PCM connector.

(2) Measure resistance between terminal 7 of TPS harness connector and terminal 48 of PCM harness connector.

Specification : Below 1Ω



(3) Is the measured resistance within specification?

YES

▸ Go to "Ground Circuit Inspection" procedure.

NO

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

3. Check short to battery in harness

(1) IG "OFF" and disconnect TPS connector and PCM connector.

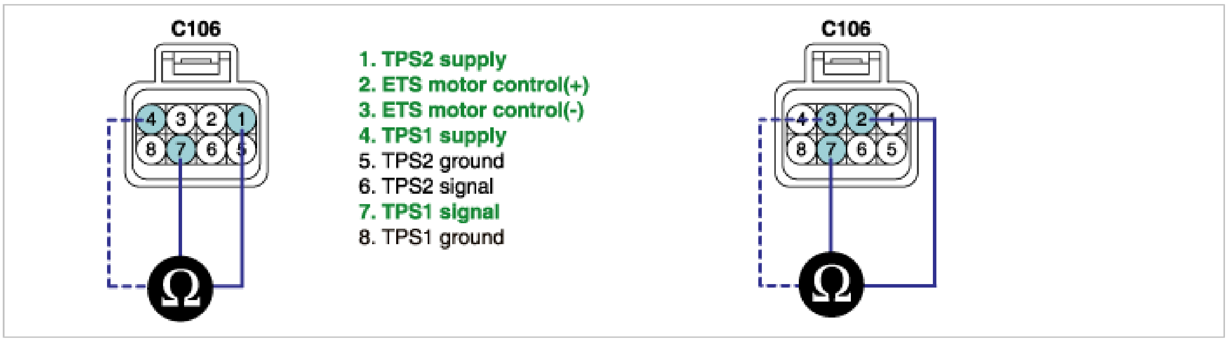
(2) Measure resistance between terminals 4 and 7 of TPS harness connector.

(3) Measure resistance between terminals 1 and 7 of TPS harness connector.

(4) Measure resistance between terminals 2 and 7 of TPS harness connector.

(5) Measure resistance between terminals 3 and 7 of TPS harness connector.

Specification : Infinite



(6) Is the measured resistance within specification?

YES

▸ Go to "Ground circuit inspection " procedure.

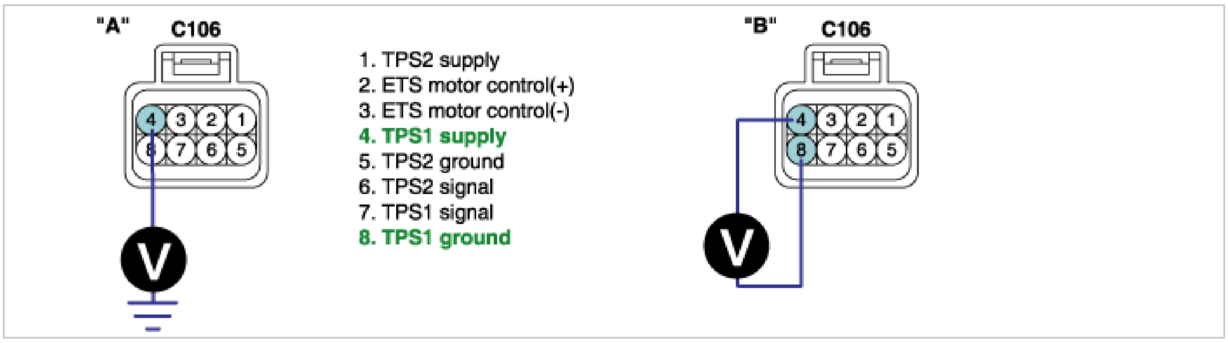
NO

▸ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF" and disconnect TPS connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 4 of TPS harness connector and chassis ground.
4. Measure voltage between terminals 4 and 8 of TPS harness connector.

Specification : Voltage difference between measurement "A" and "B" is below 200mV.



5. Is the measured voltage within specification?

YES

▸ Go to "Component inspection" procedure.

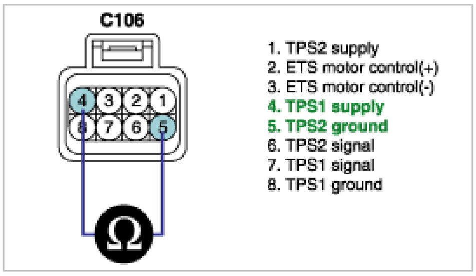
NO

▸ Repair open or contact resistance in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check TPS
   (1) IG "OFF" and disconnect TPS connector.
   (2) Measure resistance between terminals 4 and 5 of TPS connector.(component side)

Specificaton : 4 ~ 6kΩ



(3) Is the measured resistance within specification?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good ECT motor & TPS and check for proper operation. If the problem is corrected, replace ECT motor & TPS and go to "Verification of Vehicle Repair" procedure.

> **CAUTION**
>
> Procedure of ETS Initialization
> 1. Erase the trouble codes on PCM
> 2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10sec.)
> 3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

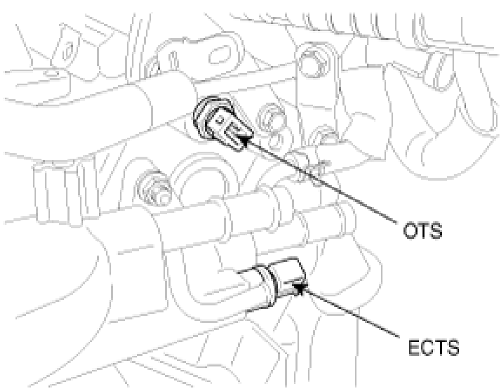
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0125

COMPONENT LOCATION



GENERAL DESCRIPTION

An Engine Coolant Temperature Sensor (ECTS) monitors the temperature of the coolant. This input is used by the PCM for engine control and as an enabling criteria for same diagnostics. The air flow coming into the engine is accumulated and used to determine if the engine has been driven within conditions that would allow the engine coolant to heat up normally to the thermostat regulating temperature. If the coolant temperature does not reach regulating temperature of the thermostat, diagnostics that use the engine coolant temperature as enabling criteria may not run when expected.

DTC DESCRIPTION

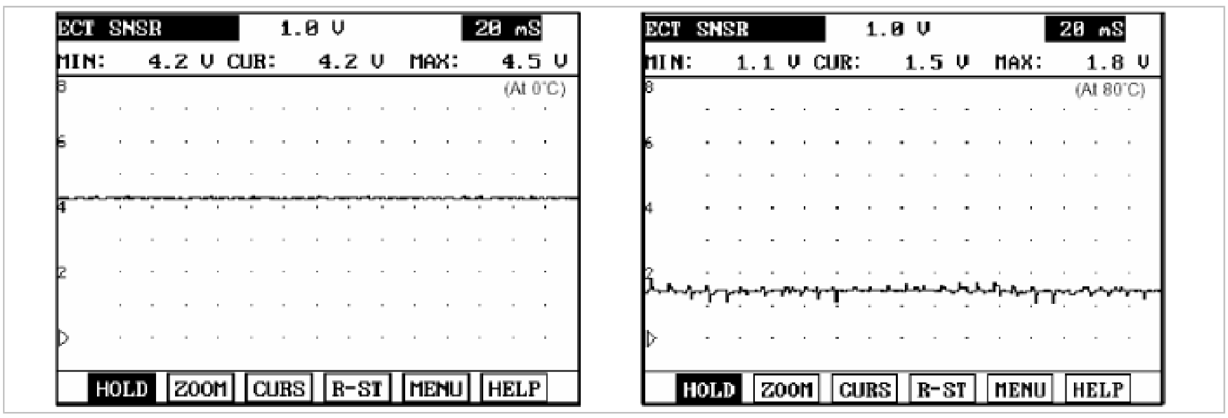
The Engine Coolant Temperature Time to Closed Loop Diagnostic monitors the time it takes the coolant to reach the temperature required for closed loop engine operation and compares it against a maximum limit dependent on the difference between the startup coolant temperature and the closed loop coolant temperature for that warm up cycle. If it takes longer than this allowed limit, a failure has occurred.

If the coolant temperature does not reach the specified value within the established time parameters, the PCM determines that a malfunction exists and a DTC is stored. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• This diagnostic monitors the time it takes for the coolant temperature to reach the closed loop temperature and compares against a maximum threshold in order to make a PASS/FAIL determination, provided airflow and idle conditions are met.	• Poor connection • Improper coolant level • Malfunctioning Cooling System • Faulty ECTS
Enable Conditions	• No disabling faults present • Coolant sensor within range • Startup coolant temp ≤ 34°C(86 °F) • Engine running	
Threshold value	• Undefaulted coolant temperature ≥ Threshold Value(°C) • Test Time = Threshold (second)	
Diagnosis Time	• More than 5 second failure.	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA



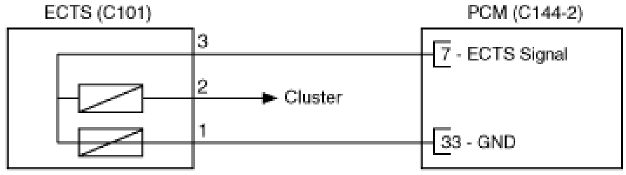
The output signals of IATS & ECTS change smoothly without any rapid changes. Those have almost same characteristic signal during the early period after start. It means that the temperatures of intake air and engine coolant are depended on the temperature of atmosphere. Meanwhile, during the warming up, the output signal of ECTS is going up increasingly. but, the output signal of IATS changes a little bit. even it may not change almost. It means that the heat of engine does not affect on the temperature of intake air.

SPECIFICATION

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59
0(32)	5.79	80(176)	0.32
20(68)	2.31 ~ 2.59		

SCHEMATIC DIAGRAM

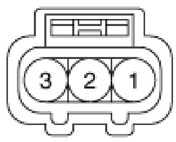
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

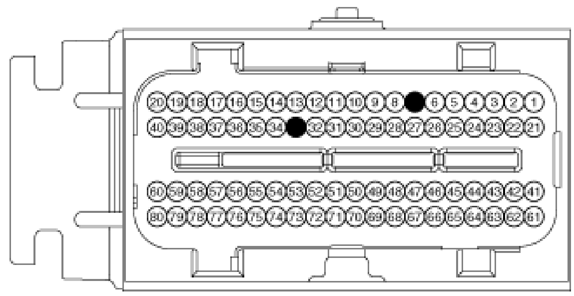
Terminal	Connected to	Funtion
1	PCM C144-2 (33)	Sensor ground
2	Cluster	-
3	PCM C144-2 (7)	ECTS Signal

[HARNESS CONNECTORS]



C101

ECTS



C144-2

PCM

MONITOR SCANTOOL DATA

1. Engine "ON"
2. Monitor Engine Coolant Temperature Sensor parameter on Current data
3. After the engine has been starting, Check that ECT rises steadily to about 82±2°C(176~ 183.2 °F) and ECT stabilizes when the thermostat opens.

Specification : ECT rises steadily to about 82±2°C(176~ 183.2 °F) and ECT stabilizes when the thermostat opens.

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59
0(32)	5.79	80(176)	0.32
20(68)	2.31 ~ 2.59		

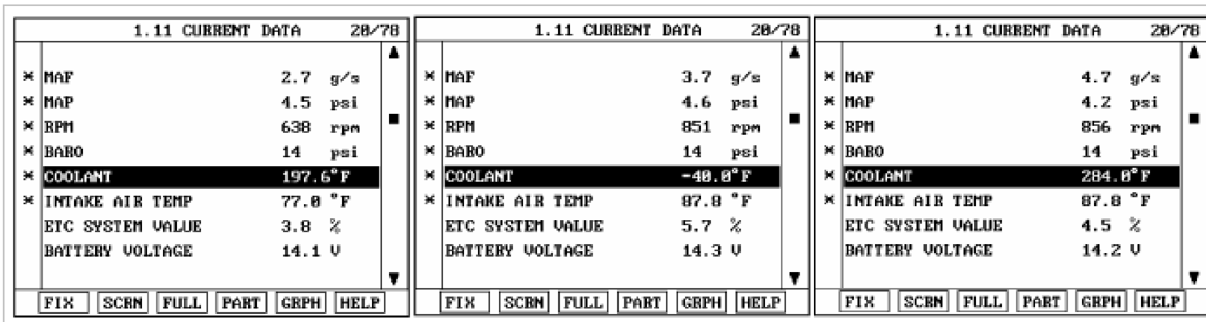


Fig. 1 Fig. 2 Fig. 3

Fig. 1 : Sensor data at normal
Fig. 2 : Sensor data at open
Fig. 3 : Sensor data at short

4. Is the measured ECTS parameter displayed within specifications ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "System Inspection" procedure

SYSTEM INSPECTION

1. Check cooling system coolant level and fill if low.
2. Check that cooling fan is operating continuously.
3. Has a problem been found ?

YES

▸ Repair or repalce as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Go to "Component Inspection" procedure.

COMPONENT INSPECTION

1. Check ECTS.

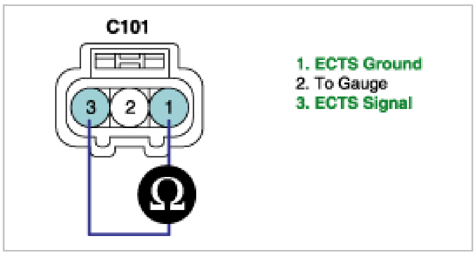
(1) Ignition "OFF"

(2) Disconnect ECTS connector

(3) Measure resistance between terminals "1" and "3" of the ECT sensor (to ECT sensor side).

Specificaton :

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59
0(32)	5.79	80(176)	0.32
20(68)	2.31 ~ 2.59		



(4) Is the measured resistance within specifications ?

YES

▸ Go to "Check PCM" as below.

NO

▸ Substitute with a known - good ECT sensor and check for proper operation. If the problem is corrected, replace ECT sensor and go to "Verification of Vehicle Repair" procedure.

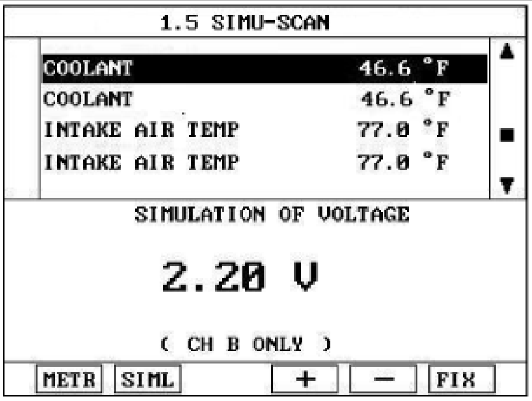
2. Check PCM

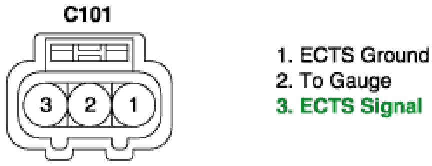
(1) Ignition "OFF".

(2) Connect Scantool and Ignition "ON" & Engine "OFF "

(3) Select simulation function on scantool.

(4) Simulate voltage at terminal "3" of ECT sensor signal connector.





(5) Does the signal value of ECT sensor changes according to simulation voltage ?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

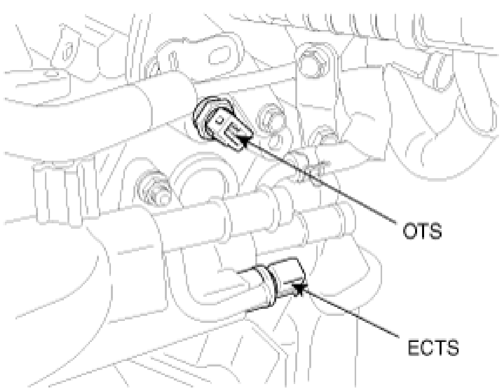
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0128

COMPONENT LOCATION



GENERAL DESCRIPTION

The Thermostat is a mechanical (thermal) device located in an engine coolant passage that allows passage of coolant into the radiator once the coolant has reached a manufacturer specified temperature called the Regulating Temperature. It has a metallic frame with a spring-loaded,centrally mounted, wax filled cylinder/piston assembly that expands and contracts with changes in temperature, thereby controlling the passage of coolant into the radiator.

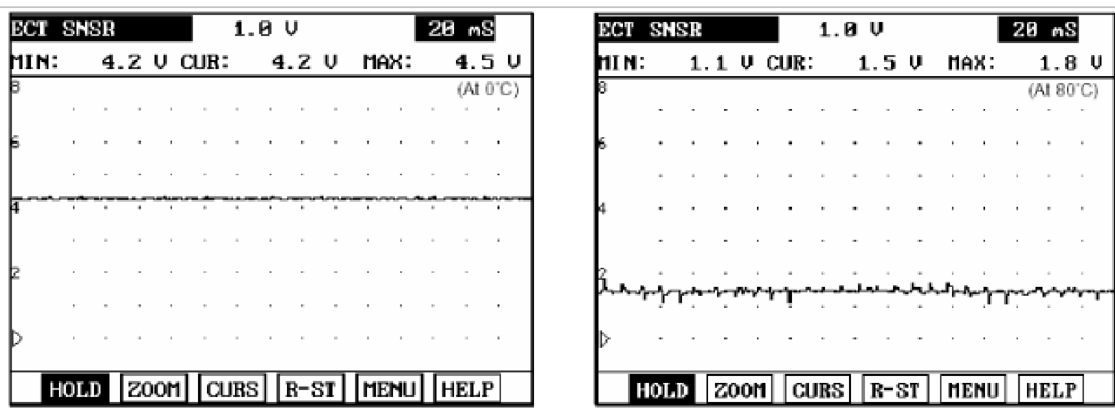
DTC DESCRIPTION

If the engine coolant temperature does not reach the specified value within the allocated period of time, the PCM determines that a malfunction exists and a DTC is stored. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• The Thermostat Diagnostic monitors the time it takes for the coolant temperature to reach either the maximum temperature required to enable other diagnostics or the Thermostat Regulating Temperature, and compares it against a threshold in order to make a PASS/FAIL determination, provided airflow and idle conditions are met.	• Poor connection • Improper coolant level • Faulty Thermostat
Enable Conditions	• No disabling faults present • Coolant sensor within range • Thermostat target temp - Startup coolant temp ≥ 20°C(68°F) • Intake air temperature >-6.6641°C(20°F) • Engine Running	
Threshold value	• Undefaulted coolant temperature ≥ Threshold Value(°C) • Test Time = Threshold (second)	
Diagnosis Time	• Continuous (More than 5 second failure.)	
MIL On Condition	• 2 driving cycles	

SIGNAL WAVEFORM AND DATA



The output signals of IATS & ECTS change smoothly without any rapid changes. Those have almost same characteristic signal during the early period after start. It means that the temperatures of intake air and engine coolant are depended on the temperature of atmosphere. Meanwhile, during the warming up, the output signal of ECTS is going up increasingly. but, the output signal of IATS changes a little bit. even it may not change almost. It means that the heat of engine does not affect on the temperature of intake air.

MONITOR SCANTOOL DATA

1. Engine "OFF"
2. Monitor Engine Coolant Temperature Sensor parameter on Current data

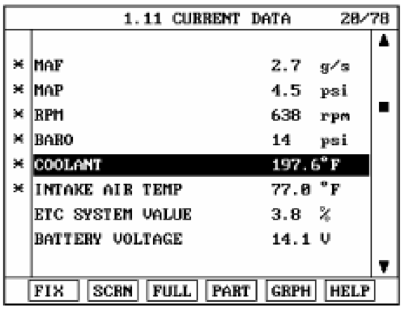


Fig. 1

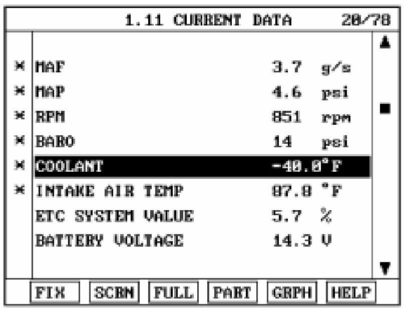


Fig. 2

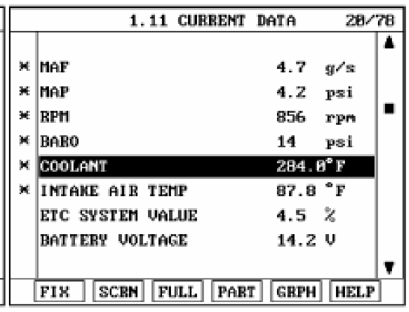


Fig. 3

Fig. 1 : Sensor data at normal
Fig. 2 : Sensor data at open
Fig. 3 : Sensor data at short

3. Is the measured ECTS parameter displayed within specifications ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Component Inspection" procedure

COMPONENT INSPECTION

1. Check Thermostat
   (1) Check cooling system coolant level and fill if low.

   (2) Check for a proper cooling system operation. Especially check that cooling and condenser fan working normally.

   (3) Remove the thermostat and check the following items:
      (1) Stuck or damaged
      (2) Verify the temperature at which the valve is open : 80 ~84°C(176~183.2°F)

   (4) Has a problem been found ?

   YES

   ▸ Substitute with a known - good Thermostat and check for proper operation. If the problem is corrected, replace Thermostat and go to "Verification of Vehicle Repair" proprocedure.

   NO

   ▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

   NOTE

   There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

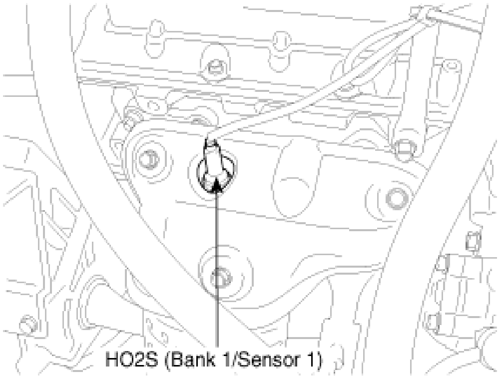
YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

COMPONENT LOCATION



GENERAL DESCRIPTION

In order to control emissions of the CO, HC and NOx components of the exhaust gas, heated oxygen sensor (HO2S), mounted on the front side and rear side of catalytic converter, detects the oxygen content in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation.
The HO2S requires a minimum temperature to operate properly and provide a closed loop fuel control system. The HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions.
The oxygen sensor generates a voltage that indicates the difference between the oxygen content of the exhaust stream and the oxygen content of ambient air. When the exhaust stream is “rich,” there is more oxygen in the ambient air than in the exhaust stream, so the voltage will be higher.
Some oxygen sensor varieties use a “bias” voltage to achieve better resolution of the exhaust stream signal. Some oxygen sensor varieties use a “pumping circuit” to force ambient air into the sensor to maintain a more pure environment for comparison.
In either case, a cold sensor will tend to indicate voltage values near the open circuit value. For the “pumping current” sensors, this open circuit value can be near 3.5 V.Since the Fuel control logic would incorrectly consider this reading to indicate a very rich mixture for an extended time, the fuel control logic can not use the oxygen sensor reading under such conditions.
The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

DTC DESCRIPTION

Checking output signals from HO2S every 15 sec. under detecting condition, if an output signal is below 0.04V for more than 12.5 sec., PCM sets P0131. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Signal low	• Poor Connection • Short to ground in harness • HO2S(B1/S1) • PCM
Enable Conditions	• Battery voltage ≥ 10V • The minimum airflow ≥ 2g/s • Engine running state ≥ 30sec. • The coolant temperature ≥ 60°C(140°F) • The feed-back control (the closed loop) state • No fuel-cut state • Above conditions are met >5 sec.	
Threshold value	• The voltage of HO2S(B1/S1)< 0.04V	
Diagnosis Time	• Continuous (more than 12.5 sec. failure for every 15 sec.test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA

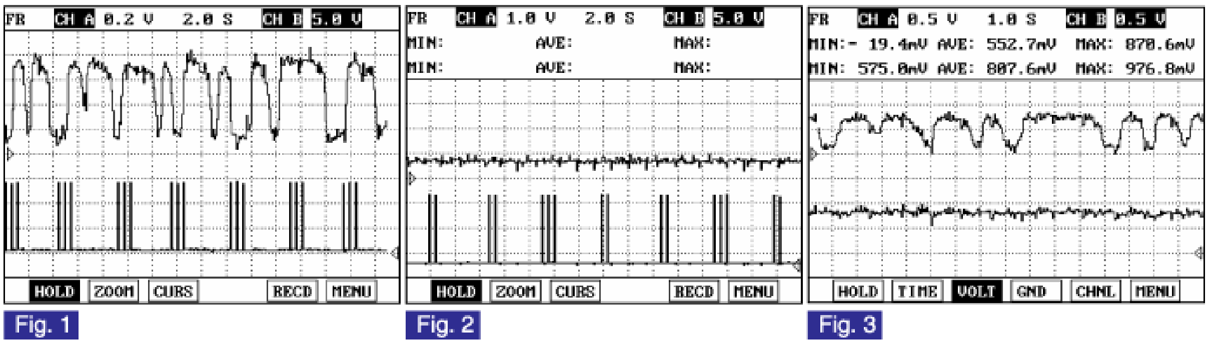


Fig. 1 : HO2S(B1S1) & Heater
Fig. 2 : HO2S(B1S2) & Heater
Fig. 3 : HO2S(B1S1) & HO2S(B1S2)

After warming-up, if accelerator pedal is released suddenly around 4000rpm, the HO2S signal reading will be lower than 200mV resulting from Fuel cut-off for the moment. Conversely, if suddenly accelerator pedal is depressed, HO2S signal reading will be around 0.6V ~1.0V. At idle, HO2S signal will switch from lean to rich normally.

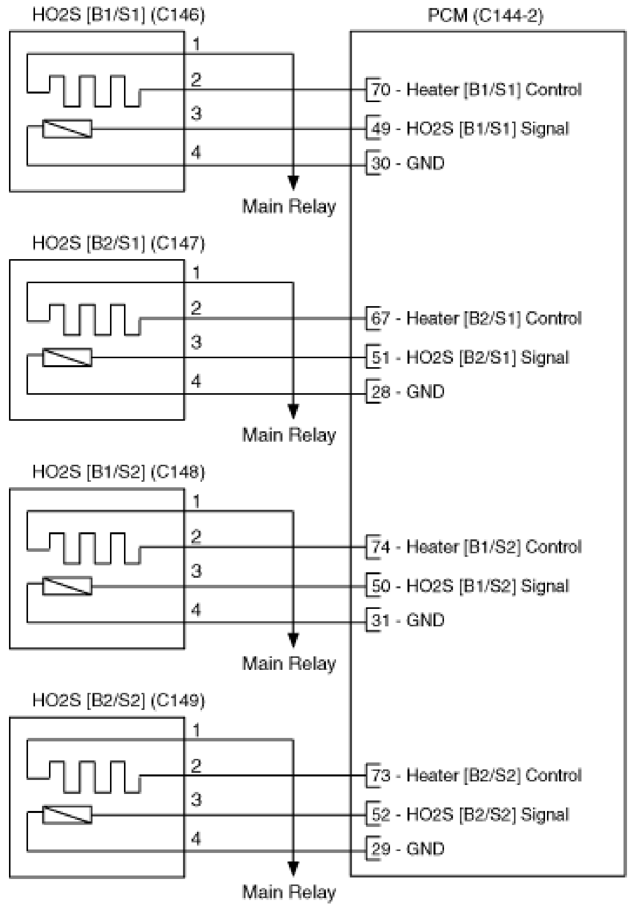
SPECIFICATION

Air/fuel mixture	Voltage(V)
Rich	0.75 ~ 1V
Lean	0 ~ 0.12V

※In case of open circuit, voltage is set to 0.45V(Pumping current OFF) or 3.5V(Pumping current ON)

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

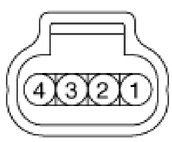
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

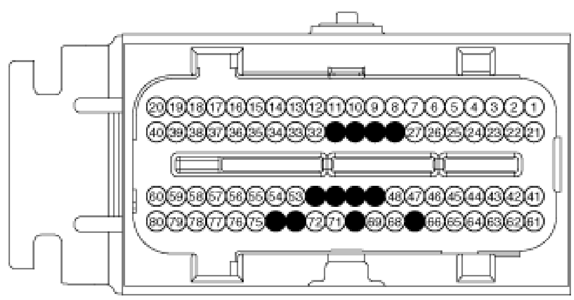
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C144-2
PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "HO2S(B1/S1)" status on the service data.

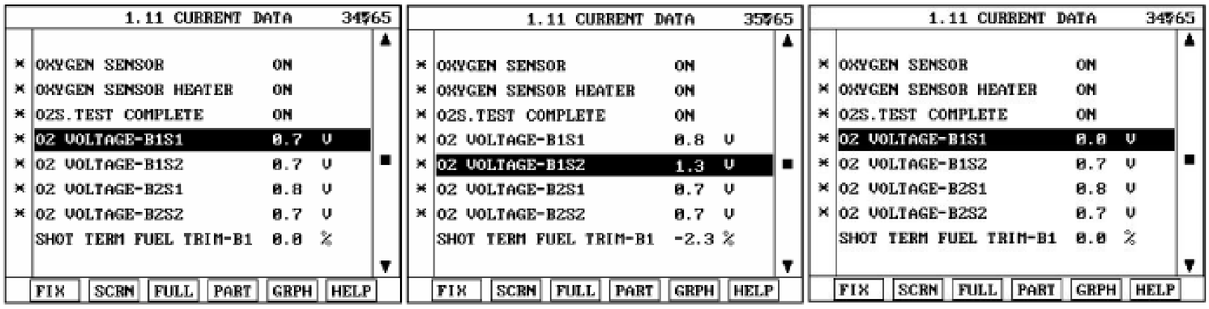


Fig. 1 Fig. 2 Fig. 3

Fig. 1 : Normal data
Fig. 2 : Open or Short to battery in HO2S(B1/S1)
Fig. 3 : Short to ground in HO2S(B1/S1)

4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

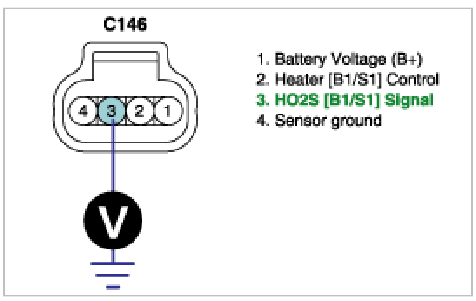
NO

▸ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. IG "OFF" and disconnect HO2S(B1/S1) connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 3 of HO2S(B1/S1) harness connector and chassis ground.

Specification : Approx. 3.5V - when pumping current is ON
Approx. 0.45V - when pumping current is OFF



4. Is the measured voltage within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check HO2S(B1/S1)
   (1) IG "OFF" and disconnect HO2S(B1/S1) connector.
   (2) Check HO2S(B1/S1) for damage or contamination caused by a foreign substance.
   (3) Is the HO2S(B1/S1) normal?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good HO2S(B1/S1) and check for proper operation. If the problem is corrected, replace HO2S (B1/S1) and go to "Verification of Vehicle Repair" procedure

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

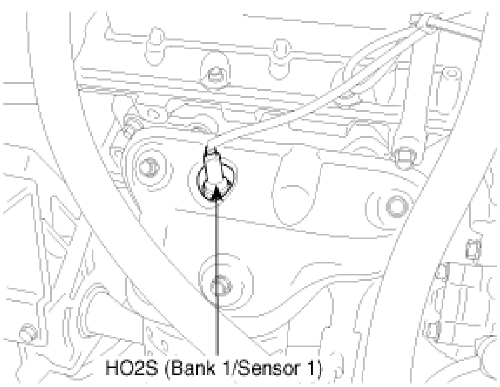
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0132

COMPONENT LOCATION



GENERAL DESCRIPTION

In order to control emissions of the CO, HC and NOx components of the exhaust gas, heated oxygen sensor (HO2S), mounted on the front side and rear side of catalytic converter, detects the oxygen content in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation.
The HO2S requires a minimum temperature to operate properly and provide a closed loop fuel control system. The HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions.
The oxygen sensor generates a voltage that indicates the difference between the oxygen content of the exhaust stream and the oxygen content of ambient air. When the exhaust stream is “rich,” there is more oxygen in the ambient air than in the exhaust stream, so the voltage will be higher.
Some oxygen sensor varieties use a “bias” voltage to achieve better resolution of the exhaust stream signal. Some oxygen sensor varieties use a “pumping circuit” to force ambient air into the sensor to maintain a more pure environment for comparison.

In either case, a cold sensor will tend to indicate voltage values near the open circuit value. For the “pumping current” sensors, this open circuit value can be near 3.5 V.Since the Fuel control logic would incorrectly consider this reading to indicate a very rich mixture for an extended time, the fuel control logic can not use the oxygen sensor reading under such conditions.
The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

DTC DESCRIPTION

Checking output signals from O2 sensor every 15 sec. under detecting condition, if an output signal is below 1.3V for more than 12.5 sec., PCM sets P0132. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Signal high	• Poor Connection • Short to battery in harness • HO2S(B1/S1) • PCM
Enable Conditions	• Battery voltage ≥ 10V • The minimum airflow ≥ 2g/s • Engine running state ≥ 30sec. • The coolant temperature ≥ 60°C(140°F) • The feed-back control (closed loop) state • No fuel-cut state • Above conditions are met >5 sec.	
Threshold value	• The voltage of HO2S(B1/S1) >1.3V	
Diagnosis Time	• Continuous (more than 12.5 sec. failure for every 15 sec.test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA

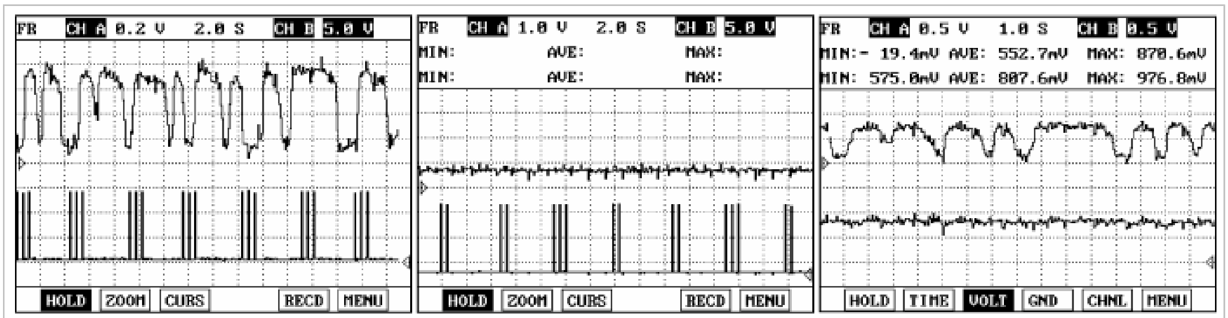


Fig. 1 Fig. 2 Fig. 3

Fig. 1 : HO2S(B1S1) & Heater
Fig. 2 : HO2S(B1S2) & Heater
Fig. 3 : HO2S(B1S1) & HO2S(B1S2)

After warming-up, if accelerator pedal is released suddenly around 4000rpm, the HO2S signal reading will be lower than 200mV resulting from Fuel cut-off for the moment. Conversely, if suddenly accelerator pedal is depressed, HO2S signal reading will be around 0.6V ~1.0V. At idle, HO2S signal will switch from lean to rich normally.

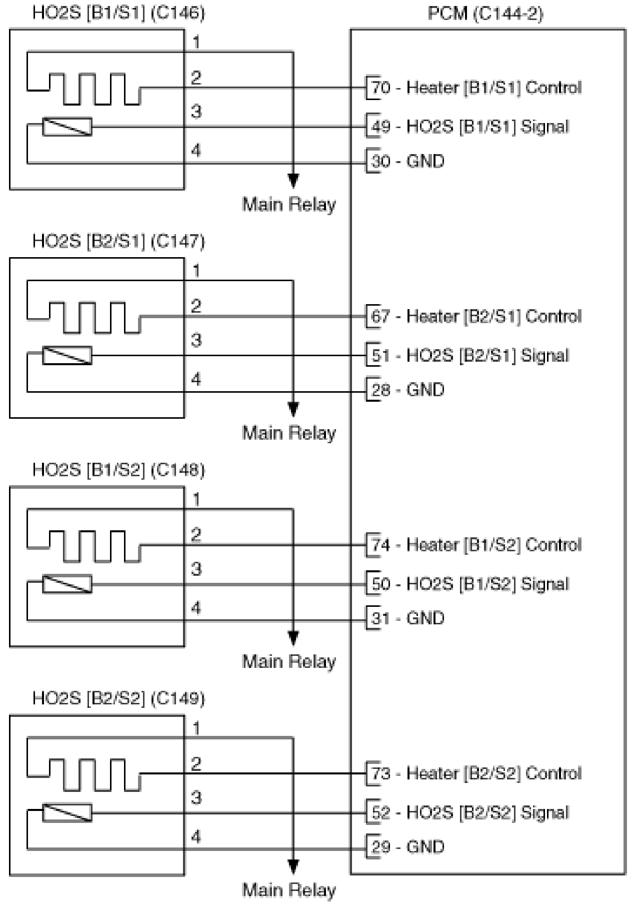
SPECIFICATION

Air/fuel mixture	Voltage(V)
Rich	0.75 ~ 1V
Lean	0 ~ 0.12V

※In case of open circuit, voltage is set to 0.45V(Pumping current OFF) or 3.5V(Pumping current ON)

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

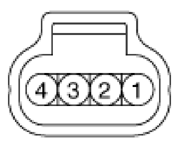
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

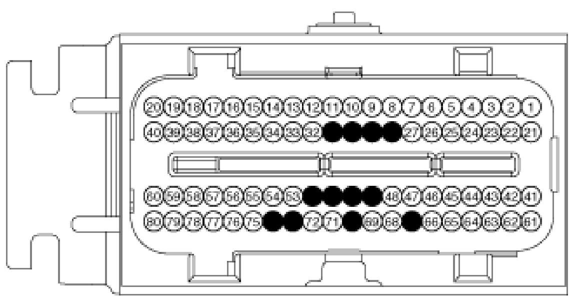
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "HO2S(B1/S1)" status on the service data.

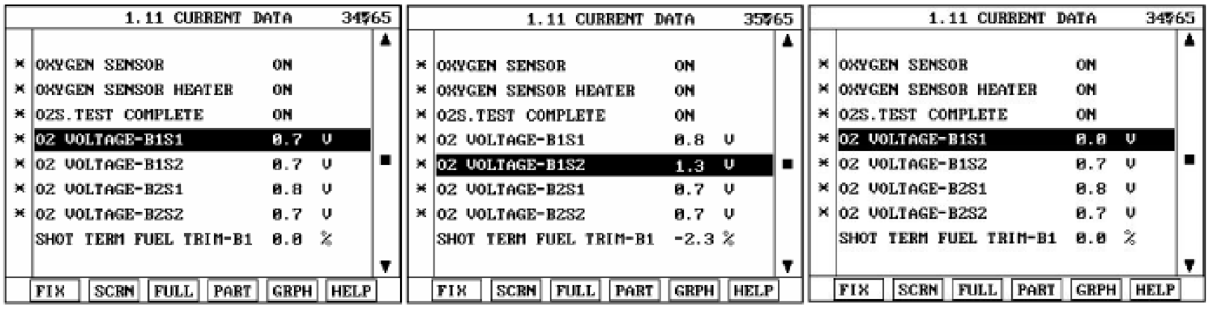


Fig. 1 Fig. 2 Fig. 3

Fig. 1 : Normal data
Fig. 2 : Open or Short to battery in HO2S(B1/S1)
Fig. 3 : Short to ground in HO2S(B1/S1)

4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

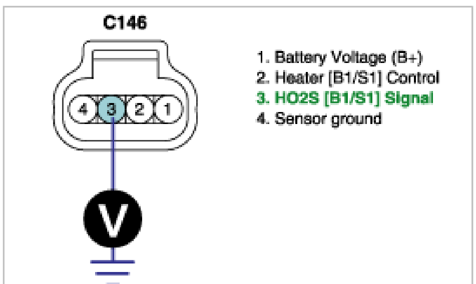
NO

▸ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. IG "OFF" and disconnect HO2S(B1/S1) connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 3 of HO2S(B1/S1) harness connector and chassis ground.

Specification : Approx. 3.5V - when pumping current is ON
Approx. 0.45V - when pumping current is OFF



4. Is the measured voltage within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check HO2S(B1/S1)
    (1) IG "OFF" and disconnect HO2S(B1/S1) connector.
    (2) Check HO2S(B1/S1) for damage or contamination caused by a foreign substance.
    (3) Is the HO2S(B1/S1) normal?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good HO2S(B1/S1) and check for proper operation. If the problem is corrected, replace HO2S (B1/S1) and go to "Verification of Vehicle Repair" procedure

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

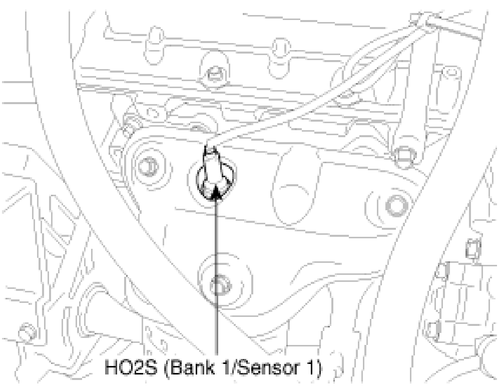
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0133

COMPONENT LOCATION



GENERAL DESCRIPTION

The HO2S is used to supply the PCM with information regarding the composition of the air/fuel mixture. The HO2S is positioned in the exhaust pipe ahead of the TWC. To measure the oxygen content, the HO2S requires a supply of ambient air as a reference. The HO2S produces a voltage that varies between 0.1V and 0.9V under normal operating conditions. The Powertrain Control Module (PCM) monitors this voltage and determines if the exhaust gas is lean or rich. If the voltage input at the PCM is under approx. 0.45V the exhaust is lean, and if the voltage input is over approx. 0.45V the exhaust is rich. The PCM constantly monitors the HO2S signal during closed loop operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary.
This oxygen sensor varieties use a “bias” voltage to achieve better resolution of the exhaust stream signal. Some oxygen sensor varieties use a “pumping circuit” to forceambient air into the sensor to maintain a more pure environment for comparison. In either case, a cold sensor will tend to indicate voltage values near the open circuit value. For the “pumping current” sensors, this open circuit value can be near 3.5 V. Since the Fuel control logic would incorrectly consider this reading to indicate a very rich mixture

for an extended time, the fuel control logic can not use the oxygen sensor reading under such conditions.

DTC DESCRIPTION

The response time of an O2 sensor can be impacted by two factors: temperature and poisoning. Poisoning of the O2 sensor is the primary failure mode of O2 sensor response time. Poisoning can come from many sources: silicone from gaskets or even in the fuel, phosphorous from engine oil, carbon from operating in a cooler environment or lead from the fuel. Most poisoning failures have the potential to clear up after the source of the poisoning has been removed. However, sometimes the poisoning may be so severe that the damage is irreversible.
Checking output signals from HO2S under detecting condition, if an output signal is out of threshold, PCM sets P0133.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Determines O2 sensor functionality by checking its response rate	• Poor connection • Faulty HO2S • Faulty PCM
Enable Conditions	• 1200 ≤ Engine RPM ≤ 4300 • 7.5g/s ≤ Air Flow ≤ 40g/s • Engine run time >60sec • Engine Coolant >70°C(158 °F) • No Decel Fuel Cut-Off Exit with Rich Bias Fueling • No torque Fuel Reduction in effect • No Disabling Faults • All of the conditions above met for more than 2 sec.	
Threshold value	• Switching counter lean to rich ≥ 13 • Switching counter rich to lean ≥ 13 • Response Lean Rich Transition Counter/Response Lean Rich Switch Counter < 29 • Response Rich Lean Transition Counter/Response Rich Lean Switch Counter < 35 • Response Rich Lean Average/Response Lean Rich Average >0.3809 • Response Rich Lean Average/Response Lean Rich Average< 3	
Diagnosis Time	• -	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA

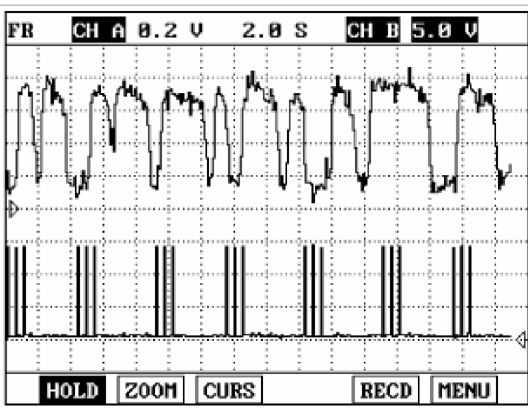


Fig. 1

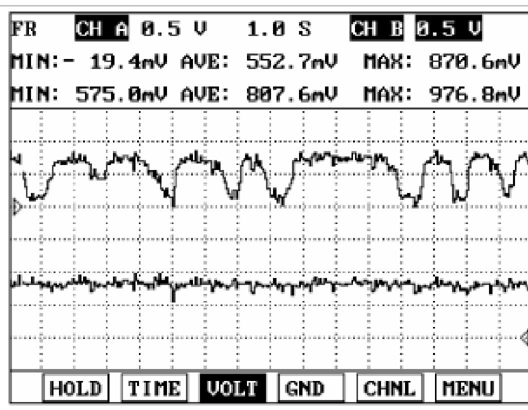


Fig. 2

Fig. 1 : HO2S(B1S1) & Heater
Fig. 2 : HO2S(B1S1) & HO2S(B1S2)

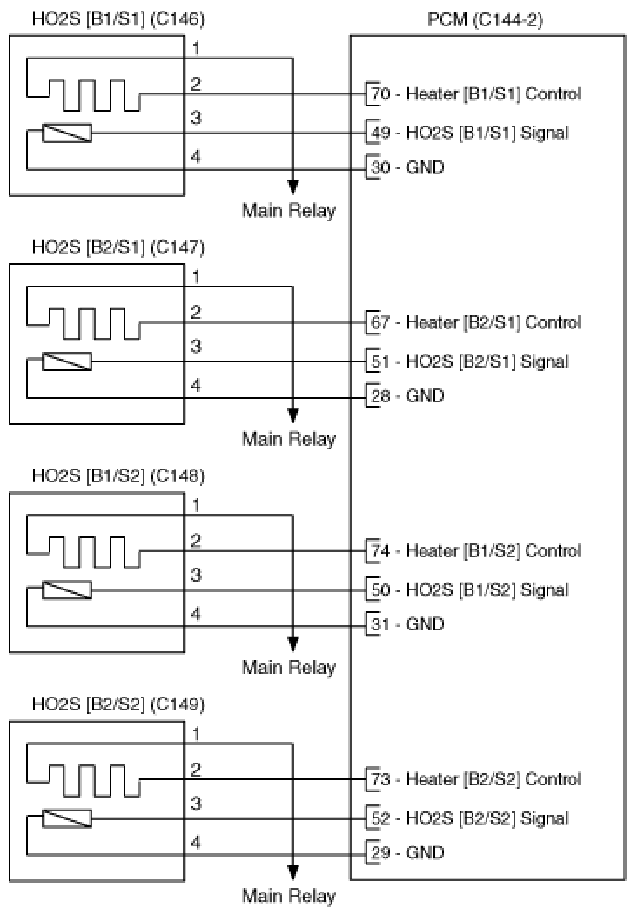
After warming-up, if accelerator pedal is released suddenly around 4000rpm, the HO2S signal reading will be lower than 200mV resulting from Fuel cut-off for the moment. Conversely, if suddenly accelerator pedal is depressed, HO2S signal reading will be around 0.6V ~1.0V. At idle, HO2S signal will switch from lean to rich normally.

SPECIFICATION

HO2S	Response Time (70% Duty at 10Hz)
	lean to rich(Less than 65ms) rich to lean(Less than 80ms)

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

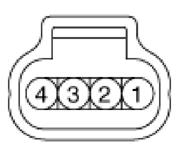
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

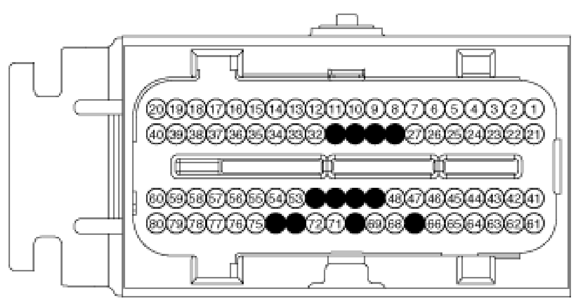
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]

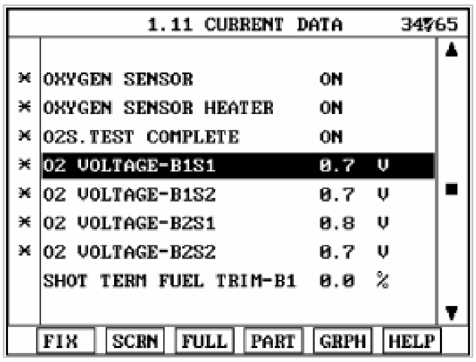


C144-2
PCM

MONITOR SCANTOOL DATA

1. Connect Scantool & Engine "ON"
2. Warm up the engine to normal operating temperature.
3. Monitor HO2S voltage(B1/S1) parameter on scantool

Specification : Voltage will vary from 0.1 to 0.9 V



4. Is the HO2S parameter displayed within specifications ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Component Inspection" procedure

COMPONENT INSPECTION

1. Visual Inspection of HO2S
   (1) Visually/physically inspect following items:
      - Inspect the front HO2S for Contaminated, deteriorated or aged Front HO2S
      - If contamination is evident on the HO2S, replace contaminated sensor

   (2) Is the HO2S visually / physically O.K ?

   YES

   ▸ Go to "Check Performance of H02S" as follows

   NO

   ▸ Substitute with a known - good HO2S and check for proper operation. If the problem is corrected, replace HO2S and go to "Verification of Vehicle Repair" procedure.

2. Check performance of HO2S
   (1) Connect scantool & Engine "ON"

   (2) Warm-up the engine to normal engine temperature.

   (3) Monitor signal waveform of HO2S with scantool.

   Specification : Response times :

HO2S	Response Time (70% Duty at 10Hz)
	lean to rich(Less than 65ms) rich to lean(Less than 80ms)

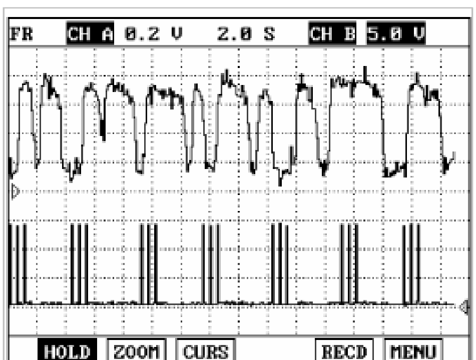


Fig. 1

Fig. 1 : HO2S(B1S1) & Heater

   (4) Is the sensor signal switching properly ?

   YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good HO2S and check for proper operation. If the problem is corrected, replace HO2S and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

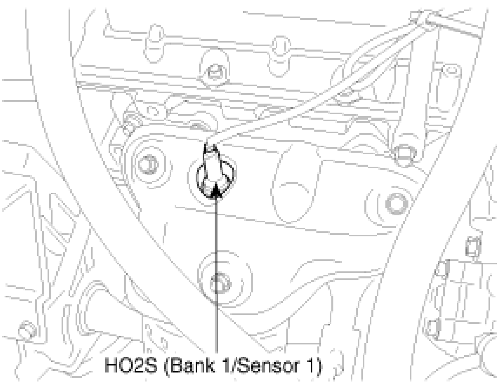
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0134

COMPONENT LOCATION



GENERAL DESCRIPTION

In order to control emissions of the CO, HC and NOx components of the exhaust gas, heated oxygen sensor (HO2S), mounted on the front side and rear side of catalytic converter, detects the oxygen content in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation.
The HO2S requires a minimum temperature to operate properly and provide a closed loop fuel control system. The HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions.
The oxygen sensor generates a voltage that indicates the difference between the oxygen content of the exhaust stream and the oxygen content of ambient air. When the exhaust stream is “rich,” there is more oxygen in the ambient air than in the exhaust stream, so the voltage will be higher.
Some oxygen sensor varieties use a “bias” voltage to achieve better resolution of the exhaust stream signal. Some oxygen sensor varieties use a “pumping circuit” to force ambient air into the sensor to maintain a more pure environment for comparison.
In either case, a cold sensor will tend to indicate voltage values near the open circuit value. For the “pumping current” sensors, this open circuit value can be near 3.5 V.Since the Fuel control logic would incorrectly consider this reading to indicate a very rich mixture for an extended time, the fuel control logic can not use the oxygen sensor reading under such conditions.
The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

DTC DESCRIPTION

Checking output signals from HO2S every 90 sec. under detecting condition, if an output signal indicating open in the circuit lasts for more than 76.5 sec., PCM sets P0134. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

<table>
<tr><th colspan="2">Item</th><th>Detecting Condition</th><th>Possible cause</th></tr>
<tr><td colspan="2">DTC Strategy</td><td>• Open</td><td rowspan="7">• Poor connection
• Open in harness
• HO2S(B1/S1)
• PCM</td></tr>
<tr><td colspan="2">Enable Conditions</td><td>• No sensor cooled status
• The minimum airflow ≥ 2g/s
• The battery voltage ≥ 10V
• Engine running state >30 sec.
• Coolant temperature ≥ 60°C(140°F)</td></tr>
<tr><td rowspan="2">Thresh old value</td><td>Case 1</td><td>• At pumping current ON
• 1.2V ≤ Voltage of HO2S ≤ 3.9V</td></tr>
<tr><td>Case 2</td><td>• At pumping current OFF
• 0.415V ≤ Voltage of HO2S ≤ 0.515V</td></tr>
<tr><td colspan="2">Diagnosis Time</td><td>• Continuous
(more than 76.5 sec.failure for every 90 sec.test)</td></tr>
<tr><td colspan="2">MIL On Condition</td><td>• 2 Driving Cycles</td></tr>
</table>

SIGNAL WAVEFORM AND DATA

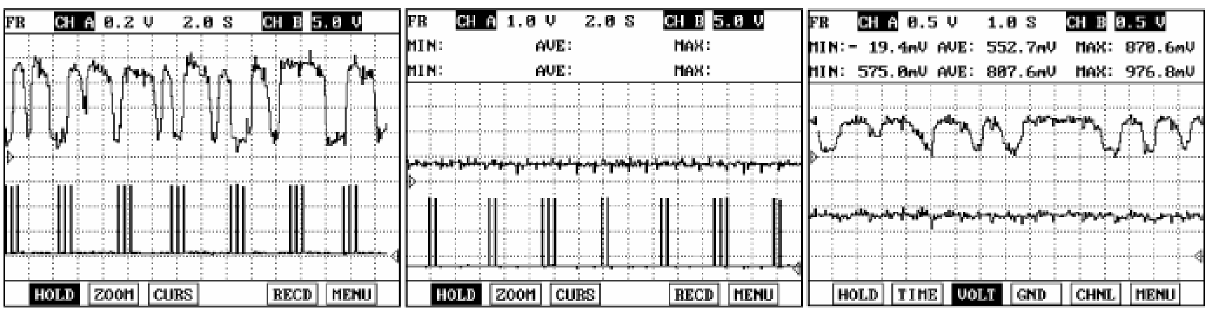


Fig. 1 Fig. 2 Fig. 3

Fig. 1 : HO2S(B1S1) & Heater
Fig. 2 : HO2S(B1S2) & Heater
Fig. 3 : HO2S(B1S1) & HO2S(B1S2)

After warming-up, if accelerator pedal is released suddenly around 4000rpm, the HO2S signal reading will be lower than 200mV resulting from Fuel cut-off for the moment. Conversely, if suddenly accelerator pedal is depressed, HO2S signal reading will be around 0.6V ~1.0V. At idle, HO2S signal will switch from lean to rich normally.

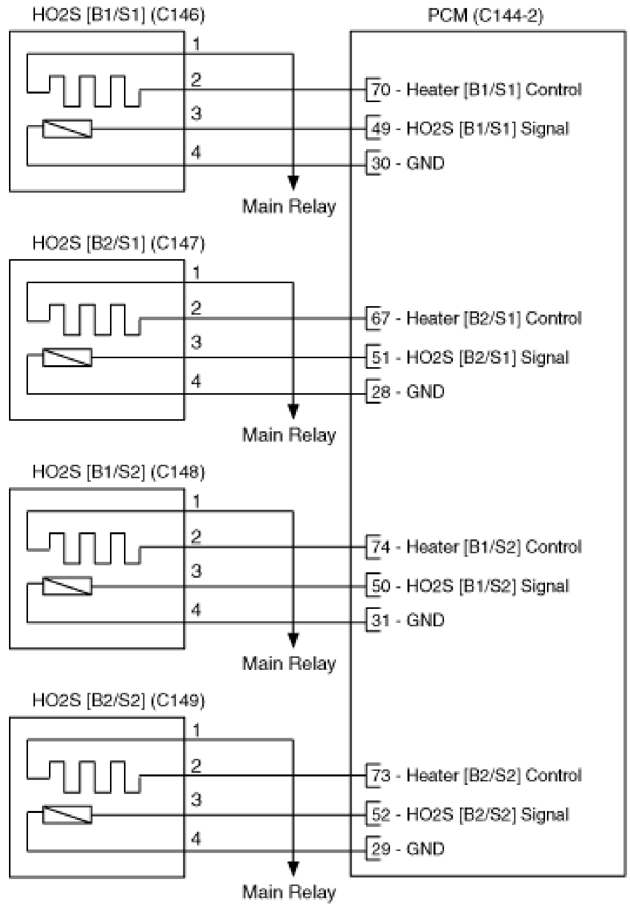
SPECIFICATION

Air/fuel mixture	Voltage(V)
Rich	0.75 ~ 1V
Lean	0 ~ 0.12V

※In case of open circuit, voltage is set to 0.45V(Pumping current OFF) or 3.5V(Pumping current ON)

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

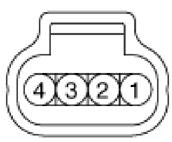
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

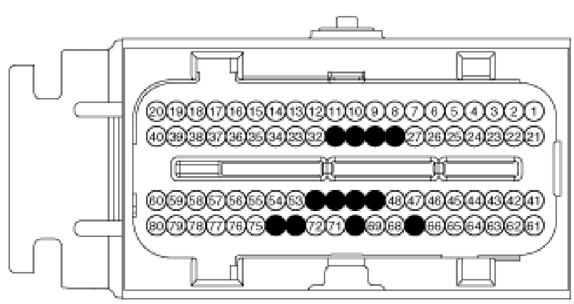
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "HO2S(B1/S1)" status on the service data.

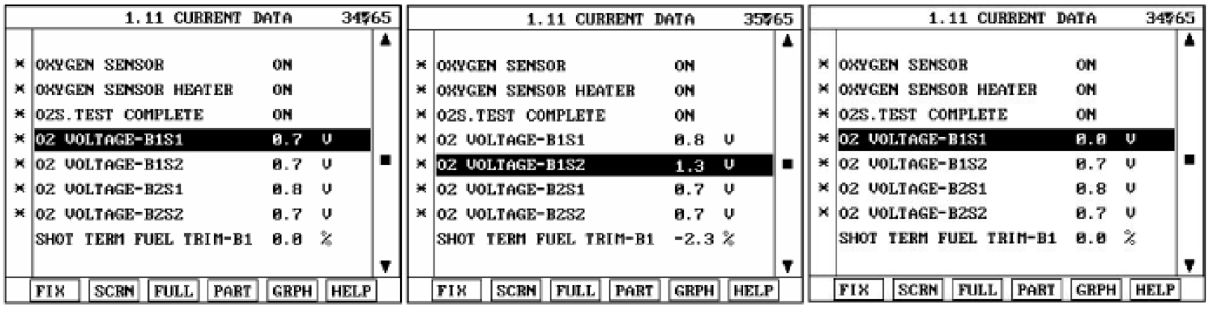


Fig. 1 Fig. 2 Fig. 3

Fig. 1 : Normal data
Fig. 2 : Open or Short to battery in HO2S(B1/S1)
Fig. 3 : Short to ground in HO2S(B1/S1)

4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

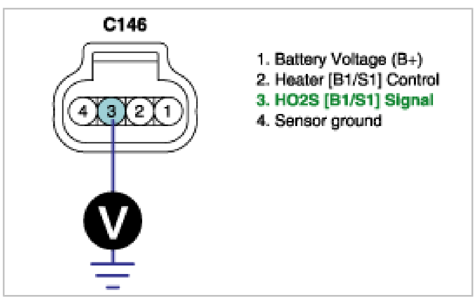
NO

▸ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. IG "OFF" and disconnect HO2S(B1/S1) connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 3 of HO2S(B1/S1) harness connector and chassis ground.

Specification : Approx. 3.5V - when pumping current is ON
Approx. 0.45V - when pumping current is OFF



4. Is the measured voltage within specification?

YES

▸ Go to "Ground circuit inspection" procedure.

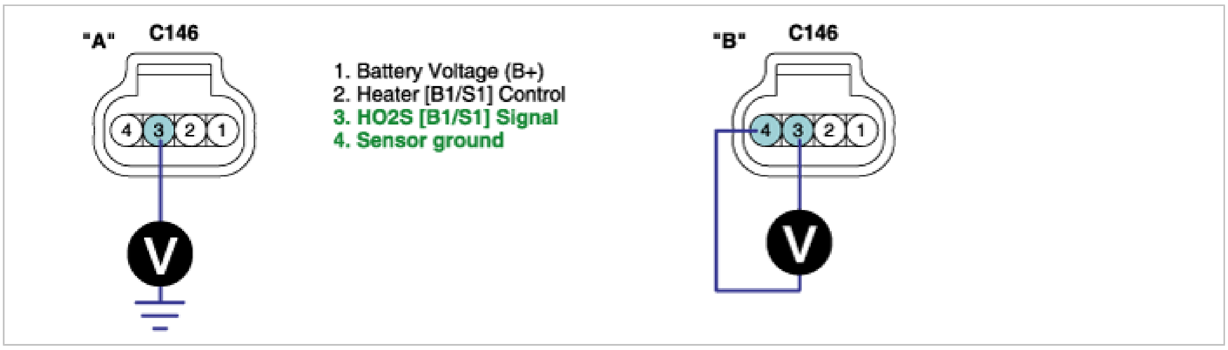
NO

▸ Repair open in harness, and go to "Verification of Vehicle Repair" prcedure.

GROUND CIRCUIT INSPECTION

1. IG "ON" and disconnect HO2S(B1/S1) connector.
2. Measure voltage between terminal 3 of HO2S(B1/S1) harness connector and chassis ground.
3. Measure voltage between terminals 3 and 4 of HO2S(B1/S1) harness connector.

Specification : Voltage difference between measurement "A" and "B" is below 200mV.



4. Is the measured voltage within specification?

YES

▸ Go to "Component inspection" procedure.

NO

▸ Repair open or contact resistance in harness, and go to "Verification of Vehicle Repair" prcedure.

COMPONENT INSPECTION

1. Check HO2S(B1/S1)
   (1) IG "OFF" and disconnect HO2S(B1/S1) connector.
   (2) Check HO2S(B1/S1) for damage or contamination caused by a foreign substance.
   (3) Is the HO2S(B1/S1) normal?

   YES

   ▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Substitute with a known - good HO2S(B1/S1) and check for proper operation. If the problem is corrected, replace HO2S (B1/S1) and go to "Verification of Vehicle Repair" procedure

   > NOTE
   >
   > There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

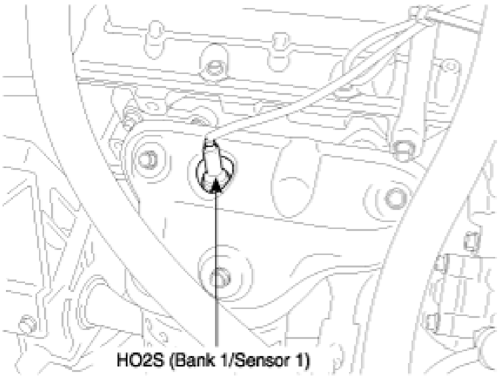
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0135

COMPONENT LOCATION



GENERAL DESCRIPTION

In order to control emissions of the CO, HC and NOx components of the exhaust gas, heated oxygen sensor (HO2S), mounted on the front side and rear side of catalytic converter, detects the oxygen content in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation.
The HO2S requires a minimum temperature to operate properly and provide a closed loop fuel control system. The HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions.
The oxygen sensor generates a voltage that indicates the difference between the oxygen content of the exhaust stream and the oxygen content of ambient air. When the exhaust stream is “rich,” there is more oxygen in the ambient air than in the exhaust stream, so the voltage will be higher.
Some oxygen sensor varieties use a “bias” voltage to achieve better resolution of the exhaust stream signal. Some oxygen sensor varieties use a “pumping circuit” to force ambient air into the sensor to maintain a more pure environment for comparison.
In either case, a cold sensor will tend to indicate voltage values near the open circuit value. For the “pumping current” sensors, this open circuit value can be near 3.5 V.Since the Fuel control logic would incorrectly consider this reading to indicate a very rich mixture for an extended time, the fuel control logic can not use the oxygen sensor reading under such conditions.
The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

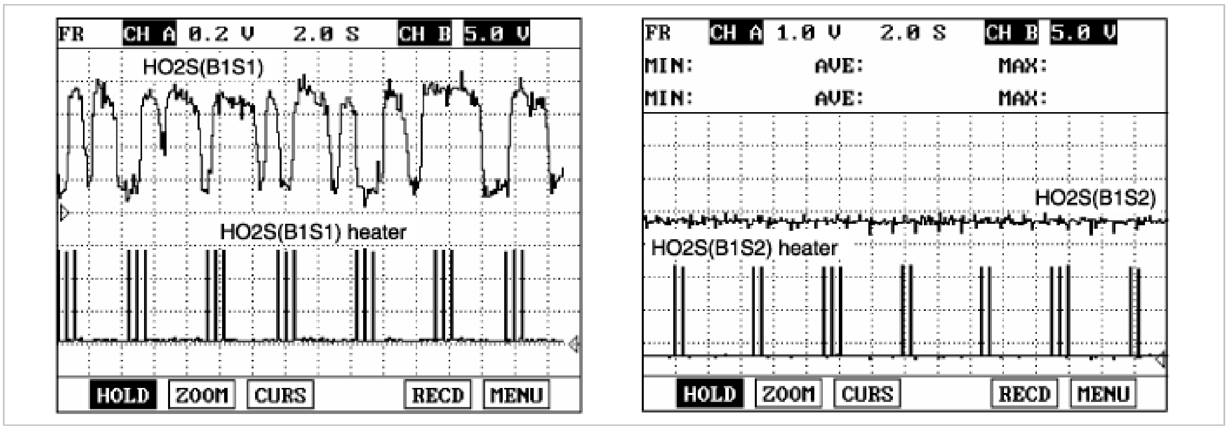
DTC DESCRIPTION

The O2 Heater diagnostic compares the current that is passing through the O2 Heater to a low limit. When the current is too low, the O2 Heater is considered failed.A failed O2 Heater will have an affect on vehicle emissions, especially on cold starts. The O2 Heater allows the O2 Sensor to work properly more quickly after the engine starts. If the PCM detects heater current is lower than threshold value for 2.5 seconds or over while enable condition is met PCM determines that a fault exists and a DTC is stored.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Compares the current that is passing through the O2 Heater to a low limit	• Poor Connection • Contact Resistance • HO2S(B1/S1) • PCM
Enable Conditions	• Ignition ON • Engine Running >60s • Heater Duty Cycle >0.4% • Max. Duty Cycle - Min. Duty Cycle< 0.05% • Delay Time ≥ 5s	
Threshold value	• Filtered O2 Heater Current < threshold value	
Diagnosis Time	• Continuous (More than 2.5 second failure for every 5 second test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA



The HO2S requires a minimum temperature to provide a closed loop fuel control system. So the HO2S contains a heater element to reduce its warm-up time and ensure its performance during all driving conditions. The HO2S heater is controlled ON after engine start except for Cold condition and high speed accelleration. The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

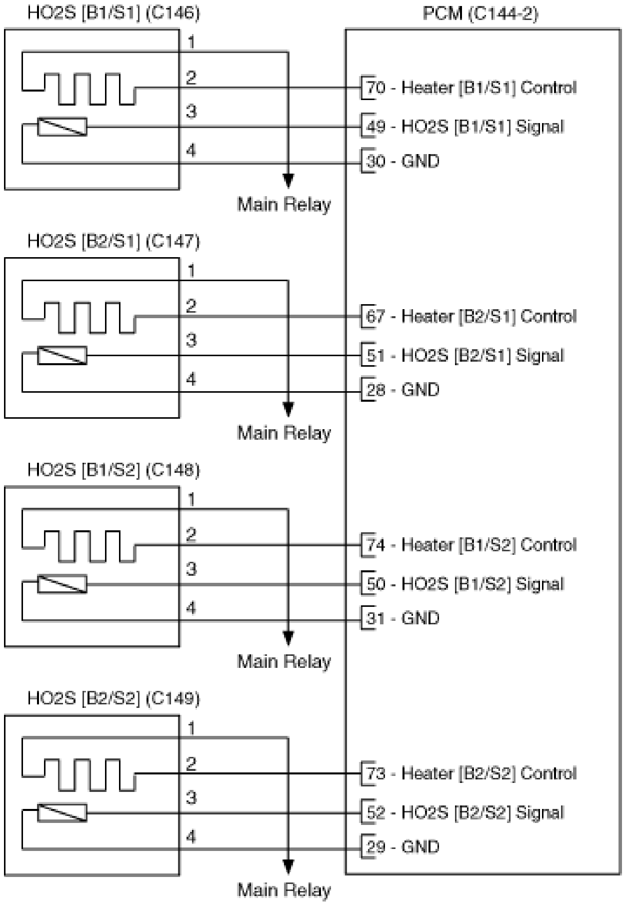
SPECIFICATION

For reference only

Condition	Current(A)
Heater Current at 13.5V, 450°C(842°F) Exhaust	0.52 ± 0.1
Heater In-rush Current at 21°C(69.8°F), 13.5V	1.7 MAX
Heater In-rush Current at -40°C(-40°F), 13.5V	2.2 MAX

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

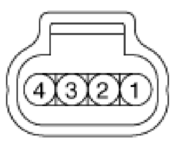
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

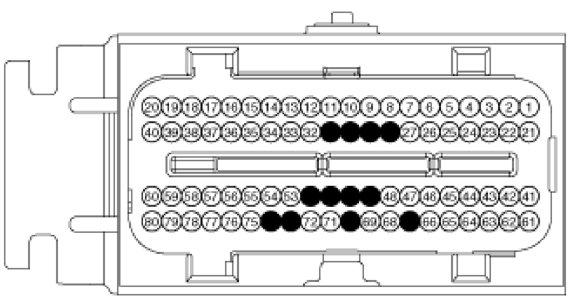
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

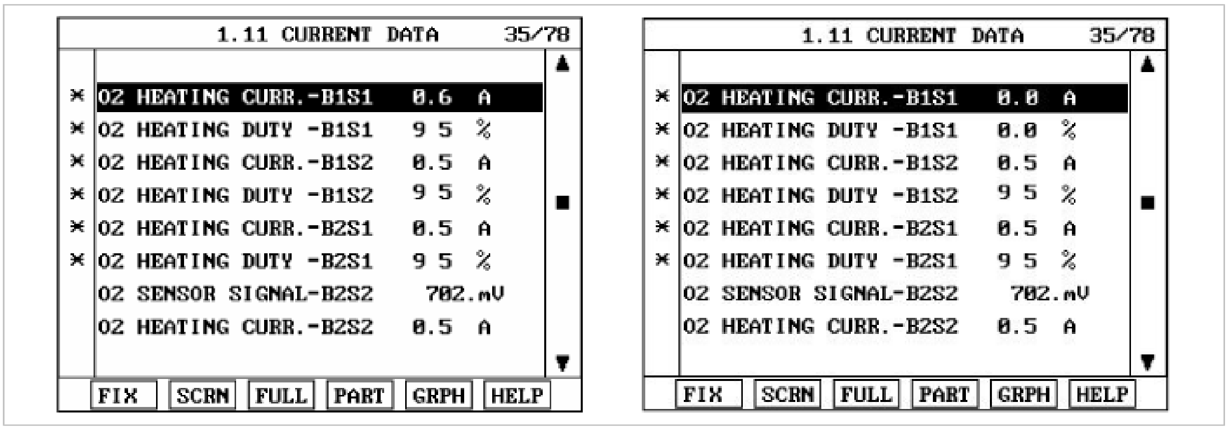
HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C144-2
PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "HO2S(B1/S1) Heater" status on the service data.



4. Is the "HO2S Heater(B1/S1)" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

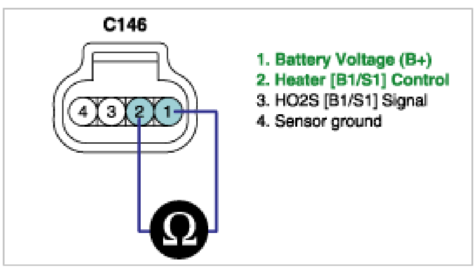
NO

▸ Go to " Component Inspection " procedure.

COMPONENT INSPECTION

1. Check HO2S(B1/S1) Heater resistance
   (1) IG "OFF" and disconnect HO2S(B1/S1) connector
   (2) Measure resistance between terminal 1 and 2 of HO2S(B1/S1)(Component Side)
   Specification :

Heater	
Resistance (Ω)	9.6 ± 1.5 at 21°C(69.8°F)



   (3) Is the measured resistance within specification ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Substitute with a known - good HO2S(B1/S1) and check for proper operation. If the problem is corrected, replace HO2S (B1/S1) and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

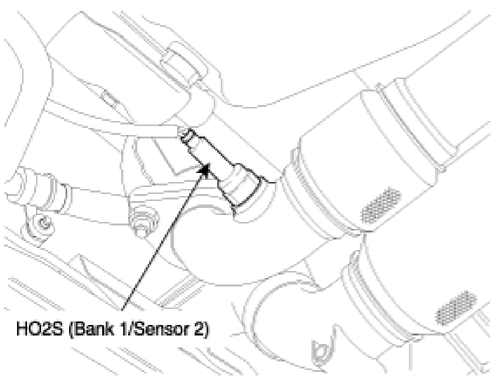
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0137

COMPONENT LOCATION



GENERAL DESCRIPTION

HO2S(B1/S2) is in the back of Catalytic Converter to check the proper operation of catalyst. As Exhaust gas already passed through catalyst, oxygen density in it is within specific range. If the oxygen density changes in accordance with HO2S(B1/S2), it means the poor performance of catalytic converter.

DTC DESCRIPTION

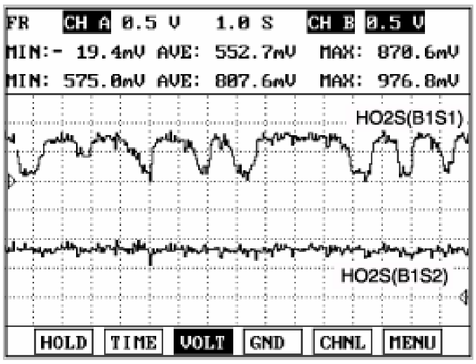
Checking output signals from HO2S every 15 sec. under detecting condition, if an output signal is below 0.05V for more than 12.5 sec. PCM sets P0137. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Signal low	• Poor Connection • Short to ground in harness • HO2S(B1/S2) • PCM
Enable Conditions	• Battery voltage ≥ 10V • The minimum airflow ≥ 2g/s • Engine running state ≥ 30 sec • The coolant temperature ≥ 60°C(140°F) • The feed-back control (the closed loop) state • No fuel-cut state • Above conditions are met >5 sec	
Threshold value	• The voltage of HO2S(B1/S2)< 0.04V	

Diagnosis Time	• Continuous (more than 12.5 sec. failure for every 15 sec.test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA



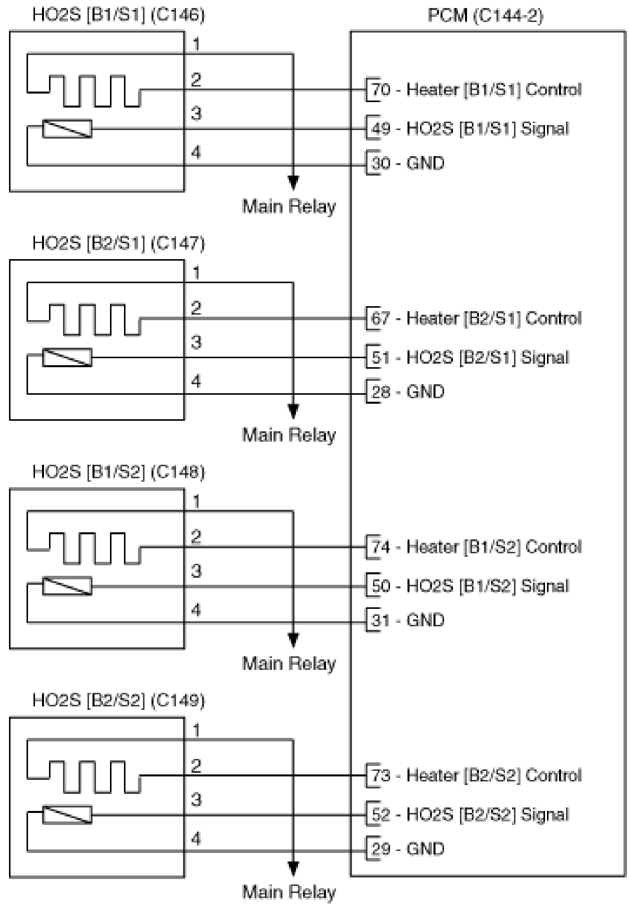
The amplitude of the signal output of the rear HO2S is small compared to the front HO2S because the rear HO2S detects emission gas purified by the catalytic converter. This is the normal signal waveform of the rear HO2S at idle.

SPECIFICATION

Air/fuel mixture	Voltage(V)
Rich	0.75 ~ 1V
Lean	0 ~ 0.12V

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

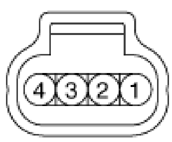
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

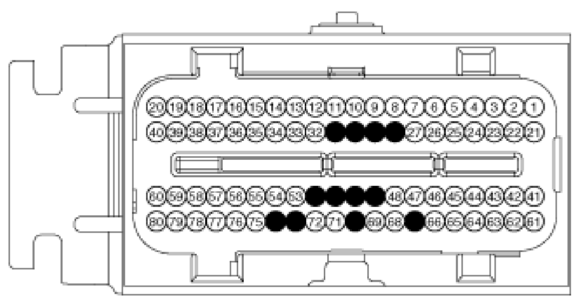
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "HO2S(B1/S2)" item on the service data.

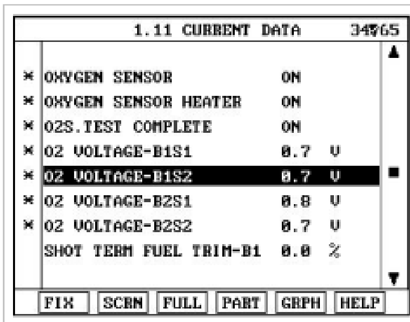


Fig. 1

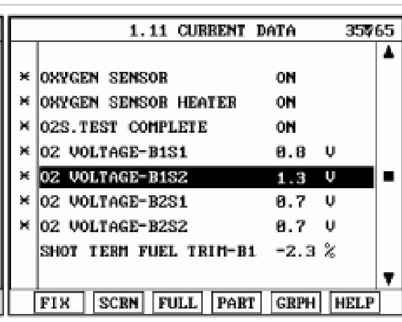


Fig. 2

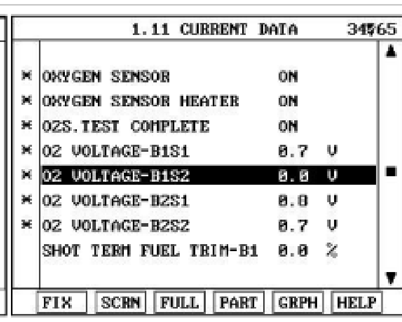


Fig. 3

4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

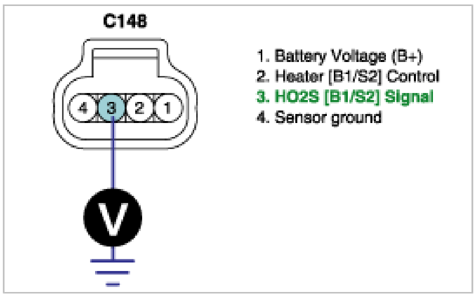
NO

▸ Go to " Signal Circuit Inspection " procedure.

SIGNAL CIRCUIT INSPECTION

1. IG "OFF" and disconnect HO2S(B1/S2)
2. IG "ON"
3. Measure voltage between terminal 3 of HO2S(B1/S2) harness connector and chassis ground.

Specification : Approx. 3.5V - when pumping current is ON
Approx. 0.45V - when pumping current is OFF



4. Is the measured voltage within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Visual Inspection of HO2S
   Visually/physically inspect following items:
   A. Inspect the Rear HO2S for Contaminated, deteriorated or aged Rear HO2S
   B. If contamination is evident on the HO2S, replace contaminated sensor
2. Is the HO2S(B1/S2) normal?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good HO2S(B1/S2) and check for proper operation. If the problem is corrected, replace HO2S (B1/S1) and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

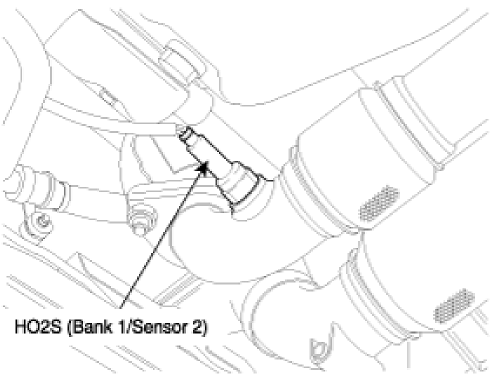
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0138

COMPONENT LOCATION



GENERAL DESCRIPTION

HO2S(B1/S2) is in the back of Catalytic Converter to check the proper operation of catalyst. As Exhaust gas already passed through catalyst, oxygen density in it is within specific range. If the oxygen density changes in accordance with HO2S(B1/S2), it means the poor performance of catalytic converter.

DTC DESCRIPTION

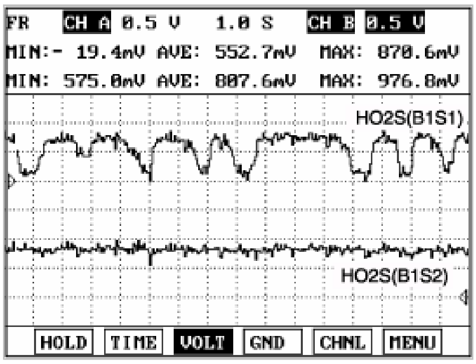
Checking output signals from HO2S every 15 sec. under detecting condition, if an output signal is above 1.3V for more than 12.5 sec. PCM sets P0138. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Signal high	• Poor connection • Short to battery in harness • HO2S(B1/S2) • PCM
Enable Conditions	• Battery voltage ≥ 10V • The minimum airflow ≥ 2g/s • Engine running state ≥ 30 sec • The coolant temperature ≥ 60°C(140°F) • Feed-back control(Closed loop) state • No fuel-cut state • Above conditions are met > 5 sec	
Threshold value	• The voltage of HO2S(B1/S2) > 1.3V	
Diagnosis Time	• Continuous	

	(more than 12.5 sec.failure for every 15 sec.test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA



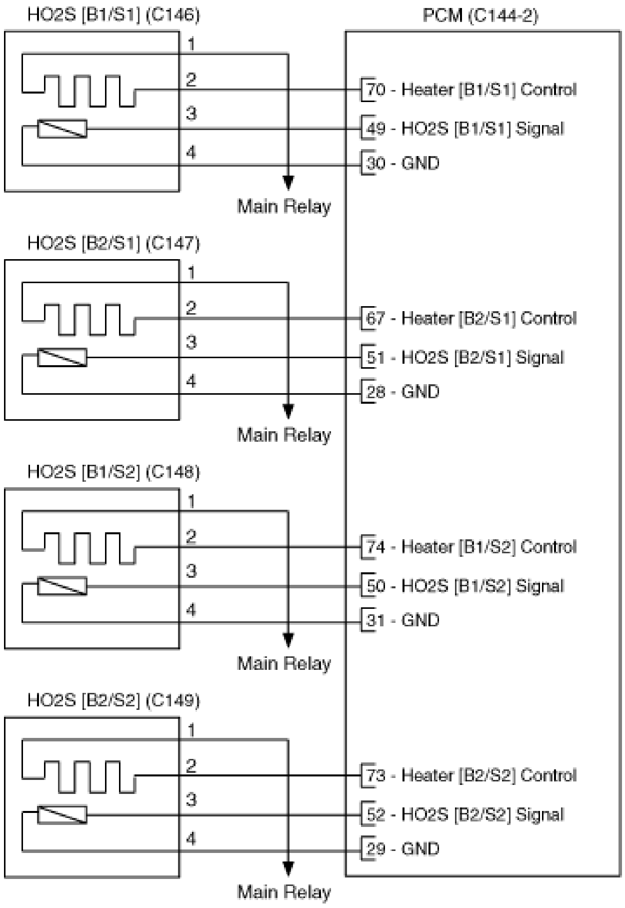
The amplitude of the signal output of the rear HO2S is small compared to the front HO2S because the rear HO2S detects emission gas purified by the catalytic converter. This is the normal signal waveform of the rear HO2S at idle.

SPECIFICATION

Air/fuel mixture	Voltage(V)
Rich	0.75 ~ 1V
Lean	0 ~ 0.12V

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

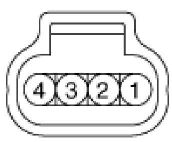
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

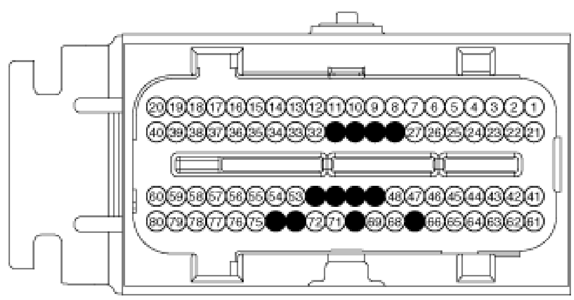
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C144-2
PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "HO2S(B1/S2)" item on the service data.

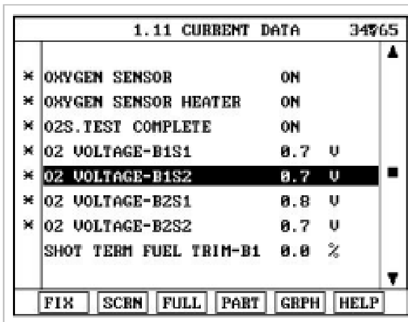


Fig. 1

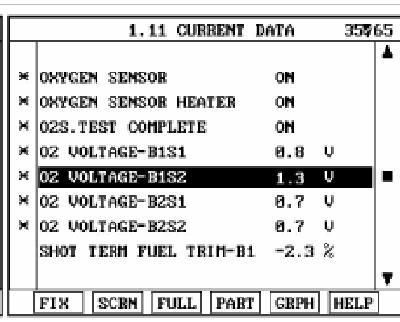


Fig. 2

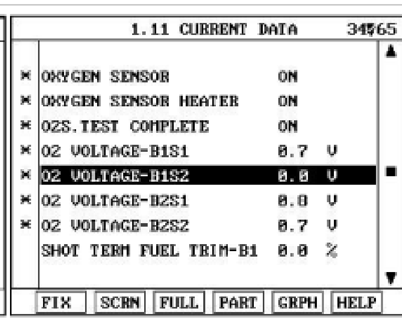


Fig. 3

4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

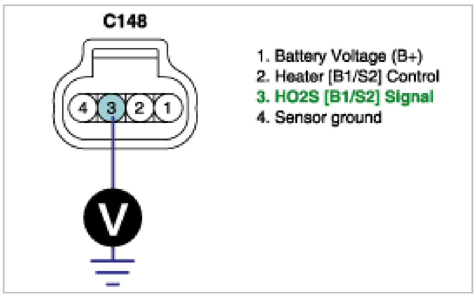
NO

▸ Go to " Signal Circuit Inspection " procedure.

SIGNAL CIRCUIT INSPECTION

1. IG "OFF" and disconnect HO2S(B1/S2) connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 3 of HO2S(B1/S2) harness connector and chassis ground.

Specification : Approx. 3.5V - when pumping current is ON
Approx. 0.45V - when pumping current is OFF



4. Is the measured voltage within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Visual Inspection of HO2S
   Visually/physically inspect following items:
   A. Inspect the Rear HO2S for Contaminated, deteriorated or aged Rear HO2S
   B. If contamination is evident on the HO2S, replace contaminated sensor
2. Is the HO2S(B1/S2) normal?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good HO2S(B1/S2) and check for proper operation. If the problem is corrected, replace HO2S (B1/S1) and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

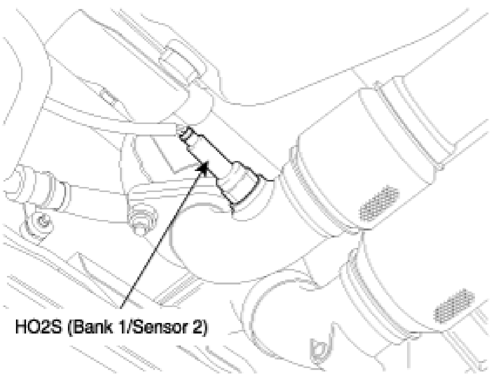
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0139

COMPONENT LOCATION



GENERAL DESCRIPTION

The rear heated oxygen sensor is mounted on the rear side of the Catalytic Converter (warm-up catalytic converter) or in the rear exhaust pipe, which is able to detect the catalyst efficiency. The rear heated oxygen sensor (HO2S) produces a voltage between 0V and 1V. This rear heated oxygen sensor is used to estimate the oxygen storage capability. If a catalyst has good conversion properties, the oxygen fluctuations are smoothed by the oxygen storage capacity of the catalyst. If the conversion provided by the catalyst is low due to aging, poisoning or misfiring, then the oxygen fluctuations are similar to signals from the front oxygen sensor.

DTC DESCRIPTION

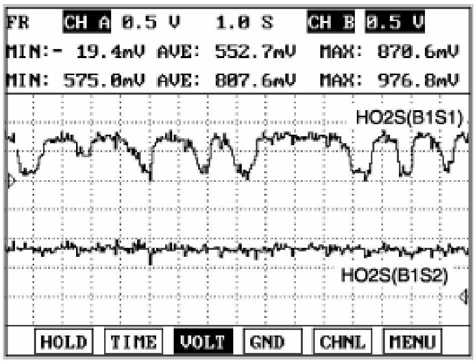
Since the Catalyst Diagnostic uses the oxygen sensors to determine the quality of the catalyst, and since an extended period of time with the rear oxygen sensor value steady is interpreted as a “good” catalyst, the Catalyst Diagnostic can be rendered inaccurate by an improperly functioning oxygen sensor. This diagnostic will extend the period of time that the Catalyst diagnostic requests a fuel shift. If the oxygen sensor still fails to respond after this extended time, then there is a fault with the sensor. Checking the Maximum time allowed between the front sensor response and the rear sensor response to the Stage1 or 2 fuel shift under detecting condition, if the fuel shift time is higher than 25sec, PCM determines a fault and sets DTC P0139. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Determines if Rear O2 Sensor is acceptable for Idle Catalyst Monitor use	
Enable Conditions	• If Idle Catalyst Monitor Diagnostic is enabled HO2S Bank 1 Sensor 2 Response Diagnostic Enable Criteria Met	

Threshold value	• Maximum time allowed between the front sensor response and the rear sensor response to the Stage1(Forced to lean) ICMD(Idle Catalyst Monitor Diagnostic)fuel shift ≥ 25sec • Maximum time allowed between the front sensor response and the rear sensor response to the Stage 2(Forced to rich) ICMD(Idle Catalyst Monitor Diagnostic) fuel shift ≥ 25sec	• Poor connection • Faulty HO2S • Faulty PCM
Diagnosis Time	• -	
MIL On Condition	• 2 driving cycles	

SIGNAL WAVEFORM AND DATA



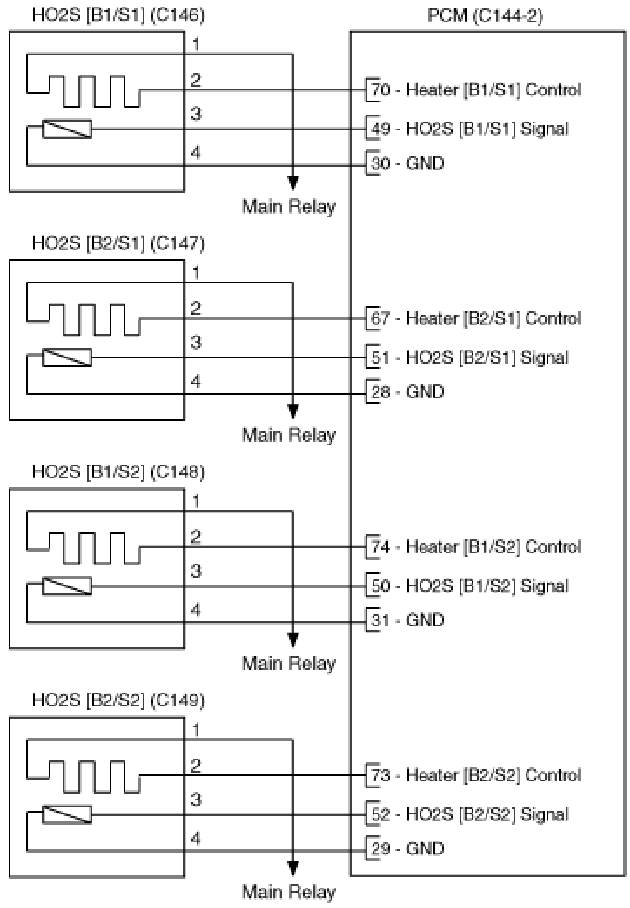
The amplitude of the signal output of the rear HO2S is small compared to the front HO2S because the rear HO2S detects emission gas purified by the catalytic converter. This is the normal signal waveform of the rear HO2S at idle.

SPECIFICATION

Air/fuel mixture	Voltage(V)
Rich	0.75 ~ 1V
Lean	0 ~ 0.12V

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

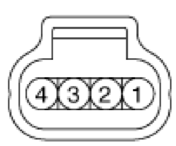
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

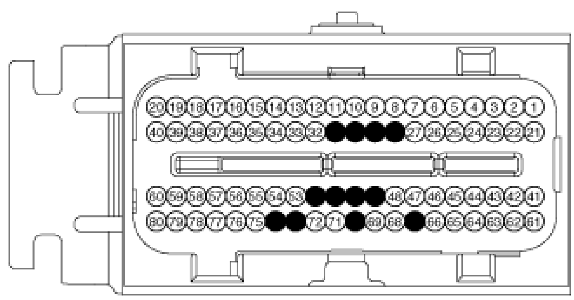
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



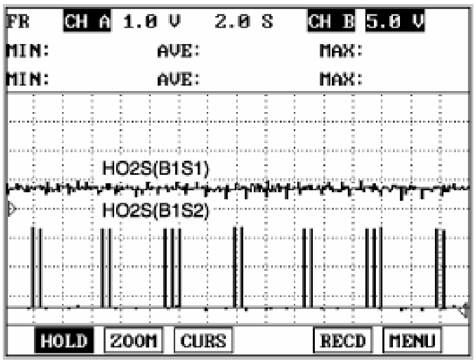
C144-2

PCM

MONITOR SCANTOOL DATA

1. Connect Scantool then Engine "ON"
2. Warm up the engine to normal operating temperature.
3. Monitor the signal waveform of HO2S(B1S2) with scantool

Specification : 0.1 ~ 0.9V



4. Is the shift time from signal waveform within specifications ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to " Component Inspection" procedure.

COMPONENT INSPECTION

1. Visual Inspection of HO2S
   Visually/physically inspect following items:
   A. Inspect the Rear HO2S for Contaminated, deteriorated or aged Rear HO2S
   B. If contamination is evident on the HO2S, replace contaminated sensor
2. Is the HO2S(B1/S2) O.K ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.

NO

▸ Substitute with a known - good HO2S(B1S2) and check for proper operation. If the problem is corrected, replace HO2S (B1S2) and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

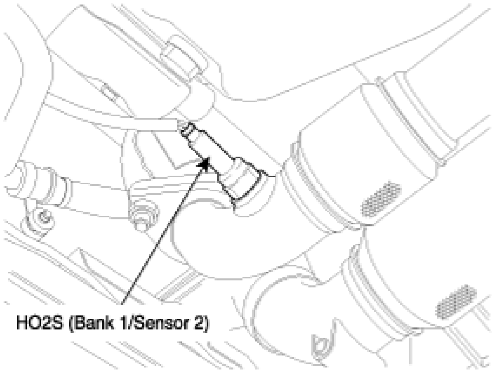
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0140

COMPONENT LOCATION



GENERAL DESCRIPTION

HO2S(B1/S2) is in the back of Catalytic Converter to check the proper operation of catalyst. As Exhaust gas already passed through catalyst, oxygen density in it is within specific range. If the oxygen density changes in accordance with HO2S(B1/S2), it means the poor performance of catalytic converter.

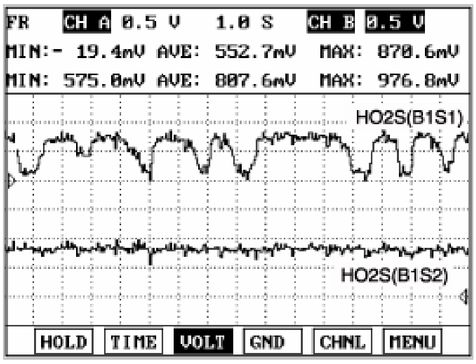
DTC DESCRIPTION

Checking output signals from HO2S every 10 sec. under detecting condition, if an output signal indicating open in the circuit lasts for more than 6.3 sec., PCM sets P0140. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible cause
DTC Strategy		• Open	• Poor Connection • Open in harness • HO2S(B1/S2) • PCM
Enable Conditions		• No sensor cooled status • The minimum airflow ≥ 2g/s • The battery voltage ≥ 10V • Engine running state >30 sec. • Coolant temperature ≥ 60°C(140°F)	
Threshold value	Case 1	• At pumping current ON • 1.2V ≤ Voltage of HO2S ≤ 3.9V	
	Case 2	• At pumping current OFF • 0.415V ≤ Voltage of HO2S ≤ 0.515V	
Diagnosis Time		• Continuous (more than 6.3 sec.failure for every 10 sec.test)	
MIL On Condition		• 2 driving cycles	

SIGNAL WAVEFORM AND DATA



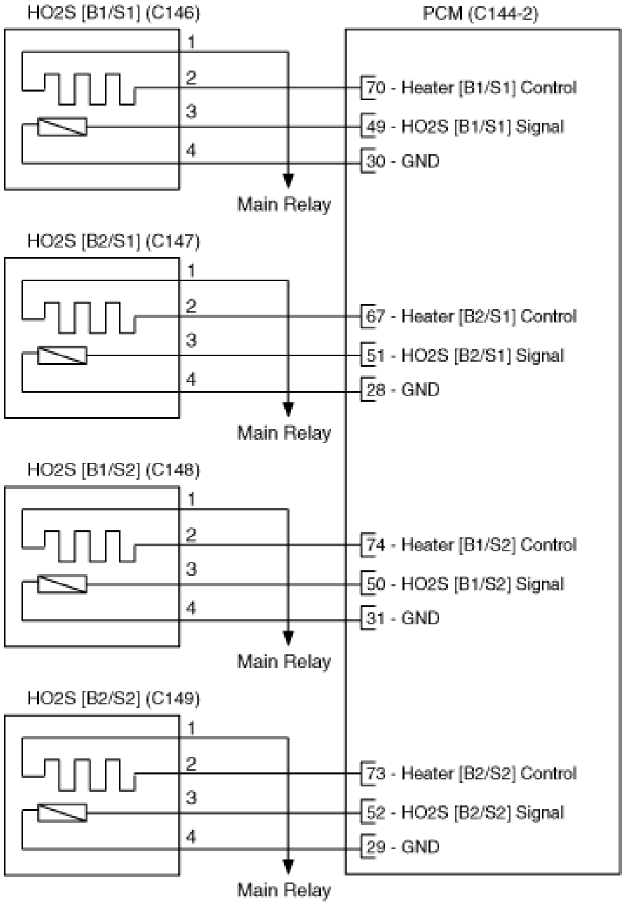
The amplitude of the signal output of the rear HO2S is small compared to the front HO2S because the rear HO2S detects emission gas purified by the catalytic converter. This is the normal signal waveform of the rear HO2S at idle.

SPECIFICATION

Air/fuel mixture	Voltage(V)
Rich	0.75 ~ 1V
Lean	0 ~ 0.12V

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

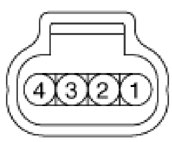
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

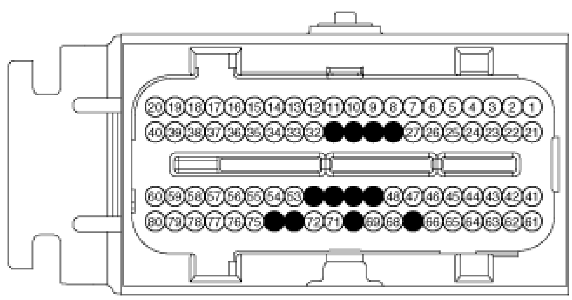
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C144-2
PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "HO2S(B1/S2)" item on the service data.

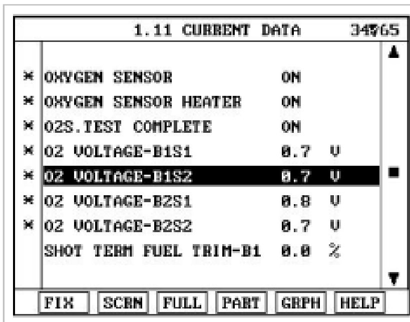


Fig. 1

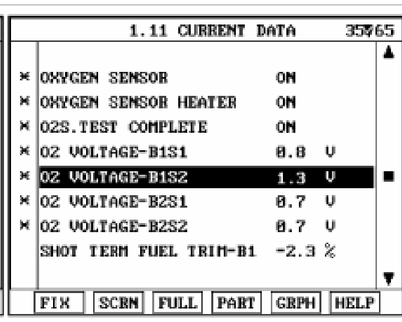


Fig. 2

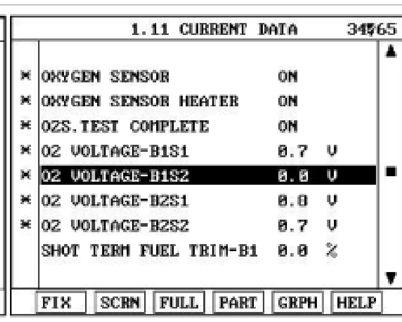


Fig. 3

4. Is the service data displayed correctly ?

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▶ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure

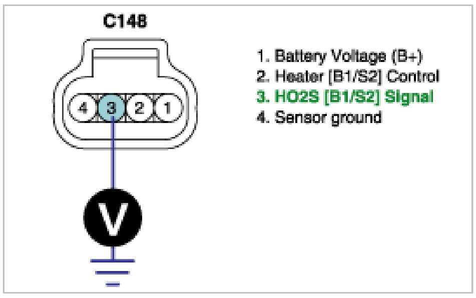
NO

▶ Go to " Signal Circuit Inspection " procedure.

SIGNAL CIRCUIT INSPECTION

1. IG "OFF" and disconnect HO2S(B1/S2) connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 3 of HO2S(B1/S2) harness connector and chassis ground.

Specification : Approx. 3.5V - when pumping current is ON
Approx. 0.45V - when pumping current is OFF



4. Is the measured voltage within specification?

YES

▶ Go to "Ground Circuit Inspection" procedure.

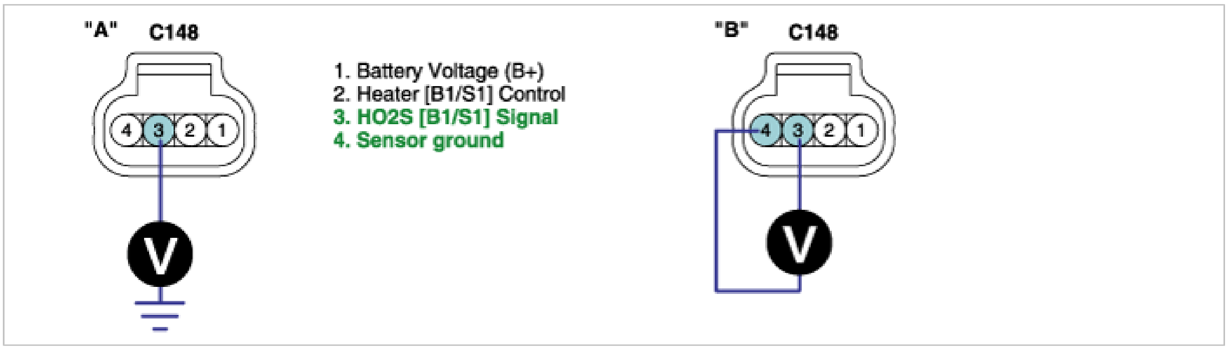
NO

▶ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "ON" and disconnect HO2S(B1/S2) connector.
2. Measure voltage between terminal 3 of HO2S(B1/S2) harness connector and chassis ground.
3. Measure voltage between terminals 3 and 4 of HO2S(B1/S2) harness connector.

Specification : Voltage difference between measurement "A" and "B" is below 200mV.



4. Is the measured voltage within specification?

YES

▸ Go to "Component inspection" procedure.

NO

▸ Repair open or contact resistance in harness, and go to "Verification of Vehicle Repair" prcedure.

COMPONENT INSPECTION

1. Visual Inspection of HO2S
   Visually/physically inspect following items:
   A. Inspect the Rear HO2S for Contaminated, deteriorated or aged Rear HO2S
   B. If contamination is evident on the HO2S, replace contaminated sensor
2. Is the HO2S(B1/S2) normal?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good HO2S(B1/S2) and check for proper operation. If the problem is corrected, replace HO2S (B1/S1) and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

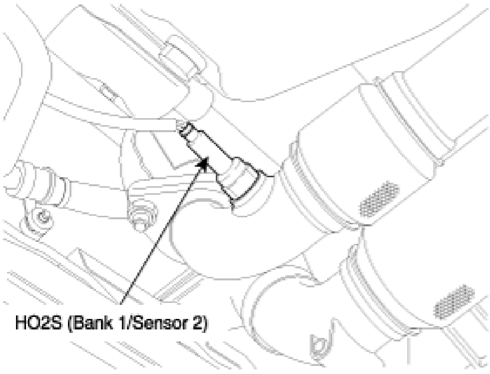
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0141

COMPONENT LOCATION



GENERAL DESCRIPTION

HO2S(B1/S2) is in the back of Catalytic Converter to check the proper operation of catalyst. As Exhaust gas already passed through catalyst, oxygen density in it is within specific range. If the oxygen density changes in accordance with HO2S(B1/S2), it means the poor performance of catalytic converter.

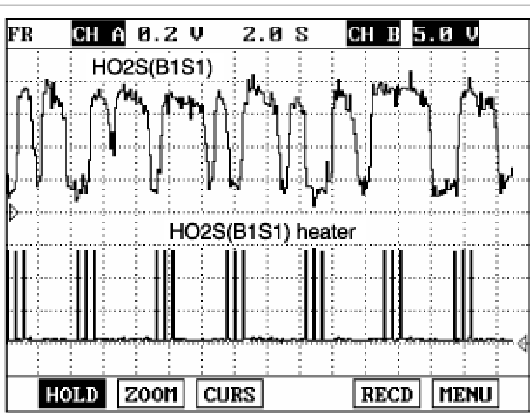
DTC DESCRIPTION

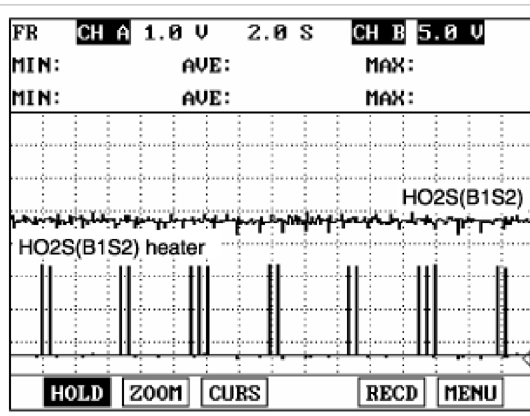
The O2 Heater diagnostic compares the current that is passing through the O2 Heater to a low limit. When the current is too low, the O2 Heater is considered failed.A failed O2 Heater will have an affect on vehicle emissions, especially on cold starts. The O2 Heater allows the O2 Sensor to work properly more quickly after the engine starts. If the PCM detects heater output voltage is lower than threshold value for 5 seconds while enable condition is met PCM determines that a fault exists and a DTC is stored.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Compares the current that is passing through the O2 Heater to a low limit	• Poor Connection • Contact Resistance • HO2S(B1/S2) • PCM
Enable Conditions	• Ignition ON • Engine Running >60s • Heater Duty Cycle >0.4% • Max. Duty Cycle - Min. Duty Cycle< 0.05% • Delay Time ≥ 5s	
Threshold value	• Filtered O2 Heater Current < 0.02A	
Diagnosis Time	• Continuous (More than 2.5 second failure for every 5 second test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA





The HO2S requires a minimum temperature to provide a closed loop fuel control system. So the HO2S contains a heater element to reduce its warm-up time and ensure its performance during all driving conditions. The HO2S heater is controlled ON after

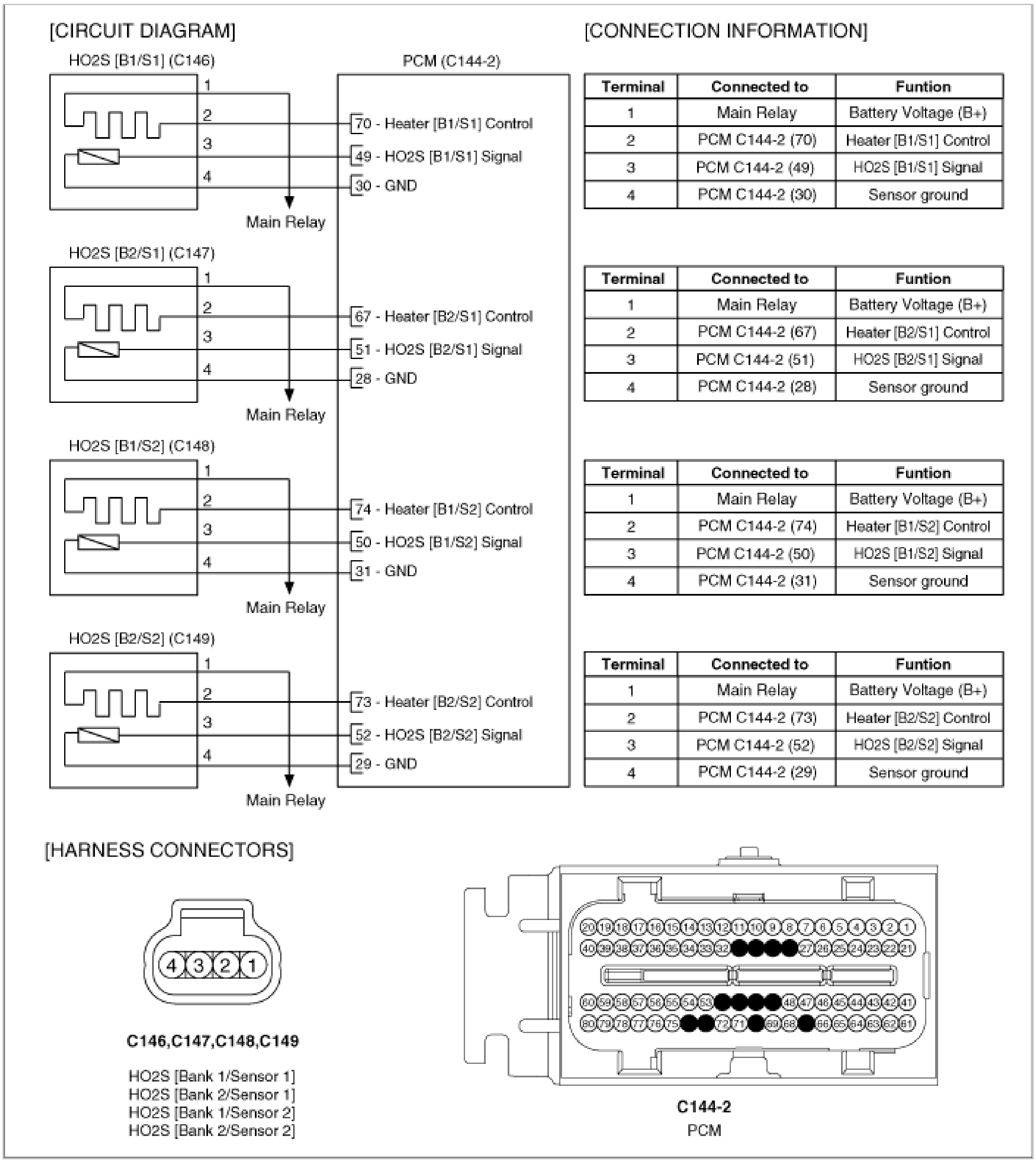
engine start except for Cold condition and high speed accelleration. The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

SPECIFICATION

For reference only

Condition	Current(A)
Heater Current at 13.5V, 450°C(842°F) Exhaust	0.52 ± 0.1
Heater In-rush Current at 21°C(69.8°F), 13.5V	1.7 MAX
Heater In-rush Current at -40°C(-40 °F), 13.5V	2.2 MAX

SCHEMATIC DIAGRAM



Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

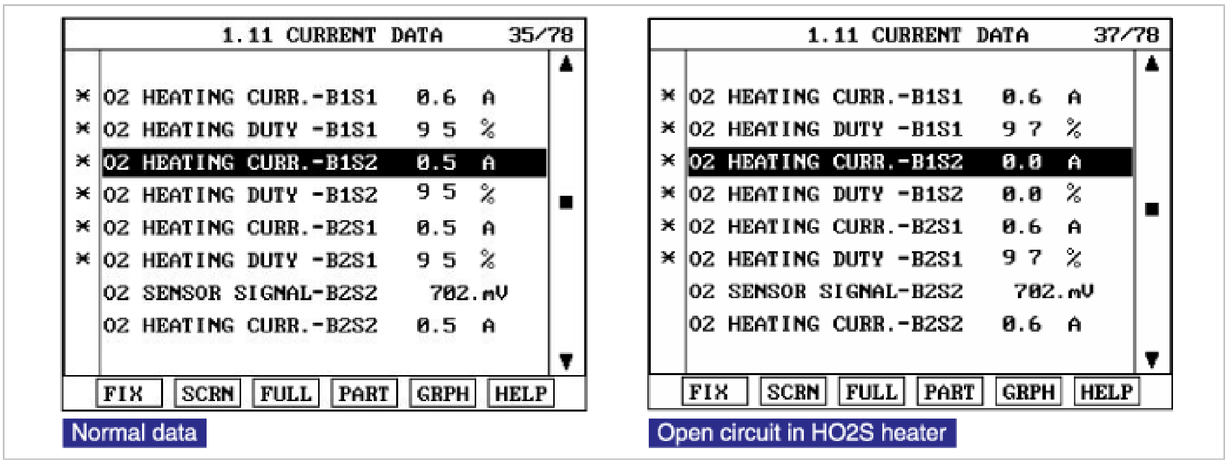
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.

2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "HO2S(B1/S2) Heater" item on the service data.



Normal data
Open circuit in HO2S heater

4. Is the "HO2S Heater(B1/S2)" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

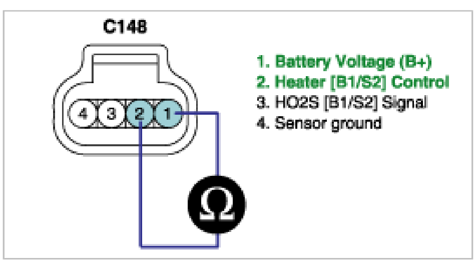
NO

▸ Go to " Component Inspection " procedure.

COMPONENT INSPECTION

1. Check HO2S(B1/S2) Heater resistance
   (1) IG "OFF" and disconnect HO2S(B1/S2) connector
   (2) Measure resistance between terminal 1 and 2 of HO2S(B1/S2)(Component Side)
   Specification :

Heater	
Resistance (Ω)	9.6 ± 1.5 at 21°C(69.8°F)



   (3) Is the measured resistance within specification ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▶ Substitute with a known - good HO2S(B1/S2) and check for proper operation. If the problem is corrected, replace HO2S (B1/S2) and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

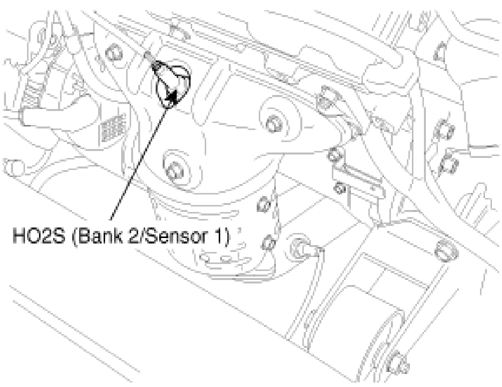
▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

Fuel System > Troubleshooting > P0151

COMPONENT LOCATION



GENERAL DESCRIPTION

In order to control emissions of the CO, HC and NOx components of the exhaust gas, heated oxygen sensor (HO2S), mounted on the front side and rear side of catalytic converter, detects the oxygen content in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation.
The HO2S requires a minimum temperature to operate properly and provide a closed loop fuel control system. The HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions.
The oxygen sensor generates a voltage that indicates the difference between the oxygen content of the exhaust stream and the oxygen content of ambient air. When the exhaust stream is “rich,” there is more oxygen in the ambient air than in the exhaust stream, so the voltage will be higher.
Some oxygen sensor varieties use a “bias” voltage to achieve better resolution of the exhaust stream signal. Some oxygen sensor varieties use a “pumping circuit” to force ambient air into the sensor to maintain a more pure environment for comparison.
In either case, a cold sensor will tend to indicate voltage values near the open circuit value. For the “pumping current” sensors, this open circuit value can be near 3.5 V.Since the Fuel control logic would incorrectly consider this reading to indicate a very rich mixture for an extended time, the fuel control logic can not use the oxygen sensor reading under such conditions.
The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

DTC DESCRIPTION

Checking output signals from HO2S every 15 sec. under detecting condition, if an output signal is below 0.05V for more than 12.5 sec., PCM sets P0151. MI (Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Signal low	• Poor connection • Short to ground in harness • HO2S(B2/S1) • PCM
Enable Conditions	• Battery voltage ≥ 10V • The minimum airflow ≥ 2g/s • Engine running state ≥ 30sec • The coolant temperature ≥ 60°C(140°F) • The feed-back control (the closed loop) state • No fuel-cut state • Above conditions are met >5 sec.	
Threshold value	• The voltage of HO2S(B2/S1)< 0.04V	
Diagnosis Time	• Continuous (more than 12.5 sec. failure for every 15 sec.test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA

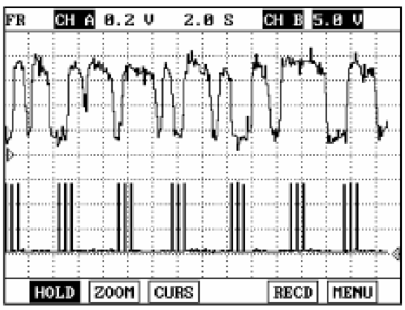


Fig. 1

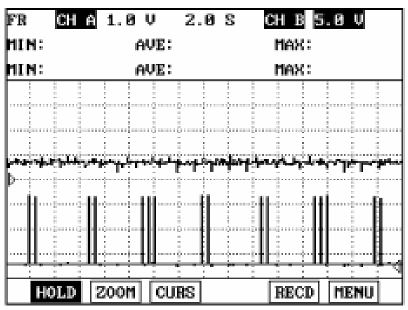


Fig. 2

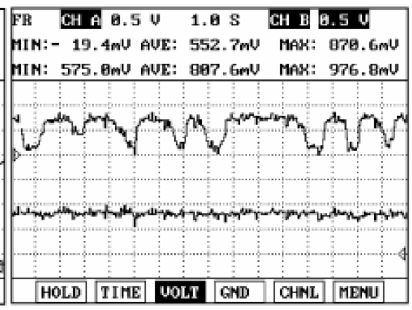


Fig. 3

Fig. 1 : HO2S(B2S1) & Heater
Fig. 2 : HO2S(B2S2) & Heater
Fig. 3 : HO2S(B2S1) & HO2S(B2S2)

After warming-up, if accelerator pedal is released suddenly around 4000rpm, the HO2S signal reading will be lower than 200mV resulting from Fuel cut-off for the moment. Conversely, if suddenly accelerator pedal is depressed, HO2S signal reading will be around 0.6V ~1.0V. At idle, HO2S signal will switch from lean to rich normally.

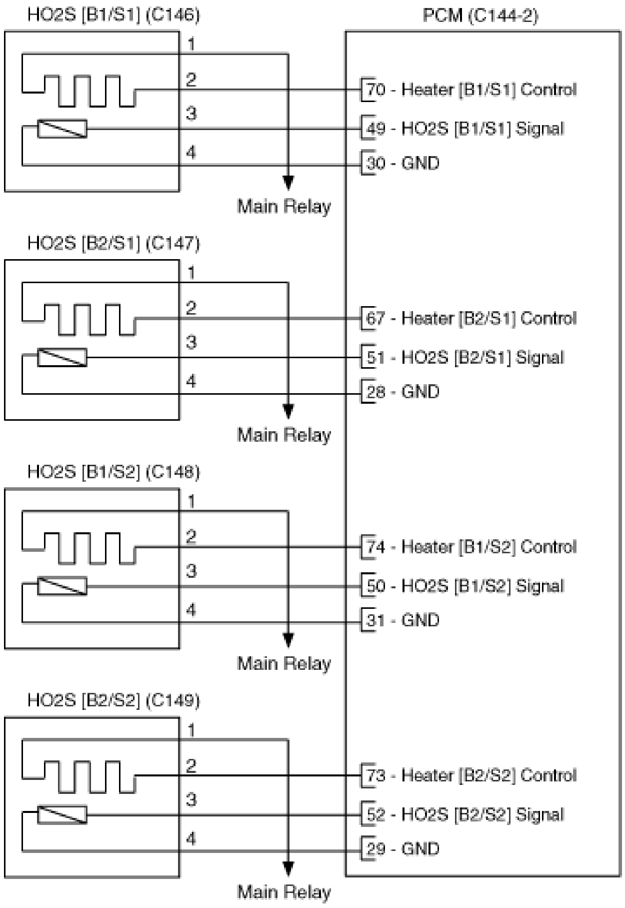
SPECIFICATION

Air/fuel mixture	Voltage(V)
Rich	0.75 ~ 1V
Lean	0 ~ 0.12V

※In case of open circuit, voltage is set to 0.45V(Pumping current OFF) or 3.5V(Pumping current ON)

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

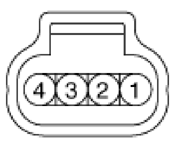
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

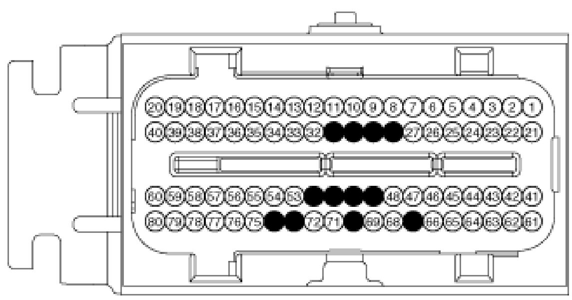
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C144-2
PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "HO2S(B2/S1)" item on the service data.

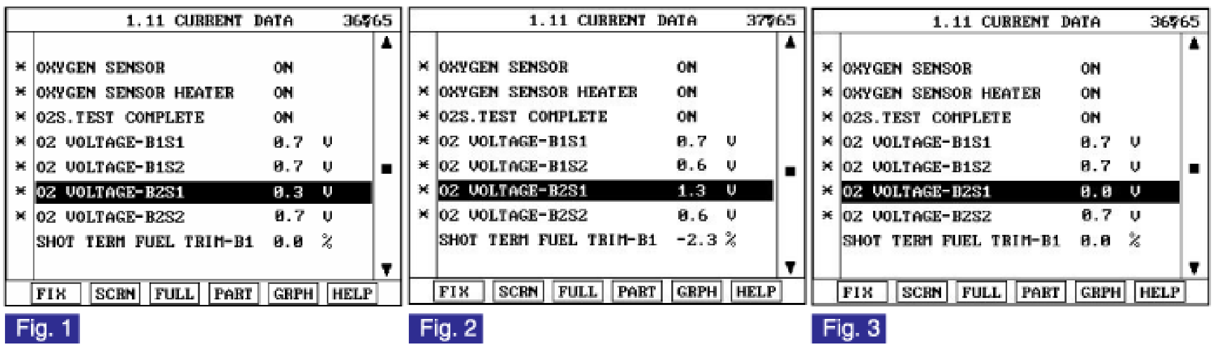


Fig. 1 : Normal data
Fig. 2 : Open or Short to battery in HO2S(B2/S1)
Fig. 3 : Short to ground in HO2S(B2/S1)

4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found ?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

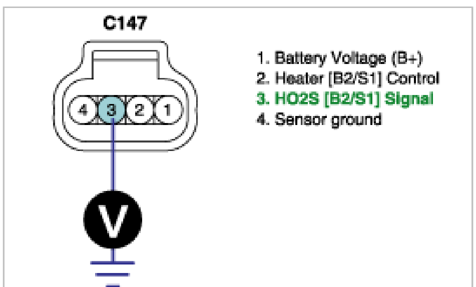
NO

▸ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. IG "OFF" and disconnect HO2S(B2/S1) connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 3 of HO2S(B2/S1) harness connector and chassis ground.

Specification :
Approx. 3.5V - when pumping current is ON
Approx. 0.45V - when pumping current is OFF



4. Is the measured voltage within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check HO2S(B2/S1)
   (1) IG "OFF" and disconnect HO2S(B2/S1) connector.
   (2) Check HO2S(B2/S1) for damage or contamination caused by a foreign substance.
   (3) Is the HO2S(B2/S1) normal?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good HO2S(B2/S1) and check for proper operation. If the problem is corrected, replace HO2S (B2/S1) and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

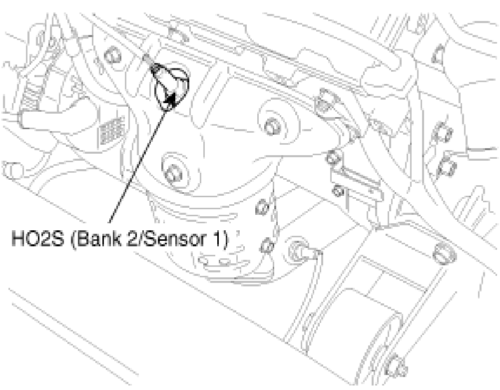
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0152

COMPONENT LOCATION



GENERAL DESCRIPTION

In order to control emissions of the CO, HC and NOx components of the exhaust gas, heated oxygen sensor (HO2S), mounted on the front side and rear side of catalytic converter, detects the oxygen content in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation.

The HO2S requires a minimum temperature to operate properly and provide a closed loop fuel control system. The HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions.

The oxygen sensor generates a voltage that indicates the difference between the oxygen content of the exhaust stream and the oxygen content of ambient air. When the exhaust stream is “rich,” there is more oxygen in the ambient air than in the exhaust stream, so the voltage will be higher.

Some oxygen sensor varieties use a “bias” voltage to achieve better resolution of the exhaust stream signal. Some oxygen sensor varieties use a “pumping circuit” to force ambient air into the sensor to maintain a more pure environment for comparison.
In either case, a cold sensor will tend to indicate voltage values near the open circuit value. For the “pumping current” sensors, this open circuit value can be near 3.5 V.Since the Fuel control logic would incorrectly consider this reading to indicate a very rich mixture for an extended time, the fuel control logic can not use the oxygen sensor reading under such conditions.
The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

DTC DESCRIPTION

Checking output signals from HO2S every 15 sec. under detecting condition, if an output signal is above 1.3V for more than 12.5 sec., PCM sets P0152. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Signal high	• Poor connection • Short to battery in harness • HO2S(B2/S1) • PCM
Enable Conditions	• Battery voltage ≥ 10V • The minimum airflow ≥ 2g/s • Engine running state ≥ 30 sec • The coolant temperature ≥ 60°C(140°F) • Feed-back control(Closed loop) state • No fuel-cut state • Above conditions are met >5 sec	
Threshold value	• The voltage of HO2S(B2/S1) >1.3V	
Diagnosis Time	• Continuous (more than 12.5 sec.failure for every 15 sec.test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA

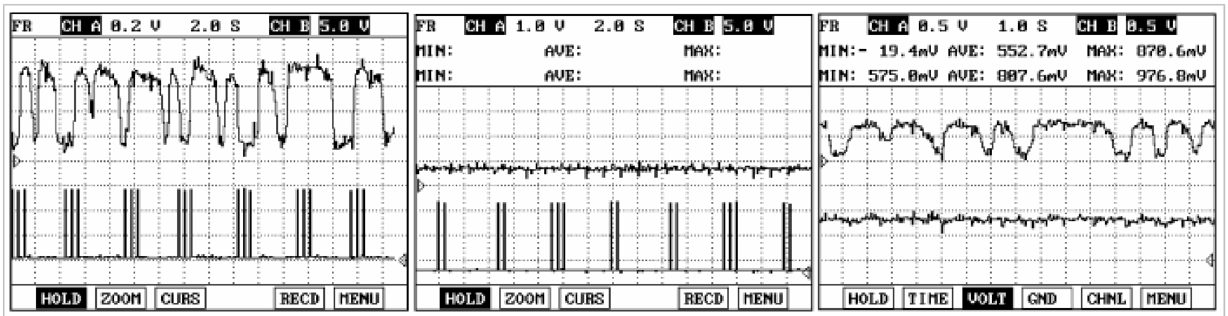


Fig. 1 Fig. 2 Fig. 3

Fig. 1 : HO2S(B2S1) & Heater
Fig. 2 : HO2S(B2S2) & Heater
Fig. 3 : HO2S(B2S1) & HO2S(B2S2)

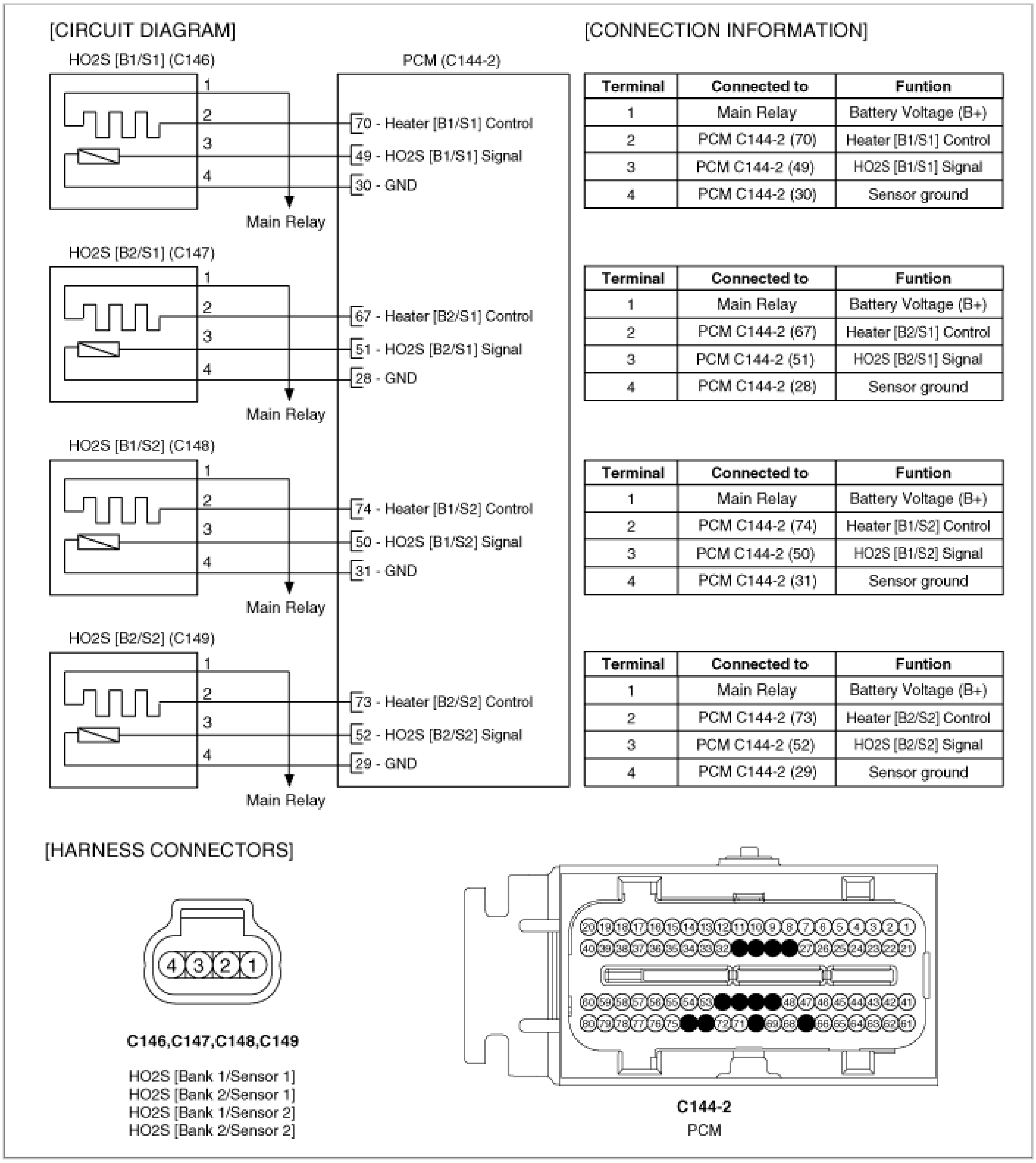
After warming-up, if accelerator pedal is released suddenly around 4000rpm, the HO2S signal reading will be lower than 200mV resulting from Fuel cut-off for the moment. Conversely, if suddenly accelerator pedal is depressed, HO2S signal reading will be around 0.6V ~1.0V. At idle, HO2S signal will switch from lean to rich normally.

SPECIFICATION

Air/fuel mixture	Voltage(V)
Rich	0.75 ~ 1V
Lean	0 ~ 0.12V

※In case of open circuit, voltage is set to 0.45V(Pumping current OFF) or 3.5V(Pumping current ON)

SCHEMATIC DIAGRAM



Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "HO2S(B2/S1)" item on the service data.

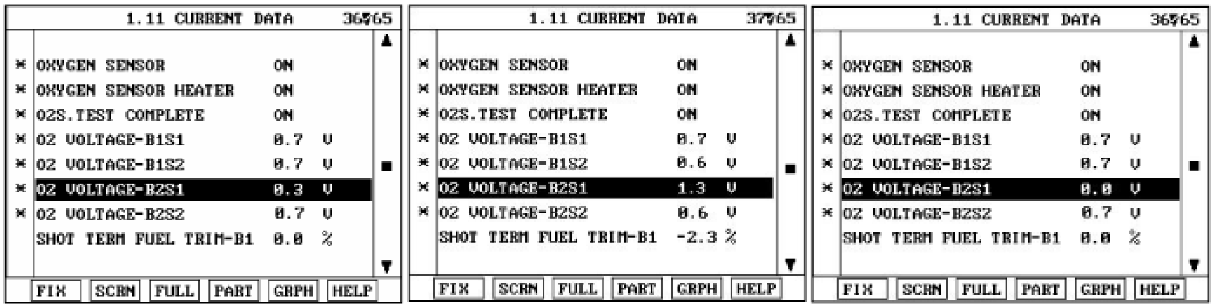


Fig. 1 Fig. 2 Fig. 3

Fig. 1 : Normal data
Fig. 2 : Open or Short to battery in HO2S(B2/S1)
Fig. 3 : Short to ground in HO2S(B2/S1)

4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

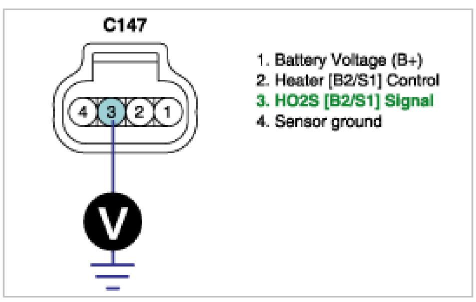
NO

▸ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. IG "OFF" and disconnect HO2S(B2/S1) connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 3 of HO2S(B2/S1) harness connector and chassis ground.

Specification :
Approx. 3.5V - when pumping current is ON
Approx. 0.45V - when pumping current is OFF



4. Is the measured voltage within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check HO2S(B2/S1)
   (1) IG "OFF" and disconnect HO2S(B2/S1) connector.
   (2) Check HO2S(B2/S1) for damage or contamination caused by a foreign substance.
   (3) Is the HO2S(B2/S1) normal?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good HO2S(B2/S1) and check for proper operation. If the problem is corrected, replace HO2S (B2/S1) and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

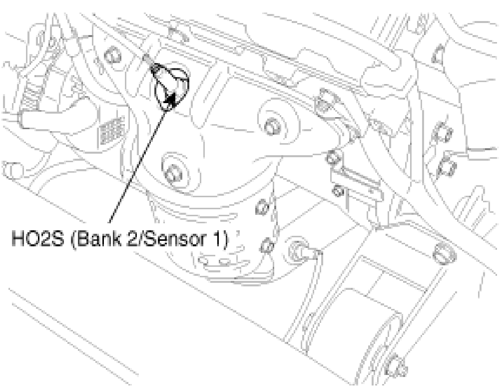
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0153

COMPONENT LOCATION



GENERAL DESCRIPTION

The HO2S is used to supply the PCM with information regarding the composition of the air/fuel mixture. The HO2S is positioned in the exhaust pipe ahead of the TWC. To measure the oxygen content, the HO2S requires a supply of ambient air as a reference. The HO2S produces a voltage that varies between 0.1V and 0.9V under normal operating conditions. The Powertrain Control Module (PCM) monitors this voltage and determines if the exhaust gas is lean or rich. If the voltage input at the PCM is under approx. 0.45V the exhaust is lean, and if the voltage input is over approx. 0.45V the exhaust is rich. The PCM constantly monitors the HO2S signal during closed loop operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary.
This oxygen sensor varieties use a “bias” voltage to achieve better resolution of the exhaust stream signal. Some oxygen sensor varieties use a “pumping circuit” to forceambient air into the sensor to maintain a more pure environment for comparison. In either

case, a cold sensor will tend to indicate voltage values near the open circuit value. For the “pumping current” sensors, this open circuit value can be near 3.5 V. Since the Fuel control logic would incorrectly consider this reading to indicate a very rich mixture for an extended time, the fuel control logic can not use the oxygen sensor reading under such conditions.

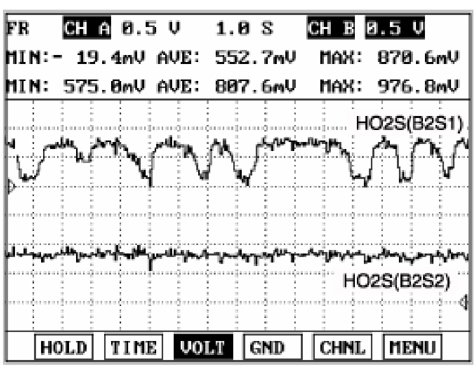
DTC DESCRIPTION

The response time of an O2 sensor can be impacted by two factors: temperature and poisoning. Poisoning of the O2 sensor is the primary failure mode of O2 sensor response time. Poisoning can come from many sources: silicone from gaskets or even in the fuel, phosphorous from engine oil, carbon from operating in a cooler environment or lead from the fuel. Most poisoning failures have the potential to clear up after the source of the poisoning has been removed. However, sometimes thepoisoning may be so severe that the damage is irreversible. Checking output signals from HO2S under detecting condition, if an output signal is out of threshold, PCM sets P0153.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Determines O2 sensor functionality by checking its response rate	• Poor connection • Faulty HO2S • Faulty PCM
Enable Conditions	• 1200 ≤ Engine RPM ≤ 4300 • 40g/s ≤ Air Flow ≤ 7.5g/s • Engine run time >60sec • Engine Coolant >70°C(158 °F) • No DFCO(Decel Fuel Cut-Off) Exit with Rich Bias Fueling • No TORQ Fuel Reduction in effect • No Disabling Faults • All of the conditions above met for more than 2sec	
Threshold value	• Switching counter lean to rich ≥ 13 • Switching counter rich to lean ≥ 13 • Response Lean Rich Transition Counter/Response Lean Rich Switch Counter < 29 • Response Rich Lean Transition Counter/Response Rich Lean Switch Counter < 35 • Response Rich Lean Average/Response Lean Rich Average > 0.3809 • Response Rich Lean Average/Response Lean Rich Average < 3	
Diagnosis Time	• -	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA



After warming-up, Releasing accellerator pedal suddenly around 4000rpm the HO2S signal reading will be lower than 200mV resulting from Fuel cut-off. Conversely, sudden depressing accellerator pedal HO2S signal reading will be around 0.6V ~1.0V. At idle, HO2S signal will be switching between lean(0.12 ~ 0.74V) to rich(above 0.75V) normally.

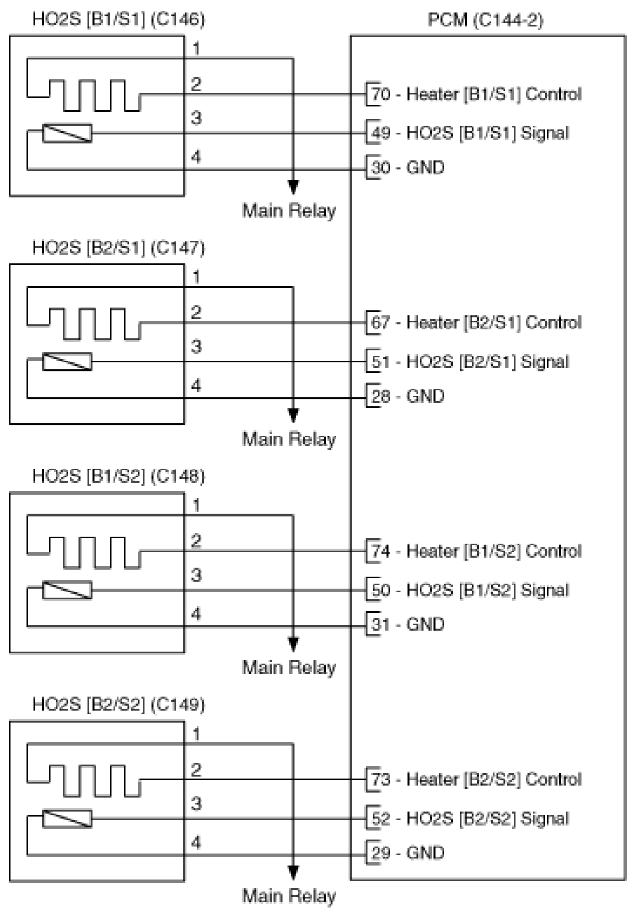
SPECIFICATION

	Response Time (70% Duty at 10Hz)

HO2S	lean to rich(Less than 0.65sec) rich to lean(Less than 0.8sec)

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

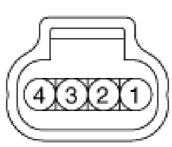
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

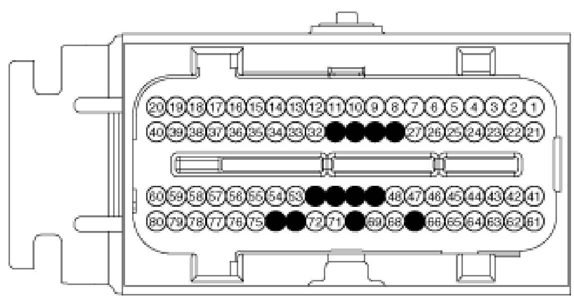
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]

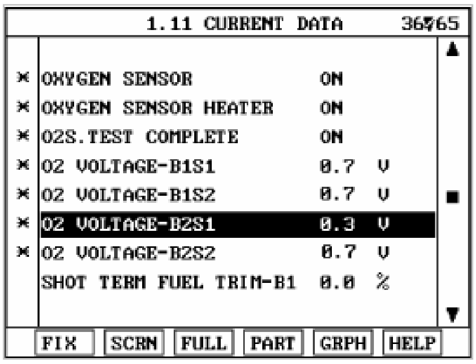


C144-2
PCM

MONITOR SCANTOOL DATA

1. Connect Scantool & Engine "ON"
2. Warm up the engine to normal operating temperature.
3. Monitor HO2S voltage(B2/S1) parameter on scantool

Specification : Voltage will vary from 0.1 to 0.9 V



4. Is the HO2S parameter displayed within specifications ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Component Inspection" procedure

COMPONENT INSPECTION

1. Visual Inspection of HO2S
   (1) Visually/physically inspect following items:
   - Inspect the front HO2S for Contaminated, deteriorated or aged Front HO2S
   - If contamination is evident on the HO2S, replace contaminated sensor

   (2) Is the HO2S visually / physically O.K ?

   YES

   ▸ Go to "Check Performance of H02S" as follows

   NO

   ▸ Substitute with a known - good HO2S and check for proper operation. If the problem is corrected, replace HO2S and go to "Verification of Vehicle Repair" procedure.

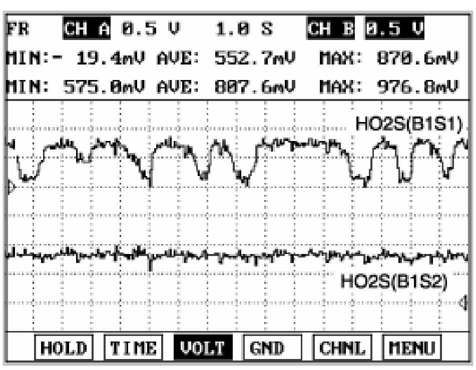
2. Check performance of HO2S
   (1) Connect scantool & Engine "ON"

   (2) Warm-up the engine to normal engine temperature.

   (3) Monitor signal waveform of HO2S with scantool

   Specification : Response times :

HO2S	Response Time (70% Duty at 10Hz)
	lean to rich(Less than 0.65sec) rich to lean(Less than 0.8sec)



   (4) Is the sensor signal switching properly ?

   YES

   ▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

   NO

▸ Substitute with a known - good HO2S and check for proper operation. If the problem is corrected, replace HO2S and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

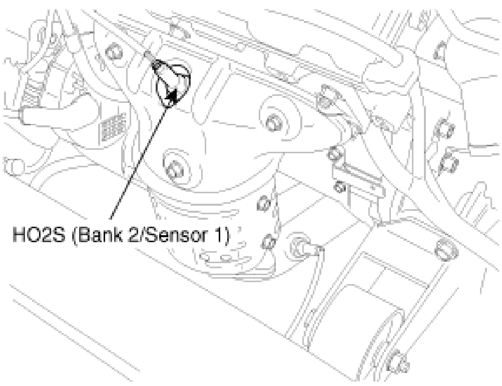
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0154

COMPONENT LOCATION



GENERAL DESCRIPTION

In order to control emissions of the CO, HC and NOx components of the exhaust gas, heated oxygen sensor (HO2S), mounted on the front side and rear side of catalytic converter, detects the oxygen content in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation.
The HO2S requires a minimum temperature to operate properly and provide a closed loop fuel control system. The HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions.
The oxygen sensor generates a voltage that indicates the difference between the oxygen content of the exhaust stream and the oxygen content of ambient air. When the exhaust stream is “rich,” there is more oxygen in the ambient air than in the exhaust stream, so the voltage will be higher.
Some oxygen sensor varieties use a “bias” voltage to achieve better resolution of the exhaust stream signal. Some oxygen sensor varieties use a “pumping circuit” to force ambient air into the sensor to maintain a more pure environment for comparison.
In either case, a cold sensor will tend to indicate voltage values near the open circuit value. For the “pumping current” sensors, this open circuit value can be near 3.5 V.Since the Fuel control logic would incorrectly consider this reading to indicate a very rich mixture for an extended time, the fuel control logic can not use the oxygen sensor reading under such conditions.
The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

DTC DESCRIPTION

Checking output signals from HO2S every 90 sec. under detecting condition, if an output signal indicating open in the circuit lasts for more than 76.5 sec., PCM sets P0154. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible cause
DTC Strategy		• Open	• Poor connection • Open in harness • HO2S(B2/S1) • PCM
Enable Conditions		• No sensor cooled status • The minimum airflow ≥ 2g/s • The battery voltage ≥ 10V • Engine running state >30 sec. • Coolant temperature ≥ 60°C(140°F)	
Threshold value	Case 1	• At pumping current ON • 1.2V ≤ Voltage of HO2S ≤ 3.9V	
	Case 2	• At pumping current OFF • 0.415V ≤ Voltage of HO2S ≤ 0.515V	
Diagnosis Time		• Continuous (more than 76.5 sec.failure for every 90 sec.test)	
MIL On Condition		• 2 driving cycles	

SIGNAL WAVEFORM AND DATA

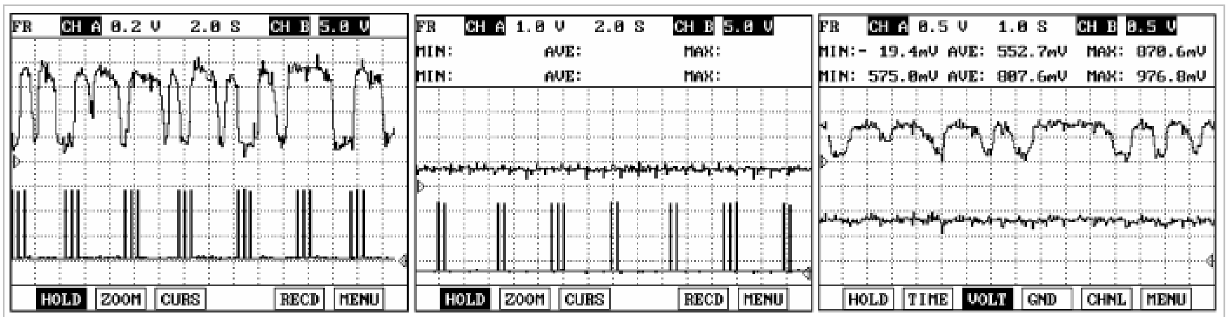


Fig. 1 Fig. 2 Fig. 3

Fig. 1 : HO2S(B2S1) & Heater
Fig. 2 : HO2S(B2S2) & Heater
Fig. 3 : HO2S(B2S1) & HO2S(B2S2)

After warming-up, if accelerator pedal is released suddenly around 4000rpm, the HO2S signal reading will be lower than 200mV resulting from Fuel cut-off for the moment. Conversely, if suddenly accelerator pedal is depressed, HO2S signal reading will be around 0.6V ~1.0V. At idle, HO2S signal will switch from lean to rich normally.

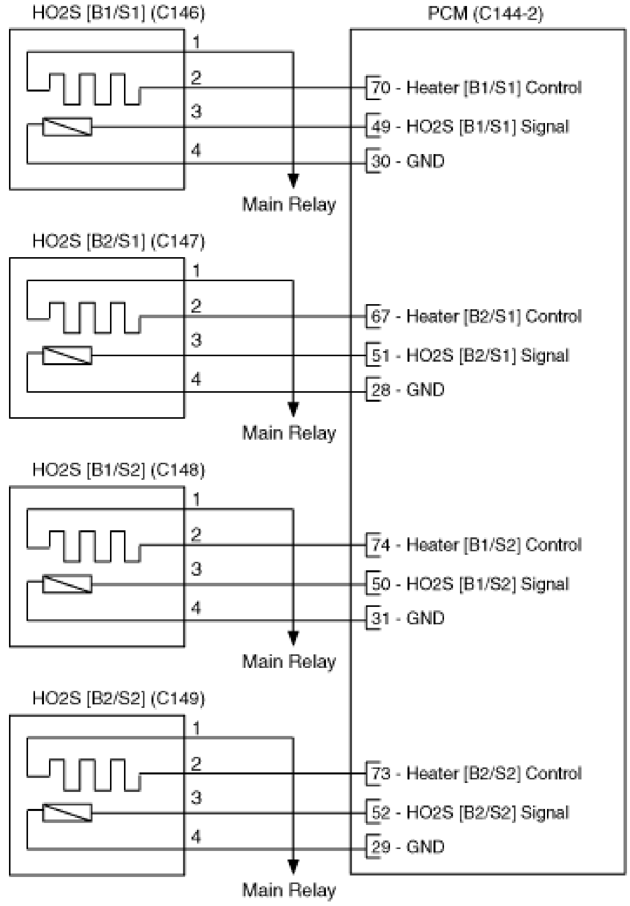
SPECIFICATION

Air/fuel mixture	Voltage(V)
Rich	0.75 ~ 1V
Lean	0 ~ 0.12V

※In case of open circuit, voltage is set to 0.45V(Pumping current OFF) or 3.5V(Pumping current ON)

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

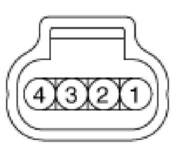
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

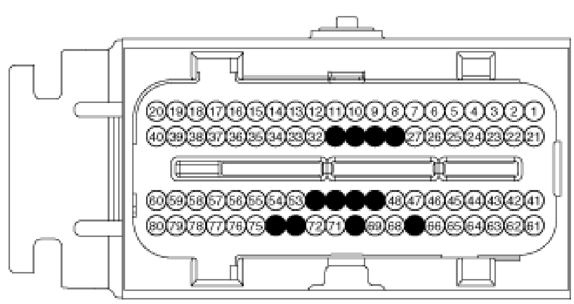
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "HO2S(B2/S1)" item on the service data.

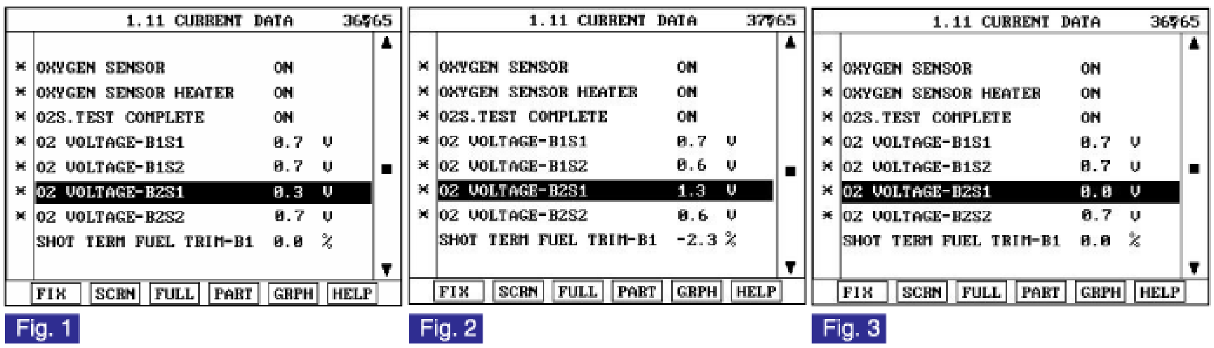


Fig. 1 : Normal data
Fig. 2 : Open or Short to battery in HO2S(B2/S1)
Fig. 3 : Short to ground in HO2S(B2/S1)

4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

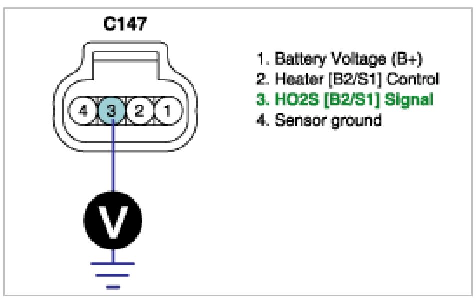
NO

▸ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. IG "OFF" and disconnect HO2S(B2/S1) connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between termianl 3 of HO2S(B2/S1) harness connector and chassis ground.

Specification :
Approx. 3.5V - when pumping current is ON
Approx. 0.45V - when pumping current is OFF



4. Is the measured voltage within specification?

YES

▸ Go to "Ground circuit inspection" procedure.

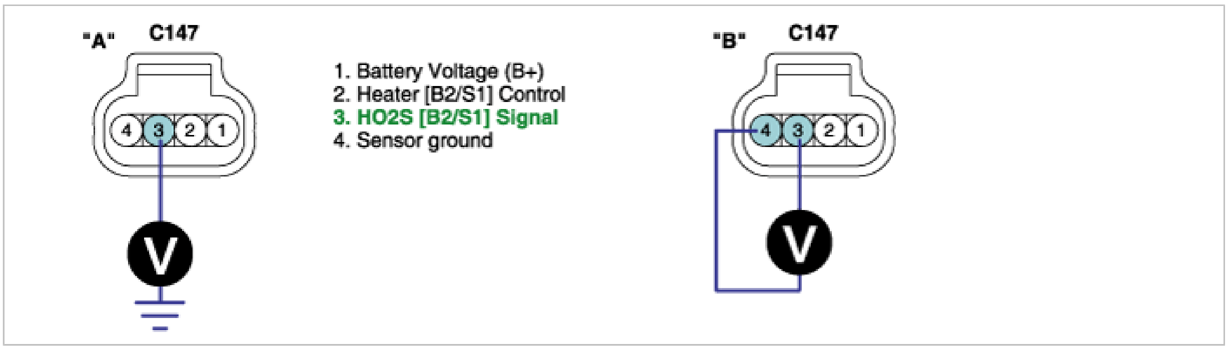
NO

▸ Repair open in harness, and go to "Verification of Vehicle Repair" prcedure.

GROUND CIRCUIT INSPECTION

1. IG "ON" and disconnect HO2S(B2/S1) connector.
2. Measure voltage between terminal 3 of HO2S(B2/S1) harness connector and chassis ground.
3. Measure voltage between terminals 3 and 4 of HO2S(B2/S1) harness connector.

Specification : Voltage difference between measurement "A" and "B" is below 200mV.



4. Is the measured voltage within specification?

YES

▸ Go to "Component inspection" procedure.

NO

▸ Repair open or contact resistance in harness, and go to "Verification of Vehicle Repair" prcedure.

COMPONENT INSPECTION

1. Check HO2S(B2/S1)
   (1) IG "OFF" and disconnect HO2S(B2/S1) connector.
   (2) Check HO2S(B2/S1) for damage or contamination caused by a foreign substance.
   (3) Is the HO2S(B2/S1) normal?

   YES

   ▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Substitute with a known - good HO2S(B2/S1) and check for proper operation. If the problem is corrected, replace HO2S (B2/S1) and go to "Verification of Vehicle Repair" procedure.

   NOTE

   There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

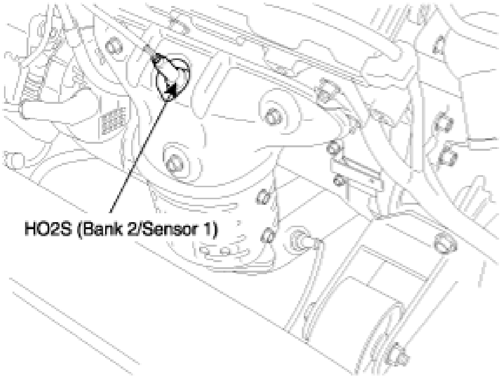
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0155

COMPONENT LOCATION



GENERAL DESCRIPTION

In order to control emissions of the CO, HC and NOx components of the exhaust gas, heated oxygen sensor (HO2S), mounted on the front side and rear side of catalytic converter, detects the oxygen content in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation.
The HO2S requires a minimum temperature to operate properly and provide a closed loop fuel control system. The HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions.
The oxygen sensor generates a voltage that indicates the difference between the oxygen content of the exhaust stream and the oxygen content of ambient air. When the exhaust stream is “rich,” there is more oxygen in the ambient air than in the exhaust stream, so the voltage will be higher.
Some oxygen sensor varieties use a “bias” voltage to achieve better resolution of the exhaust stream signal. Some oxygen sensor varieties use a “pumping circuit” to force ambient air into the sensor to maintain a more pure environment for comparison.
In either case, a cold sensor will tend to indicate voltage values near the open circuit value. For the “pumping current” sensors, this open circuit value can be near 3.5 V.Since the Fuel control logic would incorrectly consider this reading to indicate a very rich mixture for an extended time, the fuel control logic can not use the oxygen sensor reading under such conditions.
The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

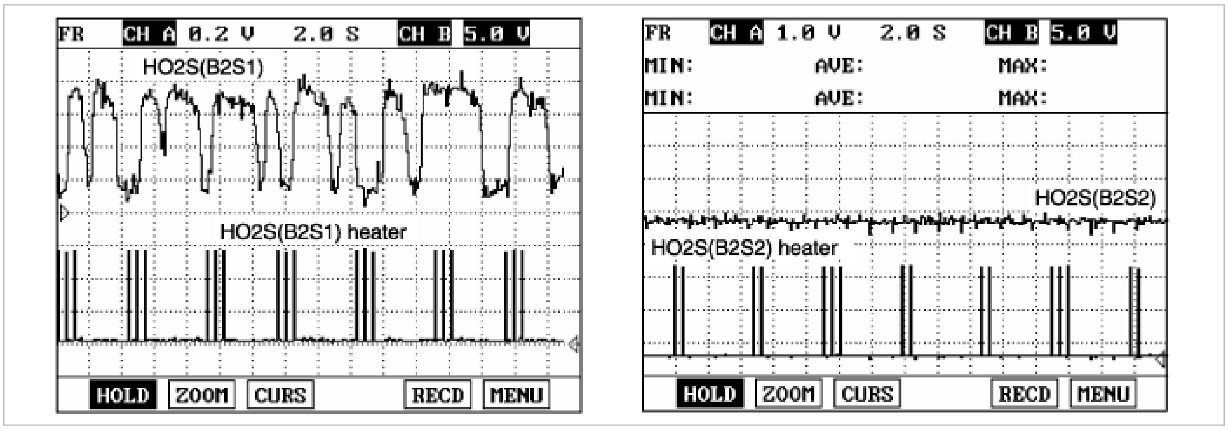
DTC DESCRIPTION

The O2 Heater diagnostic compares the current that is passing through the O2 Heater to a low limit. When the current is too low, the O2 Heater is considered failed.A failed O2 Heater will have an affect on vehicle emissions, especially on cold starts. The O2 Heater allows the O2 Sensor to work properly more quickly after the engine starts. If the PCM detects heater output voltage is lower than threshold value for 5 seconds while enable condition is met PCM determines that a fault exists and a DTC is stored.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Compares the current that is passing through the O2 Heater to a low limit	• Poor Connection • Contact Resistance • HO2S(B2/S1) • PCM
Enable Conditions	• Ignition ON • Engine Running >60sec • Heater Duty Cycle >0.4% • Max. Duty Cycle - Min. Duty Cycle< 0.05% • Delay Time ≥ 5sec	
Threshold value	• Filtered O2 Heater Current< threshold value	
Diagnosis Time	• Continuous (More than 2.5 second failure for every 5 second test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA



The HO2S requires a minimum temperature to provide a closed loop fuel control system. So the HO2S contains a heater element to reduce its warm-up time and ensure its performance during all driving conditions. The HO2S heater is controlled ON after engine start except for Cold condition and high speed accelleration. The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

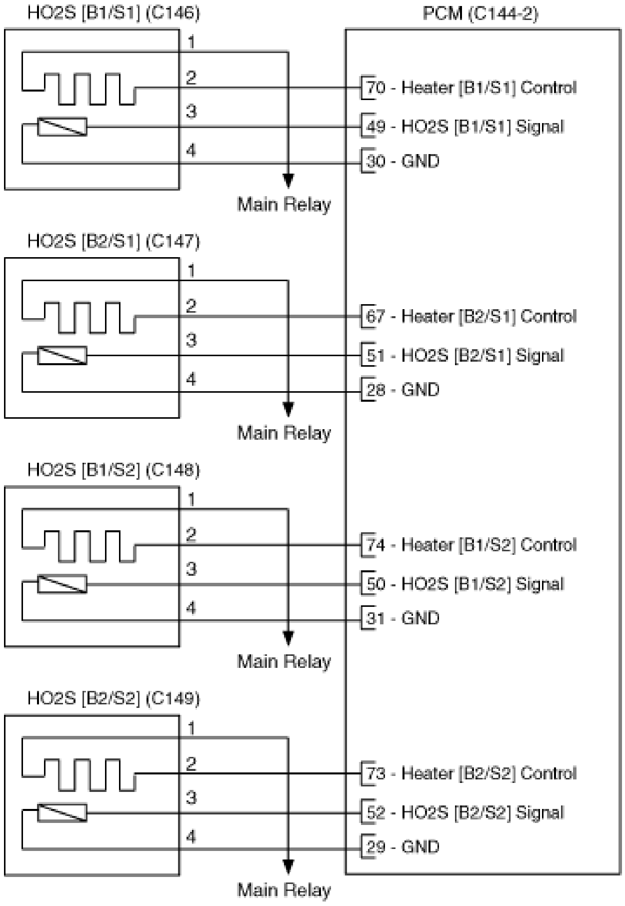
SPECIFICATION

For reference only

Condition	Current(A)
Heater Current at 13.5V, 450°C(842°F) Exhaust	0.25 ± 0.1
Heater In-rush Current at 21°C(69.8°F), 13.5V	1.7 MAX
Heater In-rush Current at -40°C(-40 °F), 13.5V	2.2 MAX

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

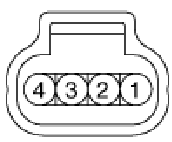
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

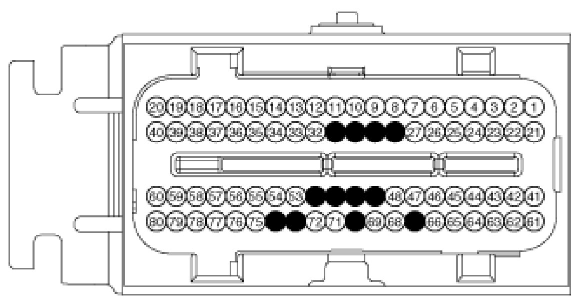
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]

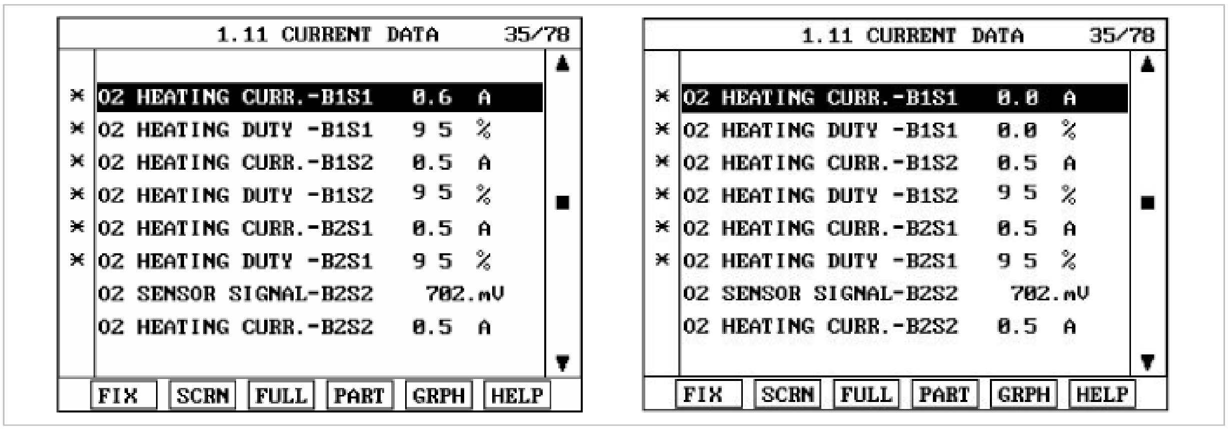


C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "HO2S(B2/S1) Heater" status on the service data.



4. Is the "HO2S Heater(B2/S1)" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

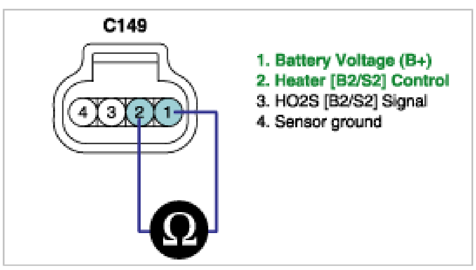
NO

▸ Go to "Component Inspection" procedure.

COMPONENT INSPECTION

1. Check HO2S(B2/S1) Heater resistance
   (1) IG "OFF" and disconnect HO2S(B2/S1) connector
   (2) Measure resistance between terminal 1 and 2 of HO2S(B2/S1)(Component Side)
   Specification :

Heater	
Resistance (Ω)	9.6 ± 1.5 at 21°C(69.8°F)



   (3) Is the measured resistance within specification ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Substitute with a known - good HO2S(B2/S1) and check for proper operation. If the problem is corrected, replace HO2S (B2/S1) and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

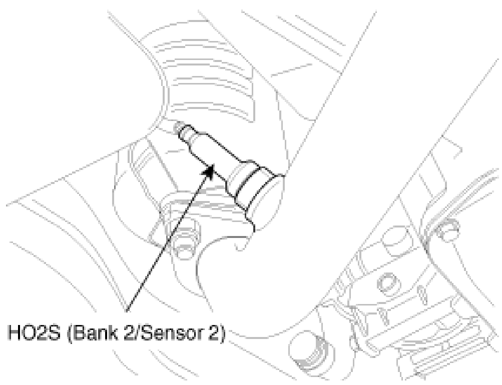
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0157

COMPONENT LOCATION



GENERAL DESCRIPTION

HO2S(B2/S2) is in the back of Catalytic Converter to check the proper operation of catalyst. As Exhaust gas already passed through catalyst, oxygen density in it is within specific range. If the oxygen density changes in accordance with HO2S(B2/S2), it means the poor performance of catalytic converter.

DTC DESCRIPTION

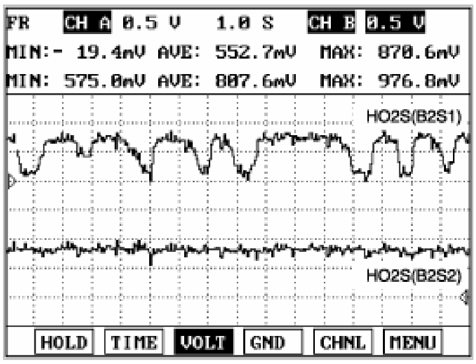
Checking output signals from HO2S every 15 sec. under detecting condition, if an output signal is below 0.05V for more than 12.5 sec., PCM sets P0157. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Signal low	• Poor connection • Short to ground in harness • HO2S(B2/S2) • PCM
Enable Conditions	• Battery voltage ≥ 10V • The minimum airflow ≥ 2g/s • Engine running state ≥ 30 sec. • The coolant temperature ≥ 60°C(140°F) • The feed-back control (the closed loop) state • No fuel-cut state • Above conditions are met >5 sec.	
Threshold value	• The voltage of HO2S(B2/S2)< 0.04V	

Diagnosis Time	• Continuous (more than 12.5 sec. failure for every 15 sec.test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA

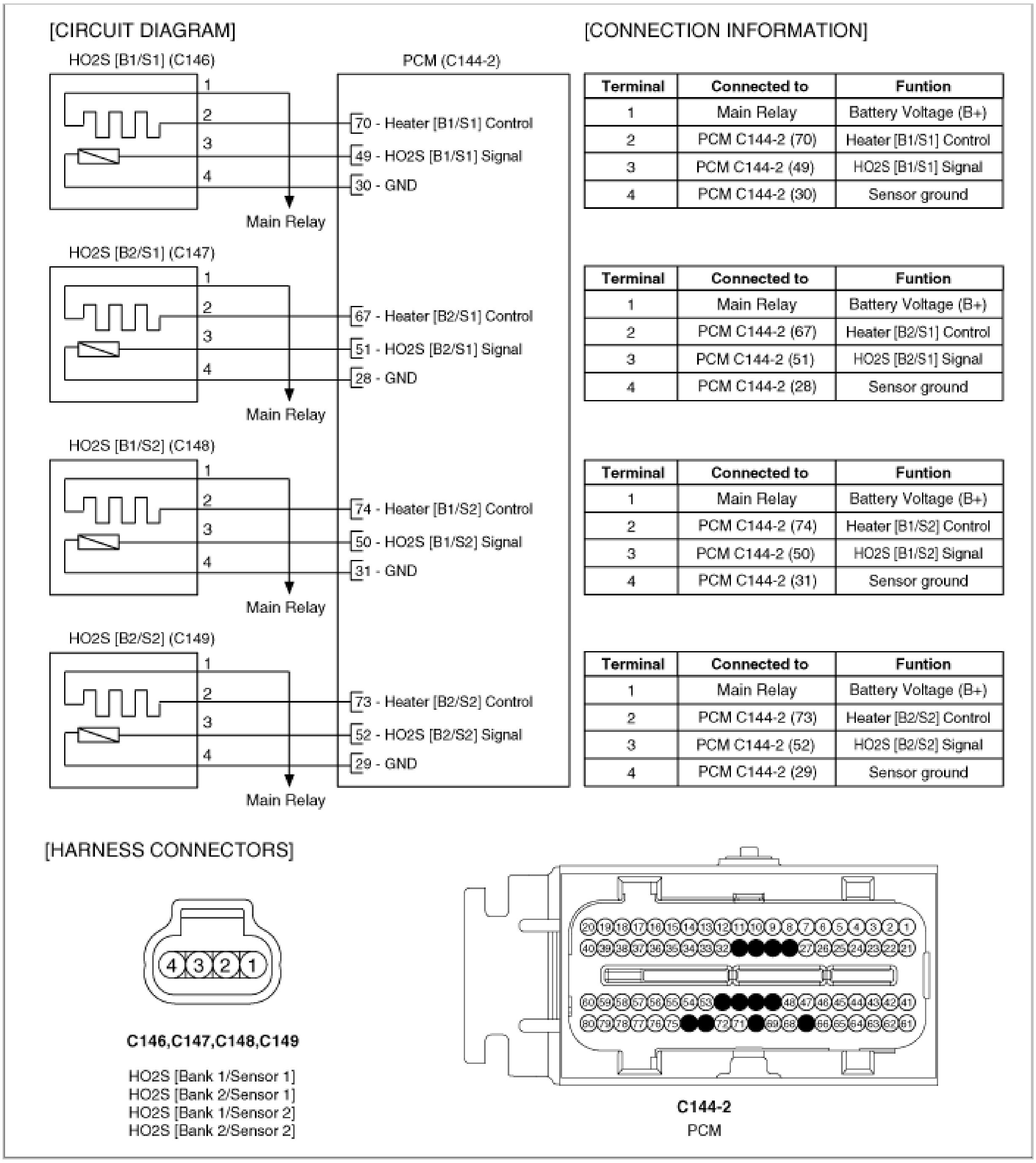


The amplitude of the signal output of the rear HO2S is small compared to the front HO2S because the rear HO2S detects emission gas purified by the catalytic converter. This is the normal signal waveform of the rear HO2S at idle.

SPECIFICATION

Air/fuel mixture	Voltage(V)
Rich	0.75 ~ 1V
Lean	0 ~ 0.12V

SCHEMATIC DIAGRAM



Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "HO2S(B2/S2)" item on the service data.

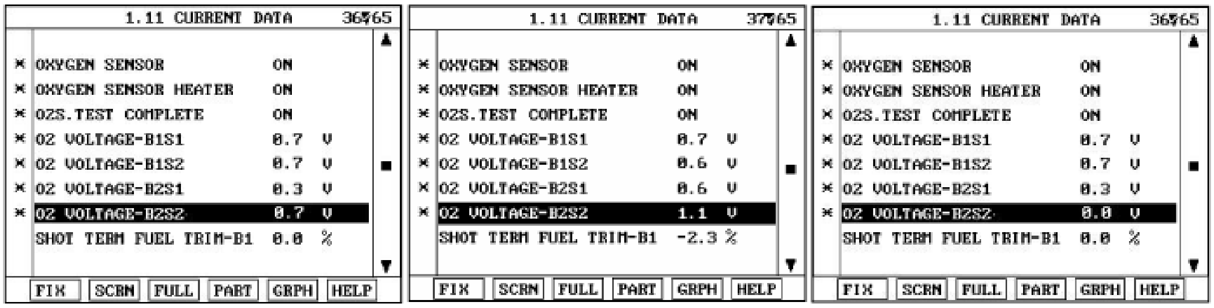


Fig. 1 Fig. 2 Fig. 3

Fig. 1 : Normal data
Fig. 2 : Open or Short to battery in HO2S(B2/S2)
Fig. 3 : Short to ground in HO2S(B2/S2)

4. Is the service data displayed correctly?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

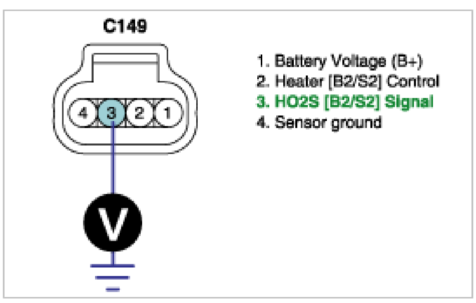
NO

▸ Go to " Signal Circuit Inspection " procedure.

SIGNAL CIRCUIT INSPECTION

1. IG "OFF" and disconnect HO2S(B2/S2)
2. IG "ON"
3. Measure voltage between terminal 3 of HO2S(B2/S2) harness connector and chassis ground.

Specification : Approx. 3.5V - when pumping current is ON
Approx. 0.45V - when pumping current is OFF



4. Is the measured voltage within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Visual Inspection of HO2S
   Visually/physically inspect following items:
   A. Inspect the Rear HO2S for Contaminated, deteriorated or aged Rear HO2S
   B. If contamination is evident on the HO2S, replace contaminated sensor
2. Is the HO2S(B2/S2) normal?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good HO2S(B2/S2) and check for proper operation. If the problem is corrected, replace HO2S (B2/S2) and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

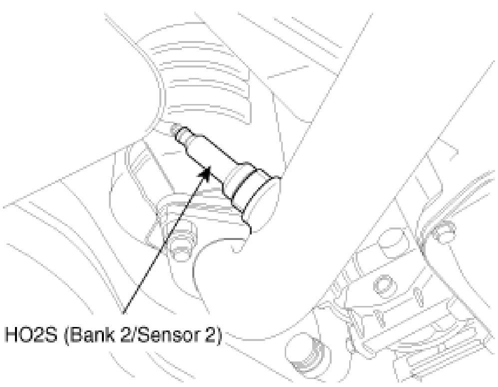
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0158

COMPONENT LOCATION



GENERAL DESCRIPTION

HO2S(B2/S2) is in the back of Catalytic Converter to check the proper operation of catalyst. As Exhaust gas already passed through catalyst, oxygen density in it is within specific range. If the oxygen density changes in accordance with HO2S(B2/S2), it means the poor performance of catalytic converter.

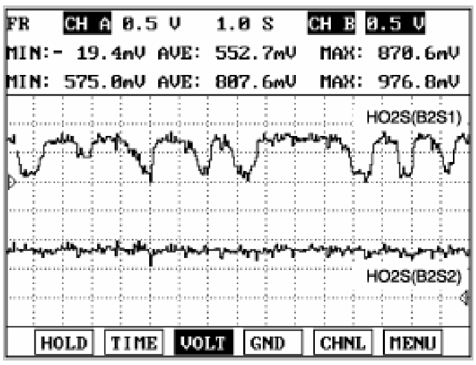
DTC DESCRIPTION

Checking output signals from HO2S every 15 sec. under detecting condition, if an output signal is above 1.3V for more than 12.5 sec, PCM sets P0158. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Signal low	• Poor connection • Short to battery in harness • HO2S(B2/S2) • PCM
Enable Conditions	• Battery voltage ≥ 10V • The minimum airflow ≥ 2g/s • Engine running state ≥ 30 sec. • The coolant temperature ≥ 60°C(140°F) • The feed-back control (the closed loop) state • No fuel-cut state • Above conditions are met >5 sec.	
Threshold value	• The voltage of HO2S(B2/S2) > 1.3V	
Diagnosis Time	• Continuous (more than 12.5 sec. failure for every 15 sec.test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA



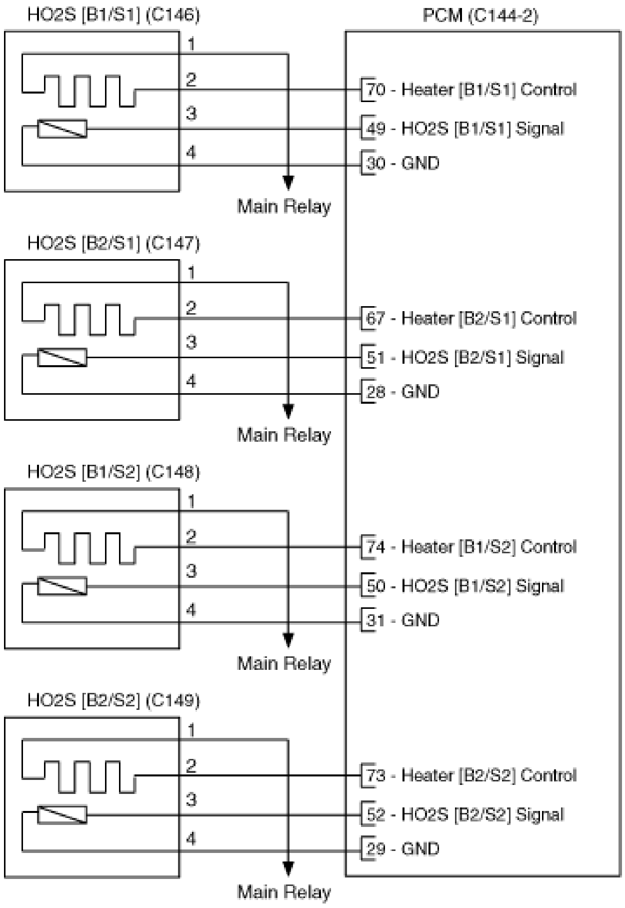
The amplitude of the signal output of the rear HO2S is small compared to the front HO2S because the rear HO2S detects emission gas purified by the catalytic converter. This is the normal signal waveform of the rear HO2S at idle.

SPECIFICATION

Air/fuel mixture	Voltage(V)
Rich	0.75 ~ 1V
Lean	0 ~ 0.12V

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

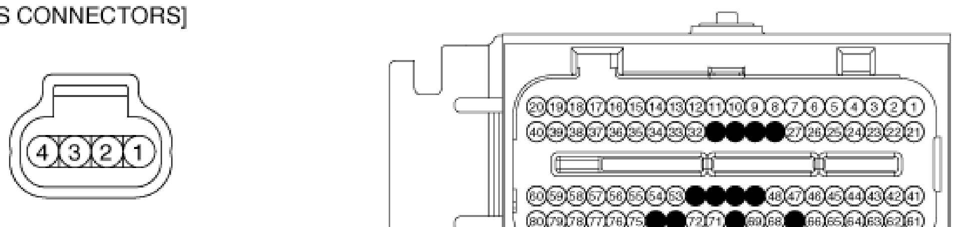
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]

C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "HO2S(B2/S2)" item on the service data.

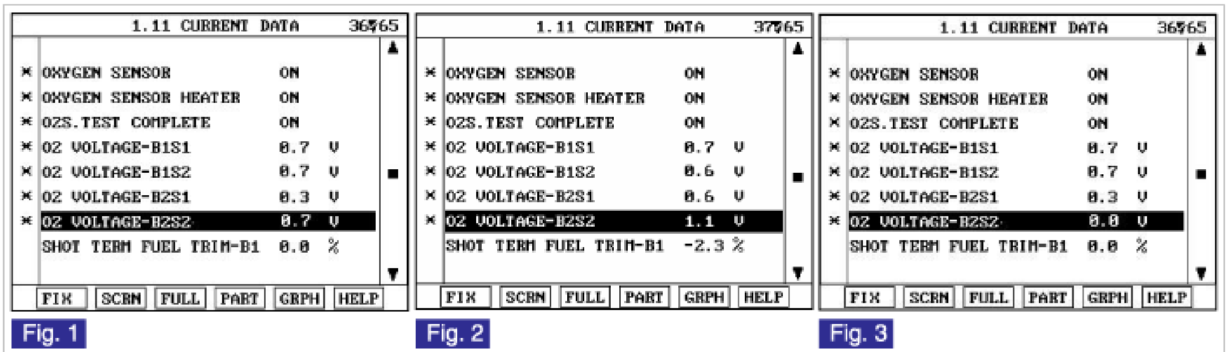


Fig. 1 : Normal data
Fig. 2 : Open or Short to battery in HO2S(B2/S2)
Fig. 3 : Short to ground in HO2S(B2/S2)

4. Is the service data displayed correctly?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

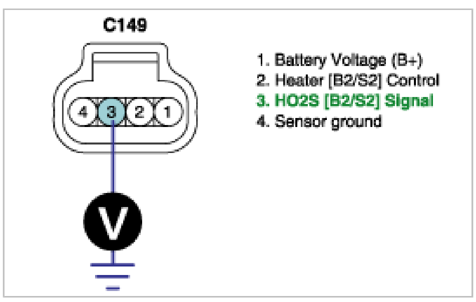
NO

▸ Go to " Signal Circuit Inspection " procedure.

SIGNAL CIRCUIT INSPECTION

1. IG "OFF" and disconnect HO2S(B2/S2) connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 3 of HO2S(B2/S2) harness connector and chassis ground.

Specification :
Approx. 3.5V - when pumping current is ON
Approx. 0.45V - when pumping current is OFF



4. Is the measured voltage within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Visual Inspection of HO2S
   Visually/physically inspect following items:
   A. Inspect the Rear HO2S for Contaminated, deteriorated or aged Rear HO2S
   B. If contamination is evident on the HO2S, replace contaminated sensor
2. Is the HO2S(B2/S2) normal?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good HO2S(B2/S2) and check for proper operation. If the problem is corrected, replace HO2S (B2/S2) and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

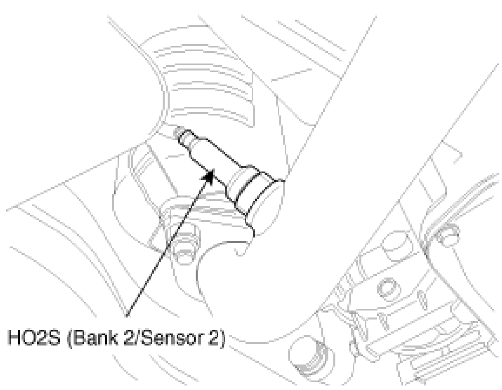
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0159

COMPONENT LOCATION



GENERAL DESCRIPTION

The rear heated oxygen sensor is mounted on the rear side of the Catalytic Converter (warm-up catalytic converter) or in the rear exhaust pipe, which is able to detect the catalyst efficiency. The rear heated oxygen sensor (HO2S) produces a voltage between 0V and 1V. This rear heated oxygen sensor is used to estimate the oxygen storage capability. If a catalyst has good conversion properties, the oxygen fluctuations are smoothed by the oxygen storage capacity of the catalyst. If the conversion provided by the catalyst is low due to aging, poisoning or misfiring, then the oxygen fluctuations are similar to signals from the front oxygen sensor.

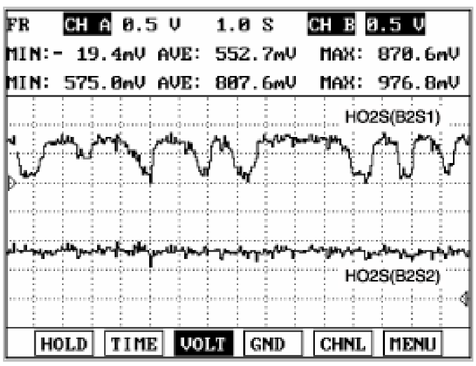
DTC DESCRIPTION

Since the Catalyst Diagnostic uses the oxygen sensors to determine the quality of the catalyst, and since an extended period of time with the rear oxygen sensor value steady is interpreted as a “good” catalyst, the Catalyst Diagnostic can be rendered inaccurate by an improperly functioning oxygen sensor. This diagnostic will extend the period of time that the Catalyst diagnostic requests a fuel shift. If the oxygen sensor still fails to respond after this extended time, then there is a fault with the sensor. Checking the Maximum time allowed between the front sensor response and the rear sensor response to the Stage1 or 2 fuel shift under detecting condition, if the fuel shift time is higher than 25sec, PCM determines a fault and sets DTC P0159. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Determines if Rear O2 Sensor is acceptable for Idle Catalyst Monitor use	• Poor connection • Faulty HO2S • Faulty PCM
Enable Conditions	• If Idle Catalyst Monitor Diagnostic is enabled HO2S Bank 1 Sensor 2 Response Diagnostic Enable Criteria Met	
Threshold value	• Maximum time allowed between the front sensor response and the rear sensor response to the Stage 1(Forced to rich) ICMD(Idle Catalyst Monitor Diagnostic)fuel shift ≥ 25sec • Maximum time allowed between the front sensor response and the rear sensor response to the Stage 2(Forced to lean) ICMD(Idle Catalyst Monitor Diagnostic) fuel shift ≥ 25sec	
Diagnosis Time	• -	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA



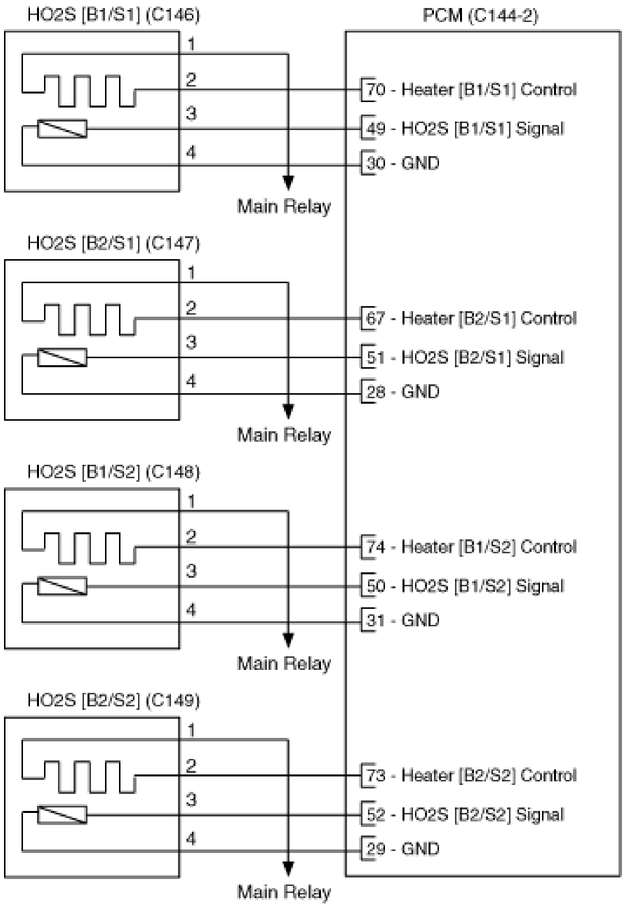
The amplitude of the signal output of the rear HO2S is small compared to the front HO2S because the rear HO2S detects emission gas purified by the catalytic converter. This is the normal signal waveform of the rear HO2S at idle.

SPECIFICATION

Air/fuel mixture	Voltage(V)
Rich	0.75 ~ 1V
Lean	0 ~ 0.12V

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

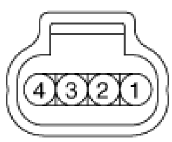
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

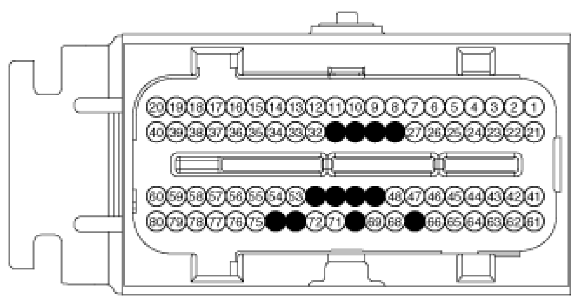
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



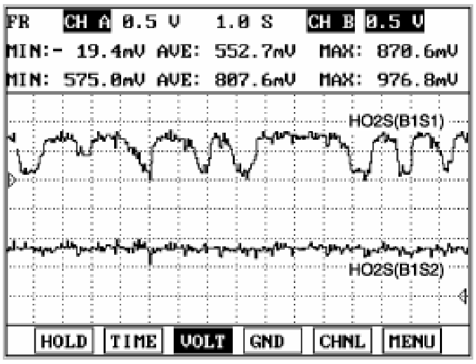
C144-2

PCM

MONITOR SCANTOOL DATA

1. Connect Scantool then Engine "ON"
2. Warm up the engine to normal operating temperature.
3. Monitor the signal waveform of HO2S(B2S2) with scantool

Specification : 0.1 ~ 0.9V



4. Is the HO2S parameter displayed within specifications ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to " Component Inspection " procedure.

COMPONENT INSPECTION

1. Visual Inspection of HO2S
   Visually/physically inspect following items:
   A. Inspect the Rear HO2S for Contaminated, deteriorated or aged Rear HO2S
   B. If contamination is evident on the HO2S, replace contaminated sensor
2. Is the HO2S(B2S2) O.K ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.

NO

▸ Substitute with a known - good HO2S(B2S2) and check for proper operation. If the problem is corrected, replace HO2S (B2S2) and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

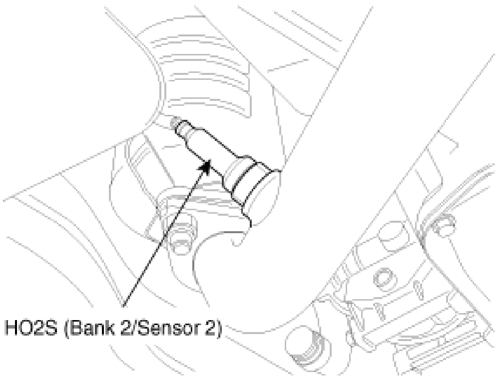
▸ Go to the applicable troubleshooooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0160

COMPONENT LOCATION



GENERAL DESCRIPTION

HO2S(B2/S2) is in the back of Catalytic Converter to check the proper operation of catalyst. As Exhaust gas already passed through catalyst, oxygen density in it is within specific range. If the oxygen density changes in accordance with HO2S(B2/S2), it means the poor performance of catalytic converter.

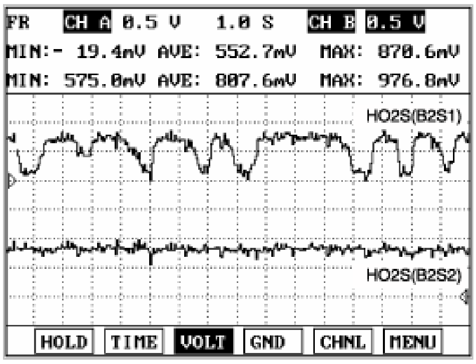
DTC DESCRIPTION

Checking output signals from HO2S every 10 sec. under detecting condition, if an output signal indicating open in the circuit lasts for more than 6.3 sec. PCM sets P0160. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

<table>
<tr><th colspan="2">Item</th><th>Detecting Condition</th><th>Possible cause</th></tr>
<tr><td colspan="2">DTC Strategy</td><td>• Open</td><td rowspan="7">• Poor connection
• Open in harness
• HO2S(B2/S2)
• PCM</td></tr>
<tr><td colspan="2">Enable Conditions</td><td>• No sensor cooled status
• The minimum airflow ≥ 2g/s
• The battery voltage ≥ 10V
• Engine running state >30 sec.
• Coolant temperature ≥ 60°C(140°F)</td></tr>
<tr><td rowspan="2">Threshold value</td><td>Case 1</td><td>• At pumping current ON
• 1.2V ≤ Voltage of HO2S ≤ 3.9V</td></tr>
<tr><td>Case 2</td><td>• At pumping current OFF
• 0.415V ≤ Voltage of HO2S ≤ 0.515V</td></tr>
<tr><td colspan="2">Diagnosis Time</td><td>• Continuous
(more than 6.3 sec.failure for every 10 sec.test)</td></tr>
<tr><td colspan="2">MIL On Condition</td><td>• 2 Driving Cycles</td></tr>
</table>

SIGNAL WAVEFORM AND DATA



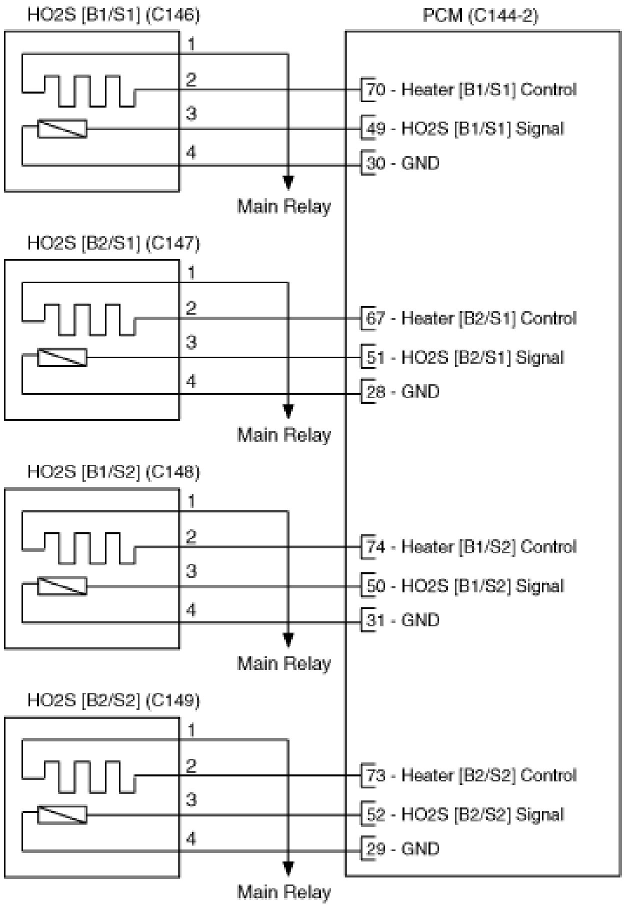
The amplitude of the signal output of the rear HO2S is small compared to the front HO2S because the rear HO2S detects emission gas purified by the catalytic converter. This is the normal signal waveform of the rear HO2S at idle.

SPECIFICATION

Air/fuel mixture	Voltage(V)
Rich	0.75 ~ 1V
Lean	0 ~ 0.12V

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

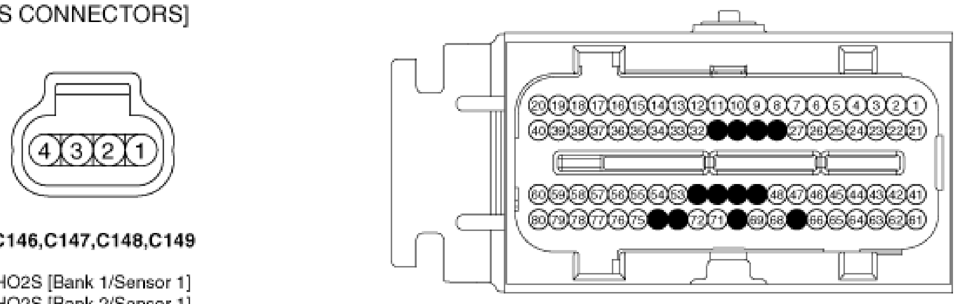
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]

C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "HO2S(B2/S2)" item on the service data.

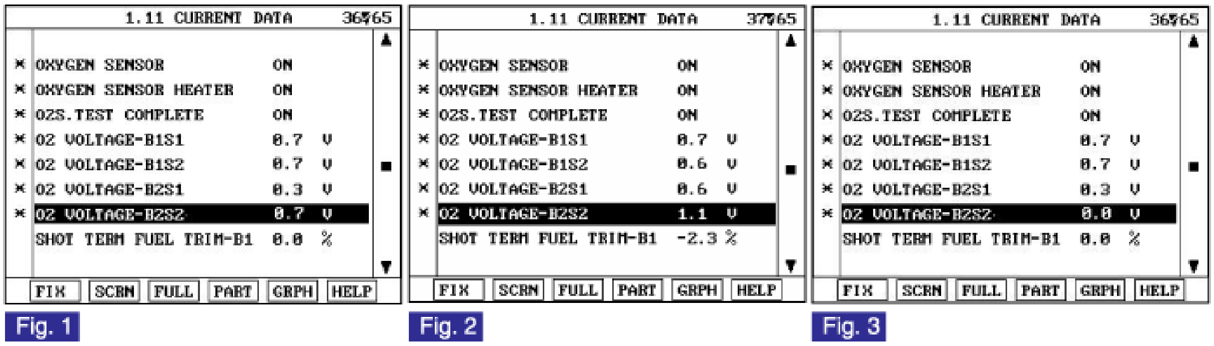


Fig. 1 : Normal data
Fig. 2 : Open or Short to battery in HO2S(B2/S2)
Fig. 3 : Short to ground in HO2S(B2/S2)

4. Is the service data displayed correctly?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found ?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

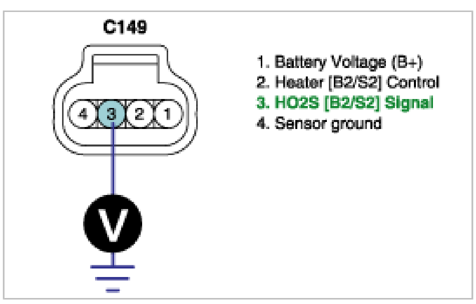
NO

▸ Go to " Signal Circuit Inspection " procedure.

SIGNAL CIRCUIT INSPECTION

1. IG "OFF" and disconnect HO2S(B2/S2) connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 3 of HO2S(B2/S2) harness connector and chassis ground.

Specification :
Approx. 3.5V - when pumping current is ON
Approx. 0.45V - when pumping current is OFF



4. Is the measured voltage within specification?

YES

▸ Go to "Ground Circuit Inspection" procedure.

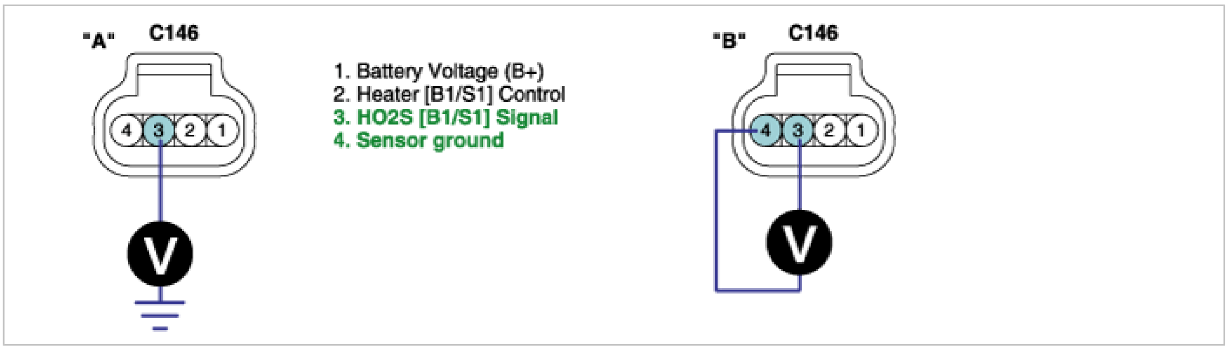
NO

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "ON" and disconnect HO2S(B2/S2) connector.
2. Measure voltage between terminal 3 of HO2S(B2/S2) harness connector and chassis ground.
3. Measure voltage between terminals 3 and 4 of HO2S(B2/S2) harness connector.

Specification : Voltage difference between measurement "A" and "B" is below 200mV.



4. Is the measured voltage within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Visual Inspection of HO2S
   Visually/physically inspect following items:
   A. Inspect the Rear HO2S for Contaminated, deteriorated or aged Rear HO2S
   B. If contamination is evident on the HO2S, replace contaminated sensor
2. Is the HO2S(B2/S2) normal?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good HO2S(B2/S2) and check for proper operation. If the problem is corrected, replace HO2S (B2/S2) and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

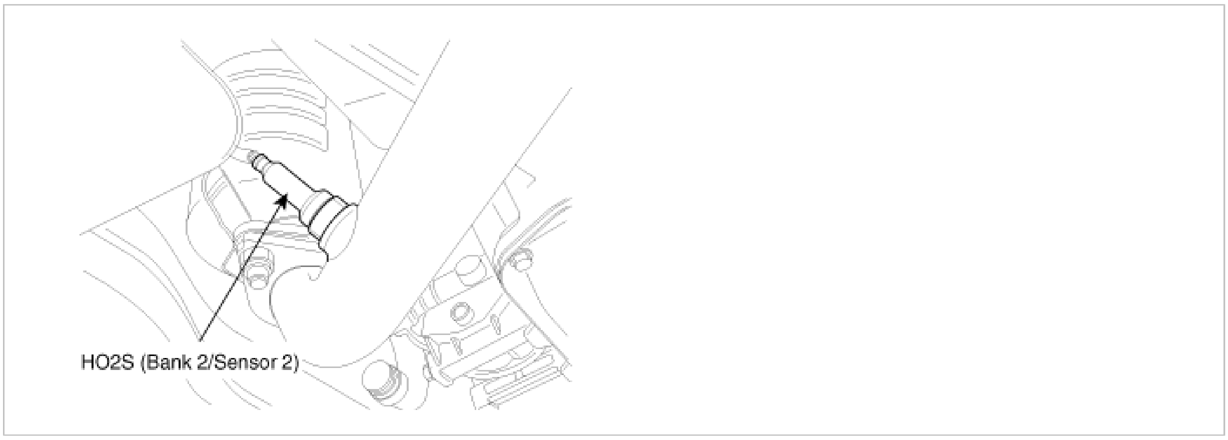
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0161

COMPONENT LOCATION



GENERAL DESCRIPTION

HO2S(B2/S2) is in the back of Catalytic Converter to check the proper operation of catalyst. As Exhaust gas already passed through catalyst, oxygen density in it is within specific range. If the oxygen density changes in accordance with HO2S(B2/S2), it means the poor performance of catalytic converter.

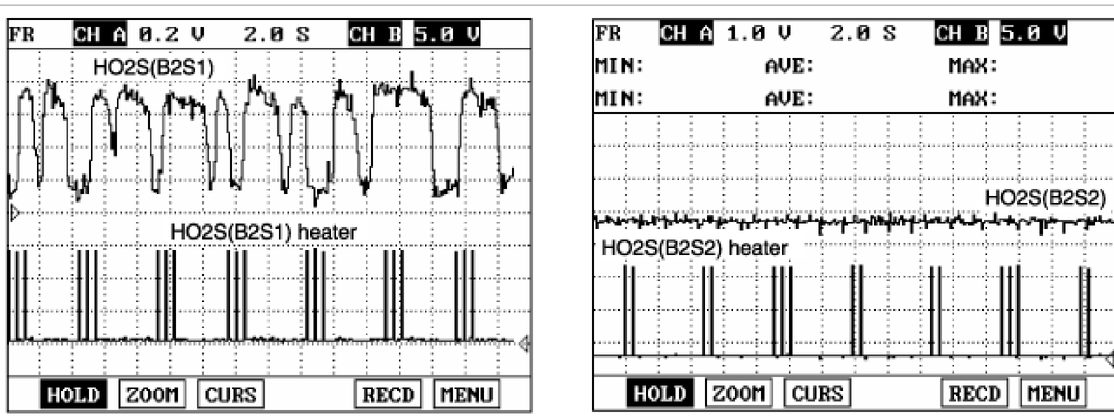
DTC DESCRIPTION

The O2 Heater diagnostic compares the current that is passing through the O2 Heater to a low limit. When the current is too low, the O2 Heater is considered failed.A failed O2 Heater will have an affect on vehicle emissions, especially on cold starts. The O2 Heater allows the O2 Sensor to work properly more quickly after the engine starts.If the PCM detects heater output voltage is lower than threshold value for 5 seconds while enable condition is met PCM determines that a fault exists and a DTC is stored.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Compares the current that is passing through the O2 Heater to a low limit	• Poor connection • Contact Resistance • HO2S(B2/S2) • PCM
Enable Conditions	• Ignition ON • Engine Running > 60s • Heater Duty Cycle > 0.4% • Max. Duty Cycle - Min. Duty Cycle < 0.05% • Delay Time ≥ 5s	
Threshold value	• Filtered O2 Heater Current < 0.02A	
Diagnosis Time	• Continuous (More than 2.5 second failure for every 5 second test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA



The HO2S requires a minimum temperature to provide a closed loop fuel control system. So the HO2S contains a heater element to reduce its warm-up time and ensure its performance during all driving conditions. The HO2S heater is controlled ON after

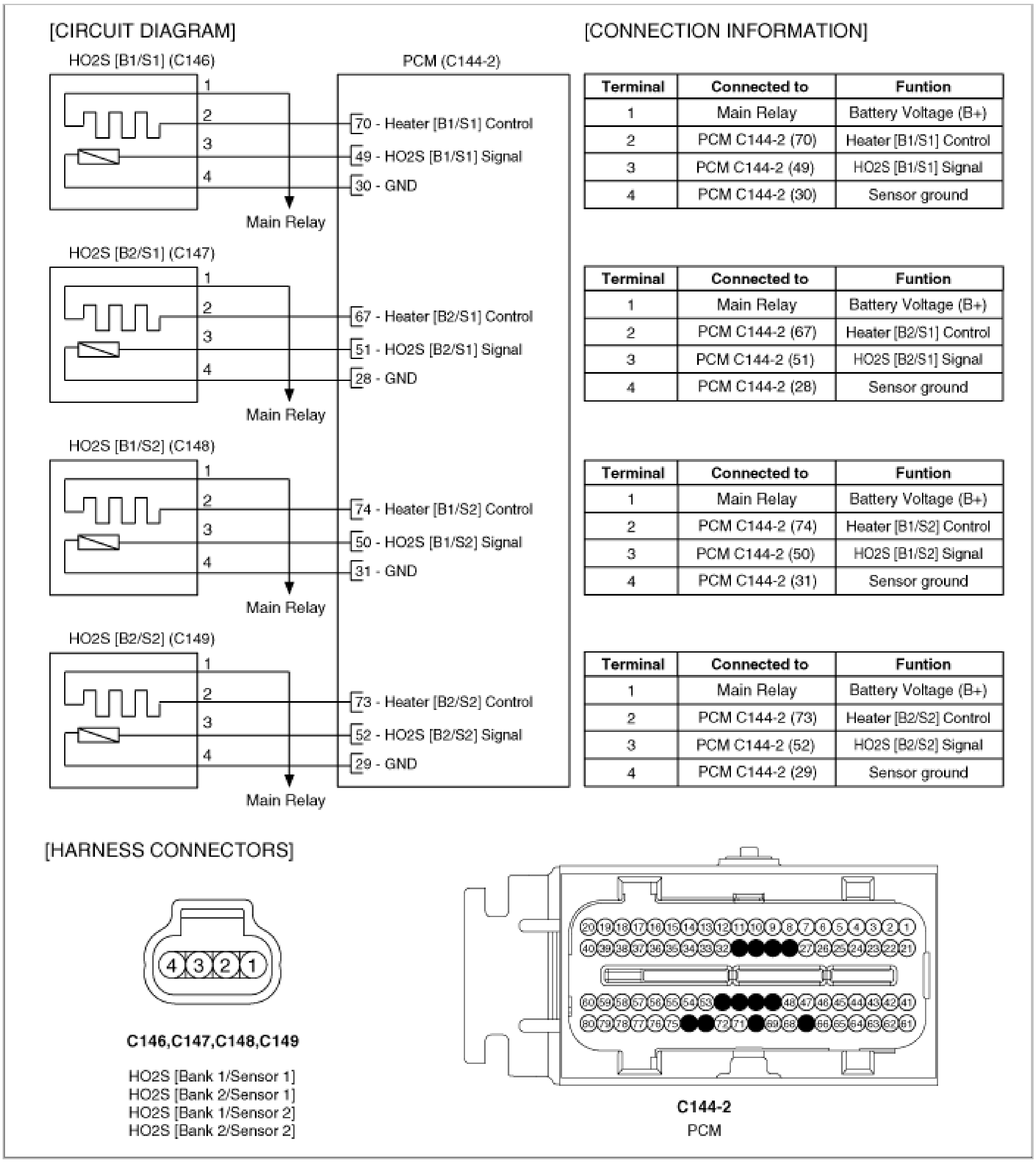
engine start except for Cold condition and high speed accelleration. The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

SPECIFICATION

(For reference only)

Condition	Current(A)
Heater Current at 13.5V, 450°C(842°F) Exhaust	0.52 ± 0.1
Heater In-rush Current at 21°C(69.8°F), 13.5V	1.7 MAX
Heater In-rush Current at -40°C(-40°F), 13.5V	2.2 MAX

SCHEMATIC DIAGRAM



Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

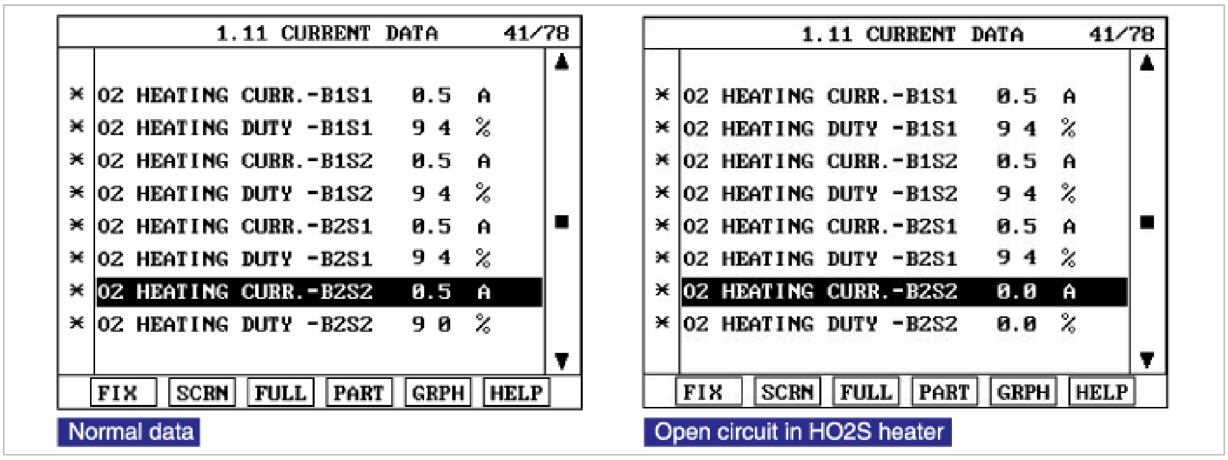
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.

2. Warm -up the engine to normal operating temperature.
3. Monitor "HO2S(B2/S2) Heater" item on the service data.



Normal data

Open circuit in HO2S heater

4. Is the "HO2S Heater(B2/S2)" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

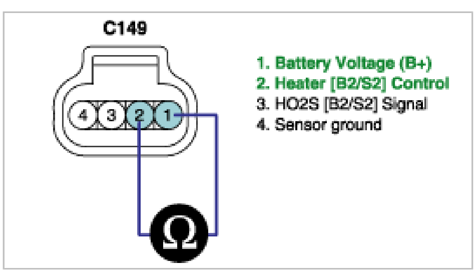
NO

▸ Go to " Component Inspection " procedure.

COMPONENT INSPECTION

1. Check HO2S(B2/S2) Heater resistance
   (1) IG "OFF" and disconnect HO2S(B2/S2) connector
   (2) Measure resistance between terminal 1 and 2 of HO2S(B2/S2)(Component Side)
   Specification :

Heater	
Resistance (Ω)	9.6 ± 1.5 at 21°C(69.8°F)



2. Is the measured resistance within specification ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Substitute with a known - good HO2S(B2/S2) and check for proper operation. If the problem is corrected, replace HO2S (B2/S2) and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0171

GENERAL DESCRIPTION

In order to provide the best possible combination of drivability, fuel economy and emission control, the PCM uses a closed loop air/fuel metering system. The PCM monitors the HO2S signal voltage and adjusts fuel delivery based it in closed loop fuel control. Changes in fuel delivery will be indicated by the long-term and the short-term fuel trim values. The ideal fuel trim value is around 0%. The PCM will add fuel when the HO2S signal is indicating a lean condition. Additional fuel is indicated by fuel trim values that are above 0%. The PCM will reduce fuel when the HO2S signal is indicating a rich condition. Reduction in fuel is indicated by fuel trim values that are below 0%. The DTC relevant to fuel trim will be set when the amount reaches excessive levels because of a lean or rich condition.

DTC DESCRIPTION

Checking air-fuel ratio correction value every 0.75 sec. under detecting condition, if an value is within detecting condition for more than 0.3 sec., PCM sets P0171. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

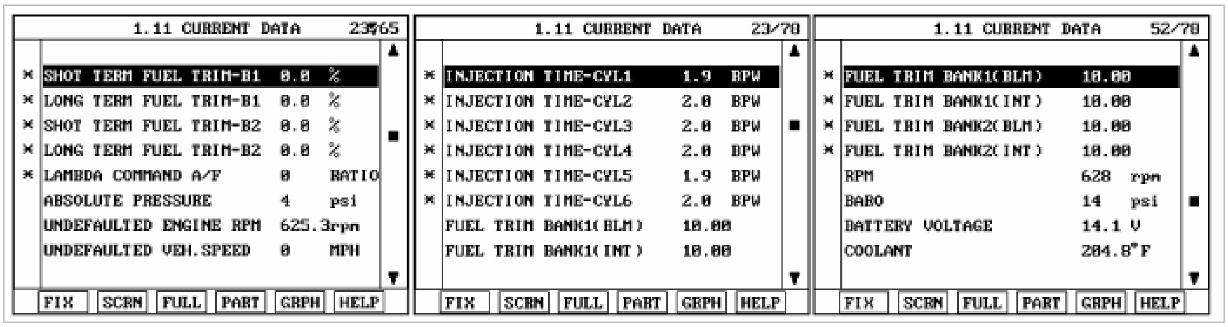
DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Fuel Trim Limits Exceeded	• Poor connection • Relevant sensor/actuator • Air leakage • PCM
Enable Conditions	• 550rpm ≤ Engine speed ≤ 4000rpm • 60°C(140°F) ≤ Engine coolant temperature ≤ 115°C(239°F) • -10°C(14°F) ≤ Intake air temperature ≤ 60°C(140°F) • 0° ≤ Throttle position ≤ 80° • 25kPa ≤ Engine load ≤ 90kPa • 1.5g/s ≤ Intake air flow ≤ 80g/s • Barometric pressure ≥ 72kPa • Vehicle speed ≤ 130km/h • System voltage ≥ 11V • Feed-back control state • No other diagnostic fault	
Threshold value	• Lean limit average < 0.8 (Average of short term fuel trim) and < 1.2(Average of long term fuel trim)	
Diagnosis Time	• Continuous (More than 0.3 second failure for every 0.75 second test)	

MIL On Condition	• 2 Driving Cycles	

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. Warm -up the engine to normal operating temperature.
3. Monitor "Sensor/actuator related to fuel system(HO2S, MAFS, MAPS, TPS, ECTS, PSCA, Injector, and so on)" items on the service data.



4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found ?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to " System Inspection " procedure.

SYSTEM INSPECTION

1. Check air leakage
   (1) Visually/physically inspect the air leakage in intake/exhaust system for following items
   - ▸ Vacuum hoses for splits, kinks and improper connections.
   - ▸ Throttle body gasket
   - ▸ Gasket between intake manifold and cylinder head
   - ▸ Seals between intake manifold and fuel injectors
   - ▸ Exhaust system between HO2S and three way catalyst for air leakage

   (2) Has a problem found in this procedure?

   YES

   ▸ Repair or replace it which has a problem, and go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Go to "Check the fuel line" as follows

2. Check the fuel line
   (1) Check the fuel line for following items
   - ▸ Connector connection state
   - ▸ Damage/ connection state for vacuum hoses connected to fuel line
   - ▸ Bent/ pressed/ twisted fuel line or fuel leakage

(2) Has a problem found in this procedure?

YES

▸ Repair or replace it which has a problem, and go to " Verification of Vehicle Repair" procedure.

NO

▸ Go to "Check fuel pressure" as follows

3. Check fuel pressure

> **NOTE**
>
> - Be cautious that Fuel is explosive and an empty fuel tank can still contain explosive gases.When working on fuel system make sure to supply adequate ventilationto the work area. Do not smoke, and keep sparks and open flames away.
> - The fuel system remains under pressure when the engine is not running. Release fuel system pressure before disconnecting any fuel line to reduce the chance of presonal injury or fire damage to vehicle components.

(1) IG "OFF" and disconnect Fuel Pump Relay in Junction Box.

(2) Start-up and wait until it stops itself.

(3) IG "OFF" and connect Fuel Pump Relay.

(4) Install the fuel pressure gauge to the delivery pipe with the fuel pressure gauge adaptor.

(5) Activate the fuel pump, and with fuel pressure applied, check that there is no fuel leakage from the pressure gauge or connection part.

(6) Disconnect the vacuum hose from the pressure regulator, and plug the hose end.

(7) Measure the fuel pressure at idle.

Specification : 374.6 ~ 384.4 kPa(3.82 ~ 3.92 kg/cm², 54.3 ~ 55.8 psi)

(8) Is the measured fuel pressure within specifications ?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair or replace according to the below table. And then, go to " Verification of Vehicle Repair"procedure.

Condition	Possible Cause
Fuel Pressure is too low	Fuel filter,fuel pressure regulator, in-tank fuel hose or the fuel pump
Fuel Pressure is too high	Fuel pressure regulator, hose or pipe
No different fuel pressure when vacuum hose is connected or not	The vacuum hose or the nipple

COMPONENT INSPECTION

1. Check PCV

(1) IG "OFF" and remove PCV valve from cylinder head

(2) With engine idling, block PCV valve and confirm that vacuum is felt.

(3) Insert thin stick into the screwed PCV valve and verify that the plunger is moving.

(4) Is the PCV valve normally moving?

YES

▸ Go to "Check PCSV as follows.

NO

▸ Replace it, and go to "Verification of Vehicle Repair" procedure.

2. Check PCSV

(1) IG "OFF" and disconnect PCSV and vacuum hose.

(2) Connect hand-vacuum gage with PCSV and supply vacuum to it.

(3) Is the vacuum maintained ?

YES

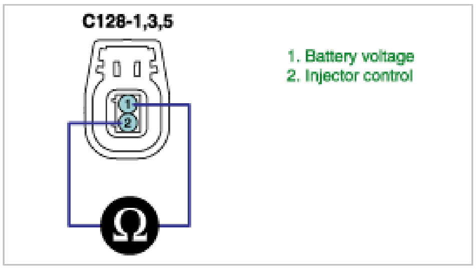
▸ Go to " Check injector" as follows.

NO

▸ Repair or replace it, and go to " Verification of Vehicle Repair" procedure.

3. Check injector
   (1) IG "OFF" and disconnect injector.
   (2) Check it for blocking caused by any foreign substance.
   (3) Measure resistance between terminals 1 and 2 of Injector connector.(Component side)
   Specification :

Temp	Coil's resistance
20°C(68°F)	11.4 ~ 12.6 Ω



   (4) Is the measured resistance within specification?

YES

▸ Go to "Check sensor/actuator related to fuel system" as follows

NO

▸ Repair or replace it, and go to "Verification of Vehicle Repair" procedure.

4. Check sensor/actuator related to fuel system
   (1) Check the signal of sensor/actuator related to fuel system(HO2S, MAFS,MAPS, TPS, ECTS, PCSV, Injector and so on)
   (Refer to each DTC diagnostic procedure)
   (2) Are all of these items normal ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Repair it, and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0172

GENERAL DESCRIPTION

In order to provide the best possible combination of drivability, fuel economy and emission control, the PCM uses a closed loop air/fuel metering system. The PCM monitors the HO2S signal voltage and adjusts fuel delivery based it in closed loop fuel control. Changes in fuel delivery will be indicated by the long-term and the short-term fuel trim values. The ideal fuel trim value is around 0%. The PCM will add fuel when the HO2S signal is indicating a lean condition. Additional fuel is indicated by fuel trim values that are above 0%. The PCM will reduce fuel when the HO2S signal is indicating a rich condition. Reduction in fuel is indicated by fuel trim values that are below 0%. The DTC relevant to fuel trim will be set when the amount reaches excessive levels because of a lean or rich condition.

DTC DESCRIPTION

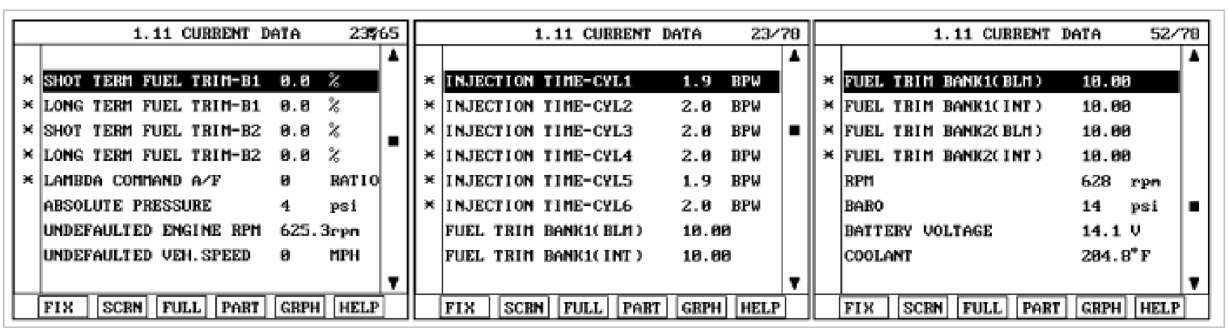
Checking air-fuel ratio correction value every 0.75 sec. under detecting condition, if an value is within detecting condition for more than 0.3 sec., PCM sets P0172. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Fuel Trim Limits Exceeded	• Poor connection • Relevant sensor/actuator • Blocking of Intake system • Fuel leakage in injector • Improper fuel line pressure • PCM
Enable Conditions	• 550rpm ≤ Engine speed ≤ 4000rpm • 60°C(140°F) ≤ Engine coolant temperature ≤ 115°C(239°F) • -10°C(14°F) ≤ Intake air temperature ≤ 60°C(140°F) • 0° ≤ Throttle position ≤ 80° • 25kPa ≤ Engine load ≤ 90kPa • 1.5g/s ≤ Intake air flow ≤ 80g/s • Barometric pressure ≥ 72kPa • Vehicle speed ≤ 130km/h • System voltage ≥ 11V • Feed-back control state • No other diagnostic fault	
Threshold value	• Lean limit average >1.2 (Average of short term fuel trim) and< 0.8(Average of long term fuel trim)	
Diagnosis Time	• Continuous (More than 0.3 second failure for every 0.75 second test)	
MIL On Condition	• 2 Driving Cycles	

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. Warm -up the engine to normal operating temperature.
3. Monitor "Sensor/actuator related to fuel system(HO2S, MAFS, MAPS, TPS, ECTS, PSCA, Injector, and so on)" items on the service data.



4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by

interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to " System Inspection " procedure.

SYSTEM INSPECTION

1. Check blocking of intake system
   (1) Visually/physically inspect the blocking in intake system for following items
   - ▸ Throttle body gasket and damage
   - ▸ Clogging of Air cleaner
   - ▸ Blocking in intake manifold and injector caused by any foreign substance

   (2) Has a problem found?

   YES

   ▸ Repair or replace it, and go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Go to " Check fuel pressure" as follows.

2. Check fuel pressure

> NOTE
>
> - Be cautious that Fuel is explosive and an empty fuel tank can still contain explosive gases.When working on fuel system make sure to supply adequate ventilationto the work area. Do not smoke, and keep sparks and open flames away.
> - The fuel system remains under pressure when the engine is not running. Release fuel systempressure before disconnecting any fuel line to reduce the chance of presonal injury orfire damage to vehicle components.

(1) IG "OFF" and disconnect Fuel Pump Relay in Junction Box.

(2) Start-up and wait until it stops itself.

(3) IG "OFF" and connect Fuel Pump Relay.

(4) Install the fuel pressure gauge to the delivery pipe with the fuel pressure gauge adaptor.

(5) Activate the fuel pump, and with fuel pressure applied, check that there is no fuel leakage from the pressure gauge or connection part.

(6) Disconnect the vacuum hose from the pressure regulator, and plug the hose end.

(7) Measure the fuel pressure at idle.

Specification : 374.6 ~ 384.4 kPa(3.82 ~ 3.92 kg/cm², 54.3 ~ 55.8 psi)

(8) Is the measured fuel pressure within specifications ?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair or replace according to the below table. And then, go to " Verification of Vehicle Repair"procedure.

Condition	Possible Cause
Fuel Pressure is too low	Fuel filter,fuel pressure regulator, in-tank fuel hose or the fuel pump
Fuel Pressure is too high	Fuel pressure regulator, hose or pipe
No different fuel pressure when vacuum hose is connected or not	The vacuum hose or the nipple

3. Check fuel leakage in injector
   (1) IG "OFF" after checking the fuel pressure test.

   (2) Stop engine and check for a change in the fuel pressure gauge reading for 5 minutes.

Specification : After engine stops, fuel gauge reading is maintained for 5 minutes.

(3) Is the fuel gauge reading within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ There is a fuel leakage in injector. Repair or replace it, and go to " Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check PCV
   (1) IG "OFF" and remove PCV valve from cylinder head

   (2) With engine idling, block PCV valve and confirm that vacuum is felt.

   (3) Insert thin stick into the screwed PCV valve and verify that the plunger is moving.

   (4) Is the PCV valve normally moving?

   YES

   ▶ Go to "Check PCSV as follows.

   NO

   ▶ Replace it, and go to "Verification of Vehicle Repair" procedure.

2. Check PCSV
   (1) IG "OFF" and disconnect PCSV and vacuum hose.

   (2) Connect hand-vacuum gage with PCSV and supply vacuum to it.

   (3) Is the vacuum maintained ?

   YES

   ▶ Go to " Check injector" as follows.

   NO

   ▶ Repair or replace it, and go to " Verification of Vehicle Repair" procedure.

3. Check injector
   (1) IG "OFF" and disconnect injector.

   (2) Check it for blocking caused by any foreign substance.

   (3) Measure resistance between terminals 1 and 2 of Injector connector.(Component side)
   Specification :

Temp	Coil's resistance
20°C(68°F)	11.4 ~ 12.6 Ω

   (4) Is the measured resistance within specification?

   YES

   ▶ Go to "Check sensor/actuator related to fuel system" as follows

   NO

   ▶ Repair or replace it, and go to "Verification of Vehicle Repair" procedure.

4. Check sensor/actuator related to fuel system
   (1) Check the signal of sensor/actuator related to fuel system(HO2S, MAFS,MAPS, TPS, ECTS, PCSV, Injector and so on)
   (Refer to each DTC diagnostic procedure)

   (2) Are all of these items normal ?

   YES

   ▶ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

   NO

   ▶ Repair it, and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0174

GENERAL DESCRIPTION

In order to provide the best possible combination of drivability, fuel economy and emission control, the PCM uses a closed loop air/fuel metering system. The PCM monitors the HO2S signal voltage and adjusts fuel delivery based it in closed loop fuel control. Changes in fuel delivery will be indicated by the long-term and the short-term fuel trim values. The ideal fuel trim value is around 0%. The PCM will add fuel when the HO2S signal is indicating a lean condition. Additional fuel is indicated by fuel trim values that are above 0%. The PCM will reduce fuel when the HO2S signal is indicating a rich condition. Reduction in fuel is indicated by fuel trim values that are below 0%. The DTC relevant to fuel trim will be set when the amount reaches excessive levels because of a lean or rich condition.

DTC DESCRIPTION

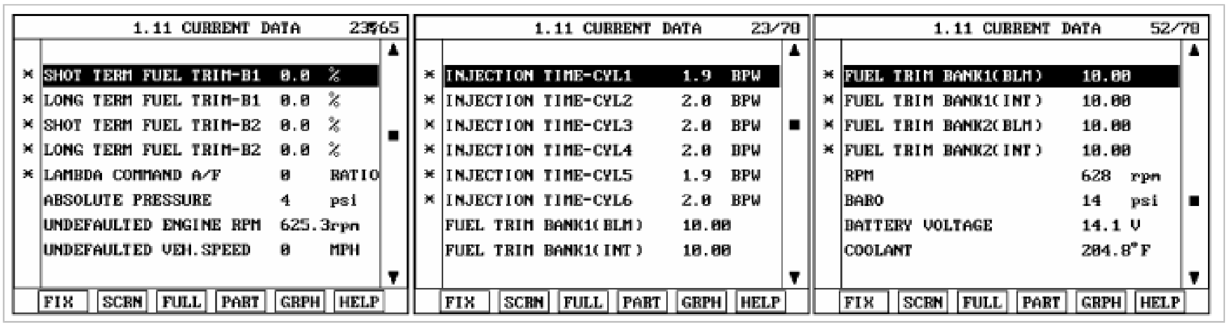
Checking air-fuel ratio correction value every 0.75 sec. under detecting condition, if an value is within detecting condition for more than 0.3 sec., PCM sets P0174. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Fuel Trim Limits Exceeded	• Poor connection • Relevant sensor/actuator • Air leakage • Improper fuel line pressure • PCM
Enable Conditions	• 550rpm ≤ Engine speed ≤ 4000rpm • 60°C(140°F) ≤ Engine coolant temperature ≤ 115°C(239°F) • -10°C(14°F) ≤ Intake air temperature ≤ 60°C(140°F) • 0° ≤ Throttle position ≤ 80° • 25kPa ≤ Engine load ≤ 90kPa • 1.5g/s ≤ Intake air flow ≤ 80g/s • Barometric pressure ≥ 72kPa • Vehicle speed ≤ 130km/h • System voltage ≥ 11V • Feed-back control state • No other diagnostic fault	
Threshold value	• Lean limit average< 0.8 (Average of short term fuel trim) and< 1.2(Average of long term fuel trim)	
Diagnosis Time	• Continuous (More than 0.3 second failure for every 0.75 second test)	
MIL On Condition	• 2 Driving Cycles	

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. Warm -up the engine to normal operating temperature.
3. Monitor "Sensor/actuator related to fuel system(HO2S, MAFS, MAPS, TPS, ECTS, PSCA, Injector, and so on)" items on the service data.



4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to " System Inspection " procedure.

SYSTEM INSPECTION

1. Check air leakage
   (1) Visually/physically inspect the air leakage in intake/exhaust system for following items
   - ▸ Vacuum hoses for splits, kinks and improper connections.
   - ▸ Throttle body gasket
   - ▸ Gasket between intake manifold and cylinder head
   - ▸ Seals between intake manifold and fuel injectors
   - ▸ Exhaust system between HO2S and three way catalyst for air leakage

   (2) Has a problem found in this procedure?

   YES

   ▸ Repair or replace it which has a problem, and go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Go to "Check the fuel line" as follows

2. Check the fuel line
   (1) Check the fuel line for following items
   - ▸ Connector connection state
   - ▸ Damage/ connection state for vacuum hoses connected to fuel line
   - ▸ Bent/ pressed/ twisted fuel line or fuel leakage

   (2) Has a problem found in this procedure?

   YES

   ▸ Repair or replace it which has a problem, and go to " Verification of Vehicle Repair" procedure.

   NO

   ▸ Go to "Check fuel pressure" as follows

3. Check fuel pressure

NOTE

- Be cautious that Fuel is explosive and an empty fuel tank can still contain explosive gases.When working on fuel

system make sure to supply adequate ventilationto the work area. Do not smoke, and keep sparks and open flames away.
- The fuel system remains under pressure when the engine is not running. Release fuel system pressure before disconnecting any fuel line to reduce the chance of presonal injury or fire damage to vehicle components.

(1) IG "OFF" and disconnect Fuel Pump Relay in Junction Box.

(2) Start-up and wait until it stops itself.

(3) IG "OFF" and connect Fuel Pump Relay.

(4) Install the fuel pressure gauge to the delivery pipe with the fuel pressure gauge adaptor.

(5) Activate the fuel pump, and with fuel pressure applied, check that there is no fuel leakage from the pressure gauge or connection part.

(6) Disconnect the vacuum hose from the pressure regulator, and plug the hose end.

(7) Measure the fuel pressure at idle.

Specification : 374.6 ~ 384.4 kPa(3.82 ~ 3.92 kg/cm², 54.3 ~ 55.8 psi)

(8) Is the measured fuel pressure within specifications ?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair or replace according to the below table. And then, go to " Verification of Vehicle Repair"procedure.

Condition	Possible Cause
Fuel Pressure is too low	Fuel filter,fuel pressure regulator, in-tank fuel hose or the fuel pump
Fuel Pressure is too high	Fuel pressure regulator, hose or pipe
No different fuel pressure when vacuum hose is connected or not	The vacuum hose or the nipple

COMPONENT INSPECTION

1. Check PCV

(1) IG "OFF" and remove PCV valve from cylinder head

(2) With engine idling, block PCV valve and confirm that vacuum is felt.

(3) Insert thin stick into the screwed PCV valve and verify that the plunger is moving.

(4) Is the PCV valve normally moving?

YES

▶ Go to "Check PCSV as follows.

NO

▶ Replace it, and go to "Verification of Vehicle Repair" procedure.

2. Check PCSV

(1) IG "OFF" and disconnect PCSV and vacuum hose.

(2) Connect hand-vacuum gage with PCSV and supply vacuum to it.

(3) Is the vacuum maintained ?

YES

▶ Go to " Check injector" as follows.

NO

▶ Repair or replace it, and go to " Verification of Vehicle Repair" procedure.

3. Check injector

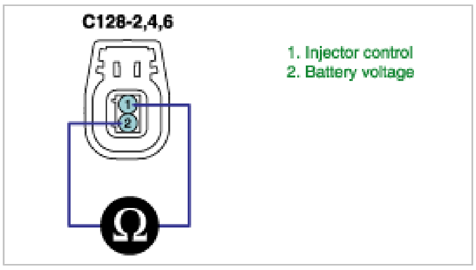
(1) IG "OFF" and disconnect injector.

(2) Check it for blocking caused by any foreign substance.

(3) Measure resistance between terminals 1 and 2 of Injector connector.(Component side)

Specification :

Temp	Coil's resistance
20°C(68°F)	11.4 ~ 12.6 Ω



(4) Is the measured resistance within specification?

YES

▸ Go to "Check sensor/actuator related to fuel system" as follows

NO

▸ Repair or replace it, and go to "Verification of Vehicle Repair" procedure.

4. Check sensor/actuator related to fuel system
   (1) Check the signal of sensor/actuator related to fuel system(HO2S, MAFS,MAPS, TPS, ECTS, PCSV, Injector and so on) (Refer to each DTC diagnostic procedure)

   (2) Are all of these items normal ?

   YES

   ▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Repair it, and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0175

GENERAL DESCRIPTION

In order to provide the best possible combination of drivability, fuel economy and emission control, the PCM uses a closed loop air/fuel metering system. The PCM monitors the HO2S signal voltage and adjusts fuel delivery based it in closed loop fuel control. Changes in fuel delivery will be indicated by the long-term and the short-term fuel trim values. The ideal fuel trim value is around 0%. The PCM will add fuel when the HO2S signal is indicating a lean condition. Additional fuel is indicated by fuel trim values that are above 0%. The PCM will reduce fuel when the HO2S signal is indicating a rich condition. Reduction in fuel is indicated by fuel trim values that are below 0%. The DTC relevant to fuel trim will be set when the amount reaches excessive levels because of a lean or rich condition.

DTC DESCRIPTION

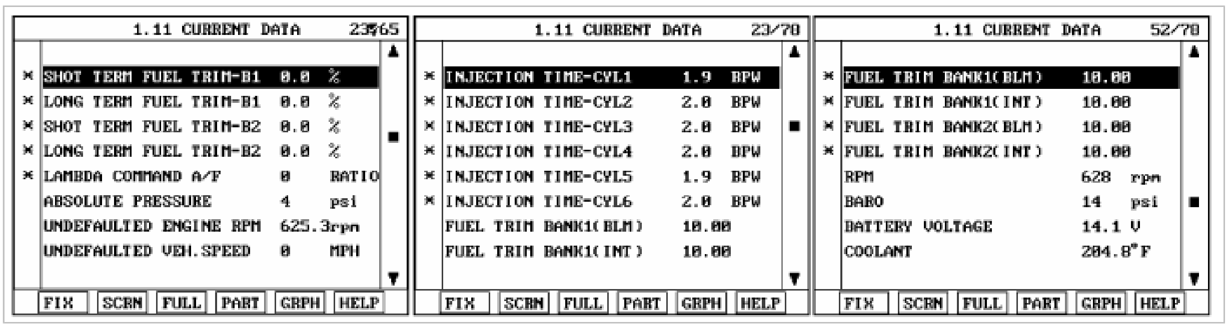
Checking air-fuel ratio correction value every 0.75 sec. under detecting condition, if an value is within detecting condition for more than 0.3 sec., PCM sets P0175. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Fuel Trim Limits Exceeded	• Poor connection • Relevant sensor/actuator • Blocking of Intake system • Fuel leakage in injector • Improper fuel line pressure • PCM
Enable Conditions	• 550rpm ≤ Engine speed ≤ 4000rpm • 60°C(140°F) ≤ Engine coolant temperature ≤ 115°C(239°F) • -10°C(14°F) ≤ Intake air temperature ≤ 60°C(140°F) • 0° ≤ Throttle position ≤ 80° • 25kPa ≤ Engine load ≤ 90kPa • 1.5g/s ≤ Intake air flow ≤ 80g/s • Barometric pressure ≥ 72kPa • Vehicle speed ≤ 130km/h • System voltage ≥ 11V • Feed-back control state • No other diagnostic fault	
Threshold value	• Lean limit average >1.2 (Average of short term fuel trim) and < 0.8(Average of long term fuel trim)	
Diagnosis Time	• Continuous (More than 0.3 second failure for every 0.75 second test)	
MIL On Condition	• 2 Driving Cycles	

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. Warm -up the engine to normal operating temperature.
3. Monitor "Sensor/actuator related to fuel system(HO2S, MAFS, MAPS, TPS, ECTS, PSCA, Injector, and so on)" items on the service data.



4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to " System Inspection " procedure.

SYSTEM INSPECTION

1. Check blocking of intake system
   (1) Visually/physically inspect the blocking in intake system for following items
   - Throttle body gasket and damage
   - Clogging of Air cleaner
   - Blocking in intake manifold and injector caused by any foreign substance

   (2) Has a problem found?

   YES
   - Repair or replace it, and go to "Verification of Vehicle Repair" procedure.

   NO
   - Go to " Check fuel pressure" as follows.

2. Check fuel pressure

   > **NOTE**
   >
   > - Be cautious that Fuel is explosive and an empty fuel tank can still contain explosive gases.When working on fuel system make sure to supply adequate ventilationto the work area. Do not smoke, and keep sparks and open flames away.
   > - The fuel system remains under pressure when the engine is not running. Release fuel system pressure before disconnecting any fuel line to reduce the chance of presonal injury or fire damage to vehicle components.

   (1) IG "OFF" and disconnect Fuel Pump Relay in Junction Box.

   (2) Start-up and wait until it stops itself.

   (3) IG "OFF" and connect Fuel Pump Relay.

   (4) Install the fuel pressure gauge to the delivery pipe with the fuel pressure gauge adaptor.

   (5) Activate the fuel pump, and with fuel pressure applied, check that there is no fuel leakage from the pressure gauge or connection part.

   (6) Disconnect the vacuum hose from the pressure regulator, and plug the hose end.

   (7) Measure the fuel pressure at idle.

   Specification : 374.6 ~ 384.4 kPa(3.82 ~ 3.92 kg/cm², 54.3 ~ 55.8 psi)

   (8) Is the measured fuel pressure within specifications ?

   YES
   - Go to "Component Inspection" procedure.

   NO
   - Repair or replace according to the below table. And then, go to " Verification of Vehicle Repair"procedure.

Condition	Possible Cause
Fuel Pressure is too low	Fuel filter,fuel pressure regulator, in-tank fuel hose or the fuel pump
Fuel Pressure is too high	Fuel pressure regulator, hose or pipe
No different fuel pressure when vacuum hose is connected or not	The vacuum hose or the nipple

3. Check fuel leakage in injector
   (1) IG "OFF" after checking the fuel pressure test.

   (2) Stop engine and check for a change in the fuel pressure gauge reading for 5 minutes.

   Specification : After engine stops, fuel gauge reading is maintained for 5 minutes.

   (3) Is the fuel gauge reading within specification?

   YES
   - Go to "Component Inspection" procedure.

   NO
   - There is a fuel leakage in injector. Repair or replace it, and go to " Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check PCV
   (1) IG "OFF" and remove PCV valve from cylinder head
   (2) With engine idling, block PCV valve and confirm that vacuum is felt.
   (3) Insert thin stick into the screwed PCV valve and verify that the plunger is moving.
   (4) Is the PCV valve normally moving?

   YES

   ▸ Go to "Check PCSV as follows.

   NO

   ▸ Replace it, and go to "Verification of Vehicle Repair" procedure.

2. Check PCSV
   (1) IG "OFF" and disconnect PCSV and vacuum hose.
   (2) Connect hand-vacuum gage with PCSV and supply vacuum to it.
   (3) Is the vacuum maintained ?

   YES

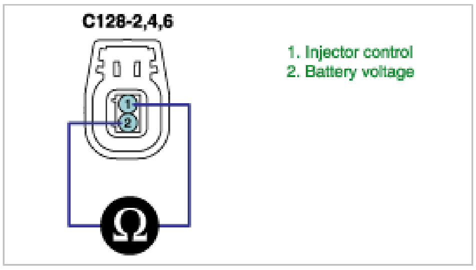
   ▸ Go to " Check injector" as follows.

   NO

   ▸ Repair or replace it, and go to " Verification of Vehicle Repair" procedure.

3. Check injector
   (1) IG "OFF" and disconnect injector.
   (2) Check it for blocking caused by any foreign substance.
   (3) Measure resistance between terminals 1 and 2 of Injector connector.(Component side)
   Specification :

Temp	Coil's resistance
20°C(68°F)	11.4 ~ 12.6 Ω



   (4) Is the measured resistance within specification?

   YES

   ▸ Go to "Check sensor/actuator related to fuel system" as follows

   NO

   ▸ Repair or replace it, and go to "Verification of Vehicle Repair" procedure.

4. Check sensor/actuator related to fuel system
   (1) Check the signal of sensor/actuator related to fuel system(HO2S, MAFS,MAPS, TPS, ECTS, PCSV, Injector and so on) (Refer to each DTC diagnostic procedure)
   (2) Are all of these items normal ?

   YES

   ▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Repair it, and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

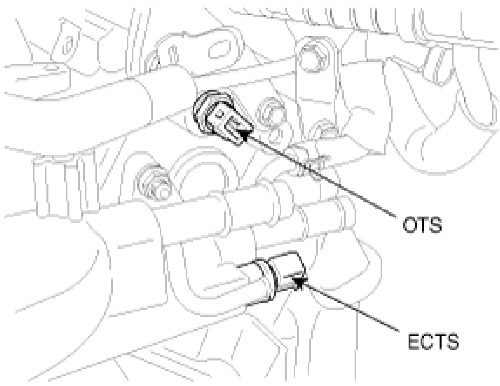
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0196

COMPONENT LOCATION



GENERAL DESCRIPTION

In CVVT system, the working fluid is engine oil. But its density varies according to temperature, PCM performs oil quantity correction based on the signal from engine oil temperature sensor over the various range of temperature. Main function of Oil Pressure Sensor is as follows.

1. intake air valve control solenoid(oil control valve) duty correction : As coil resistance varies according to oil temperature, excessive current flows at low temperture and low current at high temperature without duty correction. Therefore, PCM performs duty correction properly according to output signal from oil temperature sensor to supply constant current which is free from the change of oil temperature.
2. CVVT system operation starting temperature determination : As CVVT response gets weaker due to the friction of engine components such as valve at low temperature, PCM operates CVVT at above specific temperture based on output signal from oil temperture sensor.
3. improved CVVT controllability : CVVT response speed varies as oil temperature, PCM improves controllability throughout estimating response speed with oil temperture sensor output signal.

DTC DESCRIPTION

Checking the oil temperture , coolant temperature and intake air temperature every 25 sec. under detecting condition, if the difference in temperature at start-up exceeds threshold value, PCM sets P0196. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

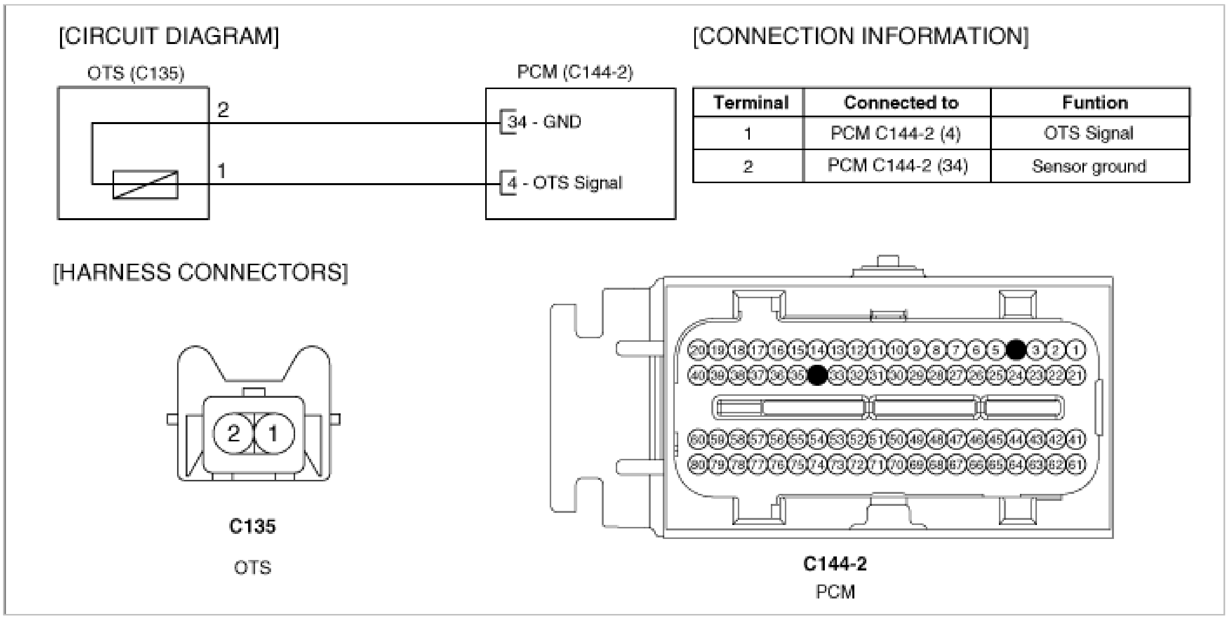
Item		Detecting Condition	Possible cause
DTC Strategy		• Determines if the oil temperature value is rational, compared to coolant and intake air temperature.	• Poor connection • Open or short in harness • Faulty OTS
Enable Conditions	Case 1	• Engine run time after startup< 30 sec • Minimum soak period required >270 min	
	Case 2	• Minimum engine run time >800 sec	
	Case 1	• The difference in temperature between oil and coolant temperatures at startup. > 35°C(63°F)	

Threshold value	Case 2	• The difference in temperature between oil temperature and intake air temperature at startup >35°C(63°F)	• PCM
Diagnosis Time		• Continuous (More than 12.5 sec.failure for every 25 sec.test)	
MIL On Condition		• 2 Driving Cycles	

SPECIFICATION

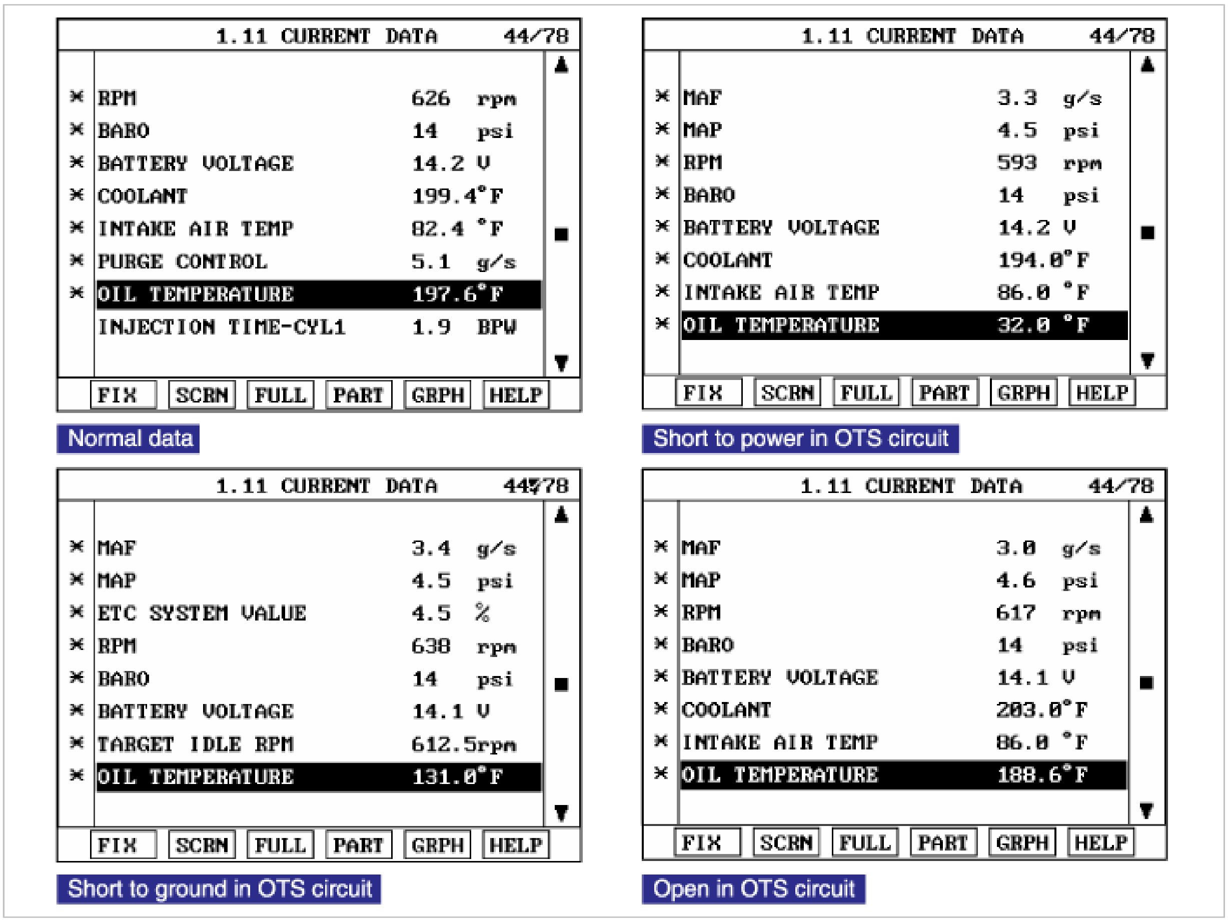
Temperature(°C/°F)	Resistance(kΩ)
-20°C/ -4°F	16.52kΩ
20°C/ 68°F	2.45kΩ
80°C/ 176°F	0.29kΩ

SCHEMATIC DIAGRAM



MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector (DLC)
2. Warm up engine to normal operating temperature
3. Monitor "Oil Temperature" parameter on the scantool.



4. Is the current data displayed correctly ?

YES

▸ Fault is intermittently caused by poor contact in the sensor and/or PCM connector or non cleared PCM memory after repair. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace if necessary and go to "Verification of vehicle Repair" .

NO

▸ Go to "Terminal and connector inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure

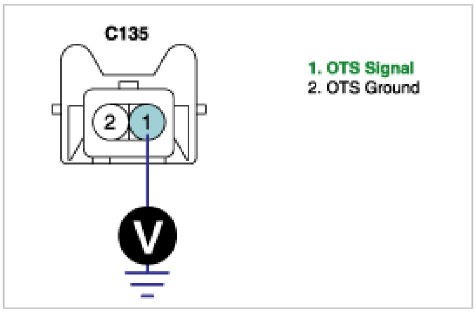
NO

▸ Go to "signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check Voltage
   (1) IG "OFF" & ENG "OFF"
   (2) Disconnect OTS connector
   (3) IG "ON" & ENG "OFF"
   (4) Measure voltage between harness terminal 1 of OTS and chassis ground.

Specification : Approx. 5V



(5) Is the measured voltage within specification ?

YES

▸ Go to "Ground Circuit Inspection" procedure.

NO

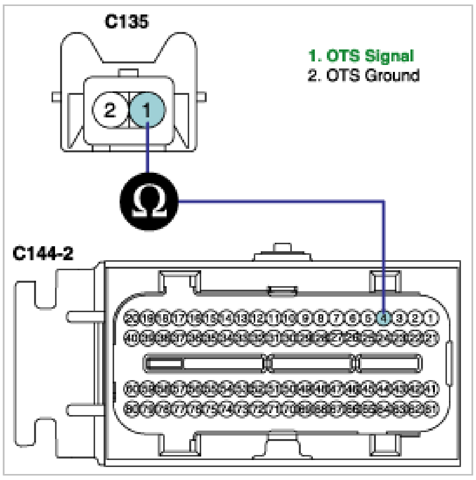
▸ Go to "Check open in harness" as follow.

2. Check open in harness
   (1) IG "OFF" & ENG "OFF"

   (2) Disconnect OTS and PCM connector.

   (3) Measure resistance between terminal 1 of OTS harness connector and terminal 4 of PCM harness connector.

Specification : Approx. below 1Ω



(4) Is the measured resistance within specification ?

YES

▸ Go to "Ground Circuit Inspection" procedure.

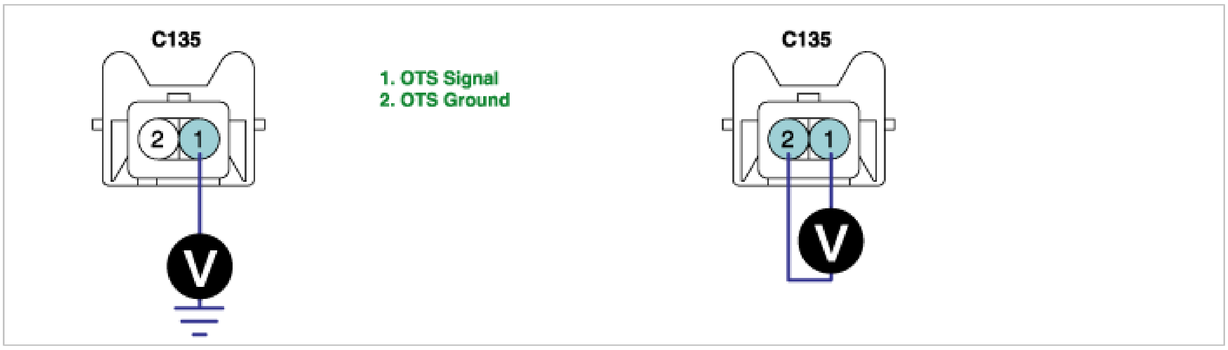
NO

▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF" & ENG "OFF"
2. Disconnect OTS connector
3. Measure voltage between terminal 1 of OTS harness connector and chassis ground.
4. Measure voltage between terminals 1 and 2 of OTS harness connector.

Specification : Measurement "A" - Measurement 'B' = Approx. below 200mV



5. Is the measured voltage within specification ?

YES

▸ Go to "Component Inspection" procedure

NO

▸ Repair or replace contact resistance or open in harness and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check resistance of OTS
   (1) IG "ON" & ENG "OFF"

   (2) Monitor Oil Temperature parameter on the scantool

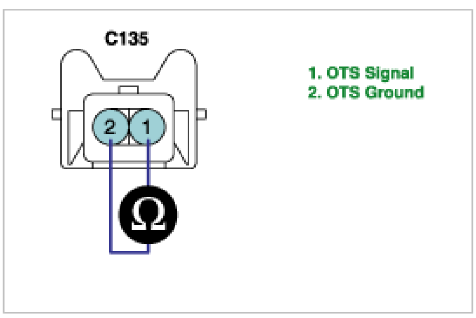
   (3) IG "OFF" & ENG "OFF"

   (4) Disconnect OTS connector.

   (5) Measure resistance between terminal 1 and 2 of OTS connector(Component Side)

   Specification :

Temperature(°C/°F)	Resistance(kΩ)
-20°C/ -4°F	16.52kΩ
20°C/ 68°F	2.45kΩ
80°C/ 176°F	0.29kΩ



   (6) Is the measured resistance within specification ?

   YES

   ▸ Go to "Check PCM" as follows.

   NO

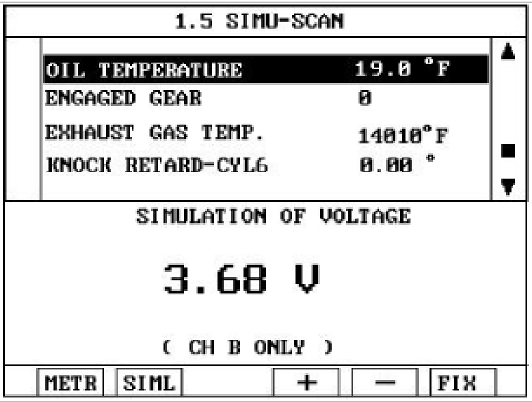
   ▸ Substitute with a known - good OTS and check for proper operation. If the problem is corrected, replace OTS and go to "Verification of Vehicle Repair" procedure.

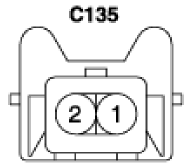
2. Check PCM
   (1) Ignition "OFF" and Connect Scantool

   (2) Ignition"ON " & Engine "OFF"

   (3) Select simulation function on scantool.

   (4) Simulate voltage at terminal "1" of OTS signal connector.





1. OTS Signal
2. OTS Ground

(5) Does the OTS signal value changes according to simulation voltage ?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

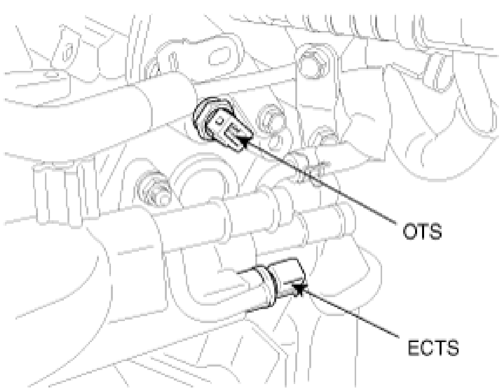
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0197

COMPONENT LOCATION



GENERAL DESCRIPTION

In CVVT system, the working fluid is engine oil. But its density varies according to temperature, PCM performs oil quantity correction based on the signal from engine oil temperature sensor over the various range of temperature. Main function of Oil Pressure Sensor is as follows.

1. intake air valve control solenoid(oil control valve) duty correction : As coil resistance varies according to oil temperature, excessive current flows at low temperture and low current at high temperature without duty correction. Therefore, PCM performs duty correction properly according to output signal from oil temperature sensor to supply constant current which is free from the change of oil temperature.
2. CVVT system operation starting temperature determination : As CVVT response gets weaker due to the friction of engine components such as valve at low temperature, PCM operates CVVT at above specific temperture based on output signal from oil temperture sensor.
3. improved CVVT controllability : CVVT response speed varies as oil temperature, PCM improves controllability throughout estimating response speed with oil temperture sensor output signal.

DTC DESCRIPTION

Checking output signals from oil temperture sensor every 15 sec. under detecting condition, if an signal is low for more than 12.5 sec., PCM sets P0197. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

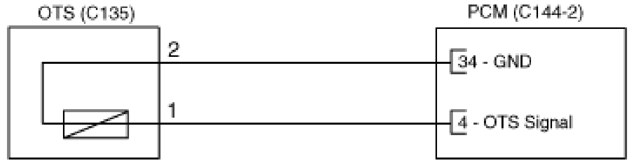
<table>
<tr><th colspan="2">Item</th><th>Detecting Condition</th><th>Possible cause</th></tr>
<tr><td colspan="2">DTC Strategy</td><td>• Signal low</td><td rowspan="7">• Poor connection
• Short to ground in harness
• Oil temp.sensor
• PCM</td></tr>
<tr><td rowspan="2">Enable Conditions</td><td>Case 1</td><td>• Engine running state >60 sec
• Coolant temperature < 110 °C(230°F)</td></tr>
<tr><td>Case 2</td><td>• Engine running state >90 sec.</td></tr>
<tr><td colspan="2">Thresh old value</td><td>• Oil temperature sensor's signal< 0.1V</td></tr>
<tr><td colspan="2">Diagnosis Time</td><td>• Continuous
(More than 12.5 sec.failure for every 15 sec.test)</td></tr>
<tr><td colspan="2">MIL On Condition</td><td>• 2 Driving Cycles</td></tr>
</table>

SPECIFICATION

Temperature(°C/°F)	Resistance(kΩ)
-20°C/ -4°F	16.52kΩ
20°C/ 68°F	2.45kΩ
80°C/ 176°F	0.29kΩ

SCHEMATIC DIAGRAM

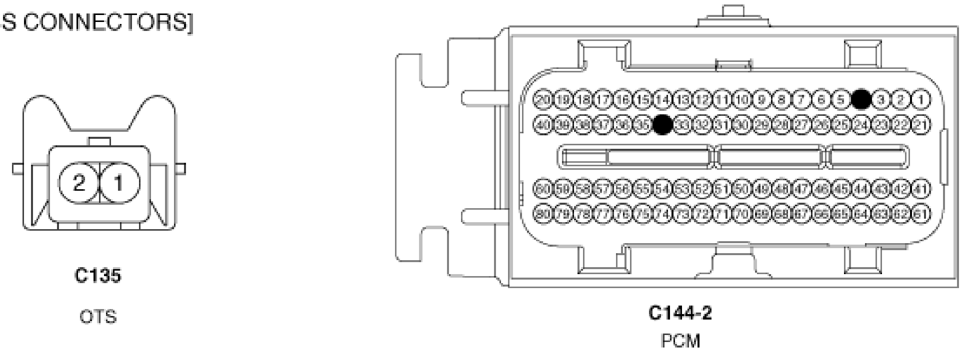
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

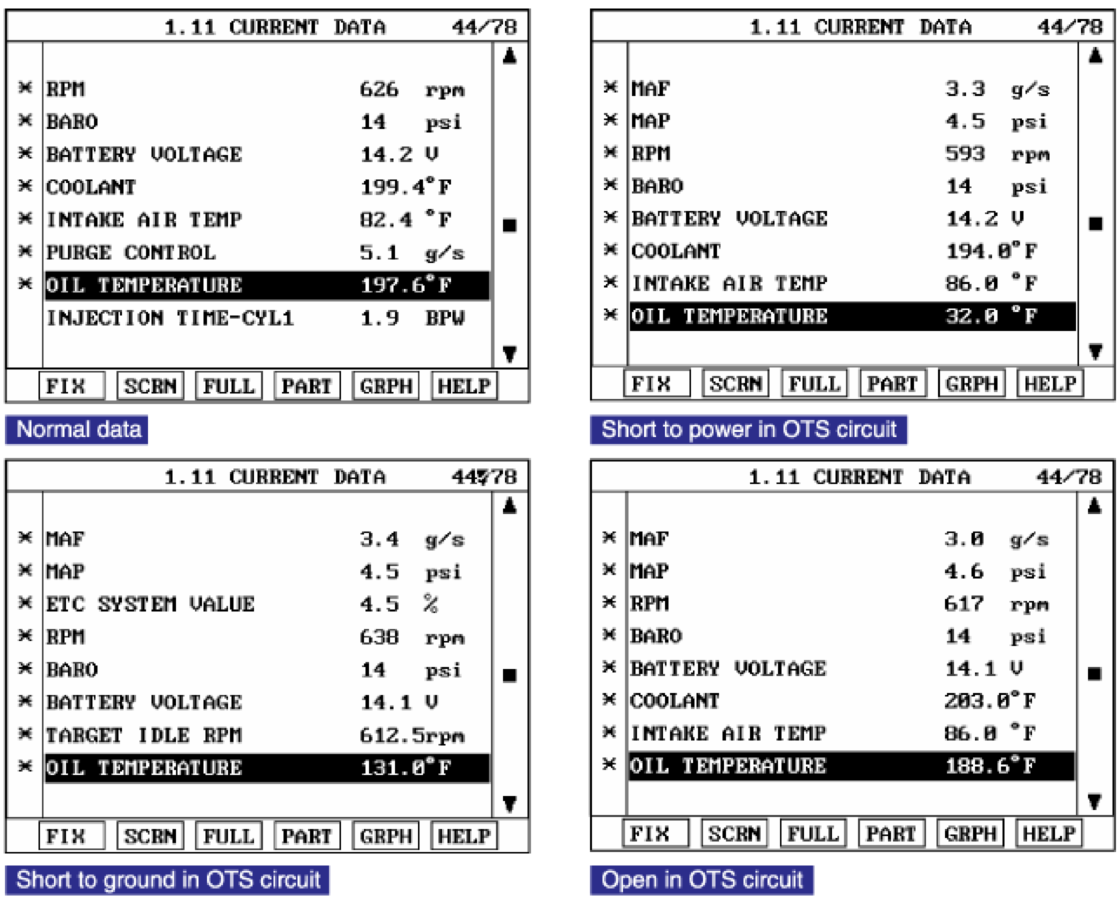
Terminal	Connected to	Funtion
1	PCM C144-2 (4)	OTS Signal
2	PCM C144-2 (34)	Sensor ground

[HARNESS CONNECTORS]



MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector (DLC)
2. Warm up engine to normal operating temperature
3. Monitor "Oil Temperature" parameter on the scantool.



4. Is the current data displayed correctly ?

YES

▸ Fault is intermittently caused by poor contact in the sensor and/or PCM connector or non cleared PCM memory after repair. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace if necessary and go to "Verification of vehicle Repair".

NO

▸ Go to "Terminal and connector inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure

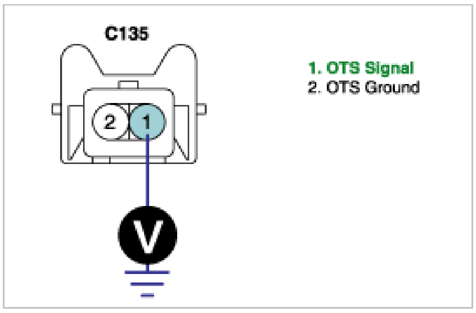
NO

▸ Go to "signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check Voltage
   (1) IG "OFF" & ENG "OFF"
   (2) Disconnect OTS connector
   (3) IG "ON" & ENG "OFF"
   (4) Measure voltage between harness terminal 1 of OTS and chassis ground.

Specification : Approx. 5V



   (5) Is the measured voltage within specification ?

YES

▸ Go to " Component Inspection" procedure.

NO

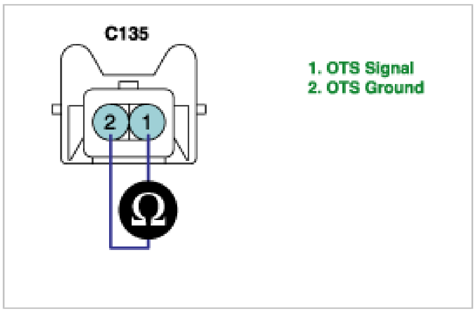
▸ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check resistance of OTS
   (1) IG "ON" & ENG "OFF"
   (2) Monitor Oil Temperature parameter on the scantool
   (3) IG "OFF" & ENG "OFF"
   (4) Disconnect OTS connector.
   (5) Measure resistance between terminal 1 and 2 of OTS connector(Component Side)

Specification :

Temperature(°C/°F)	Resistance(kΩ)
-20°C/ -4°F	16.52kΩ
20°C/ 68°F	2.45kΩ
80°C/ 176°F	0.29kΩ



(6) Is the measured resistance within specification ?

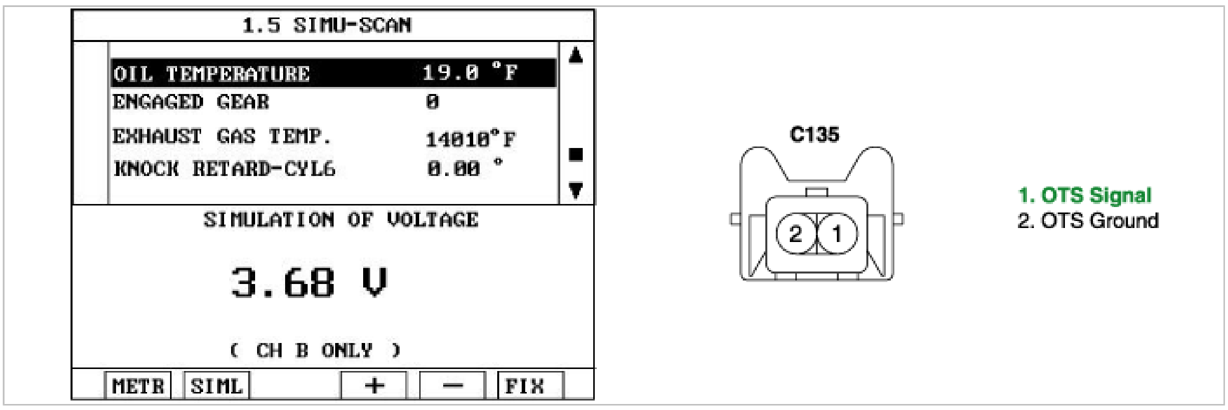
YES

▸ Go to "Check PCM" as follows.

NO

▸ Substitute with a known - good OTS and check for proper operation. If the problem is corrected, replace OTS and go to "Verification of Vehicle Repair" procedure.

2. Check PCM
   (1) Ignition "OFF" and Connect Scantool
   (2) Ignition"ON " & Engine "OFF"
   (3) Select simulation function on scantool.
   (4) Simulate voltage at terminal "1" of OTS signal connector.



(5) Does the OTS signal value changes according to simulation voltage ?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

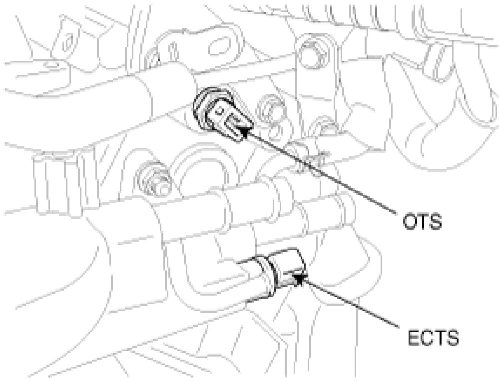
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0198

COMPONENT LOCATION



GENERAL DESCRIPTION

In CVVT system, the working fluid is engine oil. But its density varies according to temperature, PCM performs oil quantity correction based on the signal from engine oil temperature sensor over the various range of temperature. Main function of Oil Pressure Sensor is as follows.

1. intake air valve control solenoid(oil control valve) duty correction : As coil resistance varies according to oil temperature, excessive current flows at low temperture and low current at high temperature without duty correction. Therefore, PCM performs duty correction properly according to output signal from oil temperature sensor to supply constant current which is free from the change of oil temperature.
2. CVVT system operation starting temperature determination : As CVVT response gets weaker due to the friction of engine components such as valve at low temperature, PCM operates CVVT at above specific temperture based on output signal from oil temperture sensor.
3. improved CVVT controllability : CVVT response speed varies as oil temperature, PCM improves controllability throughout estimating response speed with oil temperture sensor output signal.

DTC DESCRIPTION

Checking output signals from oil temperture sensor every 15 sec. under detecting condition, if an signal is high for more than 12.5 sec., PCM sets P0198. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible cause
DTC Strategy		• Signal low	• Poor connection • Open or short to battery in signal harness • Open in ground harness • Oil temp.sensor • PCM
Enable Conditions	Case 1	• Engine running state >60 sec • Coolant temperature < 110 °C(230°F)	
	Case 2	• Engine running state >90 sec.	
Thresh old value		• Oil temperature sensor's signal >4.9V	
Diagnosis Time		• Continuous (More than 12.5 sec.failure for every 15 sec.test)	
MIL On Condition		• 2 Driving Cycles	

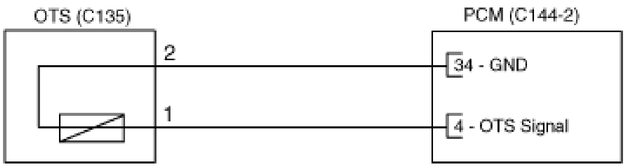
SPECIFICATION

Temperature(°C/°F)	Resistance(kΩ)
-20°C/ -4°F	16.52kΩ

20°C/ 68°F	2.45kΩ
80°C/ 176°F	0.29kΩ

SCHEMATIC DIAGRAM

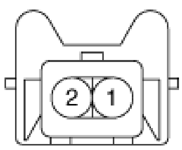
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

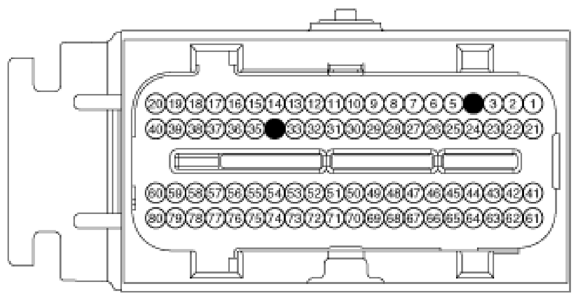
Terminal	Connected to	Funtion
1	PCM C144-2 (4)	OTS Signal
2	PCM C144-2 (34)	Sensor ground

[HARNESS CONNECTORS]



C135

OTS

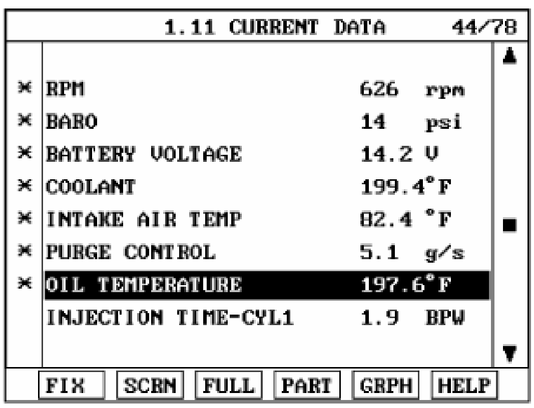


C144-2

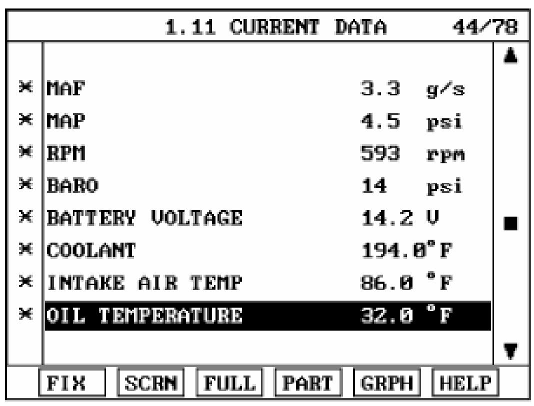
PCM

MONITOR SCANTOOL DATA

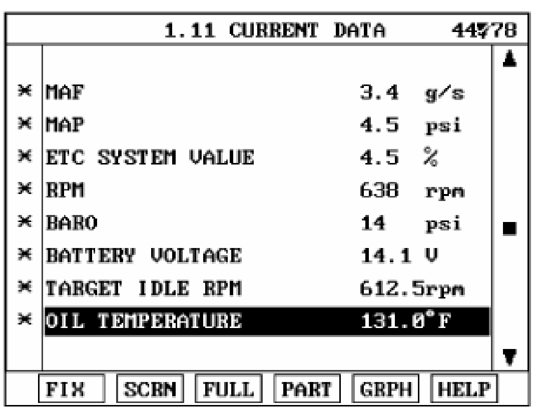
1. Connect scantool to Data Link Connector (DLC)
2. Warm up engine to normal operating temperature
3. Monitor "Oil Temperature" parameter on the scantool.



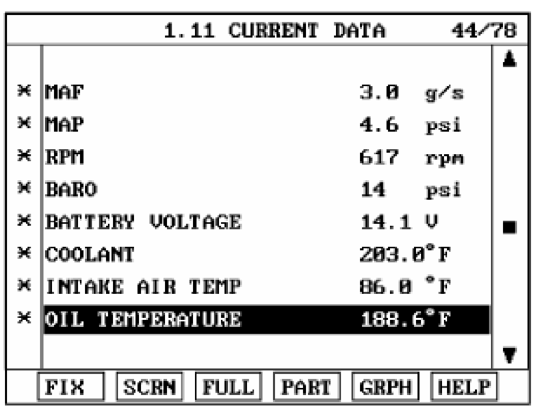
Normal data



Short to power in OTS circuit



Short to ground in OTS circuit



Open in OTS circuit

4. Is the current data displayed correctly ?

YES

▸ Fault is intermittently caused by poor contact in the sensor and/or PCM connector or non cleared PCM memory after repair. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace if necessary and go to "Verification of vehicle Repair".

NO

▸ Go to "Terminal and connector inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check Voltage

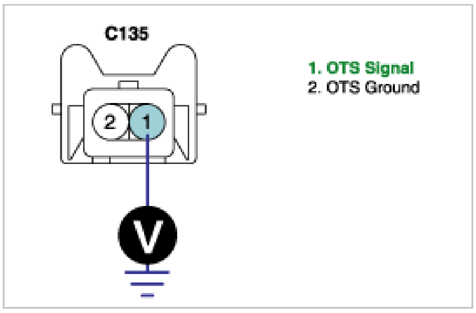
(1) IG "OFF" & ENG "OFF"

(2) Disconnect OTS connector

(3) IG "ON" & ENG "OFF"

(4) Measure voltage between harness terminal 1 of OTS and chassis ground.

Specification : Approx. 5V



(5) Is the measured voltage within specification ?

YES

▸ Go to "Ground Circuit Inspection" procedure.

NO

▸ Go to "Check open in harness" as follow.

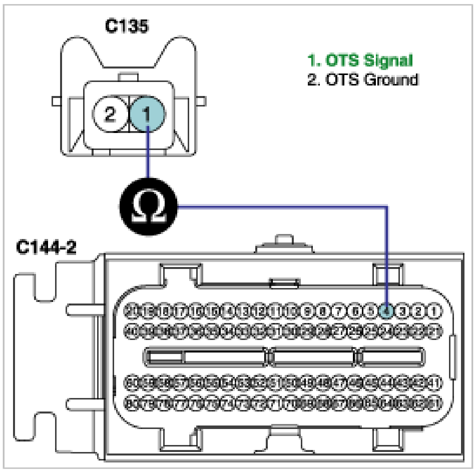
2. Check open in harness

(1) IG "OFF" & ENG "OFF"

(2) Disconnect OTS and PCM connector.

(3) Measure resistance between terminal 1 of OTS harness connector and terminal 4 of PCM harness connector.

Specification : Approx. below 1Ω



(4) Is the measured resistance within specification ?

YES

▸ Go to "Ground Circuit Inspection" procedure.

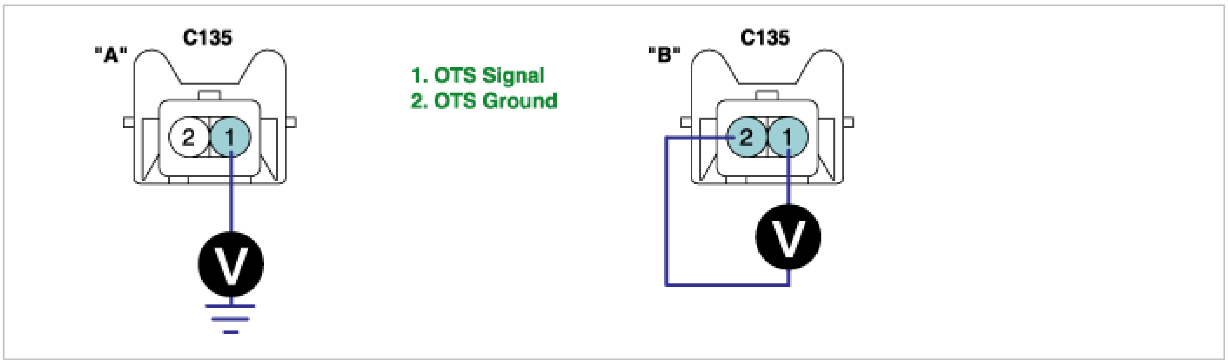
NO

▸ Repair or replace open in harness, and then go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF" & ENG "OFF"
2. Disconnect OTS connector
3. Measure voltage between terminal 1 of OTS harness connector and chassis ground.
4. Measure voltage between terminals 1 and 2 of OTS harness connector.

Specification : Measurement "A" - Measurement 'B' = Approx. below 200mV



5. Is the measured voltage within specification ?

YES

▸ Go to "Component Inspection" procedure

NO

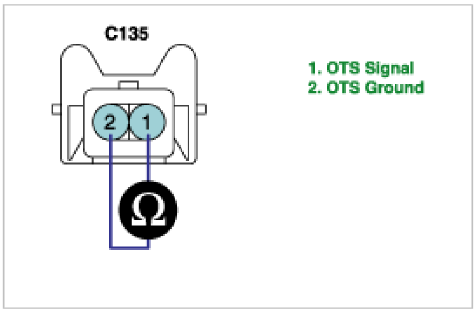
▸ Repair or replace contact resistance or open in harness and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check resistance of OTS
   (1) IG "ON" & ENG "OFF"
   (2) Monitor Oil Temperature parameter on the scantool
   (3) IG "OFF" & ENG "OFF"
   (4) Disconnect OTS connector.
   (5) Measure resistance between terminal 1 and 2 of OTS connector(Component Side)
   Specification :

Temperature(°C/°F)	Resistance(kΩ)

-20°C/ -4°F	16.52kΩ
20°C/ 68°F	2.45kΩ
80°C/ 176°F	0.29kΩ



(6) Is the measured resistance within specification ?

YES

▶ Go to "Check PCM" as follows.

NO

▶ Substitute with a known - good OTS and check for proper operation. If the problem is corrected, replace OTS and go to "Verification of Vehicle Repair" procedure.

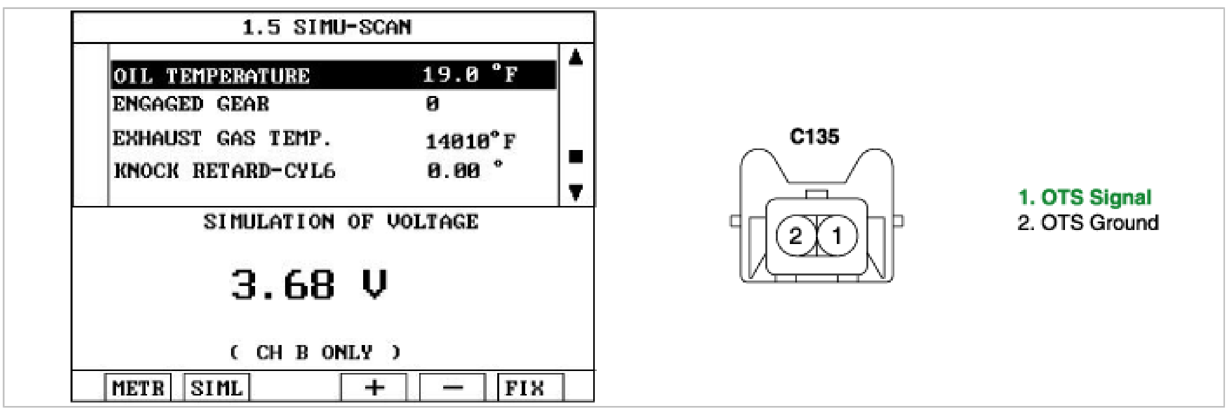
2. Check PCM

(1) Ignition "OFF" and Connect Scantool

(2) Ignition"ON " & Engine "OFF"

(3) Select simulation function on scantool.

(4) Simulate voltage at terminal "1" of OTS signal connector.



(5) Does the OTS signal value changes according to simulation voltage ?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure

NO

▶ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions

4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

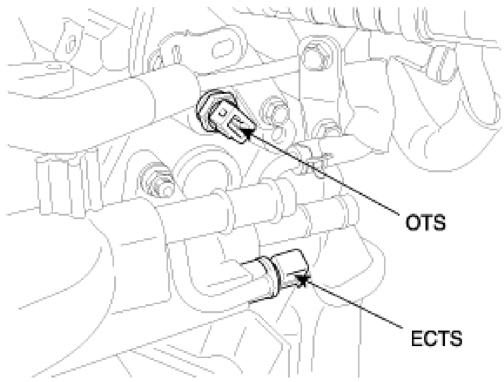
▸ Go to the applicable troubleshooooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0217

COMPONENT LOCATION



GENERAL DESCRIPTION

The Engine Coolant Temperature(ECT) Sensor measures the temperature of engine coolant. The Engine Coolant Temperature (ECT) Sensor is located near the thermostat housing of the cylinder head. ECT Sensor is a thermistor (A Variable Resistor that Changes Along with ECT) in series with a fixed resistor in the Engine Control Module (PCM). The PCM applies 5 volts to the ECT sensor. The PCM monitors the voltage across the ECT sensor and converts it into a temperature reading. When the engine is cold the ECT sensor resistance is high, and when the engine is warm the ECT sensor resistance is low. Therefore, when the engine is cold the PCM will receive a high voltage input, and when the engine is warm the PCM will receive a low voltage input. The signal from ECT sensor is used for Injection, ignition timing, idle speed and cooling fan control.

DTC DESCRIPTION

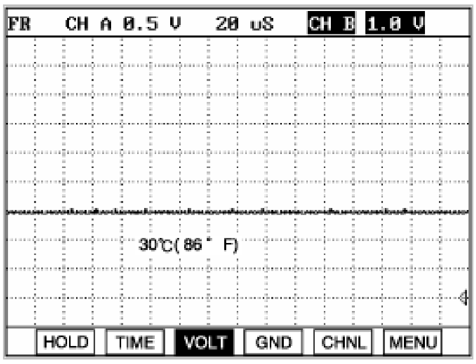
The Engine Coolant Temperature High Rationality Diagnostic checks for unusually high engine coolant temperatures under normal operating loads and if the temperature is found to be higher than a certain limit, the diagnostic declares a failure.
PCM monitors difference between the startup and current coolant temperature and compares agaist the threshold while enable condition is met. If the PCM detects that the coolant temperature exceeds the limit under normal operating condition, PCM determines that a fault exists and a DTC is stored.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• This diagnostic introduces a calibratable delay and simultaneously looks out for excessive engine loads. Once the delay period passes and excessive loads have not been experienced, the diagnostic checks whether the undefaulted coolant temperature has exceeded a maximum threshold in order to make a PASS/FAIL determination.	• Poor connection • Lack of engine coolant • Water pump • ECTS • PCM
Enable Conditions	• Engine Running status • No disabling faults present • Coolant Sensor within range • Undefaulted Coolant Temp ≥ 50°C(122 °F) • ndefaulted IAT ≥ 35°C(95 °F) • Soak time ≥ 360min or Undeafaulted Coolant temp ≤ 45°C(113 ° F)	
Thresh old	• Coolant temperature above which High Rationality fail criteria is satisfied ≥ 110°C (230 °F) (Vehicle has been under high airflow	

value	conditions that may cause the High Rationality diagnostic to false fail) - To detect a failure, Average airflow must be< 30 g/sec and EWMA Airflow must be< 50 g/sec)	
Diagnosis Time	• Continuous (More than 12.5 sec.failure for every 15 sec.test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA

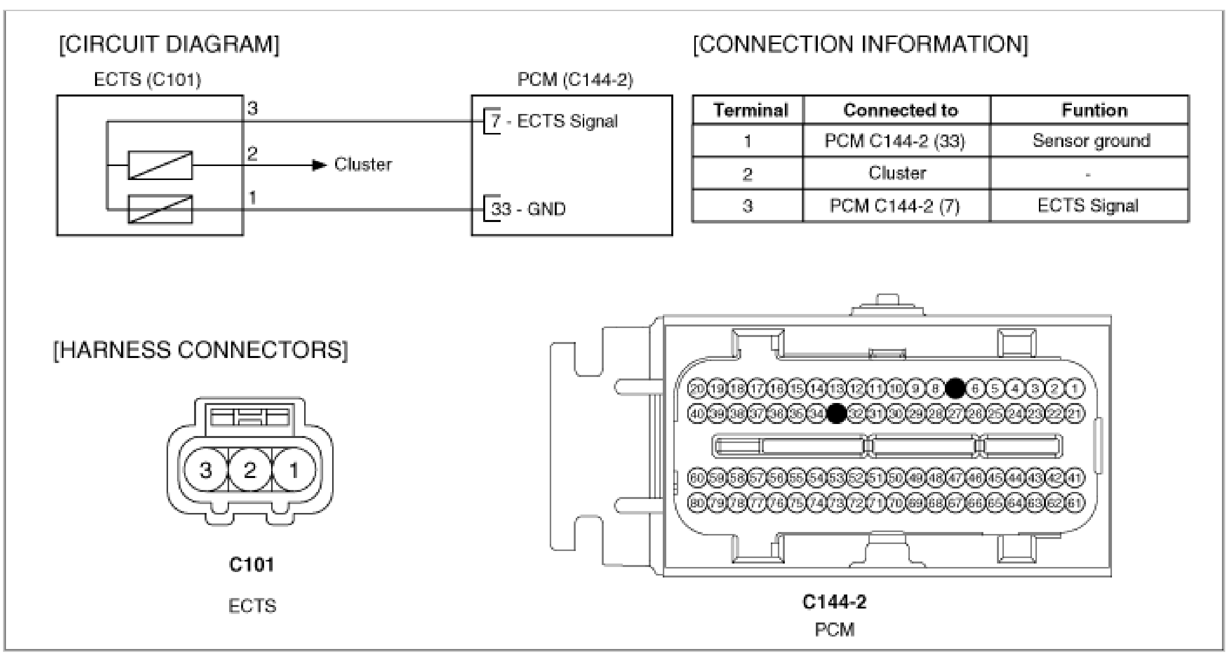


The output signals of IATS & ECTS change smoothly without any rapid changes. Those have almost same characteristic signal during the early period after start. It means that the temperatures of intake air and engine coolant are depended on the temperature of atmosphere. Meanwhile, during the warming up, the output signal of ECTS is going up increasingly. but, the output signal of IATS changes a little bit. even it may not change almost. It means that the heat of engine does not affect on the temperature of intake air.

SPECIFICATION

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59
0(32)	5.79	80(176)	0.32
20(68)	2.31 ~ 2.59		

SCHEMATIC DIAGRAM



MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "ECTS" item on the service data.

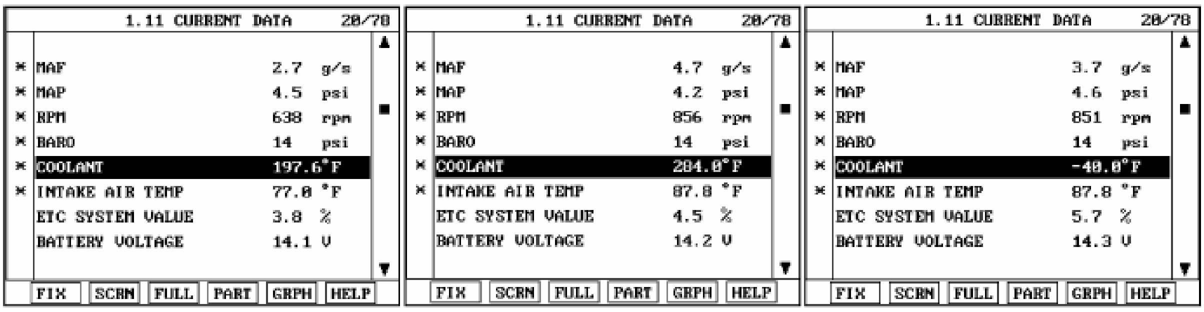


Fig. 1 Fig. 2 Fig. 3

Fig. 1 : Normal at Idle
Fig. 2 : Short to ground at idle
Fig. 3 : Open or short to battery at idle

4. Is the "ECTS" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

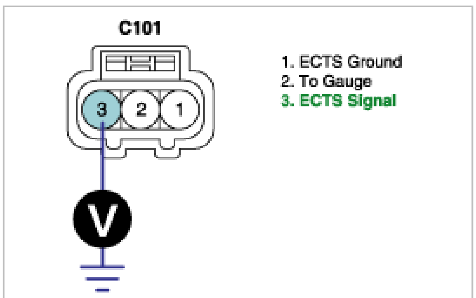
NO

▸ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. IG "OFF" and disconnect ECTS connector.
2. IG "ON" & ENG "OFF"
3. Measure voltage between terminal 3 of ECTS harness connector and chassis ground.

Specification : Approx. 5V



4. Is the measured voltage within specification ?

YES

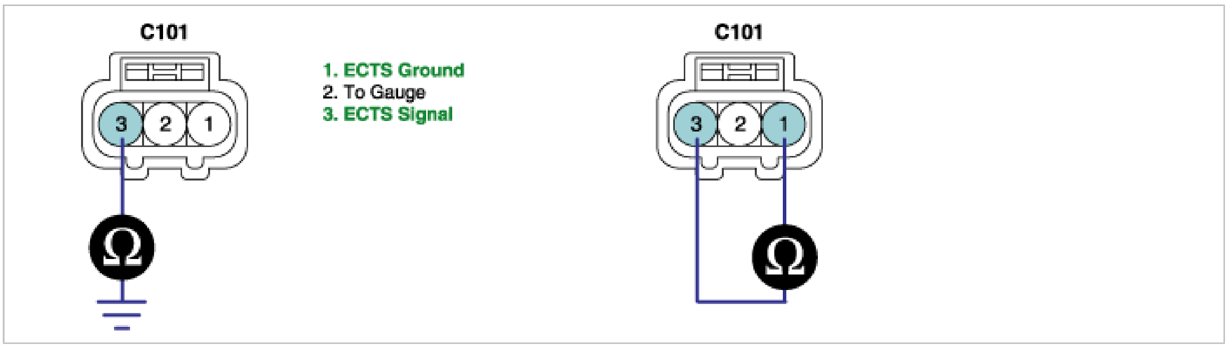
▸ Go to "System Inspection" procedure.

NO

▸ Go to "Check short to ground in harness" as follows.

5. Check short to ground in harness
   (1) IG "OFF" and disconnect ECTS connector and PCM connector.
   (2) Measure resistance between terminal 3 of ECTS harness connector and chassis ground.
   (3) Measure resistance between terminals 1 and 3 of ECTS harness connector.

Specification : Infinite



   (4) Is the measured resistance within specification?

YES

▸ Go to "System Inspection" procedure.

NO

▸ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

SYSTEM INSPECTION

1. Check if Engine coolant level is O.K
2. Check if that water pump is operating correctly.
3. Has a problem been found ?

YES

▸ Repair or replace as necessary and then go to "Verification of Vehicle Repair"procedure.

NO

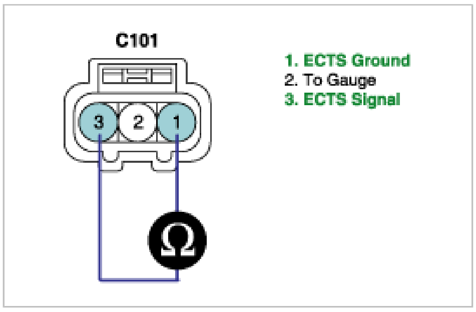
▸ Go to "Component Inspection" procedure.

COMPONENT INSPECTION

1. Check resistance of ECTS
   (1) IG "OFF" and disconnect ECTS connector.
   (2) Measure resistance between terminal 1 and 3 of ECTS connector. (Component Side)

Specification :

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59
0(32)	5.79	80(176)	0.32
20(68)	2.31 ~ 2.59		



(3) Is the measured resistance within specification ?

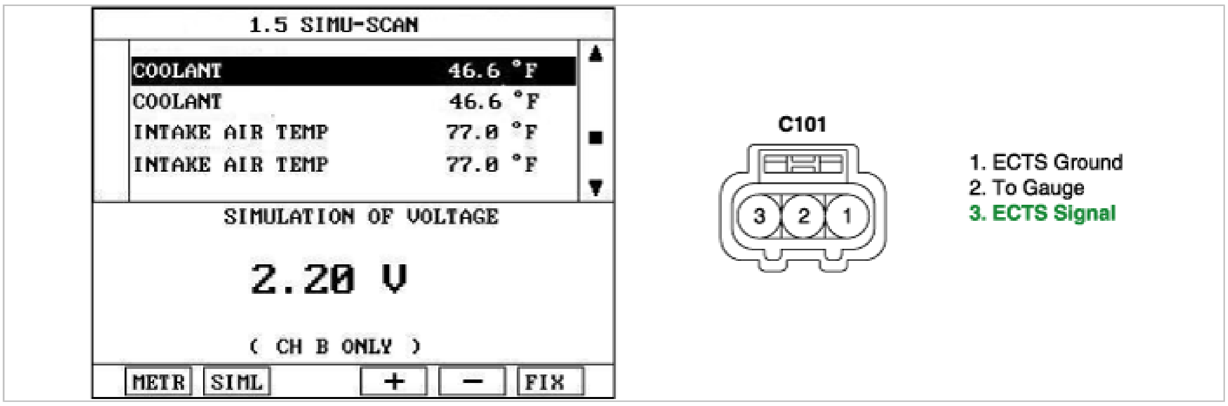
YES

▸ Go to "Check PCM" procedure.

NO

▸ Substitute with a known - good ECTS and check for proper operation. If the problem is corrected, replace ECTS and go to "Verification of Vehicle Repair" procedure.

2. Check PCM
   (1) IG "OFF" and connect scantool.
   (2) Connect probe to terminal 3 of ECTS harness connector.
   (3) IG "ON" and ENG "OFF" and simulation Function on scantool.
   (4) Simulate voltage at terminal 3 of ECTS harness connector.



(5) Does the signal value of ECT sensor change according to simulation voltage ?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

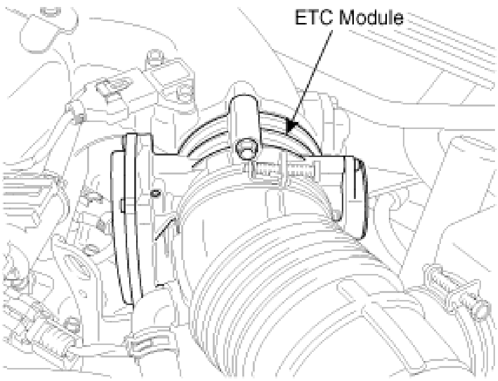
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0222

COMPONENT LOCATION



GENERAL DESCRIPTION

ETC(Electronic Throttle Control Valve) is the device controlling amount of air to engine acccording to driver's intension. Different from the existing mechanical throttle valve which is composed of accelerator pecal and connecting wire cable, ETC consists of a motor, a throttle body and a throttle position sensor. Receiving input signals from electronic accelerator pedal module, PCM lets ETC motor control throttle valve. With ETC, cruise control system works without any additional device.

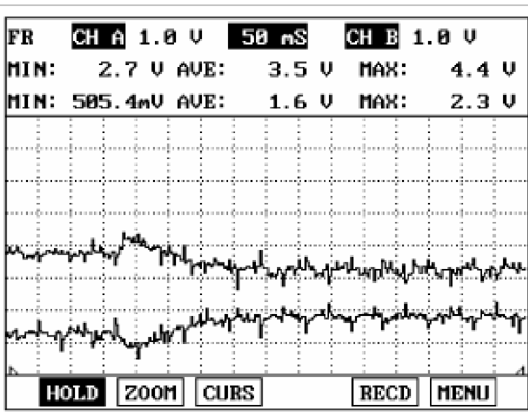
DTC DESCRIPTION

Checking output signals from TPS2 every 8.5 sec. under detecting condition, if an output signal is below 0.25V for more than 0.1 sec, PCM sets P0222. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

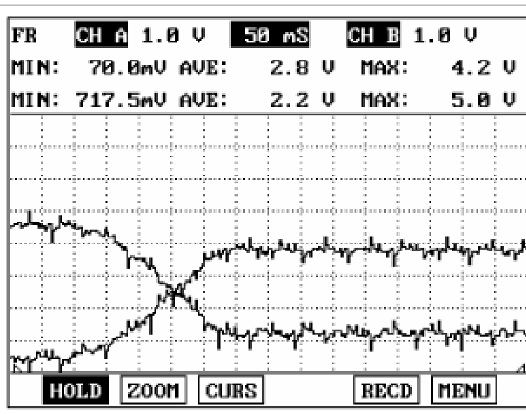
DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• signal low	• Poor connection • Open or short to ground in power harness • Open or short to ground in signal harness • TPS • PCM
Enable condition	• IG "ON"	
threshold value	• The signal voltage of TPS < 0.25V	
diagnosis time	• Continuous (more than 0.1 sec. failure for every 8.5 sec.test)	
MIL ON condition	• 2 driving cycles	

SIGNAL WAVEFORM AND DATA



Hit the accelerator at IG ON



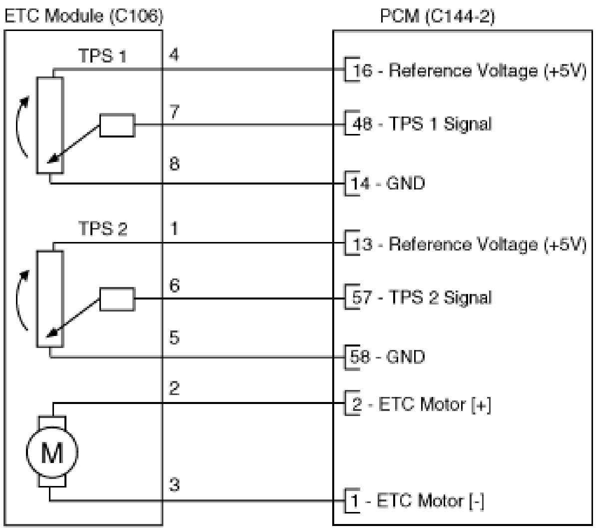
Open the throttle valve by force at IG ON

SPECIFICATION

Throttle opening (°)	Output voltage(V) [Vref=5.0]	
	TPS1	TPS2
0°	0.0V	5.0V
10°	0.5V	4.5V
20°	0.9V	4.1V
30°	1.4V	3.6V
40°	1.8V	3.2V
50°	2.3V	2.7V
60°	2.7V	2.3V
70°	3.2V	1.8V
80°	3.6V	1.4V
90°	4.1V	0.9V
100°	4.5V	0.5V
110°	5.0V	0.0V

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



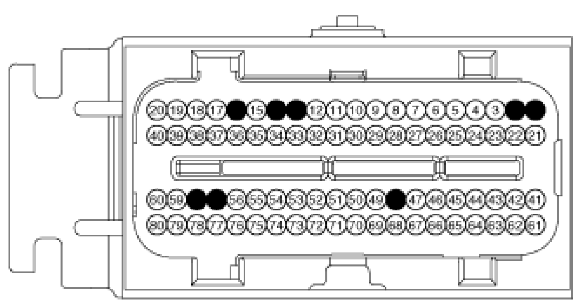
[CONNECTION INFORMATION]

Terminal	Connected to	Funtion
1	PCM C144-2 (13)	TPS 2 Reference Voltage (+5V)
2	PCM C144-2 (2)	ETC Motor [+] Control
3	PCM C144-2 (1)	ETC Motor [-] Control
4	PCM C144-2 (16)	TPS 1 Reference Voltage (+5V)
5	PCM C144-2 (58)	TPS 2 Ground
6	PCM C144-2 (57)	TPS 2 Signal
7	PCM C144-2 (48)	TPS 1 Signal
8	PCM C144-2 (14)	TPS 1 Ground

[HARNESS CONNECTORS]

C106

ETC MODULE



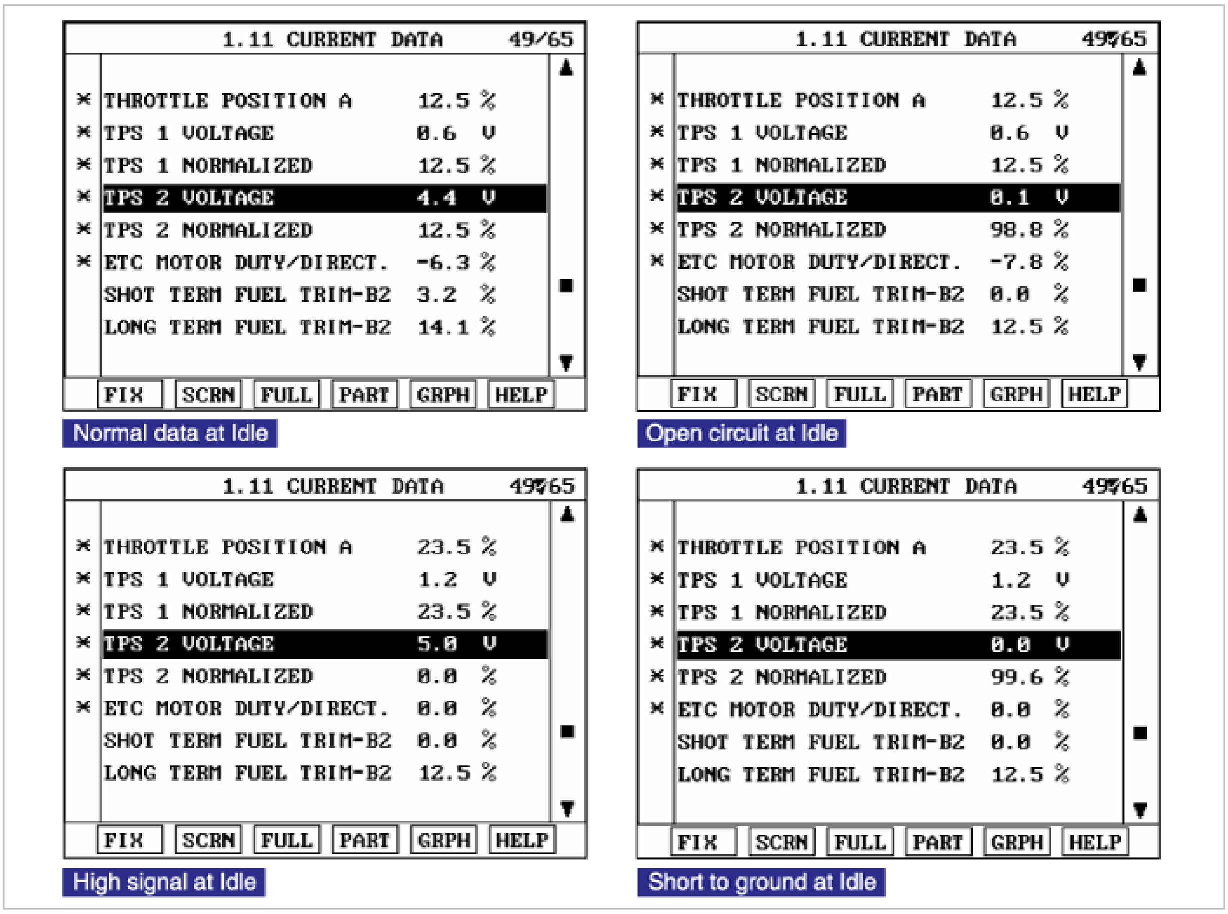
C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.

3. Monitor "TPS" item on the service data.



4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

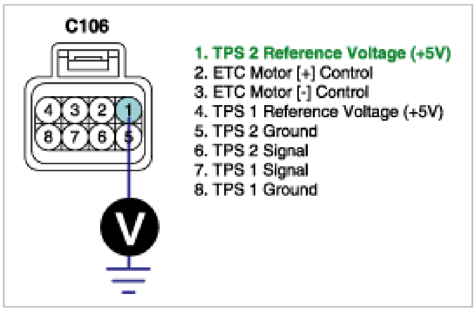
NO

▸ Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION

1. IG "OFF" and disconnect TPS connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of TPS harness connector and chassis ground.

Specification : Approx. 5V



4. Is the measured voltage within specification ?

YES

▸ Go to "Signal circuit inspection" procedure.

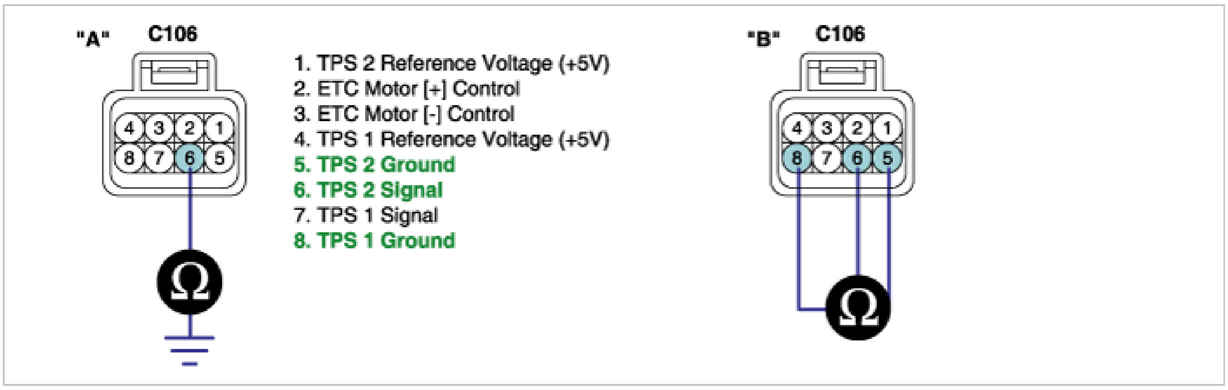
NO

▸ Repair open or short to ground in power harness, and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check short to ground in harness
   (1) IG "OFF" and disconnect TPS connector and PCM connector.
   (2) Measure resistance between terminal 6 of TPS harness connector and chassis ground.
   (3) Measure resistance between terminals 6 and 5(8) of TPS harness connector.

   Specification : Infinite



   (4) Is the measured resistance within specification?

   YES

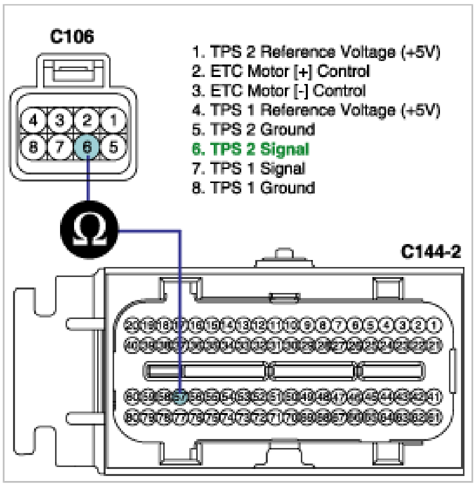
   ▸ Go to "Check open in harness" as follows

   NO

   ▸ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness
   (1) IG "OFF" and disconnect TPS connector and PCM connector.
   (2) Measure resistance between terminal 6 of TPS harness connector and terminal 57 of PCM harness connector.

   Specification : Below 1Ω



(3) Is the measured resistance within specification?

YES

▸ Go to " Component Inspection" procedure.

NO

▸ Repair open in harness, and go to "Verification of Repair" procedure.

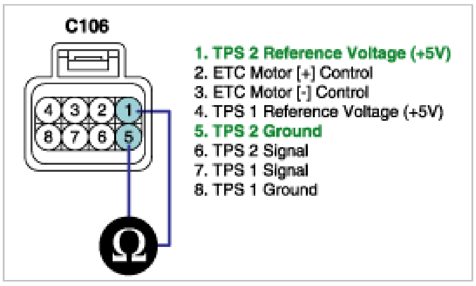
COMPONENT INSPECTION

1. Check TPS

(1) IG "OFF" and disconnect TPS connector.

(2) Measure resistance between terminals 1 and 5 of TPS connector.(Component side)

Specification : 2.7 ~ 4.1kΩ



(3) Is the measured resistance within specification?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good TPS and check for proper operation. If the problem is corrected, replace TPS and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

> CAUTION
>
> Procedure of ETS Initialization
> 1. Erase the trouble codes on PCM
> 2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10sec.)
> 3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

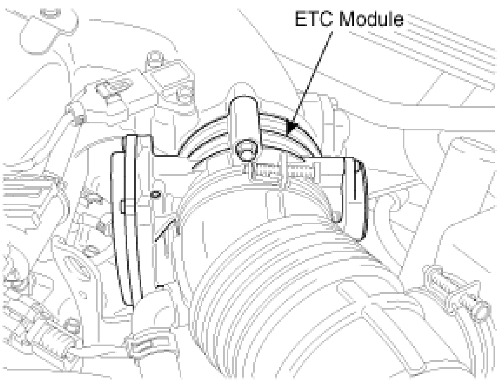
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0223

COMPONENT LOCATION



GENERAL DESCRIPTION

ETC(Electronic Throttle Control Valve) is the device controlling amount of air to engine acccording to driver's intension. Different from the existing mechanical throttle valve which is composed of accelerator pecal and connecting wire cable, ETC consists of a motor, a throttle body and a throttle position sensor. Receiving input signals from electronic accelerator pedal module, PCM lets ETC motor control throttle valve. With ETC, cruise control system works without any additional device.

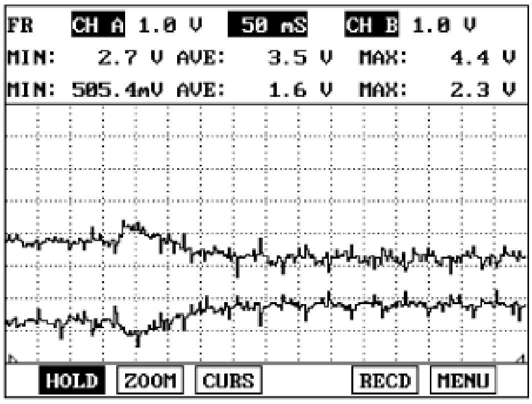
DTC DESCRIPTION

Checking output signals from TPS2 every 8.5 sec. under detecting condition, if an output signal is above 4.75V for more than 0.1 sec., PCM sets P0223. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

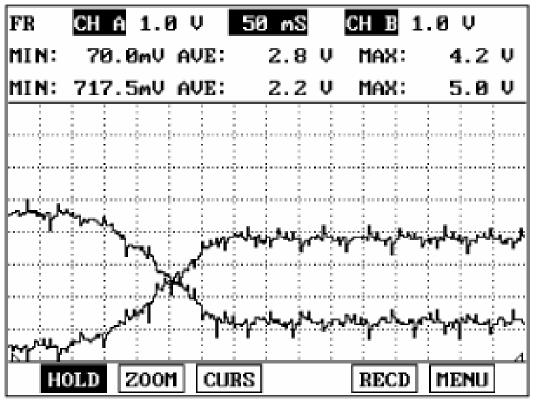
DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal High	• Poor connection • Short to battery in signal harness • Open in ground harness • TPS • PCM
Enable condition	• IG "ON"	
threshold value	• The signal voltage of TPS >4.75V	
diagnosis time	• Continuous (more than 0.1 sec. failure for every 8.5 sec.test)	
MIL ON condition	• 2 driving cycles	

SIGNAL WAVEFORM AND DATA



Hit the accelerator at IG ON



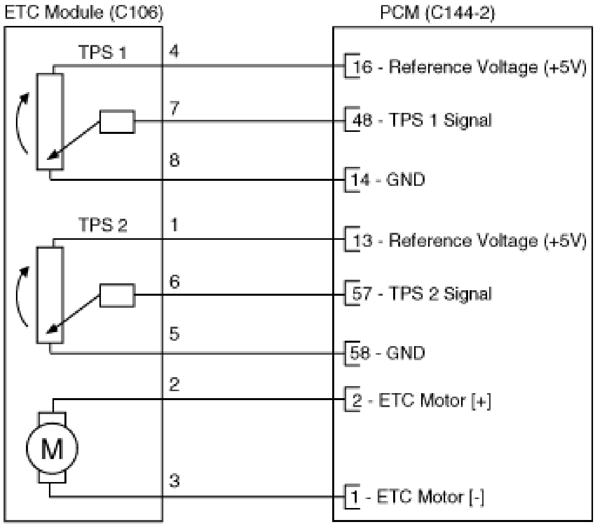
Open the throttle valve by force at IG ON

SPECIFICATION

Throttle opening (°)	Output voltage(V) [Vref=5.0]	
	TPS1	TPS2
0°	0.0V	5.0V
10°	0.5V	4.5V
20°	0.9V	4.1V
30°	1.4V	3.6V
40°	1.8V	3.2V
50°	2.3V	2.7V
60°	2.7V	2.3V
70°	3.2V	1.8V
80°	3.6V	1.4V
90°	4.1V	0.9V
100°	4.5V	0.5V
110°	5.0V	0.0V

SCHEMATIC DIAGRAM

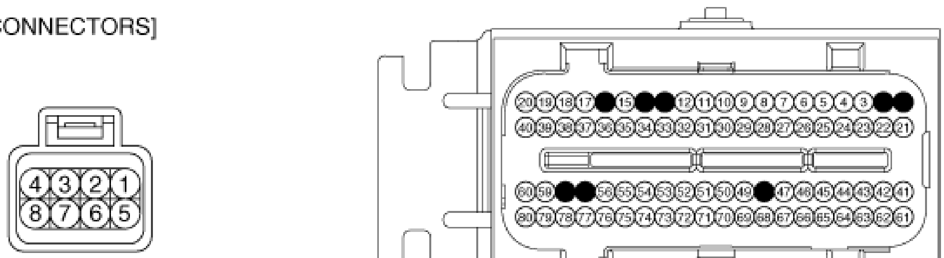
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Funtion
1	PCM C144-2 (13)	TPS 2 Reference Voltage (+5V)
2	PCM C144-2 (2)	ETC Motor [+] Control
3	PCM C144-2 (1)	ETC Motor [-] Control
4	PCM C144-2 (16)	TPS 1 Reference Voltage (+5V)
5	PCM C144-2 (58)	TPS 2 Ground
6	PCM C144-2 (57)	TPS 2 Signal
7	PCM C144-2 (48)	TPS 1 Signal
8	PCM C144-2 (14)	TPS 1 Ground

[HARNESS CONNECTORS]



C106

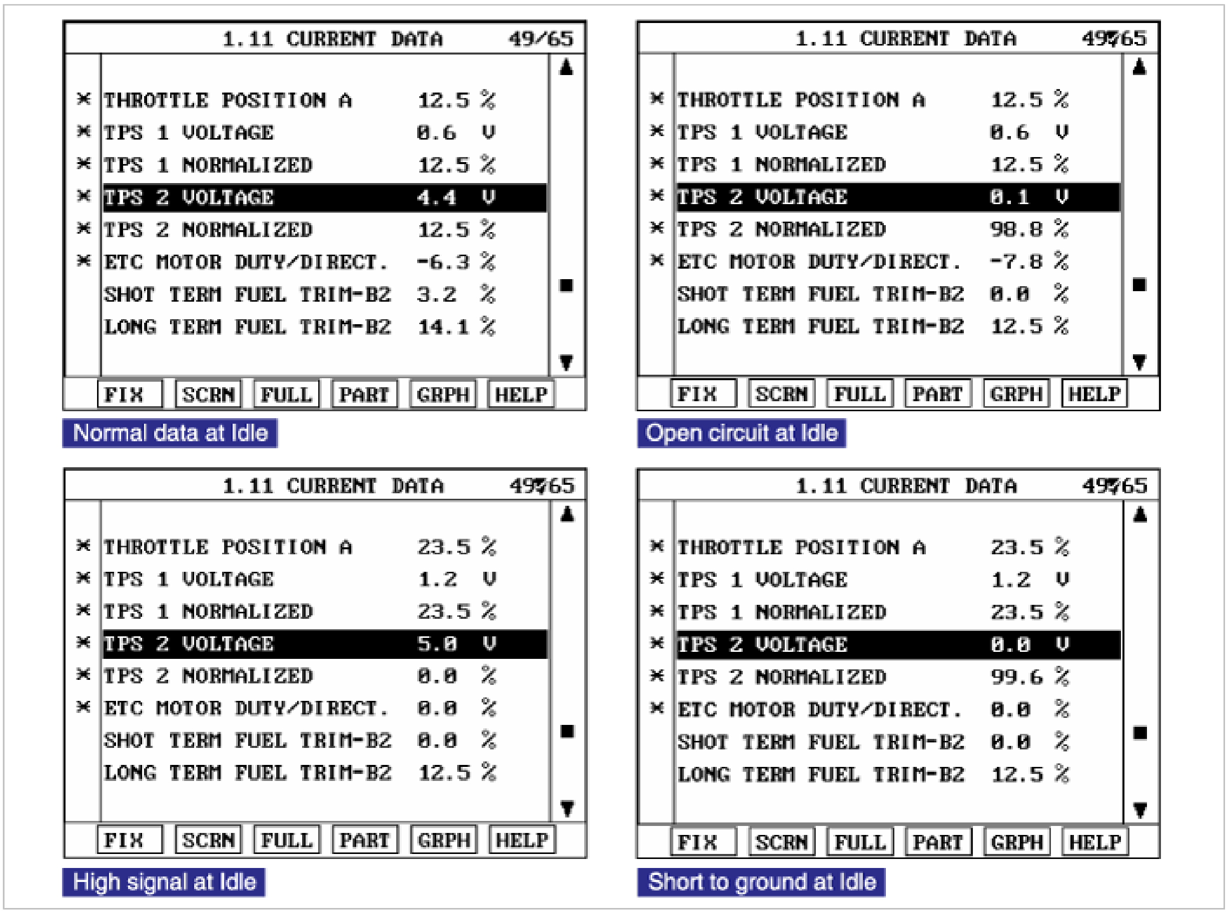
ETC MODULE

C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "TPS" item on the service data.



4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

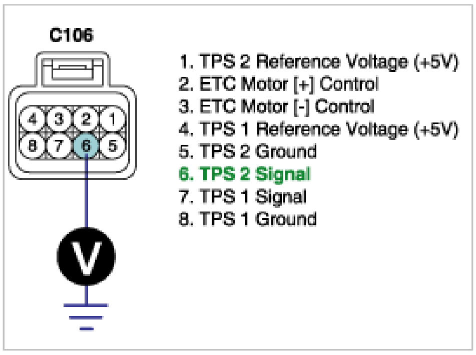
NO

▸ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF" and disconnect TPS connector.
   (2) IG "ON and ENG "OFF"
   (3) Measure voltage between terminal 6 of TPS harness connector and chassis ground.

Specification : Approx. 0V



(4) Is the measured voltage within specification?

YES

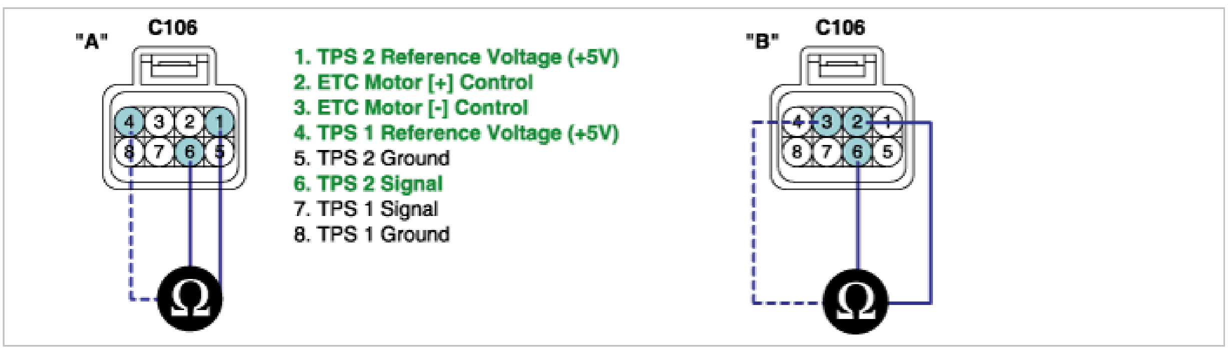
▸ Go to "Ground Circuit Inspection" procedure.

NO

▸ Go to "Check short to battery in harness" as follows.

2. Check short to battery in harness
   (1) IG "OFF" and disconnect TPS connector and PCM connector.
   (2) Measure resistance between terminals 1 and 6 of TPS harness connector.
   (3) Measure resistance between terminals 4 and 6 of TPS harness connector.
   (4) Measure resistance between terminals 2 and 6 of TPS harness connector.
   (5) Measure resistance between terminals 3 and 6 of TPS harness connector.

Specification : Infinite



(6) Is the measured resistance within specification?

YES

▸ Go to " Ground Circuit Inspection" procedure.

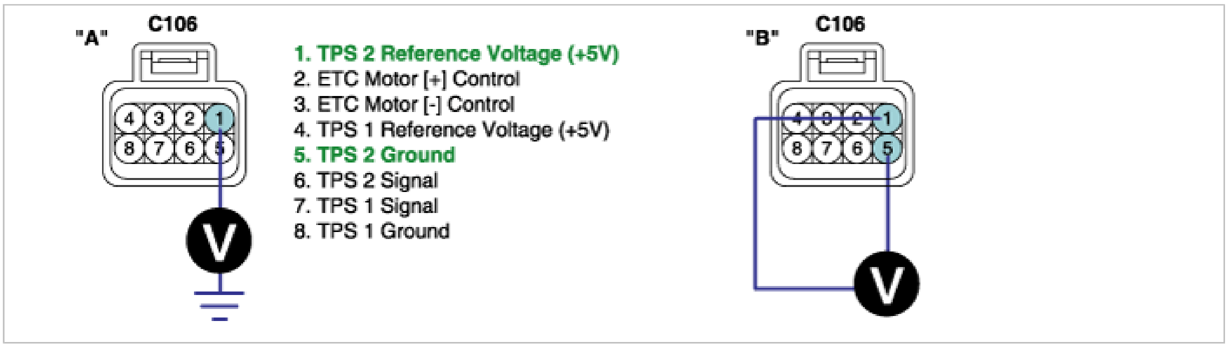
NO

▸ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF" and disconnect TPS connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of TPS harness connector and chassis ground.
4. Measure voltage between terminals 1 and 5 of TPS harness connector.

Specification : Measurement "A" - Measurement 'B' = Approx. below 200mV



5. Is the measured voltage within specification?

YES

▸ Go to "Component Inspection" procedure.

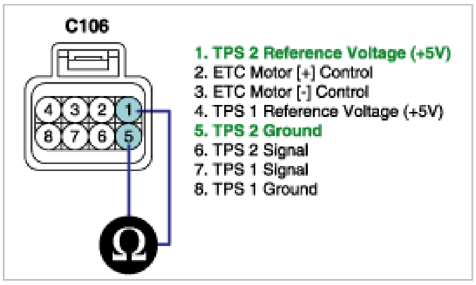
NO

▸ Repair open or contact resistance inharness, and go to "Verification of Vehicle Repair: procedure.

COMPONENT INSPECTION

1. Check TPS
   (1) IG "OFF" and disconnect TPS connector.
   (2) Measure resistance between terminals 1 and 5 of TPS connector.(Component side)

Specification : 2.7 ~ 4.1kΩ



   (3) Is the measured resistance within specification?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good TPS and check for proper operation. If the problem is corrected, replace TPS and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

CAUTION

Procedure of ETS Initialization
1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10sec.)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.
1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions

4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

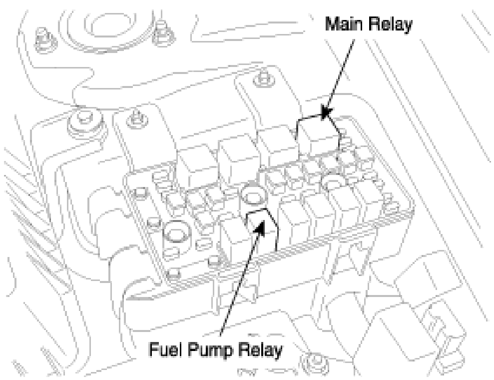
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0230

COMPONENT LOCATION



GENERAL DESCRIPTION

The PCM provides ground to one side of the coil in the fuel pump relay to control the fuel pump relay. The other side of the fuel pump relay coil is connected to fuel pump relay, which activates when the ignition switch is ON. The PCM monitors the control circuit between the fuel pump relay and the ECM. When the ignition switch is turned ON, the PCM energizes the fuel pump relay, which sends power to the fuel pump.

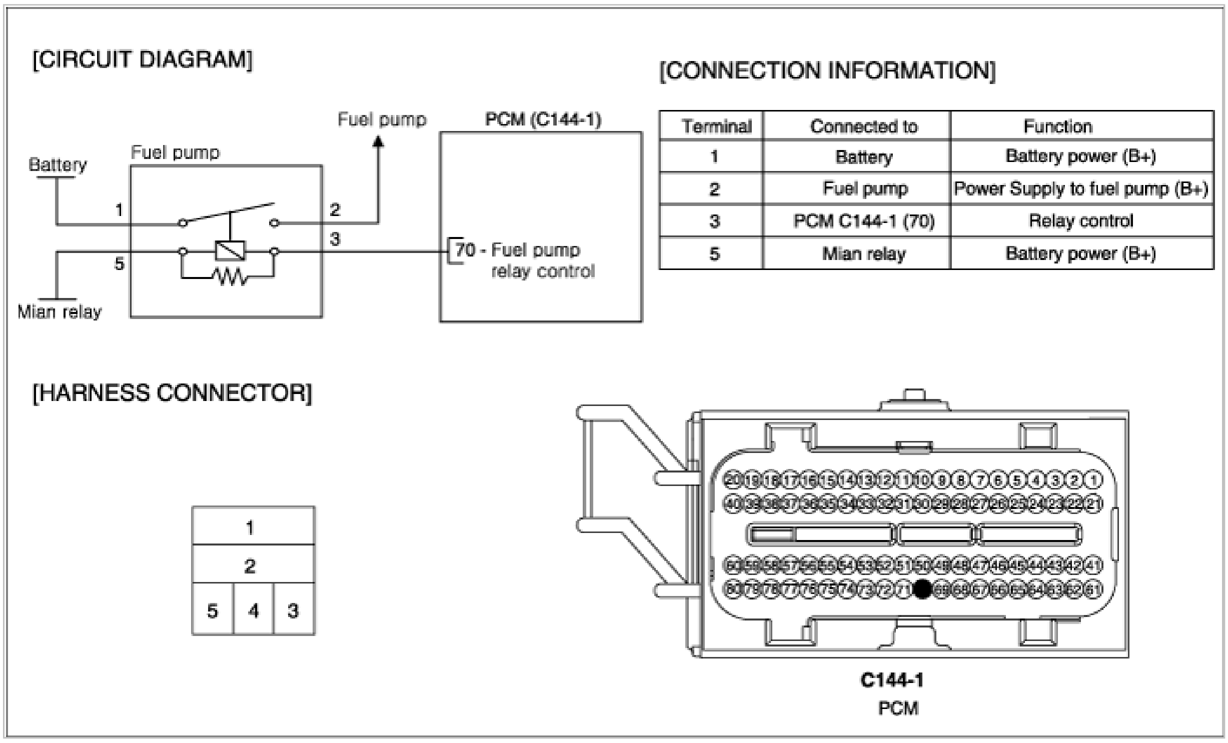
DTC DESCRIPTION

Checking fuel pump relay circuit continuously under detecting condition, if open or short in the circuit is detected PCM sets P0230.In addition, Take note that open circuit in Main Relay may cause this P0230 code.
※ In addition, Take note that open circuit in Main Relay may cause this P0230 code.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal Low or High	• Poor connection • Open or short in fuel pump relay circuit • Open in Main Relay circuit • Fuel Pump Relay • PCM
Enable condition	• 11V ≤ Battery Voltage ≤ 16V	
threshold value	• Open or short	
diagnosis time	• Continuous	
MIL ON condition	• NO MIL ON(DTC only)	

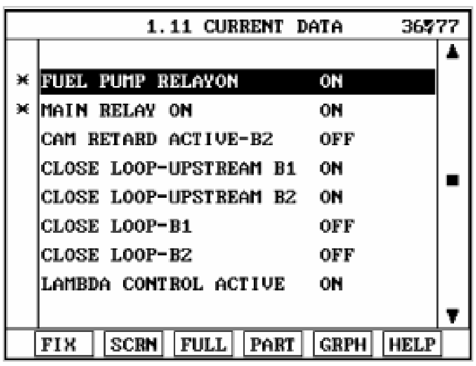
SCHEMATIC DIAGRAM



Terminal	Connected to	Function
1	Battery	Battery power (B+)
2	Fuel pump	Power Supply to fuel pump (B+)
3	PCM C144-1 (70)	Relay control
5	Mian relay	Battery power (B+)

MONITOR SCANTOOL DATA

1. Connect Scantool to Data Link Cable(DLC).
2. ENG "ON"
3. Monitor "Fuel Pump Relay" item on the scantool.



4. Is the service data displayed correctly ?

YES

▸ Fault is intermittently caused by poor contact in the sensor and/or PCM connector or non cleared PCM memory after repair. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace if necessary and go to "Verification of vehicle Repair" .

NO

▸ Go to "Terminal and connector inspection" procedure.
▸ In case of open in Main Relay, this DTC can be set. so, check it for open before going next procedure.(Refer to DTC relating to Main relay)

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure

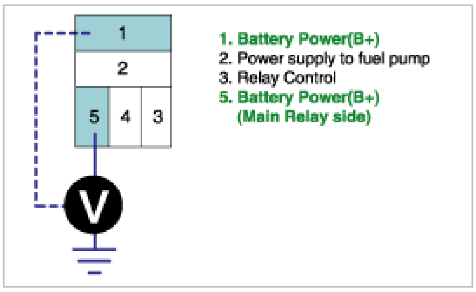
NO

▸ Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION

1. IG "OFF" & ENG "OFF"
2. Disconnect fuel pump relay.
3. IG "ON" & ENG "OFF"
4. Measure voltage between harness terminal 1(5) of chassis ground.

Specification : B+



5. Is the measured voltage within specification ?

YES

▸ Go to "Control Circuit Inspection" procedure.

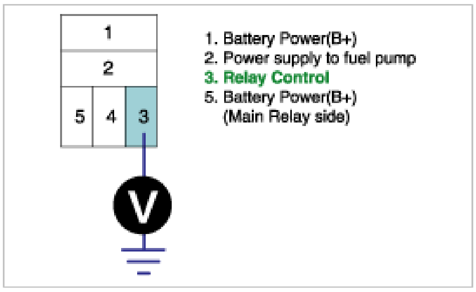
NO

▸ Check "Fuse" between fuel pump relay and main relay is not installed or blown off
▸ Check "Fuse" between fuel pump relay and battery is not installed or blown off
▸ Especially, if battery voltage at terminal 5 is not detected, replace the Main Relay.
▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. IG "OFF"
2. Disconnect fuel pump relay.
3. IG "ON" & ENG "OFF"
4. Measure voltage between harness terminal 5 and chassis ground.

Specification : Approx. 2.5V



5. Is the measured voltage within specification ?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair or repalce as necessary and then, go to "Verification of Vehicle Repair" procedure.

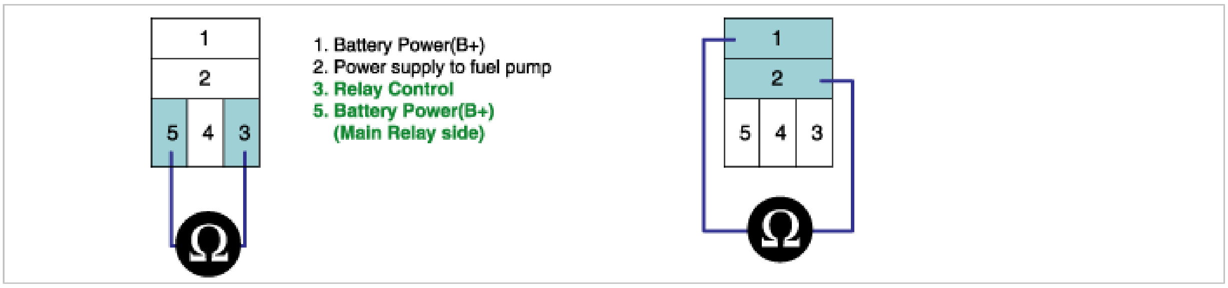
COMPONENT INSPECTION

1. Check fuel pump relay
   (1) IG "OFF"
   (2) Disconnect Fuel Pump Relay
   (3) Measure resistance between terminal 1 and 2 of Fuel Pump Relay

(4) Measure resistance between terminal 3 and 5 of Fuel Pump Relay

Specification :

Terminal	continuity
1~2	NO
3~5	YES (Approx. 70Ω ~ 120Ω)



(5) Is the measured resistance within specification ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Substitute with a known - good Fuel Pump Relay and check for proper operation.If the problem is corrected, replace Fuel Pump Relay and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

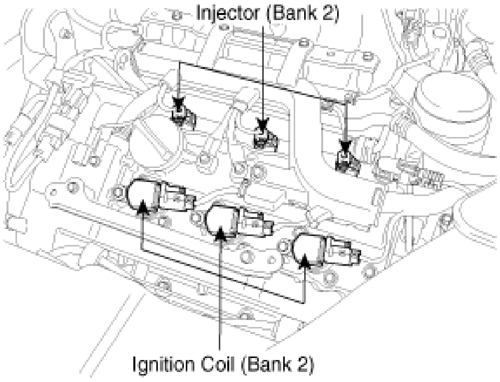
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0261

COMPONENT LOCATION



GENERAL DESCRIPTION

Electronically controlled fuel injector is a solenoid valve which supplies exactly calculated amount of fuel to engine for optimum conbustion under various engine load and speed. To meat air-fuel ratio required in system, PCM regulates fuel injection quantity as controlling injector solenoid operating duration referring air flow to cylinders and output signals from HO2S. For this precise control, quick response of solenoid is required and for perfect combustion, injection characteristic is important.

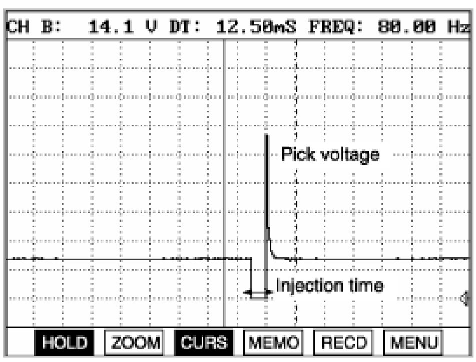
DTC DESCRIPTION

Checking output signals from injectors every 10 sec. under detecting condition, if an output signal is low for more than 5 sec., PCM sets P0261. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal Low	• Poor connection • Open or short to ground in power harness • Open or short to ground in control harness • Injector • PCM
Enable condition	• Engine running state • 11V ≤ Battery voltage ≤ 16V • Above conditions are met > 0.5sec.	
threshold value	• Open or short to ground	
diagnosis time	• Continuous (More than 2 sec.failure for every 4 sec.test)	
MIL ON condition	• 2 driving cycles	

SIGNAL WAVEFROM AND DATA



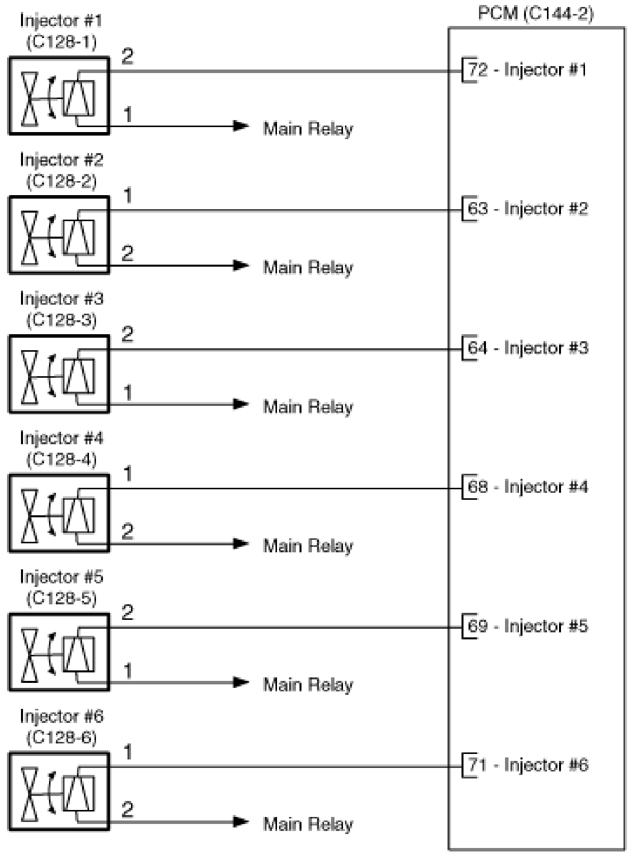
When the PCM energizes the injector by grounding control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the PCM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should be peak at a moment.

SPECIFICATION

Item	Coil resistance(Ω)
Injector	11.4 ~ 12.6Ω (at 20°C/ 68°F)

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Injector #1

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (72)	Injector #1 control

Injector #2

Terminal	Connected to	Funtion
1	PCM C144-2 (63)	Injector #2 control
2	Main Relay	Battery Voltage (B+)

Injector #3

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (64)	Injector #3 control

Injector #4

Terminal	Connected to	Funtion
1	PCM C144-2 (68)	Injector #4 control
2	Main Relay	Battery Voltage (B+)

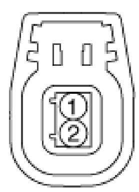
Injector #5

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (69)	Injector #5 control

Injector #6

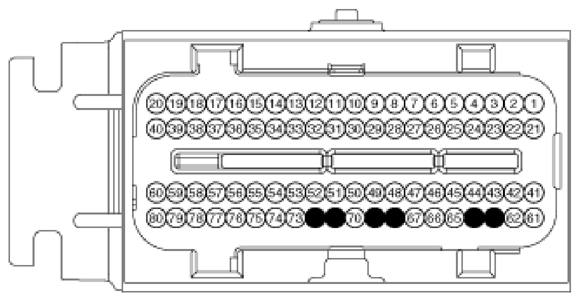
Terminal	Connected to	Funtion
1	PCM C144-2 (71)	Injector #6 control
2	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTORS]



C128-1,2,3,4,5,6

Injector #1,2,3,4,5,6

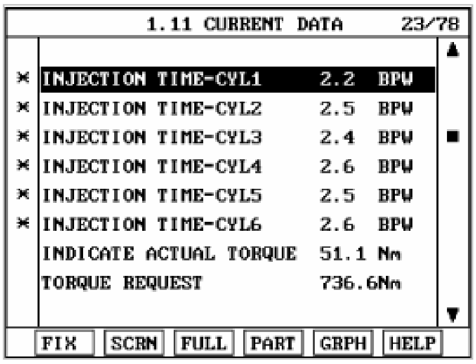


C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "fuel injection time" item on the service data.



4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

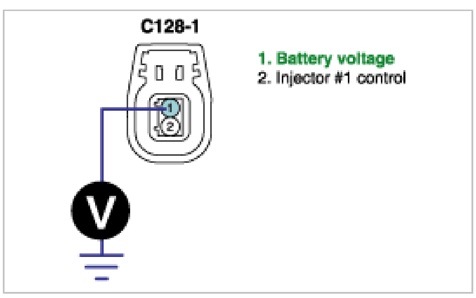
NO

▸ Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION

1. IG "ON" and disconnect injector connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of injector harness connector and chassis ground.

Specification : B+



4. Is the measured voltage within specification?

YES

▸ Go to "Control Circuit Inspection" procedure.

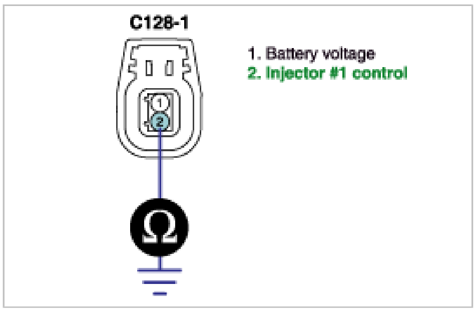
NO

▸ Check open or connection of the fuse connected to injector power supply.
▸ Repair open or short to ground in harness, and go to "Verification of Vehicle Repair' procedure.

CONTROL CIRCUIT INSPECTION

1. Check short to ground in harness
   (1) IG "OFF" and disconnect injector connector and PCM connector.
   (2) Measure resistance between terminal 2 of injector harness connector and chassis ground.

Specification : Infinite



(3) Is the measured resistance within specification?

YES

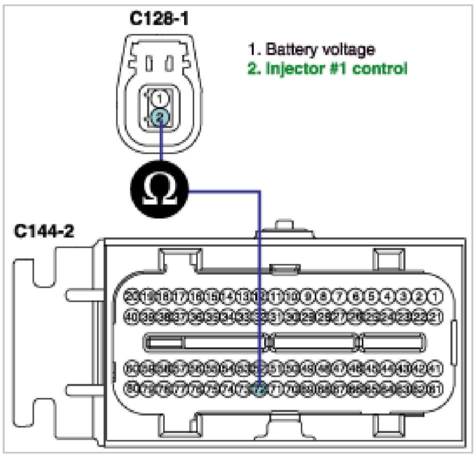
▸ Go to "Check open in harness" as follows.

NO

▸ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness
   (1) IG "OFF" and disconnect injector connector and PCM connector.
   (2) Measure resistance between terminal 2 of injector harness connector and 72 of PCM harness connector.

Specification : Below 1Ω



(3) Is the measured resistance within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

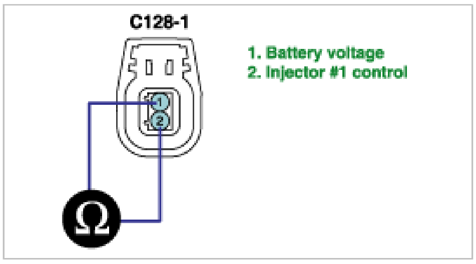
▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check injector
   (1) IG "OFF" and disconnect injector connector.
   (2) Measure resistance between terminals 1 and 2 of injector connector.(Component side)

Specification :

Item	Coil resistance(Ω)
Injector	11.4 ~ 12.6Ω (at 20°C/ 68°F)



(3) Is the measured resistance within specification?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good injector and check for proper operation. If the problem is corrected, replace injector and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

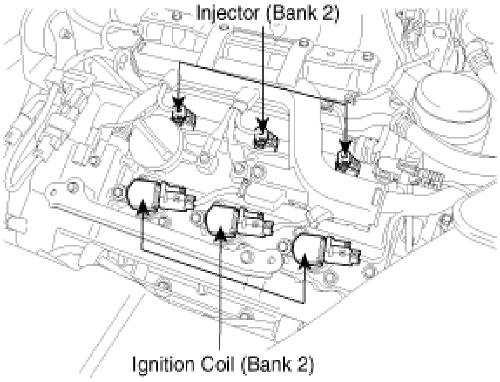
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0262

COMPONENT LOCATION



GENERAL DESCRIPTION

Electronically controlled fuel injector is a solenoid valve which supplies exactly calculated amount of fuel to engine for optimum conbustion under various engine load and speed. To meat air-fuel ratio required in system, PCM regulates fuel injection quantity as controlling injector solenoid operating duration referring air flow to cylinders and output signals from HO2S. For this precise control, quick response of solenoid is required and for perfect combustion, injection characteristic is important.

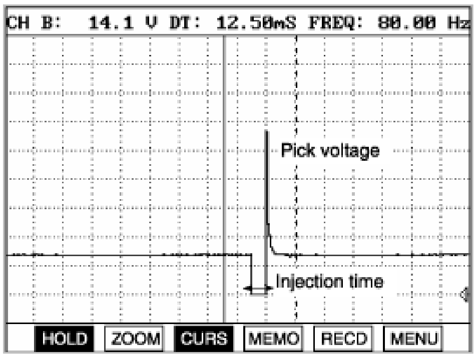
DTC DESCRIPTION

Checking output signals from injectors every 10 sec. under detecting condition, if an output signal is high for more than 5 sec., PCM sets P0262. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal High	• Poor connection • Short to battery in harness • Injector • PCM
Enable condition	• Engine running state • 11V ≤ Battery voltage ≤ 16V • Above conditions are met >0.5sec.	
threshold value	• Short to battery	
diagnosis time	• Continuous (More than 2 sec.failure for every 4 sec.test)	
MIL ON condition	• 2 driving cycles	

SIGNAL WAVEFROM AND DATA



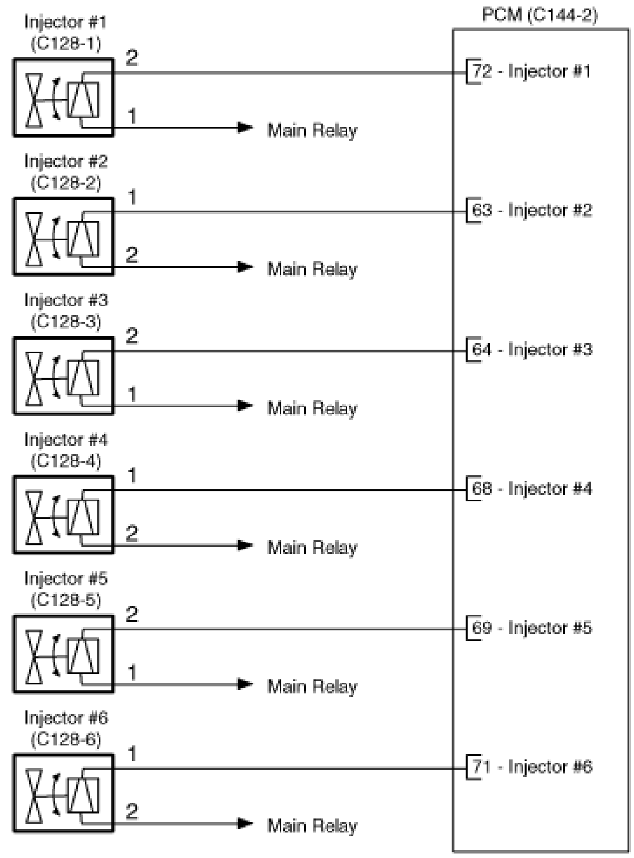
When the PCM energizes the injector by grounding control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the PCM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should be peak at a moment.

SPECIFICATION

Item	Coil resistance(Ω)
Injector	11.4 ~ 12.6Ω (at 20°C/ 68°F)

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Injector #1

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (72)	Injector #1 control

Injector #2

Terminal	Connected to	Funtion
1	PCM C144-2 (63)	Injector #2 control
2	Main Relay	Battery Voltage (B+)

Injector #3

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (64)	Injector #3 control

Injector #4

Terminal	Connected to	Funtion
1	PCM C144-2 (68)	Injector #4 control
2	Main Relay	Battery Voltage (B+)

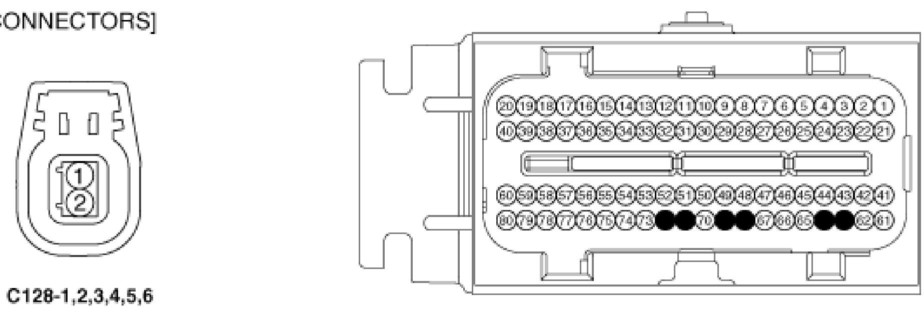
Injector #5

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (69)	Injector #5 control

Injector #6

Terminal	Connected to	Funtion
1	PCM C144-2 (71)	Injector #6 control
2	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTORS]



C128-1,2,3,4,5,6

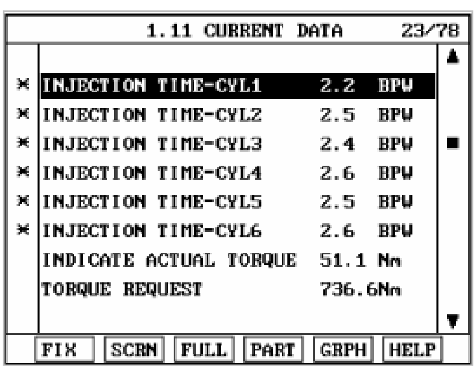
Injector #1,2,3,4,5,6

C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "fuel injection time" item on the service data.



4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

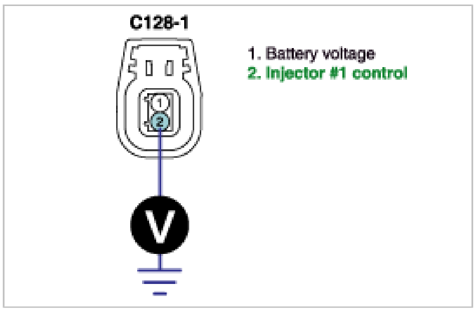
NO

▸ Go to "Control Circuit Inspection" procedure.

CONTROL CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF" and disconnect injector connector.
   (2) IG "ON" and ENG "OFF"
   (3) Measure voltage between terminal 2 of injector harness connector and chassis ground.

   Specification : Approx. 0V



   (4) Is the measured voltage within specification?

YES

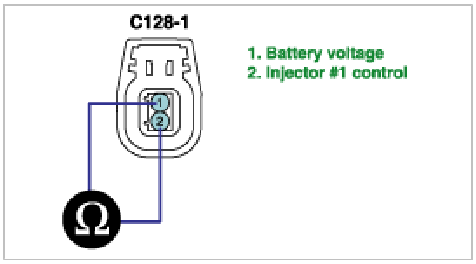
▸ Go to "Component Inspection" procedure.

NO

▸ Go to "Check short to battery in harness" as follows.

2. Check short to battery in harness
   (1) IG "OFF" and disconnect injector connector and PCM connector.
   (2) Measure resistance between terminals 1 and 2 of injector harness connector.

   Specification : Below 1Ω



   (3) Is the measured resistance within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

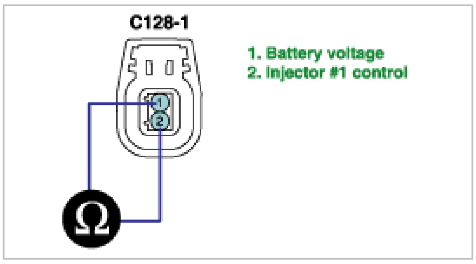
▸ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check injector
   (1) IG "OFF" and disconnect injector connector.
   (2) Measure resistance between terminals 1 and 2 of injector connector.(Component side)

   Specification :

Item	Coil resistance(Ω)
Injector	11.4 ~ 12.6Ω (at 20°C/ 68°F)



   (3) Is the measured resistance within specification?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good injector and check for proper operation. If the problem is corrected, replace injector and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

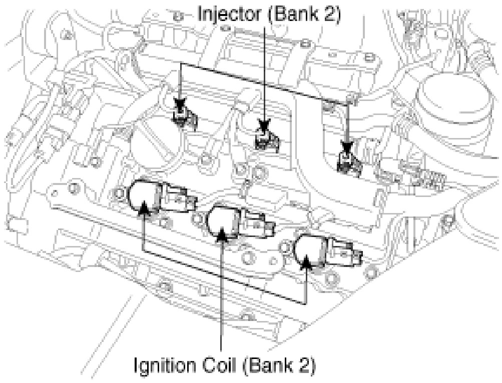
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0264

COMPONENT LOCATION



GENERAL DESCRIPTION

Electronically controlled fuel injector is a solenoid valve which supplies exactly calculated amount of fuel to engine for optimum conbustion under various engine load and speed. To meat air-fuel ratio required in system, PCM regulates fuel injection quantity as controlling injector solenoid operating duration referring air flow to cylinders and output signals from HO2S. For this precise control, quick response of solenoid is required and for perfect combustion, injection characteristic is important.

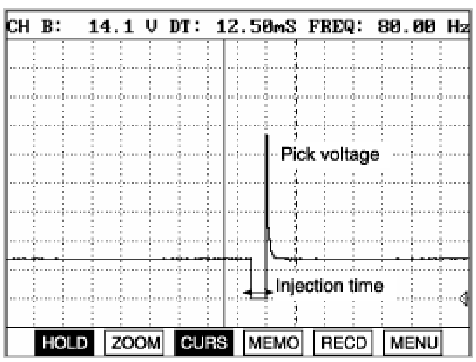
DTC DESCRIPTION

Checking output signals from injectors every 10 sec. under detecting condition, if an output signal is low for more than 5 sec., PCM sets P0264. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal Low	• Poor connection • Open or short to ground in power harness • Open or short to ground in control harness • Injector • PCM
Enable condition	• Engine running state • 11V ≤ Battery voltage ≤ 16V • Above conditions are met >0.5sec.	
threshold value	• Open or short to ground	
diagnosis time	• Continuous (More than 2 sec.failure for every 4 sec.test)	
MIL ON condition	• 2 driving cycles	

SIGNAL WAVEFROM AND DATA



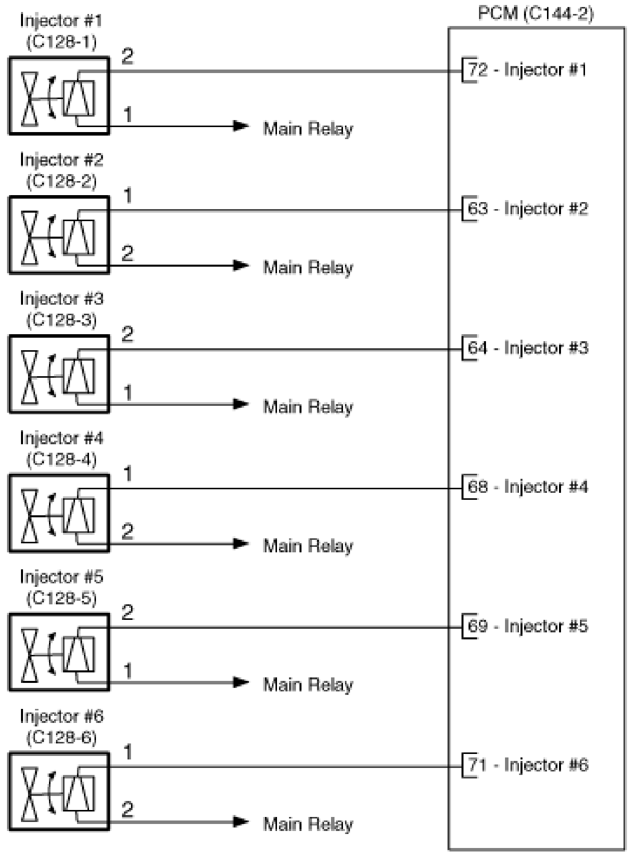
When the PCM energizes the injector by grounding control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the PCM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should be peak at a moment.

SPECIFICATION

Item	Coil resistance(Ω)
Injector	11.4 ~ 12.6Ω (at 20°C/ 68°F)

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Injector #1

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (72)	Injector #1 control

Injector #2

Terminal	Connected to	Funtion
1	PCM C144-2 (63)	Injector #2 control
2	Main Relay	Battery Voltage (B+)

Injector #3

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (64)	Injector #3 control

Injector #4

Terminal	Connected to	Funtion
1	PCM C144-2 (68)	Injector #4 control
2	Main Relay	Battery Voltage (B+)

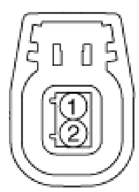
Injector #5

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (69)	Injector #5 control

Injector #6

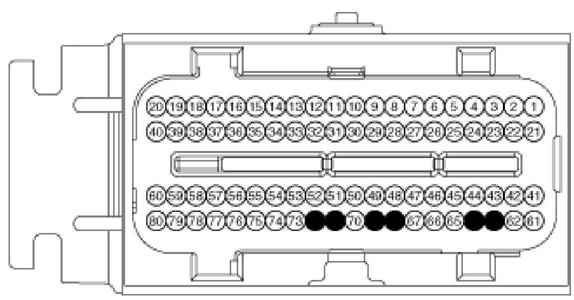
Terminal	Connected to	Funtion
1	PCM C144-2 (71)	Injector #6 control
2	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTORS]



C128-1,2,3,4,5,6

Injector #1,2,3,4,5,6

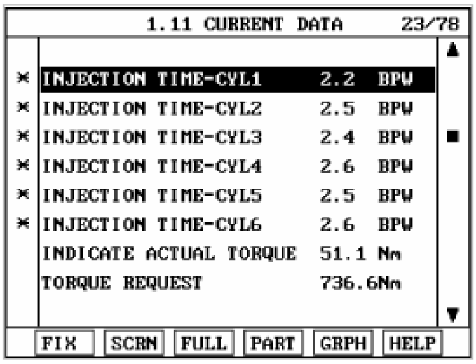


C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "fuel injection time" item on the service data.



1.11 CURRENT DATA		23/78
✕ INJECTION TIME-CYL1	2.2	BPW
✕ INJECTION TIME-CYL2	2.5	BPW
✕ INJECTION TIME-CYL3	2.4	BPW
✕ INJECTION TIME-CYL4	2.6	BPW
✕ INJECTION TIME-CYL5	2.5	BPW
✕ INJECTION TIME-CYL6	2.6	BPW
INDICATE ACTUAL TORQUE	51.1 Nm	
TORQUE REQUEST	736.6Nm	

FIX | SCRN | FULL | PART | GRPH | HELP

4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

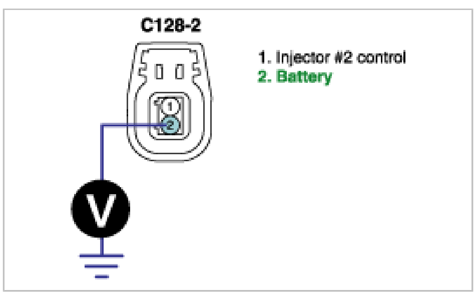
NO

▸ Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION

1. IG "ON" and disconnect injector connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 2 of injector harness connector and chassis ground.

Specification : B+



4. Is the measured voltage within specification?

YES

▸ Go to "Control Circuit Inspection" procedure.

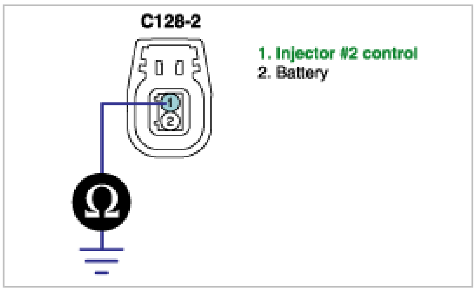
NO

▸ Check open or connection of the fuse connected to injector power supply.
▸ Repair open or short to ground in harness, and go to "Verification of Vehicle Repair' procedure.

CONTROL CIRCUIT INSPECTION

1. Check short to ground in harness
   (1) IG "OFF" and disconnect injector connector and PCM connector.
   (2) Measure resistance between terminal 1 of injector harness connector and chassis ground.

Specification : Infinite



(3) Is the measured resistance within specification?

YES

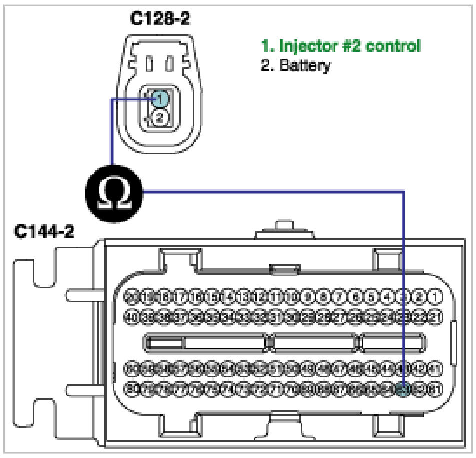
▶ Go to "Check open in harness" as follows.

NO

▶ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness
   (1) IG "OFF" and disconnect injector connector and PCM connector.
   (2) Measure resistance between terminal 1 of injector harness connector and 63 of PCM harness connector.

Specification : Below 1Ω



(3) Is the measured resistance within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

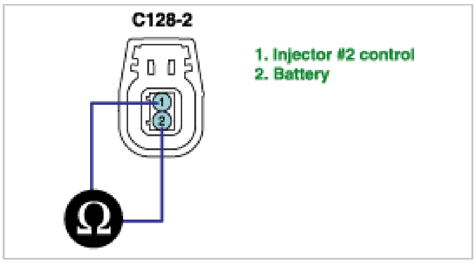
▶ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check injector
   (1) IG "OFF" and disconnect injector connector.
   (2) Measure resistance between terminals 1 and 2 of injector connector.(Component side)

Specification :

Item	Coil resistance(Ω)
Injector	11.4 ~ 12.6Ω (at 20°C/ 68°F)



(3) Is the measured resistance within specification?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good injector and check for proper operation. If the problem is corrected, replace injector and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

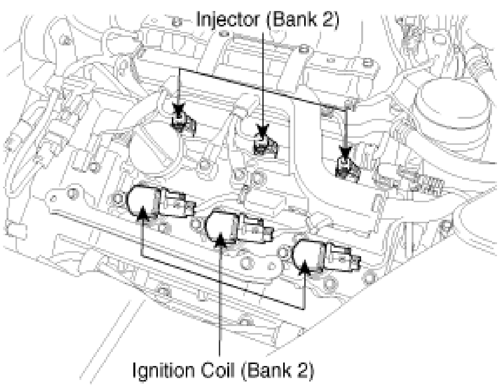
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0265

COMPONENT LOCATION



GENERAL DESCRIPTION

Electronically controlled fuel injector is a solenoid valve which supplies exactly calculated amount of fuel to engine for optimum conbustion under various engine load and speed. To meat air-fuel ratio required in system, PCM regulates fuel injection quantity as controlling injector solenoid operating duration referring air flow to cylinders and output signals from HO2S. For this precise control, quick response of solenoid is required and for perfect combustion, injection characteristic is important.

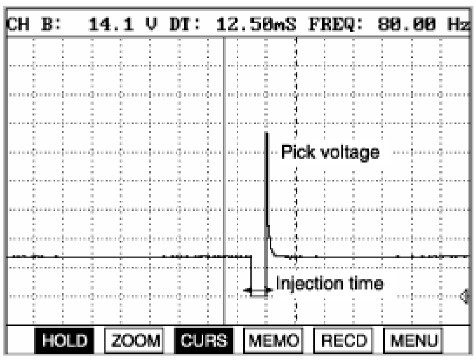
DTC DESCRIPTION

Checking output signals from injectors every 10 sec. under detecting condition, if an output signal is high for more than 5 sec., PCM sets P0265. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal High	• Poor connection • Short to battery in harness • Injector • PCM
Enable condition	• Engine running state • 11V ≤ Battery voltage ≤ 16V • Above conditions are met >0.5sec.	
threshold value	• Short to battery	
diagnosis time	• Continuous (More than 2 sec.failure for every 4 sec.test)	
MIL ON condition	• 2 driving cycles	

SIGNAL WAVEFROM AND DATA



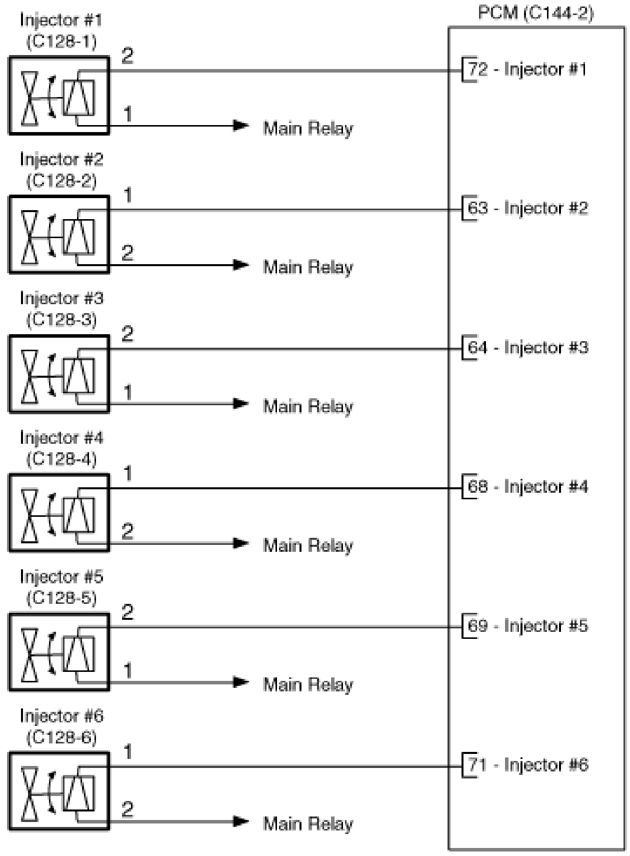
When the PCM energizes the injector by grounding control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the PCM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should be peak at a moment.

SPECIFICATION

Item	Coil resistance(Ω)
Injector	11.4 ~ 12.6Ω (at 20°C/ 68°F)

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Injector #1

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (72)	Injector #1 control

Injector #2

Terminal	Connected to	Funtion
1	PCM C144-2 (63)	Injector #2 control
2	Main Relay	Battery Voltage (B+)

Injector #3

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (64)	Injector #3 control

Injector #4

Terminal	Connected to	Funtion
1	PCM C144-2 (68)	Injector #4 control
2	Main Relay	Battery Voltage (B+)

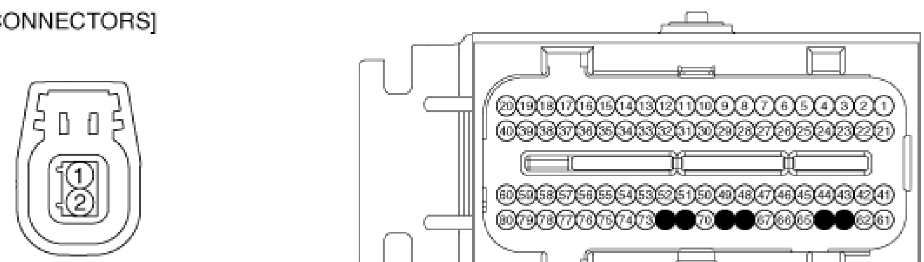
Injector #5

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (69)	Injector #5 control

Injector #6

Terminal	Connected to	Funtion
1	PCM C144-2 (71)	Injector #6 control
2	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTORS]



C128-1,2,3,4,5,6

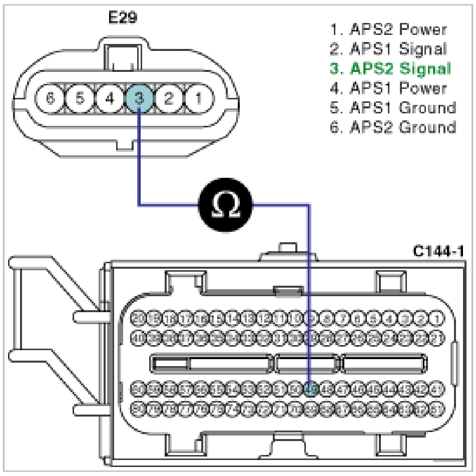
Injector #1,2,3,4,5,6

C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "fuel injection time" item on the service data.



4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

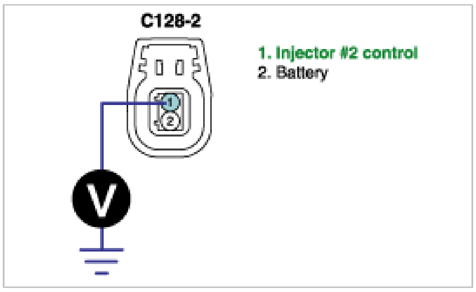
NO

▸ Go to "Control Circuit Inspection" procedure.

CONTROL CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF" and disconnect injector connector.
   (2) IG "ON" and ENG "OFF"
   (3) Measure voltage between terminal 1 of injector harness connector and chassis ground.

Specification : Approx. 0V



   (4) Is the measured voltage within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

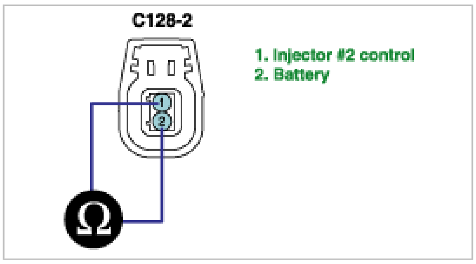
▸ Go to "Check short to battery in harness" as follows.

2. Check short to battery in harness

(1) IG "OFF" and disconnect injector connector and PCM connector.

(2) Measure resistance between terminals 1 and 2 of injector harness connector.

Specification : Below 1Ω



(3) Is the measured resistance within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

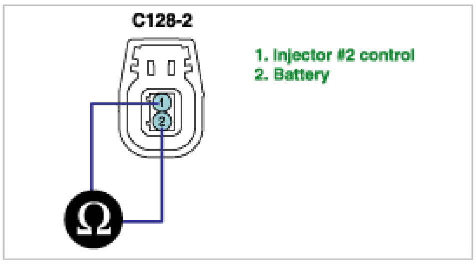
1. Check injector

(1) IG "OFF" and disconnect injector connector.

(2) Measure resistance between terminals 1 and 2 of injector connector.(Component side)

Specification :

Item	Coil resistance(Ω)
Injector	11.4 ~ 12.6Ω (at 20°C/ 68°F)



(3) Is the measured resistance within specification?

YES

▶ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known - good injector and check for proper operation. If the problem is corrected, replace injector and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

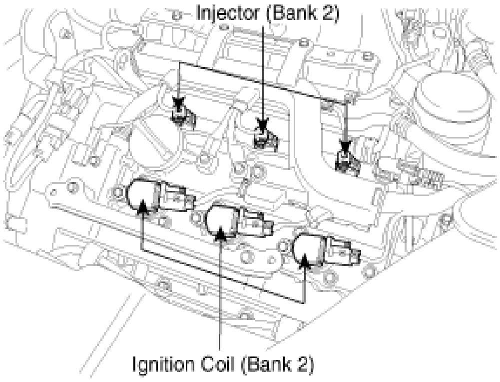
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0267

COMPONENT LOCATION



GENERAL DESCRIPTION

Electronically controlled fuel injector is a solenoid valve which supplies exactly calculated amount of fuel to engine for optimum conbustion under various engine load and speed. To meat air-fuel ratio required in system, PCM regulates fuel injection quantity as controlling injector solenoid operating duration referring air flow to cylinders and output signals from HO2S. For this precise control, quick response of solenoid is required and for perfect combustion, injection characteristic is important.

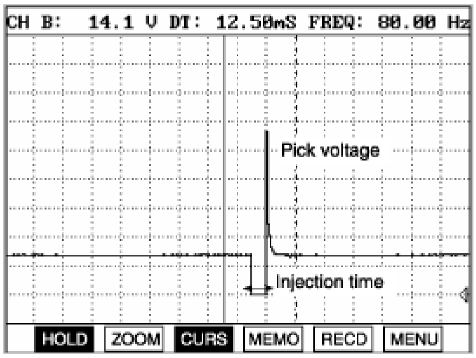
DTC DESCRIPTION

Checking output signals from injectors every 10 sec. under detecting condition, if an output signal is low for more than 5 sec., PCM sets P0267. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal Low	• Poor connection • Open or short to ground in power harness • Open or short to ground in control harness • Injector • PCM
Enable condition	• Engine running state • 11V ≤ Battery voltage ≤ 16V • Above conditions are met > 0.5sec.	
threshold value	• Open or short to ground	
diagnosis time	• Continuous (More than 2 sec.failure for every 4 sec.test)	
MIL ON condition	• 2 driving cycles	

SIGNAL WAVEFROM AND DATA



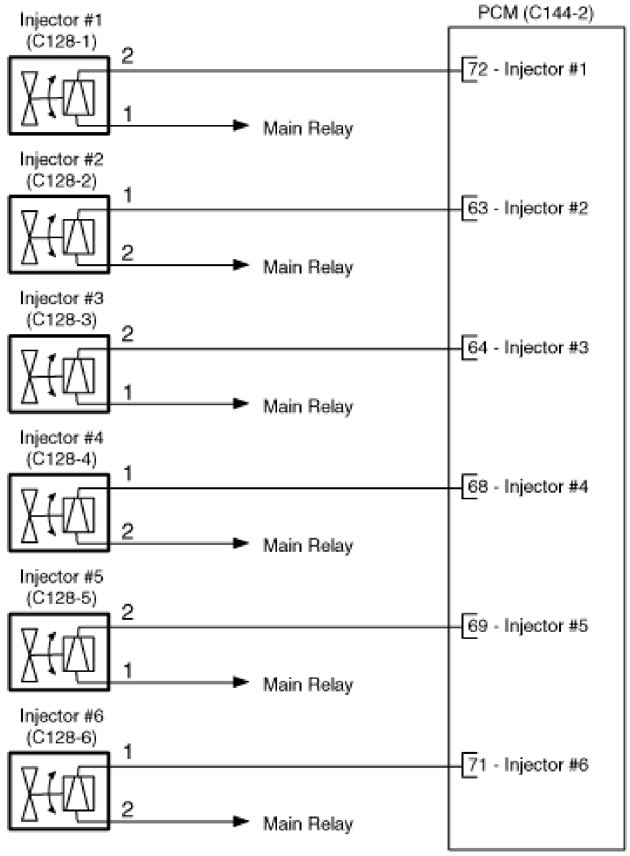
When the PCM energizes the injector by grounding control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the PCM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should be peak at a moment.

SPECIFICATION

Item	Coil resistance(Ω)
Injector	11.4 ~ 12.6Ω (at 20°C/ 68°F)

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Injector #1

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (72)	Injector #1 control

Injector #2

Terminal	Connected to	Funtion
1	PCM C144-2 (63)	Injector #2 control
2	Main Relay	Battery Voltage (B+)

Injector #3

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (64)	Injector #3 control

Injector #4

Terminal	Connected to	Funtion
1	PCM C144-2 (68)	Injector #4 control
2	Main Relay	Battery Voltage (B+)

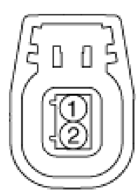
Injector #5

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (69)	Injector #5 control

Injector #6

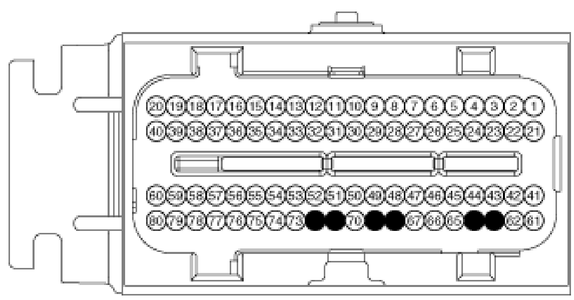
Terminal	Connected to	Funtion
1	PCM C144-2 (71)	Injector #6 control
2	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTORS]



C128-1,2,3,4,5,6

Injector #1,2,3,4,5,6

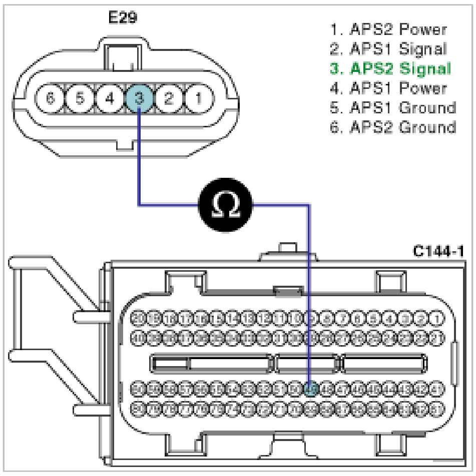


C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "fuel injection time" item on the service data.



4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

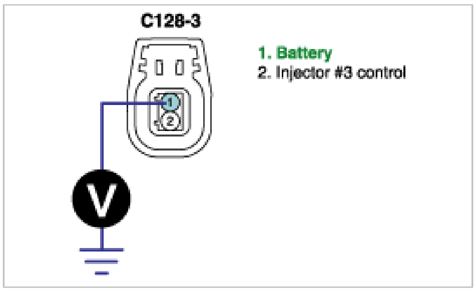
NO

▸ Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION

1. IG "ON" and disconnect injector connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of injector harness connector and chassis ground.

Specification : B+



4. Is the measured voltage within specification?

YES

▸ Go to "Control Circuit Inspection" procedure.

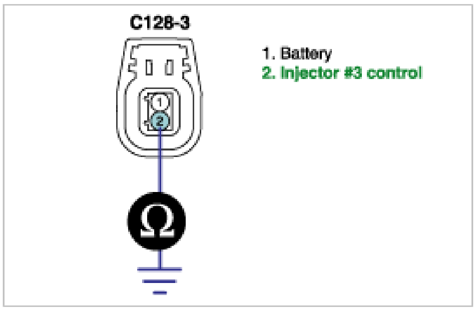
NO

▸ Check open or connection of the fuse connected to injector power supply.
▸ Repair open or short to ground in harness, and go to "Verification of Vehicle Repair' procedure.

CONTROL CIRCUIT INSPECTION

1. Check short to ground in harness
   (1) IG "OFF" and disconnect injector connector and PCM connector.
   (2) Measure resistance between terminal 2 of injector harness connector and chassis ground.

Specification : Infinite



   (3) Is the measured resistance within specification?

YES

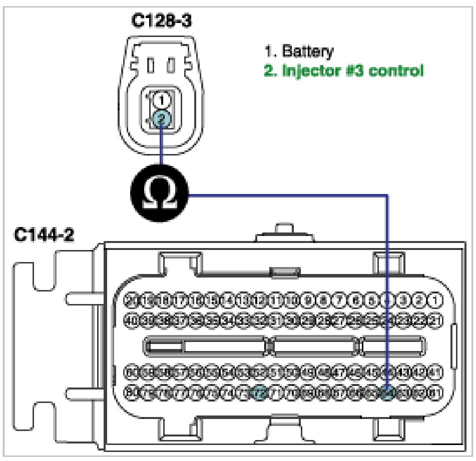
▸ Go to "Check open in harness" as follows.

NO

▸ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness
   (1) IG "OFF" and disconnect injector connector and PCM connector.
   (2) Measure resistance between terminal 2 of injector harness connector and 64 of PCM harness connector.

Specification : Below 1Ω



   (3) Is the measured resistance within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

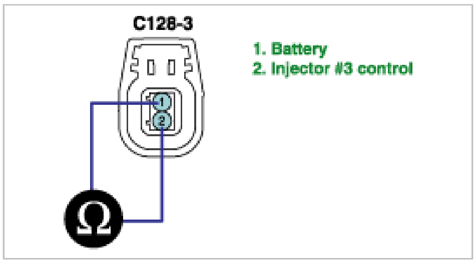
▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check injector
   (1) IG "OFF" and disconnect injector connector.
   (2) Measure resistance between terminals 1 and 2 of injector connector.(Component side)

Specification :

Item	Coil resistance(Ω)
Injector	11.4 ~ 12.6Ω (at 20°C/ 68°F)



(3) Is the measured resistance within specification?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good injector and check for proper operation. If the problem is corrected, replace injector and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

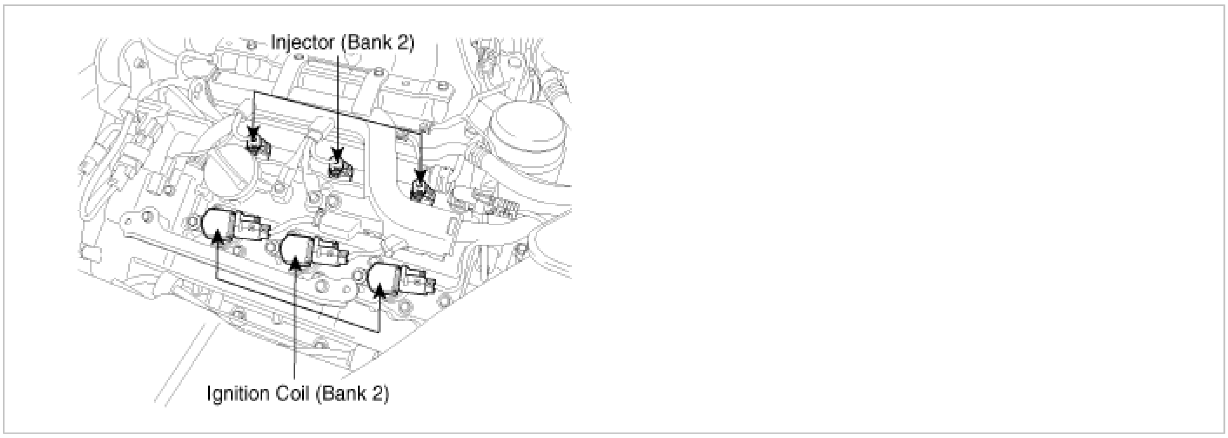
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0268

COMPONENT LOCATION



GENERAL DESCRIPTION

Electronically controlled fuel injector is a solenoid valve which supplies exactly calculated amount of fuel to engine for optimum conbustion under various engine load and speed. To meat air-fuel ratio required in system, PCM regulates fuel injection quantity as controlling injector solenoid operating duration referring air flow to cylinders and output signals from HO2S. For this precise control, quick response of solenoid is required and for perfect combustion, injection characteristic is important.

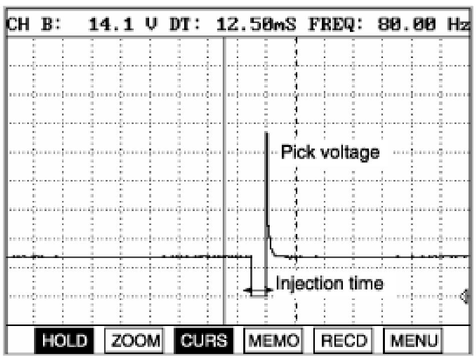
DTC DESCRIPTION

Checking output signals from injectors every 10 sec. under detecting condition, if an output signal is high for more than 5 sec., PCM sets P0268. Warning lamp turns on when the malfunction lasts till continuous 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal High	• Poor connection • Short to battery in harness • Injector • PCM
Enable condition	• Engine running state • 11V ≤ Battery voltage ≤ 16V • Above conditions are met >0.5sec.	
threshold value	• Short to battery	
diagnosis time	• Continuous (More than 2 sec.failure for every 4 sec.test)	
MIL ON condition	• 2 driving cycles	

SIGNAL WAVEFROM AND DATA



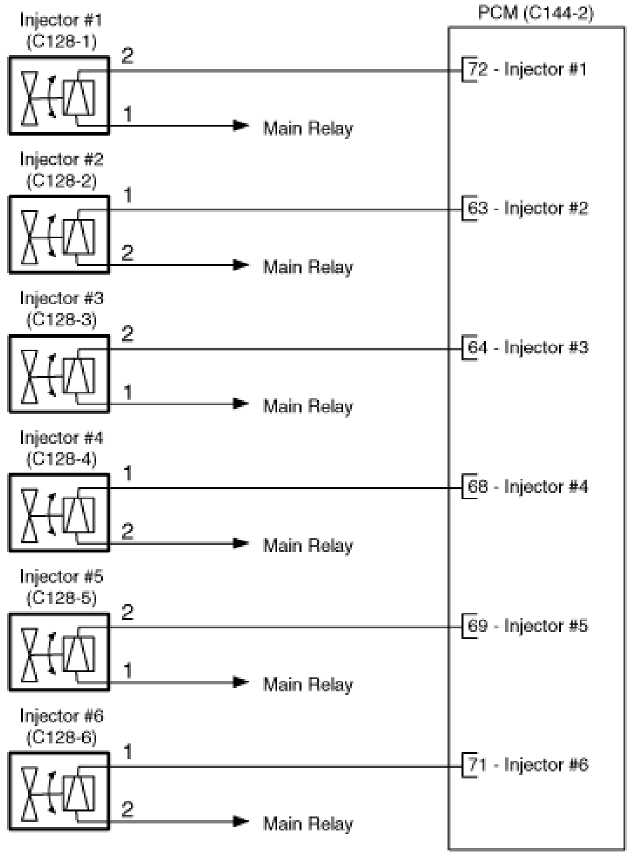
When the PCM energizes the injector by grounding control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the PCM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should be peak at a moment.

SPECIFICATION

Item	Coil resistance(Ω)
Injector	11.4 ~ 12.6Ω (at 20°C/ 68°F)

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Injector #1

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (72)	Injector #1 control

Injector #2

Terminal	Connected to	Funtion
1	PCM C144-2 (63)	Injector #2 control
2	Main Relay	Battery Voltage (B+)

Injector #3

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (64)	Injector #3 control

Injector #4

Terminal	Connected to	Funtion
1	PCM C144-2 (68)	Injector #4 control
2	Main Relay	Battery Voltage (B+)

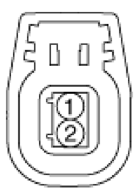
Injector #5

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (69)	Injector #5 control

Injector #6

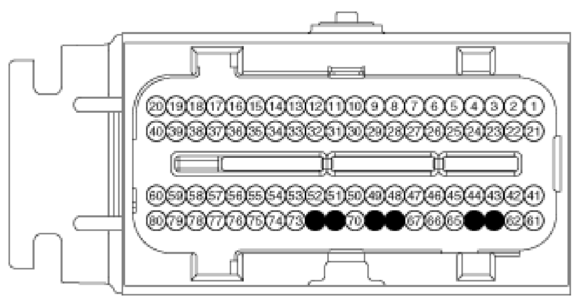
Terminal	Connected to	Funtion
1	PCM C144-2 (71)	Injector #6 control
2	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTORS]



C128-1,2,3,4,5,6

Injector #1,2,3,4,5,6

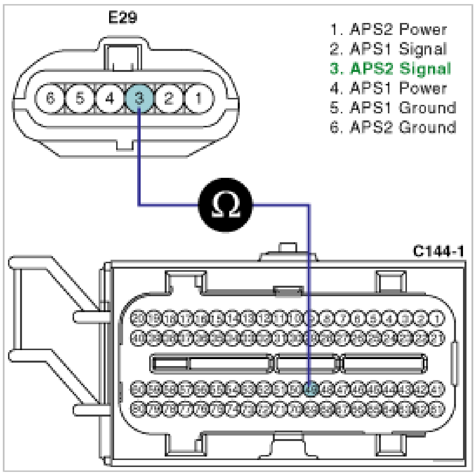


C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "fuel injection time" item on the service data.



4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

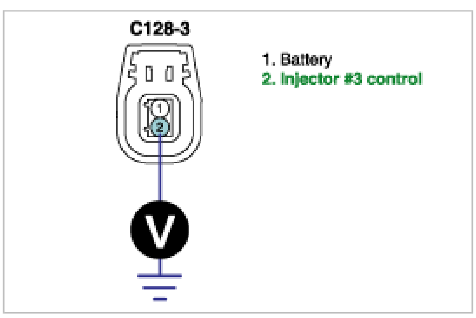
NO

▸ Go to "Control Circuit Inspection" procedure.

CONTROL CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF" and disconnect injector connector.
   (2) IG "ON" and ENG "OFF"
   (3) Measure voltage between terminal 2 of injector harness connector and chassis ground.

Specification : Approx. 0V



   (4) Is the measured voltage within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

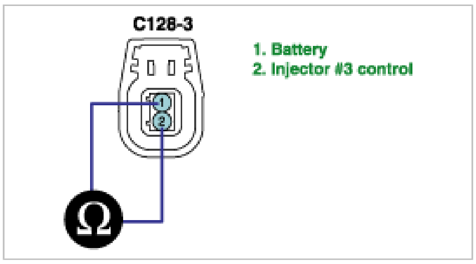
▸ Go to "Check short to battery in harness" as follows.

2. Check short to battery in harness

(1) IG "OFF" and disconnect injector connector and PCM connector.

(2) Measure resistance between terminals 1 and 2 of injector harness connector.

Specification : Below 1Ω



(3) Is the measured resistance within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

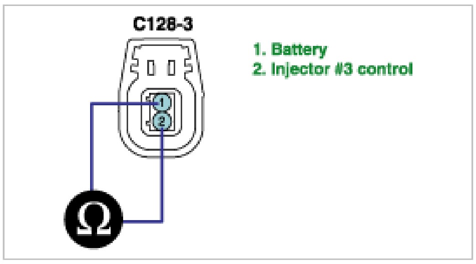
1. Check injector

(1) IG "OFF" and disconnect injector connector.

(2) Measure resistance between terminals 1 and 2 of injector connector.(Component side)

Specification :

Item	Coil resistance(Ω)
Injector	11.4 ~ 12.6Ω (at 20°C/ 68°F)



(3) Is the measured resistance within specification?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good injector and check for proper operation. If the problem is corrected, replace injector and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

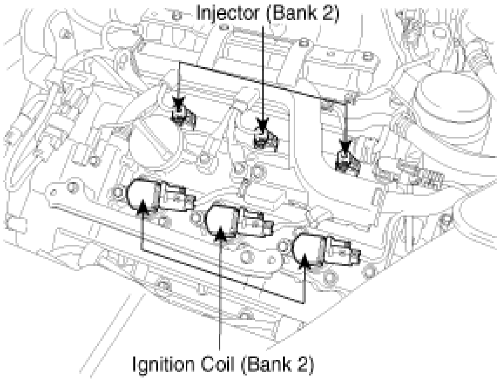
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0270

COMPONENT LOCATION



GENERAL DESCRIPTION

Electronically controlled fuel injector is a solenoid valve which supplies exactly calculated amount of fuel to engine for optimum conbustion under various engine load and speed. To meat air-fuel ratio required in system, PCM regulates fuel injection quantity as controlling injector solenoid operating duration referring air flow to cylinders and output signals from HO2S. For this precise control, quick response of solenoid is required and for perfect combustion, injection characteristic is important.

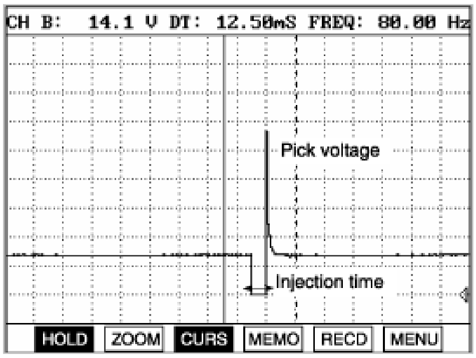
DTC DESCRIPTION

Checking output signals from injectors every 10 sec. under detecting condition, if an output signal is low for more than 5 sec., PCM sets P0270. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal Low	• Poor connection • Open or short to ground in power harness • Open or short to ground in control harness • Injector • PCM
Enable condition	• Engine running state • 11V ≤ Battery voltage ≤ 16V • Above conditions are met >0.5sec.	
threshold value	• Open or short to ground	
diagnosis time	• Continuous (More than 2 sec.failure for every 4 sec.test)	
MIL ON condition	• 2 driving cycles	

SIGNAL WAVEFROM AND DATA



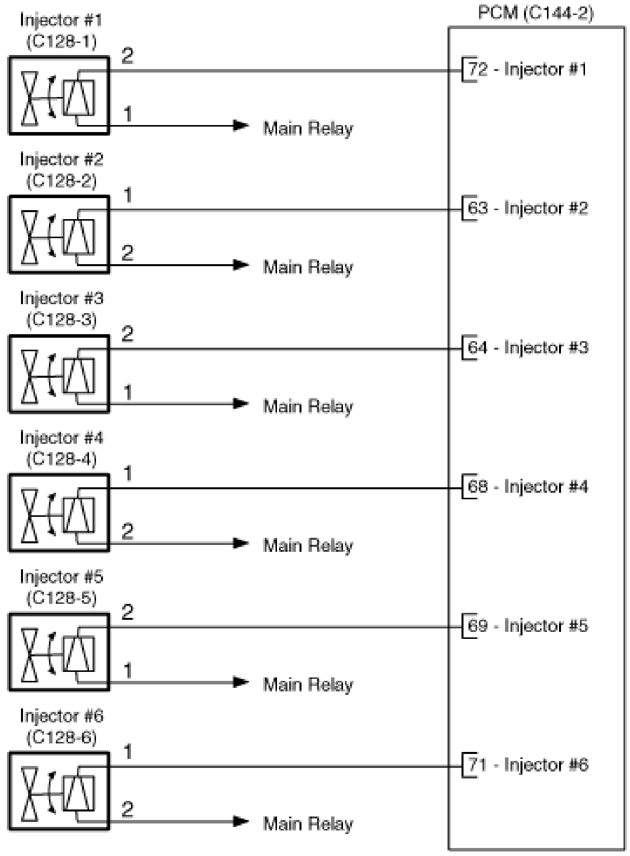
When the PCM energizes the injector by grounding control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the PCM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should be peak at a moment.

SPECIFICATION

Item	Coil resistance(Ω)
Injector	11.4 ~ 12.6Ω (at 20°C/ 68°F)

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Injector #1

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (72)	Injector #1 control

Injector #2

Terminal	Connected to	Funtion
1	PCM C144-2 (63)	Injector #2 control
2	Main Relay	Battery Voltage (B+)

Injector #3

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (64)	Injector #3 control

Injector #4

Terminal	Connected to	Funtion
1	PCM C144-2 (68)	Injector #4 control
2	Main Relay	Battery Voltage (B+)

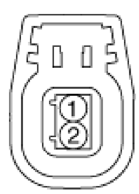
Injector #5

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (69)	Injector #5 control

Injector #6

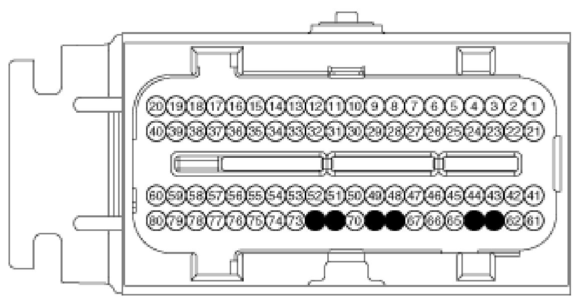
Terminal	Connected to	Funtion
1	PCM C144-2 (71)	Injector #6 control
2	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTORS]



C128-1,2,3,4,5,6

Injector #1,2,3,4,5,6

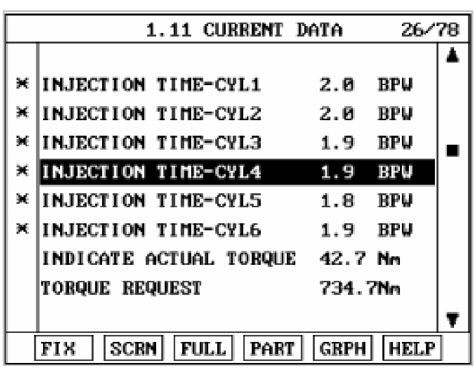


C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "fuel injection time" item on the service data.



4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

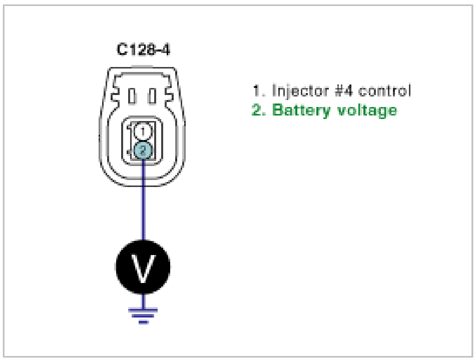
NO

▸ Go to "Terminaal and connector inspection" procedure.

POWER CIRCUIT INSPECTION

1. IG "ON" and disconnect injector connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 2 of injector harness connector and chassis ground.

Specification : B+



4. Is the measured voltage within specification?

YES

▸ Go to "Control Circuit Inspection" procedure.

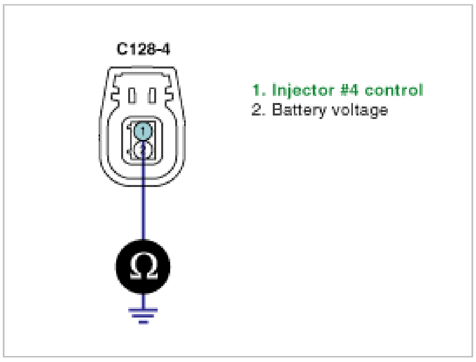
NO

▸ Check open or connection of the fuse connected to injector power supply.
▸ Repair open or short to ground in harness, and go to "Verification of Vehicle Repair' procedure.

CONTROL CIRCUIT INSPECTION

1. Check short to ground in harness
   (1) IG "OFF" and disconnect injector connector and PCM connector.
   (2) Measure resistance between terminal 1 of injector harness connector and chassis ground.

   Specification : Infinite



(3) Is the measured resistance within specification?

YES

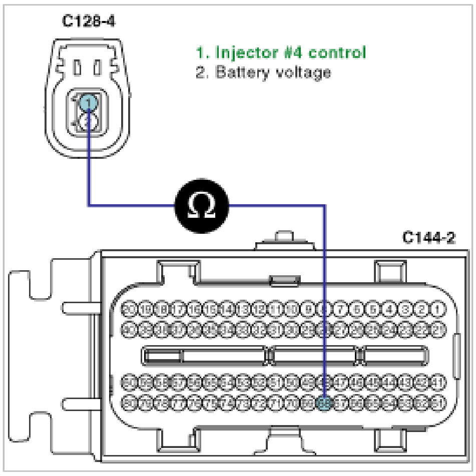
▸ Go to "Check open in harness" as follows.

NO

▸ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness
   (1) IG "OFF" and disconnect injector connector and PCM connector.
   (2) Measure resistance between terminal 1 of injector harness connector and 68 of PCM harness connector.

Specification : Below 1Ω



(3) Is the measured resistance within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

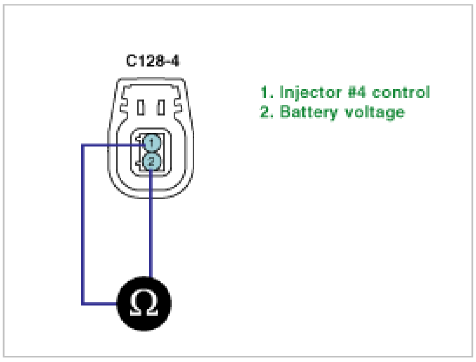
▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check injector
   (1) IG "OFF" and disconnect injector connector.
   (2) Measure resistance between terminals 1 and 2 of injector connector.(Component side)

Specification :

Item	Coil resistance(Ω)
Injector	11.4 ~ 12.6Ω (at 20°C/ 68°F)



(3) Is the measured resistance within specification?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good injector and check for proper operation. If the problem is corrected, replace injector and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

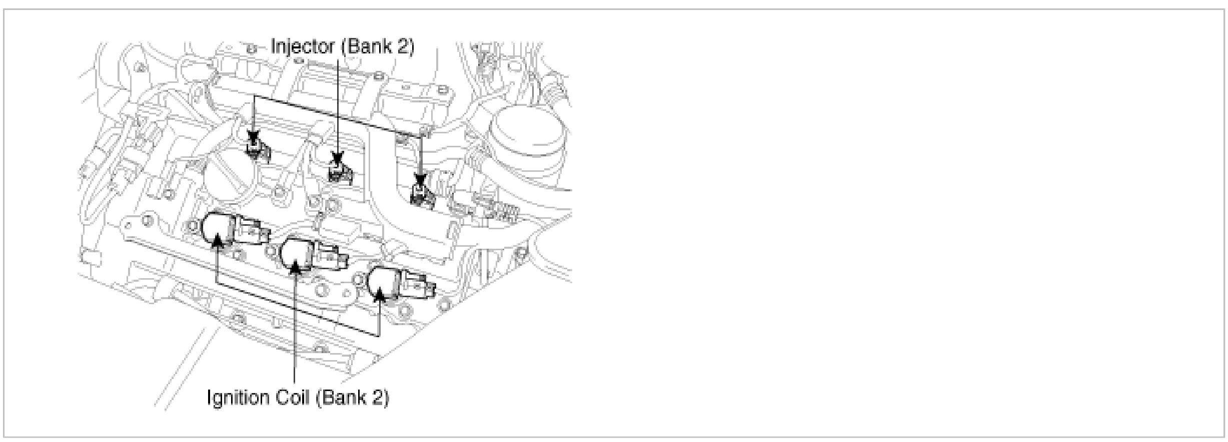
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0271

COMPONENT LOCATION



GENERAL DESCRIPTION

Electronically controlled fuel injector is a solenoid valve which supplies exactly calculated amount of fuel to engine for optimum conbustion under various engine load and speed. To meat air-fuel ratio required in system, PCM regulates fuel injection quantity

as controlling injector solenoid operating duration referring air flow to cylinders and output signals from HO2S. For this precise control, quick response of solenoid is required and for perfect combustion, injection characteristic is important.

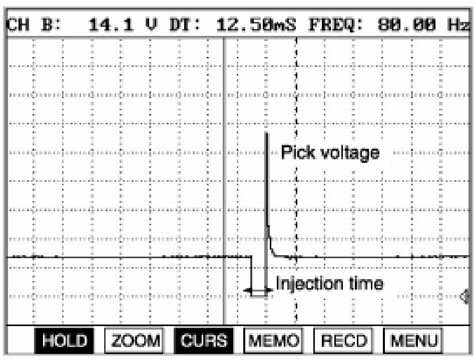
DTC DESCRIPTION

Checking output signals from injectors every 10 sec. under detecting condition, if an output signal is high for more than 5 sec., PCM sets P0271. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal High	• Poor connection • Short to battery in harness • Injector • PCM
Enable condition	• Engine running state • 11V ≤ Battery voltage ≤ 16V • Above conditions are met >0.5sec.	
Threshold value	• Short to battery	
Diagnosis time	• Continuous (More than 2 sec.failure for every 4 sec.test)	
MIL ON condition	• 2 driving cycles	

SIGNAL WAVEFROM AND DATA



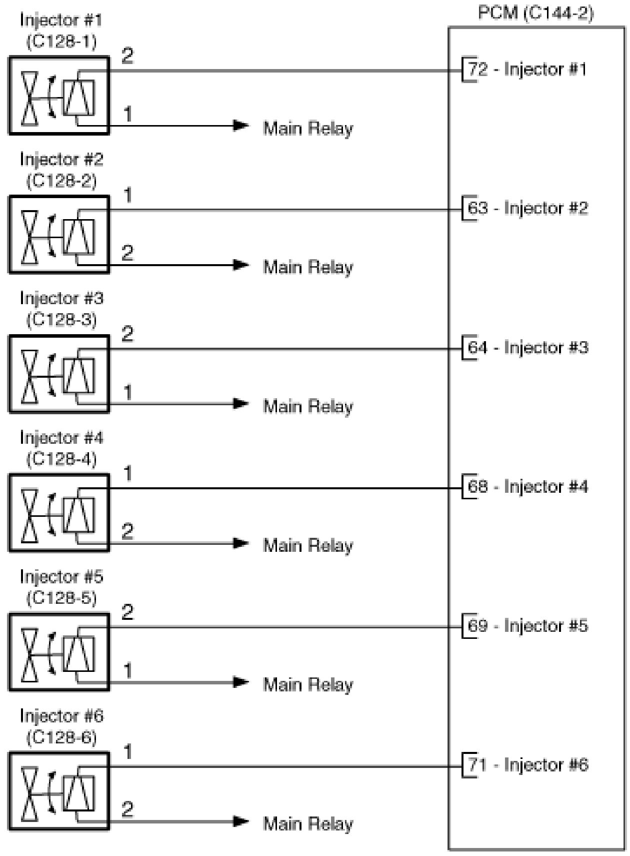
When the PCM energizes the injector by grounding control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the PCM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should be peak at a moment.

SPECIFICATION

Item	Coil resistance(Ω)
Injector	11.4 ~ 12.6Ω (at 20°C/ 68°F)

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Injector #1

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (72)	Injector #1 control

Injector #2

Terminal	Connected to	Funtion
1	PCM C144-2 (63)	Injector #2 control
2	Main Relay	Battery Voltage (B+)

Injector #3

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (64)	Injector #3 control

Injector #4

Terminal	Connected to	Funtion
1	PCM C144-2 (68)	Injector #4 control
2	Main Relay	Battery Voltage (B+)

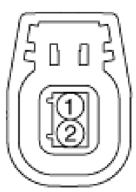
Injector #5

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (69)	Injector #5 control

Injector #6

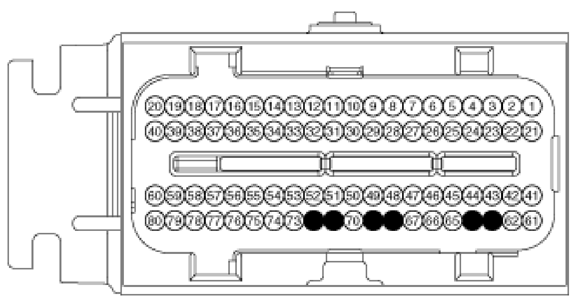
Terminal	Connected to	Funtion
1	PCM C144-2 (71)	Injector #6 control
2	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTORS]



C128-1,2,3,4,5,6

Injector #1,2,3,4,5,6

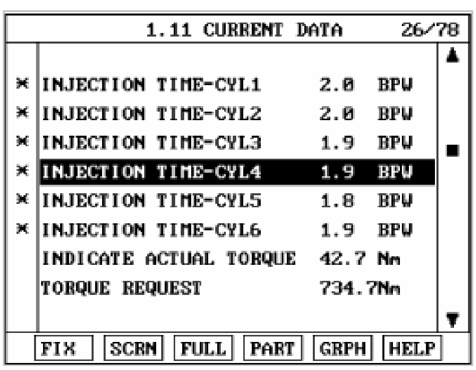


C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "fuel injection time" item on the service data.



4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

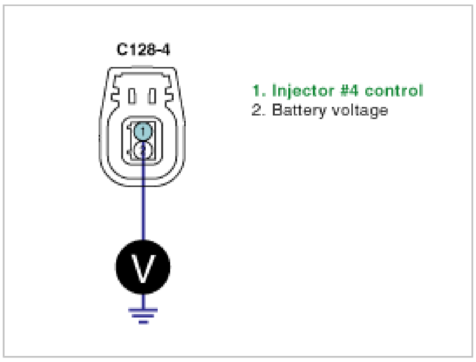
NO

▸ Go to "Control Circuit Inspection" procedure.

CONTROL CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF" and disconnect injector connector.
   (2) IG "ON" and ENG "OFF"
   (3) Measure voltage between terminal 1 of injector harness connector and chassis ground.

   Specification : Approx. 0V



   (4) Is the measured voltage within specification?

   YES

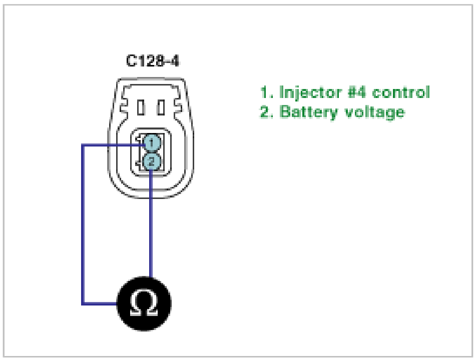
   ▸ Go to "Component Inspection" procedure.

   NO

   ▸ Go to "Check short to battery in harness" as follows.

2. Check short to battery in harness
   (1) IG "OFF" and disconnect injector connector and PCM connector.
   (2) Measure resistance between terminals 1 and 2 of injector harness connector.

   Specification : Below 1Ω



(3) Is the measured resistance within specification?

YES

▸ Go to "Component Inspection" procedure.

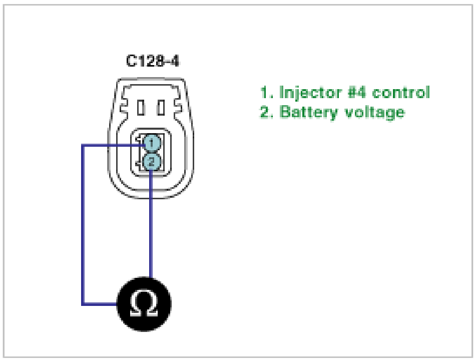
NO

▸ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check injector
   (1) IG "OFF" and disconnect injector connector.
   (2) Measure resistance between terminals 1 and 2 of injector connector.(Component side)
   Specification :

Item	Coil resistance(Ω)
Injector	11.4 ~ 12.6Ω (at 20°C/ 68°F)



(3) Is the measured resistance within specification?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good injector and check for proper operation. If the problem is corrected, replace injector and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "

5. Are any DTCs present ?

YES

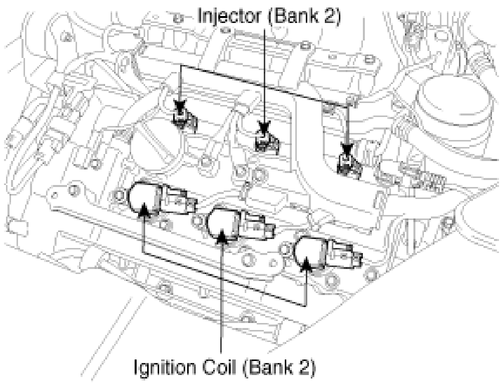
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0273

COMPONENT LOCATION



GENERAL DESCRIPTION

Electronically controlled fuel injector is a solenoid valve which supplies exactly calculated amount of fuel to engine for optimum conbustion under various engine load and speed. To meat air-fuel ratio required in system, PCM regulates fuel injection quantity as controlling injector solenoid operating duration referring air flow to cylinders and output signals from HO2S. For this precise control, quick response of solenoid is required and for perfect combustion, injection characteristic is important.

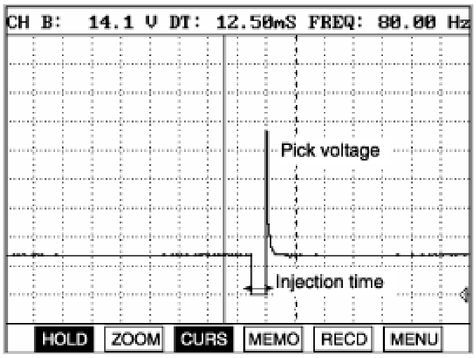
DTC DESCRIPTION

Checking output signals from injectors every 10 sec. under detecting condition, if an output signal is low for more than 5 sec., PCM sets P0273. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal Low	• Poor connection • Open or short to ground in power harness • Open or short to ground in control harness • Injector • PCM
Enable condition	• Engine running state • 11V ≤ Battery voltage ≤ 16V • Above conditions are met >0.5sec.	
Threshold value	• Open or short to ground	
Diagnosis time	• Continuous (More than 2 sec.failure for every 4 sec.test)	
MIL ON condition	• 2 driving cycles	

SIGNAL WAVEFROM AND DATA



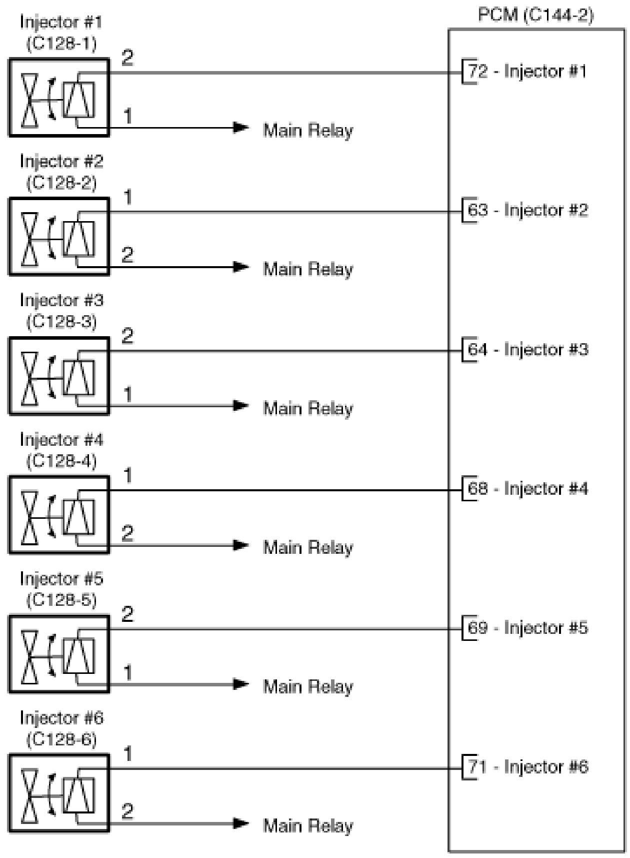
When the PCM energizes the injector by grounding control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the PCM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should be peak at a moment.

SPECIFICATION

Item	Coil resistance(Ω)
Injector	11.4 ~ 12.6Ω (at 20°C/ 68°F)

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Injector #1

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (72)	Injector #1 control

Injector #2

Terminal	Connected to	Funtion
1	PCM C144-2 (63)	Injector #2 control
2	Main Relay	Battery Voltage (B+)

Injector #3

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (64)	Injector #3 control

Injector #4

Terminal	Connected to	Funtion
1	PCM C144-2 (68)	Injector #4 control
2	Main Relay	Battery Voltage (B+)

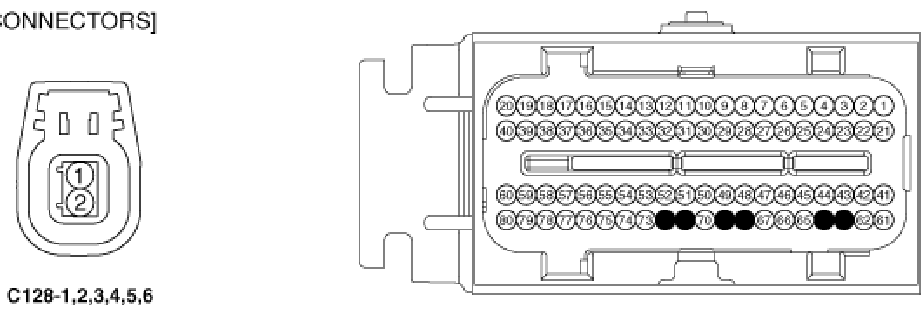
Injector #5

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (69)	Injector #5 control

Injector #6

Terminal	Connected to	Funtion
1	PCM C144-2 (71)	Injector #6 control
2	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTORS]



C128-1,2,3,4,5,6

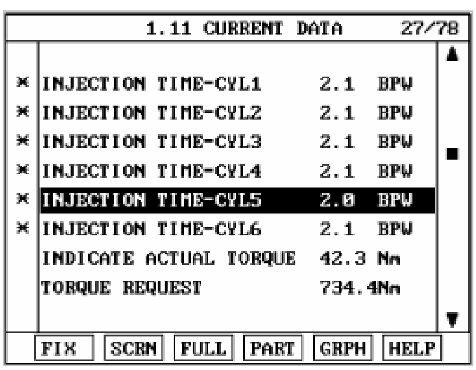
Injector #1,2,3,4,5,6

C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "fuel injection time" item on the service data.



4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

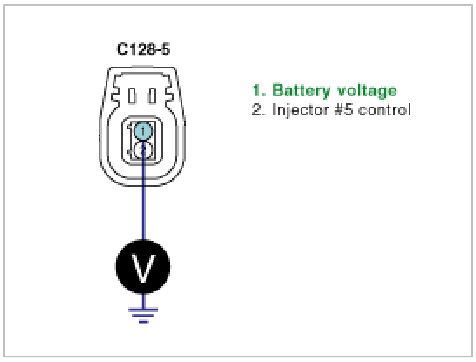
NO

▸ Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION

1. IG "ON" and disconnect injector connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of injector harness connector and chassis ground.

Specification : B+



4. Is the measured voltage within specification?

YES

▸ Go to "Control Circuit Inspection" procedure.

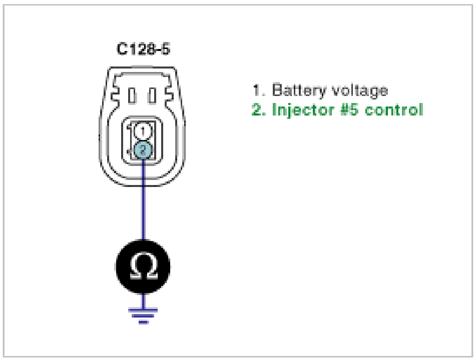
NO

▸ Check open or connection of the fuse connected to injector power supply.
▸ Repair open or short to ground in harness, and go to "Verification of Vehicle Repair' procedure.

CONTROL CIRCUIT INSPECTION

1. Check short to ground in harness
   (1) IG "OFF" and disconnect injector connector and PCM connector.
   (2) Measure resistance between terminal 2 of injector harness connector and chassis ground.

   Specification : Infinite



(3) Is the measured resistance within specification?

YES

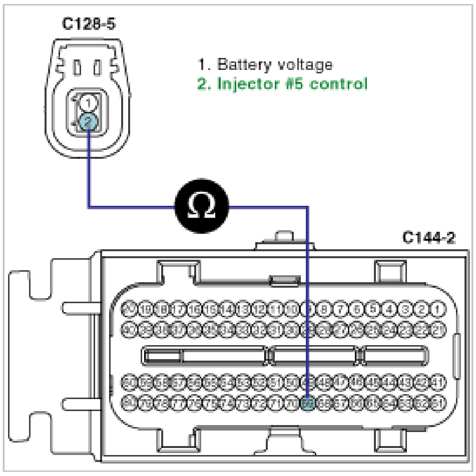
▸ Go to "Check open in harness" as follows.

NO

▸ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness
   (1) IG "OFF" and disconnect injector connector and PCM connector.
   (2) Measure resistance between terminal 2 of injector harness connector and 69 of PCM harness connector.

Specification : Below 1Ω



(3) Is the measured resistance within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

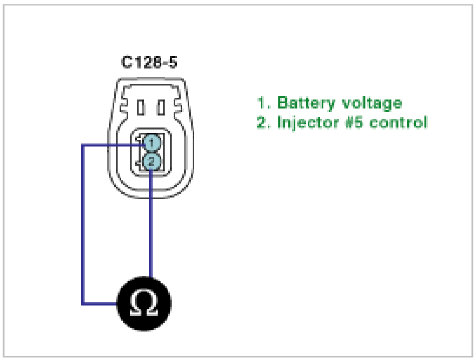
▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check injector
   (1) IG "OFF" and disconnect injector connector.
   (2) Measure resistance between terminals 1 and 2 of injector connector.(Component side)

Specification :

Item	Coil resistance(Ω)
Injector	11.4 ~ 12.6Ω (at 20°C/ 68°F)



(3) Is the measured resistance within specification?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good injector and check for proper operation. If the problem is corrected, replace injector and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

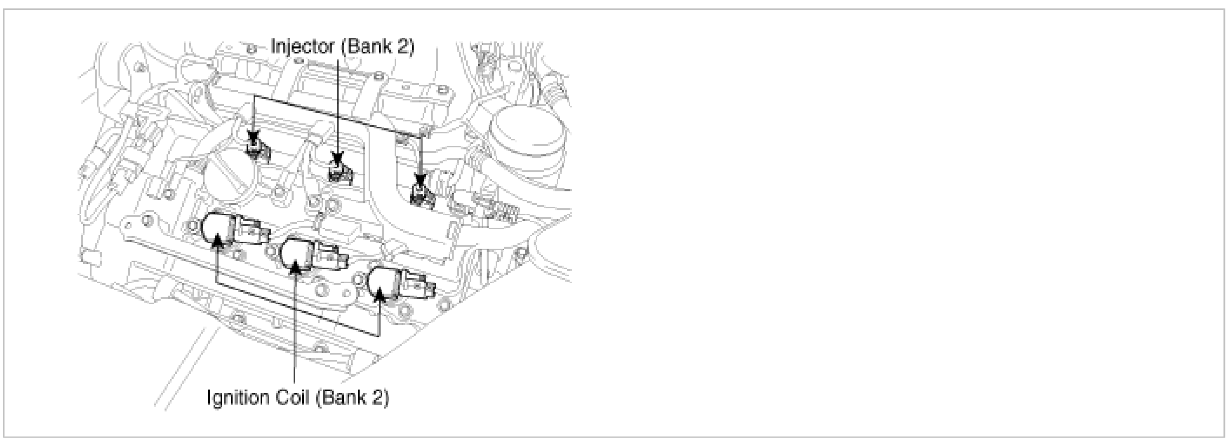
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0274

COMPONENT LOCATION



GENERAL DESCRIPTION

Electronically controlled fuel injector is a solenoid valve which supplies exactly calculated amount of fuel to engine for optimum conbustion under various engine load and speed. To meat air-fuel ratio required in system, PCM regulates fuel injection quantity

as controlling injector solenoid operating duration referring air flow to cylinders and output signals from HO2S. For this precise control, quick response of solenoid is required and for perfect combustion, injection characteristic is important.

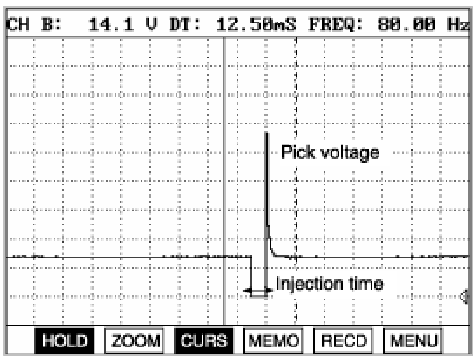
DTC DESCRIPTION

Checking output signals from injectors every 10 sec. under detecting condition, if an output signal is high for more than 5 sec., PCM sets P0274. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal High	• Poor connection • Short to battery in harness • Injector • PCM
Enable condition	• Engine running state • 11V ≤ Battery voltage ≤ 16V • Above conditions are met >0.5sec.	
Threshold value	• Short to battery	
Diagnosis time	• Continuous (More than 2 sec.failure for every 4 sec.test)	
MIL ON condition	• 2 driving cycles	

SIGNAL WAVEFROM AND DATA



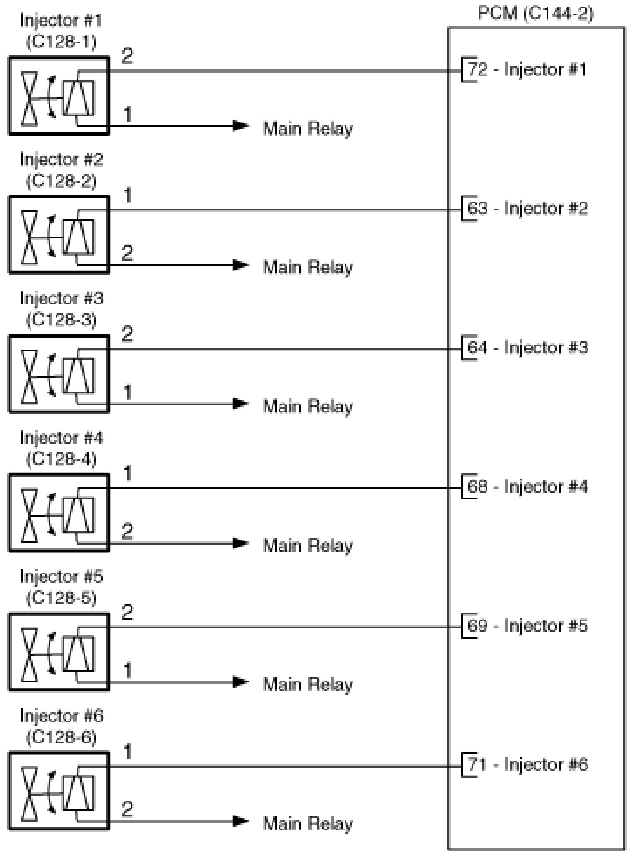
When the PCM energizes the injector by grounding control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the PCM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should be peak at a moment.

SPECIFICATION

Item	Coil resistance(Ω)
Injector	11.4 ~ 12.6Ω (at 20°C/ 68°F)

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Injector #1

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (72)	Injector #1 control

Injector #2

Terminal	Connected to	Funtion
1	PCM C144-2 (63)	Injector #2 control
2	Main Relay	Battery Voltage (B+)

Injector #3

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (64)	Injector #3 control

Injector #4

Terminal	Connected to	Funtion
1	PCM C144-2 (68)	Injector #4 control
2	Main Relay	Battery Voltage (B+)

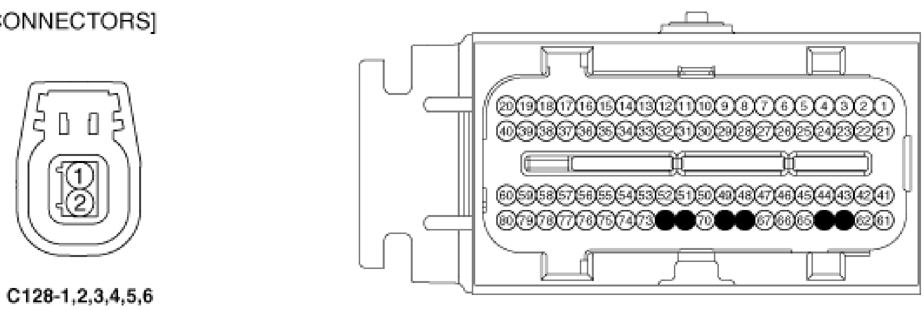
Injector #5

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (69)	Injector #5 control

Injector #6

Terminal	Connected to	Funtion
1	PCM C144-2 (71)	Injector #6 control
2	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTORS]



C128-1,2,3,4,5,6

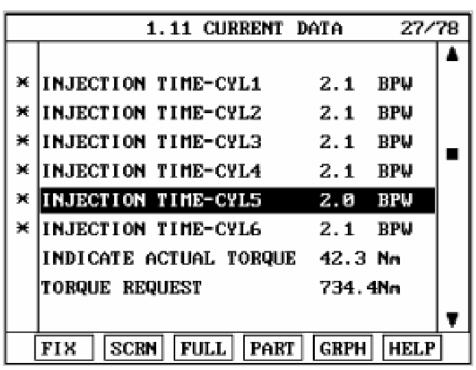
Injector #1,2,3,4,5,6

C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "fuel injection time" item on the service data.



4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

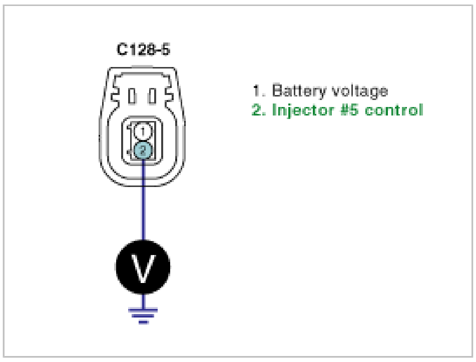
NO

▸ Go to "Control Circuit Inspection" procedure.

CONTROL CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF" and disconnect injector connector.
   (2) IG "ON" and ENG "OFF"
   (3) Measure voltage between terminal 2 of injector harness connector and chassis ground.

   Specification : Approx. 0V



   (4) Is the measured voltage within specification?

   YES

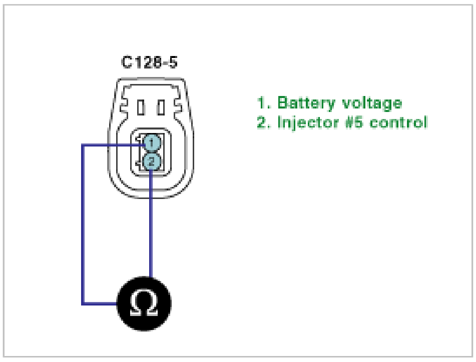
   ▸ Go to "Component Inspection" procedure.

   NO

   ▸ Go to "Check short to battery in harness" as follows.

2. Check short to battery in harness
   (1) IG "OFF" and disconnect injector connector and PCM connector.
   (2) Measure resistance between terminals 1 and 2 of injector harness connector.

   Specification : Below 1Ω



(3) Is the measured resistance within specification?

YES

▸ Go to "Component Inspection" procedure.

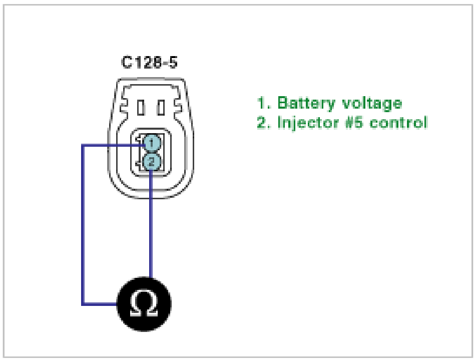
NO

▸ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check injector
   (1) IG "OFF" and disconnect injector connector.
   (2) Measure resistance between terminals 1 and 2 of injector connector.(Component side)
   Specification :

Item	Coil resistance(Ω)
Injector	11.4 ~ 12.6Ω (at 20°C/ 68°F)



(3) Is the measured resistance within specification?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good injector and check for proper operation. If the problem is corrected, replace injector and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "

5. Are any DTCs present ?

YES

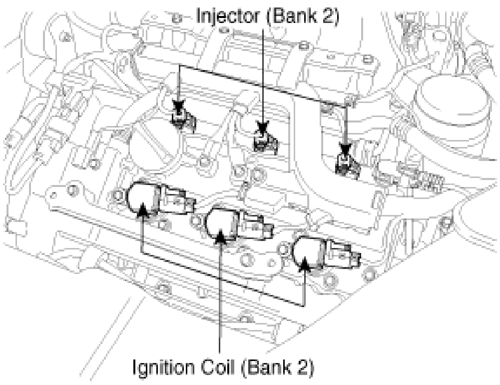
▸ Go to the applicable troubleshooooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0276

COMPONENT LOCATION



GENERAL DESCRIPTION

Electronically controlled fuel injector is a solenoid valve which supplies exactly calculated amount of fuel to engine for optimum conbustion under various engine load and speed. To meat air-fuel ratio required in system, PCM regulates fuel injection quantity as controlling injector solenoid operating duration referring air flow to cylinders and output signals from HO2S. For this precise control, quick response of solenoid is required and for perfect combustion, injection characteristic is important.

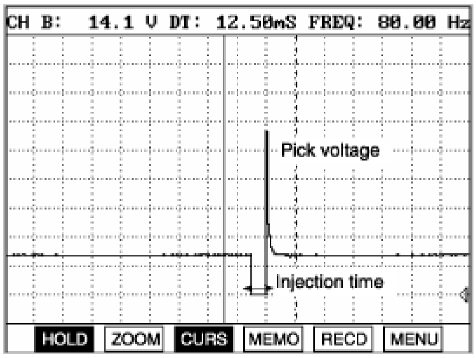
DTC DESCRIPTION

Checking output signals from injectors every 10 sec. under detecting condition, if an output signal is low for more than 5 sec., PCM sets P0276. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal Low	• Poor connection • Open or short to ground in power harness • Open or short to ground in control harness • Injector • PCM
Enable condition	• Engine running state • 11V ≤ Battery voltage ≤ 16V • Above conditions are met > 0.5sec.	
Threshold value	• Open or short to ground	
Diagnosis time	• Continuous (More than 2 sec.failure for every 4 sec.test)	
MIL ON condition	• 2 driving cycles	

SIGNAL WAVEFROM AND DATA



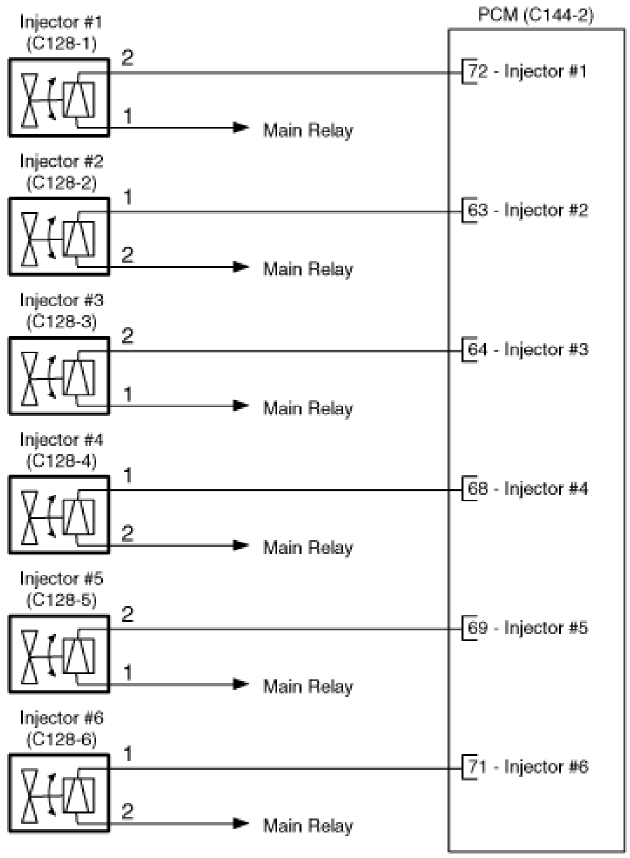
When the PCM energizes the injector by grounding control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the PCM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should be peak at a moment.

SPECIFICATION

Item	Coil resistance(Ω)
Injector	11.4 ~ 12.6Ω (at 20°C/ 68°F)

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Injector #1

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (72)	Injector #1 control

Injector #2

Terminal	Connected to	Funtion
1	PCM C144-2 (63)	Injector #2 control
2	Main Relay	Battery Voltage (B+)

Injector #3

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (64)	Injector #3 control

Injector #4

Terminal	Connected to	Funtion
1	PCM C144-2 (68)	Injector #4 control
2	Main Relay	Battery Voltage (B+)

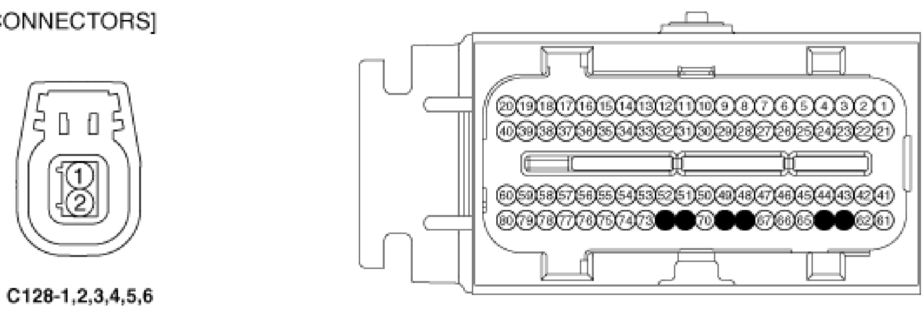
Injector #5

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (69)	Injector #5 control

Injector #6

Terminal	Connected to	Funtion
1	PCM C144-2 (71)	Injector #6 control
2	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTORS]



C128-1,2,3,4,5,6

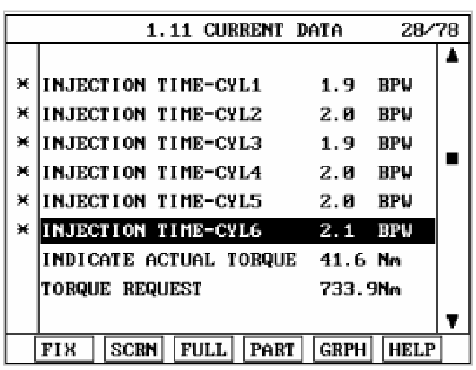
Injector #1,2,3,4,5,6

C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "fuel injection time" item on the service data.



4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

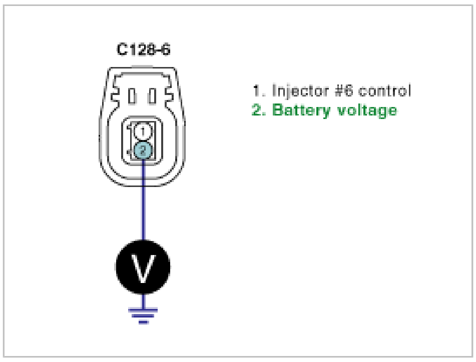
NO

▸ Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION

1. IG "ON" and disconnect injector connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 2 of injector harness connector and chassis ground.

Specification : B+



4. Is the measured voltage within specification?

YES

▸ Go to "Control Circuit Inspection" procedure.

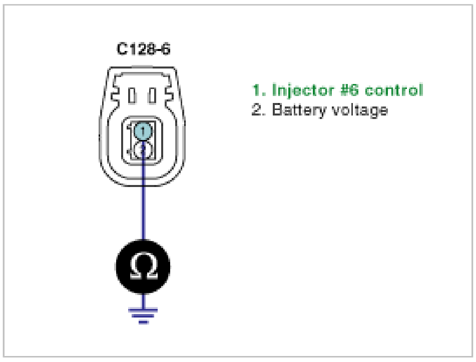
NO

▸ Check open or connection of the fuse connected to injector power supply.
▸ Repair open or short to ground in harness, and go to "Verification of Vehicle Repair' procedure.

CONTROL CIRCUIT INSPECTION

1. Check short to ground in harness
   (1) IG "OFF" and disconnect injector connector and PCM connector.
   (2) Measure resistance between terminal 1 of injector harness connector and chassis ground.

   Specification : Infinite



(3) Is the measured resistance within specification?

YES

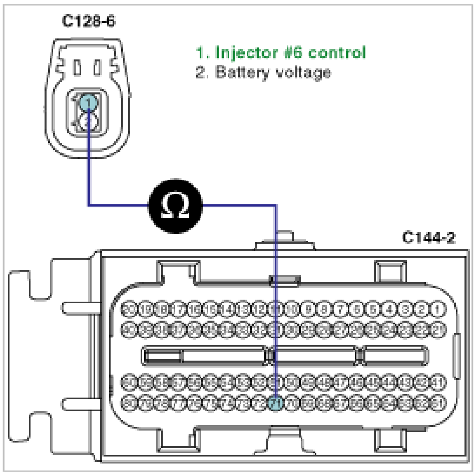
▸ Go to "Check open in harness" as follows.

NO

▸ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness
   (1) IG "OFF" and disconnect injector connector and PCM connector.
   (2) Measure resistance between terminal 1 of injector harness connector and 71 of PCM harness connector.

Specification : Below 1Ω



(3) Is the measured resistance within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

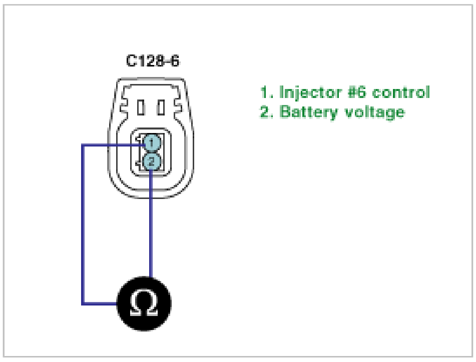
▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check injector
   (1) IG "OFF" and disconnect injector connector.
   (2) Measure resistance between terminals 1 and 2 of injector connector.(Component side)

Specification :

Item	Coil resistance(Ω)
Injector	11.4 ~ 12.6Ω (at 20°C/ 68°F)



(3) Is the measured resistance within specification?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good injector and check for proper operation. If the problem is corrected, replace injector and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

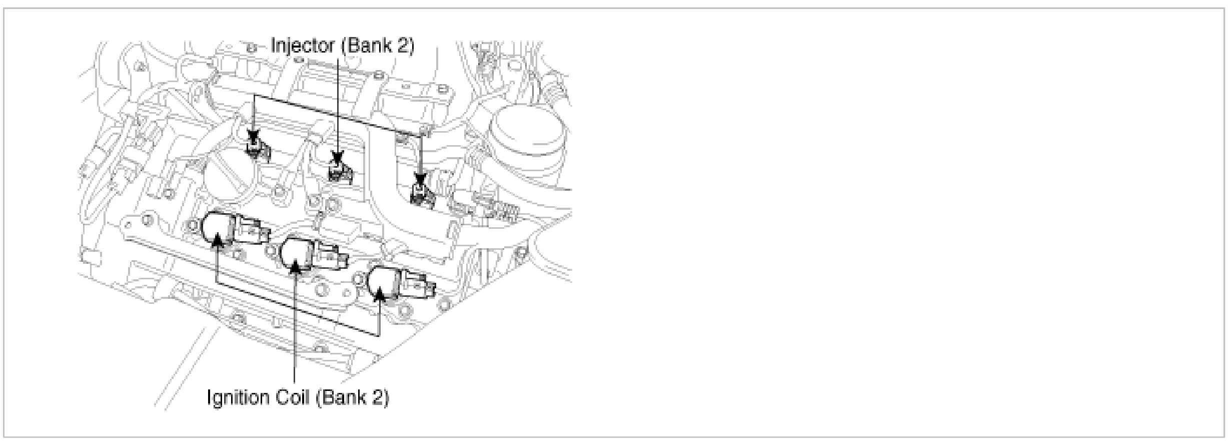
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0277

COMPONENT LOCATION



GENERAL DESCRIPTION

Electronically controlled fuel injector is a solenoid valve which supplies exactly calculated amount of fuel to engine for optimum conbustion under various engine load and speed. To meat air-fuel ratio required in system, PCM regulates fuel injection quantity

as controlling injector solenoid operating duration referring air flow to cylinders and output signals from HO2S. For this precise control, quick response of solenoid is required and for perfect combustion, injection characteristic is important.

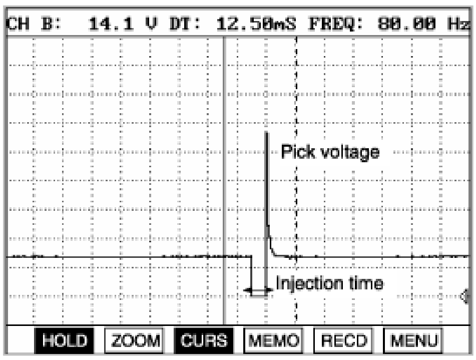
DTC DESCRIPTION

Checking output signals from injectors every 10 sec. under detecting condition, if an output signal is high for more than 5 sec., PCM sets P0277. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal High	• Poor connection • Short to battery in harness • Injector • PCM
Enable condition	• Engine running state • 11V ≤ Battery voltage ≤ 16V • Above conditions are met >0.5sec.	
Threshold value	• Short to battery	
Diagnosis time	• Continuous (More than 2 sec.failure for every 4 sec.test)	
MIL ON condition	• 2 driving cycles	

SIGNAL WAVEFROM AND DATA



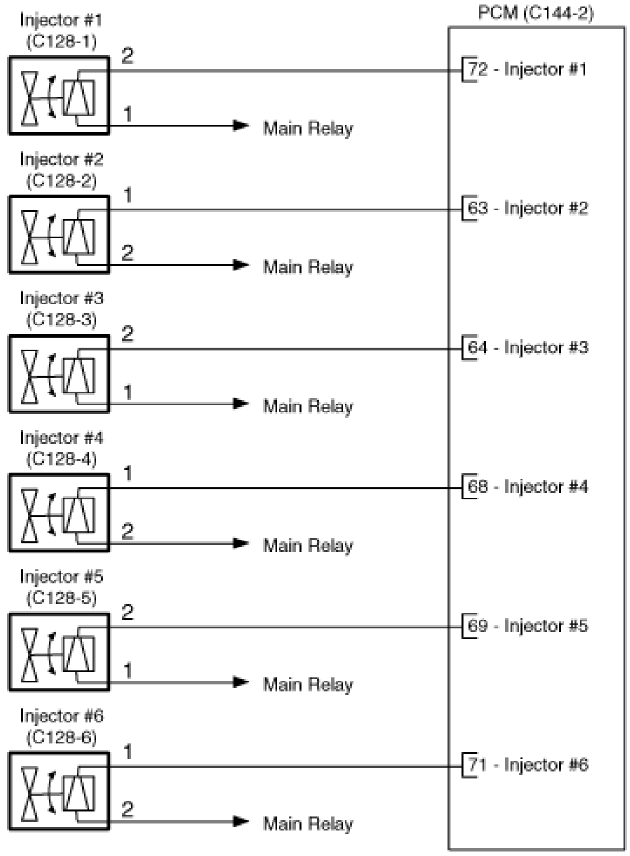
When the PCM energizes the injector by grounding control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the PCM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should be peak at a moment.

SPECIFICATION

Item	Coil resistance(Ω)
Injector	11.4 ~ 12.6Ω (at 20°C/ 68°F)

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Injector #1

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (72)	Injector #1 control

Injector #2

Terminal	Connected to	Funtion
1	PCM C144-2 (63)	Injector #2 control
2	Main Relay	Battery Voltage (B+)

Injector #3

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (64)	Injector #3 control

Injector #4

Terminal	Connected to	Funtion
1	PCM C144-2 (68)	Injector #4 control
2	Main Relay	Battery Voltage (B+)

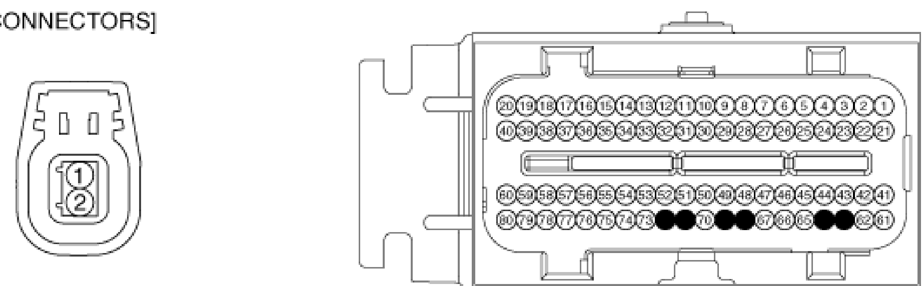
Injector #5

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (69)	Injector #5 control

Injector #6

Terminal	Connected to	Funtion
1	PCM C144-2 (71)	Injector #6 control
2	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTORS]



C128-1,2,3,4,5,6

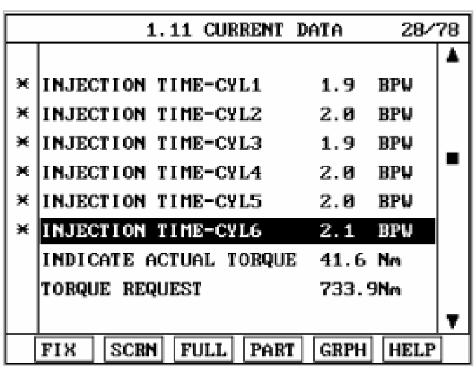
Injector #1,2,3,4,5,6

C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "fuel injection time" item on the service data.



4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

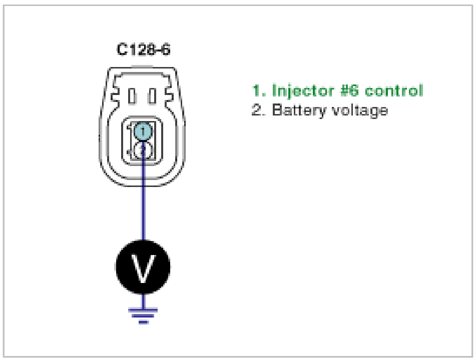
NO

▸ Go to "Control Circuit Inspection" procedure.

CONTROL CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF" and disconnect injector connector.
   (2) IG "ON" and ENG "OFF"
   (3) Measure voltage between terminal 1 of injector harness connector and chassis ground.

   Specification : Approx. 0V



   (4) Is the measured voltage within specification?

YES

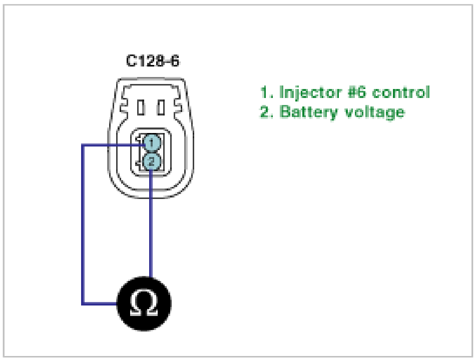
▸ Go to "Component Inspection" procedure.

NO

▸ Go to "Check short to battery in harness" as follows.

2. Check short to battery in harness
   (1) IG "OFF" and disconnect injector connector and PCM connector.
   (2) Measure resistance between terminals 1 and 2 of injector harness connector.

   Specification : Below 1Ω



(3) Is the measured resistance within specification?

YES

▸ Go to "Component Inspection" procedure.

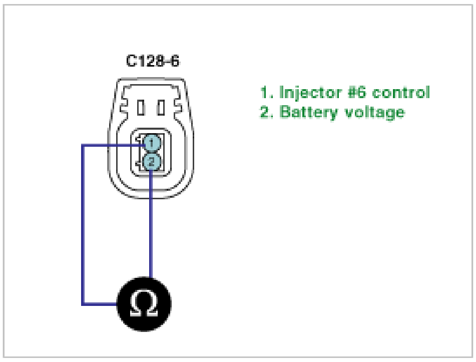
NO

▸ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check injector
   (1) IG "OFF" and disconnect injector connector.
   (2) Measure resistance between terminals 1 and 2 of injector connector.(Component side)
   Specification :

Item	Coil resistance(Ω)
Injector	11.4 ~ 12.6Ω (at 20°C/ 68°F)



(3) Is the measured resistance within specification?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good injector and check for proper operation. If the problem is corrected, replace injector and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "

5. Are any DTCs present ?

YES

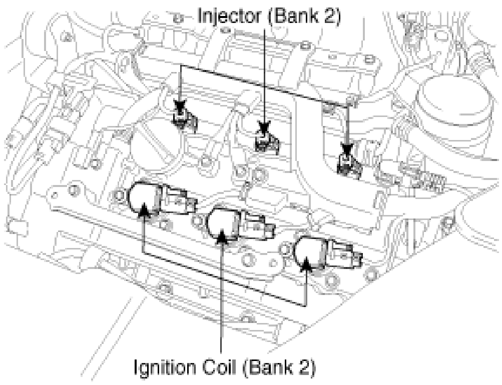
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0300

COMPONENT LOCATION



GENERAL DESCRIPTION

Misfires can be caused by lack of combustion in a cylinder due to absence of spark, poor fuel metering, poor compression, or many other causes. Even a small number of misfires may result in excessive exhaust emissions due to the unburned mixture. Increased misfire rates cause damage to the catalytic converter. The PCM monitors the crankshaft speed variation to determine if any misfiring generated. The PCM identifies the specific cylinder in which the misfire has occurred and counts individual misfire events by monitoring changes in the crankshaft rotation for each cylinder. A random misfire indicates two or more cylinders are misfiring.

DTC DESCRIPTION

The misfire diagnostic measures reference event times and calculates the positive and negative acceleration of the crank wheel to detrmine whether a misfire has occurred.
When the rate of misfire exceeds a threshold where the catalyst reaches a temperature where permanent damage can ocur, to the point that tail pipe emissions reach 1.5 times the tailpipe standard or where a cylinder misfire cause a loss of torque produced from that cylinder. PCM sets P0300. In case that misfire affects Catalyst damage, MIL(Malfunction Indicatin Lamp) will be illuminating and blinking at 1HZ frequency. However, In case of Indivisual and Emission damaging misfire, MIL will be turned on when the malfunction is detected.
Especially, if injector connector is disconnected for more than 46 sec., PCM sets DTC relating to misfire and conducts the fuel-cut to protect the catalyst.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible Cause
DTC Strategy		• Determine if a multiple cylinder misfire or a cylinder specific misfire is occurring by monitoring crankshaft acceleration.	
	Case 1	• Misfre Not Delayed (No active delays) • All delays expired (Misfire Delay Counter = 0) • Not the Air Conditioning Clutch is changing state • The number of engine cycles to delay misfire detection after the air conditioner has changed states.	
	Case 2	• The number of engine cycles to delay misfire detection if the engine is operating in a region where misfire is undetectable ≥ 10 engine cycles	
		• The time that most delays will not be enabled ≥ 10sec • If the engine load ≥ thrshold (based on vehicle speed) then the engine is considered to	

Enable condition	Case 3	be operation under negative torque conditions • Number of engine cycles to delay the misfire diagnostic ≥ 11 engine cycles (If negative torque load condition is detected. Negative torque is determined by load conditions less than a 'zero torque' line which is determined by engine speed and engine coolant temperature.) • The vehicle is in the manufacturing plant. • This is not first crank • Engine Runtime >30 (Amount of time to delay the Misfire Diagnostic on the initial vehicle start when the vehicle is being manufactured in the plant. This delay will only occur once in the life of the vehicle and is used to prevent misfire on the initial start due to a lack of fuel) • The misfire diagnostic is synchronization with the cam event. • The number of engine cycles to delay misfire detection if a cam synchronization problem is detected internal to the Misfire diagnostic >30 engine cycles If false information is received, a false misfire could be diagnosed. • Intrusive diagnostics not enabled (EGR FLOW) • Number of engine cycles to delay the misfire diagnostic if any intrusive diagnostic test that could potentially interfere with the misfire diagnostic detectability has been determined to be active • Fuel Level(Present) >0.15% • No fuel level fault • Vehicle not in plant • Engine cycles ≥ 500 • All cylinders fueled = 6 • Non in Fuel cut off not DFCO(Decelleration Fuel Cut Off) or not High Vehicle Speed Fuel Shut Off or not High RPM Fuel Shut Off • Transmission Shift in progress • Engine cycles ≥ 0 Increasing Throttle • Current Thorttle opening(WTHROT) >31ms old throttle opening(VVTHROT 31ms old) • VVTHROT - VVTHROT 31ms old< 64.9994% (Maximum positive delta throttle movement allowed in a 125 ms period (31.25 ms if using ETC). If the throttle position increases more than this threshold, the misfire diagnostic will be inhibited.) Decreasing Throttle • VVTHROT 31ms old >VVTHROT • VVTHROT 31ms old - VVTHROT < 100% • For engine cycles ≥ 5 • Engine RPM ≥ 7100 • Engine cycles >4999 • Crankshaft speed patterns normal • The seconds that most delays will not be enabled ≥ 10 • The number of consecutive positive delta times < 60 events • For engine cycles ≥ 8 • The number of consecutive negative delta times < 30 events • For engine cycles ≥ 8 • The seconds that most delays will not be enabled ≥ 10 • This is the value which is multiplied The number of consecutive positive delta times with multiple values of the number of consecutive negative delta times and The	• Faulty Spark plugs • Faulty Spark plug cables • Air Leakage • Belt deflection and Air gap of

		number of consecutive positive delta times while within the power-up no-delay timer.< 200 * 1 events • For engine cycles ≥ 8 • This is the value which is multiplied The number of consecutive positive delta times with multiple values of the number of consecutive negative delta times and The number of consecutive positive delta times while within the power-up no-delay timer.< 200 * 1 events • For engine cycles ≥ 8 Not negative torque driving conditions • throttle not less than threshold < 0% • while vehicle speed > 511KPH • For engine cycles ≥ 7 Engine Speed with in range • Run Time ≥ 10 • 470 < Engine RPM < 6600 • For engine cycles ≥ 15 • TEC(Tooth Error Correction) factor not learned • RPM >1600 • For engine Cycles ≥ 40 Ignition Voltage in range • Run Time > 10 • 10.9936 < Battery Voltage < 15.9907 • For engine cycles ≥ 15 Coolant Temperature in range If (start up coolant temperature < cold start thresh and coolant temperature greater that after cold start thresh) • Coolant temperature at start-up < -7°C(19.4 °F) • Calculated coolant temperature with default applied > 21°C (69.8 °F) Else if(coolant temperature greater that lo threshold and coolant temperature less than High threshold) • Calculated coolant temperature with default applied > -7°C (19.4 °F) • Calculated coolant temperature with default applied > 120° C(248 °F) • For engine cycles ≥ 15 Power Up delay not active • Run time > 0 Misfire not requesting TCC unlock and TCC still locked • For engine cycles ≥ 0 no disabling faults present / no disabiling Active Faults • P0340 / P0341 / P0118 / P0117 / P0115 / P0336 / P0335 / P1295 / P0103 / P0102 / 0108 / P0107 / P0106 / P0501 • Run Time< 10 • Engine Load is below zero torque line. • RPM < 1500 • For engine cycles ≥ 11	CKPS • Incorrect timing • Faulty injector • Improper fuel pressure • Improper engine compression • Faulty PCM
Thresh old value	Case 1	• Individual event misfire detection > Threshold	
	Case 2	• Emissions damaging >Threshold	
	Case 3	• Catalyst damaging > Threshold	
Diagnosis time		• Continuous	
MIL ON condition		• 2 driving cycles	

MONITOR SCANTOOL DATA

1. Is the power balance test done?

YES

▸ If injector connector for power balance test is disconnect for over 46 sec., this can cause DTC relating to misfire. Stop the test and connect it and delete DTC and then go to "Verification of Vehicle repair" procedure.

▸ If power balance test is finished within 46 sec., go to next procedure.

NO

▸ Go to "Monitor scantool data" as follows.

2. Monitor scantool data

(1) Ignition "OFF"

(2) Connect Scantool and Engine "ON"

(3) Monitor parameters related to "Random Misfire Detected" on CURRENT DATA

Specification :

Ignition	BTDC 10° ± 5°		
Idle speed	A/CON OFF	Neutral, N, R, P-range	620 ± 100 rpm
		D-range	
	A/CON ON	Neutral, N, R, P-range	
		D-range	

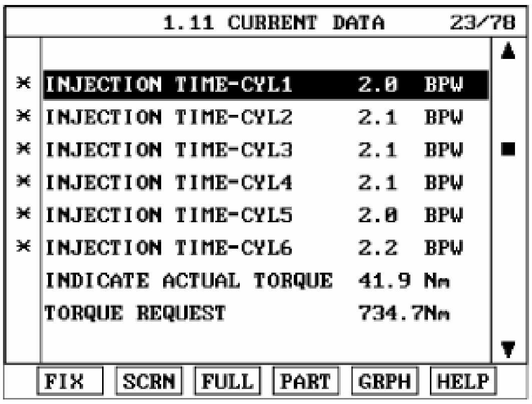


Fig. 1

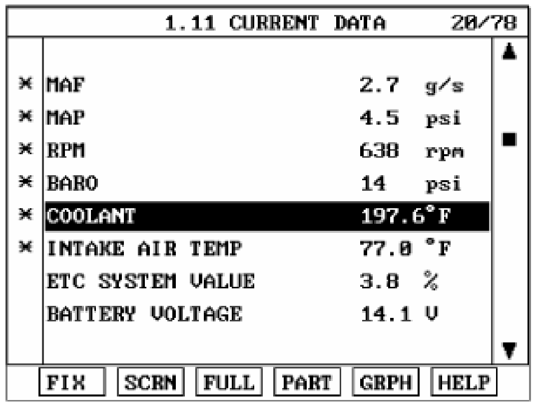


Fig. 2

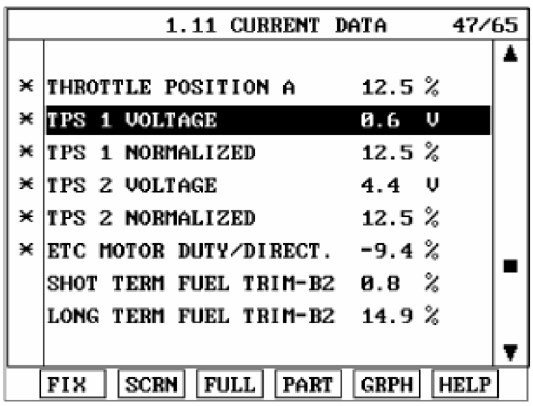


Fig. 3

(4) Are the parameters related to "Random/Multi Misfire Detected" displayed correctly on Current Data ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "System Inspection " procedure

SYSTEM INSPECTION

1. Check Spark Pulg

(1) Remove cylinder's spark plugs

(2) Visually/physically inspect the following items:
- Damaged insulation, Worn electrodes, Oil or fuel fouled, Loose terminals and cracks
- Check for plug gap : 1.0 - 1.1 mm (0.039 - 0.043 in.)
- Check if the spark plug for the relevant cylinder is lighter in color than the other plugs.

(3) Has a problem been found in any of the above areas?

YES

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Check Air Leakage " as below

2. Check Air Leakage
(1) Visually/physically inspect the air leakage in intake/exhaust system as following items,
- Vacuum hoses for splits, kinks and improper connections.
- Throttle body gasket
- Gasket between intake manifold and cylinder head
- Seals between intake manifold and fuel injectors
- Exhaust system between HO2S and Three way catalyst for air leakage

(2) Has a problem been found in any of the above areas?

YES

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Check for air leakage in Positive Crankcase Ventilation Valve(PCV)

3. Check for air leakage in Positive Crankcase Ventilation Valve(PCV)
(1) Remove PCV valve from cylinder head cover by puling ventilation hose

(2) With engine idling block PCV valve opening

(3) Verify that vacuum is felt

(4) Remove PCV valve

(5) Blow through valve from prot "A" and verify that air comes out of prot "B"

(6) Blow through valve from prot "B" and verifty that no air comes out of port "A"

(7) Has a problem been found ?

YES

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Check Compression pressure" as below

4. Check Compression pressure
(1) Warm up the engine to normal operating temperature

(2) Disconnect the spark plug cables and remove the spark plugs.

(3) Crank the engine to remove any foreign material in the cylinders.

(4) Put compression pressure gauge into spark pulg hole

(5) Crank the engine with widely opend throttle valve and check compression pressure at each cylinder

(6) Is compression pressure for each cylinder displayed within specifications ?

Specification : 1323kPa(13.5 kg/cm²,192 psi)

YES

▸ Go to "Check Timing " as below

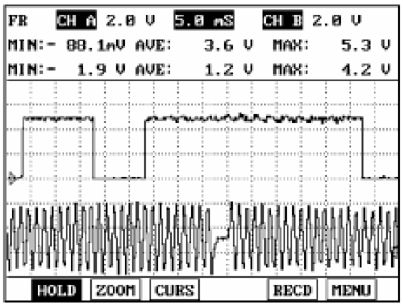
NO

▸ Add a small amount of oil through the spark plug hole, and repeat above steps. If the addition of oil causes the compression to rise, the cause is a worn or damaged piston ring or cylinder inner surface.
▸ If the compression remains the same, the cause is a burnt or defective valve seat, or pressure is leaking from the gasket. Repair as necessary and go to "Verification of Vehicle Repair" procedure

5. Check Timing
(1) Ignition "OFF"

(2) Check that Cam, Crank and Oil pump sprocket timing marks are correctly in alignment

(3) Monitor these signal waveforms from CAM and Crank shaft position Sensor are correctly in alignment



(4) Are all timing marks alligned correctly ?

YES

▸ Go to "Check Fuel Pressure Test" as below

NO

▸ Repair or readjust as necessary and go to "Verification of Vehicle Repair" procedure

6. Check Fuel Pressure Test
   (1) Refer to "Fuel pressure test" in "Fuel delivery system"
   (2) Are the measured fuel pressure within specifications ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Repair or replace as necessary above and then, go to " Verification of Vehicle Repair"procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

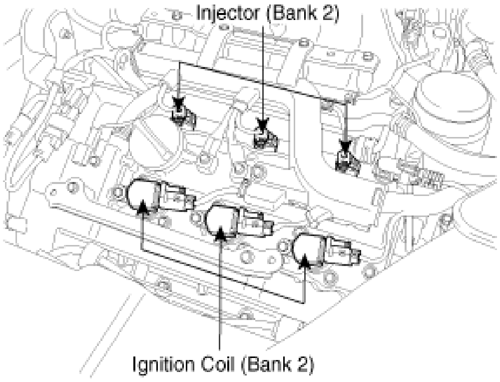
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0301

COMPONENT LOCATION



GENERAL DESCRIPTION

Misfires can be caused by lack of combustion in a cylinder due to absence of spark, poor fuel metering, poor compression, or many other causes. Even a small number of misfires may result in excessive exhaust emissions due to the unburned mixture. Increased misfire rates cause damage to the catalytic converter. The PCM monitors the crankshaft speed variation to determine if any misfiring generated. The PCM identifies the specific cylinder in which the misfire has occurred and counts individual misfire events by monitoring changes in the crankshaft rotation for each cylinder. A random misfire indicates two or more cylinders are misfiring.

DTC DESCRIPTION

The misfire diagnostic measures reference event times and calculates the positive and negative acceleration of the crank wheel to detrmine whether a misfire has occurred.
When the rate of misfire exceeds a threshold where the catalyst reaches a temperature where permanent damage can ocur, to the point that tail pipe emissions reach 1.5 times the tailpipe standard or where a cylinder misfire cause a loss of torque produced from that cylinder. PCM sets P0301. In case that misfire affects Catalyst damage, MIL(Malfunction Indicatin Lamp) will be illuminating and blinking at 1HZ frequency. However, In case of Indivisual and Emission damaging misfire, MIL will be turned on when the malfunction is detected.
Especially, if injector connector is disconnected for more than 46 sec., PCM sets DTC relating to misfire and conducts the fuel-cut to protect the catalyst.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible Cause
DTC Strategy		• determine if a multiple cylinder misfire or a cylinder specific misfire is occurring by monitoring crankshaft acceleration.	
	Case 1	• Misifre Not Delayed (No active delays) • All delays expired (Misfire Delay Counter = 0) • Not the Air Conditioning Clutch is changing state • The number of engine cycles to delay misfire detection after the air conditioner has changed states.	
	Case 2	• The number of engine cycles to delay misfire detection if the engine is operating in a region where misfire is undetectable ≥ 10 engine cycles	
		• The time that most delays will not be enabled ≥ 10sec • If the engine load ≥ thrshold(based on vehicle speed) then the engine is considered to beoperation under negative torque conditions • Number of engine cycles to delay the misfire diagnostic ≥11 engine cycles(if negative torque load condition is detected. Negative torque isdetermined by load conditions less than a 'zero torque' line whichis determined by engine speed and engine coolant temperature.) • The vehicle is in the manufacturing plant. • This is not first crank • Engine Runtime >30 (Amount of time to delay the Misfire Diagnostic on the initial	

Enable condition	Case 3	vehicle start when the vehicle is being manufactured in the plant. This delay will only occur once in the life of the vehicle and is used to prevent misfire on the initial start due to a lack of fuel) • The misfire diagnostic is synchronization with the cam event. • The number of engine cycles to delay misfire detection if a camsynchronization problem is detected internal to the Misfirediagnostic > 30 engine cyclesIf false information is received, a false misfire could bediagnosed. • Intrusive diagnostics not enabled (EGRFLOW) • Number of engine cycles to delay the misfire diagnostic ifany intrusive diagnostic test that could potentially interferewith the misfire diagnostic detectability has been determined to beactive • Fuel Level(Present) >0.15% • No fuel level fault • Vehicle not in plant • Engine cycles ≥ 500 • All cylinders fueled = 6 • Non in Fuel cut off not DFCO(Decelleration Fuel Cut Off) or not High Vehicle Speed Fuel Shut Off or not High RPM Fuel Shut Off • Transmission Shift in progress • Engine cycles ≥ 0 Increasing Throttle • Current Thorttle opening(WTHROT) >31ms old throttle opening(VVTHROT 31ms old) • VVTHROT - VVTHROT 31ms old< 64.9994% (Maximum positive delta throttle movement allowed in a 125 ms period (31.25 ms if using ETC). If the throttle position increases more than this threshold, the misfire diagnostic will be inhibited.) Decreasing Throttle • VVTHROT 31ms old >VVTHROT • VVTHROT 31ms old - VVTHROT < 100% • For engine cycles ≥ 5 • Engine RPM ≥ 7100 • Engine cycles >4999 • Crankshaft speed patterns normal • The seconds that most delays will not be enabled ≥ 10 • The number of consecutive positive delta times< 60 events • For engine cycles ≥ 8 • The number of consecutive negative delta times< 30 events • For engine cycles ≥ 8 • The seconds that most delays will not be enabled ≥ 10 • This is the value which is multiplied The number of consecutive positive delta times with multiple values of the number of consecutive negative delta times and The number of consecutive positive delta times while within the power-up no-delay timer.< 200 * 1 events • For engine cycles ≥ 8 • This is the value which is multiplied The number of consecutive positive delta times with multiple values of the number of consecutive negative delta times and The number of consecutive positive delta times while within the power-up no-delay timer.< 200 * 1 events • For engine cycles ≥ 8 Not negative torque driving conditions • throttle not less than threshold < 0% • while vehicle speed > 511KPH	• Faulty Spark plugs • Faulty Spark plug cables • Air Leakage • Belt deflection and Air gap of CKPS • Incorrect timing • Faulty injector • Improper fuel pressure • Improper engine compression • Faulty PCM	

		• For engine cycles ≥ 7 Engine Speed with in range • Run Time ≥ 10 • 470 < Engine RPM < 6600 • For engine cycles ≥ 15 • TEC(Tooth Error Correction) factor not learned • RPM >1600 • For engine Cycles ≥ 40 Ignition Voltage in range • Run Time > 10 • 10.9936 < Battery Voltage < 15.9907 • For engine cycles ≥ 15 Coolant Temperature in range If (start up coolant temperature < cold start thresh and coolant temperature greater that after cold start thresh) • Coolant temperature at start-up < -7°C(19.4 °F) • Calculated coolant temperature with default applied > 21°C (69.8 °F) Else if(coolant temperature greater that lo threshold and coolant temperature less than High threshold) • Calculated coolant temperature with default applied > -7°C (19.4 °F) • Calculated coolant temperature with default applied > 120°C(248 °F) • For engine cycles ≥ 15 Power Up delay not active • Run time > 0 Misfire not requesting TCC unlock and TCC still locked • For engine cycles ≥ 0 no disabling faults present / no disabiling Active Faults • P0340 / P0341 / P0118 / P0117 / P0115 / P0336 / P0335 / P1295 / P0103 / P0102 / 0108 / P0107 / P0106 / P0501 • Run Time< 10 • Engine Load is below zero torque line. • RPM < 1500 • For engine cycles ≥ 11	
Thresh old value	Case 1	• Individual event misfire detection > Threshold	
	Case 2	• Emissions damaging >Threshold	
	Case 3	• Catalyst damaging > Threshold	
Diagnosis time		• Continuous	
MIL ON condition		• 2 driving cycles	

MONITOR SCANTOOL DATA

1. Is the power balance test done?

   YES

   ▸ If injector connector for power balance test is disconnect for over 46 sec., this can cause DTC relating to misfire. Stop the test and connect it and delete DTC and then go to "Verification of Vehicle repair" procedure.
   ▸ If power balance test is finished within 46 sec., go to next procedure.

   NO

   ▸ Go to "Monitor scantool data" as follows.

2. Monitor scantool data
   (1) Ignition "OFF"
   (2) Connect Scantool and Engine "ON"
   (3) Monitor parameters related to " Cylinder 1 Misfire Detected" on CURRENT DATA
   Specification :

Ignition	BTDC 10° ± 5°		
Idle speed	A/CON OFF	Neutral, N, R, P-range	620 ± 100 rpm
		D-range	
	A/CON ON	Neutral, N, R, P-range	
		D-range	

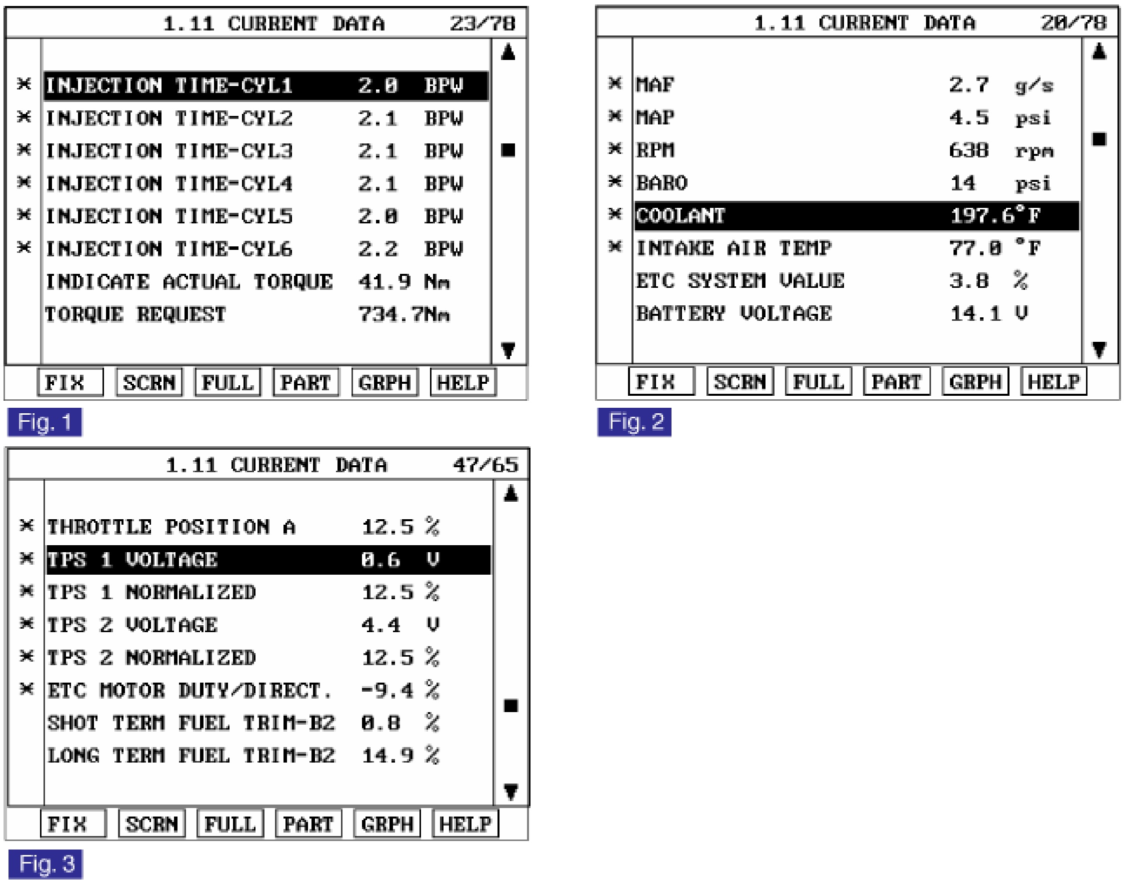


Fig. 1
Fig. 2
Fig. 3

(4) Are the parameters related to "Cylinder 1 Misfire Detected" displayed correctly on Current Data ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "System Inspection " procedure

SYSTEM INSPECTION

1. Check Spark Pulg

(1) Remove cylinder's spark plugs

(2) Visually/physically inspect the following items:

- Damaged insulation, Worn electrodes, Oil or fuel fouled, Loose terminals and cracks
- Check for plug gap : 1.0 - 1.1 mm (0.039 - 0.043 in.)
- Check if the spark plug for the relevant cylinder is lighter in color than the other plugs.

(3) Has a problem been found in any of the above areas?

YES

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Check Air Leakage " as below

2. Check Air Leakage

(1) Visually/physically inspect the air leakage in intake/exhaust system as following items,
- Vacuum hoses for splits, kinks and improper connections.
- Throttle body gasket
- Gasket between intake manifold and cylinder head
- Seals between intake manifold and fuel injectors
- Exhaust system between HO2S and Three way catalyst for air leakage

(2) Has a problem been found in any of the above areas?

YES

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Check for air leakage in Positive Crankcase Ventilation Valve(PCV)

3. Check for air leakage in Positive Crankcase Ventilation Valve(PCV)

(1) Remove PCV valve from cylinder head cover by puling ventilation hose

(2) With engine idling block PCV valve opening

(3) Verify that vacuum is felt

(4) Remove PCV valve

(5) Blow through valve from prot "A" and verify that air comes out of prot "B"

(6) Blow through valve from prot "B" and verifty that no air comes out of port "A"

(7) Has a problem been found ?

YES

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Check Compression pressure" as below

4. Check Compression pressure

(1) Warm up the engine to normal operating temperature

(2) Disconnect the spark plug cables and remove the spark plugs.

(3) Crank the engine to remove any foreign material in the cylinders.

(4) Put compression pressure gauge into spark pulg hole

(5) Crank the engine with widely opend throttle valve and check compression pressure at each cylinder

Specification : 1323kPa(13.5 kg/cm²,192 psi)

(6) Is compression pressure for each cylinder displayed within specifications ?

YES

▸ Go to "Check Timing " as below

NO

▸ Add a small amount of oil through the spark plug hole, and repeat above steps. If the addition of oil causes the compression to rise, the cause is a worn or damaged piston ring or cylinder inner surface.

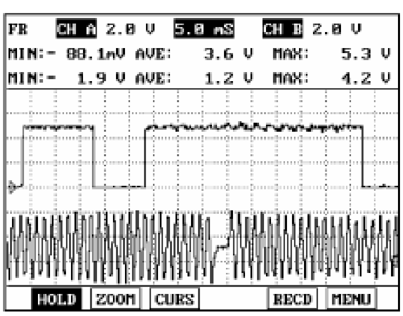
▸ If the compression remains the same, the cause is a burnt or defective valve seat, or pressure is leaking from the gasket. Repair as necessary and go to "Verification of Vehicle Repair" procedure

5. Check Timing

(1) Ignition "OFF"

(2) Check that Cam, Crank and Oil pump sprocket timing marks are correctly in alignment

(3) Monitor these signal waveforms from CAM and Crank shaft position Sensor are correctly in alignment



(4) Are all timing marks alligned correctly ?

YES

▸ Go to "Check Fuel Pressure Test" as below

NO

(5) ▸ Repair or readjust as necessary and go to "Verification of Vehicle Repair" procedure

6. Check Fuel Pressure Test
   (1) Refer to "Fuel pressure test" in "Fuel delivery system"
   (2) Are the measured fuel pressure within specifications ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Repair or replace as necessary above and then, go to " Verification of Vehicle Repair"procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

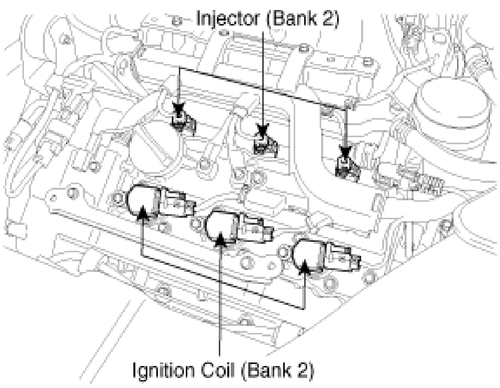
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0302

COMPONENT LOCATION



GENERAL DESCRIPTION

Misfires can be caused by lack of combustion in a cylinder due to absence of spark, poor fuel metering, poor compression, or many other causes. Even a small number of misfires may result in excessive exhaust emissions due to the unburned mixture. Increased misfire rates cause damage to the catalytic converter. The PCM monitors the crankshaft speed variation to determine if any misfiring generated. The PCM identifies the specific cylinder in which the misfire has occurred and counts individual misfire events by monitoring changes in the crankshaft rotation for each cylinder. A random misfire indicates two or more cylinders are misfiring.

DTC DESCRIPTION

The misfire diagnostic measures reference event times and calculates the positive and negative acceleration of the crank wheel to detrmine whether a misfire has occurred.
When the rate of misfire exceeds a threshold where the catalyst reaches a temperature where permanent damage can ocur, to the point that tail pipe emissions reach 1.5 times the tailpipe standard or where a cylinder misfire cause a loss of torque produced from that cylinder. PCM sets P0302. In case that misfire affects Catalyst damage, MIL(Malfunction Indicatin Lamp) will be illuminating and blinking at 1HZ frequency. However, In case of Indivisual and Emission damaging misfire, MIL will be turned on when the malfunction is detected.
Especially, if injector connector is disconnected for more than 46 sec., PCM sets DTC relating to misfire and conducts the fuel-cut to protect the catalyst.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible Cause
DTC Strategy		• determine if a multiple cylinder misfire or a cylinder specific misfire is occurring by monitoring crankshaft acceleration.	
	Case 1	• Misifre Not Delayed (No active delays) • All delays expired (Misfire Delay Counter = 0) • Not the Air Conditioning Clutch is changing state • The number of engine cycles to delay misfire detection after the air conditioner has changed states.	
	Case 2	• The number of engine cycles to delay misfire detection if the engine is operating in a region where misfire is undetectable ≥ 10 engine cycles	
		• The time that most delays will not be enabled ≥ 10sec • If the engine load ≥ thrshold(based on vehicle speed) then the engine is considered to beoperation under negative torque conditions • Number of engine cycles to delay the misfire diagnostic ≥11 engine cycles(if negative torque load condition is detected. Negative torque isdetermined by load conditions less than a 'zero torque' line whichis determined by engine speed and engine coolant temperature.) • The vehicle is in the manufacturing plant. • This is not first crank • Engine Runtime >30 (Amount of time to delay the Misfire Diagnostic on the initial vehicle start when the vehicle is being manufactured in the plant. This delay will only occur once in the life of the vehicle and is used to prevent misfire on the initial start due to a lack of fuel) • The misfire diagnostic is synchronization with the cam event. • The number of engine cycles to delay misfire detection if a camsynchronization problem is detected internal to the Misfirediagnostic > 30 engine cyclesIf false information is received, a false misfire could bediagnosed. • Intrusive diagnostics not enabled (EGRFLOW) • Number of engine cycles to delay the misfire diagnostic ifany intrusive diagnostic test that could potentially interferewith the misfire diagnostic detectability has been determined to beactive • Fuel Level(Present) >0.15% • No fuel level fault • Vehicle not in plant • Engine cycles ≥ 500 • All cylinders fueled = 6 • Non in Fuel cut off not DFCO(Decelleration Fuel Cut Off) or not High Vehicle Speed Fuel Shut Off or not High RPM Fuel	

Enable condition	Case 3	Shut Off • Transmission Shift in progress • Engine cycles ≥ 0 Increasing Throttle • Current Thorttle opening(WTHROT) >31ms old throttle opening(VVTHROT 31ms old) • VVTHROT - VVTHROT 31ms old< 64.9994% (Maximum positive delta throttle movement allowed in a 125 ms period (31.25 ms if using ETC). If the throttle position increases more than this threshold, the misfire diagnostic will be inhibited.) Decreasing Throttle • VVTHROT 31ms old >VVTHROT • VVTHROT 31ms old - VVTHROT < 100% • For engine cycles ≥ 5 • Engine RPM ≥ 7100 • Engine cycles >4999 • Crankshaft speed patterns normal • The seconds that most delays will not be enabled ≥ 10 • The number of consecutive positive delta times< 60 events • For engine cycles ≥ 8 • The number of consecutive negative delta times< 30 events • For engine cycles ≥ 8 • The seconds that most delays will not be enabled ≥ 10 • This is the value which is multiplied The number of consecutive positive delta times with multiple values of the number of consecutive negative delta times and The number of consecutive positive delta times while within the power-up no-delay timer.< 200 * 1 events • For engine cycles ≥ 8 • This is the value which is multiplied The number of consecutive positive delta times with multiple values of the number of consecutive negative delta times and The number of consecutive positive delta times while within the power-up no-delay timer.< 200 * 1 events • For engine cycles ≥ 8 Not negative torque driving conditions • throttle not less than threshold < 0% • while vehicle speed > 511KPH • For engine cycles ≥ 7 Engine Speed with in range • Run Time ≥ 10 • 470 < Engine RPM < 6600 • For engine cycles ≥ 15 • TEC(Tooth Error Correction) factor not learned • RPM >1600 • For engine Cycles ≥ 40 Ignition Voltage in range • Run Time > 10 • 10.9936 < Battery Voltage < 15.9907 • For engine cycles ≥ 15 Coolant Temperature in range If (start up coolant temperature < cold start thresh and coolant temperature greater that after cold start thresh) • Coolant temperature at start-up < -7°C(19.4 °F) • Calculated coolant temperature with default applied > 21°C (69.8 °F) Else if(coolant temperature greater that lo threshold and coolant temperature less than High threshold) • Calculated coolant temperature with default applied > -7°C (19.4 °F)	• Faulty Spark plugs • Faulty Spark plug cables • Air Leakage • Belt deflection and Air gap of CKPS • Incorrect timing • Faulty injector • Improper fuel pressure • Improper engine compression • Faulty PCM

		• Calculated coolant temperature with default applied > 120° C(248 °F) • For engine cycles ≥ 15 Power Up delay not active • Run time > 0 Misfire not requesting TCC unlock and TCC still locked • For engine cycles ≥ 0 no disabling faults present / no disabiling Active Faults • P0340 / P0341 / P0118 / P0117 / P0115 / P0336 / P0335 / P1295 / P0103 / P0102 / 0108 / P0107 / P0106 / P0501 • Run Time< 10 • Engine Load is below zero torque line. • RPM < 1500 • For engine cycles ≥ 11	
Thresh old value	Case 1	• Individual event misfire detection > Threshold	
	Case 2	• Emissions damaging >Threshold	
	Case 3	• Catalyst damaging > Threshold	
Diagnosis time		• Continuous	
MIL ON condition		• 2 driving cycles	

MONITOR SCANTOOL DATA

1. Is the power balance test done?

YES

▸ If injector connector for power balance test is disconnect for over 46 sec., this can cause DTC relating to misfire. Stop the test and connect it and delete DTC and then go to "Verification of Vehicle repair" procedure.
▸ If power balance test is finished within 46 sec., go to next procedure.

NO

▸ Go to "Monitor scantool data" as follows.

2. Monitor scantool data
   (1) Ignition "OFF"
   (2) Connect Scantool and Engine "ON"
   (3) Monitor parameters related to " Cylinder 2 Misfire Detected" on CURRENT DATA
   Specification :

Ignition	BTDC 10° ± 5°		
Idle speed	A/CON OFF	Neutral, N, R, P-range	620 ± 100 rpm
		D-range	
	A/CON ON	Neutral, N, R, P-range	
		D-range	

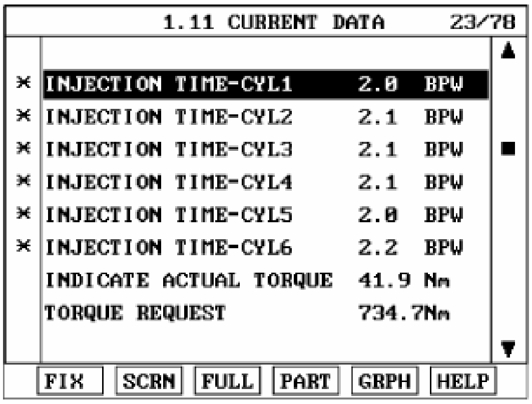


Fig. 1

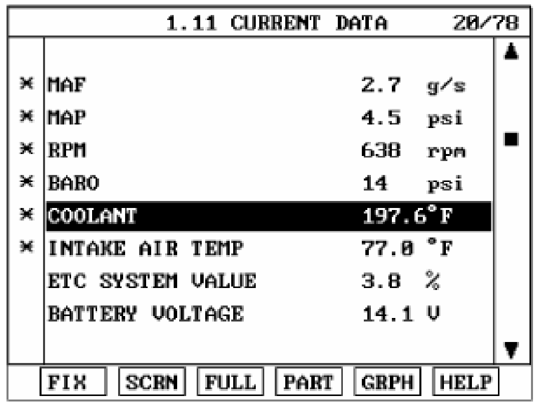


Fig. 2

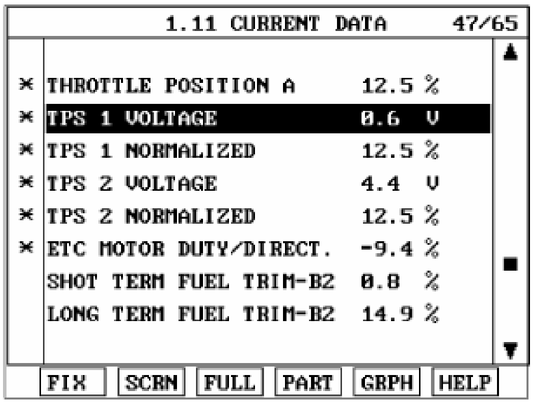


Fig. 3

(4) Are the parameters related to "Cylinder 2 Misfire Detected" displayed correctly on Current Data ?

YES

▶ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▶ Go to "System Inspection " procedure

SYSTEM INSPECTION

1. Check Spark Pulg
   (1) Remove cylinder’s spark plugs
   (2) Visually/physically inspect the following items:
   - Damaged insulation, Worn electrodes, Oil or fuel fouled, Loose terminals and cracks
   - Check for plug gap : 1.0 - 1.1 mm (0.039 - 0.043 in.)
   - Check if the spark plug for the relevant cylinder is lighter in color than the other plugs.

   (3) Has a problem been found in any of the above areas?

   YES

   ▶ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

   NO

   ▶ Go to "Check Air Leakage " as below

2. Check Air Leakage
   (1) Visually/physically inspect the air leakage in intake/exhaust system as following items,
   - Vacuum hoses for splits, kinks and improper connections.
   - Throttle body gasket
   - Gasket between intake manifold and cylinder head
   - Seals between intake manifold and fuel injectors
   - Exhaust system between HO2S and Three way catalyst for air leakage

   (2) Has a problem been found in any of the above areas?

YES

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Check for air leakage in Positive Crankcase Ventilation Valve(PCV)

3. Check for air leakage in Positive Crankcase Ventilation Valve(PCV)
   (1) Remove PCV valve from cylinder head cover by puling ventilation hose

   (2) With engine idling block PCV valve opening

   (3) Verify that vacuum is felt

   (4) Remove PCV valve

   (5) Blow through valve from prot "A" and verify that air comes out of prot "B"

   (6) Blow through valve from prot "B" and verifty that no air comes out of port "A"

   (7) Has a problem been found ?

YES

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Check Compression pressure" as below

4. Check Compression pressure
   (1) Warm up the engine to normal operating temperature

   (2) Disconnect the spark plug cables and remove the spark plugs.

   (3) Crank the engine to remove any foreign material in the cylinders.

   (4) Put compression pressure gauge into spark pulg hole

   (5) Crank the engine with widely opend throttle valve and check compression pressure at each cylinder

Specification : 1323kPa(13.5 kg/cm²,192 psi)

   (6) Is compression pressure for each cylinder displayed within specifications ?

YES

▸ Go to "Check Timing " as below

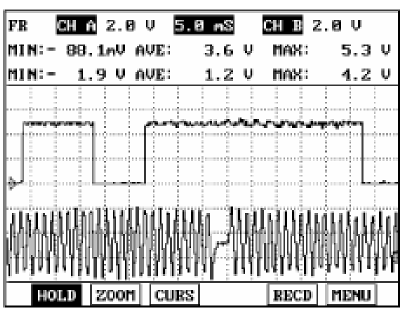
NO

▸ Add a small amount of oil through the spark plug hole, and repeat above steps. If the addition of oil causes the compression to rise, the cause is a worn or damaged piston ring or cylinder inner surface.
▸ If the compression remains the same, the cause is a burnt or defective valve seat, or pressure is leaking from the gasket. Repair as necessary and go to "Verification of Vehicle Repair" procedure

5. Check Timing
   (1) Ignition "OFF"

   (2) Check that Cam, Crank and Oil pump sprocket timing marks are correctly in alignment

   (3) Monitor these signal waveforms from CAM and Crank shaft position Sensor are correctly in alignment



   (4) Are all timing marks alligned correctly ?

YES

▸ Go to "Check Fuel Pressure Test" as below

NO

   (5) ▸ Repair or readjust as necessary and go to "Verification of Vehicle Repair" procedure

6. Check Fuel Pressure Test
   (1) Refer to "Fuel pressure test" in "Fuel delivery system"
   (2) Are the measured fuel pressure within specifications ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Repair or replace as necessary above and then, go to " Verification of Vehicle Repair"procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

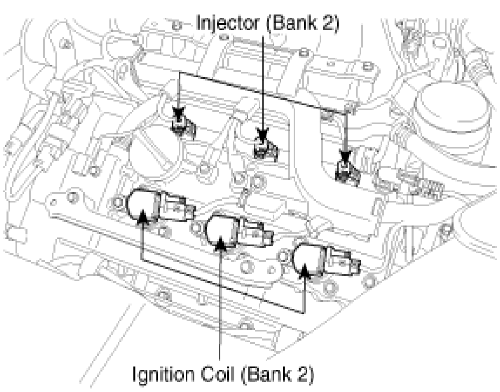
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0303

COMPONENT LOCATION



GENERAL DESCRIPTION

Misfires can be caused by lack of combustion in a cylinder due to absence of spark, poor fuel metering, poor compression, or many other causes. Even a small number of misfires may result in excessive exhaust emissions due to the unburned mixture. Increased misfire rates cause damage to the catalytic converter. The PCM monitors the crankshaft speed variation to determine if any misfiring generated. The PCM identifies the specific cylinder in which the misfire has occurred and counts individual misfire events by monitoring changes in the crankshaft rotation for each cylinder. A random misfire indicates two or more cylinders are misfiring.

DTC DESCRIPTION

The misfire diagnostic measures reference event times and calculates the positive and negative acceleration of the crank wheel to detrmine whether a misfire has occurred.
When the rate of misfire exceeds a threshold where the catalyst reaches a temperature where permanent damage can ocur, to the point that tail pipe emissions reach 1.5 times the tailpipe standard or where a cylinder misfire cause a loss of torque produced from that cylinder. PCM sets P0303. In case that misfire affects Catalyst damage, MIL(Malfunction Indicatin Lamp) will be illuminating

and blinking at 1HZ frequency. However, In case of Indivisual and Emission damaging misfire, MIL will be turned on when the malfunction is detected.
Especially, if injector connector is disconnected for more than 46 sec., PCM sets DTC relating to misfire and conducts the fuel-cut to protect the catalyst.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible Cause
DTC Strategy		• determine if a multiple cylinder misfire or a cylinder specific misfire is occurring by monitoring crankshaft acceleration.	
	Case 1	• Misifre Not Delayed (No active delays) • All delays expired (Misfire Delay Counter = 0) • Not the Air Conditioning Clutch is changing state • The number of engine cycles to delay misfire detection after the air conditioner has changed states.	
	Case 2	• The number of engine cycles to delay misfire detection if the engine is operating in a region where misfire is undetectable ≥ 10 engine cycles	
		• The time that most delays will not be enabled ≥ 10sec • If the engine load ≥ thrshold(based on vehicle speed) then the engine is considered to beoperation under negative torque conditions • Number of engine cycles to delay the misfire diagnostic ≥11 engine cycles(if negative torque load condition is detected. Negative torque isdetermined by load conditions less than a 'zero torque' line whichis determined by engine speed and engine coolant temperature.) • The vehicle is in the manufacturing plant. • This is not first crank • Engine Runtime >30 (Amount of time to delay the Misfire Diagnostic on the initial vehicle start when the vehicle is being manufactured in the plant. This delay will only occur once in the life of the vehicle and is used to prevent misfire on the initial start due to a lack of fuel) • The misfire diagnostic is synchronization with the cam event. • The number of engine cycles to delay misfire detection if a camsynchronization problem is detected internal to the Misfirediagnostic > 30 engine cyclesIf false information is received, a false misfire could bediagnosed. • Intrusive diagnostics not enabled (EGRFLOW) • Number of engine cycles to delay the misfire diagnostic ifany intrusive diagnostic test that could potentially interferewith the misfire diagnostic detectability has been determined to beactive • Fuel Level(Present) >0.15% • No fuel level fault • Vehicle not in plant • Engine cycles ≥ 500 • All cylinders fueled = 6 • Non in Fuel cut off not DFCO(Decelleration Fuel Cut Off) or not High Vehicle Speed Fuel Shut Off or not High RPM Fuel Shut Off • Transmission Shift in progress • Engine cycles ≥ 0 Increasing Throttle • Current Thorttle opening(WTHROT) >31ms old throttle opening(VVTHROT 31ms old) • VVTHROT - VVTHROT 31ms old< 64.9994% (Maximum positive delta throttle movement allowed in a 125 ms period	

Enable condition	Case 3	(31.25 ms if using ETC). If the throttle position increases more than this threshold, the misfire diagnostic will be inhibited.) Decreasing Throttle • VVTHROT 31ms old >VVTHROT • VVTHROT 31ms old - VVTHROT < 100% • For engine cycles ≥ 5 • Engine RPM ≥ 7100 • Engine cycles >4999 • Crankshaft speed patterns normal • The seconds that most delays will not be enabled ≥ 10 • The number of consecutive positive delta times< 60 events • For engine cycles ≥ 8 • The number of consecutive negative delta times< 30 events • For engine cycles ≥ 8 • The seconds that most delays will not be enabled ≥ 10 • This is the value which is multiplied The number of consecutive positive delta times with multiple values of the number of consecutive negative delta times and The number of consecutive positive delta times while within the power-up no-delay timer.< 200 * 1 events • For engine cycles ≥ 8 • This is the value which is multiplied The number of consecutive positive delta times with multiple values of the number of consecutive negative delta times and The number of consecutive positive delta times while within the power-up no-delay timer.< 200 * 1 events • For engine cycles ≥ 8 Not negative torque driving conditions • throttle not less than threshold < 0% • while vehicle speed > 511KPH • For engine cycles ≥ 7 Engine Speed with in range • Run Time ≥ 10 • 470 < Engine RPM < 6600 • For engine cycles ≥ 15 • TEC(Tooth Error Correction) factor not learned • RPM >1600 • For engine Cycles ≥ 40 Ignition Voltage in range • Run Time > 10 • 10.9936 < Battery Voltage < 15.9907 • For engine cycles ≥ 15 Coolant Temperature in range If (start up coolant temperature < cold start thresh and coolant temperature greater that after cold start thresh) • Coolant temperature at start-up < -7°C(19.4 °F) • Calculated coolant temperature with default applied > 21°C (69.8 °F) Else if(coolant temperature greater that lo threshold and coolant temperature less than High threshold) • Calculated coolant temperature with default applied > -7°C (19.4 °F) • Calculated coolant temperature with default applied > 120° C(248 °F) • For engine cycles ≥ 15 Power Up delay not active • Run time > 0 Misfire not requesting TCC unlock and TCC still locked • For engine cycles ≥ 0 no disabling faults present / no disabiling Active Faults	• Faulty Spark plugs • Faulty Spark plug cables • Air Leakage • Belt deflection and Air gap of CKPS • Incorrect timing • Faulty injector • Improper fuel pressure • Improper engine compression • Faulty PCM

		• P0340 / P0341 / P0118 / P0117 / P0115 / P0336 / P0335 / P1295 / P0103 / P0102 / 0108 / P0107 / P0106 / P0501 • Run Time< 10 • Engine Load is below zero torque line. • RPM < 1500 • For engine cycles ≥ 11	
Thresh old value	Case 1	• Individual event misfire detection > Threshold	
	Case 2	• Emissions damaging >Threshold	
	Case 3	• Catalyst damaging > Threshold	
Diagnosis time		• Continuous	
MIL ON condition		• 2 driving cycles	

MONITOR SCANTOOL DATA

1. Is the power balance test done?

YES

▶ If injector connector for power balance test is disconnect for over 46 sec., this can cause DTC relating to misfire. Stop the test and connect it and delete DTC and then go to "Verification of Vehicle repair" procedure.

▶ If power balance test is finished within 46 sec., go to next procedure.

NO

▶ Go to "Monitor scantool data" as follows.

2. Monitor scantool data
   (1) Ignition "OFF"
   (2) Connect Scantool and Engine "ON"
   (3) Monitor parameters related to " Cylinder 3 Misfire Detected" on CURRENT DATA

   Specification :

Ignition	BTDC 10° ± 5°		
Idle speed	A/CON OFF	Neutral, N, R, P-range	620 ± 100 rpm
		D-range	
	A/CON ON	Neutral, N, R, P-range	
		D-range	

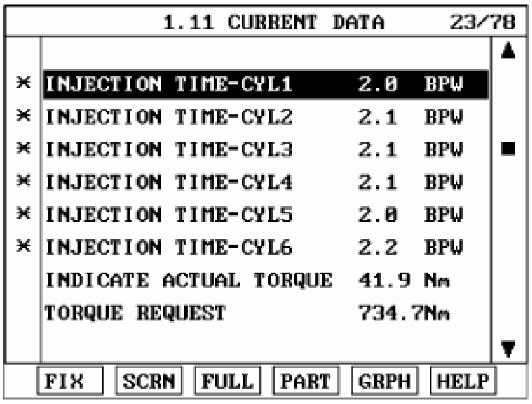


Fig. 1

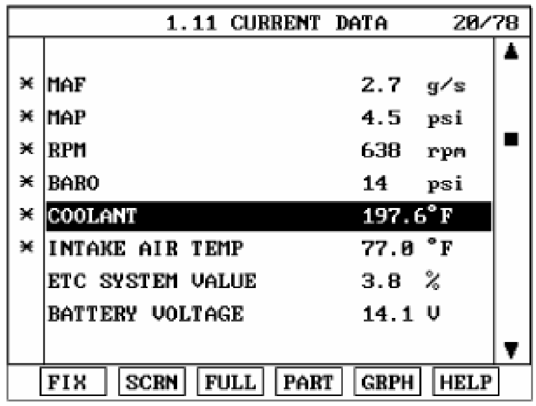


Fig. 2

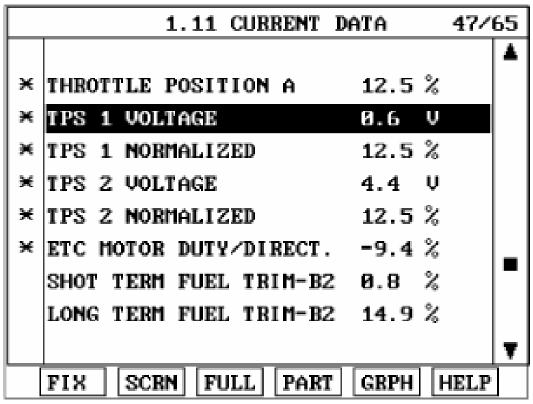


Fig. 3

(4) Are the parameters related to "Cylinder 3 Misfire Detected" displayed correctly on Current Data ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "System Inspection " procedure

SYSTEM INSPECTION

1. Check Spark Pulg
   (1) Remove cylinder's spark plugs
   (2) Visually/physically inspect the following items:
   - Damaged insulation, Worn electrodes, Oil or fuel fouled, Loose terminals and cracks
   - Check for plug gap : 1.0 - 1.1 mm (0.039 - 0.043 in.)
   - Check if the spark plug for the relevant cylinder is lighter in color than the other plugs.

   (3) Has a problem been found in any of the above areas?

   YES

   ▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

   NO

   ▸ Go to "Check Air Leakage " as below

2. Check Air Leakage
   (1) Visually/physically inspect the air leakage in intake/exhaust system as following items,
   - Vacuum hoses for splits, kinks and improper connections.
   - Throttle body gasket
   - Gasket between intake manifold and cylinder head
   - Seals between intake manifold and fuel injectors
   - Exhaust system between HO2S and Three way catalyst for air leakage

   (2) Has a problem been found in any of the above areas?

YES

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Check for air leakage in Positive Crankcase Ventilation Valve(PCV)

3. Check for air leakage in Positive Crankcase Ventilation Valve(PCV)
   (1) Remove PCV valve from cylinder head cover by puling ventilation hose

   (2) With engine idling block PCV valve opening

   (3) Verify that vacuum is felt

   (4) Remove PCV valve

   (5) Blow through valve from prot "A" and verify that air comes out of prot "B"

   (6) Blow through valve from prot "B" and verifty that no air comes out of port "A"

   (7) Has a problem been found ?

YES

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Check Compression pressure" as below

4. Check Compression pressure
   (1) Warm up the engine to normal operating temperature

   (2) Disconnect the spark plug cables and remove the spark plugs.

   (3) Crank the engine to remove any foreign material in the cylinders.

   (4) Put compression pressure gauge into spark pulg hole

   (5) Crank the engine with widely opend throttle valve and check compression pressure at each cylinder

Specification : 1323kPa(13.5 kg/cm²,192 psi)

   (6) Is compression pressure for each cylinder displayed within specifications ?

YES

▸ Go to "Check Timing " as below

NO

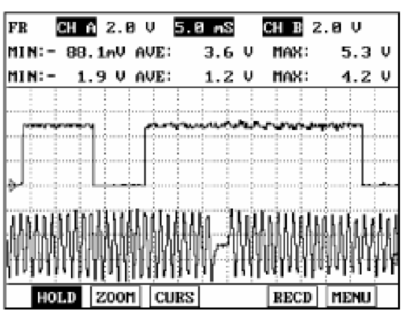
▸ Add a small amount of oil through the spark plug hole, and repeat above steps. If the addition of oil causes the compression to rise, the cause is a worn or damaged piston ring or cylinder inner surface.

▸ If the compression remains the same, the cause is a burnt or defective valve seat, or pressure is leaking from the gasket. Repair as necessary and go to "Verification of Vehicle Repair" procedure

5. Check Timing
   (1) Ignition "OFF"

   (2) Check that Cam, Crank and Oil pump sprocket timing marks are correctly in alignment

   (3) Monitor these signal waveforms from CAM and Crank shaft position Sensor are correctly in alignment



   (4) Are all timing marks alligned correctly ?

YES

▸ Go to "Check Fuel Pressure Test" as below

NO

   (5) ▸ Repair or readjust as necessary and go to "Verification of Vehicle Repair" procedure

6. Check Fuel Pressure Test
   (1) Refer to "Fuel pressure test" in "Fuel delivery system"
   (2) Are the measured fuel pressure within specifications ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Repair or replace as necessary above and then, go to " Verification of Vehicle Repair"procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

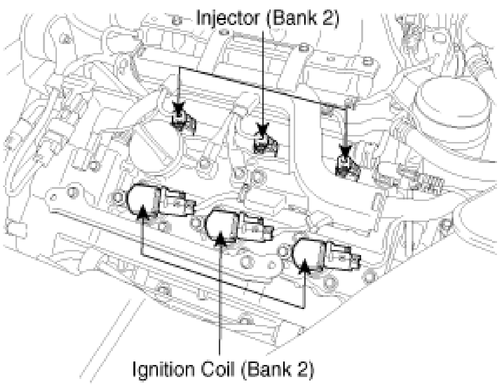
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0304

COMPONENT LOCATION



GENERAL DESCRIPTION

Misfires can be caused by lack of combustion in a cylinder due to absence of spark, poor fuel metering, poor compression, or many other causes. Even a small number of misfires may result in excessive exhaust emissions due to the unburned mixture. Increased misfire rates cause damage to the catalytic converter. The PCM monitors the crankshaft speed variation to determine if any misfiring generated. The PCM identifies the specific cylinder in which the misfire has occurred and counts individual misfire events by monitoring changes in the crankshaft rotation for each cylinder. A random misfire indicates two or more cylinders are misfiring.

DTC DESCRIPTION

The misfire diagnostic measures reference event times and calculates the positive and negative acceleration of the crank wheel to detrmine whether a misfire has occurred.
When the rate of misfire exceeds a threshold where the catalyst reaches a temperature where permanent damage can ocur, to the point that tail pipe emissions reach 1.5 times the tailpipe standard or where a cylinder misfire cause a loss of torque produced from that cylinder. PCM sets P0304. In case that misfire affects Catalyst damage, MIL(Malfunction Indicatin Lamp) will be illuminating

and blinking at 1HZ frequency. However, In case of Indivisual and Emission damaging misfire, MIL will be turned on when the malfunction is detected.
Especially, if injector connector is disconnected for more than 46 sec., PCM sets DTC relating to misfire and conducts the fuel-cut to protect the catalyst.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible Cause
DTC Strategy		• determine if a multiple cylinder misfire or a cylinder specific misfire is occurring by monitoring crankshaft acceleration.	
	Case 1	• Misifre Not Delayed (No active delays) • All delays expired (Misfire Delay Counter = 0) • Not the Air Conditioning Clutch is changing state • The number of engine cycles to delay misfire detection after the air conditioner has changed states.	
	Case 2	• The number of engine cycles to delay misfire detection if the engine is operating in a region where misfire is undetectable ≥ 10 engine cycles	
		• The time that most delays will not be enabled ≥ 10sec • If the engine load ≥ thrshold(based on vehicle speed) then the engine is considered to beoperation under negative torque conditions • Number of engine cycles to delay the misfire diagnostic ≥11 engine cycles(if negative torque load condition is detected. Negative torque isdetermined by load conditions less than a 'zero torque' line whichis determined by engine speed and engine coolant temperature.) • The vehicle is in the manufacturing plant. • This is not first crank • Engine Runtime >30 (Amount of time to delay the Misfire Diagnostic on the initial vehicle start when the vehicle is being manufactured in the plant. This delay will only occur once in the life of the vehicle and is used to prevent misfire on the initial start due to a lack of fuel) • The misfire diagnostic is synchronization with the cam event. • The number of engine cycles to delay misfire detection if a camsynchronization problem is detected internal to the Misfirediagnostic > 30 engine cyclesIf false information is received, a false misfire could bediagnosed. • Intrusive diagnostics not enabled (EGRFLOW) • Number of engine cycles to delay the misfire diagnostic ifany intrusive diagnostic test that could potentially interferewith the misfire diagnostic detectability has been determined to beactive • Fuel Level(Present) >0.15% • No fuel level fault • Vehicle not in plant • Engine cycles ≥ 500 • All cylinders fueled = 6 • Non in Fuel cut off not DFCO(Decelleration Fuel Cut Off) or not High Vehicle Speed Fuel Shut Off or not High RPM Fuel Shut Off • Transmission Shift in progress • Engine cycles ≥ 0 Increasing Throttle • Current Thorttle opening(WTHROT) >31ms old throttle opening(VVTHROT 31ms old) • VVTHROT - VVTHROT 31ms old< 64.9994% (Maximum positive delta throttle movement allowed in a 125 ms period	

Enable condition	Case 3	(31.25 ms if using ETC). If the throttle position increases more than this threshold, the misfire diagnostic will be inhibited.) Decreasing Throttle • VVTHROT 31ms old >VVTHROT • VVTHROT 31ms old - VVTHROT < 100% • For engine cycles ≥ 5 • Engine RPM ≥ 7100 • Engine cycles >4999 • Crankshaft speed patterns normal • The seconds that most delays will not be enabled ≥ 10 • The number of consecutive positive delta times< 60 events • For engine cycles ≥ 8 • The number of consecutive negative delta times< 30 events • For engine cycles ≥ 8 • The seconds that most delays will not be enabled ≥ 10 • This is the value which is multiplied The number of consecutive positive delta times with multiple values of the number of consecutive negative delta times and The number of consecutive positive delta times while within the power-up no-delay timer.< 200 * 1 events • For engine cycles ≥ 8 • This is the value which is multiplied The number of consecutive positive delta times with multiple values of the number of consecutive negative delta times and The number of consecutive positive delta times while within the power-up no-delay timer.< 200 * 1 events • For engine cycles ≥ 8 Not negative torque driving conditions • throttle not less than threshold < 0% • while vehicle speed > 511KPH • For engine cycles ≥ 7 Engine Speed with in range • Run Time ≥ 10 • 470 < Engine RPM < 6600 • For engine cycles ≥ 15 • TEC(Tooth Error Correction) factor not learned • RPM >1600 • For engine Cycles ≥ 40 Ignition Voltage in range • Run Time > 10 • 10.9936 < Battery Voltage < 15.9907 • For engine cycles ≥ 15 Coolant Temperature in range If (start up coolant temperature < cold start thresh and coolant temperature greater that after cold start thresh) • Coolant temperature at start-up < -7°C(19.4 °F) • Calculated coolant temperature with default applied > 21°C (69.8 °F) Else if(coolant temperature greater that lo threshold and coolant temperature less than High threshold) • Calculated coolant temperature with default applied > -7°C (19.4 °F) • Calculated coolant temperature with default applied > 120°C(248 °F) • For engine cycles ≥ 15 Power Up delay not active • Run time > 0 Misfire not requesting TCC unlock and TCC still locked • For engine cycles ≥ 0 no disabling faults present / no disabiling Active Faults	• Faulty Spark plugs • Faulty Spark plug cables • Air Leakage • Belt deflection and Air gap of CKPS • Incorrect timing • Faulty injector • Improper fuel pressure • Improper engine compression • Faulty PCM

		• P0340 / P0341 / P0118 / P0117 / P0115 / P0336 / P0335 / P1295 / P0103 / P0102 / 0108 / P0107 / P0106 / P0501 • Run Time< 10 • Engine Load is below zero torque line. • RPM < 1500 • For engine cycles ≥ 11	
Thresh old value	Case 1	• Individual event misfire detection > Threshold	
	Case 2	• Emissions damaging >Threshold	
	Case 3	• Catalyst damaging > Threshold	
Diagnosis time		• Continuous	
MIL ON condition		• 2 driving cycles	

MONITOR SCANTOOL DATA

1. Is the power balance test done?

YES

▸ If injector connector for power balance test is disconnect for over 46 sec., this can cause DTC relating to misfire. Stop the test and connect it and delete DTC and then go to "Verification of Vehicle repair" procedure.
▸ If power balance test is finished within 46 sec., go to next procedure.

NO

▸ Go to "Monitor scantool data" as follows.

2. Monitor scantool data
   (1) Ignition "OFF"
   (2) Connect Scantool and Engine "ON"
   (3) Monitor parameters related to " Cylinder 4 Misfire Detected" on CURRENT DATA
   Specification :

Ignition	BTDC 10° ± 5°		
Idle speed	A/CON OFF	Neutral, N, R, P-range	620 ± 100 rpm
		D-range	
	A/CON ON	Neutral, N, R, P-range	
		D-range	

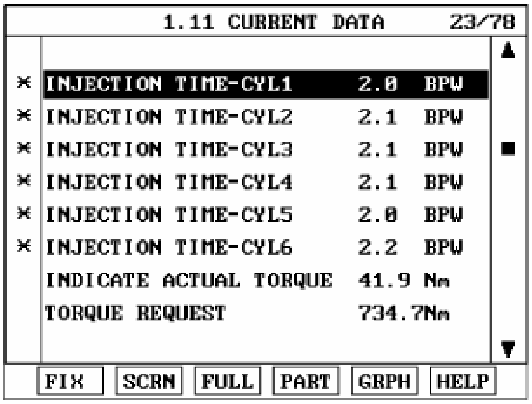


Fig. 1

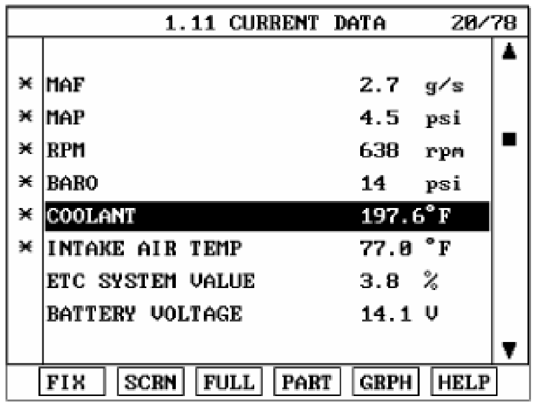


Fig. 2

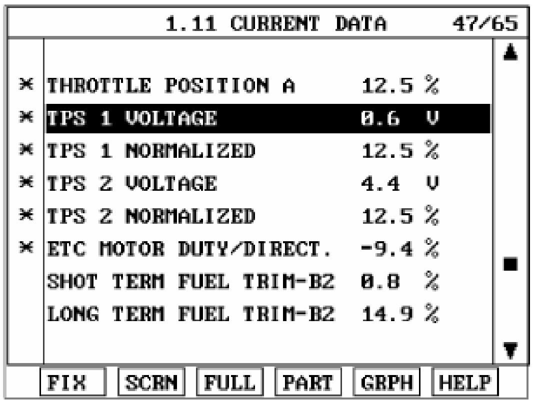


Fig. 3

(4) Are the parameters related to "Cylinder 4 Misfire Detected" displayed correctly on Current Data ?

YES

▶ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▶ Go to "System Inspection " procedure

SYSTEM INSPECTION

1. Check Spark Pulg
   (1) Remove cylinder’s spark plugs
   (2) Visually/physically inspect the following items:
   - Damaged insulation, Worn electrodes, Oil or fuel fouled, Loose terminals and cracks
   - Check for plug gap : 1.0 - 1.1 mm (0.039 - 0.043 in.)
   - Check if the spark plug for the relevant cylinder is lighter in color than the other plugs.

   (3) Has a problem been found in any of the above areas?

   YES

   ▶ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

   NO

   ▶ Go to "Check Air Leakage " as below

2. Check Air Leakage
   (1) Visually/physically inspect the air leakage in intake/exhaust system as following items,
   - Vacuum hoses for splits, kinks and improper connections.
   - Throttle body gasket
   - Gasket between intake manifold and cylinder head
   - Seals between intake manifold and fuel injectors
   - Exhaust system between HO2S and Three way catalyst for air leakage

   (2) Has a problem been found in any of the above areas?

YES

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Check for air leakage in Positive Crankcase Ventilation Valve(PCV)

3. Check for air leakage in Positive Crankcase Ventilation Valve(PCV)
   (1) Remove PCV valve from cylinder head cover by puling ventilation hose

   (2) With engine idling block PCV valve opening

   (3) Verify that vacuum is felt

   (4) Remove PCV valve

   (5) Blow through valve from prot "A" and verify that air comes out of prot "B"

   (6) Blow through valve from prot "B" and verifty that no air comes out of port "A"

   (7) Has a problem been found ?

YES

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Check Compression pressure" as below

4. Check Compression pressure
   (1) Warm up the engine to normal operating temperature

   (2) Disconnect the spark plug cables and remove the spark plugs.

   (3) Crank the engine to remove any foreign material in the cylinders.

   (4) Put compression pressure gauge into spark pulg hole

   (5) Crank the engine with widely opend throttle valve and check compression pressure at each cylinder

Specification : 1323kPa(13.5 kg/cm²,192 psi)

   (6) Is compression pressure for each cylinder displayed within specifications ?

YES

▸ Go to "Check Timing " as below

NO

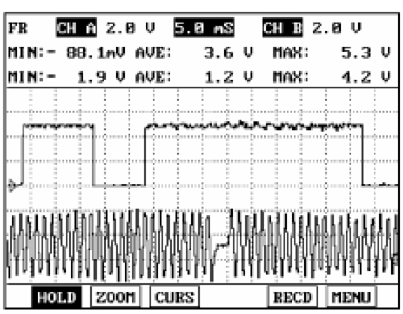
▸ Add a small amount of oil through the spark plug hole, and repeat above steps. If the addition of oil causes the compression to rise, the cause is a worn or damaged piston ring or cylinder inner surface.

▸ If the compression remains the same, the cause is a burnt or defective valve seat, or pressure is leaking from the gasket. Repair as necessary and go to "Verification of Vehicle Repair" procedure

5. Check Timing
   (1) Ignition "OFF"

   (2) Check that Cam, Crank and Oil pump sprocket timing marks are correctly in alignment

   (3) Monitor these signal waveforms from CAM and Crank shaft position Sensor are correctly in alignment



   (4) Are all timing marks alligned correctly ?

YES

▸ Go to "Check Fuel Pressure Test" as below

NO

   (5) ▸ Repair or readjust as necessary and go to "Verification of Vehicle Repair" procedure

6. Check Fuel Pressure Test
   (1) Refer to "Fuel pressure test" in "Fuel delivery system"
   (2) Are the measured fuel pressure within specifications ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Repair or replace as necessary above and then, go to " Verification of Vehicle Repair"procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

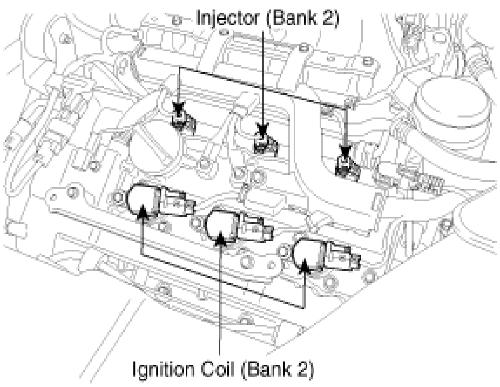
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0305

COMPONENT LOCATION



GENERAL DESCRIPTION

Misfires can be caused by lack of combustion in a cylinder due to absence of spark, poor fuel metering, poor compression, or many other causes. Even a small number of misfires may result in excessive exhaust emissions due to the unburned mixture. Increased misfire rates cause damage to the catalytic converter. The PCM monitors the crankshaft speed variation to determine if any misfiring generated. The PCM identifies the specific cylinder in which the misfire has occurred and counts individual misfire events by monitoring changes in the crankshaft rotation for each cylinder. A random misfire indicates two or more cylinders are misfiring.

DTC DESCRIPTION

The misfire diagnostic measures reference event times and calculates the positive and negative acceleration of the crank wheel to detrmine whether a misfire has occurred.
When the rate of misfire exceeds a threshold where the catalyst reaches a temperature where permanent damage can ocur, to the point that tail pipe emissions reach 1.5 times the tailpipe standard or where a cylinder misfire cause a loss of torque produced from that cylinder. PCM sets P0305. In case that misfire affects Catalyst damage, MIL(Malfunction Indicatin Lamp) will be illuminating

and blinking at 1HZ frequency. However, In case of Indivisual and Emission damaging misfire, MIL will be turned on when the malfunction is detected.
Especially, if injector connector is disconnected for more than 46 sec., PCM sets DTC relating to misfire and conducts the fuel-cut to protect the catalyst.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible Cause
DTC Strategy		• determine if a multiple cylinder misfire or a cylinder specific misfire is occurring by monitoring crankshaft acceleration.	
	Case 1	• Misifre Not Delayed (No active delays) • All delays expired (Misfire Delay Counter = 0) • Not the Air Conditioning Clutch is changing state • The number of engine cycles to delay misfire detection after the air conditioner has changed states.	
	Case 2	• The number of engine cycles to delay misfire detection if the engine is operating in a region where misfire is undetectable ≥ 10 engine cycles	
		• The time that most delays will not be enabled ≥ 10sec • If the engine load ≥ thrshold(based on vehicle speed) then the engine is considered to beoperation under negative torque conditions • Number of engine cycles to delay the misfire diagnostic ≥11 engine cycles(if negative torque load condition is detected. Negative torque isdetermined by load conditions less than a 'zero torque' line whichis determined by engine speed and engine coolant temperature.) • The vehicle is in the manufacturing plant. • This is not first crank • Engine Runtime >30 (Amount of time to delay the Misfire Diagnostic on the initial vehicle start when the vehicle is being manufactured in the plant. This delay will only occur once in the life of the vehicle and is used to prevent misfire on the initial start due to a lack of fuel) • The misfire diagnostic is synchronization with the cam event. • The number of engine cycles to delay misfire detection if a camsynchronization problem is detected internal to the Misfirediagnostic > 30 engine cyclesIf false information is received, a false misfire could bediagnosed. • Intrusive diagnostics not enabled (EGRFLOW) • Number of engine cycles to delay the misfire diagnostic ifany intrusive diagnostic test that could potentially interferewith the misfire diagnostic detectability has been determined to beactive • Fuel Level(Present) >0.15% • No fuel level fault • Vehicle not in plant • Engine cycles ≥ 500 • All cylinders fueled = 6 • Non in Fuel cut off not DFCO(Decelleration Fuel Cut Off) or not High Vehicle Speed Fuel Shut Off or not High RPM Fuel Shut Off • Transmission Shift in progress • Engine cycles ≥ 0 Increasing Throttle • Current Thorttle opening(WTHROT) >31ms old throttle opening(VVTHROT 31ms old) • VVTHROT - VVTHROT 31ms old< 64.9994% (Maximum positive delta throttle movement allowed in a 125 ms period	

Enable condition	Case 3	(31.25 ms if using ETC). If the throttle position increases more than this threshold, the misfire diagnostic will be inhibited.) Decreasing Throttle • VVTHROT 31ms old >VVTHROT • VVTHROT 31ms old - VVTHROT < 100% • For engine cycles ≥ 5 • Engine RPM ≥ 7100 • Engine cycles >4999 • Crankshaft speed patterns normal • The seconds that most delays will not be enabled ≥ 10 • The number of consecutive positive delta times< 60 events • For engine cycles ≥ 8 • The number of consecutive negative delta times< 30 events • For engine cycles ≥ 8 • The seconds that most delays will not be enabled ≥ 10 • This is the value which is multiplied The number of consecutive positive delta times with multiple values of the number of consecutive negative delta times and The number of consecutive positive delta times while within the power-up no-delay timer.< 200 * 1 events • For engine cycles ≥ 8 • This is the value which is multiplied The number of consecutive positive delta times with multiple values of the number of consecutive negative delta times and The number of consecutive positive delta times while within the power-up no-delay timer.< 200 * 1 events • For engine cycles ≥ 8 Not negative torque driving conditions • throttle not less than threshold < 0% • while vehicle speed > 511KPH • For engine cycles ≥ 7 Engine Speed with in range • Run Time ≥ 10 • 470 < Engine RPM < 6600 • For engine cycles ≥ 15 • TEC(Tooth Error Correction) factor not learned • RPM >1600 • For engine Cycles ≥ 40 Ignition Voltage in range • Run Time > 10 • 10.9936 < Battery Voltage < 15.9907 • For engine cycles ≥ 15 Coolant Temperature in range If (start up coolant temperature < cold start thresh and coolant temperature greater that after cold start thresh) • Coolant temperature at start-up < -7°C(19.4 °F) • Calculated coolant temperature with default applied > 21°C (69.8 °F) Else if(coolant temperature greater that lo threshold and coolant temperature less than High threshold) • Calculated coolant temperature with default applied > -7°C (19.4 °F) • Calculated coolant temperature with default applied > 120°C(248 °F) • For engine cycles ≥ 15 Power Up delay not active • Run time > 0 Misfire not requesting TCC unlock and TCC still locked • For engine cycles ≥ 0 no disabling faults present / no disabiling Active Faults	• Faulty Spark plugs • Faulty Spark plug cables • Air Leakage • Belt deflection and Air gap of CKPS • Incorrect timing • Faulty injector • Improper fuel pressure • Improper engine compression • Faulty PCM	

		• P0340 / P0341 / P0118 / P0117 / P0115 / P0336 / P0335 / P1295 / P0103 / P0102 / 0108 / P0107 / P0106 / P0501 • Run Time< 10 • Engine Load is below zero torque line. • RPM < 1500 • For engine cycles ≥ 11	
Thresh old value	Case 1	• Individual event misfire detection > Threshold	
	Case 2	• Emissions damaging >Threshold	
	Case 3	• Catalyst damaging > Threshold	
Diagnosis time		• Continuous	
MIL ON condition		• 2 driving cycles	

MONITOR SCANTOOL DATA

1. Is the power balance test done?

YES

▸ If injector connector for power balance test is disconnect for over 46 sec., this can cause DTC relating to misfire. Stop the test and connect it and delete DTC and then go to "Verification of Vehicle repair" procedure.
▸ If power balance test is finished within 46 sec., go to next procedure.

NO

▸ Go to "Monitor scantool data" as follows.

2. Monitor scantool data
   (1) Ignition "OFF"
   (2) Connect Scantool and Engine "ON"
   (3) Monitor parameters related to " Cylinder 5 Misfire Detected" on CURRENT DATA
   Specification :

Ignition	BTDC 10° ± 5°		
Idle speed	A/CON OFF	Neutral, N, R, P-range	620 ± 100 rpm
		D-range	
	A/CON ON	Neutral, N, R, P-range	
		D-range	

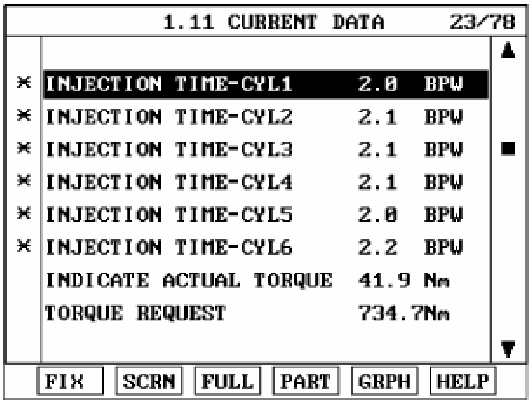


Fig. 1

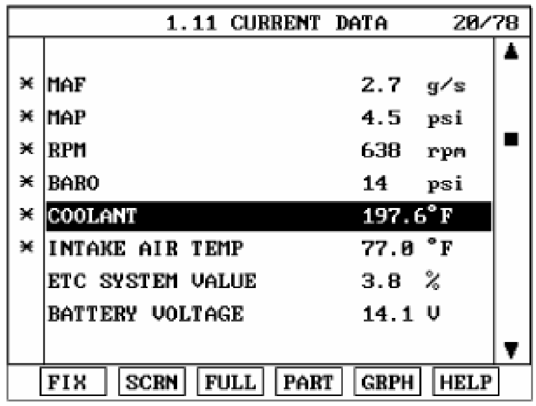


Fig. 2

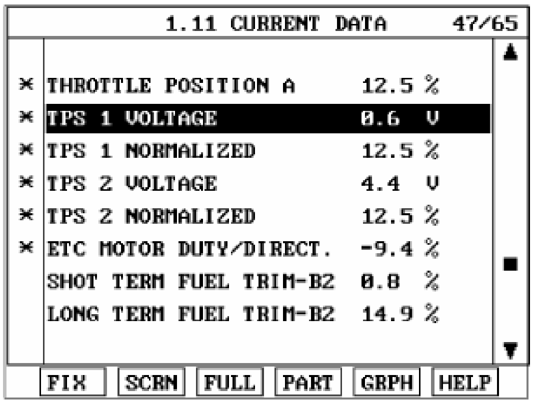


Fig. 3

(4) Are the parameters related to "Cylinder 5 Misfire Detected" displayed correctly on Current Data ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "System Inspection " procedure

SYSTEM INSPECTION

1. Check Spark Pulg
   (1) Remove cylinder's spark plugs
   (2) Visually/physically inspect the following items:
   - Damaged insulation, Worn electrodes, Oil or fuel fouled, Loose terminals and cracks
   - Check for plug gap : 1.0 - 1.1 mm (0.039 - 0.043 in.)
   - Check if the spark plug for the relevant cylinder is lighter in color than the other plugs.

   (3) Has a problem been found in any of the above areas?

   YES

   ▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

   NO

   ▸ Go to "Check Air Leakage " as below

2. Check Air Leakage
   (1) Visually/physically inspect the air leakage in intake/exhaust system as following items,
   - Vacuum hoses for splits, kinks and improper connections.
   - Throttle body gasket
   - Gasket between intake manifold and cylinder head
   - Seals between intake manifold and fuel injectors
   - Exhaust system between HO2S and Three way catalyst for air leakage

   (2) Has a problem been found in any of the above areas?

YES

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Check for air leakage in Positive Crankcase Ventilation Valve(PCV)

3. Check for air leakage in Positive Crankcase Ventilation Valve(PCV)
   (1) Remove PCV valve from cylinder head cover by puling ventilation hose

   (2) With engine idling block PCV valve opening

   (3) Verify that vacuum is felt

   (4) Remove PCV valve

   (5) Blow through valve from prot "A" and verify that air comes out of prot "B"

   (6) Blow through valve from prot "B" and verifty that no air comes out of port "A"

   (7) Has a problem been found ?

YES

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Check Compression pressure" as below

4. Check Compression pressure
   (1) Warm up the engine to normal operating temperature

   (2) Disconnect the spark plug cables and remove the spark plugs.

   (3) Crank the engine to remove any foreign material in the cylinders.

   (4) Put compression pressure gauge into spark pulg hole

   (5) Crank the engine with widely opend throttle valve and check compression pressure at each cylinder

Specification : 1323kPa(13.5 kg/cm²,192 psi)

   (6) Is compression pressure for each cylinder displayed within specifications ?

YES

▸ Go to "Check Timing " as below

NO

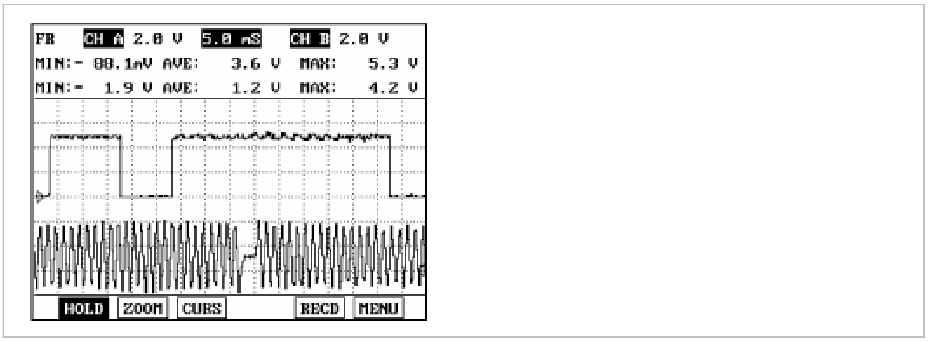
▸ Add a small amount of oil through the spark plug hole, and repeat above steps. If the addition of oil causes the compression to rise, the cause is a worn or damaged piston ring or cylinder inner surface.

▸ If the compression remains the same, the cause is a burnt or defective valve seat, or pressure is leaking from the gasket. Repair as necessary and go to "Verification of Vehicle Repair" procedure

5. Check Timing
   (1) Ignition "OFF"

   (2) Check that Cam, Crank and Oil pump sprocket timing marks are correctly in alignment

   (3) Monitor these signal waveforms from CAM and Crank shaft position Sensor are correctly in alignment



   (4) Are all timing marks alligned correctly ?

YES

▸ Go to "Check Fuel Pressure Test" as below

NO

   (5) ▸ Repair or readjust as necessary and go to "Verification of Vehicle Repair" procedure

6. Check Fuel Pressure Test
   (1) Refer to "Fuel pressure test" in "Fuel delivery system"
   (2) Are the measured fuel pressure within specifications ?

YES

▶ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▶ Repair or replace as necessary above and then, go to " Verification of Vehicle Repair"procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

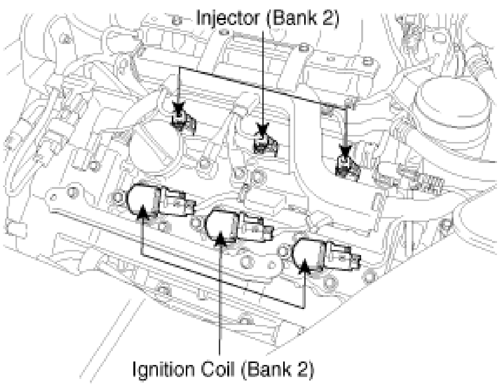
▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

Fuel System > Troubleshooting > P0306

COMPONENT LOCATION



GENERAL DESCRIPTION

Misfires can be caused by lack of combustion in a cylinder due to absence of spark, poor fuel metering, poor compression, or many other causes. Even a small number of misfires may result in excessive exhaust emissions due to the unburned mixture. Increased misfire rates cause damage to the catalytic converter. The PCM monitors the crankshaft speed variation to determine if any misfiring generated. The PCM identifies the specific cylinder in which the misfire has occurred and counts individual misfire events by monitoring changes in the crankshaft rotation for each cylinder. A random misfire indicates two or more cylinders are misfiring.

DTC DESCRIPTION

The misfire diagnostic measures reference event times and calculates the positive and negative acceleration of the crank wheel to detrmine whether a misfire has occurred.
When the rate of misfire exceeds a threshold where the catalyst reaches a temperature where permanent damage can ocur, to the point that tail pipe emissions reach 1.5 times the tailpipe standard or where a cylinder misfire cause a loss of torque produced from that cylinder. PCM sets P0306. In case that misfire affects Catalyst damage, MIL(Malfunction Indicatin Lamp) will be illuminating

and blinking at 1HZ frequency. However, In case of Indivisual and Emission damaging misfire, MIL will be turned on when the malfunction is detected.
Especially, if injector connector is disconnected for more than 46 sec., PCM sets DTC relating to misfire and conducts the fuel-cut to protect the catalyst.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible Cause
DTC Strategy		• determine if a multiple cylinder misfire or a cylinder specific misfire is occurring by monitoring crankshaft acceleration.	
	Case 1	• Misifre Not Delayed (No active delays) • All delays expired (Misfire Delay Counter = 0) • Not the Air Conditioning Clutch is changing state • The number of engine cycles to delay misfire detection after the air conditioner has changed states.	
	Case 2	• The number of engine cycles to delay misfire detection if the engine is operating in a region where misfire is undetectable ≥ 10 engine cycles	
		• The time that most delays will not be enabled ≥ 10sec • If the engine load ≥ thrshold(based on vehicle speed) then the engine is considered to beoperation under negative torque conditions • Number of engine cycles to delay the misfire diagnostic ≥11 engine cycles(if negative torque load condition is detected. Negative torque isdetermined by load conditions less than a 'zero torque' line whichis determined by engine speed and engine coolant temperature.) • The vehicle is in the manufacturing plant. • This is not first crank • Engine Runtime >30 (Amount of time to delay the Misfire Diagnostic on the initial vehicle start when the vehicle is being manufactured in the plant. This delay will only occur once in the life of the vehicle and is used to prevent misfire on the initial start due to a lack of fuel) • The misfire diagnostic is synchronization with the cam event. • The number of engine cycles to delay misfire detection if a camsynchronization problem is detected internal to the Misfirediagnostic > 30 engine cyclesIf false information is received, a false misfire could bediagnosed. • Intrusive diagnostics not enabled (EGRFLOW) • Number of engine cycles to delay the misfire diagnostic ifany intrusive diagnostic test that could potentially interferewith the misfire diagnostic detectability has been determined to beactive • Fuel Level(Present) >0.15% • No fuel level fault • Vehicle not in plant • Engine cycles ≥ 500 • All cylinders fueled = 6 • Non in Fuel cut off not DFCO(Decelleration Fuel Cut Off) or not High Vehicle Speed Fuel Shut Off or not High RPM Fuel Shut Off • Transmission Shift in progress • Engine cycles ≥ 0 Increasing Throttle • Current Thorttle opening(WTHROT) >31ms old throttle opening(VVTHROT 31ms old) • VVTHROT - VVTHROT 31ms old< 64.9994% (Maximum positive delta throttle movement allowed in a 125 ms period	

Enable condition	Case 3	(31.25 ms if using ETC). If the throttle position increases more than this threshold, the misfire diagnostic will be inhibited.) Decreasing Throttle • VVTHROT 31ms old >VVTHROT • VVTHROT 31ms old - VVTHROT < 100% • For engine cycles ≥ 5 • Engine RPM ≥ 7100 • Engine cycles >4999 • Crankshaft speed patterns normal • The seconds that most delays will not be enabled ≥ 10 • The number of consecutive positive delta times< 60 events • For engine cycles ≥ 8 • The number of consecutive negative delta times< 30 events • For engine cycles ≥ 8 • The seconds that most delays will not be enabled ≥ 10 • This is the value which is multiplied The number of consecutive positive delta times with multiple values of the number of consecutive negative delta times and The number of consecutive positive delta times while within the power-up no-delay timer.< 200 * 1 events • For engine cycles ≥ 8 • This is the value which is multiplied The number of consecutive positive delta times with multiple values of the number of consecutive negative delta times and The number of consecutive positive delta times while within the power-up no-delay timer.< 200 * 1 events • For engine cycles ≥ 8 Not negative torque driving conditions • throttle not less than threshold < 0% • while vehicle speed > 511KPH • For engine cycles ≥ 7 Engine Speed with in range • Run Time ≥ 10 • 470 < Engine RPM < 6600 • For engine cycles ≥ 15 • TEC(Tooth Error Correction) factor not learned • RPM >1600 • For engine Cycles ≥ 40 Ignition Voltage in range • Run Time > 10 • 10.9936 < Battery Voltage < 15.9907 • For engine cycles ≥ 15 Coolant Temperature in range If (start up coolant temperature < cold start thresh and coolant temperature greater that after cold start thresh) • Coolant temperature at start-up < -7°C(19.4 °F) • Calculated coolant temperature with default applied > 21°C (69.8 °F) Else if(coolant temperature greater that lo threshold and coolant temperature less than High threshold) • Calculated coolant temperature with default applied > -7°C (19.4 °F) • Calculated coolant temperature with default applied > 120° C(248 °F) • For engine cycles ≥ 15 Power Up delay not active • Run time > 0 Misfire not requesting TCC unlock and TCC still locked • For engine cycles ≥ 0 no disabling faults present / no disabiling Active Faults	• Faulty Spark plugs • Faulty Spark plug cables • Air Leakage • Belt deflection and Air gap of CKPS • Incorrect timing • Faulty injector • Improper fuel pressure • Improper engine compression • Faulty PCM

		• P0340 / P0341 / P0118 / P0117 / P0115 / P0336 / P0335 / P1295 / P0103 / P0102 / 0108 / P0107 / P0106 / P0501 • Run Time< 10 • Engine Load is below zero torque line. • RPM < 1500 • For engine cycles ≥ 11	
Thresh old value	Case 1	• Individual event misfire detection > Threshold	
	Case 2	• Emissions damaging >Threshold	
	Case 3	• Catalyst damaging > Threshold	
Diagnosis time		• Continuous	
MIL ON condition		• 2 driving cycles	

MONITOR SCANTOOL DATA

1. Is the power balance test done?

YES

▸ If injector connector for power balance test is disconnect for over 46 sec., this can cause DTC relating to misfire. Stop the test and connect it and delete DTC and then go to "Verification of Vehicle repair" procedure.
▸ If power balance test is finished within 46 sec., go to next procedure.

NO

▸ Go to "Monitor scantool data" as follows.

2. Monitor scantool data
   (1) Ignition "OFF"
   (2) Connect Scantool and Engine "ON"
   (3) Monitor parameters related to " Cylinder 6 Misfire Detected" on CURRENT DATA
   Specification :

Ignition	BTDC 10° ± 5°		
Idle speed	A/CON OFF	Neutral, N, R, P-range	620 ± 100 rpm
		D-range	
	A/CON ON	Neutral, N, R, P-range	
		D-range	

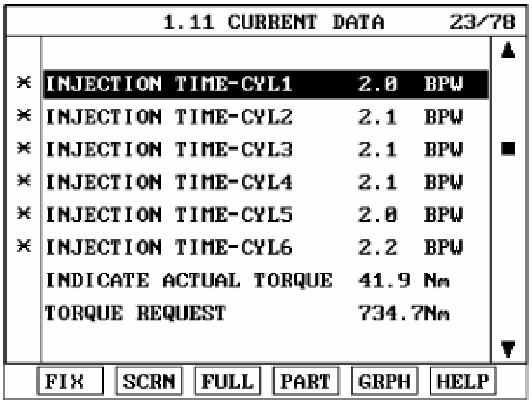


Fig. 1

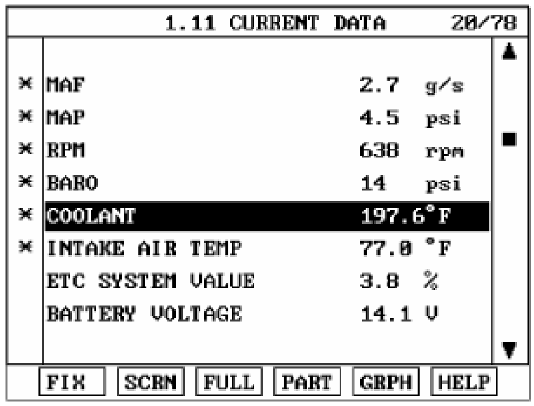


Fig. 2

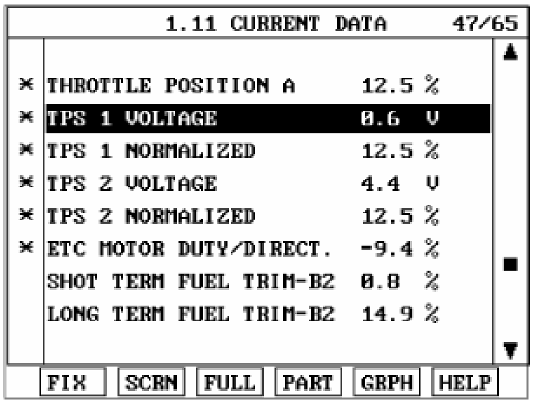


Fig. 3

(4) Are the parameters related to "Cylinder 6 Misfire Detected" displayed correctly on Current Data ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "System Inspection " procedure

SYSTEM INSPECTION

1. Check Spark Pulg
   (1) Remove cylinder's spark plugs
   (2) Visually/physically inspect the following items:
   - Damaged insulation, Worn electrodes, Oil or fuel fouled, Loose terminals and cracks
   - Check for plug gap : 1.0 - 1.1 mm (0.039 - 0.043 in.)
   - Check if the spark plug for the relevant cylinder is lighter in color than the other plugs.

   (3) Has a problem been found in any of the above areas?

   YES

   ▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

   NO

   ▸ Go to "Check Air Leakage " as below

2. Check Air Leakage
   (1) Visually/physically inspect the air leakage in intake/exhaust system as following items,
   - Vacuum hoses for splits, kinks and improper connections.
   - Throttle body gasket
   - Gasket between intake manifold and cylinder head
   - Seals between intake manifold and fuel injectors
   - Exhaust system between HO2S and Three way catalyst for air leakage

   (2) Has a problem been found in any of the above areas?

YES

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Check for air leakage in Positive Crankcase Ventilation Valve(PCV)

3. Check for air leakage in Positive Crankcase Ventilation Valve(PCV)
   (1) Remove PCV valve from cylinder head cover by puling ventilation hose

   (2) With engine idling block PCV valve opening

   (3) Verify that vacuum is felt

   (4) Remove PCV valve

   (5) Blow through valve from prot "A" and verify that air comes out of prot "B"

   (6) Blow through valve from prot "B" and verifty that no air comes out of port "A"

   (7) Has a problem been found ?

YES

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Check Compression pressure" as below

4. Check Compression pressure
   (1) Warm up the engine to normal operating temperature

   (2) Disconnect the spark plug cables and remove the spark plugs.

   (3) Crank the engine to remove any foreign material in the cylinders.

   (4) Put compression pressure gauge into spark pulg hole

   (5) Crank the engine with widely opend throttle valve and check compression pressure at each cylinder

Specification : 1323kPa(13.5 kg/cm²,192 psi)

   (6) Is compression pressure for each cylinder displayed within specifications ?

YES

▸ Go to "Check Timing " as below

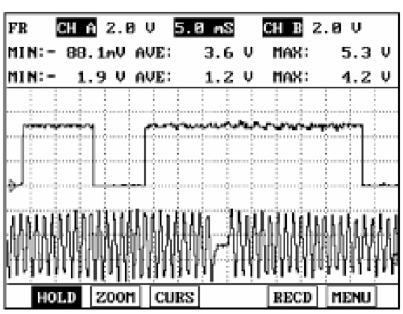
NO

▸ Add a small amount of oil through the spark plug hole, and repeat above steps. If the addition of oil causes the compression to rise, the cause is a worn or damaged piston ring or cylinder inner surface.
▸ If the compression remains the same, the cause is a burnt or defective valve seat, or pressure is leaking from the gasket. Repair as necessary and go to "Verification of Vehicle Repair" procedure

5. Check Timing
   (1) Ignition "OFF"

   (2) Check that Cam, Crank and Oil pump sprocket timing marks are correctly in alignment

   (3) Monitor these signal waveforms from CAM and Crank shaft position Sensor are correctly in alignment



   (4) Are all timing marks alligned correctly ?

YES

▸ Go to "Check Fuel Pressure Test" as below

NO

   (5) ▸ Repair or readjust as necessary and go to "Verification of Vehicle Repair" procedure

6. Check Fuel Pressure Test
   (1) Refer to "Fuel pressure test" in "Fuel delivery system"
   (2) Are the measured fuel pressure within specifications ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Repair or replace as necessary above and then, go to " Verification of Vehicle Repair"procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

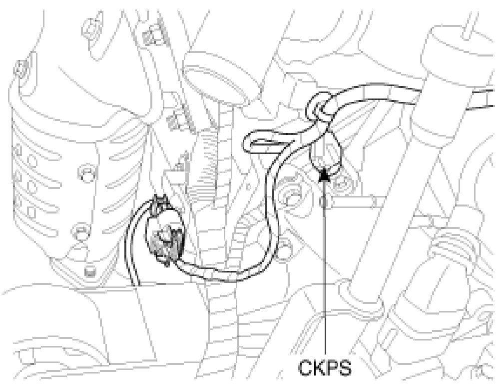
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0315

COMPONENT LOCATION



GENERAL DESCRIPTION

The Tooth Error Correction (TEC) Learn Algorithm determines engine-specific variation in crankshaft position sensing. The largest factor of variation is geometric tooth spacing although other factors, such as bearing run out, may also be present. Once TEC is learned, compensation factors are then calculated and used by the Misfire Diagnostic algorithm to improve the accuracy of engine positiondeterminations.Tooth error correction factors are normally learned only once during the life of a vehicle. However, if a vehicle controller, engine crankshaft, target wheel, or crank sensor is replaced or serviced, tooth error correction factors must be re-learned. This can be performed in a service environment with serial data commands.

DTC DESCRIPTION

It is impossible to forge or machine a perfectly proportioned crankshaft wheel. Therefore, each crankshaft wheel produced will have minor variations in the spacing and/or width of its gear teeth.These variations (tooth error), if not compensated for, can cause false misfire detection. In order to account for tooth error, the tooth error correction algorithm measures the variation in crankshaft wheel teeth and calculates a compensation factor, which is applied to the reference periods when the misfire detection algorithm runs. This compensation factor is learned once, early in the life of the vehicle, and need never be learned again unless the crank

wheel is replaced or the vehicle's PCM EEPROM or similar storage device is erased.
Checking tooth error correction under detecting condition, if the TEC is out of Threshold value, PCM sets P0315.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• This DTC indicates that crankwheel tooth error has not been learned.	• CKPS • Target wheel • PCM
Enable Conditions	• 11.4932 ≤ Ignition Voltage ≤15.9907 • 10.0006 ≤ Engine load< 89.9993 • 2000 ≤ engine speed ≤ 4000 • Vehicle speed < 5kph(3.106856 mph) • Tec RPM stability timer >10sec • 0°C(32°F)< coolant temp< 110°C(230°F) • Not active disabling faults • Not key on disabling faults	
Threshold value	• Distance driven without learning tooth error ≥ 4000km (2485.484769 mile) • Maximum allowed number of tooth error correction samples taken in the On The Road(OTR)learning mode< 50 counts • Individual tooth error factors outside calibratable range = True • Sum of tooth error factors variation outside calibratable range ≥ 50 counts	
Diagnosis Time	• Continuous (More than 0.15sec failure)	
MIL On Condition	• DTC only	

COMPONENT INSPECTION

1. Visually check CKPS and target wheel
   (1) IG "OFF"
   (2) Check CKPS and target wheel for deformation or damage visually
   (3) Is the above items normal ?

   YES

   ▸ Go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

   > **NOTE**
   >
   > There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

   YES

   ▸ Go to the applicable troubleshoooting procedure.

   NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0325

COMPONENT LOCATION

GENERAL DESCRIPTION

Knocking is a phenomenon characterized by undesirable vibration and noise that can cause engine damage. A knock sensor (KS) is mounted on the cylinder block and senses engine knocking. A knocking vibration from the cylinder block is applied as pressure to the piezoelectric element. A knock sensor (KS) detects vibration when RPM rises or drops and generates voltages based on this vibration. The PCM controls the ignition timing based on the amplitude and frequency of the knock sensor signal. For example, if engine knocking occurs, the ignition timing is retarded to prevent it.

DTC DESCRIPTION

Checking the range of input signal with a knock sensor under detecting condition, PCM senses open or short in knock sensor circuit or malfunction of sensor. If a knock signal or noise level is without the specified value during standard duration, PCM sets P0325. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Signal open	• Poor connection • Open in harness • Knock sensor • PCM
Enable Conditions	• Pressure in intake manifold is normal. • Engine speed ≤ 1600rpm	
Threshold value	• Filter coefficient < 0.8	
Diagnosis Time	• Continuous (More than 12.5 sec.failure for every 25 sec.test)	
MIL On Condition	• 2 driving cycles	

SIGNAL WAVEFROM AND DATA

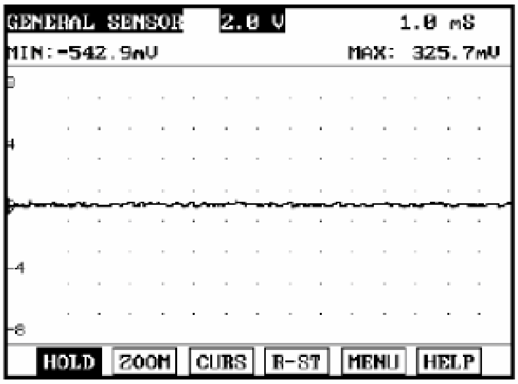
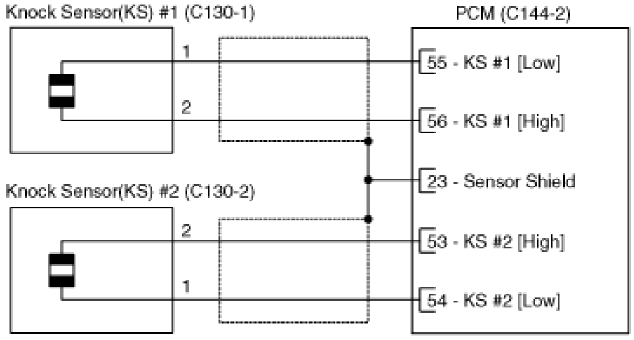


Fig. 1

The knock sensor is installed at cycliner block to detect the vibration effectively during engine running.
The above waveform shows the signal waveform of knock sensor when knock dosen't happen. Generally, knock signal has more noise than other sensor.

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

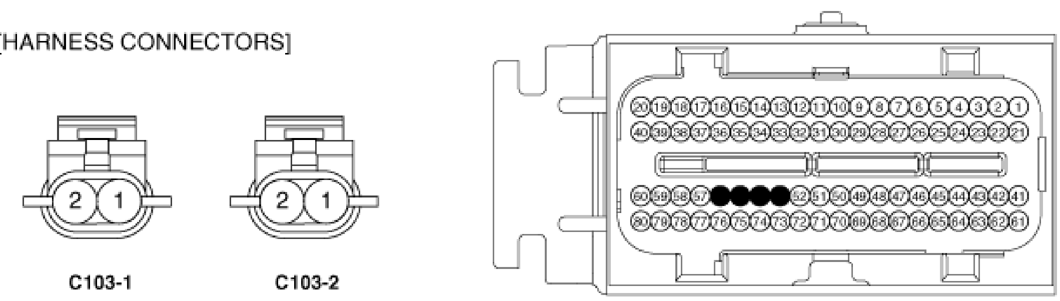
KS #1 (Cyl. #4,5,6)

Terminal	Connected to	Funtion
1	PCM C144-2 (55)	KS #1 [Low] signal
2	PCM C144-2 (56)	KS #1 [High] signal

KS #2 (Cyl. #1,2,3)

Terminal	Connected to	Funtion
1	PCM C144-2 (54)	KS #2 [Low] signal
2	PCM C144-2 (53)	KS #2 [High] signal

[HARNESS CONNECTORS]



C103-1 KS #1

C103-2 KS #2

C144-2 PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor item related to knock sensor on the service data.

Normal data at idle

4. Is the service data displayed correctly ?

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▶ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure

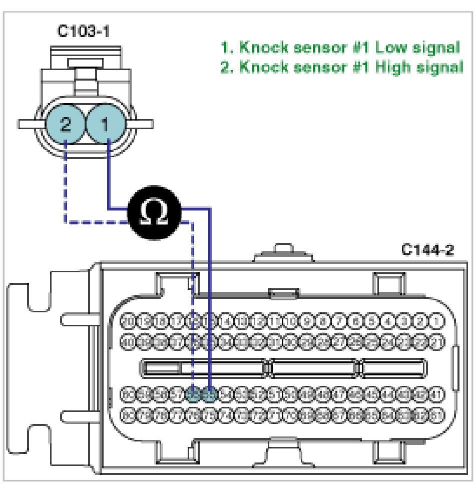
NO

▶ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check open in harness
   (1) IG "OFF" and disconnect knock sensor connector and PCM connector.
   (2) Measure resistance between terminal 1 of knock sensor harness connector and terminal 55 of PCM harness connector.
   (3) Measure resistance between terminal 2 of knock sensor harness connector and terminal 56 of PCM harness connector.

Specification : Below 1Ω



   (4) Is the measured resistance within specification?

YES

▸ If the problem is corrected after substituting with a known - good knock sensor, replace it. If the problem is pending, check for proper operating after substituting with a known - good PCM. and then if the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0326

COMPONENT LOCATION

GENERAL DESCRIPTION

Knocking is a phenomenon characterized by undesirable vibration and noise that can cause engine damage. A knock sensor (KS) is mounted on the cylinder block and senses engine knocking. A knocking vibration from the cylinder block is applied as pressure to the piezoelectric element. A knock sensor (KS) detects vibration when RPM rises or drops and generates voltages based on this vibration. The PCM controls the ignition timing based on the amplitude and frequency of the knock sensor signal. For example, if engine knocking occurs, the ignition timing is retarded to prevent it.

DTC DESCRIPTION

Checking the range of input signal with a knock sensor under detecting condition, PCM senses open or short in knock sensor circuit or malfunction of sensor. If a knock signal or noise level is without the specified value during standard duration, PCM sets P0326. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy		

	• Signal short	• Poor connection • Short in harness • Knock sensor • PCM
Enable Conditions	• Pressure in intake manifold is normal. • Engine speed ≤ 1600rpm	
Threshold value	• Knock Filtered Value < 5 or > 65	
Diagnosis Time	• Continuous (More than 12.5 sec.failure for every 25 sec.test)	
MIL On Condition	• 2 driving cycles	

SIGNAL WAVEFROM AND DATA

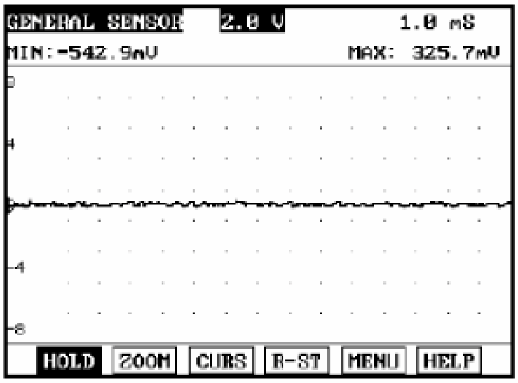
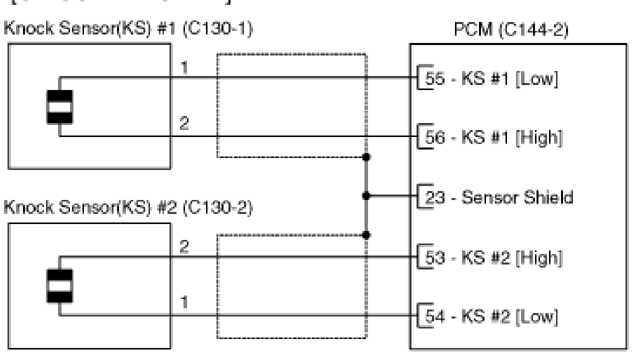


Fig. 1

The knock sensor is installed at cycliner block to detect the vibration effectively during engine running.
The above waveform shows the signal waveform of knock sensor when knock dosen't happen. Generally, knock signal has more noise than other sensor.

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

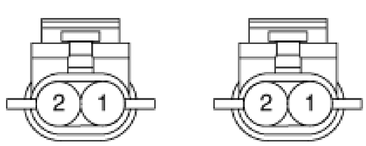
KS #1 (Cyl. #4,5,6)

Terminal	Connected to	Funtion
1	PCM C144-2 (55)	KS #1 [Low] signal
2	PCM C144-2 (56)	KS #1 [High] signal

KS #2 (Cyl. #1,2,3)

Terminal	Connected to	Funtion
1	PCM C144-2 (54)	KS #2 [Low] signal
2	PCM C144-2 (53)	KS #2 [High] signal

[HARNESS CONNECTORS]

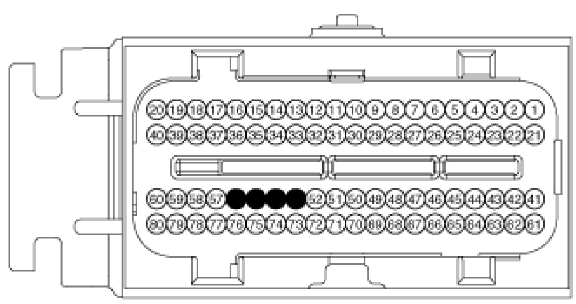


C103-1

KS #1

C103-2

KS #2



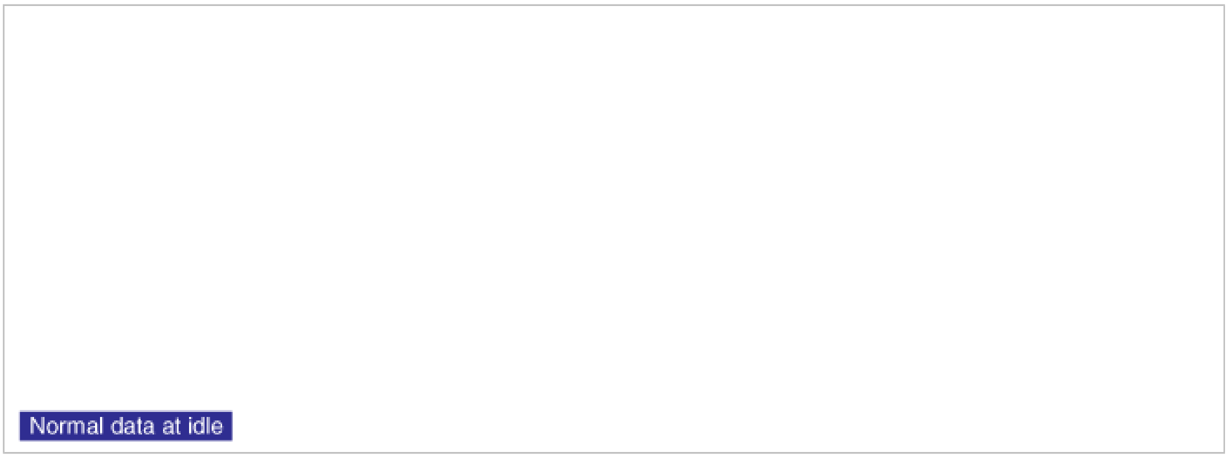
C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.

2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor item related to knock sensor on the service data.



4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

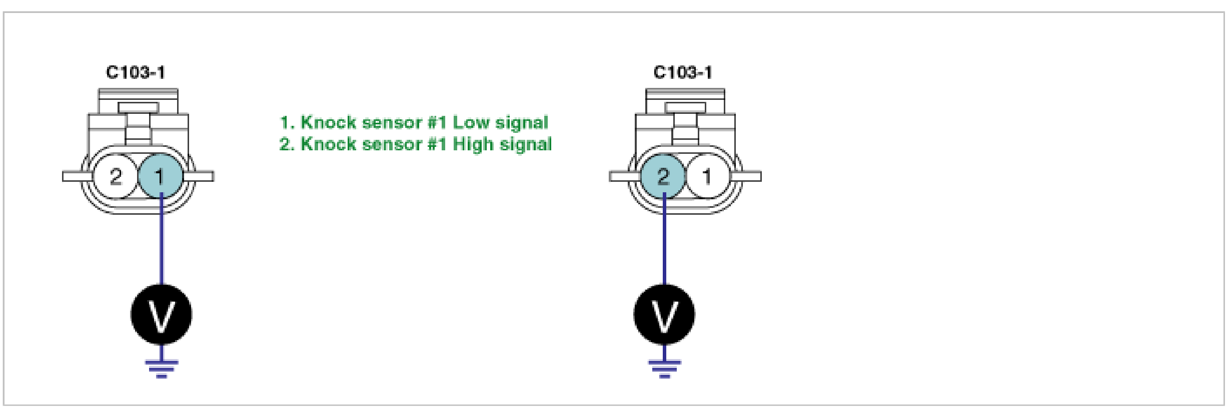
NO

▸ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check short to battery in harness
   (1) IG "OFF" and disconnect knock sensor connector.
   (2) IG "ON" and ENG "OFF"
   (3) Measure voltage between terminal 1 of knock sensor harness connector and chassis ground.
   (4) Measure voltage between terminal 2 of knock sensor harness connector and chassis ground.

   Specification : Approx. 1.5V



   (5) Is the measured voltage within specification?

YES

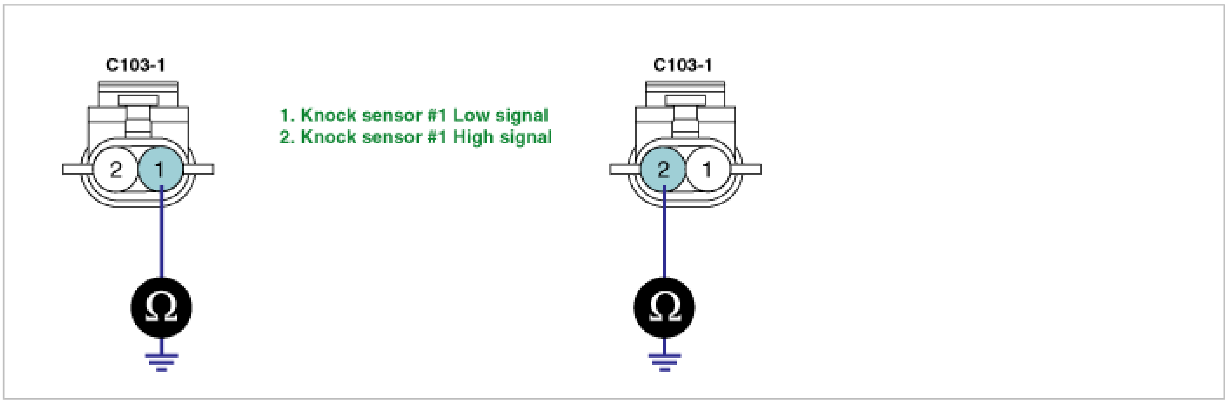
▸ Go to "Check short to ground in harness" as follows.

NO

▸ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check short to ground in harness
   (1) IG "OFF" and disconnect knock sensor connector and PCM connector.
   (2) Measure resistance between terminal 1 of knock sensor harness connector and chassis ground.
   (3) Measure resistance between terminal 2 of knock sensor harness connector and chassis ground.

Specification : Infinite



   (4) Is the measured resistance within specification ?

YES

▸ If the problem is corrected after substituting with a known - good knock sensor, replace it. If the problem is pending, check for proper operating after substituting with a known - good PCM. and then if the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0330

COMPONENT LOCATION

GENERAL DESCRIPTION

Knocking is a phenomenon characterized by undesirable vibration and noise that can cause engine damage. A knock sensor (KS) is mounted on the cylinder block and senses engine knocking. A knocking vibration from the cylinder block is applied as pressure to the piezoelectric element. A knock sensor (KS) detects vibration when RPM rises or drops and generates voltages based on this vibration. The PCM controls the ignition timing based on the amplitude and frequency of the knock sensor signal. For example, if engine knocking occurs, the ignition timing is retarded to prevent it.

DTC DESCRIPTION

Checking the range of input signal with a knock sensor under detecting condition, PCM senses open or short in knock sensor circuit or malfunction of sensor. If a knock signal or noise level is without the specified value during standard duration, PCM sets P0330. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Signal open	• Poor connection • Open in harness • Knock sensor • PCM
Enable Conditions	• Pressure in intake manifold is normal. • Engine speed ≤ 1600rpm	
Threshold value	• Filter coefficient < 0.8	
Diagnosis Time	• Continuous (More than 12.5 sec.failure for every 25 sec.test)	
MIL On Condition	• 2 driving cycles	

SIGNAL WAVEFROM AND DATA

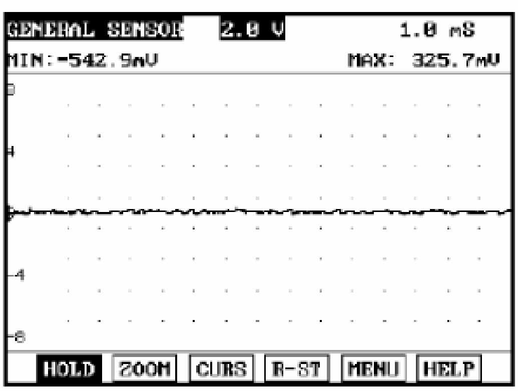
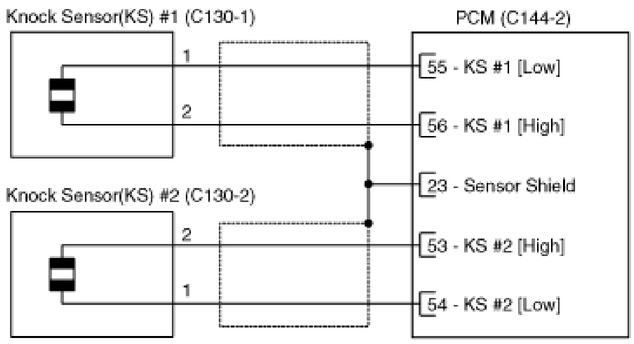


Fig. 1

The knock sensor is installed at cycliner block to detect the vibration effectively during engine running.
The above waveform shows the signal waveform of knock sensor when knock dosen't happen. Generally, knock signal has more noise than other sensor.

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

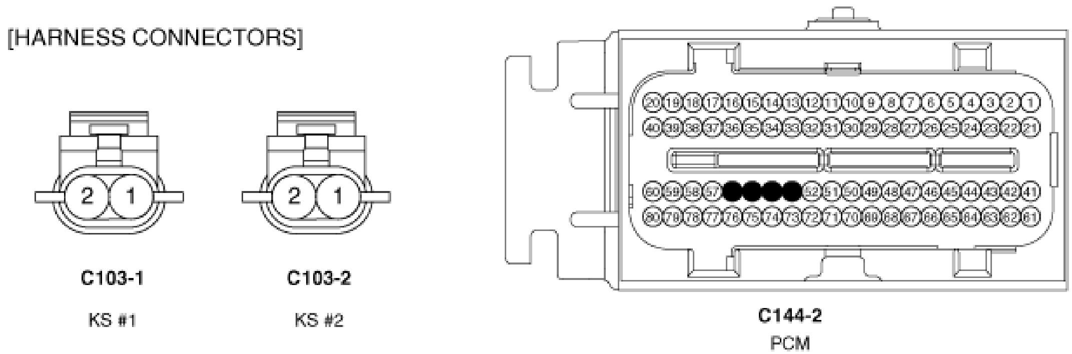
KS #1 (Cyl. #4,5,6)

Terminal	Connected to	Funtion
1	PCM C144-2 (55)	KS #1 [Low] signal
2	PCM C144-2 (56)	KS #1 [High] signal

KS #2 (Cyl. #1,2,3)

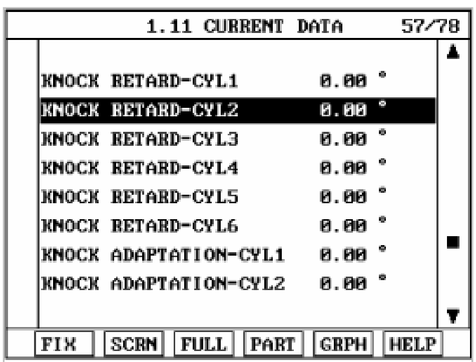
Terminal	Connected to	Funtion
1	PCM C144-2 (54)	KS #2 [Low] signal
2	PCM C144-2 (53)	KS #2 [High] signal

[HARNESS CONNECTORS]



MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor item related to knock sensor on the service data.



Normal data at idle

4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

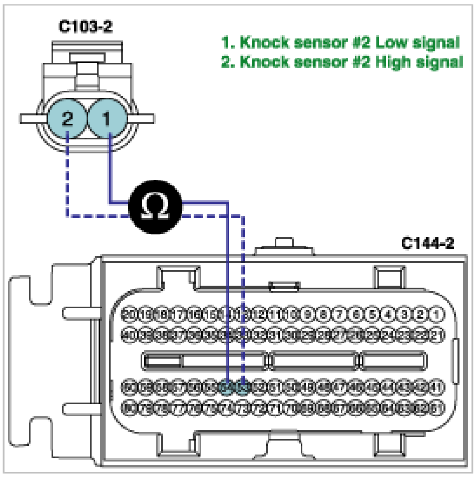
NO

▸ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check open in harness
   (1) IG "OFF" and disconnect knock sensor connector and PCM connector.
   (2) Measure resistance between terminal 1 of knock sensor harness connector and terminal 54 of PCM harness connector.
   (3) Measure resistance between terminal 2 of knock sensor harness connector and terminal 53 of PCM harness connector.

Specification : Below 1Ω



   (4) Is the measured resistance within specification?

YES

▸ If the problem is corrected after substituting with a known - good knock sensor, replace it. If the problem is pending, check for proper operating after substituting with a known - good PCM. and then if the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0331

COMPONENT LOCATION

GENERAL DESCRIPTION

Knocking is a phenomenon characterized by undesirable vibration and noise that can cause engine damage. A knock sensor (KS) is mounted on the cylinder block and senses engine knocking. A knocking vibration from the cylinder block is applied as pressure to the piezoelectric element. A knock sensor (KS) detects vibration when RPM rises or drops and generates voltages based on this vibration. The PCM controls the ignition timing based on the amplitude and frequency of the knock sensor signal. For example, if engine knocking occurs, the ignition timing is retarded to prevent it.

DTC DESCRIPTION

Checking the range of input signal with a knock sensor under detecting condition, PCM senses open or short in knock sensor circuit or malfunction of sensor. If a knock signal or noise level is without the specified value during standard duration, PCM sets P0331. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Signal short	• Poor connection • Short in harness • Knock sensor • PCM
Enable Conditions	• Pressure in intake manifold is normal. • Engine speed ≤ 1600rpm	
Threshold value	• Knock Filtered Value < 5 or > 65	
Diagnosis Time	• Continuous (More than 12.5 sec.failure for every 25 sec.test)	
MIL On Condition	• 2 driving cycles	

SIGNAL WAVEFROM AND DATA

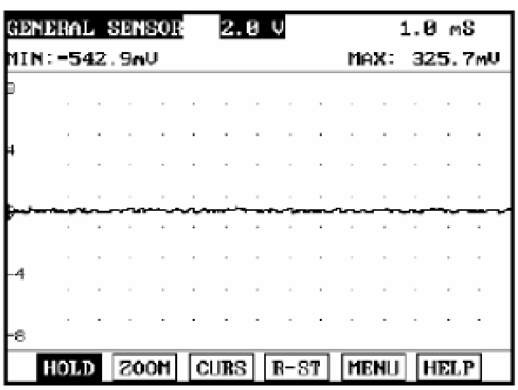
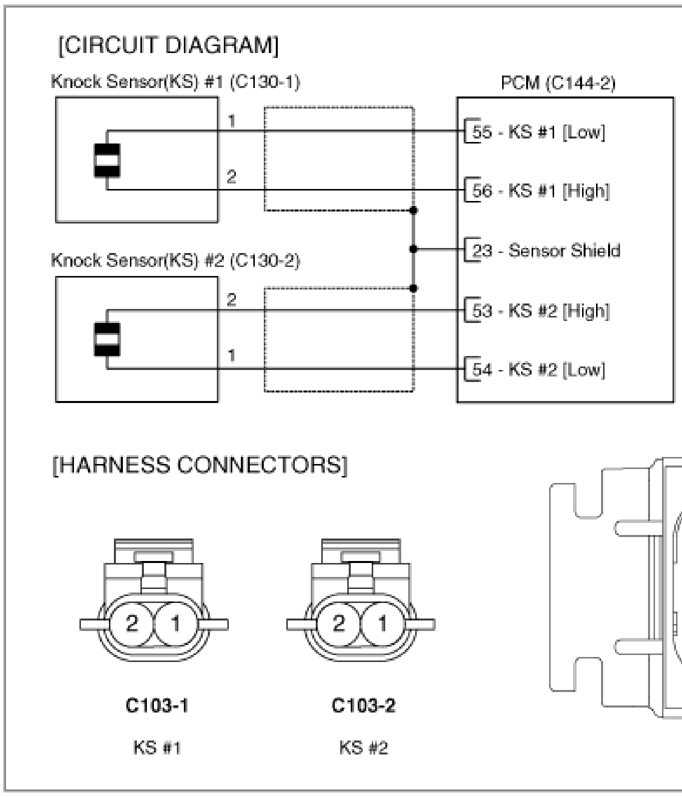


Fig. 1

The knock sensor is installed at cycliner block to detect the vibration effectively during engine running.
The above waveform shows the signal waveform of knock sensor when knock dosen't happen. Generally, knock signal has more noise than other sensor.

SCHEMATIC DIAGRAM



[CONNECTION INFORMATION]

KS #1 (Cyl. #4,5,6)

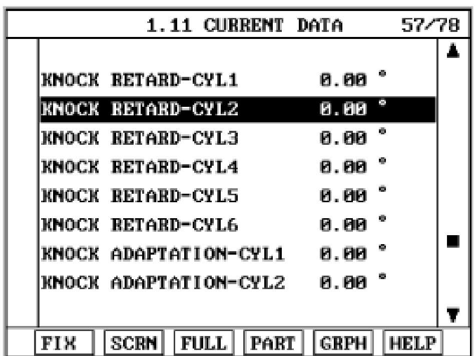
Terminal	Connected to	Funtion
1	PCM C144-2 (55)	KS #1 [Low] signal
2	PCM C144-2 (56)	KS #1 [High] signal

KS #2 (Cyl. #1,2,3)

Terminal	Connected to	Funtion
1	PCM C144-2 (54)	KS #2 [Low] signal
2	PCM C144-2 (53)	KS #2 [High] signal

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor item related to knock sensor on the service data.



Normal data at idle

4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

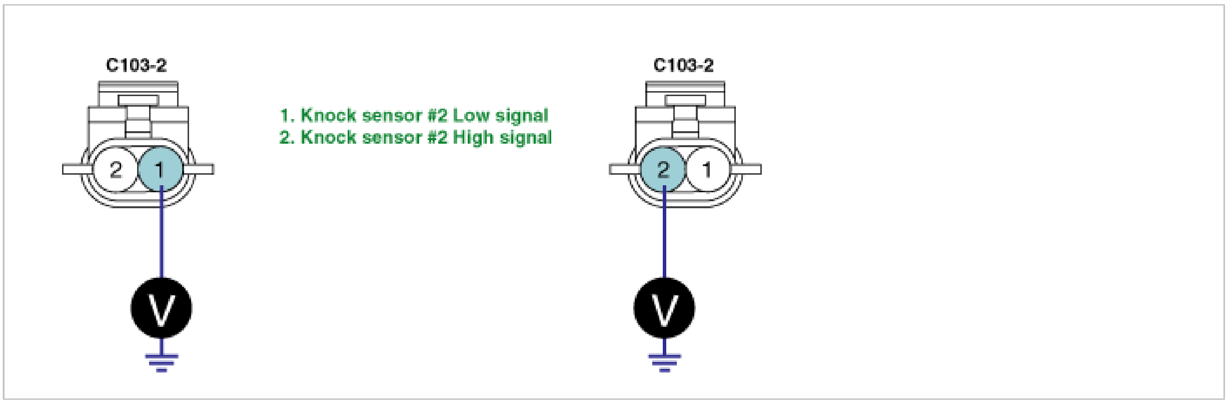
NO

▸ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check short to battery in harness
   (1) IG "OFF" and disconnect knock sensor connector.
   (2) IG "ON" and ENG "OFF"
   (3) Measure voltage between terminal 1 of knock sensor harness connector and chassis ground
   (4) Measure voltage between terminal 2 of knock sensor harness connector and chassis ground.

Specification : Approx. 1.5V



   (5) Is the measured voltage within specification?

YES

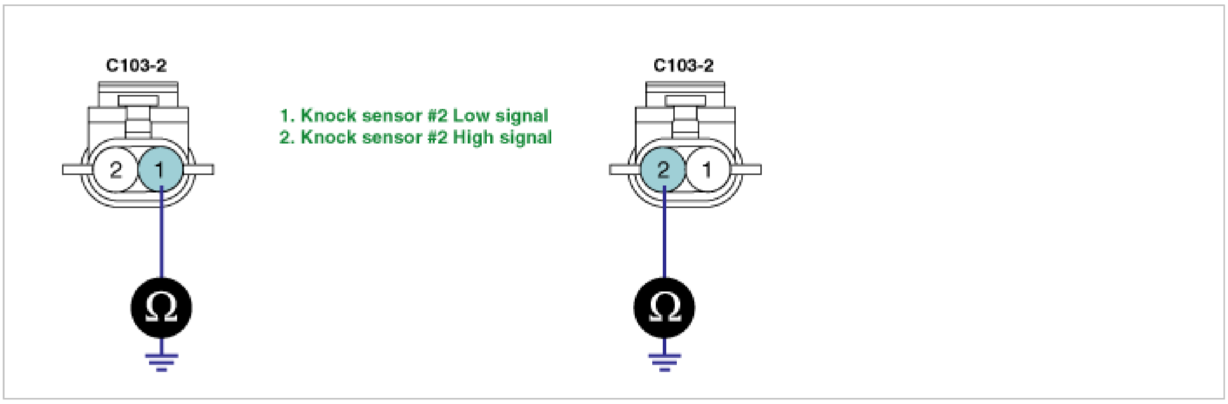
▸ Go to "Check short to ground in harness" as follows.

NO

▸ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check short to ground in harness
   (1) IG "OFF" and disconnect knock sensor connector and PCM connector.
   (2) Measure resistance between terminal 1 of knock sensor harness connector and chassis ground.
   (3) Measure resistance between terminal 2 of knock sensor harness connector and chassis ground.

Specification : Infinite



   (4) Is the measured resistance within specification?

YES

▸ If the problem is corrected after substituting with a known - good knock sensor, replace it. If the problem is pending, check for proper operating after substituting with a known - good PCM. and then if the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

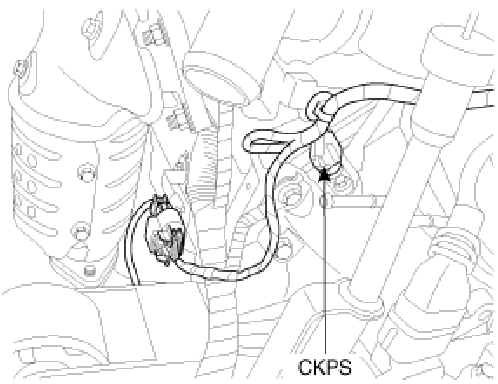
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0335

COMPONENT LOCATION



GENERAL DESCRIPTION

Crankshaft Position Sensor (58X) derives its name from the fact that current systems utilize a Crankshaft Position Sensor, coupled with a 58-tooth crankshaft wheel, to determine crankshaft angular position. Each edge of the wheel corresponds to a change in crank sensor output voltage as a tooth edge passes the sensor. The sensor will produce 58 pulses with one rotation of the crankshaft.

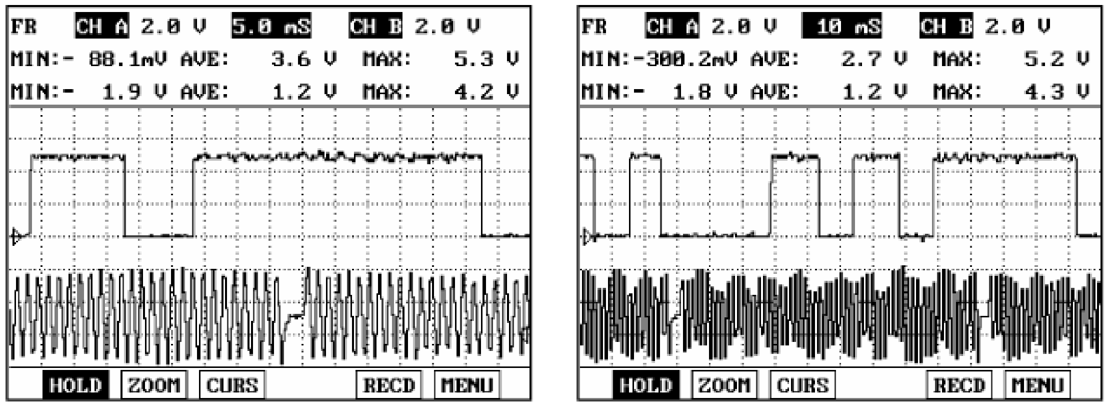
DTC DESCRIPTION

Checking reference signals from CKPS under detecting condition, if any signal is detected for more than 0.15 sec., PCM sets P0335. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Check reference wave during cranking	• Poor connection • Open in harness • CKP sensor • PCM
Enable Conditions	• IG "ON", Cranking or engine-off during driving • No DTC related to CAM	
Threshold value	• No reference signal over 0.15 sec.	
Diagnosis Time	• 0.15 sec.	
MIL On Condition	• 2 driving cycles	

SIGNAL WAVEFROM AND DATA



SPECIFICATION

Resistance	700 ± 70Ω

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]

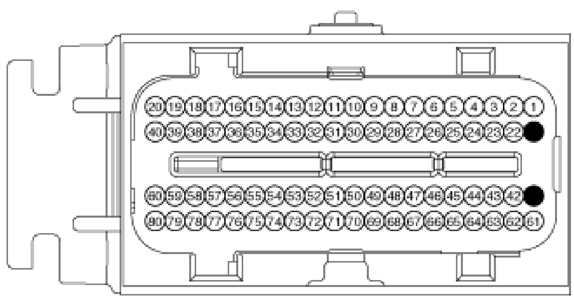
[CONNECTION INFORMATION]

Terminal	Connected to	Funtion
1	PCM C144-2 (41)	CKPS [LOW] Signal
2	PCM C144-2 (21)	CKPS [HIGH] Signal

[HARNESS CONNECTORS]

C129

CKPS



C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor engine speed item on the service data.

Specification : 620 ± 100 rpm

4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

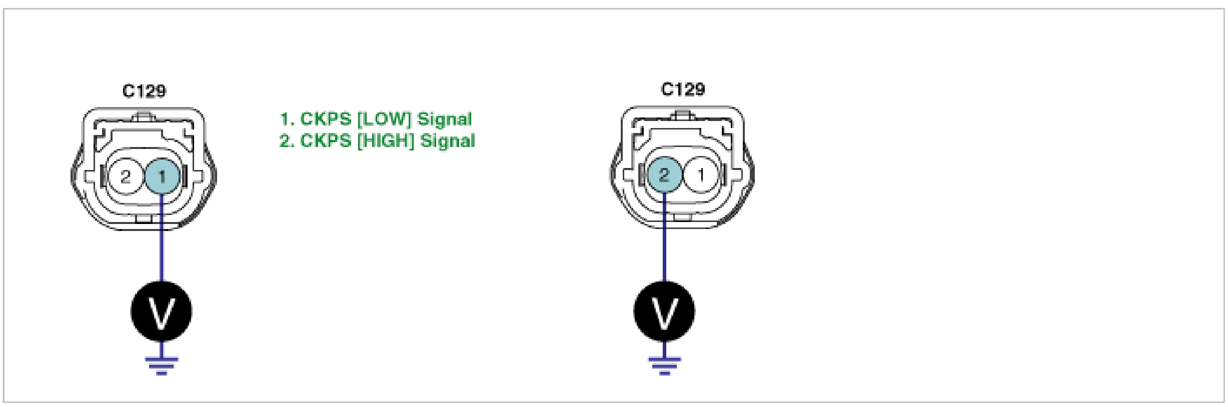
NO

▸ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF" and disconnect CKPS connector.
   (2) IG "ON" and ENG "OFF"
   (3) Measure voltage between terminal 1 of CKPS harness connector and chassis ground.
   (4) Measure voltage between terminal 2 of CKPS harness connector and chassis ground.

Specification : Approx. 1.4V



(5) Is the measured voltage within specification?

YES

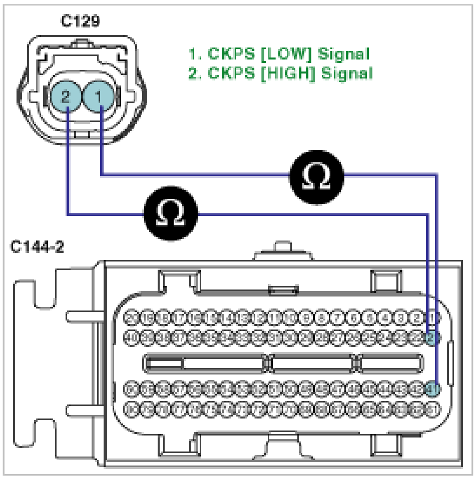
▸ Go to "Component Inspection" procedure.

NO

▸ Go to "Check openn in harness" as follows.

2. Check open in harness
   (1) IG "OFF" and disconnect CKPS connector and PCM connector.
   (2) Measure resistance between terminal 1 of CKPS harness connector and terminal 41 of PCM harness connector.
   (3) Measure resistance between terminal 2 of CKPS harness connector and terminal 21 of PCM harness connector.

Specification : Below 1Ω



   (4) Is the measured resistance within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

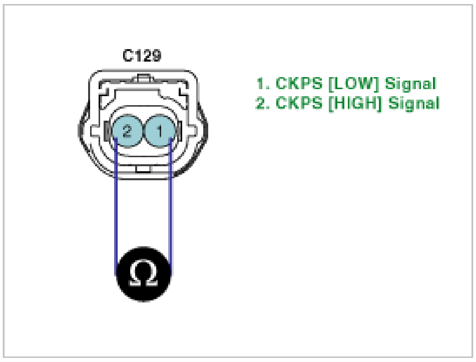
▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check CKPS
   (1) IG "OFF" and disconnect CKPS connector.
   (2) Measure resistance between terminals 1 and 2 of CKPS connector.(Component side)

Specifiation :

Resistance	700 ± 70Ω



   (3) Is the measured resistance within specification?

YES

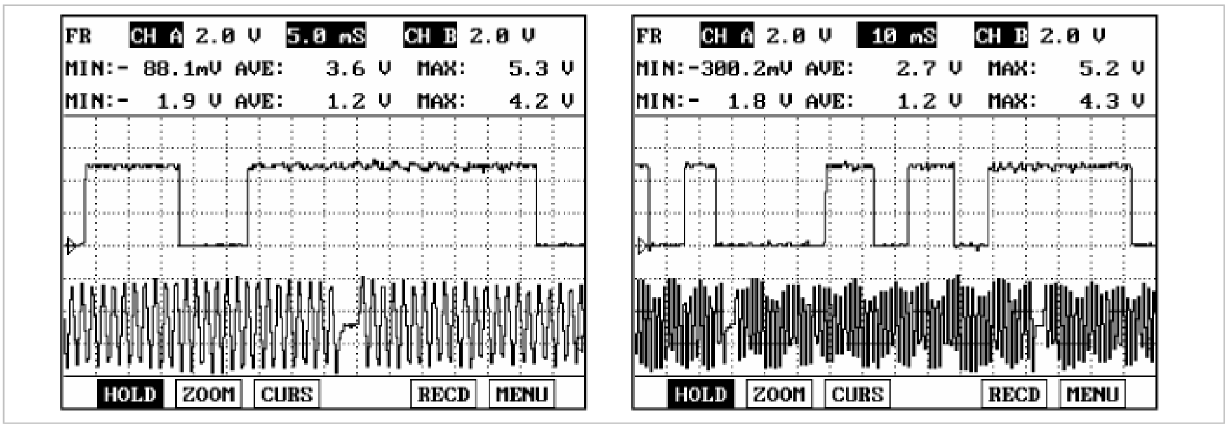
▸ Go to "Check signal waveform of CKPS" as follows.

NO

▸ Substitute with a known - good CKPS and check for proper operation. If the problem is corrected, replace CKPS and go to "Verification of Vehicle Repair" procedure.

2. Check signal waveform of CKPS
   (1) IG "OFF" and connect scantool.
   (2) ENG "ON" and Measure signal waveform at terminal 1 or 2 of CKPS.

Reference signal waveform :



(3) Is the measured siganl waveform normal?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary, and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

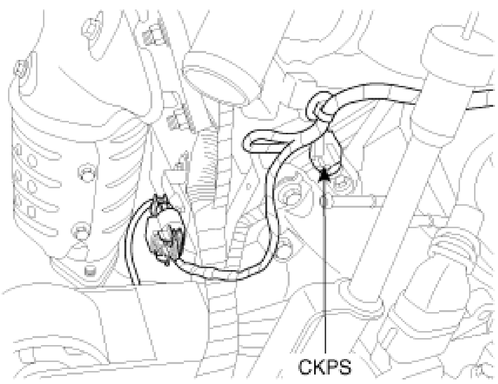
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0336

COMPONENT LOCATION



GENERAL DESCRIPTION

Crankshaft Position Sensor (58X) derives its name from the fact that current systems utilize a Crankshaft Position Sensor, coupled with a 58-tooth crankshaft wheel, to determine crankshaft angular position. Each edge of the wheel corresponds to a change in crank sensor output voltage as a tooth edge passes the sensor. The sensor will produce 58 pulses with one rotation of the crankshaft.

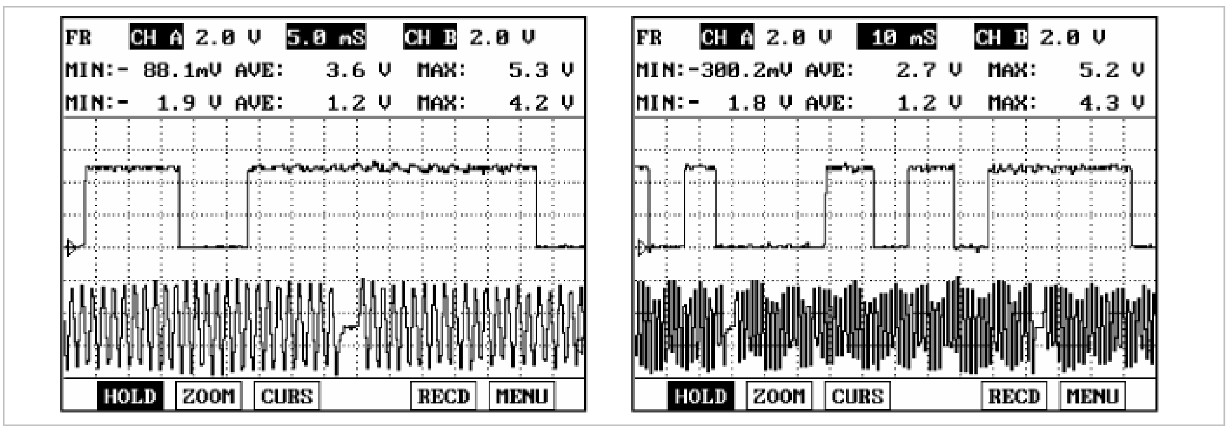
DTC DESCRIPTION

Checking output signals from CKPS every 7.8 sec. under detecting condition, if an output signal is missing or redundant for more than 1.56 sec., PCM sets P0336. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detecting extra/missing pulses between consecutive 58X reference pulses	• Poor connection • Noise • Short in harness • Target wheel • PCM
Enable Conditions	• Engine running state	
Threshold value	• Extra/ missing pulses > 2 pulses and > 1.56 sec.	
Diagnosis Time	• Continuous (More than 1.56 sec.failure for every 7.8 sec.test)	
MIL On Condition	• 2 driving cycles	

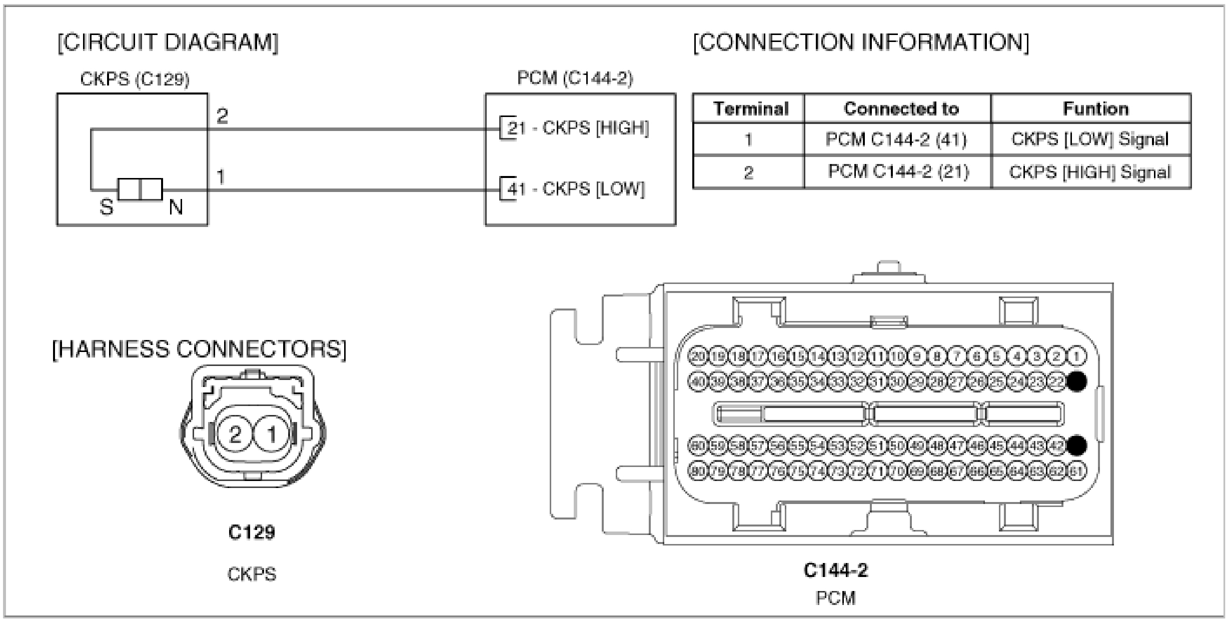
SIGNAL WAVEFROM AND DATA



SPECIFICATION

Resistance	700 ± 70Ω

SCHEMATIC DIAGRAM



MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor engine speed item on the service data.

Specification : 620 ± 100 rpm

4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

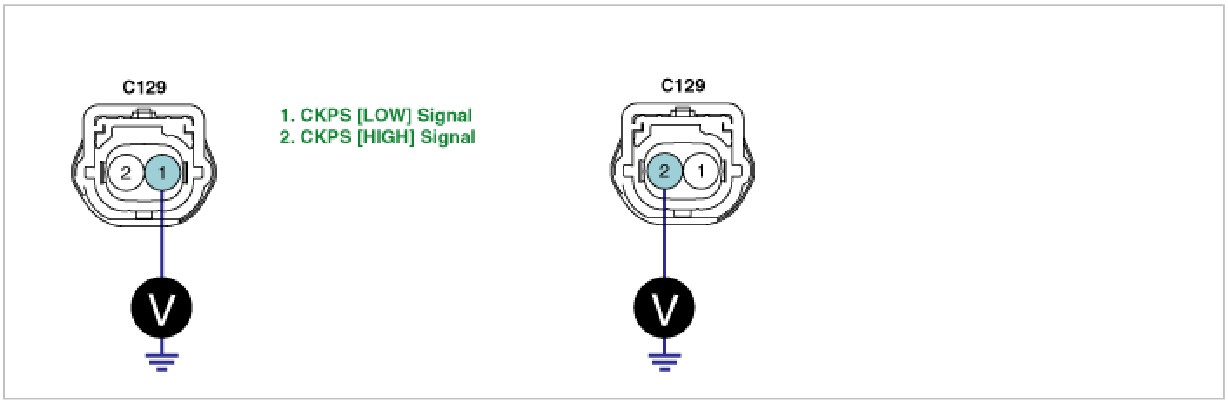
NO

▸ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF" and disconnect CKPS connector.
   (2) IG "ON" and ENG "OFF"
   (3) Measure voltage between terminal 1 of CKPS harness connector and chassis ground.
   (4) Measure voltage between terminal 2 of CKPS harness connector and chassis ground.

Specification : Approx. 1.4V



   (5) Is the measured voltage within specification?

YES

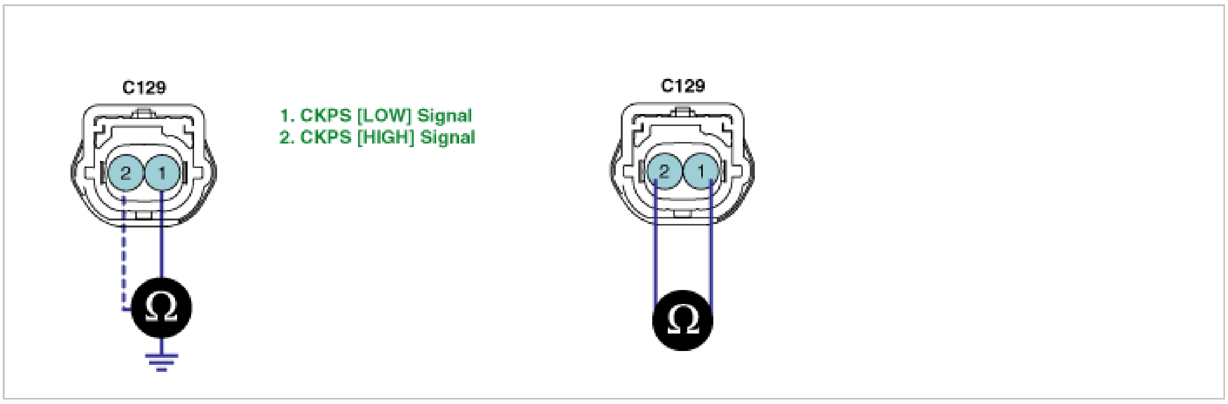
▸ Go to "Component Inspection" procedure.

NO

▸ Go to "Check short in harness" as follows.

2. Check short in harness
   (1) IG "OFF" and disconnect CKPS connector and PCM connector.
   (2) Measure resistance between terminal 1(2) of CKPS harness connector and chassis ground.
   (3) Measure resistance between terminals 1 and 2 of CKPS harness connector.

Specification : Infinite



   (4) Is the measured resistance within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair short in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Visually check CKPS and Target wheel
   (1) IG "OFF"
   (2) Check CKPS and target wheel for deformation or damage visually
   (3) Is the above items normal ?

YES

▶ Go to "Check CKPS resistance" as follows.

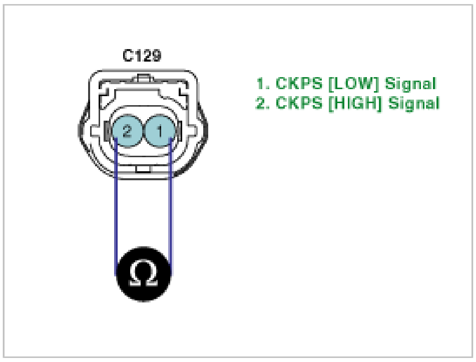
NO

▶ Repair or replace it, and go to "Verification of Vehicle Repair" procedure.

2. Check CKPS resistance
   (1) IG "OFF" and disconnect CKPS connector.
   (2) Measure resistance between terminals 1 and 2 of CKPS connector. (Component side)

Specifiation :

Resistance	700 ± 70Ω



   (3) Is the measured resistance within specification?

YES

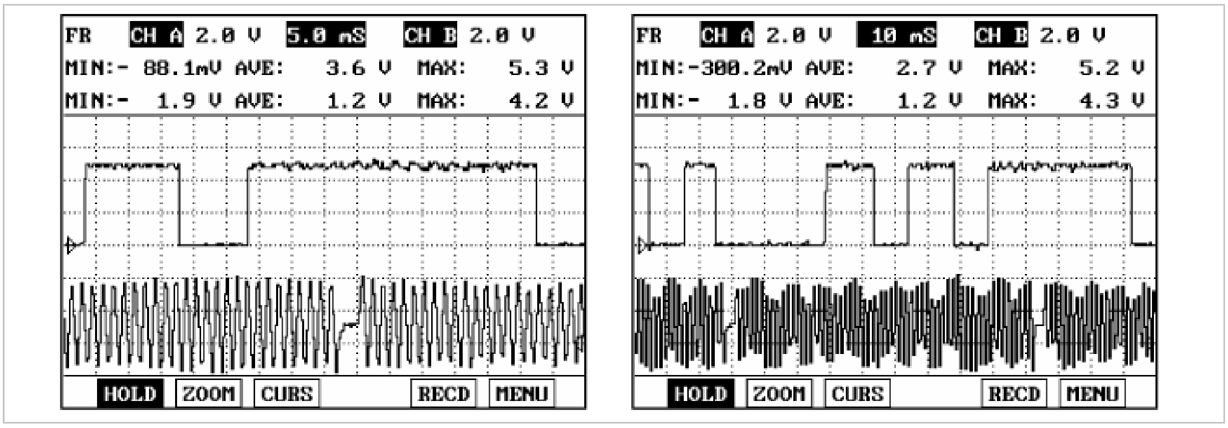
▶ Go to "Check signal waveform of CKPS" as follows.

NO

▶ Substitute with a known - good CKPS and check for proper operation. If the problem is corrected, replace CKPS and go to "Verification of Vehicle Repair" procedure.

3. Check signal waveform of CKPS
   (1) IG "OFF" and connect scantool.
   (2) ENG "ON" and Measure signal waveform at terminal 1 or 2 of CKPS.

Reference signal waveform :



   (3) Is the measured siganl waveform normal?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary, and go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

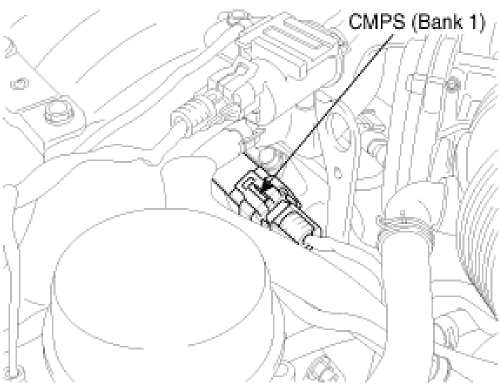
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0340

COMPONENT LOCATION



GENERAL DESCRIPTION

Camshaft Position Sensor (CMPS) is a hall sensor and detects the camshaft position by using a hall element. It is related with Crankshaft Position Sensor (CKPS) and detects the piston position of the each cylinder which the CKPS can’t detect. The two CMPS are installed on engine head cover of bank 1 and 2 and uses a target wheel installed on the camshaft. This sensor has a hall-effect IC which output voltage changes when magnetic field is made on the IC with current flow. When teeth on the target wheel trigger the sensor, output voltage is 5V. If not, it is 0V. These CMPS signal is sent to the PCM and it uses CMPS signals for determining the ignition timing with CKPS signals. CMPS makes Sequential Injection possible.

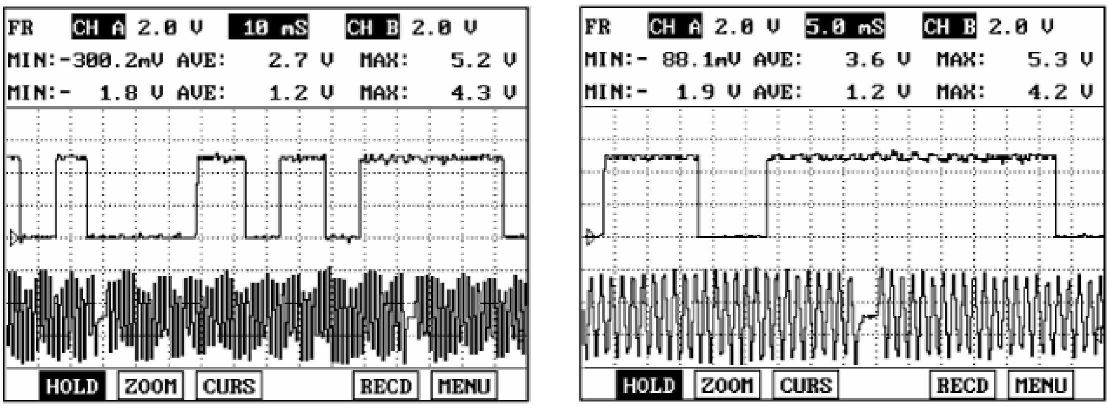
DTC DESCRIPTION

If signals from CMPS is not synchronised with CKPS for more than 3 times under detecting condition, PCM sets P0340. MIL (Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Check if CAM sensor is synchronized correctly	• Poor connection • Open in harness • CMPS(Bank 1) • PCM
Enable Conditions	• Engine running state	
Threshold value	• The number of time that CAM signal is not synchronized ≥ 3	
Diagnosis Time	• Continuous	
MIL On Condition	• 2 driving cycles	

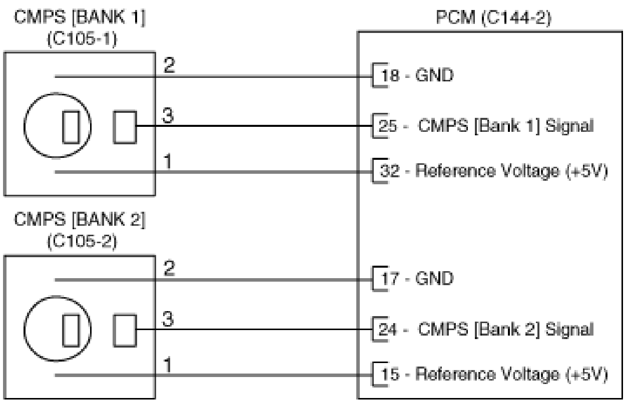
SIGNAL WAVEFROM AND DATA



This example shows a typical Crankshaft Position Sensor(CKPS) and Camshaft Position Sensor(CMPS) waveform at idle. The PCM controls the injection and ignition timing by using these signals. Generally CKPS signal is used to detect the piston's position and CMPS signal is used to detect the Top Dead Center of each cylinder.

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

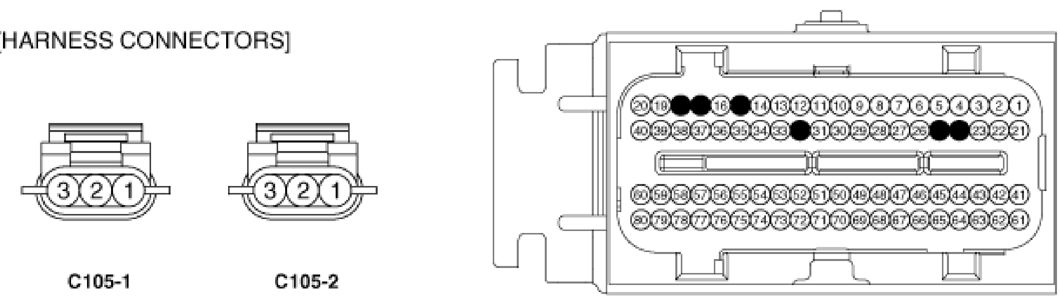
CMPS [BANK 1]

Terminal	Connected to	Funtion
1	PCM C144-2 (32)	Reference Voltage (+5V)
2	PCM C144-2 (18)	Sensor ground
3	PCM C144-2 (25)	CMPS [Bank 1] control

CMPS [BANK 2]

Terminal	Connected to	Funtion
1	PCM C144-2 (15)	Reference Voltage (+5V)
2	PCM C144-2 (17)	Sensor ground
3	PCM C144-2 (24)	CMPS [Bank 2] control

[HARNESS CONNECTORS]



C105-1

CMPS [BANK 1]

C105-2

CMPS [BANK 2]

C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor items related to CMPS on the service data.

4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

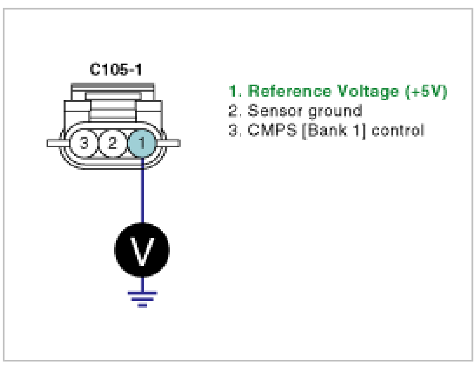
NO

▸ Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION

1. IG "OFF" and disconnect CMPS connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of CMPS(B1) harness connector and chassis ground.

Specification : Approx. 5V



4. Is the measured voltage within specification?

YES

▸ Go to "Signal Circuit Inspection" procedure.

NO

▸ Repair open or short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

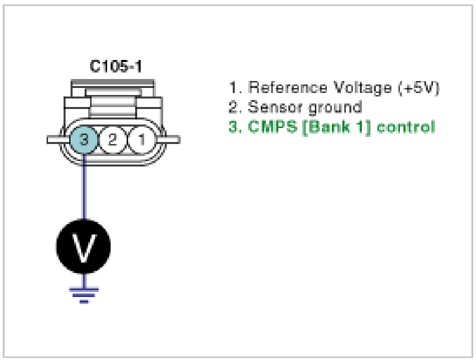
SIGNAL CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF" and disconnect CMPS connector.

(2) IG "ON" and ENG "OFF"

(3) Measure voltage between terminal 3 of CMPS(B1) harness connector and chassis ground.

Specification : Approx. 5V



(4) Is the measured voltage within specification?

YES

▸ Go to "Component Inspection" as follows.

NO

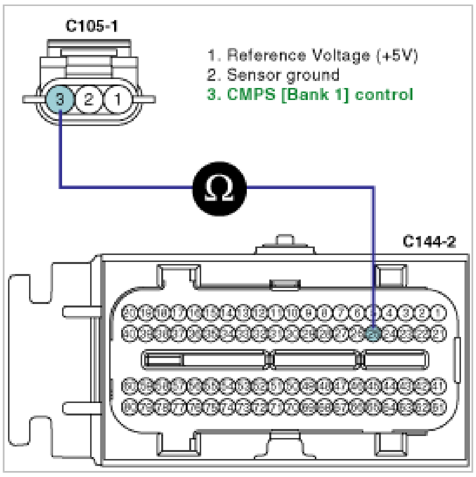
▸ Go to "Check open in harness' as follows.

2. Check open in harness

(1) IG "OFF" and disconnect CMPS connector and PCM connector.

(2) Measure resistance between terminal 3 of CMPS harness connector and terminal 25 of PCM harness connector.

Specification : Below 1Ω



(3) Is the measured resistance within specification?

YES

▸ Go to "Ground Circuit Inspection" procedure.

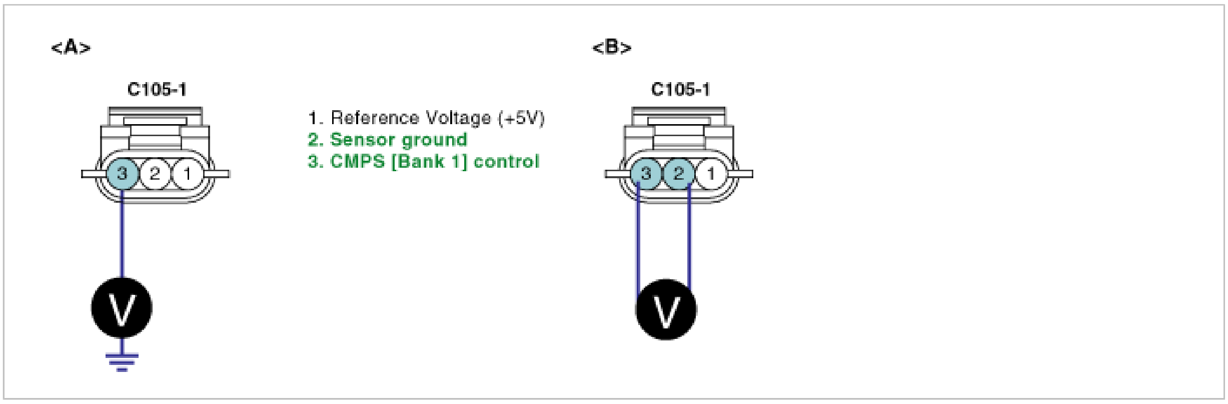
NO

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF" and disconnect CMPS connector.
2. Measure voltage between terminal 3 of CMPS harness connector and chassis ground.
3. Measure voltage between terminals 2 and 3 of CMPS harness connector.

Specification : Measurement "A" - Measurement 'B' = Approx. below 200mV



4. Is the measured voltage within specification?

YES

▸ Go to "Component Inspection" procedure.

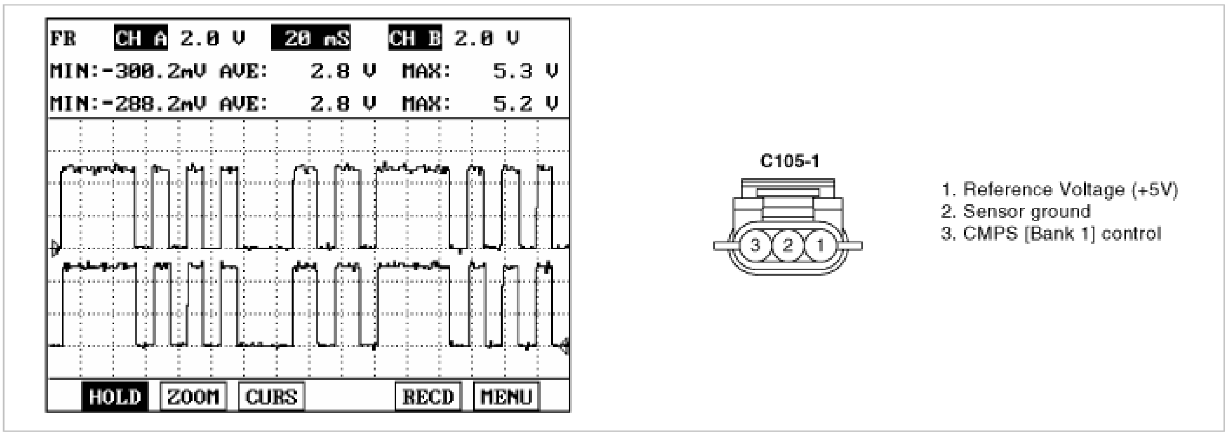
NO

▸ Repair open or contact resistance in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check CMPS
   (1) IG "OFF" and connect scantool.
   (2) ENG "ON" and Measure signal waveform at terminal 3 of CMPS.

Reference signal waveform :



(3) Is the measured siganl waveform normal?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good CMPS and check for proper operation. If the problem is corrected, replace CMPS and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "

5. Are any DTCs present ?

YES

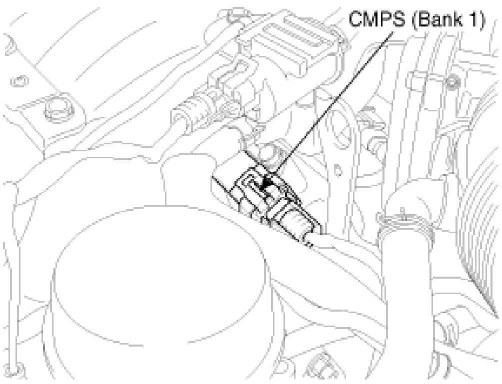
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0341

COMPONENT LOCATION



GENERAL DESCRIPTION

Camshaft Position Sensor (CMPS) is a hall sensor and detects the camshaft position by using a hall element. It is related with Crankshaft Position Sensor (CKPS) and detects the piston position of the each cylinder which the CKPS can’t detect. The two CMPS are installed on engine head cover of bank 1 and 2 and uses a target wheel installed on the camshaft. This sensor has a hall-effect IC which output voltage changes when magnetic field is made on the IC with current flow. When teeth on the target wheel trigger the sensor, output voltage is 5V. If not, it is 0V. These CMPS signal is sent to the PCM and it uses CMPS signals for determining the ignition timing with CKPS signals. CMPS makes Sequential Injection possible.

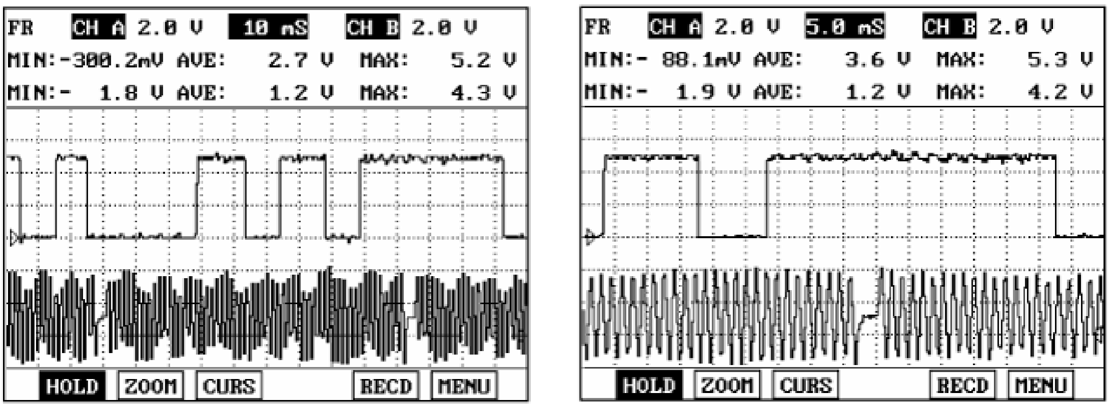
DTC DESCRIPTION

Checking oputput signals from CMP during engine running, if 15 out of 25 signals is abnormal, PCM sets P0341. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Check if CAM sensor is synchronized correctly	• Poor connection • Short in harness • electrical noise • Target wheel • CMPS • PCM
Enable Conditions	• Engine running state	
Threshold value	• Cam tooth count ≠ 6	
Diagnosis Time	• Continuous (More than 15 times failure out of 25 times test)	
MIL On Condition	• 2 driving cycles	

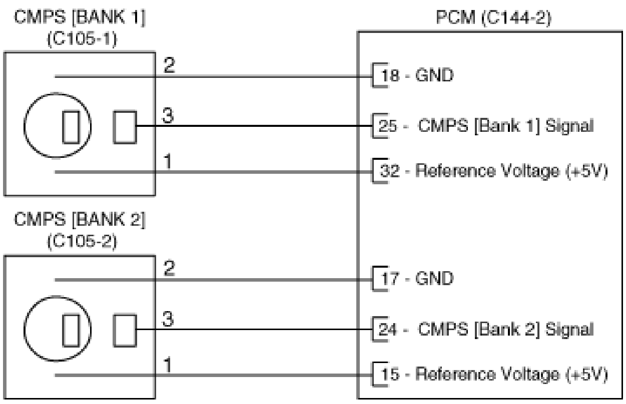
SIGNAL WAVEFROM AND DATA



This example shows a typical Crankshaft Position Sensor(CKPS) and Camshaft Position Sensor(CMPS) waveform at idle. The PCM controls the injection and ignition timing by using these signals. Generally CKPS signal is used to detect the piston's position and CMPS signal is used to detect the Top Dead Center of each cylinder.

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

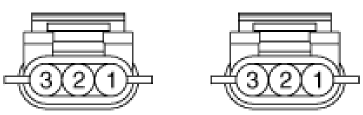
CMPS [BANK 1]

Terminal	Connected to	Funtion
1	PCM C144-2 (32)	Reference Voltage (+5V)
2	PCM C144-2 (18)	Sensor ground
3	PCM C144-2 (25)	CMPS [Bank 1] control

CMPS [BANK 2]

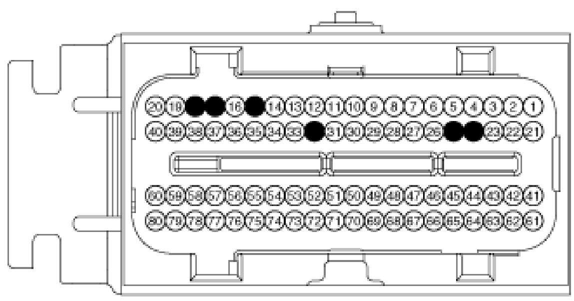
Terminal	Connected to	Funtion
1	PCM C144-2 (15)	Reference Voltage (+5V)
2	PCM C144-2 (17)	Sensor ground
3	PCM C144-2 (24)	CMPS [Bank 2] control

[HARNESS CONNECTORS]



C105-1 **C105-2**

CMPS [BANK 1] CMPS [BANK 2]



C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor items related to CMPS on the service data

4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

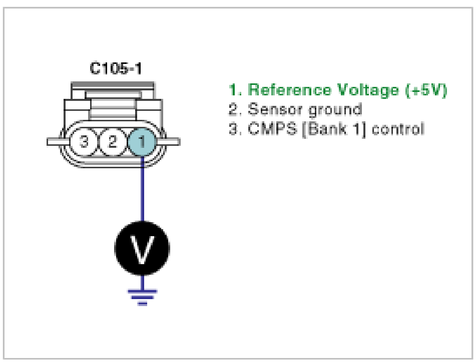
NO

▸ Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION

1. IG "OFF" and disconnect CMPS connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of CMPS(B1) harness connector and chassis ground.

Specification : Approx. 5V



4. Is the measured voltage within specification?

YES

▸ Go to "Signal Circuit Inspection" procedure.

NO

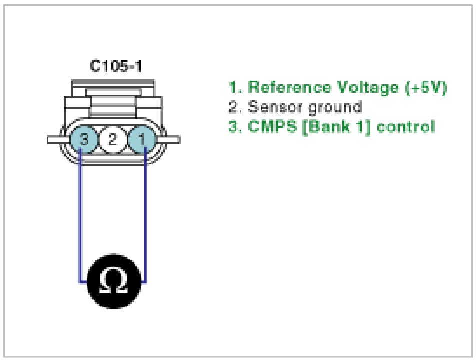
▸ Repair open or short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check short in harness
   (1) IG "OFF" and disconnect CMPS connector.

(2) Measure resistance between terminals 1 and 3 of CMPS(B1) harness connector.

Specification : Infinite



(3) Is the measured voltage within specification?

YES

▶ Go to "Check short to ground in harness' as follows.

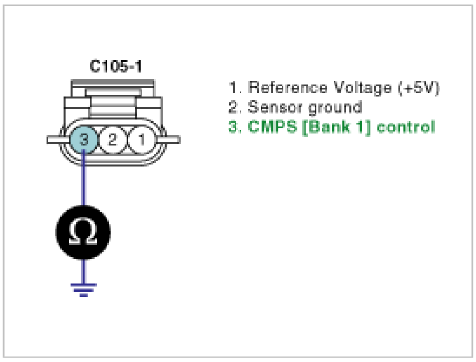
NO

▶ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check short to ground in harness
   (1) IG "OFF" and disconnect CMPS connector and PCM connector.

   (2) Measure resistance between terminal 3 of CMPS(B1) harness connector and chassis ground.

Specification : Infinite



(3) Is the measured resistance within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

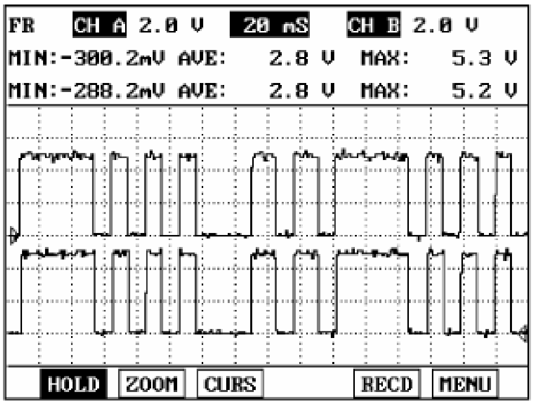
▶ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

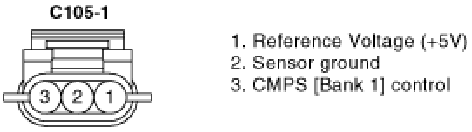
COMPONENT INSPECTION

1. Check CMPS
   (1) IG "OFF" and connect scantool.

   (2) ENG "ON" and Measure signal waveform at terminal 3 of CMPS.

Reference signal waveform :





(3) Is the measured siganl waveform normal?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good CMPS and check for proper operation. If the problem is corrected, replace CMPS and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

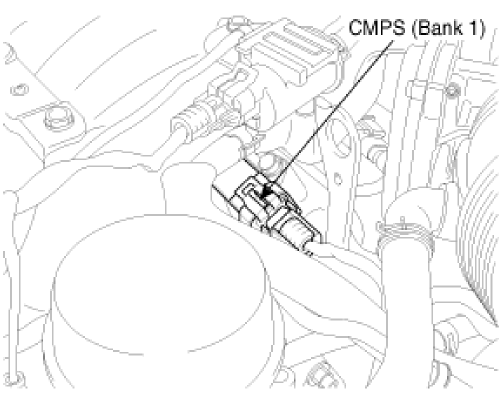
▸ Go to the applicable troubleshoooting procedure.

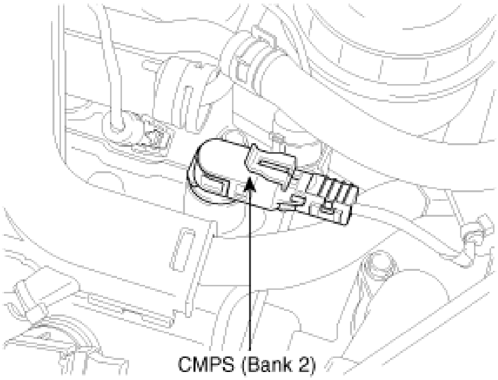
NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0346

COMPONENT LOCATION





GENERAL DESCRIPTION

Camshaft Position Sensor (CMPS) is a hall sensor and detects the camshaft position by using a hall element. It is related with Crankshaft Position Sensor (CKPS) and detects the piston position of the each cylinder which the CKPS can't detect. The two CMPS are installed on engine head cover of bank 1 and 2 and uses a target wheel installed on the camshaft. This sensor has a hall-effect IC which output voltage changes when magnetic field is made on the IC with current flow. When teeth on the target wheel trigger the sensor, output voltage is 5V. If not, it is 0V. These CMPS signal is sent to the PCM and it uses CMPS signals for determining the ignition timing with CKPS signals. CMPS makes Sequential Injection possible.

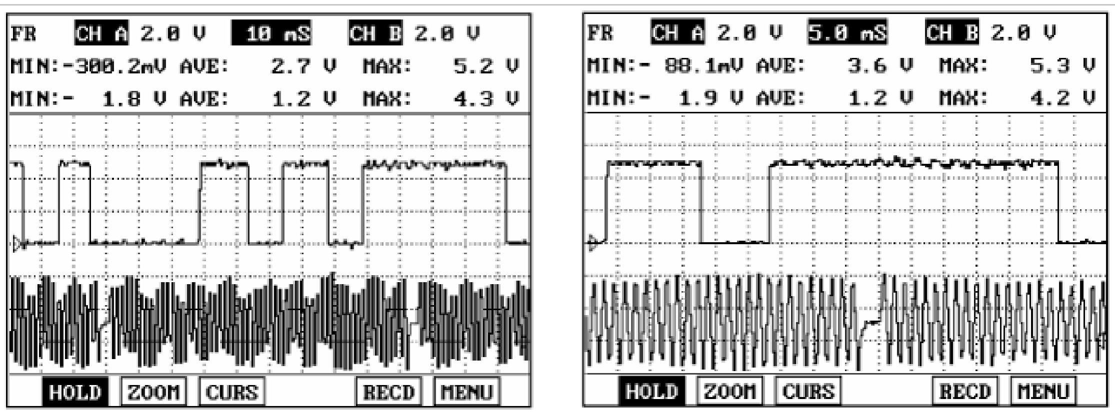
DTC DESCRIPTION

Checking oputput signals from CMP during engine running, if 15 out of 25 signals is abnormal, PCM sets P0346. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Check if CAM sensor is synchronized correctly	• Poor connection • Open or short in harness • electrical noise • Target wheel • CMPS • PCM
Enable Conditions	• Engine running state	
Threshold value	• Cam tooth count ≠ 6	
Diagnosis Time	• Continuous (More than 15 times failure out of 25 times test)	
MIL On Condition	• 2 driving cycles	

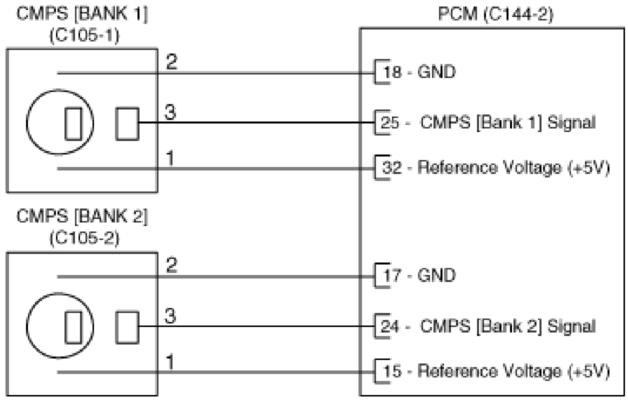
SIGNAL WAVEFROM AND DATA



This example shows a typical Crankshaft Position Sensor(CKPS) and Camshaft Position Sensor(CMPS) waveform at idle. The PCM controls the injection and ignition timing by using these signals. Generally CKPS signal is used to detect the piston's position and CMPS signal is used to detect the Top Dead Center of each cylinder.

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

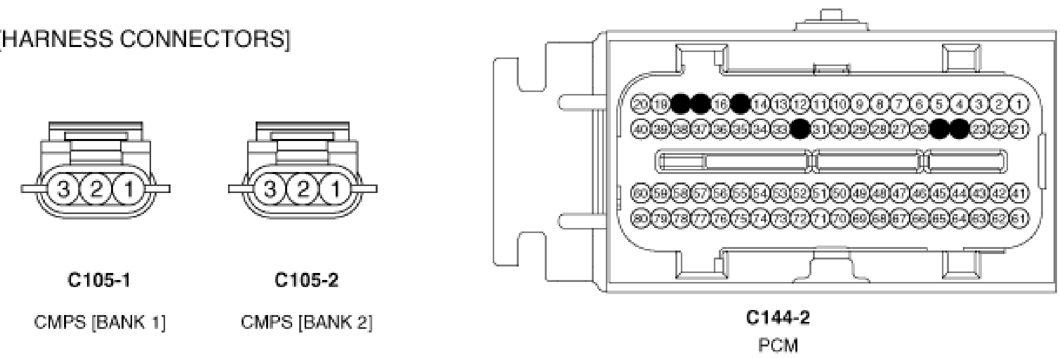
CMPS [BANK 1]

Terminal	Connected to	Funtion
1	PCM C144-2 (32)	Reference Voltage (+5V)
2	PCM C144-2 (18)	Sensor ground
3	PCM C144-2 (25)	CMPS [Bank 1] control

CMPS [BANK 2]

Terminal	Connected to	Funtion
1	PCM C144-2 (15)	Reference Voltage (+5V)
2	PCM C144-2 (17)	Sensor ground
3	PCM C144-2 (24)	CMPS [Bank 2] control

[HARNESS CONNECTORS]



MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor items related to CMPS on the service data
4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

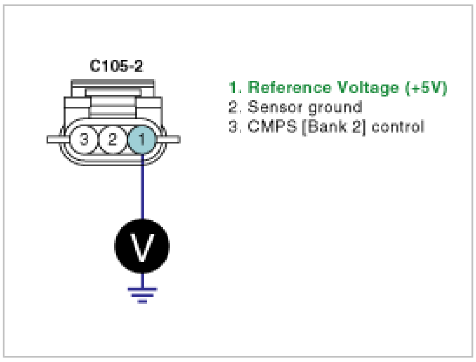
NO

▸ Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION

1. IG "OFF" and disconnect CMPS connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of CMPS(B2) harness connector and chassis ground.

Specification : Approx. 5V



4. Is the measured voltage within specification?

YES

▸ Go to "Signal Circuit Inspection" procedure.

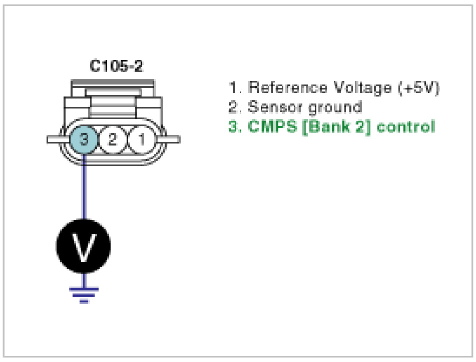
NO

▸ Repair open or short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF" and disconnect CMPS connector.
   (2) IG "ON" and ENG "OFF"
   (3) Measure voltage between terminal 3 of CMPS(B2) harness connector and chassis ground.

   Specification : Approx. 5V



   (4) Is the measured voltage within specification?

   YES

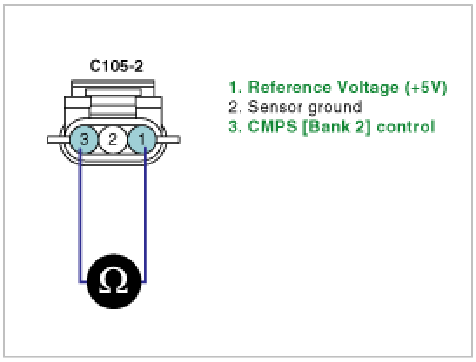
   ▸ Go to "Check short in harness" as follows.

   NO

   ▸ Go to "Check open in harness" as follows.

2. Check short in harness
   (1) IG "OFF" and disconnect CMPS connector.
   (2) Measure resistance between terminals 1 and 3 of CMPS(B2) harness connector.

   Specification : Infinite



(3) Is the measured resistance within specification?

YES

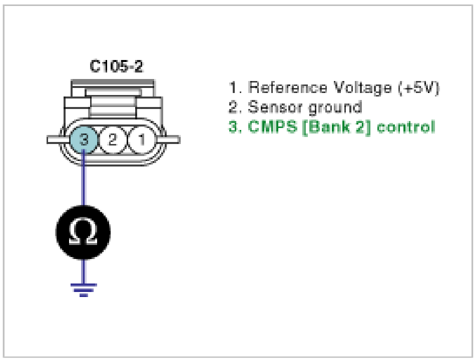
▸ Go to "Check short to ground in harness" as follows.

NO

▸ Repair short in harness, and go to "Verification of Vehicle Repair" procedure.

3. Check short to ground in harness
   (1) IG "OFF" and disconnect CMPS connector and PCM connector.
   (2) Measure resistance between terminal 3 of CMPS(B2) harness connector and chassis ground.

Specification : Infinite



(3) Is the measured resistance within specification?

YES

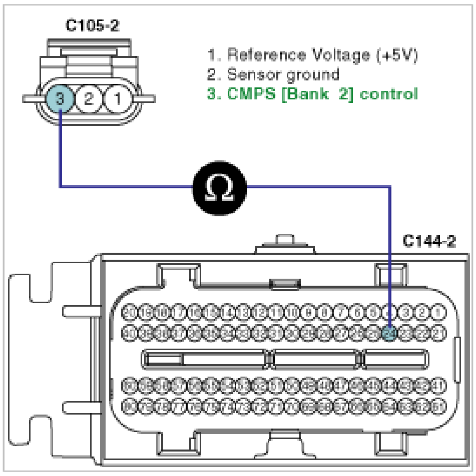
▸ Go to "Ground Circuit Inspection" procedure.

NO

▸ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

4. Check open in harness
   (1) IG "OFF" and disconnect CMPS connector and PCM connector.
   (2) Measure resistance between terminal 3 of CMPS harness connector and terminal 24 of PCM harness connector.

Specification : Below 1Ω



(3) Is the measured resistance within specification?

YES

▸ Go to "Ground Circuit Inspection" procedure.

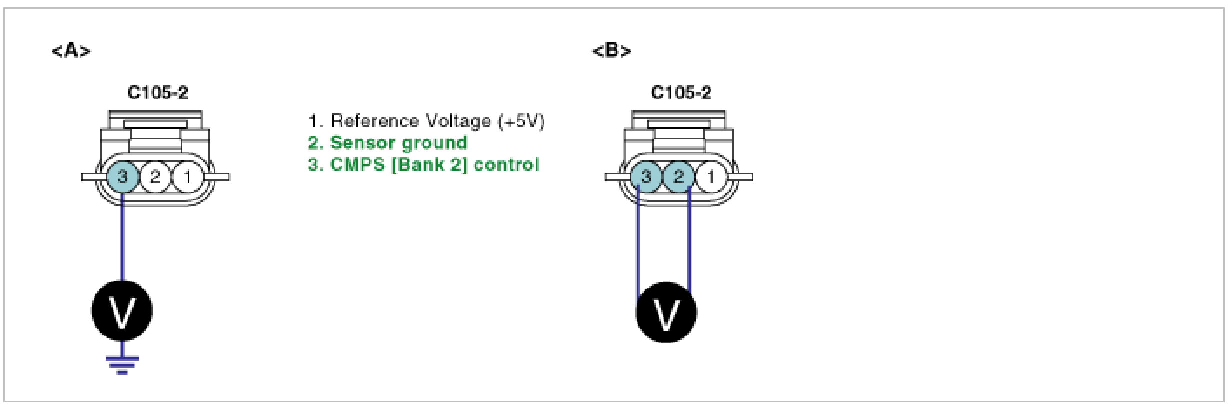
NO

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF" and disconnect CMPS connector.
2. Measure voltage between terminal 3 of CMPS harness connector and chassis ground.
3. Measure voltage between terminals 2 and 3 of CMPS harness connector.

Specification : Measurement "A" - Measurement 'B' = Approx. below 200mV



4. Is the measured voltage within specification?

YES

▸ Go to "Component Inspection" procedure.

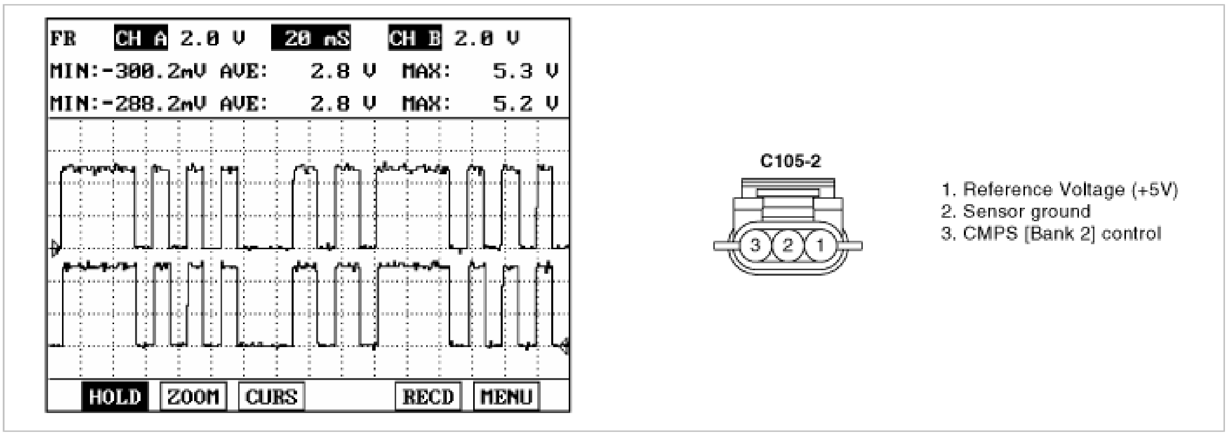
NO

▸ Repair open or contact resistance in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check CMPS
   (1) IG "OFF" and connect scantool.
   (2) ENG "ON" and Measure signal waveform at terminal 3 of CMPS.

Reference signal waveform :



(3) Is the measured siganl waveform normal?

YES

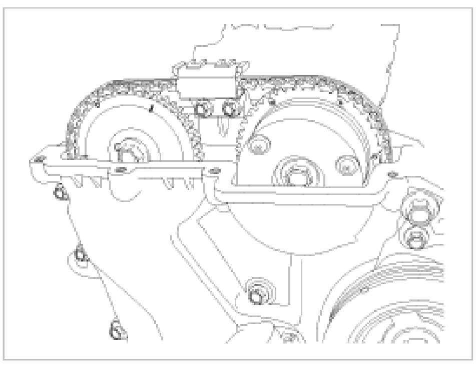
▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Check the electrical noise of siganl waveform, and go to "Check target wheel of CAM shaft" as follows.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

2. Check target wheel of CAM shaft
   (1) IG "OFF"
   (2) Remove the cover of cylinder head and check target wheel state of bank 2.



(3) Is the target wheel state normal?

YES

▸ Substitute with a known - good CMPS and check for proper operation. If the problem is corrected, replace CMPS and go to "Verification of Vehicle Repair" procedure.

NO

▸ Repair or replace it, and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0351

COMPONENT LOCATION

GENERAL DESCRIPTION

When the ignition switch is ON or START position, voltage is applied to the ignition coil. Each ignition coil consists of two coils. High tension leads go to each cylinder from ignition coils. Ignition coils fire two spark plugs on every power stroke (the cylinder under compression and the one on the exhaust stroke). PCM provides ground to a switching circuit for energizing the primary ignition coils. PCM uses the crankshaft position sensor and camshaft position sensor signals to meet the timing of energizing coil. When a primary ignition coil is energized or de-energized, the secondary coil produces a high voltage spike to the attached spark plugs.

DTC DESCRIPTION

Checking output signals from ignition coils every 10 sec. under detecting condition, if signals indicating open of short in the circuit are detected for more than 10 sec., PCM sets P0351. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

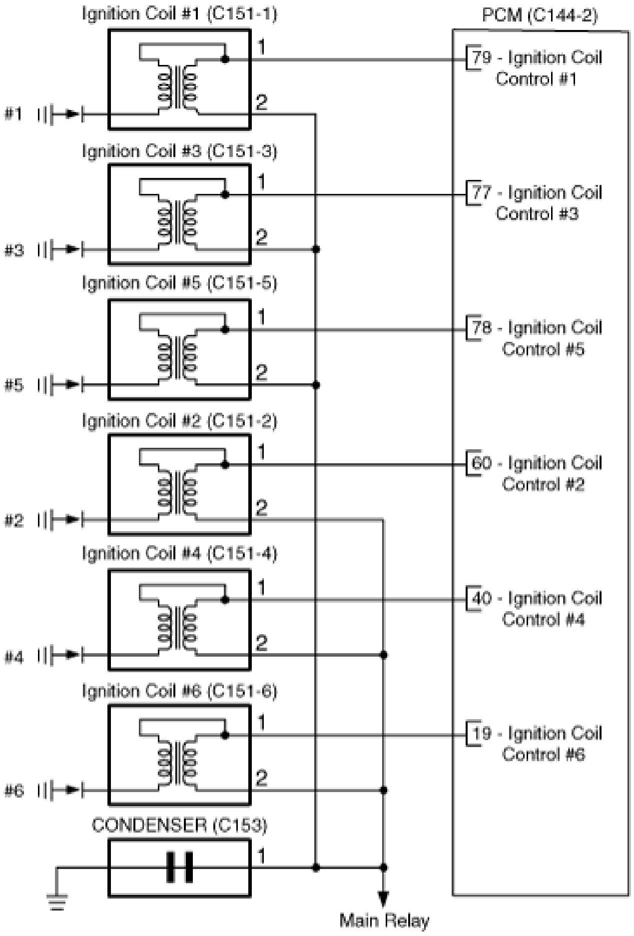
Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to ground, to battery or open circuit	• Poor connection • Open or short in harness • Ignition Coil • PCM
EnableConditions	• NO DTC related to this item • Engine running state • 11V ≤ Battery voltage ≤ 16V • The above conditions are met > 0.5 sec.	
Threshold value	• Open or short	
DiagnosisTime	• Continuous (More than 5 sec.failure for every 10 sec.test)	
MIL On Condition	• 2 driving cycles	

SPECIFICATION

Resistance (Ω)	Primary Coil	Secondary Coil
	0.62 ± 10%	7.0k ± 15%

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTOR INFORMATION]

Ignition Coil #1

Terminal	Connected to	Function
1	PCM C144-2 (79)	Ignition Coil #1
2	Main Relay	Battery (B+)

Ignition Coil #3

Terminal	Connected to	Function
1	PCM C144-2 (77)	Ignition Coil #3
2	Main Relay	Battery (B+)

Ignition Coil #5

Terminal	Connected to	Function
1	PCM C144-2 (78)	Ignition Coil #5
2	Main Relay	Battery (B+)

Ignition Coil #2

Terminal	Connected to	Function
1	PCM C144-2 (60)	Ignition Coil #2
2	Main Relay	Battery (B+)

Ignition Coil #4

Terminal	Connected to	Function
1	PCM C144-2 (40)	Ignition Coil #4
2	Main Relay	Battery (B+)

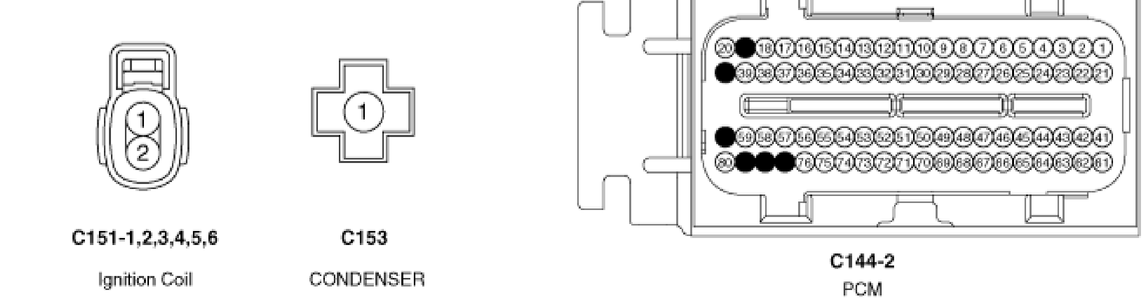
Ignition Coil #6

Terminal	Connected to	Function
1	PCM C144-2 (19)	Ignition Coil #6
2	Main Relay	Battery (B+)

CONDENSER

Terminal	Connected to	Function
1	Main Relay	Power Supply (B+)

[HARNESS CONNECTOR]



MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor items related to Ignition on the service data.

Specification : BTDC 10° ± 5°

4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, ending, corrosion, contamination, deterioration, or damage. Repair or replace asnecessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSEPCTION

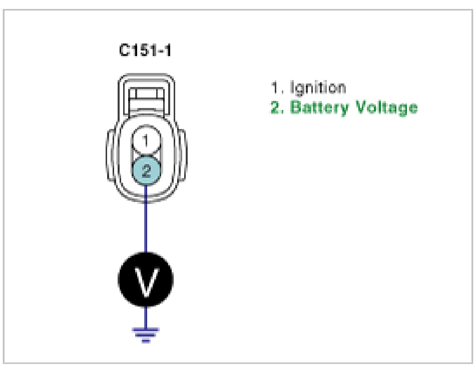
1. Check voltage

(1) IG "OFF" and disconnect Ignition Coil connector.

(2) IG "ON" and ENG "OFF"

(3) Measure voltage between terminal 2 of ignition coil harness connector and chassis ground.

Specification : Approx. B+



(4) Is the measured voltage within specification ?

YES

▸ Go to "Control Circuit Inspection" procedure.

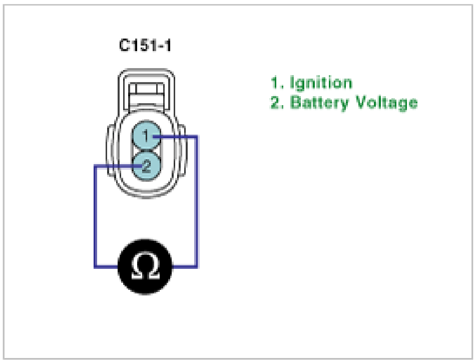
NO

▸ Check fuse connected to ignition coil for open.
▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check short to battery in harness.
   (1) IG "OFF" and disconnect ignitioncoil connector and PCM connector.
   (2) Measure resistance between terminals 1 and 2 of ignition coil harness connector.

Specification : Infinite



   (3) Is the measured resistance within specification?

YES

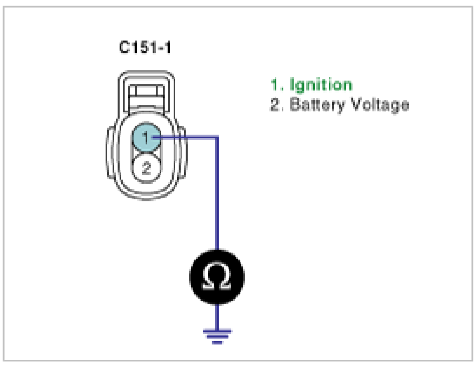
▸ Go to "Check short to ground in harness" as follows.

NO

▸ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check short to ground in harness
   (1) IG "OFF" and disconnect ignition coil connector and PCM connector.
   (2) Measure resistance between terminal 1 of ignition coil harness connector and chassis ground.

Specification : Infinite



   (3) Is the measured resistance within specification?

YES

▸ Go to "Check open in harness" as follows.

NO

▸ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

3. Check open in harness
   (1) IG "OFF" and disconnect Ignition Coil connector and PCM connector.
   (2) Measure resistance between terminal 1 of Ignition Coil harness connector and terminal 79 of PCM harness connector.

Specification : Below 1Ω

   (3) Is the measured resistance within specification?

YES

▸ Go to "Component Inspection" procedure.

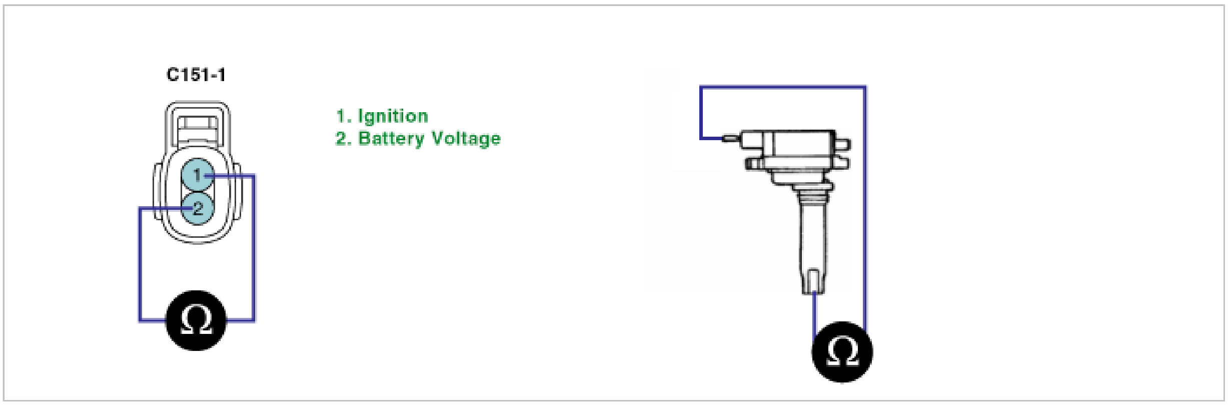
NO

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check Ignition Coil
   (1) IG "OFF" and disconnect ignition coil connector.
   (2) Measure resistance between terminals 1 and 2 of ignition coil connector.(Component side)
   (3) Measure resistance between terminal 1 of ignition coil connector and out terminal of secondary ignition coil.
   Specification :

Resistance (Ω)	Primary Coil	Secondary Coil
	0.62 ± 10%	7.0k ± 15%



   (4) Is the measured resistance within specification?

YES

▸ Substitute with a known - good PCM and check for proper operation
▸ If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good Ignition Coil and check for proper operation.
▸ If the problem is corrected, replace Ignition Coil and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0352

COMPONENT LOCATION

GENERAL DESCRIPTION

When the ignition switch is ON or START position, voltage is applied to the ignition coil. Each ignition coil consists of two coils. High tension leads go to each cylinder from ignition coils. Ignition coils fire two spark plugs on every power stroke (the cylinder under compression and the one on the exhaust stroke). PCM provides ground to a switching circuit for energizing the primary ignition coils. PCM uses the crankshaft position sensor and camshaft position sensor signals to meet the timing of energizing coil. When a primary ignition coil is energized or de-energized, the secondary coil produces a high voltage spike to the attached spark plugs.

DTC DESCRIPTION

Checking output signals from ignition coils every 10 sec. under detecting condition, if signals indicating open of short in the circuit are detected for more than 10 sec., PCM sets P0352. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

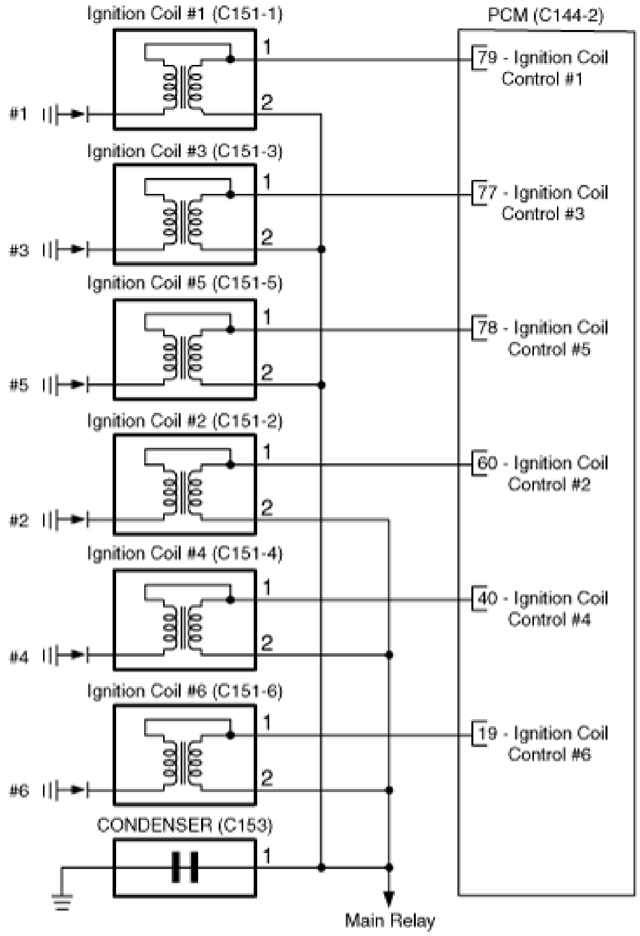
Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to ground, to battery or open circuit	• Poor connection • Open or short in harness • Ignition Coil • PCM
EnableConditions	• NO DTC related to this item • Engine running state • 11V ≤ Battery voltage ≤ 16V • The above conditions are met > 0.5 sec.	
Threshold value	• Open or short	
DiagnosisTime	• Continuous (More than 5 sec.failure for every 10 sec.test)	
MIL On Condition	• 2 driving cycles	

SPECIFICATION

Resistance (Ω)	Primary Coil	Secondary Coil
	0.62 ± 10%	7.0k ± 15%

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTOR INFORMATION]

Ignition Coil #1

Terminal	Connected to	Function
1	PCM C144-2 (79)	Ignition Coil #1
2	Main Relay	Battery (B+)

Ignition Coil #3

Terminal	Connected to	Function
1	PCM C144-2 (77)	Ignition Coil #3
2	Main Relay	Battery (B+)

Ignition Coil #5

Terminal	Connected to	Function
1	PCM C144-2 (78)	Ignition Coil #5
2	Main Relay	Battery (B+)

Ignition Coil #2

Terminal	Connected to	Function
1	PCM C144-2 (60)	Ignition Coil #2
2	Main Relay	Battery (B+)

Ignition Coil #4

Terminal	Connected to	Function
1	PCM C144-2 (40)	Ignition Coil #4
2	Main Relay	Battery (B+)

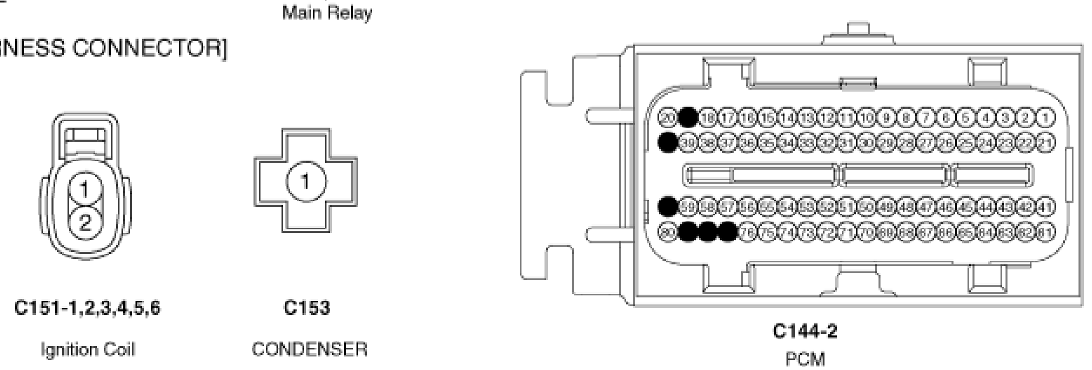
Ignition Coil #6

Terminal	Connected to	Function
1	PCM C144-2 (19)	Ignition Coil #6
2	Main Relay	Battery (B+)

CONDENSER

Terminal	Connected to	Function
1	Main Relay	Power Supply (B+)

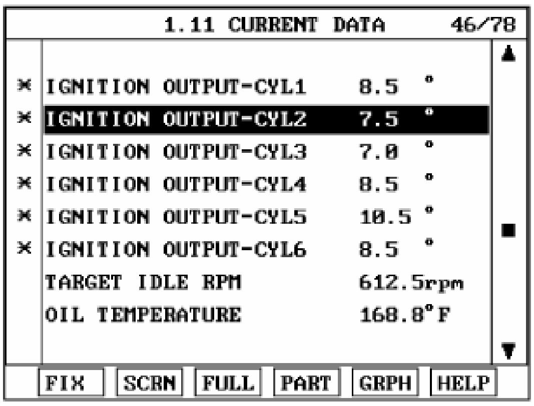
[HARNESS CONNECTOR]



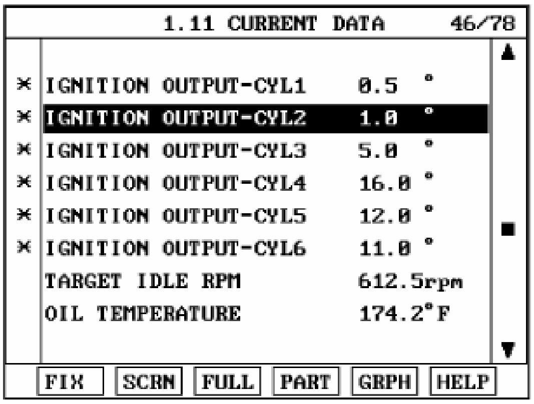
MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor items related to Ignition on the service data.

Specification : BTDC 10° ± 5°



Normal at idle



Open at idle

4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, ending, corrosion, contamination, deterioration, or damage. Repair or replace asnecessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

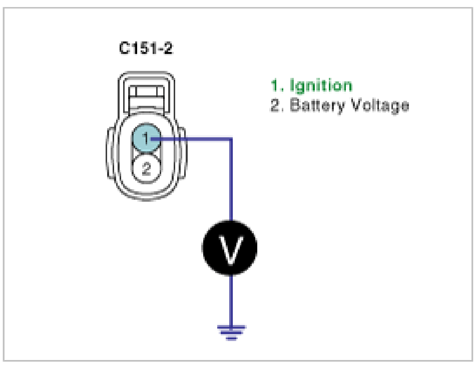
NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSEPCTION

1. Check voltage
   (1) IG "OFF" and disconnect Ignition Coil connector.
   (2) IG "ON" and ENG "OFF"
   (3) Measure voltage between terminal 1 of ignition coil harness connector and chassis ground.

Specification : Approx. B+



   (4) Is the measured voltage within specification ?

YES

▸ Go to "Control Circuit Inspection" procedure.

NO

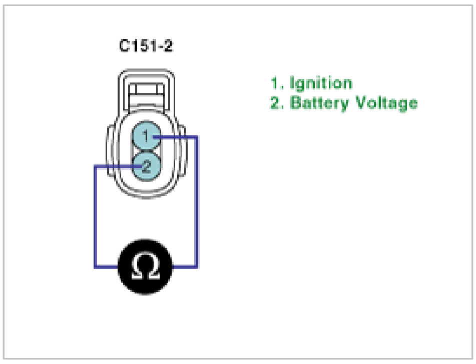
▸ Check fuse connected to ignition coil for open.

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check short to battery in harness.
   (1) IG "OFF" and disconnect ignitioncoil connector and PCM connector.
   (2) Measure resistance between terminals 1 and 2 of ignition coil harness connector.

Specification : Infinite



   (3) Is the measured resistance within specification?

YES

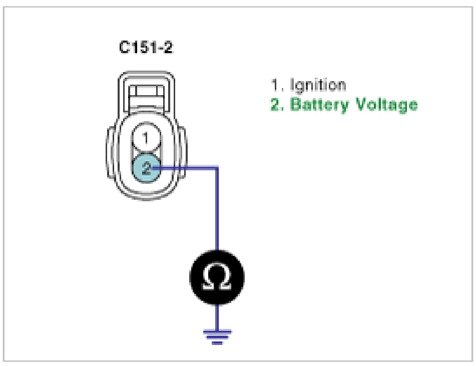
▸ Go to "Check short to ground in harness" as follows.

NO

▸ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check short to ground in harness
   (1) IG "OFF" and disconnect ignition coil connector and PCM connector.
   (2) Measure resistance between terminal 2 of ignition coil harness connector and chassis ground.

Specification : Infinite



   (3) Is the measured resistance within specification?

YES

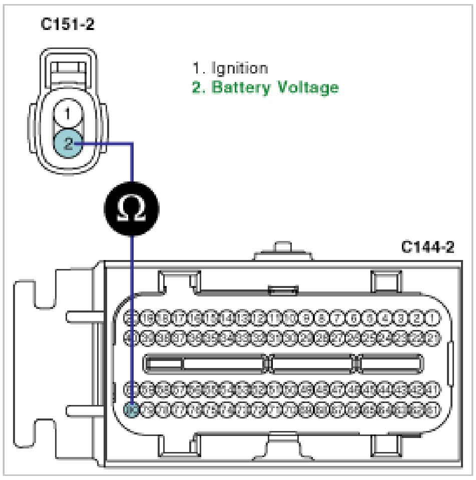
▸ Go to "Check open in harness" as follows.

NO

▸ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

3. Check open in harness
   (1) IG "OFF" and disconnect Ignition Coil connector and PCM connector.
   (2) Measure resistance between terminal 2 of Ignition Coil harness connector and terminal 60 of PCM harness connector.

Specification : Below 1Ω



(3) Is the measured resistance within specification?

YES

▸ Go to "Component Inspection" procedure.

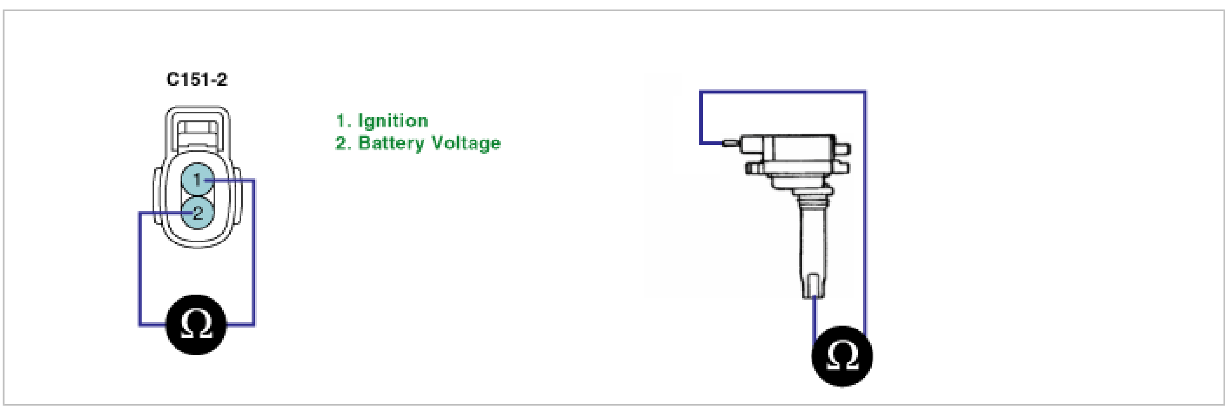
NO

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check Ignition Coil
   (1) IG "OFF" and disconnect ignition coil connector.
   (2) Measure resistance between terminals 1 and 2 of ignition coil connector.(Component side)
   (3) Measure resistance between terminal 1 of ignition coil connector and out terminal of secondary ignition coil.
   Specification :

Resistance (Ω)	Primary Coil	Secondary Coil
	0.62 ± 10%	7.0k ± 15%



(4) Is the measured resistance within specification?

YES

▸ Substitute with a known - good PCM and check for proper operation
▸ If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good Ignition Coil and check for proper operation.
▸ If the problem is corrected, replace Ignition Coil and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0353

COMPONENT LOCATION

GENERAL DESCRIPTION

When the ignition switch is ON or START position, voltage is applied to the ignition coil. Each ignition coil consists of two coils. High tension leads go to each cylinder from ignition coils. Ignition coils fire two spark plugs on every power stroke (the cylinder under compression and the one on the exhaust stroke). PCM provides ground to a switching circuit for energizing the primary ignition coils. PCM uses the crankshaft position sensor and camshaft position sensor signals to meet the timing of energizing coil. When a primary ignition coil is energized or de-energized, the secondary coil produces a high voltage spike to the attached spark plugs.

DTC DESCRIPTION

Checking output signals from ignition coils every 10 sec. under detecting condition, if signals indicating open of short in the circuit are detected for more than 10 sec., PCM sets P0353. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

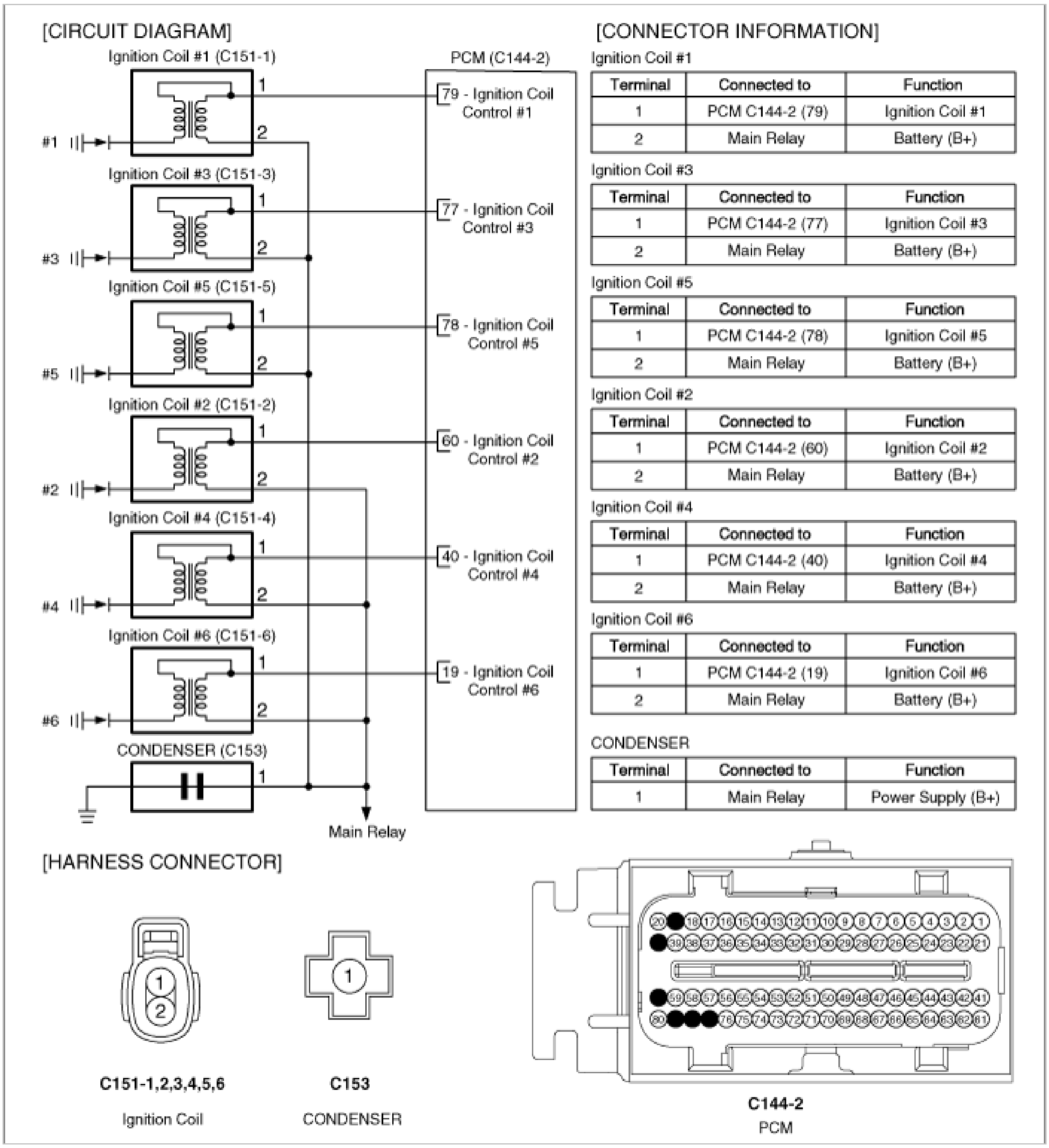
DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to ground, to battery or open circuit	• Poor connection • Open or short in harness • Ignition Coil • PCM
EnableConditions	• NO DTC related to this item • Engine running state • 11V ≤ Battery voltage ≤ 16V • The above conditions are met > 0.5 sec.	
Threshold value	• Open or short	
DiagnosisTime	• Continuous (More than 5 sec.failure for every 10 sec.test)	
MIL On Condition	• 2 driving cycles	

SPECIFICATION

Resistance (Ω)	Primary Coil	Secondary Coil
	0.62 ± 10%	7.0k ± 15%

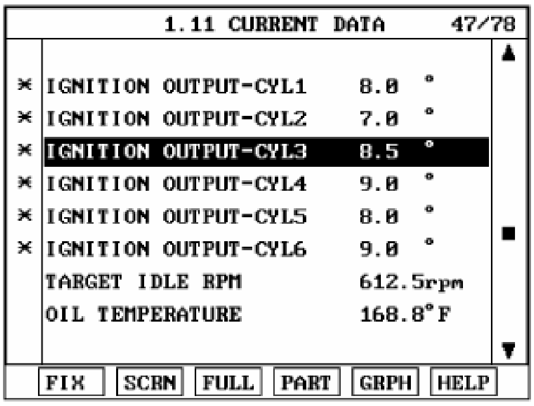
SCHEMATIC DIAGRAM



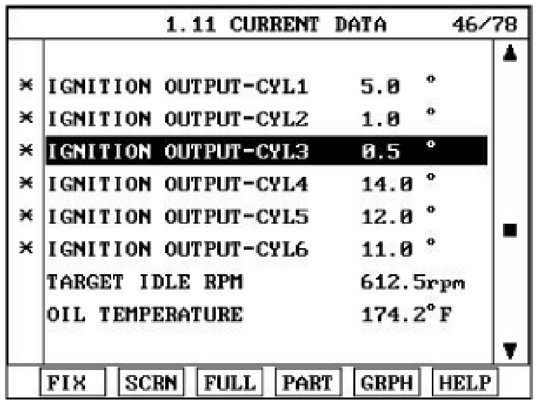
MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor items related to Ignition on the service data.

Specification : BTDC 10° ± 5°



Normal at idle



Open at idle

4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, ending, corrosion, contamination, deterioration, or damage. Repair or replace asnecessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

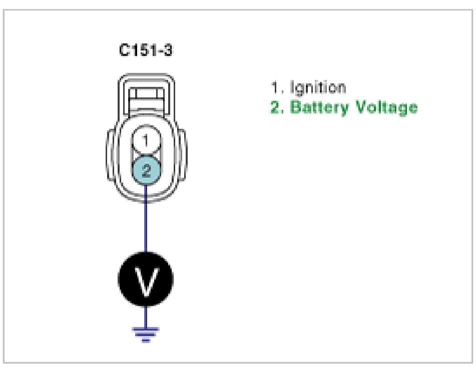
NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSEPCTION

1. Check voltage
   (1) IG "OFF" and disconnect Ignition Coil connector.
   (2) IG "ON" and ENG "OFF"
   (3) Measure voltage between terminal 2 of ignition coil harness connector and chassis ground.

Specification : Approx. B+



(4) Is the measured voltage within specification ?

YES

▸ Go to "Control Circuit Inspection" procedure.

NO

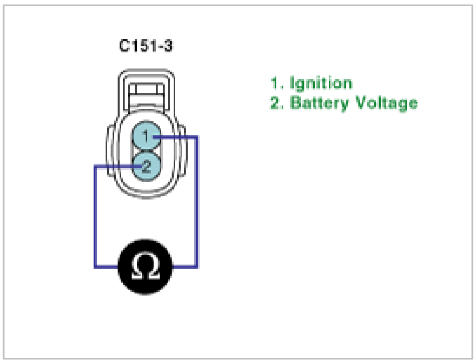
▸ Check fuse connected to ignition coil for open.

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check short to battery in harness.
   (1) IG "OFF" and disconnect ignitioncoil connector and PCM connector.
   (2) Measure resistance between terminals 1 and 2 of ignition coil harness connector.

Specification : Infinite



   (3) Is the measured resistance within specification?

YES

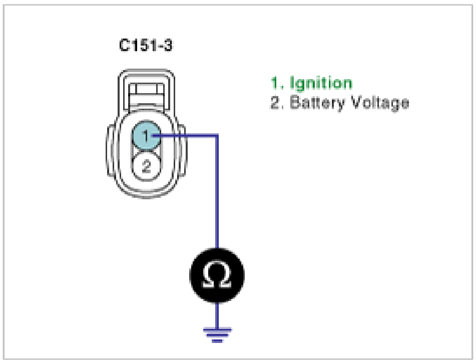
▸ Go to "Check short to ground in harness" as follows.

NO

▸ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check short to ground in harness
   (1) IG "OFF" and disconnect ignition coil connector and PCM connector.
   (2) Measure resistance between terminal 1 of ignition coil harness connector and chassis ground.

Specification : Infinite



   (3) Is the measured resistance within specification?

YES

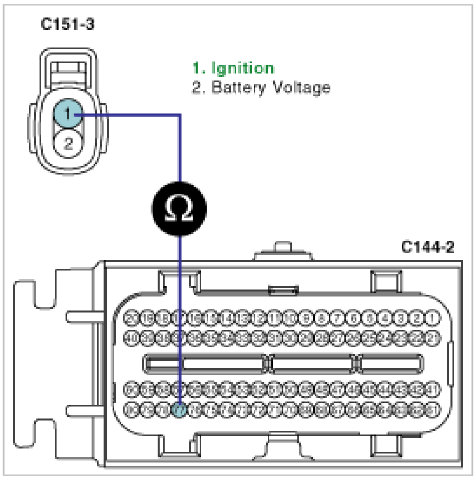
▸ Go to "Check open in harness" as follows.

NO

▸ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

3. Check open in harness
   (1) IG "OFF" and disconnect Ignition Coil connector and PCM connector.
   (2) Measure resistance between terminal 1 of Ignition Coil harness connector and terminal 77 of PCM harness connector.

Specification : Below 1Ω



(3) Is the measured resistance within specification?

YES

▸ Go to "Component Inspection" procedure.

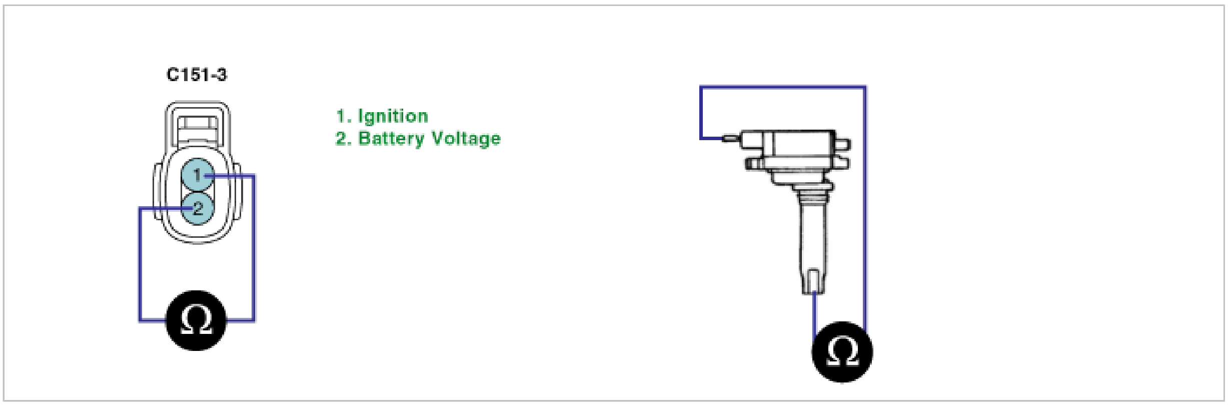
NO

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check Ignition Coil
   (1) IG "OFF" and disconnect ignition coil connector.
   (2) Measure resistance between terminals 1 and 2 of ignition coil connector.(Component side)
   (3) Measure resistance between terminal 1 of ignition coil connector and out terminal of secondary ignition coil.
   Specification :

Resistance (Ω)	Primary Coil	Secondary Coil
	0.62 ± 10%	7.0k ± 15%



(4) Is the measured resistance within specification?

YES

▸ Substitute with a known - good PCM and check for proper operation
▸ If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good Ignition Coil and check for proper operation.
▸ If the problem is corrected, replace Ignition Coil and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0354

COMPONENT LOCATION

GENERAL DESCRIPTION

When the ignition switch is ON or START position, voltage is applied to the ignition coil. Each ignition coil consists of two coils. High tension leads go to each cylinder from ignition coils. Ignition coils fire two spark plugs on every power stroke (the cylinder under compression and the one on the exhaust stroke). PCM provides ground to a switching circuit for energizing the primary ignition coils. PCM uses the crankshaft position sensor and camshaft position sensor signals to meet the timing of energizing coil. When a primary ignition coil is energized or de-energized, the secondary coil produces a high voltage spike to the attached spark plugs.

DTC DESCRIPTION

Checking output signals from ignition coils every 10 sec. under detecting condition, if signals indicating open of short in the circuit are detected for more than 10 sec., PCM sets P0354. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

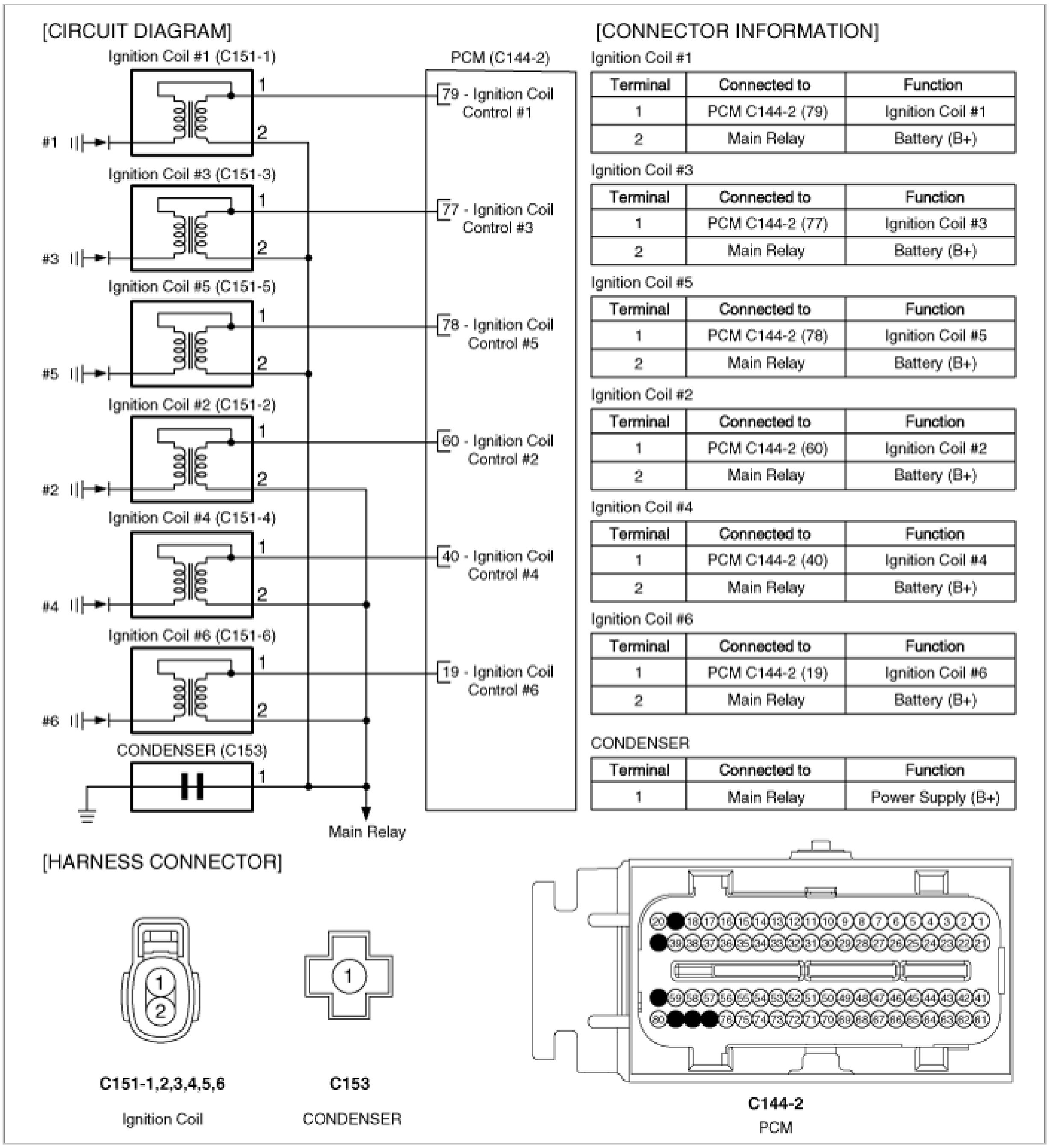
DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to ground, to battery or open circuit	• Poor connection • Open or short in harness • Ignition Coil • PCM
EnableConditions	• NO DTC related to this item • Engine running state • 11V ≤ Battery voltage ≤ 16V • The above conditions are met > 0.5 sec.	
Threshold value	• Open or short	
DiagnosisTime	• Continuous (More than 5 sec.failure for every 10 sec.test)	
MIL On Condition	• 2 driving cycles	

SPECIFICATION

Resistance (Ω)	Primary Coil	Secondary Coil
	0.62 ± 10%	7.0k ± 15%

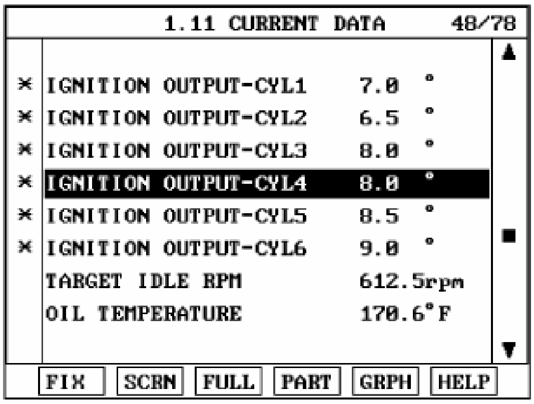
SCHEMATIC DIAGRAM



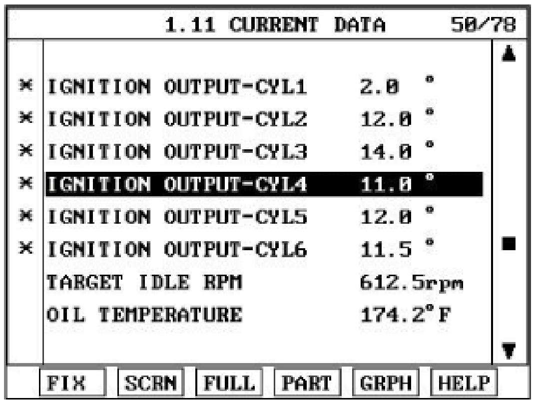
MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor items related to Ignition on the service data.

Specification : BTDC 10° ± 5°



Normal at idle



Open at idle

4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, ending, corrosion, contamination, deterioration, or damage. Repair or replace asnecessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

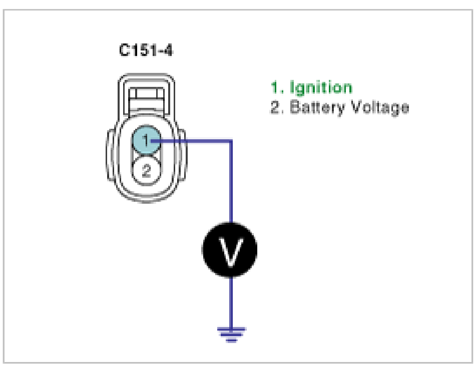
NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSEPCTION

1. Check voltage
   (1) IG "OFF" and disconnect Ignition Coil connector.
   (2) IG "ON" and ENG "OFF"
   (3) Measure voltage between terminal 1 of ignition coil harness connector and chassis ground.

Specification : Approx. B+



(4) Is the measured voltage within specification ?

YES

▸ Go to "Control Circuit Inspection" procedure.

NO

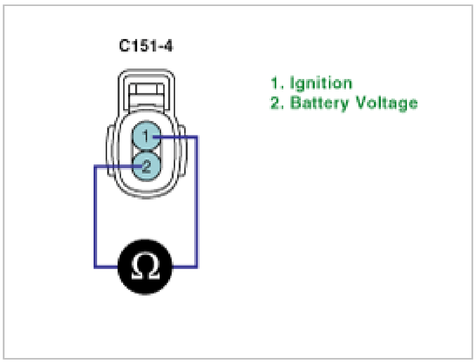
▸ Check fuse connected to ignition coil for open.

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check short to battery in harness.
   (1) IG "OFF" and disconnect ignitioncoil connector and PCM connector.
   (2) Measure resistance between terminals 1 and 2 of ignition coil harness connector.

Specification : Infinite



   (3) Is the measured resistance within specification?

YES

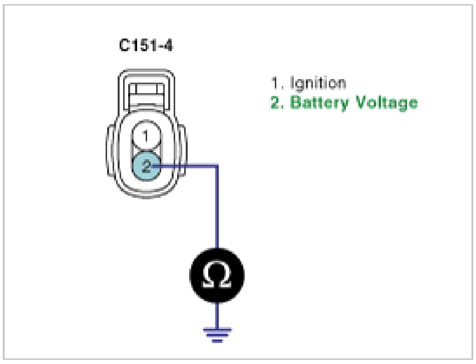
▸ Go to "Check short to ground in harness" as follows.

NO

▸ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check short to ground in harness
   (1) IG "OFF" and disconnect ignition coil connector and PCM connector.
   (2) Measure resistance between terminal 2 of ignition coil harness connector and chassis ground.

Specification : Infinite



   (3) Is the measured resistance within specification?

YES

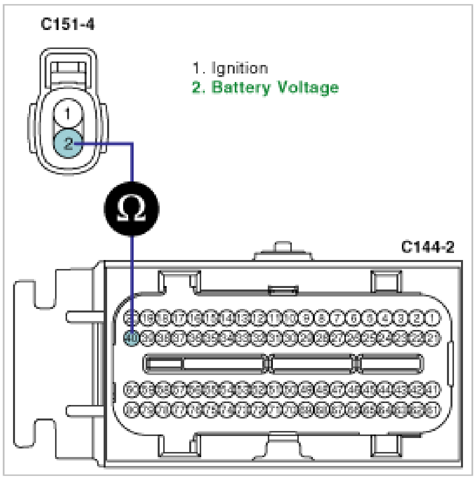
▸ Go to "Check open in harness" as follows.

NO

▸ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

3. Check open in harness
   (1) IG "OFF" and disconnect Ignition Coil connector and PCM connector.
   (2) Measure resistance between terminal 2 of Ignition Coil harness connector and terminal 40 of PCM harness connector.

Specification : Below 1Ω



(3) Is the measured resistance within specification?

YES

▸ Go to "Component Inspection" procedure.

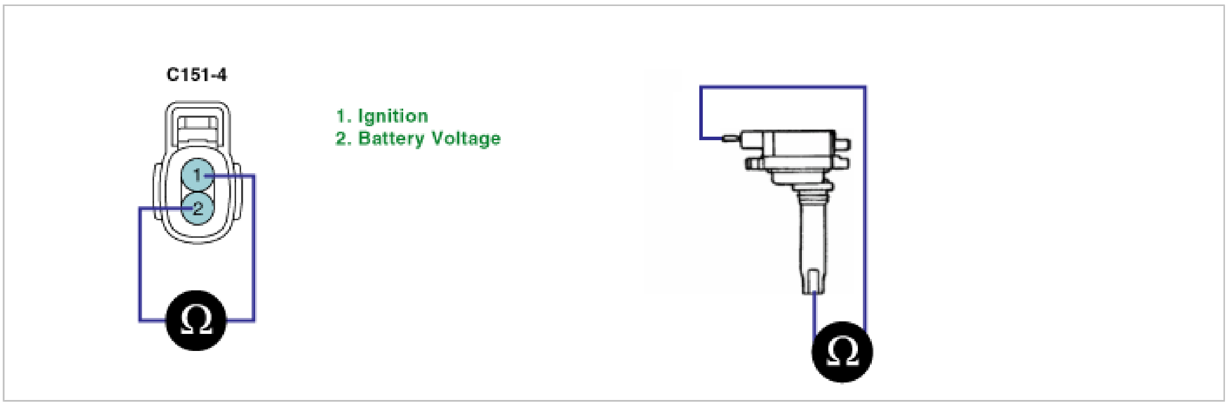
NO

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check Ignition Coil
   (1) IG "OFF" and disconnect ignition coil connector.
   (2) Measure resistance between terminals 1 and 2 of ignition coil connector.(Component side)
   (3) Measure resistance between terminal 1 of ignition coil connector and out terminal of secondary ignition coil.
   Specification :

Resistance (Ω)	Primary Coil	Secondary Coil
	0.62 ± 10%	7.0k ± 15%



(4) Is the measured resistance within specification?

YES

▸ Substitute with a known - good PCM and check for proper operation
▸ If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good Ignition Coil and check for proper operation.
▸ If the problem is corrected, replace Ignition Coil and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0355

COMPONENT LOCATION

GENERAL DESCRIPTION

When the ignition switch is ON or START position, voltage is applied to the ignition coil. Each ignition coil consists of two coils. High tension leads go to each cylinder from ignition coils. Ignition coils fire two spark plugs on every power stroke (the cylinder under compression and the one on the exhaust stroke). PCM provides ground to a switching circuit for energizing the primary ignition coils. PCM uses the crankshaft position sensor and camshaft position sensor signals to meet the timing of energizing coil. When a primary ignition coil is energized or de-energized, the secondary coil produces a high voltage spike to the attached spark plugs.

DTC DESCRIPTION

Checking output signals from ignition coils every 10 sec. under detecting condition, if signals indicating open of short in the circuit are detected for more than 10 sec., PCM sets P0355. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

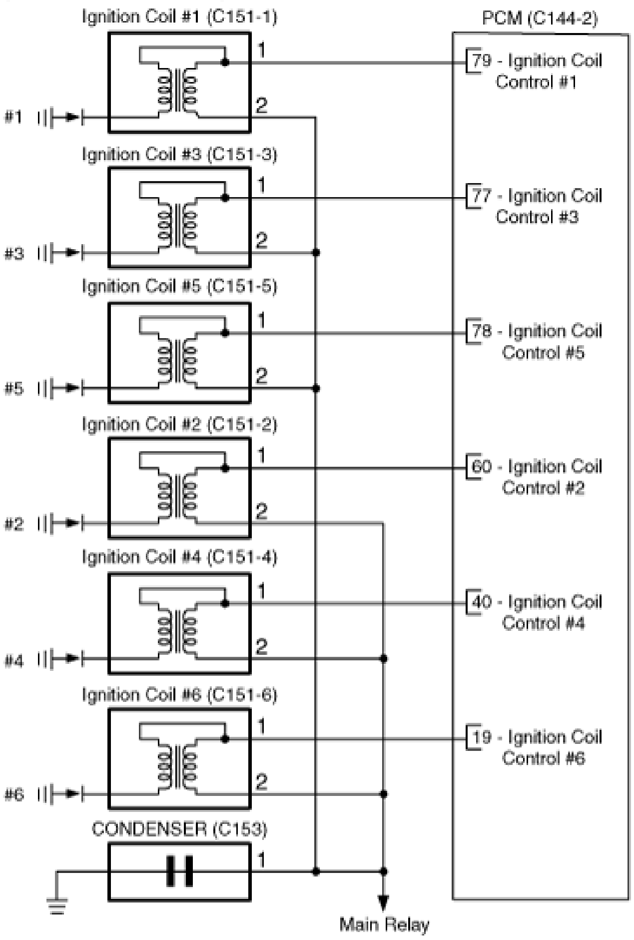
<table>
<tr><th>Item</th><th>Detecting Condition</th><th>Possible cause</th></tr>
<tr><td>DTC Strategy</td><td>• Detects a short to ground, to battery or open circuit</td><td rowspan="5">• Poor connection
• Open or short in harness
• Ignition Coil
• PCM</td></tr>
<tr><td>EnableConditions</td><td>• NO DTC related to this item
• Engine running state
• 11V ≤ Battery voltage ≤ 16V
• The above conditions are met > 0.5 sec.</td></tr>
<tr><td>Threshold value</td><td>• Open or short</td></tr>
<tr><td>DiagnosisTime</td><td>• Continuous
(More than 5 sec.failure for every 10 sec.test)</td></tr>
<tr><td>MIL On Condition</td><td>• 2 driving cycles</td></tr>
</table>

SPECIFICATION

Resistance (Ω)	Primary Coil	Secondary Coil
	0.62 ± 10%	7.0k ± 15%

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTOR INFORMATION]

Ignition Coil #1

Terminal	Connected to	Function
1	PCM C144-2 (79)	Ignition Coil #1
2	Main Relay	Battery (B+)

Ignition Coil #3

Terminal	Connected to	Function
1	PCM C144-2 (77)	Ignition Coil #3
2	Main Relay	Battery (B+)

Ignition Coil #5

Terminal	Connected to	Function
1	PCM C144-2 (78)	Ignition Coil #5
2	Main Relay	Battery (B+)

Ignition Coil #2

Terminal	Connected to	Function
1	PCM C144-2 (60)	Ignition Coil #2
2	Main Relay	Battery (B+)

Ignition Coil #4

Terminal	Connected to	Function
1	PCM C144-2 (40)	Ignition Coil #4
2	Main Relay	Battery (B+)

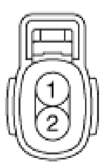
Ignition Coil #6

Terminal	Connected to	Function
1	PCM C144-2 (19)	Ignition Coil #6
2	Main Relay	Battery (B+)

CONDENSER

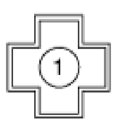
Terminal	Connected to	Function
1	Main Relay	Power Supply (B+)

[HARNESS CONNECTOR]



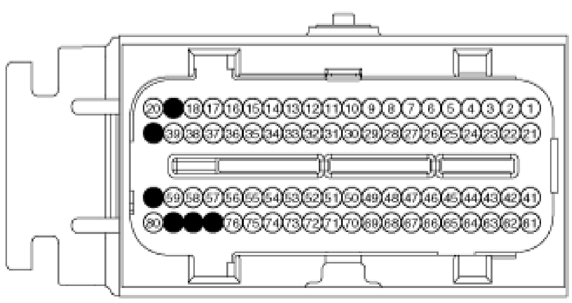
C151-1,2,3,4,5,6

Ignition Coil



C153

CONDENSER



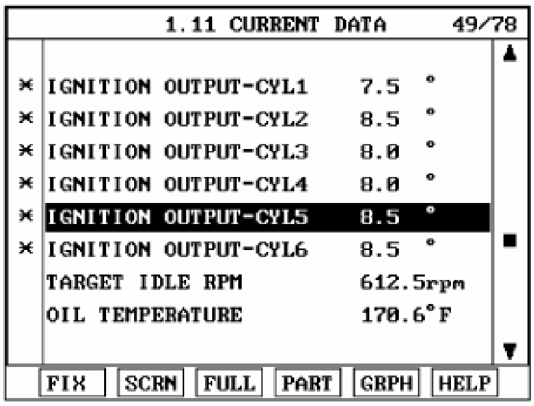
C144-2

PCM

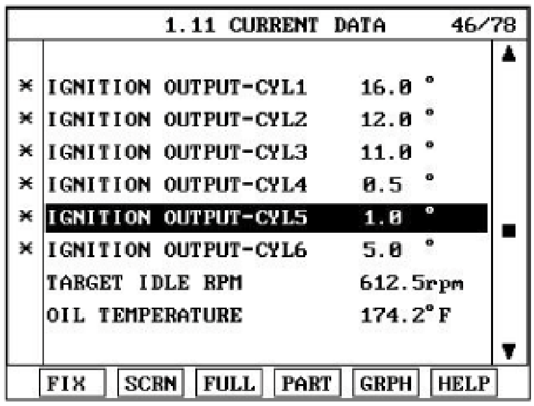
MONITOR SCANTOOL DATA

1. IG "OFF"& connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor items related to Ignition on the service data.

Specification : BTDC 10° ± 5°



Normal at idle



Open at idle

4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, ending, corrosion, contamination, deterioration, or damage. Repair or replace asnecessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

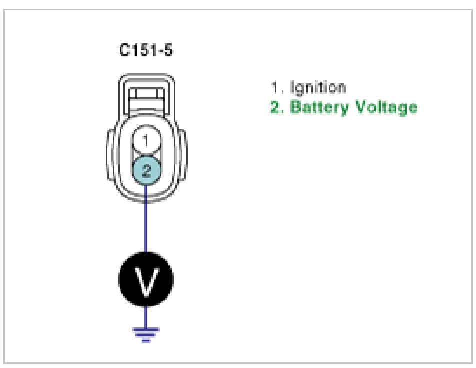
NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSEPCTION

1. Check voltage
   (1) IG "OFF" and disconnect Ignition Coil connector.
   (2) IG "ON" and ENG "OFF"
   (3) Measure voltage between terminal 2 of ignition coil harness connector and chassis ground.

Specification : Approx. B+



(4) Is the measured voltage within specification ?

YES

▸ Go to "Control Circuit Inspection" procedure.

NO

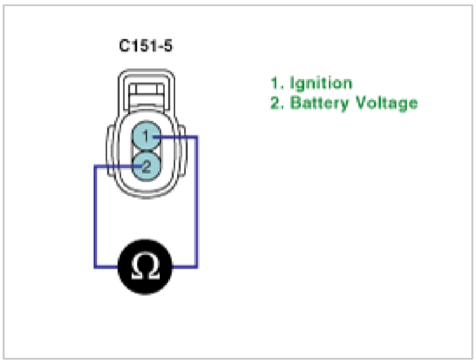
▸ Check fuse connected to ignition coil for open.

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check short to battery in harness.
   (1) IG "OFF" and disconnect ignitioncoil connector and PCM connector.
   (2) Measure resistance between terminals 1 and 2 of ignition coil harness connector.

Specification : Infinite



   (3) Is the measured resistance within specification?

YES

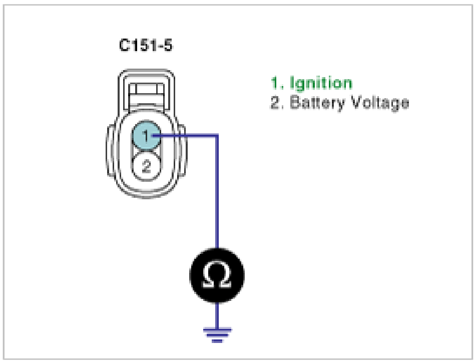
▸ Go to "Check short to ground in harness" as follows.

NO

▸ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check short to ground in harness
   (1) IG "OFF" and disconnect ignition coil connector and PCM connector.
   (2) Measure resistance between terminal 1 of ignition coil harness connector and chassis ground.

Specification : Infinite



   (3) Is the measured resistance within specification?

YES

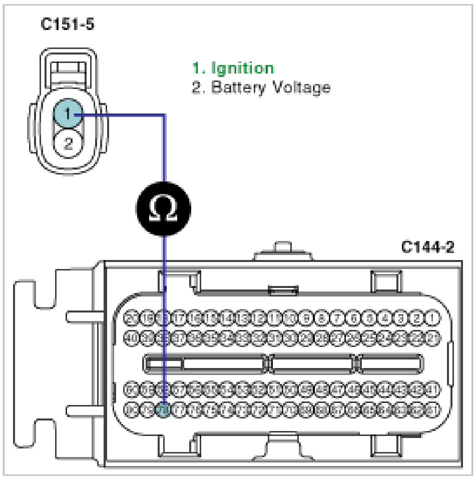
▸ Go to "Check open in harness" as follows.

NO

▸ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

3. Check open in harness
   (1) IG "OFF" and disconnect Ignition Coil connector and PCM connector.
   (2) Measure resistance between terminal 1 of Ignition Coil harness connector and terminal 78 of PCM harness connector.

Specification : Below 1Ω



(3) Is the measured resistance within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check Ignition Coil

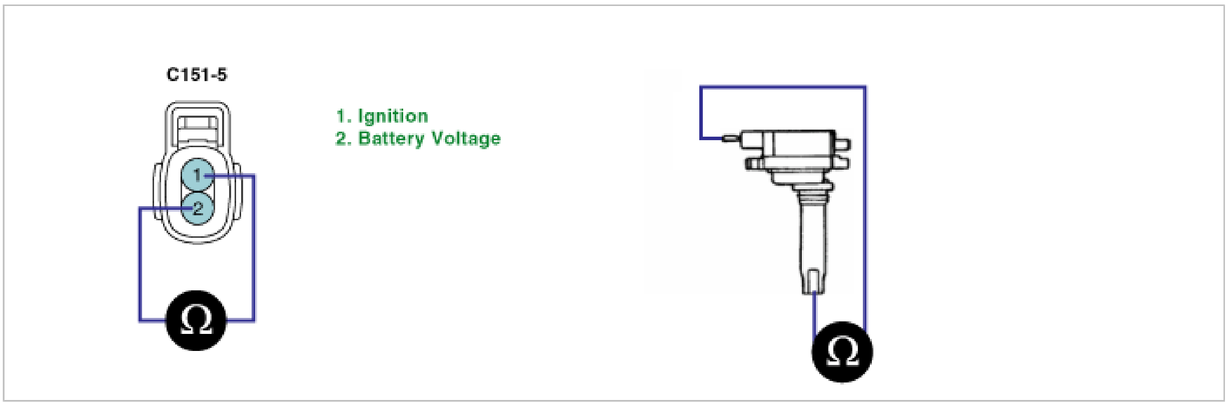
(1) IG "OFF" and disconnect ignition coil connector.

(2) Measure resistance between terminals 1 and 2 of ignition coil connector.(Component side)

(3) Measure resistance between terminal 1 of ignition coil connector and out terminal of secondary ignition coil.

Specification :

Resistance (Ω)	Primary Coil	Secondary Coil
	0.62 ± 10%	7.0k ± 15%



(4) Is the measured resistance within specification?

YES

▸ Substitute with a known - good PCM and check for proper operation

▸ If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good Ignition Coil and check for proper operation.

▸ If the problem is corrected, replace Ignition Coil and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0356

COMPONENT LOCATION

GENERAL DESCRIPTION

When the ignition switch is ON or START position, voltage is applied to the ignition coil. Each ignition coil consists of two coils. High tension leads go to each cylinder from ignition coils. Ignition coils fire two spark plugs on every power stroke (the cylinder under compression and the one on the exhaust stroke). PCM provides ground to a switching circuit for energizing the primary ignition coils. PCM uses the crankshaft position sensor and camshaft position sensor signals to meet the timing of energizing coil. When a primary ignition coil is energized or de-energized, the secondary coil produces a high voltage spike to the attached spark plugs.

DTC DESCRIPTION

Checking output signals from ignition coils every 10 sec. under detecting condition, if signals indicating open of short in the circuit are detected for more than 10 sec., PCM sets P0356. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

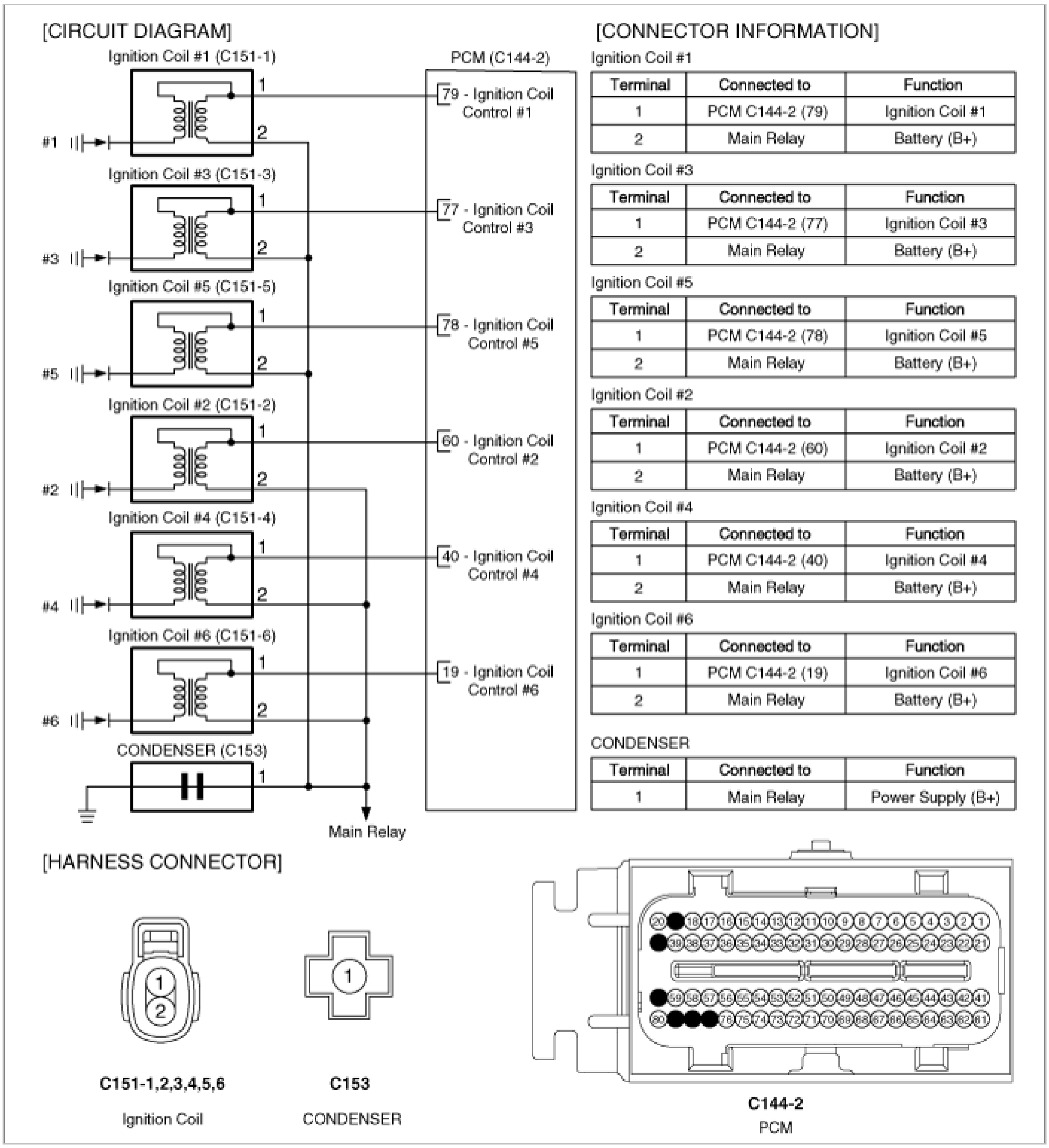
DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to ground, to battery or open circuit	• Poor connection • Open or short in harness • Ignition Coil • PCM
EnableConditions	• NO DTC related to this item • Engine running state • 11V ≤ Battery voltage ≤ 16V • The above conditions are met > 0.5 sec.	
Threshold value	• Open or short	
DiagnosisTime	• Continuous (More than 5 sec.failure for every 10 sec.test)	
MIL On Condition	• 2 driving cycles	

SPECIFICATION

Resistance (Ω)	Primary Coil	Secondary Coil
	0.62 ± 10%	7.0k ± 15%

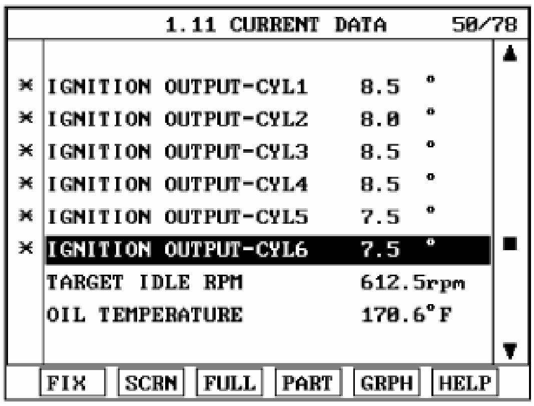
SCHEMATIC DIAGRAM



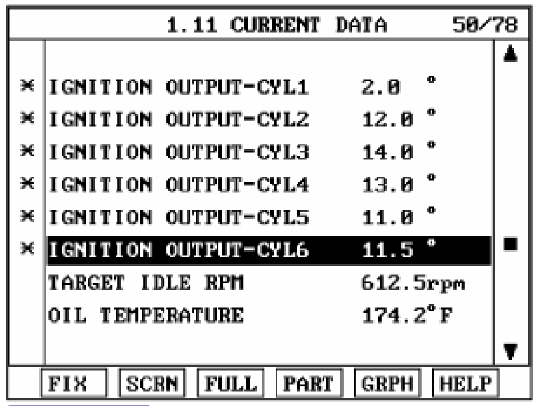
MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor items related to Ignition on the service data.

Specification : BTDC 10° ± 5°



Normal at idle



Open at idle

4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, ending, corrosion, contamination, deterioration, or damage. Repair or replace asnecessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

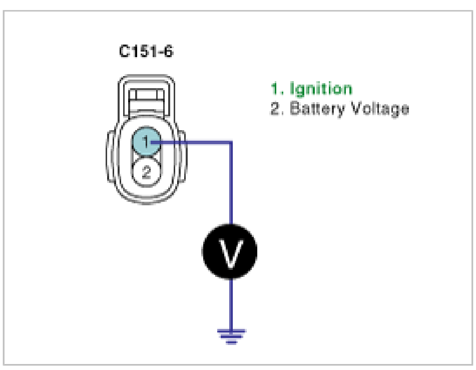
NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSEPCTION

1. Check voltage
   (1) IG "OFF" and disconnect Ignition Coil connector.
   (2) IG "ON" and ENG "OFF"
   (3) Measure voltage between terminal 1 of ignition coil harness connector and chassis ground.

Specification : Approx. B+



(4) Is the measured voltage within specification ?

YES

▸ Go to "Control Circuit Inspection" procedure.

NO

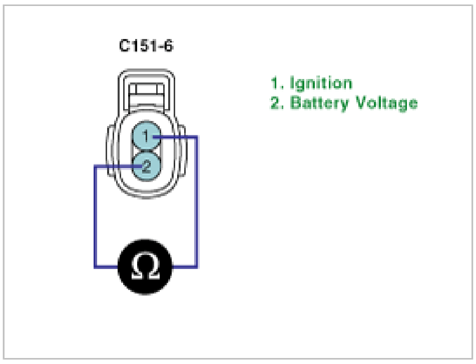
▸ Check fuse connected to ignition coil for open.

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check short to battery in harness.
   (1) IG "OFF" and disconnect ignitioncoil connector and PCM connector.
   (2) Measure resistance between terminals 1 and 2 of ignition coil harness connector.

Specification : Infinite



   (3) Is the measured resistance within specification?

YES

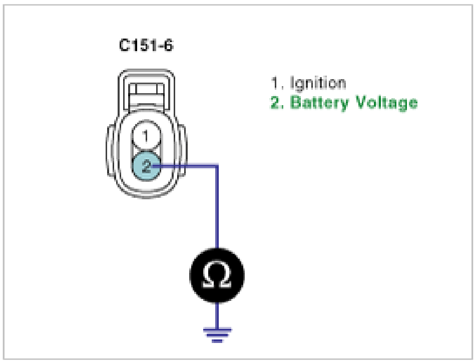
▸ Go to "Check short to ground in harness" as follows.

NO

▸ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check short to ground in harness
   (1) IG "OFF" and disconnect ignition coil connector and PCM connector.
   (2) Measure resistance between terminal 2 of ignition coil harness connector and chassis ground.

Specification : Infinite



   (3) Is the measured resistance within specification?

YES

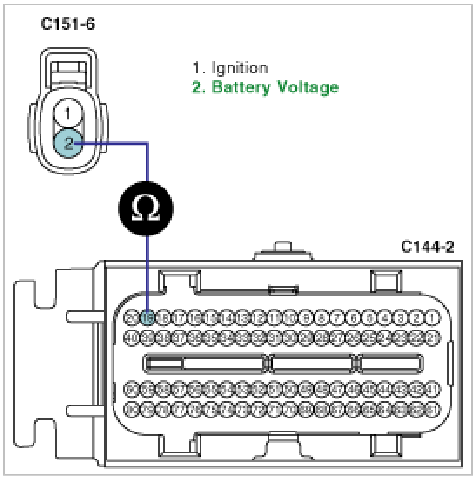
▸ Go to "Check open in harness" as follows.

NO

▸ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

3. Check open in harness
   (1) IG "OFF" and disconnect Ignition Coil connector and PCM connector.
   (2) Measure resistance between terminal 2 of Ignition Coil harness connector and terminal 19 of PCM harness connector.

Specification : Below 1Ω



(3) Is the measured resistance within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

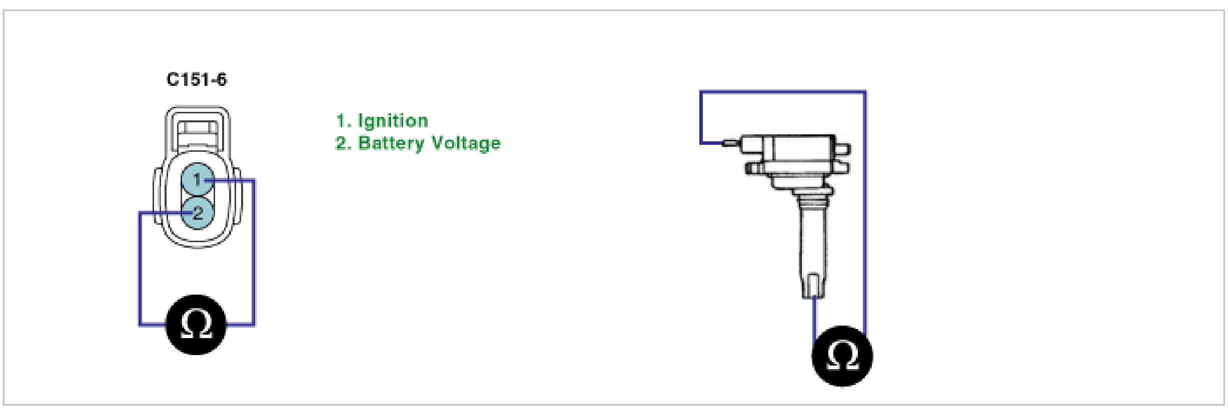
COMPONENT INSPECTION

1. Check Ignition Coil
   (1) IG "OFF" and disconnect ignition coil connector.

   (2) Measure resistance between terminals 1 and 2 of ignition coil connector.(Component side)

   (3) Measure resistance between terminal 1 of ignition coil connector and out terminal of secondary ignition coil.
   Specification :

Resistance (Ω)	Primary Coil	Secondary Coil
	0.62 ± 10%	7.0k ± 15%



(4) Is the measured resistance within specification?

YES

▸ Substitute with a known - good PCM and check for proper operation
▸ If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good Ignition Coil and check for proper operation.
▸ If the problem is corrected, replace Ignition Coil and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0420

COMPONENT LOCATION

GENERAL DESCRIPTION

The catalyst's efficiency is demonstrated by its ability to oxidize CO and hydrocarbon emissions. The Powertrain Control Module (PCM) compares the output signals of the front and rear oxygen sensors to determine whether the output of the rear sensor is beginning to match the output of the front oxygen sensor. Air/fuel mixture compensation keeps the frequency of the front oxygen sensor high due to the changes from rich-to-lean combusition. The catalyst causes the rear oxygen sensor to have a lower frequency. As the catalyst wears, the rear oxygen sensor's signal trace begins to match the front oxygen sensor's signal trace. That is because the catalyst becomes saturated with oxygen and cannot use the oxygen to convert hydrocarbon and CO into H_2O and CO_2 with the same efficiency as when it was new. A completely worn catalyst shows a 100% match between the frequency of the front and rear sensors.

DTC DESCRIPTION

If the oxygen storage time for B1 is higher than threshold , the PCM determines that a fault exists and a DTC is stored. MIL (Malfunction Indicatin Lamp) turns on when the malfunction lasts till 1 driving cycle.

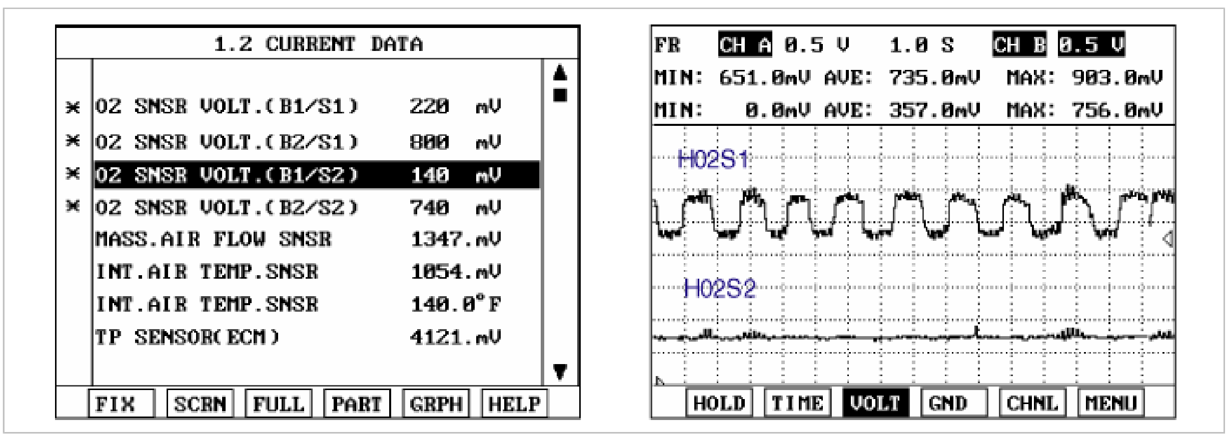
DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• The ICMD Diagnostic manipulates Airfuel and stores the times it takes for the pre and post converter oxygen sensors to switch. It then calculates EWMA values and compares them against calibratable thresholds in order to determine the PASS/FAIL status.	
	• Engine Runtime Sufficient ≥ 580sec • Purge Concentration Learned • 3g/s ≤ Airflow within range ≤ 10g/s • Throttle closed ≤ 1.5015% • 70°C(158 °°F) ≤ Coolant Temp ≤ 120°C(248 °F) • -7°C(19.4 °F) ≤ Ambient Temp ≤ 105°C(221 °F)	

EnableConditions	• Barometer ≥ 72kPa • Too many test attempts ≤ 12 • Closed Loop • 250°C(482 °F) ≤ Catalyst Temp ≤ 950°C(1742 °°F) • Fuel Integrator deviation from stoich below maximum ≤ 0.05 • Vehicle speed ≤ 3kph(1.864114mph) • BLM Learn completed • Low idle airflow not present (airflow delay complete) • Not airfuel ramping • Not idling for too long ≤ 60sec • Test not complete • No disabling faults present • No instrumentation slews active • No OFVC device control active	• Leakage in the exhaust system • Faulty Catalyst Converter • Faulty HO2S • Faulty PCM
Threshold value	• EWMA Oxygen Storage Time for Bank 1 ≥ 3.25s(Passing) 3.75s	
DiagnosisTime	• -	
MIL On Condition	• 1 Driving cycle	

MONITOR SCANTOOL DATA

1. Ignition "OFF"
2. Connect Scantool and Ignition "ON".
3. Monitor the HO2S parameters and signal waveform on scantool.



4. Are the signal of rear HO2S and waveform the same as that of the front HO2S?

YES

▸ Go to "System Inspection" procedure.

NO

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection,bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and goto "Verification vehicle Repair" procedure.

SYSTEM INSPECTION

1. Check Exhaust sytem.
   (1) Visually/physically inspect the following conditions:
      A. Exhaust system between HO2S and Three way catalyst for air leakage
      B. Damage, and for loose or missing hardware:

   (2) Has a problem been found in any of the above areas?

   YES

   ▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

   NO

▸ Go to "Component Inspection" procedure.

COMPONENT INSPECTION

1. Check Rear HO2S.
   (1) Visually/physically inspect the rear HO2S for the following conditions:
      A. Ensure that the HO2S is securely installed.
         (Pigtail and wiring harness not making contact with the exhaust pipe)
      B. Check for corrosion on terminals.
      C. Check for terminal tension (at the HO2S and at the PCM).
      D. Any damage.

   (2) Has a problem been found in any of the above areas?

   YES

   ▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Go to "Check TWC" as below.

2. Check TWC
   (1) Visually/physically inspect the three-way catalyst(TWC) converter for the following damage:
      A. Severe discoloration caused by excessive temperature
      B. Dents and holes
      C. Internal rattle caused by a damaged catalyst

   (2) Also, ensure that the TWC is a proper original equipment manufacturer part.

   (3) Has a problem been found?

   YES

   ▸ Substitute with a known - good TWC and check for proper operation.
   ▸ If the problem is corrected, replace TWC and go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Substitute with a known - good PCM and check for proper operation.
   ▸ If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.
1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

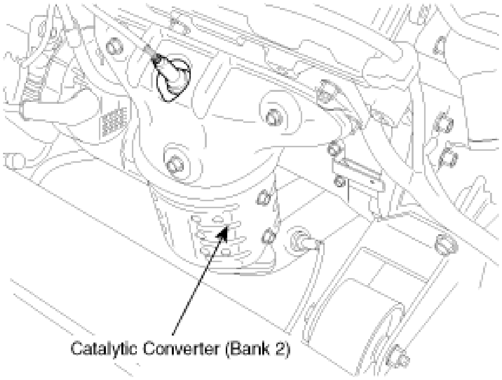
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0430

COMPONENT LOCATION



GENERAL DESCRIPTION

The catalyst's efficiency is demonstrated by its ability to oxidize CO and hydrocarbon emissions. The Powertrain Control Module (PCM) compares the output signals of the front and rear oxygen sensors to determine whether the output of the rear sensor is beginning to match the output of the front oxygen sensor. Air/fuel mixture compensation keeps the frequency of the front oxygen sensor high due to the changes from rich-to-lean combusition. The catalyst causes the rear oxygen sensor to have a lower frequency. As the catalyst wears, the rear oxygen sensor's signal trace begins to match the front oxygen sensor's signal trace. That is because the catalyst becomes saturated with oxygen and cannot use the oxygen to convert hydrocarbon and CO into H_2O and CO_2 with the same efficiency as when it was new. A completely worn catalyst shows a 100% match between the frequency of the front and rear sensors.

DTC DESCRIPTION

If the oxygen storage time for B2 is higher than threshold , the PCM determines that a fault exists and a DTC is stored. MIL (Malfunction Indicatin Lamp) turns on when the malfunction lasts till 1 driving cycle.

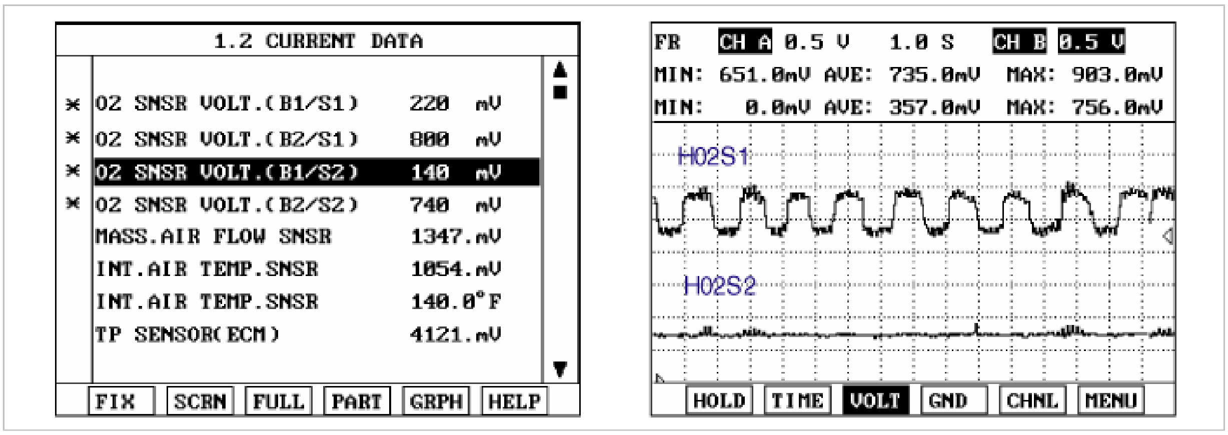
DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• The ICMD Diagnostic manipulates Airfuel and stores the times it takes for the pre and post converter oxygen sensors to switch. It then calculates EWMA values and compares them against calibratable thresholds in order to determine the PASS/FAIL status.	• Leakage in the exhaust system • Faulty Catalyst Converter • Faulty HO2S • Faulty PCM
EnableConditions	• Engine Runtime Sufficient ≥ 580sec • Purge Concentration Learned • 3g/s ≤ Airflow within range ≤ 10g/s • Throttle closed ≤ 1.5015% • 70°C(158 °°F) ≤ Coolant Temp ≤ 120°C(248 °F) • -7°C(19.4 °F) ≤ Ambient Temp ≤ 105°C(221 °F) • Barometer ≥ 72kPa • Too many test attempts ≤ 12 • Closed Loop • 250°C(482 °F) ≤ Catalyst Temp ≤ 950°C(1742 °°F) • Fuel Integrator deviation from stoich below maximum ≤ 0.05 • Vehicle speed ≤ 3kph(1.864114mph) • BLM Learn completed • Low idle airflow not present (airflow delay complete) • Not airfuel ramping • Not idling for too long ≤ 60sec • Test not complete • No disabling faults present • No instrumentation slews active • No OFVC device control active	
Threshold value	• EWMA Oxygen Storage Time for Bank 1 ≥ 3.25s(Passing)	

	3.75s	
DiagnosisTime	• -	
MIL On Condition	• 1 Driving cycle	

MONITOR SCANTOOL DATA

1. Ignition "OFF"
2. Connect Scantool and Ignition "ON".
3. Monitor the HO2S parameters and signal waveform on scantool.



4. Are the signal of rear HO2S and waveform the same as that of the front HO2S?

YES

▸ Go to "System Inspection" procedure.

NO

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection,bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and goto "Verification vehicle Repair" procedure.

SYSTEM INSPECTION

1. Check Exhaust sytem.
   (1) Visually/physically inspect the following conditions:
      A. Exhaust system between HO2S and Three way catalyst for air leakage
      B. Damage, and for loose or missing hardware:

   (2) Has a problem been found in any of the above areas?

   YES

   ▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Go to "Component Inspection" procedure.

COMPONENT INSPECTION

1. Check Rear HO2S.
   (1) Visually/physically inspect the rear HO2S for the following conditions:
      A. Ensure that the HO2S is securely installed.
         (Pigtail and wiring harness not making contact with the exhaust pipe)
      B. Check for corrosion on terminals.
      C. Check for terminal tension (at the HO2S and at the PCM).
      D. Any road damage.

   (2) Has a problem been found in any of the above areas?

   YES

   ▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

   NO

▸ Go to "Check TWC" as below.

2. Check TWC
   (1) Visually/physically inspect the three-way catalyst(TWC) converter for the following damage:
      A. Severe discoloration caused by excessive temperature
      B. Dents and holes
      C. Internal rattle caused by a damaged catalyst
   (2) Also, ensure that the TWC is a proper original equipment manufacturer part.
   (3) Has a problem been found?

YES

▸ Substitute with a known - good TWC and check for proper operation.
▸ If the problem is corrected, replace TWC and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good PCM and check for proper operation.
▸ If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0441

GENERAL DESCRIPTION

The evaporative emission control system prevents hydrocarbon (HC) vapors from the fuel tank from escaping into the atmosphere where they could form photochemical smog. Gasoline vapors are collected in the charcoal canister. The evaporative canister is designed to trap and store fuel vapor emissions from the fuel tank.
When the carbon in the canister is unsaturated, fuel vapor passing over and through the activated carbon surface is absorbed and fresh air can pass out through the vent system with very little residual fuel vapor. When fresh air is drawn through the canister from the vent system, fuel vapors recombine with the air and are metered into the engine.

DTC DESCRIPTION

This test detects a leak across the purge valve by measuring an increase in evaporative system vacuum. A leak across the purge valve can allow hydrocarbons from the tank to leak to the atmosphere when the engine is off. The test should be calibrated to detect a 0.02” (0.5mm) leak path across the purge valve. This testdoes not require idle conditions to run.
Checking output signals from tank vaccum under detecting condition, if signals is high than threshold for more than 2 sec., PCM sets P0441. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till 1 driving cycle.

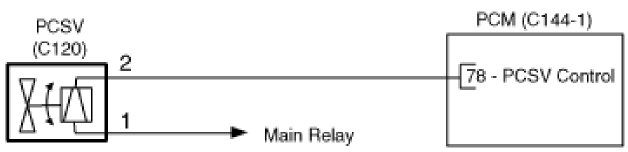
DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Test is failed if tank vacuum exceeds prescribed threshold, based on fuel level for a prescribed time	
	• 10 < Ignition Volt < 15.9907 • Barometric pressure > 72 kPa	

EnableConditions	• Engine off time > 720min or Startup IAT-Startup ECT < 12° C(53.6 °F) • Startup ECT -Startup IAT < 12°C(53.6 °F) • 0°C(32 °F) < Startup ECT < 40°C(104 °F) • 0°C(32 °F) < Startup IAT < 40°C(104 °F) • Start-up IAT-IAT < 1°C(33.8 °F) • 1s < Engine Run Time < 100s	• PCSV • PCM
Threshold value	• Tank vacuum ≥ 10 inH2O • Fail time > 2s	
DiagnosisTime	• Continuous	
MIL On Condition	• 1 driving cycle	

SCHEMATIC DIAGRAM

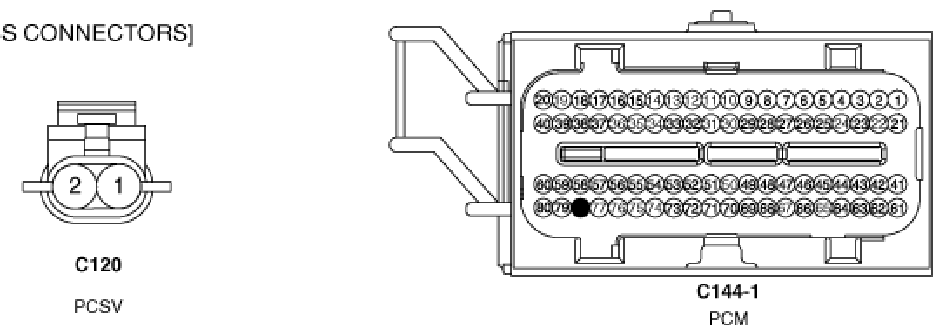
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-1 (78)	PCSV Control

[HARNESS CONNECTORS]

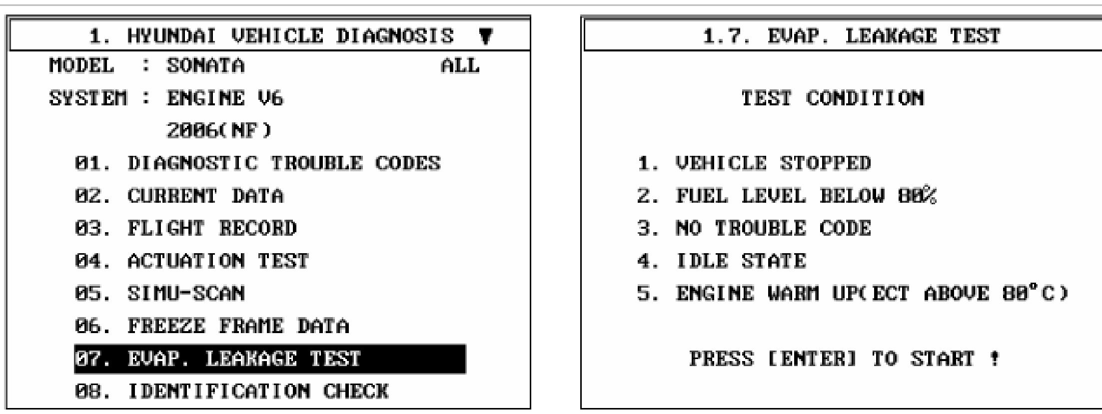


MONITOR SCANTOOL DATA

1. Warm-up engine to normal operating temperature.

> NOTE
>
> Evaporative Emissions Systems (EVAP) Leak Tests can be run by the Scan Tool.
> The tests are automated and provide either a pass-fail result or directions to check for DTCs.

2. Install scan tool and clear DTC
3. Perform "EVAP. LEAKAGE TEST" mode referring to enable conditions as below



4. Monitoring for (pending) DTC by performing " DIAGNOSTIC TROUBLE CODES" or "MONITORING TEST RESULTS". Is the

same DTC set ?

YES

▸ Go to "Component Inspection" procedure.

NO

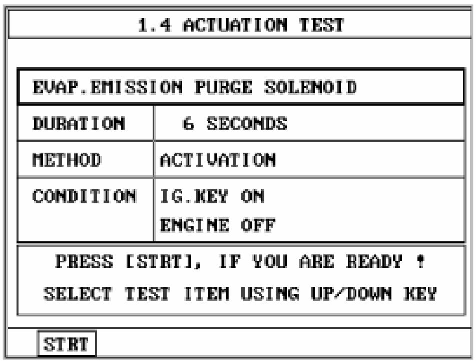
▸ Fault is intermittent caused by poor contact in sensor’s and/or PCM’s connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection,bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and goto "Verification of vehicle Repair" procedure.

COMPONENT INSPECTION

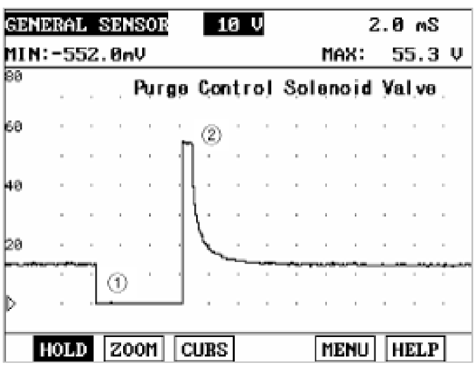
1. Check PCSV
   (1) Ignition "OFF"
   (2) Remove PCSV and check it for open stuck or leak
   (3) Measure resistance between terminals "1" and "2" of the PCSV connector.

   Specification: Approx. 24.5 ~ 27.5Ω(20°C(68°F))

   (4) Connect Scantool and Perform ACTUATION TEST for PCSV with scantool
   (5) Check that clicking sound can be heard by actuation test.



   (6) Monitor the PCSV signal waveform and verify that the ground voltage is less than approx. 0.3V (①) and the surge voltage (②) is between 40 V and 60 V.



   (7) Is the PCSV normal?

YES

▸ Substitute with a known - good PCM and check for proper operation.
▸ If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Substitute with a known - good PCSV and check for proper operation.
▸ If the problem is corrected, replace PCSV and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0442

GENERAL DESCRIPTION

The Small Leak test determines the presence of a leak in the evaporative system that is 0.040”diameter (1.0 mm) or larger, as defined by CARB. The EVPD(Evaporative System Diagnostics) will only perform this test when idle conditions are present and the Large Leak test has reported a “pass” condition, indicating that the current tank vacuum level is approximately 10.2inH2O.

DTC DESCRIPTION

This test detects a leak across the purge valve by measuring an increase in evaporative system vacuum. A leak across the purge valve can allow hydrocarbons from the tank to leak to the atmosphere when the engine is off. The test should be calibrated to detect a 0.02” (0.5mm) leak path across the purge valve. This testdoes not require idle conditions to run.
Checking output signal from tank vaccum under detecting condition, if the signal is high than threshold, PCM sets P0442. MIL (Malfunction Indicatin Lamp) turns on when the malfunction lasts till 1 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• If a corrected vacuum decay slope and the individual segment slopes exceed their respective thresholds and the segment slopes are not convex then a small leak is present	• Leakage in each hose/fuel filler pipe • Leakage in PCSV/ CCV/Canister/ Fuel tank • PCM
EnableConditions	• 10 < Ignition Volt < 15.9907 • Barometric pressure > 72 kPa • Engine off time > 720min or Startup IAT-Startup ECT < 12°C(53.6 °F) • Startup ECT -Startup IAT < 12°C(53.6 °F) • 0°C(32 °F) < Startup ECT < 40°C(104 °F) • 0°C(32 °F) < Startup IAT < 40°C(104 °F) • Start-up IAT-IAT <1°C(33.8 °F) • 1s < Engine Run Time < 100s • Purge enabling Rum time < Threshold • Cold Test Timer < 300sec. • 0.03% < Fuel level < 0.97% **Under Idle conditions** • Engine RPM < 1500 • Vehicle Speed < 3KPH(1.864114 MPH) • Throttle Position < 1% **Creep Conditions** • Engine RPM < 1500 • Vehicle Speed < 6KPH(3.728227 MPH) • Throttle Position < 1.9989% **Fuel not Sloshing** • Vehicle Speed > 2KPH(1.242742 MPH) • Thorttle Postion > 1% • 125mS MAP change > 10KPa • 125mS Engine Speed > 100RPM • 125mS Fuel Level change > Threshold	
	• Decay slope (beginning at decay start < 10 inH2O and	

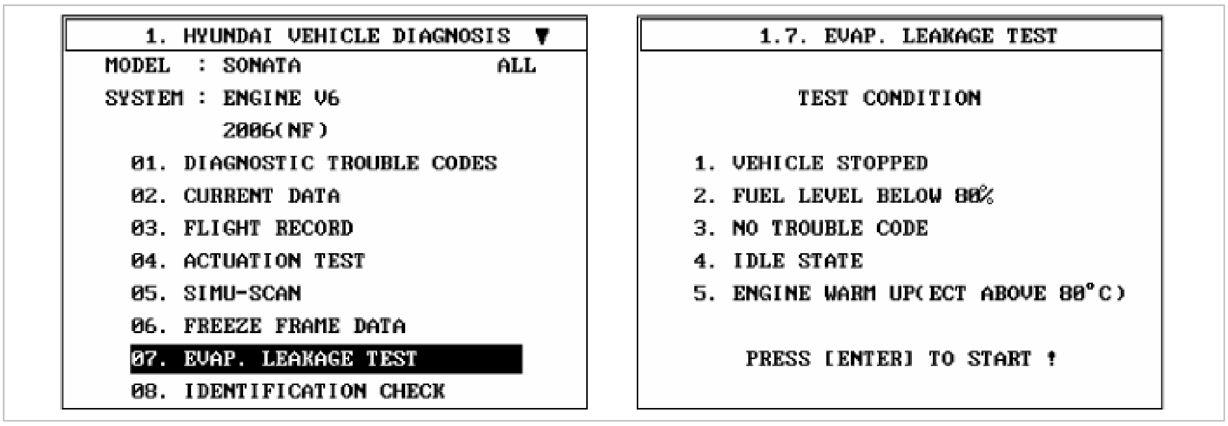
Threshold value	lasting for decay time < 10sec) minus the larger vapor correction term (purge leak vapor term OR Post decay vapor term) is greater than threshold (the product of a base term using fuel level AND a temperature bias term) • All segment slopes greater than their threshold(the product of a base term AND a temperature bias term AND a segment bias term)	
DiagnosisTime	• Continuous	
MIL On Condition	• 1 driving cycle	

MONITOR SCANTOOL DATA

1. Warm-up engine to normal operating temperature.

> **NOTE**
>
> Evaporative Emissions Systems (EVAP) Leak Tests can be run by the Scan Tool.
> The tests are automated and provide either a pass-fail result or directions to check for DTCs.

2. Install scan tool and clear DTC.
3. Perform "EVAP. LEAKAGE TEST" mode referring to enable conditions as below.



4. Monitoring for (pending) DTC by performing " DIAGNOSTIC TROUBLE CODES"or "MONITORING TEST RESULTS".
5. Is the same DTC set ?

YES

▸ Go to "System Inspection" procedure.

NO

▸ Fault is intermittent caused by poor contact in sensor’s and/or PCM’s connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection,bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and goto "Verification of vehicle Repair" procedure,

SYSTEM INSPECTION

1. Check vapor hoses for leakage in fuel system.
   (1) Check vapor hoses between the following components for leakage:
      A. Intake manifoled ~ Purge control solenoid valve (PCSV)
      B. Purge control solenoid valve (PCSV) ~ Canister
      C. Canister ~ Canister close valve (CCV)
      D. Canister ~ fuel tank

   (2) Does a leak exist?

   YES

   ▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Go to "Check fuel filler pipe for leakage" as below.

2. Check fuel filler pipe for crack or leakage.

(1) Check that there is crack or leakage in fuel filler pipe.

(2) Does a malfunction exist?

YES

▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

NO

▸ Go to "Component inspection" procedure.

COMPONENT INSPECTION

1. Check CCV for leakage.

(1) Disconnect the hose leading from the CCV to Canister at CCV.

(2) When the CCV is operated, apply a vacuum at the nipple and verify that the CCV holds vacuum.

(3) Does a leak exist?

YES

▸ Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Go to "Check Canister for leakage" as necessary.

2. Check Canister for leakage.

(1) Disconnect the hose leading from the CCV to Canister at Canister.

(2) When the other nipples are plugged, apply a vacuum at the vent nipple and verify that the Canister holds vacuum.

(3) Does a leak exist?

YES

▸ Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Go to "Check fuel tank for leakage" as below.

3. Check fuel tank for leakage.

(1) Check fuel tank for crack or leakage.

(2) Does a leak exist?

YES

▸ Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good PCM and check for proper operation.
▸ If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0444

COMPONENT LOCATION

GENERAL DESCRIPTION

The purge solenoid is a pneumatic device that meters the air and fuel (purge) vapor flow to thepurge port. In a sense, the purge solenoid is comparable to a fuel injector, because the meteredpurge flow follows the same slope and offset characteristics. However, the purge solenoidnormally runs with a duty cycle at a fixed frequency because the opening response is significantly slower than a fuel injector. It would not practical to run the solenoid synchronouslywith engine events except perhaps at very low RPM. The normal frequencies for the purgesolenoid are between 8 and 20 Hz.

DTC DESCRIPTION

Checking output signals from PCSV every 10 sec. under detecting condition, if signals indicating open or short to ground in the circuit are detected for more than 5 sec., PCM sets P0444. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Open, short to ground	• Poor connection • Open or short to ground in harness • PCSV • PCM
EnableConditions	• Engine running state • 11V ≤ Battery voltage ≤ 16V • Above enable conditions are met > 0.5 sec.	
Threshold value	• Open or short to ground	
DiagnosisTime	• Continuous (More than 5 sec.failure for every 10 sec.test)	
MIL On Condition	• 2 driving cycles	

SIGNAL WAVEFORM AND DATA

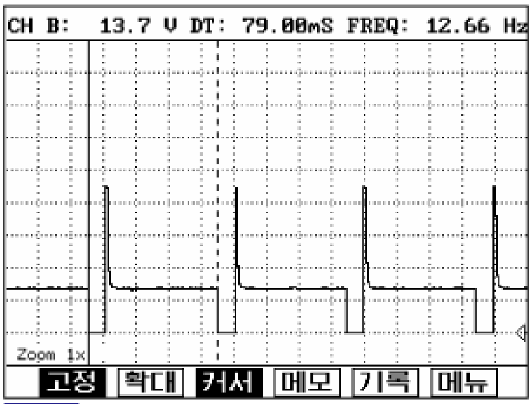


Fig. 1

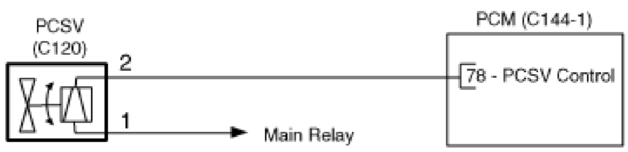
The Purge Control Solenoid Valve(PCSV) is open or closed by PCM and vacuum of intake manifold.
At opening, fuel vapor from canister enters into intake manifold. To prevent vacuum from forming inside canister, PCM controls to open it. This photo shows the signal waveform of PCSV operating normally.

SPECIFICATION

Item	Coil resistance(Ω)
PCSV	19.0 ~ 22.0Ω (at 20°C / 68°F)

SCHEMATIC DIAGRAM

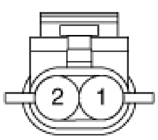
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

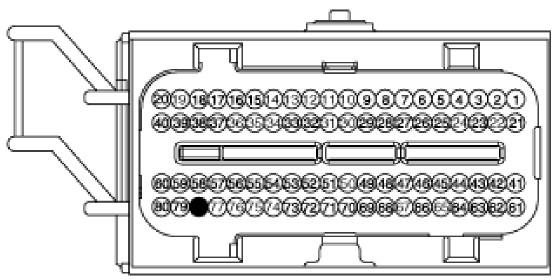
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-1 (78)	PCSV Control

[HARNESS CONNECTORS]



C120

PCSV



C144-1

PCM

MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Cable (DLC)
2. Warm up engine to normal operating temperature.
3. Monitor "PCSV" parameter on the scantool.

4. Is the current data displayed correctly?

YES

▸ Fault is intermittently caused by poor contact in the sensor and/or PCM connector or non cleared PCM memory after repair. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace if necessary and go to "Verification of vehicle Repair".

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

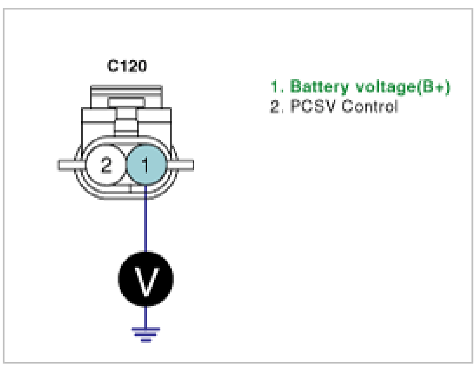
NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSEPCTION

1. IG "OFF" and disconnect PCSV connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of PCSV harness connector and chassis ground.

Specification : B+



4. Is the measured voltage within specification?

YES

▸ Go to "Control Circuit Inspection" procedure.

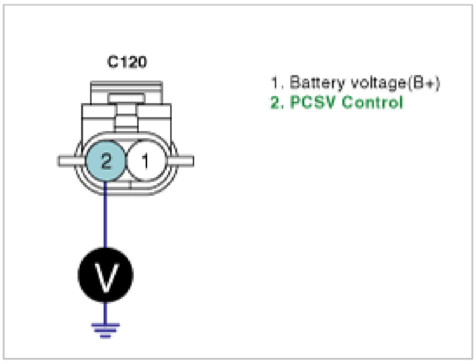
NO

▸ Repair open or short to ground in harness, and go to " Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check short to ground in harness.
   (1) IG "OFF" and disconnect PCSV connector.
   (2) IG "ON"
   (3) Measure voltage between terminal 2 of PCSV harness connector and chassis ground.

Specification : Approx. 0.5V



   (4) Is the measured resistance within specification?

YES

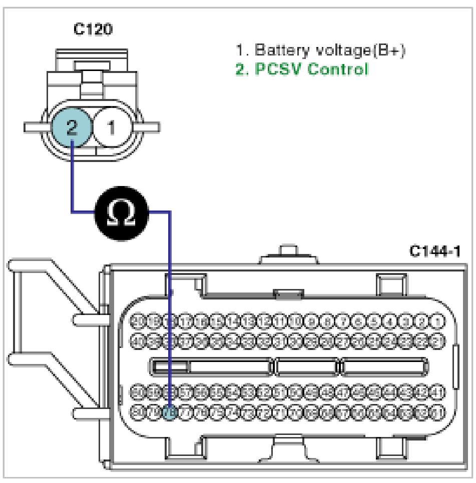
▸ Go to "Check open in harness" as follows.

NO

▸ Repair short to ground in harness, and go to " Verification of Vehicle Repair" procedure.

2. Check open in harness.
   (1) IG "OFF" and disconnect PCSV connector and PCM connector.
   (2) Measure resistance between terminal 2 of PCSV harness connector and terminal 78 of PCM harness connector.

Specification : Below 1Ω



   (3) Is the measured voltage within specification?

YES

▸ Go to " Component Inspection" procedure.

NO

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

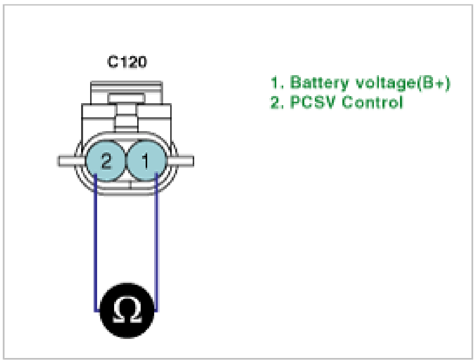
COMPONENT INSPECTION

1. Check PCSV
   (1) IG "OFF" and disconnect PCSV connector.
   (2) Measure resistance between terminals 1 and 2 of PCSV connector.(Component side)

Specification :

Item	Coil resistance(Ω)

PCSV	19.0 ~ 22.0Ω (at 20°C / 68°F)



(3) Is the measured resistance within specification?

YES

- Substitute with a known - good PCM and check for proper operation.
- If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

- Substitute with a known - good PCSV and check for proper operation.
- If the problem is corrected, replace PCSV and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

- Go to the applicable troubleshoooting procedure.

NO

- System is performing to specification at this time.

Fuel System > Troubleshooting > P0445

COMPONENT LOCATION

GENERAL DESCRIPTION

The purge solenoid is a pneumatic device that meters the air and fuel (purge) vapor flow to thepurge port. In a sense, the purge solenoid is comparable to a fuel injector, because the meteredpurge flow follows the same slope and offset characteristics. However, the purge solenoidnormally runs with a duty cycle at a fixed frequency because the opening response is significantly slower than a fuel injector. It would not practical to run the solenoid synchronouslywith engine events except perhaps at very low RPM. The normal frequencies for the purgesolenoid are between 8 and 20 Hz.

DTC DESCRIPTION

Checking output signals from PCSV every 10 sec. under detecting condition, if signals indicating short to battery in the circuit are detected for more than 5 sec., PCM sets P0445. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Short to battery	• Poor connection • Short to battery in harness • PCSV • PCM
EnableConditions	• Engine running state • 11V ≤ Battery voltage ≤ 16V • Above enable conditions are met > 0.5 sec.	
Threshold value	• Short to battery	
DiagnosisTime	• Continuous (More than 5 sec.failure for every 10 sec.test)	
MIL On Condition	• 2 driving cycles	

SIGNAL WAVEFORM AND DATA

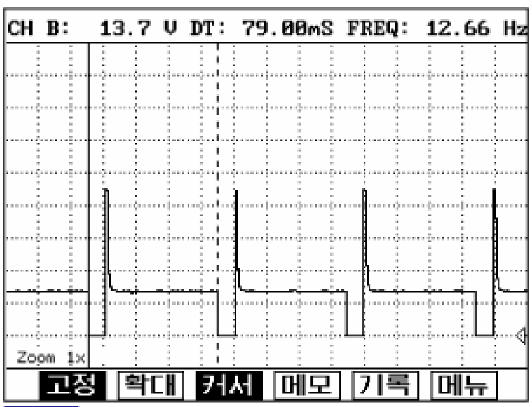


Fig. 1

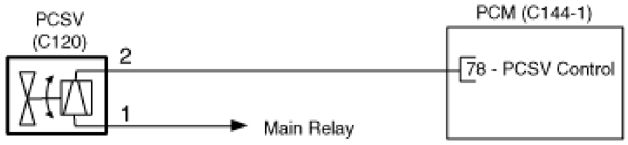
The Purge Control Solenoid Valve(PCSV) is open or closed by PCM and vacuum of intake manifold.
At opening, fuel vapor from canister enters into intake manifold. To prevent vacuum from forming inside canister, PCM controls to open it. This photo shows the signal waveform of PCSV operating normally.

SPECIFICATION

Item	Coil resistance(Ω)
PCSV	19.0 ~ 22.0Ω (at 20°C / 68°F)

SCHEMATIC DIAGRAM

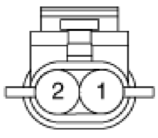
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

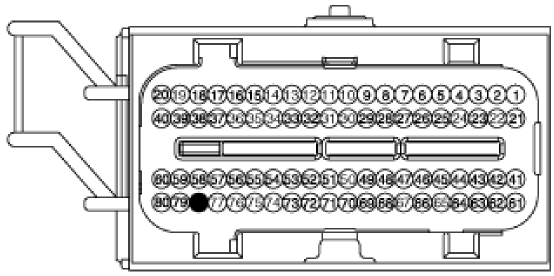
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-1 (78)	PCSV Control

[HARNESS CONNECTORS]



C120

PCSV



C144-1

PCM

MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Cable (DLC)
2. Warm up engine to normal operating temperature.
3. Monitor "PCSV" parameter on the scantool.

Normal data at idle

Normal data at accel.

4. Is the current data displayed correctly?

YES

▸ Fault is intermittently caused by poor contact in the sensor and/or PCM connector or non cleared PCM memory after repair. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace if necessary and go to "Verification of vehicle Repair".

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

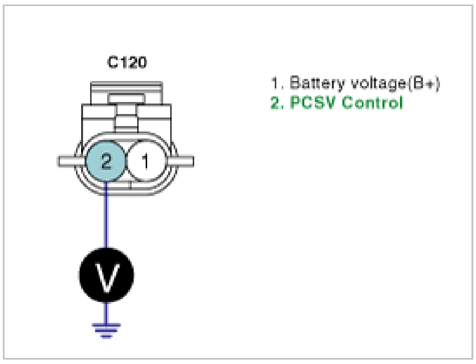
NO

▸ Go to " Control Circuit Inspection " procedure.

CONTROL CIRCUIT INSPECTION

1. IG "OFF" and disconnect PCSV connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 2 of PCSV harness connector and chassis ground.

Specification : Approx. 0.5V



4. Is the measured voltage within specification?

YES

▸ Go to "Component Insepction" procedure.

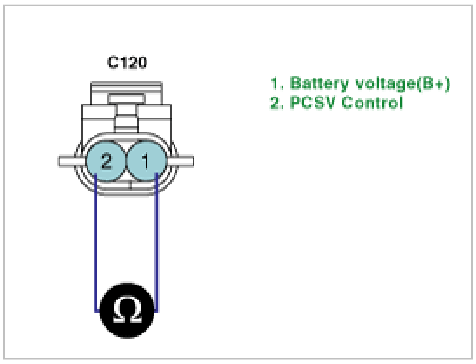
NO

▸ Repair short to battery in harness, and go to " Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check PCSV
   (1) IG "OFF" and disconnect PCSV connector.
   (2) Measure resistance between terminals 1 and 2 of PCSV connector.(Component side)
   Specification :

Item	Coil resistance(Ω)
PCSV	19.0 ~ 22.0Ω (at 20°C / 68°F)



   (3) Is the measured resistance within specification?

YES

▸ Substitute with a known - good PCM and check for proper operation.
▸ If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good PCSV and check for proper operation.
▸ If the problem is corrected, replace PCSV and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

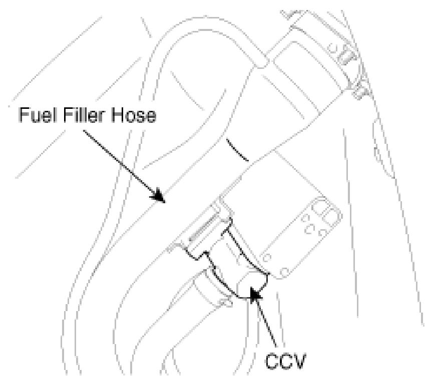
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0447

COMPONENT LOCATION



GENERAL DESCRIPTION

The vent valve is a device that is designed to close off the fresh air inlet to the canister. Currentvent valve designs are powered closed. An electrically operated vent valve solenoid is requiredfor OBD II compliant evaporative systems. Normally the vent valve is in the open (unpowered)state, but to control the vacuum levels in the fuel tank the EVPD will command the vent valvesolenoid to the closed position. This controlled vacuum level will allow the EVPD to determine the integrity of the evaporative system.
The vent valve orifice is much larger than the purge valve orifice or purge lines so that when thevent valve is open, the purge flow is not restricted. The fresh air inlet in the vent valve solenoid is normally filtered with a serviceable dust filter that helps to prevent contaminants from being drawn into the evaporative system (e.g. water, salt, silica, etc.).

DTC DESCRIPTION

Checking output signals from PCSV every 10 sec. under detecting condition, if signals indicating open or short to ground in the circuit are detected for more than 5 sec., PCM sets P0447. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

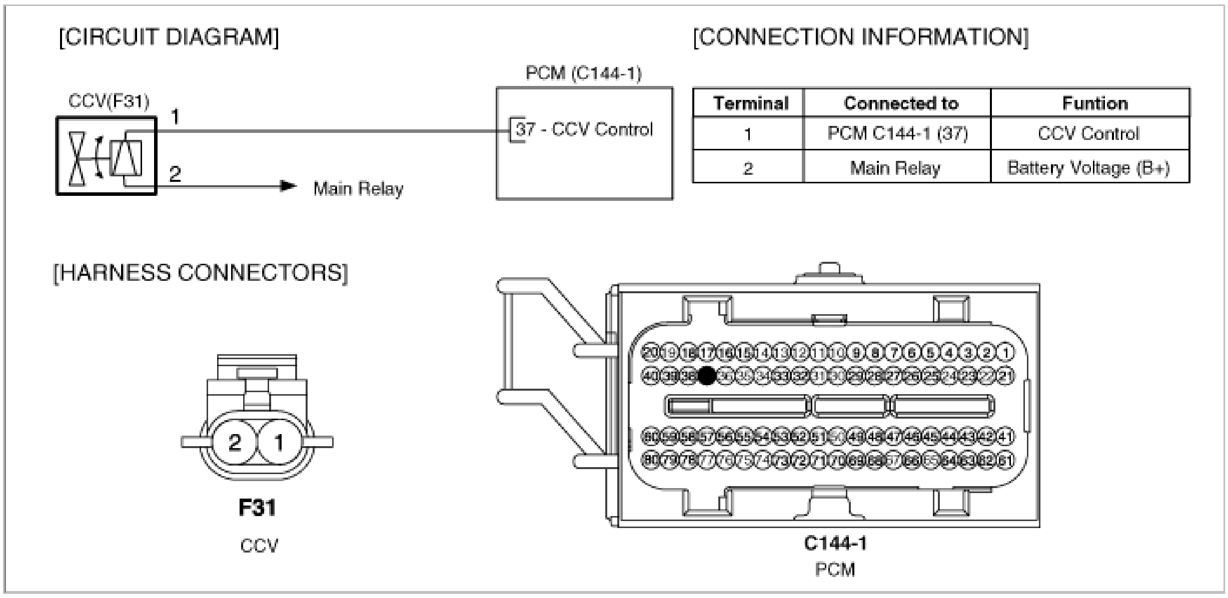
DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to ground or open circuit on Vent Valve output circuit. Fault information provided by an output driver chip.	• Poor Connection • Open or Short in Power Circuit • Open or short in Control Circuit • CCV • PCM
EnableConditions	No disabling Faults Present • Engine Running • 11V ≤ Ignition Voltage ≤ 16V • Enable Time delay ≥ 0.5sec.	
Threshold value	• Open or short to ground	
DiagnosisTime	• Continuous (More than 5sec.Test failure for every 10sec. tests)	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION

Item	Specification
Coil Resistance (Ω)	19.8 ~ 21.8Ω (20°C)

SCHEMATIC DIAGRAM



ACTUATION TEST

1. Connect scantool on the DLC(Data Link Connector).
2. Perform Actuation Test for Canister Vent Solenoid Valve with scantool.
3. Check that clicking sound can be heard by actuation test.
4. Is the CCV normal ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

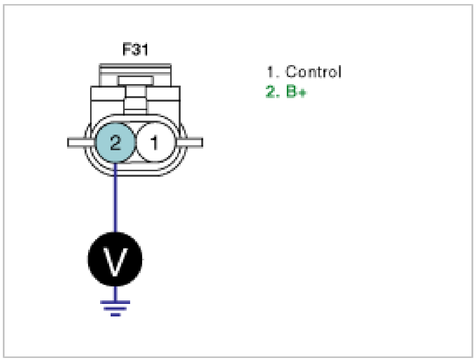
NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. Engine "OFF"
2. Disconnect CCV connector.
3. Ignition " ON " & Engine "OFF".
4. Measure voltage between terminal "2" of CCV harness connector and chassis ground.

Specification : B+



5. s the measured voltage within specifications?

YES

▸ Go to " Control Circuit Inspection" procedure.

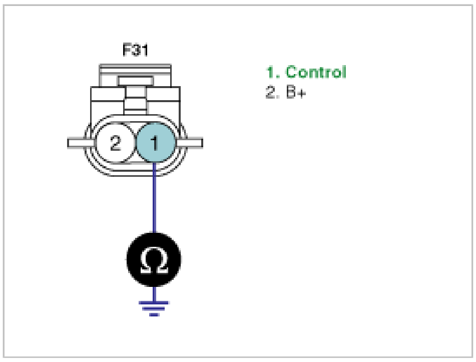
NO

▸ Check open or short to ground in harenss between control relay and CCV.
▸ Repair or replace as necessary and then, go to " Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check for short to ground in harness.
   (1) Ignition "OFF"
   (2) Disconnect CCV connector
   (3) Measure resistance between terminal "1" of CCV harness connector and chassis ground.

   Specification : Infinite



   (4) Is the measured resistance within specifications?

   YES

   ▸ Go to " Check for open in harness" as below.

   NO

   ▸ Check short to ground in signal harness.
   ▸ Repair or replace as necessary and then, go to " Verification of Vehicle Repair" procedure.

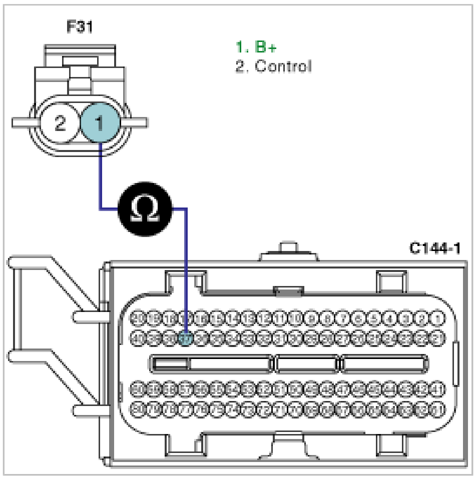
2. Check for open in harness.

(1) Ignition "OFF"

(2) Disconnect CCV and PCM connector

(3) Measure resistance between terminal "1" of CCV harness connector and terminal "37" of PCM harness connector.

Specification : Approx. below 1Ω



3. Is the measured resistance within specifications?

YES

▸ Go to " Component Inspection " procedure.

NO

▸ Check open in harenss between CCV connector and PCM connector.

▸ Repair or replace as necessary and then, go to " Verification of Vehicle Repair" procedure.

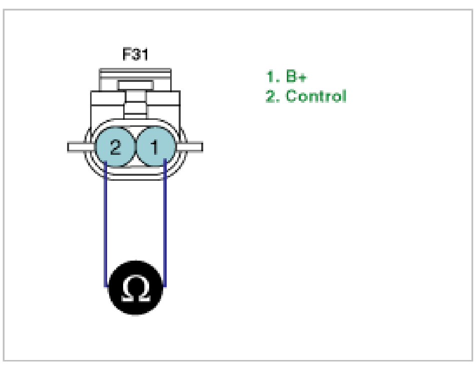
COMPONENT INSPECTION

1. Check CCV

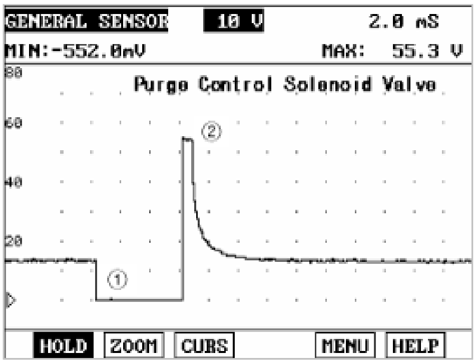
(1) Ignition "OFF"

(2) Measure resistance between terminals "1" and "2" of the CCV connector.

Specification: Approx. 19.8 ~21.8Ω(20°C(68°F))



(3) Monitor the CCV signal waveform and verify that the ground voltage is less than approx. 0.3V (①) and the surge voltage (②) is between 40 V and 60 V.



(4) Is the CCV normal?

YES

- Substitute with a known - good PCM and check for proper operation.
- If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

- Substitute with a known - good CCV and check for proper operation.
- If the problem is corrected, replace CCV and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

- Go to the applicable troubleshoooting procedure.

NO

- System is performing to specification at this time.

Fuel System > Troubleshooting > P0448

COMPONENT LOCATION

GENERAL DESCRIPTION

The vent valve is a device that is designed to close off the fresh air inlet to the canister. Currentvent valve designs are powered closed. An electrically operated vent valve solenoid is requiredfor OBD II compliant evaporative systems. Normally the vent valve

is in the open (unpowered)state, but to control the vacuum levels in the fuel tank the EVPD will command the vent valvesolenoid to the closed position. This controlled vacuum level will allow the EVPD to determine the integrity of the evaporative system.
The vent valve orifice is much larger than the purge valve orifice or purge lines so that when thevent valve is open, the purge flow is not restricted. The fresh air inlet in the vent valve solenoid is normally filtered with a serviceable dust filter that helps to prevent contaminants from being drawn into the evaporative system (e.g. water, salt, silica, etc.).

DTC DESCRIPTION

Checking output signals from PCSV every 10 sec. under detecting condition, if signals indicating short to battery in the circuit are detected for more than 5 sec., PCM sets P0448. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

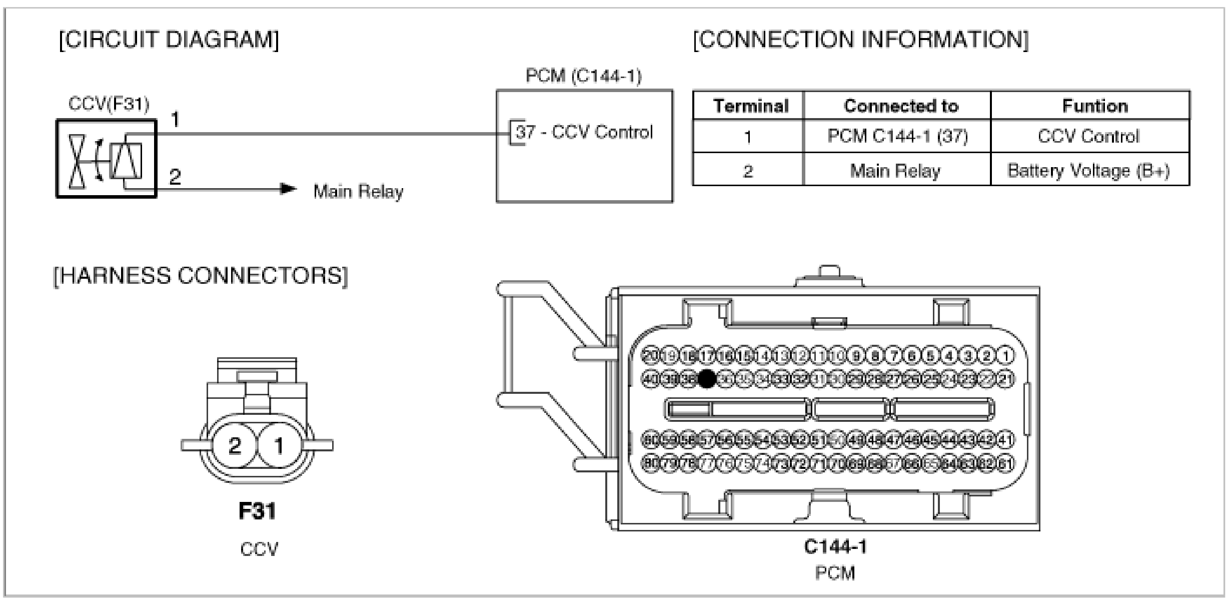
DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to battery on Vent Valve output circuit. Fault information provided by an output driver chip.	• Poor Connection • Short to battery in CCV circuit • CCV • PCM
EnableConditions	• No disabling Faults Present • Engine Running • 11V ≤ Ignition Voltage ≤ 16V • Enable Time delay ≥ 0.5sec.	
Threshold value	• Short to battery	
DiagnosisTime	• Continuous (More than 5sec.Test failure for every 10sec. tests)	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION

Item	Specification
Coil Resistance (Ω)	19.8 ~ 21.8Ω (20°C)

SCHEMATIC DIAGRAM



Terminal	Connected to	Funtion
1	PCM C144-1 (37)	CCV Control
2	Main Relay	Battery Voltage (B+)

ACTUATION TEST

1. Connect scantool on the DLC(Data Link Connector).
2. Perform Action Test for Canister Vent Solenoid Valve with scantool.
3. Check that clicking sound can be heard by actuation test.

4. Is the CCV normal ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

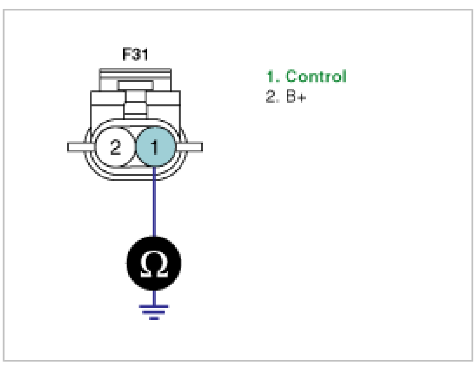
NO

▸ Go to " Control Circuit Inspection " procedure.

CONTROL CIRCUIT INSPECTION

1. Check for short to ground in harness.
   (1) Ignition "OFF"
   (2) Disconnect CCV connector
   (3) Measure resistance between terminal "1" of CCV harness connector and chassis ground.

   Specification : Infinite



   (4) Is the measured resistance within specifications?

   YES

   ▸ Go to " Check for open in harness" as below.

   NO

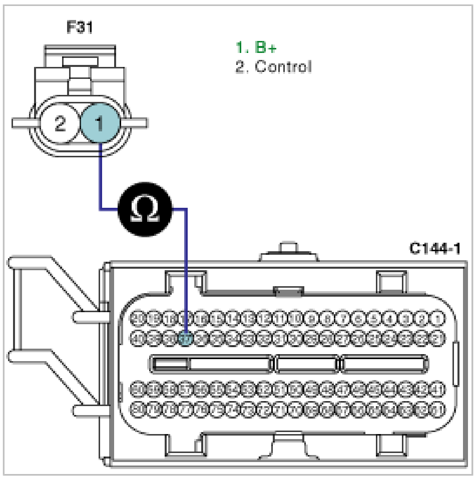
   ▸ Check short to ground in signal harness.
   ▸ Repair or replace as necessary and then, go to " Verification of Vehicle Repair" procedure.

2. Check for open in harness.
   (1) Ignition "OFF"

(2) Disconnect CCV and PCM connector

(3) Measure resistance between terminal "1" of CCV harness connector and terminal "37" of PCM harness connector.

Specification : Approx. below 1Ω



3. Is the measured resistance within specifications?

YES

▸ Go to " Component Inspection " procedure.

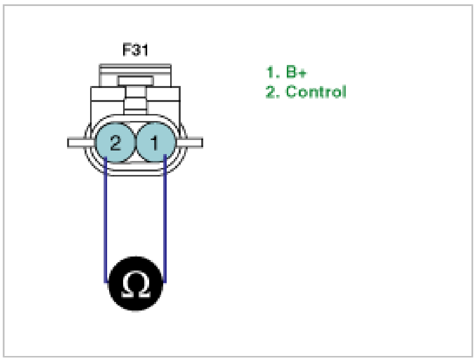
NO

▸ Check open in harenss between CCV connector and PCM connector.
▸ Repair or replace as necessary and then, go to " Verification of Vehicle Repair" procedure.

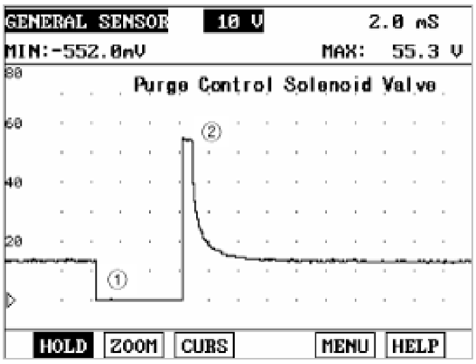
COMPONENT INSPECTION

1. Check CCV
   (1) Ignition "OFF"
   (2) Measure resistance between terminals "1" and "2" of the CCV connector.

Specification: Approx. 19.8 ~21.8Ω(20°C(68°F))



(3) Monitor the CCV signal waveform and verify that the ground voltage is less than approx. 0.3V (①) and the surge voltage (②) is between 40 V and 60 V.



(4) Is the CCV normal?

YES

- Substitute with a known - good PCM and check for proper operation.
- If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

- Substitute with a known - good CCV and check for proper operation.
- If the problem is corrected, replace CCV and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

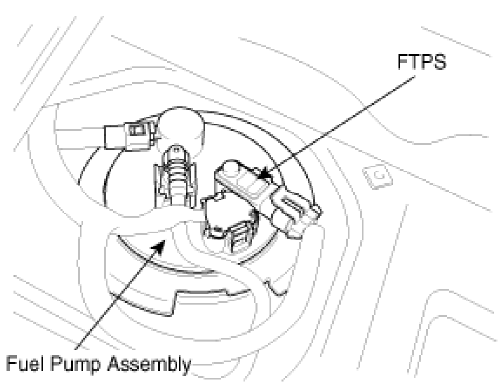
- Go to the applicable troubleshoooting procedure.

NO

- System is performing to specification at this time.

Fuel System > Troubleshooting > P0451

COMPONENT LOCATION



GENERAL DESCRIPTION

The Fuel Tank Pressure Sensor(FTPS) converts fuel tank pressure to a proportional analog voltage signal which is read by the engine controller for evaluation during execution of the Evaporative System Diagnostic. The Tank Pressure may be below atmospheric pressure (ie. a vacuum) or above atmospheric pressure.

The fuel tank pressure is used to measure the difference between the air pressure (or vacuum) in the fuel tank and the ambient air pressure. The Powertrain Control Module (ECM) supplies a 5-volt reference and a ground to the sensor, which allows the sensor's output voltage to range from 0.1 to 4.9 volts. When the air pressure in the fuel tank is equal to the ambient air pressure, as when the fuel cap is removed, the output voltage of the sensor will be from 1.3 to 1.7 volts.

DTC DESCRIPTION

The Tank Pressure Sensor Stuck Diagnostic continuously monitors the fuel tank pressure sensor output for a stuck condition. It does this by comparing the maximum and minimum raw tank pressure voltages. If the difference between the two values exceeds a threshold, then the diagnostic is considered to have passed. The diagnostic is not allowed to fail unless (a) a significant portion of the EVPD(Evaporative Diagnostics) tank draw has occurred or (b) the tank pressure has not changed after purge transitions off from a flow level high enough to cause a change in the tank pressure.

Checking output signals of tank pressure under detecting condition, if the tank pressure difference between maximum and minimum is low than 0.9996 for 60 sec, PCM sets P0451 MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

DTC DETECTING CONDITION

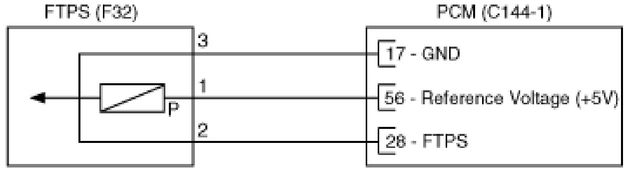
<table>
<tr><th colspan="2">Item</th><th>Detecting Condition</th><th>Possible cause</th></tr>
<tr><td colspan="2">DTC Strategy</td><td>• Continuously monitors the fuel tank pressure sensor output for a stuck condition</td><td rowspan="8">• Poor connection
• Open or short in FTPS circuit
• Faulty FTPS
• Faulty PCM</td></tr>
<tr><td rowspan="2">Enable Conditions</td><td>Case 1</td><td>Transiton Monitor LogicEnable Conditions when test is run during Normal Purge
• The type of canister purge duty cycle calculation and used as an input for the vent valve solenoid status = Not equal to 2
• EVAP system value during previous loop =0
• Required minimum purge flow rate immediately prior to a purge off transition to trigger the transition monitor portion of the tank pressure stuck diagnostic > 0.5g/s</td></tr>
<tr><td>Case 2</td><td>Diagnostic Mode Logic:
• The stuck diag completed during EVPD operation = False
• The type of canister purge duty cycle calculation and used as an input for the vent valve solenoid status = Not equal to 2</td></tr>
<tr><td rowspan="2">Threshold value</td><td>Case 1</td><td>Transiton Monitor Logic
• Minimum change in tank pressure required to pass the stuck diagnostic < 0.9995
• For Time period After Purge Duty Cycle is transitioned Off > 60sec.</td></tr>
<tr><td>Case 2</td><td>Diagnostic Mode Logic
• The signed vacuum integral increment used to calculate the signed incremented vacuum integral > 0.95
• Minimum change in tank pressure required to pass the stuck diagnostic < 0.9995</td></tr>
<tr><td colspan="2">Diagnosis Time</td><td>• Continuous
(More than 15 seconds failure for every 32 seconds test)</td></tr>
<tr><td colspan="2">MIL On Condition</td><td>• 2 Driving Cycles</td></tr>
</table>

SPECIFICATION

Pressure (kPa)	Output Voltage (V)
-2.5 kPA	0.5V
0 kPA	2.5V
2.5 kPa	4.5V

SCHEMATIC DIAGRAM

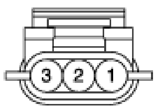
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

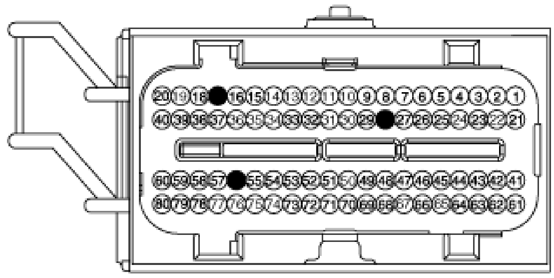
Terminal	Connected to	Funtion
1	PCM C144-1 (56)	Reference Voltage (+5V)
2	PCM C144-1 (28)	FTPS signal
3	PCM C144-1 (17)	Sensor ground

[HARNESS CONNECTORS]



F32

MAPS



C144-1

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "FTPS" parameter on the service data.

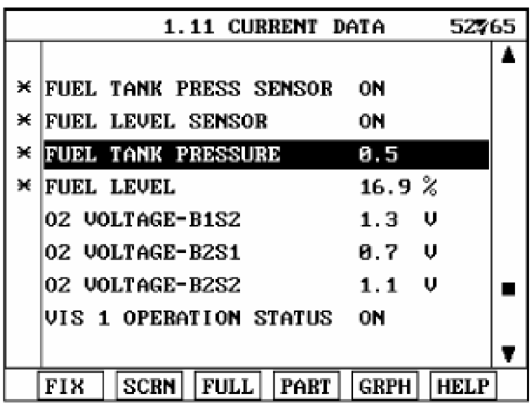


Fig. 1

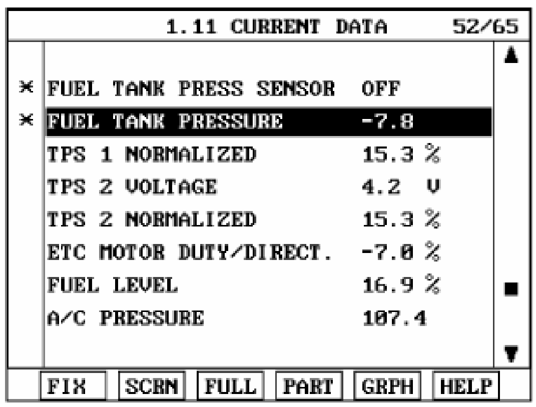


Fig. 2

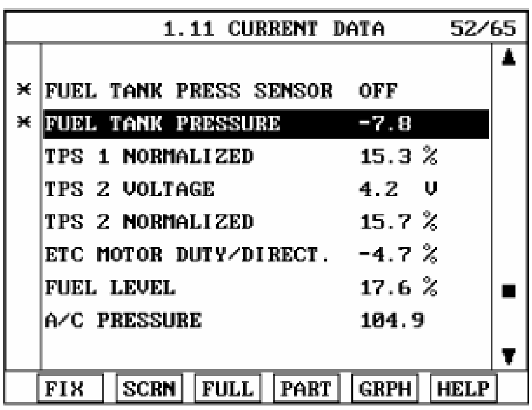


Fig. 3

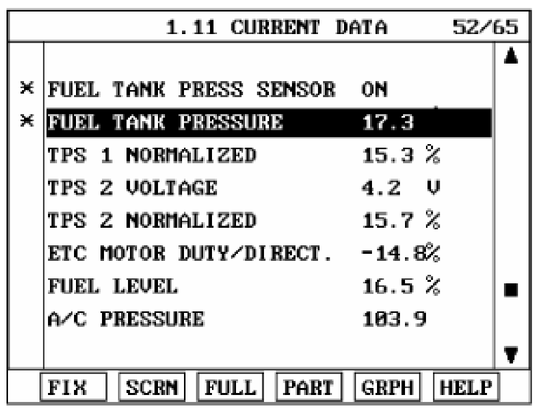


Fig. 3

Fig.1: Normal at idle
Fig.2: Open at idle
Fig.3: Short to ground at idle
Fig.4: Shrot to 5V at idle

4. Is the "FTPS" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, ending, corrosion, contamination, deterioration, or damage. Repair or replace asnecessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

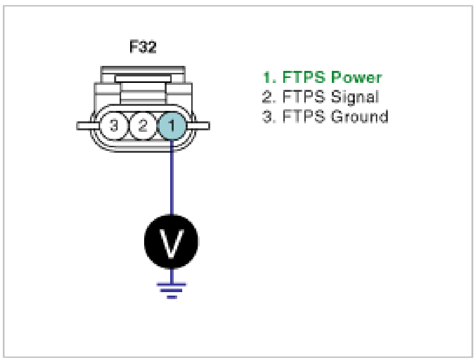
NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. IG "OFF" and disconnect FTPS connector.
2. IG "ON" & ENG "OFF"
3. Measure voltage between terminal 1 of FTPS harness connector and chassis ground.

Specification : Approx. 5V



4. Is the measured voltage within specification ?

YES

▸ Go to "Ground circuit inspection" procedure.

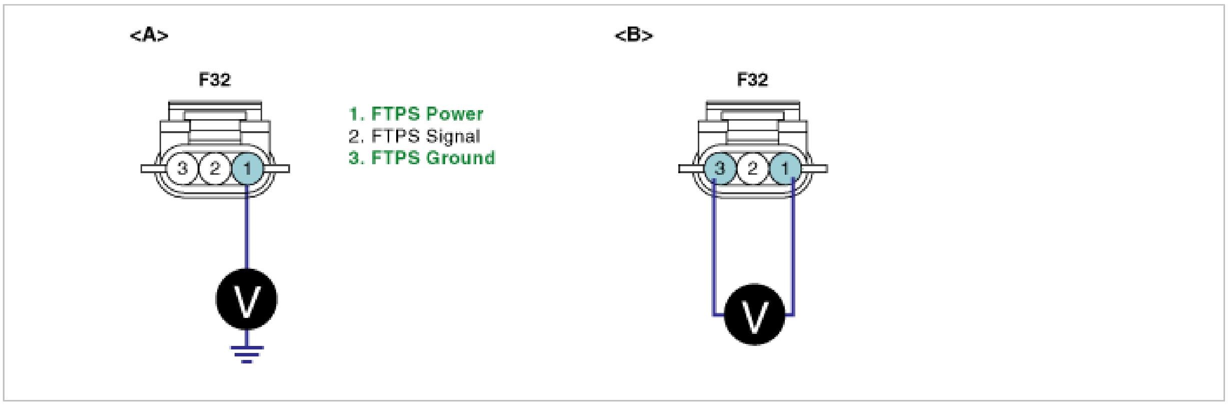
NO

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF" and disconnect FTPS connector.
2. Measure voltage between terminal 1 of FTPS harness connector and chassis ground.
3. Measure voltage between terminal 1 and 3 of FTPS harness connector.

Specification : Voltage difference between Measurement "A" and "B" is below 200mV.



4. Is the measured voltage within specification ?

YES

▸ Go to "Signal Circuit Inspection" procedure.

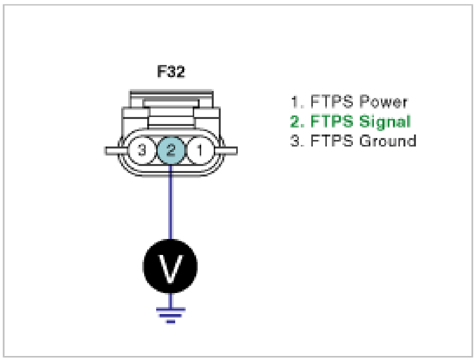
NO

▸ Repair contact reistance or open in harness and then go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check voltage.
   (1) IG "OFF" and disconnect FTPS connector.
   (2) IG "ON" & ENG "OFF"
   (3) Measure voltage between terminal 2 of FTPS harness connector and chassis ground.

Specification : Approx. 0V



(4) Is the measured voltage within specification ?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check FTPS.
   (1) IG "OFF" and connect scatool to DLC(Data Link Connector).
   (2) Monitor "FTPS" parameter with accelleration on service data.

Specification

Pressure (kPa)	Output Voltage (V)
-2.5 kPA	0.5V
0 kPA	2.5V
2.5 kPa	4.5V

(3) Does the "FTPS" parameter with accelleraton on the service data change ?

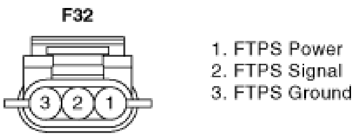
YES

▸ Go to "Check PCM" as follows.

NO

▸ Substitute with a known - good FTPS and check for proper operation.
▸ If the problem is corrected, replace FTPS and go to "Verification of Vehicle Repair" procedure.

2. Check PCM.
   (1) IG "OFF" disconnect FTPS connector
   (2) Connect Scantool and IG "ON" & ENG "OFF"
   (3) Select simulation function on scantool.
   (4) Simulate voltage at terminal 2 of FTPS harness connector.



   (5) Does the signal value of FTP sensor change according to simulation voltage ?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good PCM and check for proper operation.
If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

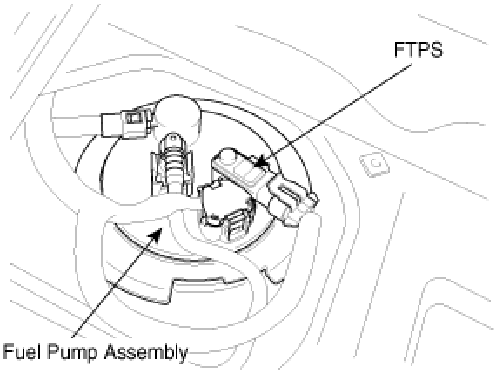
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0452

COMPONENT LOCATION



GENERAL DESCRIPTION

The Fuel Tank Pressure Sensor(FTPS) converts fuel tank pressure to a proportional analog voltage signal which is read by the engine controller for evaluation during execution of the Evaporative System Diagnostic. The Tank Pressure may be below atmospheric pressure (ie. a vacuum) or above atmospheric pressure.
The fuel tank pressure is used to measure the difference between the air pressure (or vacuum) in the fuel tank and the ambient air pressure. The Powertrain Control Module (ECM) supplies a 5-volt reference and a ground to the sensor, which allows the sensor's output voltage to range from 0.1 to 4.9 volts. When the air pressure in the fuel tank is equal to the ambient air pressure, as when the fuel cap is removed, the output voltage of the sensor will be from 1.3 to 1.7 volts.

DTC DESCRIPTION

The fuel tank pressure sensor diagnostic will detect a fuel tank pressure sensor signal that is outof range or malfunctioning. The Tank Pressure Sensor Circuit Diagnostic compares the sensor input voltage to low and high limits. When the analog voltage is outside the allowable limits, the circuit is determined to be failed.
Checking output signals of tank pressure under detecting condition, if the tank pressure is low than 2V PCM sets P0452. MIL (Malfunction Indicatin Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

DTC DETECTING CONDITION

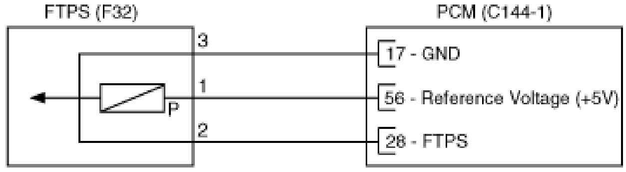
Item	Detecting Condition	Possible cause
DTC Strategy	• Detects sensor signal short to low voltage	• Poor connection • Open in Power Circuit • Open or short to ground in signal Ciruict • Faulty FTPS • Faulty PCM
Enable Conditions	• Ignition ON • The FTPS diagnostic has met all enable criteria and will begin fault processing	
Threshold value	• Raw Tank Pressure < 2V	
Diagnosis Time	• Continuous (More than 15 seconds failure for every 32 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION

Pressure (kPa)	Output Voltage (V)
-2.5 kPA	0.5V
0 kPA	2.5V
2.5 kPa	4.5V

SCHEMATIC DIAGRAM

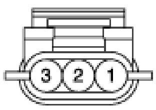
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

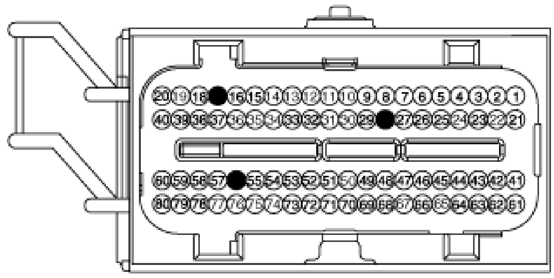
Terminal	Connected to	Funtion
1	PCM C144-1 (56)	Reference Voltage (+5V)
2	PCM C144-1 (28)	FTPS signal
3	PCM C144-1 (17)	Sensor ground

[HARNESS CONNECTORS]



F32

MAPS



C144-1

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "FTPS" parameter on the service data.

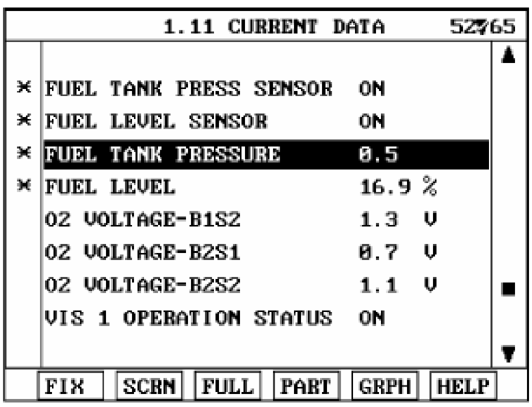


Fig. 1

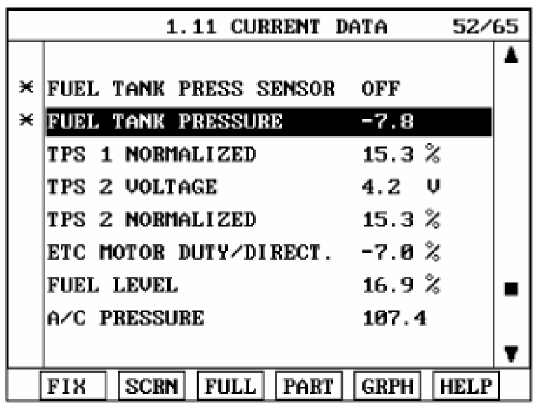


Fig. 2

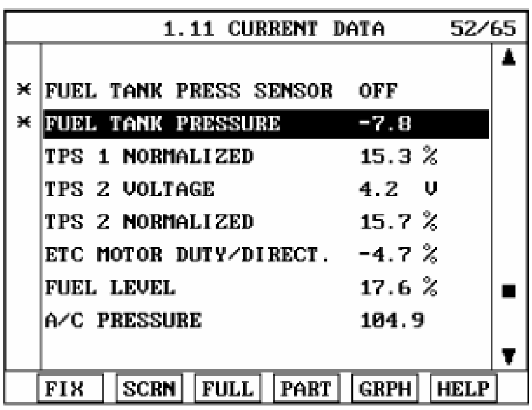


Fig. 3

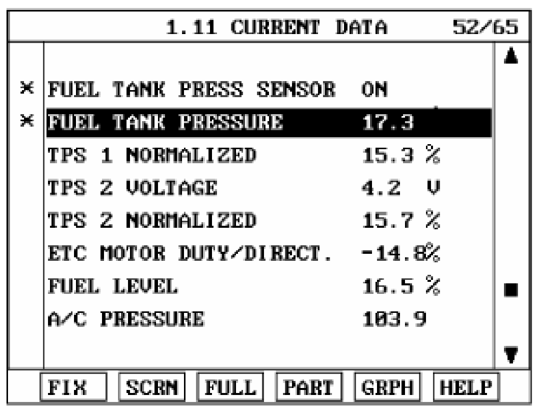


Fig. 3

Fig.1: Normal at idle
Fig.2: Open at idle

Fig.3: Short to ground at idle
Fig.4: Shrot to 5V at idle

4. Is the "FTPS" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, ending, corrosion, contamination, deterioration, or damage. Repair or replace asnecessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

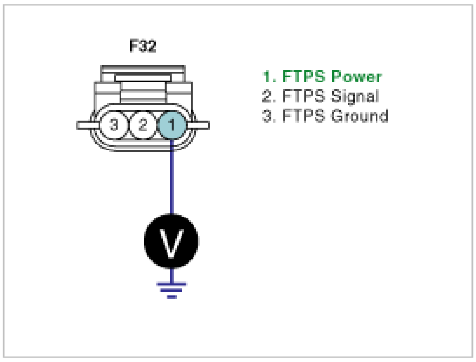
NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. IG "OFF" and disconnect FTPS connector.
2. IG "ON" & ENG "OFF"
3. Measure voltage between terminal 1 of FTPS harness connector and chassis ground.

Specification : Approx. 5V



4. Is the measured voltage within specification ?

YES

▸ Go to "Ground circuit inspection" procedure.

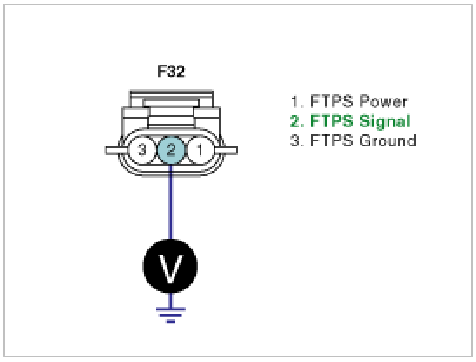
NO

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check voltage.
   (1) IG "OFF" and disconnect FTPS connector.
   (2) IG "ON" & ENG "OFF"
   (3) Measure voltage between terminal 2 of FTPS harness connector and chassis ground.

   Specification : Approx. 0V



(4) Is the measured voltage within specification ?

YES

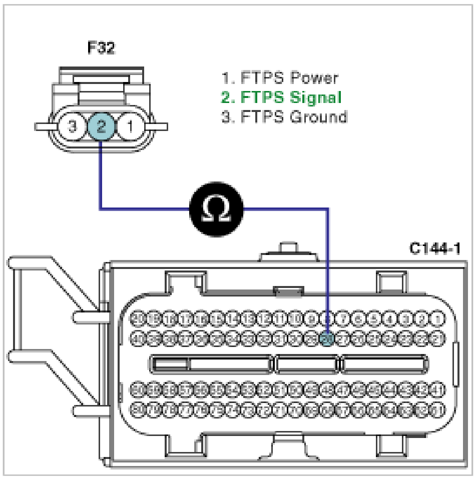
▸ Go to "Check open in harness" as follows.

NO

▸ Repair short to ground in harness and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness.
   (1) IG "OFF" and disconnet FTPS and PCM connector.
   (2) Measure resistance between terminal 2 of FTPS harness connector and terminal 28/C144-1 of PCM harness connector.

Specification : Approx. Below 1Ω



(3) Is the measured resistance within specification ?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair open in harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check FTPS.
   (1) IG "OFF" and connect scatool to DLC(Data Link Connector).
   (2) Monitor "FTPS" parameter with accelleration on service data.

Specification

Pressure (kPa)	Output Voltage (V)
-2.5 kPA	0.5V
0 kPA	2.5V
2.5 kPa	4.5V

(3) Does the "FTPS" parameter with accelleraton on the service data change ?

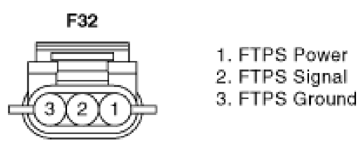
YES

▸ Go to "Check PCM" as follows.

NO

▸ Substitute with a known - good FTPS and check for proper operation.
▸ If the problem is corrected, replace FTPS and go to "Verification of Vehicle Repair" procedure.

2. Check PCM.
   (1) IG "OFF" disconnect FTPS connector
   (2) Connect Scantool and IG "ON" & ENG "OFF"
   (3) Select simulation function on scantool.
   (4) Simulate voltage at terminal 2 of FTPS harness connector.



   (5) Does the signal value of FTP sensor change according to simulation voltage ?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good PCM and check for proper operation.
If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

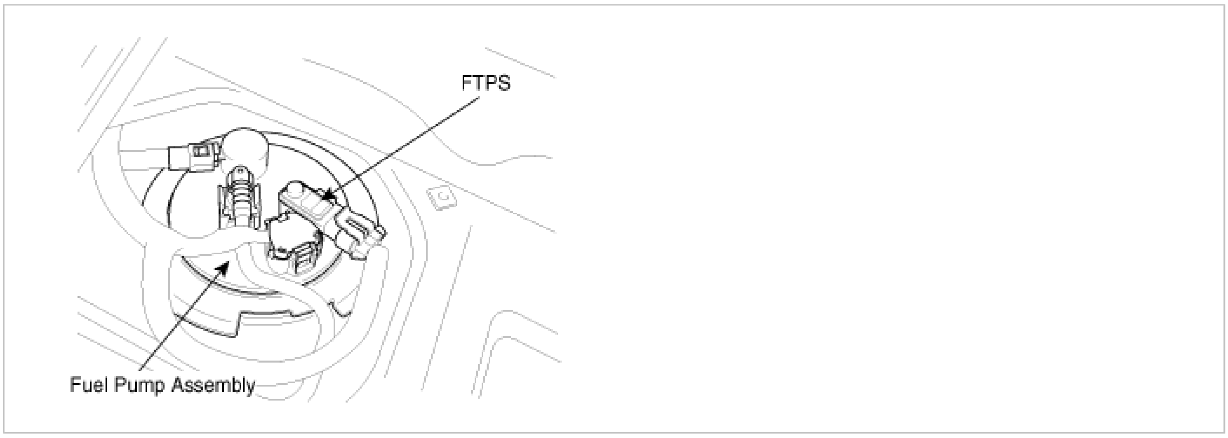
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0453

COMPONENT LOCATION



GENERAL DESCRIPTION

The Tank Pressure Sensor converts fuel tank pressure to a proportional analog voltage signal which is read by the engine controller for evaluation during execution of the Evaporative System Diagnostic. The Tank Pressure may be below atmospheric pressure (ie. a vacuum) or above atmospheric pressure.
The fuel tank pressure is used to measure the difference between the air pressure (or vacuum) in the fuel tank and the ambient air pressure. The Powertrain Control Module (ECM) supplies a 5-volt reference and a ground to the sensor, which allows the sensor's output voltage to range from 0.1 to 4.9 volts. When the air pressure in the fuel tank is equal to the ambient air pressure, as when the fuel cap is removed, the output voltage of the sensor will be from 1.3 to 1.7 volts.

DTC DESCRIPTION

The fuel tank pressure sensor diagnostic will detect a fuel tank pressure sensor signal that is outof range or malfunctioning. The Tank Pressure Sensor Circuit Diagnostic compares the sensor input voltage to low and high limits. When the analog voltage is outside the allowable limits, the circuit is determined to befailed.
Checking output signals of tank pressure under detecting condition, if the tank pressure is high than 2V PCM sets P0453. MIL (Malfunction Indicatin Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

DTC DETECTING CONDITION

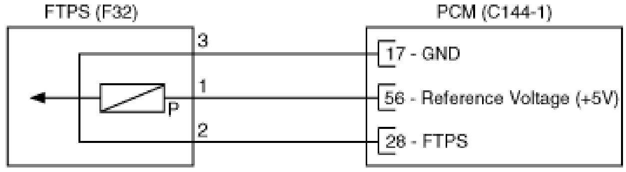
Item	Detecting Condition	Possible cause
DTC Strategy	• Detects sensor signal short to high voltage	• Poor connection • Short to battery in signal Cirucit • Faulty FTPS • Faulty PCM
Enable Conditions	• Ignition ON • The FTPS diagnostic has met all enable criteria and will begin fault processing	
Threshold value	• Raw Tank Pressure > 2V	
Diagnosis Time	• Continuous (More than 15 seconds failure for every 32 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION

Pressure (kPa)	Output Voltage (V)
-2.5 kPA	0.5V
0 kPA	2.5V
2.5 kPa	4.5V

SCHEMATIC DIAGRAM

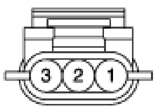
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

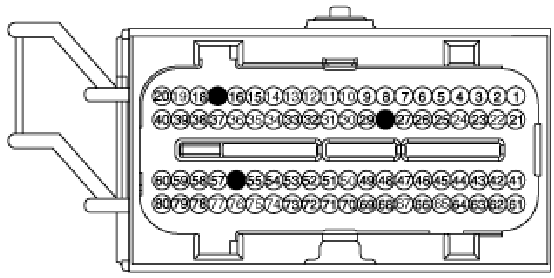
Terminal	Connected to	Funtion
1	PCM C144-1 (56)	Reference Voltage (+5V)
2	PCM C144-1 (28)	FTPS signal
3	PCM C144-1 (17)	Sensor ground

[HARNESS CONNECTORS]



F32

MAPS



C144-1

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "FTPS" parameter on the service data.

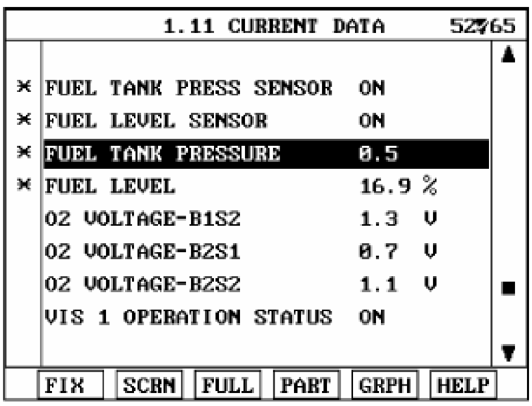


Fig. 1

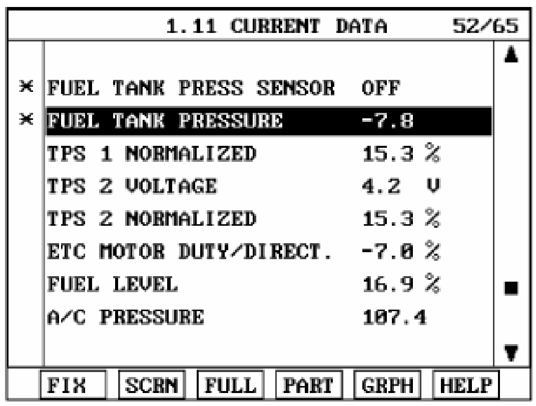


Fig. 2

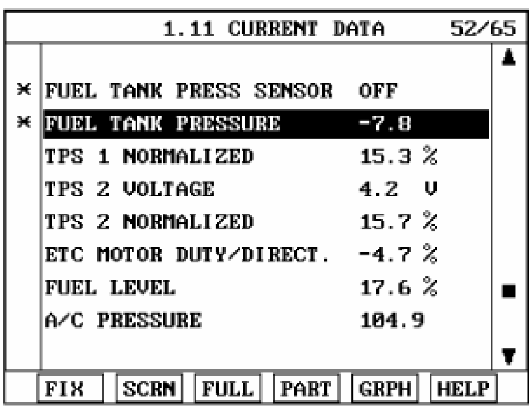


Fig. 3

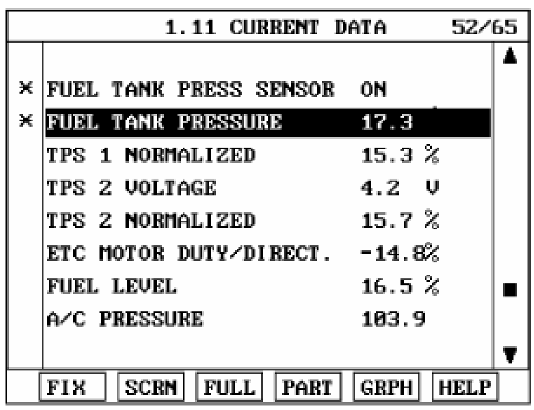


Fig. 3

Fig.1: Normal at idle
Fig.2: Open at idle
Fig.3: Short to ground at idle
Fig.4: Shrot to 5V at idle

4. Is the "FTPS" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, ending, corrosion, contamination, deterioration, or damage. Repair or replace asnecessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

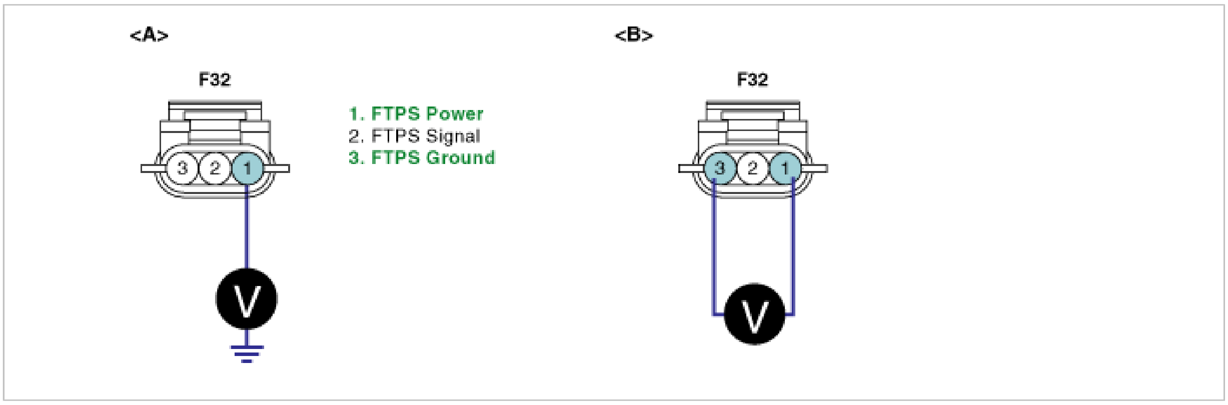
NO

▸ Go to " Ground Circuit Inspection " procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF" and disconnect FTPS connector.
2. Measure voltage between terminal 1 of FTPS harness connector and chassis ground.
3. Measure voltage between terminal 1 and 3 of FTPS harness connector.

Specification : Voltage difference between Measurement "A" and "B" is below 200mV.



4. Is the measured voltage within specification ?

YES

▸ Go to "Signal Circuit Inspection" procedure.

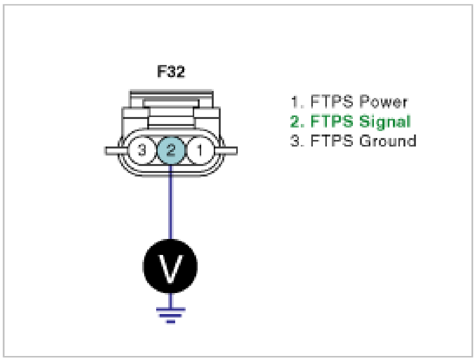
NO

▸ Repair contact reistance or open in harness and then go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check voltage.
   (1) IG "OFF" and disconnect FTPS connector.
   (2) IG "ON" & ENG "OFF"
   (3) Measure voltage between terminal 2 of FTPS harness connector and chassis ground.

   Specification : Approx. 0V



(4) Is the measured voltage within specification ?

YES

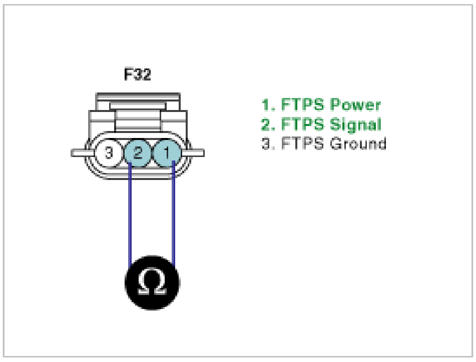
▸ Go to "Component Inspection" procedure.

NO

▸ Go to "Check short to battery in harness" as follows.

2. Check short to battery in harness
   (1) IG "OFF" and disconnet FTPS connector.
   (2) G "ON" & ENG "OFF"
   (3) Measure resistance between terminals 2 and 1 of FTPS harness connector.

Specification : Infinite



(4) Is the measured resistance within specification ?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair short to battery in harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check FTPS.
   (1) IG "OFF" and connect scatool to DLC(Data Link Connector).
   (2) Monitor "FTPS" parameter with accelleration on service data.

Specification

Pressure (kPa)	Output Voltage (V)
-2.5 kPA	0.5V
0 kPA	2.5V
2.5 kPa	4.5V

(3) Does the "FTPS" parameter with accelleraton on the service data change ?

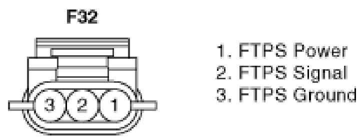
YES

▸ Go to "Check PCM" as follows.

NO

▸ Substitute with a known - good FTPS and check for proper operation.
▸ If the problem is corrected, replace FTPS and go to "Verification of Vehicle Repair" procedure.

2. Check PCM.
   (1) IG "OFF" disconnect FTPS connector
   (2) Connect Scantool and IG "ON" & ENG "OFF"
   (3) Select simulation function on scantool.
   (4) Simulate voltage at terminal 2 of FTPS harness connector.



   (5) Does the signal value of FTP sensor change according to simulation voltage ?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good PCM and check for proper operation.
If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.
1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

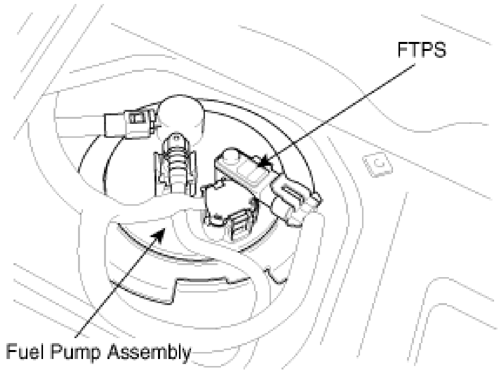
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0454

COMPONENT LOCATION



GENERAL DESCRIPTION

The Tank Pressure Sensor converts fuel tank pressure to a proportional analog voltage signal which is read by the engine controller for evaluation during execution of the Evaporative System Diagnostic. The Tank Pressure may be below atmospheric pressure (ie. a vacuum) or above atmospheric pressure.
The fuel tank pressure is used to measure the difference between the air pressure (or vacuum) in the fuel tank and the ambient air pressure. The Powertrain Control Module (ECM) supplies a 5-volt reference and a ground to the sensor, which allows the sensor's output voltage to range from 0.1 to 4.9 volts. When the air pressure in the fuel tank is equal to the ambient air pressure, as when the fuel cap is removed, the output voltage of the sensor will be from 1.3 to 1.7 volts.

DTC DESCRIPTION

The Tank Pressure Noisy Diagnostic continuously monitors the fuel tank pressure to determine if there is external noise impinging on the fuel tank pressure measurement.
Checking output signals from FTPS under detecting condition, if the stored previous - current signals is high than 33.0002., PCM sets P0454. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

DTC DETECTING CONDITION

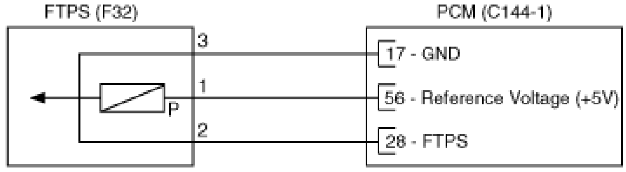
Item	Detecting Condition	Possible cause
DTC Strategy	• The Tank Pressure Noisy Diagnostic continuously monitors the fuel tank pressure to determine if there isexternal noise impinging on the fuel tank pressuremeasurement.	• Poor connection • Faulty FTPS • Faulty PCM
Enable Conditions	• Engine Running • Intake Air Temperature ≥ -4°C(24.8 °F) • Fuel Tank Vac Offset Update Completed • No Tank Pres Short Fault Present and Nosiy SignalDisabling Faults Present • Nosiy Signal Enable Criteria Met	
Threshold value	• Tank Pressure Difference > 33.0002	
Diagnosis Time	• Continuous (More than 15 seconds failure for every 32 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION

Pressure (kPa)	Output Voltage (V)
-2.5 kPA	0.5V
0 kPA	2.5V
2.5 kPa	4.5V

SCHEMATIC DIAGRAM

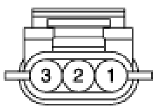
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

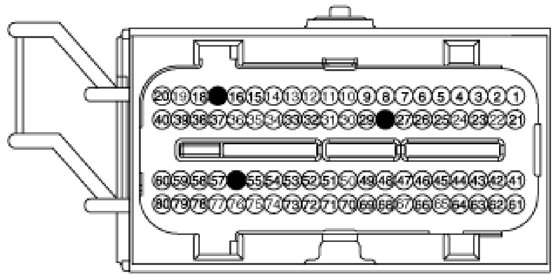
Terminal	Connected to	Funtion
1	PCM C144-1 (56)	Reference Voltage (+5V)
2	PCM C144-1 (28)	FTPS signal
3	PCM C144-1 (17)	Sensor ground

[HARNESS CONNECTORS]



F32

MAPS



C144-1

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "FTPS" parameter on the service data.

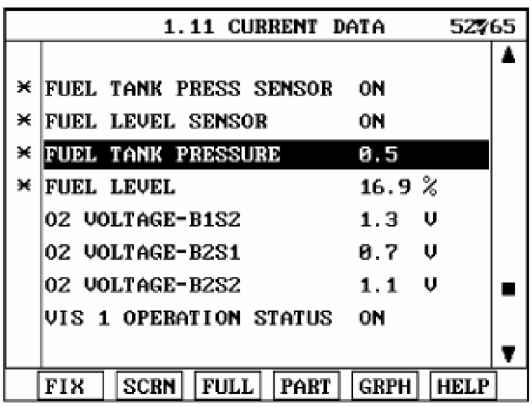


Fig. 1

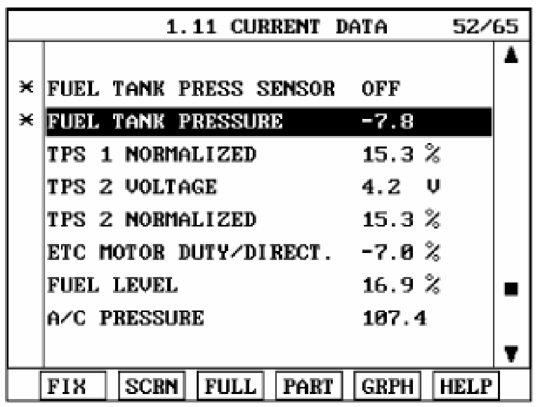


Fig. 2

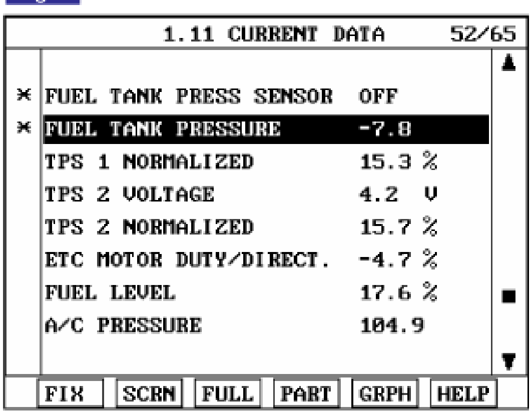


Fig. 3

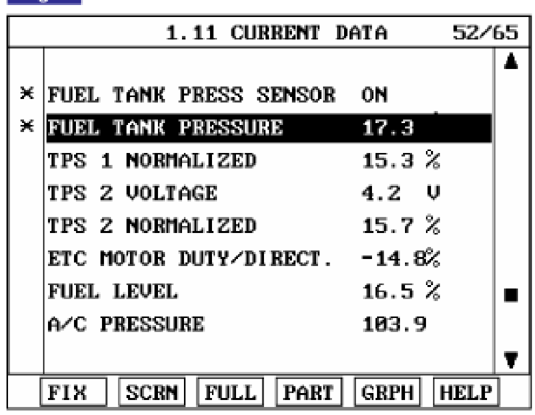


Fig. 3

Fig.1: Normal at idle
Fig.2: Open at idle

Fig.3: Short to ground at idle
Fig.4: Shrot to 5V at idle

4. Is the "FTPS" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, ending, corrosion, contamination, deterioration, or damage. Repair or replace asnecessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

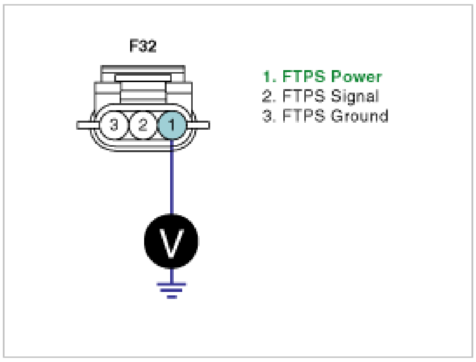
NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. IG "OFF" and disconnect FTPS connector.
2. IG "ON" & ENG "OFF"
3. Measure voltage between terminal 1 of FTPS harness connector and chassis ground.

Specification : Approx. 5V



4. Is the measured voltage within specification ?

YES

▸ Go to "Ground circuit inspection" procedure.

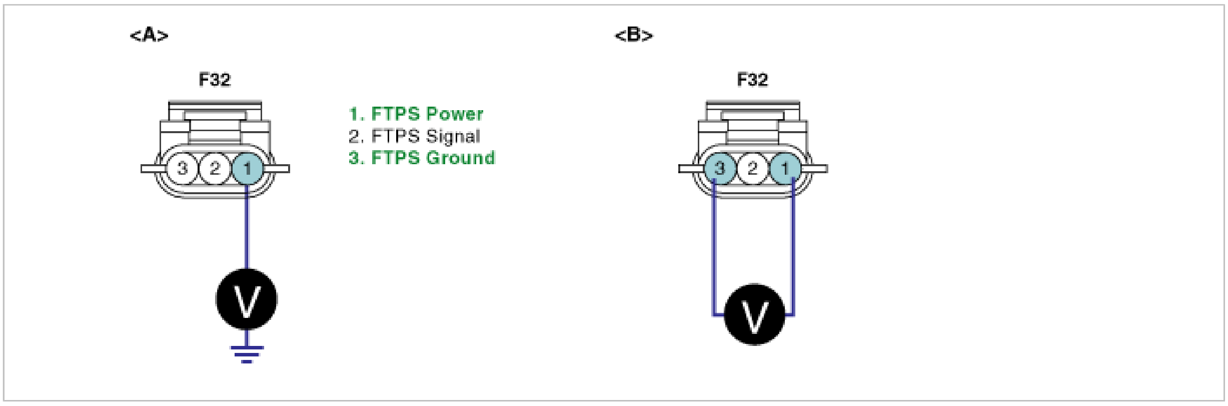
NO

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF" and disconnect FTPS connector.
2. Measure voltage between terminal 1 of FTPS harness connector and chassis ground.
3. Measure voltage between terminal 1 and 3 of FTPS harness connector.

Specification : Voltage difference between Measurement "A" and "B" is below 200mV.



4. Is the measured voltage within specification ?

YES

▸ Go to "Signal Circuit Inspection" procedure.

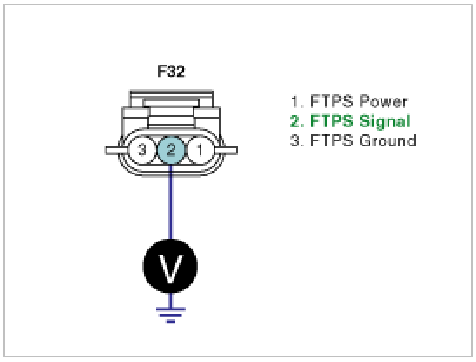
NO

▸ Repair contact reistance or open in harness and then go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF" and disconnect FTPS connector.
   (2) IG "ON" & ENG "OFF"
   (3) Measure voltage between terminal 2 of FTPS harness connector and chassis ground.

Specification : Approx. 0V



   (4) Is the measured voltage within specification ?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check FTPS
   (1) IG "OFF" and connect scatool to DLC(Data Link Connector).
   (2) Monitor "FTPS" parameter with accelleration on service data.

Specification

Pressure (kPa)	Output Voltage (V)
-2.5 kPA	0.5V
0 kPA	2.5V
2.5 kPa	4.5V

   (3) Does the "FTPS" parameter with accelleraton on the service data change ?

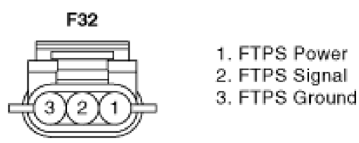
YES

▸ Go to "Check PCM" as follows.

NO

▸ Substitute with a known - good FTPS and check for proper operation.
▸ If the problem is corrected, replace FTPS and go to "Verification of Vehicle Repair" procedure.

2. Check PCM.
   (1) IG "OFF" disconnect FTPS connector
   (2) Connect Scantool and IG "ON" & ENG "OFF"
   (3) Select simulation function on scantool.
   (4) Simulate voltage at terminal 2 of FTPS harness connector.



   (5) Does the signal value of FTP sensor change according to simulation voltage ?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good PCM and check for proper operation.
▸ If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0455

GENERAL DESCRIPTION

This test determines the presence of a large leak, such as a fuel fill cap not installed or a hosedisconnected, by initially bringing the evaporative system to a vacuum level of10.2inH2O during idle conditions. This is done by commanding the vent valve toclose and requesting the Canister Purge Subsystem to enter the tank draw mode. Note: thisvacuum increase process is a continuation

of the preset mode process that was initiated duringthe Preset Large Leak Function.
During this vacuum level increase process, the vacuum level in the fuel tank is monitored using afuel tank pressure sensor for a duration that is determined by the accumulated purge volume thathas exited the evaporative system. This accumulated purge volume is determined by the vacuumindex tracking logic. A normally functioning or passing evaporative system will achieve thecalibration-specified vacuum level before the accumulated purge volume exceeds calibratedthreshold, but a failing evaporative system will not achieve this calibration-specified vacuum level.

DTC DESCRIPTION

This test detects a large leak (> 0.04”) in the evaporative system by measuring the time it takes to draw a pre-determined amount of vacuum in the evaporative system. The inability to draw a vacuum under controlled conditions is indicative of having a large leak. Test failures can be caused by either hardware failures (i.e. a hole, broken seal, etc) or by the customer not correctly reinstalling the gas cap following re-fueling.
The Large Leak test is split up in to two sub-tests, the Preset Large Leak Test and the Idle Large Leak Test. The Idle Large Leak test runs when the vehicle is at idle. The Preset Large Leak test runs when the vehicle is off idle and will report it’s results if the diagnostic times out and ends before the vehicle returns to idle.
Checking tank vaccum from tank pressure sensor under detecting condition, if tank vaccum signals is less than 10.0996 at idle condition or not after purge volume has been drawn from tank, PCM sets P0455. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till 1 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Test is failed if tank vacuum cannot reach prescribedvaccum after a prescribed purge volume has been drawn from the tank	• Leakage in each hose/fuel filler pipe • Leakage in CCV/Canister/ Fuel tank • Faulty PCM
Enable Conditions	• 10 < Ignition Volt < 15.9907 • Barometric pressure > 72 kPa • Engine off time > 720min or Startup IAT-Startup ECT < 12°C(53.6 °F) • Startup ECT -Startup IAT < 12°C(53.6 °F) • 0°C(32 °F) < Startup ECT < 40°C(104 °F) • 0°C(32 °F) < Startup IAT < 40°C(104 °F) • Start-up IAT-IAT < 1°C(33.8 °F) • 1s < Engine Run Time < 100s • Purge enabling Rum time < Threshold • Cold Test Timer < 300sec. • 15% < Fuel level < 85% • Engine RPM < 1500 • Vehicle Speed < 3KPH(1.864114 MPH) • Throttle Position < 1% • Engine RPM < 1500 • Vehicle Speed < 6KPH(3.728227 MPH) • Throttle Position < 1.9989% • Vehicle Speed > 2KPH(1.242742 MPH)	
Threshold value	At idle Condition • Tank Vaccum <10.0996 in HO2 • purge integral > Threshold	
Diagnosis Time	• -	
MIL On Condition	• 1 driving cycles	

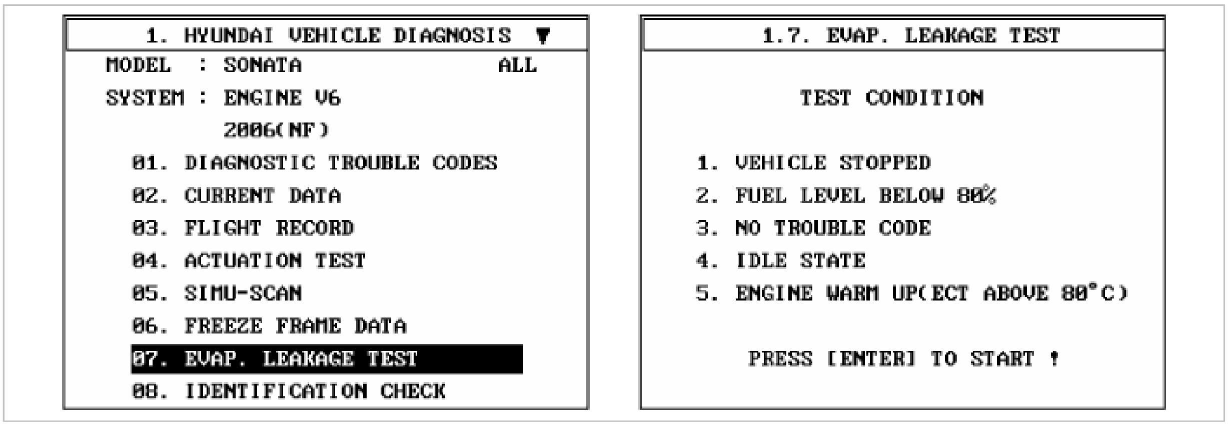
MONITOR SCANTOOL DATA

1. Warm-up engine to normal operating temperature.

> NOTE
>
> Evaporative Emissions Systems (EVAP) Leak Tests can be run by the Scan Tool.
> The tests are automated and provide either a pass-fail result or directions to check for DTCs.

2. Install scan tool and clear DTC

3. Perform "EVAP. LEAKAGE TEST" mode referring to enable conditions as below



4. Monitoring for (pending) DTC by performing " DIAGNOSTIC TROUBLE CODES" or "MONITORING TEST RESULTS". Is the same DTC set ?

YES

▸Go to "System Inspection" procedure.

NO

▸ Fault is intermittent caused by poor contact in sensor's and/or PCM's connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection,bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and goto "Verification of vehicle Repair" procedure.

SYSTEM INSPECTION

1. Check vapor hoses for leakage in fuel system.
   (1) Check vapor hoses between the following components for leakage:
      A. Intake manifoled ~ Purge control solenoid valve (PCSV)
      B. Purge control solenoid valve (PCSV) ~ Canister
      C. Canister ~ Canister close valve (CCV)
      D. Canister ~ fuel tank

   (2) Does a leak exist?

   YES

   ▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Go to "Check fuel filler pipe for leakage" as below.

2. Check fuel filler pipe for crack or leakage.
   (1) Check that there is crack or leakage in fuel filler pipe

   (2) Is there any crack or leakage ?

   YES

   ▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Go to "Component inspection" procedure.

COMPONENT INSPECTION

1. Check CCV for leakage.
   (1) Disconnect the hose leading from the CCV to Canister at CCV.

   (2) Visually Check any tear of the hose leading from the CCV to Canister

   (3) When the CCV operates, apply a vacuum at the nipple and verify that the CCV holds vacuum.

   (4) Does a leak exist?

   YES

   ▸ Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Go to "Check Canister for leakage" as necessary.

2. Check Canister for leakage.
   (1) Disconnect the hose leading from the CCV to Canister at Canister.
   (2) When the other nipples are plugged, apply a vacuum at the vent nipple and verify that the Canister holds vacuum
   (3) Does a leak exist?

   YES

   ▸ Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Go to "Check fuel tank for leakage" as below.

3. Check fuel tank for leakage.
   (1) Check fuel tank for crack or leakage.
   (2) Does a leak exist?

   YES

   ▸ Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Substitute with a known - good PCM and check for proper operation.
   ▸ If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0456

GENERAL DESCRIPTION

Similar in operation to the Small Leak test, the Very Small Leak test will detect the presence of aleak that is 0.020” (0.5 mm) or larger in the evaporative system if the Small Leak test reports a“pass” condition. To prevent a possible misdiagnosis, the Very Small Leak test may use tighteroperational limits than required by the Small Leak test. If any of the Very Small Leak test enablingconditions are not met, such as coolant and intake air temperature, the Very Small Leak test willbe disabled for the current trip.

DTC DESCRIPTION

The EVPD(Evap. Leak Diagnostic) calculates some intermediate segment slopes for the Very Small Leak test as in theSmall Leak test. These segment slopes may result in the disablement of only the Very Small Leaktest, not the Small Leak test.
The very small leak test normally takes 25 seconds to complete. However, it may be allowed topass at the end of the small leak test if the decay slope is sufficiently small enough to pass thevery small leak slope criteria. This is allowed because the decay slope decreases with time.If the decay slope is passing after 10 seconds, then it will pass by an even greater marginafter 25 seconds.
Checking tank vaccum from tank pressure sensor under detecting condition, if tank vaccum signals is less than 10.0996 at idle condition or not after purge volume has been drawn from tank, PCM sets P0455. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till 1 driving cycle.

DTC DETECTING CONDITION

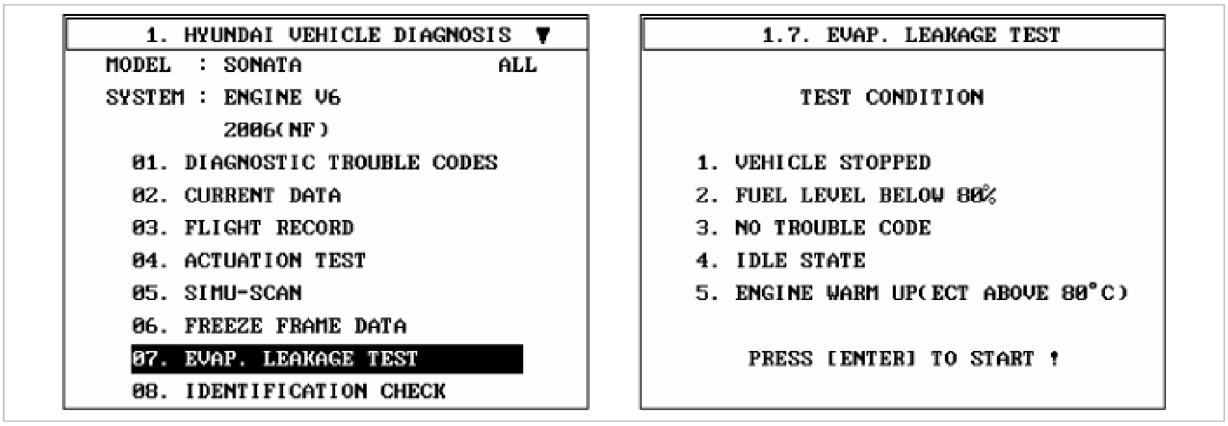
Item	Detecting Condition	Possible cause
DTC Strategy	• If a corrected vacuum decay slope and the individual segment slopes exceed their respective thresholds and the segment slopes are not convex then a small leak is present	• Leakage in each hose/fuel filler pipe • Leakage in CCV/Canister/ Fuel tank • Faulty PCM
Enable Conditions	• 10 < Ignition Volt < 15.9907 • Barometric pressure > 72 kPa • Engine off time > 720min or Startup IAT-Startup ECT < 12°C(53.6 °F) • Startup ECT -Startup IAT < 12°C(53.6 °F) • 0°C(32 °F) < Startup ECT < 40°C(104 °F) • 0°C(32 °F) < Startup IAT < 40°C(104 °F) • Start-up IAT-IAT < 1°C(33.8 °F) • 1s < Engine Run Time < 100s • Purge enabling Rum time < Threshold • Cold Test Timer < 300sec. • 15% < Fuel level < 85%Under Idle conditions • Engine RPM < 1500 • Vehicle Speed < 3KPH(1.864114 MPH) • Throttle Position < 1%Creep Conditions • Engine RPM < 1500 • Vehicle Speed < 6KPH(3.728227 MPH) • Throttle Position < 1.9989%Fuel not Sloshing • Vehicle Speed > 2KPH(1.242742 MPH)OR • Throttle position > 1.1%OR • 125ms MAP change > 10kPaOR • 125ms Engine speed > 100OR • 125ms Fuel level delta > Threshold(Creep delay time • Time vehicle speed > 2kph • divided by decay time = 25sec.	
Threshold value	• Decay slope(beginning at decay start < 10in HO2 and lasting 300sec for decay time) minus the larger vapor correction term ,(purge leak vapor term OR Post decay vapor term) greater than a threshold, (the product of a base term using fuel level AND a temperature bias term) • All segment slopes greater than their threshold(The product of bias term and temperature bias term,anda segment bias term) • The current segment slope minus the prior segment slope less thanthe convex threshold(in HO2)	
Diagnosis Time	• -	
MIL On Condition	• 1 driving cycles	

MONITOR SCANTOOL DATA

1. Warm-up engine to normal operating temperature.

> NOTE
>
> Evaporative Emissions Systems (EVAP) Leak Tests can be run by the Scan Tool.
> The tests are automated and provide either a pass-fail result or directions to check for DTCs.

2. Install scan tool and clear DTC
3. Perform "EVAP. LEAKAGE TEST" mode referring to enable conditions as below



4. Monitoring for (pending) DTC by performing " DIAGNOSTIC TROUBLE CODES" or "MONITORING TEST RESULTS". Is the same DTC set ?

YES

▸Go to "System Inspection" procedure.

NO

▸ Fault is intermittent caused by poor contact in sensor's and/or PCM's connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection,bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and goto "Verification of vehicle Repair" procedure.

SYSTEM INSPECTION

1. Check vapor hoses for leakage in fuel system.
   (1) Check vapor hoses between the following components for leakage:
      A. Intake manifoled ~ Purge control solenoid valve (PCSV)
      B. Purge control solenoid valve (PCSV) ~ Canister
      C. Canister ~ Canister close valve (CCV)
      D. Canister ~ fuel tank

   (2) Does a leak exist?

   YES

   ▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Go to "Check fuel filler pipe for leakage" as below.

2. Check fuel filler pipe for crack or leakage.
   (1) Check that there is crack or leakage in fuel filler pipe

   (2) Is there any crack or leakage ?

   YES

   ▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Go to "Component inspection" procedure.

COMPONENT INSPECTION

1. Check CCV for leakage.
   (1) Disconnect the hose leading from the CCV to Canister at CCV.

   (2) Visually Check any tear of the hose leading from the CCV to Canister

   (3) When the CCV operates, apply a vacuum at the nipple and verify that the CCV holds vacuum.

   (4) Does a leak exist?

   YES

   ▸ Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Go to "Check Canister for leakage" as necessary.

2. Check Canister for leakage.
   (1) Disconnect the hose leading from the CCV to Canister at Canister.

(2) When the other nipples are plugged, apply a vacuum at the vent nipple and verify that the Canister holds vacuum

(3) Does a leak exist?

YES

▸ Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Go to "Check fuel tank for leakage" as below.

3. Check fuel tank for leakage.
   (1) Check fuel tank for crack or leakage.

   (2) Does a leak exist?

YES

▸ Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good PCM and check for proper operation.
▸ If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

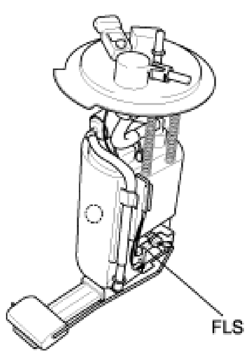
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0461

COMPONENT LOCATION



GENERAL DESCRIPTION

In order to measure the Fuel Level within the tank, the Fuel Level Sender consists of a variable resistor card mounted in the Fuel Pump and Sender unit (located in the fuel tank). A float located in the fuel tank swivels up and down as fuel level varies. A wiper is attached to the float and sweeps across the resistor card, thus providing a variable resistive input to the PCM. As the float sweeps across the Fuel Level Sender resistor card, the input voltage to the PCM varies accordingly. The PCM has calibrations and software which convert this analog voltage to a Fuel Level reading.

DTC DESCRIPTION

This function will check the difference between the current fuel level sender voltage and the previous fuel level sender voltage to determine the amount of fuel removed from the tank. This information, coupled with the distance traveled, can determine whether the fuel level sender is functioning correctly, or if it is stuck.
When the Fuel Level Sender fails, it may cause the Evaporative System Diagnostic to function improperly since it relies on Fuel Level in its leak detection algorithm. A failed Fuel Level Sender will also provide misleading Fuel Level information to the driver (in cases where the PCM drives the fuel gauge).
Checking fuel level change under detecting condition, if not only the fuel level difference between current and previous is lower than 0.035 but also odometer difference between present and previous is higher than 200km, PCM sets P0451. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

DTC DETECTING CONDITION

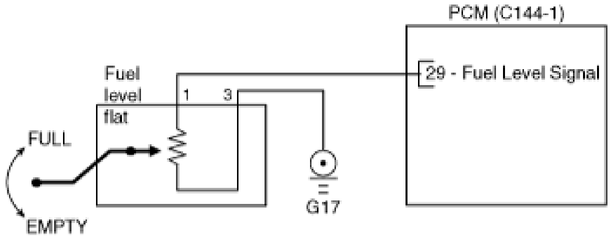
Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a stuck fuel level sender	• Poor connection • Faulty Fuel Level Sensor • Faulty PCM
Enable Conditions	• Engine Running • Fuel Level Fault Not Present • Set Enable Criteria Met to True	
Threshold value	• Current Raw Fuel Lvl Sender - Prev Raw Fuel Lvl Sender ≤ 0.035 • Present Odometer - Previous Odometer ≥ 200km (124.274238 mile)	
Diagnosis Time	•	
MIL On Condition	• 2 driving cycles	

SPECIFICATION

FLS	Normal Parameter				
Float position	8/8	7/8	5/8	2/8	Warning Lamp ON
Resistance(Ω)	15.0±1	25.0±1	50±1	110±1.5	170±1.5
Fuel volume(ℓ)	63	56	42	21	9

SCHEMATIC DIAGRAM

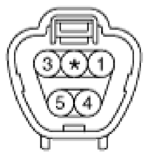
[CIRCUIT DIAGRAM]



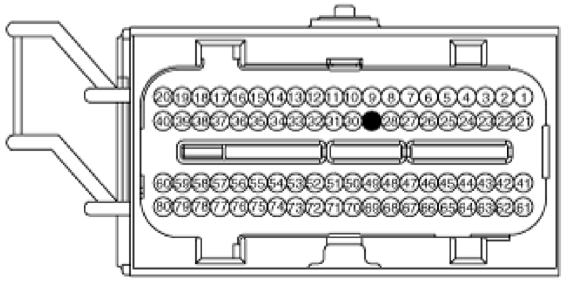
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	PCM C144-1 (29)	Fuel level signal
3	Chassis Ground (G17)	Sensor ground

[HARNESS CONNECTOR]



F45
Main Relay



C144-1
PCM

MONITOR SCANTOOL DATA

1. Ignition "OFF".
2. Connect Scantool and Engine "ON".
3. Monitor "FLS" parameter on Current Data.

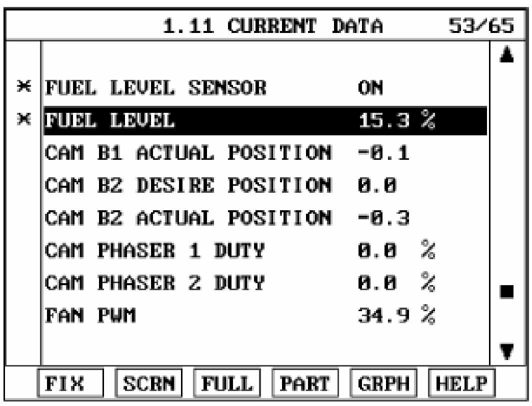


Fig.1 Normal

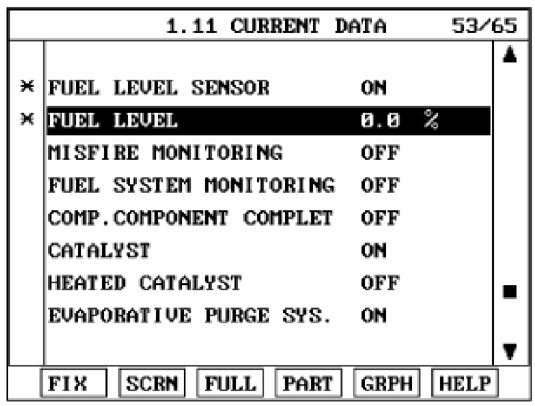


Fig.2 Short to ground in signal harness

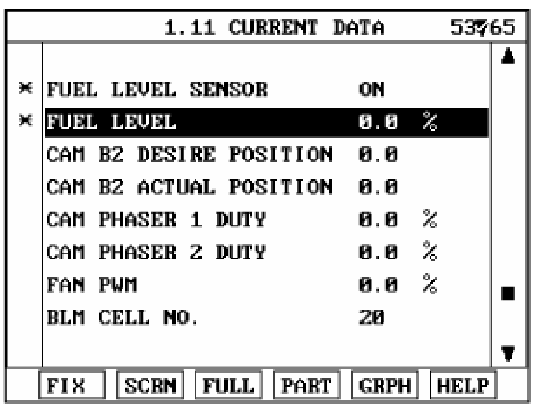


Fig.3 Open in signal harness

4. Is the "FLS" parameter displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor's and/or PCM's connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection,bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and goto "Verification of Vehicle Repair" procedure.

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

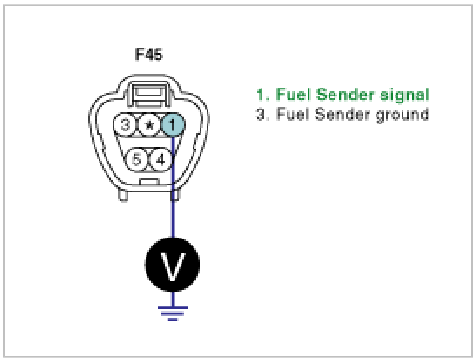
NO

▸ Go to " Signal Circuit Inspection " procedure.

SIGNAL CIRCUIT INSPECTION

1. IG "OFF" and disconnect FLS connector.
2. IG "ON" & ENG "OFF"
3. Measure voltage between terminal 1 of FLS harness connector and chassis ground.

Specification : Approx. 11.46V



4. Is the measured voltage within specification ?

YES

▸ Go to "Ground Circuit Inspection" procedure.

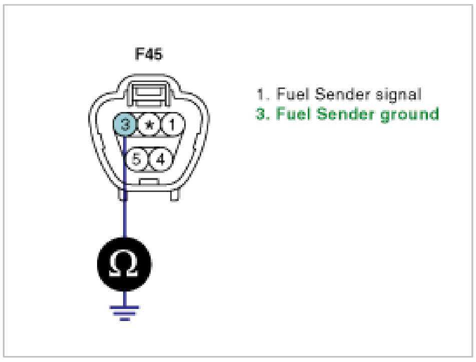
NO

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF"
2. Disconnect FLS & PCM connector.
3. Measure resistance between terminal 3 of FLS harness connector and chassis ground.

Specification : Approx. below 1Ω



4. Is the measured resistance within specification ?

YES

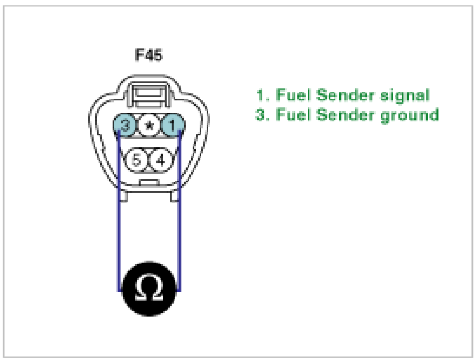
▸ Go to "Component Crcuit Inspection" procedure.

NO

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF"
2. Disconnect Fuel Level Sensor connector and Remove Fuel Sender from fuel tank.
3. Measure reistance between terminal 1 and 3 of Fuel Sender.(Component Side)



4. Does the resistance of FLS change as lifting up and down the fuel level float?

YES

▸ Substitute with a known - good PCM and check for proper operation.
▸ If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good Fuel Level Sensor and check for proper operation.
▸ If the problem is corrected, replace Fuel Level Sensor and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

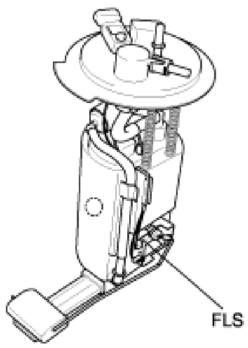
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0462

COMPONENT LOCATION



GENERAL DESCRIPTION

In order to measure the Fuel Level within the tank, the Fuel Level Sender consists of a variable resistor card mounted in the Fuel Pump and Sender unit (located in the fuel tank). A float located in the fuel tank swivels up and down as fuel level varies. A wiper is attached to the float and sweeps across the resistor card, thus providing a variable resistive input to the PCM. As the float sweeps across the Fuel Level Sender resistor card, the input voltage to the PCM varies accordingly. The PCM has calibrations and software which convert this analog voltage to a Fuel Level reading.

DTC DESCRIPTION

The Fuel Level Circuit Diagnostic compares the Fuel Level Sender voltage to low and high limits. When the voltage is outside the allowable limits, the circuit is determined to be failed.
When the Fuel Level Sender fails, it may cause the Evaporative System Diagnostic to function improperly since it relies on Fuel Level in its leak detection algorithm. A failed Fuel Level Sender will also provide misleading Fuel Level information to the driver (in cases where the PCM drives the fuel gauge).
Checking output signals of tank level sensor under detecting condition, if the fuel level voltage is low than 0.2V PCM sets P0462. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

DTC DETECTING CONDITION

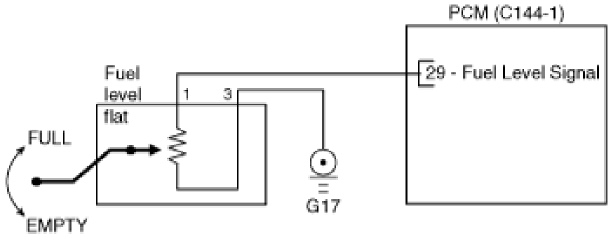
Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a continuous short to low or open in either the signal circuit or the fuel level sender	• Poor connection • Open or short to ground in signal Circuit • Faulty Fuel Level Sensor • Faulty PCM
Enable Conditions	• Engine Running • Set Short diagnostic Enable Criteria Met Flag	
Threshold value	• Raw fuel level sender output & 0.2V	
Diagnosis Time	• -	
MIL On Condition	• 2 driving cycles	

SPECIFICATION

FLS	Normal Parameter				
Float position	8/8	7/8	5/8	2/8	Warning Lamp ON
Resistance(Ω)	15.0±1	25.0±1	50±1	110±1.5	170±1.5
Fuel volume(ℓ)	63	56	42	21	9

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]

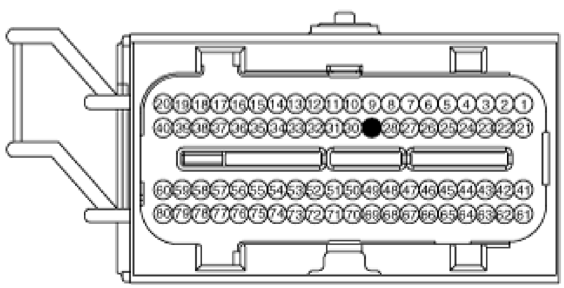


[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	PCM C144-1 (29)	Fuel level signal
3	Chassis Ground (G17)	Sensor ground

[HARNESS CONNECTOR]

F45
Main Relay



C144-1
PCM

MONITOR SCANTOOL DATA

1. Ignition "OFF"
2. Connect Scantool and Engine "ON"
3. Monitor "FLS" parameter on Current Data

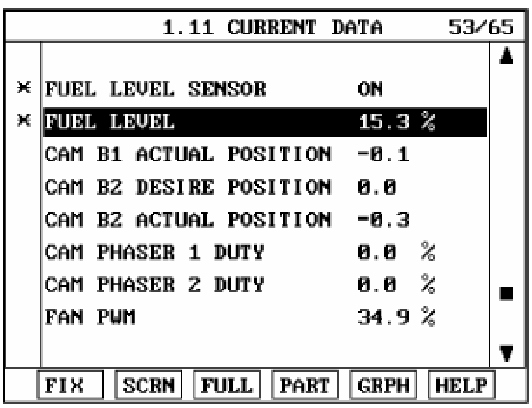


Fig.1 Normal

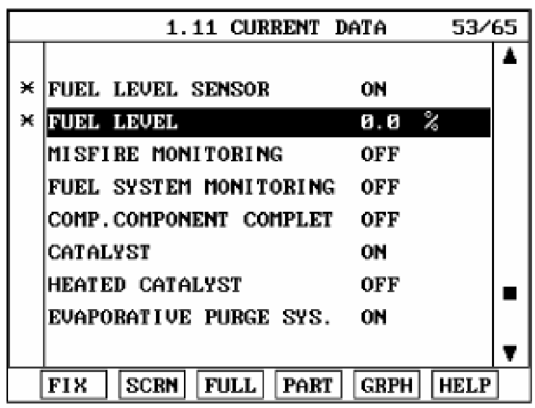


Fig.2 Short to ground in signal harness

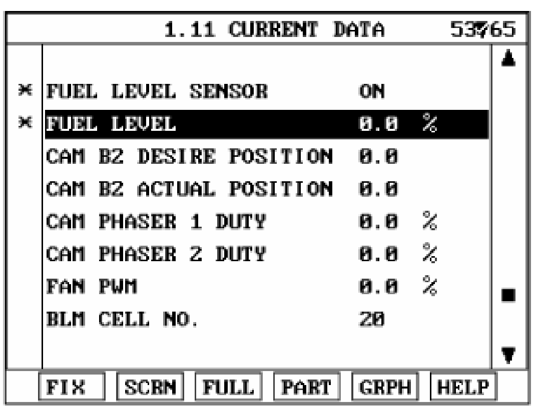


Fig.3 Open in signal harness

4. Is the "FLS" parameter displayed correctly ?

YES

▶ Fault is intermittent caused by poor contact in Sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▶ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure

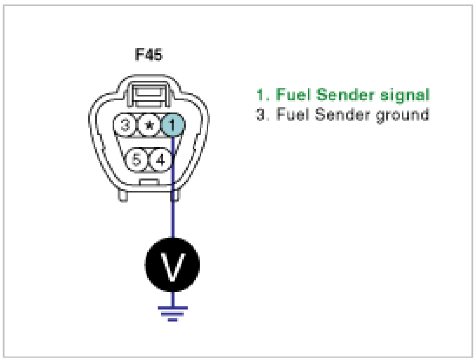
NO

▶ Go to " Signal Circuit Inspection " procedure

SIGNAL CIRCUIT INSPECTION

1. Check Voltage
   (1) IG "OFF" and disconnect FLS connector.
   (2) IG "ON" & ENG "OFF"
   (3) Measure voltage between terminal 1 of FLS harness connector and chassis ground.

Specification : Approx. 11.46V



   (4) Is the measured voltage within specification ?

YES

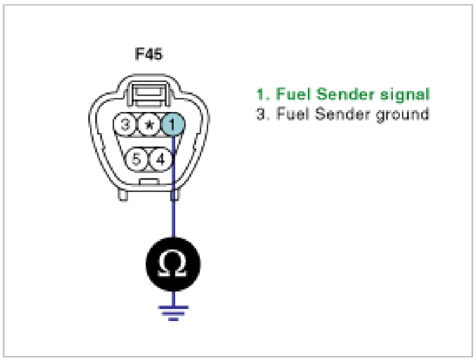
▶ Go to "Component Inspection" procedure.

NO

▶ Go to "Check short to ground in harness" as follows

2. Check short to ground in harness
   (1) IG "OFF" and disconnect FLS connector.
   (2) Measure resistance between terminal 1 of FLS harness connector and chassis ground.

Specification : Infinite



(3) Is the measured resistance within specification ?

YES

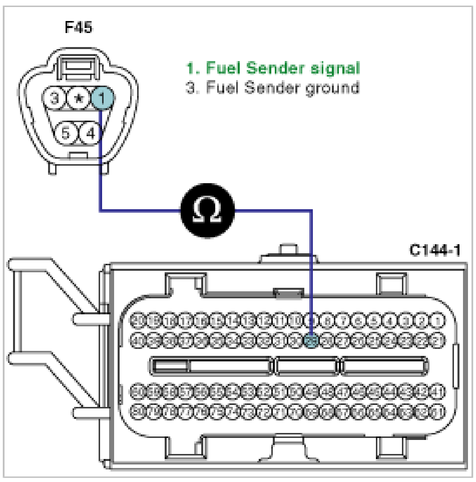
▸ Go to "Check open in harness" procedure.

NO

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

3. Check open in harness
   (1) IG "OFF" and disconnect FLS connector and PCM connector.
   (2) Measure resistance between terminal 1 of FLS harness connector and terminal 29 of PCM harness connector.

Specification : Approx. Below 1Ω



(3) Is the measured resistance within specification ?

YES

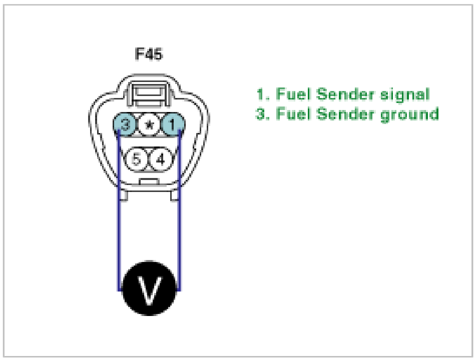
▸ Go to "Component Inspection" procedure.

NO

▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair"procedure.

COMPONENT INSPECTION

1. Ignition "OFF"
2. Disconnect Fuel Level Sensor connector and Remove Fuel Sender from fuel tank.
3. Measure reistance between terminal 1 and 3 of Fuel Sender.(Component Side)



4. Does the resistance of FLS change with lifting up and down the fuel level float ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good Fuel Level Sensor and check for proper operation. If the problem is corrected, replace Fuel Level Sensor and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

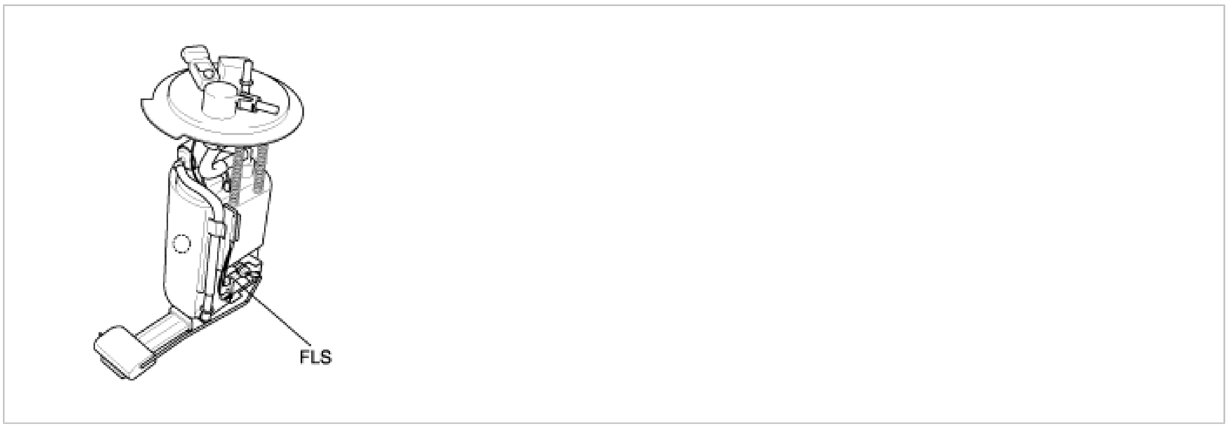
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0463

COMPONENT LOCATION



GENERAL DESCRIPTION

In order to measure the Fuel Level within the tank, the Fuel Level Sender consists of a variable resistor card mounted in the Fuel Pump and Sender unit (located in the fuel tank). A float located in the fuel tank swivels up and down as fuel level varies. A wiper is attached to the float and sweeps across the resistor card, thus providing a variable resistive input to the PCM. As the float sweeps

across the Fuel Level Sender resistor card, the input voltage to the PCM varies accordingly. The PCM has calibrations and software which convert this analog voltage to a Fuel Level reading.

DTC DESCRIPTION

The Fuel Level Circuit Diagnostic compares the Fuel Level Sender voltage to low and high limits. When the voltage is outside the allowable limits, the circuit is determined to be failed.
When the Fuel Level Sender fails, it may cause the Evaporative System Diagnostic to function improperly since it relies on Fuel Level in its leak detection algorithm. A failed Fuel Level Sender will also provide misleading Fuel Level information to the driver (in cases where the PCM drives the fuel gauge).
Checking output signals of tank level sensor under detecting condition, if the fuel level voltage is high than 4.41V PCM sets P0463. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

DTC DETECTING CONDITION

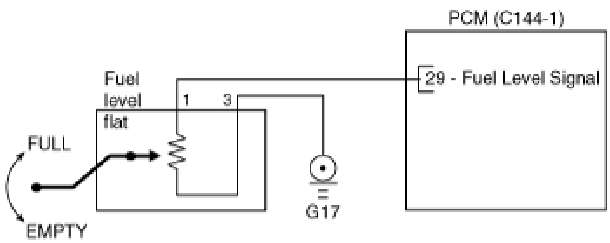
Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a continuous short to low or open in either the signal circuit or the fuel level sender	• Poor connection • Short to battery in signal Circuit • Faulty Fuel Level Sensor • Faulty PCM
Enable Conditions	• Engine Running • Set Short diagnostic Enable Criteria Met Flag	
Threshold value	• Raw fuel level sender output >4.5V	
Diagnosis Time	• -	
MIL On Condition	• 2 driving cycles	

SPECIFICATION

FLS	Normal Parameter				
Float position	8/8	7/8	5/8	2/8	Warning Lamp ON
Resistance(Ω)	15.0±1	25.0±1	50±1	110±1.5	170±1.5
Fuel volume(ℓ)	63	56	42	21	9

SCHEMATIC DIAGRAM

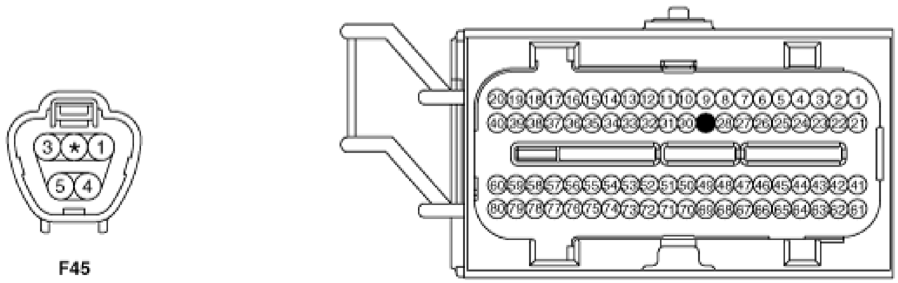
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	PCM C144-1 (29)	Fuel level signal
3	Chassis Ground (G17)	Sensor ground

[HARNESS CONNECTOR]



MONITOR SCANTOOL DATA

1. Ignition "OFF"
2. Connect Scantool and Engine "ON"
3. Monitor "FLS" parameter on Current Data

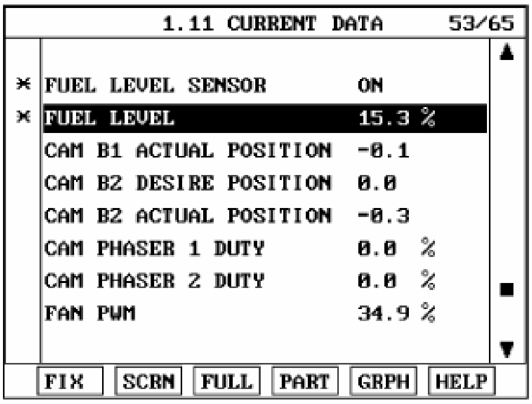


Fig.1 Normal

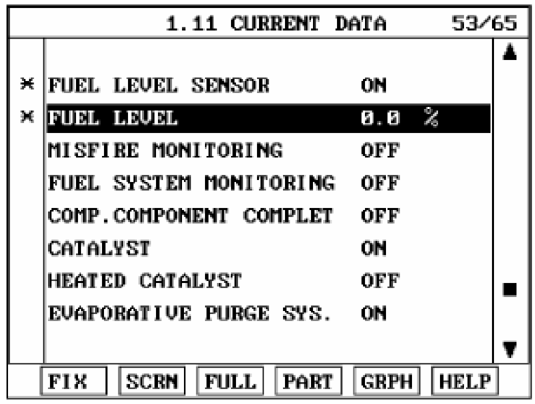


Fig.2 Short to ground in signal harness

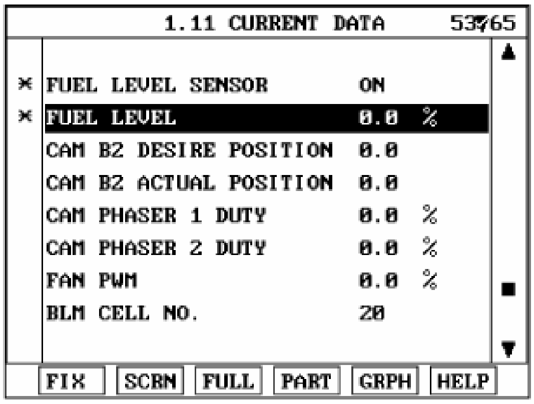


Fig.3 Open in signal harness

4. Is the "FLS" parameter displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

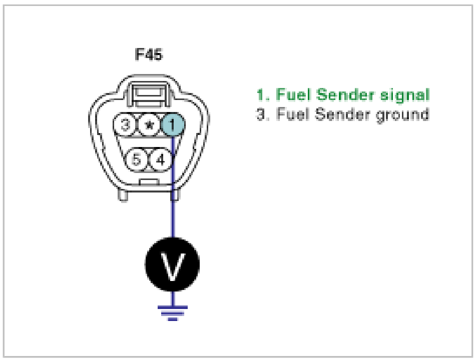
NO

▸ Go to " Signal Circuit Inspection " procedure

SIGNAL CIRCUIT INSPECTION

1. Check Voltage
   (1) IG "OFF" and disconnect FLS connector.
   (2) IG "ON" & ENG "OFF"
   (3) Measure voltage between terminal 1 of FLS harness connector and chassis ground.

Specification : Approx. 11.46V



(4) Is the measured voltage within specification ?

YES

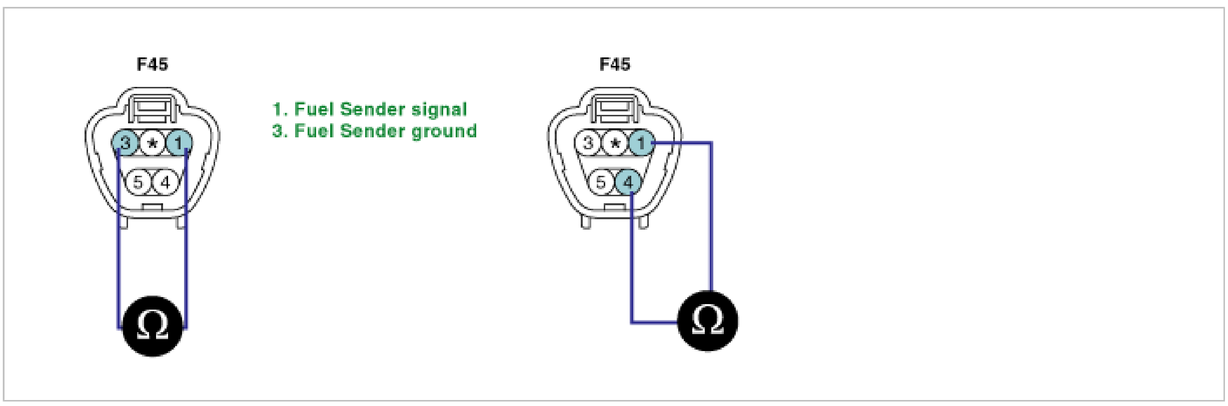
▸ Go to "Component Inspection" procedure.

NO

▸ Go to "Check short to battery in harness" as follows.

2. Check short to battery in harness
   (1) IG "OFF"
   (2) Disconnect FLS and PCM connector.
   (3) Measure resistance between terminals 1 and 3 of FLS harness connector.
   (4) Measure resistance between terminals 1 and 4 of FLS harness connector.

Specification : Infinite



(5) Is the measured resistance within specification ?

YES

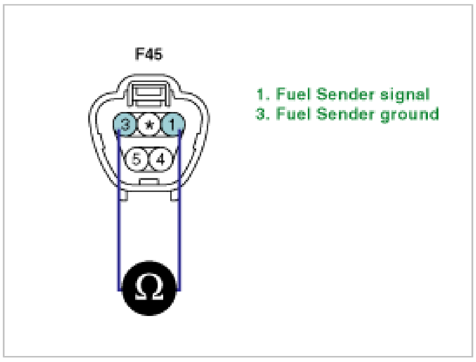
▸ Go to "Component Inspection" procedure.

NO

▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF"
2. Disconnect Fuel Level Sensor connector and Remove Fuel Sender from fuel tank.
3. Measure reistance between terminal 1 and 3 of Fuel Sender.(Component Side)



4. Does the resistance of FLS change with lifting up and down the fuel level float ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Substitute with a known - good Fuel Level Sensor and check for proper operation. If the problem is corrected, replace Fuel Level Sensor and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

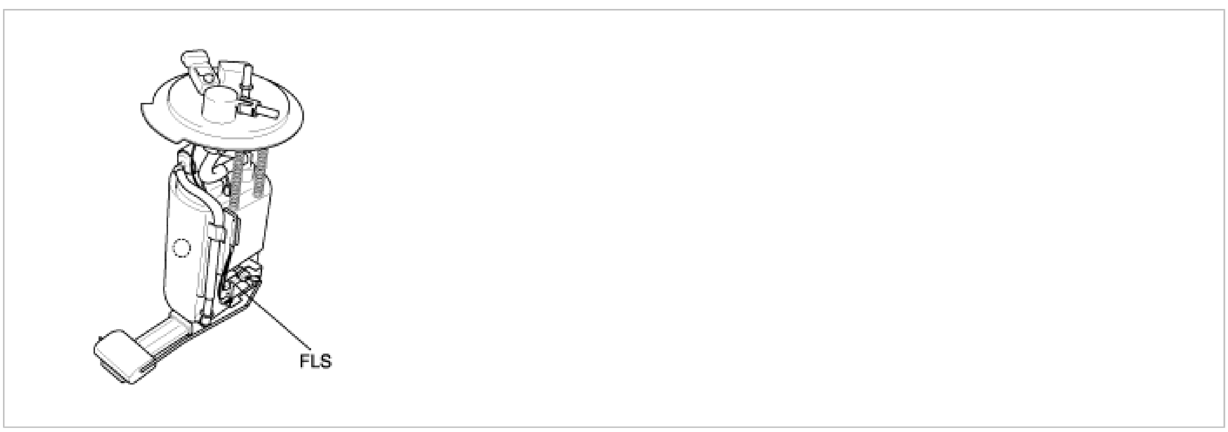
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0464

COMPONENT LOCATION



GENERAL DESCRIPTION

In order to measure the Fuel Level within the tank, the Fuel Level Sender consists of a variable resistor card mounted in the Fuel Pump and Sender unit (located in the fuel tank). A float located in the fuel tank swivels up and down as fuel level varies. A wiper is attached to the float and sweeps across the resistor card, thus providing a variable resistive input to the PCM. As the float sweeps

across the Fuel Level Sender resistor card, the input voltage to the PCM varies accordingly. The PCM has calibrations and software which convert this analog voltage to a Fuel Level reading.

DTC DESCRIPTION

The Fuel Level Noisy Signal Diagnostic monitors variations in Fuel Level and looks for erratic or irregular behavior. When the Fuel Level is determined to display unstable, the Fuel Level Sender is determined to be failed.
When the Fuel Level Sender fails, it may cause the Evaporative System Diagnostic to function improperly since it relies on Fuel Level in its leak detection algorithm. A failed Fuel Level Sender will also provide misleading Fuel Level information to the driver (in cases where the PCM drives the fuel gauge).
Checking output signals from FLS under detecting condition, if Difference between previous and current Fuel Level Signal is high than 0.8V , PCM sets P0464. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

DTC DETECTING CONDITION

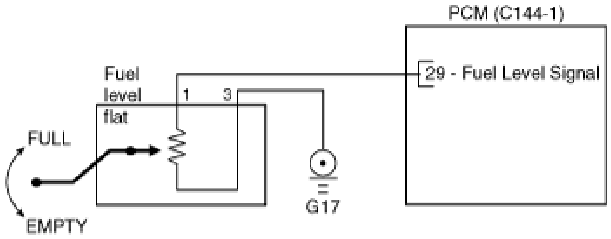
<table>
<tr><th colspan="2">Item</th><th>Detecting Condition</th><th>Possible cause</th></tr>
<tr><td colspan="2">DTC Strategy</td><td>• Detects a stuck fuel level sender</td><td rowspan="6">• Poor connection
• Faulty Fuel Level Sensor
• Faulty PCM</td></tr>
<tr><td rowspan="2">Enable Conditions</td><td>Case 1</td><td>Determination of Steady Conditions
Engine Running
• Delta MAP ≤ 10kPa
• Delay Time ≥ 5sec
• Set Delta MAP Condition Not Exceeded Flag to TRUE
OR
• Delta RPM ≤ 50
• Delay Time ≥ 5sec
• Set Delta RPM Conditon Not Exceeded Flag to TRUE
OR
• Thottle Position ≤ 1.9989%
• Delay Time ≥ 5sec
• Set TPS Condition Not Exceeded Flag to TRUE
OR
• Vehicle Speed ≥ 1kph(0.621371 mile)
• Delay Time ≥ 5sec
• Set V. Speed Condition Not Exceeded Flag to TRUE</td></tr>
<tr><td>Case 2</td><td>Determination of Noisy Signal Enable Conditons
• Engine Running
• Intake Air temperature > -10°C(14 °F)
• Fuel Level Active Not Present
• No Nosiy Signal Disabling Faults Present
• Delta MAP Condition Not Exceeded
• Delta RPM Conditon Not Exceeded
• TPS Conditon Not Exceeded
• Vehicle Speed Conditon Not Exceeded
• Set Enable Criteria Met Conditions are Satisfied</td></tr>
<tr><td colspan="2">Threshold value</td><td>• Difference between previous and current Fuel Level Raw Signal > 0.1667</td></tr>
<tr><td colspan="2">Diagnosis Time</td><td>• -</td></tr>
<tr><td colspan="2">MIL On Condition</td><td>• 2 driving cycles</td></tr>
</table>

SPECIFICATION

FLS	Normal Parameter				
Float position	8/8	7/8	5/8	2/8	Warning Lamp ON
Resistance(Ω)	15.0±1	25.0±1	50±1	110±1.5	170±1.5
Fuel volume(ℓ)	63	56	42	21	9

SCHEMATIC DIAGRAM

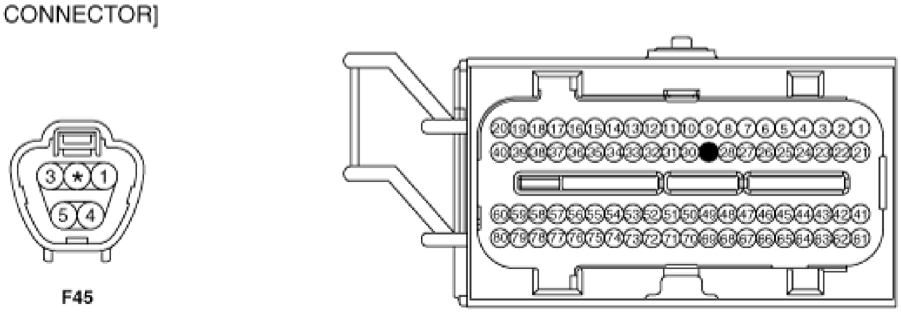
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	PCM C144-1 (29)	Fuel level signal
3	Chassis Ground (G17)	Sensor ground

[HARNESS CONNECTOR]



F45
Main Relay

C144-1
PCM

MONITOR SCANTOOL DATA

1. Ignition "OFF"
2. Connect Scantool and Engine "ON"
3. Monitor "FLS" parameter on Current Data

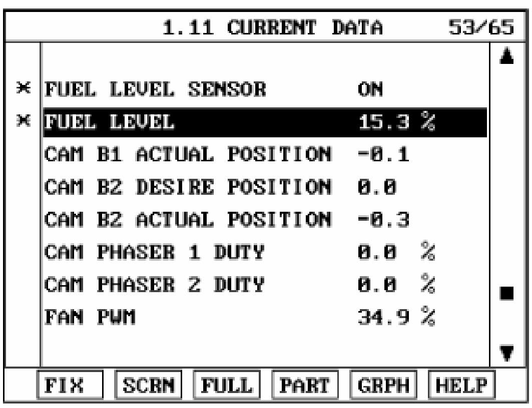


Fig.1 Normal

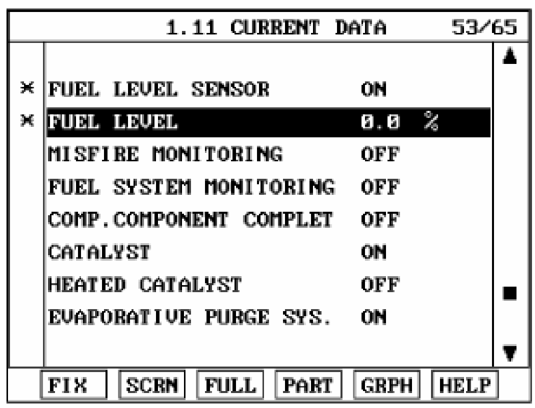


Fig.2 Short to ground in signal harness

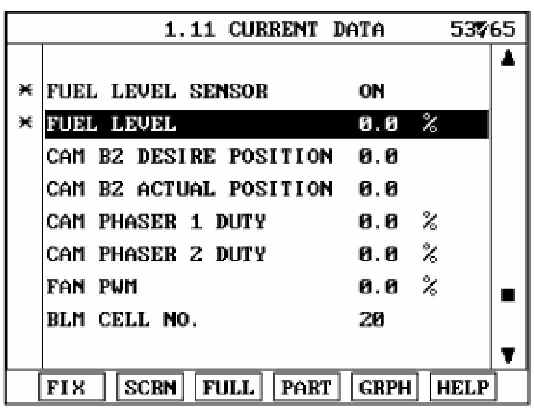


Fig.3 Open in signal harness

4. Is the "FLS" parameter displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

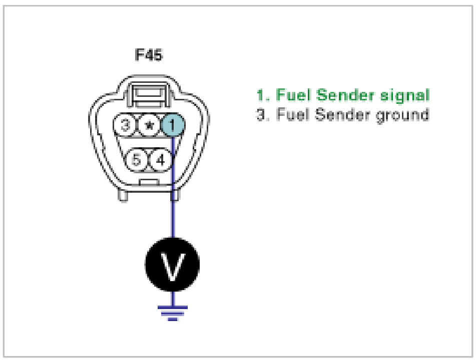
NO

▸ Go to " Signal Circuit Inspection " procedure

SIGNAL CIRCUIT INSPECTION

1. IG "OFF" and disconnect FLS connector.
2. IG "ON" & ENG "OFF"
3. Measure voltage between terminal 1 of FLS harness connector and chassis ground.

Specification : Approx. 11.46V



4. Is the measured voltage within specification ?

YES

▸ Go to "Ground Circuit Inspection" procedure.

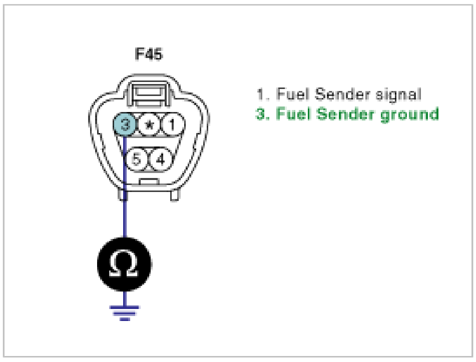
NO

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF"
2. Disconnect FLS & PCM connector.
3. Measure resistance between terminal 3 of FLS harness connector and chassis ground

Specification : Approx. below 1Ω



4. Is the measured resistance within specification ?

YES

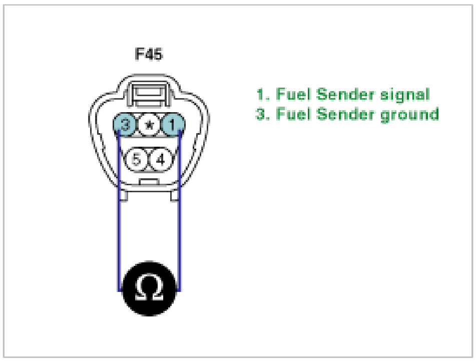
▸ Go to "Component Crcuit Inspection" procedure.

NO

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF"
2. Disconnect Fuel Level Sensor connector and Remove Fuel Sender from fuel tank.
3. Measure reistance between terminal 1 and 3 of Fuel Sender.(Component Side)



4. Does the resistance of FLS change as lifting up and down the fuel level float ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good Fuel Level Sensor and check for proper operation. If the problem is corrected, replace Fuel Level Sensor and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0480

GENERAL DESCRIPTION

When the ambient air temperature is warm or the airflow across the engine is low, the enginecoolant temperature can become hot. If the coolant temperature becomes too hot, it is possiblethat the engine could be damaged. High coolant temperatures can also cause the A/C system tobe disabled, in order to reduce load on the engine and protect the A/C system components. Thepurpose of activating the engine compartment ventilation fan(s) is to help reduce the enginecoolant temperature to a level that is not threatening to engine performance and maintains the airconditioning system pressure at safe levels.
Electric fan responsible for causing air movement around the engine coolant radiator. The amount of air movement caused by the fan is controlled based on the Vehicle Speed, coolant temperature, A/C pressure status, A/C switch request status, and A/C clutch state. A duty cycle is determined based on these input parameters. This duty cycle corresponds to fan speed which correlates to the amount of air movement caused by the fan. The increased air movement enhances the heat exchanger function of the radiator in the confined space of the enginecompartment, thereby reducing the engine coolant temperature more quickly.This fan also causes air movement around the A/C Condenser, thereby enhancing condensationwithin the condenser, results in lower pressure within the A/C system.

DTC DESCRIPTION

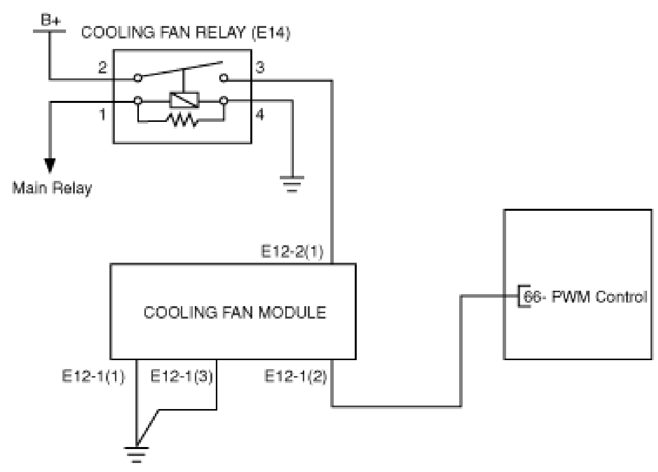
The Delphi EMS system provides for a method of electrically controlling when the fan(s) should beactivated and deactivated based on a variety of engine conditions, including the coolanttemperature, vehicle speed, air conditioning switch status and air conditioning pressurestatus. As the coolant temperature or air conditioning pressure rises, increased airflow is requiredto reduce the engine temperature and A/C system pressure. The engine cooling fan(s) areactivated to increase airflow across the engine components.
Checking power supply to cooling fan relay to cooling fan module and control signals under detecting condition, if the PCM detects short to ground, to battery or open circuit, PCM sets P0480. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• This will detect a short to ground, to battery or open circuit on Fan relay output. Fault information provided by an output driver chip.	• Poor connection • Open in Power circuit to cooling fan module • Open or short in control circuit to PCM • Faulty Fan Relay • Faulty cooling fan module • Faulty PCM
Enable Conditions	• No disabling Faults Present • Engine Running • 11V ≤ Ignition Voltage ≤ 16V • Enable Time delay ≥ 0.5sec.	
Threshold value	• Open or short on Fan relay output	
Diagnosis Time	• Continuous (More than 5sec. failure for every 10 sec. test.)	
MIL On Condition	• 2 driving cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

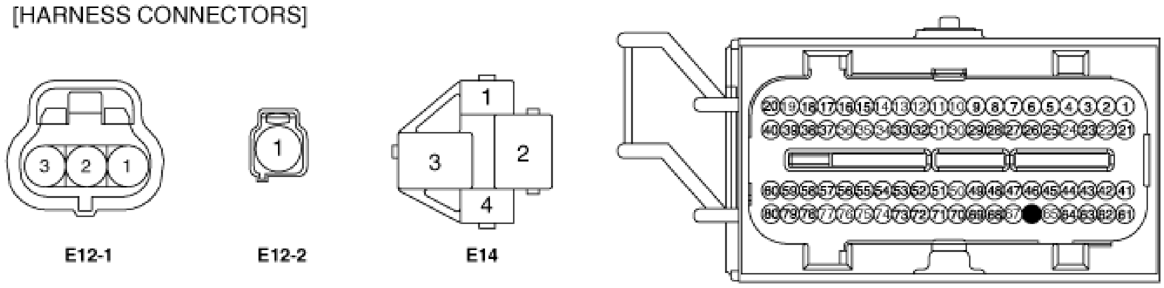
COOLING FAN MODULE (E12-1)

Terminal	Connected to	Funtion
1	Chassis Ground	Ground
2	PCM C144-1 (66)	PWM Control
3	Chassis Ground	Ground

COOLING FAN MODULE (E12-2)

Terminal	Connected to	Funtion
1	Cooling fan relay E14(3)	Battery Power (B+)

[HARNESS CONNECTORS]



E12-1 E12-2 E14 C144-1

COOLING FAN MODULE COOLING FAN RELAY PCM

MONITOR SCANTOOL DATA

1. Ignition "OFF"
2. Connect Scantool and Engine "ON"
3. Monitor "Fan PWM" parameter with scantool

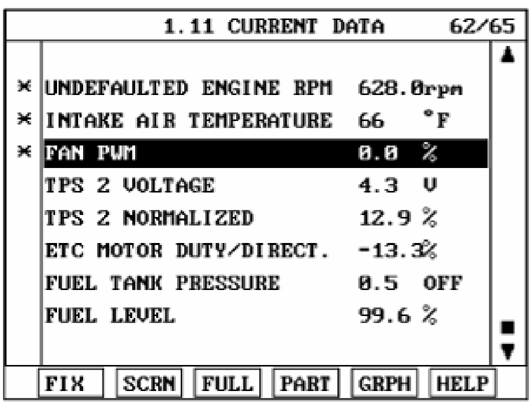


Fig.1 Fan OFF

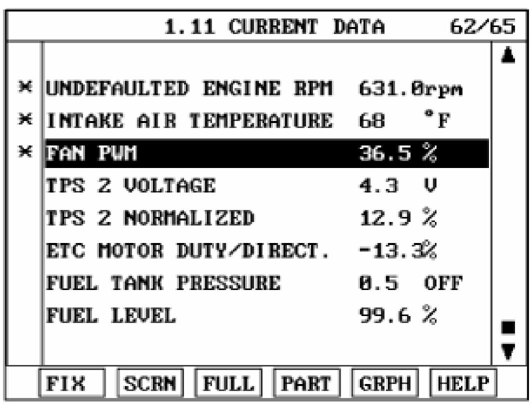


Fig.2 Fan ON

4. Is the "Fan PWM" parameter displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor’s and/or PCM’s connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection,bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and goto "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

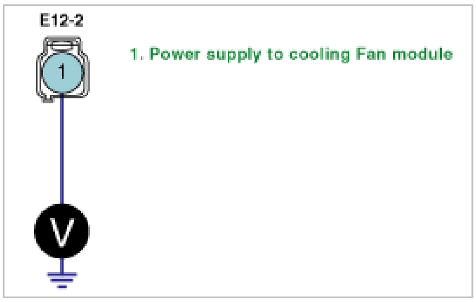
NO

▸ Go to " Power Circuit Inspection " procedure

POWER CIRCUIT INSPECTION

1. IG "OFF" and disconnect Cooling fan module connector.
2. IG "ON" & ENG "OFF"
3. Measure voltage between terminal 1 of Cooling fan module harness connector and chassis ground.

Specification : Approx. B+



4. Is the measured voltage within specification

YES

▸ Go to "Control Circuit Inspection" procedure.

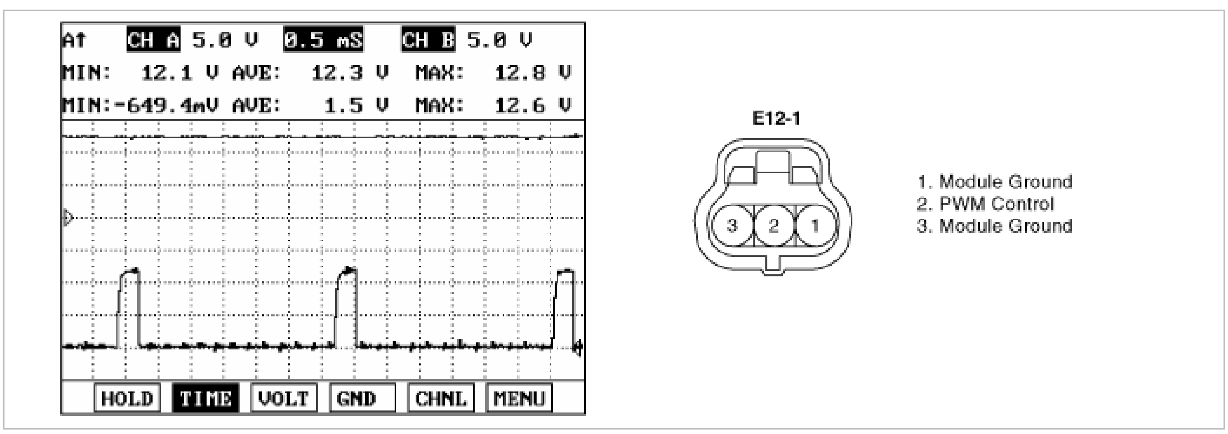
NO

▸ Check if cooling fan fusible link 60A is open or not installed.
▸ Check if cooling fan relay is not installed or faulty
▸ Check if the line between cooling fan relay and Cooling fan module is open.
▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. IG "OFF"
2. Disconnect Cooling fan module connector.
3. IG "ON" & ENG "OFF"
4. Measure signal waveform at terminal 2 of cooling fan module.

Reference signal waveform :



5. Is the measured signal waveform normal?

YES

▸ If the problem is corrected after substituting with a known - good Cooling Fan module, replace it. If the problem is pending, check for proper operating after substituting with a known - good PCM. and then if the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Check that harness connected at engine compartment junction block is disconnected or not.
▸ Check the line between terminal 2 of Cooling Fan module harness connector and terminal 66 of PCM harness connector for open.
▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0501

GENERAL DESCRIPTION

The wheel speed sensor is the essential component taht the PCM uses to calculate vehicle speed. This wheel speed sensor is the active hall-sensor type and good at temperature and noise chariteristic. Digital wave is produced as tone wheel rotate according as hall sensor principle. Frequency of duty wave is changed in proportion to rotation of tone wheel and PCM gets vehicle speed through ABS control unit or ESP control unit.

DTC DESCRIPTION

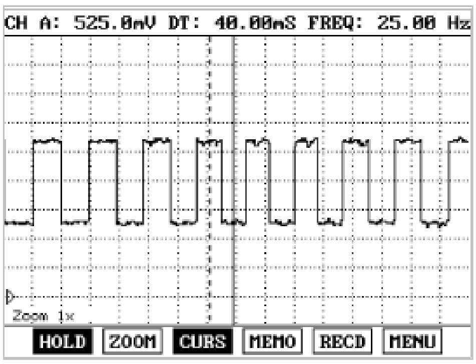
Checking vehicle speed signal every from wheel speed sensor or ABS control unit 30 sec. under detecting condition, if an signal is in the detecting condition for more than 20 sec., PCM sets P0501. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

DTC DETECTING CONDITION

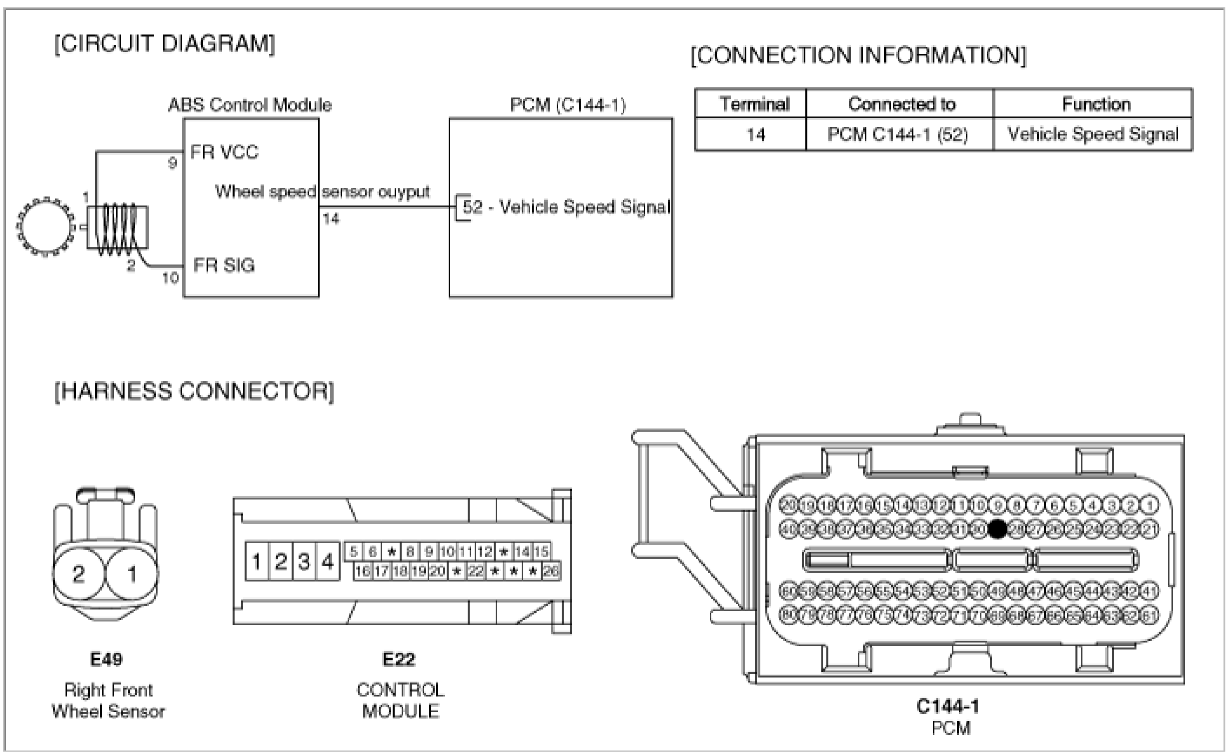
<table>
<tr><th colspan="2">Item</th><th>Detecting Condition</th><th>Possible cause</th></tr>
<tr><td colspan="2">DTC Strategy</td><td>• Detects the lack of vehicle speed signal to the PCM</td><td rowspan="3">• Poor connection
• Open or short in harness
• Wheel speed sensor(FR)</td></tr>
<tr><td rowspan="2">Enable Conditions</td><td>Case 1 (Power)</td><td>• Engine Running
• No VSS disabling malfunction present
• No TPS fault present
• No MAP fault present
• 11V< Ignition Voltage< 16V
• Engine Coolant Temperature >60°C
• MAP >55kPa
• 25% ≤ TPS ≤ 60%
• 1200rpm ≤ Engine Speed ≤ 4000rpm
• Vehicle Speed derived from TOSS (If TOSS available) ≥ 0KPH(0MPH)</td></tr>
<tr><td></td><td>• Engine Running
• No VSS disabling malfunction present
• No TPS fault present
• No MAP fault present</td></tr>
</table>

	Case 2 (Decel)	• 11V< Ignition Voltage< 16V • Engine Coolant Temperature >60°C • MAP< 32kPa • TPS< 1.001% • 1800rpm ≤ Engine Speed ≤ 6000rpm • Transmission in gear	• ABS or ESP control unit • PCM
Threshold value	Case 1 (Power)	Power Enable Criteira Met • IF VSS Fault Vehicle Speed ≤ 10kph • ELSE Vehicle Speed< 5kph	
	Case 2 (Decel)	Decel. Enable Criteira Met • Vehicle Speed< 5kph • Delta Engine Speed ≥ 100rpm	
Diagnosis Time		• Continuous (More than 20 seconds failure for every 30 seconds test)	
MIL On Condition		• 2 driving cycles	

SIGNAL WAVEFROM AND DATA

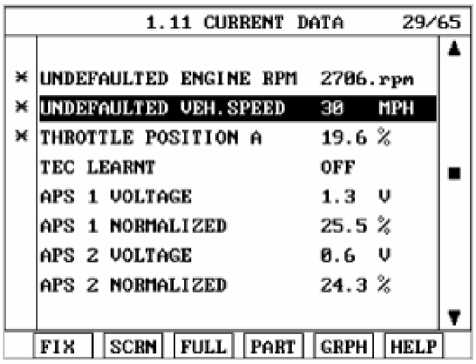


SCHEMATIC DIAGRAM



MONITOR SCANTOOL DATA

1. Ignition "OFF"
2. Connect Scantool and Engine "ON"
3. Drive vehicle in gear and monitor "vehicle speed" item on the scantool.



4. Are thsoe "VSS" parameters displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to " Signal Circuit Inspection " procedure.

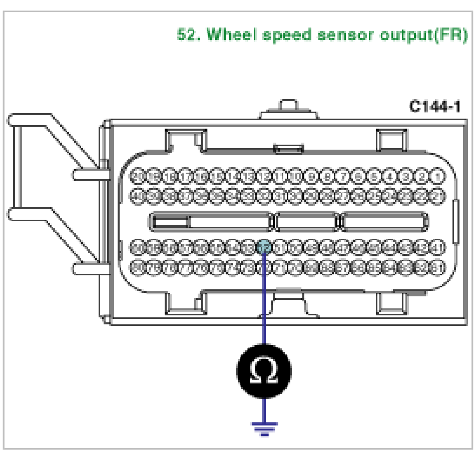
SIGNAL CIRCUIT INSPECTION

> **WARNING**
>
> This procedure is applied to vehicle with ABS (or ESP). In case of no ABS(or ESP), refer to "C1203 Wheel speed sensor front-RH open/short".

1. Check short to ground in harness
   (1) IG "OFF"

   (2) Disconnect PCM connector and ABS or EPS control module connector.

   (3) Measure resistance between terminal 52 of PCM harness connector and chassis ground.



Specification : Infinite

(4) Is the measured resistance within specifications?

YES

▸ Go to "Check open in harness" as follows.

NO

▸ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

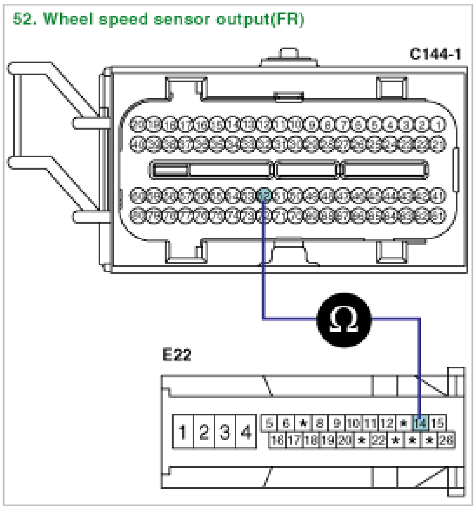
2. Check for open in harness

(1) Ignition "OFF"

(2) Disconnect PCM connector and ABS or ESP control module connector.

(3) Measure resistance between terminal "52" of PCM harness connector and terminal "14(With ESP: terminal 40)" of ABS control module harness connector.

Specification : Approx. below 1Ω



NOTE

Note: This picture is only applied to vehicle with ABS

(4) Is the measured resistance within specifications?

YES

▸ Go to " Check wheel speed sensor " procedure.

NO

▸ Check open in harenss.

▸ Repair or replace as necessary and then, go to " Verification of Vehicle Repair" procedure.

3. Check wheel speed sensor

(1) IG "OFF"

(2) Check open or short in wheel speed sensor (Refer to "C1203 Wheel speed sensor front-RH open/short")

(3) Is the wheel speed sensor normal?

YES

▸ Substitute with a known - good PCM/ ABS or ESP control unit and check for proper operation. If the problem is corrected, replace PCM/ ABS or ESP control unit and go to "Verification of Vehicle Repair" procedure.

NO

▸ Repair or replace it as necessary.

▸ And then go to " Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

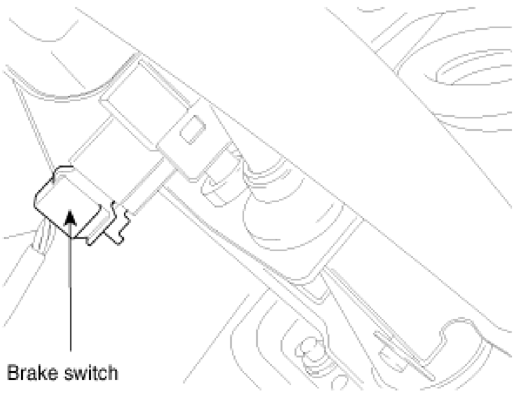
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0504

COMPONENT LOCATION



GENERAL DESCRIPTION

Brake switch connected to brake pedal transfers brake operating state to ECM. For diagnosis of abnormal operation of Brake switch, two types of signals(one from Brake warning lamp switch, the other from Brake checking switch) are used and those two types output different signals at both condition, depressing or releasing brake pedal. When brake pedal is depressed brake checking switch outputs B+ voltage while brake warning lamp switch emits 0V. Conversly, when brake pedal is released, the output signals of each switch are opposite.

DTC DESCRIPTION

Checking output signals from both brake switch every 2.5 sec. when all of them are On or OFF simultaneously, if abnormal signal is detected for more than 0.5 sec., an error is recognized. And if this condition lasts for more than 4.8 sec., PCM sets P0504. MIL (Malfunction Indicatin Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

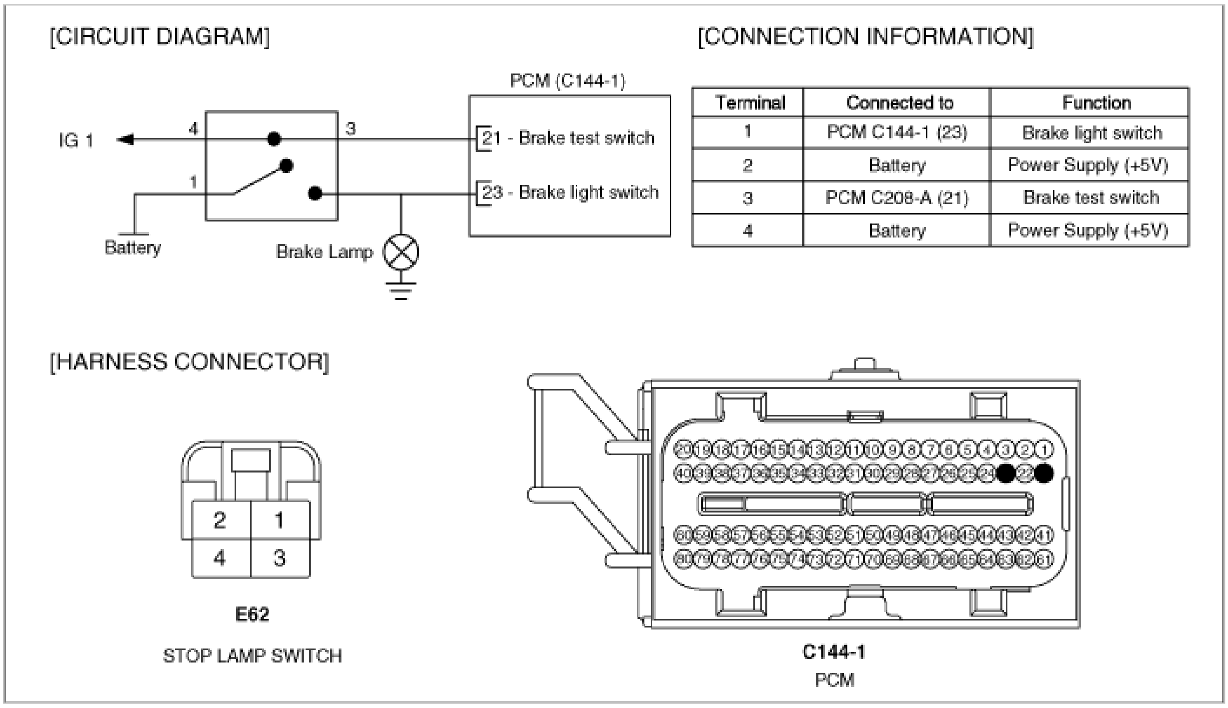
DTC DETECTING CONDITION

Item		Detecting Condition	Possible cause
DTC Strategy		• Comparing 2 brake signals during driving	• Poor connection • Open or Short • Faulty PCM
Enable Conditions	Case 1	• Engine works • Vehicle Speed Sensor is abnormal.	
	Case 2	• Engine works • Vehicle Speed Sensor is normal and Vehicle Speed is over 20kph dring 1sec or more.	
Threshold value		• The one brake signal's change duration when another signal has been changed < 0.5 sec	
Diagnosis Time		• Continuous (More than 1.625 seconds for every 2.5 seconds test)	
MIL On Condition		• 2 driving cycles	

SPECIFICATION

Item	During taking off the brake	During stepping on the brake
Brake Lamp Switch	0V	Battery voltage
Brake Switch	Battery voltage	0V

SCHEMATIC DIAGRAM



Terminal	Connected to	Function
1	PCM C144-1 (23)	Brake light switch
2	Battery	Power Supply (+5V)
3	PCM C208-A (21)	Brake test switch
4	Battery	Power Supply (+5V)

MONITOR SCANTOOL DATA

1. Ignition "OFF"
2. Connect Scantool and Engine "ON"
3. Monitor "Brake Switch" parameter on Current Data

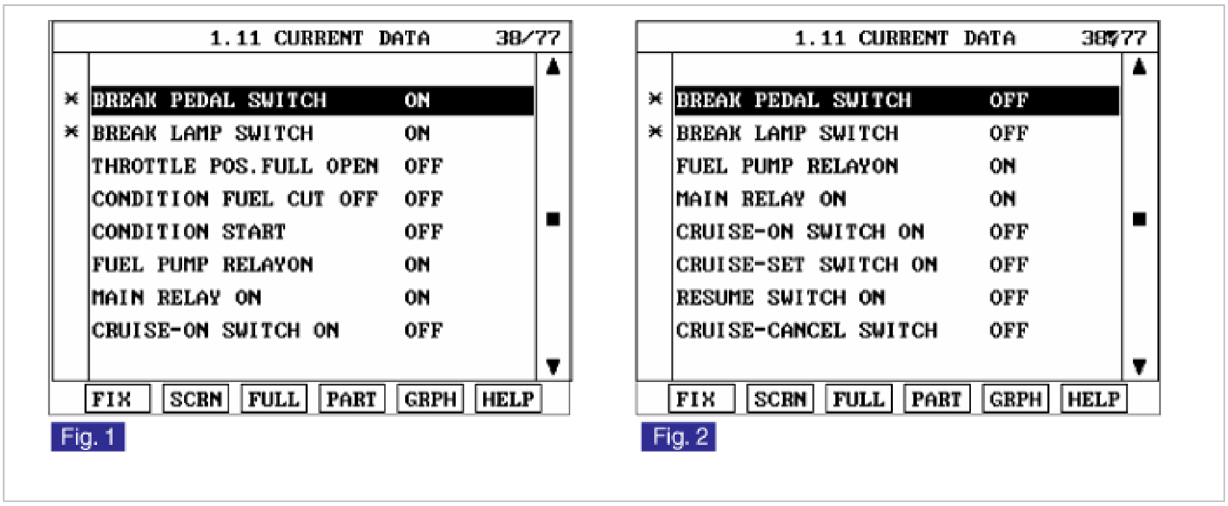


Fig. 1 Fig. 2

4. Are those "Brake Switch" parameters displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

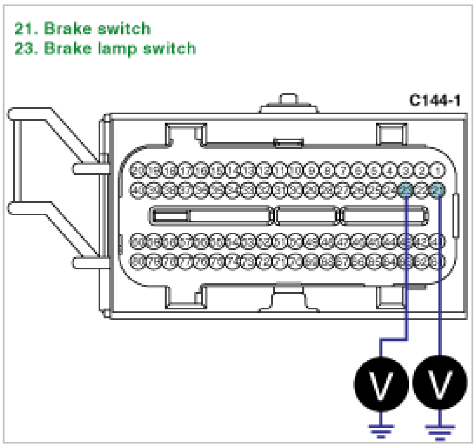
▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. Votage check
   (1) Key "OFF".
   (2) Disconnect the PCM connector.
   (3) Key "ON" and keep the brake taking off.
   (4) Measure the voltage between terminal 21 of PCM connector and chassis ground.
   (5) Measure the voltage between terminal 23 of PCM connector and chassis ground .
   (6) Keep the brake stepping on.
   (7) Measure the voltage between terminal 21 of PCM connector and chassis ground.
   (8) Measure the voltage between terminal 23 of PCM connector and chassis ground .

Specification :

Item	During taking off the brake	During stepping on the brake
Brake Lamp Switch	0V	Battery voltage
Brake Switch	Battery voltage	0V



   (9) Is the measured voltage within specification ?

YES

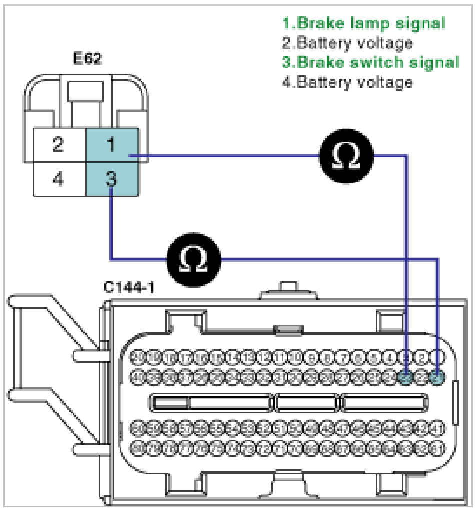
▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Go to "Check open in harness" as follows.

2. Check open in harness
   (1) Key "OFF".
   (2) Disconnect the brake switch and PCM connector.
   (3) Measure the resistance between terminal 21 of PCM harness connector and terminal 3 of Brake switch harness side.
   (4) Measure the resistance between terminal 23 of PCM harness connector and terminal 1 of Brake switch harness side.

Specification : Approx. below 1Ω



(5) Is the measured resistance within specification ?

YES

▸ Go to "Check voltagen" procedure.

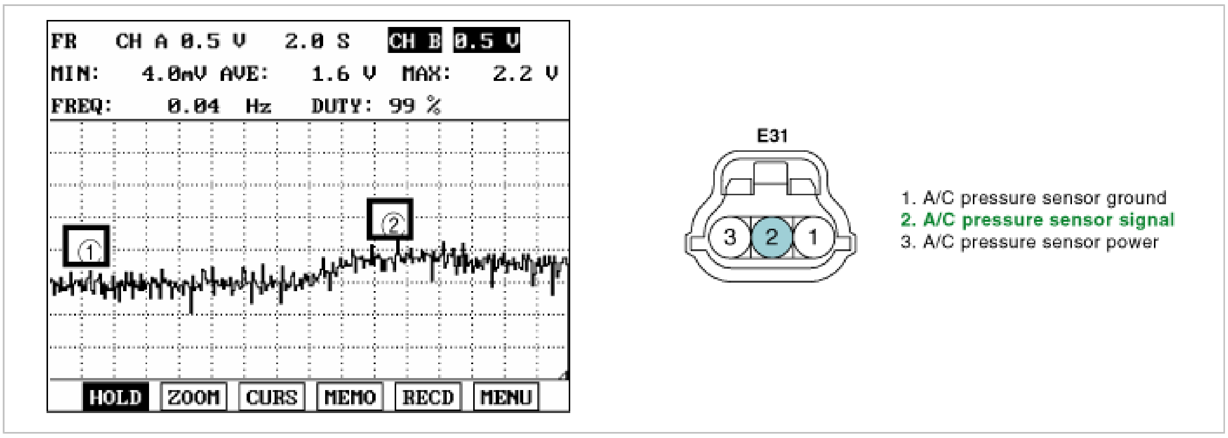
NO

▸ Repair open in circuit and go to "Verification of Vehicle Repair" procedure.

3. Check voltage
   (1) Key "OFF".
   (2) Disconnect the brake switch connector.
   (3) Measure the voltage between brake lamp switch terminal and chassis ground.
   (4) Measure the voltage between brake switch terminal and chassis ground.
   (5) Key "ON".
   (6) Measure the voltage between brake lamp switch terminal and chassis ground.
   (7) Measure the voltage between brake switch terminal and chassis ground.

Specification :

Item	During taking off the brake	During stepping on the brake
Brake Lamp Switch	0V	Battery voltage
Brake Switch	Battery voltage	0V



(8) Is the measured voltage within specification ?

YES

▸ Substitute with a known - good brake switch and check for proper operation. If the problem is corrected, replace brake switch and go to "Verification of Vehicle Repair" procedure.

NO

▸ Check the fuse between battery and brake switch.

▸ Repair open or short in power circuit of brake switch and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0506

GENERAL DESCRIPTION

The IAC System is designed to maintain a steady desired idle speed. Idle airflow is adjustedthrough the idle air actuator, which may be ETC throttle body, in order to maintain the desired idle speed under various load conditions. Load conditions vary due to numerous factors, such as engine temperature, air conditioning, electrical load and power steering load.

DTC DESCRIPTION

Checking idle RPM from ETC throttle body under detecting condition, if if the idle speed is 100RPM below desired idle speed for 10 sec., PCM sets P0506. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Determines if a low idle condition exists.	• Poor connection • Intake/Exhaust system for blockage • Throttle plate for carbon deposits • Faulty ETS motor • Faulty TPS • Faulty ETS system • Faulty PCM
Enable Conditions	• Normal Idle conditions • Canister Purge Fuel Flow ≤ 100 • Barometric Pressure > 72kPa • Engine running long enough • Air Intake Temperature • Coolant Temperature • 10V ≤ Ignition Voltage ≤ 16V • Above conditions met period • No intrumentation slew commanded • OFVC Device Control Not Active	
Thresh old value	• Real engine speed - Target engine speed< -100rpm	
Diagnosis Time	• Continuous	
MIL On Condition	• 2 driving cycles	

MONITOR SCANTOOL DATA

1. Ignition "OFF"
2. Connect Scantool and Engine "ON"
3. Monitor items which affect idle rpm on scantool.

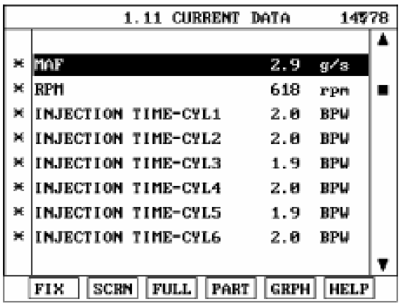


Fig. 1

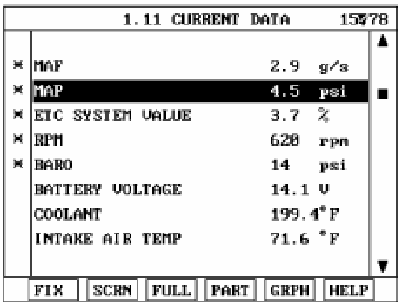


Fig. 2

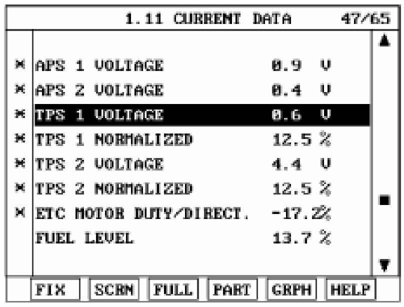


Fig. 3

4. Are those items on scantool displayed correctly ?

YES

▸ Go to "Terminal and Connector Inspection" procedure.

NO

▸ Check DTCs related to Mass airflow sensor(MAF),Injectors,Throttle position sensor(TPS), Purge control solenoid valve (PCSV), Acceleration position sensor(APS), Heated oxygen sensors(HO2S), ETS system

▸ Perform all repairs associated with those codes and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to " System Inspection " procedure

SYSTEM INSPECTION

1. Check intake/exhaust system for blockage
   (1) Visually/physically inspect the following items:
   - Air cleaner filter element for excessive dirt or for any foreign objects
   - Hoses of intake system for blockage
   - Throttle body inlet for damage or for any foreign objects
   - Throttle plate for carbon deposits
   - Restricted exhaust system

   (2) Has a problem been found in any of the above areas?

   YES

   ▸ Replace or repair as necessary and go to "Verification of Vehicle Repair" procedure

   NO

   ▸ Go to "Visually check ETS System" as below

2. Visually check ETS System
   (1) Ignition "OFF"

   (2) Remove the air hose between MAF sensor and Throttle body.

   (3) Visually check the overall ETS system(Throttle valve,ETS motor,APS and TPS).

   (4) Has a problem been found?

   YES

   ▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Go to " Component Inspection" procedure.

COMPONENT INSPECTION

1. Check ETS motor

(1) Ignition "OFF"

(2) Disconnect ETS motor connector

(3) Measure resistance between terminals "1" and "2" of the ETS motor connector.

Specification: Approx. 1.275 ~ 1.725Ω at 20°C(68 °F)

(4) Is the measured resistance within specifications?

YES

▸ Go to "Check TPS" as below

NO

▸ Substitute with a known-good ETS motor and check for proper operation. If the problem is corrected, replace ETS motor and then do "ETS Initialization" and go to "Verification of Vehicle Repair" procedure.

2. Check TPS

(1) Disconnect TPS connector and measure resistance between terminals 4 and 8 of the TPS connector.

Specification : Approx. 4.0~6.0kΩ(with throttle valve fully closed) at 20°C(68°F)

(2) Disconnect TPS connector and measure resistance between terminals 1 and 5 of the TPS connector.

Specification:

Item	Sensor Resistance
TPS 1	4.0 ~ 6.0 kΩ (20°C)
TPS 2	2.72 ~ 4.08 kΩ (20°C)

(3) Are the TPS resistance within specifications?

YES

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure. If PCM needs to be replaced, do "ETS Initialization" after it is replaced.

NO

▸ Substitute with a known-good TPS and check for proper operation.If the problem is corrected, replace TPS and then do "ETS Initialization". And go to "Verification of Vehicle Repair" procedure.

※ Procedure of ETS Initialization

1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10 second)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0507

GENERAL DESCRIPTION

The IAC System is designed to maintain a steady desired idle speed. Idle airflow is adjustedthrough the idle air actuator, which may be ETC throttle body, in order to maintain the desired idle speed under various load conditions. Load conditions vary due to numerous factors, such as engine temperature, air conditioning, electrical load and power steering load.

DTC DESCRIPTION

Checking idle RPM from ETC throttle body under detecting condition, if the idle speed is more than 200 RPM above desired idle speed for 10 sec., PCM sets P0507. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Determines if a high idle condition exists.	• Poor connection • Intake system/Vapor hoses for air leakage or disconnection • Faulty Accelerator cable • Faulty ETS motor • Faulty TPS • Faulty ETS system • Faulty PCM
Enable Conditions	• Normal Idle conditions • Canister Purge Fuel Flow ≤ 100 • Barometric Pressure > 72kPa • Engine running long enough • Air Intake Temperature • Coolant Temperature • 10V ≤ Ignition Voltage ≤ 16V • Above conditions met period • No intrumentation slew commanded • OFVC Device Control Not Active	
Thresh old value	• Real engine speed - Target engine speed >200rpm	
Diagnosis Time	• Continuous	
MIL On Condition	• 2 driving cycles	

MONITOR SCANTOOL DATA

1. Ignition "OFF"
2. Connect Scantool and Engine "ON"
3. Monitor items which affect idle rpm on scantool.

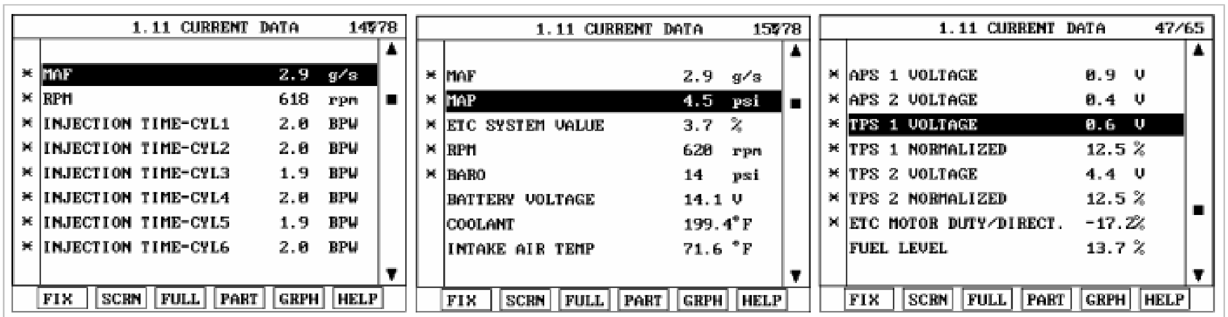


Fig. 1 Fig. 2 Fig. 3

4. Are those items on scantool displayed correctly ?

YES

▸ Go to "Terminal and Connector Inspection" procedure.

NO

▸ Check DTCs related to Mass airflow sensor(MAF),Injectors,Throttle position sensor(TPS), Purge control solenoid valve (PCSV), Acceleration position sensor(APS), Heated oxygen sensors(HO2S), ETS system
▸ Perform all repairs associated with those codes and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to " System Inspection " procedure

SYSTEM INSPECTION

1. Check intake/exhaust system for blockage
   (1) Visually/physically inspect the following items:
   - Intake system for air leakage
   - Vapor hoses for cracks or disconnection

   (2) Has a problem been found in any of the above areas?

   YES

   ▸ Replace or repair as necessary and go to "Verification of Vehicle Repair" procedure

   NO

   ▸ Go to "Visually check ETS System" as below

2. Visually check ETS System
   (1) Ignition "OFF"

   (2) Remove the air hose between MAF sensor and Throttle body.

   (3) Visually check the overall ETS system(Throttle valve,ETS motor,APS and TPS).

   (4) Has a problem been found?

   YES

   ▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Go to " Component Inspection" procedure.

COMPONENT INSPECTION

1. Check Accelerator Cable
   (1) Ignition "OFF" & Engine "OFF"

   (2) Check free play of accelerator Cable

   Specification 1.0 ~ 3.0mm(0.04 ~ 0.12 in)

   (3) Is the measured resistance within specifications?

   YES

   ▸ Go to "Check TPS" as below

   NO

   ▸ Substitute with a known-good ETS motor and check for proper operation. If the problem is corrected, replace ETS motor and then do "ETS Initialization" and go to "Verification of Vehicle Repair" procedure.

2. Check ETS motor
   (1) Ignition "OFF"

   (2) Disconnect ETS motor connector

   (3) Measure resistance between terminals "1" and "2" of the ETS motor connector.

   Specification: Approx. 1.275 ~ 1.725Ω at 20°C(68 °F)

Item	Sensor Resistance
Coll Resistance (Ω)	1.275 ~ 1.725Ω (20°C)

   (4) Are the TPS resistance within specifications?

   YES

   ▸ Go to "Check TPS" as below

   NO

   ▸ Substitute with a known-good ETS motor and check for proper operation. If the problem is corrected, replace ETS motor and then do "ETS Initialization" and go to "Verification of Vehicle Repair" procedure.

3. Check TPS
   (1) Disconnect TPS connector and measure resistance between terminals 4 and 8 of the TPS connector.

Specification : Approx. 4.0~6.0kΩ(with throttle valve fully closed) at 20°C(68°F)

(2) Disconnect TPS connector and measure resistance between terminals 1 and 5 of the TPS connector.
Specification:

Item	Sensor Resistance
TPS 1	4.0 ~ 6.0 kΩ (20°C)
TPS 2	2.72 ~ 4.08 kΩ (20°C)

(3) Are the TPS resistance within specifications?

YES

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure. If PCM needs to be replaced, do "ETS Initialization" after it is replaced.

NO

▸ Substitute with a known-good TPS and check for proper operation.If the problem is corrected, replace TPS and then do "ETS Initialization". And go to "Verification of Vehicle Repair" procedure.
※ Procedure of ETS Initialization
1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10 second)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

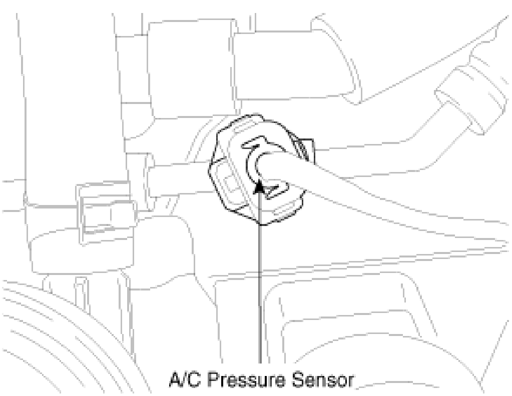
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0532

COMMPONENT LOCATION



GENERAL DESCRIPTION

A/C pressure sensor is installed betweem receiver driver and inflation valve. Sensing coolant pressure, this sensor converts pressure into voltage to input the value to PCM. With this signal, PCM performs idle control, cooling fan control, aircon compresser control.

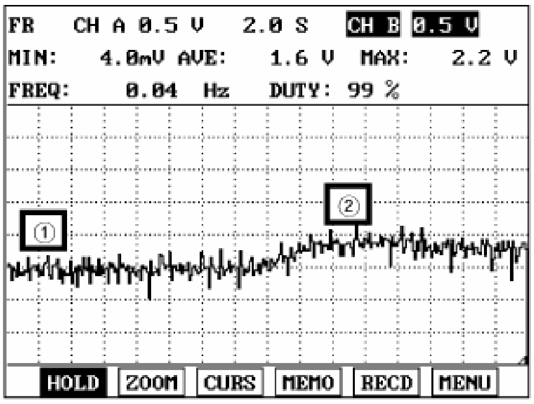
DTC DESCRIPTION

Checking output signals from A/C pressure sensor every 25 sec. under detecting condition, if an signal below 0.05V lasts for more than 12.5 sec., PCM sets P0532.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects sensor signal short to low voltage	• Poor connection • Open in power circuit • Open or short to ground in signal circuit • Faulty A/C pressure sensor • Faulty PCM
Enable Conditions	• Engine works	
Thresh old value	• Sensor output voltage< 0.05V	
Diagnosis Time	• Continuous (More than 12.5 seconds failure for every 25 seconds test)	
MIL On Condition	• DTC only (NO MIL ON)	

SIGNAL WAVEFORM AND DATA



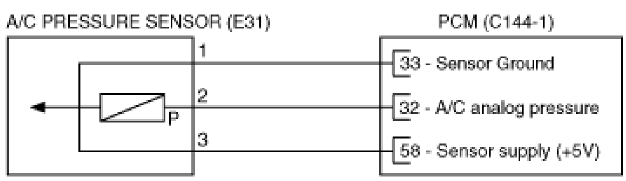
① - A/C OFF & idle state
② - A/C ON & idle state

SPECIFICATION

Pressure(psi)	14.7	56.7	250	439.7	465
Voltage(V)	0.203	0.629	2.633	4.649	4.8

SCHEMATIC DIAGRAM

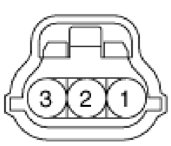
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

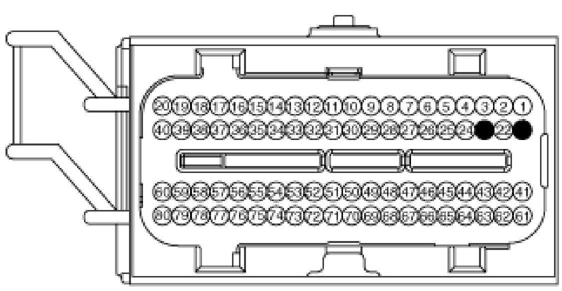
Terminal	Connected to	Function
1	PCM C144-1 (33)	Sensor Ground
2	PCM C144-1 (32)	A/C analog pressure
3	PCM C144-1 (58)	Sensor supply (+5V)

[HARNESS CONNECTOR]



E31

A/C PRESSURE SENSOR



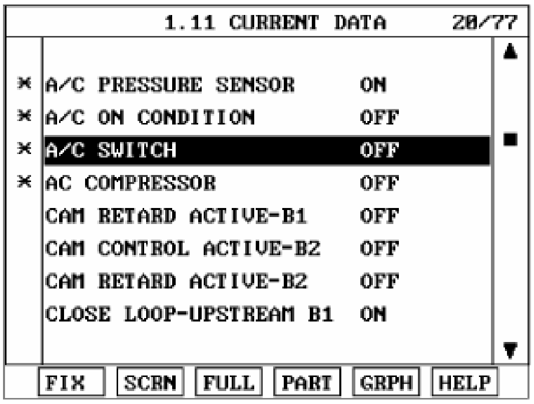
C144-1

PCM

MONITOR SCANTOOL DATA

1. Ignition "OFF"
2. Connect Scantool and Engine "ON"
3. Check whether Air-Con pressure is rising during acceclerating.

Fig : A/C - OFF



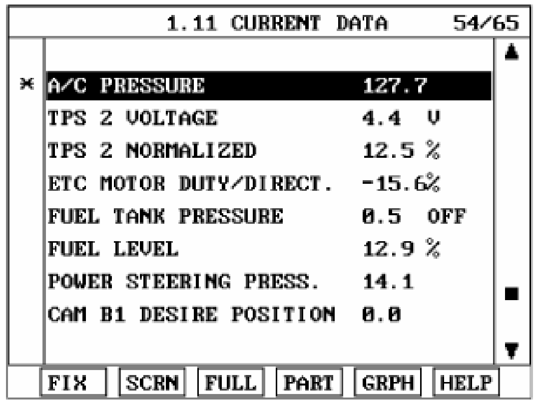
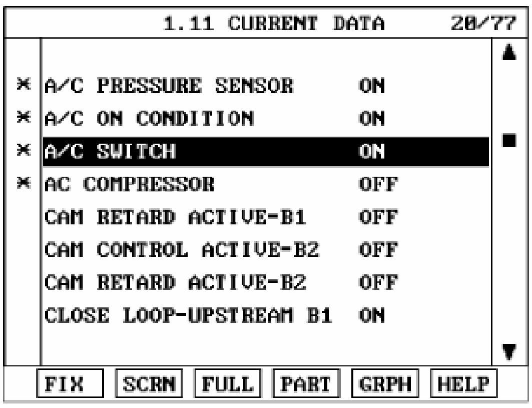


Fig : A/C Switch - ON



4. Are those items on scantool displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

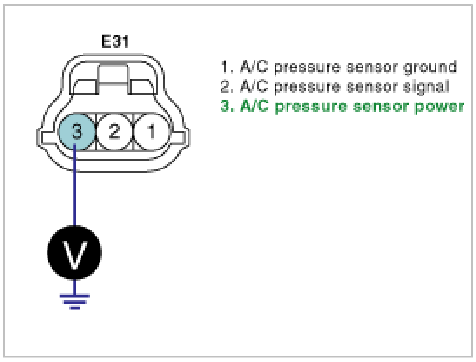
NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. Key "OFF".
2. Disconnect the A/C pressure sensor connector.
3. Key "ON".
4. Measure the voltage between terminal 3 of A/C pressure sensor harness connector and chassis ground.

Specification : approx. 5V



5. Is the measured voltage within specification ?

YES

▸ Go to "Signal circuit inspection" procedure.

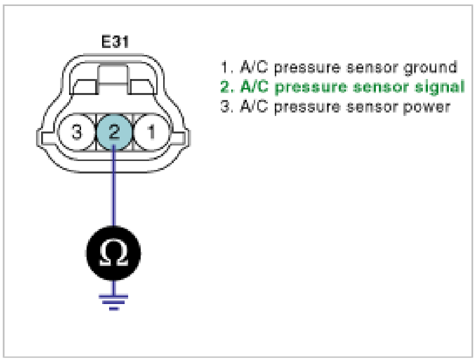
NO

▸ Repair Open or Short to ground in A/C pressure sensor power circuit and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check short to ground inspection
   (1) Key "OFF".
   (2) Disconnect A/C pressure sensor and PCM connector.
   (3) Measure the resistance between terminal 2 of A/C pressure sensor harness connector and chassis ground.

   Specification : Infinite



   (4) Is the measured resistance within specification ?

   YES

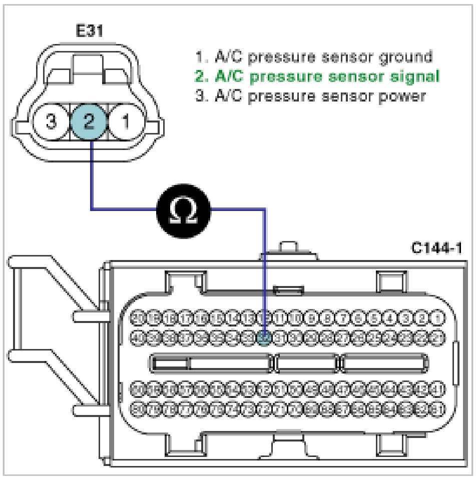
   ▸ Go to "Check open in harness" procedure.

   NO

   ▸ Repair Short to ground in A/C pressure sensor signal circuit and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness
   (1) Key "OFF".
   (2) Disconnect A/C pressure sensor and PCM connector.
   (3) Measure the resistance between terminal 2 of A/C pressure sensor harness connector and terminal 32/C144-1 of PCM harness connector.

   Specification : Approx. below 1Ω



(4) Is the measured resistance within specification ?

YES

▸ Go to "Component inspection" procedure.

NO

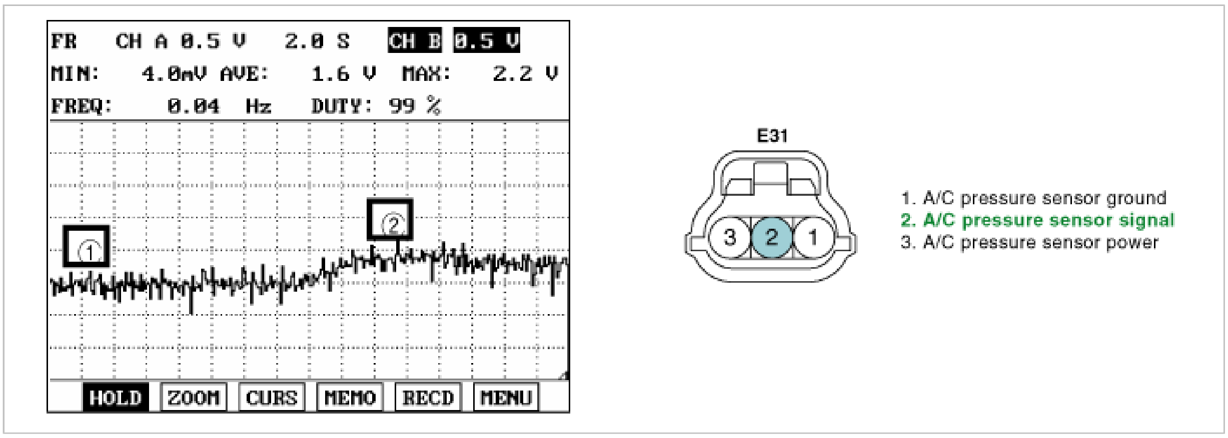
▸ Repair Open in A/C pressure signal circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. A/C pressure sensor inspection
   (1) Key "OFF" and connect the scantool.
   (2) Connect the probe to A/C pressure sensor signal and select the oscilloscope in the menu.
   (3) Check the waveform with acceleration and deceleration after engine start.

Specification :

Pressure(psi)	14.7	56.7	250	439.7	465
Voltage(V)	0.203	0.629	2.633	4.649	4.8



(4) Is the measured waveform of A/C pressure sensor normal?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good A/C pressure sensor and check for proper operation. If the problem is corrected, replace A/C pressure sensor and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

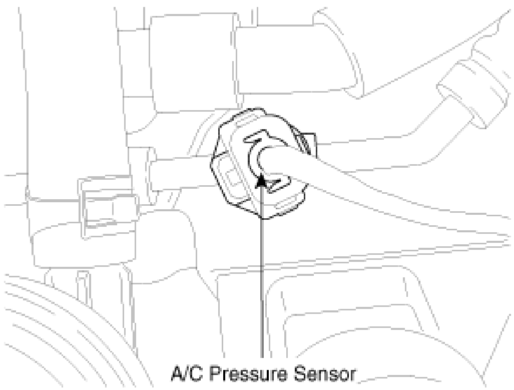
▸ Go to the applicable troubleshooooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0533

COMMPONENT LOCATION



GENERAL DESCRIPTION

A/C pressure sensor is installed betweem receiver driver and inflation valve. Sensing coolant pressure, this sensor converts pressure into voltage to input the value to PCM. With this signal, PCM performs idle control, cooling fan control, aircon compresser control.

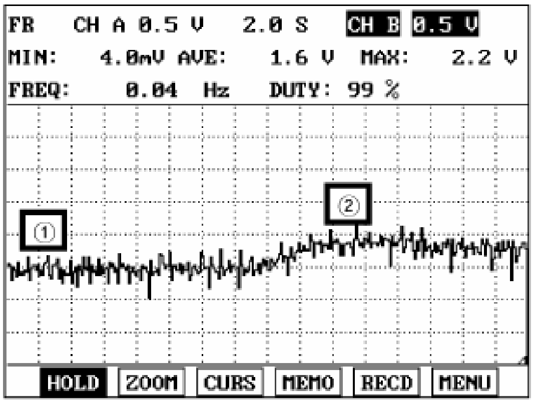
DTC DESCRIPTION

Checking output signals from A/C pressure sensor every 25 sec. under detecting condition, if an signal above 4.65V lasts for more than 12.5 sec., PCM sets P0533.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects sensor signal short to high voltage	• Poor connection • Short in signal circuit • Open in ground circuit • Faulty A/C pressure sensor • Faulty PCM
Enable Conditions	• Engine works	
Thresh old value	• Sensor output voltage< 4.65V	
Diagnosis Time	• Continuous (More than 12.5 seconds failure for every 25 seconds test)	
MIL On Condition	• DTC only (NO MIL ON)	

SIGNAL WAVEFORM AND DATA



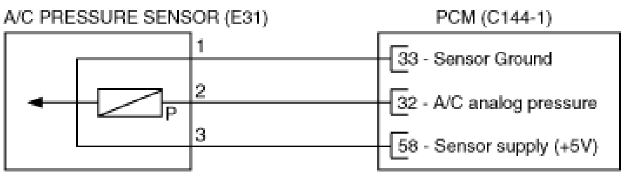
① - A/C OFF & idle state
② - A/C ON & idle state

SPECIFICATION

Pressure(psi)	14.7	56.7	250	439.7	465
Voltage(V)	0.203	0.629	2.633	4.649	4.8

SCHEMATIC DIAGRAM

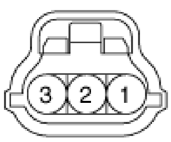
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

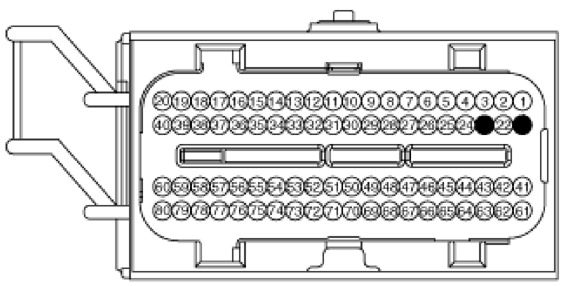
Terminal	Connected to	Function
1	PCM C144-1 (33)	Sensor Ground
2	PCM C144-1 (32)	A/C analog pressure
3	PCM C144-1 (58)	Sensor supply (+5V)

[HARNESS CONNECTOR]



E31

A/C PRESSURE SENSOR



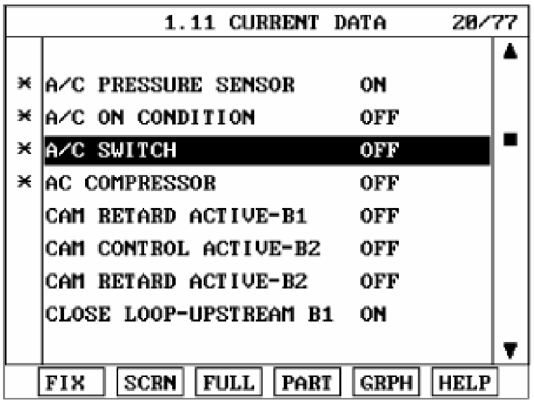
C144-1

PCM

MONITOR SCANTOOL DATA

1. Ignition "OFF"
2. Connect Scantool and Engine "ON"
3. Check whether Air-Con pressure is rising during accclerating.

Fig : A/C - OFF



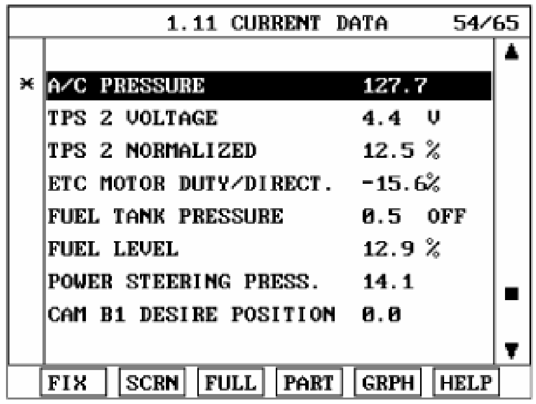
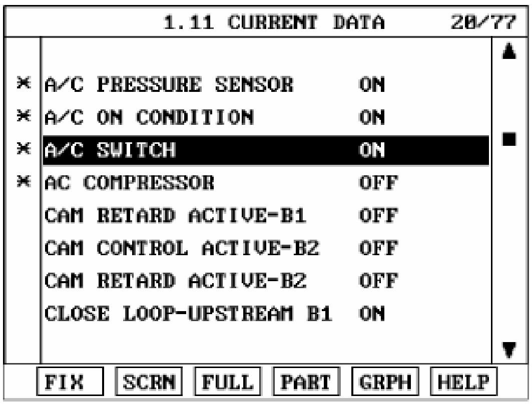


Fig : A/C Switch - ON



4. Are those items on scantool displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

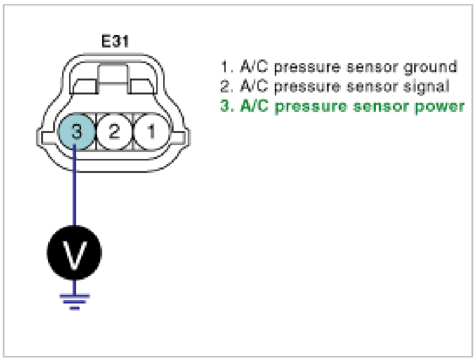
NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. Key "OFF".
2. Disconnect the A/C pressure sensor connector.
3. Key "ON".
4. Measure the voltage between terminal 3 of A/C pressure sensor harness connector and chassis ground.

Specification : approx. 5V



5. Is the measured voltage within specification ?

YES

▸ Go to "Ground inspection" procedure.

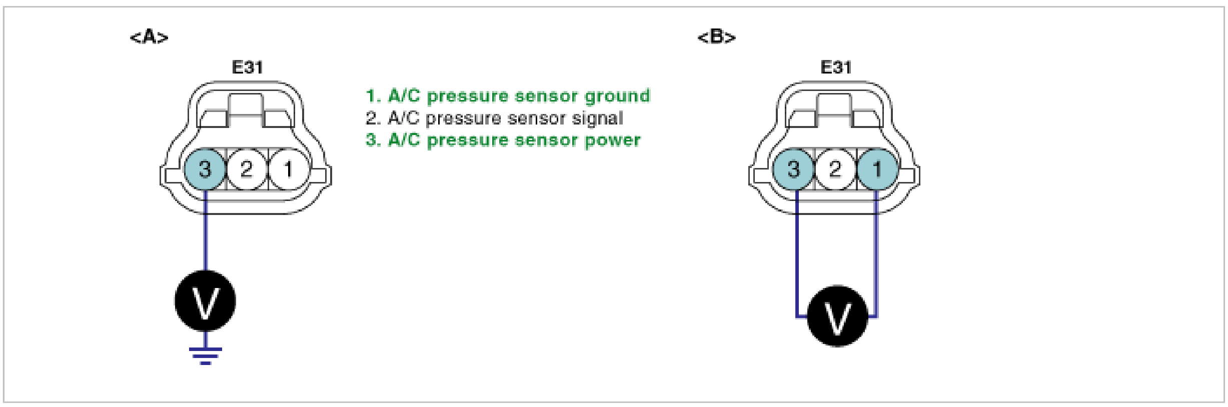
NO

▸ Repair Open in power circuit and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. Key "OFF".
2. Disconnect the A/C pressure sensor connector.
3. Key "ON".
4. Measure the voltage between terminal 3 of A/C pressure sensor harness connector and chassis ground. (Fig A)
5. Measure the voltage between terminal 3 and terminal 1 of A/C pressure sensor harness connector. (Fig B)

Specification : The Difference between "A" and "B" is below 200mV.



6. Is the measured voltage within specification ?

YES

▸ Go to "Signal circuit inspection" procedure.

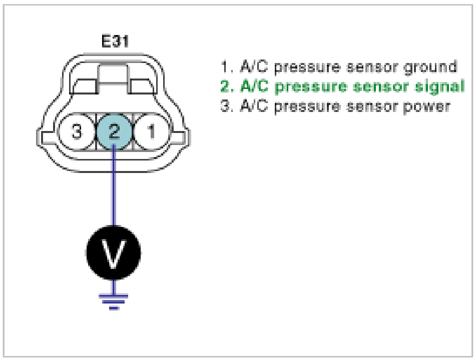
NO

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Voltage inspection
   (1) Key "OFF".
   (2) Disconnect the A/C pressure sensor connector.
   (3) Key "ON".
   (4) Measure the voltage between terminal 2 of A/C pressure sensor harness connector and chassis ground.

   Specification : Approx. 0V



(5) Is the measured voltage within specification ?

YES

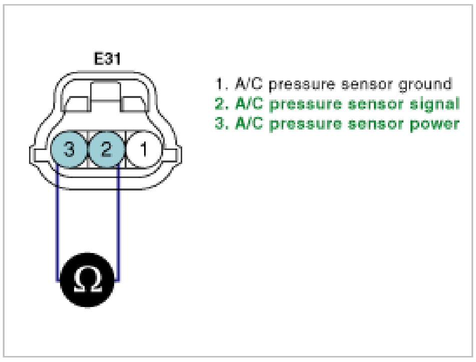
▸ Go to "Component inspection" procedure.

NO

▸ Go to "Short in circuit inspection" procedure.

2. Short in circuit inspection
   (1) Key "OFF".
   (2) Disconnect A/C pressure sensor connector and PCM connector.
   (3) Measure the resistance between terminal 2 and terminal 3 of A/C pressure sensor harness connector.

Specification : Infinite



(4) Is the measured resistance within specification ?

YES

▸ Go to "Component inspection" procedure.

NO

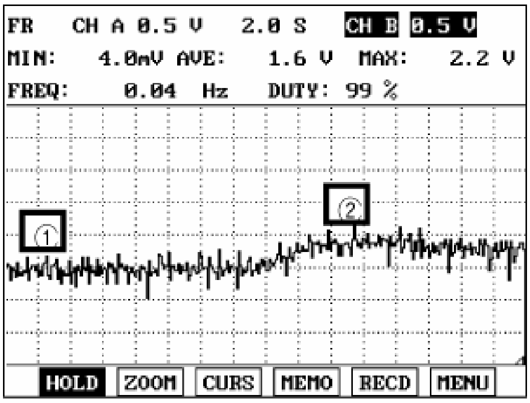
▸ Repair Short in signal circuit and go to "Verification of Vehicle Repair" procedure.

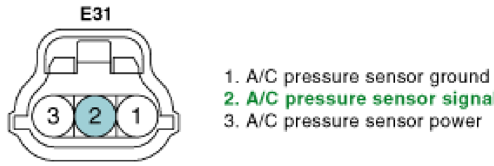
COMPONENT INSPECTION

1. A/C pressure sensor inspection
   (1) Key "OFF" and connect the scantool.
   (2) Connect the probe to A/C pressure sensor signal and select the oscilloscope in the menu.
   (3) Check the waveform with acceleration and deceleration after engine start.

Specification :

Pressure(psi)	14.7	56.7	250	439.7	465
Voltage(V)	0.203	0.629	2.633	4.649	4.8





(4) Is the measured waveform of A/C pressure sensor normal?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good A/C pressure sensor and check for proper operation. If the problem is corrected, replace A/C pressure sensor and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

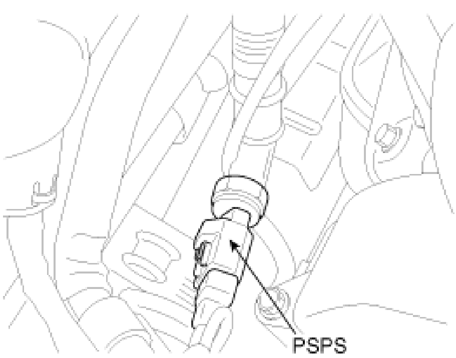
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0552

COMMPONENT LOCATION



GENERAL DESCRIPTION

To reduce the required power to manipulate steering wheel, hydraulic pressure is used in power steering system. A load is sensed at steering oil pressure sensor then inputted to PCM as a wheel position signal. Controlling idle speed valve, PCM performs appropriate electric load correction With this signal.

DTC DESCRIPTION

Checking output signals from P/S PS(power steering pressure sensor) every 2.5 sec. under detecting condition, if an signal below 0.05V lasts for more than 1.25 sec., PCM sets P0552. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

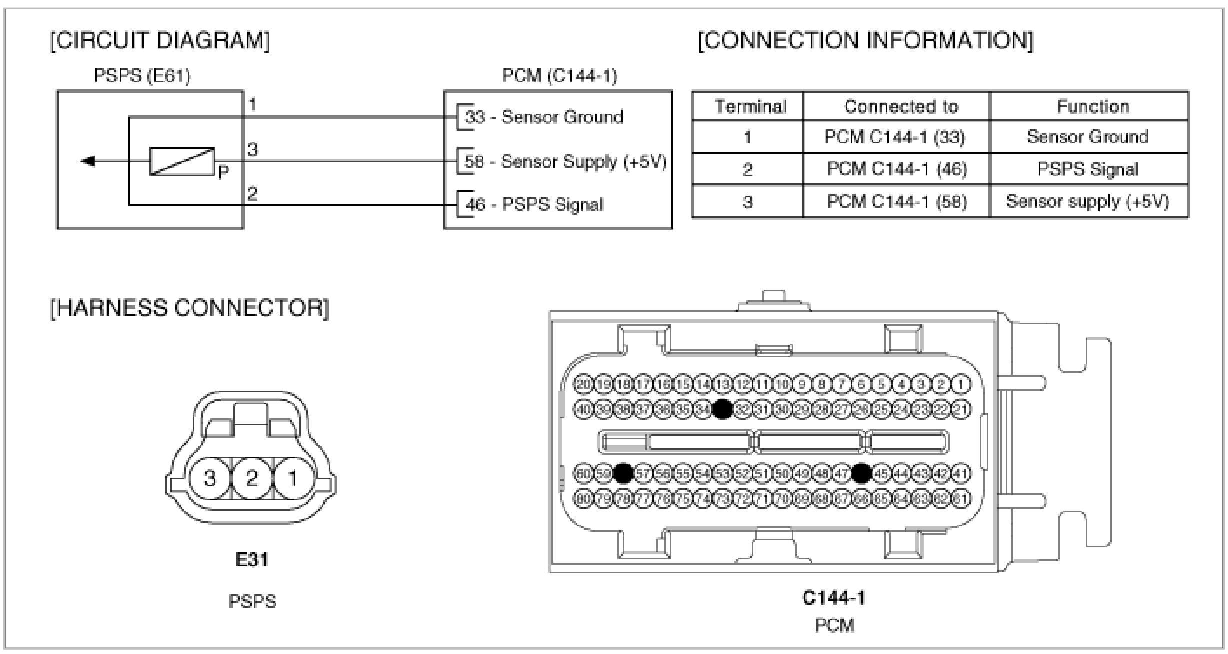
DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects sensor signal short to low voltage	• Poor connection • Open in power circuit • Open or short to ground in signal circuit • Faulty P/S pressure sensor • Faulty PCM
Enable Conditions	• Engine works • 11V ≤ Battery voltage ≤ 16V	
Thresh old value	• Sensor output voltage< 0.25V	
Diagnosis Time	• Continuous (More than 1.25 seconds failure for every 2.5 seconds test)	
MIL On Condition	• 2 driving cycles	

SPECIFICATION

Pressure(Kgf/cm²)	37.9	41.3	68.8	96.4
Voltage(V)	1	2	3	4

SCHEMATIC DIAGRAM



MONITOR SCANTOOL DATA

1. Ignition "OFF"
2. Connect Scantool and Engine "ON"
3. Check whether steering pressure is rising during operating. (Keep the idling status)

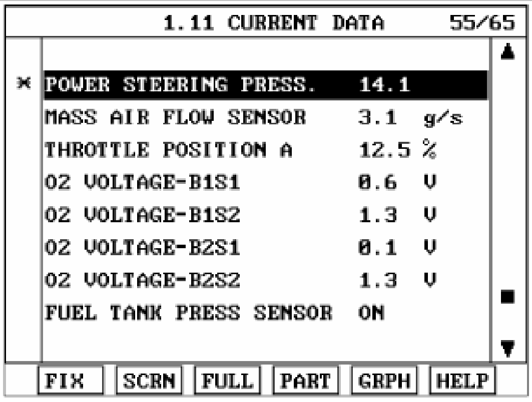


Fig.1

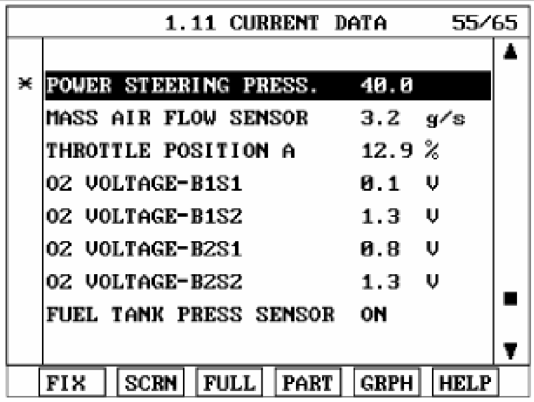


Fig.2

Fig1) Data with not turning steering wheel at idle
Fig2) Data with turning steering wheel at idle

4. Is the current data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

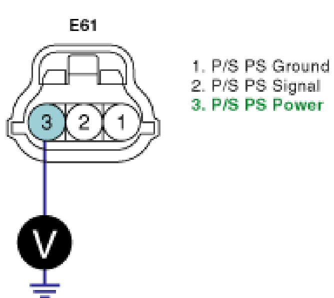
NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. Key "OFF".
2. Disconnect the P/S pressure sensor connector.
3. Key "ON".
4. Measure the voltage between terminal 3 of P/S pressure sensor harness connector and chassis ground.

Specification : approx. 5V



5. Is the measured voltage within specification ?

YES

▸ Go to "Signal circuit inspection" procedure.

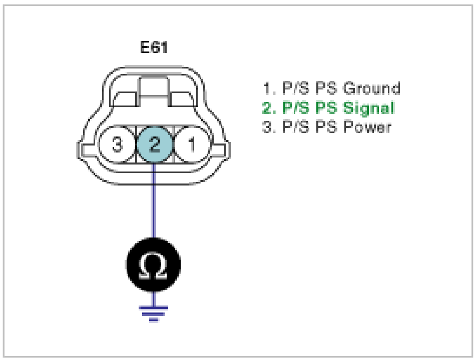
NO

▸ Repair Open in power circuit and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check short to ground inspection
   (1) Key "OFF".
   (2) Disconnect P/S pressure sensor connector and PCM connector.
   (3) Measure the resistance between terminal 2 of P/S pressure sensor harness connector and chassis ground.

Specification : Infinite



   (4) Is the measured resistance within specification ?

YES

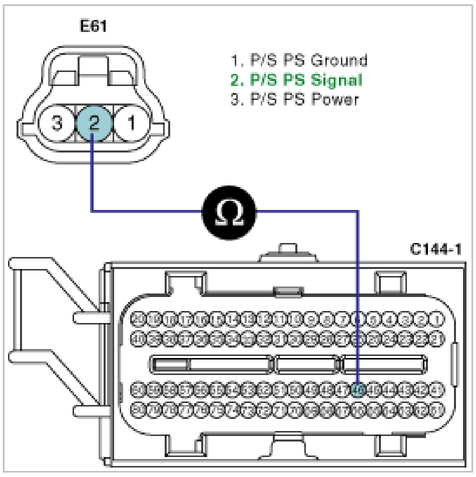
▸ Go to "Check open in harness" procedure.

NO

▸ Repair Short to ground in signal circuit and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness
   (1) Key "OFF".
   (2) Disconnect P/S pressure sensor connector and PCM connector.
   (3) Measure the resistance between terminal 2 of P/S pressure sensor harness connector and terminal 46 of PCM connector.

Specification : Approx. below 1Ω



   (4) Is the measured resistance within specification ?

YES

▸ Go to "Component inspection" procedure.

NO

▸ Repair Open in signal circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. P/S pressure sensor inspection

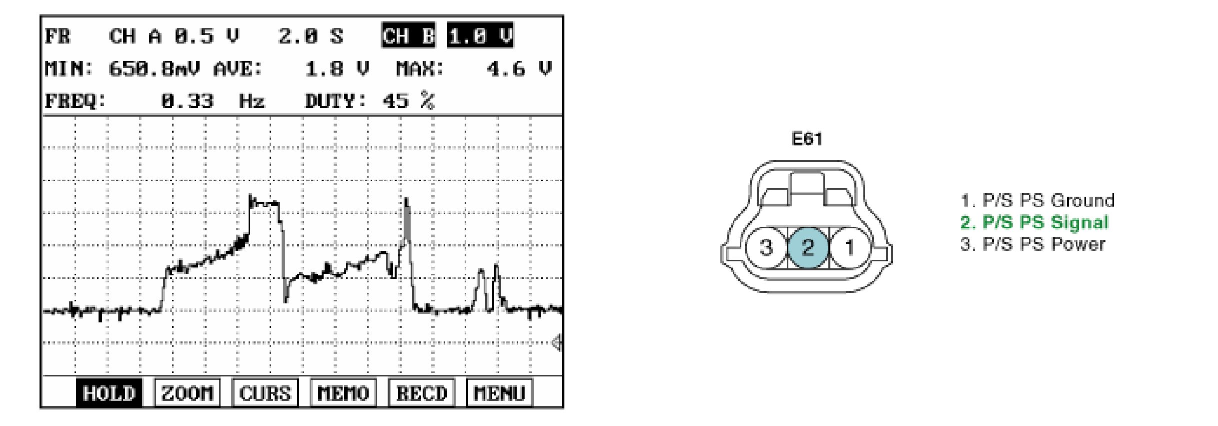
(1) Key "OFF" and connect the scantool.

(2) Connect the probe to signal line of P/S pressure sensor and select the oscilloscope in menu.

(3) Check the waveform with steering handle movement after engine start.

Specification :

Pressure(Kgf/cm²)	37.9	41.3	68.8	96.4
Voltage(V)	1	2	3	4



(4) Is the measured waveform of P/S pressure sensor normal?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good P/S pressure sensor and check for proper operation. If the problem is corrected, replace P/S pressure sensor and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

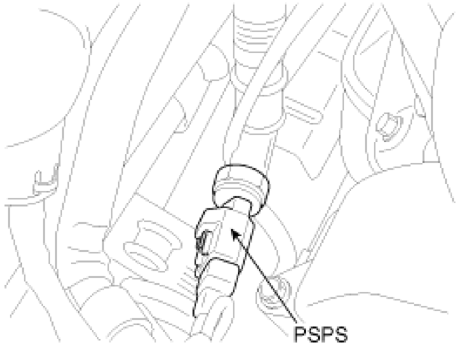
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0553

COMMPONENT LOCATION



GENERAL DESCRIPTION

To reduce the required power to manipulate steering wheel, hydraulic pressure is used in power steering system. A load is sensed at steering oil pressure sensor then inputted to PCM as a wheel position signal. Controlling idle speed valve, PCM performs appropriate electric load correction With this signal.

DTC DESCRIPTION

Checking output signals from P/S PS(power steering pressure sensor) every 2.5 sec. under detecting condition, if an signal below 0.05V lasts for more than 1.25 sec., PCM sets P0552. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects sensor signal short to low voltage	• Poor connection • Short in signal circuit • Open in ground circuit • Faulty P/S pressure sensor • Faulty PCM
Enable Conditions	• Engine works • 11V ≤ Battery voltage ≤ 16V	
Thresh old value	• Sensor output voltage >4.65V	
Diagnosis Time	• Continuous (More than 1.25 seconds failure for every 2.5 seconds test)	
MIL On Condition	• 2 driving cycles	

SPECIFICATION

Pressure(Kgf/cm²)	37.9	41.3	68.8	96.4
Voltage(V)	1	2	3	4

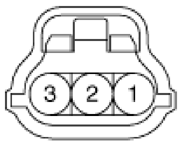
SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]

[CONNECTION INFORMATION]

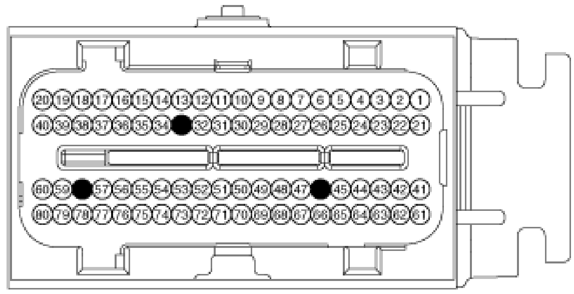
Terminal	Connected to	Function
1	PCM C144-1 (33)	Sensor Ground
2	PCM C144-1 (46)	PSPS Signal
3	PCM C144-1 (58)	Sensor supply (+5V)

[HARNESS CONNECTOR]



E31

PSPS



C144-1

PCM

MONITOR SCANTOOL DATA

1. Ignition "OFF"
2. Connect Scantool and Engine "ON"
3. Check whether steering pressure is rising during operating. (Keep the idling status)

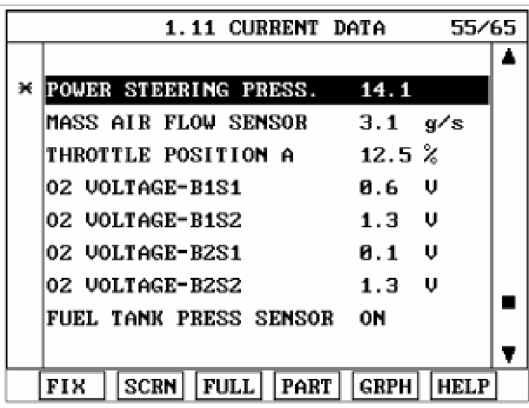


Fig.1

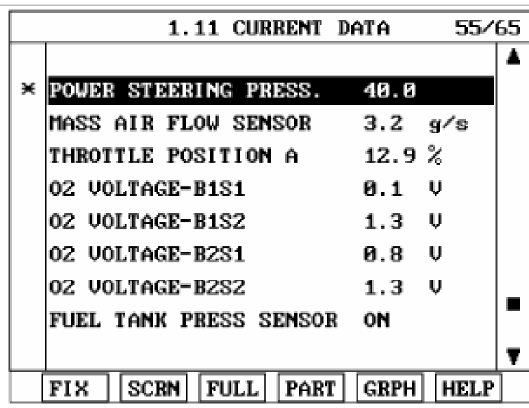


Fig.2

Fig1) Data with not turning steering wheel at idle
Fig2) Data with turning steering wheel at idle

4. Are those items on scantool displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

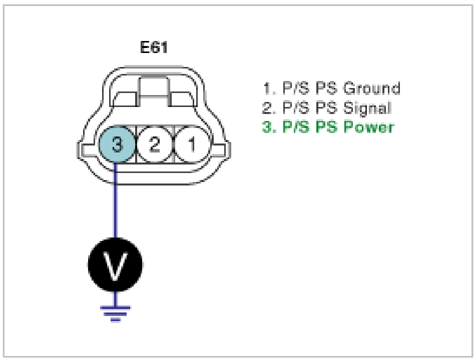
NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. Key "OFF".
2. Disconnect the P/S pressure sensor connector.
3. Key "ON".
4. Measure the voltage between terminal 3 of P/S pressure sensor harness connector and chassis ground.

Specification : approx. 5V



5. Is the measured voltage within specification ?

YES

▸ Go to "Ground circuit inspection" procedure.

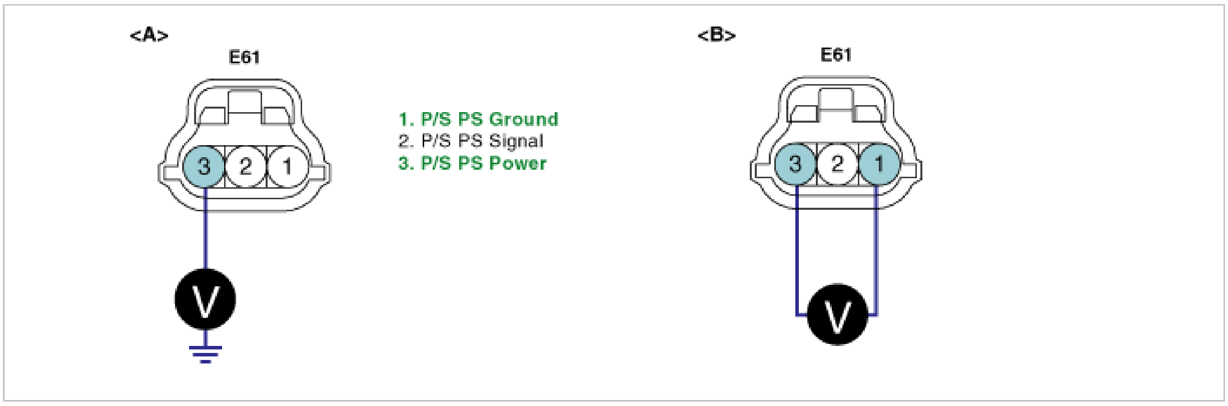
NO

▸ Repair Short in power circuit and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. Key "OFF".
2. Disconnect the P/S pressure sensor connector.
3. Key "ON"
4. Measure the voltage between terminal 3 of P/S pressure sensor harness connector and chassis ground. (Fig A)
5. Measure the voltage between terminal 3 and terminal 1 of P/S pressure sensor harness connector. (Fig B)

Specification : The Difference between "A" and "B" is below 200mV.



6. Is the measured voltage within specification ?

YES

▸ Go to "Signal circuit inspection" procedure.

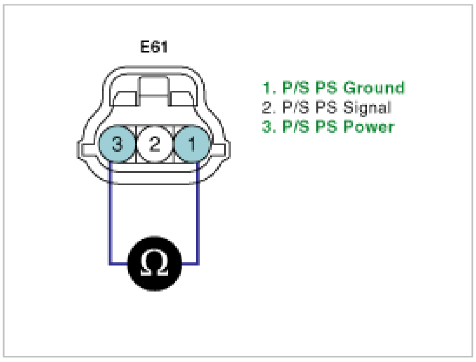
NO

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check short in harness
   (1) Key "OFF".
   (2) Disconnect P/S pressure sensor connector and PCM connector.
   (3) Measure the resistance between terminal 2 and terminal 3 of P/S pressure sensor harness connector.

Specification : Infinite



   (4) Is the measured resistance within specification ?

YES

▸ Go to "Component inspection" procedure.

NO

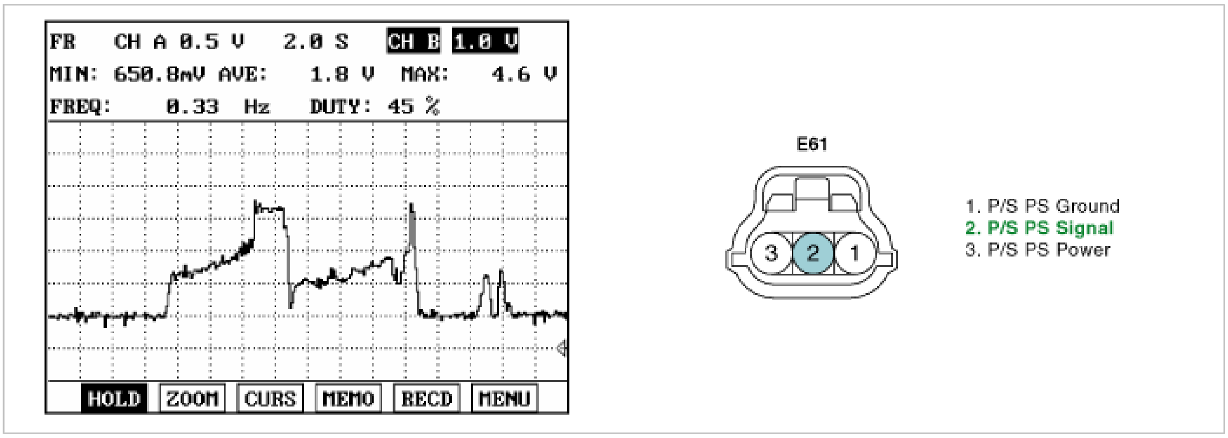
▸ Repair Short in signal circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. P/S pressure sensor inspection
   (1) Key "OFF" and connect the scantool.
   (2) Connect the probe to signal line of P/S pressure sensor and select the oscilloscope in menu.
   (3) Check the waveform with steering handle movement after engine start.

Specification :

Pressure(Kgf/cm²)	37.9	41.3	68.8	96.4
Voltage(V)	1	2	3	4



   (4) Is the measured waveform of P/S pressure sensor normal?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good P/S pressure sensor and check for proper operation. If the problem is corrected, replace P/S pressure sensor and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

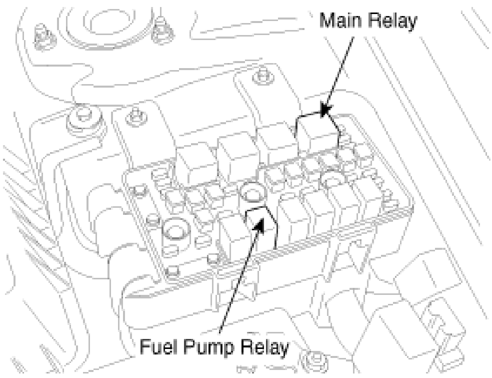
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0562

COMMPONENT LOCATION



GENERAL DESCRIPTION

The purpose of the System Voltage is to detect an excessively low or high system voltage that may be caused by a malfunctioning charging system.

DTC DESCRIPTION

System Voltage is the ignition voltage potential at the Powertrain Control Module (PCM).PCM measures and compares voltage from ignition key and each relay. With this mechanism, PCM knows if the main relay switch turns on after IG on or if turns OFF after IG off.
During engine running, if battery voltage is below 11V, PCM sets P0562. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

DTC DETECTING CONDITION

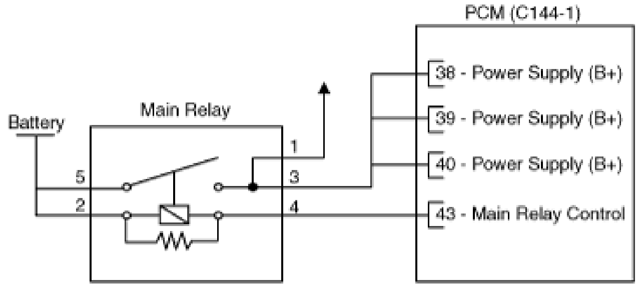
Item	Detecting Condition	Possible cause
DTC Strategy	• Detects circuit short to low voltage	• Poor connection • Open in power circuit • Faulty charging system • Faulty main relay • Faulty PCM
Enable Conditions	• Engine works • 11V ≤ Battery voltage ≤ 16V	
Thresh old value	• Battery voltage< 11V	
Diagnosis Time	• Continuous (More than 37.5 seconds failure for every 45 seconds test)	
MIL On Condition	• 2 driving cycles	

SPECIFICATION

Coil Resistance	70Ω ~ 120Ω

SCHEMATIC DIAGRAM

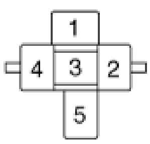
[CIRCUIT DIAGRAM]



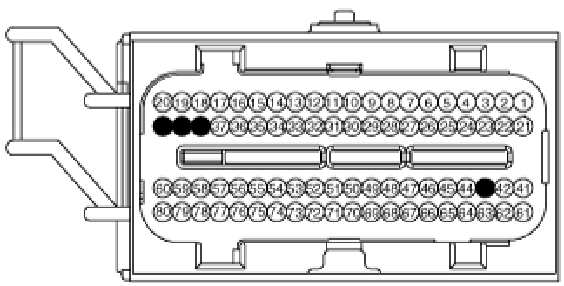
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	-	Power Supply (B+)
2	Battery	Battery Power (B+)
3	PCM C144-1 (38)	Power Supply (B+)
	PCM C144-1 (39)	
	PCM C144-1 (40)	
4	PCM C144-1 (43)	Main Relay Control
5	Battery	Battery Power (B+)

[HARNESS CONNECTOR]



Main Relay



C144-1
PCM

MONITOR SCANTOOL DATA

1. Ignition "OFF"
2. Connect Scantool and Engine "ON"
3. Monitor "Main Relay" parameter on Current Data
4. Is the "Main Relay" parameter displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by

interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

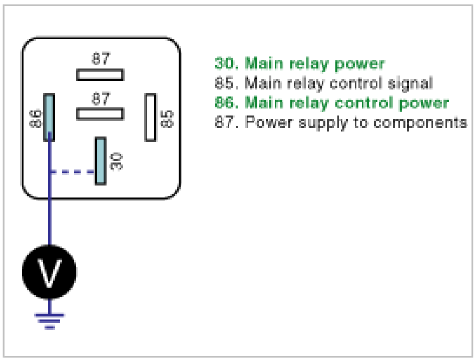
NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. Power circuit inspection
   (1) Key "OFF".
   (2) Disconnect the main relay connector.
   (3) Key "ON".
   (4) Measure the voltage between terminal 2 of main relay harness connector and chassis ground.
   (5) Measure the voltage between terminal 5 of main relay harness connector and chassis ground.

Specification : B+



   (6) Is the measured voltage within specification ?

YES

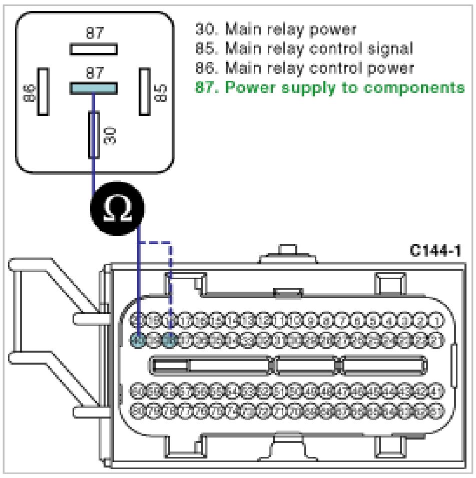
▸ Go to "Check open in harness" procedure.

NO

▸ Check the fuse between battery and main relay.
▸ Repair Open or Short to ground in power circuit and go to "Verification of Vehicle Repair" procedure

2. Check open in harness
   (1) Key "OFF".
   (2) Disconnect main relay and PCM connector.
   (3) Measure the resistance between terminal 3 of main relay harness connector and terminals 38,40 of PCM connector.

Specification : Approx. below 1Ω



(4) Is the measured resistance within specification ?

YES

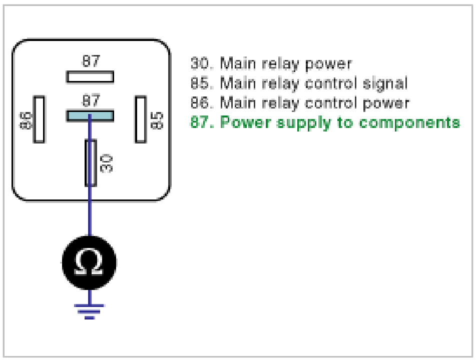
▸ Go to "Check short in harness" procedure.

NO

▸ Repair open in harness and go to "Verification of Vehicle Repair" procedure .

3. Check short in harness
   (1) Key "OFF".
   (2) Disconnect main relay and PCM connector.
   (3) Measure the resistance between terminal 3 of main relay harness connector and chassis ground.

Specification : Infinite



(4) Is the measured resistance within specification ?

YES

▸ Go to "Control circuit inspection" procedure.

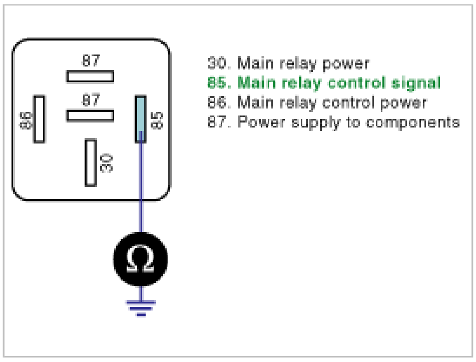
NO

▸ Repair short in harness and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check short in harness
   (1) Key "OFF".
   (2) Disconnect main relay and PCM connector.
   (3) Measure the resistance between terminal 4 of main relay harness connector and chasses ground.

Specification : Infinite



(4) Is the measured resistance within specification ?

YES

▸ Go to "Check open in harness" procedure.

NO

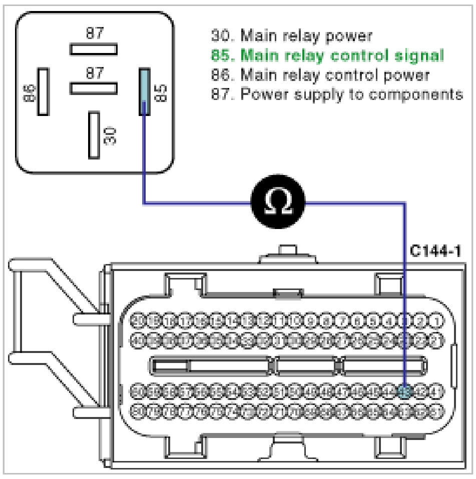
(5) ▸ Repair short in control harness and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness
   (1) Key "OFF".

(2) Disconnect main relay and PCM connector.

(3) Measure the resistance between terminal 4 of main relay harness connector and terminal 43 of PCM connector.

Specification : Approx. below 1Ω



(4) Is the measured resistance within specification ?

YES

▸ Go to "Ground circuit inspection" procedure.

NO

▸ Repair Open in control harness and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

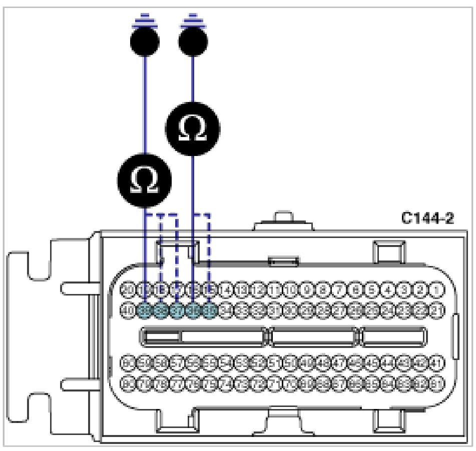
1. Open in circuit inspection
   (1) Key "OFF".

   (2) Disconnect PCM connector.

   (3) Measure the resistance between terminals 35,36 of PCM(C144-2) connector and chassis ground.

   (4) Measure the resistance between terminals 37,38,39 of PCM(C144-2) connector and chassis ground.

Specification : Approx. blow 1Ω



(5) Is the measured resistance within specification ?

YES

▸ Go to "System inspection" procedure.

NO

▸ Repair Open in control harness and go to "Verification of Vehicle Repair" procedure.

SYSTEM INSPECTION

1. Check Alternator circuit

(1) Key "OFF".

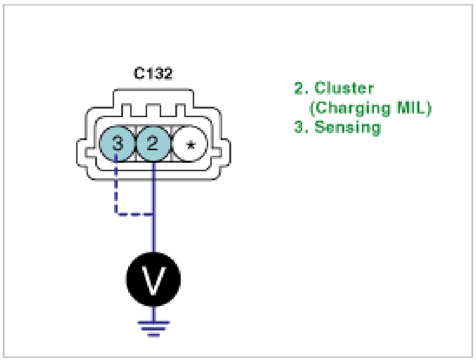
(2) Disconnect alternator connector.

(3) Key "ON".

(4) Measure the voltage between terminal 2 of alternator and chassis gound.

(5) Measure the voltage between terminal 3 of alternator and chassis gound.

Specification : B+



(6) Is the measured voltage within specification?

YES

▸ Go to "Component inspection" procedure.

NO

▸ In case terminal 2 : Repair MIL circuit, MIL resistor or Open in circuit and go to "Verification of Vehicle Repair" procedure.
▸ In case terminal 3 : Repair the fuse(30A IG2) between battery and Ignition switch, the fuse(10A IG3) between Ignition switch and alternator or Open in circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Main relay inspection

(1) Key "OFF".

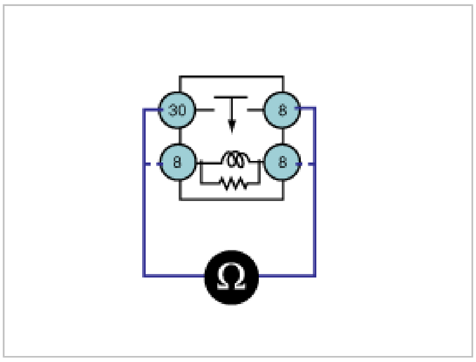
(2) Disconnect the main relay.

(3) Measure the resistance between terminal 3 and 5 of main relay.

(4) Measure the resistance between terminal 2 and 4 of main relay.

Specification : 70 ~ 120Ω

Terminal	Power approval
3 ~ 5	NO
2 ~ 4	YES (Approx. 70Ω ~ 120Ω)



(5) Is the measured resistance within specification ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good Main relay and check for proper operation. If the problem is corrected, replace Main relay and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

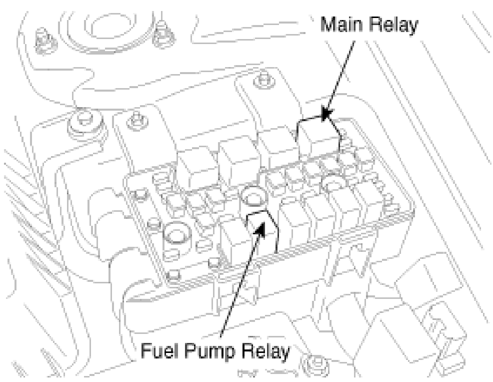
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0563

COMMPONENT LOCATION



GENERAL DESCRIPTION

The purpose of the System Voltage is to detect an excessively low or high system voltage that may be caused by a malfunctioning charging system.

DTC DESCRIPTION

System Voltage is the ignition voltage potential at the Powertrain Control Module (PCM).PCM measures and compares voltage from ignition key and each relay. With this mechanism, PCM knows if the main relay switch turns on after IG on or if turns OFF after IG off.
During engine running, if battery voltage is below 16V, PCM sets P0563. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects circuit short to high voltage	• Poor connection • Short in circuit • Faulty charging system
Enable Conditions	• Engine works	
Thresh old value	• Battery voltage >16V	

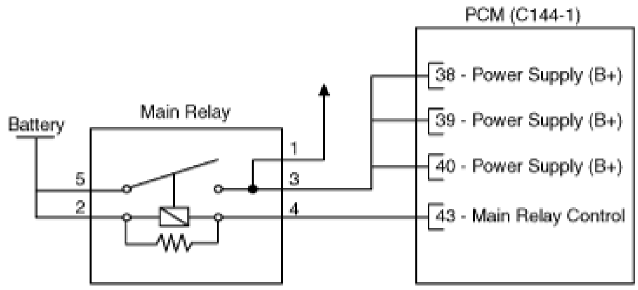
Diagnosis Time	• Continuous (More than 37.5 seconds failure for every 45 seconds test)	• Faulty main relay • Faulty PCM
MIL On Condition	• 2 driving cycles	

SPECIFICATION

Coil Resistance	70Ω ~ 120Ω

SCHEMATIC DIAGRAM

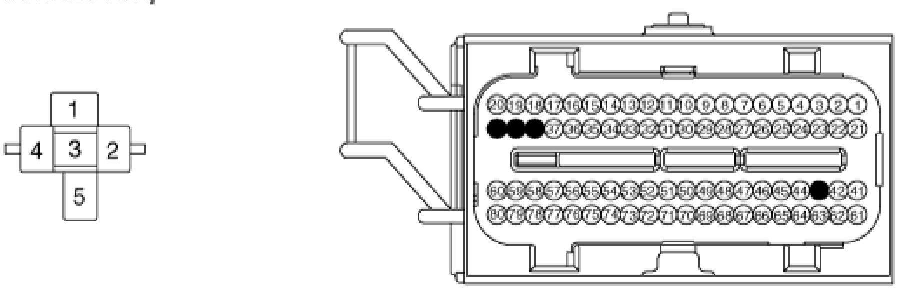
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	-	Power Supply (B+)
2	Battery	Battery Power (B+)
3	PCM C144-1 (38)	Power Supply (B+)
	PCM C144-1 (39)	
	PCM C144-1 (40)	
4	PCM C144-1 (43)	Main Relay Control
5	Battery	Battery Power (B+)

[HARNESS CONNECTOR]



Main Relay

C144-1
PCM

MONITOR SCANTOOL DATA

1. Ignition "OFF"
2. Connect Scantool and Engine "ON"
3. Monitor "Main Relay" parameter on Current Data
4. Is the "Main Relay" parameter displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

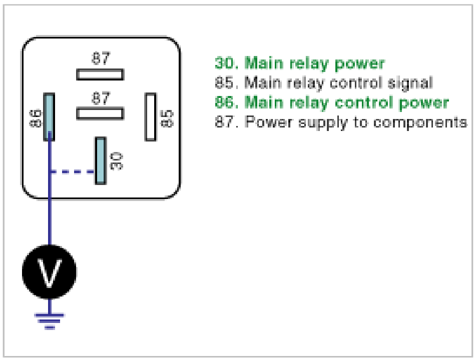
NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. Power circuit inspection
   (1) Key "OFF".
   (2) Disconnect the main relay connector.
   (3) Key "ON".
   (4) Measure the voltage between terminal 2 of main relay harness connector and chassis ground.
   (5) Measure the voltage between terminal 5 of main relay harness connector and chassis ground.

   Specification : B+



   (6) Is the measured voltage within specification ?

   YES

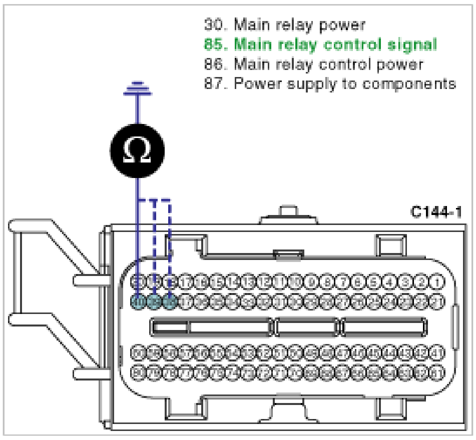
   ▸ Go to "Check short in harness" procedure.

   NO

   ▸ Repair Short in power harness and go to "Verification of Vehicle Repair" procedure.

2. Check short in harness
   (1) Key "ON".
   (2) Measure the voltage between terminal 38, 40 of PCM harness terminal and chassis ground.

   Specification : B+



(3) Is the measured voltage within specification ?

YES

▸ Go to "System inspection" procedure.

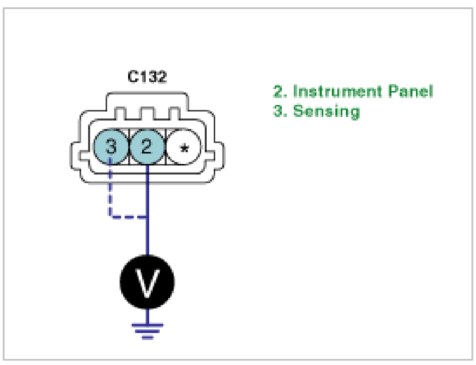
NO

▸ Repair short in power harness and go to "Verification of Vehicle Repair" procedure .

SYSTEM INSPECTION

1. Check Alternator circuit
   (1) Key "OFF".
   (2) Disconnect alternator connector.
   (3) Key "ON".
   (4) Measure the voltage between terminal 2 of alternator and chassis gound.
   (5) Measure the voltage between terminal 3 of alternator and chassis gound.

Specification : B+



(6) Is the measured voltage within specification?

YES

▸ Go to "Component inspection" procedure.

NO

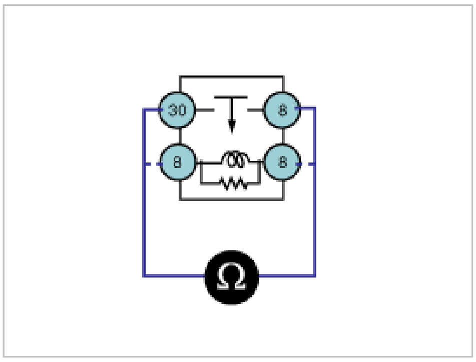
▸ Repair short in Sensing circuit or MIL circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Main relay inspection
   (1) Key "OFF".
   (2) Disconnect the main relay.
   (3) Measure the resistance between terminal 3 and 5 of main relay.
   (4) Measure the resistance between terminal 2 and 4 of main relay.

Specification : 70 ~ 120Ω

Terminal	Power approval
3 ~ 5	NO
2 ~ 4	YES (Approx. 70Ω ~ 120Ω)



(5) Is the measured resistance within specification ?

YES

▸ Go to "Check Alternator" procedure.

NO

▸ Substitute with a known - good Main relay and check for proper operation. If the problem is corrected, replace Main relay and go to "Verification of Vehicle Repair" procedure.

2. Check Alternator
   (1) Key "OFF".
   (2) Check the tension of the belt.
   (3) Check Battery terminal and Alternator B+ terminal for looseness, corrosion or damage.
   (4) Engine "ON".
   (5) Operate electric equipments (Head lamp, Hot wire, etc).
   (6) accelerate engine to 2000 RPM and measure the battery voltage.

Specification : Approx. 12.5V ~ 14.5V

(7) Is the measured voltage within specification ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good Alternator and check for proper operation. If the problem is corrected, replace Alternator and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

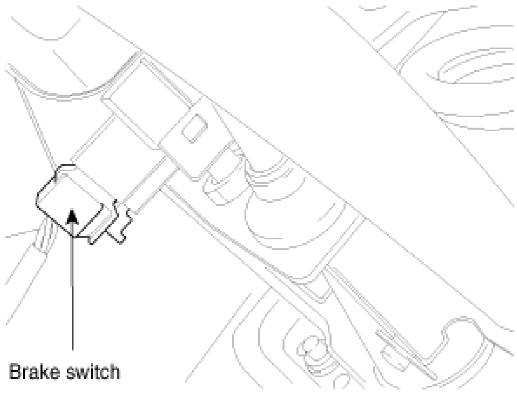
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0571

COMPONENT LOCATION



GENERAL DESCRIPTION

Brake switch connected to brake pedal transfers brake operating state to ECM. For diagnosis of abnormal operation of Brake switch, two types of signals(one from Brake warning lamp switch, the other from Brake checking switch) are used and those two types output different signals at both condition, depressing or releasing brake pedal. When brake pedal is depressed brake checking switch outputs B+ voltage while brake warning lamp switch emits 0V. Conversly, when brake pedal is released, the output signals of each switch are opposite.

DTC DESCRIPTION

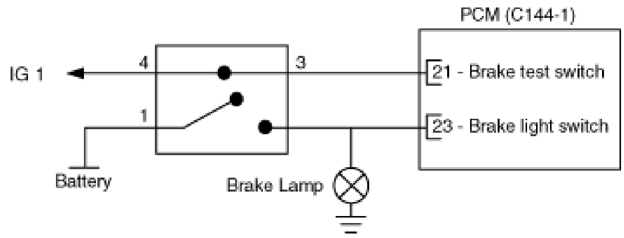
Checking input signals from brake lamp switch every 2 sec. under detecting condition, if the operation state of brake lamp switch does not change for more than 2 sec., PCM sets P0571. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• PCM detects brake lamp input signal when vehicle stops.	• Poor connection • Open or short to ground in signal circuit • Faulty PCM
Enable onditions	• Engine works • Vehicle speed signal is normal. • Vehicle speed >0kph (during 1sec or more)	
Threshold value	• Vehicle speed < 3kph • Vehicle acceleration< 20kph/s • Brake lamp "ON" • There should be a brake lamp change.	
Diagnosis Time	• Continuous (More than 2 seconds failure for every 2 seconds test)	
MIL On Condition	• 2 driving cycles	

SCHEMATIC DIAGRAM

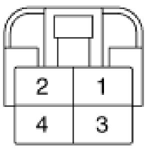
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

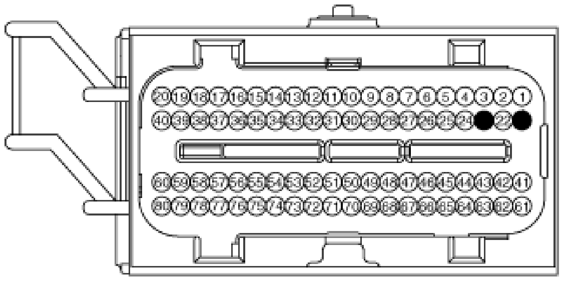
Terminal	Connected to	Function
1	PCM C144-1 (23)	Brake light switch
2	Battery	Power Supply (+5V)
3	PCM C208-A (21)	Brake test switch
4	Battery	Power Supply (+5V)

[HARNESS CONNECTOR]



E62

STOP LAMP SWITCH



C144-1

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "Brake Switch" parameter on the service data with stepping on and off the brake.

Fig. 1

Fig. 2

4. Are those related current data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

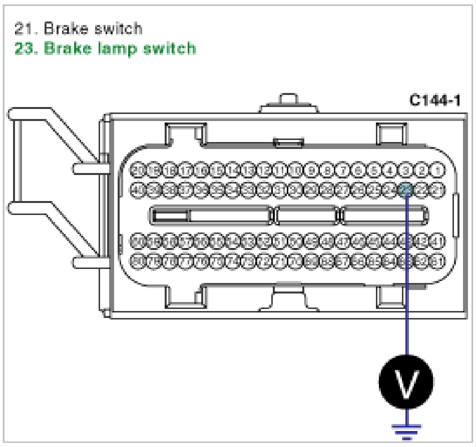
NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF".
   (2) Disconnect the PCM connector.
   (3) IG "ON" and ENG "OFF"
   (4) During taking off the brake : Measure the voltage between terminal 23 of PCM harness connector and chassis ground.
   (5) During stepping on the brake : Measure the voltage between terminal 23 of PCM harness connector and chassis ground.
   Specification :

Item	During taking off the brake	During stepping on the brake
Brake Lamp Switch	0V	Battery voltage
Brake Switch	Battery voltage	0V



   (6) Is the measured voltage within specification ?

YES

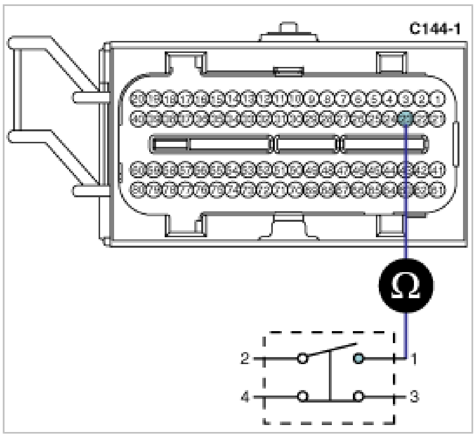
▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Go to "Check open in harness" as follows.

2. Check open in harness
   (1) IG "OFF".
   (2) Disconnect the brake switch and PCM connector.
   (3) Measure the resistance between terminal 23 of PCM harness connector and terminal 1 of Brake switch harness side.

Specification : Approx. below 1Ω



(4) Is the measured resistance within specification ?

YES

▸ o to "Check voltage" as follows.

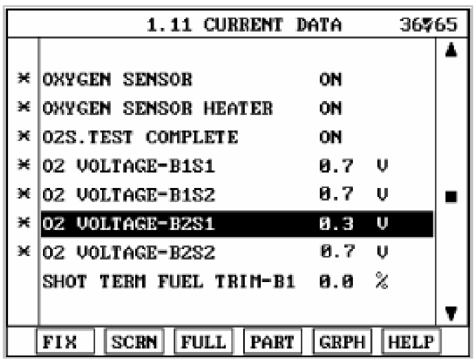
NO

▸ Repair open in circuit and go to "Verification of Vehicle Repair" procedure.

3. Check voltage
   (1) IG "OFF".
   (2) Disconnect the brake switch connector.
   (3) Measure the voltage between brake lamp switch terminal and chassis ground.
   (4) IG "ON" and ENG "OFF"
   (5) Measure the voltage between brake lamp switch terminal and chassis ground.

Specification :

Item	During taking off the brake	During stepping on the brake
Brake Lamp Switch	Battery voltage	Battery voltage
Brake Switch	0V	Battery voltage



(6) Is the measured voltage within specification ?

YES

▸ Substitute with a known - good brake switch and check for proper operation. If the problem is corrected, replace brake switch and go to "Verification of Vehicle Repair" procedure..

NO

▸ Check the fuse between battery and brake switch.
▸ Repair open or short in power circuit of brake switch and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

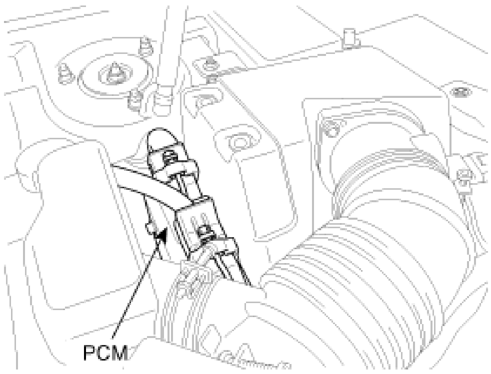
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0601

COMPONENT LOCATION



GENERAL DESCRIPTION

PCM monitors errors through checksum. Every information consists of the combination of 0 and 1, checksum means summing up all values in a row. Thus, errors are recognized comparing checksum value and the memory value at PCM.

DTC DESCRIPTION

If real checksum does not accord with memory checksum, PCM sets P0601 and MIL(Malfunction Indication Lamp) turns on.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Checksum check	• Faulty PCM
Enable onditions	• -	
Threshold value	• Discordance between the real checksum and the memorized checksum	
Diagnosis Time	• -	
MIL On Condition	• 1 driving cycle	

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "

5. Are any DTCs present ?

YES

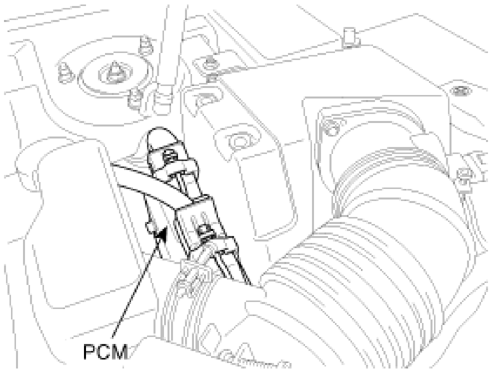
▸ Go to the applicable troubleshooooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0602

COMPONENT LOCATION



GENERAL DESCRIPTION

PCM monitors errors through checksum. Every information consists of the combination of 0 and 1, checksum means summing up all values in a row. Thus, errors are recognized comparing checksum value and the memory value at PCM.

DTC DESCRIPTION

If CPU software version dose not accord with main CPU, PCM sets P0602.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Check internal CPU	• Faulty PCM
Enable onditions	• -	
Threshold value	• The version discordance among PCU S/W or Calibration	
Diagnosis Time	• Continuous (More than 125 ms failure for every 125 ms test)	
MIL On Condition	• 1 driving cycle	

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by

PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

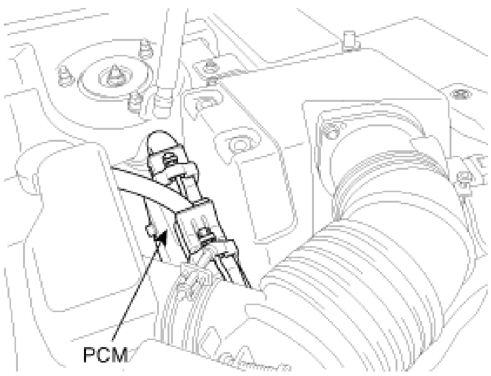
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0604

COMPONENT LOCATION



GENERAL DESCRIPTION

PCM monitors errors through checksum. Every information consists of the combination of 0 and 1, checksum means summing up all values in a row. Thus, errors are recognized comparing checksum value and the memory value at PCM.

DTC DESCRIPTION

If real checksum does not accord with memory checksum, PCM sets P0604 and MIL(Malfunction Indicatin Lamp) turns on.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Check internal CPU	• Faulty PCM
Enable onditions	• -	
Threshold value	• Discordance between the real checksum and the memorized checksum	
Diagnosis Time	• -	
MIL On Condition	• 1 driving cycle	

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0606

COMPONENT LOCATION

GENERAL DESCRIPTION

The Controller Diagnostic receives data from several self-diagnosing devices onboard the powertrain control module. Conditions which are detected include supply voltage out of limits, acceptable temperature exceeded, low-power counter clock failure, and general device fault.

DTC DESCRIPTION

Checking PCM every 10 sec. under detecting condition, if internal error is detected for more than 5 sec., PCM sets P0606. And MIL(Malfunction Indicatin Lamp) turns on.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Check PCM internal error	
Enable onditions	• 7V< Battery voltage< 20V	

Threshold value	• PCM internal error (A/D unit error)	• Faulty PCM
Diagnosis Time	• Continuous (More than 0.5 seconds failure for every 9.3 seconds test)	
MIL On Condition	• 1 driving cycle	

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P061B

COMPONENT LOCATION

GENERAL DESCRIPTION

Checking torque control state and torque, torque calculation protect RAM. ROM, or ALU when the torque calculated inside of PCM is higher than actually required torque. This type of malfunction is very difficult to find, however if it happens, it influences safety a lot. Therefore, detecting and decreasing torque is strongly required.

DTC DESCRIPTION

If desired torque is calculated much higher than actual torque, PCM senses it and decreases desired torque. The causes of this error are abnormal operation of PCM (RAM,ROM, ALU errors) and hardware malfunction such that actual air flow enters the engine is more than the flow recognized by PCM.If actual checksum do not correspont with memory checksum, PCM sets P061B. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till 1 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Desired torque error	• Faulty PCM
Enable onditions	• Engine works	
Threshold value	• Desired torque is much higher than actual torque.	
Diagnosis Time	• Continuous	
MIL On Condition	• 1 driving cycle	

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0630

GENERAL DESCRIPTION

Regulations require that all 2005 and subsequent model year vehicles shall have the Vehicle Identification Number(VIN) available in a standardized format through the standardized data link connector in accordance with SAE J1979 specifications. Using a scan tool, PERFORM "VIN WRITING" procedure after replacing or reflashing a PCM.

DTC DESCRIPTION

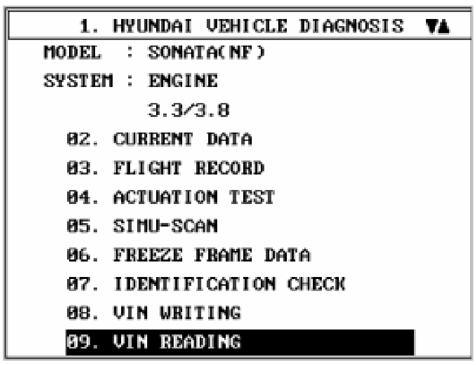
The purpose of this logic is to prevent a vehicle from leaving the assembly plant or service station without a VIN in its EEPROM memory.
If the VIN writing is not programmed or incompatible, the PCM determines that a fault exists and a DTC is stored.MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till 1 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• VIN not programmed or incompatible	1. VIN is not programmed. 2. Faulty PCM
Enable onditions	• None	
Threshold value	• Error Code: "ON"	
Diagnosis Time	• Continuous	
MIL On Condition	• 1 driving cycle	

MONITOR SCANTOOL DATA

1. Ignition "OFF"
2. Connect Scantool and Ignition "ON"
3. Monitor the ECM status by VIN reading whether it is virgin or learnt



4. Is the ECM status Virgin ?

YES

▸ Perform VIN writing procedure according to the direction on the scantool screen and go to "Verification of Vehicle Reapair" procedure.

NO

▸ Fault is intermittent caused by poor contact in Sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

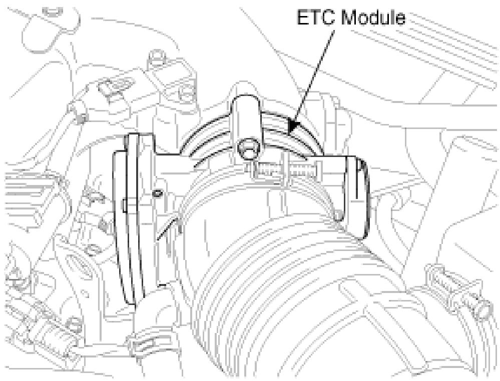
▸ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

Fuel System > Troubleshooting > P0638

COMPONENT LOCATION



GENERAL DESCRIPTION

ETC(Electronic Throttle Control Valve) is the device controlling amount of air to engine acccording to driver's intension. Different from the existing mechanical throttle valve which is composed of accelerator pecal and connecting wire cable, ETC consists of a motor, a throttle body and a throttle position sensor. Receiving input signals from electronic accelerator pedal module, PCM lets ETC motor control throttle valve. With ETC, cruise control system works without any additional device.

DTC DESCRIPTION

Checking output signals from TPS every 8.5 sec. under detecting condition, if the difference between real and target throttle position is above the specified value, PCM sets P0638. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till 1 driving cycle.

DTC DETECTING CONDITION

<table>
<tr><th colspan="2">Item</th><th>Detecting Condition</th><th>Possible cause</th></tr>
<tr><td colspan="2">DTC Strategy</td><td>• ETS position control malfunction</td><td rowspan="7">• Throttle stuck
• Open in motor circuit
• Faulty motor
• Faulty PCM</td></tr>
<tr><td colspan="2">Enable Conditions</td><td>• Engine works
• Battery voltage >5V</td></tr>
<tr><td rowspan="3">Thresh old value</td><td>Case1</td><td>• l real ETS motor & TPS value - target ETS motor & TPS value l >4.5°</td></tr>
<tr><td>Case2</td><td>• When real Throttle position <36°, real throttle position - target throttle position < - 4.5°</td></tr>
<tr><td>Case3</td><td>• real throttle position - target throttle position < - 18°</td></tr>
<tr><td colspan="2">Diagnosis Time</td><td>• Continuous
(More than 0.6 seconds failure for every 15.6 seconds test)</td></tr>
<tr><td colspan="2">MIL On Condition</td><td>• 1 driving cycle</td></tr>
</table>

SIGNAL WAVEFORM AND DATA

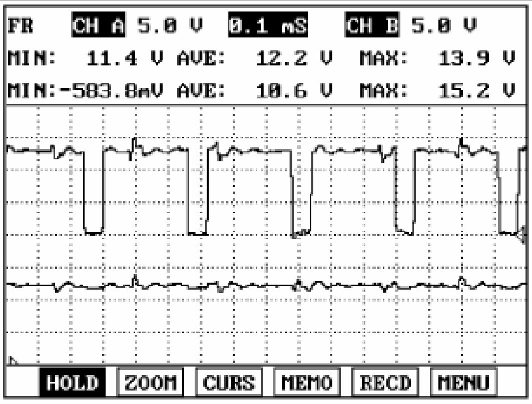


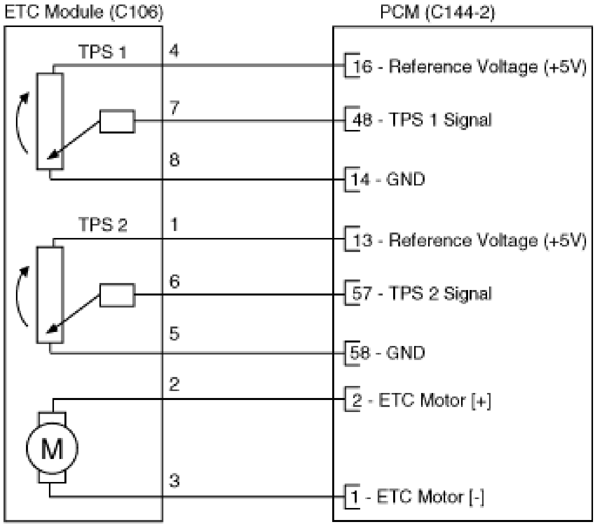
Fig. 1

SPECIFICATION

Throttle opening (°)	Output voltage (V) [Vref = 5.0V]	
	TPS1	**TPS2**
0°	0.0V	5.0V
10°	0.5V	4.5V
20°	0.9V	4.1V
30°	1.4V	3.6V
40°	1.8V	3.2V
50°	2.3V	2.7V
60°	2.7V	2.3V
70°	3.2V	1.8V
80°	3.6V	1.4V
90°	4.1V	0.9V
100°	4.5V	0.5V
110°	5.0V	0.0V

SCHEMATIC DIAGRAM

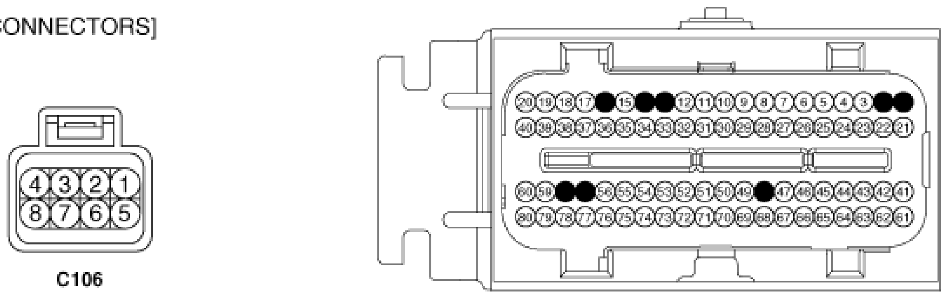
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Funtion
1	PCM C144-2 (13)	TPS 2 Reference Voltage (+5V)
2	PCM C144-2 (2)	ETC Motor [+] Control
3	PCM C144-2 (1)	ETC Motor [-] Control
4	PCM C144-2 (16)	TPS 1 Reference Voltage (+5V)
5	PCM C144-2 (58)	TPS 2 Ground
6	PCM C144-2 (57)	TPS 2 Signal
7	PCM C144-2 (48)	TPS 1 Signal
8	PCM C144-2 (14)	TPS 1 Ground

[HARNESS CONNECTORS]



C106

ETC MODULE

C144-2

PCM

MONITOR SCANTOOL DATA

1. Ignition "OFF"
2. Connect Scantool and Engine "ON"
3. Monitor "ETS Motor" items on Current Data
4. Are those related current data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor’s and/or PCM’s connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection,bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and goto "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

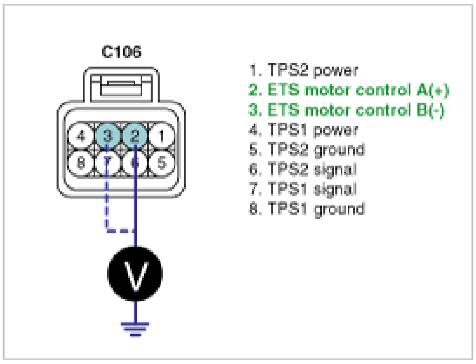
NO

▸ Go to " Control Circuit Inspection " procedure.

CONTROL CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF".
   (2) Disconnect ETS motor & TPS connector.
   (3) IG "ON" and ENG "OFF"
   (4) Measure the voltage between terminal 2,3 of ETS motor & TPS harness connector and chassis ground.

   Specification : Approx. 12V

   (5) Is the measured voltage within specification?

   YES

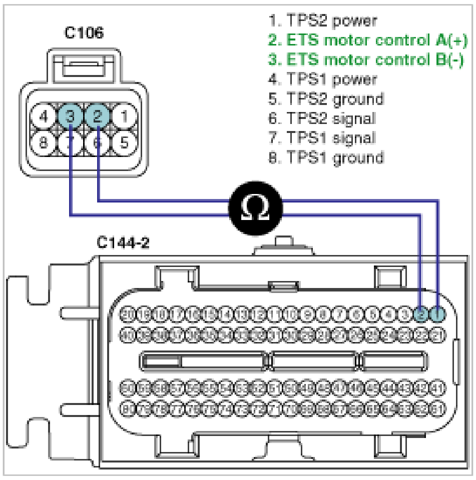
   ▸ Go to "Component inspection" procedure.

   NO

   ▸ Go to "Check open in harness" as follows.

2. Open in control circuit inspection
   (1) IG "OFF"
   (2) Disconnect ETS motor & TPS connector and PCM connector.
   (3) Measure the resistance between terminal 2 of ETS motor & TPS harness connector and terminal 2 of PCM harness connector.
   (4) Measure the resistance between terminal 3 of ETS motor & TPS harness connector and terminal 1 of PCM harness connector.

   Specification : Approx. below 1Ω



(5) Is the measured resistance within specification ?

YES

▸ Go to "Component inspection" procedure.

NO

▸ Repair Open in motor harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check throttle valve for stuck
   (1) IG "OFF".
   (2) Disconnect the air hose between throttle body and air mass flow sensor.
   (3) Check stuck on throttle valve.
   (4) Is the throttle valve normal?

YES

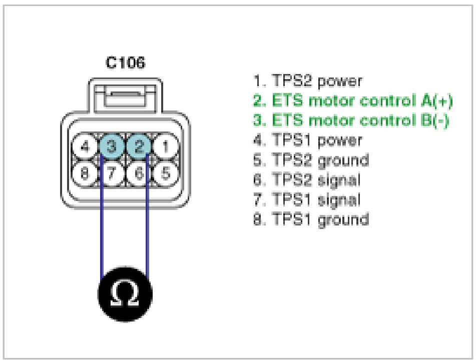
▸ Go to check "ETS motor resistance" as follows.

NO

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check ETS motor resistance
   (1) IG "OFF".
   (2) Disconnect ETS motor & TPS connector.
   (3) Measure the resistance between terminal 2 and 3 of ETS motor & TPS connector(component side).

Specification : Approx. 1.275 ~ 1.725Ω @ 23°C (73.4°F)



(4) Is the measured resistance within specification?

YES

▸ Go to "ETC motor actuation test" procedure.

NO

▸ Substitute with a known - good ETC motor and check for proper operation. If the problem is corrected, replace ETC motor and go to "Verification of Vehicle Repair" procedure.

※ Procedure of ETS Initialization
1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10 second)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

3. ETC motor actuation test
   (1) IG "OFF".
   (2) Connect ETS motor & TPS connector.
   (3) After IG "ON", execute the "ETC motor actuation test" by Scantool.
   (4) Does the "ETC motor actuation test" execute normally?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good ETC motor and check for proper operation. If the problem is corrected, replace ETC motor and go to "Verification of Vehicle Repair" procedure.
※ Procedure of ETS Initialization
1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10 second)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.
1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0641

GENERAL DESCRIPTION

ETC(Electronic Throttle Control Valve) is the device controlling amount of air to engine acccording to driver's intension. Different from the existing mechanical throttle valve which is composed of accelerator pecal and connecting wire cable, ETC consists of a motor, a throttle body and a throttle position sensor. Receiving input signals from electronic accelerator pedal module, PCM lets ETC motor control throttle valve. With ETC, cruise control system works without any additional device.

DTC DESCRIPTION

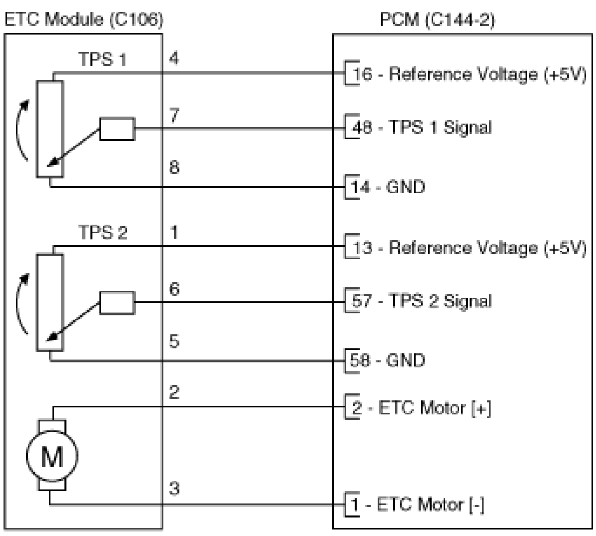
Checking the voltage from sensor power supply every 1.87 sec. under detecting condition, if the value within detecting condition lasts for more than 0.2 sec., PCM sets P0641. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Sensor reference voltage check	• Short in sensor power supply line • Faulty PCM
Enable Conditions	• IG "ON"	
Threshold value	• Sensor supply power < 4.5V or > 5.5V	
Diagnosis Time	• Continuous (More than 0.2 seconds failure for every 1.87 seconds test)	
MIL On Condition	• 2 driving cycle	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



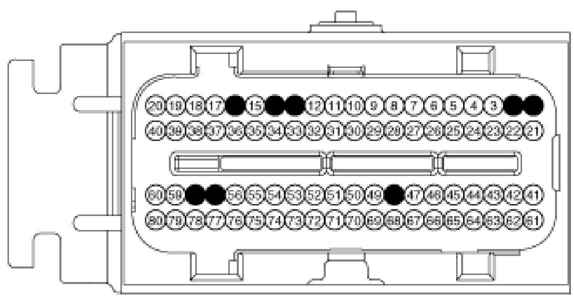
[CONNECTION INFORMATION]

Terminal	Connected to	Funtion
1	PCM C144-2 (13)	TPS 2 Reference Voltage (+5V)
2	PCM C144-2 (2)	ETC Motor [+] Control
3	PCM C144-2 (1)	ETC Motor [-] Control
4	PCM C144-2 (16)	TPS 1 Reference Voltage (+5V)
5	PCM C144-2 (58)	TPS 2 Ground
6	PCM C144-2 (57)	TPS 2 Signal
7	PCM C144-2 (48)	TPS 1 Signal
8	PCM C144-2 (14)	TPS 1 Ground

[HARNESS CONNECTORS]

C106

ETC MODULE



C144-2

PCM

MONITOR SCANTOOL DATA

1. Ignition "OFF".
2. Connect Scantool and Engine "ON".
3. Monitor "TPS1, TPS2" items on Current Data

Fig. 1

4. Are those related current data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor’s and/or PCM’s connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection,bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and goto "Verification of Vehicle Repair" procedure.

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. Check voltage

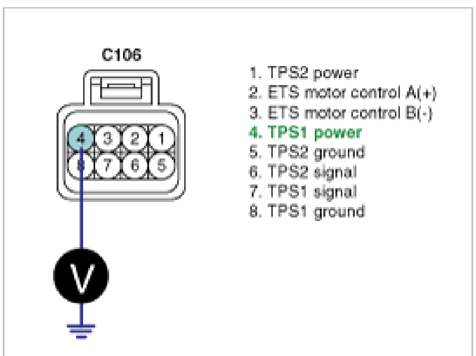
(1) IG "OFF".

(2) Disconnect TPS connector.

(3) IG "ON" and ENG "OFF"

(4) Measure the voltage between terminal 4 of TPS harness connector and chassis ground.

Specification : Approx. 5V



(5) Is the measured voltage within specification ?

YES

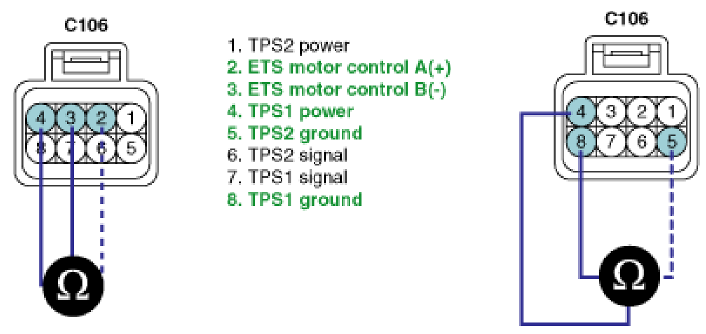
▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Go to "Check short in power harness" as follows.

2. Check short in power harness
   (1) IG "OFF".
   (2) Disconnect TPS connector and PCM connector.
   (3) Measure the resistance between terminal 4 and 2 of TPS harness connector.
   (4) Measure the resistance between terminal 4 and 3 of TPS harness connector.
   (5) Measure the resistance between terminal 4 and 5 of TPS harness connector.
   (6) Measure the resistance between terminal 4 and 8 of TPS harness connector.

Specification : Infinite



   (7) Is the measured resistance within specification ?

YES

▸ Substitute with a known - good PCM and check for proper operation.
▸ If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Repair Short in power circuit and go to "Verification of Vehicle Repair" procedure.
※ Procedure of ETS Initialization
1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10 second)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0646

GENERAL DESCRIPTION

A/C compressor raises pressure to condensen the evaporated refrigerant at evaporator in A/C system more easily. Without A/C signal, A/C compressor does not operate but with ON signal, PCU activate A/C compressor relay. With the relay activation, A/C compressor turns on using the power of the engine.

DTC DESCRIPTION

PCM monitors inputted voltage through A/C compressor relay. Checking voltage every 10 sec. under detecting condition, if the voltage lower than the specified value is detected for more than 5 sec., PCM sets P0646.

DTC DETECTING CONDITION

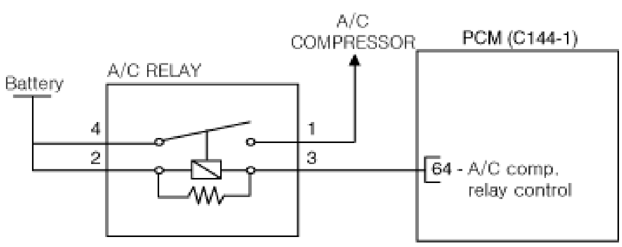
Item	Detecting Condition	Possible cause
DTC Strategy	• Detects circuit short to low voltage	• Poor connection • Open or short to ground in A/C relay circuit • Faulty A/C relay • Faulty PCM
Enable Conditions	• After 0.5 sec under conditions below • No DTC exists • Engine works • 11V ≤ Battery voltage ≤ 16V	
Threshold value	• Open or short to ground	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• DTC only (NO MIL ON)	

SPECIFICATION

Coil Resistance
70Ω ~ 120Ω

SCHEMATIC DIAGRAM

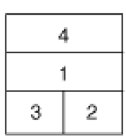
[CIRCUIT DIAGRAM]

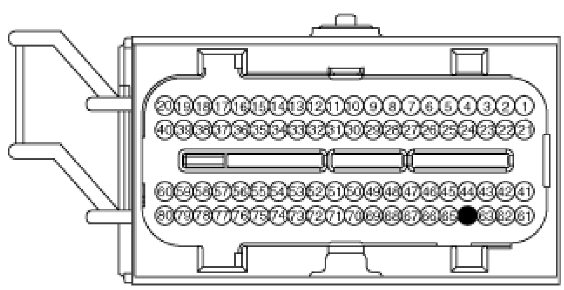


[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	A/C COMPRESSOR	COMPRESSOR Supply
2	Battery	Power Supply (B+)
3	PCM C144-1 (64)	A/C comp. relay control
4	Battery	Power Supply (B+)

[HARNESS CONNECTOR]





C144-1
PCM

MONITOR SCANTOOL DATA

1. Ignition "OFF"
2. Connect Scantool and Engine "ON"
3. Monitor items related to "A/C" on Current Data

Fig. 1

Fig. 2

4. Are those related current data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor’s and/or PCM’s connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection,bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and goto "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

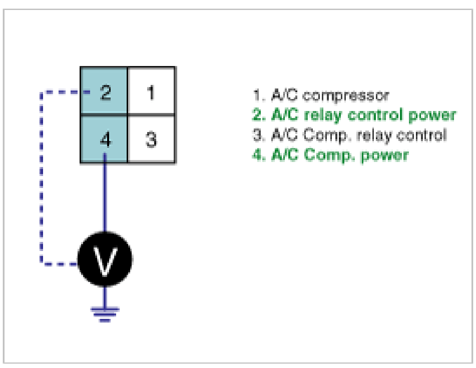
NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF".
   (2) Disconnect A/C relay connector.
   (3) IG "ON" and ENG "OFF"
   (4) Measure the voltage between terminal 2 of A/C relay harness connector and chassis ground.
   (5) Measure the voltage between terminal 4 of A/C relay harness connector and chassis ground.

Specification : B+



   (6) Is the measured voltage normal?

YES

▸ Go to "Control circuit inspection" procedure.

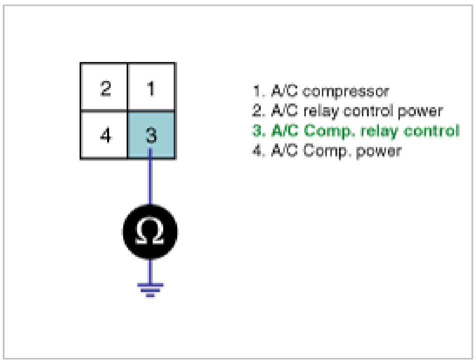
NO

▸ Check the fuse between Battery and A/C relay.
▸ Check Chassis ground 1 and 2 for looseness.
▸ Repair Open or Short to ground in power circuit and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check short in harness
   (1) IG "OFF".
   (2) Disconnect A/C relay and PCM connector.
   (3) Measure the resistance between terminal 3 of A/C relay harness connector and chassis ground.

Specification : Infinite



   (4) Is the measured resistance within specification ?

YES

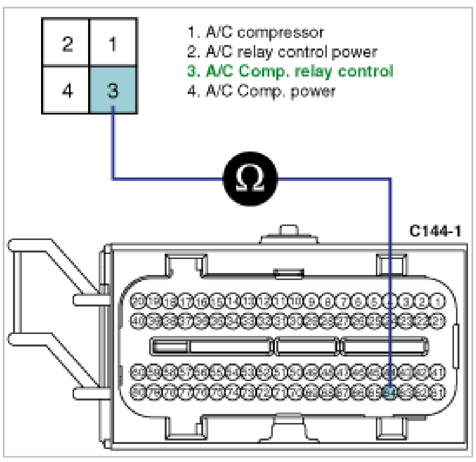
▸ Go to "Check open in harness" as follows.

NO

▸ Repair Short in Coil control harness and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness
   (1) IG "OFF".
   (2) Disconnect A/C relay and PCM connector.
   (3) Measure the resistance between terminal 3 of A/C relay harness connector and terminal 64 of PCM harness connector.

Specification : Approx. below 1Ω



   (4) Is the measured resistance within specification ?

YES

▸ Go to "Component inspection" procedure.

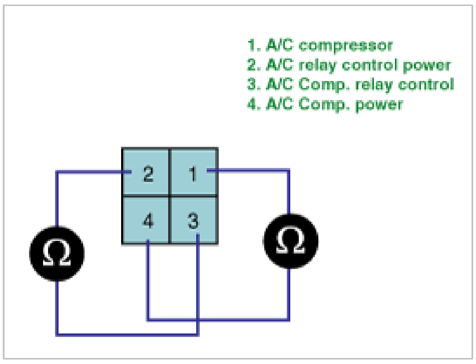
NO

▸ Repair Open in Coil control harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check A/C relay
   (1) IG "OFF".
   (2) Disconnect A/C relay.
   (3) Measure the resistance between terminal 2 and 3 of A/C relay.
   (4) Measure the resistance between terminal 1 and 4 of A/C relay.

Terminal	Power approval
1~4	NO
2~3	YES (약 70Ω ~ 120Ω)



   (5) Is the measured resistance within specification ?

YES

▶ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known - good A/C relay and check for proper operation. If the problem is corrected, replace A/C relay and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

Fuel System > Troubleshooting > P0647

GENERAL DESCRIPTION

A/C compressor raises pressure to condensen the evaporated refrigerant at evaporator in A/C system more easily. Without A/C signal, A/C compressor does not operate but with ON signal, PCU activate A/C compressor relay. With the relay activation, A/C compressor turns on using the power of the engine.

DTC DESCRIPTION

PCM monitors inputted voltage through A/C compressor relay. Checking voltage every 10 sec. under detecting condition, if the voltage higher than the specified value is detected for more than 5 sec., PCM sets P0647.

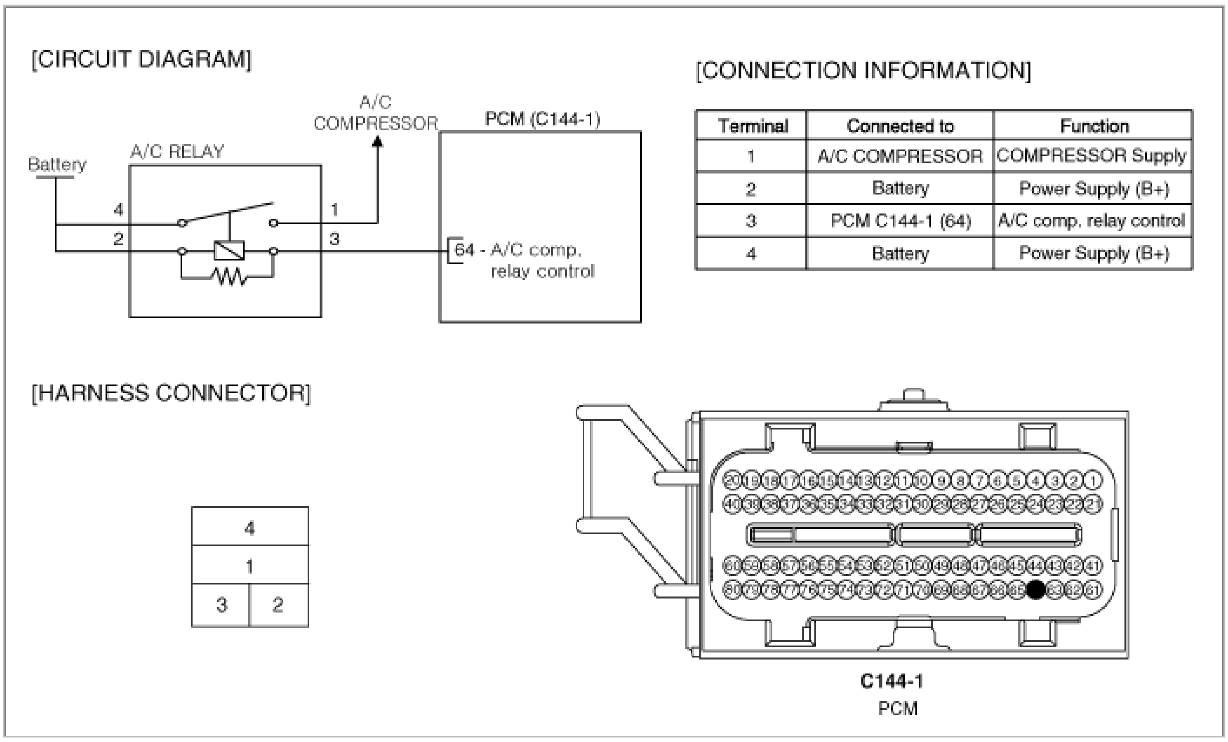
DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects circuit short to high voltage	• Poor connection • Short to power in A/C relay circuit • Faulty A/C relay • Faulty PCM
Enable Conditions	• After 0.5 sec under conditions below • No DTC exists • Engine works • 11V ≤ Battery voltage ≤ 16V	
Threshold value	• Short to power	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• DTC only (NO MIL ON)	

SPECIFICATION

Coil Resistance
70Ω ~ 120Ω

SCHEMATIC DIAGRAM



MONITOR SCANTOOL DATA

1. Ignition "OFF"
2. Connect Scantool and Engine "ON"
3. Monitor items related to "A/C" on Current Data

Fig. 1

Fig. 2

4. Are those related current data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor’s and/or PCM’s connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection,bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and goto "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. Check voltage

(1) IG "OFF".

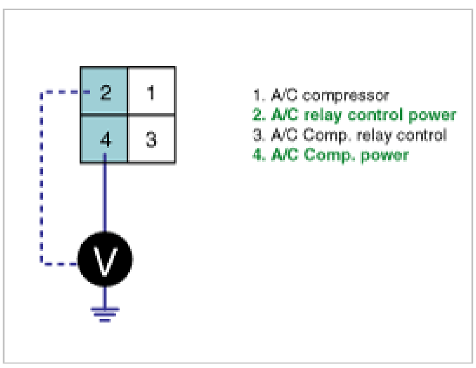
(2) Disconnect A/C relay connector.

(3) IG "ON" and ENG "OFF"

(4) Measure the voltage between terminal 2 of A/C relay harness connector and chassis ground.

(5) Measure the voltage between terminal 4 of A/C relay harness connector and chassis ground.

Specification : B+



(6) Is the measured voltage normal?

YES

▸ Go to "Control circuit inspection" procedure.

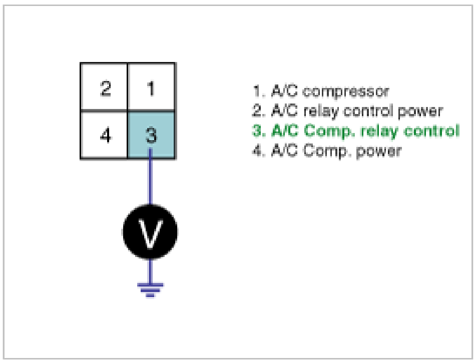
NO

▸ Check the fuse between Battery and A/C relay.
▸ Check Chassis ground 1 and 2 for looseness.
▸ Repair Open or Short to ground in power circuit and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check short in harness
   (1) IG "ON".
   (2) Disconnect A/C relay.
   (3) Measure the resistance between terminal 3 of A/C relay harness connector and chassis ground.

Specification : Approx. 0V



   (4) Is the measured voltage within specification ?

YES

▸ Go to "Component inspection" procedure.

NO

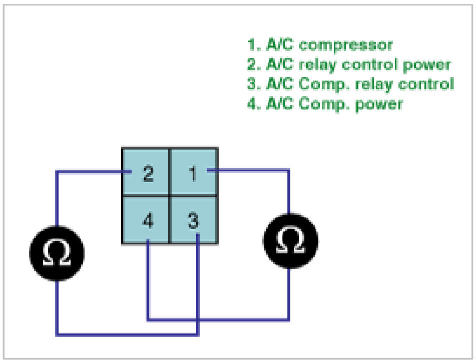
▸ Repair Short in Coil control harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check A/C relay
   (1) IG "OFF".
   (2) Disconnect A/C relay.
   (3) Measure the resistance between terminal 2 and 3 of A/C relay.
   (4) Measure the resistance between terminal 1 and 4 of A/C relay.

SPECIFICATION

Terminal	Power approval
1~4	NO
2~3	YES (약 70Ω ~ 120Ω)



(5) Is the measured resistance within specification ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good A/C relay and check for proper operation. If the problem is corrected, replace A/C relay and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0650

GENERAL DESCRIPTION

As monitoring the errors of several sensors and actuators circuit,if any problem occurs, PCM turns engine check lamp ON at cluster to notify driver occurence of a problem.Generally, engine check lamp turns ON at Ignition ON and turns OFF within couple of seconds after turning engine ON. If engine check lamp turns on during driving, perform diagnosis of engine system and auto-transaxle system.

DTC DESCRIPTION

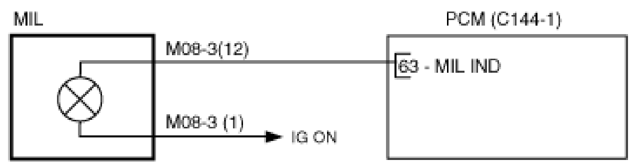
Checking input signal of engine check lamp every 10 sec. under detecting condition, if open, or short to battery or ground is detected for more than 5 sec., PCM sets P0650.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Signal low, high	• Poor connection • Open or short in MIL circuit • Faulty MIL • Faulty PCM
Enable Conditions	• After 0.5 sec under conditions below • Engine works • 11V ≤ Battery voltage ≤ 16V	
Threshold value	• Open or short	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• DTC only (NO MIL ON)	

SCHEMATIC DIAGRAM

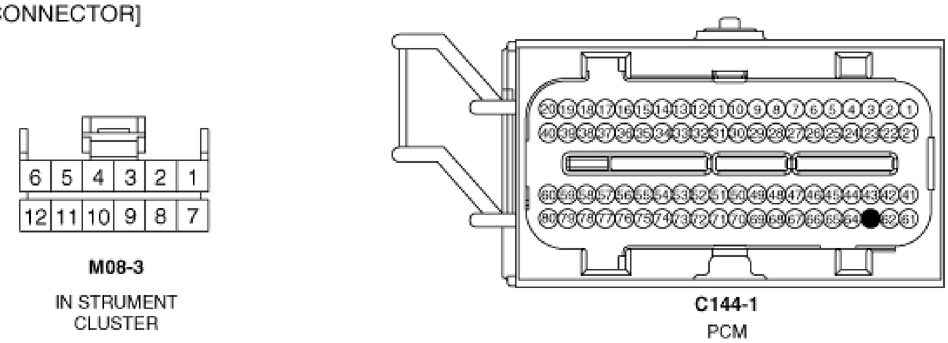
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

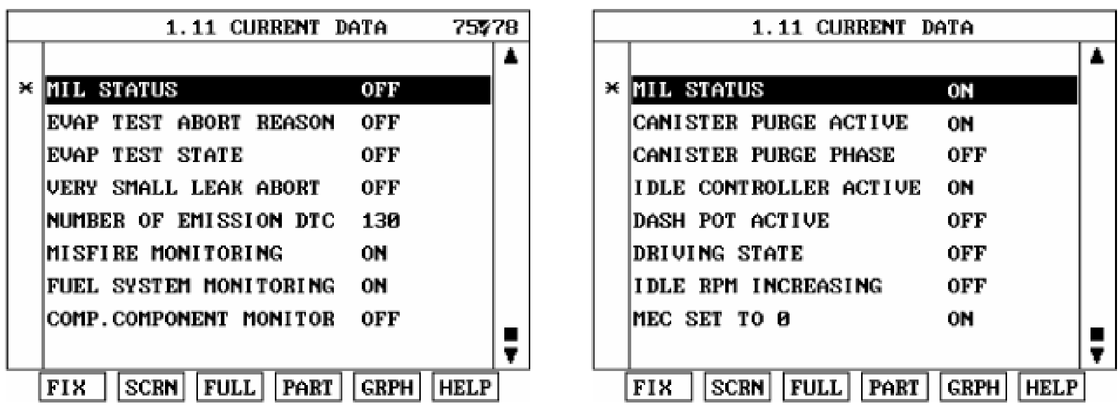
Terminal	Connected to	Function
M08-3 (1)	IG ON	Power Supply (B+)
M08-3 (12)	PCM C144-1 (63)	MIL IND

[HARNESS CONNECTOR]



MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Compare "Current data" on scantool with "Engine Warning Lamp" on cluster.



4. Is the current data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor’s and/or PCM’s connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection,bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and goto "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

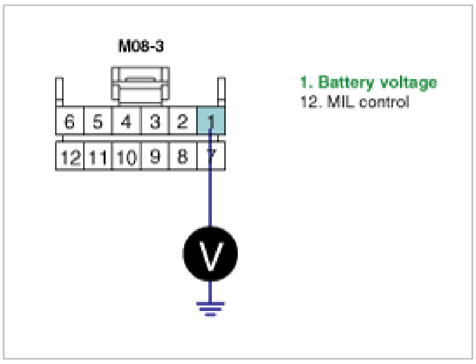
NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. IG "OFF" and disconnect Instrument cluster connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of instrument cluster harness connector and chassis ground.

Specification : Approx. B+



4. Is the measured voltage within specification?

YES

▸ Go to "Control Circuit Inspection" procedure.

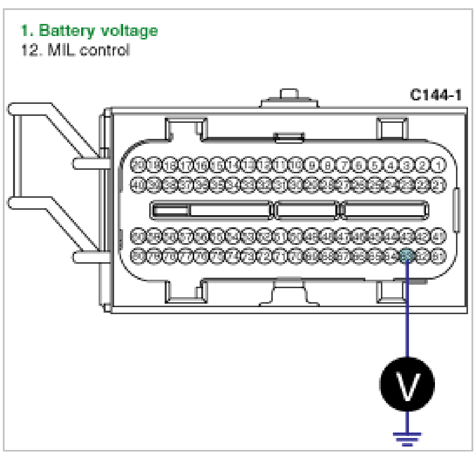
NO

▸ Check fuse between battery and instrument cluster for open or blown-off.
▸ Repair open or short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. IG "OFF" and disconnect PCM connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between 63 of PCM harness connector and chassis ground.

Specification : Approx. B+



4. Is the measured voltage within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Check open in Engine warning lamp's filament.
▸ Repair open or short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check instrument cluster

(1) IG "OFF"

(2) Substitute with a known - good instrument cluster and check for proper operation.

(3) Does it normally operate after replacement?

YES

▸ Replace instrument cluster and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0651

GENERAL DESCRIPTION

ETC(Electronic Throttle Control Valve) is the device controlling amount of air to engine acccording to driver's intension. Different from the existing mechanical throttle valve which is composed of accelerator pecal and connecting wire cable, ETC consists of a motor, a throttle body and a throttle position sensor. Receiving input signals from electronic accelerator pedal module, PCM lets ETC motor control throttle valve. With ETC, cruise control system works without any additional device.

DTC DESCRIPTION

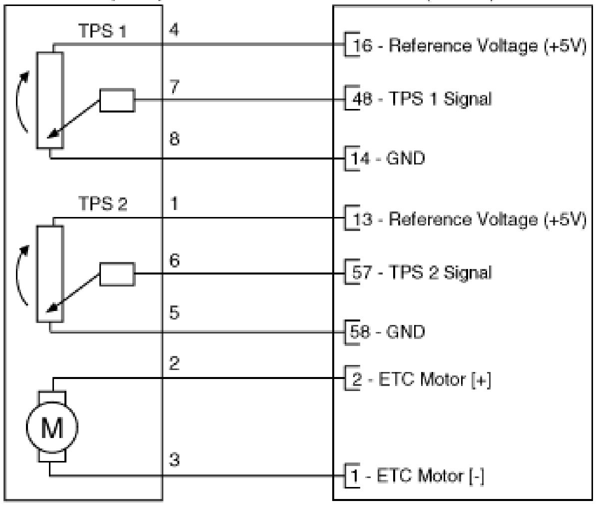
Checking the voltage from sensor power supply every 1.87 sec. under detecting condition, if the value within detecting condition lasts for more than 0.2 sec., PCM sets P0651. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Sensor reference voltage check	• Short in sensor power supply line • Faulty PCM
Enable condition	• Key "ON"	
threshold value	• Sensor supply power < 4.5V or > 5.5V	
diagnosis time	• Continuous (More than 0.2 seconds failure for every 1.87 seconds test)	
MIL ON condition	• 2 driving cycles	

SCHEMATIC DIAGRAM

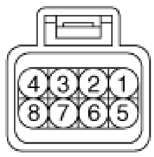
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

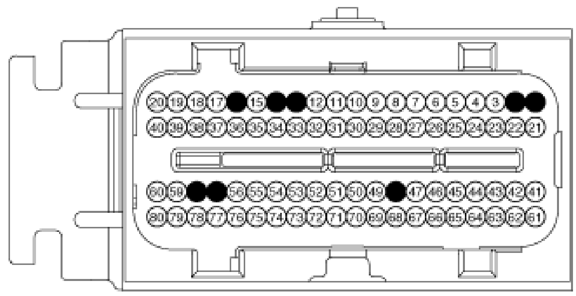
Terminal	Connected to	Funtion
1	PCM C144-2 (13)	TPS 2 Reference Voltage (+5V)
2	PCM C144-2 (2)	ETC Motor [+] Control
3	PCM C144-2 (1)	ETC Motor [-] Control
4	PCM C144-2 (16)	TPS 1 Reference Voltage (+5V)
5	PCM C144-2 (58)	TPS 2 Ground
6	PCM C144-2 (57)	TPS 2 Signal
7	PCM C144-2 (48)	TPS 1 Signal
8	PCM C144-2 (14)	TPS 1 Ground

[HARNESS CONNECTORS]



C106

ETC MODULE



C144-2

PCM

MONITOR SCANTOOL DATA

1. Ignition "OFF"
2. Connect Scantool and Engine "ON"
3. Monitor "TPS1, TPS2" items on Current Data

Fig. 1

4. Are those related current data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor’s and/or PCM’s connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection,bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and goto "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

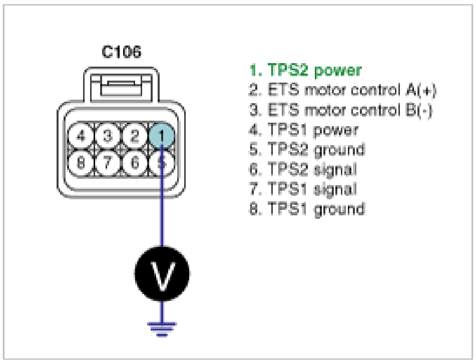
NO

▸ Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF".
   (2) Disconnect TPS connector.
   (3) IG "ON" and ENG "OFF"
   (4) Measure the voltage between terminal 1 of TPS harness connector and chassis ground.

   Specification : Approx. 5V

   (5) Is the measured voltage within specification ?

   YES

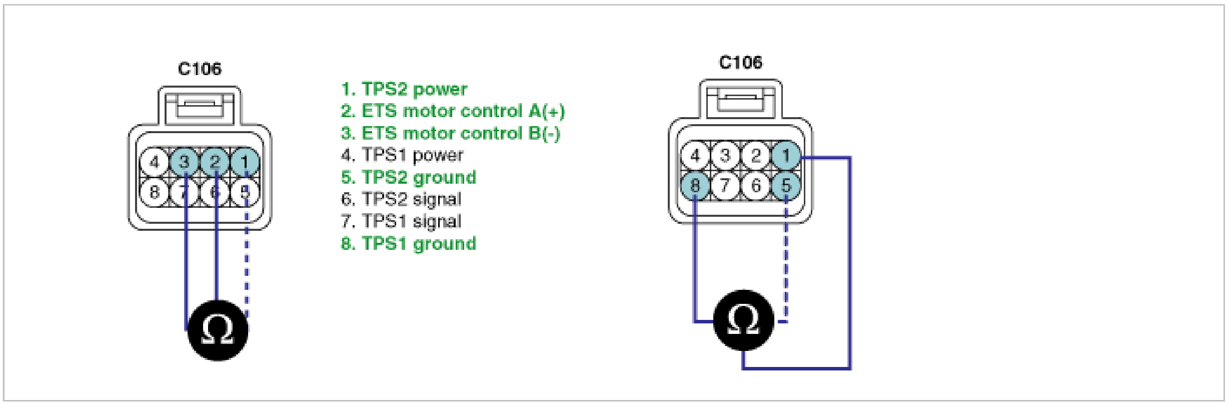
   ▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Go to "Check short in harness" as follows.

2. Check short in harness
   (1) IG "OFF".
   (2) Disconnect TPS connector and PCM connector.
   (3) Measure the resistance between terminal 1 and 2 of TPS harness connector.
   (4) Measure the resistance between terminal 1 and 3 of TPS harness connector.
   (5) Measure the resistance between terminal 1 and 5 of TPS harness connector.
   (6) Measure the resistance between terminal 1 and 8 of TPS harness connector.

   Specification : Infinite



(7) Is the measured resistance within specification ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Repair Short in power harness and go to "Verification of Vehicle Repair" procedure.

※ Procedure of ETS Initialization

1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10 second)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

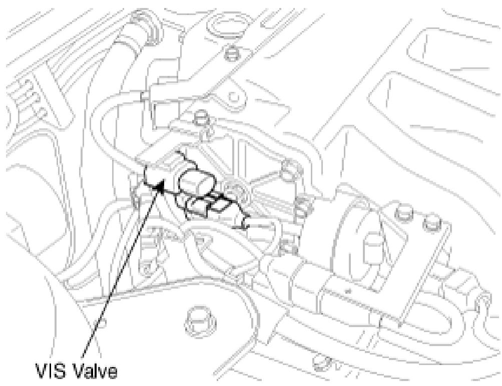
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0660

COMPONENT LOCATION



GENERAL DESCRIPTION

VIS(Variable intake system) is a device which varies the length of intake manifold to genetate maximum power at certain RPM. VIS lengthens intake manifold to improve the torque at low RPM when vehicle speed is low while it shortens intake manifold to raise torque at high RPM when vehicle speed is hign. PCU controlls VIS using RPM signal.

DTC DESCRIPTION

Checking the output voltage from VIS every 10 sec. under detecting condition, if the value within detecting condition lasts for more than 5 sec., PCM sets P0660. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

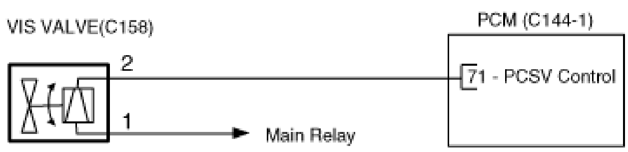
Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal low, high	• Poor connection • Open or short in VIS circuit • Faulty VIS • Faulty PCM
Enable condition	• After 0.5 sec under conditions below • Engine works • 11V ≤ Battery voltage ≤ 16V	
Threshold value	• Open or short	
Diagnosis time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL ON condition	• 2 driving cycles	

SPECIFICATION

Item	Specification
Coil Resistance (Ω)	21.8 ~ 28.5Ω[22°C (71.6°F)]

SCHEMATIC DIAGRAM

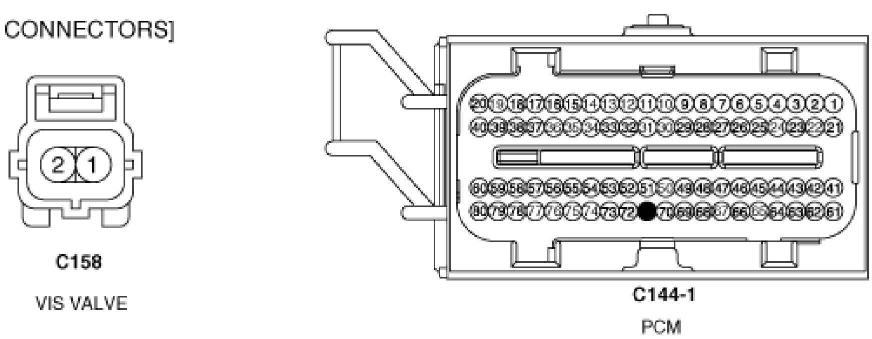
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

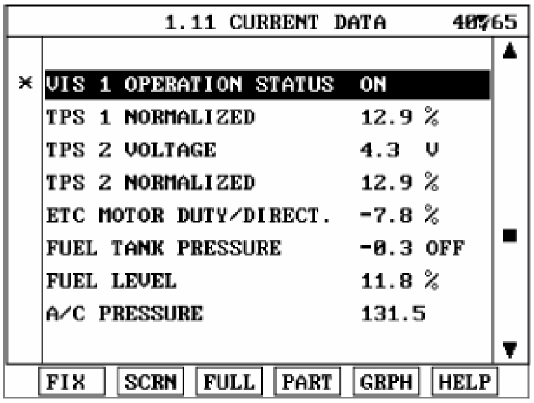
Terminal	Connected to	Funtion
1	Main Relay	Battery voltage (B+)
2	PCM C144-1 (71)	VIS Valve control

[HARNESS CONNECTORS]



MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "VIS 1" item on the service data.



VIS ON at idle

4. Is the related current data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor's and/or PCM's connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection,bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and goto "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

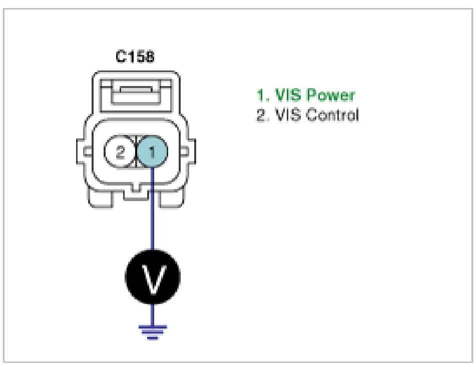
NO

▸ Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION

1. IG "OFF" and disconnect VIS connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of VIS harness connector and chassis ground.

Specification : Approx. B+



4. Is the measured voltage within specification?

YES

▸ Go to "Control Circuit Inspection" procedure.

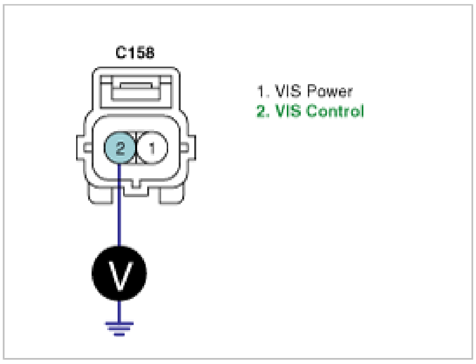
NO

▸ Check fuse connected to power of VIS for open or blown-off.
▸ Repair open or short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF" and disconnect VIS connector.
   (2) IG "ON" and ENG "OFF"
   (3) Measure voltage between terminal 2 of VIS harness connector and chassis ground.

Specification : Approx. 2.5V



   (4) Is the measured voltage within specification?

YES

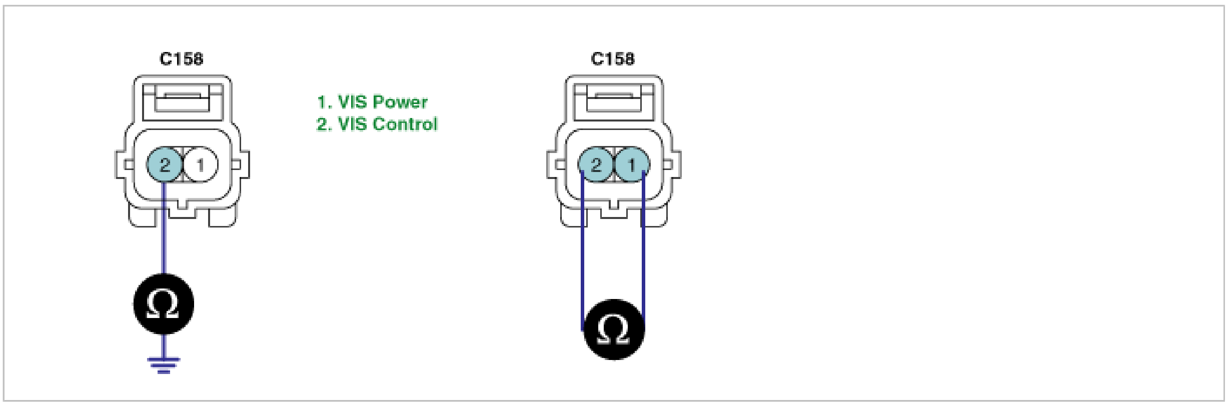
▶ Go to "Component Inspection" procedure.

NO

▶ Go to "Check short in harness" as follows.

2. Check short in harness
   (1) IG "OFF" and disconnect VIS connector and PCM connector.
   (2) Measure resistance between terminal 2 of VIS harness connector and chassis ground.
   (3) Measure resistance between terminals 1 and 2 of VIS harness connector.

Specification : Infinite



   (4) Is the measured resistance within specification?

YES

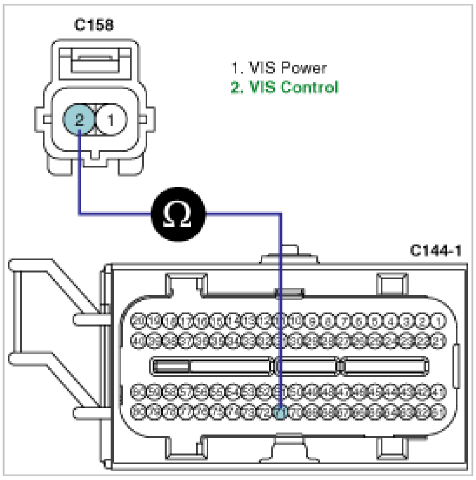
▶ Go to "Check open in harness" as follows.

NO

▶ Repair short in harness, and go to "Verification of Vehicle Repair" procedure.

3. Check open in harness
   (1) IG "OFF" and disconnect VIS connector and PCM connector.
   (2) Measure resistance between terminal 2 of VIS harness connector and terminal 71 of PCM harness connector.

Specification : Below 1Ω



(3) Is the measured resistance within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

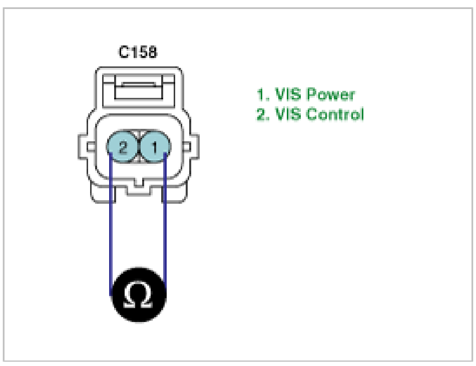
COMPONENT INSPECTION

1. Check VIS

(1) IG "OFF" and disconnect VIS connector.

(2) Measure resistance between terminals 1 and 2 of VIS connector.(Component side)

Specification : 21.8 ~ 28.5 Ω [22°C(71.6°F)]



(3) Is the measured resistance within specification?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good VIS and check for proper operation. If the problem is corrected, replace VIS and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions

4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

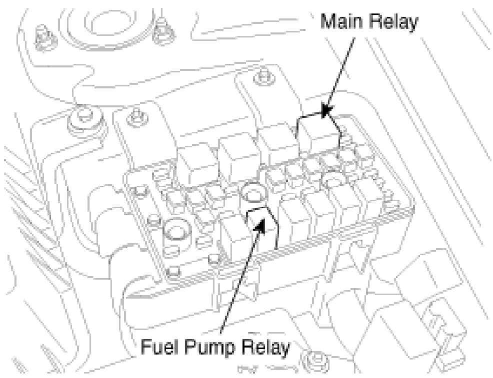
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0685

COMPONENT LOCATION



GENERAL DESCRIPTION

One terminal of main relay is connected to battery and the other terminal which is ground point is conneted to PCM. PCM monitors the voltages flowing into main relay and going through it.

DTC DESCRIPTION

Checking the contolling state of main relay every 10 sec. under detecting condition, if open or short in the circuit is detected for more than 5 sec., PCM sets P0685.

DTC DETECTING CONDITION

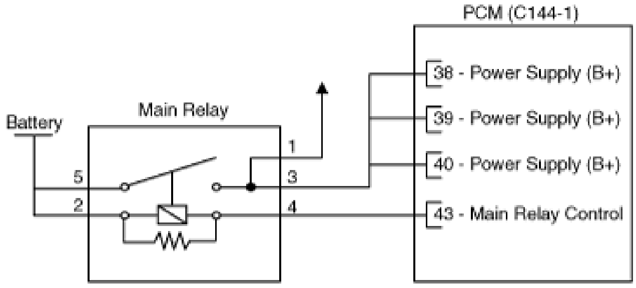
Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to ground, to battery or open circuit on Main Relay output Fault information provided by an output driver chip.	• Poor Connection • Open or short in control circuit. • Main Relay • PCM
EnableConditions	• Engine Running • 11V ≤ Ignition Voltage ≤ 16V • Enable Time delay ≥ 0.5sec.	
Threshold value	• Open or Short	
DiagnosisTime	• Contineous (More than 5sec. Failure for every 10 sec. test)	
MIL On Condition	• DTC only (NO MIL ON)	

SPECIFICATION

Coil Resistance
70Ω ~ 120Ω

SCHEMATIC DIAGRAM

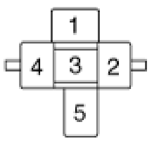
[CIRCUIT DIAGRAM]



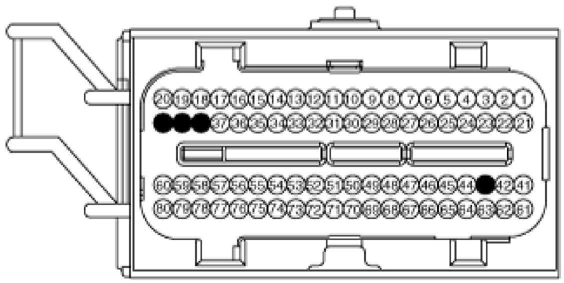
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	-	Power Supply (B+)
2	Battery	Battery Power (B+)
3	PCM C144-1 (38)	Power Supply (B+)
	PCM C144-1 (39)	
	PCM C144-1 (40)	
4	PCM C144-1 (43)	Main Relay Control
5	Battery	Battery Power (B+)

[HARNESS CONNECTOR]



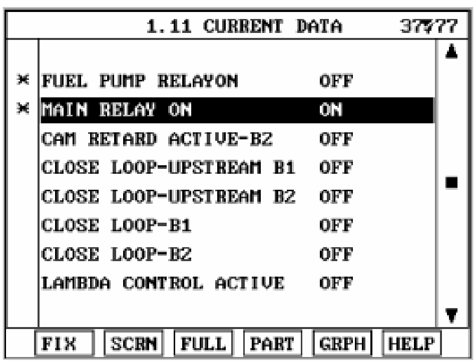
Main Relay



C144-1
PCM

MONITOR SCANTOOL DATA

1. Connect scantool to DLC(Data Link Connector)
2. Warm up the engine to normal operating temperature.
3. Monitor "Main Relay" parameter on scantool.



4. Is the "Main Relay" parameter displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

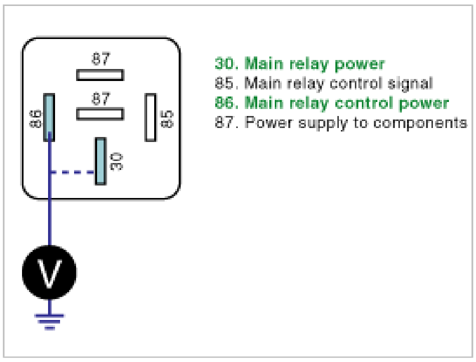
NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSEPCTION

1. IG "OFF"
2. Disconnect Main Relay
3. IG "ON" & ENG "OFF".
4. Measure voltage between harness terminal 2 of Main Relay and chassis ground.
5. Measure voltage between harness terminal 5 of Main Relay and chassis ground.

Specification : B+



6. Is the measured voltage within specification ?

YES

▸ Go to "Control Circuit Inspecition" procedure.

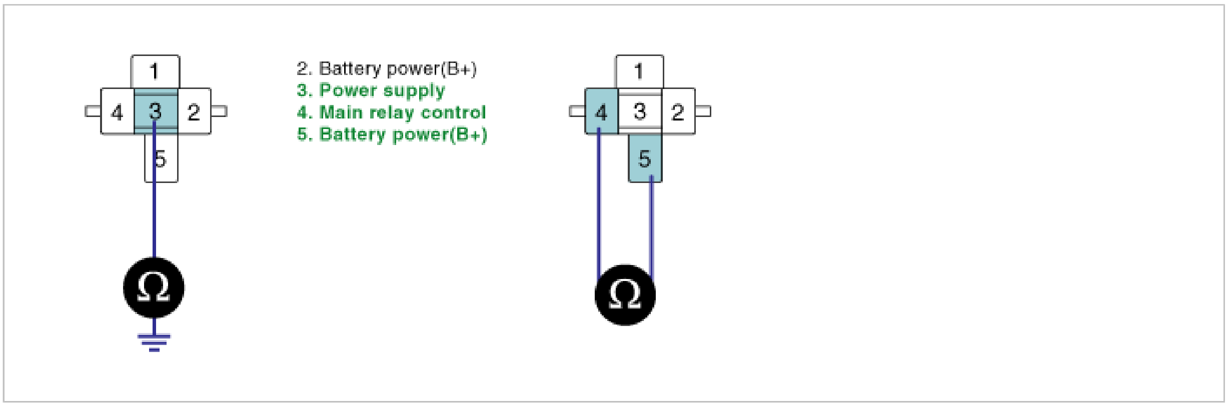
NO

▸ Check fuse between battery and main relay is disconnected.
▸ Repair or replace open or short in harness and then go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check short in coil control
   (1) IG "OFF".
   (2) Disconnect Main Relay and PCM connector.
   (3) Measure resistance between harness terminal 4 and chassis ground.
   (4) Measure resistance between harness terminal 4 and 5 of Main Relay.

   Specification : Infinite



   (5) Is the measured resistance within specification ?

   YES

   ▸ Go to "Check open in coil control" as follows.

   NO

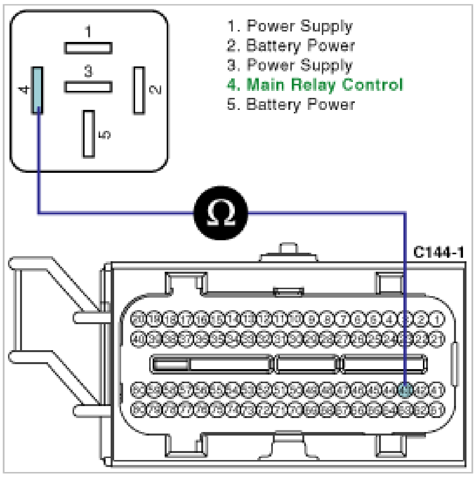
   ▸ Repair or replace as necessary and then go to " Verification of Vehicle Repair" procedure.

2. Check open in coil control
   (1) IG "OFF".

(2) Disconnect Main Relay and PCM connector.

(3) Measure resistance between harness terminal 4 of Main Relay and harness terminal 43/C144-1 of PCM harness connector.

Specification : Approx. below 1Ω



(4) Is the measured resistance within specifications ?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check Main Relay

(1) IG "OFF"

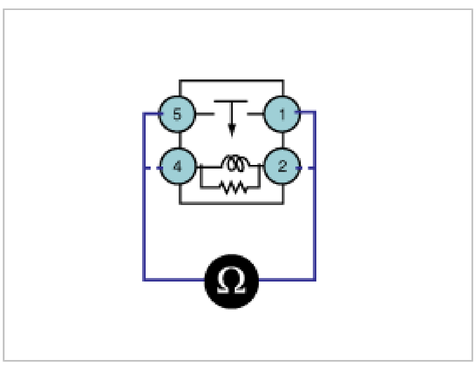
(2) Disconnect Main Relay

(3) Measure resistance between terminal 5 and 3 of Main Relay

(4) Measure resistance between terminal 4 and 2 of Main Relay.

Specification :

Terminal	continuity
3 ~ 5	NO
2 ~ 4	YES (Approx. 70Ω ~ 120Ω)



(5) Is the measured reisistance within specification ?

YES

▸ Substitute with a known - good PCM and check for proper operation.

If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by

PCM.

NO

▸ Substitute with a known - good Main Relay and check for proper operation.
If the problem is corrected, replace Main Relay and go to "Verification of Vehicle Repair"procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

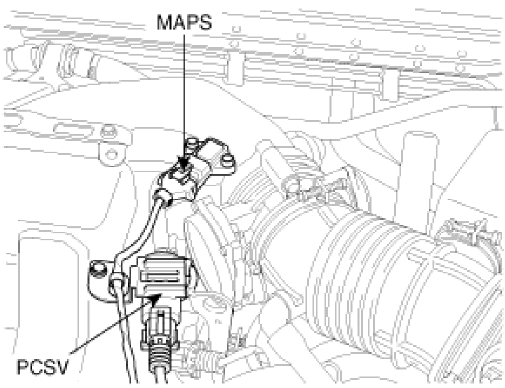
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P1106

COMPONENT LOCATION



GENERAL DESCRIPTION

The amount of intake air flow must be inputted to PCM in order to determine the fuel injection quantity. To measure the pressure inside of intake manifold, MAFS is used at idle and MAPS is required at accelerating. MAPS(Manifold Absolute Pressure) calculates the amount of air indirectly as measuring the pressure inside of intake manifold. This mechanism is alsl called Speed-Density Type.MAPS transfers analog output signal which is proportional to the change of intake manifold pressure, then, with this signal and RPM, PCM calculates the amount of intake air flow. MAPS is mounted on surge tank to measure the pressure inside of intake manifold, and it consists of a piezo electric element and hybrid IC which amplifies output signal from the element. A piezo electric element is a sort of a diaphragm using piezo electric effect. One side of the diaphragm is surrounded with vacuum chamber while intake pressure is applied to the other side. Thus, signals are output by the transformation of diagphragm according to the change of pressure inside of intake manifold.

DTC DESCRIPTION

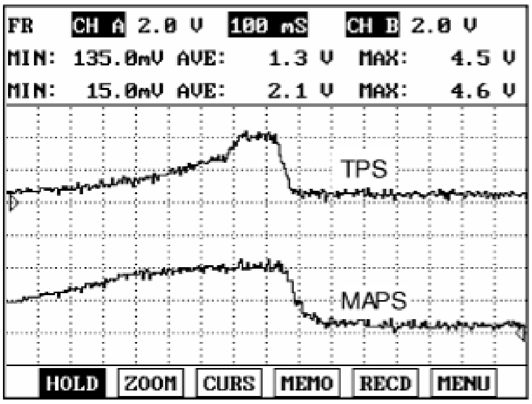
Checking output signals of MAPS every 60 sec. under detecting condition, if an output signal is above 4.5V for more than 2 sec., PCM sets P1106.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible Cause
DTC Strategy		• This code detects a intermittent short to high in either the signal circuit or the MAP sensor	
		• No TPS Active Fault Present	

EnableConditions	Case 1	• No TPS Short Fail Criteria Met • Engine Speed < 2500rpm • Throttle Position ≤ 30%	• Poor connection • Short to batteryin signal circuit • Open in groundcircuit • Faulty MAPS • Faulty PCM
	Case 2	• No TPS Active Fault Present • No TPS Short Fail Criteria Met • Engine Speed > 2500rpm • Throttle Position > 40%	
Threshold value		• MAP signal > 4.5V	
Diagnosis Time		• Continuous (More than 2 sec. failure for every 60 sec. test)	
MIL On Condition		• DTC only (NO MIL ON)	

SIGNAL WAVEFROM AND DATA



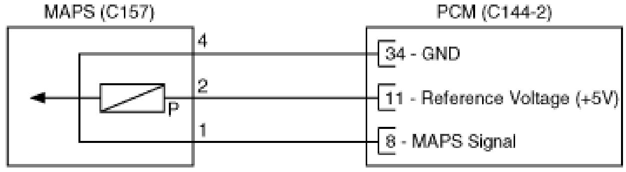
Comparing MAPS and TPS, The signals of MAPS and TPS increasess and decrease simultaneously.

SPECIFICATION

Pressure(kPa)	20	35	60	95	101.32
Voltage(V)	0.789	1.382	2.369	3.75	4
Allowable error(V)	± 0.045				

SCHEMATIC DIAGRAM

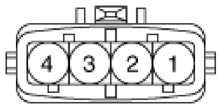
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

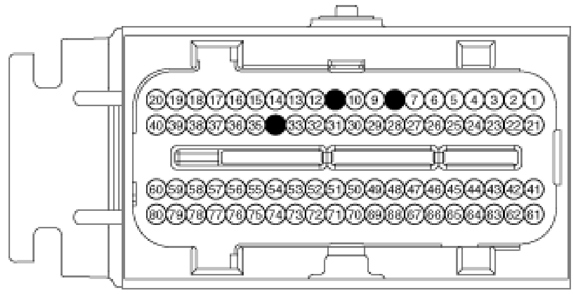
Terminal	Connected to	Funtion
1	PCM C144-2 (8)	MAPS Signal
2	PCM C144-2 (11)	Reference Voltage (+5V)
3	-	-
4	PCM C144-2 (34)	Sensor ground

[HARNESS CONNECTORS]



C157

MAPS

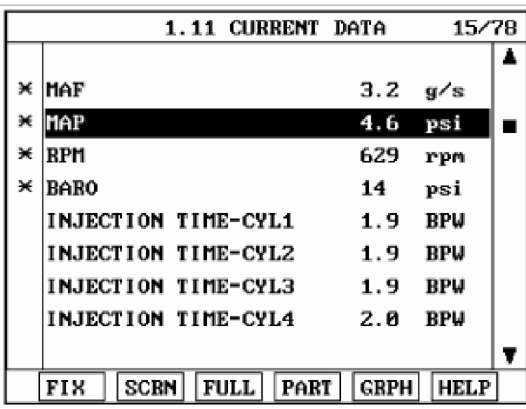


C144-2

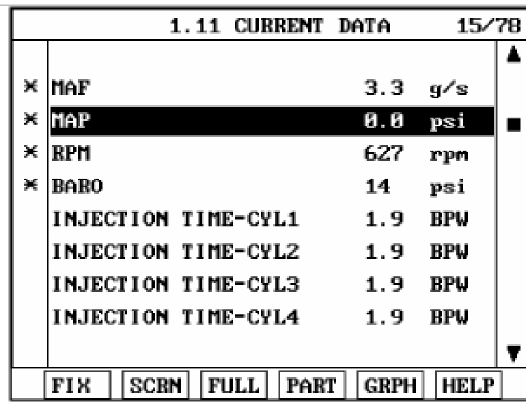
PCM

MONITOR SCANTOOL DATA

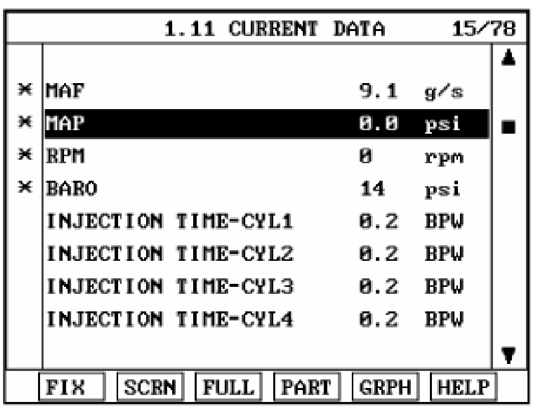
1. Connect scantool to Data Link Connector (DLC)
2. Warm up engine to normal operating temperature
3. Monitor "MAPS" parameter on the scantool.



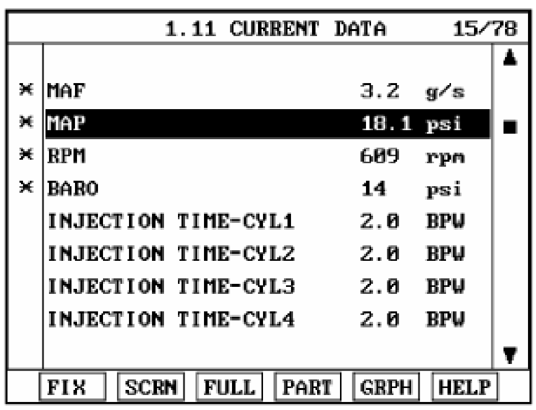
normal at idle



open



short to ground



short to 5V line

4. Is the current data displayed correctly ?

YES

▸Fault is intermittently caused by poor contact in the sensor and/or PCM connector or non cleared PCM memory after repair. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace if necessary and go to "Verification of vehicle Repair" .

NO

▸Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found ?

YES

▸ Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure

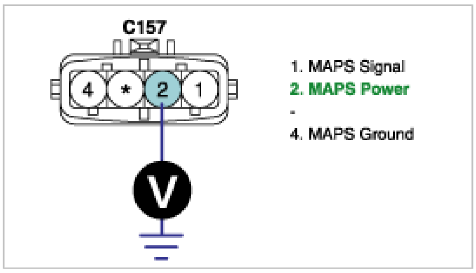
NO

▸ Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION

1. IG "OFF"
2. Disconnect MAPS connector
3. IG "ON"
4. Measure the voltage between terminal 2 of MAPS harness connector and ground.

Specification : Approx. 5V



5. Is the measured voltage within specification ?

YES

▸ Go to "Ground Circuit Inspection" procedure.

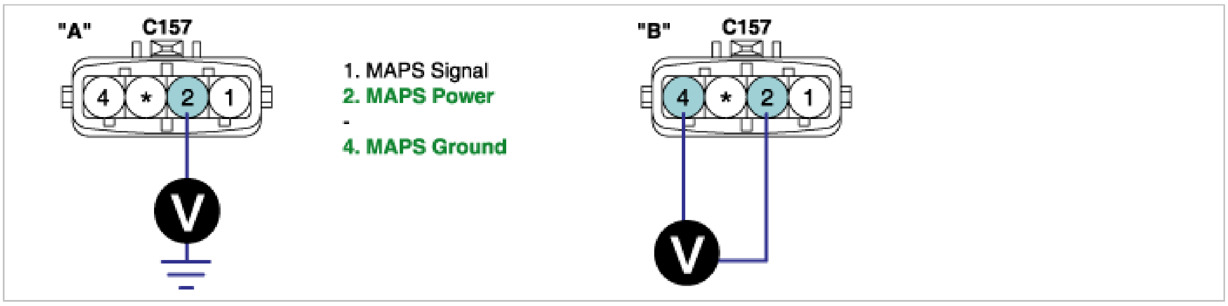
NO

▸ If the voltage is over 5.1V, check short to battery in harness.
▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF".
2. Disconnect MAPS connector.
3. IG "ON" & ENG "OFF"
4. Measure the voltage between terminal 2 of MAPS harness connector and chassis ground.
5. Measure the voltage between terminal 2 and 4 of MAPS harness connector.

Specification : "A" - "B" = : Approx. below 200mV



6. Is the measured voltage within specification ?

YES

▸ Go to "Signal Circuit Inspection" procedure.

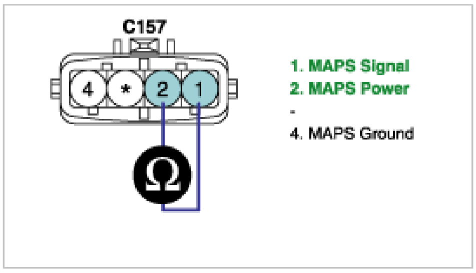
NO

▸ Repair contact reistance or open in harness and then go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. IG "OFF"
2. Disconnect MAPS and PCM connector.
3. Measure resistance between terminal 1 and 2 of MAPS harness connector.

Specification : Infinite



4. Is the measured resistance within specification ?

YES

▸ Go to "Component inspection" procedure.

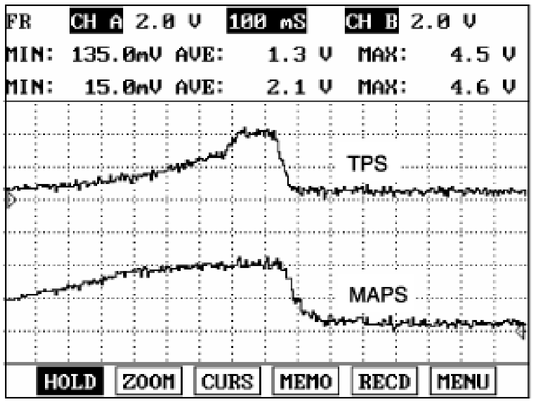
NO

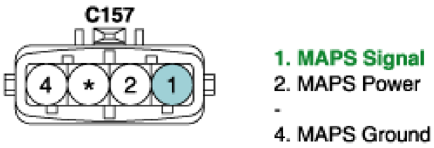
▸ Repair contact reistance or open in harness and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. MAPS performance test
   (1) IG "OFF"
   (2) Connect scantool to Data Link Connector(DLC) and selest "Oscilloscope" then, connect probes to output signal lines of MAPS and TPS.Turn engine "ON" and monitor the waveforms accelerating or decelerating
   (3) Start engine and monitor signal waveform during accelleration and decelleration.
   Specificaton :

Pressure (kPa)	20	35	60	95	101.32
Voltage (V)	0.789	1.382	2.369	3.75	4
Tolerance (V)	± 0.045				





   (4) Is the waveform displayed correctly?(Compare the response time of TPS and MAPS)

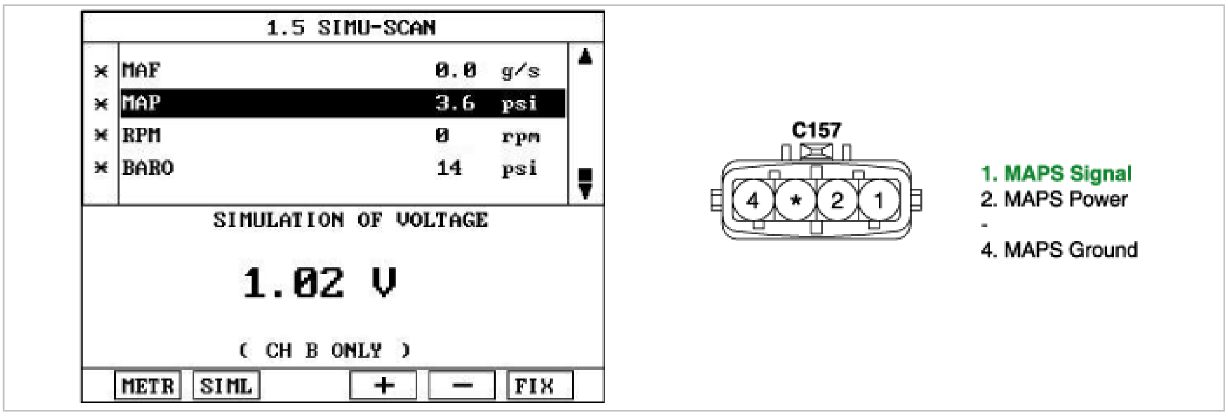
YES

▸ Go to "Check PCM".

NO

▸ After replacing MAPS with new one, if it operates normally, replace MAPS and go to "Verification of Vehicle Repair".

2. Check PCM
   (1) IG "OFF" and disconnect MAPS connector.
   (2) Connect scantool and IG "ON" & ENG "OFF"
   (3) Select simulation function on scantool.
   (4) Simulate voltage at terminal 1 of MAPS harness connector.



   (5) Does the output voltage response to the change of signal by simulation?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

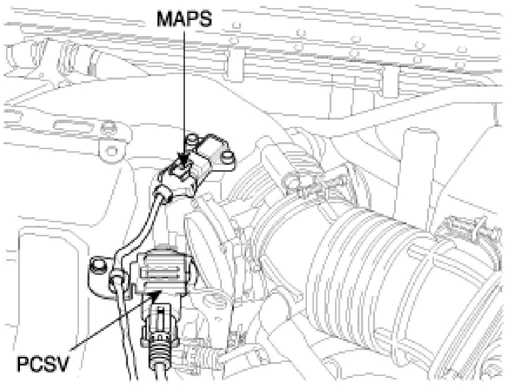
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P1107

COMPONENT LOCATION



GENERAL DESCRIPTION

The amount of intake air flow must be inputted to PCM in order to determine the fuel injection quantity. To measure the pressure inside of intake manifold, MAFS is used at idle and MAPS is required at accelerating. MAPS(Manifold Absolute Pressure) calculates the amount of air indirectly as measuring the pressure inside of intake manifold. This mechanism is alsl called Speed-Density Type.MAPS transfers analog output signal which is proportional to the change of intake manifold pressure, then, with this signal and RPM, PCM calculates the amount of intake air flow. MAPS is mounted on surge tank to measure the pressure inside of intake manifold, and it consists of a piezo electric element and hybrid IC which amplifies output signal from the element. A piezo electric element is a sort of a diaphragm using piezo electric effect. One side of the diaphragm is surrounded with vacuum chamber while intake pressure is applied to the other side. Thus, signals are output by the transformation of diagphragm according to the change of pressure inside of intake manifold.

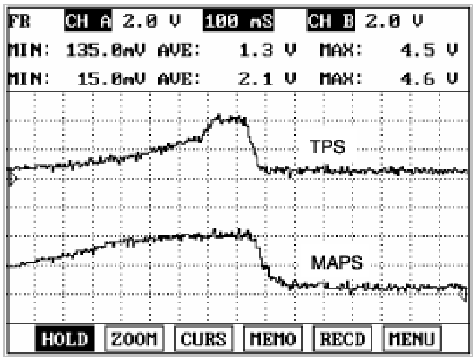
DTC DESCRIPTION

Checking output signals of MAPS every 60 sec. under detecting condition, if an output signal is below 0.25V for more than 2 sec., PCM sets P1107.

DTC DETECTING CONDITION

<table>
<tr><th colspan="2">Item</th><th>Detecting Condition</th><th>Possible Cause</th></tr>
<tr><td colspan="2">DTC Strategy</td><td>• This code detects a intermittent short to low or open in either the signal circuit or the MAP</td><td rowspan="6">• Poor Connection
• Open or Short to ground in Power Circuit
• Open or short to ground in Signal Circuit.
• Faulty MAPS
• Faulty PCM</td></tr>
<tr><td rowspan="2">Enable Conditions</td><td>Case 1</td><td>• No TPS Active Fault Present
• No TPS Short Fail Criteria Met
• Ignition Voltage ≥ 11V
• Engine Speed < 1000rpm
• Throttle Position ≤ 0%</td></tr>
<tr><td>Case 2</td><td>• No TPS Active Fault Present
• Ignition Voltage ≥ 11V
• Engine Speed > 1000rpm
• Throttle Position > 30%</td></tr>
<tr><td colspan="2">Threshold value</td><td>• MAP signal < 0.25V</td></tr>
<tr><td colspan="2">Diagnosis Time</td><td>• Continuous
(More than 2 sec. failure for every 60 sec. test)</td></tr>
<tr><td colspan="2">MIL On Condition</td><td>• DTC only (NO MIL ON)</td></tr>
</table>

SIGNAL WAVEFORM AND DATA

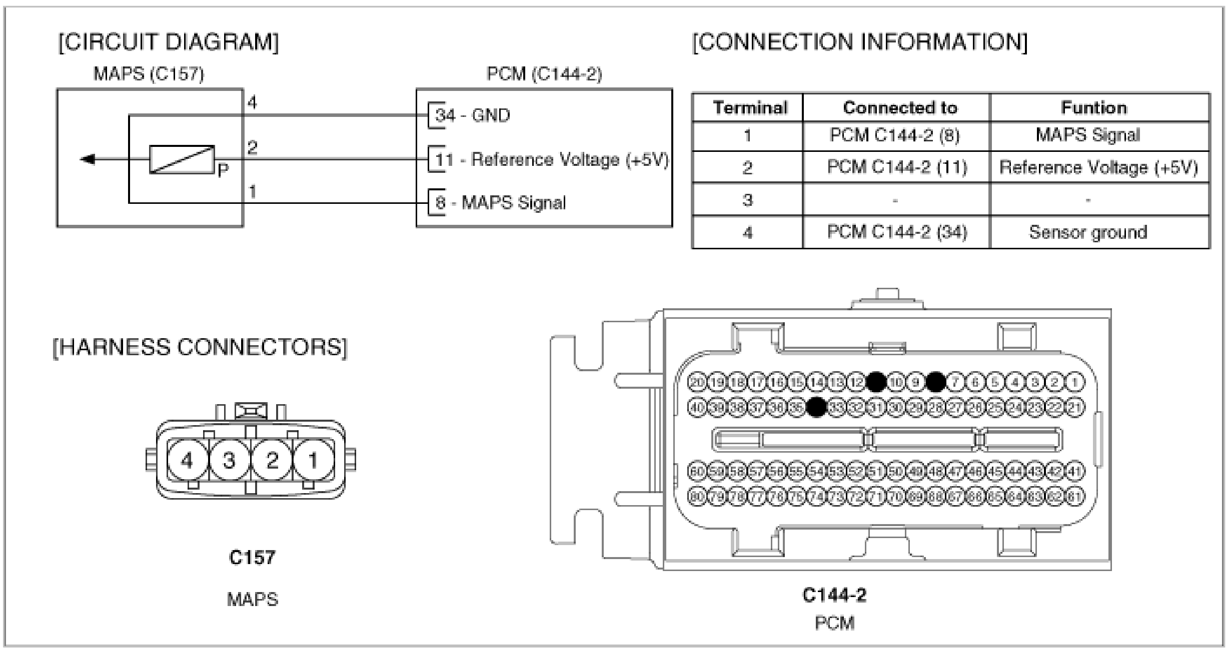


Comparing MAPS and TPS, The signals of MAPS and TPS increasess and decrease simultaneously.

SPECIFICATION

Pressure(kPa)	20	35	60	95	101.32
Voltage(V)	0.789	1.382	2.369	3.75	4
Allowable error(V)	± 0.045				

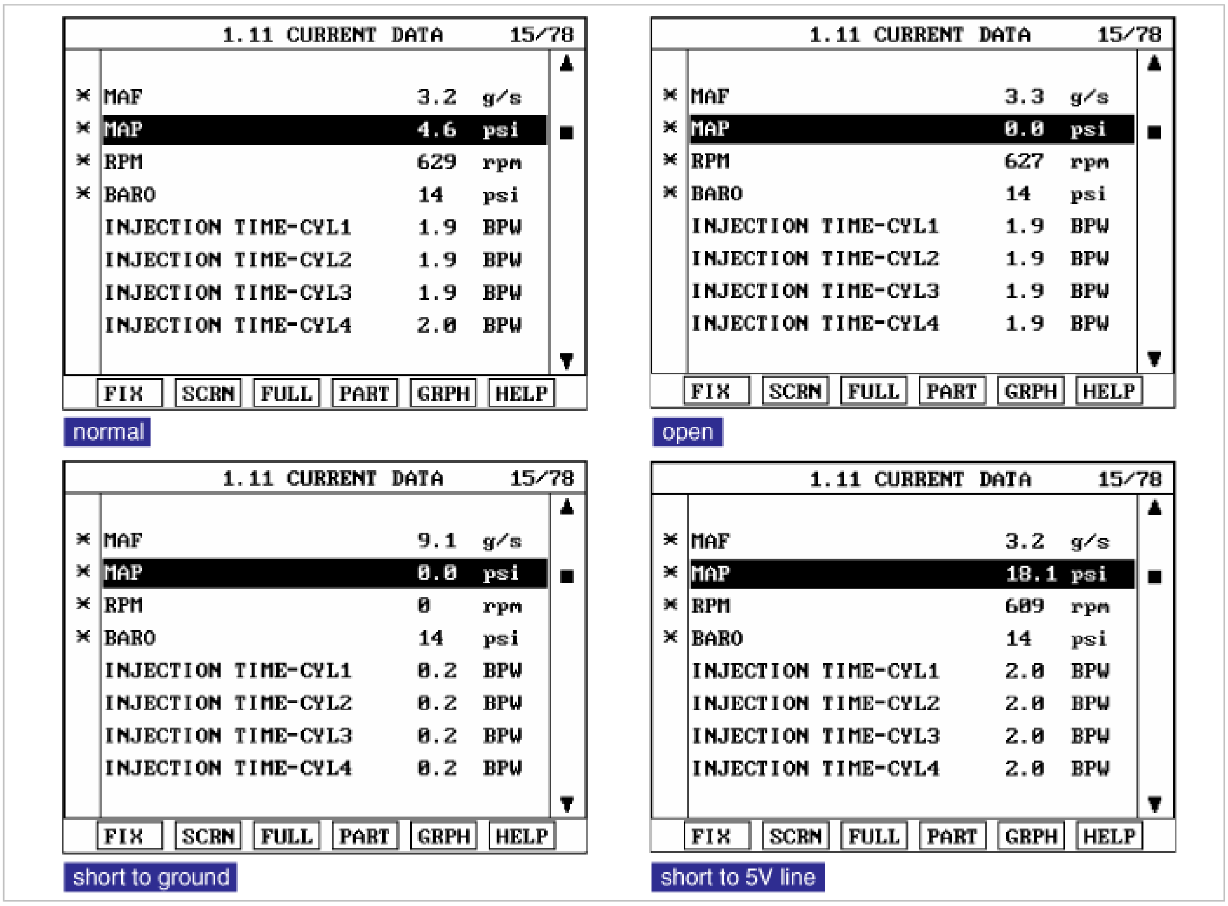
SCHEMATIC DIAGRAM



Terminal	Connected to	Funtion
1	PCM C144-2 (8)	MAPS Signal
2	PCM C144-2 (11)	Reference Voltage (+5V)
3	-	-
4	PCM C144-2 (34)	Sensor ground

MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector (DLC)
2. Warm up engine to normal operating temperature
3. Monitor "MAPS" parameter on the scantool.



4. Is the current data displayed correctly ?

YES

▸ Fault is intermittently caused by poor contact in the sensor and/or PCM connector or non cleared PCM memory after repair. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace if necessary and go to "Verification of vehicle Repair" .

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure

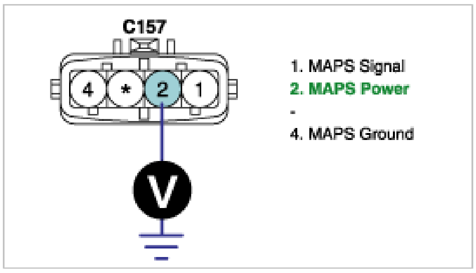
NO

▸ Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION

1. IG "OFF"
2. Disconnect MAPS connector.
3. IG "ON"
4. Measure the voltage between terminal 2 of MAPS harness connector and ground.

Specification : Approx. 5V



5. Is the measured voltage within specification ?

YES

▸ Go to "Signal Circuit Inspection" of MAPS.

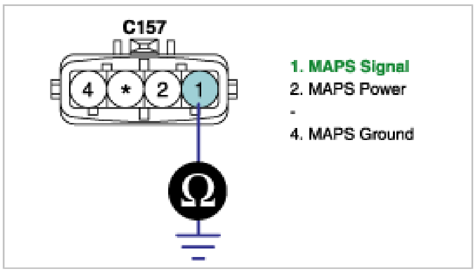
NO

▸ After repairing open or short to ground in harness and go to "Verification of Vehicle Repair"

SIGNAL CIRCUIT INSPECTION

1. Check short to ground in harness
   (1) IG "OFF"
   (2) Disconnect MAPS and PCM connector.
   (3) Measure the resistance between terminal 1 of MAPS harness connector and ground.

   Specification : Infinite

   (4) Is the measured resistance within the specification?

   YES

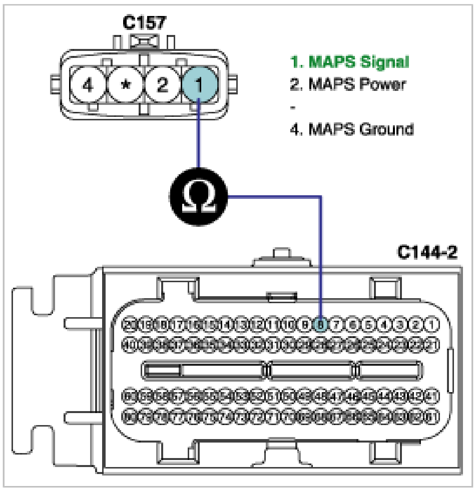
   ▸ Go to "Check open in the harness" of MAPS.

   NO

   ▸ After repairing short to ground in circuits and go to "Verification of Vehicle Repair"

2. Check open in the harness
   (1) IG "OFF"
   (2) Disconnect MAPS and PCM connector.
   (3) Measure the resistance between terminal 1 of MAPS harness connector and terminal 8/C144-2 of PCM harness connector

   Specification : Approx. below 1 Ω



(4) Is the measured resistance within the specification?

YES

▶ Go to "Component Inspection" of MAPS.

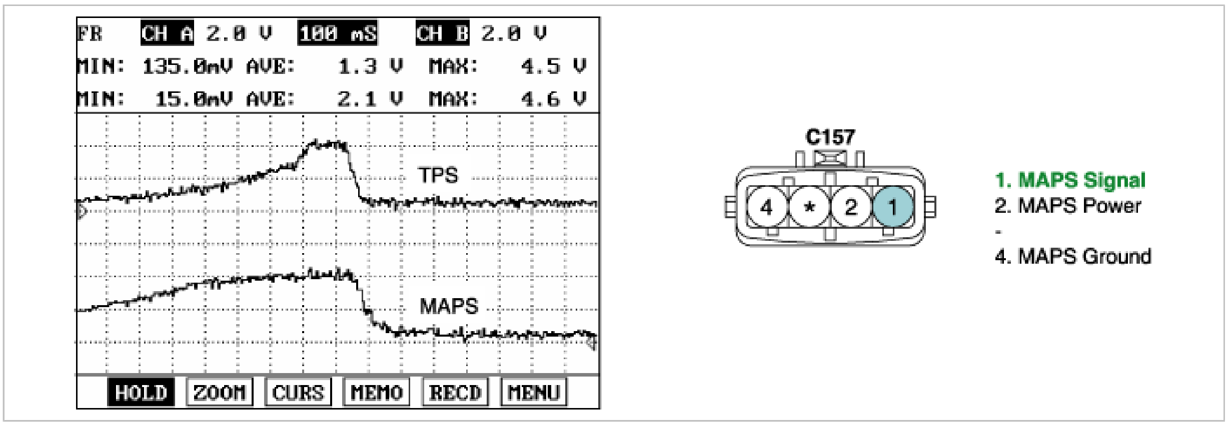
NO

▶ Repair open in the harness and go to "Verification of Vehicle Repair".

COMPONENT INSPECTION

1. MAPS performance test
   (1) IG "OFF"
   (2) Connect scantool to Data Link Connector(DLC) and selest "Oscilloscope" then, connect probes to output signal lines of MAPS and TPS.Turn engine "ON" and monitor the waveforms accelerating or decelerating
   (3) ENG "ON" and monitor signal waveform during accelleration and decelleration.
   Specificaton :

Pressure (kPa)	20	35	60	95	101.32
Voltage (V)	0.789	1.382	2.369	3.75	4
Tolerance (V)	± 0.045				



   (4) Is the waveform displayed correctly?(Compare the response time of TPS and MAPS)

YES

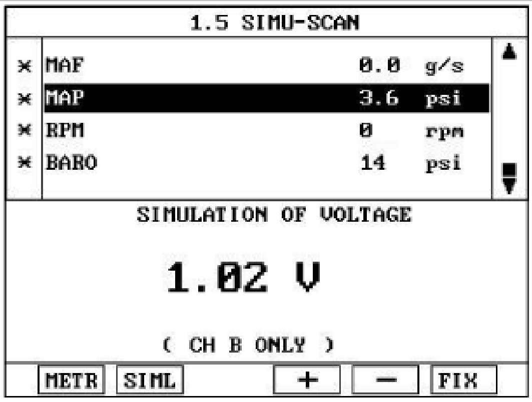
▶ Go to "Check PCM".

NO

▶ After replacing MAPS with new one, if it operates normally, replace MAPS and go to "Verification of Vehicle Repair".

2. Check PCM
   (1) IG "OFF" disconnect MAPS connector
   (2) Connect Scantool and IG "ON" & ENG "OFF"
   (3) Select simulation function on scantool.

(4) Simulate voltage at terminal 1 of MAPS harness connector.



(5) Does the output voltage response to the change of signal by simulation?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

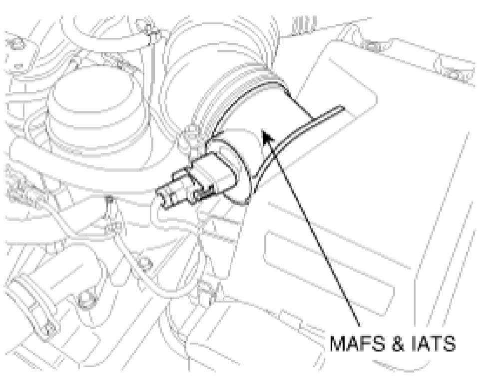
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P1111

COMPONENT LOCATION



GENERAL DESCRIPTION

The Intake Air Temperature (IAT) sensor measures the temperature of engine intake air. The Intake Air Temperature (IAT) sensor is a thermistor (a variable resistor that changes along with outside air temperature) in series with a fixed resistor in the PCM. The PCM applies 5V to the IAT sensor. The PCM monitors the voltage across the IAT sensor and converts it into a temperature reading. When the outside air temperature is cold the IAT sensor resistance is high, and when the outside air temperature is warm the IAT sensor resistance is low. Therefore, when the air temperature is cold the PCM will receive a high voltage input, and when the air temperature is warm the PCM will receive a low voltage input. The signal from IAT sensor is used for injection time correction, ignition timing correction and idle speed correction(Air-density correction).

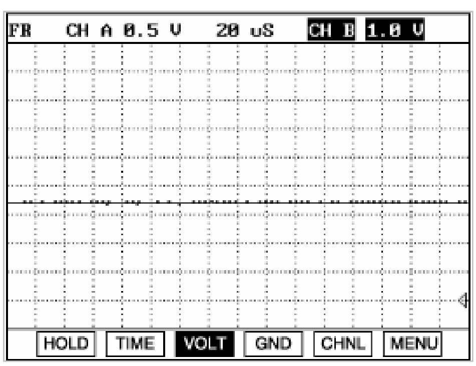
DTC DESCRIPTION

Checking output signals of IATS every 120 sec. under detecting condition, if an ouput signal is over 4.9V for more than 4 sec., PCM sets P1111.

DTC DETECTING CONDITION

<table>
<tr><th colspan="2">Item</th><th>Detecting Condition</th><th>Possible Cause</th></tr>
<tr><td colspan="2">DTC Strategy</td><td>• This code detects a continuous short to high in either the signal circuit or the sensor</td><td rowspan="6">• Poor Connection
• Open or short in signal circuit
• Open in ground circuit
• Faulty IATS
• Faulty PCM</td></tr>
<tr><td rowspan="2">Enable Conditions</td><td>Case 1</td><td>• No VSS Fault Active (No P0501)
• No Coolant Short Active Fault Present
• No MAF Active Fault Present
• Engine Air Flow < 15 g/s
• Vehicle Speed < 25kph
• Engine Coolant Temperature > 50°C(122 °F)
• Engine Running Time > 120 sec.</td></tr>
<tr><td>Case 2</td><td>• No VSS Fault Active (No P0501)
• No Coolant Short Active Fault Present
• No MAF Active Fault Present
• Engine Air Flow < 15 g/s
• Vehicle Speed < 25kph
• Ignition off time > 360 min.
• Engine Coolant Temperature > -10°C(14 °F)
• Engine Running</td></tr>
<tr><td colspan="2">Threshold value</td><td>• IATS signal > 4.9V</td></tr>
<tr><td colspan="2">Diagnosis Time</td><td>• Continuous
(More than 4 sec. failure for every 120 sec. test)</td></tr>
<tr><td colspan="2">MIL On Condition</td><td>• DTC only (NO MIL ON)</td></tr>
</table>

SIGNAL WAVEFORM AND DATA



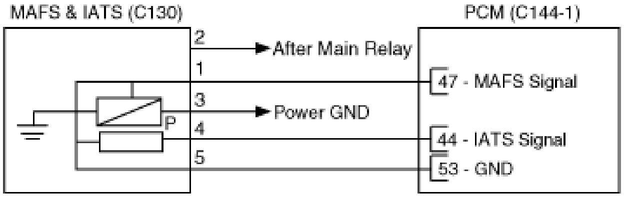
The output signals of IATS & ECTS change smoothly without any rapid changes. Those have almost same characteristic signal during the early period after start. It means that the temperatures of intake air and engine coolant are depended on the temperature of atmosphere. Meanwhile, during the warming up, the output signal of ECTS is going up increasingly. but, the output signal of IATS changes a little bit. even it may not change almost. It means that the heat of engine does not affect on the temperature of intake air.

SPECIFICATION

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	95.95 ~ 105.78	20(68)	3.42 ~ 3.61
-20(-4)	27.4 ~ 29.77	40(104)	1.43 ~ 1.5
0(32)	9.08 ~ 9.72	60(140)	0.66 ~ 0.69
10(50)	5.49 ~ 5.83	80(176)	0.33 ~ 0.34

SCHEMATIC DIAGRAM

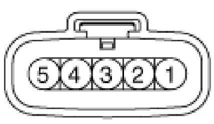
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

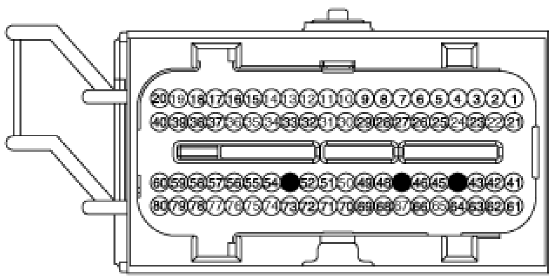
Terminal	Connected to	Funtion
1	PCM C144-1 (47)	MAFS Signal
2	Main Relay	Battery Voltage (B+)
3	Chassis Ground	Ground
4	PCM C144-1 (44)	IATS Signal
5	PCM C144-1 (53)	Sensor Ground

[HARNESS CONNECTORS]



C130

MAFS & IATS



C144-1

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "IATS" item on the service data.

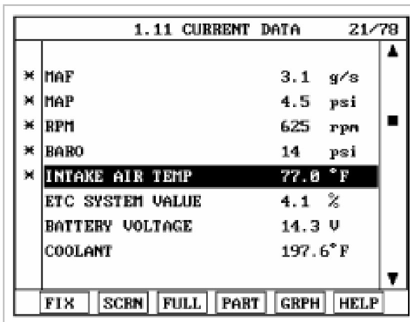


Fig. 1

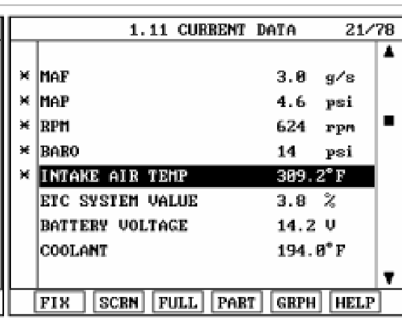


Fig. 2

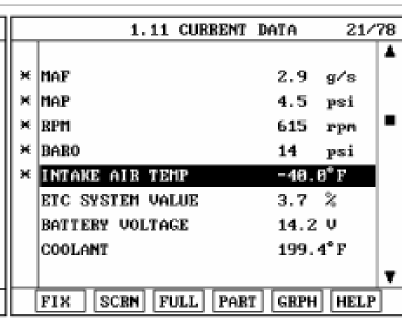


Fig. 3

Fig. 1 : Open at idle
Fig. 2 : Short to ground
Fig. 3 : Short to battery

4. Is the "IATS" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

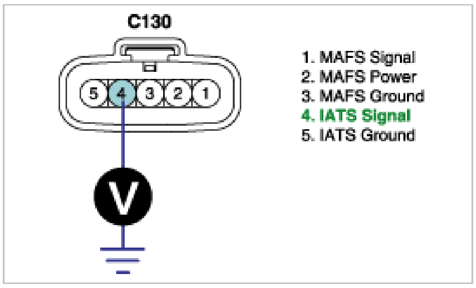
NO

▸ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF" and disconnect IATS connector.
   (2) IG "ON" and ENG "OFF"
   (3) Measure voltage between terminal 4 of IATS harness connector and chassis ground.

   Specification : Approx. 5V



   (4) Is the measured voltage within specification ?

   YES

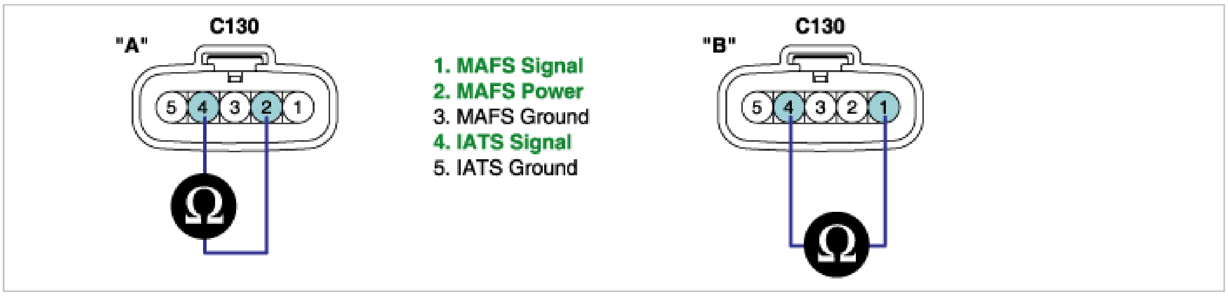
   ▸ Go to "Ground Circuit Inspection" procedure.

   NO

   ▸ If the voltage is 0V, go to "Check open in harness" as follows. If the voltage is more than 5.1V, go to "Check short to battery in harness" as follows.

2. Check short to battery in harness
   (1) IG "OFF" and disconnect IATS connector and PCM connector.
   (2) Measure resistance between terminals 2 and 4 of IATS harness connector.
   (3) Measure resistance between terminals 1 and 4 of IATS harness connector.

   Specification : Infinite



   (4) Is the measured resistance within specification?

   YES

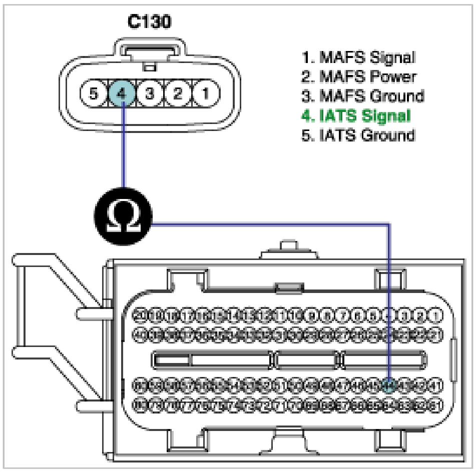
   ▸ Go to "Component Inspection" procedure.

   NO

   ▸ Repair short to battery in harness and go to "Verification of Vehicle Repair" procedure.

3. Check open in harness
   (1) IG "OFF" and disconnect IATS connector and PCM connctor.
   (2) Measure resistance between terminal 4 of IATS harness connector and 44 of PCM harness connector.

Specification : below 1Ω



   (3) Is the measured resistance within specification?

YES

▸ Go to "Ground Circuit Inspection" procedure.

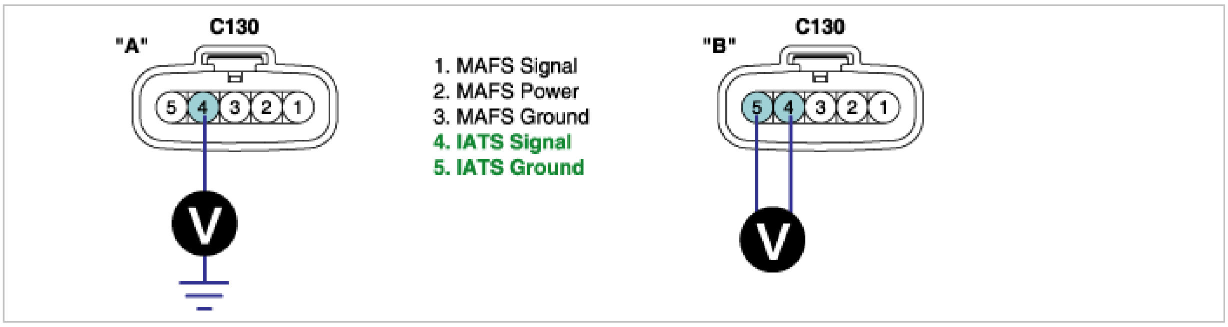
NO

▸ Repair open in harness and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF" and disconnect IATS connector.
2. Measure voltage between terminal 4 of IATS harness connector and chassis ground.
3. Measure voltage between terminals 4 and 5 of IATS harness connector.

Specification : Voltage difference between measurement "A" and "B" is below 200mV.



4. Is the measured voltage within specification ?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair contact resistance or open in harness and go to "Verification of Vehicle Repair" procedure.

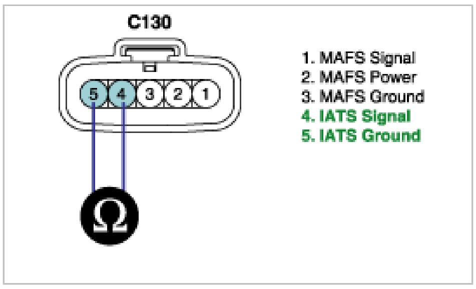
COMPONENT INSPECTION

1. Check IATS
   (1) IG "OFF" and disconnect IATS connector.
   (2) Measure resistance between teminals 4 and 5 of IATS connector.(Component side)

Specificaton :

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)

-40(-40)	95.95 ~ 105.78	20(68)	3.42 ~ 3.61
-20(-4)	27.4 ~ 29.77	40(104)	1.43 ~ 1.5
0(32)	9.08 ~ 9.72	60(140)	0.66 ~ 0.69
10(50)	5.49 ~ 5.83	80(176)	0.33 ~ 0.34



(3) Is the measured resistance within specification ?

YES

▶ Go to "Check PCM" as follows.

NO

▶ Substitute with a known - good IATS and check for proper operation. If the problem is corrected, replace IATS and go to "Verification of Vehicle Repair" procedure.

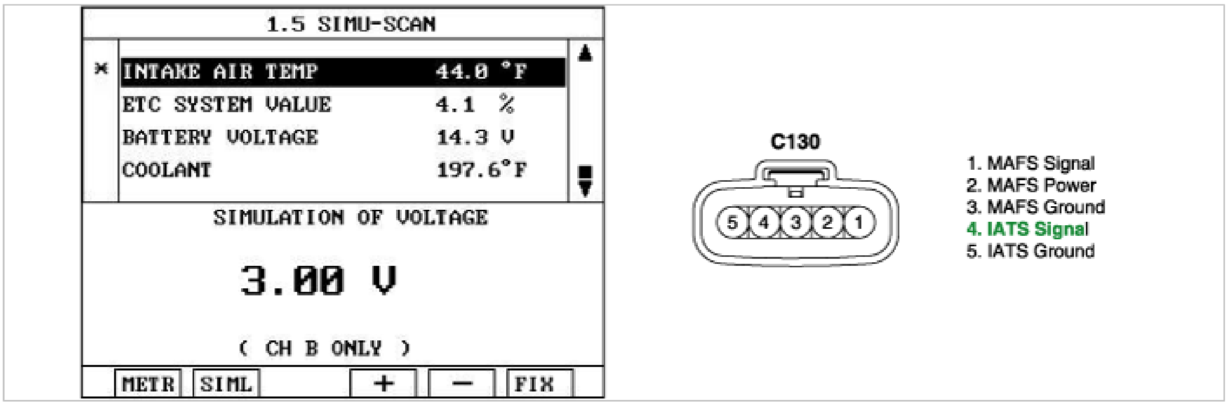
2. Check PCM

(1) IG "OFF" and connect scantool.

(2) Disconnect IATS connector and connect probe to terminal 4 of IATS harness connector.

(3) IG "ON" and ENG "OFF" and simulation Function on scantool.

(4) Simulate voltage at terminal 4 of IATS harness connector.



(5) Does the signal value of IAT sensor change according to simulation voltage ?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs

3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P1112

COMPONENT LOCATION

GENERAL DESCRIPTION

The Intake Air Temperature (IAT) sensor measures the temperature of engine intake air. The Intake Air Temperature (IAT) sensor is a thermistor (a variable resistor that changes along with outside air temperature) in series with a fixed resistor in the PCM. The PCM applies 5V to the IAT sensor. The PCM monitors the voltage across the IAT sensor and converts it into a temperature reading. When the outside air temperature is cold the IAT sensor resistance is high, and when the outside air temperature is warm the IAT sensor resistance is low. Therefore, when the air temperature is cold the PCM will receive a high voltage input, and when the air temperature is warm the PCM will receive a low voltage input. The signal from IAT sensor is used for injection time correction, ignition timing correction and idle speed correction(Air-density correction).

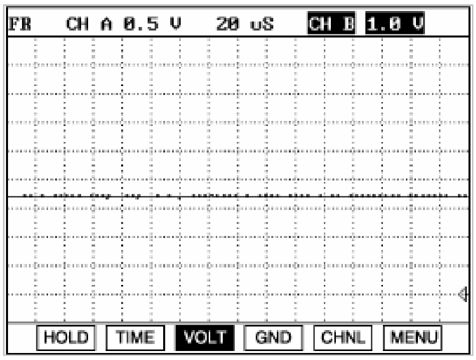
DTC DESCRIPTION

Checking output signals of IATS every 20 sec. under detecting condition, if an ouput signal is below 0.1V for more than 10 sec., PCM sets P1112.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible Cause
DTC Strategy		• This code detects a continuous short to ground in either the signal circuit or the sensor	• Poor Connection • Short to ground in signal circuit. • Faulty IATS • Faulty PCM
Enable Conditions	Case 1	• Engine Run State • No VSS Fault Active • Vehicle Speed > 50kph(31mph) • IAT Short Low Enable Criteria Met	
	Case 2	• Engine Running Time > 120sec. • IG "OFF" time > 360min. • IAT Short Low Enable Criteria Met	
Threshold value		• IATS signal < 0.1V	
Diagnosis Time		• Continuous (More than 10 sec. failure for every 20 sec. test)	
MIL On Condition		• DTC only	

SIGNAL WAVEFORM AND DATA



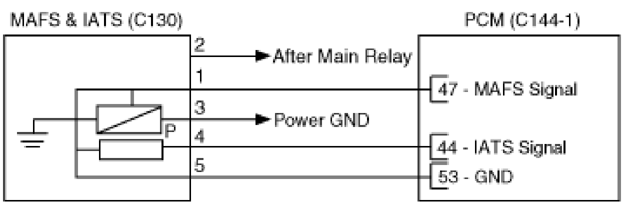
The output signals of IATS & ECTS change smoothly without any rapid changes. Those have almost same characteristic signal during the early period after start. It means that the temperatures of intake air and engine coolant are depended on the temperature of atmosphere. Meanwhile, during the warming up, the output signal of ECTS is going up increasingly. but, the output signal of IATS changes a little bit. even it may not change almost. It means that the heat of engine does not affect on the temperature of intake air.

SPECIFICATION

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	95.95 ~ 105.78	20(68)	3.42 ~ 3.61
-20(-4)	27.4 ~ 29.77	40(104)	1.43 ~ 1.5
0(32)	9.08 ~ 9.72	60(140)	0.66 ~ 0.69
10(50)	5.49 ~ 5.83	80(176)	0.33 ~ 0.34

SCHEMATIC DIAGRAM

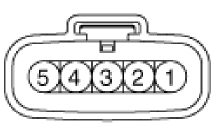
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

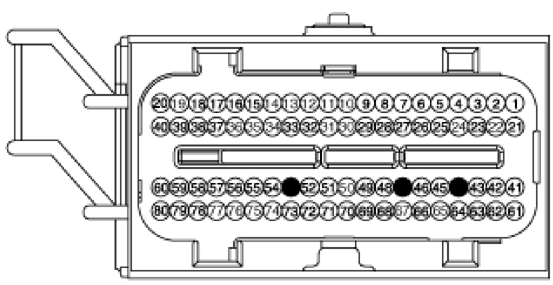
Terminal	Connected to	Funtion
1	PCM C144-1 (47)	MAFS Signal
2	Main Relay	Battery Voltage (B+)
3	Chassis Ground	Ground
4	PCM C144-1 (44)	IATS Signal
5	PCM C144-1 (53)	Sensor Ground

[HARNESS CONNECTORS]



C130

MAFS & IATS



C144-1

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "IATS" item on the service data.

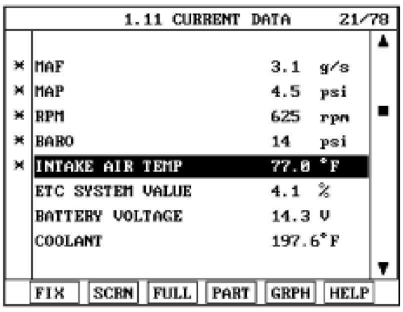


Fig. 1

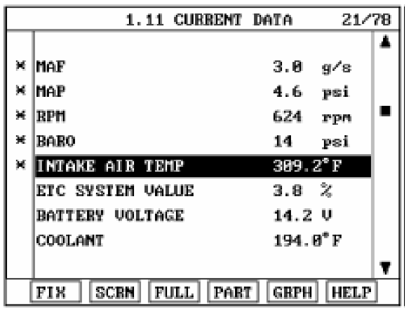


Fig. 2

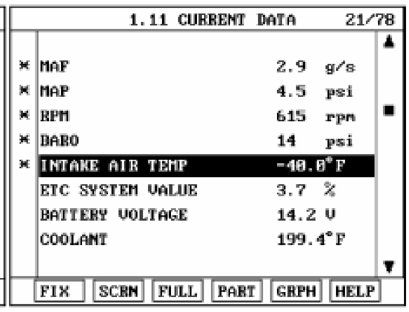


Fig. 3

Fig. 1 : Open at idle
Fig. 2 : Short to ground
Fig. 3 : Short to battery

4. Is the "IATS" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to " Signal Circuit Inspection " procedure.

SIGNAL CIRCUIT INSPECTION

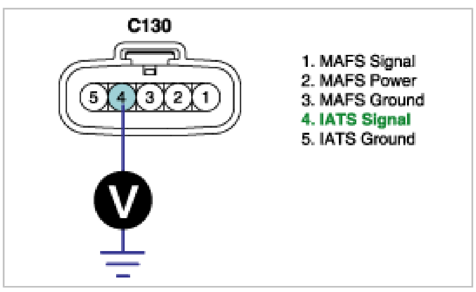
1. Check voltage

(1) IG "OFF" and disconnect IATS connector.

(2) IG "ON" and ENG "OFF"

(3) Measure voltage between terminal 4 of IATS harness connector and chassis ground.

Specification : Approx. 5V



(4) Is the measured voltage within specification ?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Go to " Check short to ground in harness" procedure.

2. Check short to ground in harness

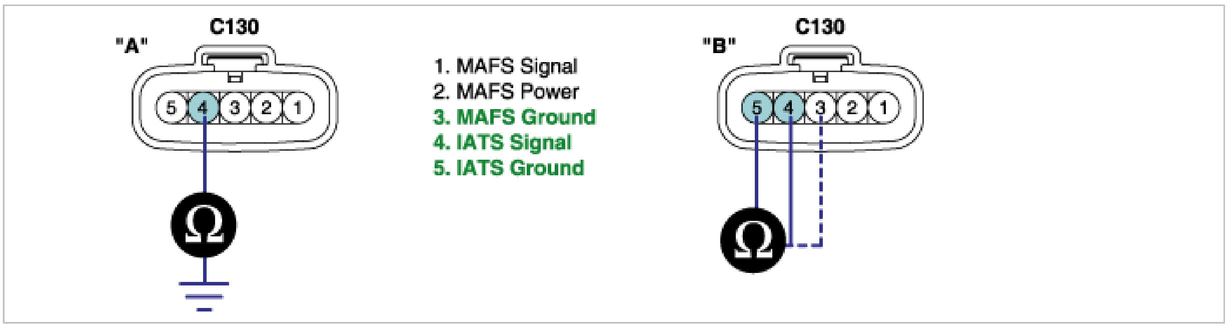
(1) IG "OFF" and disconnect IATS connector and PCM connector.

(2) Measure resistance between terminal 4 of IATS harness connector and chassis ground.

(3) Measure resistance between terminals 4 and 5 of IATS harness connector.

(4) Measure resistance between terminals 4 and 3 of IATS harness connector.

Specification : Infinite



(5) Is the measured resistance within specification?

YES

▸ Go to "Component inspection" procedure.

NO

▸ Repair short to ground in harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

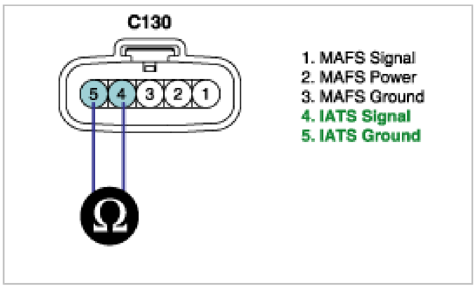
1. Check IATS

(1) IG "OFF" and disconnect IATS connector.

(2) Measure resistance between teminals 4 and 5 of IATS connector.(Component side)

Specificaton :

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	95.95 ~ 105.78	20(68)	3.42 ~ 3.61
-20(-4)	27.4 ~ 29.77	40(104)	1.43 ~ 1.5
0(32)	9.08 ~ 9.72	60(140)	0.66 ~ 0.69
10(50)	5.49 ~ 5.83	80(176)	0.33 ~ 0.34



(3) Is the measured resistance within specification ?

YES

▸ Go to "Check PCM" as follows.

NO

▸ Substitute with a known - good IATS and check for proper operation. If the problem is corrected, replace IATS and go to "Verification of Vehicle Repair" procedure.

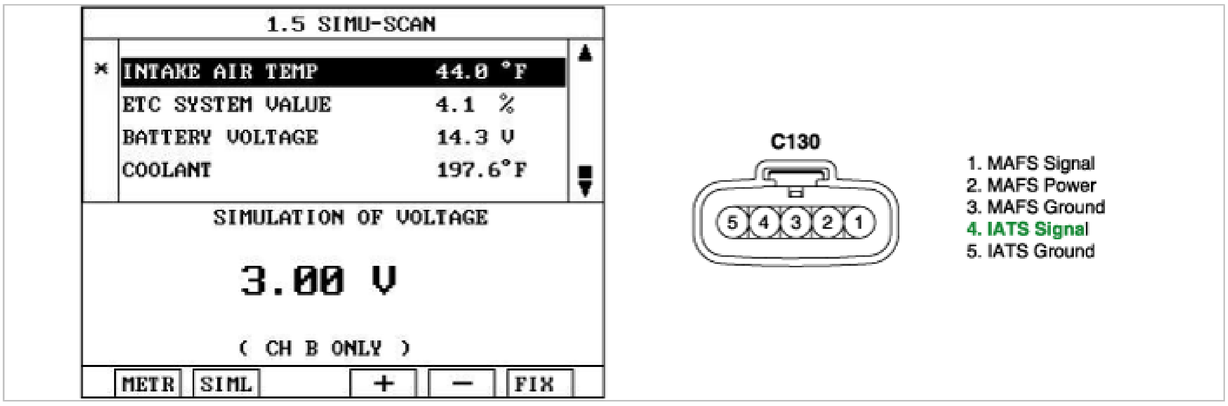
2. Check PCM

(1) IG "OFF" and connect scantool.

(2) Disconnect IATS connector and connect probe to terminal 4 of IATS harness connector.

(3) IG "ON" and ENG "OFF" and simulation Function on scantool.

(4) Simulate voltage at terminal 4 of IATS harness connector.



(5) Does the signal value of IAT sensor change according to simulation voltage ?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

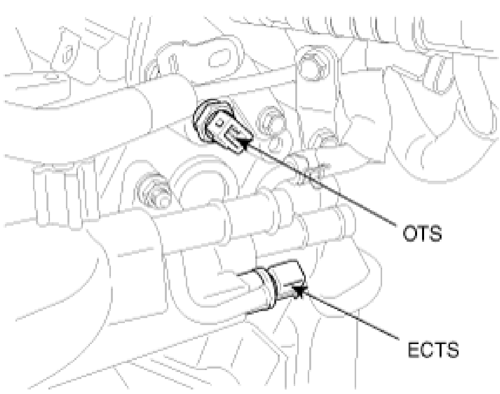
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P1114

COMPONENT LOCATION



GENERAL DESCRIPTION

The Engine Coolant Temperature(ECT) Sensor measures the temperature of engine coolant. The Engine Coolant Temperature (ECT) Sensor is located near the thermostat housing of the cylinder head. ECT Sensor is a thermistor (A Variable Resistor that Changes Along with ECT) in series with a fixed resistor in the Engine Control Module (PCM). The PCM applies 5 volts to the ECT sensor. The PCM monitors the voltage across the ECT sensor and converts it into a temperature reading. When the engine is cold the ECT sensor resistance is high, and when the engine is warm the ECT sensor resistance is low. Therefore, when the engine is cold the PCM will receive a high voltage input, and when the engine is warm the PCM will receive a low voltage input. The signal from ECT sensor is used for Injection, ignition timing, idle speed and cooling fan control.

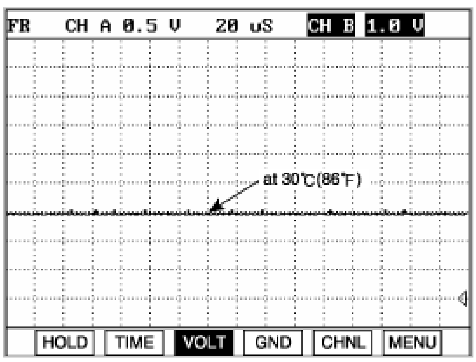
DTC DESCRIPTION

Checking output signals from ECTS every 120 sec. under detecting condition, if an output signal is below 0.1V for more than 4 sec., PCM sets P1114.

DTC DETECTING CONDITION

<table>
<tr><th colspan="2">Item</th><th>Detecting Condition</th><th>Possible Cause</th></tr>
<tr><td colspan="2">DTC Strategy</td><td>• This code detects a intermittent short to ground in the signal circuit or the sensor</td><td rowspan="7">• Poor Connection
• Short to ground in signal Circuit
• Faulty ECTS
• Faulty PCM</td></tr>
<tr><td rowspan="2">Enable Conditions</td><td>Case 1</td><td>• Engine Running Time > 120sec.
• Coolant Short Low Enable Criteria Met</td></tr>
<tr><td>Case 2</td><td>• Soak Time > 360min.
• Engine Running
• Coolant Short Low Enable Criteria Met</td></tr>
<tr><td colspan="2">Threshold value</td><td>• Coolant signal < 0.1V</td></tr>
<tr><td colspan="2">Diagnosis Time</td><td>• Continuous
(More than 4 sec. failure for every 120 sec. test)</td></tr>
<tr><td colspan="2">MIL On Condition</td><td>• DTC only (NO MIL ON)</td></tr>
</table>

SIGNAL WAVEFORM AND DATA



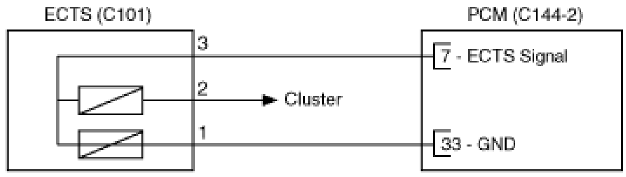
The output signals of IATS & ECTS change smoothly without any rapid changes. Those have almost same characteristic signal during the early period after start. It means that the temperatures of intake air and engine coolant are depended on the temperature of atmosphere. Meanwhile, during the warming up, the output signal of ECTS is going up increasingly. but, the output signal of IATS changes a little bit. even it may not change almost. It means that the heat of engine does not affect on the temperature of intake air.

SPECIFICATION

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59
0(32)	5.79	80(176)	0.32
20(68)	2.31 ~ 2.59		

SCHEMATIC DIAGRAM

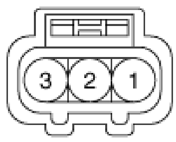
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

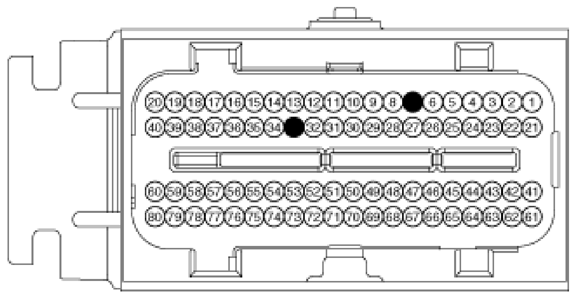
Terminal	Connected to	Funtion
1	PCM C144-2 (33)	Sensor ground
2	Cluster	-
3	PCM C144-2 (7)	ECTS Signal

[HARNESS CONNECTORS]



C101

ECTS



C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "Monitor "ECTS" status on the service data." item on the service data.

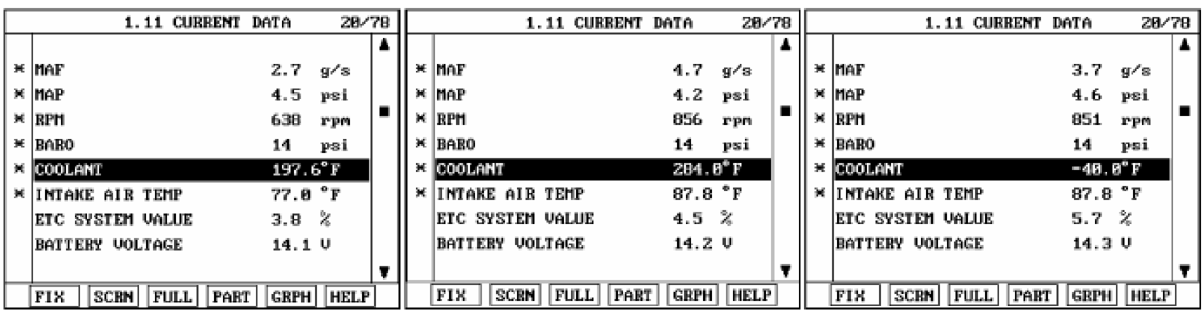


Fig. 1 Fig. 2 Fig. 3

Fig. 1 : Normal at Idle
Fig. 2 : Short to ground at idle
Fig. 3 : Open or short to battery at idle

4. Is the "ECTS" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Signal Circuit Inspection" procedure.

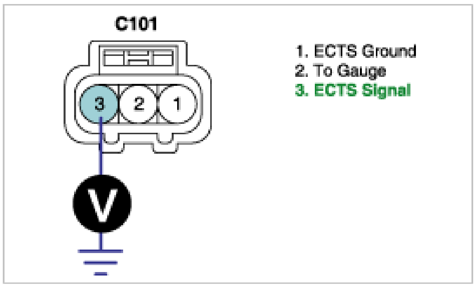
SIGNAL CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF" and disconnect ECTS connector.

   (2) IG "ON" and ENG "OFF"

   (3) Measure voltage between terminal 3 of ECTS harness connector and chassis ground.

Specification : Approx. 5V



   (4) Is the measured voltage within specification ?

YES

▸ Go to "Component Inspection" procedure.

NO

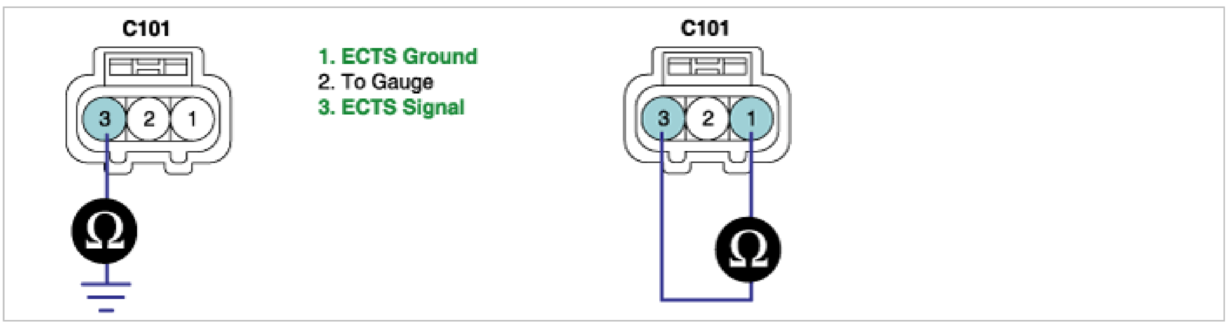
▸ Go to "Check short to ground in harness" as follows.

2. Check short to ground in harness
   (1) IG "OFF" and disconnect ECTS connector and PCM connector.

   (2) Measure resistance between terminal 3 of ECTS harness connector and chassis ground.

   (3) Measure resistance between terminals 1 and 3 of ECTS harness connector.

Specification : Infinite



   (4) Is the measured resistance within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check ECTS
   (1) IG "OFF" and disconnect ECTS connector.

   (2) Measure resistance between terminals 1 and 3 of ECTS connector.(Component side)

Specificaton :

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59
0(32)	5.79	80(176)	0.32

20(68)	2.31 ~ 2.59		

(3) Is the measured resistance within specification?

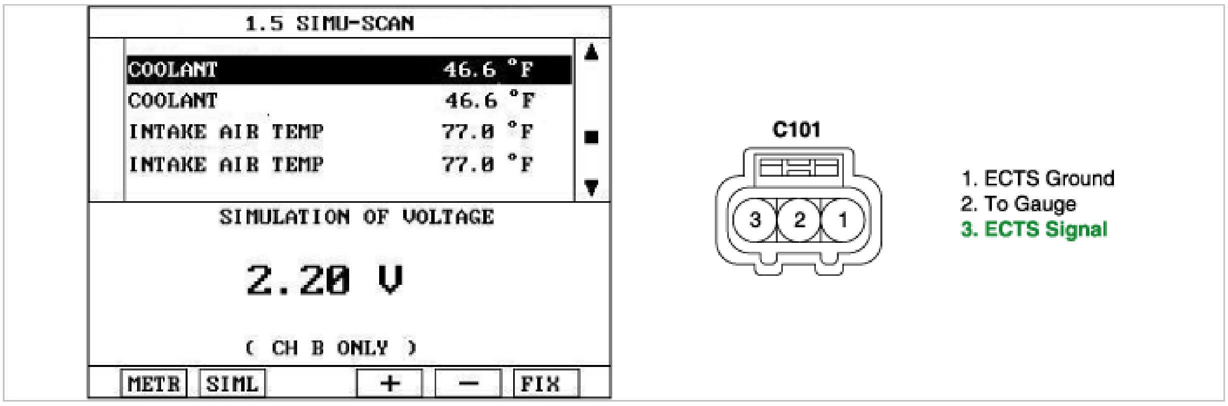
YES

▸ Go to "Check PCM" as follows.

NO

▸ Substitute with a known - good ECTS and check for proper operation. If the problem is corrected, replace ECTS and go to "Verification of Vehicle Repair" procedure.

2. Check PCM
   (1) IG "OFF" and connect scantool.
   (2) Connect probe to terminal 3 of ECTS harness connector.
   (3) IG "ON" and ENG "OFF" and simulation Function on scantool.
   (4) Simulate voltage at terminal 3 of ECTS harness connector.



(5) Does the signal value of ECT sensor change according to simulation voltage ?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

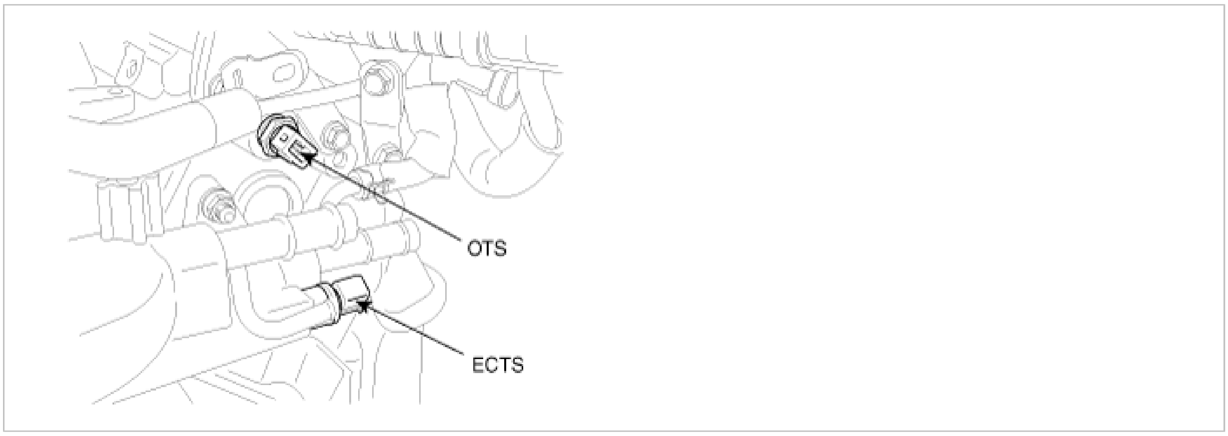
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P1115

COMPONENT LOCATION



GENERAL DESCRIPTION

The Engine Coolant Temperature(ECT) Sensor measures the temperature of engine coolant. The Engine Coolant Temperature (ECT) Sensor is located near the thermostat housing of the cylinder head. ECT Sensor is a thermistor (A Variable Resistor that Changes Along with ECT) in series with a fixed resistor in the Engine Control Module (PCM). The PCM applies 5 volts to the ECT sensor. The PCM monitors the voltage across the ECT sensor and converts it into a temperature reading. When the engine is cold the ECT sensor resistance is high, and when the engine is warm the ECT sensor resistance is low. Therefore, when the engine is cold the PCM will receive a high voltage input, and when the engine is warm the PCM will receive a low voltage input. The signal from ECT sensor is used for Injection, ignition timing, idle speed and cooling fan control.

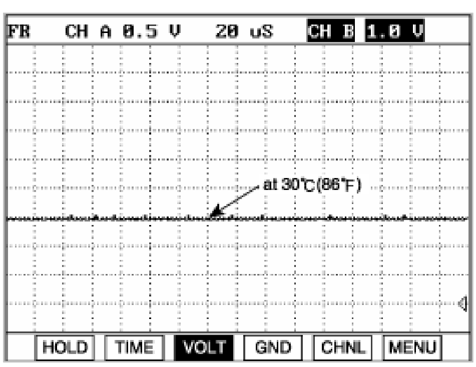
DTC DESCRIPTION

Checking output signals from ECTS every 120 sec. under detecting condition, if an output signal is above 4.9V for more than 4 sec., PCM sets P1115.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible Cause
DTC Strategy		• This code detects a intermittent open or short to battey in the signal circuit or the sensor	• Poor Connection • Open or short to battery in signal Circuit • Open in Ground Circuit. • Faulty ECTS • Faulty PCM
Enable Conditions	Case 1	• Engine Running Time > 120sec. • Coolant Short Low Enable Criteria Met	
	Case 2	• Soak Time > 360min. • Engine Running • Coolant Short Low Enable Criteria Met	
Threshold value		• Coolant signal > 4.9V	
Diagnosis Time		• Continuous (More than 4 sec. failure for every 120 sec. test)	
MIL On Condition		• DTC only (NO MIL ON)	

SIGNAL WAVEFORM AND DATA

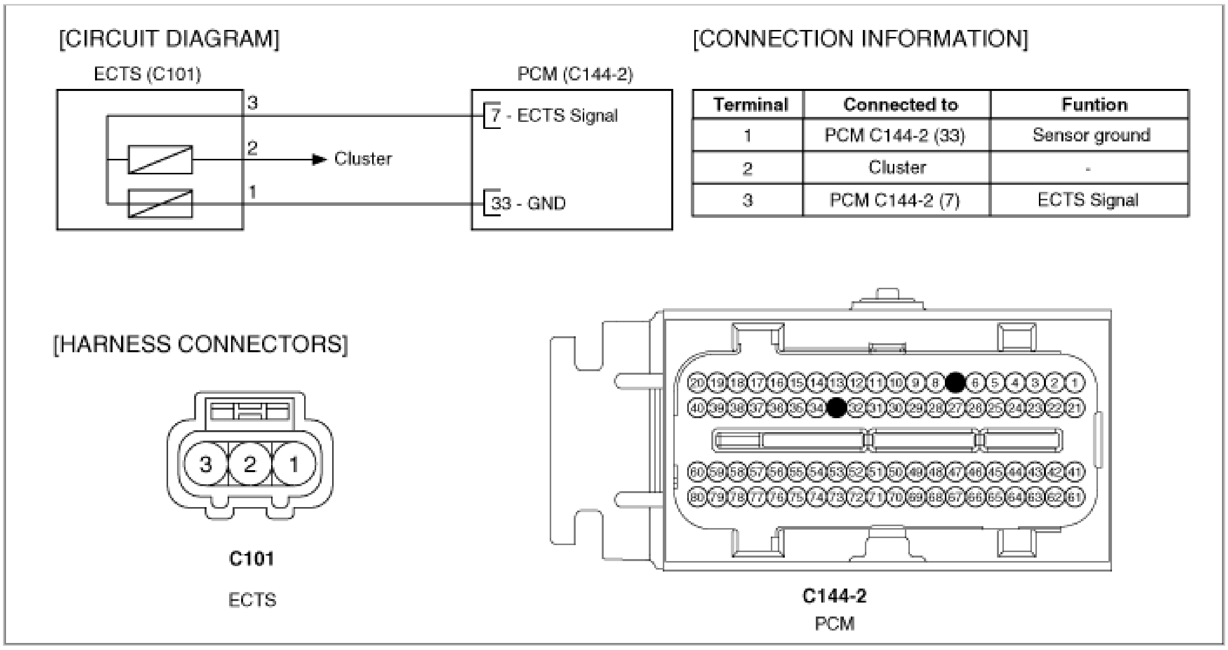


The output signals of IATS & ECTS change smoothly without any rapid changes. Those have almost same characteristic signal during the early period after start. It means that the temperatures of intake air and engine coolant are depended on the temperature of atmosphere. Meanwhile, during the warming up, the output signal of ECTS is going up increasingly. but, the output signal of IATS changes a little bit. even it may not change almost. It means that the heat of engine does not affect on the temperature of intake air.

SPECIFICATION

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59
0(32)	5.79	80(176)	0.32
20(68)	2.31 ~ 2.59		

SCHEMATIC DIAGRAM



MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "Monitor "ECTS" status on the service data." item on the service data.

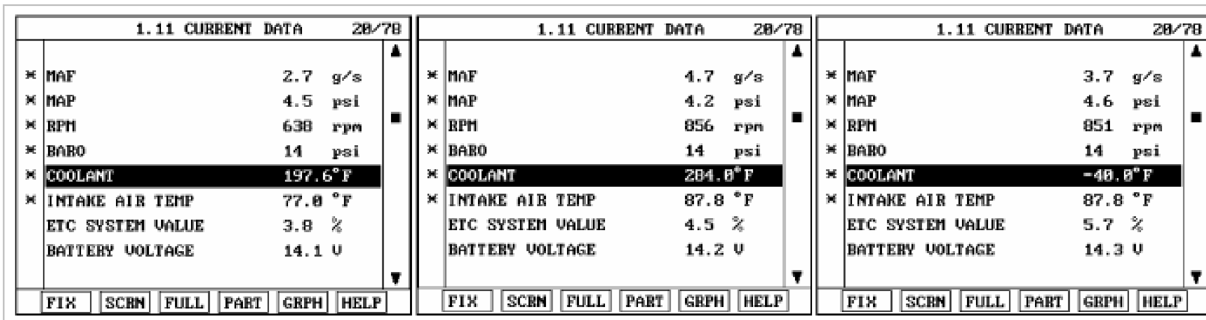


Fig. 1 Fig. 2 Fig. 3

Fig. 1 : Normal at Idle
Fig. 2 : Short to ground at idle
Fig. 3 : Open or short to battery at idle

4. Is the "ECTS" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

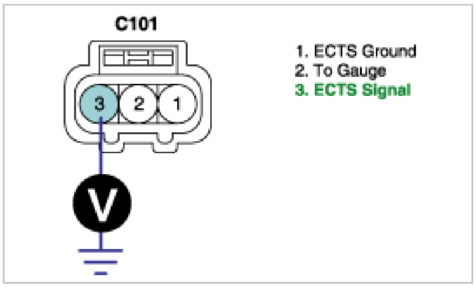
NO

▸ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF" and disconnect ECTS connector.
   (2) IG "ON" and ENG "OFF"
   (3) Measure voltage between terminal 3 of ECTS harness connector and chassis ground.

Specification : Approx. 5V



   (4) Is the measured voltage within specification ?

YES

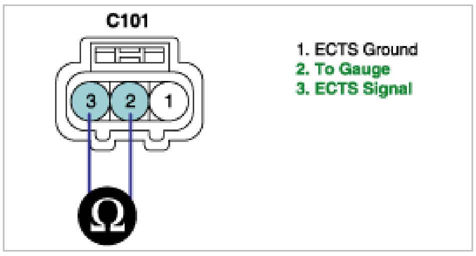
▸ Go to "Ground Circuit Inspection" procedure.

NO

▸ If voltage is 0V, go to "Check open in harness" as follows. If it is more than 5.1V, go to "Check short to battery in harness" as follows

2. Check short to battery in harness
   (1) IG "OFF" and disconnect ECTS connector and PCM connector.
   (2) Measure resistance between terminals 2 and 3 of ECTS harness connector.

Specification : Infinite



   (3) Is the measured resistance within specification?

YES

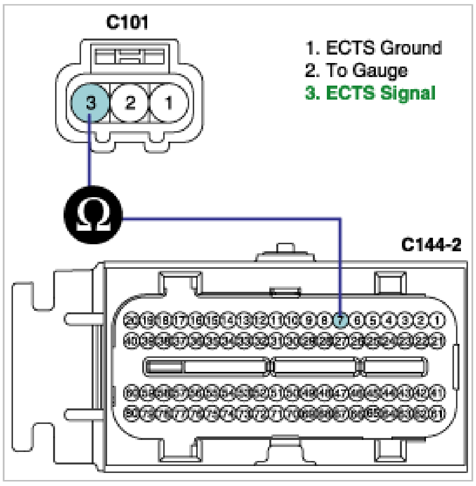
▸ Go to "Component Inspection" procedure.

NO

▸ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

3. Check open in harness
   (1) IG "OFF" and disconnect ECTS connector and PCM connector.
   (2) Measure resistance between terminal 3 of ECTS harness connector and terminal 7 of PCM harness connector.

Specification : Below 1Ω



   (3) Is the measured resistance within specification?

YES

▸ Go to "Ground Circuit Inspection" procedure.

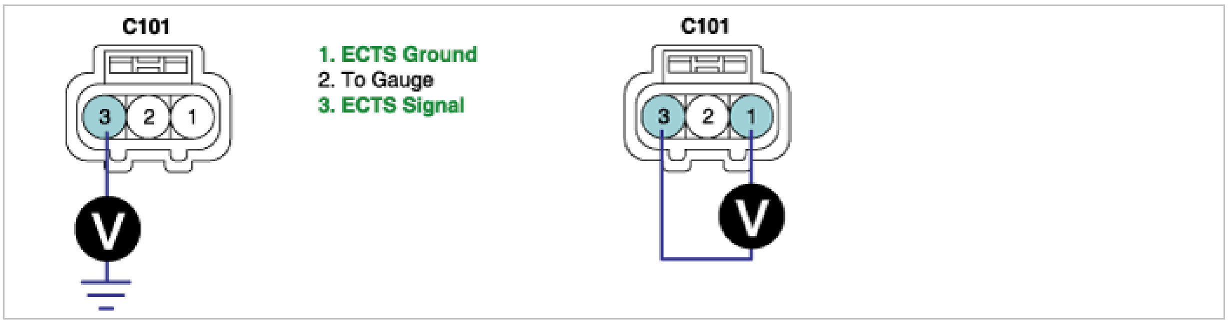
NO

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF" and disconnect ECTS connector.
2. Measure voltage between terminal 3 of ECTS harness connector and chassis ground.
3. Measure voltage between terminals 1 and 3 of ECTS harness connector.

Specification : Voltage difference between measurement "A" and "B" is below 200mV.



4. Is the measured voltage within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair open or contact resistance in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check ECTS
   (1) IG "OFF" and disconnect ECTS connector.
   (2) Measure resistance between terminals 1 and 3 of ECTS connector.(Component side)

Specificaton :

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)

-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59
0(32)	5.79	80(176)	0.32
20(68)	2.31 ~ 2.59		

(3) Is the measured resistance within specification?

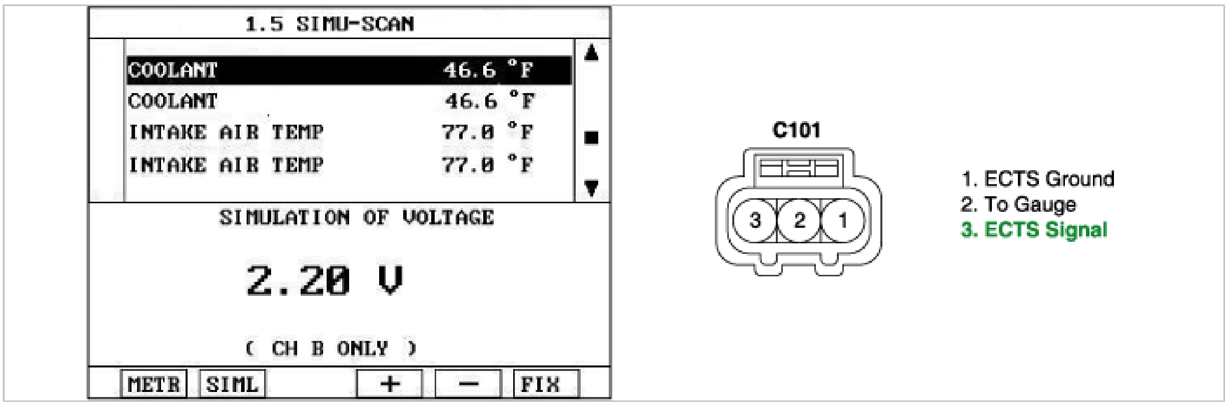
YES

▸ Go to "Check PCM" as follows.

NO

▸ Substitute with a known - good ECTS and check for proper operation. If the problem is corrected, replace ECTS and go to "Verification of Vehicle Repair" procedure.

2. Check PCM
   (1) IG "OFF" and connect scantool.
   (2) Connect probe to terminal 3 of ECTS harness connector.
   (3) IG "ON" and ENG "OFF" and simulation Function on scantool.
   (4) Simulate voltage at terminal 3 of ECTS harness connector.



(5) Does the signal value of ECT sensor change according to simulation voltage ?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P1295

COMPONENT LOCATION

GENERAL DESCRIPTION

ETC(Electronic Throttle Control Valve) is the device controlling amount of air to engine acccording to driver's intension. Different from the existing mechanical throttle valve which is composed of accelerator pecal and connecting wire cable, ETC consists of a motor, a throttle body and a throttle position sensor. Receiving input signals from electronic accelerator pedal module, PCM lets ETC motor control throttle valve. With ETC, cruise control system works without any additional device.

DTC DESCRIPTION

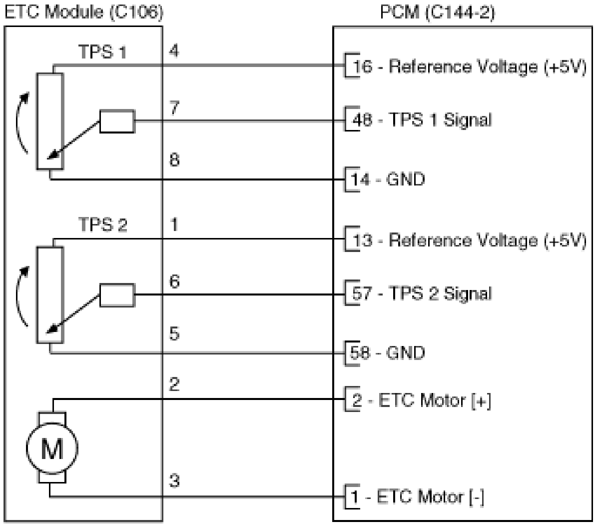
If power management mode is recognized under detecting condition, PCM sets P1295. And MIL(Malfunction Indicatin Lamp) turns on.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• This code detects if the system is in Power Management Mode	• TPS Malfunction • TPS Malfunction + MAFSMalfunction • MAP Malfunction + TPSMalfunction • Faulty PCM
EnableConditions	• Ignition On	
Threshold value	• Power Management Mode is active	
DiagnosisTime	• -	
MIL On Condition	• 1 Driving Cycle	

SCHEMATIC DIAGRAM

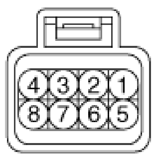
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

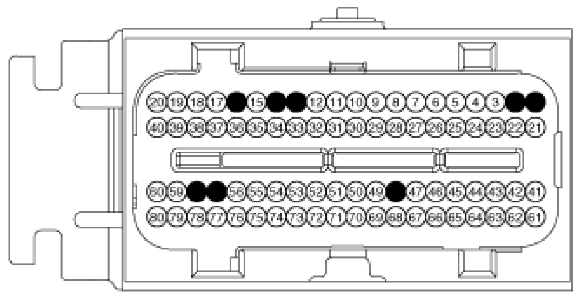
Terminal	Connected to	Funtion
1	PCM C144-2 (13)	TPS 2 Reference Voltage (+5V)
2	PCM C144-2 (2)	ETC Motor [+] Control
3	PCM C144-2 (1)	ETC Motor [-] Control
4	PCM C144-2 (16)	TPS 1 Reference Voltage (+5V)
5	PCM C144-2 (58)	TPS 2 Ground
6	PCM C144-2 (57)	TPS 2 Signal
7	PCM C144-2 (48)	TPS 1 Signal
8	PCM C144-2 (14)	TPS 1 Ground

[HARNESS CONNECTORS]



C106

ETC MODULE



C144-2

PCM

MONITOR SCANTOOL DATA

1. Connect scantool to DLC(Data Link Connector)
2. IG "ON" & Monitor that any different DTC(Diagnostic Trouble Code) is existed.
   (There will be at least one more DTC which causes this DTC P1295 to retrieve)
3. Repair the DTCs cause DTC P1295 first according to the designated trouble shooting guide.
   (After repairing the DTCs cause DTC P1295, don't forget to do "ETC Initialization" as follows.
4. Is the same DTC occurred ?

YES

▸Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Go to "Verification of Vehicle Repair" procedure.

※ Procedure of ETS Initialization

1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10sec.)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs

3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P1523

COMPONENT LOCATION

GENERAL DESCRIPTION

ETC(Electronic Throttle Control Valve) is the device controlling amount of air to engine acccording to driver's intension. Different from the existing mechanical throttle valve which is composed of accelerator pecal and connecting wire cable, ETC consists of a motor, a throttle body and a throttle position sensor. Receiving input signals from electronic accelerator pedal module, PCM lets ETC motor control throttle valve. With ETC, cruise control system works without any additional device.

DTC DESCRIPTION

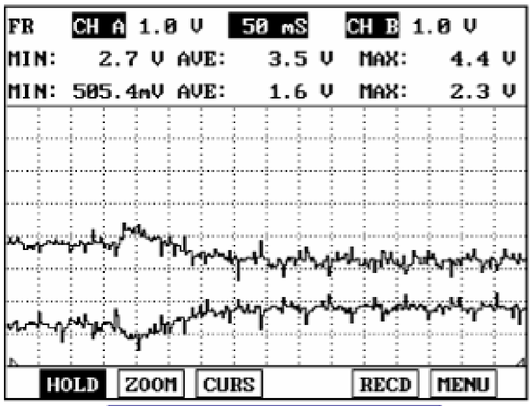
Checking throttle valve return state, under detecting condition, if an output signal is within the threshold value for more than designated time, PCM sets P1523.

DTC DETECTING CONDITION

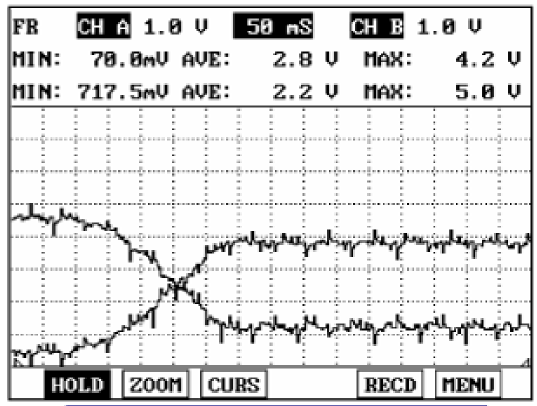
Item	Detecting Condition	Possible cause
DTC Strategy	• This code detects when throttle fails to return to the unpowered default position when power to the ETC motor is turned off. Fault set for failure to return to default position within a time.	• Carbon in throttle • Broken Throttle return spring • throttle sticky • throttle icy • PCM
EnableConditions	• Throttle Actuation Mode Previous NOT Off • Throttle Actuation Mode is Off • ETC Power Control Mode = Normal • TPS 1 & 2 = normal • Sensor Supply voltage = Normal	
Threshold value	• If throttle did not return to default range within cal seconds of turning off, increment fail count. • Normalized value of either TPS within expected default range anytime while enabled. (TPS1 Norm > 0.9V AND TPS1 Norm < 1.85V)OR (TPS2 Norm > 1.85V AND TPS2 Norm < 0.9V)Time depends on engine temperature (Below -20°C(-4 °F): less than 4sec.,Over -20°C(-4 °F) : less than 1sec.)	

DiagnosisTime	• Contineous	
MIL On Condition	• DTC only (NO MIL ON)	

SIGNAL WAVEFROM AND DATA



Stepping on accelleraton pedal.



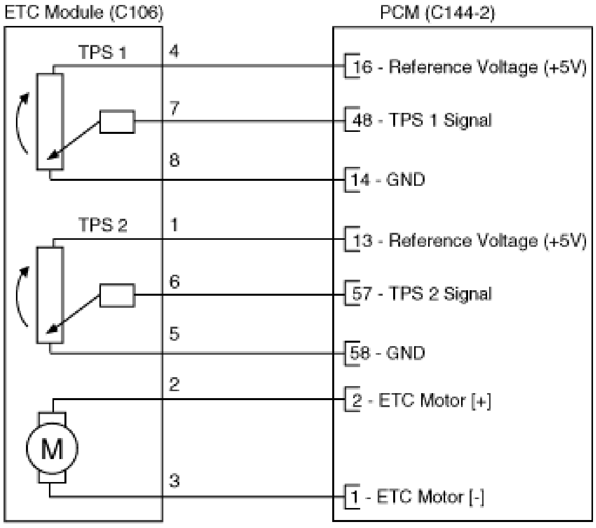
Pulling out accelleration cable with hand.

SPECIFICATION

Throttle opening (°)	Output voltage (V) [Vref = 5.0V]	
	TPS1	**TPS2**
0°	0.0V	5.0V
10°	0.5V	4.5V
20°	0.9V	4.1V
30°	1.4V	3.6V
40°	1.8V	3.2V
50°	2.3V	2.7V
60°	2.7V	2.3V
70°	3.2V	1.8V
80°	3.6V	1.4V
90°	4.1V	0.9V
100°	4.5V	0.5V
110°	5.0V	0.0V

SCHEMATIC DIAGRAM

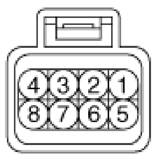
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

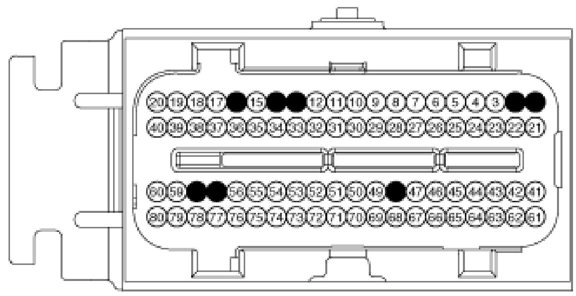
Terminal	Connected to	Funtion
1	PCM C144-2 (13)	TPS 2 Reference Voltage (+5V)
2	PCM C144-2 (2)	ETC Motor [+] Control
3	PCM C144-2 (1)	ETC Motor [-] Control
4	PCM C144-2 (16)	TPS 1 Reference Voltage (+5V)
5	PCM C144-2 (58)	TPS 2 Ground
6	PCM C144-2 (57)	TPS 2 Signal
7	PCM C144-2 (48)	TPS 1 Signal
8	PCM C144-2 (14)	TPS 1 Ground

[HARNESS CONNECTORS]



C106

ETC MODULE



C144-2

PCM

MONITOR SCANTOOL DATA

1. Connect scantool to DLC.(Data Link Connector)
2. IG "ON" & ENG "OFF"
3. Monitor "Throttle Position Sensor" by stepping on and off the accellerator pedal on scantool
4. Are those parameters related to "TPS" operating correctly ?

YES

▸Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, ending, corrosion, contamination, deterioration, or damage. Repair or replace asnecessary and go to "Verification of Vehicle Repair" procedure

NO

▸Go to "System Inspection" procedure.

SYSTEM INSPECTION

1. Visual Inspection
   (1) IG "OFF".
   (2) Check throttle valve after removing air duct.
      A. Carbon deposit.
      B. Throttle icy
      C. Broken return spring.
      D. Throttle sticky
   (3) Is the throttle valve return O.K ?

YES

▸Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Repair or replace as necessary and then, do ETS Initialization" as follows. then, go to "Verification of Vehicle Repair" procedure.
※ Procedure of ETS Initialization
1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10sec.)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P161B

COMPONENT LOCATION

GENERAL DESCRIPTION

Comparing actual torque and desired torque, PCM diagnoses calculated torque state. Actual torque keeps lower than desired torque, PCM checks if actual torque is higher than desired torque. deviding condition into two state, dynamic and steady states, PCM applies different diagnosis logic. Because the responses due to this code is similar to that of MAF control error, checking MAF at first.

DTC DESCRIPTION

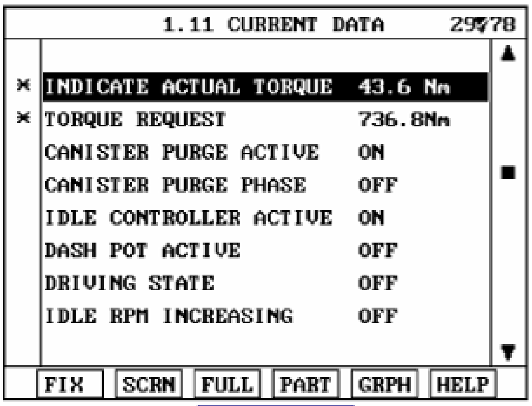
PCM checks if actual torque is higher than desired torque. deviding condition into two state, dynamic and steady states. At diagnosis during steady state, if the difference between actual torque and desired torque is higher than the threshold value, an error is recognized. And at dynamic diagnosis, desired torque of fly wheel and actual dynamic torque is compared. If ETS is on Power Management Mode, total engine torquemodulated by PCM is used instead of total actual engine torque. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till 1 driving cycle.

DTC DETECTING CONDITION

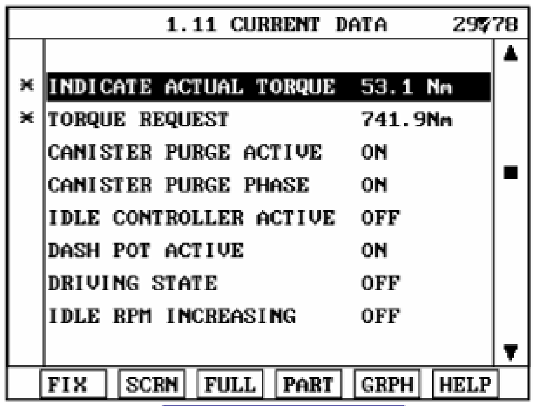
ITEM		Detecting Condition	Possible Cause
DTC Strategy	Case 1	• Determines if Delivered Torque Is Grossly Different fromDesired Torque	• Intake air leakage • Faulty ETS System • Clogged exhaust system • Faulty PCM
	Case 2	• Determines if Delivered Torque is Grossly Different fromDesired Torque	
	Case 3	• Determines if Delivered Torque is Greater than DesiredTorque With Zero Pedal	
Enable Conditions	Case 1	• Engine Running state	
	Case 2	• Engine Running state • Engine Speed > 600rpm • Desired Flywheel Torque Within 20Nm • Steady State Torque Timer > 1sec.	
	Case 3	• Pedal Position < 0.8% • Torque Command Source = Engine off	
Threshold value	Case 1	• When Dynamic torque error (difference between actualand desired torque value) above which the torque toohigh fail criteria is met > 25%While Net Torque ≥ 20NmOR torque throttle load > 1%	
		• Dynamic Torque ErrorThe torque error (differencebetween actual and desired torque value) below whichthe torque too low fail criteria is met < -120%While Desired ETC throttle position < 0%	
	Case 2	• When Steady State Torque Error > 60NmWhile Actual Net Torque ≥ 20NmOR Torque Throttle Load ≥ 2%	
	Case 3	• Maximum limit for the fuel flow rate to pass theredundant torque rationality diagnostic versus enginespeed. > 3g/s	
Diagnosis Time		• Contineous Case1: More than 7.8sec. failure for every 15.6sec.Test Case2: More than 0.03sec. failure for every 0.6sec.Test Case3: More than 7.8sec. failure for every 15.6sec.Test	
MIL On Condition		• 1 Driving Cycle	

MONITOR SCANTOOL DATA

1. Conect scantool to DLC(Data Link Connector)
2. Warm-up the engine to normal operating temperature.
3. Monitor "Actual Torque & Torque Request" parameters on scantool
4. Monitor DTC related to "ETS or CAM" on scantool



Torque at Idle



Torque at accelleration

5. Are there any DTC related to "ETS" or "CAM" on the scantool ?

YES

▸ Repair "ETS" or "CAM" system first, then, go to "Terminal and Connector Inspection" procedure.

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to " System Inspection " procedure.

SYSTEM INSPECTION

1. Check air leakage
   (1) Check contamination or installation of Gasket
   - ▸ Check throttle body gasket
   - ▸ Check gasket between intake manifold and surge tank.
   - ▸ Check contamination or clog by foreign material of gasket between intake manifold and injector.
   - ▸ Check contamination or open stuck resulting from foreign material between surge tank and PCSV.

   (2) Is there any air leakage ?

   YES

   ▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Go to "Check exhaust system for clogging" as follows.

2. Check exhaust system for clogging
   (1) Check exhaust system.
   - ▸ Clogged or broken muffler
   - ▸ Broken catalyst

   (2) Is the exhaust system colgged ?

   YES

   ▸ Go to "Check throttle valve for stuck" as follows.

   NO

   ▸ Repair or repalce as necessary and then, go to "Verification of Vehicle Repair" procedure.

3. Check throttle valve for stuck
   (1) IG "OFF".

   (2) Remove air hose between throttle body and airflow sensor.

(3) Check if throttle valve is sutck by foreign material.

(4) Is the throttle valve normal ?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ After getting rid of foreign material, check that throttle valve is normal and check for proper operation. If the problem is corrected,replace ETC and then go to "Verification of Vehicle Repair" procedure.

※ Procedure of ETS Initialization

1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10sec.)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

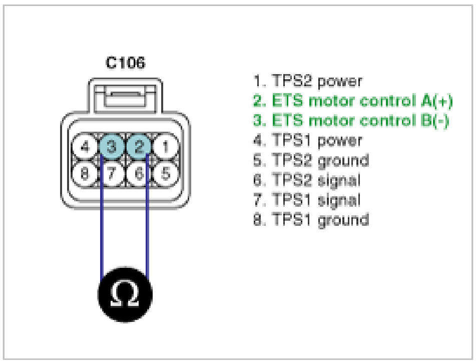
COMPONENT INSPECTION

1. Check resistance of ETS Motor
   (1) IG "OFF"

   (2) Disconnect ETS motor & TPS connector.

   (3) Measure resistance between terminal 2 and 3 of ETS motor & TPS connector.(Component Side)

Specification : Approx. 1.275 ~ 1.725Ω@ 23°C(73.4 °F)



   (4) Is the measured resistance within specifications ?

YES

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Substitute with a known-good ETC and check for proper operation. If the problem is corrected,replace ETC and then go to "Verification of Vehicle Repair" procedure.

※ Procedure of ETS Initialization

1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10sec.)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions

4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

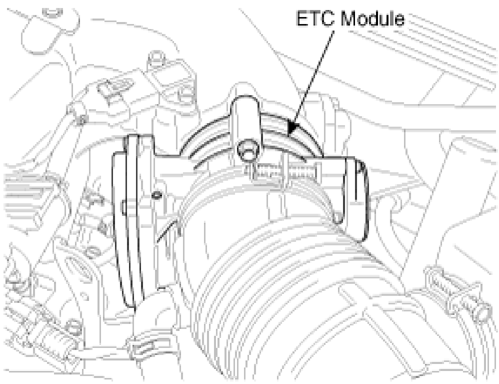
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P2104

COMPONENT LOCATION



GENERAL DESCRIPTION

ETC(Electronic Throttle Control Valve) is the device controlling amount of air to engine acccording to driver's intension. Different from the existing mechanical throttle valve which is composed of accelerator pecal and connecting wire cable, ETC consists of a motor, a throttle body and a throttle position sensor. Receiving input signals from electronic accelerator pedal module, PCM lets ETC motor control throttle valve. With ETC, cruise control system works without any additional device.

DTC DESCRIPTION

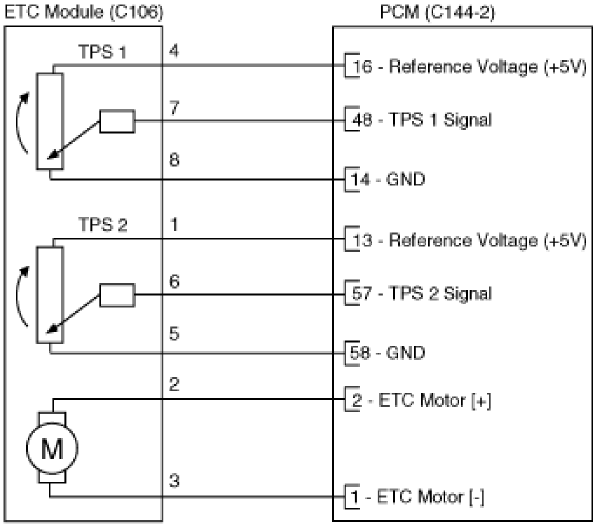
PCM recognizes vehicle state as forced idle under detecting condition, and sets P2104. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till 1 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• This code detects if the system is in Forced Idle Mode	• Faulty APS • Faulty APS+Brake • Faulty APS + Vehicle speed sensor • Faulty APS + Vehicle speed sensor + Brake • Faulty PCM
EnableConditions	• Ignition "ON"	
Threshold value	• Forced Idle Mode is active	
DiagnosisTime	• -	
MIL On Condition	• 1 Driving Cycles	

SCHEMATIC DIAGRAM

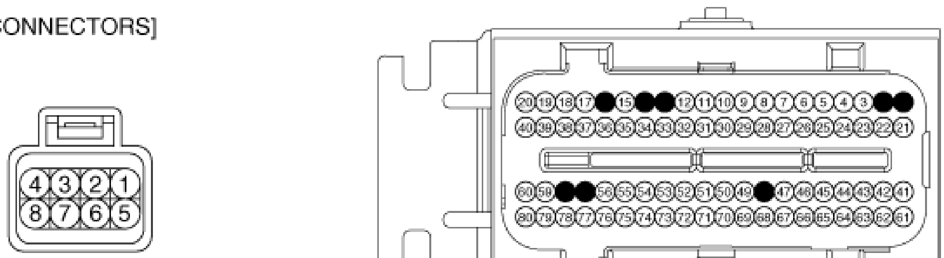
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Funtion
1	PCM C144-2 (13)	TPS 2 Reference Voltage (+5V)
2	PCM C144-2 (2)	ETC Motor [+] Control
3	PCM C144-2 (1)	ETC Motor [-] Control
4	PCM C144-2 (16)	TPS 1 Reference Voltage (+5V)
5	PCM C144-2 (58)	TPS 2 Ground
6	PCM C144-2 (57)	TPS 2 Signal
7	PCM C144-2 (48)	TPS 1 Signal
8	PCM C144-2 (14)	TPS 1 Ground

[HARNESS CONNECTORS]



C106

ETC MODULE

C144-2

PCM

MONITOR SCANTOOL DATA

1. Connect scantool to DLC(Data Link Connector)
2. IG "ON" & Monitor that any different DTC(Diagnostic Trouble Code) is existed.
   (There will be at least one more DTC which causes this DTC P2104 to retrieve)
3. Repair the DTCs cause DTC P2104 first according to the designated trouble shooting guide.
   (After repairing the DTCs cause DTC P2104 , don't forget to do "ETC Initialization" as follows.
4. Is the same DTC occurred ?

YES

▸Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Go to "Verification of Vehicle Repair" procedure.

※ Procedure of ETS Initialization

1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10sec.)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs

3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

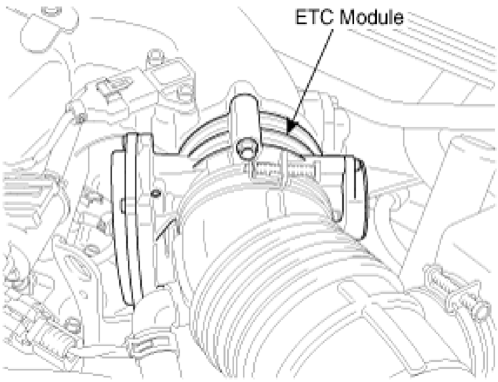
▸ Go to the applicable troubleshooooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P2105

COMPONENT LOCATION



GENERAL DESCRIPTION

ETC(Electronic Throttle Control Valve) is the device controlling amount of air to engine acccording to driver's intension. Different from the existing mechanical throttle valve which is composed of accelerator pecal and connecting wire cable, ETC consists of a motor, a throttle body and a throttle position sensor. Receiving input signals from electronic accelerator pedal module, PCM lets ETC motor control throttle valve. With ETC, cruise control system works without any additional device.

DTC DESCRIPTION

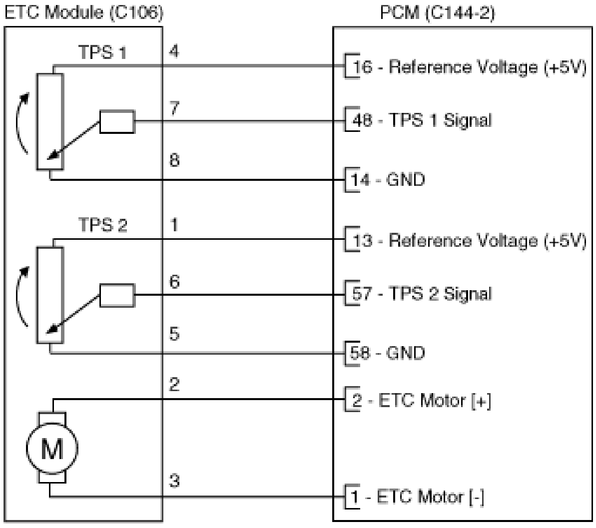
PCM recognizes vehicle state as forced engine stop under detecting condition, and sets P2105. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till 1 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• This code detects if the system is in Forced Engine Shutdown Mode	• Faulty AFS+MAPS+ETS • Faulty PCM
EnableConditions	• Ignition "ON"	
Threshold value	• Forced Engine Shutdown Mode Active	
DiagnosisTime	• -	
MIL On Condition	• 1 Driving Cycles	

SCHEMATIC DIAGRAM

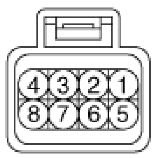
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

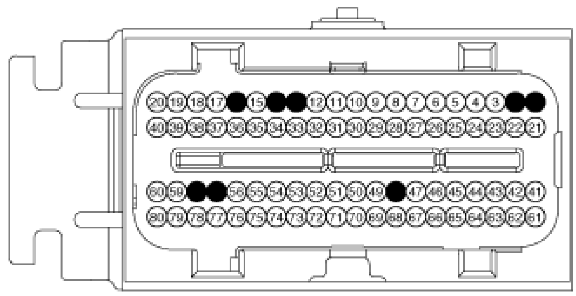
Terminal	Connected to	Funtion
1	PCM C144-2 (13)	TPS 2 Reference Voltage (+5V)
2	PCM C144-2 (2)	ETC Motor [+] Control
3	PCM C144-2 (1)	ETC Motor [-] Control
4	PCM C144-2 (16)	TPS 1 Reference Voltage (+5V)
5	PCM C144-2 (58)	TPS 2 Ground
6	PCM C144-2 (57)	TPS 2 Signal
7	PCM C144-2 (48)	TPS 1 Signal
8	PCM C144-2 (14)	TPS 1 Ground

[HARNESS CONNECTORS]



C106

ETC MODULE



C144-2

PCM

MONITOR SCANTOOL DATA

1. Connect scantool to DLC(Data Link Connector)
2. IG "ON" & Monitor that any different DTC(Diagnostic Trouble Code) is existed.
   (There will be at least one more DTC which causes this DTC P2105 to retrieve)
3. Repair the DTCs cause DTC P2105 first according to the designated trouble shooting guide.
   (After repairing the DTCs cause DTC P2105 , don't forget to do "ETC Initialization" as follows.
4. Is the same DTC occurred ?

YES

▸Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Go to "Verification of Vehicle Repair" procedure.
※ Procedure of ETS Initialization
1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10sec.)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs

3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

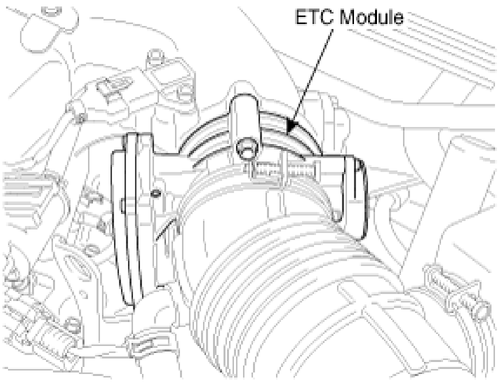
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P2106

COMPONENT LOCATION



GENERAL DESCRIPTION

ETC(Electronic Throttle Control Valve) is the device controlling amount of air to engine acccording to driver's intension. Different from the existing mechanical throttle valve which is composed of accelerator pecal and connecting wire cable, ETC consists of a motor, a throttle body and a throttle position sensor. Receiving input signals from electronic accelerator pedal module, PCM lets ETC motor control throttle valve. With ETC, cruise control system works without any additional device.

DTC DESCRIPTION

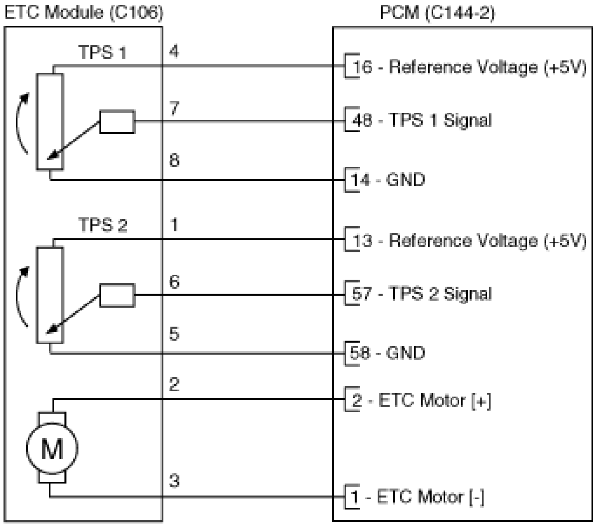
PCM recognizes vehicle state as forced limited power mode under detecting condition, and sets P2106. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till 1 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• This code detects if the system is in Limit Performance Mode	• Faulty APS • Faulty APS+Brake • Faulty APS + Vehicle speed sensor • Faulty APS + Vehicle speed sensor + Brake • Faulty PCM
EnableConditions	• Ignition "ON"	
Threshold value	• Limit Performance Mode is active	
DiagnosisTime	• -	
MIL On Condition	• 1 Driving Cycle	

SCHEMATIC DIAGRAM

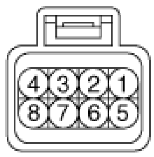
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

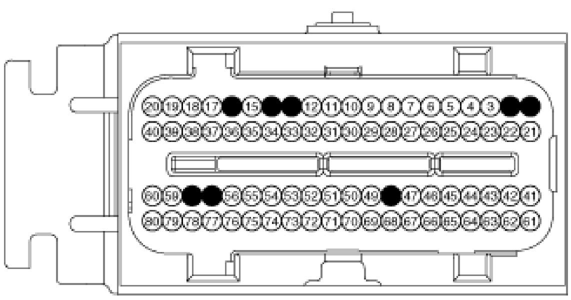
Terminal	Connected to	Funtion
1	PCM C144-2 (13)	TPS 2 Reference Voltage (+5V)
2	PCM C144-2 (2)	ETC Motor [+] Control
3	PCM C144-2 (1)	ETC Motor [-] Control
4	PCM C144-2 (16)	TPS 1 Reference Voltage (+5V)
5	PCM C144-2 (58)	TPS 2 Ground
6	PCM C144-2 (57)	TPS 2 Signal
7	PCM C144-2 (48)	TPS 1 Signal
8	PCM C144-2 (14)	TPS 1 Ground

[HARNESS CONNECTORS]



C106

ETC MODULE



C144-2

PCM

MONITOR SCANTOOL DATA

1. Connect scantool to DLC(Data Link Connector)
2. IG "ON" & Monitor that any different DTC(Diagnostic Trouble Code) is existed.
   (There will be at least one more DTC which causes this DTC P2106 to retrieve)
3. Repair the DTCs cause DTC P2106 first according to the designated trouble shooting guide.
   (After repairing the DTCs cause DTC P2106 , don't forget to do "ETC Initialization" as follows.
4. Is the same DTC occurred ?

YES

▸Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Go to "Verification of Vehicle Repair" procedure.

※ Procedure of ETS Initialization

1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10sec.)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs

3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

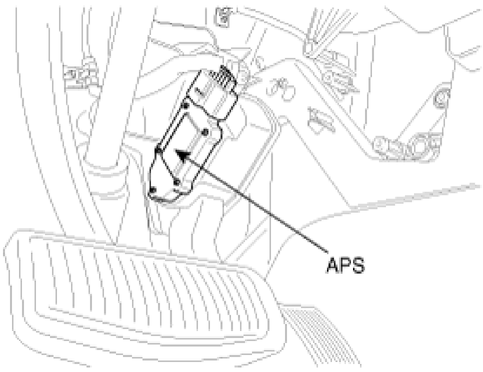
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P2122

COMPONENT LOCATION



GENERAL DESCRIPTION

APS(Acceleration Position Sensor) measures driver's accelerating intension using a potentiometer and APS signal is transmitted to the PCM. The pedal's position is converted as voltages of potentiometer in the APS.The absence of a mechanical link between the accelerator pedal and throttle valve presents a risk of loss of control of the engine in the event of a failure of the component. Therefore, APS has the two potentiometers whose slides are mechanically solid. APS 2 decides whether or not APS 1 & 2 is faulty.

DTC DESCRIPTION

Checking output signals from APS 1 every 78 sec., under detecting condition, if output signals are detected as out of threshold more than the specified number of times., PCM sets P2122. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till 1 driving cycle.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible Cause
DTC Strategy		• This code detects a continuous short to ground or open in either the circuit or the sensor (0-100%)	• Poor connection • Open or short to ground in Power circuit • Open or short to ground in Signal Circuit • Faulty APS • Faulty PCM
EnableConditions		• Ignition "ON" • Fail is NOT reported if: VrefA Fail Count > 0OR A/D converter is not failed.	
Threshold	Case 1	• APS1 < 0.125V	
	Case 2	• VrefA Fail Criteria is met	
Diagnosis Time		• Contineous (More than 4sec. Failure for every 78sec. Test)	
MIL On Condition		• 1 Driving Cycle	

SIGNAL WAVEFROM AND DATA

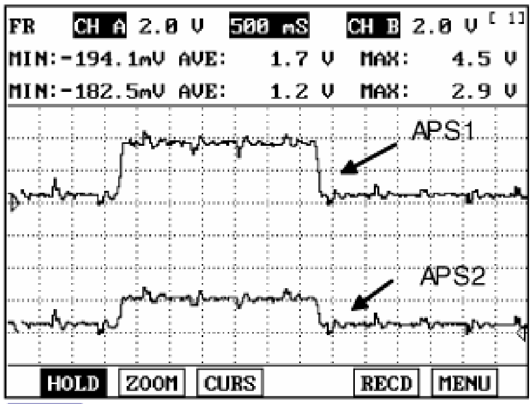


Fig. 1

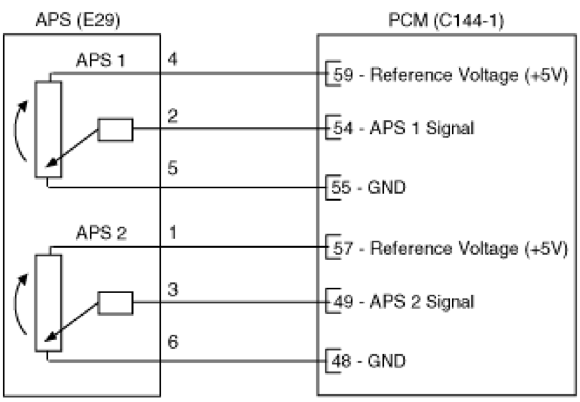
Fig. 1 : This is a signal waveform of APS 1 & 2 which shows that APS 2 increases voltage just half of APS 1 voltage increase when accelleration.

SPECIFICATION

Pedal Position	Output Voltage(V) [Vref = 5.0V]	
	APS1	APS2
C.T	0.7 ~ 0.8V	0.275 ~ 0.475V
W.O.T	3.8 ~ 4.4V	1.75 ~ 2.35V

SCHEMATIC DIAGRAM

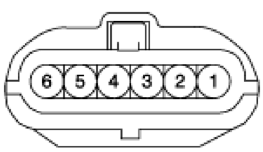
[CIRCUIT DIAGRAM]



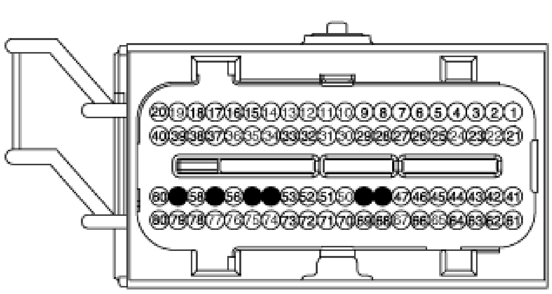
[CONNECTION INFORMATION]

Terminal	Connected to	Funtion
1	PCM C144-1 (57)	APS 2 Reference Voltage (+5V)
2	PCM C144-1 (54)	APS 1 Signal
3	PCM C144-1 (49)	APS 2 Signal
4	PCM C144-1 (59)	APS 1 Reference Voltage (+5V)
5	PCM C144-1 (55)	APS 1 Ground
6	PCM C144-1 (48)	APS 2 Ground

[HARNESS CONNECTORS]



E29
APS

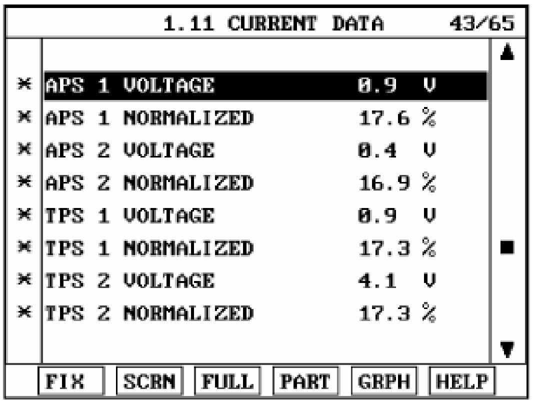


C144-1
PCM

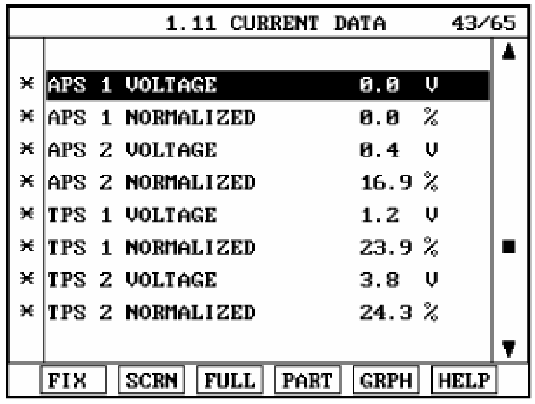
MONITOR SCANTOOL DATA

1. Connect scantool to DLC(Data Link Connector).
2. Warm up the engine to normal operating temperature.
3. Monitor "APS1 & APS2" parameters on the scantool.

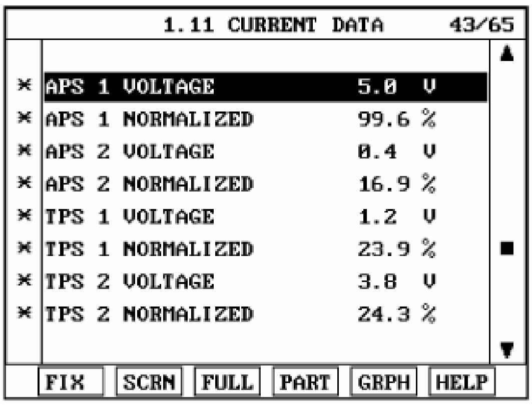
Pedal Position	Output Voltage(V) [Vref = 5.0V]	
	APS1	APS2
C.T	0.7 ~ 0.8V	0.275 ~ 0.475V
W.O.T	3.8 ~ 4.4V	1.75 ~ 2.35V



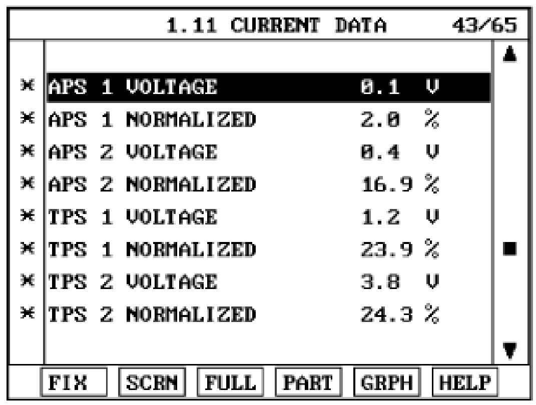
Normal at idle



Ground Short at IG ON



Short to 5V at IG ON



Open at IG ON

4. Are those "APS1 & APS2" parameters displayed correctly ?

YES

▸Fault is intermittent caused by poor contact in Sensor's and/or PCM's connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replaceas necessary and go to "Verification of Vehicle Repair" procedure

NO

▸Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸Repair as necessary and go to "Verification of Vehicle Repair" procedure

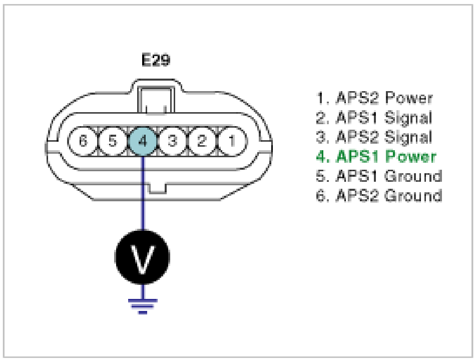
NO

▸Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. IG "OFF" and disconnect APS connector.
2. IG "ON" & ENG "OFF"
3. Measure voltage between harness terminal 4 of APS and chassis ground.

Specification : Approx. 5V



4. Is the measured voltage within specification ?

YES

▸ Go to "Signal Circuit Inspection" procedure.

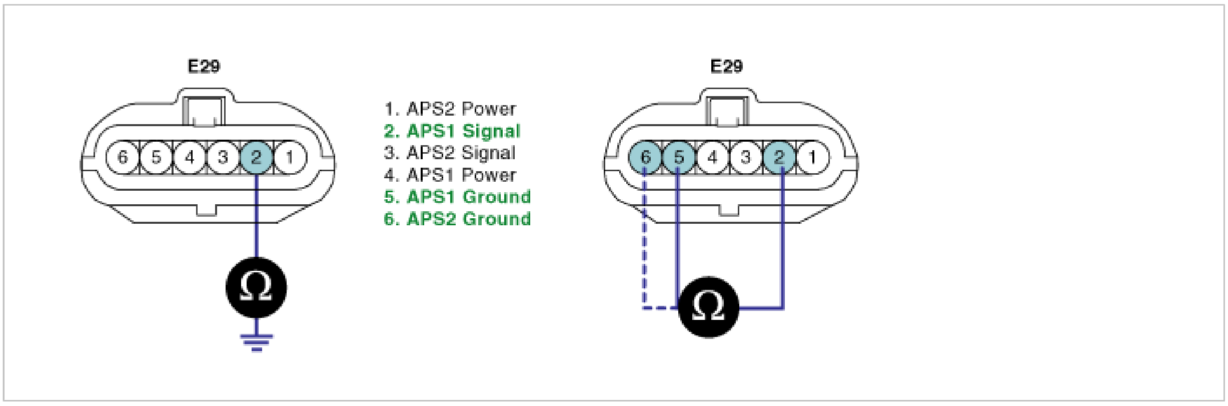
NO

▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check short to ground in harness
   (1) IG "OFF".
   (2) Disconnect APS & PCM connector.
   (3) Measure resistance between terminal 2 of APS harness connector and chassis ground.
   (4) Measure resistance between terminal 2 and 5 of APS harness connector.
   (5) Measure resistance between terminal 2 and 6 of APS harness connector.

   Specification : Infinite



   (6) Is the measured resistance within specification ?

   YES

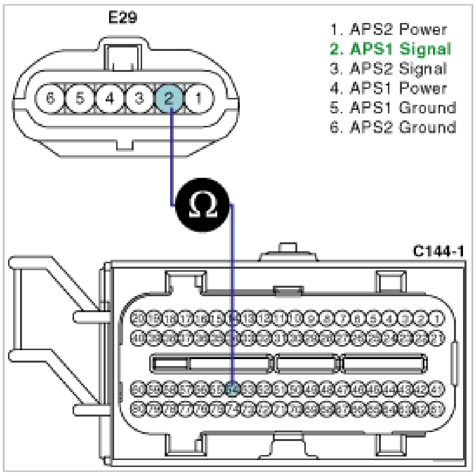
   ▸ Go to "Check open in harness" as follows.

   NO

   ▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

2. Check open in harness
   (1) IG "OFF"
   (2) Disconnect "APS" and "PCM" connector.
   (3) Measure resistance between terminal 2 of APS harness connector and terminal 54/C144-1 of PCM harness connector.

   Specification : Approx. below 1Ω



(4) Is the measured resistance within in specification ?

YES

▸ Go to "Component Inspection" procedure.

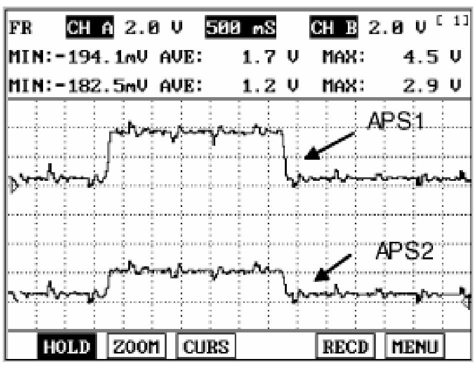
NO

▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check APS
   (1) IG "ON" & ENG "OFF".
   (2) Measure signal waveform of APS by pressing and depressing accellerator pedal.
   Specification :

Pedal Position	Output Voltage(V) [Vref = 5.0V]	
	APS1	APS2
C.T	0.7 ~ 0.8V	0.275 ~ 0.475V
W.O.T	3.8 ~ 4.4V	1.75 ~ 2.35V



(3) Is the measured signal waveform O.K ?

YES

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Substitute with a known-good APS and check for proper operation. If the problem is corrected,replace APS and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

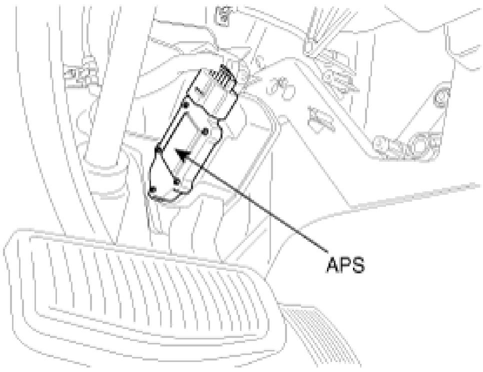
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P2123

COMPONENT LOCATION



GENERAL DESCRIPTION

APS(Acceleration Position Sensor) measures driver's accelerating intension using a potentiometer and APS signal is transmitted to the PCM. The pedal's position is converted as voltages of potentiometer in the APS.The absence of a mechanical link between the accelerator pedal and throttle valve presents a risk of loss of control of the engine in the event of a failure of the component. Therefore, APS has the two potentiometers whose slides are mechanically solid. APS 2 decides whether or not APS 1 & 2 is faulty.

DTC DESCRIPTION

Checking output signals from APS 1 every 78 sec., under detecting condition, if output signals are detected as out of threshold more than the specified number of times., PCM sets P2123. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till 1 driving cycle.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible Cause
DTC Strategy		• This code detects a short to high in either the circuit or the sensor (0-100%)	• Poor connection • Short to battery in signal circuit. • Open in Ground Circuit. • Faulty APS • Faulty PCM
EnableConditions		• Ignition "ON"	
Threshold	Case 1	• APS1 > 4.5V	
	Case 2	• 5.5V < Sensor Power Supply < 4.5V	
Diagnosis Time		• Contineous (More than 4sec. Failure for every 78sec. Test)	
MIL On Condition		• 1 Driving Cycle	

SIGNAL WAVEFROM AND DATA

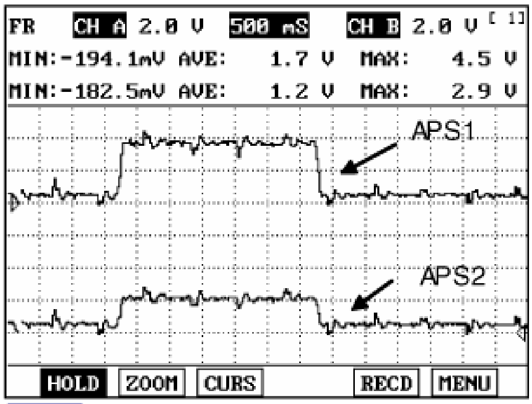


Fig. 1

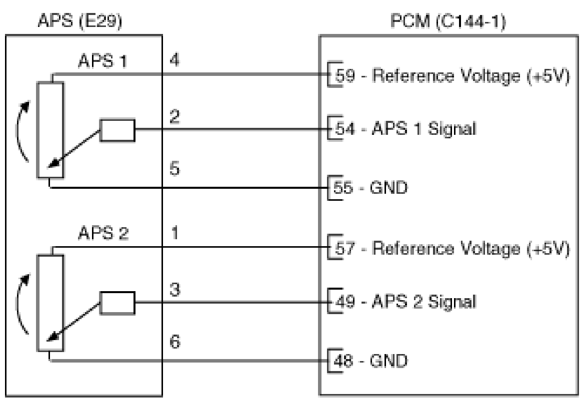
Fig. 1 : This is a signal waveform of APS 1 & 2 which shows that APS 2 increases voltage just half of APS 1 voltage increase when accelleration.

SPECIFICATION

Pedal Position	Output Voltage(V) [Vref = 5.0V]	
	APS1	**APS2**
C.T	0.7 ~ 0.8V	0.275 ~ 0.475V
W.O.T	3.8 ~ 4.4V	1.75 ~ 2.35V

SCHEMATIC DIAGRAM

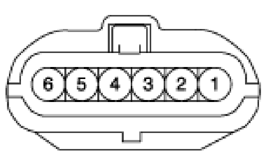
[CIRCUIT DIAGRAM]



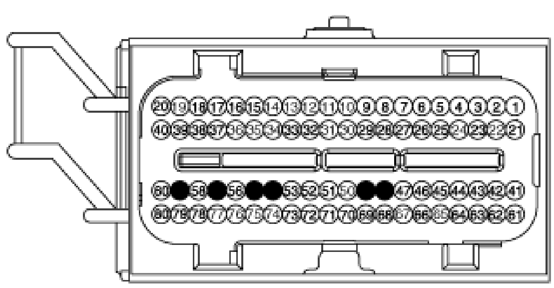
[CONNECTION INFORMATION]

Terminal	Connected to	Funtion
1	PCM C144-1 (57)	APS 2 Reference Voltage (+5V)
2	PCM C144-1 (54)	APS 1 Signal
3	PCM C144-1 (49)	APS 2 Signal
4	PCM C144-1 (59)	APS 1 Reference Voltage (+5V)
5	PCM C144-1 (55)	APS 1 Ground
6	PCM C144-1 (48)	APS 2 Ground

[HARNESS CONNECTORS]



E29
APS



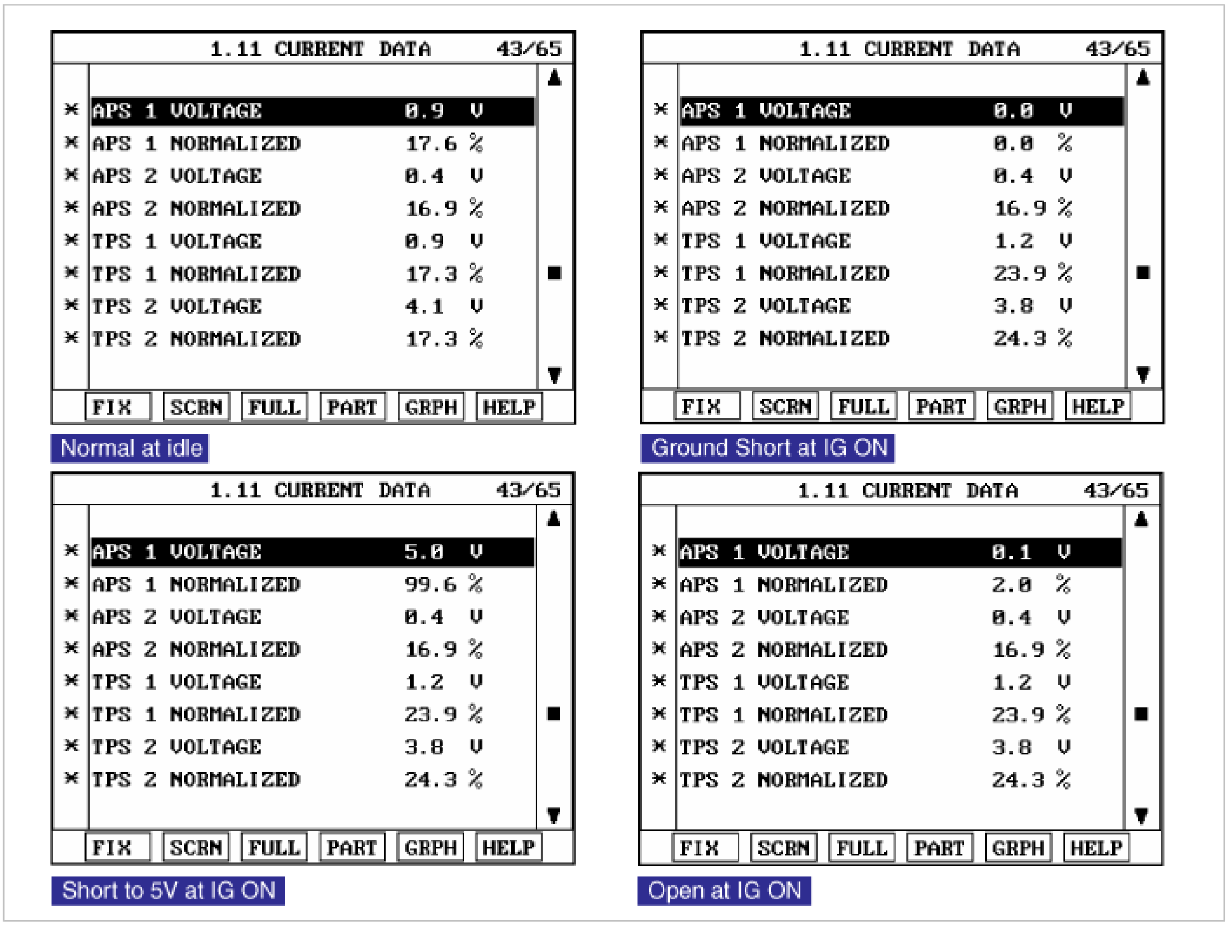
C144-1
PCM

MONITOR SCANTOOL DATA

1. Connect scantool to DLC(Data Link Connector).
2. Warm up the engine to normal operating temperature.

3. Monitor "APS1 & APS2" parameters on the scantool.

Pedal Position	Output Voltage(V) [Vref = 5.0V]	
	APS1	**APS2**
C.T	0.7 ~ 0.8V	0.275 ~ 0.475V
W.O.T	3.8 ~ 4.4V	1.75 ~ 2.35V



4. Are those "APS1 & APS2" parameters displayed correctly ?

YES

▸Fault is intermittent caused by poor contact in Sensor's and/or PCM's connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replaceas necessary and go to "Verification of Vehicle Repair" procedure

NO

▸Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Signal Circuit Inspection " procedure.

SIGNAL CIRCUIT INSPECTION

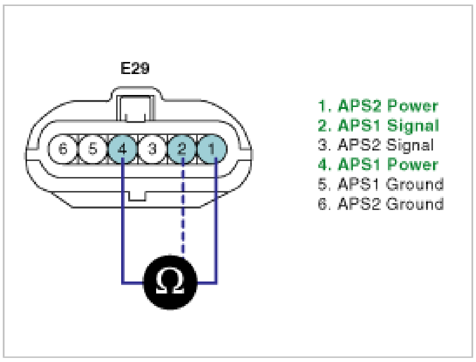
1. Check short to battery in harness
   (1) IG "OFF".

(2) Disconnect APS and PCM connector.

(3) Measure resistance between terminal 1 and 2 of APS harness connector.

(4) Measure resistance between terminal 2 and 4 of APS harness connector.

Specification : Infinite



(5) Is the measured resistance within specification ?

YES

▸ Go to "Ground Circuit Inspection" procedure.

NO

▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. Check open in harness

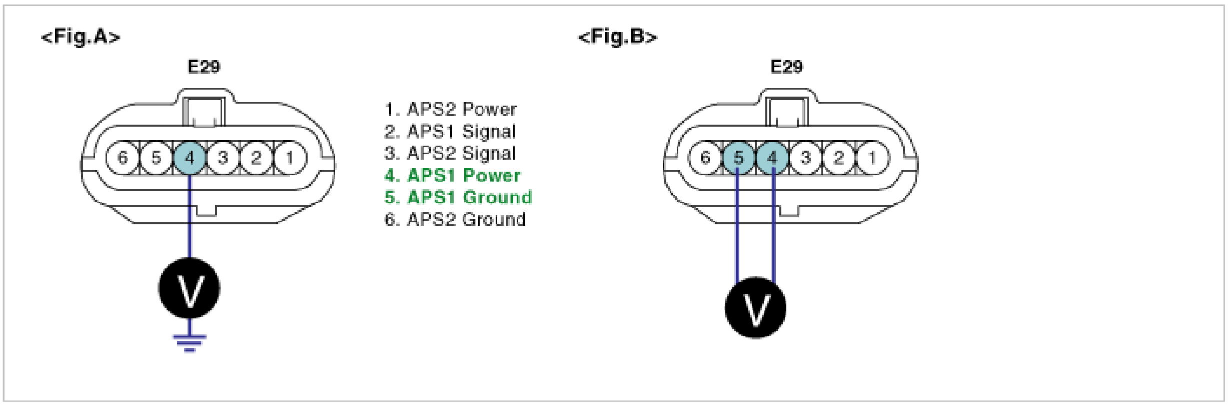
(1) IG "OFF".

(2) Disconnect APS connector.

(3) Measure voltage between terminal 4 of APS harness connector and chassis ground.(Fig. A)

(4) Measure voltage between terminal 4 and 5 of APS harness connector.(Fig. B)

Specification : Fig. "A" - Fig. "B" = approx. below. 200mV.



(5) Is the measured voltage within specification ?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair or replace contact resistance or open in harness and then, go to "Verification of VehicleRepair" procedure.

COMPONENT INSPECTION

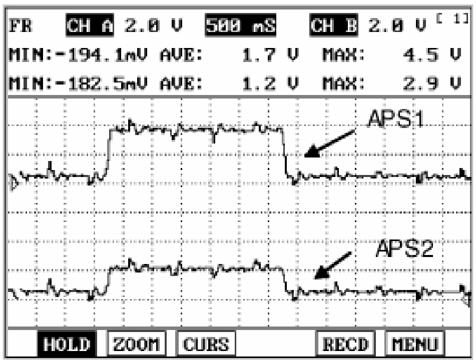
1. Check APS

(1) Ignition "ON" & ENG "OFF".

(2) Measure waveform of APS by pressing and depressing accellerator pedal with scantool.

Specification :

Pedal Position	Output Voltage(V) [Vref = 5.0V]	
	APS1	**APS2**
C.T	0.7 ~ 0.8V	0.275 ~ 0.475V
W.O.T	3.8 ~ 4.4V	1.75 ~ 2.35V



(3) Is the measured signal waveform O.K ?

YES

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Substitute with a known-good APS and check for proper operation. If the problem is corrected,replace APS and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

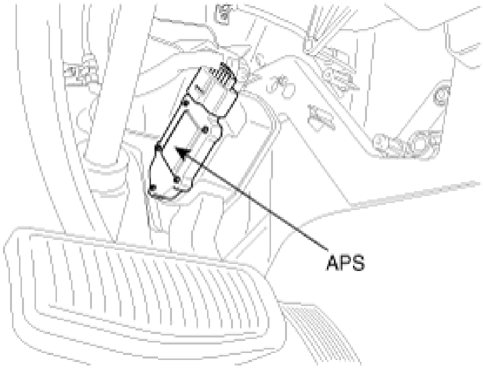
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P2127

COMPONENT LOCATION



GENERAL DESCRIPTION

APS(Acceleration Position Sensor) measures driver's accelerating intension using a potentiometer and APS signal is transmitted to the PCM. The pedal's position is converted as voltages of potentiometer in the APS.The absence of a mechanical link between the accelerator pedal and throttle valve presents a risk of loss of control of the engine in the event of a failure of the component. Therefore, APS has the two potentiometers whose slides are mechanically solid. APS 2 decides whether or not APS 1 & 2 is faulty.

DTC DESCRIPTION

Checking output signals from APS 2 every 78 sec., under detecting condition, if output signals are detected as out of threshold more than the specified number of times., PCM sets P2127. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till 1 driving cycle.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible Cause
DTC Strategy		• This code detects a continuous short to ground or open in either the circuit or the sensor (0-100%)	• Poor connection • Open or short to ground in Power circuit. • Open or short to ground in signal circuit. • Faulty APS • Faulty PCM
EnableConditions		• Ignition "ON"	
Threshold	Case 1	• APS2 < 0.125V	
	Case 2	• 5.5V < Sensor Power Supply < 4.5V	
Diagnosis Time		• Contineous (More than 4sec. Failure for every 78sec. Test)	
MIL On Condition		• 1 Driving Cycle	

SIGNAL WAVEFROM AND DATA

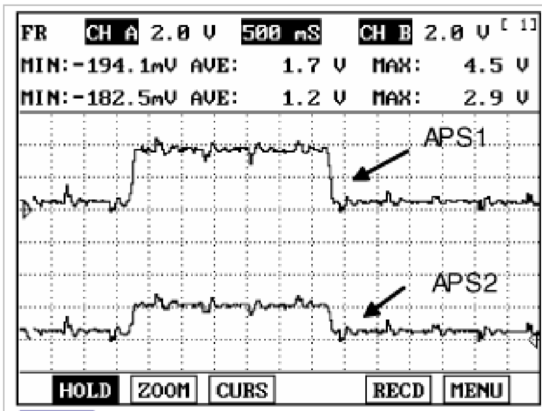


Fig. 1

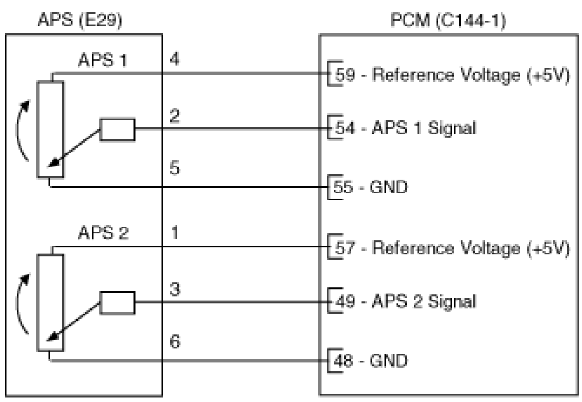
Fig. 1 : This is a signal waveform of APS 1 & 2 which shows that APS 2 increases voltage just half of APS 1 voltage increase when accelleration.

SPECIFICATION

Pedal Position	Output Voltage(V) [Vref = 5.0V]	
	APS1	APS2
C.T	0.7 ~ 0.8V	0.275 ~ 0.475V
W.O.T	3.8 ~ 4.4V	1.75 ~ 2.35V

SCHEMATIC DIAGRAM

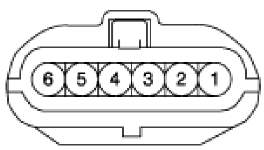
[CIRCUIT DIAGRAM]



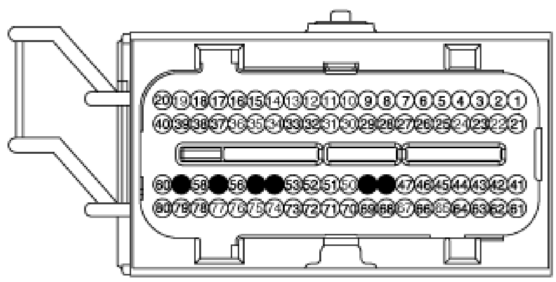
[CONNECTION INFORMATION]

Terminal	Connected to	Funtion
1	PCM C144-1 (57)	APS 2 Reference Voltage (+5V)
2	PCM C144-1 (54)	APS 1 Signal
3	PCM C144-1 (49)	APS 2 Signal
4	PCM C144-1 (59)	APS 1 Reference Voltage (+5V)
5	PCM C144-1 (55)	APS 1 Ground
6	PCM C144-1 (48)	APS 2 Ground

[HARNESS CONNECTORS]



E29
APS

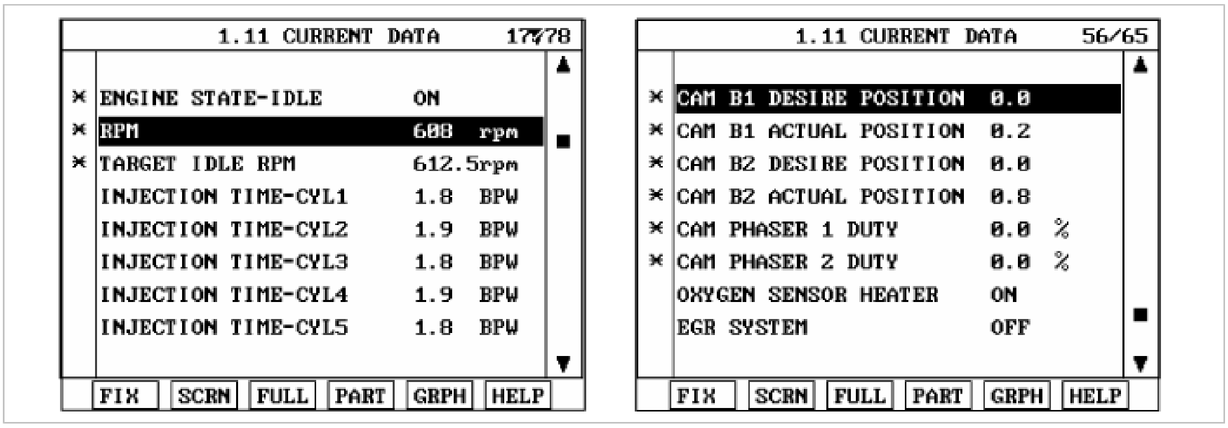


C144-1
PCM

MONITOR SCANTOOL DATA

1. Connect scantool to DLC.(Data Link Connector)
2. Warm up the engine to normal operating temperature.
3. Monitor "APS1 & APS2" parameters on the scantool.

Pedal Position	Output Voltage(V) [Vref = 5.0V]	
	APS1	APS2
C.T	0.7 ~ 0.8V	0.275 ~ 0.475V
W.O.T	3.8 ~ 4.4V	1.75 ~ 2.35V



4. Are those "APS1 & APS2" parameters displayed correctly ?

YES

▸Fault is intermittent caused by poor contact in Sensor's and/or PCM's connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replaceas necessary and go to "Verification of Vehicle Repair" procedure

NO

▸Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

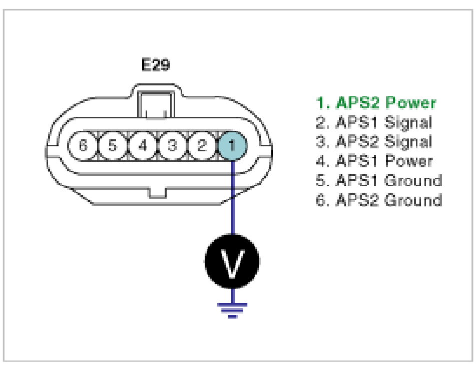
NO

▸ Go to "Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. IG "OFF".
2. Disconnect APS connector.
3. IG "ON" & ENG "OFF".
4. Measure voltage between termial 1 of APS harness connector and chassis ground.

Specification : Approx. 5V



5. Is the measured voltage within specification ?

YES

▸ Go to "Signal Circuit Inspection" procedure.

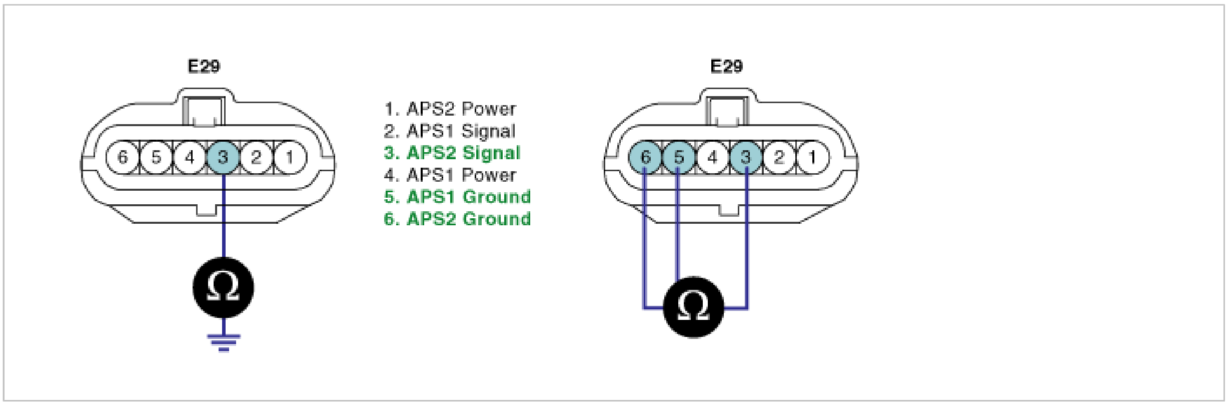
NO

▸ Repair or replace as necessary and then, go to 'Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check short to ground in harness
    (1) IG "OFF".
    (2) Disconnect APS and PCM connector.
    (3) Measure resistance between terminal 3 of APS harness connector and chassis ground.
    (4) Measure resistance between terminal 3 and 5 of APS harness connector.
    (5) Measure resistance between terminal 3 and 6 of APS harness connector.

Specification : Infinite



    (6) Is the measured resistance within specification ?

YES

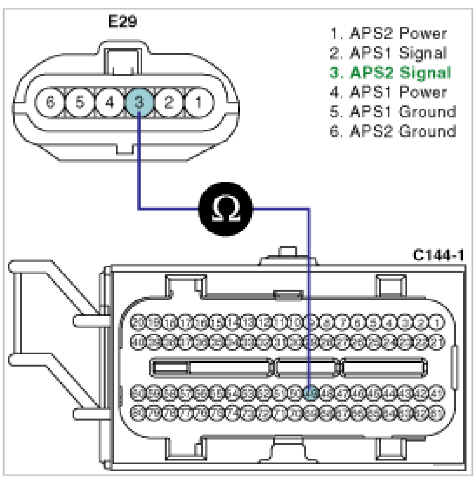
▸ Go to "Check open in harness" as follows.

NO

▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

2. Check open in harness
    (1) IG "OFF".
    (2) Disconnect APS and PCM connector.
    (3) Measure resistance between terminal 3 of APS harness connector and terminal 49/C144-1 of PCM harness connector.

Specification : Approx. below 1Ω



    (4) Is the measured resistance within specification ?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

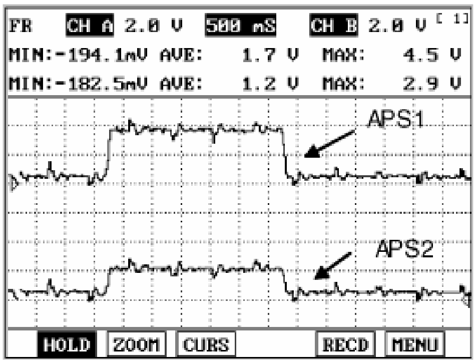
1. Check APS

(1) Ignition "ON" & ENG "OFF".

(2) Measure waveform of APS by pressing and depressing accellerator pedal with scantool.

Specification :

Pedal Position	Output Voltage(V) [Vref = 5.0V]	
	APS1	APS2
C.T	0.7 ~ 0.8V	0.275 ~ 0.475V
W.O.T	3.8 ~ 4.4V	1.75 ~ 2.35V



(3) Is the measured signal waveform O.K ?

YES

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Substitute with a known-good APS and check for proper operation. If the problem is corrected,replace APS and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

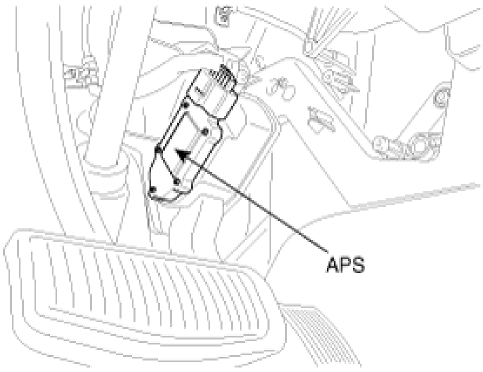
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P2128

COMPONENT LOCATION



GENERAL DESCRIPTION

APS(Acceleration Position Sensor) measures driver's accelerating intension using a potentiometer and APS signal is transmitted to the PCM. The pedal's position is converted as voltages of potentiometer in the APS.The absence of a mechanical link between the accelerator pedal and throttle valve presents a risk of loss of control of the engine in the event of a failure of the component. Therefore, APS has the two potentiometers whose slides are mechanically solid. APS 2 decides whether or not APS 1 & 2 is faulty.

DTC DESCRIPTION

Checking output signals from APS 2 every 78 sec., under detecting condition, if output signals are detected as out of threshold more than the specified number of times., PCM sets P2128. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till 1 driving cycle.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible Cause
DTC Strategy		• This code detects a short to high in either the circuit or the sensor (0-100%)	• Poor connection • Short to battery in Signal Circuit • Open in Ground Circuit • Faulty APS • Faulty PCM
EnableConditions		• Ignition "ON"	
Threshold	Case 1	• APS2 > 3V	
	Case 2	• 4.5V < Sensor Power Supply < 5.5V	
Diagnosis Time		• Contineous (More than 4sec. Failure for every 78sec. Test)	
MIL On Condition		• 1 Driving Cycle	

SIGNAL WAVEFROM AND DATA

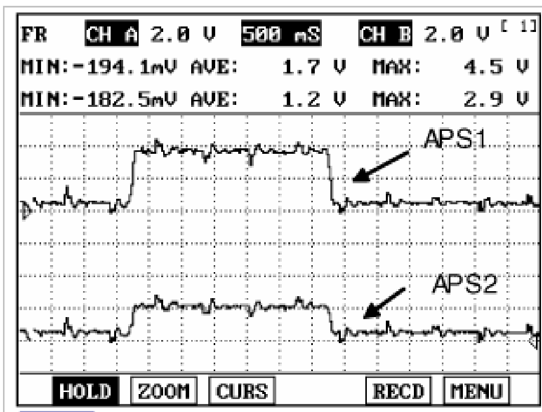


Fig. 1

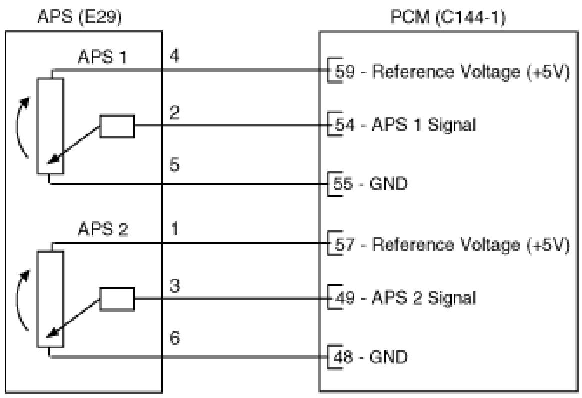
Fig. 1 : This is a signal waveform of APS 1 & 2 which shows that APS 2 increases voltage just half of APS 1 voltage increase when accelleration.

SPECIFICATION

Pedal Position	Output Voltage(V) [Vref = 5.0V]	
	APS1	**APS2**
C.T	0.7 ~ 0.8V	0.275 ~ 0.475V
W.O.T	3.8 ~ 4.4V	1.75 ~ 2.35V

SCHEMATIC DIAGRAM

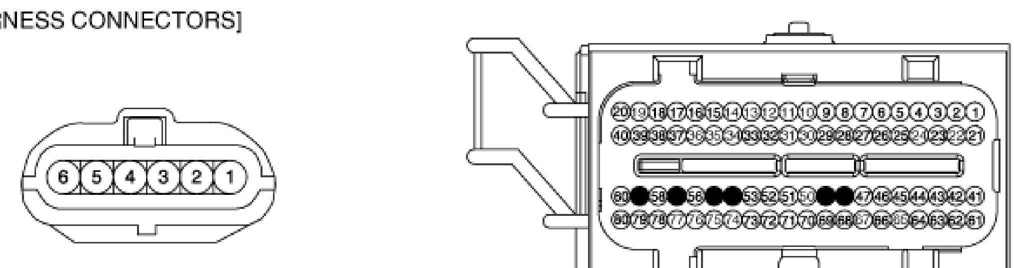
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Funtion
1	PCM C144-1 (57)	APS 2 Reference Voltage (+5V)
2	PCM C144-1 (54)	APS 1 Signal
3	PCM C144-1 (49)	APS 2 Signal
4	PCM C144-1 (59)	APS 1 Reference Voltage (+5V)
5	PCM C144-1 (55)	APS 1 Ground
6	PCM C144-1 (48)	APS 2 Ground

[HARNESS CONNECTORS]



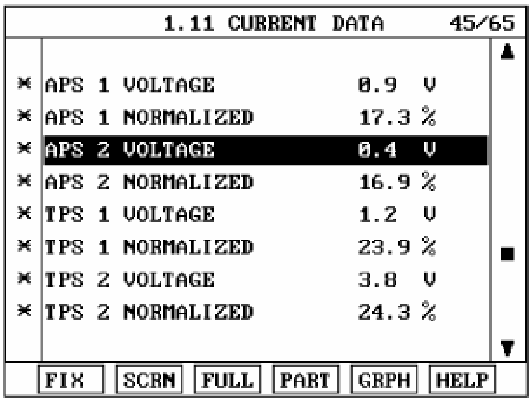
E29
APS

C144-1
PCM

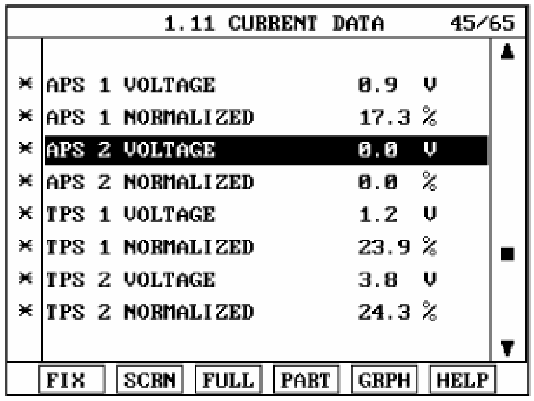
MONITOR SCANTOOL DATA

1. Connect scantool to DLC(Data Link Connector).
2. Warm up the engine to normal operating temperature.
3. Monitor "APS1 & APS2" parameters on the scantool.

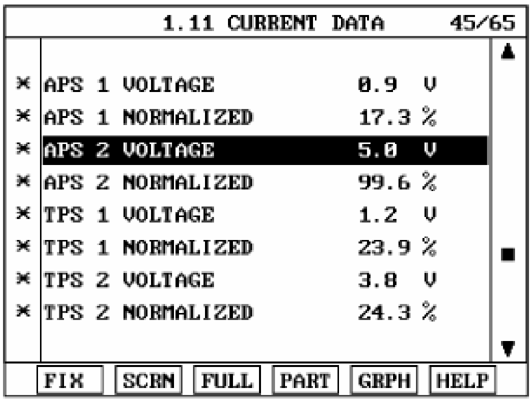
Pedal Position	Output Voltage(V) [Vref = 5.0V]	
	APS1	**APS2**
C.T	0.7 ~ 0.8V	0.275 ~ 0.475V
W.O.T	3.8 ~ 4.4V	1.75 ~ 2.35V



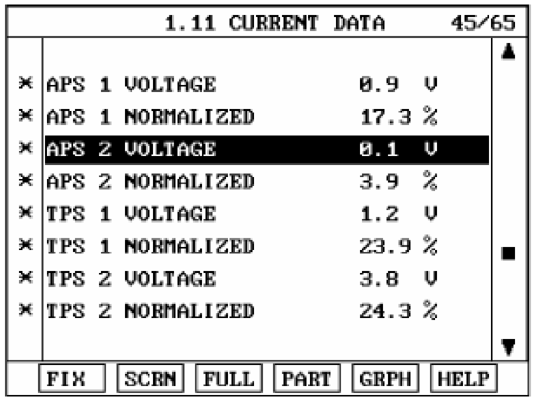
Normal at idle



Ground Short at IG ON



Short to 5V at IG ON



Open at IG ON

4. Are those "APS1 & APS2" parameters displayed correctly ?

YES

▸Fault is intermittent caused by poor contact in Sensor’s and/or PCM’s connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replaceas necessary and go to "Verification of Vehicle Repair" procedure

NO

▸Go to "Terminal and connector inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

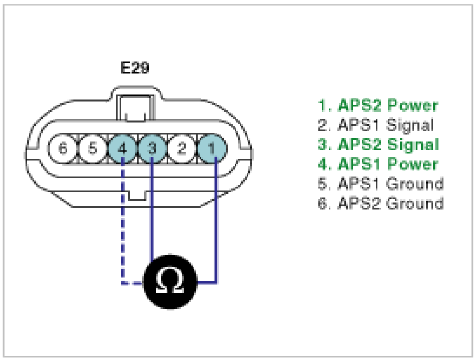
NO

▸ Go to "Signal Circuit Inspection " procedure.

SIGNAL CIRCUIT INSPECTION

1. Check short to battery in harness
   (1) IG "OFF".
   (2) Disconnect APS and PCM connector.
   (3) Measure resistance between terminal 1 and 3 of APS harness connector.
   (4) Measure resistance between terminal 3 and 4 of APS harness connector.

Specification : Infinite



(5) Is the measured reisistance within specification ?

YES

▸ Go to "Ground Circuit Inpsection" procedure.

NO

▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. Check open in harness

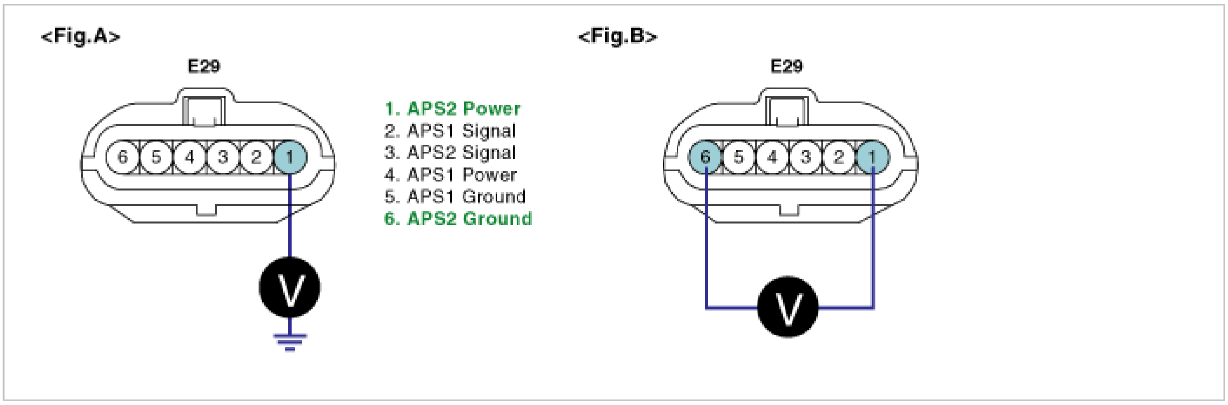
(1) IG "OFF"

(2) Disconnect APS connector.

(3) Measure voltage between terminal 1 of APS harness connector and chassis ground.(Fig. A)

(4) Measure voltage between terminal 1 and 6 of APS harness connector.(Fig. B)

Specification : Fig."A" - Fig. "B" = Approx. below 200mV



(5) Is the measured voltage within specification ?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

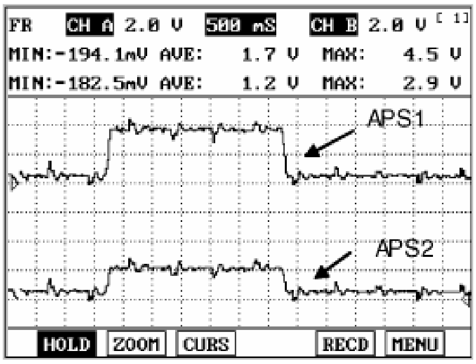
1. Check APS

(1) Ignition "ON" & ENG "OFF".

(2) Measure waveform of APS by pressing and depressing accellerator pedal with scantool.

Specification :

Pedal Position	Output Voltage(V) [Vref = 5.0V]	
	APS1	APS2
C.T	0.7 ~ 0.8V	0.275 ~ 0.475V
W.O.T	3.8 ~ 4.4V	1.75 ~ 2.35V



(3) Is the measured signal waveform O.K ?

YES

▶ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▶ Substitute with a known-good APS and check for proper operation. If the problem is corrected,replace APS and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

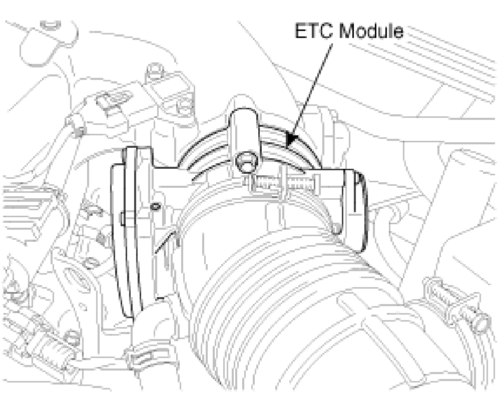
▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

Fuel System > Troubleshooting > P2135

COMPONENT LOCATION



GENERAL DESCRIPTION

ETC(Electronic Throttle Control Valve) is the device controlling amount of air to engine acccording to driver's intension. Different from the existing mechanical throttle valve which is composed of accelerator pecal and connecting wire cable, ETC consists of a motor, a throttle body and a throttle position sensor. Receiving input signals from electronic accelerator pedal module, PCM lets ETC motor control throttle valve. With ETC, cruise control system works without any additional device.

DTC DESCRIPTION

Checking output signals from TPS 1 and 2 every 109.2 sec., under detecting condition, if output signals difference between TPS1 and TPS2 are detected more than 3.5% for the specified number of times., PCM sets P2135. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

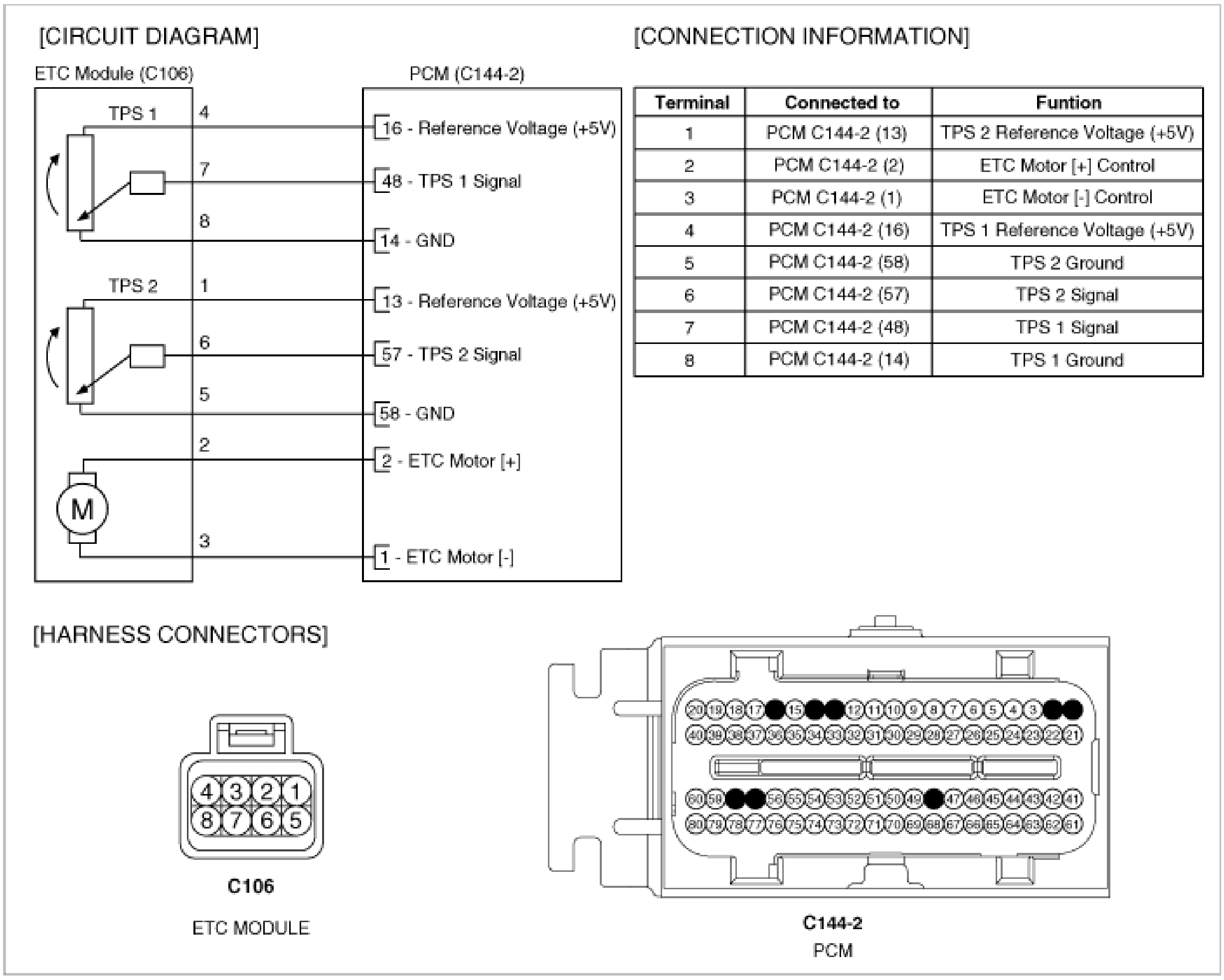
DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Determines if TPS # 1 disagrees with TPS # 2 (0-100%)	• Poor connection • Open or short in TPS circuit • Faulty TPS • Faulty PCM
Enable condition	• Ignition "ON"	
threshold value	• Difference between average values of TPS1 and TPS2 > 4.5%	
diagnosis time	• Continuous (More than 0.1sec failure for every 10.92sec. Test)	
MIL ON condition	• 2 driving cycles	

SPECIFICATION

Throttle opening (°)	Output voltage(V) [Vref=5.0V]	
	TPS1	TPS2
0°	0.0V	5.0V
10°	0.5V	4.5V
20°	0.9V	4.1V
30°	1.4V	3.6V
40°	1.8V	3.2V
50°	2.3V	2.7V
60°	2.7V	2.3V
70°	3.2V	1.8V
80°	3.6V	1.4V
90°	4.1V	0.9V
100°	4.5V	0.5V
110°	5.0V	0.0V

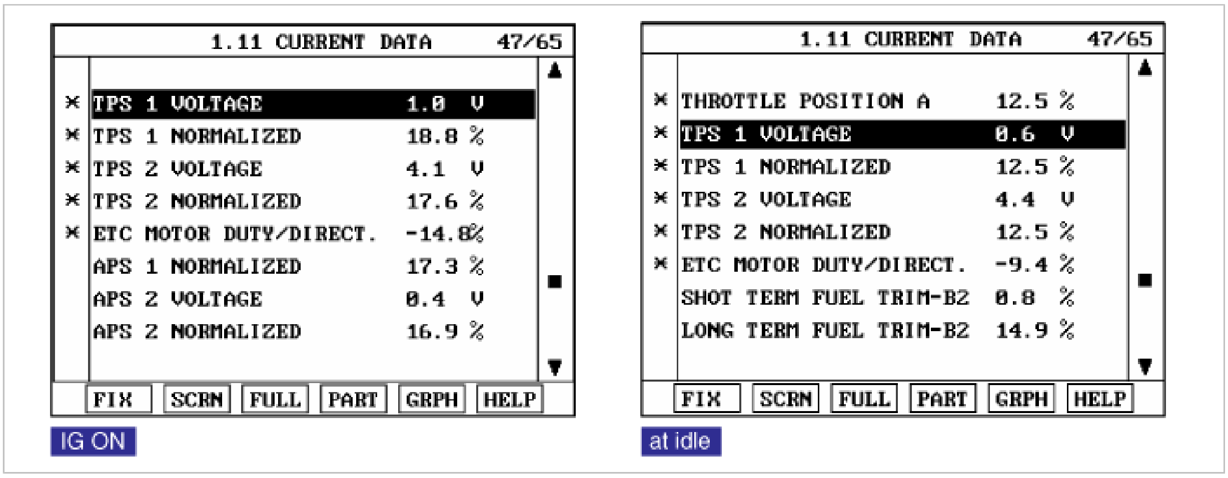
SCHEMATIC DIAGRAM



MONITOR SCANTOOL DATA

1. Connect scantool to DLC.(Data Link Connector)
2. IG "ON" & ENG "OFF"
3. Monitor "TPS1 & TPS2" items by pressing and depressing accellerator pedal.
   Specification :

Throttle opening (°)	Output voltage(V) [Vref=5.0V]	
	TPS1	TPS2
0°	0.0V	5.0V
10°	0.5V	4.5V
20°	0.9V	4.1V
30°	1.4V	3.6V
40°	1.8V	3.2V
50°	2.3V	2.7V
60°	2.7V	2.3V
70°	3.2V	1.8V
80°	3.6V	1.4V
90°	4.1V	0.9V
100°	4.5V	0.5V
110°	5.0V	0.0V



4. Are those "TPS1 & TPS2" parameters displayed correctly ?

YES

▸Fault is intermittent caused by poor contact in Sensor’s and/or PCM’s connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replaceas necessary and go to "Verification of Vehicle Repair" procedure

NO

▸Go to "Terminal and connector inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

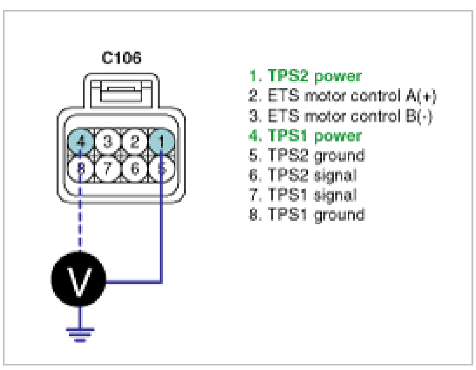
NO

▸ Go to "Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. IG "OFF".
2. Disconnect TPS connector.
3. IG "ON" & ENG "OFF".
4. Measure voltage between terminal 1 of TPS harness connector and chassis ground.
5. Measure voltage between terminal 4 of TPS harness connector and chassis ground.

Specification : Approx. 5V



6. Is the measured voltage within specification ?

YES

▸ Go to "Signal Circuit Inspection" procedure.

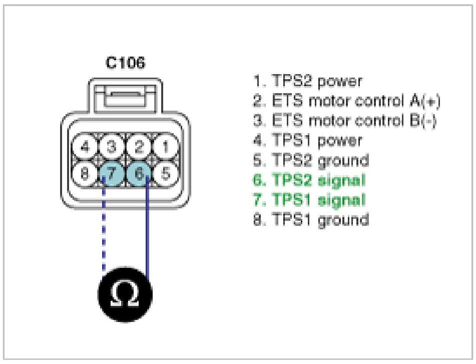
NO

▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. IG "OFF".
2. Disconnect TPS & PCM connector.
3. Measure resistance between terminal 6 and 7 of TPS harness connector.

Specification : Infinite



4. Is the measured resistance within specification ?

YES

▸ Go to "Component Inspection" procedure.

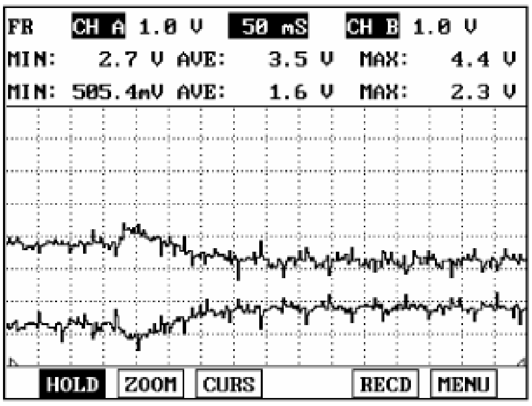
NO

▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

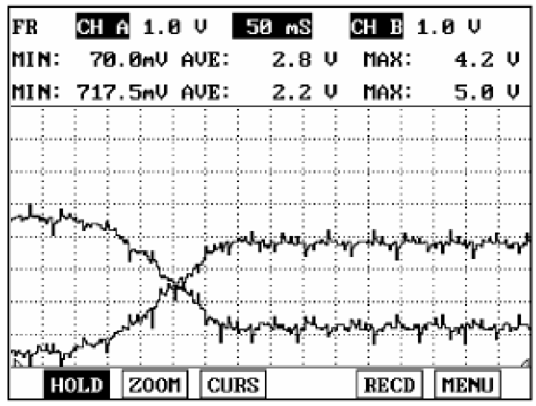
COMPONENT INSPECTION

1. Check TPS
   (1) Ignition "ON" & ENG "OFF".
   (2) Monitor signal waveform of TPS by stepping on and off the accellerator padel on scantool
   Specification :

Throttle opening (°)	Output voltage(V) [Vref=5.0V]	
	TPS1	TPS2
0°	0.0V	5.0V
10°	0.5V	4.5V
20°	0.9V	4.1V
30°	1.4V	3.6V
40°	1.8V	3.2V
50°	2.3V	2.7V
60°	2.7V	2.3V
70°	3.2V	1.8V
80°	3.6V	1.4V
90°	4.1V	0.9V
100°	4.5V	0.5V
110°	5.0V	0.0V



Pressing acclerator pedal at idle



Pulling out accellerator cable with hand at idle

(3) Is the measured signal waveform O.K ?

YES

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Substitute with a known-good TPS and check for proper operation. If the problem is corrected,replace TPS and then go to "Verification of Vehicle Repair" procedure.
(After replacing ETC, do initialization of ETC as follows)

※ Procedure of ETS Initialization

1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10sec.)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

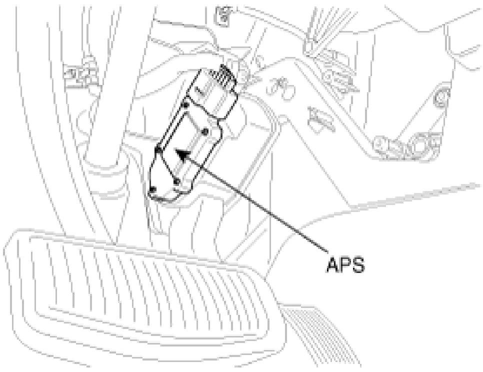
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P2138

COMPONENT LOCATION



GENERAL DESCRIPTION

APS(Acceleration Position Sensor) measures driver's accelerating intension using a potentiometer and APS signal is transmitted to the PCM. The pedal's position is converted as voltages of potentiometer in the APS.The absence of a mechanical link between the accelerator pedal and throttle valve presents a risk of loss of control of the engine in the event of a failure of the component. Therefore, APS has the two potentiometers whose slides are mechanically solid. APS 2 decides whether or not APS 1 & 2 is faulty.

DTC DESCRIPTION

Checking output signals from APS 1 and 2 every 93.6 sec., under detecting condition, if output signals difference between APS 1 and 2 are detected more than 4.5% for the specified number of times., PCM sets P2138. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till 1 driving cycle.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible Cause
DTC Strategy		• This code detects a correlation error between APS 1 and APS 2 (0-100%)	• Poor connection • Open or short in APS Circuit • Faulty APS • Faulty PCM
EnableConditions		• Ignition "ON"	
Threshold	Case 1	• Difference between APS1 and APS2 Normalized values > 4.5%	
	Case 2	• Difference between APS learned minimums > 4.5%	
Diagnosis Time		• Contineous (More than 0.32sec. Failure for every 9.36sec. Test)	
MIL On Condition		• 1 Driving Cycle	

SIGNAL WAVEFROM AND DATA

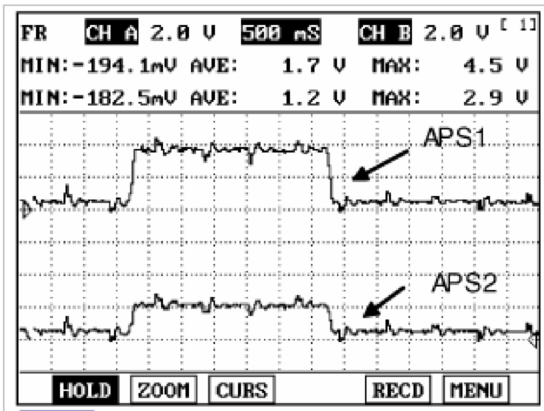


Fig. 1

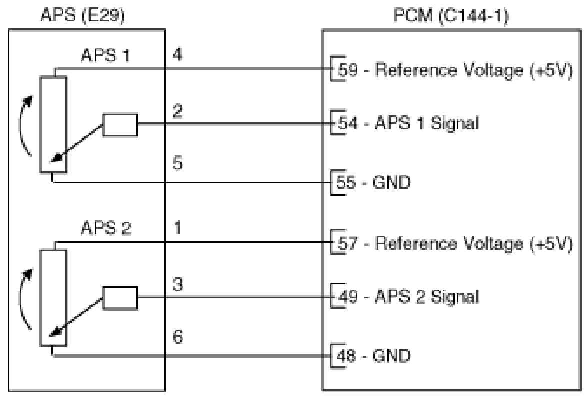
Fig. 1 : This is a signal waveform of APS 1 & 2 which shows that APS 2 increases voltage just half of APS 1 voltage increase when accelleration.

SPECIFICATION

Pedal Position	Output Voltage(V) [Vref = 5.0V]	
	APS1	**APS2**
C.T	0.7 ~ 0.8V	0.275 ~ 0.475V
W.O.T	3.8 ~ 4.4V	1.75 ~ 2.35V

SCHEMATIC DIAGRAM

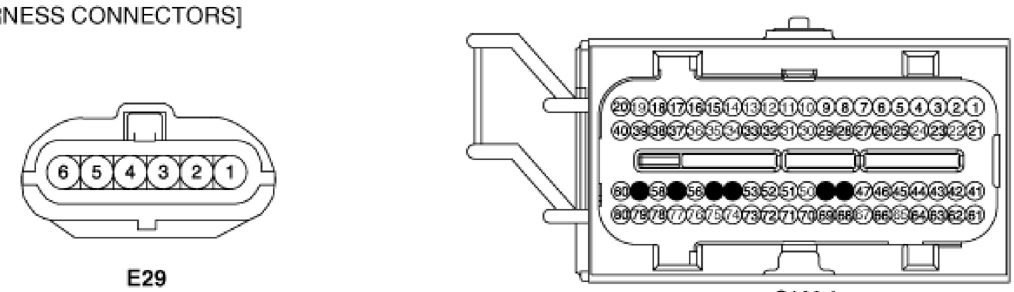
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Funtion
1	PCM C144-1 (57)	APS 2 Reference Voltage (+5V)
2	PCM C144-1 (54)	APS 1 Signal
3	PCM C144-1 (49)	APS 2 Signal
4	PCM C144-1 (59)	APS 1 Reference Voltage (+5V)
5	PCM C144-1 (55)	APS 1 Ground
6	PCM C144-1 (48)	APS 2 Ground

[HARNESS CONNECTORS]



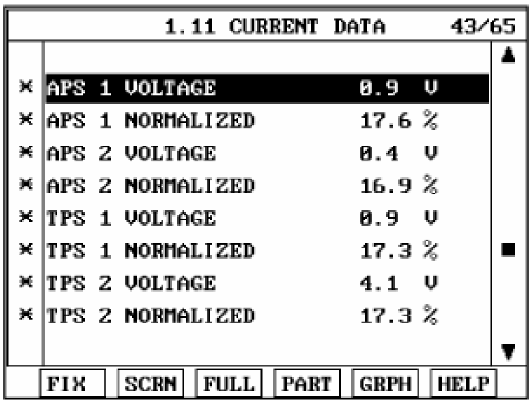
E29
APS

C144-1
PCM

MONITOR SCANTOOL DATA

1. Connect scantool to DLC.(Data Link Connector)
2. Warm up the engine to normal operating temperature.
3. Monitor "APS1 & APS2" parameters on the scantool.

Pedal Position	Output Voltage(V) [Vref = 5.0V]	
	APS1	**APS2**
C.T	0.7 ~ 0.8V	0.275 ~ 0.475V
W.O.T	3.8 ~ 4.4V	1.75 ~ 2.35V



Normal at IG ON

4. Are those "APS1 & APS2" parameters displayed correctly ?

YES

▸Fault is intermittent caused by poor contact in Sensor's and/or PCM's connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replaceas necessary and go to "Verification of Vehicle Repair" procedure

NO

▸Go to "Terminal and connector inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸Repair as necessary and go to "Verification of Vehicle Repair" procedure

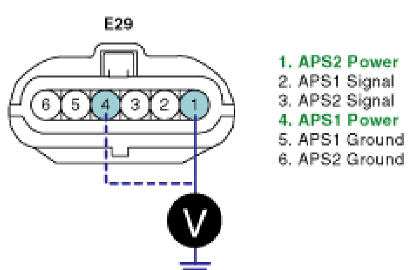
NO

▸Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. IG "OFF"
2. Disconnect APS connector.
3. IG "ON" & ENG "OFF".
4. Measure voltage between terminal 1 of APS harness connector and chassis ground.
5. Measure voltage between terminal 4 of APS harnesss connector and chassis ground.

Specification : Approx. 5V



6. Is the measured voltage within specification ?

YES

▸ Go to "Signal Circuit Inspection" procedure.

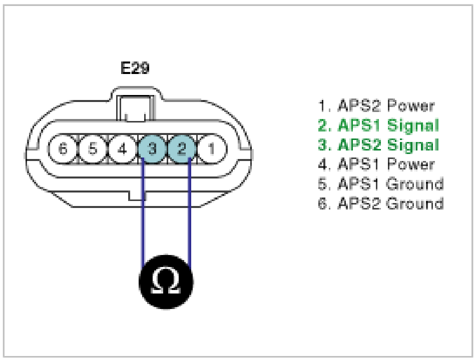
NO

▸ Repair or replace as necessary and then, go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. IG "OFF".
2. Disconnect APS and PCM connector.
3. Measure resistance between terminal 2 and 3 of APS harness connector.

Specification : Infinite



4. Is the measured resistance within specification ?

YES

▸ Go to "Component Inspection" procedure.

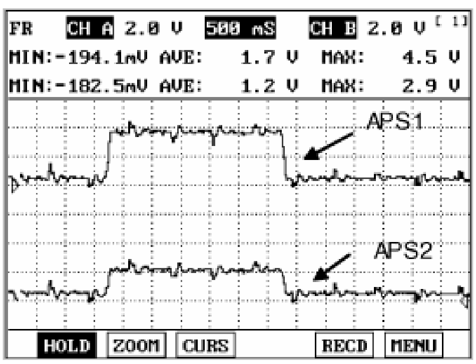
NO

▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check APS
   (1) IG "ON" & ENG "OFF".
   (2) Measure signal waveform of APS 1 and APS 2 by stepping on and off with scantool
   Specification :

Pedal Position	**Output Voltage(V) [Vref = 5.0V]**	
	APS1	**APS2**
C.T	0.7 ~ 0.8V	0.275 ~ 0.475V
W.O.T	3.8 ~ 4.4V	1.75 ~ 2.35V



   (3) Is the measured signal waveform O.K ?

YES

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by

PCM.
Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Substitute with a known-good APS and check for proper operation. If the problem is corrected,replace APS and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

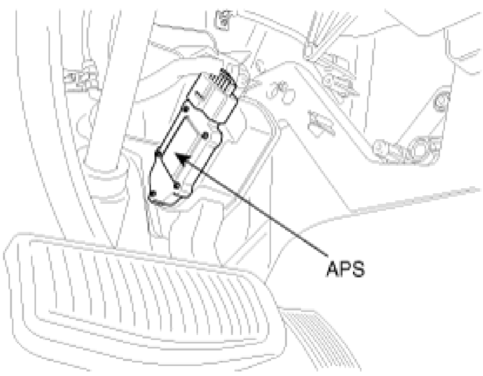
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P2173

COMPONENT LOCATION



GENERAL DESCRIPTION

ETC(Electronic Throttle Control Valve) is the device controlling amount of air to engine acccording to driver's intension. Different from the existing mechanical throttle valve which is composed of accelerator pecal and connecting wire cable, ETC consists of a motor, a throttle body and a throttle position sensor. Receiving input signals from electronic accelerator pedal module, PCM lets ETC motor control throttle valve. With ETC, cruise control system works without any additional device.

DTC DESCRIPTION

Comparing real intake air flow and the intake air flow calculated by ETS every 15.6 sec., under detecting condition, if the difference of air flow more than 200g/s is detected for more than 1.3 sec., PCM sets P2173. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till 1 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• The engine airflow measurements not based on throttle position are compared with throttle position based estimated airflow. If measured airflow is much higher than throttle based estimated airflow, the throttle body may not be throttling the engine.	
	• Engine running	

<table>
<tr><td colspan="2">EnableConditions</td><td>• Throttle Actuation Mode is not OFF
• MAP Sensor is not failed
• MAF Sensor is not failed
• IAT sensor is not failed</td><td rowspan="5">• Air Leakage between TPS and MAFS
• Faulty throttle body
• Faulty PCM</td></tr>
<tr><td rowspan="2">Threshold</td><td>Case 1</td><td>• Speed-Density Airflow - ETC estimated airflow > 9 g/s</td></tr>
<tr><td>Case 2</td><td>• MAF reading - ETC estimated airflow > 7g/s</td></tr>
<tr><td colspan="2">Diagnosis Time</td><td>• Contineous
(More than 3.9sec. Failure for every 15.6sec. Test)</td></tr>
<tr><td colspan="2">MIL On Condition</td><td>• 1 Driving Cycle</td></tr>
</table>

SPECIFICATION

MAFS

Air flow (kg/h)	Frequency (Hz)
0 kg/h	720 ~ 880 Hz
12.6 kg/h	2,595 Hz
18.0 kg/h	2,930 Hz
23.4 kg/h	3,208 Hz
32.4 kg/h	3,609 Hz
43.2 kg/h	3,975 Hz
57.6 kg/h	4,361 Hz
72.0 kg/h	4,683 Hz
108.0 kg/h	5,362 Hz
144.0 kg/h	5,885 Hz
198.0 kg/h	6,527 Hz
270.0 kg/h	7,219 Hz
360.0 kg/h	7,945 Hz
486.0 kg/h	8,736 Hz
666.0 kg/h	9,660 Hz
900.0 kg/h	10,613 Hz

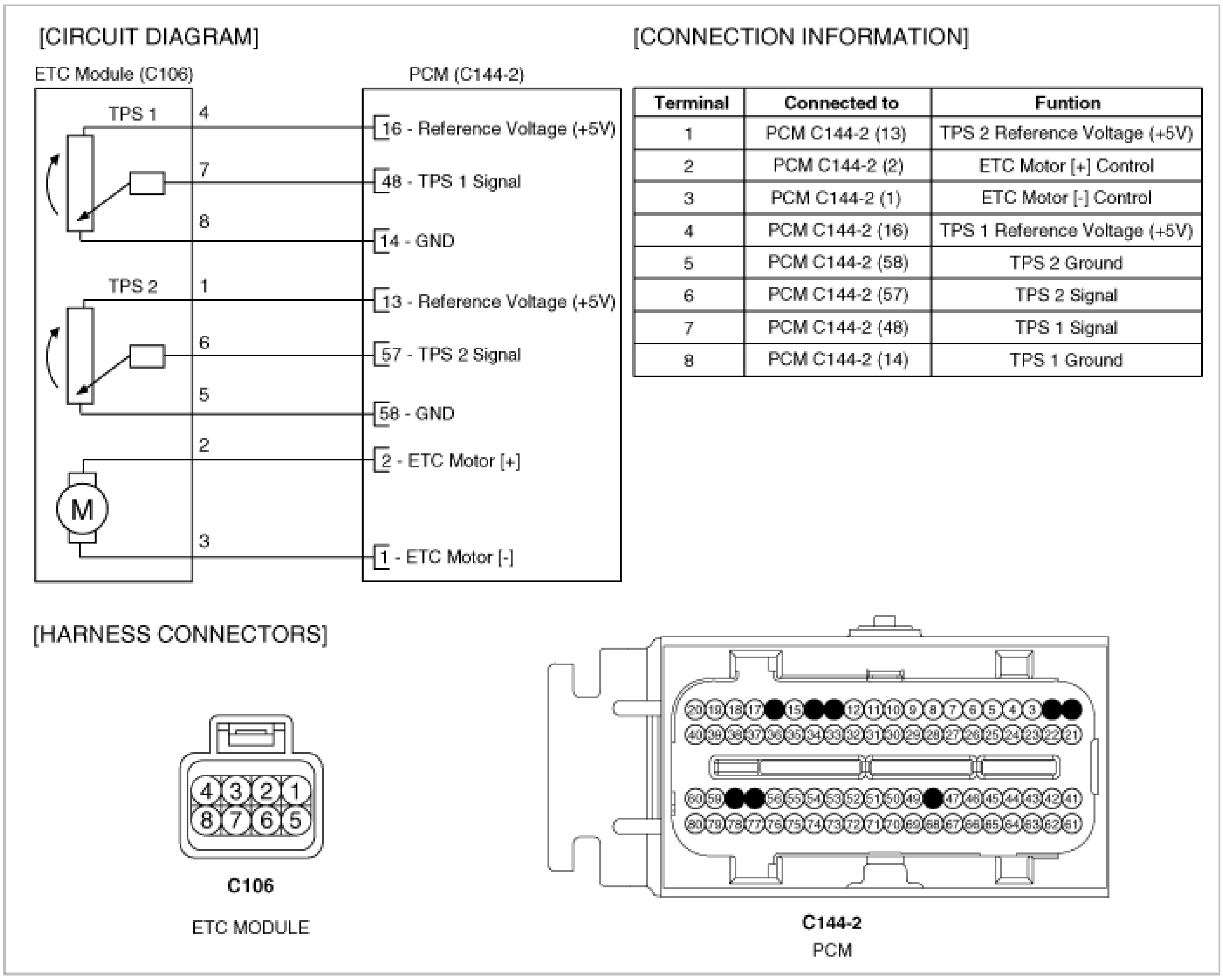
TPS

Throttle opening (°)	Output voltage(V) [Vref=5.0V]	
	TPS1	TPS2
0°	0.0V	5.0V
10°	0.5V	4.5V
V20°	0.9V	4.1V
30°	1.4V	3.6V
40°	1.8V	3.2V
50°	2.3V	2.7V
60°	2.7V	2.3V
70°	3.2V	1.8V
80°	3.6V	1.4V
90°	4.1V	0.9V
100°	4.5V	0.5V
110°	5.0V	0.0V

MAPS

Pressure(kPa)(kPa)	Output voltage(V)
20.0kPa	0.79V
35kPa	1.382V
46.66kPa	1.84V
60kPa	2.369V
90kPa	3.75V
101.32kPa	4.00V

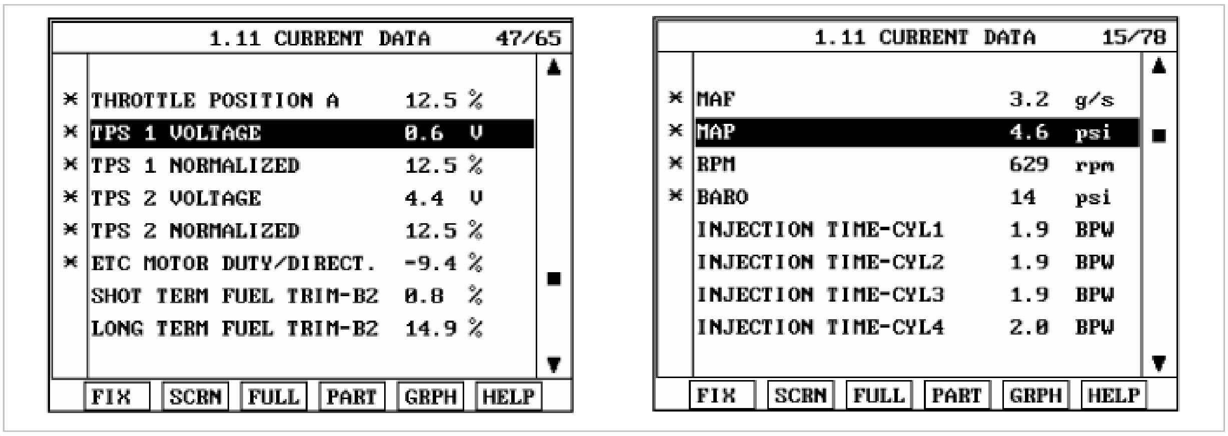
SCHEMATIC DIAGRAM



Terminal	Connected to	Funtion
1	PCM C144-2 (13)	TPS 2 Reference Voltage (+5V)
2	PCM C144-2 (2)	ETC Motor [+] Control
3	PCM C144-2 (1)	ETC Motor [-] Control
4	PCM C144-2 (16)	TPS 1 Reference Voltage (+5V)
5	PCM C144-2 (58)	TPS 2 Ground
6	PCM C144-2 (57)	TPS 2 Signal
7	PCM C144-2 (48)	TPS 1 Signal
8	PCM C144-2 (14)	TPS 1 Ground

MONITOR SCANTOOL DATA

1. Connect scantool to DLC.(Data Link Connector)
2. Warm up the engine to normal operating temperature.
3. Monitor "TPS1&2, MAPS,MAFS" parameters on scantool



YES

▸Fault is intermittent caused by poor contact in Sensor's and/or PCM's connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replaceas necessary and go to "Verification of Vehicle Repair" procedure

NO

▸Go to "System Inspection" procedure.

SYSTEM INSPECTION

1. Visual Inspection
   (1) Check the air hose between MAFS and throttle body is torn or installation.
   (2) Check deforamtion, crack or installation of throttle valve(body)
   (3) Has a problem been found ?

   YES

   ▸ Substitute with a known-good Air hose or throttle body and check for proper operation.
   If the problem is corrected,replace air hose or throttle body and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

   > NOTE
   >
   > There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.
   > Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

※ Procedure of ETS Initialization

1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10sec.)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

GENERAL DESCRIPTION

Air-fuel feed back control is the modulation which increases or decreases fuel injection quantity as determining exhaust gas rich or lean with HO2S adjust combustion is done at ideal air-fuel ratioto so as to raise the efficiency of catalytic convertor. Generally, NOx increases at lean combustion while CO, HC increases in rich combustion. Thus, in order to purge all of these gases with catalytic convertor, air-fuel ratio should be nearly at the ideal ratio. However the range in which all gases purified successfully is too narrow, it is impossible to meet ideal range with open loop control, therefore feed back control using HO2S is required. HO2S output signal changes rapidly near ideal air-fuel ratio and this characteristic is used at feed back control. comparing HO2S output signal and reference value, PCM increases fuel injection quantity at lean condition and decreases at rich condition. As deterioration of engine, due to the characteristic changes of many components of intake and fuel line or inevitable tolerance of components at production process, achieving ideal air-fuel ratio is almost impossible with the fixed fuel injection duration. Regarding the change of cross section by clogged injector, feed back correction is performed yet, it cannot cover all the ranges. It means if the correction range is massively seperated from the ideal value or if the mean of feed back control range too inclines to lean or rich condition, feed back correction does not work efficiently. Therefore processing correction value throughout long time statistically during driving, PCM controlls fuel injection duration as fitting the mean to be the ideal air-fuel ratio value. Through adaptive control, accuracy of the control could be improved and the value of adaptive control varies countiuously during driving and is always up-dated.

DTC DESCRIPTION

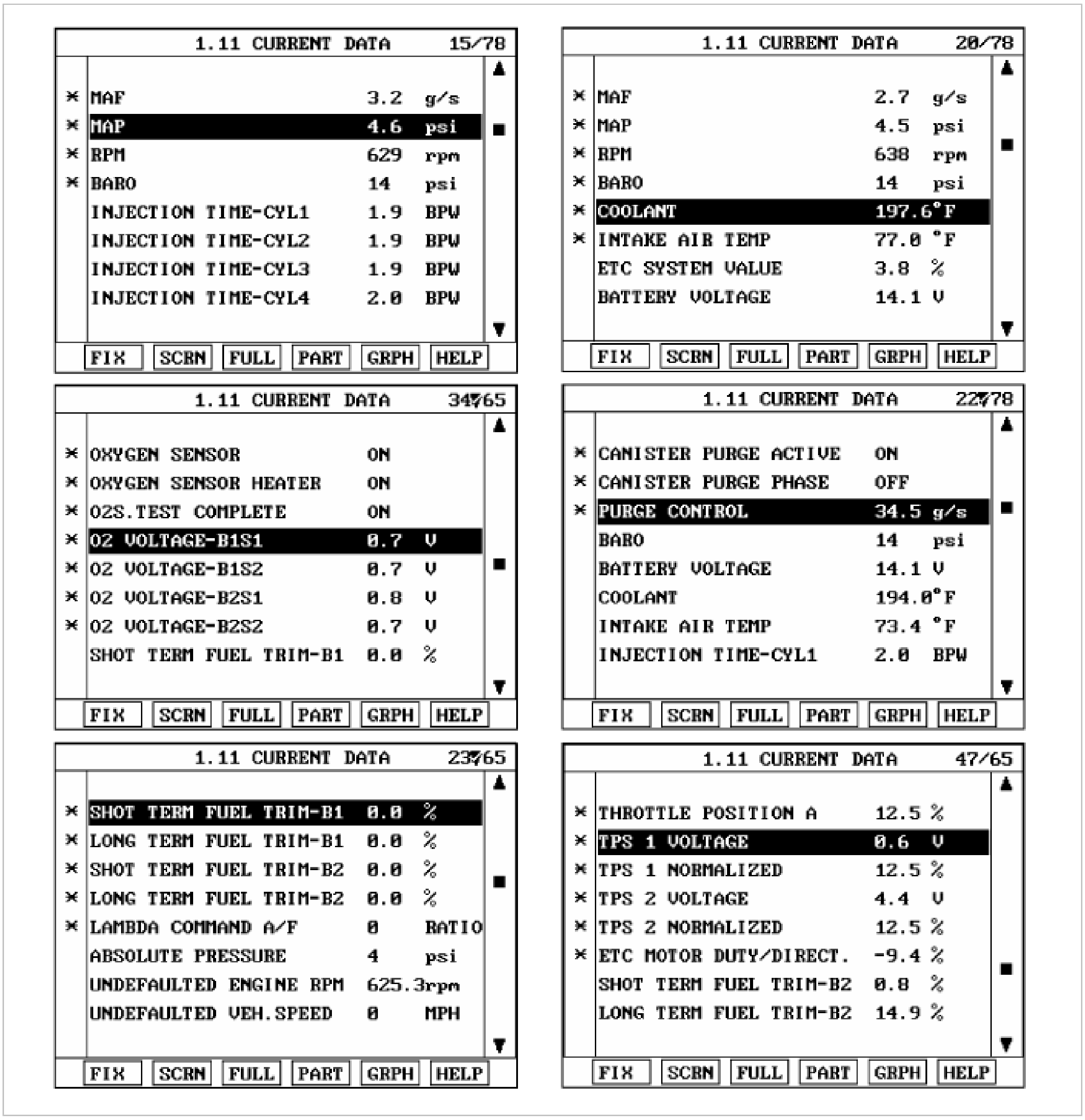
Checking air-fuel ratio correction value every 0.75 sec. at idle, if the value within the detecting condition for more than 0.3 sec., PCM sets P2187. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Fuel Trim Idle Condition Option Limits Exceeded	• Sensors related to Fuel Trim • Intake system • Fuel Pressure • Faulty PCM
EnableConditions	• 550rpm ≤ Engine Speed ≤ 4000rpm • 60°C ≤ Engine coolant temperature ≤ 114.992°C • -10°C ≤ Intake Air Temperature ≤ 60°C • 0° ≤ Throttle Position ≤ 72° • 25kPa ≤ Engine Load ≤ 90kPa • 1.5g/s ≤ Intake Air Flow ≤ 80g/s • Barometric Pressure ≥ 72kPa • Vehicle Speed ≤ 130km/h • System Voltage ≥ 11V • BLM learn Allowed • Closed Loop Active • Other diagnostic fault not active	
Threshold value	• Lean Limit Average > 0.8 (The average of short term fuel trim values) • Lean Limit Average > 1.25 (The average of adaptive index multiplier values)	
DiagnosisTime	• Contineous (More than 0.375sec. Failure for every 0.75sec. Test)	
MIL On Condition	• 2 Driving Cycles	

MONITOR SCANTOOL DATA

1. Connect scantool to DLC(Data Link Connector)
2. Warm up the engine to normal operating temperature.
3. Monitor sensors related to fuel trim(Ex. HO2S,MAFS,MAPS,TPS,MAPS,TPS,ECTS,PCSV,Injectors etc.) with scantool



4. Are those parameters displayed correctly ?

YES

▸Fault is intermittent caused by poor contact in Sensor's and/or PCM's connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replaceas necessary and go to "Verification of Vehicle Repair" procedure

NO

▸Go to "Terminal and connector inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "System Inspection " procedure.

SYSTEM INSPECTION

1. Check Air leakage
   (1) Check gasket is contaminated or misinstalled.
      - Installation or any damage of Throttle body gasket
      - Installation or any damage of the gasket between intake manifold and surge tank.
      - Clogging of intake manifold or injectors resulting from foreign materials.
      - Open stuck of PCSV caused by foreign materials between surge tank and PCSV.

   (2) Has a problem been found ?

   YES

   - Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

   NO

   - Go to "Check Fuel Line Inspection" as follows.

2. Check Fuel Line Inspection
   (1) Check clog, contamination and installation of each hose as follows.
      - Check connection of each fuel line.
      - Check damage, interference and installation of vaccum hose connected to fuel line.
      - Check that fuel pipe in the fuel line is bent and sqeezed.
      - Check any fuel leakage from fuel pipe in the fuel line.

   (2) Has a problem been found ?

   YES

   - Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

   NO

   - Go to "Check fuel pressure" as follows.

3. Check Fuel Pressure
   (1) Refer to "Fuel pressure test" in "Fuel delivery system"

   (2) Is the measured fuel pressure within specification ?

   YES

   - Go to "Component Inspection" procedure.

   YES

   - Repair or replace as necessary and the, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check PCV
   (1) IG "OFF".

   (2) Remove PCV valve and then, check that plunger in the PCV is moving.

   (3) Is the PCV normal ?

   YES

   - Go to "Check PCSV" as follows.

   NO

   - Substitute with a known-good PCV and check for proper operation. If the problem is corrected,replace PCV and then go to "Verification of Vehicle Repair" procedure.

2. Check PCSV
   (1) IG "OFF".

   (2) Remove PCSV and Vaccum Hose

   (3) Check that PCSV is just one way solenoid valve

   (4) Is the PCSV normal ?

   YES

   - Go to "Check injector" as follows.

   NO

   - Substitute with a known-good PCSV and check for proper operation. If the problem is corrected,replace PCSV and then go to "Verification of Vehicle Repair" procedure.

3. Check injector
   (1) IG "OFF"

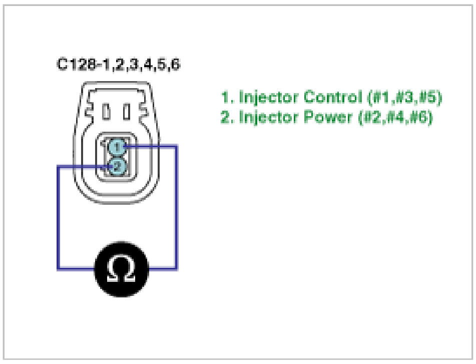
(2) Remove injector.

(3) Check that injector hole is clogged by foreign materials.

(4) Measure resistance between terminal 1 an 2 of injector connector.(Component Side)

Specification :

Temp.	Resistance
20°C (68°F)	11.4 ~ 12.6Ω



(5) Is the measured resistance within specification ?

YES

▸ Go to "Check component related to fuel trim" as follows.

NO

▸ Substitute with a known-good injector and check for proper operation. If the problem is corrected,replace injector and then go to "Verification of Vehicle Repair" procedure.

4. Check component related to fuel trim

(1) Check component related to fuel trim such as HO2S, MAFS,MAPS, TPS, ECTS, PCSV and Injectores) - Refer to each designated trouble shooting guide.

(2) Are those component related to fuel trim O.K ?

YES

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.

NO

▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P2188

GENERAL DESCRIPTION

Air-fuel feed back control is the modulation which increases or decreases fuel injection quantity as determining exhaust gas rich or lean with HO2S adjust combustion is done at ideal air-fuel ratioto so as to raise the efficiency of catalytic convertor. Generally, NOx increases at lean combustion while CO, HC increases in rich combustion. Thus, in order to purge all of these gases with catalytic convertor, air-fuel ratio should be nearly at the ideal ratio. However the range in which all gases purified successfully is too narrow, it is impossible to meet ideal range with open loop control, therefore feed back control using HO2S is required. HO2S output signal changes rapidly near ideal air-fuel ratio and this characteristic is used at feed back control. comparing HO2S output signal and reference value, PCM increases fuel injection quantity at lean condition and decreases at rich condition. As deterioration of engine, due to the characteristic changes of many components of intake and fuel line or inevitable tolerance of components at production process, achieving ideal air-fuel ratio is almost impossible with the fixed fuel injection duration. Regarding the change of cross section by clogged injector, feed back correction is performed yet, it cannot cover all the ranges. It means if the correction range is massively seperated from the ideal value or if the mean of feed back control range too inclines to lean or rich condition, feed back correction does not work efficiently. Therefore processing correction value throughout long time statistically during driving, PCM controlls fuel injection duration as fitting the mean to be the ideal air-fuel ratio value. Through adaptive control, accuracy of the control could be improved and the value of adaptive control varies countiuously during driving and is always up-dated.

DTC DESCRIPTION

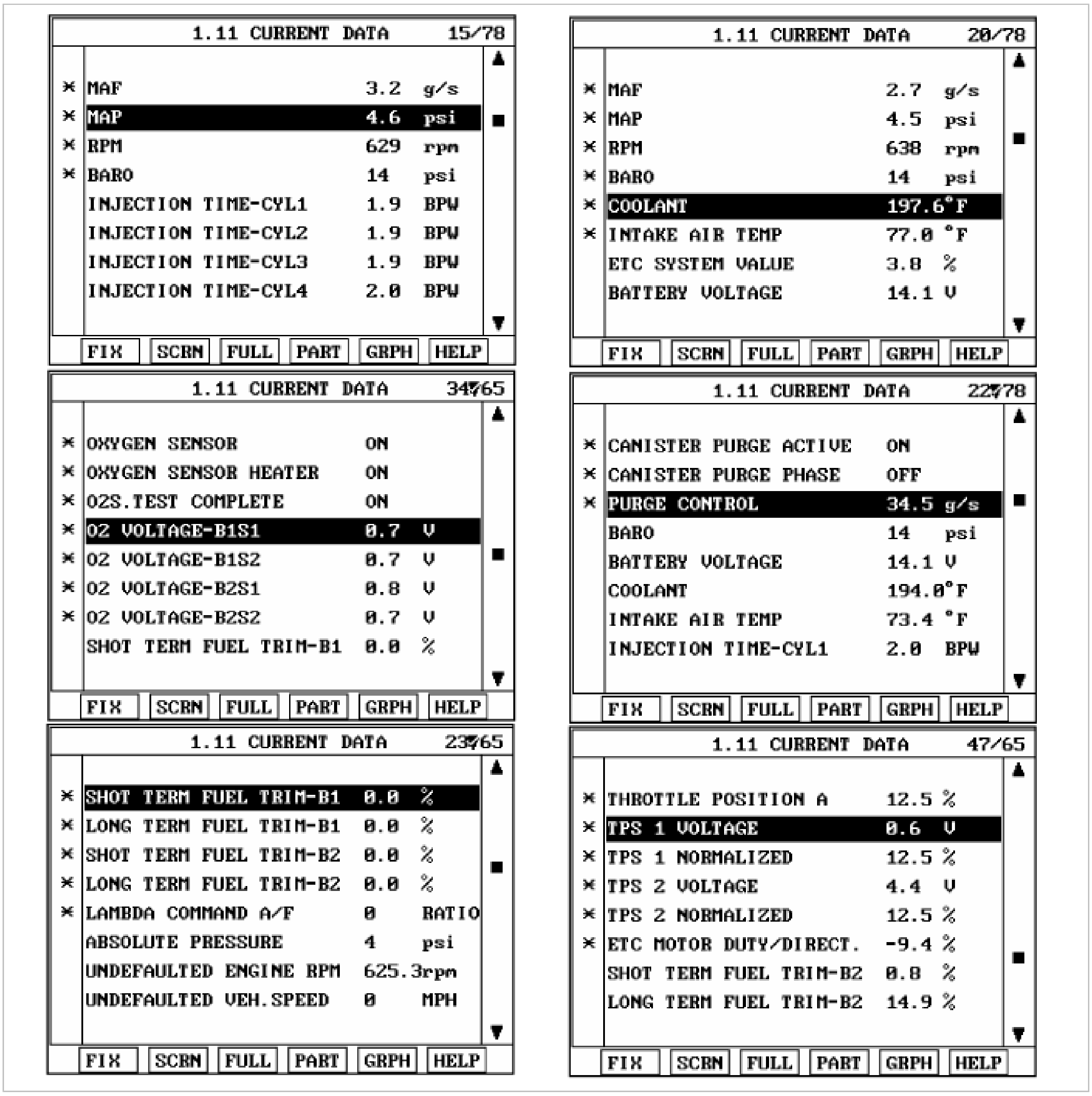
Checking air-fuel ratio correction value every 0.75 sec. at idle, if the value within the detecting condition for more than 0.3 sec., PCM sets P2188. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Fuel Trim Idle Condition Option Limits Exceeded	• Sensors related to Fuel Trim • Intake system • Fuel Pressure • Faulty PCM
EnableConditions	• 550rpm ≤ Engine Speed ≤ 4000rpm • 60°C ≤ Engine coolant temperature ≤ 114.992°C • -10°C ≤ Intake Air Temperature ≤ 60°C • 0° ≤ Throttle Position ≤ 72° • 25kPa ≤ Engine Load ≤ 90kPa • 1.5g/s ≤ Intake Air Flow ≤ 80g/s • Barometric Pressure ≥ 72kPa • Vehicle Speed ≤ 130km/h • System Voltage ≥ 11V • BLM learn Allowed • Closed Loop Active • Other diagnostic fault not active	
Threshold value	• Rich Limit Average < 1.5 (The average of short term fuel trim values) • Rich Limit Average < 0.76 (The average of adaptive index multiplier values)	
DiagnosisTime	• Contineous (More than 0.375sec. Failure for every 0.75sec. Test)	
MIL On Condition	• 2 Driving Cycles	

MONITOR SCANTOOL DATA

1. Connect scantool to DLC(Data Link Connector)
2. Warm up the engine to normal operating temperature.
3. Monitor sensors related to fuel trim(Ex. HO2S,MAFS,MAPS,TPS,MAPS,TPS,ECTS,PCSV,Injectors etc.) with scantool



4. Are those parameters displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor's and/or PCM's connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replaceas necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "System Inspection " procedure.

SYSTEM INSPECTION

1. Check air clog.
   (1) Check Contamination ,Gasket installation as follows
      ▸ Damage or installation of throttle body gasket.
      ▸ Check clog of air cleaner
      ▸ Clog or contamination of intake manifold or injectors caused by foreign materials
      ▸ Check vaccum hose connected to surge tank is normal.

   (2) Has a problem been found ?

      YES

      ▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair"procedure.

      NO

      ▸ Go to "Check Fuel Pressure" as follows

2. Check Fuel Pressure.
   (1) Refer to "Fuel pressure test" in "Fuel delivery system"

   (2) Is the measured fuel pressure within specification ?

      YES

      ▸ Go to "Component Inspection"procedure.

      NO

      ▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check PCV
   (1) IG "OFF".

   (2) Remove PCV valve and then, check that plunger in the PCV is moving.

   (3) Is the PCV normal ?

      YES

      ▸ Go to "Check PCSV" as follows.

      NO

      ▸ Substitute with a known-good PCV and check for proper operation. If the problem is corrected,replace PCV and then go to "Verification of Vehicle Repair" procedure.

2. Check PCSV
   (1) IG "OFF".

   (2) Remove PCSV and Vaccum Hose

   (3) Check that PCSV is just one way solenoid valve

   (4) Is the PCSV normal ?

      YES

      ▸ Go to "Check injector" as follows.

      NO

      ▸ Substitute with a known-good PCSV and check for proper operation. If the problem is corrected,replace PCSV and then go to "Verification of Vehicle Repair" procedure.

3. Check injector
   (1) IG "OFF"

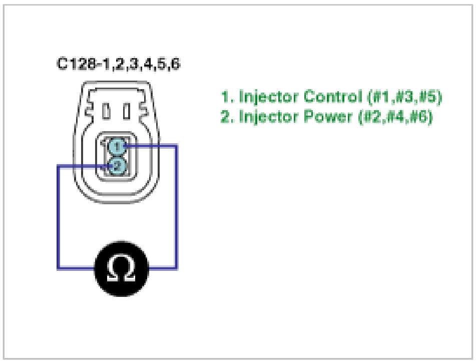
   (2) Remove injector.

   (3) Check that injector hole is clogged by foreign materials.

   (4) Measure resistance between terminal 1 an 2 of injector connector.(Component Side)

      Specification :

Temp.	Resistance
20°C (68°F)	11.4 ~ 12.6Ω



(5) Is the measured resistance within specification ?

YES

▸ Go to "Check component related to fuel trim" as follows.

NO

▸ Substitute with a known-good injector and check for proper operation. If the problem is corrected,replace injector and then go to "Verification of Vehicle Repair" procedure.

4. Check component related to fuel trim
   (1) Check component related to fuel trim such as HO2S, MAFS,MAPS, TPS, ECTS, PCSV and Injectores) - Refer to each designated trouble shooting guide.

   (2) Are those component related to fuel trim O.K ?

YES

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.

NO

▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P2189

GENERAL DESCRIPTION

Air-fuel feed back control is the modulation which increases or decreases fuel injection quantity as determining exhaust gas rich or lean with HO2S adjust combustion is done at ideal air-fuel ratioto so as to raise the efficiency of catalytic convertor. Generally, NOx increases at lean combustion while CO, HC increases in rich combustion. Thus, in order to purge all of these gases with catalytic convertor, air-fuel ratio should be nearly at the ideal ratio. However the range in which all gases purified successfully is too narrow, it is impossible to meet ideal range with open loop control, therefore feed back control using HO2S is required. HO2S output signal changes rapidly near ideal air-fuel ratio and this characteristic is used at feed back control. comparing HO2S output signal and reference value, PCM increases fuel injection quantity at lean condition and decreases at rich condition. As deterioration of engine, due to the characteristic changes of many components of intake and fuel line or inevitable tolerance of components at production process, achieving ideal air-fuel ratio is almost impossible with the fixed fuel injection duration. Regarding the change of cross section by clogged injector, feed back correction is performed yet, it cannot cover all the ranges. It means if the correction range is massively seperated from the ideal value or if the mean of feed back control range too inclines to lean or rich condition, feed back correction does not work efficiently. Therefore processing correction value throughout long time statistically during driving, PCM controlls fuel injection duration as fitting the mean to be the ideal air-fuel ratio value. Through adaptive control, accuracy of the control could be improved and the value of adaptive control varies countiuously during driving and is always up-dated.

DTC DESCRIPTION

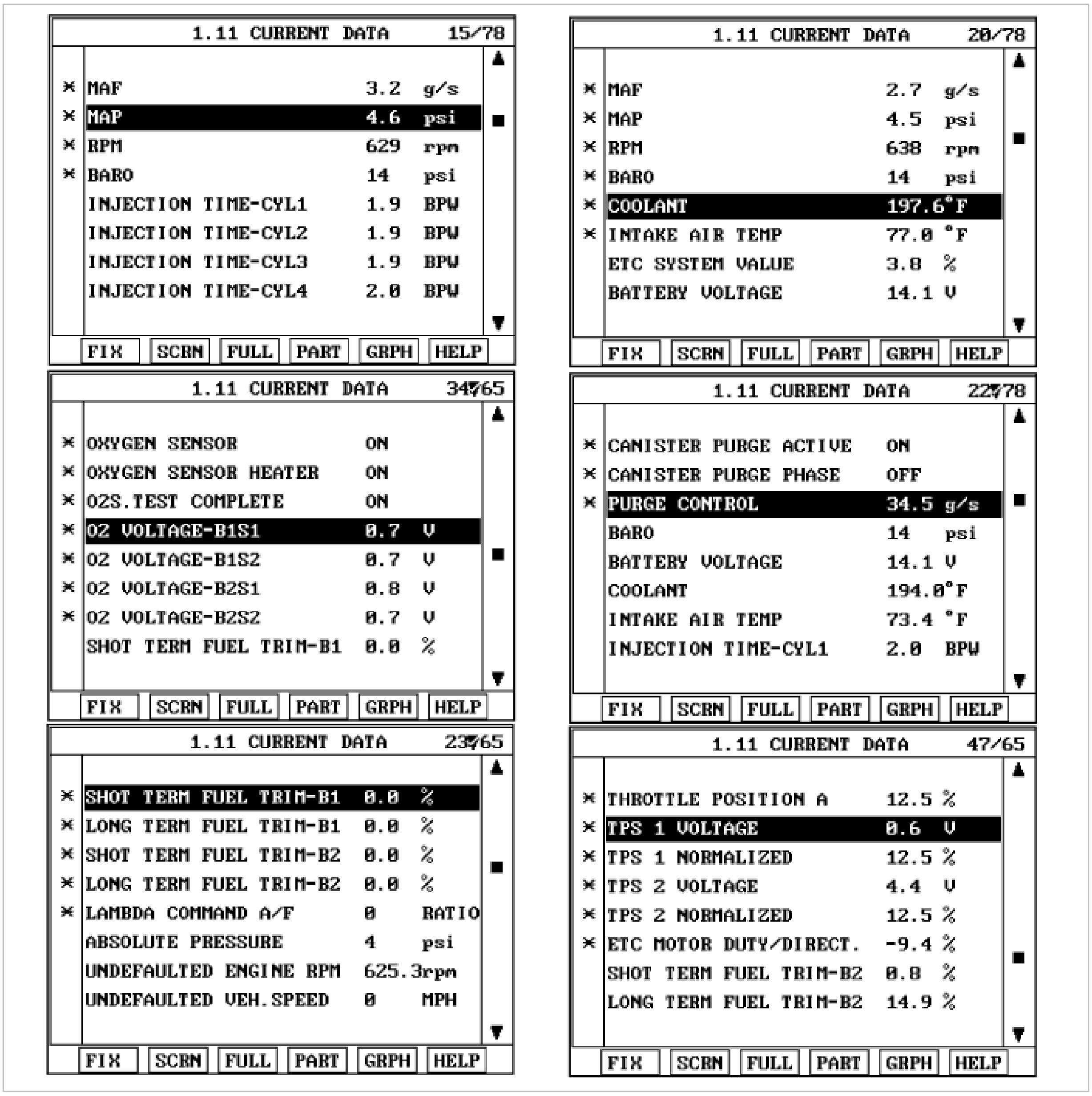
Checking air-fuel ratio correction value every 0.75 sec. at idle, if the value within the detecting condition for more than 0.3 sec., PCM sets P2189. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Fuel Trim Idle Condition Option Limits Exceeded	• Sensors related to Fuel Trim • Intake system • Fuel Pressure • Faulty PCM
EnableConditions	• 550rpm ≤ Engine Speed ≤ 4000rpm • 60°C ≤ Engine coolant temperature ≤ 114.992°C • -10°C ≤ Intake Air Temperature ≤ 60°C • 0° ≤ Throttle Position ≤ 72° • 25kPa ≤ Engine Load ≤ 90kPa • 1.5g/s ≤ Intake Air Flow ≤ 80g/s • Barometric Pressure ≥ 72kPa • Vehicle Speed ≤ 130km/h • System Voltage ≥ 11V • BLM learn Allowed • Closed Loop Active • Other diagnostic fault not active	
Threshold value	• Lean Limit Average > 0.8 (The average of short term fuel trim values) • Lean Limit Average > 1.24 (The average of adaptive index multiplier values)	
DiagnosisTime	• Contineous (More than 0.375sec. Failure for every 0.75sec. Test)	
MIL On Condition	• 2 Driving Cycles	

MONITOR SCANTOOL DATA

1. Connect scantool to DLC(Data Link Connector)
2. Warm up the engine to normal operating temperature.
3. Monitor sensors related to fuel trim(Ex. HO2S,MAFS,MAPS,TPS,MAPS,TPS,ECTS,PCSV,Injectors etc.) with scantool



4. Are those parameters displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor’s and/or PCM’s connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replaceas necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "System Inspection " procedure.

SYSTEM INSPECTION

1. Check Air leakage
   (1) Check gasket is contaminated or misinstalled.
      ▸ Installation or any damage of Throttle body gasket
      ▸ Installation or any damage of the gasket between intake manifold and surge tank.
      ▸ Clogging of intake manifold or injectors resulting from foreign materials.
      ▸ Open stuck of PCSV caused by foreign materials between surge tank and PCSV.

   (2) Has a problem been found ?

      YES

      ▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

      NO

      ▸ Go to "Check Fuel Line Inspection" as follows.

2. Check Fuel Line Inspection
   (1) Check clog, contamination and installation of each hose as follows.
      ▸ Check connection of each fuel line.
      ▸ Check damage, interference and installation of vaccum hose connected to fuel line.
      ▸ Check that fuel pipe in the fuel line is bent and sqeezed.
      ▸ Check any fuel leakage from fuel pipe in the fuel line.

   (2) Has a problem been found ?

      YES

      ▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

      NO

      ▸ Go to "Check fuel pressure" as follows.

3. Check Fuel Pressure
   (1) Refer to "Fuel pressure test" in "Fuel delivery system"

   (2) Is the measured fuel pressure within specification ?

      YES

      ▸ Go to "Component Inspection" procedure.

      NO

      ▸ Repair or replace as necessary and the, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check PCV
   (1) IG "OFF".

   (2) Remove PCV valve and then, check that plunger in the PCV is moving.

   (3) Is the PCV normal ?

      YES

      ▸ Go to "Check PCSV" as follows.

      NO

      ▸ Substitute with a known-good PCV and check for proper operation. If the problem is corrected,replace PCV and then go to "Verification of Vehicle Repair" procedure.

2. Check PCSV
   (1) IG "OFF".

   (2) Remove PCSV and Vaccum Hose

   (3) Check that PCSV is just one way solenoid valve

   (4) Is the PCSV normal ?

      YES

      ▸ Go to "Check injector" as follows.

      NO

      ▸ Substitute with a known-good PCSV and check for proper operation. If the problem is corrected,replace PCSV and then go to "Verification of Vehicle Repair" procedure.

3. Check injector
   (1) IG "OFF"

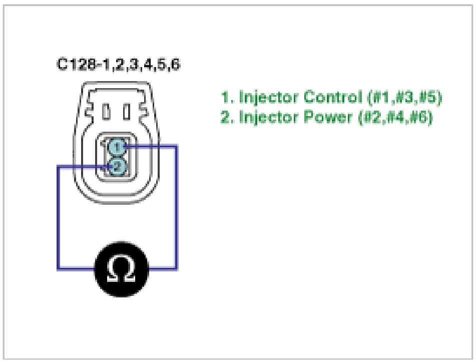
   (2) Remove injector.

(3) Check that injector hole is clogged by foreign materials.

(4) Measure resistance between terminal 1 an 2 of injector connector.(Component Side)

Specification :

Temp.	Resistance
20°C (68°F)	11.4 ~ 12.6Ω



(5) Is the measured resistance within specification ?

YES

▸ Go to "Check component related to fuel trim" as follows.

NO

▸ Substitute with a known-good injector and check for proper operation. If the problem is corrected,replace injector and then go to "Verification of Vehicle Repair" procedure.

4. Check component related to fuel trim

(1) Check component related to fuel trim such as HO2S, MAFS,MAPS, TPS, ECTS, PCSV and Injectores) - Refer to each designated trouble shooting guide.

(2) Are those component related to fuel trim O.K ?

YES

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.

NO

▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P2190

GENERAL DESCRIPTION

Air-fuel feed back control is the modulation which increases or decreases fuel injection quantity as determining exhaust gas rich or lean with HO2S adjust combustion is done at ideal air-fuel ratioto so as to raise the efficiency of catalytic convertor. Generally, NOx increases at lean combustion while CO, HC increases in rich combustion. Thus, in order to purge all of these gases with catalytic convertor, air-fuel ratio should be nearly at the ideal ratio. However the range in which all gases purified successfully is too narrow, it is impossible to meet ideal range with open loop control, therefore feed back control using HO2S is required. HO2S output signal changes rapidly near ideal air-fuel ratio and this characteristic is used at feed back control. comparing HO2S output signal and reference value, PCM increases fuel injection quantity at lean condition and decreases at rich condition. As deterioration of engine, due to the characteristic changes of many components of intake and fuel line or inevitable tolerance of components at production process, achieving ideal air-fuel ratio is almost impossible with the fixed fuel injection duration. Regarding the change of cross section by clogged injector, feed back correction is performed yet, it cannot cover all the ranges. It means if the correction range is massively seperated from the ideal value or if the mean of feed back control range too inclines to lean or rich condition, feed back correction does not work efficiently. Therefore processing correction value throughout long time statistically during driving, PCM controlls fuel injection duration as fitting the mean to be the ideal air-fuel ratio value. Through adaptive control, accuracy of the control could be improved and the value of adaptive control varies countiuously during driving and is always up-dated.

DTC DESCRIPTION

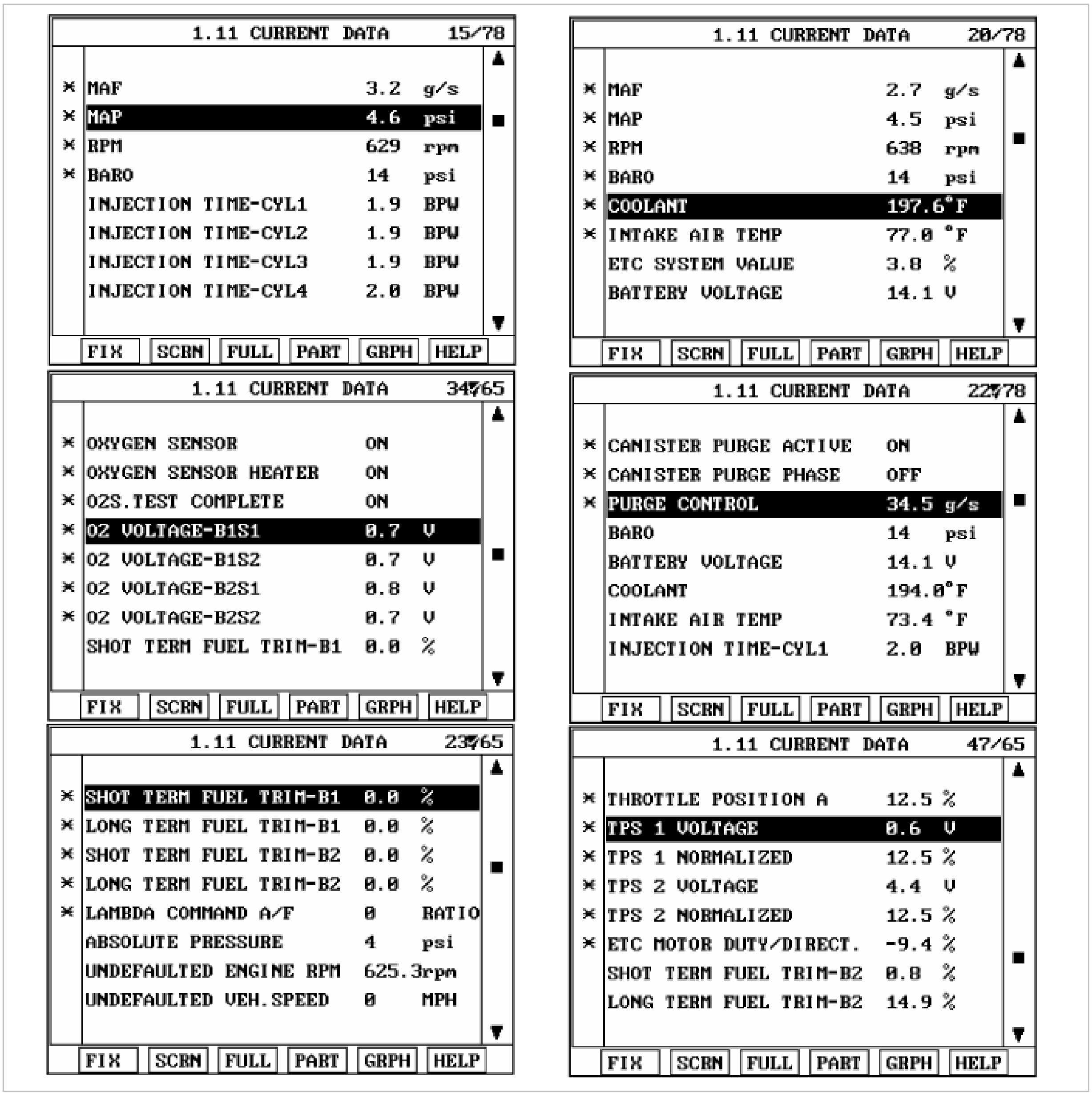
Checking air-fuel ratio correction value every 0.75 sec. at idle, if the value within the detecting condition for more than 0.3 sec., PCM sets P2190. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

<table>
<tr><th>Item</th><th>Detecting Condition</th><th>Possible cause</th></tr>
<tr><td>DTC Strategy</td><td>• Fuel Trim Idle Condition Option Limits Exceeded</td><td rowspan="5">• Sensors related to Fuel Trim
• Intake system
• Fuel Pressure
• Faulty PCM</td></tr>
<tr><td>EnableConditions</td><td>• 550rpm ≤ Engine Speed ≤ 4000rpm
• 60°C ≤ Engine coolant temperature ≤ 114.992°C
• -10°C ≤ Intake Air Temperature ≤ 60°C
• 0° ≤ Throttle Position ≤ 72°
• 25kPa ≤ Engine Load ≤ 90kPa
• 1.5g/s ≤ Intake Air Flow ≤ 80g/s
• Barometric Pressure ≥ 72kPa
• Vehicle Speed ≤ 130km/h
• System Voltage ≥ 11V
• BLM learn Allowed
• Closed Loop Active
• Other diagnostic fault not active</td></tr>
<tr><td>Threshold value</td><td>• Rich Limit Average < 1.5
(The average of short term fuel trim values)
• Rich Limit Average < 0.76
(The average of adaptive index multiplier values)</td></tr>
<tr><td>DiagnosisTime</td><td>• Contineous
(More than 0.375sec. Failure for every 0.75sec. Test)</td></tr>
<tr><td>MIL On Condition</td><td>• 2 Driving Cycles</td></tr>
</table>

MONITOR SCANTOOL DATA

1. Connect scantool to DLC(Data Link Connector)
2. Warm up the engine to normal operating temperature.
3. Monitor sensors related to fuel trim(Ex. HO2S,MAFS,MAPS,TPS,MAPS,TPS,ECTS,PCSV,Injectors etc.) with scantool



4. Are those parameters displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor’s and/or PCM’s connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replaceas necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "System Inspection " procedure.

SYSTEM INSPECTION

1. Check air clog.
   (1) Check Contamination ,Gasket installation as follows
      - Damage or installation of throttle body gasket.
      - Check clog of air cleaner
      - Clog or contamination of intake manifold or injectors caused by foreign materials
      - Check vaccum hose connected to surge tank is normal.

   (2) Has a problem been found ?

      YES

      - Repair or replace as necessary and then, go to "Verification of Vehicle Repair"procedure.

      NO

      - Go to "Check Fuel Pressure" as follows

2. Check Fuel Pressure
   (1) Refer to "Fuel pressure test" in "Fuel delivery system"

   (2) Is the measured fuel pressure within specification ?

      YES

      - Go to "Component Inspection" procedure.

      NO

      - Repair or replace as necessary and the, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check PCV
   (1) IG "OFF".

   (2) Remove PCV valve and then, check that plunger in the PCV is moving.

   (3) Is the PCV normal ?

      YES

      - Go to "Check PCSV" as follows.

      NO

      - Substitute with a known-good PCV and check for proper operation. If the problem is corrected,replace PCV and then go to "Verification of Vehicle Repair" procedure.

2. Check PCSV
   (1) IG "OFF".

   (2) Remove PCSV and Vaccum Hose

   (3) Check that PCSV is just one way solenoid valve

   (4) Is the PCSV normal ?

      YES

      - Go to "Check injector" as follows.

      NO

      - Substitute with a known-good PCSV and check for proper operation. If the problem is corrected,replace PCSV and then go to "Verification of Vehicle Repair" procedure.

3. Check injector
   (1) IG "OFF"

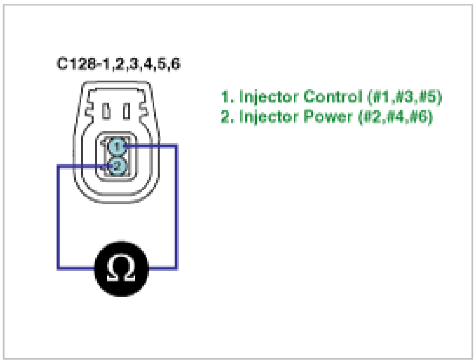
   (2) Remove injector.

   (3) Check that injector hole is clogged by foreign materials.

   (4) Measure resistance between terminal 1 an 2 of injector connector.(Component Side)

      Specification :

Temp.	Resistance
20°C (68°F)	11.4 ~ 12.6Ω



(5) Is the measured resistance within specification ?

YES

▶ Go to "Check component related to fuel trim" as follows.

NO

▶ Substitute with a known-good injector and check for proper operation. If the problem is corrected,replace injector and then go to "Verification of Vehicle Repair" procedure.

4. Check component related to fuel trim
   (1) Check component related to fuel trim such as HO2S, MAFS,MAPS, TPS, ECTS, PCSV and Injectores) - Refer to each designated trouble shooting guide.

   (2) Are those component related to fuel trim O.K ?

YES

▶ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

Fuel System > Troubleshooting > P2195

COMPONENT LOCATION

GENERAL DESCRIPTION

In order to control emissions of the CO, HC and NOx components of the exhaust gas, heated oxygen sensor (HO2S), mounted on the front side and rear side of catalytic converter, detects the oxygen content in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation.The HO2S requires a minimum temperature to operate properly and provide a closed loop fuel control system. The HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions.
The oxygen sensor generates a voltage that indicates the difference between the oxygen content of the exhaust stream and the oxygen content of ambient air. When the exhaust stream is “rich,” there is more oxygen in the ambient air than in the exhaust stream, so the voltage will be higher.
This oxygen sensor varieties use a “bias” voltage to achieve better resolution of the exhaust stream signal. Some oxygen sensor varieties use a “pumping circuit” to force ambient air into the sensor to maintain a more pure environment for comparison.In either case, a cold sensor will tend to indicate voltage values near the open circuit value. For the “pumping current” sensors, this open circuit value can be near 3.5 V. Since the Fuel control logic would incorrectly consider this reading to indicate a very rich mixture for an extended time, the fuel control logic can not use the oxygen sensor reading under such conditions.
The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

DTC DESCRIPTION

Checking output signals from HO2S under detecting condition, if an output signal within the detecting condition lasts continuously, PCM sets P2195. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Determines if O2 sensor indicates lean exhaust while in Power Enrichment (PE)	• Poor Connection • Faulty HO2S • Faulty PCM
EnableConditions	• Sensor not in cooled status flag • Not in Transient Conditions status flag • Device control not active • Min airflow present ≥ 2 g/s • Ignition voltage ≥ 10V • Fuel reduction not active • Engine running • Engine running long enough ≥ 60sec. • Power Enrichment conditions present • Engine coolant warm enough ≥ 60°C(140 °F) • Above conditions met long enough ≥ 1.5sec.	
Threshold value	• O2 sensor voltage < 0.35V and Air Fuel Ratio ≤ 13.5	
DiagnosisTime	• Contineous (More than 11.25sec. failure for every 12.5sec. Test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFROM AND DATA

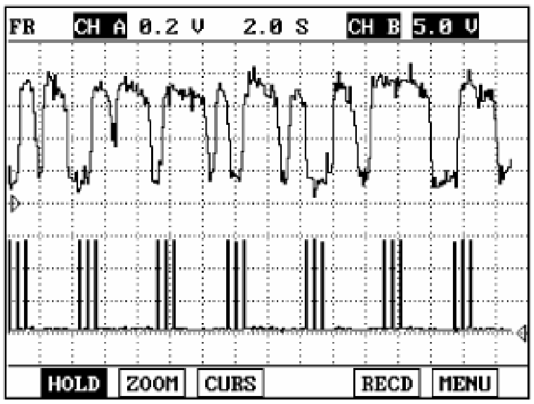


Fig.1:B1S1 & Heater

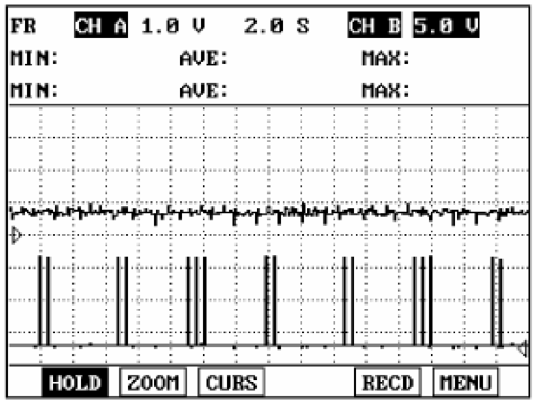


Fig.2:B1S2 & Heater

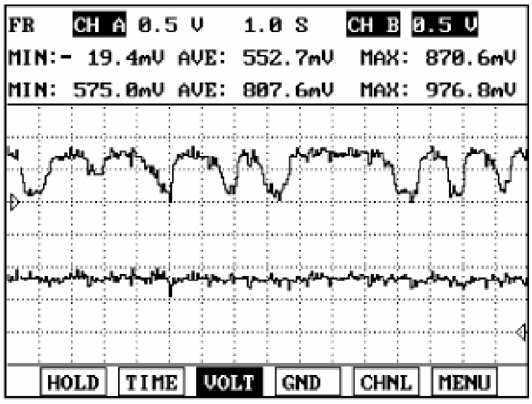


Fig.3:B1S1 & B1S2

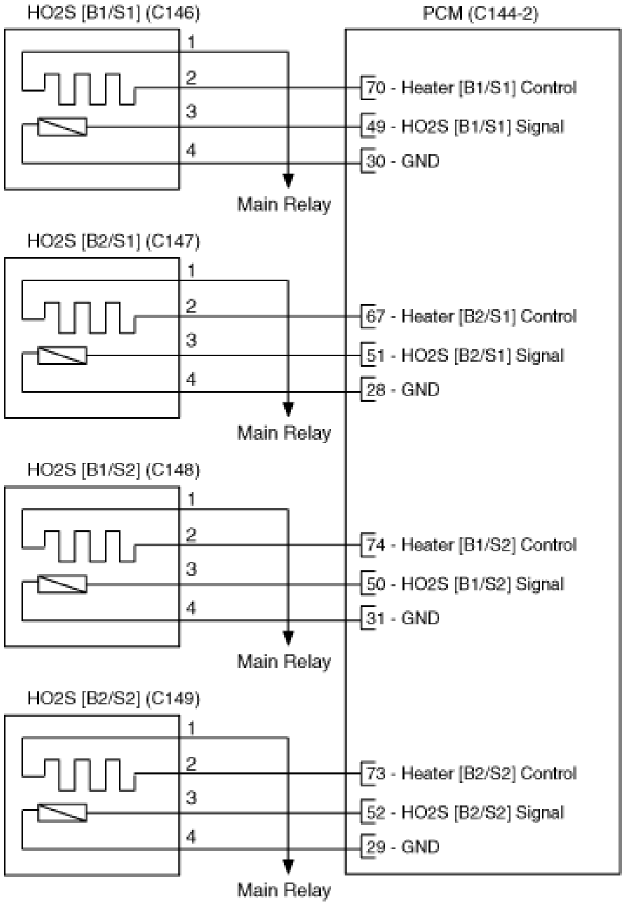
After warming-up, if accelerator pedal is released suddenly around 4000rpm, the HO2S signal reading will be lower than 200mV resulting from Fuel cut-off for the moment. Conversely, if suddenly accelerator pedal is depressed, HO2S signal reading will be around 0.6V ~1.0V. At idle, HO2S signal will switch from lean to rich normally.

SPECIFICATION

A/F Ratio	Output Voltage(V)
Rich	0.75 ~ 1.00V
Lean	0 ~ 0.12V

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

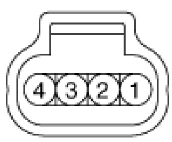
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

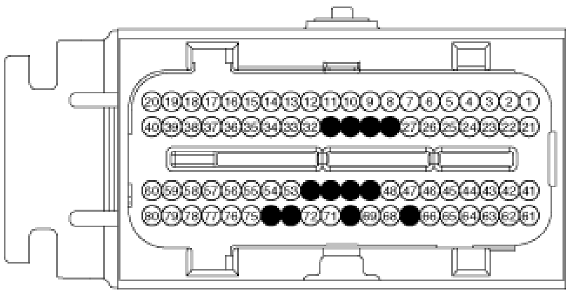
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]

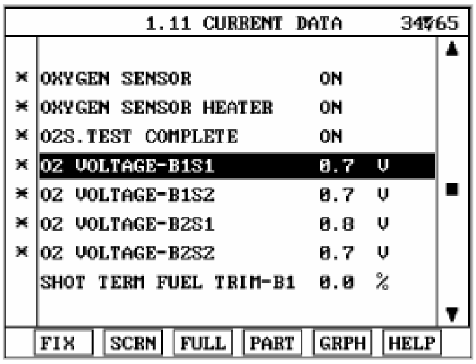


C144-2
PCM

MONITOR SCANTOOL DATA

1. Connect scantool to DLC(Data Link Connector)
2. Warm up the engine to normal operating temperature.
3. Monitor "HO2S(B1S1)" parameter on scantool

Specification : 0.1 ~ 0.9V



4. Does the "HO2S(B1S1)" parameter operates correctly ?

YES

▸Fault is intermittent caused by poor contact in Sensor’s and/or PCM’s connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replaceas necessary and go to "Verification of Vehicle Repair" procedure

NO

▸Go to "Component Inspection" procedure.

COMPONENT INSPECTION

1. Visual Inspection
   (1) Visually check HO2S as follow.
      A. Contamination, deformation or age of HO2S(B1/S1)
   (2) Is the HO2S(B1/S1) normal ?

   YES

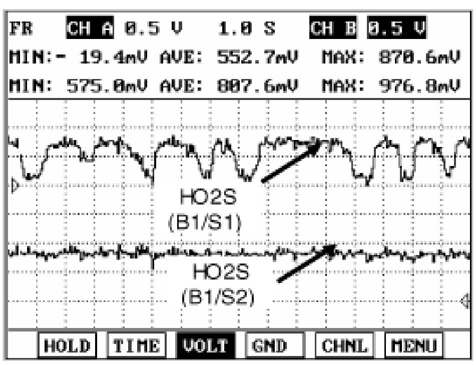
   ▸ Go to "Check performance of HO2S" as follows.

   NO

   ▸ Substitute with a known-good HO2S(B1S1) and check for proper operation. If the problem is corrected,replace HO2S (B1S1) and then go to "Verification of Vehicle Repair" procedure.

2. Check performance of HO2S
   (1) Connect scantool to DLC(Data Link Connector)
   (2) Warm up the engine to normal operating temperature.
   (3) Monitor signal waveform of HO2S with scantool.

   Specification : 0.1 ~ 0.9V.



   (4) Is the HO2S(B1S1) working properly ?

   YES

   ▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

   > **NOTE**
   >
   > There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.

   NO

▸ Substitute with a known-good HO2S(B1S1) and check for proper operation. If the problem is corrected,replace HO2S (B1S1) and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P2196

COMPONENT LOCATION

GENERAL DESCRIPTION

In order to control emissions of the CO, HC and NOx components of the exhaust gas, heated oxygen sensor (HO2S), mounted on the front side and rear side of catalytic converter, detects the oxygen content in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation.The HO2S requires a minimum temperature to operate properly and provide a closed loop fuel control system. The HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions.
The oxygen sensor generates a voltage that indicates the difference between the oxygen content of the exhaust stream and the oxygen content of ambient air. When the exhaust stream is “rich,” there is more oxygen in the ambient air than in the exhaust stream, so the voltage will be higher.
This oxygen sensor varieties use a “bias” voltage to achieve better resolution of the exhaust stream signal. Some oxygen sensor varieties use a “pumping circuit” to force ambient air into the sensor to maintain a more pure environment for comparison. In either case, a cold sensor will tend to indicate voltage values near the open circuit value. For the “pumping current” sensors, this open circuit value can be near 3.5 V. Since the Fuel control logic would incorrectly consider this reading to indicate a very rich mixture for an extended time, the fuel control logic can not use the oxygen sensor reading under such conditions.
The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

DTC DESCRIPTION

Checking output signals from HO2S under detecting condition, if an output signal within the detecting condition lasts continuously, PCM sets P2196. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

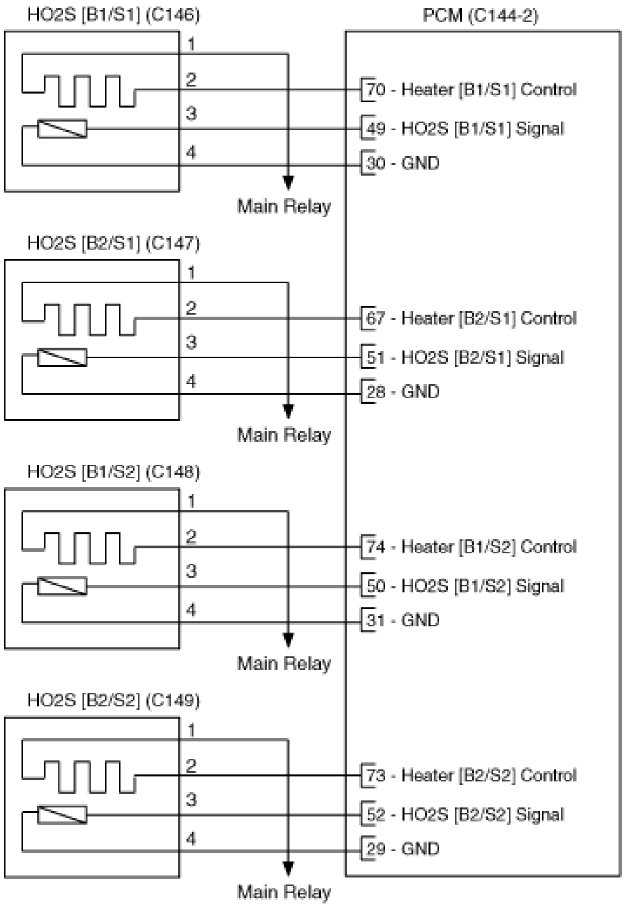
DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause

DTC Strategy	• Determines if O2 sensor indicates rich exhaust while in decel fuel cut-off (DFCO)	• Poor Connection • Faulty HO2S • Faulty PCM
EnableConditions	• Sensor not in cooled status flag • Not in Transient Conditions status flag • Device control not active • Min airflow present ≥ 2 g/s • Ignition voltage ≥ 10V • Fuel reduction not active • Engine running • Engine running long enough ≥ 60sec. • Power Enrichment conditions present • Engine coolant warm enough ≥ 60°C(140 °F) • Above conditions met long enough ≥ 1.5sec.	
Threshold value	• O2 sensor voltage > 0.55V	
DiagnosisTime	• Contineous (More than 11.25sec. failure for every 12.5sec. Test)	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

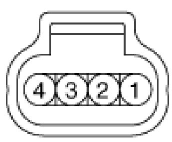
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

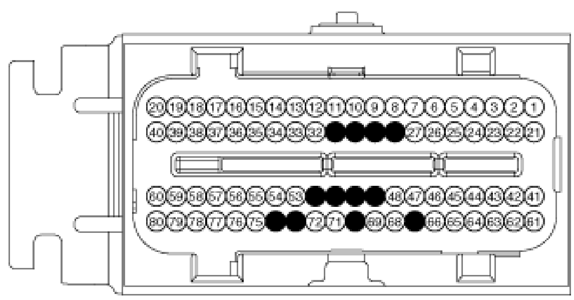
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]

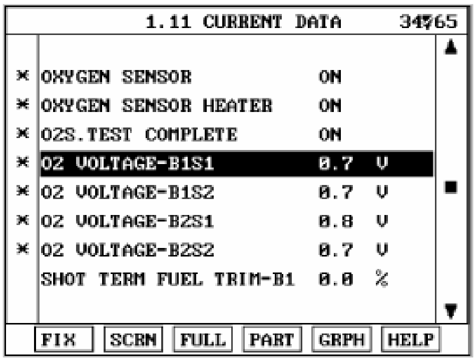


C144-2
PCM

MONITOR SCANTOOL DATA

1. Connect scantool to DLC(Data Link Connector).
2. Warm up the engine to normal operating temperature.
3. Monitor "HO2S(B1S1)" parameter on scantool

Specification : 0.1 ~ 0.9V



4. Does the "HO2S(B1S1)" parameter operates correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor’s and/or PCM’s connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replaceas necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸Go to "Component Inspection " procedure.

COMPONENT INSPECTION

1. Visual Inspection

(1) Visually check HO2S as follow.

A. Contamination, deformation or age of HO2S(B1/S1)

(2) Is the HO2S(B1/S1) normal ?

YES

▸ Go to "Check performance of HO2S" as follows.

NO

▸ Substitute with a known-good HO2S(B1S1) and check for proper operation. If the problem is corrected,replace HO2S (B1S1) and then go to "Verification of Vehicle Repair" procedure.

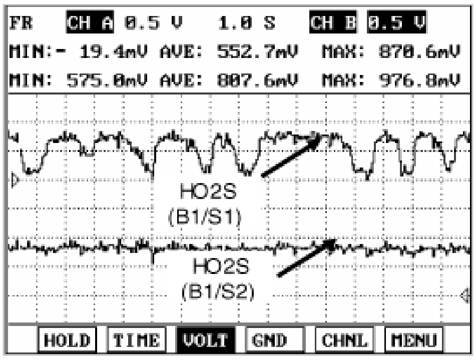
2. Check performance of HO2S

(1) Connect scantool to DLC(Data Link Connector)

(2) Warm up the engine to normal operating temperature.

(3) Monitor signal waveform of HO2S with scantool.

Specification : 0.1 ~ 0.9V.



(4) Is the HO2S(B1S1) working properly ?

YES

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.

NO

▸ Substitute with a known-good HO2S(B1S1) and check for proper operation. If the problem is corrected,replace HO2S (B1S1) and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

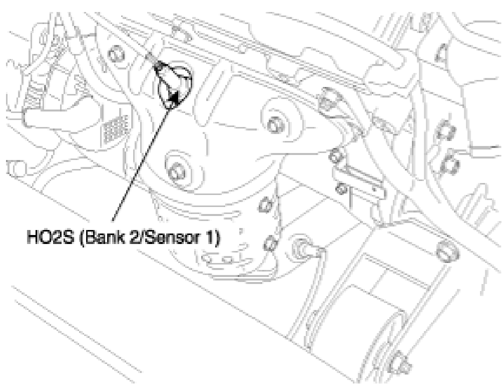
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P2197

COMPONENT LOCATION



GENERAL DESCRIPTION

In order to control emissions of the CO, HC and NOx components of the exhaust gas, heated oxygen sensor (HO2S), mounted on the front side and rear side of catalytic converter, detects the oxygen content in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper

operation.The HO2S requires a minimum temperature to operate properly and provide a closed loop fuel control system. The HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions.
The oxygen sensor generates a voltage that indicates the difference between the oxygen content of the exhaust stream and the oxygen content of ambient air. When the exhaust stream is “rich,” there is more oxygen in the ambient air than in the exhaust stream, so the voltage will be higher.
This oxygen sensor varieties use a “bias” voltage to achieve better resolution of the exhaust stream signal. Some oxygen sensor varieties use a “pumping circuit” to force ambient air into the sensor to maintain a more pure environment for comparison. In either case, a cold sensor will tend to indicate voltage values near the open circuit value. For the “pumping current” sensors, this open circuit value can be near 3.5 V. Since the Fuel control logic would incorrectly consider this reading to indicate a very rich mixture for an extended time, the fuel control logic can not use the oxygen sensor reading under such conditions.
The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

DTC DESCRIPTION

Checking output signals from HO2S under detecting condition, if an output signal within the detecting condition lasts continuously, PCM sets P2197. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Determines if O2 sensor indicates lean exhaust while in Power Enrichment (PE)	• Poor Connection • Faulty HO2S • Faulty PCM
EnableConditions	• Sensor not in cooled status flag • Not in Transient Conditions status flag • Device control not active • Min airflow present ≥ 2 g/s • Ignition voltage ≥ 10V • Fuel reduction not active • Engine running • Engine running long enough ≥ 60sec. • Power Enrichment conditions present • Engine coolant warm enough ≥ 60°C(140 °F) • Above conditions met long enough ≥ 1.5sec.	
Threshold value	• O2 sensor voltage < 0.48V and, Air Fuel Ratio ≤ 13.5	
DiagnosisTime	• Contineous (More than 11.25sec. failure for every 12.5sec. Test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFROM AND DATA

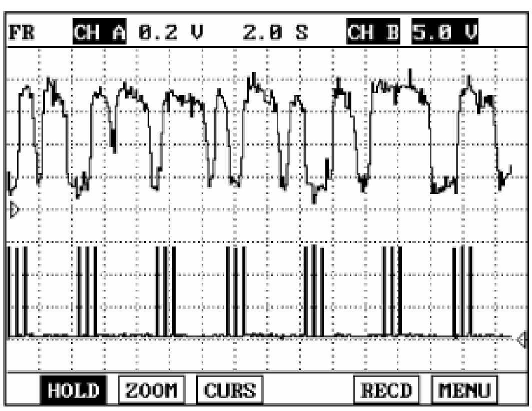


Fig.1: B2S1 & Heater

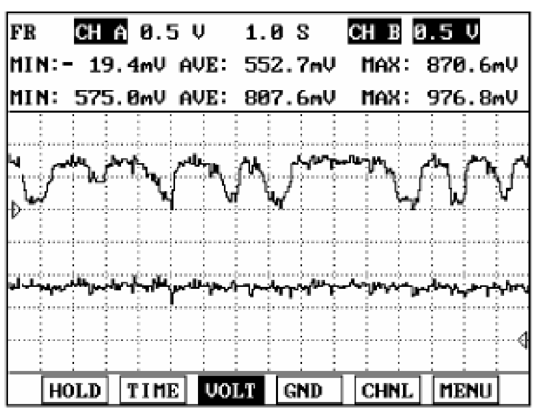


Fig.2: B2S1 & B2S2

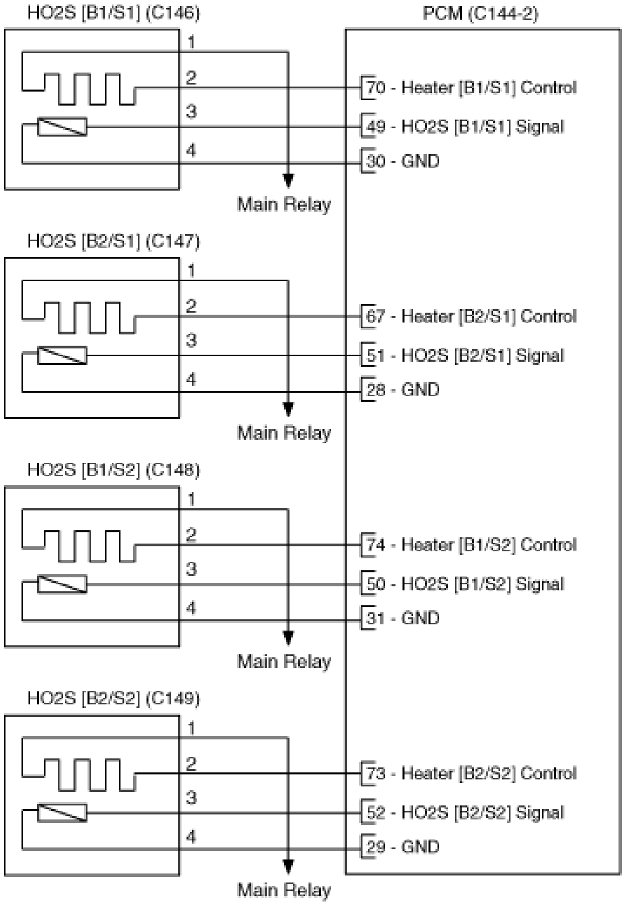
After warming-up, if accelerator pedal is released suddenly around 4000rpm, the HO2S signal reading will be lower than 200mV resulting from Fuel cut-off for the moment. Conversely, if suddenly accelerator pedal is depressed, HO2S signal reading will be around 0.6V ~1.0V. At idle, HO2S signal will switch from lean to rich normally.

SPECIFICATION

A/F Ratio	Output Voltage(V)
Rich	0.75 ~ 1.00V
Lean	0 ~ 0.12V

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

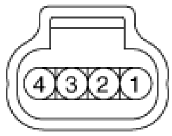
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

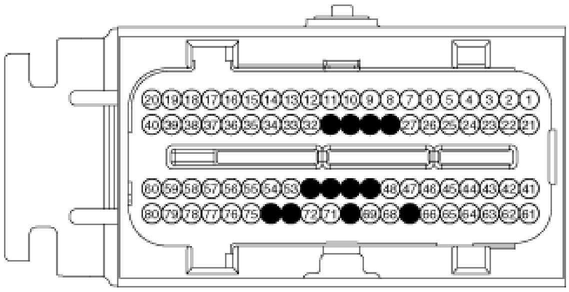
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]

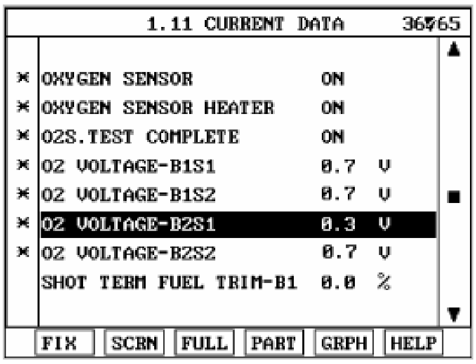


C144-2
PCM

MONITOR SCANTOOL DATA

1. Connect scantool to DLC(Data Link Connector)
2. Warm up the engine to normal operating temperature.
3. Monitor "HO2S(B2S1)" parameter on scantool

Specification : 0.1 ~ 0.9V



4. Does the "HO2S(B2S1)" parameter operates correctly ?

YES

▶Fault is intermittent caused by poor contact in Sensor's and/or PCM's connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replaceas necessary and go to "Verification of Vehicle Repair" procedure

NO

▶Go to "Component Inspection" procedure.

COMPONENT INSPECTION

1. Visual Inspection
   (1) Visually check HO2S as follow.
      A. Contamination, deformation or age of HO2S(B2/S1)

   (2) Is the HO2S(B2/S1) normal ?

   YES

   ▶ Go to "Check performance of HO2S" as follows.

   NO

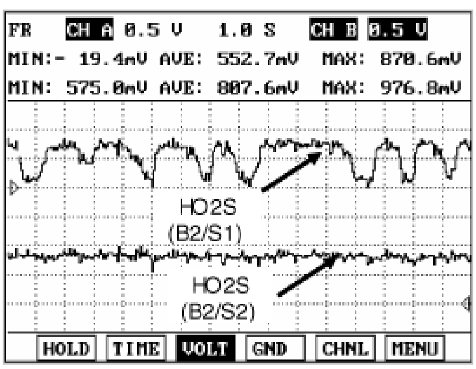
   ▶ Substitute with a known-good HO2S(B2S1) and check for proper operation. If the problem is corrected,replace HO2S (B2S1) and then go to "Verification of Vehicle Repair" procedure.

2. Check performance of HO2S
   (1) Connect scantool to DLC(Data Link Connector)

   (2) Warm up the engine to normal operating temperature.

   (3) Monitor signal waveform of HO2S with scantool.

   Specification : 0.1 ~ 0.9V.



   (4) Is the HO2S(B2S1) working properly ?

   YES

   ▶ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.

NO

▸ Substitute with a known-good HO2S(B2S1) and check for proper operation. If the problem is corrected,replace HO2S (B2S1) and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

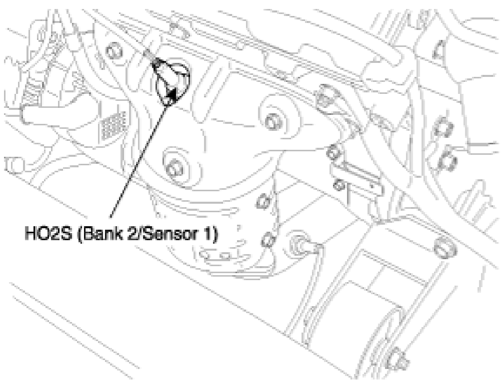
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P2198

COMPONENT LOCATION



GENERAL DESCRIPTION

In order to control emissions of the CO, HC and NOx components of the exhaust gas, heated oxygen sensor (HO2S), mounted on the front side and rear side of catalytic converter, detects the oxygen content in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation.The HO2S requires a minimum temperature to operate properly and provide a closed loop fuel control system. The HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions.
The oxygen sensor generates a voltage that indicates the difference between the oxygen content of the exhaust stream and the oxygen content of ambient air. When the exhaust stream is “rich,” there is more oxygen in the ambient air than in the exhaust stream, so the voltage will be higher.
This oxygen sensor varieties use a “bias” voltage to achieve better resolution of the exhaust stream signal. Some oxygen sensor varieties use a “pumping circuit” to force ambient air into the sensor to maintain a more pure environment for comparison. In either case, a cold sensor will tend to indicate voltage values near the open circuit value. For the “pumping current” sensors, this open circuit value can be near 3.5 V. Since the Fuel control logic would incorrectly consider this reading to indicate a very rich mixture for an extended time, the fuel control logic can not use the oxygen sensor reading under such conditions.
The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

DTC DESCRIPTION

Checking output signals from HO2S under detecting condition, if an output signal within the detecting condition lasts continuously, PCM sets P2198. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

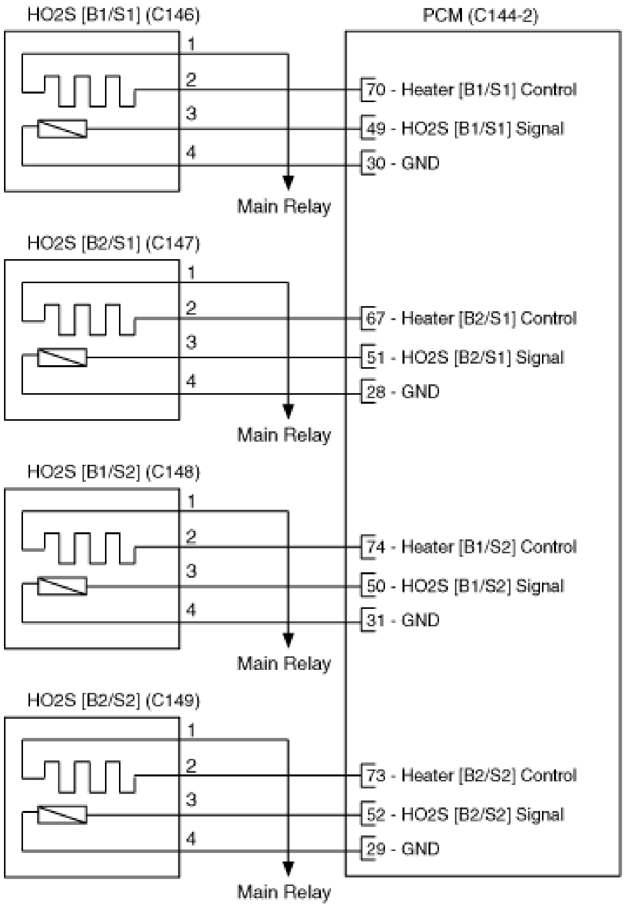
DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause

DTC Strategy	• Determines if O2 sensor indicates rich exhaust while in decel fuel cut-off (DFCO)	
EnableConditions	• Sensor not in cooled status flag • Not in Transient Conditions status flag • Device control not active • Min airflow present ≥ 2 g/s • Ignition voltage ≥ 10V • Fuel reduction not active • Engine running • Engine running long enough ≥ 60sec. • Power Enrichment conditions present • Engine coolant warm enough ≥ 60°C(140 °F) • Above conditions met long enough ≥ 1sec.	• Poor Connection • Faulty HO2S • Faulty PCM
Threshold value	• O2 sensor voltage > 0.4199V	
DiagnosisTime	• Contineous (More than 11.25sec. failure for every 12.5sec. Test)	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

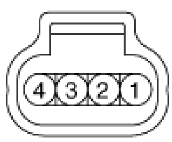
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

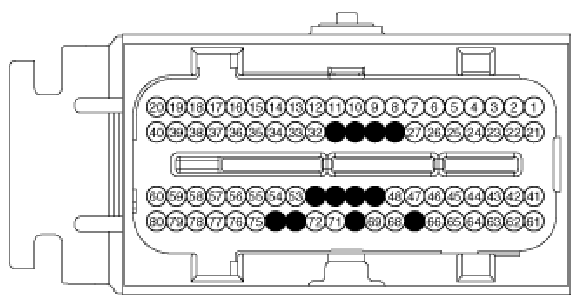
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]

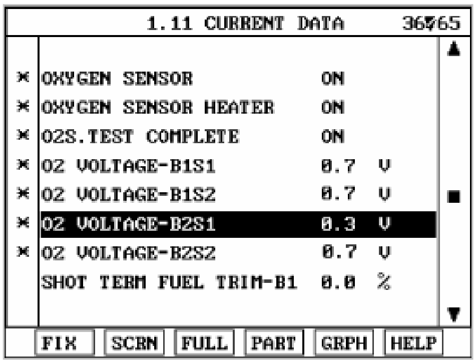


C144-2
PCM

MONITOR SCANTOOL DATA

1. Connect scantool to DLC(Data Link Connector)
2. Warm up the engine to normal operating temperature.
3. Monitor "HO2S(B2S1)" parameter on scantool

Specification : 0.1 ~ 0.9V



4. Does the "HO2S(B2S1)" parameter operates correctly ?

YES

▸Fault is intermittent caused by poor contact in Sensor's and/or PCM's connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replaceas necessary and go to "Verification of Vehicle Repair" procedure

NO

▸Go to "Terminal and connector inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸Go to "Component Inspection " procedure.

COMPONENT INSPECTION

1. Visual Inspection
   (1) Visually check HO2S as follow.
      A. Contamination, deformation or age of HO2S(B2/S1)

   (2) Is the HO2S(B2/S1) normal ?

   YES

   ▸ Go to "Check performance of HO2S" as follows.

   NO

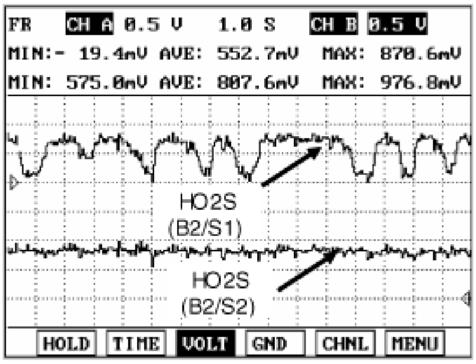
   ▸ Substitute with a known-good HO2S(B2S1) and check for proper operation. If the problem is corrected,replace HO2S (B2S1) and then go to "Verification of Vehicle Repair" procedure.

2. Check performance of HO2S
   (1) Connect scantool to DLC(Data Link Connector)

   (2) Warm up the engine to normal operating temperature.

   (3) Monitor signal waveform of HO2S with scantool.

   Specification : 0.1 ~ 0.9V.



(4) Is the HO2S(B2S1) working properly ?

YES

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.

NO

▸ Substitute with a known-good HO2S(B2S1) and check for proper operation. If the problem is corrected,replace HO2S (B2S1) and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P2270

COMPONENT LOCATION

GENERAL DESCRIPTION

Rear HO2S behind the catalytic conveter checks if purifying process performs well. purifying process is already done, the oxygen

density of exhaust gas through catalytic converter is in the specified value.

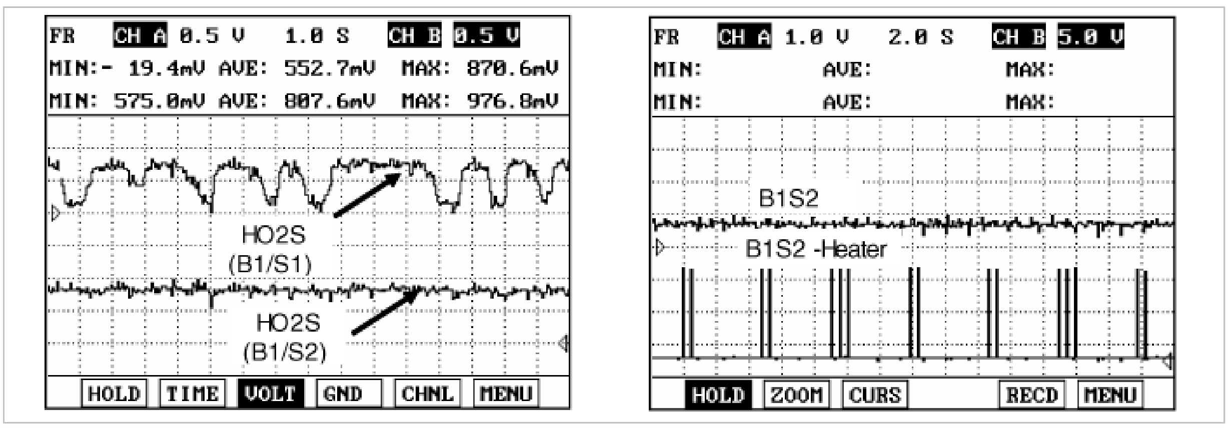
DTC DESCRIPTION

Checking output signals from HO2S under detecting condition, if an output signal within the threshold lasts continuously, PCM sets P2270. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Determines if O2 sensor indicates lean exhaust while in Power Enrichment (PE)	• Poor Connection • Faulty HO2S • Faulty PCM
EnableConditions	• Sensor not in cooled status flag • Not in Transient Conditions status flag • Device control not active • Min airflow present ≥ 2 g/s • Ignition voltage ≥ 10V • Fuel reduction not active • Engine running • Engine running long enough ≥ 60sec. • Power Enrichment conditions present • Engine coolant warm enough ≥ 60°C(140 °F) • Above conditions met long enough ≥ 2.5sec.	
Threshold value	• O2 sensor voltage < 0.48V and, Air Fuel Ratio ≤ 13.5	
DiagnosisTime	• Contineous (More than 11.25sec. failure for every 12.5sec. Test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFROM AND DATA



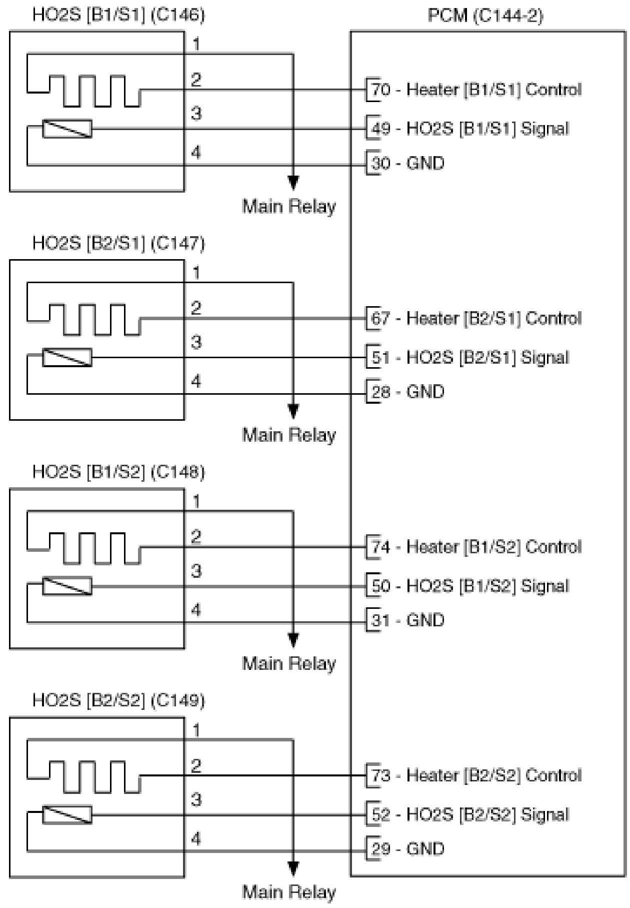
After warming-up, if accelerator pedal is released suddenly around 4000rpm, the HO2S signal reading will be lower than 200mV resulting from Fuel cut-off for the moment. Conversely, if suddenly accelerator pedal is depressed, HO2S signal reading will be around 0.6V ~1.0V. At idle, HO2S signal will switch from lean to rich normally.

SPECIFICATION

A/F Ratio	Output Voltage(V)
Rich	0.75 ~ 1.00V
Lean	0 ~ 0.12V

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

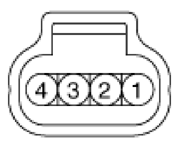
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

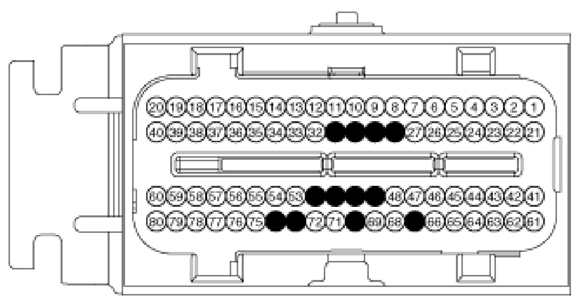
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C144-2
PCM

MONITOR SCANTOOL DATA

1. Connect scantool to DLC(Data Link Connector)
2. Warm up the engine to normal operating temperature.
3. Monitor "HO2S(B1S2)" parameter on scantool

Specification : 0.1 ~ 0.9V

4. Does the "HO2S(B1S2)" parameter operates correctly ?

YES

▸Fault is intermittent caused by poor contact in Sensor’s and/or PCM’s connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replaceas necessary and go to "Verification of Vehicle Repair" procedure

NO

▸Go to "Component Inspection" procedure.

COMPONENT INSPECTION

1. Visual Inspection
   (1) Visually check HO2S as follow.
      A. Contamination, deformation or age of HO2S(B1/S2)

   (2) Is the HO2S(B1/S2) normal ?

   YES

   ▸ Go to "Check performance of HO2S" as follows.

   NO

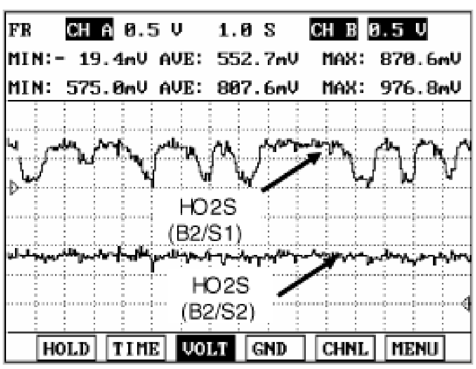
   ▸ Substitute with a known-good HO2S(B1S2) and check for proper operation. If the problem is corrected,replace HO2S (B1S2) and then go to "Verification of Vehicle Repair" procedure.

2. Check performance of HO2S
   (1) Connect scantool to DLC(Data Link Connector)

   (2) Warm up the engine to normal operating temperature.

   (3) Monitor signal waveform of HO2S with scantool.

   Specification : 0.1 ~ 0.9V.



   (4) Is the HO2S(B1S2) working properly ?

   YES

   ▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.

NO

▸ Substitute with a known-good HO2S(B1S2) and check for proper operation. If the problem is corrected,replace HO2S (B1S2) and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P2271

COMPONENT LOCATION

GENERAL DESCRIPTION

Rear HO2S behind the catalytic conveter checks if purifying process performs well. purifying process is already done, the oxygen density of exhaust gas through catalytic converter is in the specified value.

DTC DESCRIPTION

Checking output signals from HO2S under detecting condition, if an output signal within the detecting condition lasts continuously, PCM sets P2271. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

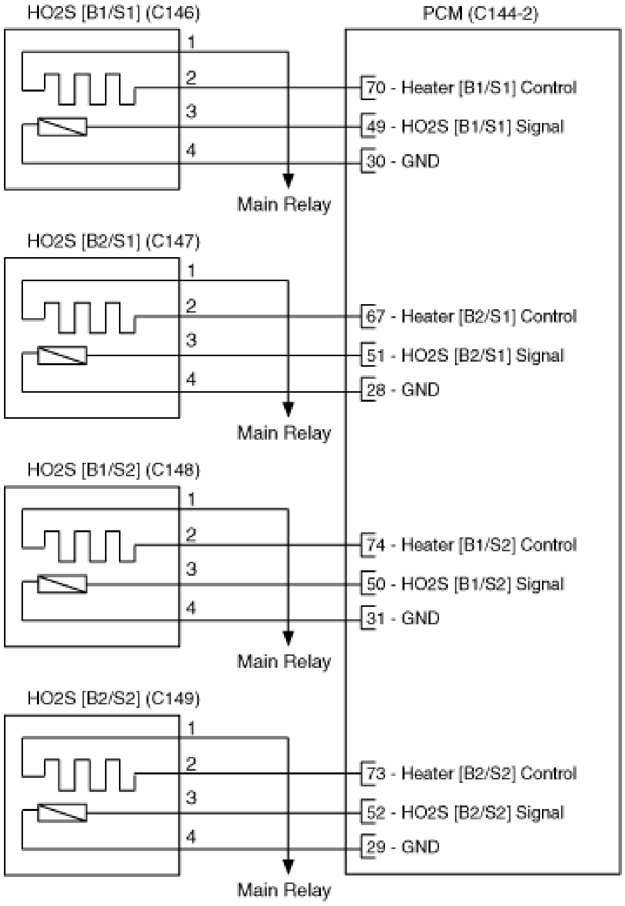
DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Determines if O2 sensor indicates rich exhaust while in decel fuel cut-off (DFCO)	
	• Sensor not in cooled status flag • Not in Transient Conditions status flag • Device control not active • Min airflow present ≥ 2 g/s	

EnableConditions	• Ignition voltage ≥ 10V • Fuel reduction not active • Engine running • Engine running long enough ≥ 60sec. • Power Enrichment conditions present • Engine coolant warm enough ≥ 60°C(140 °F) • Above conditions met long enough ≥ 2sec.	• Poor Connection • Faulty HO2S • Faulty PCM
Threshold value	• O2 sensor voltage > 0.42V	
DiagnosisTime	• Contineous (More than 11.25sec. failure for every 12.5sec. Test)	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

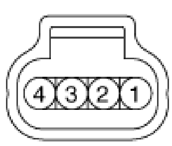
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

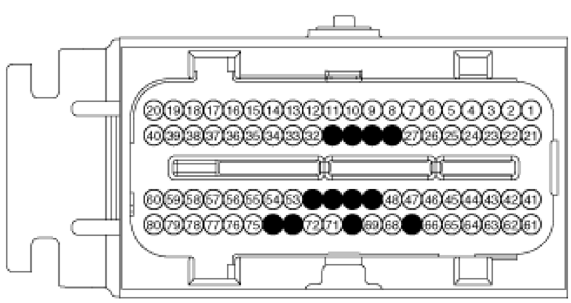
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]

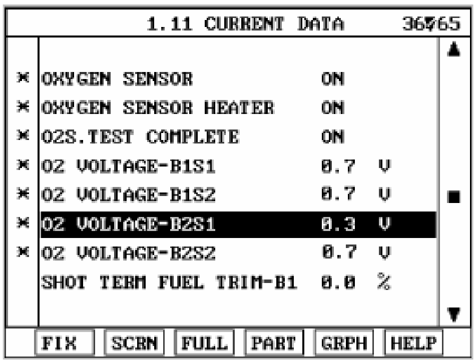


C144-2
PCM

MONITOR SCANTOOL DATA

1. Connect scantool to DLC(Data Link Connector).
2. Warm up the engine to normal operating temperature.
3. Monitor "HO2S(B1S2)" parameter on scantool

Specification : 0.1 ~ 0.9V



4. Does the "HO2S(B1S2)" parameter operates correctly ?

YES

▸Fault is intermittent caused by poor contact in Sensor's and/or PCM's connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replaceas necessary and go to "Verification of Vehicle Repair" procedure

NO

▸Go to "Terminal and connector inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸Go to "Component Inspection " procedure.

COMPONENT INSPECTION

1. Visual Inspection
   (1) Visually check HO2S as follow.
      A. Contamination, deformation or age of HO2S(B1/S2)

   (2) Is the HO2S(B1/S2) normal ?

   YES

   ▸ Go to "Check performance of HO2S" as follows.

   NO

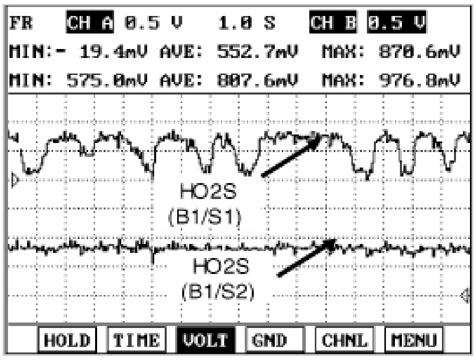
   ▸ Substitute with a known-good HO2S(B1S2) and check for proper operation. If the problem is corrected,replace HO2S (B1S2) and then go to "Verification of Vehicle Repair" procedure.

2. Check performance of HO2S
   (1) Connect scantool to DLC(Data Link Connector)

   (2) Warm up the engine to normal operating temperature.

   (3) Monitor signal waveform of HO2S with scantool.

   Specification : 0.1 ~ 0.9V.



(4) Is the HO2S(B1S2) working properly ?

YES

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.

NO

▸ Substitute with a known-good HO2S(B1S2) and check for proper operation. If the problem is corrected,replace HO2S (B1S2) and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshooooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P2272

COMPONENT LOCATION

GENERAL DESCRIPTION

Rear HO2S behind the catalytic conveter checks if purifying process performs well. purifying process is already done, the oxygen

density of exhaust gas through catalytic converter is in the specified value.

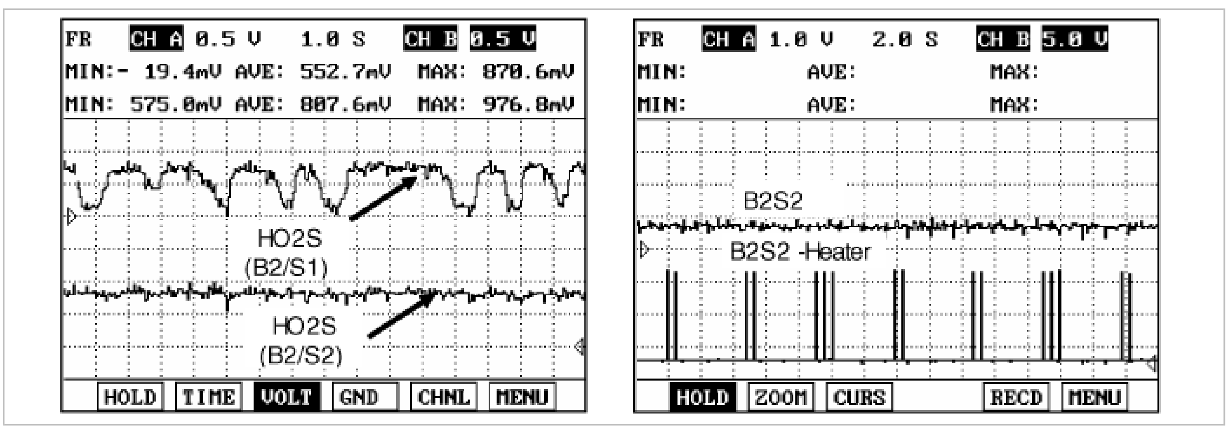
DTC DESCRIPTION

Checking output signals from HO2S under detecting condition, if an output signal within the detecting condition lasts continuously, PCM sets P2272. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Determines if O2 sensor indicates lean exhaust while in Power Enrichment (PE)	• Poor Connection • Faulty HO2S • Faulty PCM
EnableConditions	• Sensor not in cooled status flag • Not in Transient Conditions status flag • Device control not active • Min airflow present ≥ 2 g/s • Ignition voltage ≥ 10V • Fuel reduction not active • Engine running • Engine running long enough ≥ 60sec. • Power Enrichment conditions present • Engine coolant warm enough ≥ 60°C(140 °F) • Above conditions met long enough ≥ 2.5sec.	
Threshold value	• O2 sensor voltage < 0.48V and, Air Fuel Ratio ≤ 13.5	
DiagnosisTime	• Contineous (More than 11.25sec. failure for every 12.5sec. Test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFROM AND DATA



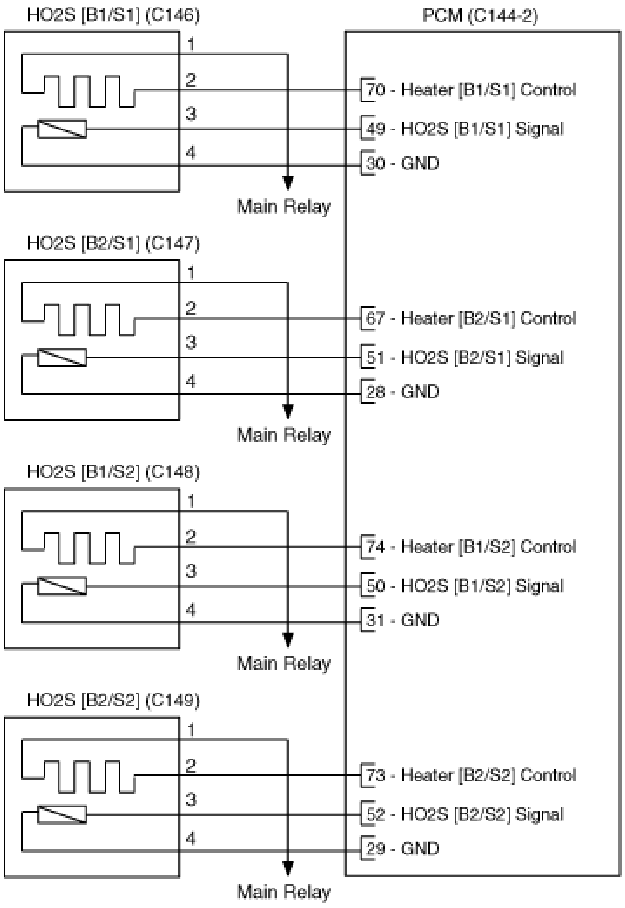
After warming-up, if accelerator pedal is released suddenly around 4000rpm, the HO2S signal reading will be lower than 200mV resulting from Fuel cut-off for the moment. Conversely, if suddenly accelerator pedal is depressed, HO2S signal reading will be around 0.6V ~1.0V. At idle, HO2S signal will switch from lean to rich normally.

SPECIFICATION

A/F Ratio	Output Voltage(V)
Rich	0.75 ~ 1.00V
Lean	0 ~ 0.12V

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

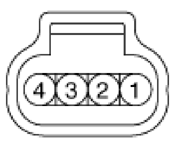
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

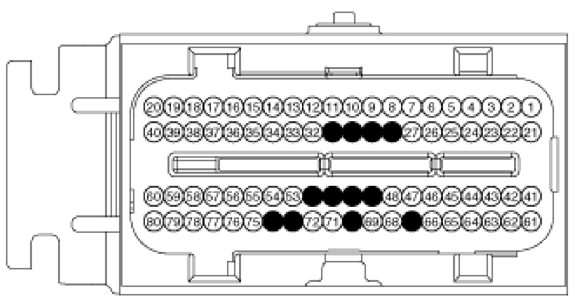
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C144-2

PCM

MONITOR SCANTOOL DATA

1. Connect scantool to DLC(Data Link Connector)
2. Warm up the engine to normal operating temperature.
3. Monitor "HO2S(B2S2)" parameter on scantool

Specification : 0.1 ~ 0.9V

4. Does the "HO2S(B2S2)" parameter operates correctly ?

YES

▸Fault is intermittent caused by poor contact in Sensor’s and/or PCM’s connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replaceas necessary and go to "Verification of Vehicle Repair" procedure

NO

▸Go to "Component Inspection" procedure.

COMPONENT INSPECTION

1. Visual Inspection
   (1) Visually check HO2S as follow.
      A. Contamination, deformation or age of HO2S(B2/S2)

   (2) Is the HO2S(B2/S2) normal ?

   YES

   ▸ Go to "Check performance of HO2S" as follows.

   NO

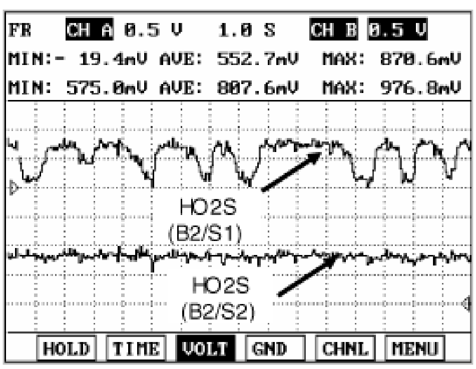
   ▸ Substitute with a known-good HO2S(B2S2) and check for proper operation. If the problem is corrected,replace HO2S (B2S2) and then go to "Verification of Vehicle Repair" procedure.

2. Check performance of HO2S
   (1) Connect scantool to DLC(Data Link Connector)

   (2) Warm up the engine to normal operating temperature.

   (3) Monitor signal waveform of HO2S with scantool.

   Specification : 0.1 ~ 0.9V.



   (4) Is the HO2S(B2S2) working properly ?

   YES

   ▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.

NO

▸ Substitute with a known-good HO2S(B2S2) and check for proper operation. If the problem is corrected,replace HO2S (B2S2) and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P2273

COMPONENT LOCATION

GENERAL DESCRIPTION

Rear HO2S behind the catalytic conveter checks if purifying process performs well. purifying process is already done, the oxygen density of exhaust gas through catalytic converter is in the specified value.

DTC DESCRIPTION

Checking output signals from HO2S under detecting condition, if an output signal within the detecting condition lasts continuously, PCM sets P2273. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

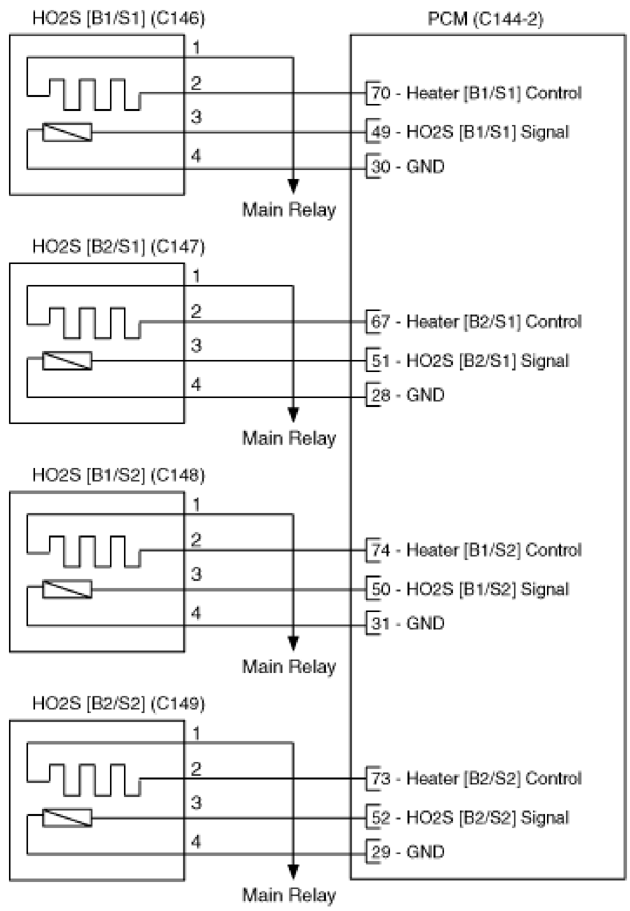
DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Determines if O2 sensor indicates rich exhaust while in decel fuel cut-off (DFCO)	
	• Sensor not in cooled status flag • Not in Transient Conditions status flag • Device control not active • Min airflow present ≥ 2 g/s	

EnableConditions	• Ignition voltage ≥ 10V • Fuel reduction not active • Engine running • Engine running long enough ≥ 60sec. • Power Enrichment conditions present • Engine coolant warm enough ≥ 60°C(140 °F) • Above conditions met long enough ≥ 2sec.	• Poor Connection • Faulty HO2S • Faulty PCM
Threshold value	• O2 sensor voltage > 0.42V	
DiagnosisTime	• Contineous (More than 11.25sec. failure for every 12.5sec. Test)	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

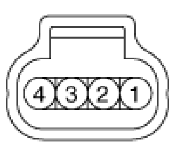
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

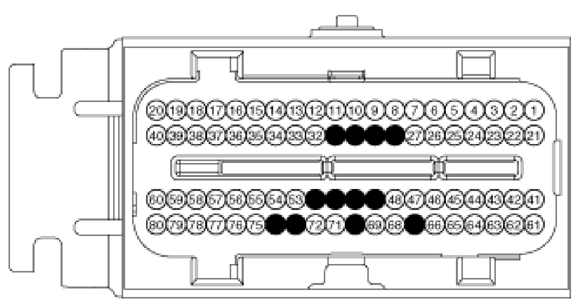
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



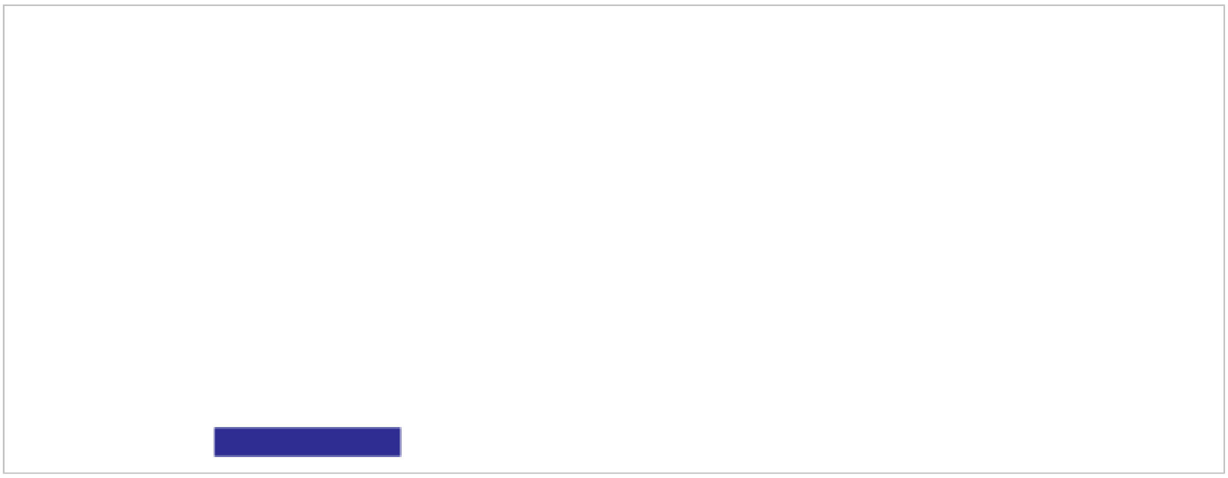
C144-2

PCM

MONITOR SCANTOOL DATA

1. Connect scantool to DLC(Data Link Connector)
2. Warm up the engine to normal operating temperature.
3. Monitor "HO2S(B2S2)" parameter on scantool

Specification : 0.1 ~ 0.9V



4. Does the "HO2S(B2S2)" parameter operates correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor’s and/or PCM’s connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replaceas necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Component Inspection " procedure.

COMPONENT INSPECTION

1. Visual Inspection
   (1) Visually check HO2S as follow.
      A. Contamination, deformation or age of HO2S(B2/S2)

   (2) Is the HO2S(B2/S2) normal ?

   YES

   ▸ Go to "Check performance of HO2S" as follows.

   NO

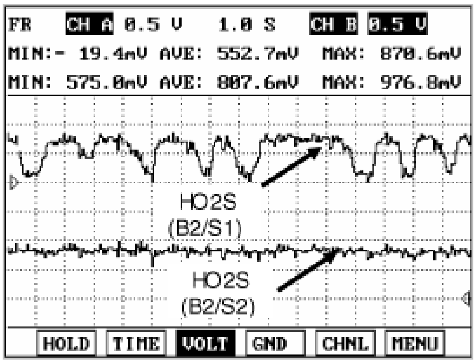
   ▸ Substitute with a known-good HO2S(B2S2) and check for proper operation. If the problem is corrected,replace HO2S (B2S2) and then go to "Verification of Vehicle Repair" procedure.

2. Check performance of HO2S
   (1) Connect scantool to DLC(Data Link Connector)

   (2) Warm up the engine to normal operating temperature.

   (3) Monitor signal waveform of HO2S with scantool.

Specification : 0.1 ~ 0.9V.



(4) Is the HO2S(B2S2) working properly ?

YES

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.

NO

▸ Substitute with a known-good HO2S(B2S2) and check for proper operation. If the problem is corrected,replace HO2S (B2S2) and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P2422

COMPONENT LOCATION

GENERAL DESCRIPTION

The vent valve is a device that is designed to close off the fresh air inlet to the canister. Current vent valve designs are powered closed. An electrically operated vent valve solenoid is requiredfor OBD II compliant evaporative systems. Normally the vent valve is in the open (unpowered)state, but to control the vacuum levels in the fuel tank the EVPD will command the vent valvesolenoid to the closed position. This controlled vacuum level will allow the EVPD to determine the integrity of the evaporative system.
The vent valve orifice is much larger than the purge valve orifice or purge lines so that when thevent valve is open, the purge flow is not restricted. The fresh air inlet in the vent valve solenoid is normally filtered with a serviceable dust filter that helps to prevent contaminants from being drawn into the evaporative system (e.g. water, salt, silica, etc.).

DTC DESCRIPTION

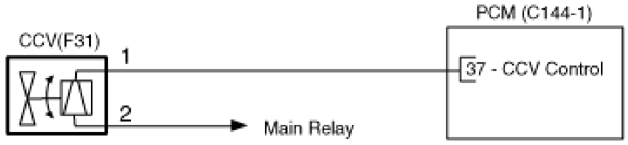
This test will detect blockage by commanding the vent solenoid to its normally open state and commanding the purge system to maintain a calibratable constant amount of purge flow. The fuel tank vacuum is monitored using the fuel tank pressure sensor for a calibration-specified amount of time. Anormally functioning evaporative system will maintain a relatively low vacuum level. Whereas, a failing evaporative system will experience an increasing vacuum level until a “fail” threshold is reached, at which time the test reports a “fail” condition.
Checking output signals from FTPS under detecting condition, if FTPS signal is detected higher than 14in H_2O for more than 5sec. when purging at 0.15 g/s. PCM sets P2422.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Test is failed if tank vacuum exceeds a prescribed threshold for a prescribed time when purging at a prescribed rate.	• Faulty Canister Close Valve • Clogging of canister air filter • Open in ground harness of FTPS • Faulty PCM
EnableConditions	• 10 < Ignition Volt < 15.9907 • Barometric pressure > 72 kPa • Engine off time > 720min or Startup IAT-Startup ECT < 12°C(53.6 °F) • Startup ECT -Startup IAT < 12°C(53.6 °F) • 0°C(32 °F) < Startup ECT < 40°C(104 °F) • 0°C(32 °F) < Startup IAT < 40°C(104 °F) • Start-up IAT-IAT < 1°C(33.8 °F) • Engine Run Time > 1sec • Purge enable time < Threshold • Cold Start Time < 300sec. • 15 % < Fuel Level < 85% • Restricted path test time < 120sec.	
Threshold value	• Tank vacuum ≥ 14 inH_2O • Fail time > 5s • Purge rate 0.15 g/s	
DiagnosisTime	• -	
MIL On Condition	• 1 driving cycle	

SCHEMATIC DIAGRAM

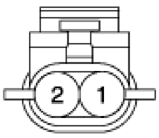
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

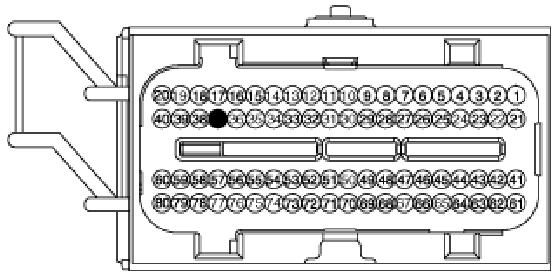
Terminal	Connected to	Funtion
1	PCM C144-1 (37)	CCV Control
2	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTORS]



F31

CCV



C144-1

PCM

MONITOR SCANTOOL DATA

1. Warm-up engine to normal operating temperature.

> **NOTE**
>
> Evaporative Emissions Systems (EVAP) Leak Tests can be run by the Scan Tool.The tests are automated and provide either a pass-fail result or directions to check for DTCs.

2. Install scan tool and clear DTC
3. Perform "EVAP. LEAKAGE TEST" mode referring to enable conditions as below
4. Monitoring for (pending) DTC by performing " DIAGNOSTIC TROUBLE CODES"or "MONITORING TEST RESULTS". Is the same DTC set ?

YES

▸ Go to "System Inspection" procedure.

NO

▸ Fault is intermittent caused by poor contact in sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of vehicle Repair" procedure

SYSTEM INSPECTION

1. Check Canister air filter and CCV
   (1) Visually inspect air filter is clogged.

   (2) Visually inspect duck between air filter and CCV is clogged.

   (3) Check that Canister is deformed or clogged by foreign materials.

   (4) Has a problem been found ?

   YES

   ▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Open in ground harness of FTPS(Fuel tank pressure sensor) can cause this DTC. so check it for open.(Refer to DTC P0454) If the problem is not corrected, substitute with a known-good PCM and check for proper operation.If the problem is corrected, replace PCM and then go to "Verification of Vehicle Repair" procedure.

   > **NOTE**
   >
   > There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P2610

COMPONENT LOCATION

GENERAL DESCRIPTION

Continuing to calculate data of several sensor despite turning ignition OFF, when ignition turns ON, PCM enables turning ignition ON to be easy using calculated data.

DTC DESCRIPTION

If there is a value difference between desired torque and real torque for more than 20 sec. or if errors exist inside of memory, PCM sets P2610. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

<table>
<tr><th colspan="2">ITEM</th><th>Detecting Condition</th><th>Possible Cause</th></tr>
<tr><td rowspan="2">DTC Strategy</td><td>Case 1</td><td>• The LPC SPI Diagnostic allows the Low Power Counter to count down and simulateneously enables a test timer to run for a calibratable length of time and then compares the time elapsed recorded by the LPC (counter delta) against that recorded by the test timer in order to make a PASS/FAIL determination.</td><td rowspan="5">• PCM</td></tr>
<tr><td>Case 2</td><td>• The LPC Reset Test checks for abnormal resets of the Low Power Counter</td></tr>
<tr><td rowspan="2">EnableCondition</td><td>Case 1</td><td>• Test not complete
• Engine running
• Enough runtime > 10sec.
• Battery voltage > 8V</td></tr>
<tr><td>Case 2</td><td>• No Memory Failure Occurred</td></tr>
<tr><td></td><td>Case 1</td><td>• The difference between the Counter Delta (test time as recoded by the low power counter) and the calibration the test timer clocks up to should be less than a maximum tolerance > 20sec.</td></tr>
</table>

Threshold	Case 2	• The InItial Register Read flag is set to TRUE only when the Low Power Counter has been reset due to power supply problems or the like. • The Diagnostic logs a failure when it sees this flag set to TRUE, • Provided the engine is not running, • The battery voltage is not too low • The test has not already run this key cycle.	
Diagnosis Time		• -	
MIL On Condition		• 2 Driving Cycle	

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

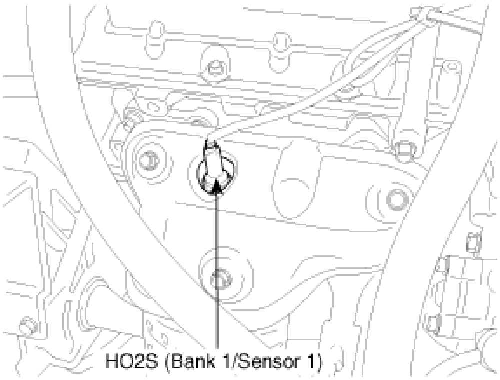
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P2A00

COMPONENT LOCATION



GENERAL DESCRIPTION

In order to control emissions of the CO, HC and NOx components of the exhaust gas, heated oxygen sensor (HO2S), mounted on the front side and rear side of catalytic converter, detects the oxygen content in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation.The HO2S requires a minimum temperature to operate properly and provide a closed loop fuel control system. The HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions.
The oxygen sensor generates a voltage that indicates the difference between the oxygen content of the exhaust stream and the oxygen content of ambient air. When the exhaust stream is “rich,” there is more oxygen in the ambient air than in the exhaust stream, so the voltage will be higher.
Some oxygen sensor varieties use a “bias” voltage to achieve better resolution of the exhaust stream signal. Some oxygen sensor varieties use a “pumping circuit” to force ambient air into the sensor to maintain a more pure environment for comparison. In either case, a cold sensor will tend to indicate voltage values near the open circuit value. For the “pumping current” sensors, this open circuit value can be near 3.5 V. Since the Fuel control logic would incorrectly consider this reading to indicate a very rich mixture for an extended time, the fuel control logic can not use the oxygen sensor reading under such conditions.
. The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

DTC DESCRIPTION

Detect when the oxygen sensor reading has forced closed loop fuel control to stop executing, and Open Loop fuel control is in effect. This action will happen for OSP (flat plate) oxygen sensors that are not yet warmed up when the pumping current is in use. The California Air Resources Board (CARB) will not approve the current strategy without this modification. CARB considers this Open Loop operation to be a “default mode of operation,” and thus CARB expects the Malfunction Indicator Lamp (MIL) to be illuminated.
Checking output signals from B1S1 every 12 sec. under detecting condition, if an output signal is near 3.5V for more than 10 sec., PCM sets P2A00. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till 1 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects Loss of O2 Ready status, which would lead to OpenLoop Fueling operation, a default mode.	• Poor Connection • Faulty HO2S • Faulty PCM
EnableConditions	• Engine Running • Ignition ON • DFCO Not present too long ≤ 15sec. • No Disabling Faults Present • All of the above for minimum time ≥ 20sec.	
Threshold value	• O2 Ready Status lost	
DiagnosisTime	• Contineous (More than 10 second failure for every 12 second test .)	
MIL On Condition	• 1 Driving Cycles	

SIGNAL WAVEFROM AND DATA

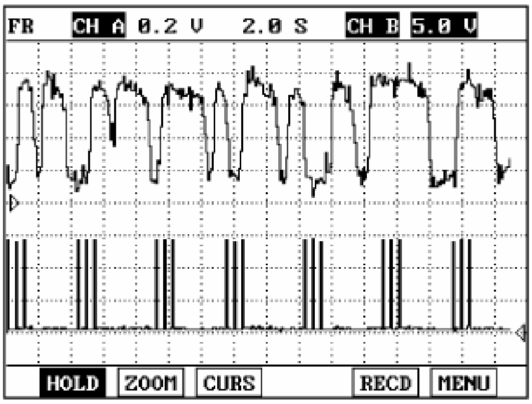


Fig.1 : B1S1 & Heater

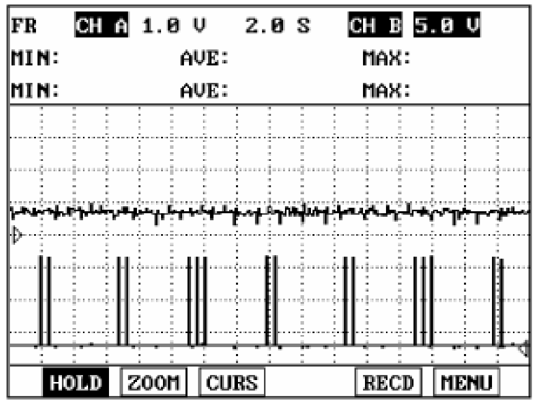


Fig. 2 : B1S2 & Heater

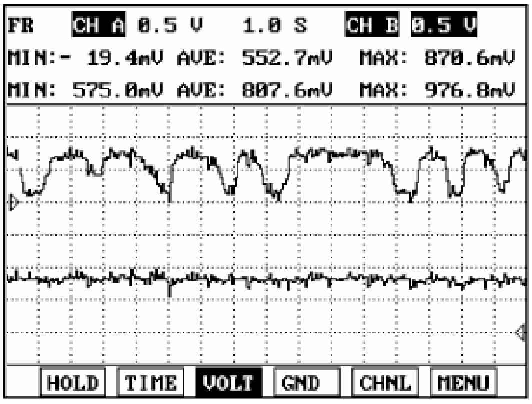


Fig. 3 : B1S1 & B1S2

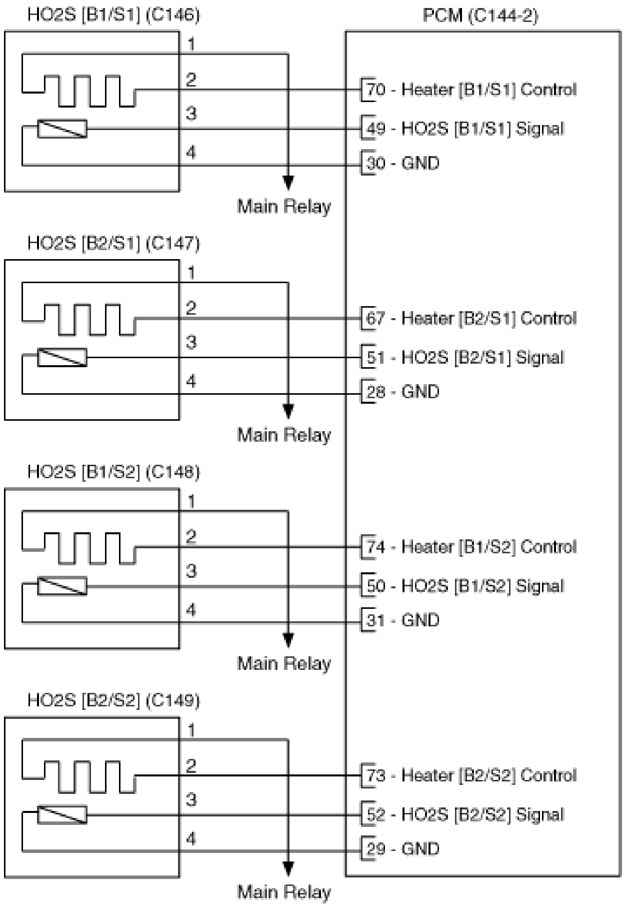
After warming-up, Releasing accellerator pedal suddenly around 4000rpm the HO2S signal reading will be lower than 200mV resulting from Fuel cut-off. Conversely, sudden depressing accellerator pedal HO2S signal reading will be around 0.6V ~1.0V. At idle, HO2S signal will be switching between lean(below 0.48V) to rich(above 0.48V) normally.

SPECIFICATION

HO2S(B1S1)	Warmed up	0 ~ 1V
	Not warmed up	Near 3.5V

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

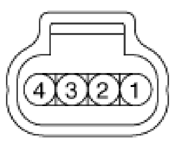
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

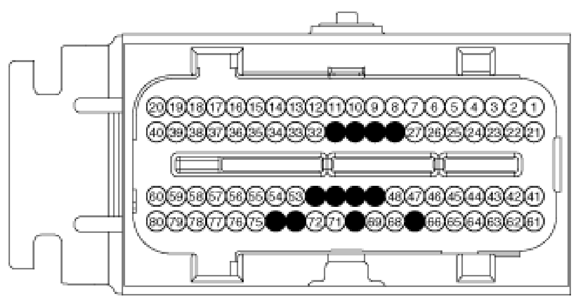
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]

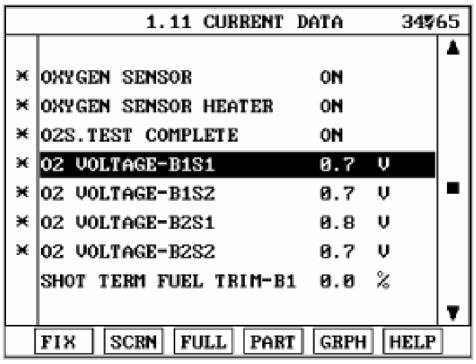


C144-2
PCM

MONITOR SCANTOOL DATA

1. Connect Scantool & Engine "ON"
2. Warm up the engine to normal operating temperature.
3. Monitor HO2S voltage(B1/S1) parameter on scantool

Specification : Voltage will vary from 0.1 to 0.9 V



4. Is the HO2S parameter displayed within specifications ?

YES

▸Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection,bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and goto "Verification of Vehicle Repair" procedure.

NO

▸Go to "Component Inspection" procedure

COMPONENT INSPECTION

1. Visual Inspection of HO2S
   (1) Visually/physically inspect following items:
      A. Inspect the front HO2S for Contaminated, deteriorated or aged Front HO2S
      B. If contamination is evident on the HO2S, replace contaminated sensor

   (2) Is the HO2S visually / physically O.K ?

   YES

   ▸ Go to "Check Performance of H02S" as below

   NO

   ▸ Substitute with a known - good HO2S and check for proper operation. If the problem is corrected, replace HO2S and go to "Verification of Vehicle Repair"

2. Check performance of HO2S
   (1) Connect scantool & Engine "ON"

   (2) Warm-up the engine to normal engine temperature.

   (3) Monitor signal waveform of HO2S with scantool

   Specification : Voltage will vary from 0.1 to 0.9 V

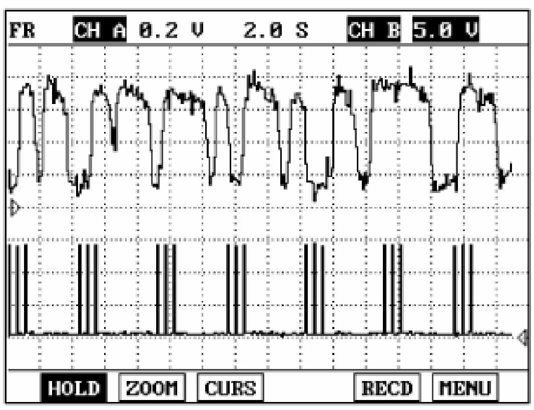


Fig.1: B1S1 & Heater

   (4) Is the sensor signal switching properly ?

   YES

   ▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

   NO

▸ Substitute with a known - good HO2S and check for proper operation. If the problem is corrected, replace HO2S and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

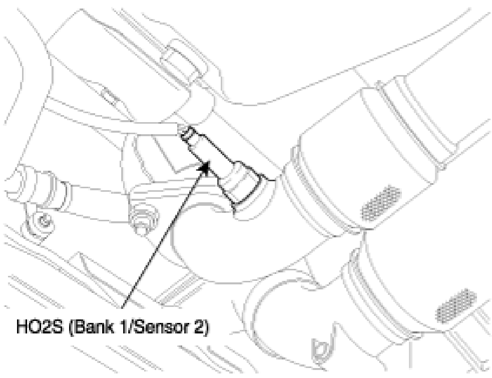
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P2A03

COMPONENT LOCATION



GENERAL DESCRIPTION

In order to control emissions of the CO, HC and NOx components of the exhaust gas, heated oxygen sensor (HO2S), mounted on the front side and rear side of catalytic converter, detects the oxygen content in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation.The HO2S requires a minimum temperature to operate properly and provide a closed loop fuel control system. The HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions.
The oxygen sensor generates a voltage that indicates the difference between the oxygen content of the exhaust stream and the oxygen content of ambient air. When the exhaust stream is “rich,” there is more oxygen in the ambient air than in the exhaust stream, so the voltage will be higher.
Some oxygen sensor varieties use a “bias” voltage to achieve better resolution of the exhaust stream signal. Some oxygen sensor varieties use a “pumping circuit” to force ambient air into the sensor to maintain a more pure environment for comparison. In either case, a cold sensor will tend to indicate voltage values near the open circuit value. For the “pumping current” sensors, this open circuit value can be near 3.5 V. Since the Fuel control logic would incorrectly consider this reading to indicate a very rich mixture for an extended time, the fuel control logic can not use the oxygen sensor reading under such conditions.
The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

DTC DESCRIPTION

Detect when the oxygen sensor reading has forced closed loop fuel control to stop executing, and Open Loop fuel control is in effect. This action will happen for OSP (flat plate) oxygen sensors that are not yet warmed up when the pumping current is in use. The California Air Resources Board (CARB) will not approve the current strategy without this modification. CARB considers this

Open Loop operation to be a “default mode of operation,” and thus CARB expects the Malfunction Indicator Lamp (MIL) to be illuminated.
Checking output signals from B1S1 every 12 sec. under detecting condition, if an output signal is near 3.5V for more than 10 sec., PCM sets P2A03. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till 1 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects Loss of O2 Ready status, which would lead to OpenLoop Fueling operation, a default mode.	• Poor Connection • Faulty HO2S • Faulty PCM
EnableConditions	• Engine Running • Ignition ON • DFCO Not present too long ≤ 15sec. • No Disabling Faults Present • All of the above for minimum time ≥ 20sec.	
Threshold value	• O2 Ready Status lost	
DiagnosisTime	• Contineous (More than 10 second failure for every 12 second test .)	
MIL On Condition	• 1 Driving Cycles	

SIGNAL WAVEFROM AND DATA

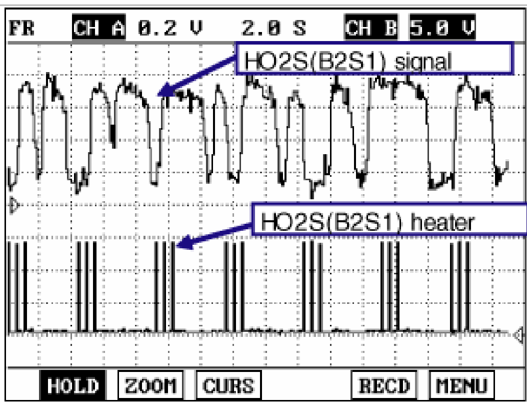


Fig1

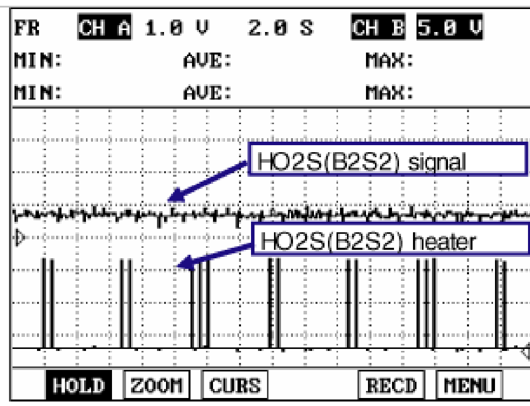


Fig2

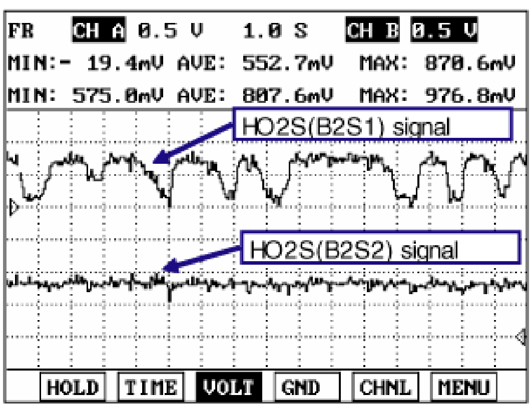


Fig3

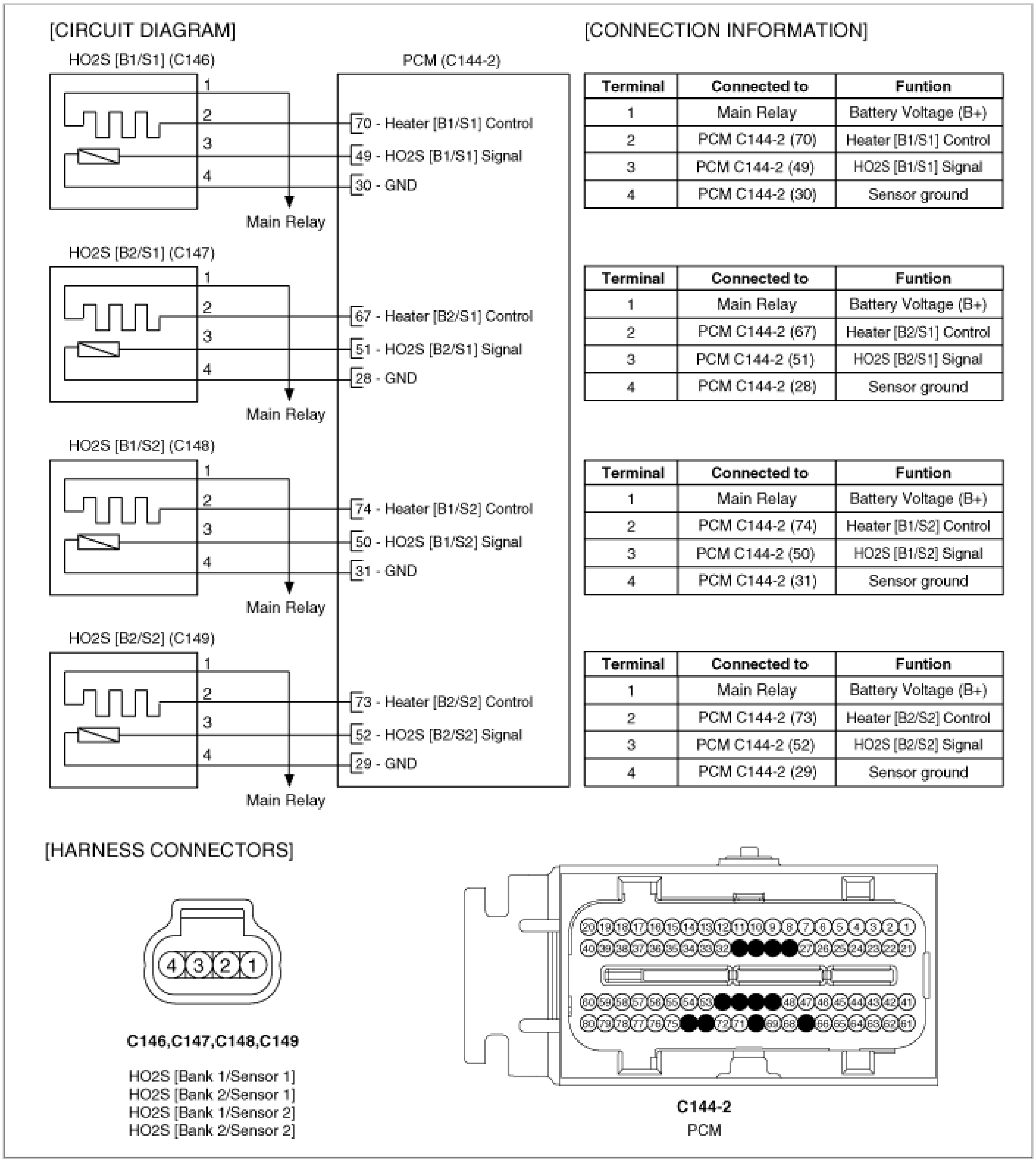
Fig1 : HO2S(B1S1) & Heater
Fig2 : HO2S(B2S2) & Heater
Fig3 : HO2S(B2S1) & (B2S2)

After warming-up, Releasing accellerator pedal suddenly around 4000rpm the HO2S signal reading will be lower than 200mV resulting from Fuel cut-off. Conversely, sudden depressing accellerator pedal HO2S signal reading will be around 0.6V ~1.0V. At idle, HO2S signal will be switching between lean(below 0.48V) to rich(above 0.48V) normally.

SPECIFICATION

HO2S(B2S1)	Warmed up	0 ~ 1V
	Not warmed up	Near 3.5V

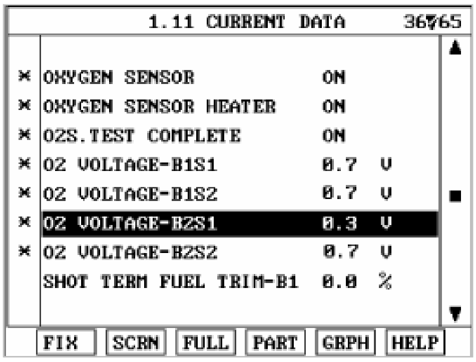
SCHEMATIC DIAGRAM



MONITOR SCANTOOL DATA

1. Connect Scantool & "ON"
2. Warm up the engine to normal operating temperature.
3. Monitor HO2S voltage(B2/S1) parameter on scantool

Specification : Voltage will vary from 0.1 to 0.9 V



4. Is the HO2S parameter displayed within specifications ?

YES

▶Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection,bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and goto "Verification of Vehicle Repair" procedure.

NO

▶Go to "Component Inspection" procedure

COMPONENT INSPECTION

1. Visual Inspection of HO2S
   (1) Visually/physically inspect following items:
      A. Inspect the front HO2S for Contaminated, deteriorated or aged Front HO2S
      B. If contamination is evident on the HO2S, replace contaminated sensor

   (2) Is the HO2S visually / physically O.K ?

   YES

   ▶ Go to "Check Performance of H02S" as below

   NO

   ▶ Substitute with a known - good HO2S and check for proper operation. If the problem is corrected, replace HO2S and go to "Verification of Vehicle Repair"

2. Check performance of HO2S
   (1) Connect scantool & Engine "ON"

   (2) Warm-up the engine to normal engine temperature.

   (3) Monitor signal waveform of HO2S with scantool

   Specification : Voltage will vary from 0.1 to 0.9 V

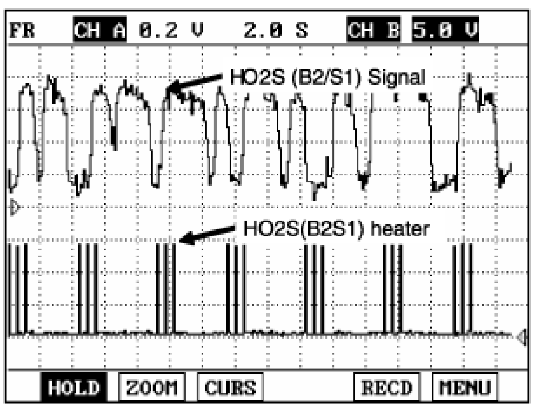


Fig.1 : HO2S(B2S1) & Heater

   (4) Is the sensor signal switching properly ?

   YES

   ▶ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

   NO

▸ Substitute with a known - good HO2S and check for proper operation. If the problem is corrected, replace HO2S and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > U0001

GENERAL DESCRIPTION

As vehicles electronically controlled, various control unit is applied to vehicle and several units are controlled based on the signals from the sensors. Therefore sharing signals of sensors and information is required. To meet this requirement, CAN communication type, which is insensible to external noises and whose communication speed is fast, is applied to power train control.Sharing signals from RPM, APS, gear shifting, torque reduction in ESP, ABS and various modules, adtive control is performed.

DTC DESCRIPTION

Checking CAN communication every 1 sec., under detecting condition, if an output signal within the detecting condition is detected for more than 1.5 sec., PCM sets U0001. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects failures in communication between the PCM and another or allmodules in the vehicle which are on the CAN serial bus.	• CAN Communicatio line • CAN Communication Module
EnableConditions	• Engine Run Time ≥ 2sec. • Ignition Voltage ≥ 11V	
Threshold value	• CAN communicatin error	
DiagnosisTime	• Contineous (More than 1.5sec. Failure for every 1sec. Test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFROM AND DATA

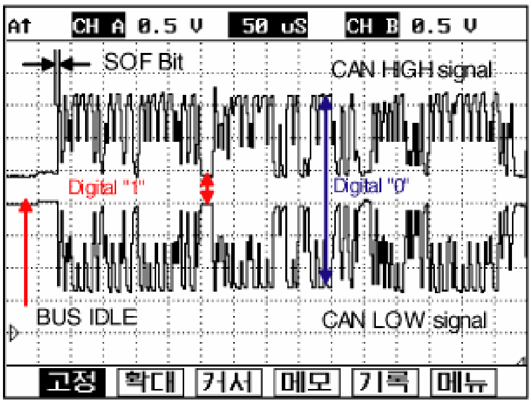


Fig.1

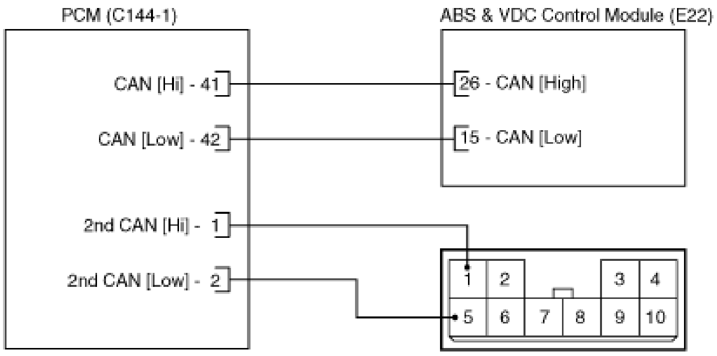
Monitoring CAN HIGH and LOW simultaneously is important in monitoring CAN communication waveform. When CAN HIGH signal rise to 3.5V and LOW signal drops to 1.5V - voltage difference between HIGH and LOW signal is 2V - at BUS IDLE state (DIGITAL "1") whose reference voltage is 2.5V, "0" is recognized. Besides, comparing HIGH and LOW signal if opposite waveform is detected with the reference voltage of 2.5V, Check if current CAM signal is transfers correctly.
Continuous "0"signal above 6BIT means the occurence of error in CAN communication. 1BIT is easily distinguished as calculating the time when "SOF"(START OF FRAME) which notifies the start of frame occurs. Check if "0"signal above 6BIT is detected continuously when monitoring CAN communication waveform.

SPECIFICATION

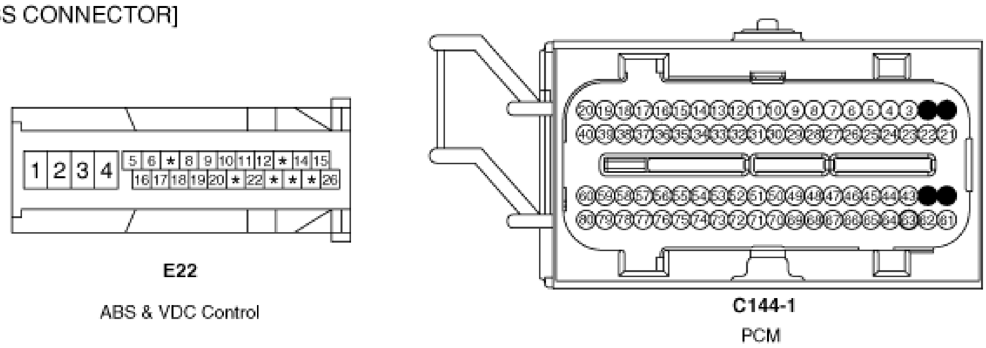
Format	DIGITAL "0"		DIGITAL "1"(BUS IDLE)		CAN Resistance	
	HIGH	LOW	HIGH	LOW	PCM	ESP
CAN 2.0B	3.5V	1.5V	2.5V	2.5V	120Ω (20°C)	120Ω (20°C)

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[HARNESS CONNECTOR]



MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector (DLC).

2. Warm engine up to normal operating temperature.
3. Turn "OFF" electrical devices and A/C.
4. Monitor the data from PCM through CAN communication among ABSCM or ESP data

If CAN is normal, vehicle speed data is showed through CAN communication line from ABS or ESP control module.

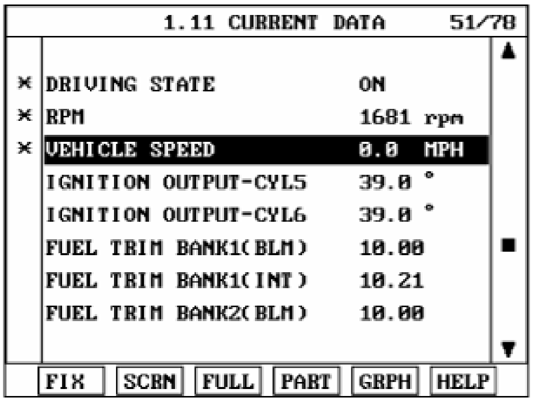


Fig. 1

Fig1 : Vehicle speed data on current data during driving state.

5. Is the data displayed correctly?

YES

▶ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▶ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure

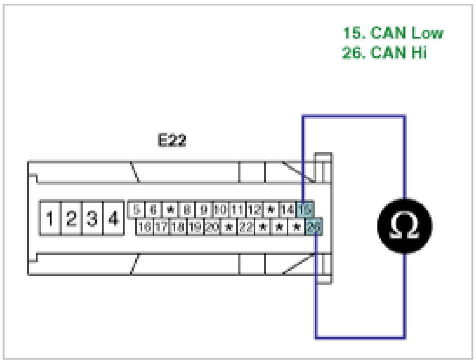
NO

▶ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check CAN communication bus resistance
   (1) Ignition "OFF".
   (2) Check connection state of PCM connector(C144-1) and ESP or ABS connector(E22)
   (3) Measure the resistance between ESP or ABS connector 15 and 26 refering to the checking condition of specification as follows.

Specification : ※ PCM connector, ESP or ABS connector connected : 60Ω ± 5Ω
※ PCM connecotor disconnected, ESP or ABS connector connected : 120Ω ± 10Ω
※ PCM connector connected, ESP or ABS connector disconnected : 120Ω ± 10Ω



(4) Is CAN BUS resistance within the specification?

YES

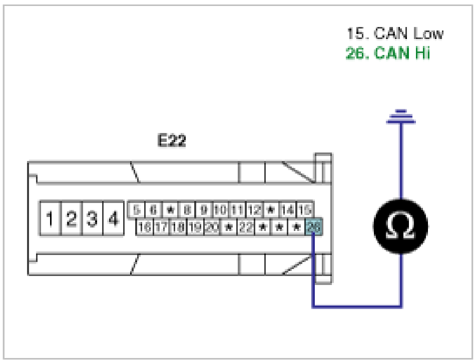
▸ Go to "Check short to ground in CAN BUS" as follows.

NO

▸ When resistance is about 1.0Ω : Go to "3. Check short between CAN communication lines" as follows
▸ When resistance is infinite Ω : Go to "4. Check open in CAN communication line" as follows

2. Check short to ground in CAN communication bus
   (1) Ignition "OFF"
   (2) Disconnect ESP or ABS connector.
   (3) Measure resistance between terminal 26 of ESP or ABS harness connector and chassis ground.

specification : Infinite



(4) Is the measured resistance within the specification?

YES

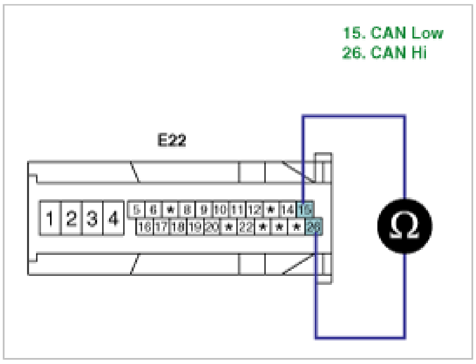
▸ Go to "Component Inspection" procedure

NO

▸ Below 1.0Ω is detected : Repair short to ground in CAN High circuit and go to "Verification of Vehicle Repair" procedure.
▸ Above 120Ω is detected : Repair short to ground in CAN Low circuit and go to "Verification of Vehicle Repair" procedure.

3. Check short between CAN communication lines(LOW and HIGH)
   (1) Ignition "OFF"
   (2) Disconnect PCM connector and ESP or ABS connector.
   (3) Measure resistance between terminal 15 and 26 of ESP or ABS harness connector.

specification : Infinite



(4) Is the measured resistance within the specification?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Below 1.0Ω is detected : Repair short between CAN LOW and HIGH signal line and go to "Verification of Vehicle Repair" procedure.

4. Check open in CAN communication line

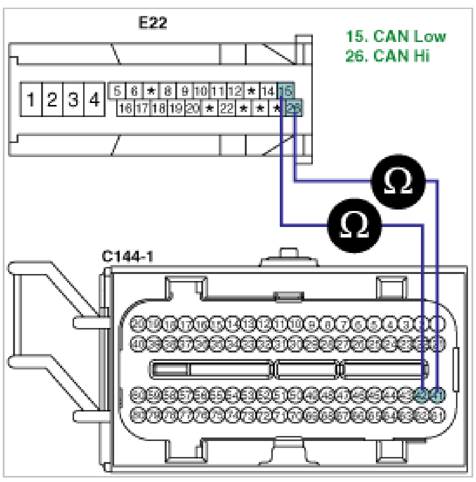
(1) Ignition "OFF".

(2) Disconnect PCM connector and ESP or ABS connector.

(3) Measure resistance between terminal 42/C144-1 of PCM harness connector and terminal 15 of ABS or EPS harness connector.(CAN Low)

(4) Measure resistance between terminal 41/C144-1 of PCM harness connector and terminal 26 of ABS or EPS harness connector (CAN hi)

specification : Below 1.0Ω



(5) Is the measured resistance within the specification?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair open in harness and go to "Verification of Vehicle Repair" procedure.

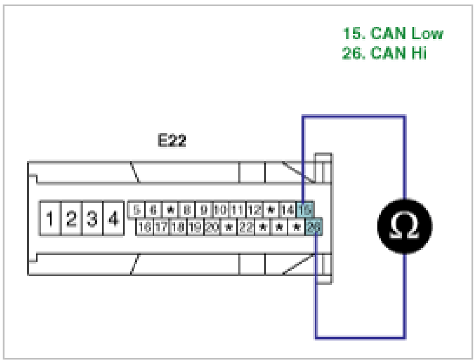
COMPONENT INSPECTION

1. Check the resistance of CAN BUS inside of module

(1) Ignition "OFF"

(2) Measure the resistance between ABS or ESP connector 15 and 26 refering to the checking condition of specification as follows.

Specification : ※ PCM connector disconnected, ESP or ABS connector connected. (TEST "A") : 120Ω ± 10Ω
※ PCM connector connected, ESP or ABS connector disconnected (TEST "B") : 120Ω ± 10Ω



(3) Is the measured resistance within the specification?

YES

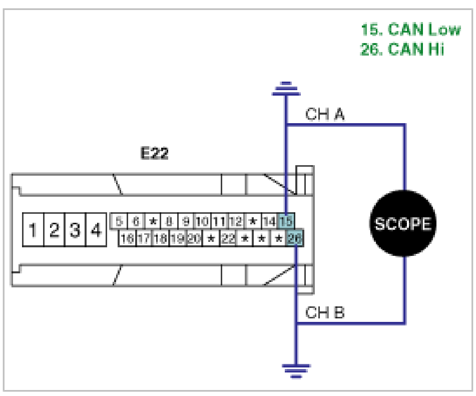
▸ Go to "2. Check CAN communication waveform" as follows

NO

▸ TEST "A" problem : the resistance of CAN BUS inside of ABS or ESP is without specification. Replace ABS or ESP and go to "Verification of Vehicle Repair"
▸ TEST "B" problem : the resistance of CAN BUS inside of PCM is without specification. Replace PCM and go to "Verification of Vehicle Repair"

2. Check CAN communication waveform output
   (1) Ignition "OFF"
   (2) Connect 2 channel scope to ABS or ESP connector terminal 15 and 26.
   (3) Disconnect ABS or ESP connector and check CAN communication waveform after Ignition "ON". (TEST "A")
   (4) Disconnect PCM connector and check CAN communication waveform after Ignition "ON". (TEST "B")

Sspecification : Communication waveform similar to the waveform of "Signal Waveform & Data" is displayed when Ignition "ON"
※ It means communication error of connected module when, being different from reference waveform, 1) CAN HIGH and LOW signals are fixed at 2.5V or 2)HIGH and LOW signals are fixed at 3.5V and 1.5V,respectively



(5) Does correct waveform generate from ECM and TCM?

YES

▸ Go to "Verification of Vehicle Repair"

NO

▸ TEST "A" waveform is abnormal : Repalce PCM due to the communication error with PCM and go to "Verification of Vehicle Repair"
▸ TEST "B" waveform is abnormal : Repalce ABS or ESP due to the communication error with ABS or ESP and go to "Verification of Vehicle Repair"
※ Repeat this process 2~3 times.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.

2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

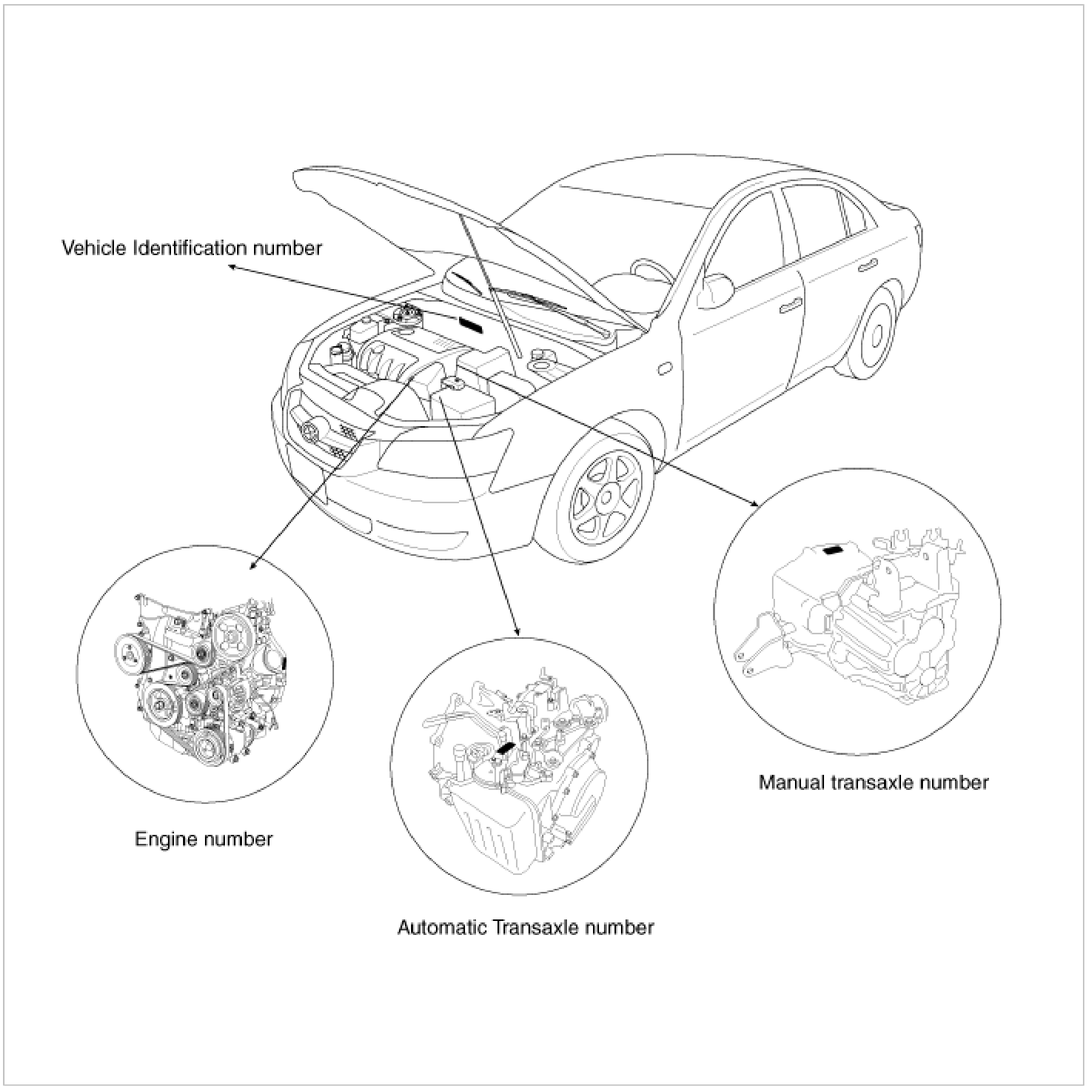
YES

▸ Go to the applicable troubleshoooting procedure.

NO

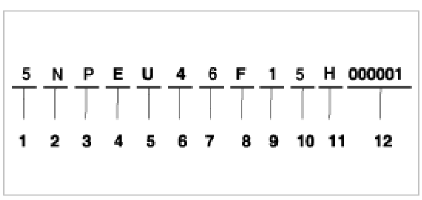
▸ System is performing to specification at this time.

IDENTIFICATION NUMBER LOCATIONS



IDENTIFICATION NUMBER DESCRIPTION

VEHICLE IDENTIFICATION NUMBER



1. Geographic zone
   - K : Korea
2. Manufacturer
   - M : Hyundai motor company
3. Vehicle type
   - 5NP : Passenger cars
   - H : Passenger cars
4. Vehicle line
   - E : SONATA
5. Model & Series
   - S : STANDARD (L)
   - T : DELUXE (GL)
   - U : SUPER DELUXE (GLS)
   - V : GRAND SALON (GDS)

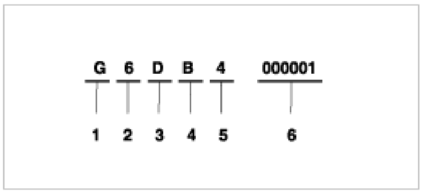
- W : SUPER GRAND SALON (HGS)

6. Body type
   - 4 : Sedan
7. Restraint system
   - 5 : Depowered airbag.
   - 6 : Advanced airbag.
8. Engine type
   - C : Gas 2.4
   - F : Gas 3.3
9. Check digit or others
10. Production year
    - 5 : 2005, 6 : 2006
11. Plant of production
    - H : Alabama in U.S.A
    - A : A-SAN (korea)
12. Vehicle production sequence number
    - 000001 ~ 999999

PAINT CODE

CODE	COLOR
EB	Ebony Black
OT	Special Color
N2	Pure Pearl white
S7	Sleek Silver
B7	Grace Beige
D2	Deep Pearl Blue
W2	Presting Dark R
D3	Aurora Blue
G6	Charming Gray

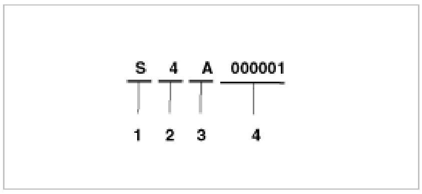
ENGINE IDENTIFICATION NUMBER



1. Engine fuel
   - G : Gasoline
2. Engine range
   - 4 : 4 cycle 4 cylinder
   - 6 : 4 cycle 6 cylinder
3. Engine development order
   - K : Theta engine
   - D : Lamda engine
4. Engine capacity
   - C : 2359 cc (Gasoline)
   - B : 3342 cc (Gasoline)
5. Production year
   - 5 : 2005, 6 : 2006
6. Engine production sequence number
   - 000001 ~ 999999

TRANSMISSION IDENTIFICATION NUMBER

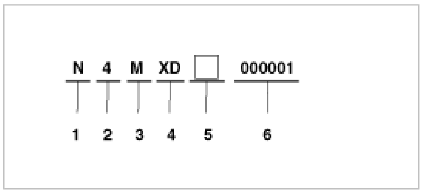
MANUAL



1. Model

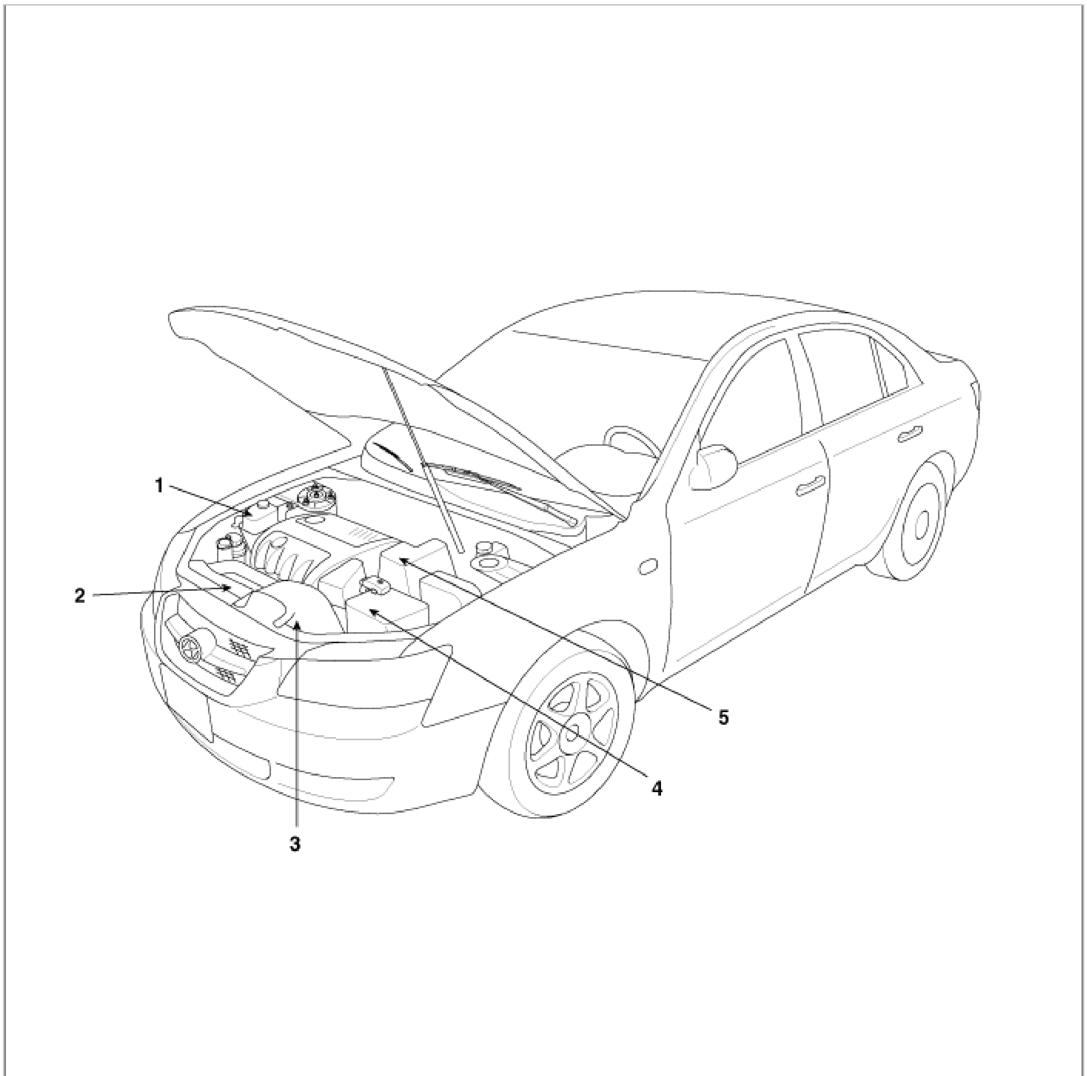
- S : M5GF2
2. Production year
   - 4 : 2004, 5 : 2005, 6 : 2006, 7 : 2007
3. Gear ratio
   - A : 4.680
   - B : 4.333
4. Transaxle production sequence number
   - 000001 ~ 999999

AUTOMATIC



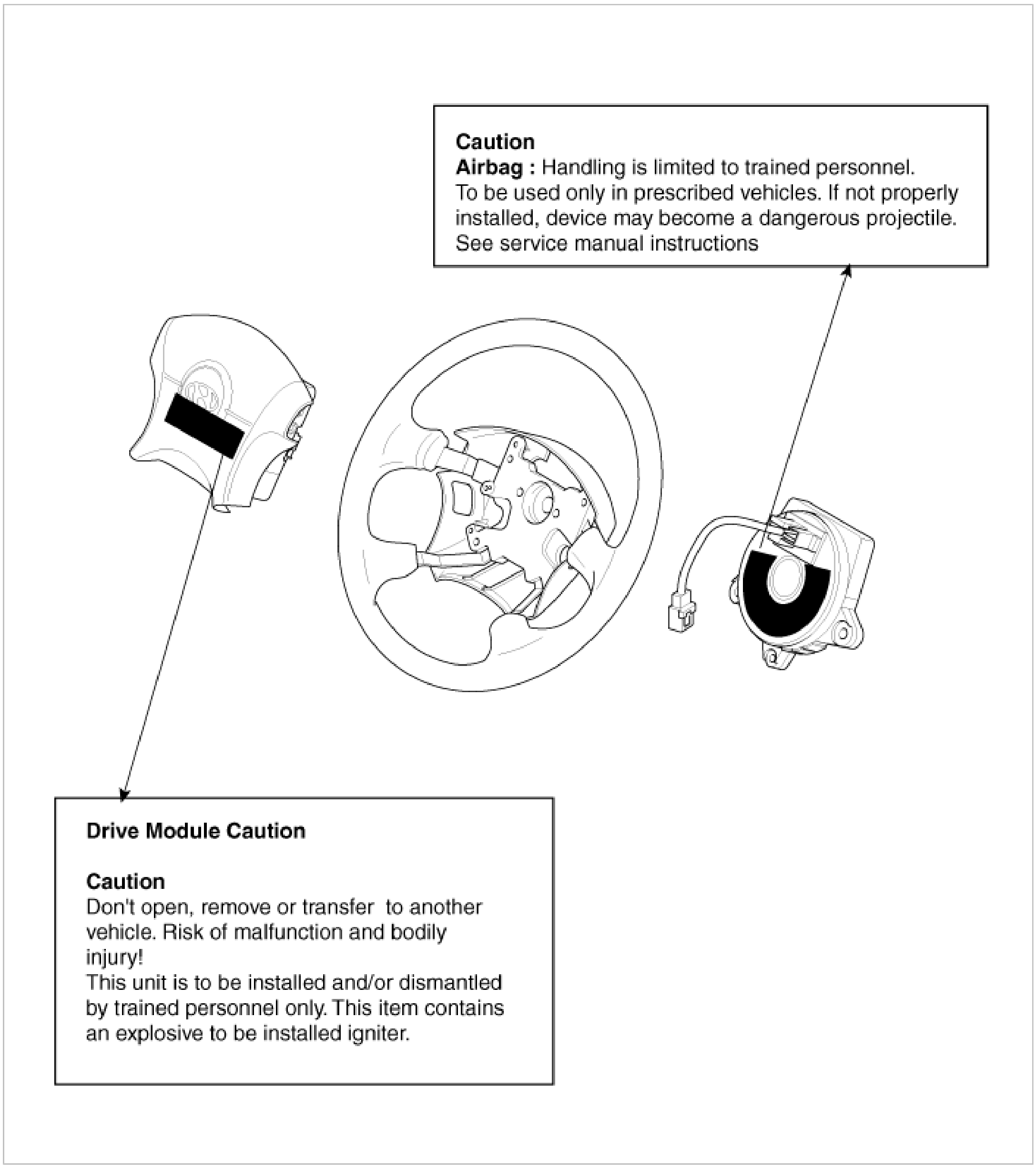
1. Model
   - N : F4A42-2
   - U : A5HF1
2. Production year
   - 4 : 2004, 5 : 2005, 6 : 2006, 7 : 2007
3. Gear ratio
   - M : 3.770
   - K : 3.333
4. Detailed classification
   - XD : 2.4 (Theta engine)
   - GD : 3.3 (Lambda engine)
5. Spare
6. Transaxle production sequence number
   - 000001 ~ 999999

WARNING / CAUTION LABEL LOCATIONS

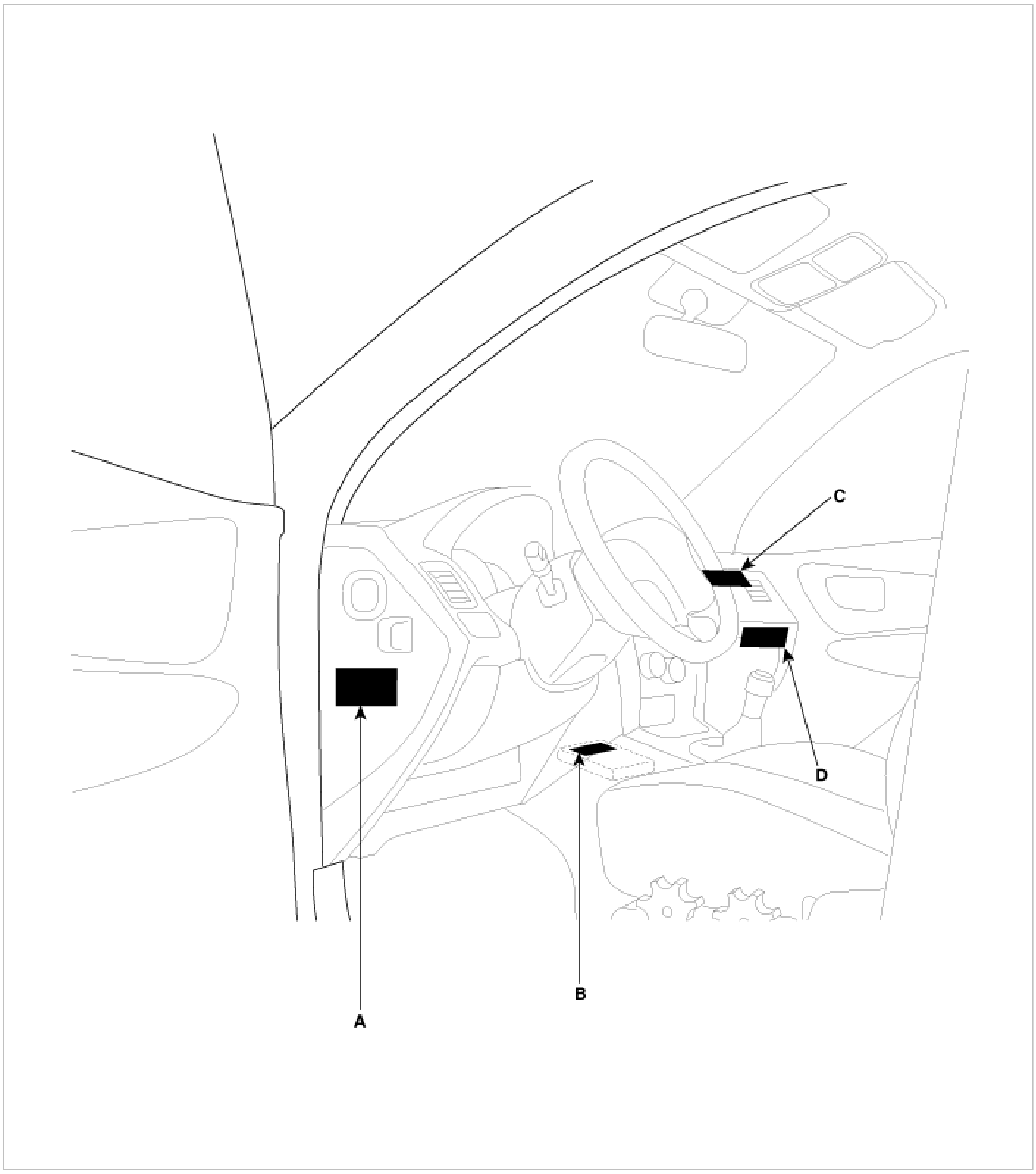


1. COOLANT LEVEL CAUTION
2. FAN CAUTION
3. RADIATOR CAP CAUTION
4. BATTERY CAUTION
5. AIR CLEANER CAUTION

AIR BAG WARNING / CAUTION LABEL



AIR BAG WARING / CAUTION LABEL (CONT'D)



WARNING / CAUTION LABEL (cont'd)

A : WARNING
SEE OWNER'S MANUAL.
This car is equipped a side airbag for each front seat.

- Do not use any accessory seat covers.
- Use of other seat covers could reduce the effect of the system.
- Do not install any accessories on the side or near the side airbag.
- Do not use excessive force on the side of the seal.
- For further information, see the owner's manual.

B : CAUTION
AIRBAG ESPE UNIT

Detach connector before dismounting. Assemble strictly according to manual instructions.

C : PASSENGER MODULE CAUTION

CAUTION
Don't open, remove or transfer to another vehicle. Risk of malfunction and bodily injury!
This unit is to be installed and/or dismantled by trained personnel only. This item contains an explosive igniter.

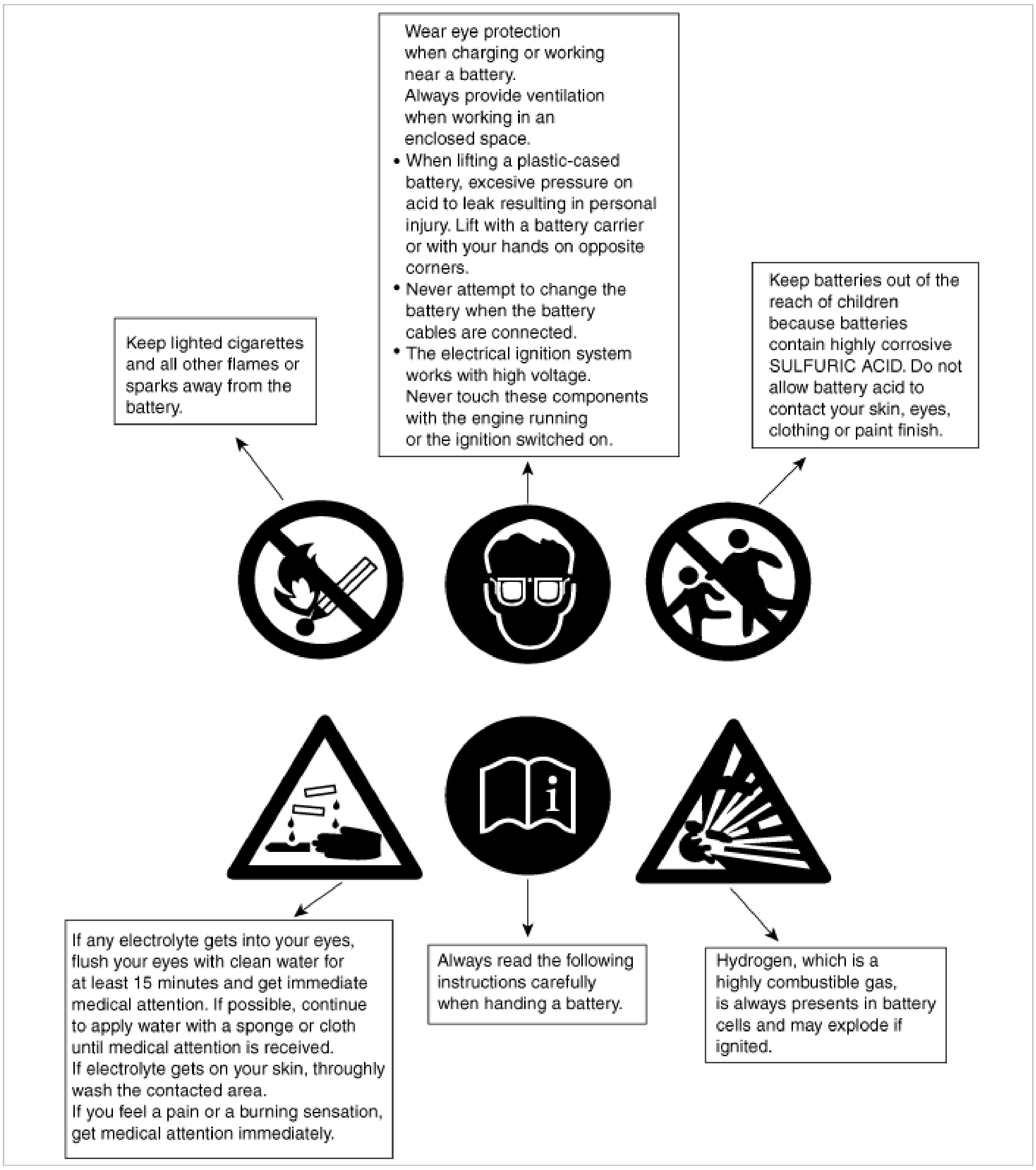
D : SUPPLEMENTAL RESTRAINT SYSTEM (AIRBAG) INFORMATION

- The airbag is a Supplement Restraint System (SRS).

You must always wear seat belts.
- The airbag system condition is normal when the "SRS" lamp in the cluster flashes approximately 6 times after the ignition key is turned on and then goes off.
- If any of the following condition soccur, the system must be serviced.
  - "SRS" lamp does not light up when the key is turned on.
  - "SRS" lamp stays lit or flashes continuously.
  - The airbag has inflated.
- The airbag system must be inspected by an authorized dealer ten years after the vehicle manufacture date shown on the certification label, located on left front door opening area.

WARNING
Failure to the above instructions may result in injury to you or other occupants in the vehicle
- See the "SRS" section in Owner's Manual for more information about airbags.

BATTERY CAUTION LABEL DESCRIPTION



LIFT AND SUPPORT POINTS

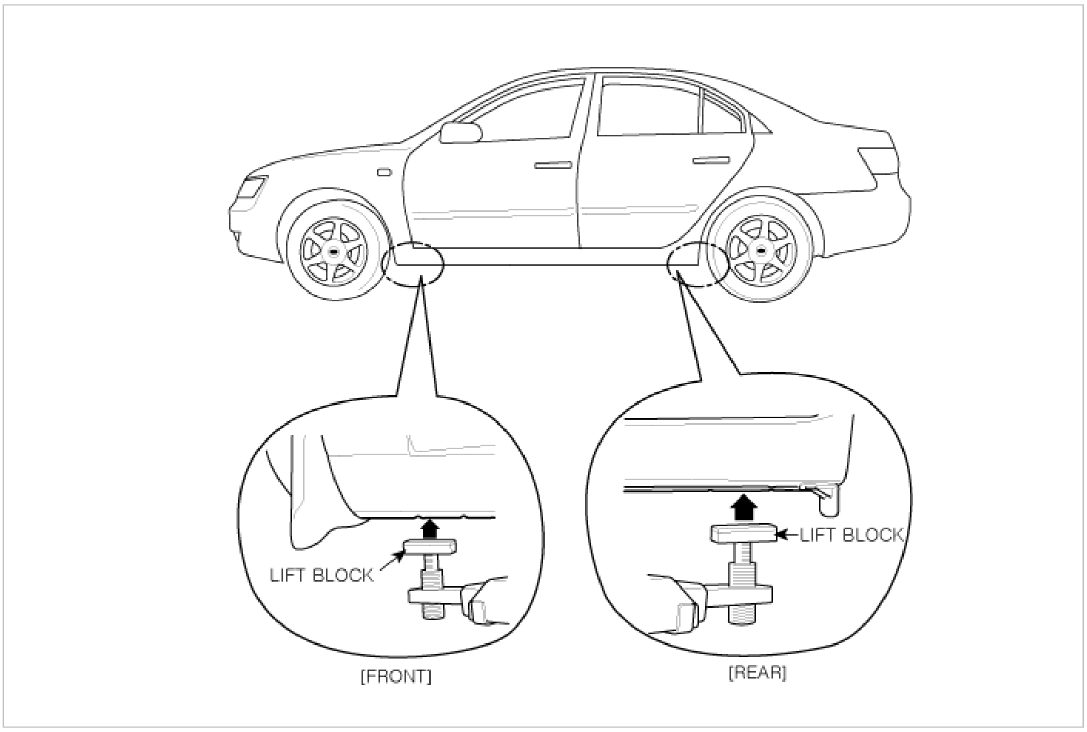
WARNING

When heavy rear components such as suspension, fuel tank, spare tire, tailgate and trunk lid are to be removed, place additional weight in the luggage area before hoisting. When substantial weight is removed from the rear of the vehicle, thecenter of gravity may change and can cause the vehicle to tip forward on the hoist.

NOTE

- Since each tire/wheel assembly weights approximately 30lbs (14kg), placing the front wheels in the luggage area can assist with the weight distribution.
- Use the same support points to support the vehicle on safety stands.

1. Place the lift blocks under the support points as shown in the illustration.
2. Raise the hoist a few inches (centimeters) and rock the vehicle to be sure it is firmly supported.
3. Raise the hoist to full height and inspect the lift points for secure support.



TOWING

If the vehicle needs to be towed, call a professional towing service. Never tow vehicle with just a rope or chain. It is very dangerous.

Emergency Towing

There are three popular methods of towing a vehicle :
If the vehicle cannot be transported by flat-bed, it should be towed with the front wheels off the ground. If due to damage, the vehicle must be tow with the front wheels on the ground, do the following :
Manual Transmission

- Release the parking brake.
- Shift the transmission to neutral

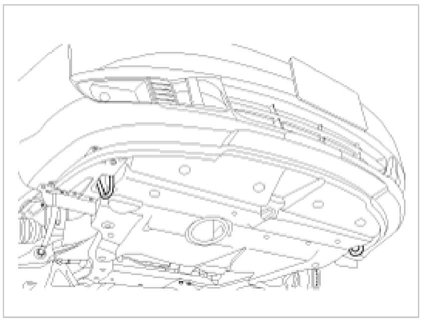
Automatic Transmission

- Release the parking brake.
- Start the engine.
- Shift to [D] position, then [N] position.
- Turn off the engine.

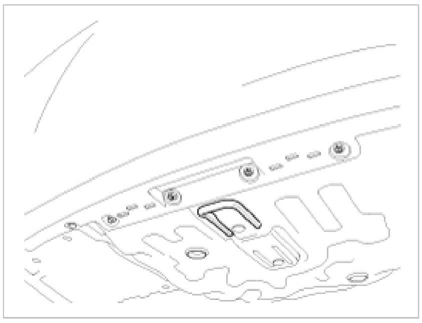
CAUTION

- Improper towing preparation will damage the transmission. Follow the above procedure exactly. If you cannot shift the transmission or start the engine(automatic transmission), your vehicle must be transported on a flatbed.
- It is the best to tow vehicle no farther than 19miles (30km), and keep the speed below 30mph (50km/h).
- Trying to lift or tow your vehicle by the bumpers will cause serious damage. The bumpers are not designed to support the vehicle's weight.

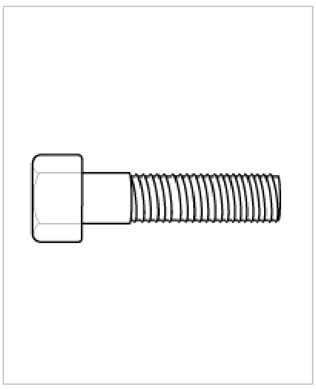
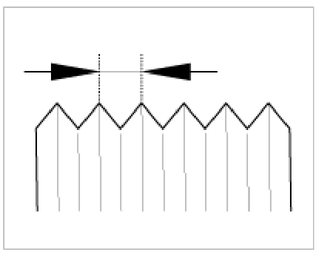
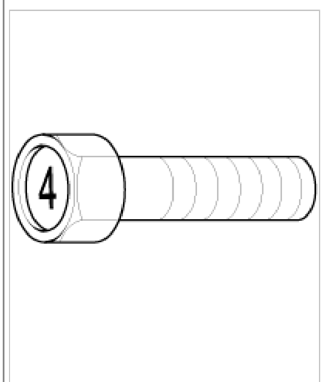
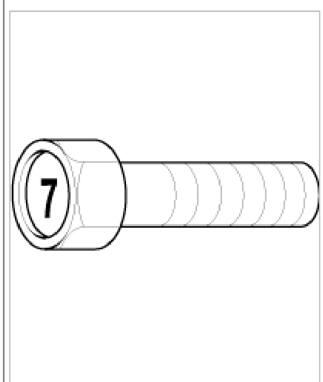
Front :



Rear :



TIGHTENING TORQUE TABLE OF STANDARD PARTS

Bolt nominal diameter (mm)	Pitch (mm)	Torque Nm (kg.cm, lb.ft)	
		Head Mark 4	Head Mark 7
			
M5	0.8	3 ~ 4 (30 ~ 40, 2.2 ~ 2.9)	5 ~ 6 (50 ~ 60, 3.6 ~ 4.3)
M6	1.0	5 ~ 6 (50 ~ 50, 3.6 ~ 4.3)	9 ~ 11 (90 ~ 110, 6.5 ~ 8.0)
M8	1.25	12 ~ 15 (120 ~ 150, 9 ~ 11)	20 ~ 25 (200 ~ 250, 14.5 ~ 18.0)
M10	1.25	25 ~ 30 (250 ~ 300, 18 ~ 22)	30 ~ 50 (300 ~ 500, 22 ~ 36)
M12	1.25	35 ~ 45 (350 ~ 450, 25 ~ 33)	60 ~ 80 (600 ~ 800, 43 ~ 58)
M14	1.5	75 ~ 85 (750 ~ 850, 54 ~ 61)	120 ~ 140 (1,200 ~ 1,400, 85 ~ 100)
M16	1.5	110 ~ 130 (1,100 ~ 1,300, 80 ~ 94)	180 ~ 210 (1,800 ~ 2,100, 130 ~ 150)
M18	1.5	160 ~ 180 (1,600 ~ 1,800, 116 ~ 130)	260 ~ 300 (2,600 ~ 3,000, 190 ~ 215)
M20	1.5	220 ~ 250 (2,200 ~ 2,500, 160 ~ 180)	360 ~ 420 (3,600 ~ 4,200, 260 ~ 300)
M22	1.5	290 ~ 330 (2,900 ~ 3,300, 210 ~ 240)	480 ~ 550 (4,800 ~ 5,500, 350 ~ 400)
M24	1.5	360 ~ 420 (3,600 ~ 4,200, 260 ~ 300)	610 ~ 700 (6,100 ~ 7,000, 440 ~ 505)

NOTE

1. The torques shown in the table are standard values under the following conditions :
   - Nuts and bolts are made of galvanized steel bar.

- Galvanized plain steel washers are inserted.
- All nuts, bolts and plain washers are dry.

2. The torques shown in the table are not applicable :
   - When spring washers, toothed washers and the like are inserted.
   - If plastic parts are fastened.
   - If self-tapping screws or self-locking nuts are used.
   - If threads and surfaces are coated with oil.
3. If you reduce the torques in the table to the percentage indicated below, under the following conditions, if will be the standard value.
   - If spring washers are used : 85%
   - If threads and bearing sufaces are stained with oil : 85%

LUBRICANTS

RECOMMENDED LUBRICANTS

Parts		OIL & GREASE STANDARD	
Engine Oil	Gasoline	API SJ or ABOVE	SAE 5W -20 *1, *2
		*1. SAE 5W-20 engine oil is preferred regardless of regional option and engine variation. *2. If 5W-20 engine oil is not available, secondary recommended engine oil can be used for corresponding temperature range.	
Transaxle	Manual	HYUNDAI GENUINE PART MTF 75W/90 (API GL - 4)	
	Auto	DIAMOND ATF SP-III, SK ATF SP-III	
Power Steering		PSF -4	
Breake Steering		DOT 3, DOT 4 or equivalent	
Coolant		Ethlyene glycol base for aluminium radiator	
Transaxle linkage, parking brake cable mechanism, hood, door latch, seat adjuster, tailgate latch, door hinges, tailgate hinge		Multipurpose grease NIGL grade #2	

WARNING

Always use Genuine Hyundai parts and recommedended fluid.
Using any other type of parts and fluid can cause serious damaged if the vehicle.RECOMMENDED LUBRICANTS

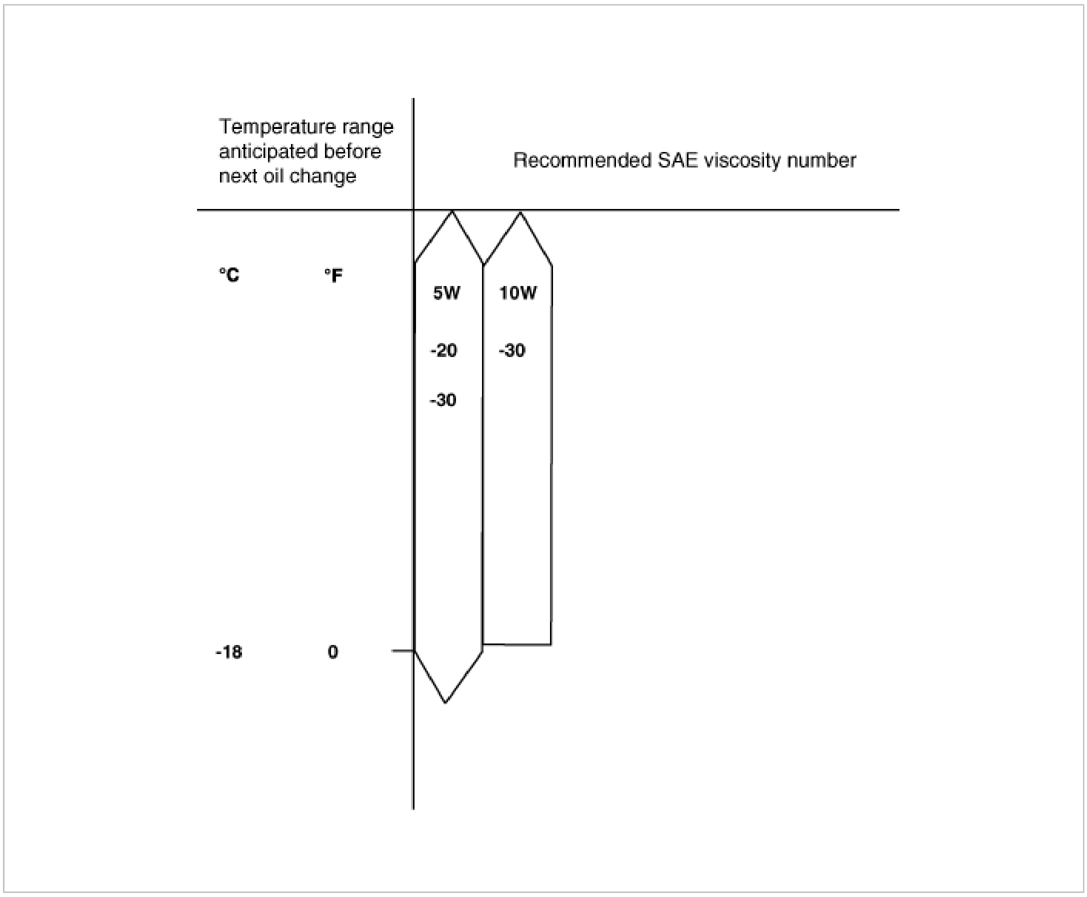
LUBRICANTS CAPACITIES

Description		2.4 (G4KC)	3.3 (G6DB)
Engine oil	Oil pan	3.7 (3.90, 3.26)	5.5 (5.81, 4.84)
	Oil filter	0.3 (0.32, 0.26)	0.4 (0.42, 0.35)
	Drain and refill	4.0 (4.23, 3.52)	5.2 (5.49, 4.58)
	Total	4.0 (4.23, 3.52)	5.9 (6.23, 5.19)
Cooling system		7.8 (8.2, 6.8)	8.9 (9.40, 7.83)
Manual transaxle		2.15 (2.3, 1.86)	-
Automatic transaxle		7.8 (8.2, 6.8)	10.9 (11.51, 9.59)
Power steering		0.9 (0.95, 0.79) ~ 1.0 (1.05, 0.88)	0.9 (0.95, 0.79) ~ 1.0 (1.05, 0.88)

Capacities : [liter (U.S.q-s, Imp.qts)]

SELECTION OF ENGINE OIL : 2.4 Gasoline

Recommended API classification : SJ OR SL ABOVE
Recommended SAE viscosity grades :



NOTE

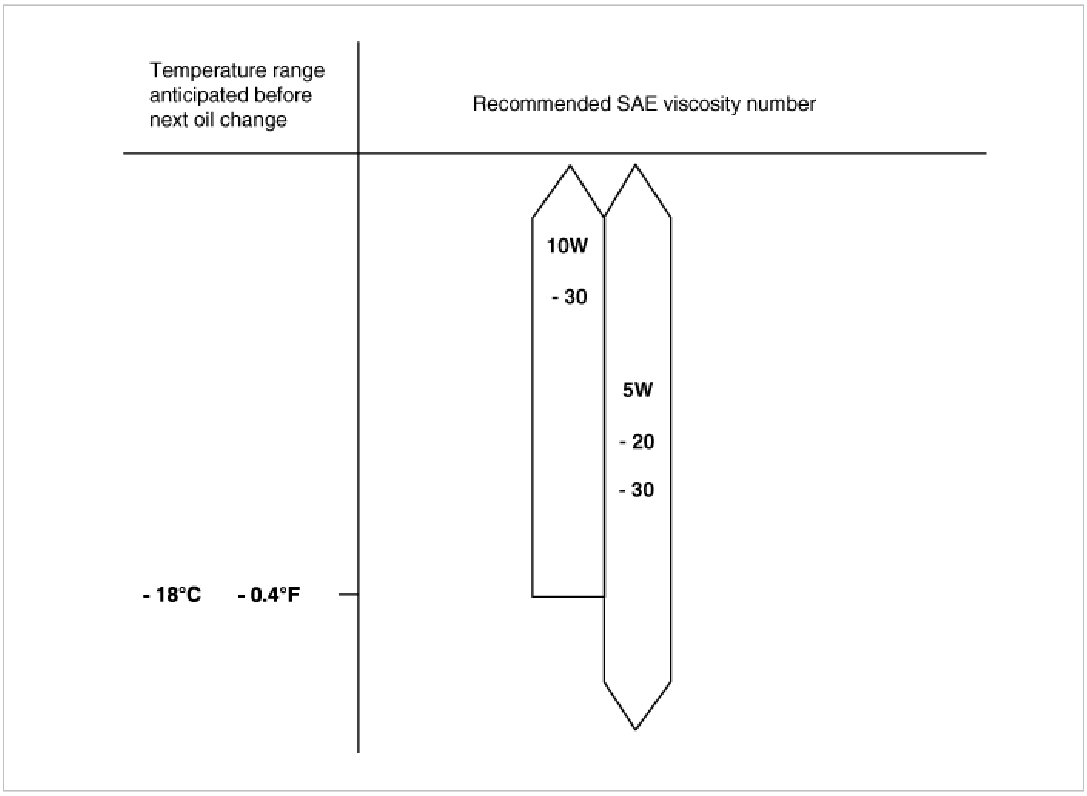
For best performance and maximum protection of all types of operation, select only those lubricants which :

1. Satisfy the requirements of the API classification.
2. Have the proper SAE grade number for expected ambient temperature range.

Lubricants which do not have both an SAE grade number and an API service classification on the container should not be used.

SELECTION OF ENGINE OIL : 3.3 Gasoline

Recommended API classification : SJ OR SL ABOVE
Recommended SAE viscosity grades :



NOTE

For best performance and maximum protection of all types of operation, select only those lubricants which :

1. Satisfy the requirements of the API classification.
2. Have the proper SAE grade number for expected ambient temperature range.

Lubricants which do not have both an SAE grade number and an API service classification on the container should not be used.

GENERAL SERVICE INFORMATION

PROTECTION OF THE VEHICLE

Always be sure to cover fenders, seats, and floor areas before starting work.

CAUTION

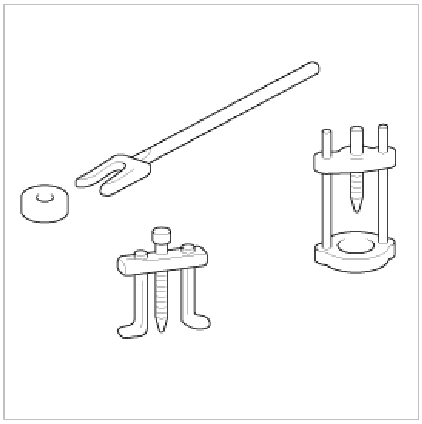
The support rod must be inserted into the hole near the edge of the hood whenever you inspect the engine compartment to prevent the hood from falling and causing possible injury.
Make sure that the support rod has been released prior to closing the hood. Always check to be sure the hood is firmly latched before driving the vehicle.

PREPARATION OF TOOLS AND MESURING EQUIPMENT

Be sure that all necessary tools and measuring equipment are available starting work.

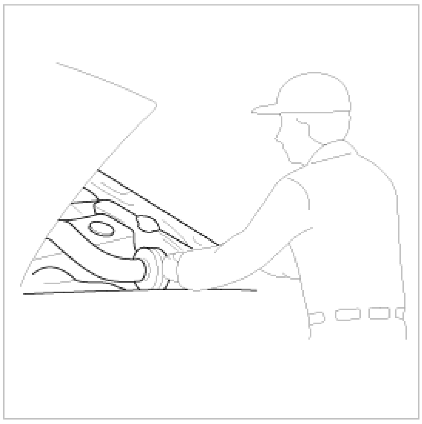
SPECIAL TOOLS

Use special tools when they are required.



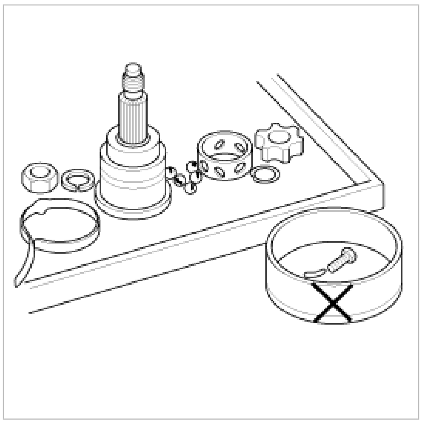
REMOVAL OF PARTS

First find the cause of the problem and then determine whether removal or disassembly is required before starting the job.



DISASSEMBLY

If the disassembly procedure is complex, requiring many parts to be disassembled, all parts should be disassembled in a way that will not affect their performance or external appearance.

1. **Inspection of parts**
   Each part, when removed, should be carefully inspected for malfunction, deformation, damage, and other problems.
   
2. **Arrangement of parts**
   All disassembled parts should be carefully arranged for effective reassembly.
   Be sure to separate and correctly identify the parts to be replaced from those that will be used again.
   
3. **Cleaning parts for reuse**
   All parts to be used again should be carefully and thoroughly cleaned by an appropriate method.

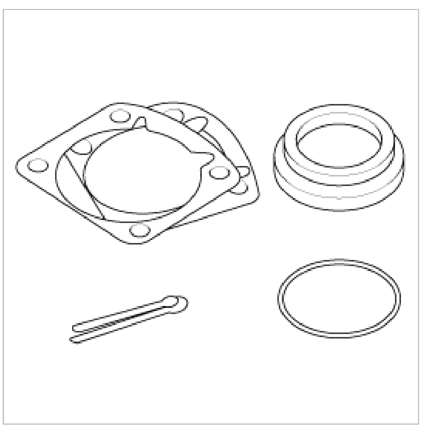
PARTS

When replacing parts, use HYUNDAI genuine parts.

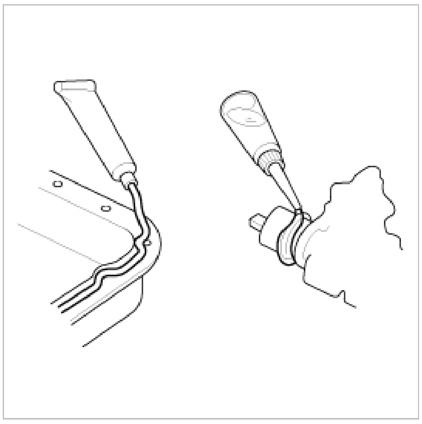
REPLACEMENT

Standard values, such as torques and certain adjustments, must be strictly observed in the reassembly of all parts.
If removed, the following parts should always be replaced with new ones.

1. Oil seals
2. Gaskets
3. O-rings
4. Lock washers
5. Cotter pins (split pins)
6. Plastic nuts

   Depending on their location.
7. Sealant should be applied to gaskets.
8. Oil should be applied to the moving components of parts.
9. Specified oil or grease should be applied to the prescribed locations (oil seals, etc) before assembly.

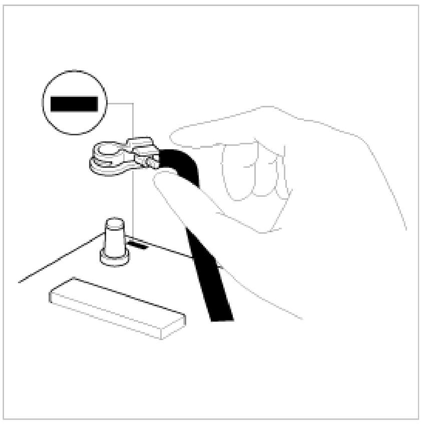


ADJUSTMENT

Use gauges and testers to correclty adjust the parts to standard values.

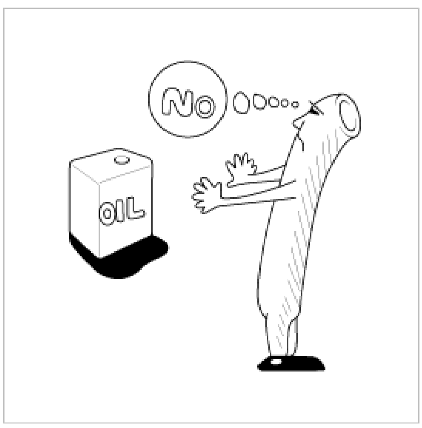
ELECTRICAL SYSTEM

1. Be sure to disconnect the battery cable from the negative (-) terminal of the battery.
2. Never pull on the wires when disconnecting connectors.
3. Locking connectors will click when the connector is secure.
4. Handle sensors and relays carefully. Be careful not to drop them against other parts.



RUBER PARTS AND TUBES

Always prevent gasoline or from touching rubber parts or tubing.

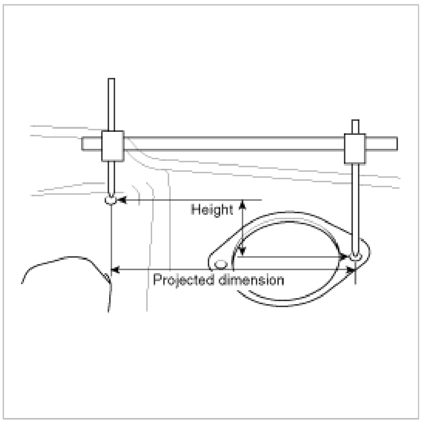


MEASURING BODY DIMENSIONS

1. Basically, all measurements in this manual are taken with a tracking gauge.
2. When a measuring tape is used, check to be sure there is no elongation, twisting or bending.
3. For measuring dimensions, both projected dimensions and actual - measurement dimensions are used in this manual.

DIMENSIONS PROJECTED

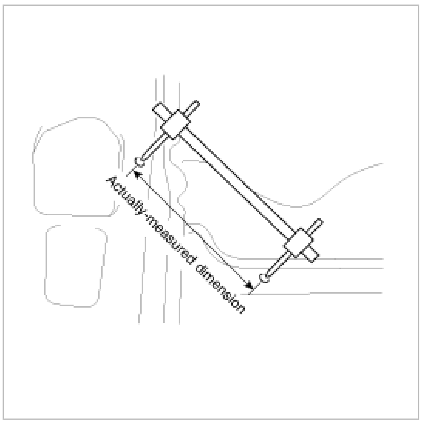
1. These are the dimensions measured when the measurement points are projected from the vehicle's surface, and are the reference dimensions used for used for body alterations.
2. If the length of the tracking gauge probes is adjustable, measure it by lengthening one of two probes as long as the different value in height of the two surfaces.



MEASURING ACTUAL DIMENSIONS

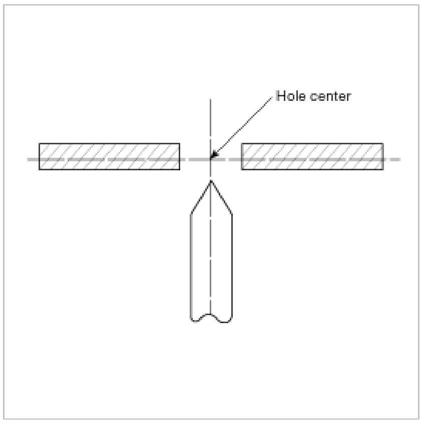
1. These dimensions indicate the actual linear distance between mesaurement points, and are used as the reference dimensions when a tracking gauge is used for measurement.
2. First adjust both probes to the same length (A=A') before measurement.

> NOTE
>
> Check the probes and gauge itself to make sure there is no free play.



MEASUREMENT POINT

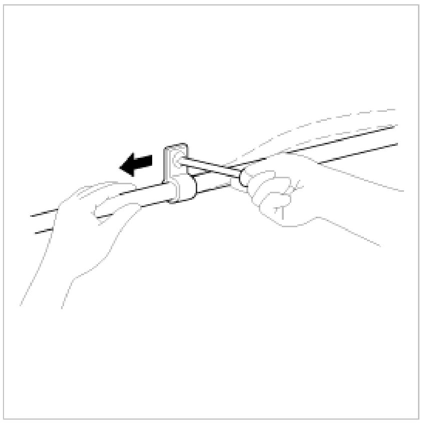
Measurements should be taken at the center of the hole.



CHECKING CABLES AND WIRES

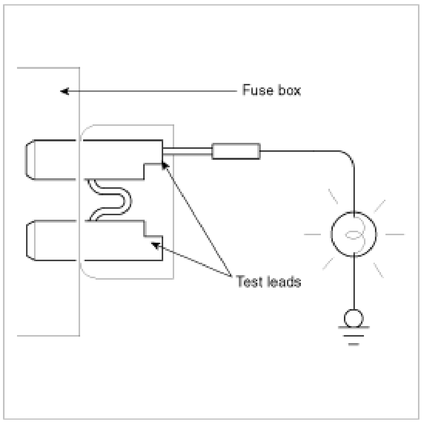
1. Check the terminal for tightness.
2. Check terminals and wires for corrosion from battery electrolyte, etc.
3. Check terminals and wires for open circuits.
4. Check wire insulation and coating for damage, cracks and degrading.
5. Check the conductive parts of terminals for contact with other metallic parts (vehicle body and other parts).
6. Check grounded parts to verify that there is complete continuity between thier attaching bolt(s) and the vehicle's body.
7. Check for incorrect wiring.
8. Check that the wiring is so clamped to prevent contact with sharp corners of the vehicle body, etc. or hot parts (exhaust manifold, etc.)

9. Check that the wiring is clamped firmy to provide enough clearance from the fan pulley, fan belt and other rotating or moving parts.
10. Check that the wiring has a little space so that it can vibrate between fixed and moving parts such as the vehicle body and the engine.



CHECK FUSES

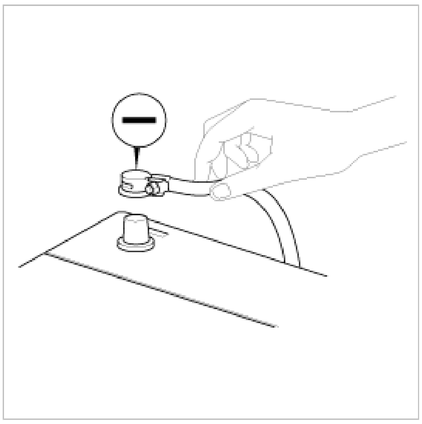
A blade type fuse test taps provided to allow checking the fuse itself without removing if from the fuse box. The fuse is good if the test lamp lights up when one lead is connected to the test taps (one at a time) and the other lead is grounded. (Turn the ignition switch so that the fuse circuit becomes operative)



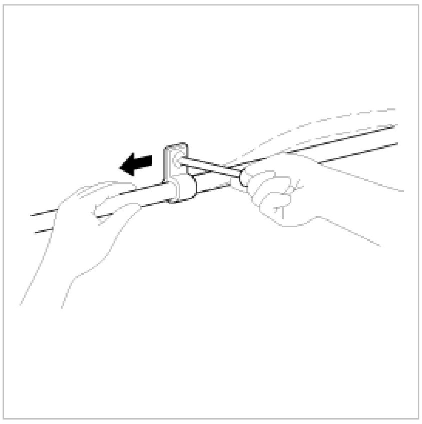
SERVICING THE ELECTRICAL SYSTEM

1. Prior to servicing the electrical system, be sure to turn off the ignition switch and disconnect the battery ground cable.

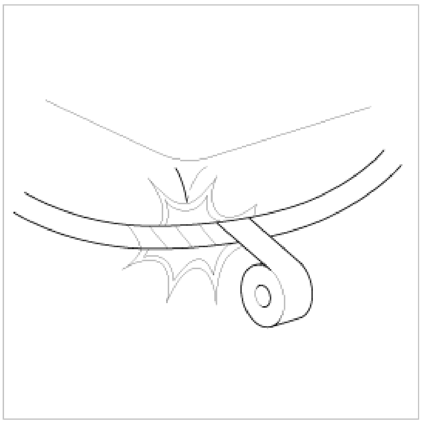
> NOTE
>
> In the course of MFI or ELC system diagnosis, when the battery cable is removed, any diagnostic trouble code retained bythe computer will be cleared. There fore, if necessary, read the diagnostic procedure before removing the battery cable.



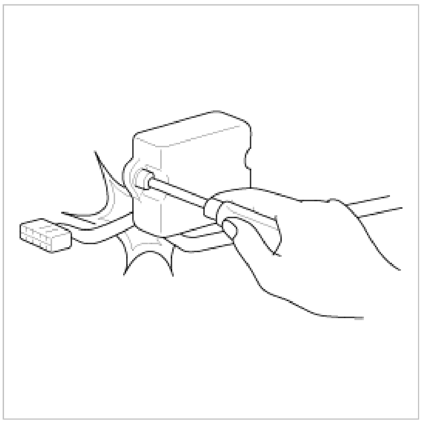
2. Attach the wiring harnesses with clamps so that there is no slack. However, for any harness which passes through the engine or other vibrating parts of the vehicle, allow some slack within a range that does not allow the engine vibrations to cause the harness to come into contact with any of the surrounding parts and then secure the harness by using a clamp.



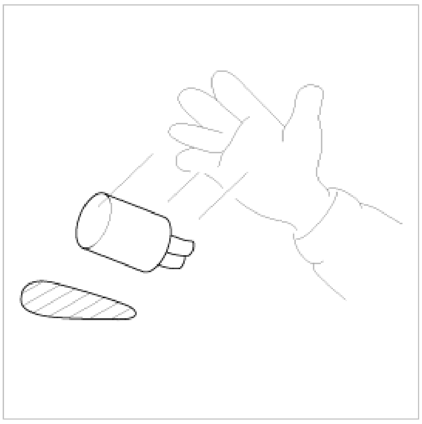
3. If any section of a wiring harness interferes with the edge of a parts, or a corner, wrap the section of the harness with tape or something similar in order to protect it from damage.



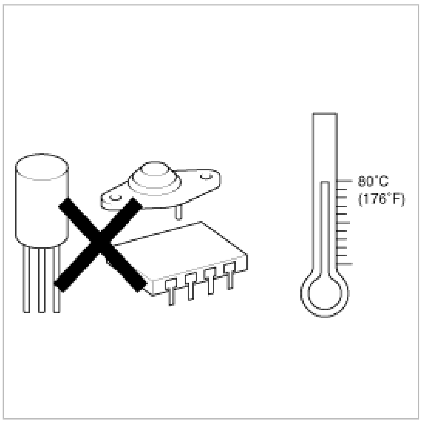
4. When installing any parts, be careful not to pinch or damage any of the wiring harness.



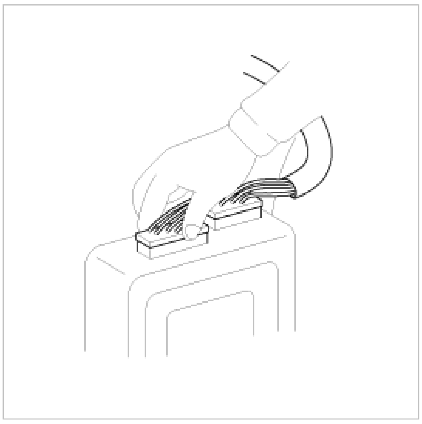
5. Never throw relays, sensors or electrical parts, or expose them to strong shock.



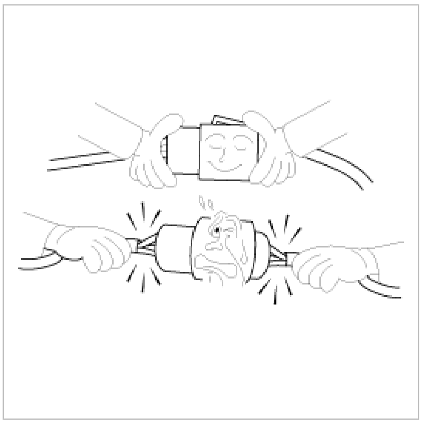
6. The electronic parts used in the computer, relays, etc. are readily damaged by heat. If there is a need for service operations that may cause the temperature to exceed 80°C (176°F), remove the electronic parts before hand.



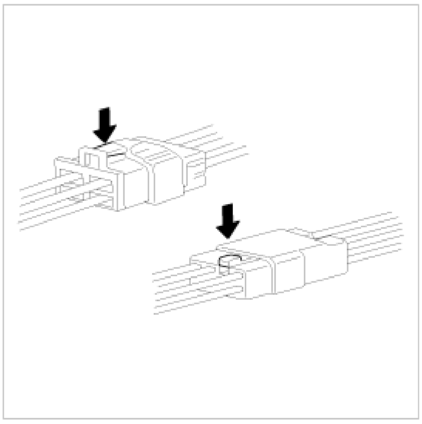
7. Loose connectors cause problems. Make sure that the connectors are always securely fastened.



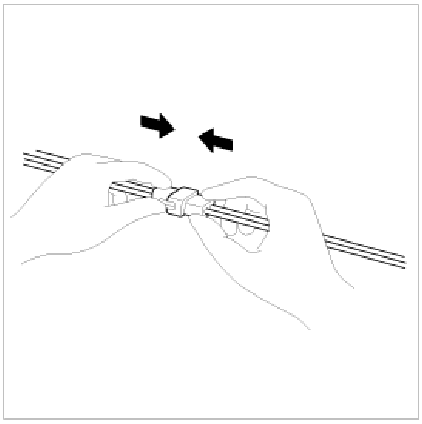
8. When disconnecting a connector, be sure to grip only the connector, not the wires.



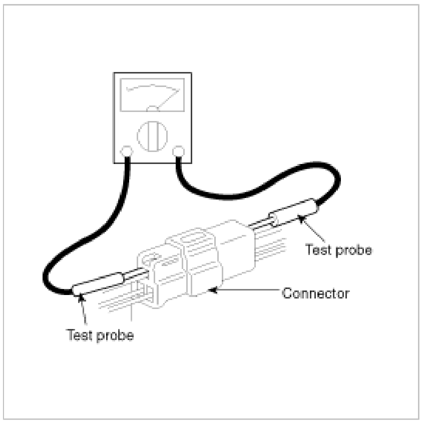
9. Disconnect connectors which have catches by pressing in the direction of the arrows shown the illustration.



10. Connect connectors which have catches by inserting the connectors until they make a clicking sound.



11. When using a circuit tester to check continuity or voltage on connector terminals, insert the test probe into the harness side. If the connector is a sealed connector, insert the test probe through the hole in the rubber cap until it contacts the terminal, being careful not to damage the insulation of the wires.



12. To avoid overloading the wiring, take the electrical current load of the optional equipment into consideration, and determine the appropartate wire size.

Nominal size	SAE gauge No.	Permissible current	
		In engine compartment	Other areas
0.3mm²	AWG 22	-	5A
0.5mm²	AWG 20	7A	13A
0.85mm²	AWG 18	9A	17A
1.25mm²	AWG 16	12A	22A
2.0mm²	AWG 14	16A	30A
3.0mm²	AWG 12	21A	40A
5.0mm²	AWG 10	31A	54A

PRECAUTIONS FOR CATALYTIC CONVERTER

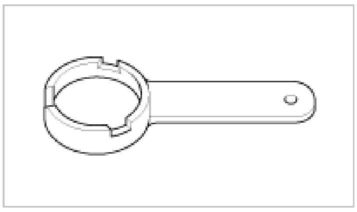
CAUTION

If a large amount of unburned gasoline flow into the converter, it may overheat and create a fire hazard. To prevent this observe the following precautions and explain them to your customer.

1. Use only unleaded gasoline.
2. Do not run the engine while the car is at rest for a long time. Avoid running the engine at fast idle for more than 10minutes and idle speed for more than 20 minutes.
3. Avoid start-jump tests. Do start-jumps only when absolutely necessary. Perform this test as rapidly as possible and, while testing, never race the engine.
4. Do not measure engine compression for an extended time. Engine compression tests must be made as rapidly as possible.
5. Avoid coasting with the ignition turned on and during prolonged braking.
6. Do not dispose of used catalytic converter together with parts contaminated with gasoline or oil.

Heating,Ventilation, Air Conditioning > General Information > Special Service Tools

SPECIAL TOOLS

Tool (Number and name)	Illustration	Use
09977-29000 Disc & hub assembly bolt remover		Removal and installation of the disc & hub assembly bolt

Heating,Ventilation, Air Conditioning > General Information > Troubleshooting

TROUBLESHOOTING

SYMPTOMS TABLE

Before replacing or repairing air conditioning components, first determine if the malfunction is due to the refrigerant charge, air flow or compressor.
Use the table below to help you find the cause of the problem. The numbers indicate the priority of the likely cause of the problem. Check each part in order. If necessary, replace these parts.
After correcting the malfunction, check the complete system to ensure that performance is satisfactory.
STANDARD :

Symptom	Suspect Area	See page
No blower operation	1. Blower fuse	-
	2. Blower relay	HA - 56
	3. Blower motor	HA - 54
	4. Power mosfet / Resistor	HA - 58, 60
	5. Blower speed control switch	HA - 65, 70
	6. Wire harness	-
No air temperature control	1. Engine coolant capacity	-
	2. Heater & A/C controller	HA - 65, 70
No compressor operation	1. Refrigerant capacity	HA - 3
	2. A/C fuse	-
	3. Magnetic clutch	HA - 18
	4. Compressor	HA - 15
	5. APT (A/C pressure transducer)	HA - 23
	6. A/C switch	-
	7. Evaporator temperature sensor	HA - 27
	8. Wire harness	-
No cool air comes out	1. Refrigerant capacity	HA - 3
	2. Refrigerant pressure	-
	3. Drive belt	-
	4. Magnetic clutch	HA - 18
	5. Compressor	HA - 15
	6. APT (A/C pressure transducer)	HA - 23
	7. Evaporator temperature sensor	HA - 27
	8. A/C switch	-

	9. Heater & A/C controller	HA - 65, 70
	10. Wire harness	-
Insufficient cooling	1. Refrigerant capacity	HA - 3
	2. Drive belt	-
	3. Magnetic clutch	HA - 18
	4. Compressor	HA - 15
	5. Condenser	HA - 20
	6. Expansion valve	HA - 45
	7. Evaporator	HA - 44
	8. Refrigerant lines	HA - 25
	9. APT (A/C pressure transducer)	HA - 23
	10. Heater & A/C controller	HA - 65, 70
No engine idle-up when A/C switch ON	1. Engine ECU	-
	2. Wire harness	-
No air inlet control	1. Heater & A/C controller	HA - 65, 70
No mode control	1. Heater & A/C controller	HA - 65, 70
	2. Mode actuator	HA - 49
No cooling fan operation	1. Cooling fan fuse	-
	2. Fan motor	-
	3. Engine ECU	-
	4. Wire harness	-

Heating,Ventilation, Air Conditioning > General Information > Specifications

SPECIFICATION

AIR CONDITIONER

Item		Specification
Compressor	Type	VS 18 (Variable capacity)
	Oil type & Capacity	FD 46 XG(PAG) 150±10cc
	Pulley type	6PK
	Displacement	180cc/rev
Condenser	Heat rejection	14,000 ±5% kcal/hr
APT (A/C pressure transducer)	The method to measure the pressure	Voltage = 0.00878835 * Pressure (psig) + 0.5
Expansion valve	Type	Block
Refrigerant	Type	R-134a
	Capacity [oz.(g)]	19.4 ± 0.88 (550 ± 25)

BLOWER UNIT

Item		Specification
Intake	Operating method	Actuator
Blower	Type	Sirocco
	Speed step	Auto + 8 speed (Automatic), 4 speed (Manual)
	Speed control	Power mosfet (Automatic), Resistor (Manual)
Air filter	Type	Particle filter

HEATER AND EVAPORATOR UNIT

Item		Specification
Heater	Type	Pin & Tube type
	Heating capacity	4,600 - 5% kcal/hr
	Mode operating method	Actuator
	Temperature operating method	Actuator
Evaporator	Temperature control type	Evaporator temperature sensor
	A/C ON/OFF [°C(°F)]	ON : 2.5 ± 0.5(35.8 ± 0.9), OFF: 0.6 ± 0.5(33.0 ± 0.9)

Heating,Ventilation, Air Conditioning > Air conditioning System > General Information

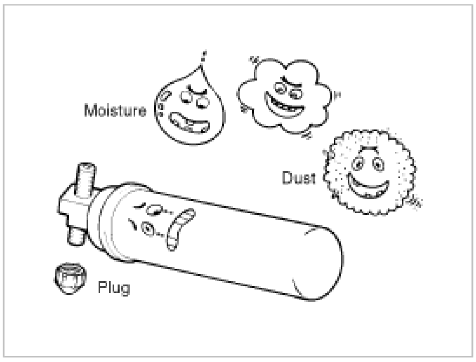
INSTRUCTIONS

WHEN HANDLING REFRIGERANT

1. R-134a liquid refrigerant is highly volatile. A drop on the skin of your hand could result in localized frostbite. When handling the refrigerant, be sure to wear gloves.
2. It is standard practice to wear goggles or glasses to protect your eyes, and gloves to protect your hands. If the refrigerant splashes into your eyes, wash them with clean water immediately.
3. The R-134a container is highly pressurized. Never leave it in a hot place, and check that the storage temperature is below 52°C (126°F)
4. An electronic leak detector should be used to check the system for refrigerant leakage. Bear in mind that the R-134a, upon coming into contact with flame, produces phosgene, a highly toxic gas.
5. Use only recommended the lubricant for R-134a systems. If lubricants other than the recommended one used, system failure may occur.
6. PAG lubricant absorbs moisture from the atmosphere at a rapid rate, therefore the following precautions must be observed:
   A. When removing refrigerant components from a vehicle, cap immediately the components to prevent from the entry of moisture.
   B. When installing refrigerant components to a vehicle, do not remove the cap until just before connecting the components.
   C. Complete the connection of all refrigerant tubes and hoses without delay to prevent the A/C system from taking on moisture.
   D. Use the recommended lubricant from a sealed container only.
7. If an accidental discharge in the system occurs, ventilate the work area before resuming service.

WHEN REPLACING PARTS ON A/C SYSTEM

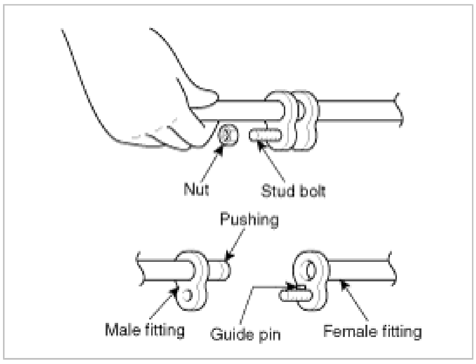
1. Never open or loosen a connection before discharging the system.
2. Seal the open fittings of components with a cap or plug immediately to prevent intrusion of moisture or dust.
3. Do not remove the sealing caps from a replacement component until it is ready to be installed.
4. Before connecting an open fitting, always install a new sealing ring. Coat the fitting and seal with refrigerant oil before making the connection.



WHEN INSTALLING CONNECTING PARTS

FLANGE WITH GUIDE PIN

Check the new O-ring for damage and lubricate it using compressor oil. Tighten the nut to specified torque.



Size	Tightening torque (N.m (kg.m, lb-ft))	
	General bolt, nut	
	4T	7T
M6	5~6 (0.5~0.6, 3.6~4.3)	9~11 (0.9~1.1, 6.5~7.9)
M8	12~14 (1.2~1.4, 8.7~10)	20~26 (2.0~2.6, 14~18)
M10	25~28 (2.5~2.8, 18~20)	45~55 (4.5~5.5, 32~39)
Size	Flange bolt, nut	
	4T	7T
M6	5~7 (0.5~0.7, 3.6~5.0)	8~12 (0.8~1.2, 5.8~8.6)
M8	10~15 (1.0~1.5, 7~10)	19~28 (1.9~2.8, 14~20)
M10	21~31 (2.1~3.1, 15~22)	39~60 (3.9~6.0, 28~43)

NOTE

T means tensile intensity, which is stamped on the head of bolt only numeral.

HANDLING TUBING AND FITTINGS

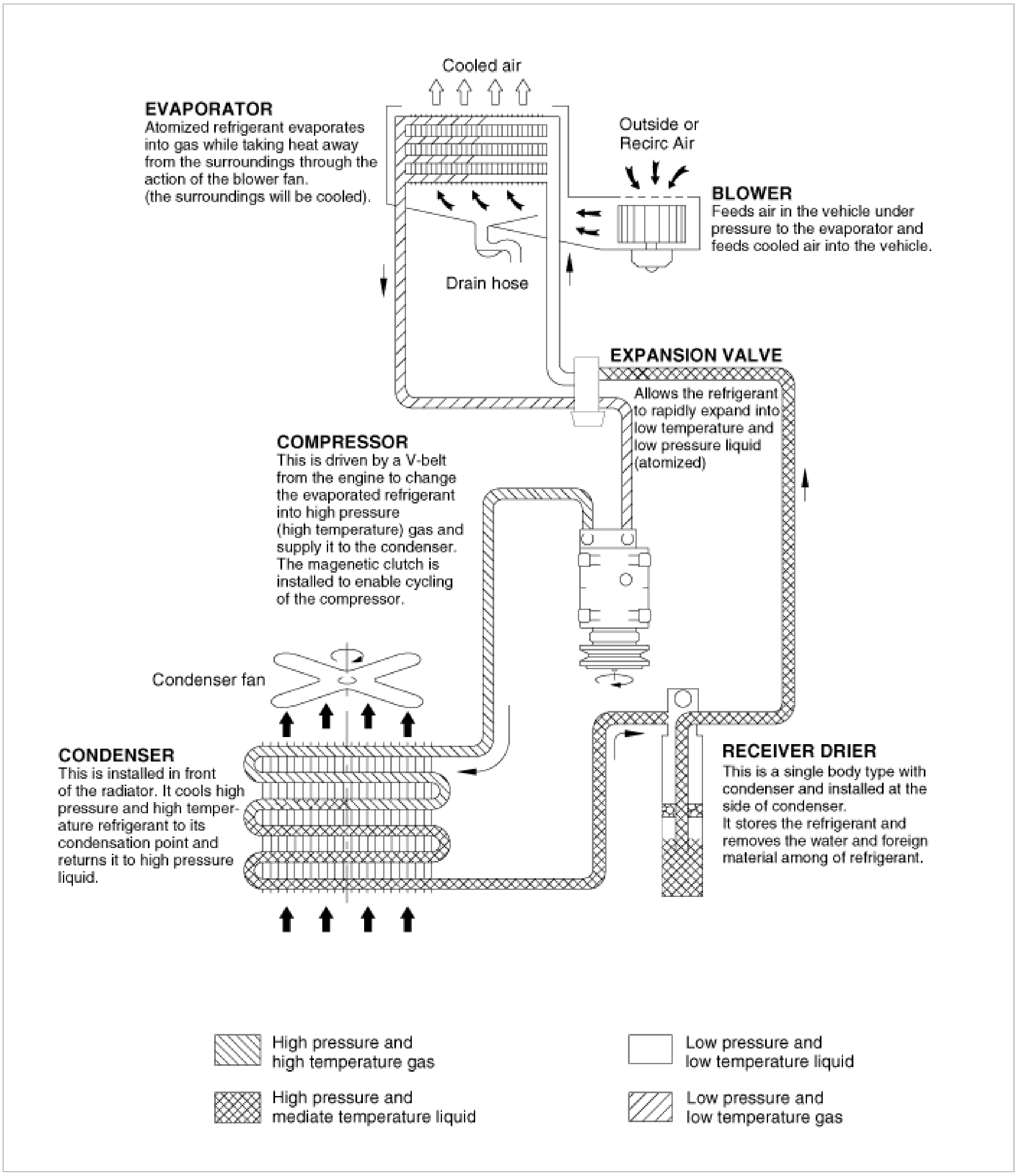
The internal parts of the refrigeration system will remain in a state of chemical stability as long as pure moisture-free refrigerant and refrigerant oil are used. Abnormal amounts of dirt, moisture or air can upset the chemical stability and cause problems or serious damage.

THE FOLLOWING PRECAUTIONS MUST BE OBSERVED

1. When it is necessary to open the refrigeration system, have everything you will need to service the system ready so the system will not be left open any longer than necessary.
2. Cap or plug all lines and fittings as soon as they are opened to prevent the entrance of dirt and moisture.
3. All lines and components in parts stock should be capped or sealed until they are ready to be used.
4. Never attempt to rebind formed lines to fit. Use the correct line for the installation you are servicing.
5. All tools, including the refrigerant dispensing manifold, the gauge set manifold and test hoses, should be kept clean and dry.

Heating,Ventilation, Air Conditioning > Air conditioning System > Description and Operation

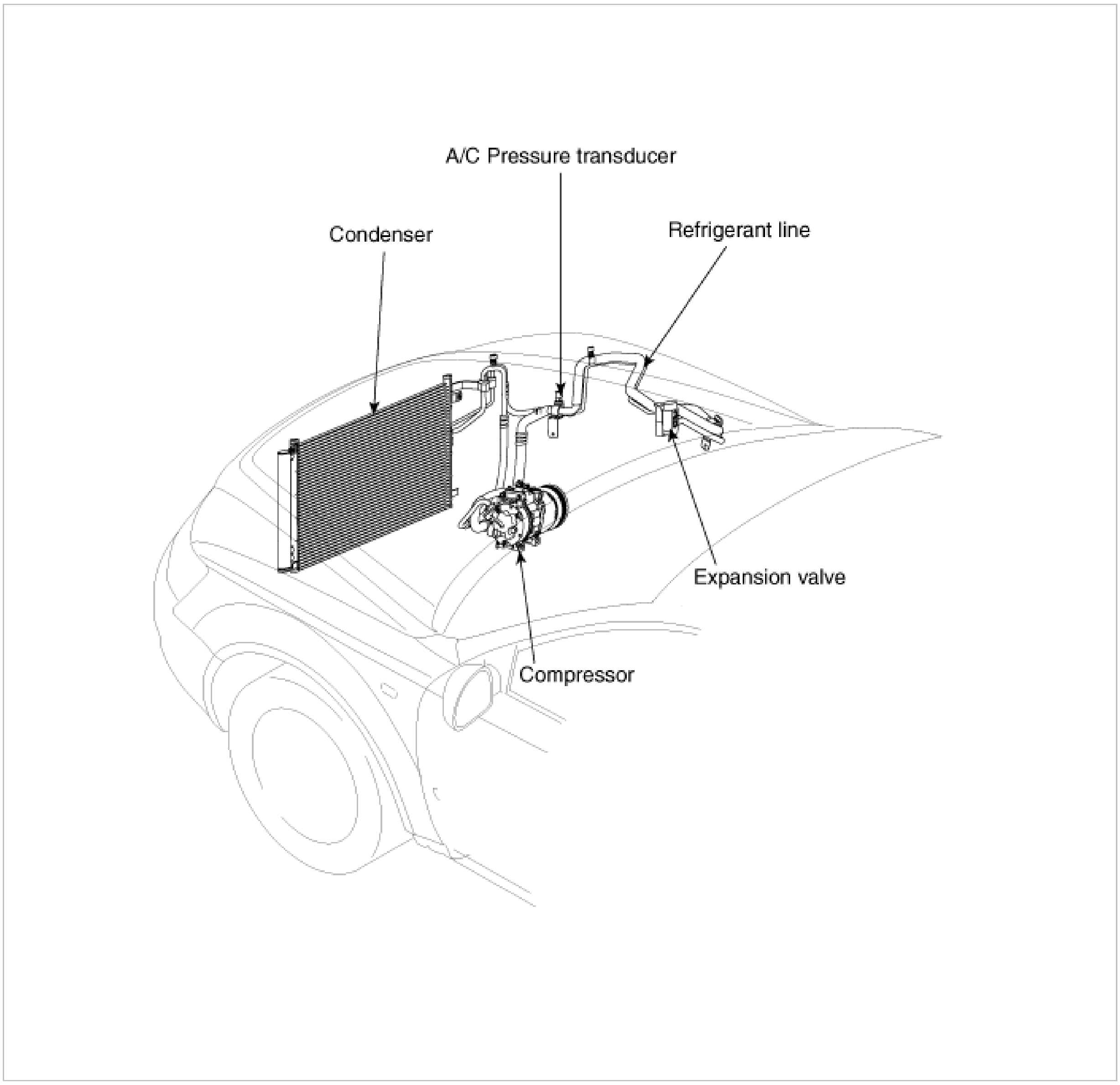
REFRIGERATION CYCLE



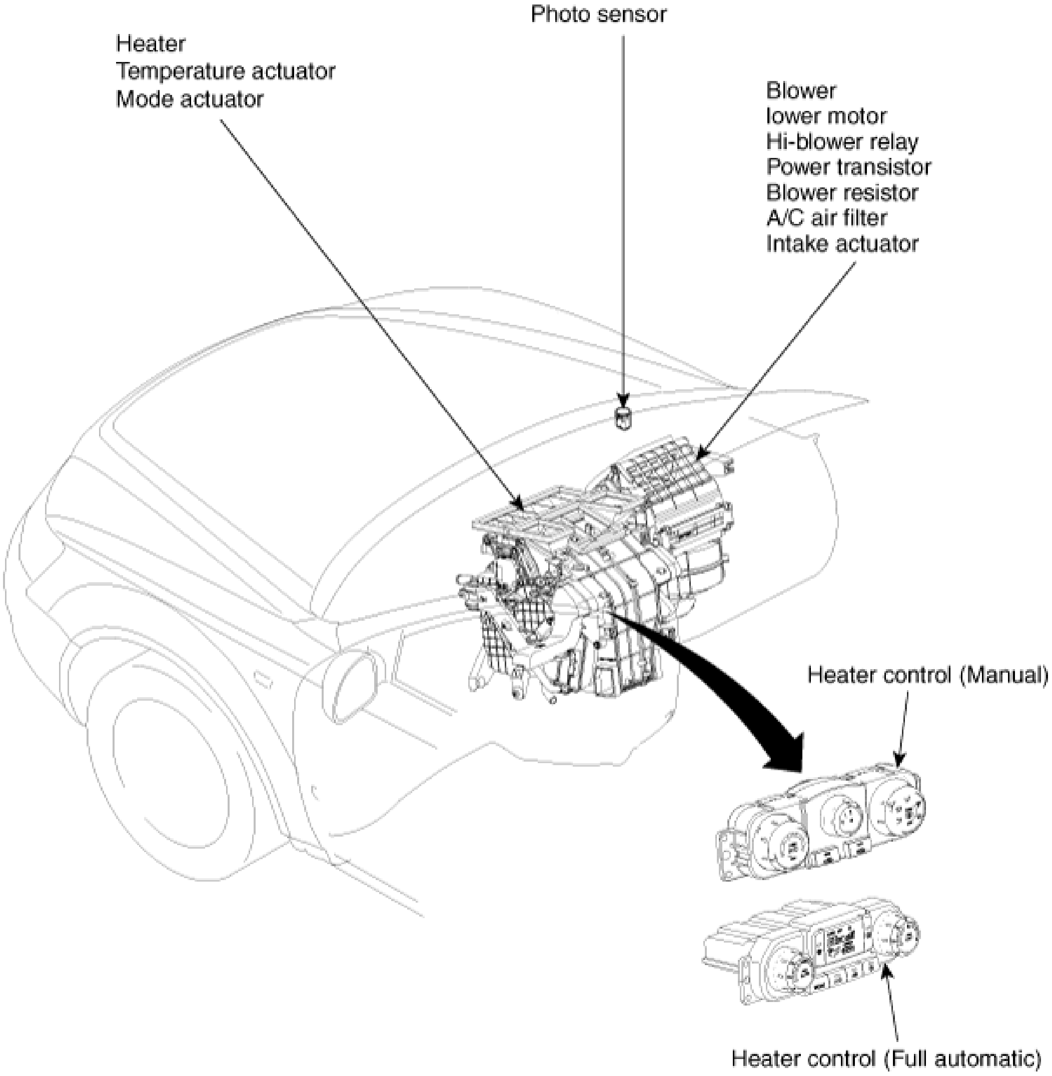
Heating,Ventilation, Air Conditioning > Air conditioning System > Components and Components Location

COMPONENT LOCATION INDEX

ENGINE ROOM


A/C Pressure transducer
Condenser
Refrigerant line
Expansion valve
Compressor

INTERIOR



Heating,Ventilation, Air Conditioning > Air conditioning System > Repair procedures

REFRIGERANT SYSTEM SERVICE BASICS

REFRIGERANT RECOVERY

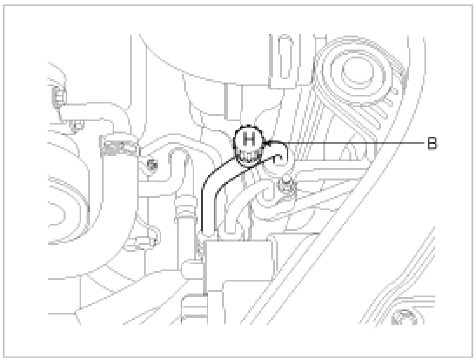
Use only service equipment that is U.L-listed and is certified to meet the requirements of SAE J2210 to remove HFC-134a(R-134a) from the air conditioning system.

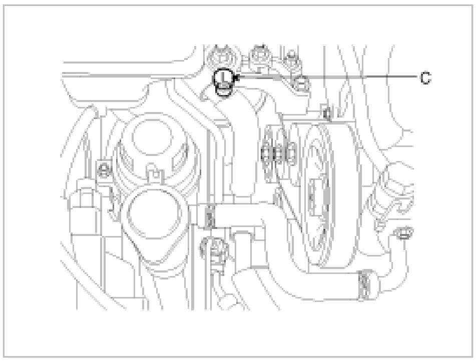
CAUTION

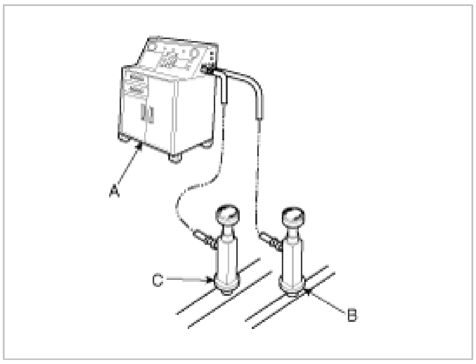
- Air conditioning refrigerant or lubricant vapor can irritate your eyes, nose, or throat.
- Be careful when connecting service equipment.
- Do not breathe refrigerant or vapor.

If accidental system discharge occurs, ventilate work area before resuming service.
Additional health and safety information may be obtained from the refrigerant and lubricant manufacturers.

1. Connect an R-134a refrigerant.
   Recovery/Recycling/Charging System (A) to the high-pressure service port (B) and the low-pressure service port (C) as shown, following the equipment manufacturer's instructions.







2. Measure the amount of refrigerant oil removed from the A/C system after the recovery process is completed. Be sure to install the same amount of new refrigerant oil back into the A/C system before charging.

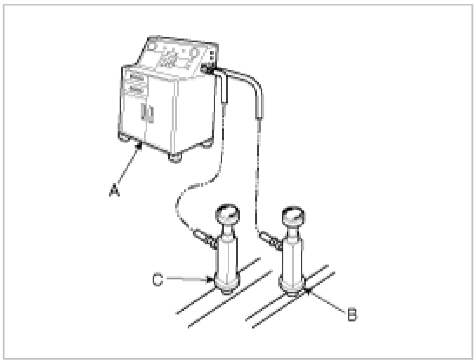
SYSTEM EVACUATION

Use only service equipment that is U.L-listed and is certified to meet the requirements of SAE J2210 to remove HFC-134a(R-134a) from the air conditioning system.

> **CAUTION**
>
> - Air conditioning refrigerant or lubricant vapor can irritate your eyes, nose, or throat.
> - Be careful when connecting service equipment.
> - Do not breathe refrigerant or vapor.

If accidental system discharge occurs, ventilate work area before resuming service.
Additional health and safety information may be obtained from the refrigerant and lubricant manufacturers.

1. When an A/C System has been opened to the atmosphere, such as during installation or repair, it must be evacuated using an R-134a refrigerant Recovery/Recycling/Charging System. (If the system has been open for several days, the receiver/dryer should be replaced, and the system should be evacuated for several hours.)
2. Connect an R-134a refrigerant.
   Recovery/Recycling/Charging System (A) to the high-pressure service port (B) and the low-pressure service port (C) as shown, following the equipment manufacturer's instructions.



3. If the low-pressure does not reach more than 93.3 kPa (700 mmHg, 27.6 in.Hg) in 10 minutes, there is probably a leak in the system. Partially charge the system, and check for leaks (Refer to Leak Test.).
4. Remove the low pressure valve from the low-pressure service port.

SYSTEM CHARGING

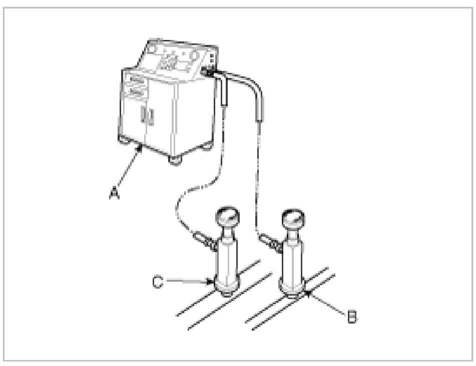
Use only service equipment that is U.L-listed and is certified to meet the requirements of SAE J2210 to remove HFC-134a(R-134a) from the air conditioning system.

CAUTION

- Air conditioning refrigerant or lubricant vapor can irritate your eyes, nose, or throat.
- Be careful when connecting service equipment.
- Do not breathe refrigerant or vapor.

If accidental system discharge occurs, ventilate work area before resuming service.
Additional health and safety information may be obtained from the refrigerant and lubricant manufacturers.

1. Connect an R-134a refrigerant.
   Recovery/Recycling/Charging System (A) to the high-pressure service port (B) as shown, following the equipment manufacturer's instructions.



2. Add the same amount of new refrigerant oil to system that was removed during recovery. Use only specified refrigerant oil. Charge the system with 19.4 ± 0.88 oz. (550 ± 25g) of R-134a refrigerant. Do not overcharge the system the compressor will be damaged.

REFRIGERANT LEAK TEST

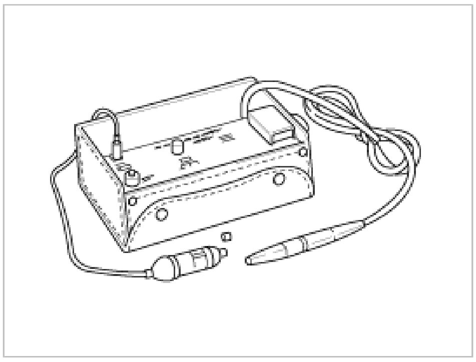
Always conduct a leak test with an electronic leak detector whenever leakage of refrigerant is suspected and when conducting service operations which are accompanied by disassembly or loosening or connection fittings.

NOTE

In order to use the leak detector properly, read the manual supplied by the manufacturer.

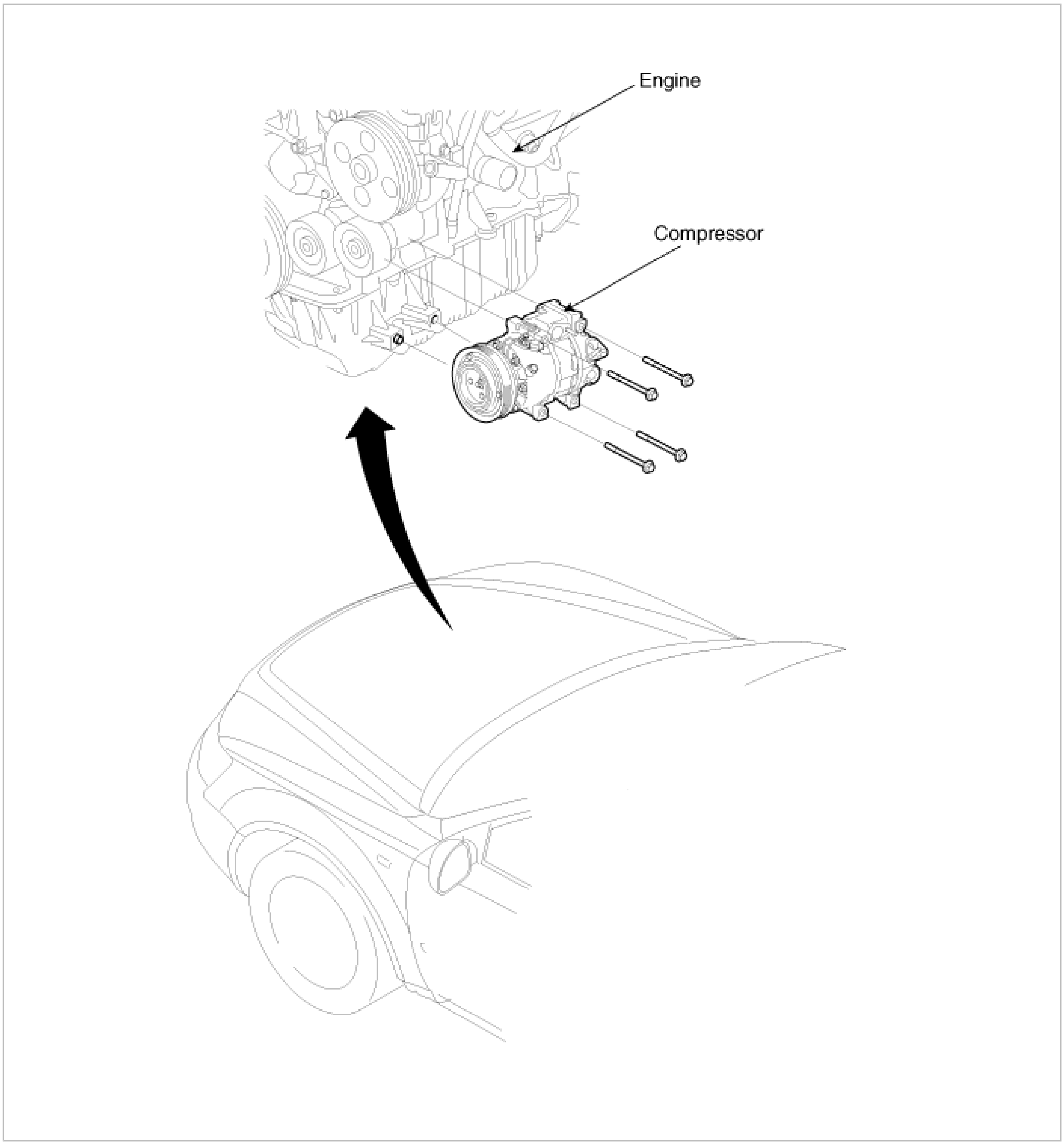
If a gas leak is detected, proceed as follows:

1. Check the torque on the connection fittings and, if too loose, tighten to the proper torque. Check for gas leakage with a leak detector.
2. If leakage continues even after the fitting has been tightened, discharge the refrigerant from the system, disconnect the fittings, and check their seating faces for damage. Always replace, even if the damage is slight.
3. Check the compressor oil and add oil if required.
4. Charge the system and recheck for gas leaks. If no leaks are found, evacuate and charge the system again.

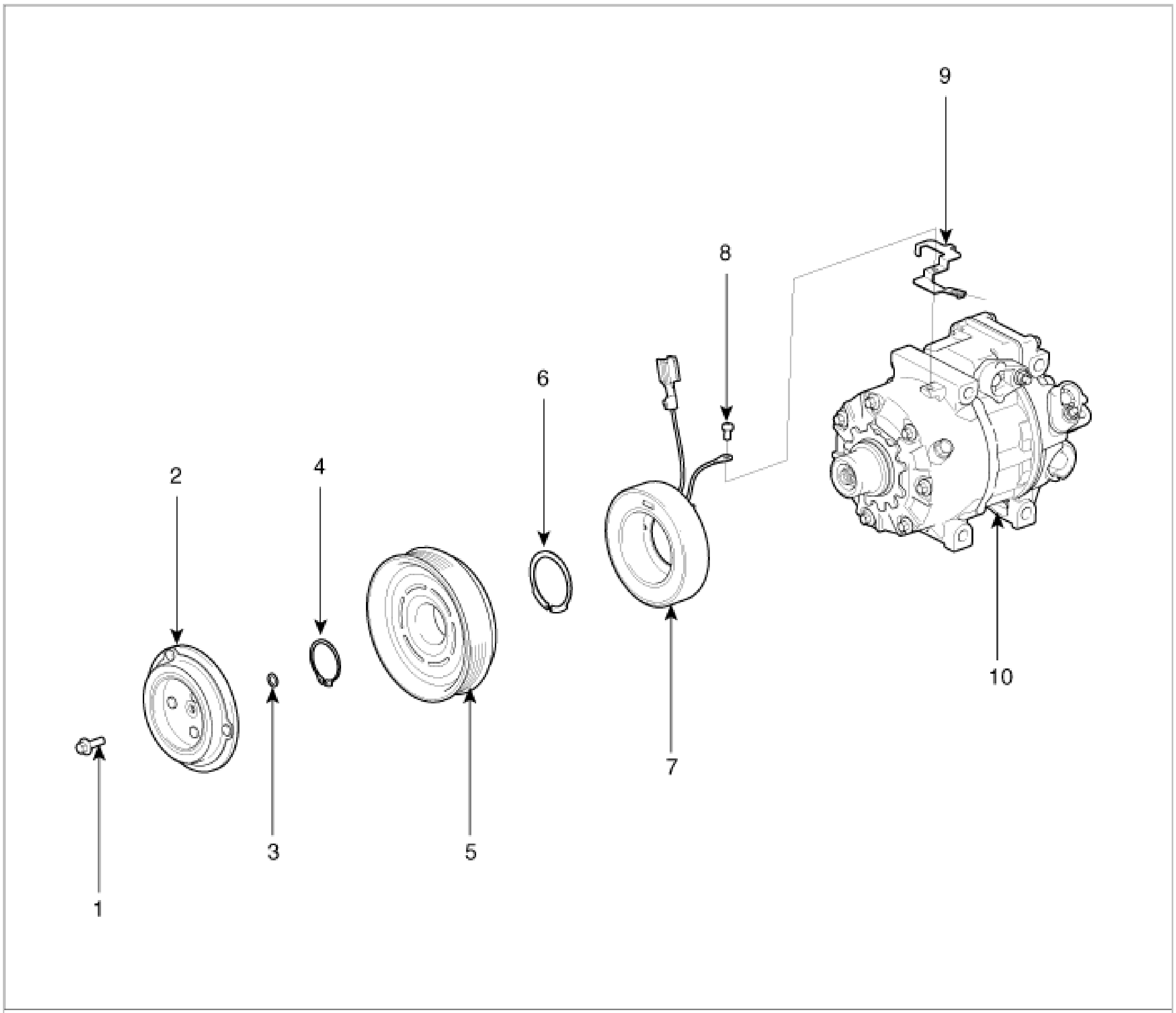


Heating,Ventilation, Air Conditioning > Air conditioning System > Compressor > Components and Components Location

COMPONENT LOCATION



COMPONENTS

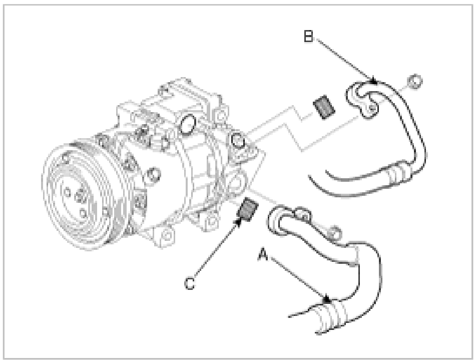


1. Bolt	6. Retainer ring
2. Disc & hub assembly	7. Field coil
3. Shim	8. Screw
4. Retainer ring	9. Connector bracket
5. Pulley	10. Compressor assembly

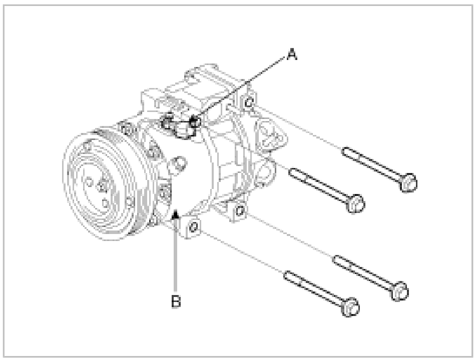
Heating,Ventilation, Air Conditioning > Air conditioning System > Compressor > Repair procedures

REMOVAL

1. If the compressor is marginally operable, run the engine at idle speed, and let the air conditioning work for a few minutes, then shut the engine off.
2. Disconnect the negative cable from the battery.
3. Recover the refrigerant with a recovery/charging station (Refer to page HA-9).
4. Loosen the drive belt (Refer to the EM-Timing).
5. Remove the bolts, then disconnect the suction line (A) and discharge line (B) from the compressor. Plug (C) or cap the lines immediately after disconnecting them to avoid moisture and dust contamination.



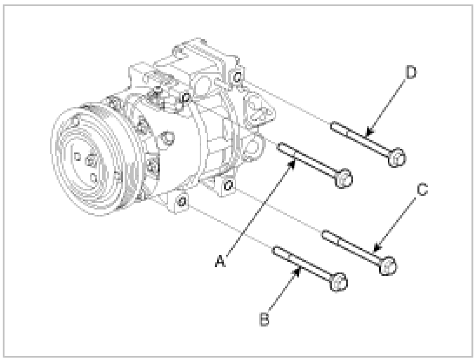
6. Disconnect the compressor clutch connector (A), then remove the mounting bolts and the compressor (B).



INSTALLATION

1. Make sure of the length of compressor mounting bolts, and then tighten it A→B→C→D order.

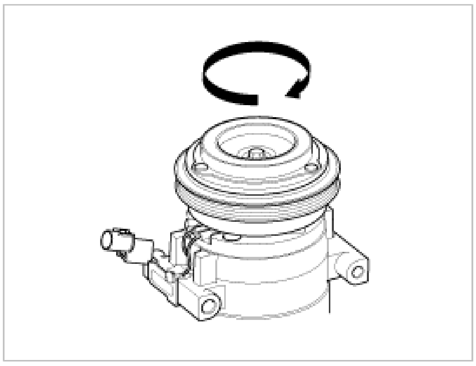
TORQUE : 20~33N.m (2.04 ~ 3.36 kgf.m, 14.7~24.3lb-ft)



2. Install in the reverse order of removal, and note these items.
   A. If you're installing a new compressor, drain all the refrigerant oil from the removed compressor, and measure its volume, Subtract the volume of drained oil from 150cc the result is the amount of oil you should drain from the new compressor (through the suction fitting).
   B. Replace the O-rings with new ones at each fitting, and apply a thin coat of refrigerant oil before installing them. Be sure to use the right O-rings for R-134a to avoid leakage.
   C. To avoid contamination, do not return the oil to the container once dispensed, and never mix it with other refrigerant oils.
   D. Immediately after using the oil, replace the cap on the container and seal it to avoid moisture absorption.
   E. Do not spill the refrigerant oil on the vehicle; it may damage the paint; if the refrigerant oil contacts the paint, wash it off immediately.
   F. Adjust the drive belt (Refer to the EM-Timing) Charge the system and test its performance.

INSPECTION

1. Check the plated parts of the disc & hub assembly for color changes, peeling or other damage. If there is damage, replace the clutch set.
2. Check the pulley bearing play and drag by rotating the pulley by hand. Replace the clutch set with a new one if it is noisy or has excessive play/drag.

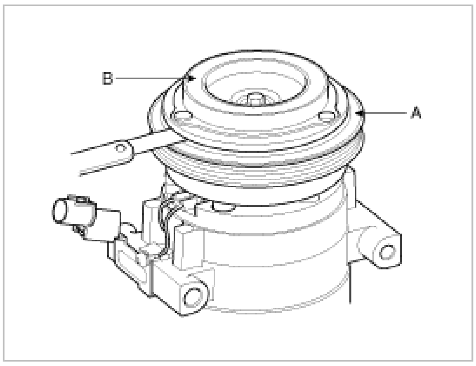


3. Measure the clearance between the pulley (A) and the disc & hub assembly (B) all the way around. If the clearance is not within specified limits, remove the disc & hub assembly (Refer to page HA-17) and add or remove shims as needed to increase or decrease clearance.

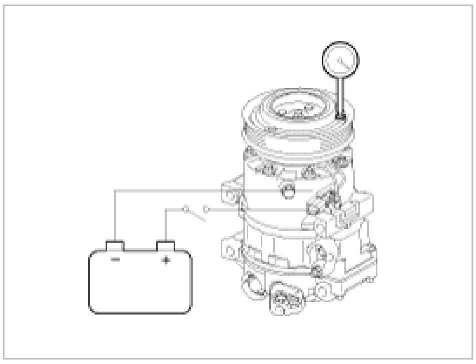
Clearance: 0.5 ± 0.15mm (0.020 ± 0.006 in.)

NOTE

The shims are available in eight thicknesses: 0.7mm, 0.8mm, 0.9mm, 1.0mm, 1.1mm, 1.2mm, 1.3mm and 1.4mm



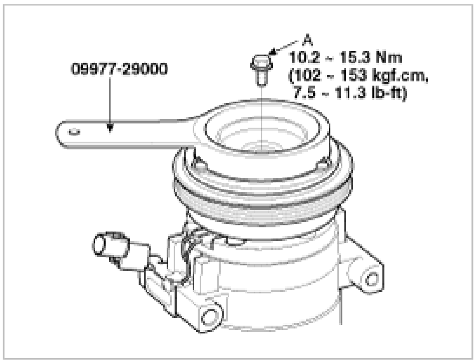
4. Check operation of the magnetic clutch.
Connect the compressor side terminals to the battery (+) terminal and the ground battery (-) terminal to the compressor body.
Check the magnetic clutch operating noise to determine the condition.



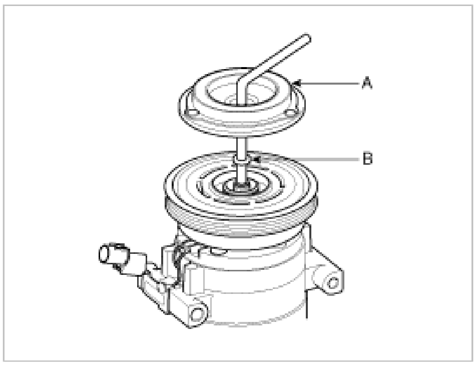
DISASSEMBLY

1. Remove the center bolt (A) while holding the disc & hub assembly with a commercially available disc & hub assembly bolt remover; Special tool number 09977-29000.

TORQUE : 10~15N.m (1.02~1.53 kgf.m, 7.5~11.3 lb-ft)

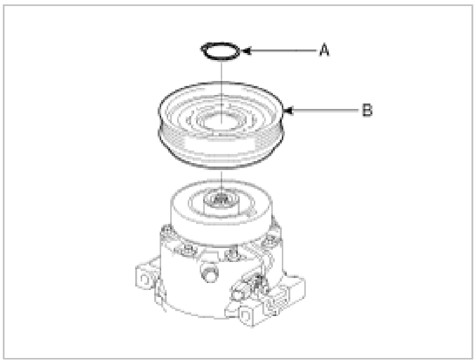


2. Remove the disc & hub assembly (A) and shim (B), taking care not to lose the shims. If the clutch needs adjustment, increase or decrease the number and thickness of shims as necessary, then reinstall the disc & hub assembly, and recheck its clearance (Refer to page HA-18).

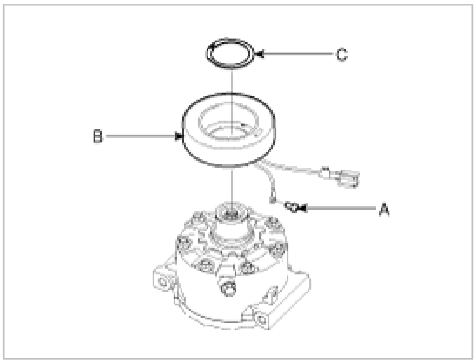


3. If you remove the field coil, remove retainer ring (A) with retainer ring pliers.

> **NOTE**
>
> - Be careful not to damage the pulley (B) and compressor during removal/installation.
> - Once retainer ring (A) is removed, replace it with a new one.



4. Remove the screw (A) from the field coil ground terminal and then remove the field coil (B) and retainer ring (C).



5. Reassemble the compressor clutch in the reverse order of disassembly, and note these items :
   A. Clean the pulley and compressor sliding surfaces with non-petroleum solvent.
   B. Install new retainer rings, and make sure they are fully seated in the groove.
   C. Make sure that the pulley turns smoothly after its reassembled.

Heating,Ventilation, Air Conditioning > Air conditioning System > Compressor oil > Repair procedures

OIL SPECIFICATION

- The HFC-134a system requires synthetic (PAG) compressor oil whereas the R-12 system requires mineral compressor oil. The two oils must never be mixed.
- Compressor (PAG) oil varies according to compressor model. Be sure to use oil specified for the model of compressor.

HANDLING OF OIL

- The oil should be free from moisture, dust, metal powder, etc.
- Do not mix with other oil.
- The water content in the oil increases when exposed to the air. After use, seal oil from air immediately. (HFC-134a Compressor Oil absorbs moisture very easily.)
- The compressor oil must be stored in steel containers, not in plastic containers.

COMPRESSOR OIL CHECK

The oil used to lubricate the compressor is circulating with the refrigerant.
Whenever replacing any component of the system or a large amount of gas leakage occurs, add oil to maintain the original amount of oil.

Oil total volume in system: PAG 150cc (5.07 fl.oz)

OIL RETURN OPERATION

There is close affinity between the oil and the refrigerant.
During normal operation, part of the oil recirculates with the refrigerant in the system. When checking the amount of oil in the system, or replacing any component of the system, the compressor must be run in advance for oil return operation. The procedure is as follows:

1. Open all the doors and the engine hood.
2. Start the engine and air conditioning switch to "ON" and set the blower motor control knob at its highest position.
3. Run the compressor for more than 20 minutes between 800 and 1,000 rpm in order to operate the system.
4. Stop the engine.

REPLACEMENT OF COMPONENT PARTS

When replacing the system component parts, supply the following amount of oil to the component parts to be installed.

Component parts to be installed	Amount of Oil
Evaporator	50 cc (1.70 fl.oz)
Condenser	30 cc (1.02 fl.oz)
Receiver/dryer	30 cc (1.02 fl.oz)
Refrigerant line(One piece)	10 cc (0.34 fl.oz)

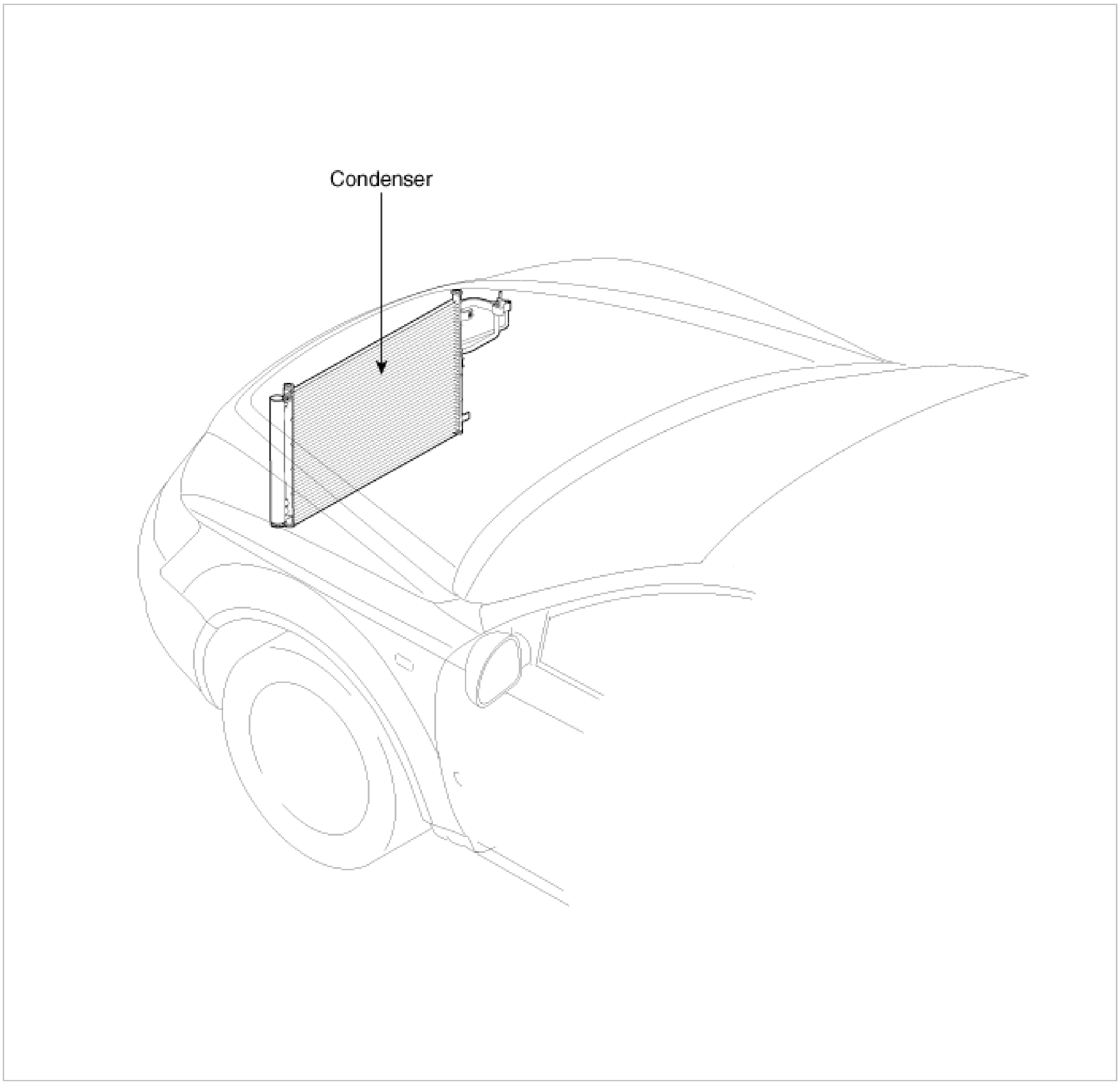
For compressor replacement, subtract the volume of oil drained from the removed compressor from the specified volume, and drain the calculated volume of oil from the new compressor:
The specified volume - volume of removed compressor = volume to drain from the new compressor.

NOTE

Even if no oil is drained from the removed compressor, don't drain more than 50cc from new compressor.

Heating,Ventilation, Air Conditioning > Air conditioning System > Condenser > Components and Components Location

COMPONENT LOCATION



Heating,Ventilation, Air Conditioning > Air conditioning System > Condenser > Repair procedures

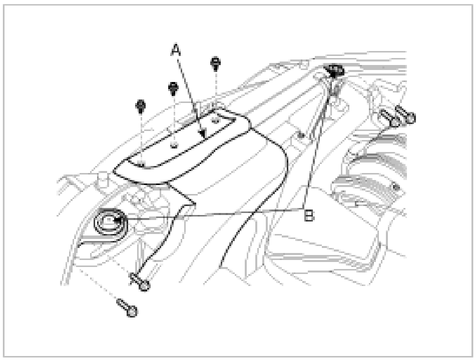
INSPECTION

1. Check the condenser fins for clogging and damage. If clogged, clean them with water, and blow them with compressed air. If bent, gently bend them using a screwdriver or pliers.
2. Check the condenser connections for leakage, and repair or replace it, if required.

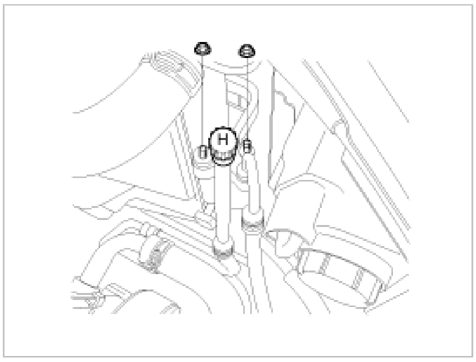
REPLACEMENT

CONDENSER

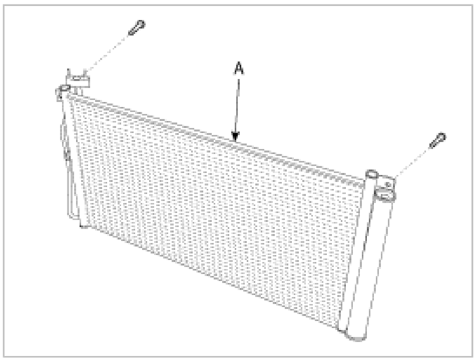
1. Recover the refrigerant with a recovery/ recycling/ charging station (Refer to page HA-9).
2. Disconnect the negative (-) battery terminal.
3. Remove the air duct (A) after loosening 3 fasteners.
4. Remove the radiator bracket (B) after loosening the bolts.



5. Remove the 2 nuts, then disconnect the discharge line and condenser line from the condenser.
   Plug or cap the lines immediately after disconnecting them to avoid moisture and dust contamination.



6. Remove the bolts, then remove the condenser (A) by lifting it up. Be careful not to damage the radiator and condenser fins when removing the condenser.



7. Install in the reverse order of removal, and note these items :
   A. If you're installing a new condenser, add refrigerant oil.
   B. Replace the O-rings with new ones at each fitting, and apply a thin coat of refrigerant oil before installing them. Be sure to use the right O-rings for R-134a to avoid leakage.
   C. Be careful not to damage the radiator and condenser fins when installing the condenser.
   D. Be sure to install the lower mount cushions of condenser securely into the holes.
   E. Charge the system, and test its performance. (Refer to HA-10)

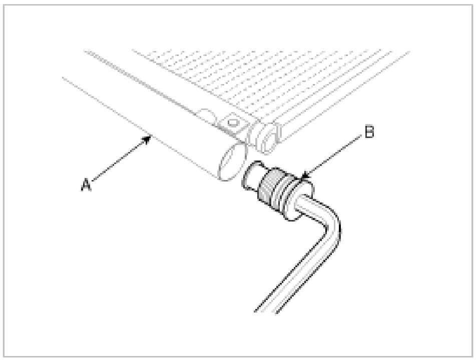
DESICCANT

1. Remove the condenser, and then remove the bottom cap (B) from the receiver/drier tank (A).

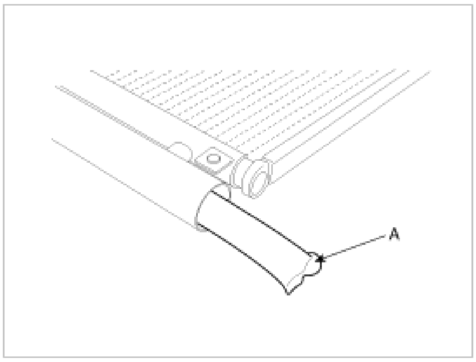
TORQUE : 20~25N.m (2.0~2.5kgf·m, 14.5~18.2lb-ft)

WARNING

Use of impact wrench may cause cracking on the receiver/drier tank connecting pipe to the condenser.



2. Remove the desiccant (A) from the receiver/drier tank using a long nose plier.



Check for crumbled desiccant and clogged bottom cap filter.

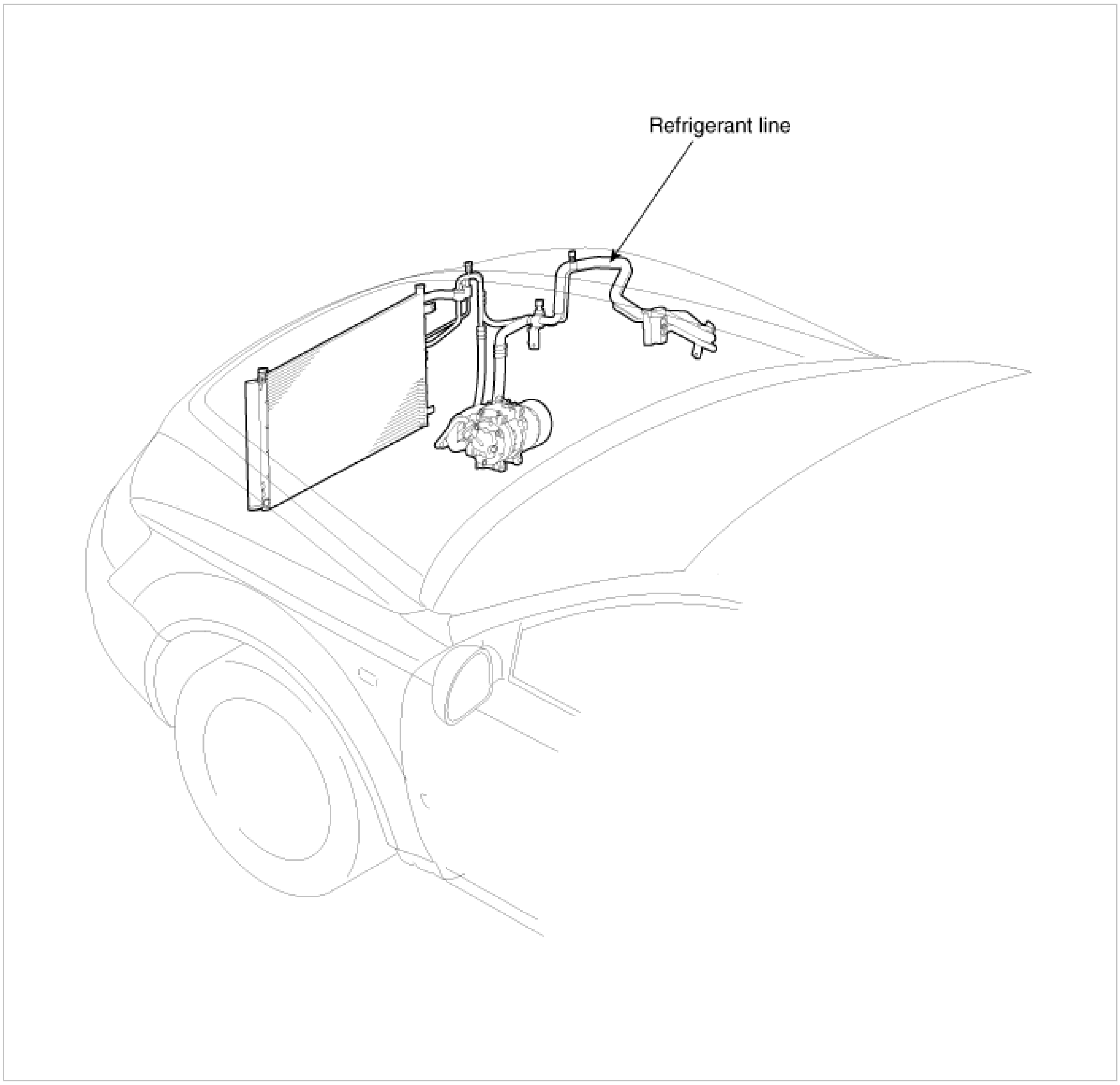
3. Apply air conditioning compressor oil along the O-rings and threads of the new bottom cap.
4. Insert the new desiccant into the receiver drier tank. The desiccant must be sealed in vacuum before it is exposed to air for use.
5. Install the new bottom cap to the receiver drier tank.

NOTE

- Always replace the desiccant and bottom cap at the same time.
- Replace the O-rings with new ones at each fitting, and apply a thin coat of refrigerant oil before installing them. Be sure to use the right O-rings for R-134a to avoid leakage.
- Be careful not to damage the radiator and condenser fins when installing the condenser.
- Be sure to install the lower mount cushions of condenser securely into the holes.
- Charge the system, and test its performance. (Refer to HA-10)

Heating,Ventilation, Air Conditioning > Air conditioning System > Refrigerant line > Components and Components Location

COMPONENT LOCATION



Heating,Ventilation, Air Conditioning > Air conditioning System > Refrigerant line > Repair procedures

REPLACEMENT

1. Discharge refrigerant from refrigeration system (Refer to page HA-9).
2. Replace faulty tube or hose.

> CAUTION
>
> Cap the open fittings immediately to keep moisture or dirt out of the system.

3. Tighten joint of bolt or nut to specified torque.

> CAUTION
>
> Connections should not be torque tighter than the specified torque.

Part tightened	N.m	kgf.m	lb-ft
Condenser x Discharge hose	5 ~ 7	0.5 ~ 0.6	3.7 ~ 5.2
Condenser x Liquid tube			
Compressor x Discharge hose	5 ~ 7	0.5 ~ 0.6	3.7 ~ 5.2
Compressor x Suction hose			

Expansion valve x Evaporator	12 ~ 15	1.2 ~ 1.5	8.7 ~ 10.8

4. Evacuate air in refrigeration system and charge system with refrigerant (Refer to page HA-9).

Specified amount: 550 ± 25g (19.4 ± 0.88 oz.)

5. Inspect for leakage of refrigerant.
   Using a gas leak detector, check for leakage of refrigerant (Refer to page HA-11).
6. Inspect A/C operation.

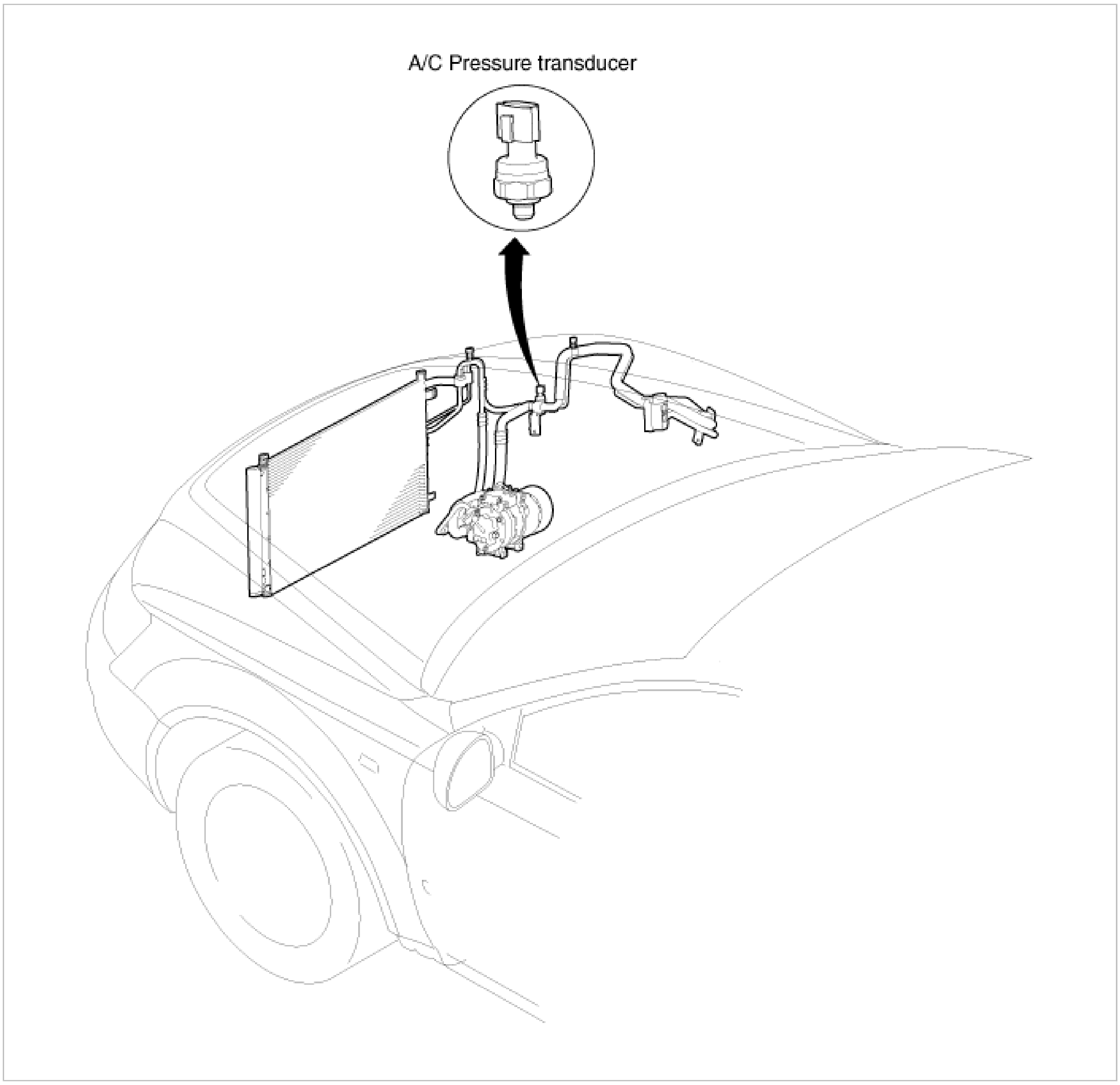
Heating,Ventilation, Air Conditioning > Air conditioning System > A/C pressure transducer > Description and Operation

DESCRIPTION

A/C pressure transducer convert the pressure value of high pressure line into voltage value after measure it. By converted voltage value, engine ECU controls cooling fan by operating it high speed or low speed. Engine ECU stop the operation of compressor when the temperature of refrigerant line is so high or so low irregularly to optimize air conditioning system.

Heating,Ventilation, Air Conditioning > Air conditioning System > A/C pressure transducer > Components and Components Location

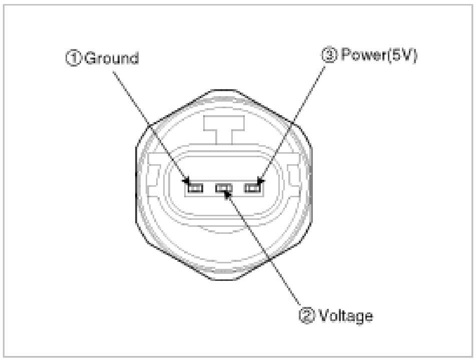
COMPONENT LOCATION



Heating,Ventilation, Air Conditioning > Air conditioning System > A/C pressure transducer > Repair procedures

INSPECTION

1. Measure the pressure of high pressure line by measuring voltage output between NO.1 and NO.2 terminals.



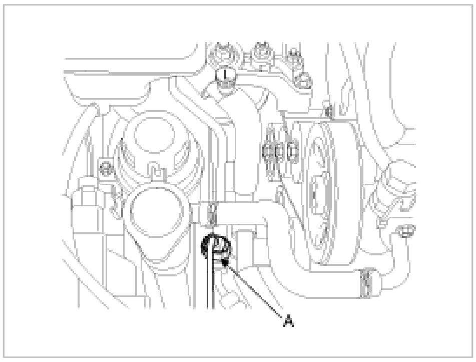
2. Inspection the voltage value whether it is sufficient to be regular value or not.

Voltage = 0.00878835 * Pressure (psig) + 0.5

3. If the measured voltage value is not specification, replace the A/C pressure transducer.

REPLACEMENT

1. Disconnect negative (-) battery terminal.
2. Disconnect A/C pressure transducer connector(A) (3P) from wiring harness.



3. Remove the A/C pressure transducer.

CAUTION

Take care that liquid suction pipe is not bent.

4. Installation is the reverse order of removal.

TORQUE : 10~12 N.m (1.02~1.22 kgf.m, 7.4~8.8 lb-ft)

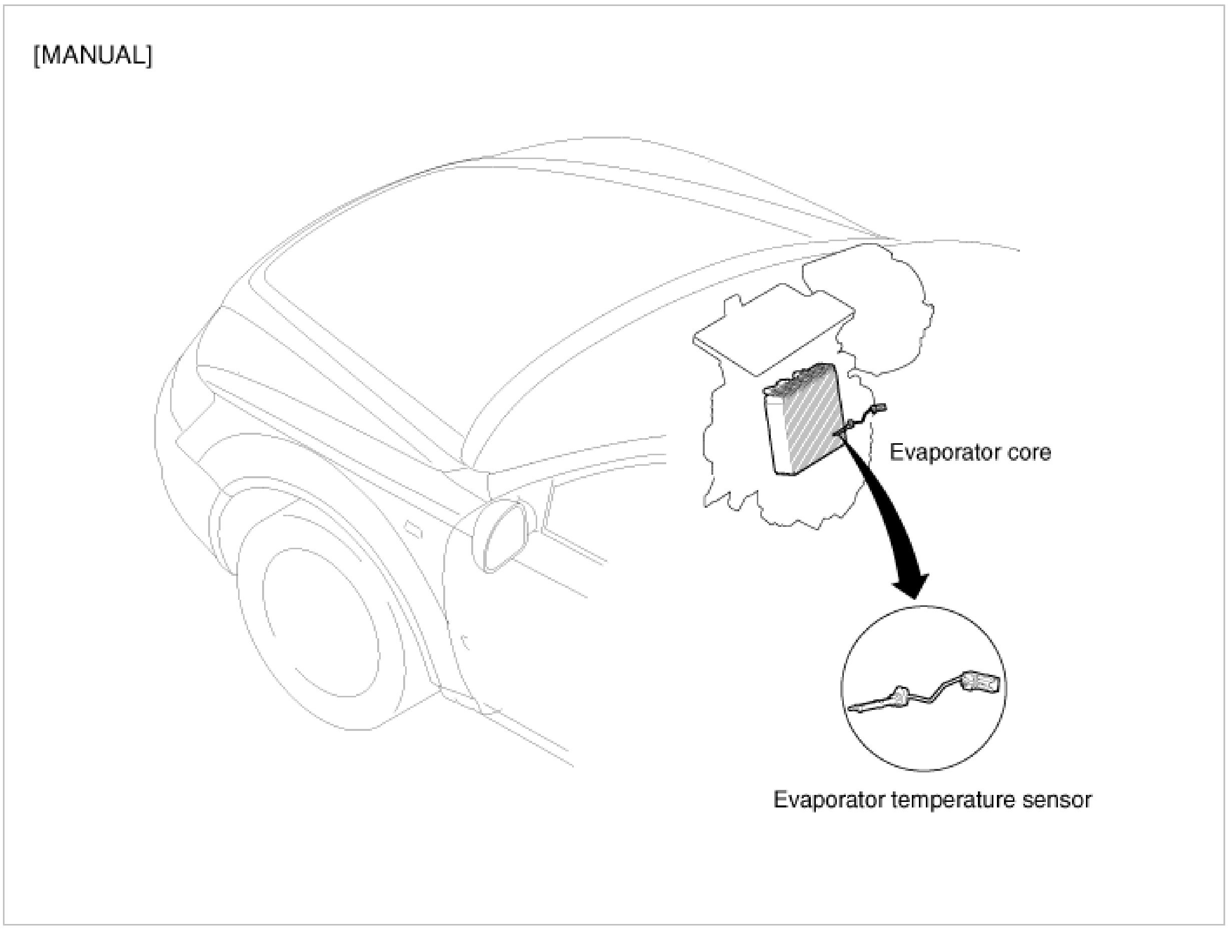
Heating,Ventilation, Air Conditioning > Air conditioning System > Evaporator temperature sensor > Description and Operation

DESCRIPTION

The evaporator temperature sensor will detect the evaporator core temperature and interrupt compressor relay power in order to prevent evaporator freezing by excessive cooling.
It is a negative type thermistor whose resistance is inversely proportional to temperature.

Heating,Ventilation, Air Conditioning > Air conditioning System > Evaporator temperature sensor > Components and Components Location

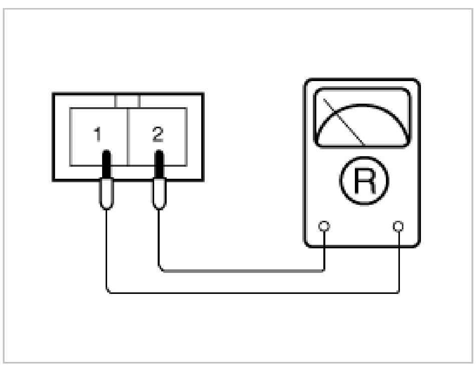
COMPONENT LOCATION



Heating,Ventilation, Air Conditioning > Air conditioning System > Evaporator temperature sensor > Repair procedures

INSPECTION

1. Ignition "ON".
2. Turn on the A/C switch.
3. Disconnect evaporator temperature sensor.
4. Using the multi-tester, Measure resistance between terminal "1" and "2" of evaporator temperature sensor.



Specification

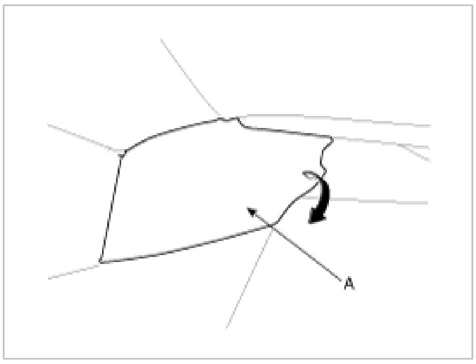
Evaporator core temperature [°C(°F)]	Resistance [KΩ]
-10 (14)	18.31
0 (32)	11.60
10 (50)	7.55
15 (59)	5.04

30 (86)	3.44
40 (104)	2.40

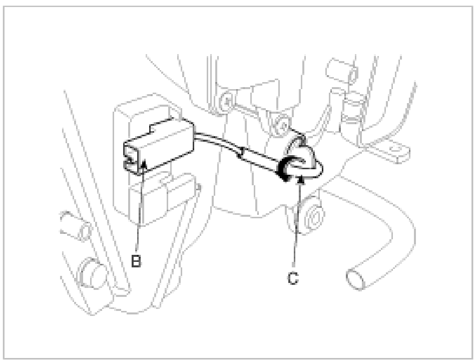
5. If the measured resistance is not specification, substitute with a known-good evaporator temperature sensor and check for proper operation.
6. If the problem is corrected, replace the evaporator temperature sensor.

REPLACEMENT

1. Pull out out the passenger's crash pad center low cover (A).



2. Disconnect the connector pin (B).
3. Remove the evaporator temperature sensor (C) by pulling it after rotating 90° in a counterclockwise direction.

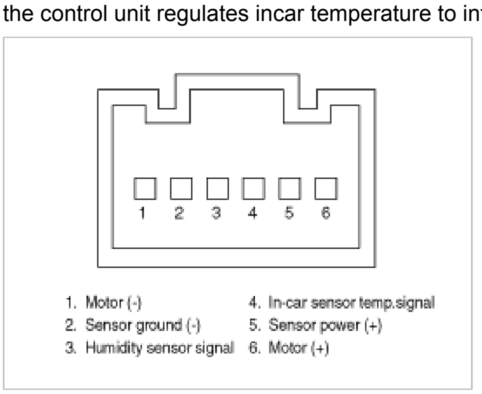


4. Installation is the reverse order of removal.

Heating,Ventilation, Air Conditioning > Air conditioning System > In-car sensor > Description and Operation

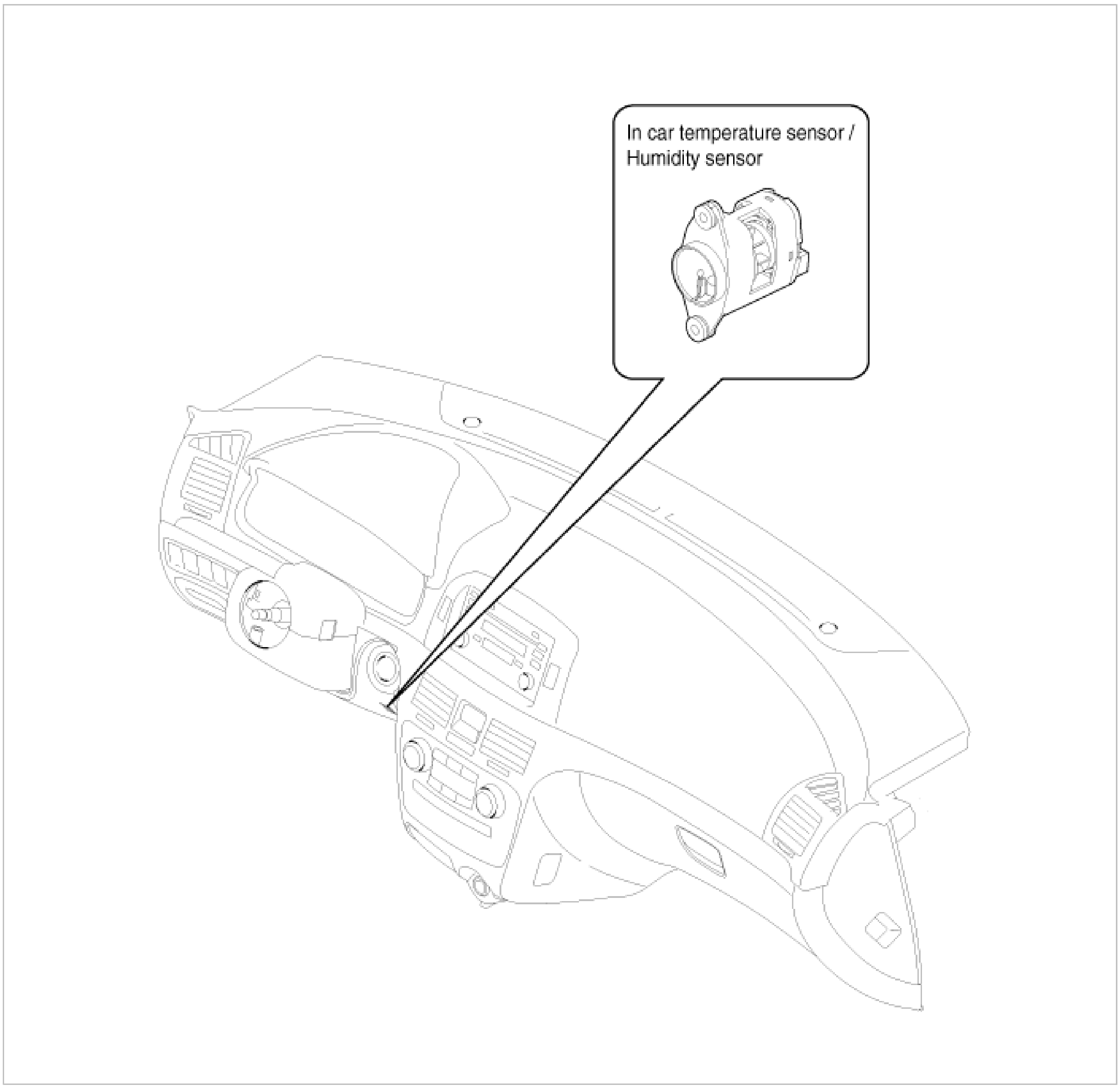
DESCRIPTION

1. In-car air temperature sensor is located at the lower crash pad.
2. The sensor contains a thermistor which measures the temperature of the inside. The signal, decided by the resistance value which changes in accordance with perceived inside temperature, is delivered to heater control unit and according to this signal the control unit regulates incar temperature to intended value.



Heating,Ventilation, Air Conditioning > Air conditioning System > In-car sensor > Components and Components Location

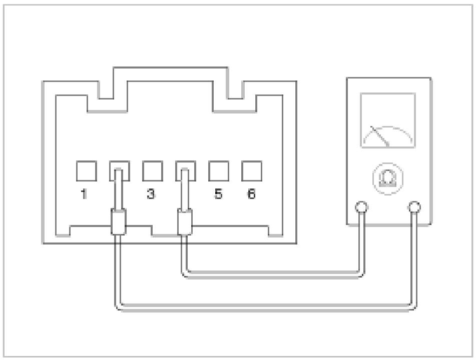
COMPONENT LOCATION



Heating,Ventilation, Air Conditioning > Air conditioning System > In-car sensor > Repair procedures

INSPECTION

1. Ignition "OFF".
2. Disconnect in-car sensor.
3. Using the multi-tester, Measure resistance between terminal "2" and "4" of in-car sensor.

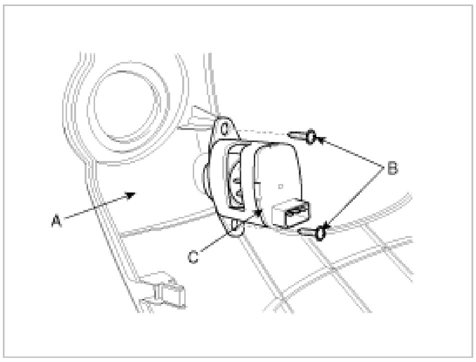


Specification

Temperature [°C(°F)]	Resistance between terminals 2 and 4 (KΩ)
-15 (5) 0 (32) 15 (59) 25 (77) 35 (95) 50 (122)	216.1 ± 3.2% 97.71 ± 2.4% 47.13 ± 1.7% 30.00 ± 1.2% 19.59 ± 1.6% 10.81 ± 2.2%

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the lower crash panel (A) (Refer to the Body group).
3. Disconnect the connector of in-car sensor.
4. Loosen the mounting screws (B) and then remove the in-car sensor (C).



5. Installation is the reverse order of removal.

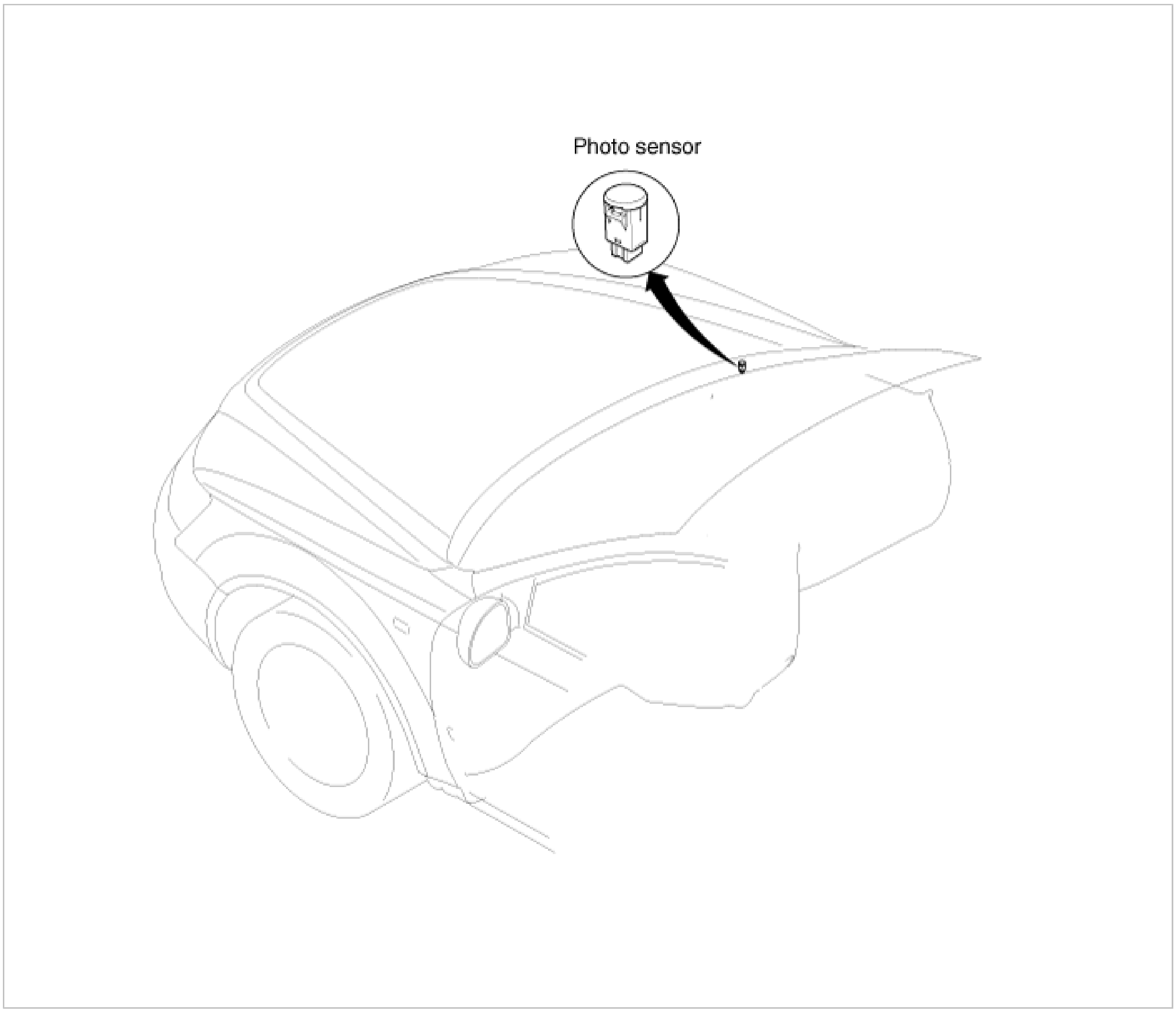
Heating,Ventilation, Air Conditioning > Air conditioning System > Photo sensor > Description and Operation

DESCRIPTION

1. The photo sensor is located at the right part of defrost nozzle.
2. The photo sensor contains a photovoltaic (sensitive to sunlight) diode. The solar radiation received by its light receiving portion, generates an electromotive force in proportion to the amount of radiation received which is transferred to the automatic temperature control module so that the solar radiation compensation will be performed.

Heating,Ventilation, Air Conditioning > Air conditioning System > Photo sensor > Components and Components Location

COMPONENT LOCATION

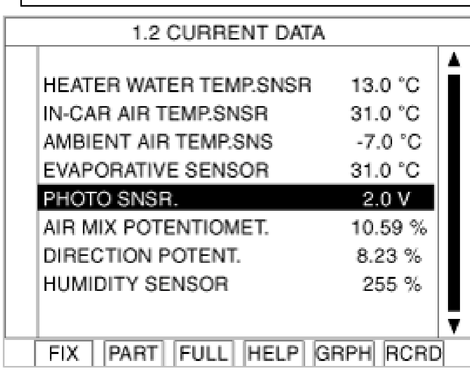


Heating,Ventilation, Air Conditioning > Air conditioning System > Photo sensor > Repair procedures

INSPECTION

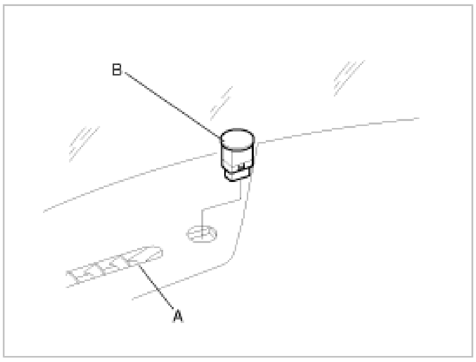
1. Ignition "ON".
2. Using the scan tool.
3. Emit intensive light toward photo sensor using sunshine, and check the output absolute voltage change.
4. The absolute voltage will rise with higher intensive light and reduce with lower intensive light.

> **NOTE**
>
> When checking photo sensor, select a place where is exposed to sunshine directly.



REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Using the (-) driver, Remove the photo sensor (B) from the right part of defrost nozzle (A).
3. Disconnect the connector.

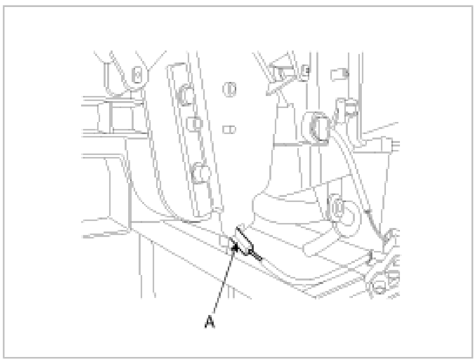


4. Installation is the reverse order of removal.

Heating,Ventilation, Air Conditioning > Air conditioning System > Water temperature sensor > Description and Operation

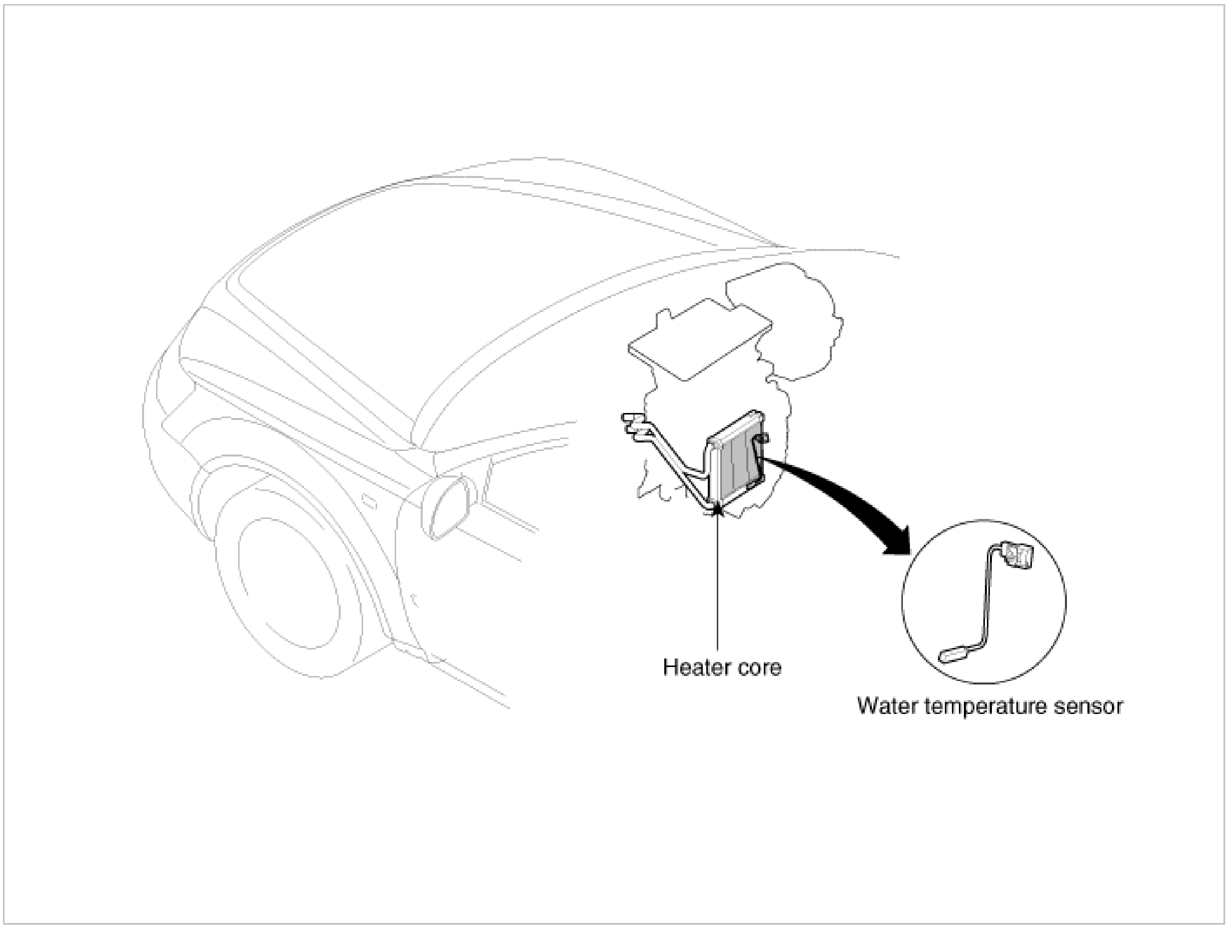
DESCRIPTION

1. Water temperature sensor (A) is located at the heater unit.
2. It detects coolant temperature. Its signal is used for cold engine lockout control. When the driver operates the heater before the engine is warmed up, the signal from sensor causes the heater control unit to reduce blower motor speed until coolant temperature reaches the threshold value.



Heating,Ventilation, Air Conditioning > Air conditioning System > Water temperature sensor > Components and Components Location

COMPONENT LOCATION



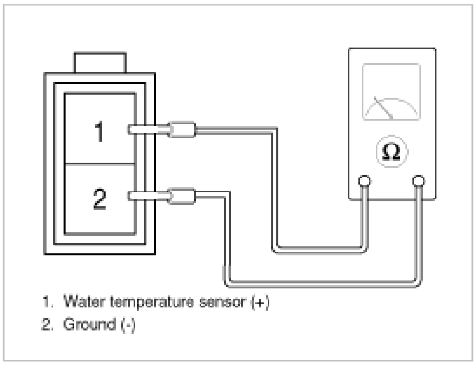
Heating,Ventilation, Air Conditioning > Air conditioning System > Water temperature sensor > Repair procedures

INSPECTION

1. Ignition "OFF".
2. Disconnect water temperature sensor connector.
3. Using the multi-tester, Measure resistance between terminal "1" and "2" of water temperature sensor.
   Specification

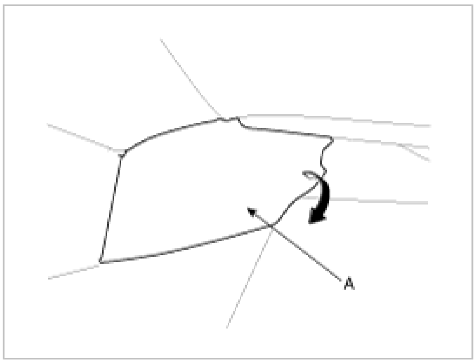
Coolant temperature [°C(°F)]	Resistance between terminals 1and 2 (KΩ)
-10 (14)	55.27
0 (32)	32.61
20 (68)	12.48
40 (104)	5.33
60 (140)	2.50
80 (176)	1.27

4. If the measured resistance is not specification, substitute with a known-good water temperature sensor and check for proper operation.
5. If the problem is corrected, replace the water temperature sensor.

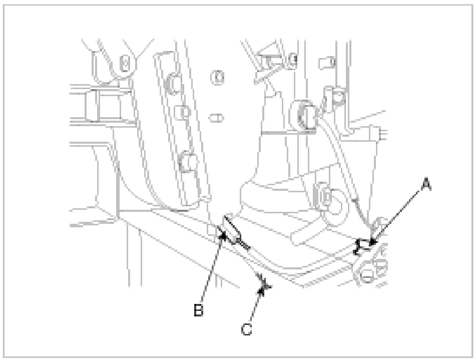


REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Pull out the passenger's crash pad center low cover (A).



3. Remove the under cover after loosening 2 screws.
4. Disconnect the connector (A) of water temperature sensor.
5. Pull the water temperature sensor(B) out at the heater unit with the stopper (C).



6. Install in the reverse order of removal.

> NOTE
>
> Take care that wire of water temperature sensor is not to be damaged.

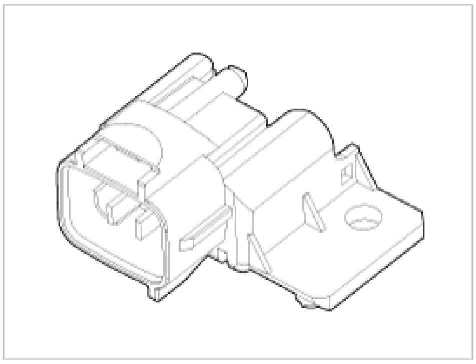
Heating,Ventilation, Air Conditioning > Air conditioning System > Ambient sensor > Description and Operation

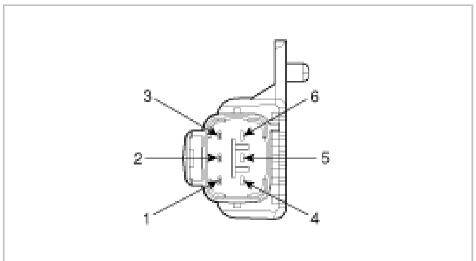
DESCRIPTION

1. The ambient temperature sensor is located at the front of the condenser and detects ambient air temperature. It is a negative type thermistor; resistance will increase with lower temperature, and decrease with higher temperatures.
2. The sensor output will be used for discharge temperature control, temperature regulation door control, blower motor level control, mix mode control and in-car humidity control.

> NOTE

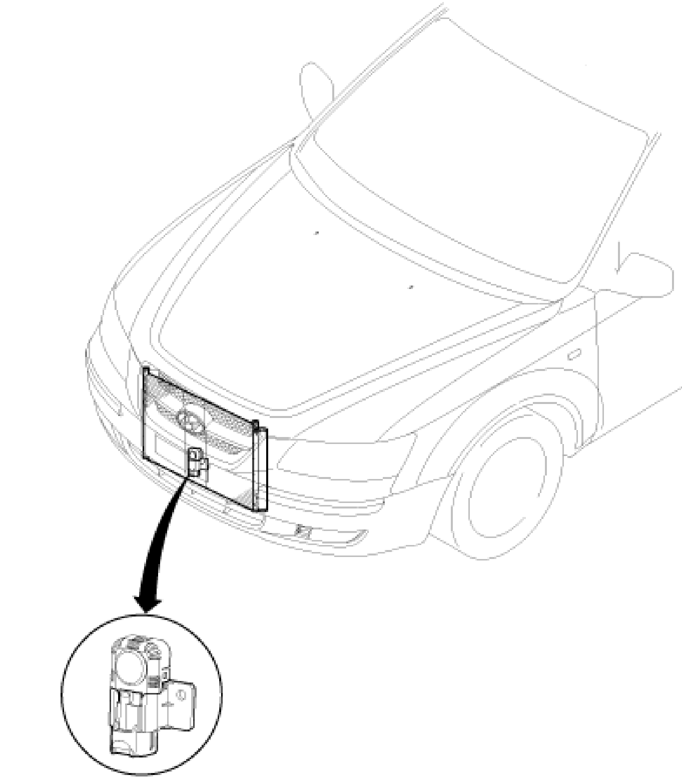
If the ambient temperature is below 2.0°C (35.6°F), the A/C compressor will be stopped.
The compressor will be operated by manual operating.





Heating,Ventilation, Air Conditioning > Air conditioning System > Ambient sensor > Components and Components Location

COMPONENT LOCATION



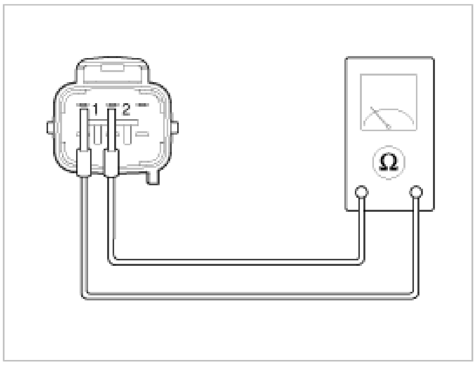
Heating,Ventilation, Air Conditioning > Air conditioning System > Ambient sensor > Repair procedures

INSPECTION

1. Ignition "OFF".
2. Disconnect ambient temperature sensor connector.
3. Check the resistance of ambient temperature sensor between terminals 1 and 2 whether it is changed by changing temperature of the ambient temperature sensor.
   Specification

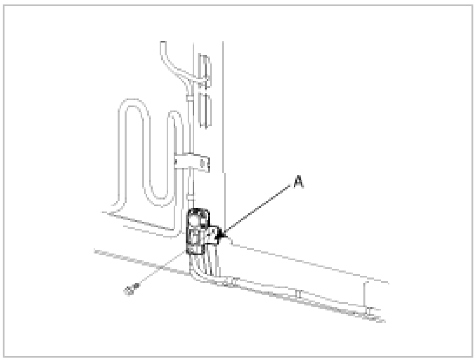
Ambient temperature [°C(°F)]	Resistance between terminals 1 and 2 (KΩ±3%)
-20 (-4) 0 (32) 25 (77) 50 (122) 80 (176)	271.1 95.1 30.0 10.9 3.83

4. If the measured resistance is not specification, substitute with a known-good ambient temperature sensor and check for proper operation.
5. If the problem is corrected, replace the ambient temperature sensor.



REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the front bumper. (Refer to BD group)
3. Remove the ambient temperature sensor(A) after loosening the mounting bolt.



4. Installation is the reverse order of removal.

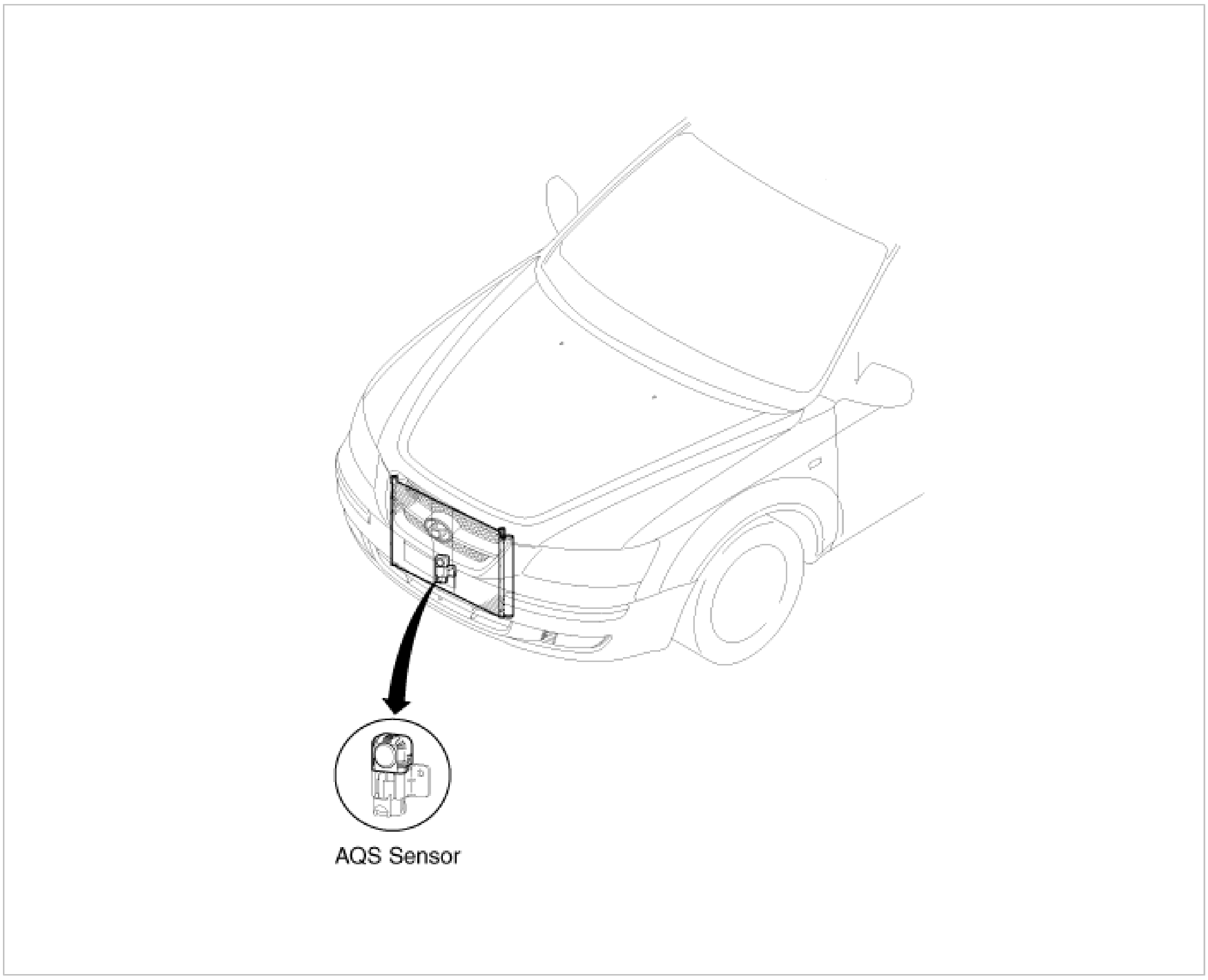
Heating,Ventilation, Air Conditioning > Air conditioning System > A.Q.S (Air Quality Sensor) > Description and Operation

DESCRIPTION

1. A.Q.S is located at center support in front of the engine radiator, and detects hazardous elements in ambient air providing output signal to control.
2. It will detect sulfurous acid gas, carbon dioxide, carbon monoxide, hydrocarbon and allergen.

Heating,Ventilation, Air Conditioning > Air conditioning System > A.Q.S (Air Quality Sensor) > Components and Components Location

COMPONENT LOCATION

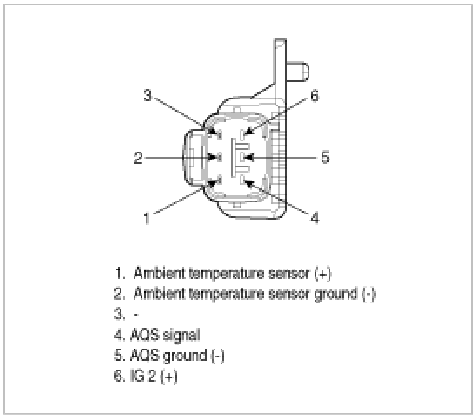


Heating,Ventilation, Air Conditioning > Air conditioning System > A.Q.S (Air Quality Sensor) > Repair procedures

INSPECTION

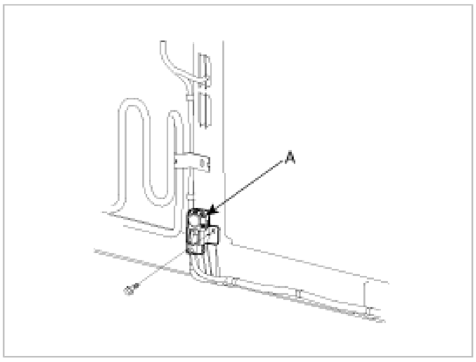
1. Ignition "ON".
2. Using the scan tool.
3. Check the output voltage of AQS between terminals 4 and 5.
   Specification

Condition	Output signal	Intake
Normal condition	4 ~ 5V	Fresh
Hazardous gas detection	0 ~ 1V	Recirculation



REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the front bumper (Refer to the BD group).
3. Remove the AQS sensor (A) after loosening the mounting screws.

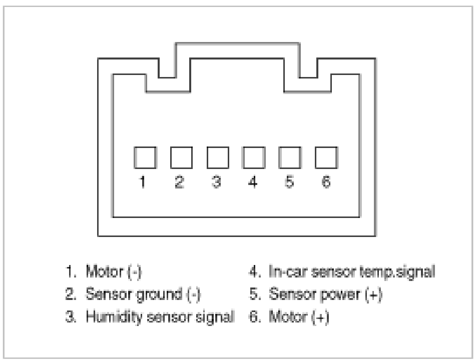


4. Install in the reverse order of removal.

Heating,Ventilation, Air Conditioning > Air conditioning System > Humidity Sensor > Description and Operation

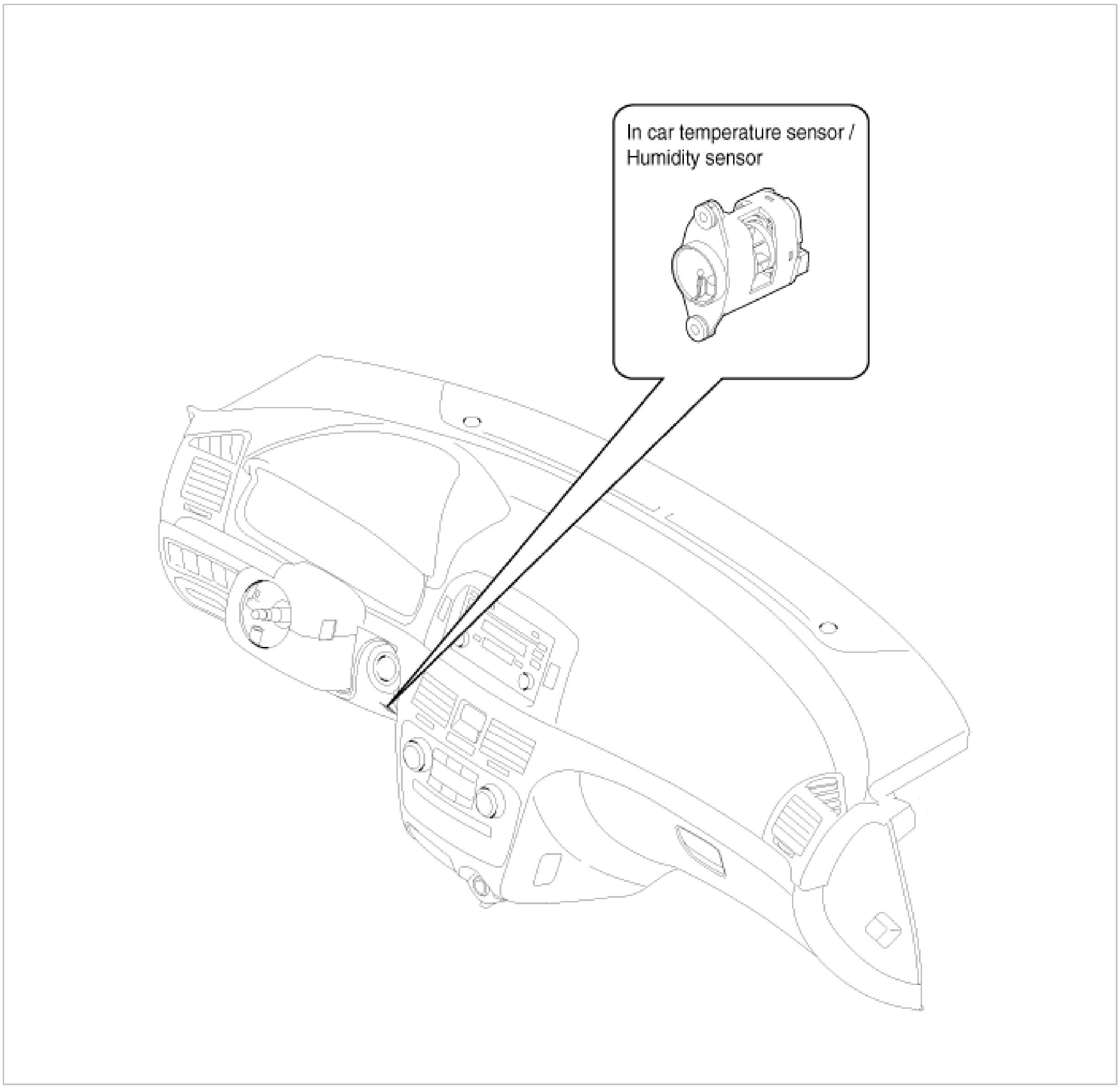
DESCRIPTION

1. Humidity sensor is located at the lower crash pad and detects in-car humidity for in-car humidity control.
2. If ambient air temperature or in-car humidity is outside certain range, it will turn on A/C to control in-car humidity preventing in car fogging.
   Air conditioner operation depends on ambient temperature and humidity.



Heating,Ventilation, Air Conditioning > Air conditioning System > Humidity Sensor > Components and Components Location

COMPONENT LOCATION



Heating,Ventilation, Air Conditioning > Air conditioning System > Humidity Sensor > Repair procedures

INSPECTION

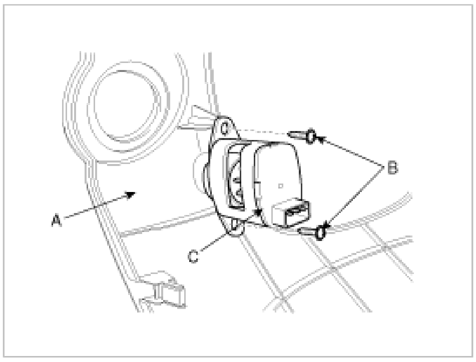
1. Ignition "ON".
2. Using the scan tool.
3. Check the frequency of humidity sensor between terminals 2 and 3.

Humidity (%)	Frequency between terminals 2 and 3(Hz)
0	7351± 10%
10	7224± 10%
20	7100± 5%
30	6976 ± 5%
50	6728 ± 5%
60	6600 ± 5%
70	6468 ± 5%
80	6330 ± 5%
90	6186 ± 10%
100	6033 ± 10%

4. If the measured resistance is not specification, substitute with a known-good humidity sensor and check for proper operation.
5. If the problem is corrected, replace the Humidity sensor.

REPLACEMENT

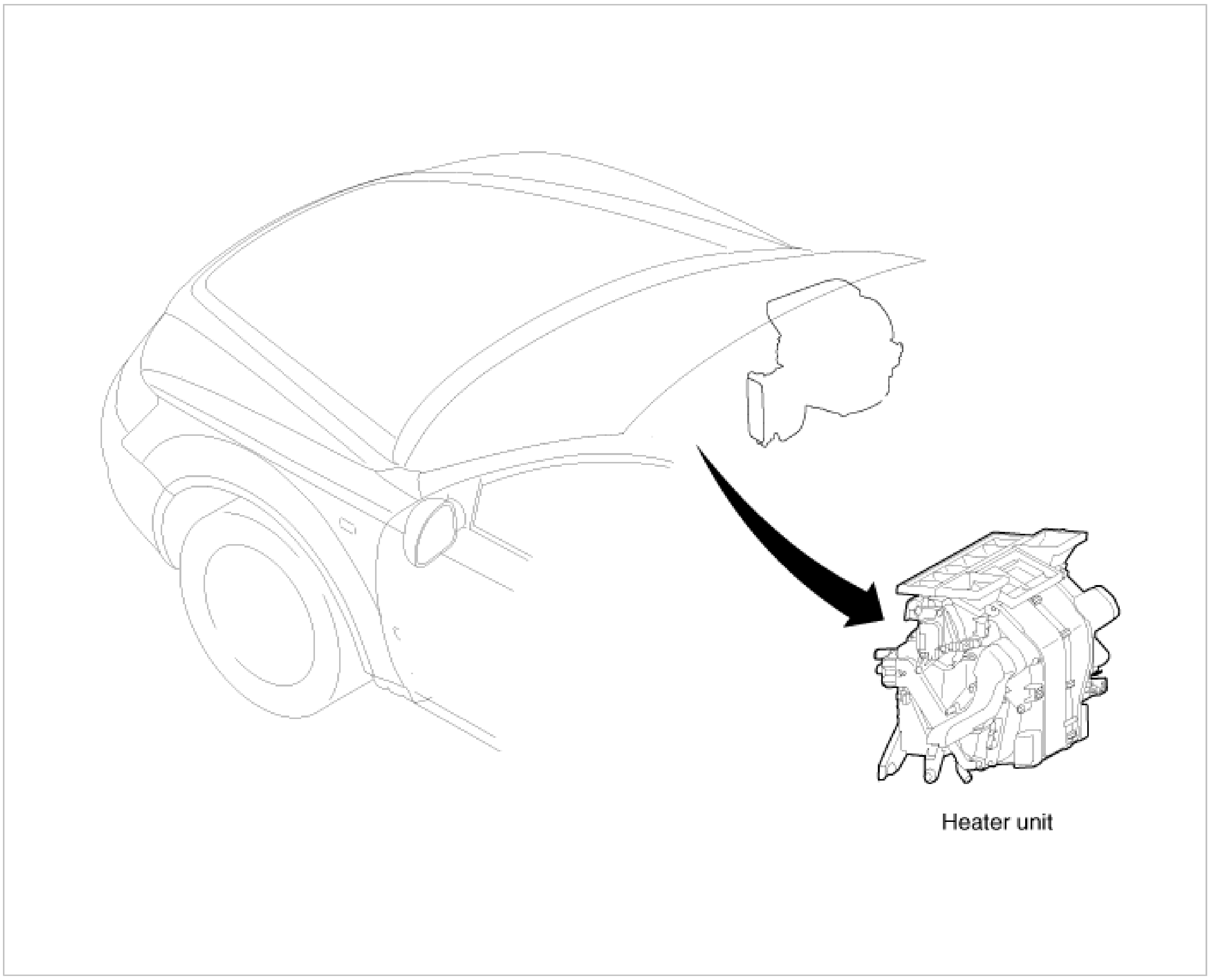
1. Disconnect the negative (-) battery terminal.
2. Remove the lower crash panel (A) (Refer to BD group).
3. Disconnect humidity sensor connector.
4. Loosen the mounting screws (B) and then remove the humidity sensor (C).



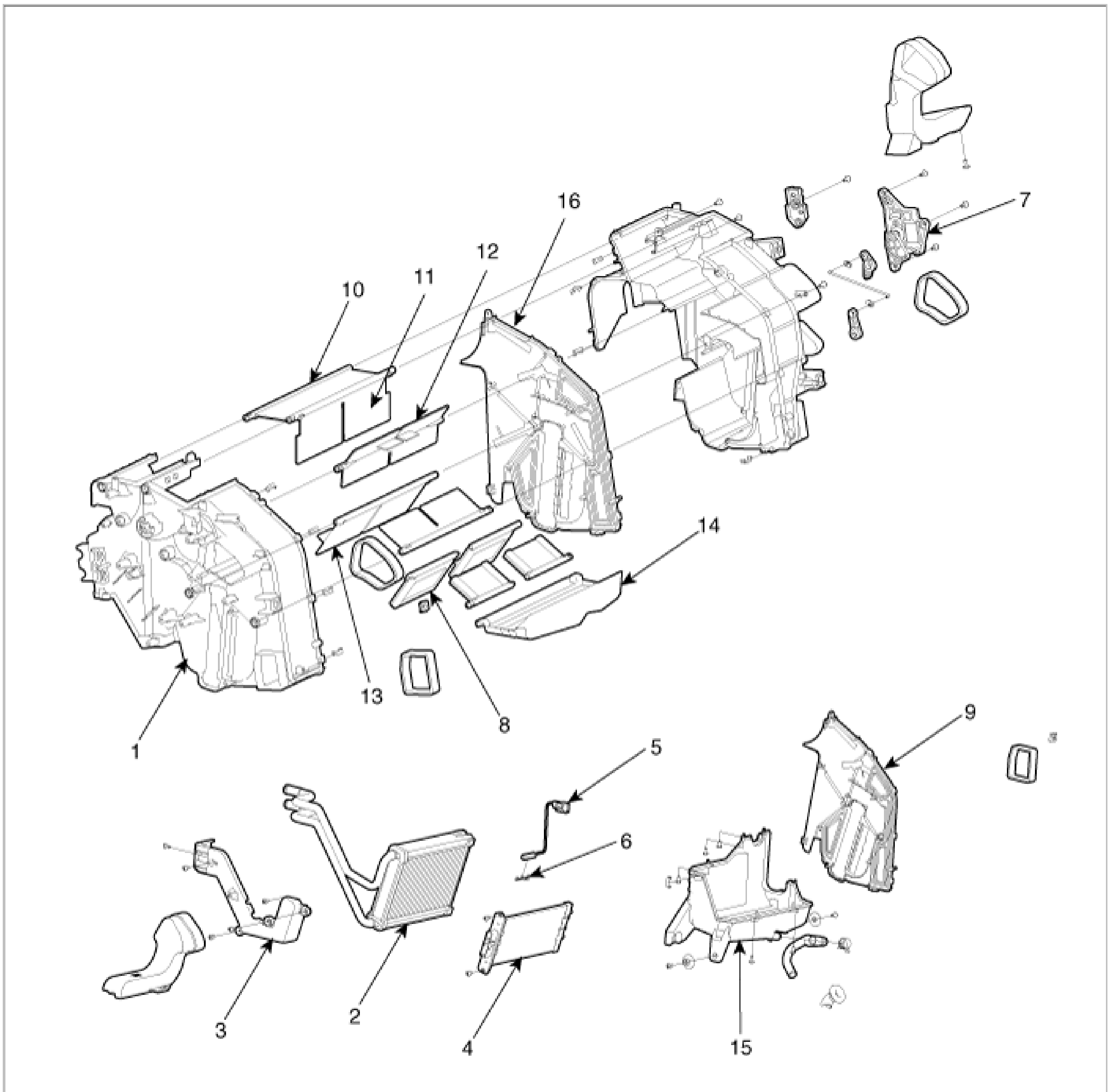
5. Installation is the reverse order of removal.

Heating,Ventilation, Air Conditioning > Heater > Heater Unit > Components and Components Location

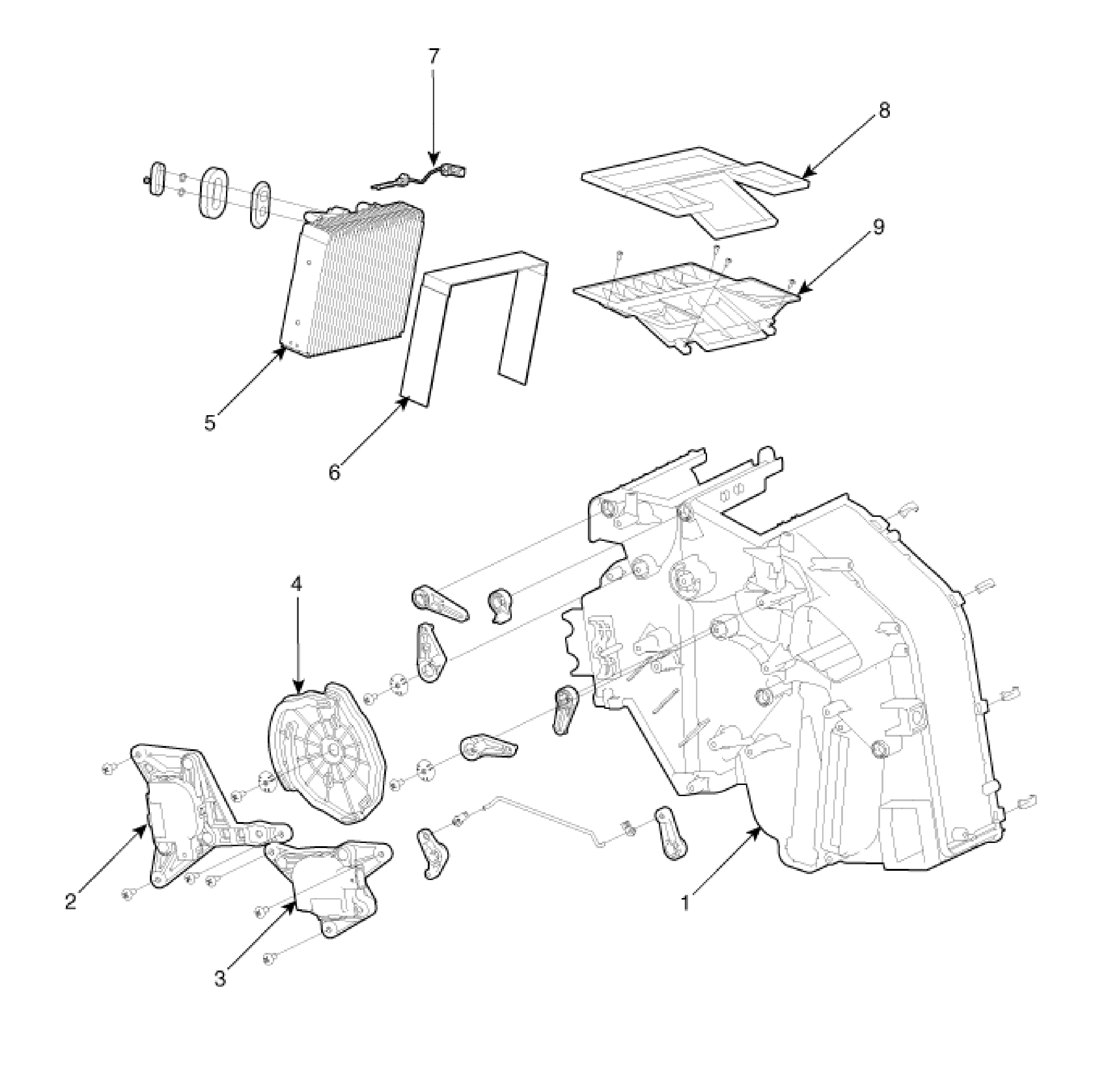
COMPONENT LOCATION



COMPONENTS



1. Heater & Evaporator case	9. Heater separator (Dual type)
2. Heater core	10. Defrost door
3. Heater core cover	11. Vent door
4. PTC heater (Diesel only)	12. Floor door
5. Water temperature sensor	13. Temperature control door (Single type)
6. Water temperature sensor stopper	14. Insulation
7. Temperature control actuator	15. Heater & Evaporator lower case
8. Temperature control door (Dual type)	16. Heater separator (Single type)

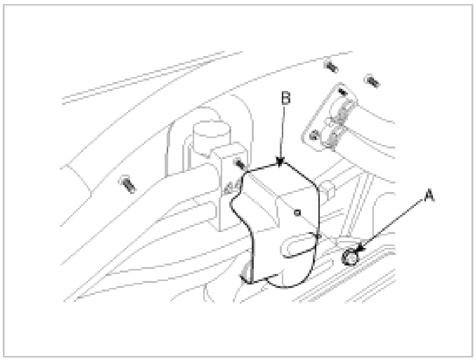


1. Heater & Evaporator case	6. Evaporator case seal
2. Mode control actuator	7. Evaporator temperature sensor
3. Temperature control actuator (Dual type)	8. Upper case seal
4. Mode cam	9. Heater & Evaporator upper case
5. Evaporator core	

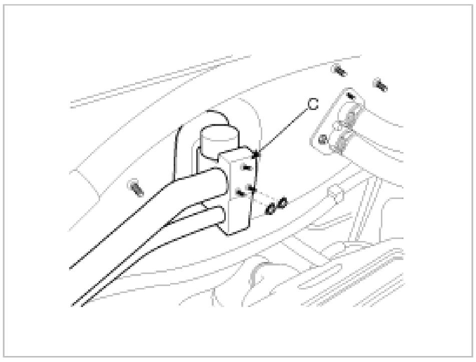
Heating,Ventilation, Air Conditioning > Heater > Heater Unit > Repair procedures

REPLACEMENT

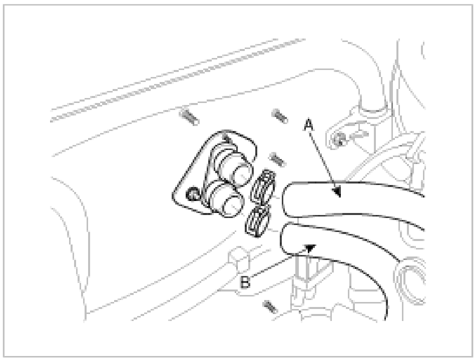
1. Disconnect the negative (-) battery terminal.
2. Recover the refrigerant with a recovery/ recycling/ charging station.
3. When the engine is cool, drain the engine coolant from the radiator.
4. Remove the expansion valve cover after loosening the nut (A).



5. Remove the expansion valve (C) from evaporator core after loosening nuts. Plug or cap the lines immediately after disconnecting them to avoid moisture and dust contamination.

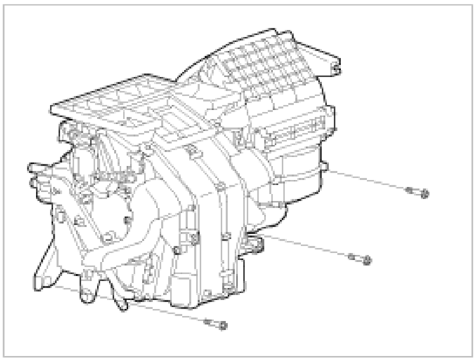


6. Disconnect the inlet (A) and outlet (B) heater hoses from the heater unit.

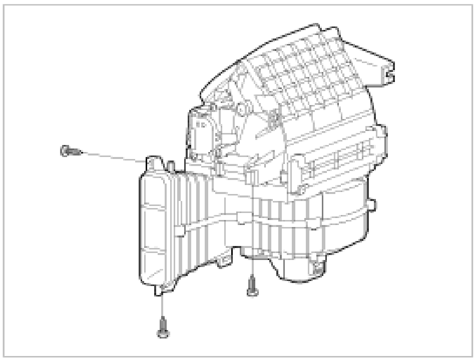


> **CAUTION**
>
> Engine coolant will run out when the hoses are disconnected; drain it into a clean drip pan. Be sure not to let coolant spill on electrical parts or painted surfaces. If any coolant spills, rinse it off immediately.

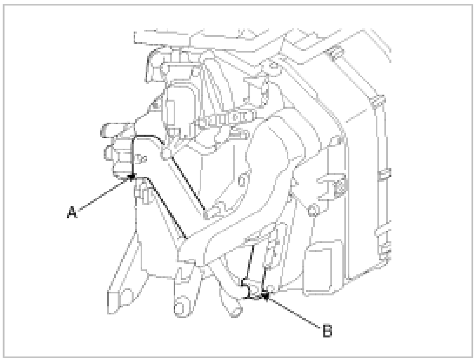
7. Remove the crash pad. (Refer to BD group)
8. Remove the cowl cross member. (Refer to BD group)
9. Disconnect the connectors from the temperature control actuator, the mode control actuator and the evaporator temperature sensor, then remove the mounting nut and the mounting bolts.
10. Remove the heater & evaporator unit after loosening the mounting bolts.



11. Remove the blower unit from heater unit after loosening fixing screws on the connected part.



12. Remove the side bracket (A) and heater core (B).



13. Be careful that inlet and outlet pipes are not to be bent during heater core removal, and pull out the heater core.
14. Install the heater core in the reverse order of removal.
15. Install in the reverse order of removal, and note these items :
    A. If you're installing a new evaporator, add refrigerant oil.
    B. Replace the O-rings with new ones at each fitting, and apply a thin coat of refrigerant oil before installing them. Be sure to use the right O-rings for R-134a to avoid leakage.
    C. Immediately after using the oil, replace the cap on the container, and seal it to avoid moisture absorption.
    D. Do not spill the refrigerant oil on the vehicle ; it may damage the paint ; if the refrigerant oil contacts the paint, wash it off immediately.
    E. Apply sealant to the grommets.
    F. Make sure that there is no air leakage.
    G. Charge the system and test its performance.
    H. Do not interchange the inlet and outlet heater hoses and install the hose clamps securely.
    I. Refill the cooling system with engine coolant.

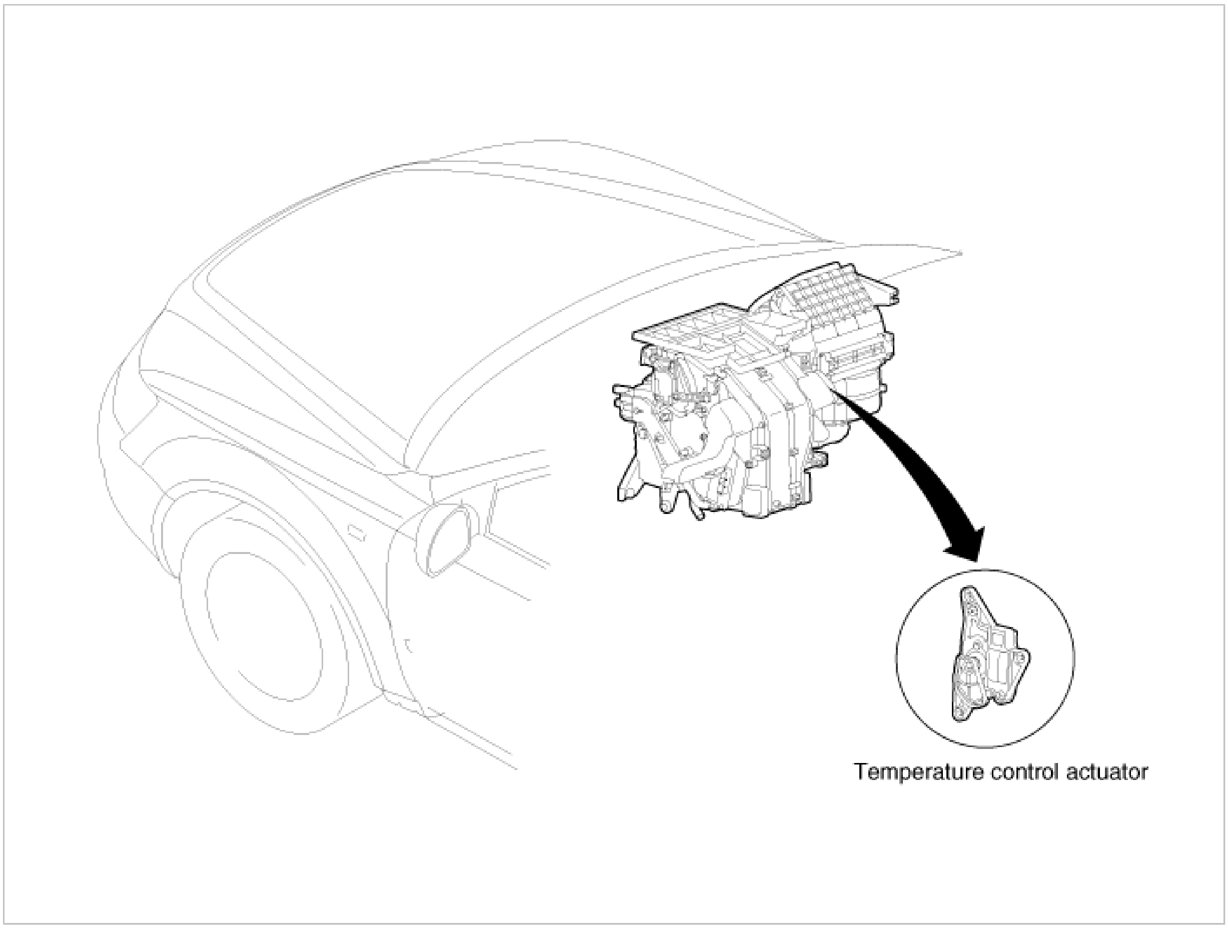
Heating,Ventilation, Air Conditioning > Heater > Temperature Control Actuator > Description and Operation

DESCRIPTION

1. Heater unit includes mode control actuator and temperature control actuator.
2. Temperature control actuator is located at the heater unit. Signal from control unit adjusts position of temperature door by operating temperature switch and then temperature will be regulated by the hot/cold air ratio determined by position of temperature door.

Heating,Ventilation, Air Conditioning > Heater > Temperature Control Actuator > Components and Components Location

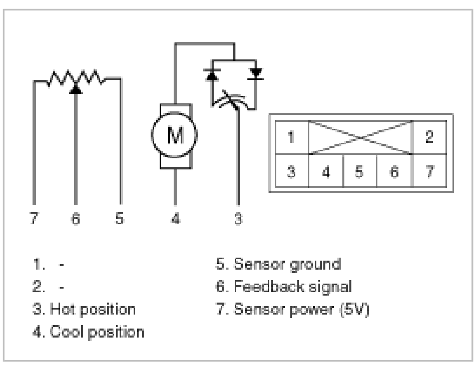
COMPONENT LOCATION



Heating,Ventilation, Air Conditioning > Heater > Temperature Control Actuator > Repair procedures

INSPECTION

1. Ignition "OFF".
2. Disconnect the connector of temperature control actuator.
3. Verify that the temperature control actuator operates to the hot position when connecting 12V to the terminal 3 and grounding terminal 4.
4. Verify that the temperature control actuator operates to the cool position when the connections in are reversed.



5. Check the voltage between terminals 5 and 6.

Specification

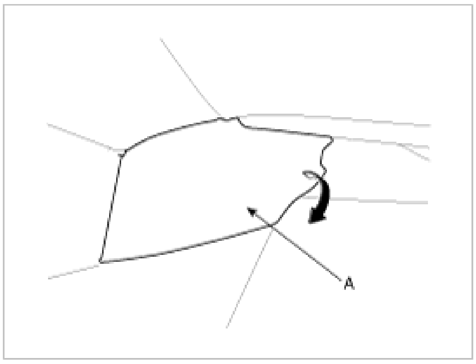
Door position	Voltage (5-6)	Error detecting
Max. cooling	0.3 ± 0.15V	Low voltage : 0.1V or less
Max. heating	4.7 ± 0.15V	High voltage : 4.9V or more

It will feedback current position of actuator to controls.

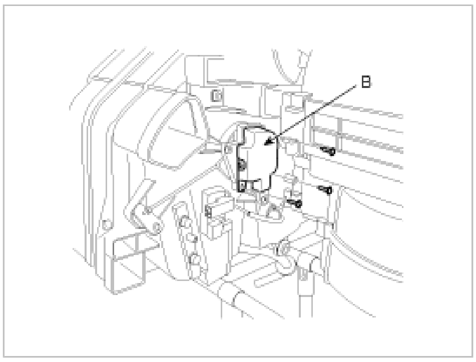
6. If the measured voltage is not within specification, substitute with a known-good temperature control actuator and check for proper operation.
7. If the problem is corrected, replace the temperature control actuator.

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Pull out the passenger's crash pad center lower cover (A).



3. Disconnect the connector of temperature control actuator after removing the air duct.
4. Loosen the mounting screw and then remove the temperature control actuator (B).



5. Install in the reverse order of removal.

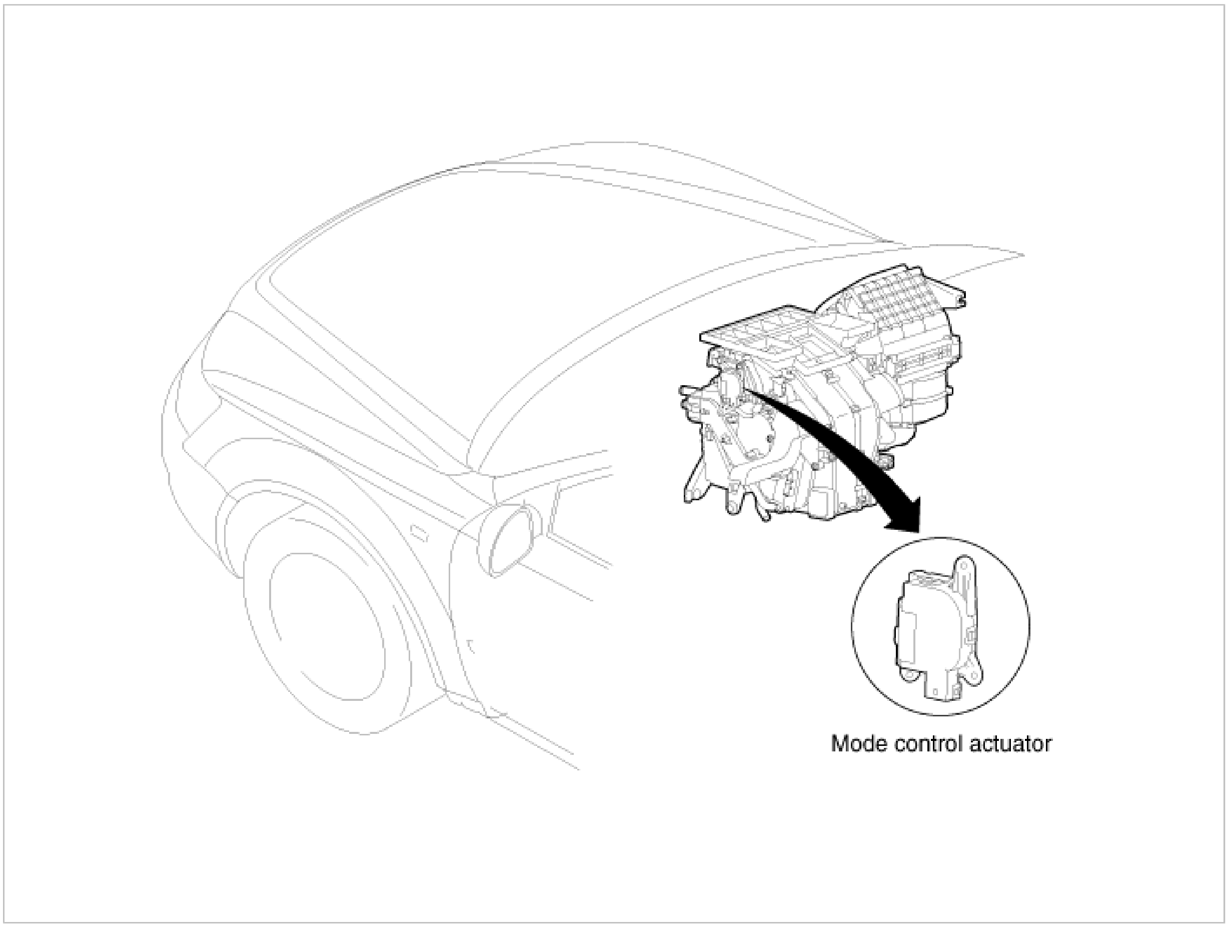
Heating,Ventilation, Air Conditioning > Heater > Mode Control Actuator > Description and Operation

DESCRIPTION

The mode control actuator is located at the heater unit.
It adjusts position of mode door by operating mode control actuator based on signal of A/C control unit. Pressing mode select switch makes the mode control actuator shift in order of vent→ BI/LEVEL → floor → mix.

Heating,Ventilation, Air Conditioning > Heater > Mode Control Actuator > Components and Components Location

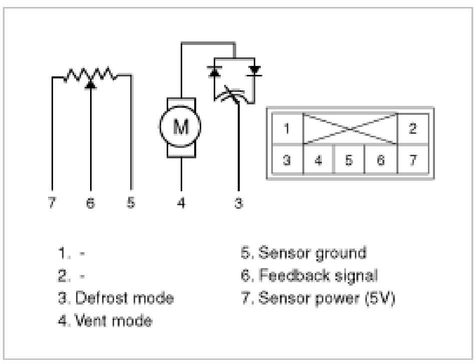
COMPONENT LOCATION



Heating,Ventilation, Air Conditioning > Heater > Mode Control Actuator > Repair procedures

INSPECTION

1. Ignition "OFF”.
2. Disconnect the connector of mode control actuator.
3. Verify that the mode control actuator operates to the defrost position when connecting 12V to the terminal 3 and grounding terminal 4.
4. Verify that the mode control actuator operates to the vent position when connecting in the reverse.



5. Check the voltage between terminals 5 and 6.

Door position	Voltage (5-6)	Error detecting
Vent	0.3 ± 0.15V	Low voltage : 0.1V or less
Defrost	4.7 ± 0.15V	High voltage : 4.9V or more

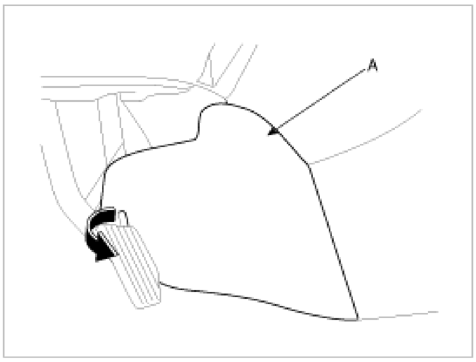
It will feedback current position of actuator to controls.

6. If the measured voltage is not specification, substitute with a known-good mode control actuator and check for proper operation.

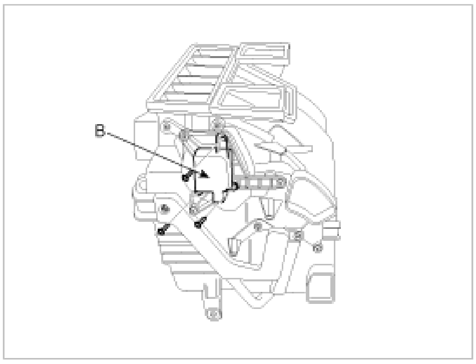
7. If the problem is corrected, replace the mode control actuator.

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Pull out the driver’s crush pad center lower cover (A).



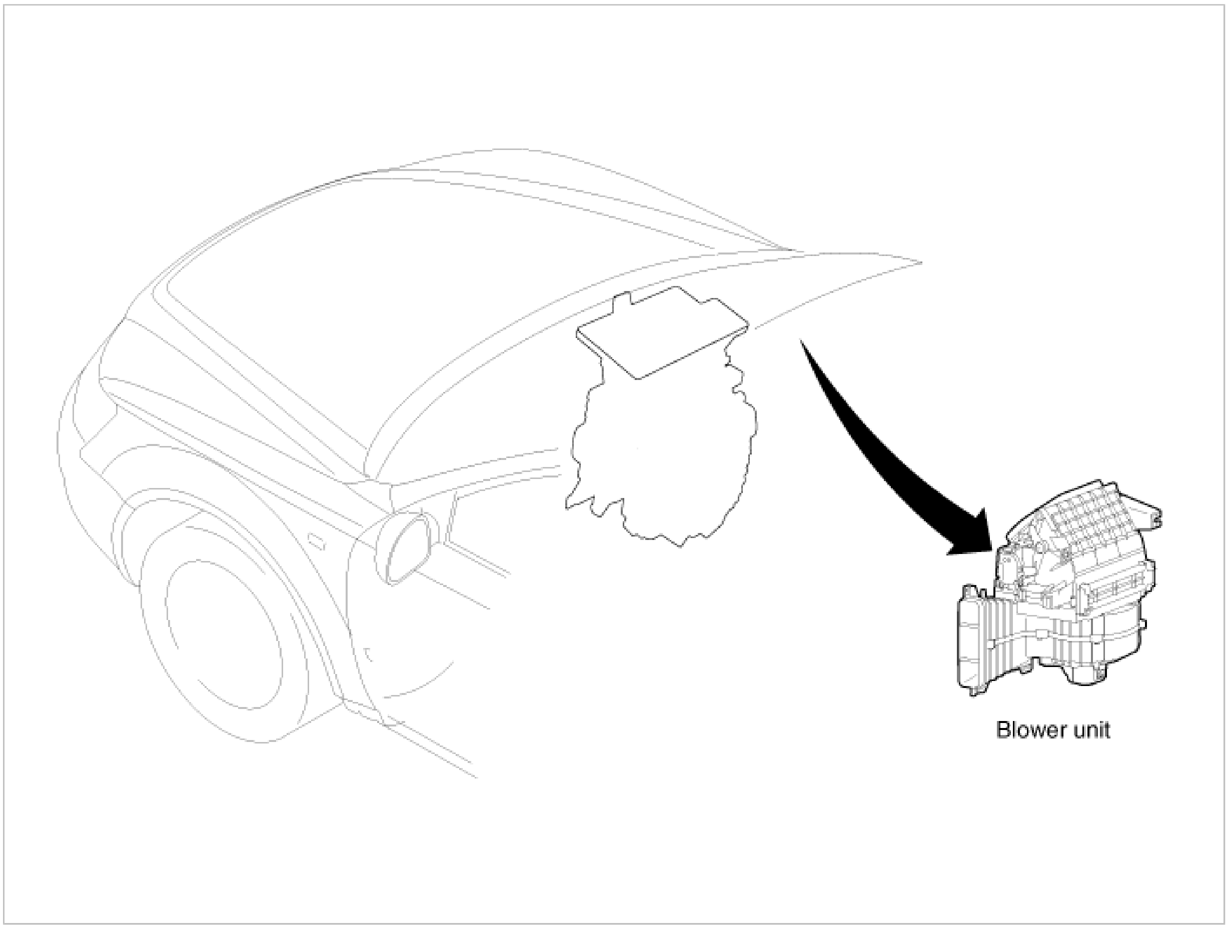
3. Disconnect the connector of mode control actuator after removing the air duct.
4. Loosen the mounting screws and then remove the mode control actuator (B).



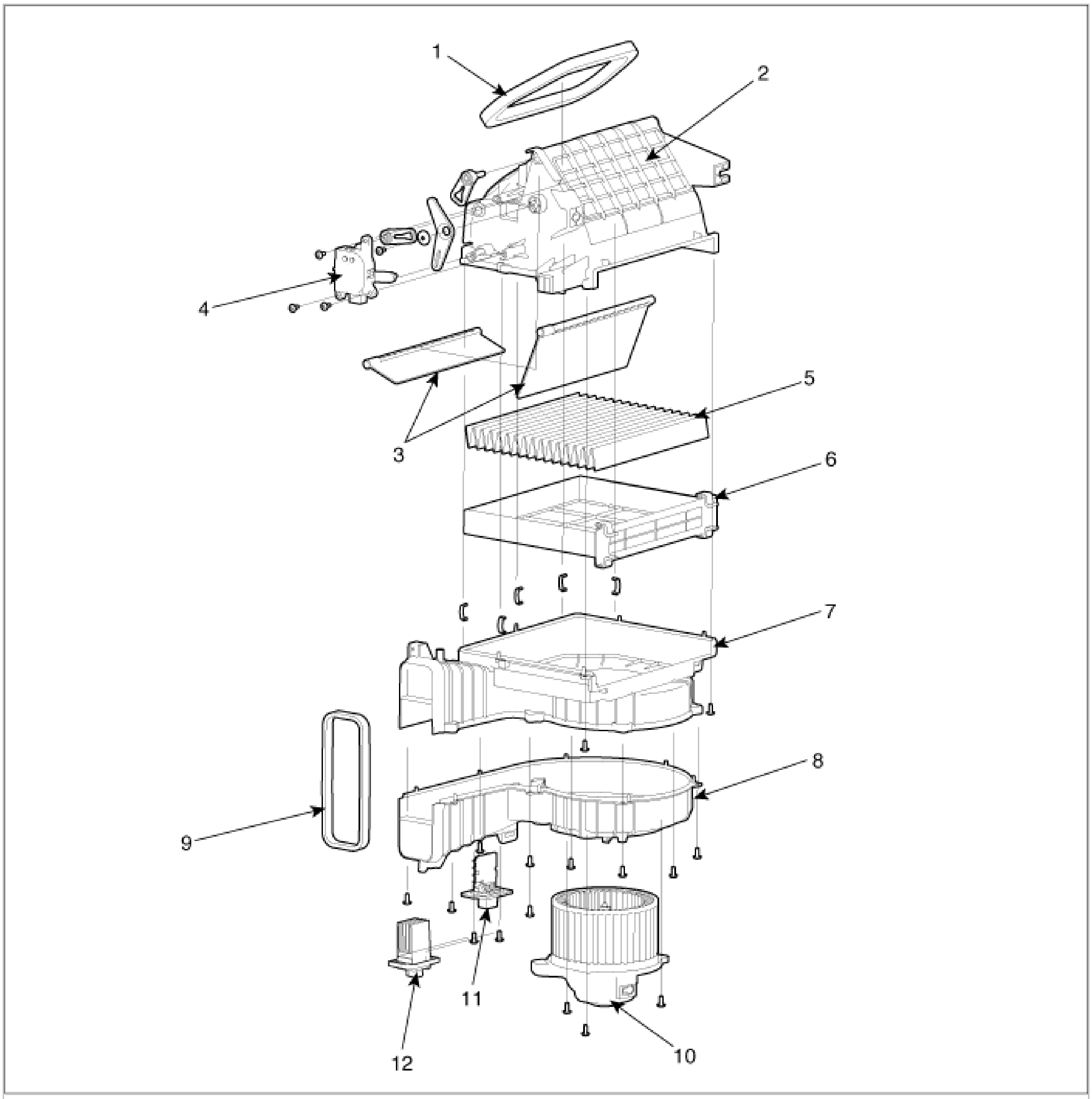
5. Install in the reverse order of removal.

Heating,Ventilation, Air Conditioning > Blower > Blower Unit > Components and Components Location

COMPONENT LOCATION



COMPONENTS

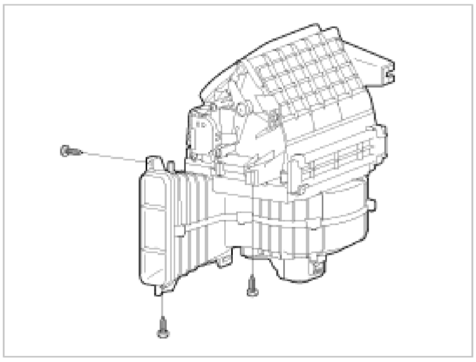


1. Outlet duct seal	7. Blower upper case
2. Inlet duct case	8. Blower lower case
3. Inlet door	9. Blower seal
4. Intake actuator	10. Blower motor
5. Air filter	11. Resistor (MANUAL)
6. Air filter housing	12. Power mosfet (AUTOMATIC)

Heating,Ventilation, Air Conditioning > Blower > Blower Unit > Repair procedures

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the heater & blower unit (Refer to HA-51)
3. Disconnect the connectors from the intake actuator, blower relay, the blower motor, resistor (MANUAL) and power mosfet (AUTOMATIC).
4. Remove the self-tapping screws and the blower unit.



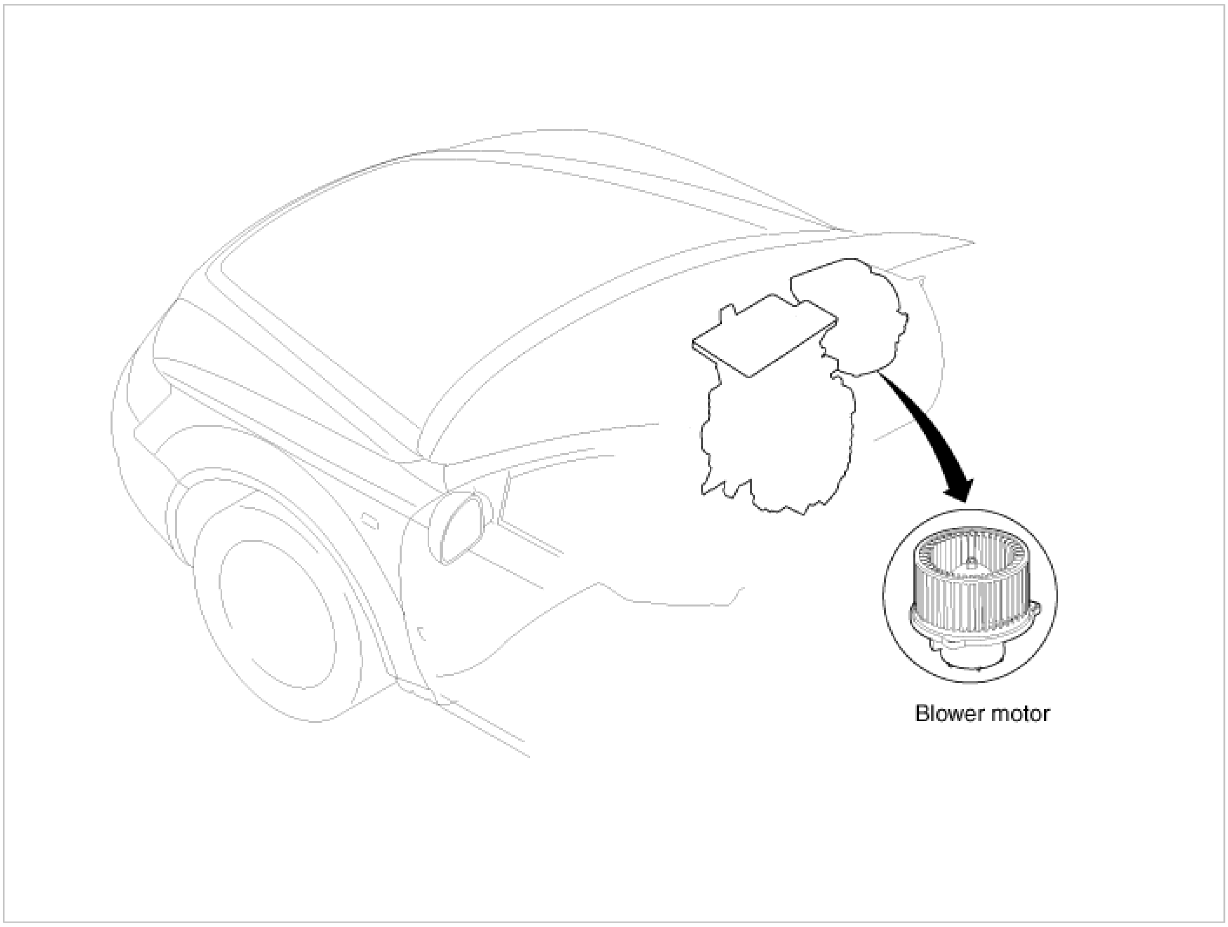
NOTE

Make sure that there is no air leaking out of the blower and duct joints.

5. Install in the reverse order of removal.

Heating,Ventilation, Air Conditioning > Blower > Blower Motor > Components and Components Location

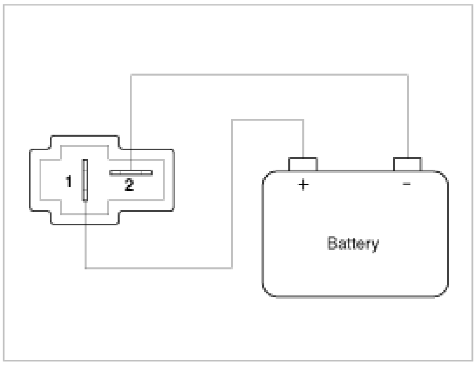
COMPONENT LOCATION



Heating,Ventilation, Air Conditioning > Blower > Blower Motor > Repair procedures

INSPECTION

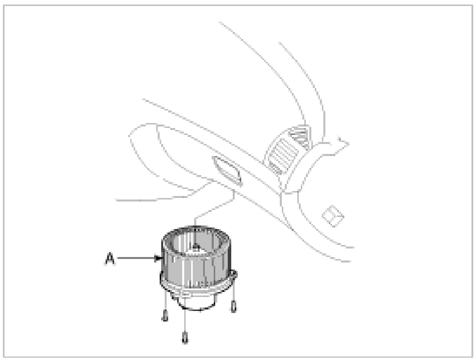
1. Connect the battery voltage and check the blower motor rotation.



2. If the blower motor does not operate properly, substitute with a known-good blower motor and check for proper operation.
3. If the problem is corrected, replace the blower motor.

REPLACEMENT

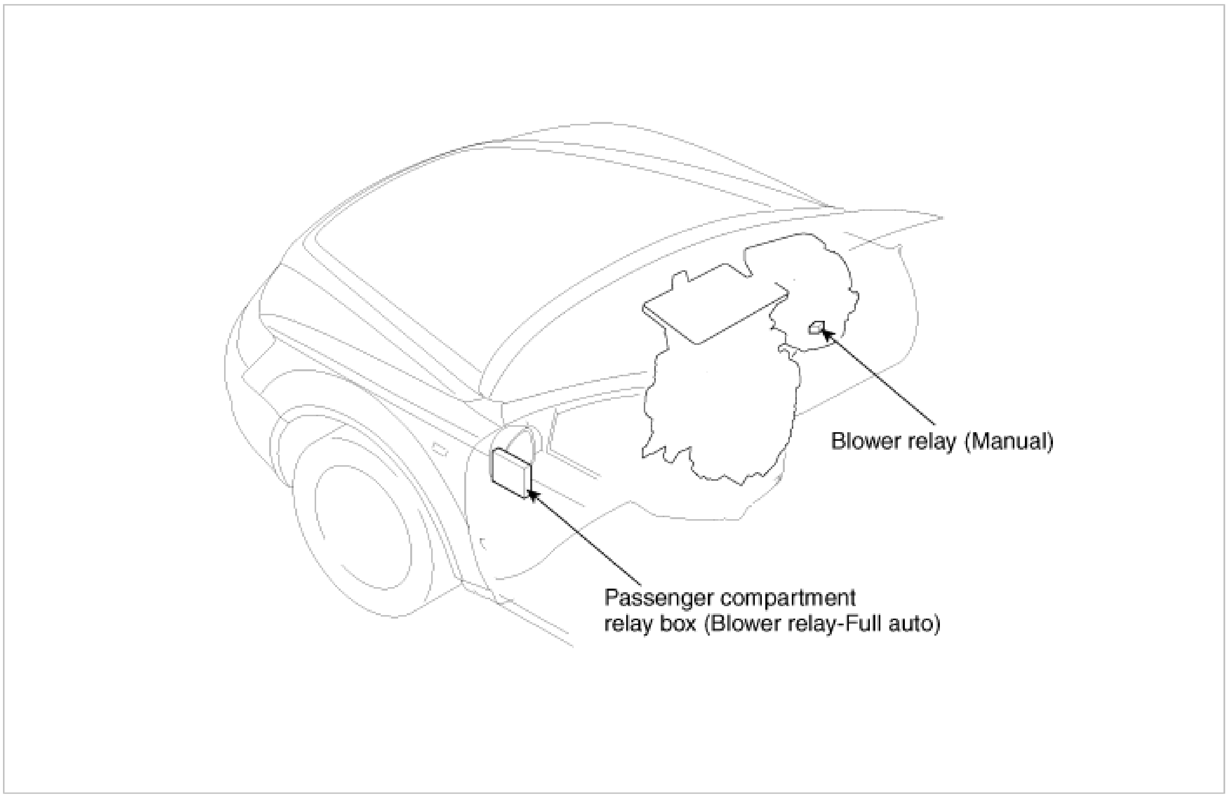
1. Disconnect the negative (-) battery terminal.
2. Remove the under cover after loosening 2 screws.
3. Disconnect the connector of the blower motor.
4. Remove the blower motor (A) after loosening the mounting 3 screws.



5. Installation is the reverse order of removal.

Heating,Ventilation, Air Conditioning > Blower > Blower Relay > Components and Components Location

COMPONENT LOCATION

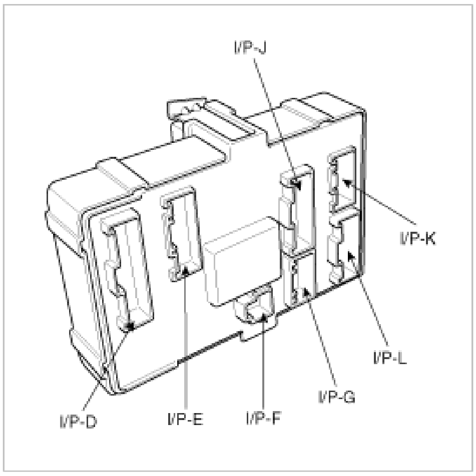


Heating,Ventilation, Air Conditioning > Blower > Blower Relay > Repair procedures

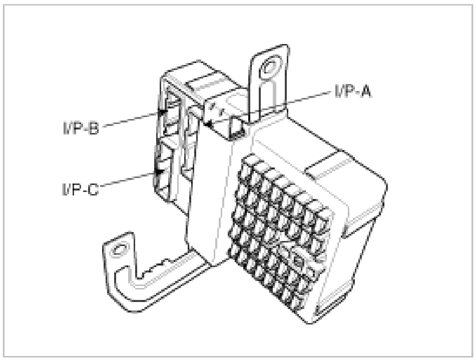
INSPECTION

FULL AUTO TYPE

1. Disconnect the negative (-) battery terminal.
2. Remove the passenger compartment relay box.
   Check for continuity between the terminals.
3. There should be continuity between the No.9 in the I/P-K and No.15 in the I/P-A terminals when power and ground are connected to the No.16 in the I/P-D and No.13 I/P-B terminals in the passenger compartment relay box.
4. There should be no continuity between the No.9 in the I/P-K and No.15 in the I/P-A terminals when power is disconnected.



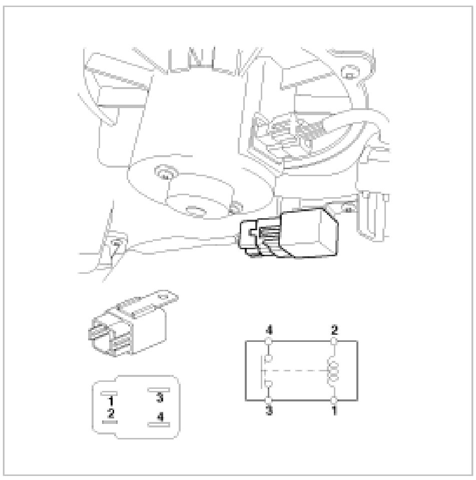
Terminal / Position	I/P-K (9)	I/P-A (15)	I/P-D (16)	I/P-B (13)
Disconnected			○	○
Connected	○	○	⊖	⊕



5. If the blower motor voltage does not operate properly, substitute with a known-good blower relay and check for proper operation.
6. If the problem is corrected, replace the blower relay.

HI-BLOWER RELAY INSPECTION

1. There should be continuity between the No.3 and No.4 terminals when power and ground are connected to the No.1 and No.2 terminals.
2. There should be no continuity between the No.3 and No.4 terminals when power is disconnected.

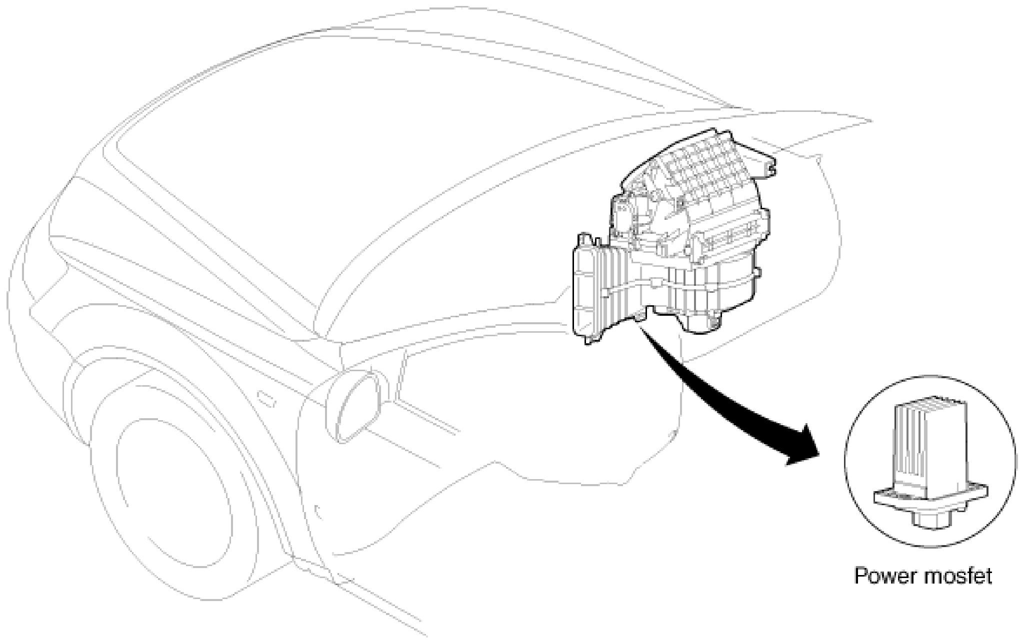


Position \ Terminal	3	4	1	2
Disconnected			○	○
Connected	○	○	⊕	⊖

Heating,Ventilation, Air Conditioning > Blower > Power Mosfet > Components and Components Location

COMPONENT LOCATION

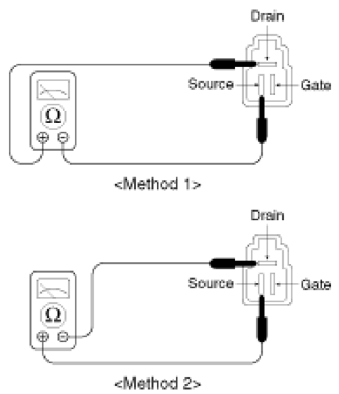
[AUTOMATIC]



Heating,Ventilation, Air Conditioning > Blower > Power Mosfet > Repair procedures

INSPECTION

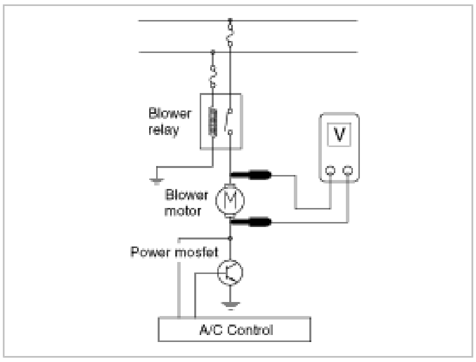
1. Disconnect the negative (-) battery terminal.
2. Remove the power mosfet.Measure resistance between Drain and Source using resistance tester. You can estimate whether power mosfet is failure or not refering to the specification.



FET Fail Check

Resistance (Drain-Source)		Specification	
Measuring method		1	2
Mosfet	Drain	+	-
	Source	-	+
Classification	Normal	∞	About 3 MΩ
	Short	About 0~300Ω	About 0~300Ω
	Open	∞	∞

3. If If the measured resistance is not normal specification, replace the power mosfet.
4. If it is normal, install the power mosfet and ignition "ON".
   Manually operate the control switch and measure the voltage between pin 1 and 2 of blower motor.
5. Select the control switch to raise voltage until high speed.

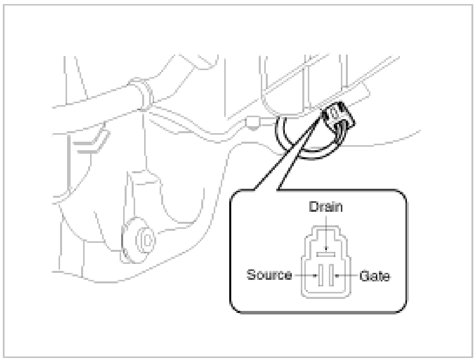


Fan	Motor voltage(V) ± 0.5V
First speed	3.8
Second speed	4.9
Third speed	6.1
Fourth speed	7.2
Fifth speed	8.3
Sixth speed	9.5
Seventh speed	10.6
Eighth speed	Battery (+)

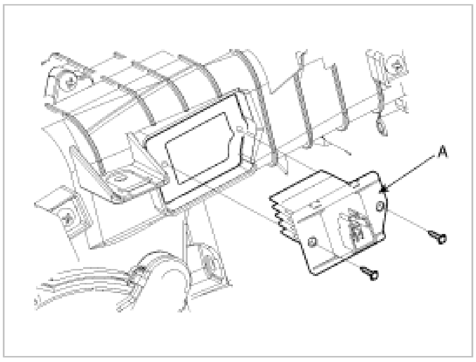
6. If the measured voltage is not within specification, substitute with a known-good power mosfet and check for proper operation.
7. If the problem is corrected, replace the power mosfet.

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Disconnect the connector of the power mosfet at the below blower unit.



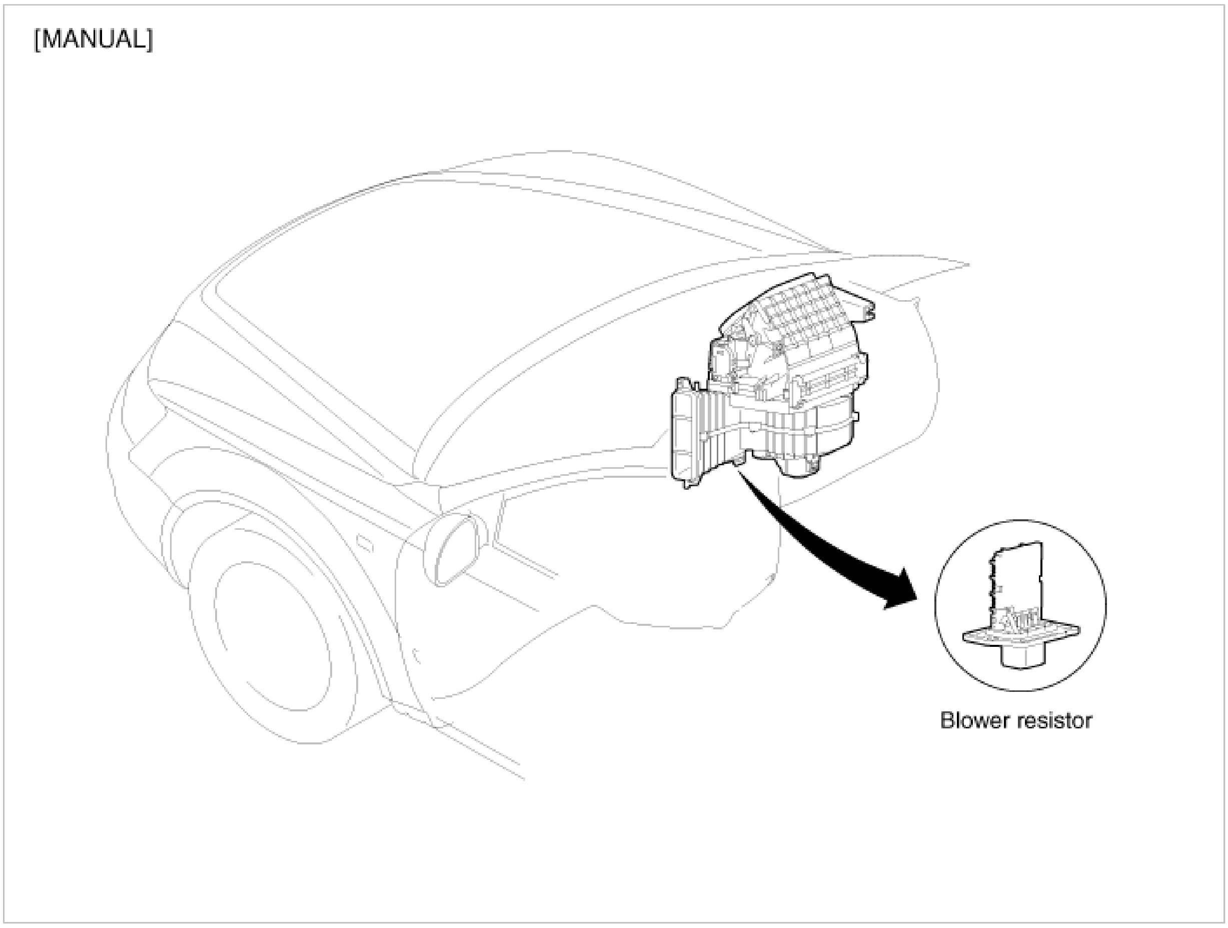
3. Remove the power mosfet (A) after loosening the mounting screws.



4. Install in the reverse order of removal.

Heating,Ventilation, Air Conditioning > Blower > Blower Resistor > Components and Components Location

COMPONENT LOCATION

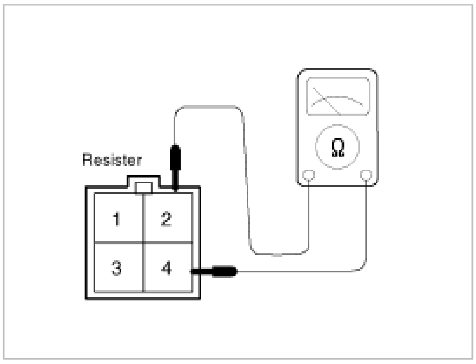


Heating,Ventilation, Air Conditioning > Blower > Blower Resistor > Repair procedures

INSPECTION

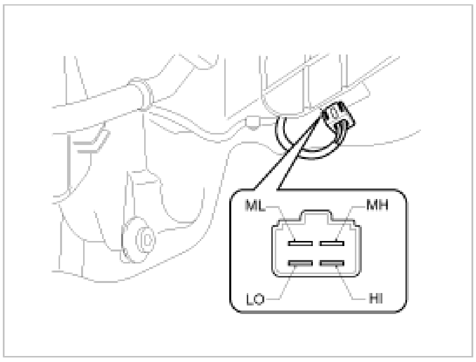
1. Measure terminal-to-terminal resistance of the blower resistor.
2. If measured resistance is not within specification, the blower resistor must be replaced. (After removing the resistor)

Terminal / Speed / Resistance ohmmeter	2	1	4	3	Resistance (Ω)
	MH	ML	HI	LO	
Measurement of resistance between each terminal			O	O	2.9 ± 5%
		O	O		1.5 ± 5%
	O		O		0.5 ± 5%

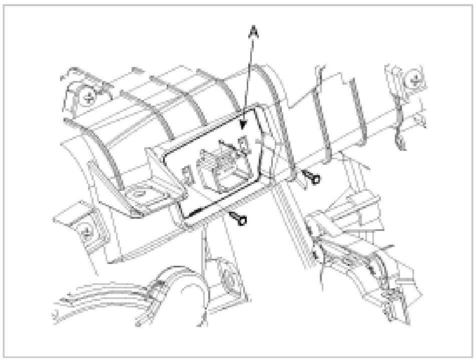


REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Disconnect the connector of the blower resistor at the below blower unit.



3. Remove the blower resistor(A) after loosening the mounting screws.



4. Install in the reverse order of removal.

Heating,Ventilation, Air Conditioning > Blower > A/C Air Filter > Description and Operation

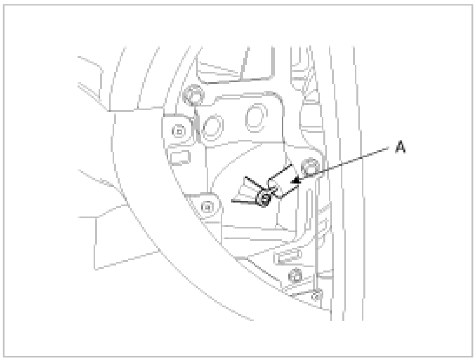
DESCRIPTION

This has particle filter which eliminates foreign materials and odor. The particle filter includes odor filter as well as conventional dust filter to ensure a comfortable interior environment.

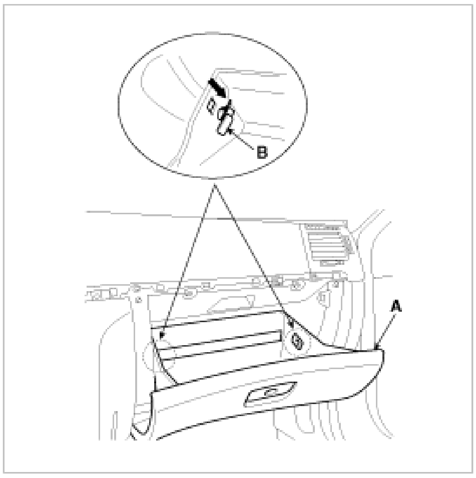
Heating,Ventilation, Air Conditioning > Blower > A/C Air Filter > Repair procedures

REPLACEMENT

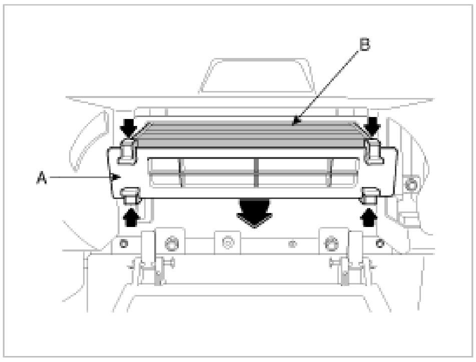
1. Remove the damper (A) from the glove box after removing side cover.



2. Open the glove box (A). Lower the glove box down completely by removing the glove box stopper (B) to the glove box.



3. Remove the filter cover (A) with pushing the knob.
4. Replace the air filter (B), install it after making sure of the direction of air filter.



NOTE

In case of driving in an air-polluted area or rugged terrain, check and replace the air filter as frequently as possible.

Replacement period : 15,000 km (9320 mile)

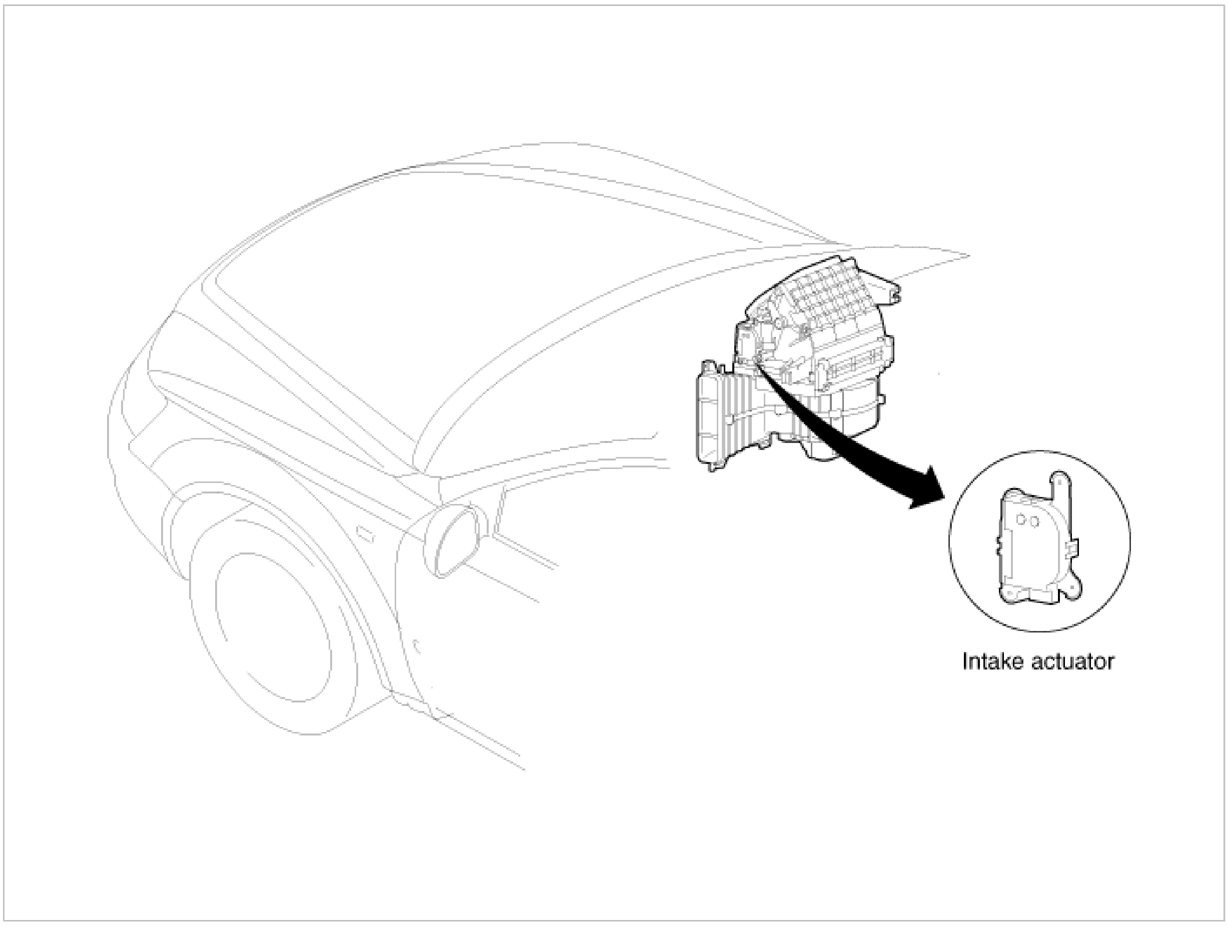
Heating,Ventilation, Air Conditioning > Blower > Intake Actuator > Description and Operation

DESCRIPTION

1. The intake actuator is located at the blower unit.
2. It regulates the intake door by signal from control unit.
3. Pressing the intake selection switch will shift between recirculation and fresh air modes.

Heating,Ventilation, Air Conditioning > Blower > Intake Actuator > Components and Components Location

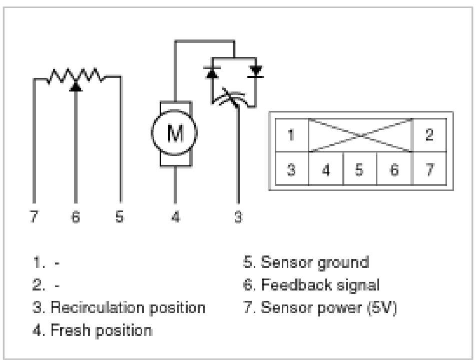
COMPONENT LOCATION



Heating,Ventilation, Air Conditioning > Blower > Intake Actuator > Repair procedures

INSPECTION

1. Ignition "OFF".
2. Disconnect the connector of intake actuator.
3. Verify that the intake actuator actuator operates to the recirculation position when connecting 12V to the terminal 3 and grounding terminal 4.
4. Verify that the intake actuator operates to the fresh position when the connections are reversed.



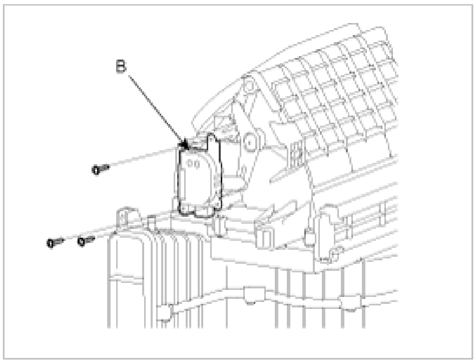
Door position	Voltage (5 - 6)	Error detecting
Recirculation	0.3 ± 0.15V	Low voltage : 0.1V or less
Fresh	4.7 ± 0.15V	High voltage : 4.9V or more

5. If the intake actuator does not operate properly, substitute with a known-good intake actuator and check for proper operation.

6. If the problem is corrected, replace the intake actuator.

REPLACEMENT

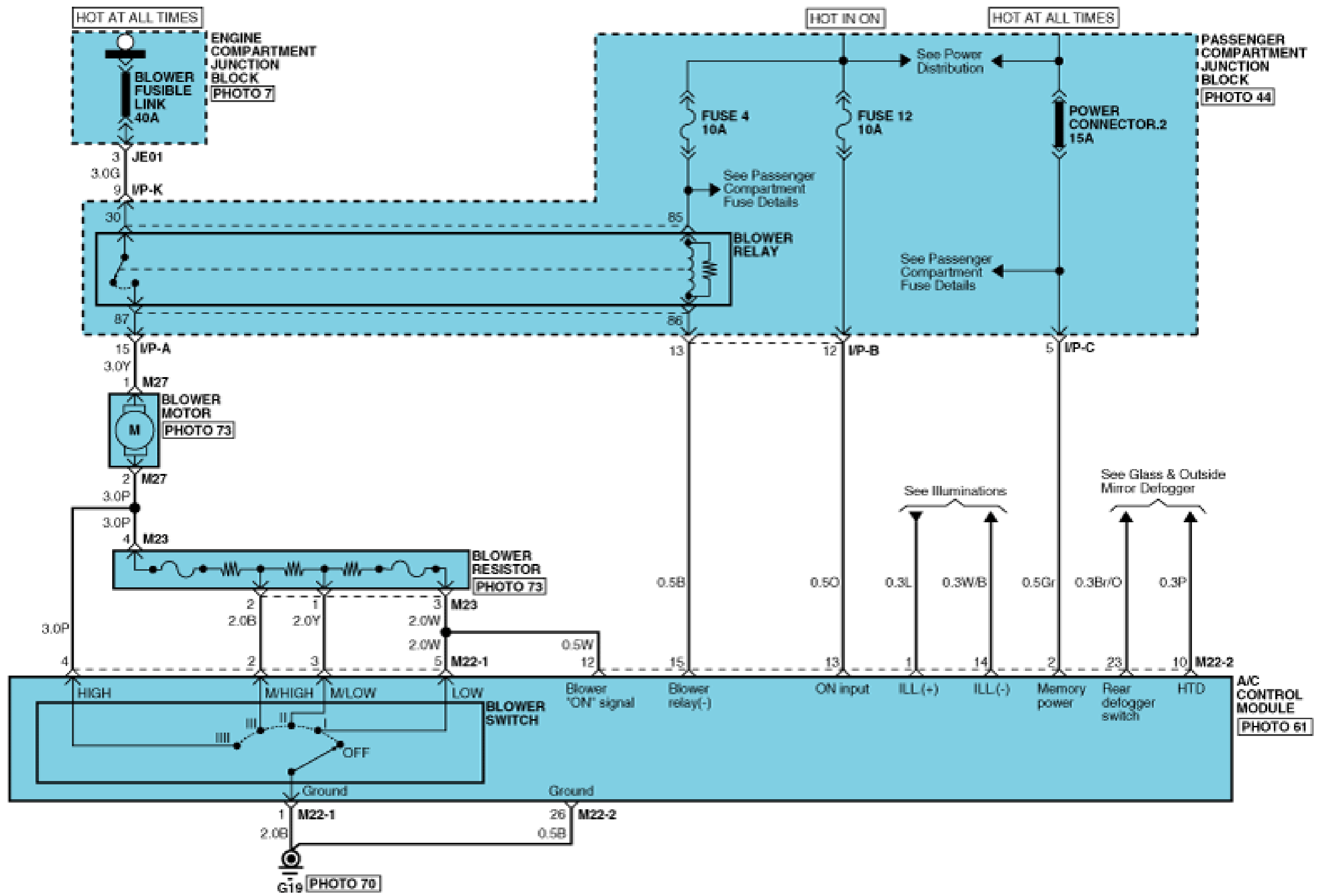
1. Disconnect the negative (-) battery terminal.
2. Remove the glove box (Refer to the BD group).
3. Disconnect the intake actuator connector.
4. Loosen the mounting screw and then remove the intake actuator (B) from the blower unit (A).



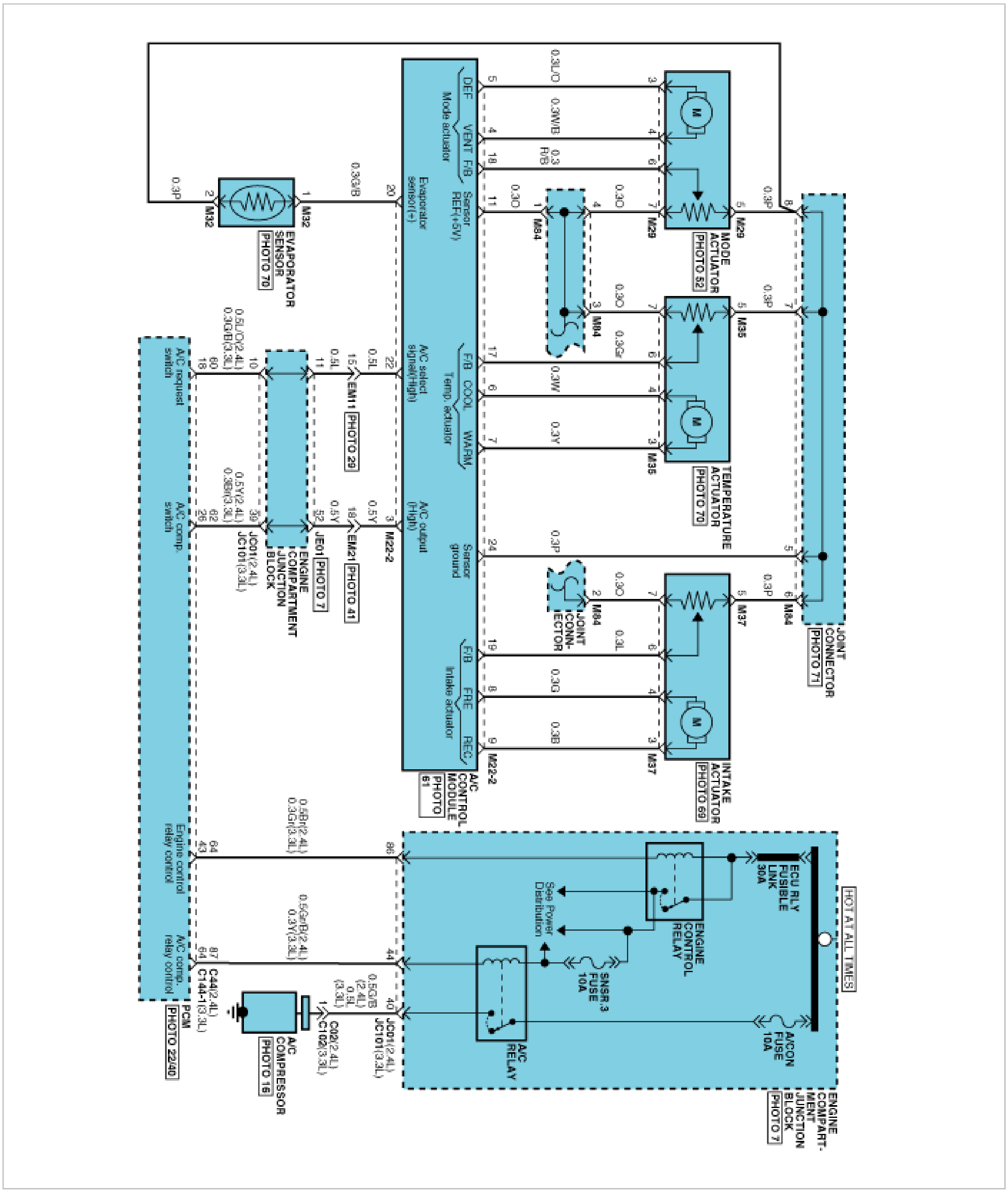
5. Install in the reverse order of removal.

Heating,Ventilation, Air Conditioning > Blower > Control Panel > Schematic Diagrams

CIRCUIT DIAGRAM

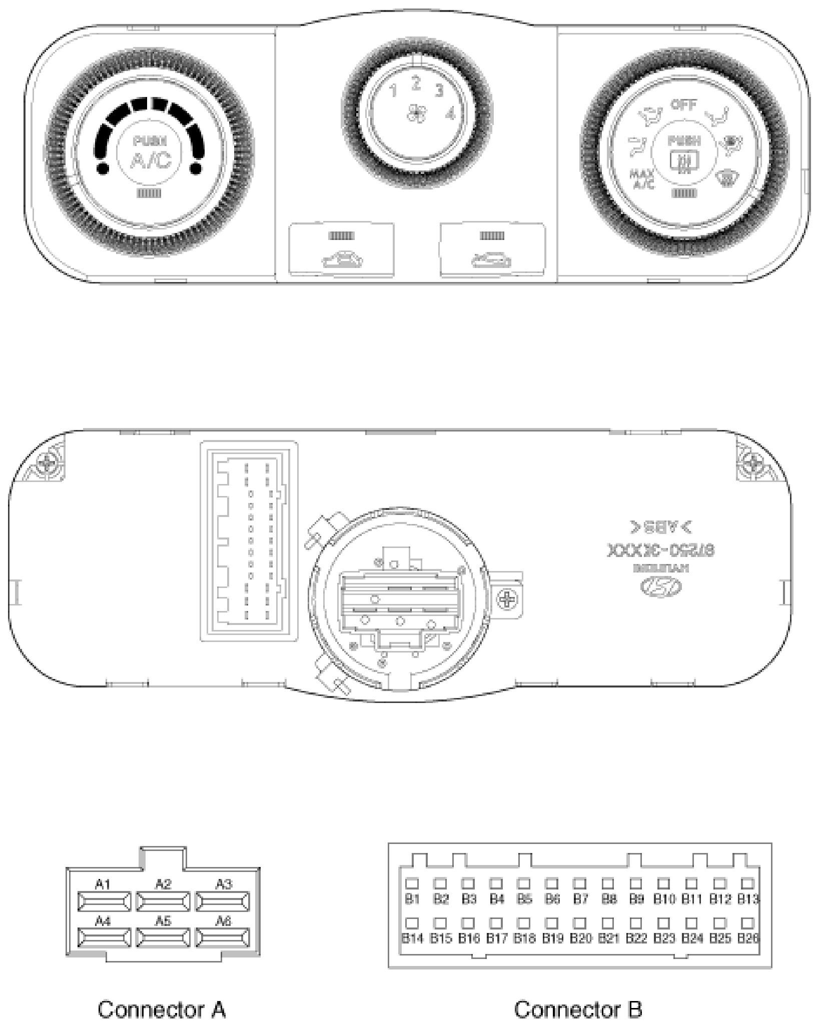


HOT AT ALL TIMES
ENGINE COMPARTMENT JUNCTION BLOCK
PHOTO 7
BLOWER FUSIBLE LINK 40A
3 JE01
3.0G
9 I/P-K
30
87
85
86
BLOWER RELAY
15 I/P-A
3.0Y
1 M27
BLOWER MOTOR
PHOTO 73
M
2 M27
3.0P
4 M23
BLOWER RESISTOR
PHOTO 73
2.0B
2.0Y
2.0W
3 M23
0.5W
5 M22-1
HOT IN ON
HOT AT ALL TIMES
PASSENGER COMPARTMENT JUNCTION BLOCK
PHOTO 44
See Power Distribution
FUSE 4 10A
FUSE 12 10A
POWER CONNECTOR.2 15A
See Passenger Compartment Fuse Details
See Passenger Compartment Fuse Details
13
12 I/P-B
5 I/P-C
See Illuminations
See Glass & Outside Mirror Defogger
0.5B
0.5O
0.3L
0.3W/B
0.5Gr
0.3Br/O
0.3P
10 M22-2
HIGH
M/HIGH
M/LOW
LOW
BLOWER SWITCH
IIII
III
II
I
OFF
Blower "ON" signal
Blower relay(-)
ON input
ILL.(+)
ILL.(-)
Memory power
Rear defogger switch
HTD
A/C CONTROL MODULE
PHOTO 61
Ground
Ground
1 M22-1
2.0B
26 M22-2
0.5B
G19
PHOTO 70



Heating,Ventilation, Air Conditioning > Blower > Control Panel > Components and Components Location

COMPONENTS



CONNECTOR PIN FUNCTION

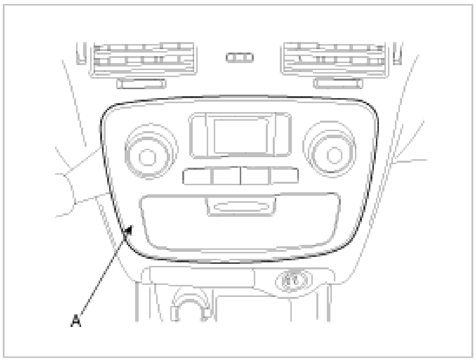
CONNECTOR	PIN	FUNCTION
Connector (A)	1	Ground
	2	Middle high
	3	Middle low
	4	High
	5	Low
	6	-
	1	Tail lamp (+)
	2	Battery
	3	A/C output
	4	Mode vent
	5	Mode defrost
	6	Temp actuator cool
	7	Temp actuator warm

Connector (B)	8	Intake (Fresh)
	9	Intake (Recirculation)
	10	Rear defogger indicator
	11	Sensor power (+5V)
	12	Blower ON signal
	13	IG2
	14	Tail lamp (-) : Rheostat
	15	Blower relay (-)
	16	-
	17	Temp actuator feedback signal
	18	Mode actuator feedback signal
	19	Intake actuator feedback signal
	20	Evaporator temperature sensor
	21	-
	22	A/C select signal
	23	Rear defogger switch
	24	Sensor ground
	25	-
	26	Ground

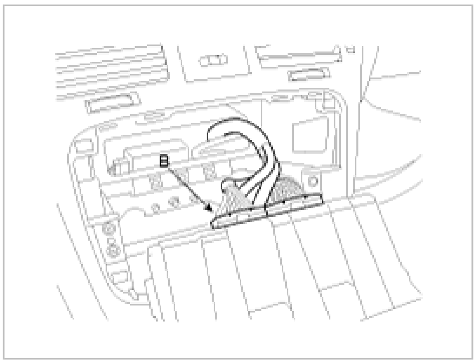
Heating,Ventilation, Air Conditioning > Blower > Control Panel > Repair procedures

REPLACEMENT

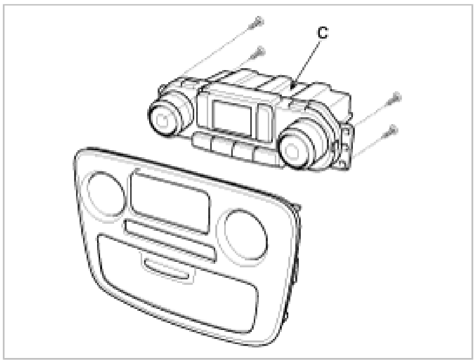
1. Disconnect the negative (-) battery terminal.
2. Remove the center facia panel (A) after pulling it by using a regular screwdriver (-).



3. Disconnect the connectors (B) from the center facia.



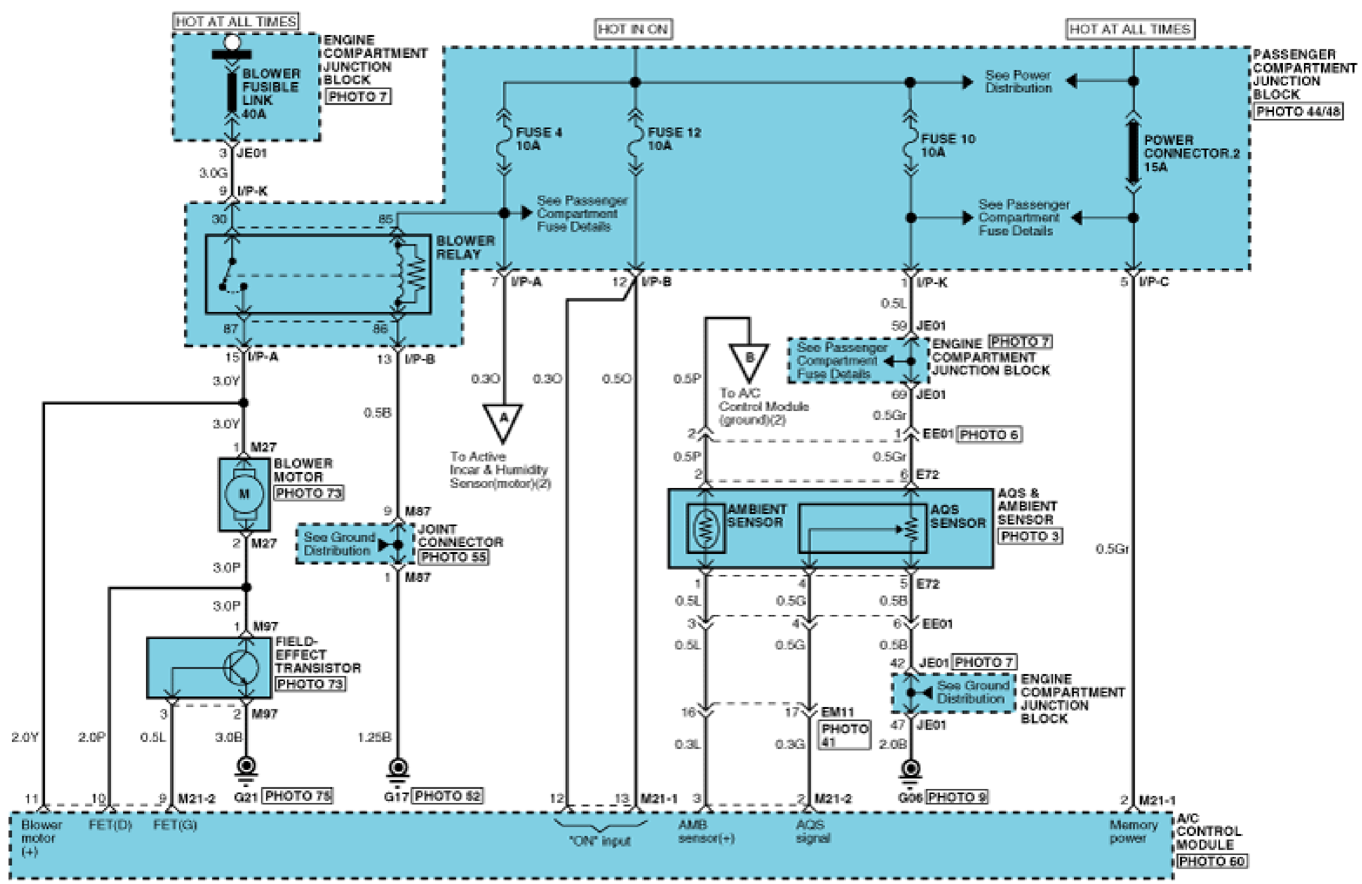
4. Remove the heater & A/C controller (C).

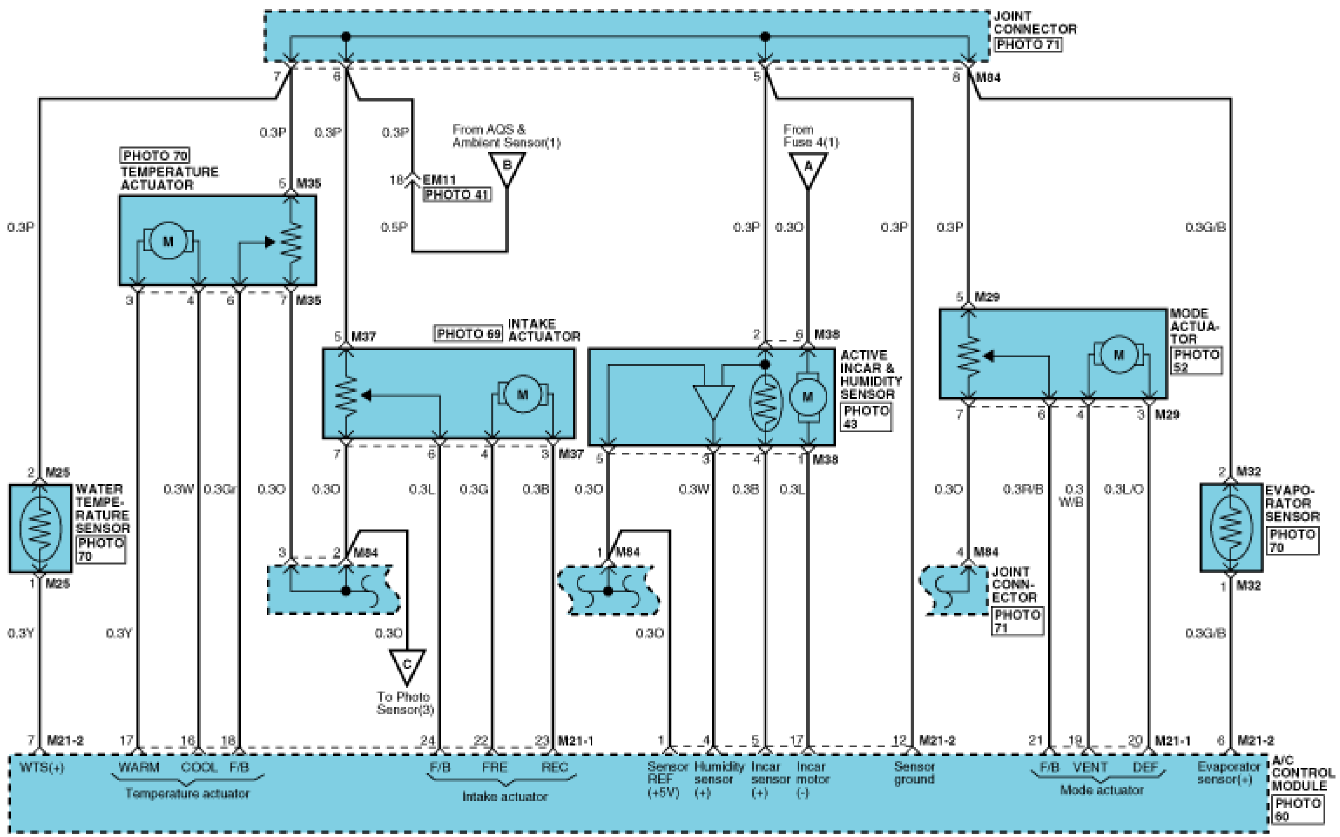


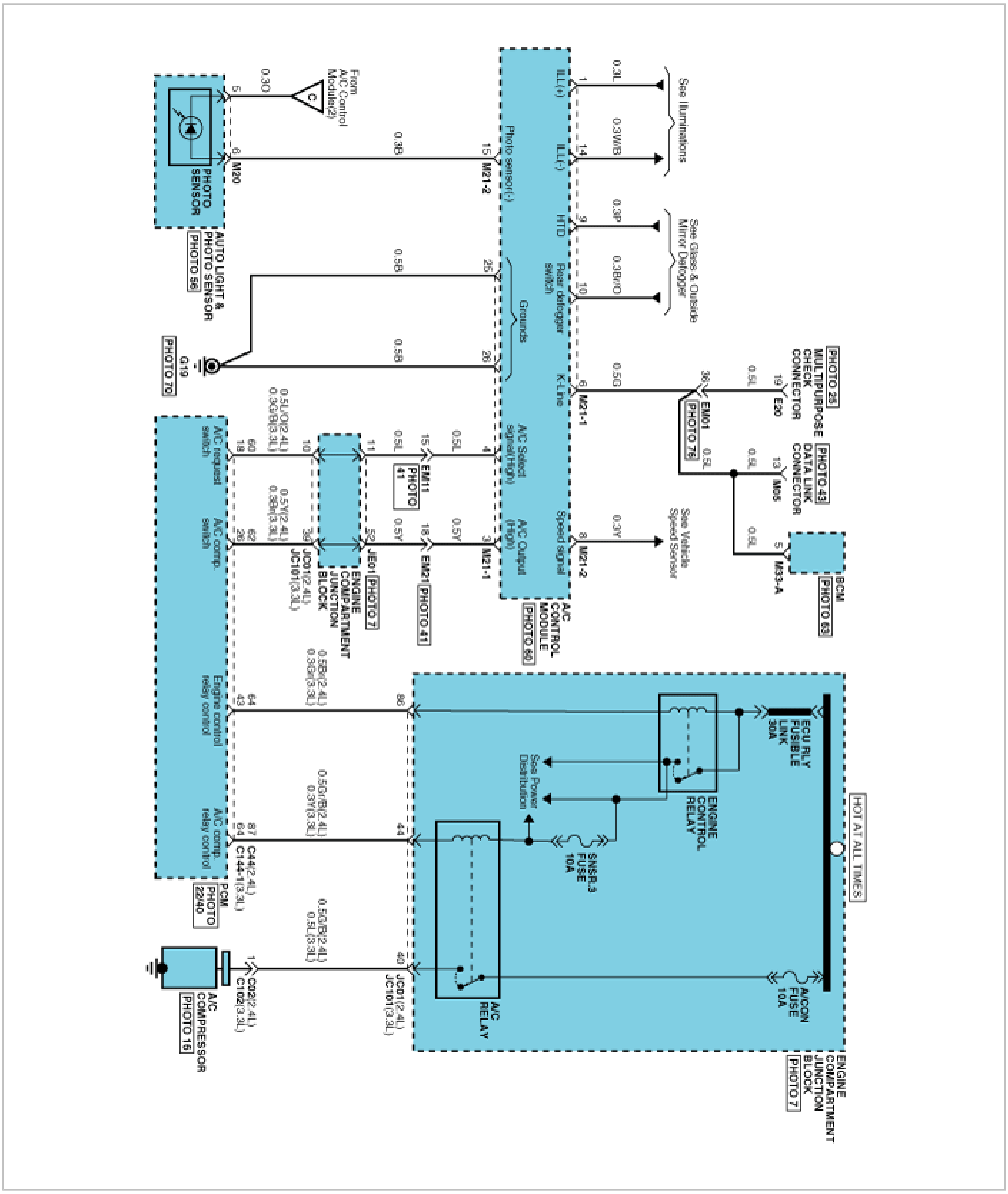
5. Install in the reverse order of removal.

Heating,Ventilation, Air Conditioning > Controller > Manual Controller > Schematic Diagrams

CIRCUIT DIAGRAM

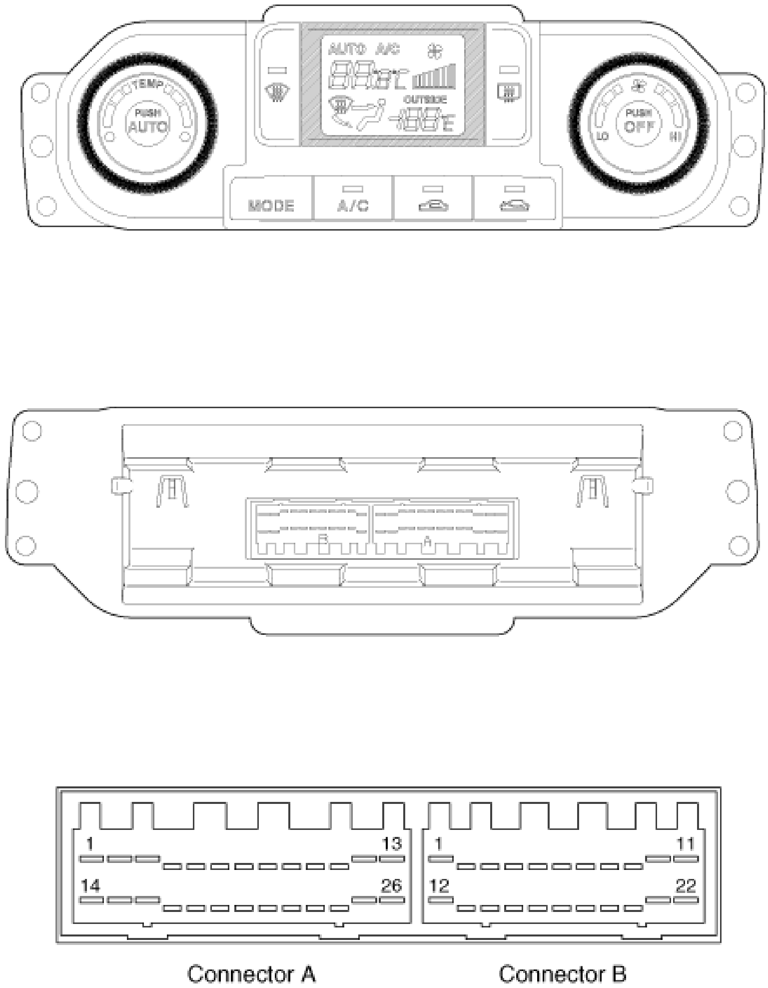

HOT AT ALL TIMES
ENGINE COMPARTMENT JUNCTION BLOCK
PHOTO 7
BLOWER FUSIBLE LINK 40A
HOT IN ON
HOT AT ALL TIMES
PASSENGER COMPARTMENT JUNCTION BLOCK
PHOTO 44/48
FUSE 4 10A
FUSE 12 10A
FUSE 10 10A
POWER CONNECTOR.2 15A
See Power Distribution
See Passenger Compartment Fuse Details
See Passenger Compartment Fuse Details
BLOWER RELAY
To Active Incar & Humidity Sensor(motor)(2)
To A/C Control Module (ground)(2)
See Passenger Compartment Fuse Details
ENGINE COMPARTMENT JUNCTION BLOCK
PHOTO 7
PHOTO 6
BLOWER MOTOR
PHOTO 73
See Ground Distribution
JOINT CONNECTOR
PHOTO 55
AMBIENT SENSOR
AQS SENSOR
AQS & AMBIENT SENSOR
PHOTO 3
FIELD-EFFECT TRANSISTOR
PHOTO 73
JE01 PHOTO 7
See Ground Distribution
ENGINE COMPARTMENT JUNCTION BLOCK
EM11 PHOTO 41
G21 PHOTO 75
G17 PHOTO 52
G06 PHOTO 9
Blower motor (+)
FET(D)
FET(G)
"ON" input
AMB sensor(+)
AQS signal
Memory power
A/C CONTROL MODULE
PHOTO 60


JOINT CONNECTOR
PHOTO 71
M84
From AQS & Ambient Sensor(1)
B
EM11
PHOTO 41
From Fuse 4(1)
A
PHOTO 70
TEMPERATURE ACTUATOR
M35
PHOTO 69
INTAKE ACTUATOR
M37
ACTIVE INCAR & HUMIDITY SENSOR
PHOTO 43
M38
MODE ACTUA-TOR
PHOTO 52
M29
WATER TEMPE-RATURE SENSOR
PHOTO 70
M25
EVAPO-RATOR SENSOR
PHOTO 70
M32
JOINT CONN-ECTOR
PHOTO 71
To Photo Sensor(3)
C
0.3P
0.5P
0.3O
0.3G/B
0.3Y
0.3W
0.3Gr
0.3L
0.3G
0.3B
0.3R/B
0.3 W/B
0.3L/O
M21-2
M21-1
WTS(+)
WARM
COOL
F/B
Temperature actuator
F/B
FRE
REC
Intake actuator
Sensor REF (+5V)
Humidity sensor (+)
Incar sensor (+)
Incar motor (-)
Sensor ground
F/B
VENT
DEF
Mode actuator
Evaporator sensor(+)
A/C CONTROL MODULE
PHOTO 60



Heating,Ventilation, Air Conditioning > Controller > Manual Controller > Components and Components Location

COMPONENTS



CONNECTOR PIN FUNCTION

CONNECTOR	PIN	FUNCTION	CONNECTOR	PIN	FUNCTION
	1	Tail lamp (+)		1	Sensor power (5V)
	2	Battery (+)		2	-
	3	A/C output		3	Ambient sensor (+)
	4	A/C select signal		4	Humidity sensor (+)
	5	-		5	In car sensor (+)
	6	Diagnostic tool		6	Evaporator temperature sensor (+)
	7	-		7	Water temperature sensor
	8	-		8	Speed sensor
	9	Rear defogger indicator		9	Power mosfet (G)
	10	Rear defogger switch		10	Power mosfet (D)
	11	-		11	Blower motor (+)
	12	IG2		12	Sensor ground

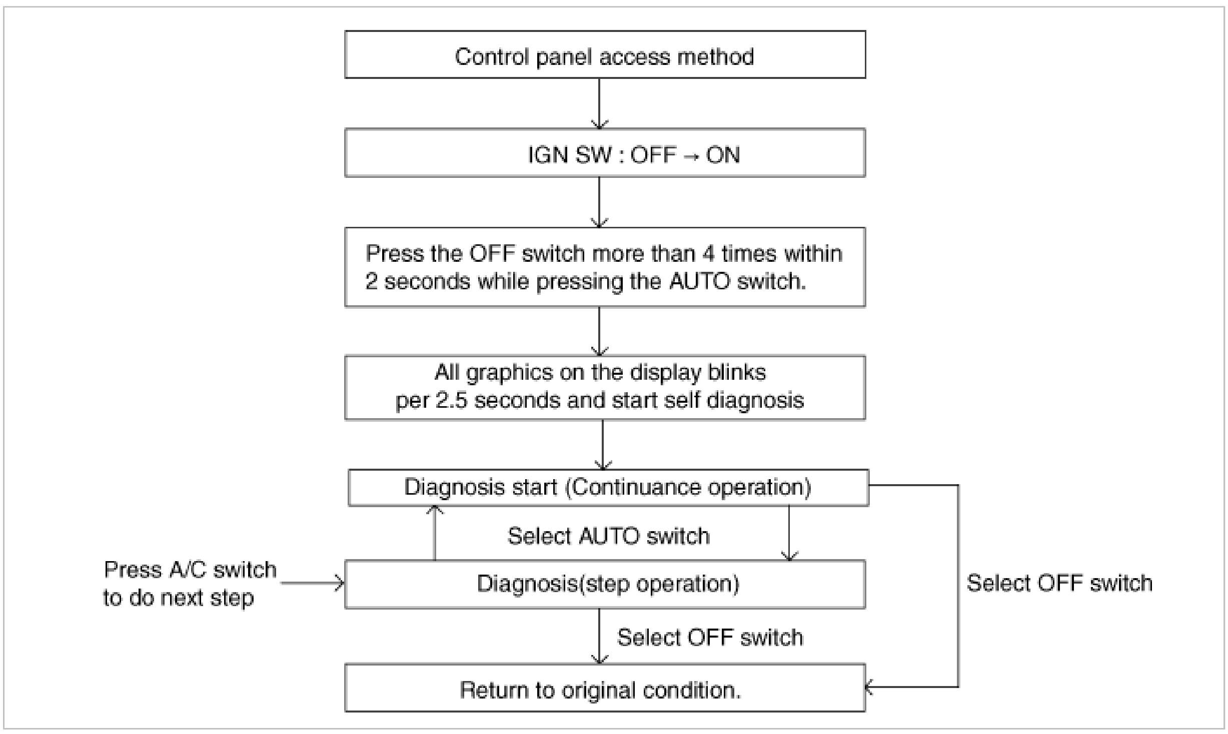
CONNECTOR (A)	13	IG2	CONNECTOR (B)	13	-
	14	Rheostat		14	-
	15	-		15	Photo sensor (+)
	16	Temp actuator cool		16	-
	17	Temp actuator warm		17	In car motor
	18	Temp actuator feedback signal		18	-
	19	Mode vent		19	Blower ON signal
	20	Mode defrost		20	
	21	Mode actuator feedback signal		21	
	22	Intake fresh		22	
	23	Intake recirculation			
	24	Intake feedback signal			
	25	Ground			
	26	Ground			

Heating,Ventilation, Air Conditioning > Controller > Manual Controller > Repair procedures

SELF-DIAGNOSIS

Self-diagnosis process

The F.A.T.C. module self test feature will detect electrical malfunction and provide error codes for system components with suspected failures.



> **NOTE**
>
> Turn off the A/C system during the DTC check.

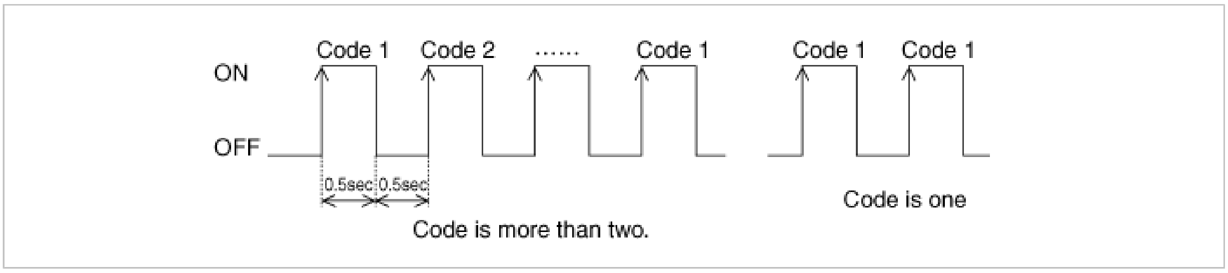
HOW TO READ SELF-DIAGNOSTIC CODE

1. After the display panel flickers three times every 0.5 second, the corresponding fault code flickers on the setup temperature display panel every 0.5 second and will show two figures.
2. Fault code

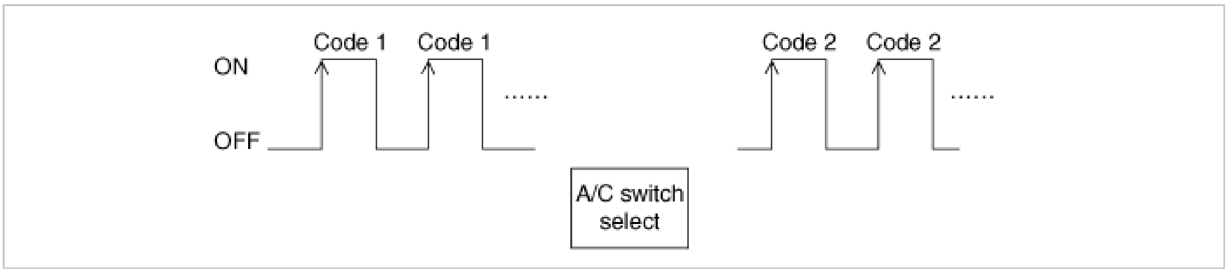
Fault code		

Control unit	Scan tool (DTC)	Fail description
00	-	Normal
11	B1234	In-car temperature sensor open (High)
12	B1233	In-car temperature sensor short (Low)
13	B1238	Ambient temperature sensor open (High)
14	B1237	Ambient temperature sensor short (Low)
15	B1202	Water temperature sensor open (High)
16	B1203	Water temperature sensor short (Low)
17	B1242	Evaporator temperature sensor open (High)
18	B1241	Evaporator temperature sensor short (Low)
19	B1245	Air mix potentiometer open (Low) - Driver
19	B1246	Air mix potentiometer short (High) - Driver
20	B2406	Air mix motor failure (Driver)
21	B1249	Direction potentiometer open (Low) - Driver
21	B1250	Direction potentiometer short (High) - Driver
22	B2409	Direction control motor failure (Driver)
23	B1200	Humidity sensor open (High)
24	B1201	Humidity sensor short (Low)
25	B1208	Intake potentiometer open (Low)
25	B1209	Intake potentiometer short (High)
26	B2408	Intake motor failure
27	B1257	AQS sensor open (High)
28	B1258	AQS sensor short (Low)
29	B1259	AQS sensor failure

3. Fault code display
   (1) Continuance operation



   (2) Step operation



4. If a fault code is displayed during the DTC check, Inspect a malfunction cause by referring to the DTC code.
5. Fail safe
   (1) In-car temperature sensor: Control with the value of 25°C(77°F)
   (2) Ambient temperature sensor: Control with the value of 20°C(67°F)
   (3) Evaporator temperature sensor: Control with the value of -2°C(28.4°F)

(4) Humidity sensor: Control with the value of 10%

(5) Temperature sensor : Control with the value of -2°C (28.4°F)

(6) Temperature control actuator (Air mix potentiometer):
If temperature setting 17°C-24.5°C, fix at maximum cooling position.
If temperature setting 25°C-32°C, fix at maximum heating position.

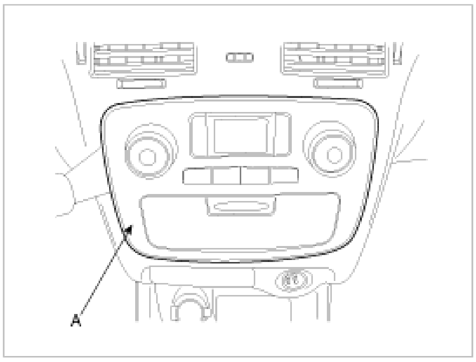
(7) Mode control actuator (Direction potentiometer):
Fix vent position, while selecting vent mode.
Fix defrost position, while selecting all except vent mode.

(8) Intake control actuator :
Fix fresh position, while selecting fresh mode.
Fix recirculation position, while selecting recirculation mode.

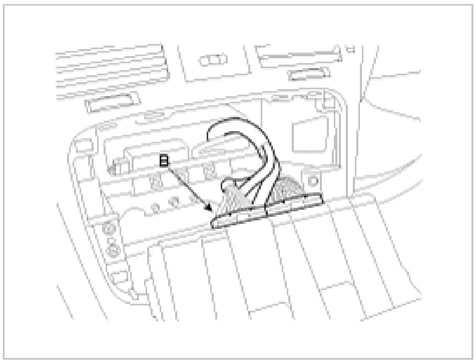
(9) AQS sensor : AQS operation OFF.
A. Intake position : The position before selecting AQS switch.

REPLACEMENT

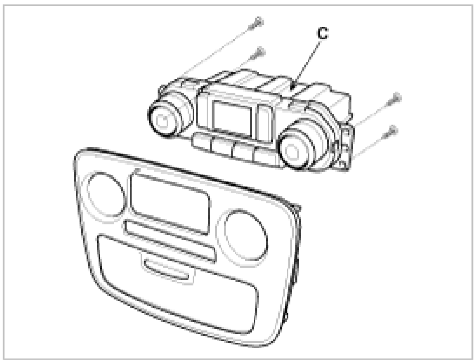
1. Disconnect the negative (-) battery terminal.
2. Remove the center facia panel (A) after pulling it by using a regular screw driver (-).



3. Disconnect the connectors (B) from the center facia.



4. Remove the heater & A/C controller (C).



5. Install in the reverse order of removal.

Heating,Ventilation, Air Conditioning > Controller > B1200 Humidity Sensor Open(High)

Component Location

General Description

Humidity sensor located at heater control unit detects in-car humidity for in-car humidity control. If ambient air temperature or in-car humidity is outside a specified range, A/C will be activated to control in-car humidity to prevent fogging of the windows.

DTC Description

The ECM sets DTC B1200 if there is an open circuit in humidity sensor signal harness or the measured frequency value of sensor is more than the threshold value(about 7,100Hz)

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	● Frequency check	● Open Circuit in signal harness ● Fault Humidity Sensor ● Faulty A/C control unit
Threshold value	● > 7,100Hz	
Detecting time	● 10msec	
FAIL SAFE	● Control with the vlaue of 10%	

Schematic Diagram

Signal Waveform

※ Frequency value of humidity sensor as a function of humidity.

Relative humidity(%)	Frequency(Hz)	Relative humidity(%)	Frequency(Hz)
20	7100	60	6600
30	6976	70	6468
40	6853	80	6330
50	6728	90	6186

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "Humidity Sensor" Parameter on the Scantool. While drying the humidity sensor with the implement such as hair drier
4. Are the DTC B1200 present and is parameter of "Humidity Sensor" fixed ?
   ※Parameter of "Humidity Sensor" will be fixed at 10%, if there is any fault in Humidity Sensor

   YES

   1) Go to "Inspection & Repair" procedure

   NO

   1) Fault is intermittent caused by poor contact in the sensor's and/or A/C control unit's connector or was repaired and A/C control unit memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by

interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

1) Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

1) Go to "Signal Circuit Inspection" procedure

Signal Circuit Inspection

Check for open in harness

1. Ignition "OFF"
2. Disconnect Humidity Sensor.
3. Measure resistance between terminal "3" of Humidity Sensor and terminal "4" of A/C Control Unit
   A. Specification :Approx. 0 Ω
4. Is the measured resistance within specifications?

YES

1) Go to "Ground Circuit Inspection " procedure.

NO

1) Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Ground Circuit inspection

Check for open in ground harness

1. Ignition "OFF"
2. Disconnect Humidity Sensor.
3. Measure resistance between terminal "2" of Humidity Sensor and terminal "12" of A/C Control Unit
   A. Specification :Approx. 0 Ω
4. Is the measured resistance within specifications?

YES

1) Go to "Component Inspection " procedure.

NO

1) Check for open in ground harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Component Inspection

Check Humidity Sensor

1. Engine "ON"
2. Connect Humidity Sensor.
3. Measure Frequency between terminal "3" and "2" of Humidity sensor while increasing humidity.
   A. Specification : Refer the specifications in fig5)
4. Is the measured frequency within specifications in fig5)? (tolerance limits ±5%)

YES

1) Go to "Check A/C Control Unit" procedure

NO

1) Substitute with a known-good Humidity sensor and check for proper operation.

If the problem is corrected, replace Humidity sensor and then go to "Verification of Vehicle Repair" procedure.

Check A/C Control Unit

1. Engine "ON"
2. Disconnect Humidity Sensor.
3. Measure voltage value between terminal "4" of A/C control unit and chassis ground.
   A. Specification : 5V
4. Is the measured voltage within specifications?

   YES

   1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

   NO

   1) Substitute with a known-good A/C Control Unit and check for proper operation.
   If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

   YES

   1) Go to the applicable troubleshooting procedure

   NO

   1) System is performing to specification at this time.

Heating,Ventilation, Air Conditioning > Controller > B1201 Humidity Sensor Short(Low)

Component Location

General Description

Humidity sensor located at heater control unit detects in-car humidity for in-car humidity control. If ambient air temperature or in-car humidity is outside a specified range, A/C will be activated to control in-car humidity to prevent fogging of the windows.

DTC Description

The ECM sets DTC B1201 if there is a short circuit in humidity sensor signal harness or the measured frequency value of the sensor is less than the threshold value(about 6,186Hz)

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	● Frequency check	● Open Circuit in power harness ● Short Circuit in signal harness ● Faulty Humidity Sensor ● Faulty A/C control unit
Threshold value	● < 6,186Hz	
Detecting time	● 10msec	
FAIL SAFE	● Control with the vlaue of 10%	

Schematic Diagram

Signal Waveform

※ Frequency value of humidity sensor as a function of humidity.

Humidity(%)	Frequency(Hz)	Humidity(%)	Frequency(Hz)
20	7100	60	6600
30	6976	70	6468
40	6853	80	6330
50	6728	90	6186

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "Humidity Sensor" Parameter on the Scantool. While drying the humidity sensor with the implement such as hair drier
4. Are the DTC B1201 present and is parameter of "Humidity Sensor" fixed ?
   ※Parameter of "Humidity Sensor" will be fixed at 10%, if there is any fault in Humidity Sensor

   YES

   1) Go to "Inspection & Repair" procedure

   NO

   1) Fault is intermittent caused by poor contact in the sensor's and/or A/C control unit's connector or was repaired and A/C control unit memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   1) Repair as necessary and go to "Verification of Vehicle Repair" procedure

   NO

   1) Go to "Signal Circuit Inspection" procedure

Signal Circuit Inspection

Check for short to ground in harness

1. Ignition "OFF"
2. Disconnect Humidity Sensor.
3. Measure resistance between terminal "3" of Humidity sensor and chassis ground.
   A. Specification :Approx. ∞ Ω
4. Is the measured resistance within specifications?

   YES

   1) Go to "Power Circuit Inspection " procedure.

   NO

   1) Check for short to ground in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Power Supply Circuit Inspection

Check for open in power harness

1. Ignition "ON"
2. Disconnect Humidity Sensor.

3. Measure voltage value between terminal "5" of Humidity Sensor and chassis ground
   A. Specification :5V

4. Is the measured voltage value within specifications?

   YES

   1) Go to "Component Inspection " procedure.

   NO

   1) Check for open in power harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Component Inspection

Check Humidity Sensor

1. Engine "ON"
2. Connect Humidity Sensor.
3. Measure Frequency between terminal "3" and "2" of Humidity sensor while increasing humidity.
   A. Specification : Refer the specifications in fig3)

4. Is the measured frequency within specifications in fig5)? (tolerance limits ±5%)

   YES

   1) Go to "Check A/C Control Unit" procedure

   NO

   1) Substitute with a known-good Humidity sensor and check for proper operation.
   If the problem is corrected, replace Humidity sensor and then go to "Verification of Vehicle Repair" procedure.

Check A/C Control Unit

1. Engine "ON"
2. Disconnect Humidity Sensor.
3. Measure voltage value between terminal "4" of A/C control unit and chassis ground.
   A. Specification : 5V

4. Is the measured voltage within specifications?

   YES

   1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

   NO

   1) Substitute with a known-good A/C Control Unit and check for proper operation.
   If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

   YES

   1) Go to the applicable troubleshooting procedure

   NO

   1) System is performing to specification at this time.

Heating,Ventilation, Air Conditioning > Controller > B1202 Water Temperature Sensor Open (High)

Component Location

General Description

A water temp sensor located at heater unit detects coolant temperature. Its signal is used for cold engine lockout control.When the driver operates the heater before the engine is warmed up, the signal from sensor causes the heater control unit to reduce blower motor speed until coolant temperature reaches the threshold value.

DTC Description

The ECM sets DTC B1202 if there is an open circuit in water temp sensor signal harness or the measured resistance value of the sensor is more than the threshold value(about 176.3kΩ)

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Resistance check	• Open Circuit in harness • Fault water temp. Sensor • Fault A/C Control Unit
Threshold value	• > 176.3kΩ	
Detecting time	• 0.3sec	
FAIL SAFE	• Control with the value of 28.4°F	

Schematic Diagram

Signal Waveform

※ Resistance value of water temp sensor as a function of temperature.

Temperature(°F)	Resistance(kΩ)	Temperature(°F)	Resistance(kΩ)
-22	176.3	77	10
5	73.6	95	6.5
32	32.9	140	2.5
59	15.8	176	1.2

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "WATER TEMP SENSOR" Parameter on the Scantool.
4. Are the DTC B1202 present and is parameter of "WATER TEMP SENSOR" fixed?
   ※ Parameter of "WATER TEMP SENSOR" will be fixed at 28.4°F, if there is any fault in WATER TEMP SENSOR

   YES

   1) Go to "Inspection & Repair" procedure

   NO

   1) Fault is intermittent caused by poor contact in the sensor's and/or A/C control unit's connector or was repaired and A/C control unit memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by

interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

1) Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

1) Go to "Signal Circuit Inspection" procedure

Signal Circuit Inspection

Check for open in harness

1. Ignition "OFF"
2. Disconnect water temp. sensor.
3. Measure resistance between terminal "1" of water temp. sensor and terminal "7" of A/C Control Unit

A. Specification :Approx. 0 Ω

4. Is the measured resistance within specifications?

YES

1) Go to "Ground Circuit Inspection " procedure.

NO

1) Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Ground Circuit inspection

Check for open in ground harness

1. Ignition "OFF"
2. Disconnect water temp. sensor.
3. Measure resistance between terminal "2" of water temp. sensor and chasis ground

A. Specification :Approx. 0 Ω

4. Is the measured resistance within specifications?

YES

1) Go to "Component Inspection " procedure.

NO

1) Check for open in ground harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Component Inspection

Check WATER TEMP Sensor

1. Ignition "OFF"
2. Disconnect water temp. sensor.
3. Measure resistance between terminal "1" and "2" of water temp. sensor.

A. Specification : Refer the specifications in fig3)

4. Is the measured resistance within specifications in fig3)? (tolerance limits ±3%)

YES

1) Go to "Check A/C Control Unit" procedure

NO

1) Substitute with a known-good water temp. sensor and check for proper operation. If the problem is corrected, replace water temp. sensor and then go to "Verification of Vehicle Repair" procedure.

Check A/C Control Unit

1. Engine "ON"
2. Disconnect water temp. sensor.
3. Measure Voltage between terminal "7" of A/C Control Unit and chasis ground
   A. Specification : Approx. 5V
4. Is the measured voltage within specifications?

   YES

   1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

   NO

   1) Substitute with a known-good A/C Control Unit and check for proper operation.
   If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

   YES

   1) Go to the applicable troubleshooting procedure

   NO

   1) System is performing to specification at this time.

Heating,Ventilation, Air Conditioning > Controller > B1203 Water Temperature Sensor Short (Low)

Component Location

General Description

A water temp sensor located at heater unit detects coolant temperature. Its signal is used for cold engine lockout control. When the driver operates the heater before the engine is warmed up, the signal from sensor causes the heater control unit to reduce blower motor speed until coolant temperature reaches the threshold value.

DTC Description

The ECM sets DTC B1203 if there is a short circuit in water temp sensor signal harness or the measured resistance value of the sensor is less than the threshold value(about 1.2kΩ)

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	● Resistance check	● Short circuit in harness ● Fault water temp. Sensor ● Fault A/C Control Unit
Threshold value	● <1.2kΩ	
Detecting time	● 0.3sec	
FAIL SAFE	● Control with the value of 28.4°F	

Schematic Diagram

Signal Waveform

※ Resistance value of water temp sensor as a function of temperature.

Temperature(°F)	Resistance(kΩ)	Temperature(°F)	Resistance(kΩ)
-22	176.3	77	10
5	73.6	95	6.5
32	32.9	140	2.5
59	15.8	176	1.2

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "WATER TEMP SENSOR" Parameter on the Scantool.
4. Are the DTC B1203 present and is parameter of "WATER TEMP.SENSOR" fixed ?
   ※ Parameter of "WATER TEMP SENSOR" will be fixed at 28.4°F, if there is any fault in WATER TEMP SENSOR

   YES

   1) Go to "Inspection & Repair" procedure

   NO

   1) Fault is intermittent caused by poor contact in the sensor’ss and/or A/C control unit’ss connector or was repaired and A/C control unit memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   1) Repair as necessary and go to "Verification of Vehicle Repair" procedure

   NO

   1) Go to "Signal Circuit Inspection" procedure

Signal Circuit Inspection

Check for short to ground in harness

1. Ignition "OFF"
2. Disconnect water temp. sensor.
3. Measure resistance between terminal "1" of water temp. sensor and chassis ground.
   A. Specification :Approx. ∞ Ω
4. Is the measured resistance within specifications?

   YES

   1) Go to "Component Inspection" procedure.

   NO

   1) Check for short to ground in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Component Inspection

Check WATER TEMP Sensor

1. Ignition "OFF"
2. Disconnect water temp. sensor.
3. Measure resistance between terminal "1" and "2" of water temp. sensor.

A. Specification : Refer the specifications in fig3)

4. Is the measured resistance within specifications in fig3)? (tolerance limits ±3%)

YES

1) Go to "Check A/C Control Unit" procedure

NO

1) Substitute with a known-good water temp. sensor and check for proper operation. If the problem is corrected, replace water temp. sensor and then go to "Verification of Vehicle Repair" procedure.

Check A/C Control Unit

1. Engine "ON"
2. Disconnect water temp. sensor.
3. Measure Voltage between terminal "7" of A/C Control Unit and chasis ground

A. Specification : Approx. 5V

4. Is the measured voltage within specifications?

YES

1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

1) Substitute with a known-good A/C Control Unit and check for proper operation. If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

YES

1) Go to the applicable troubleshooting procedure

NO

1) System is performing to specification at this time.

Heating,Ventilation, Air Conditioning > Controller > B1233 In-car Temperature Sensor Short (Low)

Component Location

General Description

The incar temperature sensor is located at heater control unit. It contains a thermistor which measures the temperature of the inside. The signal,decided by the resistance value which changes in accordance with perceived inside temperature, is delivered to heater control unit and according to this signal, the control unit regulates incar temperature to intended value

DTC Description

The ECM sets DTC B1233 if there is a short circuit in incar temp sensor signal harness or the measured resistance value of the sensor is less than the threshold value(about 7.46kΩ)

DTC Detecting Condition

Item	Detecting Condition	Possible Cause

DTC Strategy	● Resistance check	● Short circuit in harness ● Fault incar temp.sensor ● Fault A/C Control Unit
Threshold value	● <7.46kΩ	
Detecting time	● 0.3sec	
FAIL SAFE	● Control with the value of 77°F	

Schematic Diagram

Signal Waveform

※ Resistance value of water temp sensor as a function of temperature.

Temperature(°F)	Resistance(kΩ)	Temperature(°F)	Resistance(kΩ)
-22	509.57	77	30
5	216.07	95	15.59
32	97.71	122	10.81
59	47.13	140	7.46

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "INCAR TEMP.SENSOR" Parameter on the Scantool.
4. Are the DTC B1233 present and is parameter of "INCAR TEMP.SENSOR" fixed ?
   ※ Parameter of "INCAR TEMP.SENSOR" will be fixed at 77°F, if there is any fault in INCAR SENSOR

   YES

   1) Go to "Inspection & Repair" procedure

   NO

   1) Fault is intermittent caused by poor contact in the sensor's and/or A/C control unit's connector or was repaired and A/C control unit memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   1) Repair as necessary and go to "Verification of Vehicle Repair" procedure

   NO

   1) Go to "Signal Circuit Inspection" procedure

Signal Circuit Inspection

Check for short to ground in harness

1. Ignition "OFF"
2. Disconnect incar sensor.
3. Measure resistance between terminal "4" of incar sensor and chassis ground
   A. Specification :Approx. ∞ Ω

4. Is the measured resistance within specifications?

YES

1) Go to "Component Inspection" procedure.

NO

1) Check for short to ground in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Component Inspection

Check Incar Temp. sensor

1. Ignition "OFF"
2. Disconnect incar sensor.
3. Measure resistance between terminal "4" and "2" of incar sensor
   A. Specification : Refer the specifications in fig3)
4. Is the measured resistance within specifications in fig3)? (tolerance limits ±3%)

YES

1) Go to "Check A/C Control Unit" procedure

NO

1) Substitute with a known-good incar sensor and check for proper operation. If the problem is corrected, replace incar sensor and then go to "Verification of Vehicle Repair" procedure.

Check A/C Control Unit

1. Engine : "ON"
2. Disconnect incar sensor.
3. Measure Voltage between terminal "5" of A/C Control Unit and chassis ground
   A. Specification :Approx. 5V
4. Is the measured voltage within specifications?

YES

1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

1) Substitute with a known-good A/C Control Unit and check for proper operation. If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

YES

1) Go to the applicable troubleshooting procedure

NO

1) System is performing to specification at this time.

Heating,Ventilation, Air Conditioning > Controller > B1234 In-car Temperature Sensor Open (High)

Component Location

General Description

The incar temperature sensor is located at heater control unit. It contains a thermistor which measures the temperature of the inside. The signal,decided by the resistance value which changes in accordance with perceived inside temperature, is delivered to heater control unit and according to this signal, the control unit regulates incar temperature to intended value

DTC Description

The ECM sets DTC B1234 if there is an open circuit in incar temp sensor signal harness or the measured resistance value of the sensor is more than the threshold value(about 509.57kΩ)

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	● Resistance check	● Open Circuit in harness ● Fault incar temp.sensor ● Fault A/C Control Unit
Threshold value	● > 509.57kΩ	
Detecting time	● 0.3sec	
FAIL SAFE	● Control with the value of 25°C	

Schematic Diagram

Signal Waveform

※ Resistance value of water temp sensor as a function of temperature.

Temperature(°F)	Resistance(kΩ)	Temperature(°F)	Resistance(kΩ)
-22	509.57	77	30
5	216.07	95	15.59
32	97.71	122	10.81
59	47.13	140	7.46

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "INCAR TEMP.SENSOR" Parameter on the Scantool.
4. Are the DTC B1234 present and is parameter of "INCAR TEMP.SENSOR" fixed ?
   ※ Parameter of "INCAR TEMP.SENSOR" will be fixed at 77°F, if there is any fault in INCAR SENSOR

   YES

   1) Go to "Inspection & Repair" procedure

   NO

   1) Fault is intermittent caused by poor contact in the sensor's and/or A/C control unit's connector or was repaired and A/C control unit memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?
   - YES
     1) Repair as necessary and go to "Verification of Vehicle Repair" procedure
   - NO
     1) Go to "Signal Circuit Inspection" procedure

Signal Circuit Inspection

Check for open in harness

1. Ignition "OFF"
2. Disconnect incar temp.sensor.
3. Measure resistance between terminal "4" of incar temp.sensor and terminal "5" of A/C Control Unit
   A. Specification :Approx. 0 Ω
4. Is the measured resistance within specifications?
   - YES
     1) Go to "Ground Circuit Inspection " procedure.
   - NO
     1) Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Ground Circuit inspection

Check for open in ground harness

1. Ignition "OFF"
2. Disconnect incar temp.sensor.
3. Measure resistance between terminal "2" of incar temp.sensor and terminal "12" of A/C Control Unit
   A. Specification :Approx. 0 Ω
4. Is the measured resistance within specifications?
   - YES
     1) Go to "Component Inspection " procedure.
   - NO
     1) Check for open in ground harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Component Inspection

Check Incar Temp. sensor

1. Ignition "OFF"
2. Disconnect incar sensor.
3. Measure resistance between terminal "4" and "2" of incar sensornsor
   A. Specification : Refer the specifications in fig3)
4. Is the measured resistance within specifications in fig3)? (tolerance limits ±3%)
   - YES
     1) Go to "Check A/C Control Unit" procedure
   - NO
     1) Substitute with a known-good incar sensor and check for proper operation. If the problem is corrected, replace incar sensor and then go to "Verification of Vehicle Repair" procedure.

Check A/C Control Unit

1. Engine : "ON"

2. Disconnect incar sensor.
3. Measure Voltage between terminal "5" of A/C Control Unit and chassis ground
   A. Specification :Approx. 5V

4. Is the measured voltage within specifications?

   YES

   1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

   NO

   1) Substitute with a known-good A/C Control Unit and check for proper operation. If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

   YES

   1) Go to the applicable troubleshooting procedure

   NO

   1) System is performing to specification at this time.

Heating,Ventilation, Air Conditioning > Controller > B1237 Ambient Temperature Sensor Short (Low)

Component Location

General Description

The ambient temperature sensor located at the center stay of the condensor detects ambient air temperature. It is a negative type thermistor whose resistance is inversely proportional to temperature. Its output is used for sensor fail-safe, temperature regulation door lock, blower motor level control, mix mode control and in-car humidity control

DTC Description

The ECM sets DTC B1237 if there is a short circuit in ambient temp sensor signal harness or the measured resistance value of the sensor is less than the threshold value(about 7.48kΩ)

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	● Resistance check	● Short circuit in harness ● Faulty ambient temp.sensor ● Faulty A/C Control Unit
Threshold Value	● <7.48kΩ	
Detecting Time	● 0.3sec	
Fail Safe	● Control with the value of 68°F	

Specification

※ Resistance value of ambient temp.sensor as a function of temperature.

Temperature(°F)	Resistance(kΩ)	Temperature(°F)	Resistance(kΩ)
-22	527.99	77	30
5	218.21	95	19.6

32	97.83	122	10.82
59	47.12	140	7.48

Schematic Diagram

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "AMBIENT TEMP.SENSOR" Parameter on the Scantool..
   ※ Parameter of "AMBIENT TEMP.SENSOR" will be fixed at 68°F, if there is any fault in AMBIENT TEMP.SENSOR.
4. Are the DTC B1237 present and is parameter of "AMBIENT TEMP.SENSOR" fixed ?
   YES
   1) Go to "Inspection & Repair" procedure
   NO
   1) Fault is intermittent caused by poor contact in the sensor’s and/or A/C control unit’s connector or was repaired and A/C control unit memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?
   YES
   1) Repair as necessary and go to "Verification of Vehicle Repair" procedure
   NO
   1) Go to "Signal Circuit Inspection" procedure

Signal Circuit Inspection

Check for short to ground in harness

1. Ignition "OFF"
2. Disconnect ambient sensor.
3. Measure resistance between terminal "1" of ambient sensor and chassis ground
   A. Specification :Approx. ∞ Ω
4. Is the measured resistance within specifications??
   YES
   1) Go to "Component Inspection" procedure.
   NO
   1) Check for short to ground in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Component Inspection

Check Ambient sensor

1. Ignition "OFF"
2. Disconnect ambient sensor.

3. Measure resistance between terminal "1" and "2" of ambient sensor
   A. Specification : Refer the specifications in fig3)

4. Is the measured resistance within specifications in fig3)? (tolerance limits ±3%)

   YES

   1) Go to "Check A/C Control Unit" procedure

   NO

   1) Substitute with a known-good incar sensor and check for proper operation. If the problem is corrected, replace incar sensor and then go to "Verification of Vehicle Repair" procedure.

Check A/C Control Unit

1. Engine : "ON"
2. Disconnect ambient sensor.
3. Measure voltage between terminal "3" of A/C Control Unit and chassis ground
   A. Specification :Approx. 5V

4. Is the measured voltage within specifications?

   YES

   1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

   NO

   1) Substitute with a known-good A/C Control Unit and check for proper operation. If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

   YES

   1) Go to the applicable troubleshooting procedure

   NO

   1) System is performing to specification at this time.

Heating,Ventilation, Air Conditioning > Controller > B1238 Ambient Temperature Sensor Open (High)

Component Location

General Description

The ambient temperature sensor located at the center stay of the condensor detects ambient air temperature. It is a negative type thermistor whose resistance is inversely proportional to temperature. Its output is used for sensor fail-safe, temperature regulation door lock, blower motor level control, mix mode control and in-car humidity control

DTC Description

The ECM sets DTC B1238 if there is an open circuit in ambient temp sensor signal harness or the measured resistance value of the sensor is more than the threshold value(about 527kΩ)

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	● Resistance check	● Short circuit in harness ● Faulty ambient temp.sensor ● Faulty A/C Control Unit
Threshold Value	● > 527kΩ	
Detecting Time	● 0.3sec	
Fail Safe	● Control with the value of 68°F	

Specification

※ Resistance value of ambient temp.sensor as a function of temperature.

Temperature(°F)	Resistance(kΩ)	Temperature(°F)	Resistance(kΩ)
-22	527.99	77	30
5	218.21	95	19.6
32	97.83	122	10.82
59	47.12	140	7.48

Schematic Diagram

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "AMBIENT TEMP.SENSOR" Parameter on the Scantool..
   ※ Parameter of "AMBIENT TEMP.SENSOR" will be fixed at 68°F, if there is any fault in AMBIENT TEMP.SENSOR.
4. Are the DTC B1238 present and is parameter of "AMBIENT TEMP.SENSOR" fixed ?
   - YES
     1) Go to "Inspection & Repair" procedure
   - NO
     1) Fault is intermittent caused by poor contact in the sensor's and/or A/C control unit's connector or was repaired and A/C control unit memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?
   - YES
     1) Repair as necessary and go to "Verification of Vehicle Repair" procedure
   - NO
     1) Go to "Signal Circuit Inspection" procedure

Signal Circuit Inspection

Check for open in harness

1. Ignition "OFF"
2. Disconnect ambient temp.sensor.
3. Measure resistance between terminal "1" of ambient temp.sensor and terminal "3" of A/C Control Unit

A. Specification :Approx. ∞ Ω

4. Is the measured resistance within specifications?

YES

1) Go to "Ground Circuit Inspection " procedure.

NO

1) Check for short to ground in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Ground Circuit inspection

Check for open in ground harness

1. Ignition "OFF"
2. Disconnect ambient temp.sensor.
3. Measure resistance between terminal "2" of ambient temp.sensor and chassis ground.
   A. Specification :Approx. 0 Ω
4. Is the measured resistance within specifications?

YES

1) Go to "Component Inspection " procedure.

NO

1) Check for open in ground harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Component Inspection

Check Ambient sensor

1. Ignition "OFF"
2. Disconnect ambient sensor.
3. Measure resistance between terminal "1" and "2" of ambient sensor
   A. Specification : Refer the specifications in fig3)
4. Is the measured resistance within specifications in fig3)? (tolerance limits ±3%)

YES

1) Go to "Check A/C Control Unit" procedure

NO

1) Substitute with a known-good ambient sensor and check for proper operation. If the problem is corrected, replace ambient sensor and then go to "Verification of Vehicle Repair" procedure.

Check A/C Control Unit

1. Engine : "ON"
2. Disconnect ambient sensor.
3. Measure voltage between terminal "3" of A/C Control Unit and chassis ground
   A. Specification :Approx. 5V
4. Is the measured voltage within specifications?

YES

1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

1) Substitute with a known-good A/C Control Unit and check for proper operation. If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

YES

1) Go to the applicable troubleshooting procedure

NO

1) System is performing to specification at this time.

Heating,Ventilation, Air Conditioning > Controller > B1241 Evaporator Sensor Short(Low)

Component Location

General Description

The Evaporator sensor located on heater unit detects the core temperature and interrupts compressor relay power, in order to prevent evaporator freezing by excessive cooling. It is a negative type thermistor whose resistance is inversely proportional to temperature

DTC Description

The ECM sets DTC B1241 if there is a short circuit in evaporator sensor signal harness or the measured resistance value of the sensor is less than the threshold value(about 0.9kΩ)

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	● Resistance check	● Short circuit in harness. ● Fault Evaporator sensor ● Fault A/C Control Unit
Threshold value	● < 0.9kΩ	
Detecting time	● 0.3sec	
FAIL SAFE	● Control with the value of 28.4°F	

Schematic Diagram

Signal Waveform

※ Resistance value of evaporator sensor as a function of temperature.

Temperature(°F)	Resistance(kΩ)	Temperature(°F)	Resistance(kΩ)
14	13.6	59	3.9
32	8	86	2
41	6.2	104	1.3
50	4.9	122	0.9

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "EVAPORATIVE SENSOR" Parameter on the Scantool.

4. Are the DTC B1241 present and is parameter of "EVAPORATIVE SENSOR" fixed ?
   ※ Parameter of "EVAPORATIVE SENSOR" will be fixed at 28.4°F, if there is any fault in EVAPORATIVE SENSOR.
   - YES
     1) Go to "Inspection & Repair" procedure
   - NO
     1) Fault is intermittent caused by poor contact in the sensor's and/or A/C control unit's connector or was repaired and A/C control unit memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?
   - YES
     1) Repair as necessary and go to "Verification of Vehicle Repair" procedure
   - NO
     1) Go to "Signal Circuit Inspection" procedure

Signal Circuit Inspection

Check for short to ground in harness

1. Ignition "OFF"
2. Disconnect evaporator sensor.
3. Measure resistance between terminal "1" of evaporator sensor and chassis ground
   A. Specification :Approx. ∞ Ω
4. Is the measured resistance within specifications?
   - YES
     1) Go to "Component Inspection" procedure.
   - NO
     1) Check for short to ground in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Component Inspection

Check evaporator sensor

1. Ignition "OFF"
2. Disconnect evaporator sensor.
3. Measure resistance between terminal "1" and "2" of evaporator sensor
   A. Specification : Refer the specifications in fig3)
4. Is the measured resistance within specifications in fig3)? (tolerance limits ±3%)
   - YES
     1) Go to "Check A/C Control Unit" procedure
   - NO
     1) Substitute with a known-good evaporator sensor and check for proper operation. If the problem is corrected, replace evaporator sensor and then go to "Verification of Vehicle Repair" procedure.

Check A/C Control Unit

1. Engine "ON"
2. Disconnect evaporator sensor.
3. Measure voltage between terminal "6" of A/C Control Unit and chassis ground
   A. Specification :Approx. 5V
4. Is the measured voltage within specifications?
   YES
   1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

   NO
   1) Substitute with a known-good A/C Control Unit and check for proper operation. If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?
   YES
   1) Go to the applicable troubleshooting procedure

   NO
   1) System is performing to specification at this time.

Heating,Ventilation, Air Conditioning > Controller > B1242 Evaporator Sensor Open(HIGH)

Component Location

General Description

The Evaporator sensor located on heater unit detects the core temperature and interrupts compressor relay power, in order to prevent evaporator freezing by excessive cooling. It is a negative type thermistor whose resistance is inversely proportional to temperature

DTC Description

The ECM sets DTC B1242 if there is an open circuit in evaporator sensor signal harness or the measured resistance value of the sensor is more than the threshold value(about 13.6kΩ)

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	● Resistance check	● Open Circuit in harness ● Fault Evaporator sensor ● Fault A/C Control Unit
Threshold value	● > 13.6kΩ	
Detecting time	● 0.3sec	
FAIL SAFE	● Control with the value of 28.4°F	

Schematic Diagram

Signal Waveform

※ Resistance value of evaporator sensor as a function of temperature.

Temperature(°F)	Resistance(kΩ)	Temperature(°F)	Resistance(kΩ)
14	13.6	59	3.9
32	8	86	2
41	6.2	104	1.3
50	4.9	122	0.9

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "EVAPORATIVE SENSOR" Parameter on the Scantool.
4. Are the DTC B1242 present and is parameter of "EVAPORATIVE SENSOR" fixed ?
   ※ Parameter of "EVAPORATIVE SENSOR" will be fixed at 28.4°F, if there is any fault in EVAPORATIVE SENSOR.
   YES
   1) Go to "Inspection & Repair" procedure
   NO
   1) Fault is intermittent caused by poor contact in the sensor's and/or A/C control unit's connector or was repaired and A/C control unit memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?
   YES
   1) Repair as necessary and go to "Verification of Vehicle Repair" procedure
   NO
   1) Go to "Signal Circuit Inspection" procedure

Signal Circuit Inspection

Check for open in harness

1. Ignition "OFF"
2. Disconnect evaporator sensor.
3. Measure resistance between terminal "1" of evaporator sensor and terminal "6" of A/C Control Unit
   A. Specification :Approx. 0 Ω
4. Is the measured resistance within specifications?
   YES
   1) Go to "Ground Circuit Inspection " procedure.
   NO
   1) Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Ground Circuit inspection

Check for open in ground harness

1. Ignition "OFF"
2. Disconnect evaporator sensor.
3. Measure resistance between terminal "2" of evaporator sensor and chassis ground.

A. Specification :Approx. 0 Ω

4. Is the measured resistance within specifications?

YES

1) Go to "Component Inspection " procedure.

NO

1) Check for open in ground harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Component Inspection

Check evaporator sensor

1. Ignition "OFF"
2. Disconnect evaporator sensor.
3. Measure resistance between terminal "1" and "2" of evaporator sensor

A. Specification : Refer the specifications in fig3)

4. Is the measured resistance within specifications in fig3)? (tolerance limits ±3%)

YES

1) Go to "Check A/C Control Unit" procedure

NO

1) Substitute with a known-good evaporator sensor and check for proper operation. If the problem is corrected, replace evaporator sensor and then go to "Verification of Vehicle Repair" procedure.

Check A/C Control Unit

1. Engine "ON"
2. Disconnect evaporator sensor.
3. Measure voltage between terminal "6" of A/C Control Unit and chassis ground

A. Specification :Approx. 5V

4. Is the measured voltage within specifications?

YES

1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

1) Substitute with a known-good A/C Control Unit and check for proper operation. If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

YES

1) Go to the applicable troubleshooting procedure

NO

1) System is performing to specification at this time.

Heating,Ventilation, Air Conditioning > Controller > B1245 Air Mix Potentiometer Open(Low) - Driver

Component Location

General Description

Temperature control actuator located at heater unit regulates the temperature by the procedure as follows. Signal from control unit adjusts position of temp door by operating temp motor and then temperature will be regulated by the hot/cold air ratio decided by position of temp door

DTC Description

The ECM sets DTC B1245 if there is an open circuit or poor connection of connected part in the air mix potentiometer.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
Monitor Strategy	● Voltage check	● Poor connection of connected part ● Open circuit in harness ● Short circuit in harness ● Faulty DR Air Mix potentiometer
Threshold value	●<0.1V	
Detecting time	● 0.3sec	
FAIL SAFE	● setting temperature : 62 - 76°F fix at max. cooling position ● setting temperature : 77 - 90°F fix at max. heating position	

Specification

※ Voltage value of Air Mix potentiometer as a function of setting temperature

Schematic Diagram

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "DR AIR MIX potentiometer" Parameter on the Scantool. While operating temp switch
4. Are the DTC B1245 present and is parameter of "DR AIR MIX Potentiometor" fixed ?
   ※ Parameter of "DR AIR MIX potentiometer" will be fixed at 100%(or any value above 90%), or 0% (or any value below 10%), if there is any fault in DR AIR MIX potentiometer.

   YES

   1) Go to "Inspection & Repair" procedure

   NO

   1) Fault is intermittent caused by poor contact in the sensor's and/or A/C control unit's connector or was repaired and A/C control unit memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

1) Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

1) Go to "Signal Circuit Inspection" procedure

Signal Circuit Inspection

Check for open in harness

1. Ignition "OFF"
2. Disconnect DR Air Mix potentiometer
3. Measure resistance between terminal "6" of DR Air Mix potentiometer and terminal "18" of A/C control unit.
   A. Specification :Approx. 0 Ω
4. Is the measured resistance within specifications?

YES

1) Go to "Check for short to ground in harness" procedure.

NO

1) Check for open in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Check for short to ground in harness

1. Ignition "OFF"
2. Disconnect DR Air Mix Actuator
3. Measure resistance between terminal "6" of DR Air Mix potentiometer and chassis ground
   A. Specification :Approx. ∞ Ω
4. Is the measured resistance within specifications?

YES

1) Go to "Power Circuit Inspection" procedure

NO

1) Check for short to ground in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Power Supply Circuit Inspection

Check for short or open in harness

1. Ignition "ON"
2. Connect DR Air Mix Potentiometer.
3. Measure voltage between terminal "7" of DR Air Mix potentiometer and chassis ground
   A. Specification :Approx.5V
4. Is the measured voltage within specifications?

YES

1) Go to "Component Inspection " procedure.

NO

1) Check for short or open in power harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Component Inspection

Check actuator motor

1. Ignition "OFF"
2. Disconnect DR Air Mix Potentiometer.
3. Connect (+) terminal of battery to terminal 3 of Air Mix potentiometer and (-) terminal to terminal 4
4. Verify that the temperature actuator operates to the hot position
5. Verify that the temperature actuator operates to the cool position with reverse connecting.((+) to 4 and (-) to 3)

6. Dose the actuator work properly?

YES

1) Go to "Check potentiometer" procedure.

NO

1) Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace actuator and then go to "Verification of Vehicle Repair" procedure.

Check potentiometer

1. Ignition "ON"
2. Connect DR Air Mix potentiometer
3. Measure voltage between terminal "5" and "6" of DR AIR MIX potentiometer while operating the temp switch.
   A. Specification : Refer the specifications in fig3)

Door position	Voltage (5-6)	Threshold value
MAX. Cooling	0.3±0.15V	Low voltage : 0.08V or less
MAX. Heating	4.7±0.15V	High voltage : 4.9V or more

4. Is the measured voltage within specifications in fig3)?

YES

1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

1) Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace actuator and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

YES

1) Go to the applicable troubleshooting procedure

NO

1) System is performing to specification at this time.

Heating,Ventilation, Air Conditioning > Controller > B1246 Air Mix Potentiometer Short(High) - Driver

Component Location

General Description

Temperature control actuator located at heater unit regulates the temperature by the procedure as follows. Signal from control unit adjusts position of temp door by operating temp motor. then temperature will be regulated by the hot/cold air ratio decided by position of temp door

DTC Description

The ECM sets DTC B1246 if there is a short to power harness in the air mix potentiometer.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
Monitor Strategy	● Voltage check	● Open circuit in harness ● Short circuit in harness ● Faulty DR Air Mix potentiometer
Threshold value	●>4.9V	
Detecting time	● 0.3sec	
FAIL SAFE	● setting temperature : 62 - 76°F fix at max. cooling position ● setting temperature : 77 - 90°F fix at max. heating position	

Specification

※ Voltage value of Air Mix potentiometer as a function of setting temperature

Schematic Diagram

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "DR AIR MIX potentiometer" Parameter on the Scantool. While operating temp switch
4. Are the DTC B1246 present and is parameter of "DR AIR MIX Potentiomotor" fixed ?
   ※ Parameter of "DR AIR MIX potentiometer" will be fixed at 100%(or any value above 90%), or 0% (or any value below 10%), if there is any fault in DR AIR MIX potentiometer.

   YES

   1) Go to "Inspection & Repair" procedure

   NO

   1) Fault is intermittent caused by poor contact in the sensor's and/or A/C control unit's connector or was repaired and A/C control unit memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   1) Repair as necessary and go to "Verification of Vehicle Repair" procedure

   NO

   1) Go to "Signal Circuit Inspection" procedure

Signal Circuit Inspection

Check for short in harness

1. Ignition "OFF"
2. Disconnect DR Air mix potentiometer
3. Measure resistance between terminal "6" and "7" of DR Air mix potentiometer
   A. Specification :Approx. ∞ Ω

4. Is the measured resistance within specifications?
   YES
   1) Go to "Ground Circuit Inspection" procedure
   NO
   1) Check for short to power harness in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Ground Circuit inspection

Check for open in ground harness

1. Ignition "OFF"
2. Disconnect DR Air mix potentiometer.
3. Measure resistance between terminal "5" of DR Air mix potentiometer and chassis ground.
   A. Specification :Approx. 0 Ω
4. Is the measured resistance within specifications?
   YES
   1) Go to "Component Inspection " procedure.
   NO
   1) Check for open in ground harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Component Inspection

Check actuator motor

1. Ignition "OFF"
2. Disconnect DR Air mix potentiometer.
3. Connect (+) terminal of battery to terminal 3 of Air mix potentiometer and (-) terminal to terminal 4
4. Verify that the temperature actuator operates to the hot position
5. Verify that the temperature actuator operates to the cool position with reverse connecting.((+) to 4 and (-) to 3)
6. Dose the actuator work properly?
   YES
   1) Go to "Check potentiometer" procedure.
   NO
   1) Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace actuator and then go to "Verification of Vehicle Repair" procedure.

Check potentiometer

1. Ignition "ON"
2. Connect DR Air mix potentiometer
3. Measure voltage between terminal "5" and "6" of DR Air mix potentiometer while operating the temp switch.
   A. Specification : Refer the specifications in fig3)

Door position	Voltasge (5-6)	Threshold value
MAX. Cooling	0.3±0.15V	voltage value > 0.08V
MAX. Heating	4.7±0.15V	voltage value > 4.9V

4. Is the measured voltage within specifications in fig3)?

YES

1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

1) Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace actuator and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

YES

1) Go to the applicable troubleshooting procedure

NO

1) System is performing to specification at this time.

Heating,Ventilation, Air Conditioning > Controller > B1249 Direction Potentiometer Open(Low) - Driver

Component Location

General Description

The mode control actuator mounted on heater unit adjusts position of mode door by operating Direction Motor based on signal of A/C control unit. Pressing mode select switch makes the mode control actuator shift in order of vent→ B/L → floor → mix.

DTC Description

The ECM sets DTC B1249 if there is an open circuit or poor connection of connected part in the Direction potentiometer.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Voltage check	• Poor connection of connected part • Open circuit in harness • Short circuit in harness • Faulty DR Direction potentiometer
Threshold value	• <0.1V	
Detecting time	• 0.3sec	
FAIL SAFE	• Fix vent position • Fix in defrost mode	

Specification

※ Voltage value of Direction potentiometer as a function of position of mode switch

Schematic Diagram

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "DR DIRECTION POTENTIO" parameter on the scantool. While operating mode switch

4. Are the DTC B1249 present and is parameter of "DR DIRECTION POTENTIO" fixed ?
   ※ Parameter of "DR DIRECTION POTENTIO" will be fixed at 100%(or any value above 90%), or 0% (or any value below 10%), if there is any fault in DR direction potentiometer
   - YES
     1) Go to "Inspection & Repair" procedure
   - NO
     1) Fault is intermittent caused by poor contact in the sensor's and/or A/C control unit's connector or was repaired and A/C control unit memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?
   - YES
     1) Repair as necessary and go to "Verification of Vehicle Repair" procedure
   - NO
     1) Go to "Signal Circuit Inspection" procedure

Signal Circuit Inspection

Check for open in harness

1. Ignition "OFF"
2. Disconnect DR Direction Actuator
3. Measure resistance between terminal "6 of DR Direction Potentiometor and terminal "21" of A/C control unit.
   A. Specification :Approx. 0 Ω
4. Is the measured resistance within specifications?
   - YES
     1) Go to "Check for short to ground in harness" procedure.
   - NO
     1) Check for open in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Check for short to ground in harness

1. Ignition "OFF"
2. Disconnect DR Direction Actuator
3. Measure resistance between terminal "6" of DR Direction Potentiometor and chasis ground
   A. Specification :Approx. ∞ Ω
4. Is the measured resistance within specifications?
   - YES
     1) Go to "Power Circuit Inspection" procedure
   - NO
     1) Check for short to ground in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Power Supply Circuit Inspection

1. Ignition "ON"
2. Connect DR Direction Potentiometor.
3. Measure voltage between terminal "7" of DR Direction Potentiometor and chasis ground
   A. Specification :Approx.5V

4. Is the measured voltage within specifications?
   - YES
     1) Go to "Component Inspection" procedure.
   - NO
     1) Check for short or open in power harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Component Inspection

Check actuator motor

1. Ignition "OFF"
2. Disconnect DR Direction Potentiometer.
3. Connect (+) terminal of battery to terminal 3 of DR Direction potentiometer and (-) terminal to terminal 4
4. Verify that the mode actuator operates to the hot position
5. Verify that the mode actuator operates to the cool position with reverse connecting.((+) to 4 and (-) to 3)
6. Dose the actuator work properly?
   - YES
     1) Go to "Check potentiometer" procedure.
   - NO
     1) Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace actuator and then go to "Verification of Vehicle Repair" procedure.

Check potentiometer

1. Ignition "ON"
2. Connect DR Direction Potentiometer.
3. Measure voltage between terminal "5" and "6" of DR Direction Potentiometer while operating mode switch
   A. Specification : Refer the specifications in fig3)

Door position	Voltasge (5-6)	Error detecting
VENT	0.3±0.15V	Undervoltage : 0.08V or less Overvoltage : 4.92V or more
BI-LEVEL(1)	1.35±0.4V	
BI-LEVEL(2)	2.25±0.4V	
FLOOR	3.0±0.4V	
MIX	3.6±0.4V	
DEF	4.7±0.15V	

4. Is the measured voltage within specifications in fig3)?
   - YES
     1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
   - NO
     1) Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace actuator and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC

2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

   YES

   1) Go to the applicable troubleshooting procedure

   NO

   1) System is performing to specification at this time.

Heating,Ventilation, Air Conditioning > Controller > B1250 Direction Potentiometer Short(High) - Driver

Component Location

General Description

The mode control actuator mounted on heater unit adjusts position of mode door by operating Direction Motor based on signal of A/C control unit. Pressing mode select switch makes the mode control actuator shift in order of vent→ B/L → floor → mix.

DTC Description

The ECM sets DTC B1250 if there is a short to power harness in the Direction potentiometer.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
Monitor Strategy	● Voltage check	● Open circuit in harness ● Short circuit in harness ● Faulty DR Direction potentiometer
Threshold value	● >4.9V	
Detecting time	● 0.3sec	
FAIL SAFE	● Fix vent position	

Specification

※ Voltage value of Direction potentiometer as a function of position of mode switch

Schematic Diagram

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "DR DIRECTION POTENTIO" parameter on the scantool. While operating mode switch
4. Are the DTC B1250 present and is parameter of "DR DIRECTION POTENTIO" fixed ?
   ※Parameter of "DR DIRECTION POTENTIO" will be fixed at 100%(or any value above 90%), or 0% (or any value below 10%), if there is any fault in DR direction Potentiometer

   YES

   1) Go to "Inspection & Repair" procedure

   NO

   1) Fault is intermittent caused by poor contact in the sensor’s and/or A/C control unit’s connector or was repaired and A/C control unit memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   1) Repair as necessary and go to "Verification of Vehicle Repair" procedure

   NO

   1) Go to "Signal Circuit Inspection" procedure

Signal Circuit Inspection

Check for short in harness

1. Ignition "OFF"
2. Disconnect DR Direction potentiometer
3. Measure resistance between terminal "6" and "7" of DR Direction potentiometer

   A. Specification :Approx. ∞ Ω

4. Is the measured resistance within specifications?

   YES

   1) Go to "Ground Circuit Inspection " procedure

   NO

   1) Check for short to power harness in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Ground Circuit inspection

Check for open in ground harness

1. Ignition "OFF"
2. Disconnect DR Direction Actuator.
3. Measure resistance between terminal "5" of DR Direction Actuator and chassis ground.

   A. Specification :Approx. 0 Ω

4. Is the measured resistance within specifications?

   YES

   1) Go to "Component Inspection " procedure.

   NO

   1) Check for open in ground harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Component Inspection

Check actuator motor

1. Ignition "OFF"
2. Disconnect DR Direction Potentiometor.
3. Connect (+) terminal of battery to terminal 3 of DR Direction potentiometer and (-) terminal to terminal 4
4. Verify that the mode actuator operates to the hot position
5. Verify that the mode actuator operates to the cool position with reverse connecting.((+) to 4 and (-) to 3)
6. Dose the actuator work properly?

   YES

   1) Go to "Check potentiometer" procedure.

   NO

1) Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace actuator and then go to "Verification of Vehicle Repair" procedure.

Check potentiometer

1. Ignition "ON"
2. Connect DR Direction Potentiometer.
3. Measure voltage between terminal "5" and "6" of DR Direction potentiometer while operating mode switch .
   A. Specification : Refer the specifications in fig3)

Door position	Voltasge (5-6)	Error detecting
VENT	0.3±0.15V	Undervoltage : 0.08V or less Overvoltage : 4.92V or more
BI-LEVEL(1)	1.35±0.4V	
BI-LEVEL(2)	2.25±0.4V	
FLOOR	3.0±0.4V	
MIX	3.6±0.4V	
DEF	4.7±0.15V	

4. Is the measured voltage within specifications in fig3)?

YES

1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

1) Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace actuator and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

YES

1) Go to the applicable troubleshooting procedure

NO

1) System is performing to specification at this time.

Heating,Ventilation, Air Conditioning > Controller > B2406 Air Mix Motor(Driver)

Component Location

General Description

Temperature control actuator located at heater unit regulates the temperature by the procedure as follows. Signal from control unit adjusts position of temp door by operating temp motor. then temperature will be regulated by the hot/cold air ratio decided by position of temp door

DTC Description

The ECM sets DTC B2406 if the air mix actuator dosen‘t move to intended position within 40sec (The ECM attempts to move the temp door for a 2 second duration at a frequency of 3 times every 20 seconds before storing a DTC.)

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	● Voltage check	● Poor connection of connected part ● Open circuit in harness ● Short circuit in harness ● Faulty DR Air Mix potentiometer ● Faulty A/C Control Unit
Threshold value	●< 0.1V	
Detecting time	● 0.3sec	
FAIL SAFE		

Specification

※ Voltage value of Air Mix potentiometer as a function of setting temperature

Schematic Diagram

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "DR AIR MIX Potentiometer" Parameter on the Scantool. While operating temp switch
4. Are the DTC B2406 present and is parameter of "DR AIR MIX Potentiometer" fixed?
   ※ There is any fault in DR AIR MIX Motor. If the parameter of "DRIVER AIR MIX DOOR" is 30% or less when the actuator operates to the hot position, or If the parameter is 60% and more when the actuator operates to the cold position

   YES

   1) Go to "Inspection & Repair" procedure

   NO

   1) Fault is intermittent caused by poor contact in the sensor's and/or A/C control unit's connector or was repaired and A/C control unit memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   1) Repair as necessary and go to "Verification of Vehicle Repair" procedure

   NO

   1) Go to "Signal Circuit Inspection" procedure

Signal Circuit Inspection

Check for open in harness

1. Ignition "OFF"
2. Disconnect DR Air Mix Actuator
3. Measure resistance between terminal "3,4" of DR Air Mix Motor and terminal "16,17" of A/C control unit.
   A. Specification :Approx. 0 Ω
4. Is the measured resistance within specifications?

YES

1) Go to "Check for short to ground in harness" procedure.

NO

1) Check for open in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Check for short to ground in harness

1. Ignition "OFF"
2. Disconnect DR Air Mix Actuator
3. Measure resistance between terminal "3,4" of DR Air Mix Motor and chasis ground
   A. Specification :Approx. ∞ Ω
4. Is the measured resistance within specifications?

YES

1) Go to "Visual/Physical Inspection " procedure

NO

1) Check for short to ground in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Visual / Physical Inspection

Check actuator

※Check if DR Air Mix Actuator works properly through ACTUATION TEST.

1. Ignition : ON
2. Connect Scantool and select " ACTUATION TEST" mode and press [F1]
3. Dose DR Air Mix Actuator work properly?

YES

1) Go to "Component Inspection" procedure

NO

1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Component Inspection

Check actuator motor

1. Ignition "OFF"
2. Disconnect DR Air Mix Potentiometer.
3. Connect (+) terminal of battery to terminal 3 of DR Air Mix Actuator and (-) terminal to terminal 4
4. Verify that the mode actuator operates to the hot position
5. Verify that the mode actuator operates to the cool position with reverse connecting.((+) to 4 and (-) to 3)
6. Dose the actuator work properly?

YES

1) Go to "Check potentiometer" procedure.

NO

1) Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace actuator and then go to "Verification of Vehicle Repair" procedure.

Check potentiometer

1. Ignition "ON"
2. Connect DR Air Mix Actuator
3. Measure voltage between terminal "5" and "6" of DR AIR MIX potentiometer while operating the temp switch.
   A. Specification : Refer the specifications in fig5)

Door position	Voltage (5-6)	Threshold value
MAX. Cooling	0.3±0.15V	Voltage value > 0.08V
MAX. Heating	4.7±0.15V	Voltage value > 4.9V

4. Is the measured voltage within specifications in fig3)?

YES

1) Go to "Check A/C Control Unit" procedure

NO

1) Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace actuator and then go to "Verification of Vehicle Repair" procedure.

Check A/C Control Unit

1. Engine "ON"
2. Connect A/C Control Unit.
3. Measure voltage between terminal "16" and "17" of A/C Control Unit while operating the temp switch.
   A. Specification :Approx. 12V
4. Is the measured voltage within specifications?

YES

1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

1) Substitute with a known-good A/C Control Unit and check for proper operation. If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

YES

1) Go to the applicable troubleshooting procedure

NO

1) System is performing to specification at this time.

Heating,Ventilation, Air Conditioning > Controller > B2409 Direction Control Motor(Driver)

Component Location

General Description

The mode control actuator mounted on heater unit adjusts position of mode door by generating Direction Motor in accordance with signal of A/C control unit. Pressing mode select switch makes the mode control actuator shift in order of vent→ B/L → floor → mix.

DTC Description

The ECM sets DTC B2409 if the direction motor dosen’t move to intended position within 40sec(The ECM attempts to move the temp door for a 2 second duration at a frequency of 3 times every 20 seconds before storing a DTC.)

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	● Voltage check	● Poor connection of connected part ● Open circuit in harness ● Short circuit in harness ● Faulty DR Direction potentiometer ● Faulty A/C Control Unit
Threshold value	● < 0.1V	
Detecting time	● 0.3sec	
FAIL SAFE		

Specification

※ Voltage value of Direction potentiometer as a function of position of mode switch

Schematic Diagram

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "DR AIR MIX Potentiometer" Parameter on the Scantool. While operating mode switch
4. Are the DTC B2409 present and is parameter of "DR DIRECTION POTENTIO" fixed?
   ※ There is any fault in DR Direction Motor. If the parameter of "DR DIRECTION POTENTIO" is 10% or less on "VENT" mode, or If the parameter is 90% or more on "DEF" mode.

   YES

   1) Go to "Inspection & Repair" procedure

   NO

   1) Fault is intermittent caused by poor contact in the sensor's and/or A/C control unit's connector or was repaired and A/C control unit memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   1) Repair as necessary and go to "Verification of Vehicle Repair" procedure

   NO

   1) Go to "Signal Circuit Inspection" procedure

Signal Circuit Inspection

Check for open in harness

1. Ignition "OFF"
2. Disconnect DR Direction Actuator.
3. Measure resistance between terminal "3,4" of DR Direction Motor and terminal "19,20" of A/C control unit.
   A. Specification :Approx. 0 Ω
4. Is the measured resistance within specifications?

YES

1) Go to "Check for short to ground in harness" procedure.

NO

1) Check for open in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Check for short to ground in harness

1. Ignition "OFF"
2. Disconnect DR Direction Actuator.
3. Measure resistance between terminal "3,4" of DR Direction Motor and chasis ground
   A. Specification :Approx. ∞ Ω
4. Is the measured resistance within specifications?

YES

1) Go to "Visual/Physical Inspection " procedure

NO

1) Check for short to ground in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Visual / Physical Inspection

Check actuator

※ Check if DR Direction Actuator works properly through ACTUATION TEST.

1. Ignition : ON
2. Connect Scantool and select " ACTUATION TEST" mode and press [F1]
3. Dose DR Direction Actuator work properly?

YES

1) Go to "Component Inspection" procedure

NO

1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Component Inspection

Check actuator motor

1. Ignition "OFF"
2. Disconnect DR Direction Potentiometer.
3. Connect (+) terminal of battery to terminal 3 of DR Direction potentiometer and (-) terminal to terminal 4
4. Verify that the mode actuator operates to the hot position
5. Verify that the mode actuator operates to the cool position with reverse connecting.((+) to 4 and (-) to 3)
6. Dose the actuator work properly?

YES

1) Go to "Check potentiometer" procedure.

NO

1) Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace actuator and then go to "Verification of Vehicle Repair" procedure.

Check potentiometer

1. Ignition "ON"
2. Connect DR Direction Potentiometer.
3. Measure voltage between terminal "5" and "6" of DR Direction Potentiometor while operating the mode switch.
   A. Specification : Refer the specifications in fig5)

Door position	Voltasge (5-6)	Error detecting
VENT	0.3±0.15V	Undervoltage : 0.08V or less Overvoltage : 4.92V or more
BI-LEVEL(1)	1.35±0.4V	
BI-LEVEL(2)	2.25±0.4V	
FLOOR	3.0±0.4V	
MIX	3.6±0.4V	
DEF	4.7±0.15V	

4. Is the measured voltage within specifications in fig3)?

YES

1) Go to "Check A/C Control Unit" procedure

NO

1) Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace actuator and then go to "Verification of Vehicle Repair" procedure.

Check A/C Control Unit

1. Engine "ON"
2. Connect A/C Control Unit.
3. Measure voltage between terminal "19" and "20" of A/C Control Unit while operating the mode switch.
   A. Specification :Approx. 12V
4. Is the measured voltage within specifications?

YES

1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

1) Substitute with a known-good A/C Control Unit and check for proper operation. If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

YES

1) Go to the applicable troubleshooting procedure

NO

1) System is performing to specification at this time.

Heating,Ventilation, Air Conditioning > Controller > B1208 Intake Potentiometer Open (Low)

Component Location

General Description

Intake door located at heater unit controls the inlet of car. When driver operates the intake switch, ECU receives mode signal from intake switch and operates intake door actuator to turn intake door to intended position. (with FRE mode signal, intake door is closed and with REC mode signal, intake door is opened)

DTC Description

The ECM sets DTC B1208 if there is an open circuit or poor connection in the Intake potentiometer

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	● Voltage check	● Poor connection of connected part ● Open circuit in harness ● Short circuit in harness ● Faulty Intake potentiometer
Threshold value	● < 0.1V	
Detecting time	● 0.3sec	
FAIL SAFE	● Fix at FRE	

Specification

※ Voltage value of Intake potentiometer as a function of position of Intake door

Door position	Voltage	Threshold value
FRE	0.3±0.15V	Voltage value > 0.08V
REC	4.7±0.15V	Voltage value > 4.9V

Schematic Diagram

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the " Intake potentiometer" Parameter on the Scantool. While operating intake switch
4. Are the DTC B1208 present and is parameter of "Intake potentiometer" fixed?
   ※ Parameter of "Intake potentiometer" will be fixed at 100%(or any value above 90%), or 0% (or any value below 10%), if there is any fault in Intake potentiometer

   YES

   1) Go to "Inspection & Repair" procedure

   NO

   1) Fault is intermittent caused by poor contact in the sensor's and/or A/C control unit's connector or was repaired and A/C control unit memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   1) Repair as necessary and go to "Verification of Vehicle Repair" procedure

   NO

   1) Go to "W/Harness Inspection" procedure

Signal Circuit Inspection

Check for open in harness

1. Ignition "OFF"
2. Disconnect Intake potentiometer
3. Measure resistance between terminal "6" of Intake potentiometer and terminal "24" of A/C control unit.
   A. Specification :Approx. 0 Ω
4. Is the measured resistance within specifications?

   YES

   1) Go to "Check for short to ground in harness" procedure.

   NO

   1) Check for open in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Check for short to ground in harness

1. Ignition "OFF"
2. Disconnect Intake potentiometer
3. Measure resistance between terminal "6" of Intake potentiometer and chassis ground
   A. Specification :Approx. ∞ Ω
4. Is the measured resistance within specifications?

   YES

   1) Go to "Power Circuit Inspection" procedure

   NO

   1) Check for short to ground in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Power Supply Circuit Inspection

Check for short or open in harness

1. Ignition "ON"
2. Connect Intake potentiometer
3. Measure voltage between terminal "7" of Intake potentiometer and chassis ground.
   A. Specification :Approx.5V
4. Is the measured voltage within specifications?

   YES

   1) Go to "Component Inspection " procedure.

   NO

   1) Check for short or open in power harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Component Inspection

Check actuator motor

1. Ignition "OFF"
2. Disconnect Intake potentiometer.
3. Connect (+) terminal of battery to terminal 3 of Intake potentiometer and (-) terminal to terminal 4
4. Verify that the mode actuator operates to the hot position
5. Verify that the mode actuator operates to the cool position with reverse connecting.((+) to 4 and (-) to 3)
6. Dose the actuator work properly?

   YES

   1) Go to "Check potentiometer" procedure.

   NO

   1) Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace actuator and

then go to "Verification of Vehicle Repair" procedure.

Check potentiometer

1. Ignition "ON"
2. Connect Intake potentiometer.
3. Measure voltage between terminal "5" and "6" of Intake potentiometer while operating Intake switch
   A. Specification : Refer the specifications in fig3)
4. Is the measured voltage within specifications in fig3)?

   YES

   1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

   NO

   1) Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace actuator and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

   YES

   1) Go to the applicable troubleshooting procedure

   NO

   1) System is performing to specification at this time.

Heating,Ventilation, Air Conditioning > Controller > B1209 Intake Potentiometer Short (High)

Component Location

General Description

Intake door located at heater unit controls the inlet of car. When driver operates the intake switch, ECU receives mode signal from intake switch and operates intake door actuator to turn intake door to intended position. (with FRE mode signal, intake door is closed and with REC mode signal, intake door is opened)

DTC Description

The ECM sets DTC B1209 if there is a short to power in the Intake potentiometer.

DTC Detecting Condition

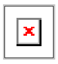
Item	Detecting Condition	Possible Cause
DTC Strategy	• Voltage check	• Open circuit in harness • Short circuit in harness • Faulty Intake potentiometer
Threshold value	• < 4.9V	
Detecting time	• 0.3sec	
FAIL SAFE	• Fix at FRE	

Specification

※ Voltage value of Intake potentiometer as a function of position of Intake door

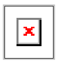
Door position	Voltage	Threshold value
FRE	0.3±0.15V	Voltage value > 0.08V
REC	4.7±0.15V	Voltage value > 4.9V

Schematic Diagram



Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the " Intake potentiometer" Parameter on the Scantool. While operating intake switch



4. Are the DTC B1209 present and is parameter of "Intake potentiometer" fixed?
   ※ Parameter of "Intake potentiometer" will be fixed at 100%(or any value above 90%), or 0% (or any value below 10%), if there is any fault in Intake potentiometer

   YES

   1) Go to "Inspection & Repair" procedure

   NO

   1) Fault is intermittent caused by poor contact in the sensor's and/or A/C control unit's connector or was repaired and A/C control unit memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   1) Repair as necessary and go to "Verification of Vehicle Repair" procedure

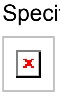
   NO

   1) Go to "W/Harness Inspection" procedure

Signal Circuit Inspection

Check for short in harness

1. Ignition "OFF"
2. Disconnect Intake potentiometer
3. Measure resistance between terminal "6" and "7" of Intake potentiometer.
   A. Specification :Approx. ∞ Ω



4. Is the measured resistance within specifications?

   YES

   1) Go to "Ground Circuit Inspection " procedure

   NO

   1) Check for short to power harness in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Ground Circuit inspection

Check for open in ground harness

1. Ignition "OFF"
2. Disconnect Intake potentiometer
3. Measure resistance between terminal "5" of Intake potentiometer and chassis ground.
   A. Specification :Approx. 0 Ω
4. Is the measured resistance within specifications?

   YES

   1) Go to "Component Inspection " procedure.

   NO

   1) Check for open in ground harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Component Inspection

Check actuator motor

1. Ignition "OFF"
2. Disconnect Intake potentiometer.
3. Connect (+) terminal of battery to terminal 3 of Intake potentiometer and (-) terminal to terminal 4
4. Verify that the mode actuator operates to the hot position
5. Verify that the mode actuator operates to the cool position with reverse connecting.((+) to 4 and (-) to 3)
6. Dose the actuator work properly?

   YES

   1) Go to "Check potentiometer" procedure.

   NO

   1) Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace actuator and then go to "Verification of Vehicle Repair" procedure.

Check potentiometer

1. Ignition "ON"
2. Connect Intake potentiometer.
3. Measure voltage between terminal "5" and "6" of Intake potentiometer while operating Intake switch
   A. Specification : Refer the specifications in fig3)
4. Is the measured voltage within specifications in fig3)?

   YES

   1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

   NO

   1) Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace actuator and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

   YES

   1) Go to the applicable troubleshooting procedure

   NO

1) System is performing to specification at this time.

Heating,Ventilation, Air Conditioning > Controller > B2408 Intake Motor

Component Location

General Description

Intake door located at heater unit controls the inlet of car. When driver operates the intake switch, ECU receives mode signal from intake switch and operates intake door actuator to turn intake door to intended position. (with FRE mode signal, intake door is closed and with REC mode signal, intake door is opened)

DTC Description

The ECM sets DTC B2408 if the intake motor dosen’t move to intended position within 40sec(The ECM attempts to move the intake door for a 2 second duration at a frequency of 3 times every 20 seconds before storing a DTC.)

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	● Voltage check	● Poor connection of connected part ● Open circuit in harness ● Short circuit in harness ● Faulty Intake potentiometer
Threshold value	●< 0.1V	
Detecting time	● 0.3sec	
FAIL SAFE		

Specification

※ Voltage value of Intake potentiometer as a function of position of Intake door

Door position	Voltage	Threshold value
FRE	0.3±0.15V	Voltage value > 0.08V
REC	4.7±0.15V	Voltage value > 4.9V

Schematic Diagram

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the " Intake potentiometer" Parameter on the Scantool. While operating Intake switch
4. Are the DTC B2408 present and is parameter of "Intake potentiometer" fixed?
   ※ There is any fault in Intake potentiometer. If the parameter of "Intake potentiometer" is 30% or less when the actuator operates to the FRE position, or If the parameter is 60% and more when the actuator operates to the REC position

   YES

   1) Go to "Inspection & Repair" procedure

   NO

   1) Fault is intermittent caused by poor contact in the sensor’s and/or A/C control unit’s connector or was repaired and A/C control unit memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   1) Repair as necessary and go to "Verification of Vehicle Repair" procedure

   NO

   1) Go to "Signal Circuit Inspection" procedure

Signal Circuit Inspection

Check for open in harness

1. Ignition "OFF"
2. Disconnect Intake potentiometer
3. Measure resistance between terminal "3,4" of Intake potentiometer and terminal "22,23" of A/C control unit.
   A. Specification :Approx. 0 Ω
4. Is the measured resistance within specifications?

   YES

   1) Go to "Check for short to ground in harness" procedure.

   NO

   1) Check for open in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Check for short to ground in harness

1. Ignition "OFF"
2. Disconnect Intake potentiometer
3. Measure resistance between terminal "3,4" of Intake potentiometer and chassis ground
   A. Specification :Approx. ∞ Ω
4. Is the measured resistance within specifications?

   YES

   1) Go to "Visual/Physical Inspection " procedure

   NO

   1) Check for short to ground in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Visual / Physical Inspection

Check actuator

※ Check if Intake potentiometer works properly through ACTUATION TEST.

1. Ignition : ON
2. Connect Scantool and select " ACTUATION TEST" mode and press [F1]
3. Dose Intake potentiometer work properly?

   YES

   1) Go to "Component Inspection" procedure

   NO

   1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Component Inspection

Check actuator motor

1. Ignition "OFF"
2. Disconnect Intake potentiometer
3. Connect (+) terminal of battery to terminal 3 of Intake potentiometer and (-) terminal to terminal 4
4. Verify that the mode actuator operates to the hot position
5. Verify that the mode actuator operates to the cool position with reverse connecting.((+) to 4 and (-) to 3)
6. Dose the actuator work properly?
   - YES
     1) Go to "Check potentiometer" procedure.
   - NO
     1) Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace actuator and then go to "Verification of Vehicle Repair" procedure.

Check potentiometer

1. Ignition "ON"
2. Connect Intake potentiometer.
3. Measure voltage between terminal "5" and "6" of Intake potentiometer while operating Intake switch
   A. Specification : Refer the specifications in fig3)
4. Is the measured voltage within specifications in fig3)?
   - YES
     1) Go to "Check A/C Control Unit" procedure
   - NO
     1) Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace actuator and then go to "Verification of Vehicle Repair" procedure.

Check A/C Control Unit

1. Engine "ON"
2. Connect A/C Control Unit.
3. Measure voltage between terminal "22" and "23" of A/C Control Unit while operating the Intake switch.
   A. Specification :Approx. 12V
4. Is the measured voltage within specifications?
   - YES
     1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
   - NO
     1) Substitute with a known-good A/C Control Unit and check for proper operation. If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?
   - YES
     1) Go to the applicable troubleshooting procedure
   - NO
     1) System is performing to specification at this time.

Component Location

General Description

AQS(Air Quality System) keeps air inside in the most suitable state for driver. In polluted area AQS detects hazardous gas and intercepts inflow automatically, Inversely, In fresh area it allows the inflow of air to prevent the shortage of air and the accumulation of carbon dioxide. AQS sensor is located at front side of condensor and once hazardous gas is detected, it delivers the voltage signal to ECU for closing intake door.

DTC Description

The ECM sets DTC B1257 if there is an open circuit in AQS sensor signal harness or the measured voltage value of the sensor is more than the threshold value

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	● Voltage check	● Open circuit in power harness ● Open circuit in ground harness ● Faulty AQS sensor ● Poor connection of connected part
Threshold value	● < 4.9V	
Detecting time	● 1sec	
FAIL SAFE	● AQS function OFF ● Intake door : return to previous state	

Specification

※ Voltage value of AQS sensor as a function of position of operating condition.

Operating condition	Voltage	Note
Right after IGN "ON"	2.5V ± 0.3V	Preheating(35 ± 2sec)
Normal	4.3V ± 0.3V	Intake door : REC
Gas detected	0.9V ± 0.3V	Intake door : FRE

Schematic Diagram

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the " AQS sensor " Parameter on the Scantool. While making hazardous gas such as tobacco fumes around the AQS sensor
4. Are the DTC B1257 present and is parameter of " AQS sensor " fixed?
   ※ Parameter of " AQS sensor" will be fixed even though hazardous gas is around AQS sensor, if there is any fault in AQS sensor

   YES

   1) Go to "Inspection & Repair" procedure

   NO

   1) Fault is intermittent caused by poor contact in the sensor’s and/or A/C control unit’s connector or was repaired and A/C control unit memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   1) Repair as necessary and go to "Verification of Vehicle Repair" procedure

   NO

   1) Go to "Signal Circuit Inspection" procedure

Signal Circuit Inspection

Check for open in harness

1. Ignition "OFF"
2. Disconnect AQS sensor
3. Measure resistance between terminal "4" of AQS sensor and terminal "2" of A/C Control Unit
   A. Specification :Approx. 0 Ω
4. Is the measured resistance within specifications?

   YES

   1) Go to "Ground Circuit Inspection " procedure.

   NO

   1) Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Ground Circuit inspection

Check for open in ground harness

1. Ignition "OFF"
2. Disconnect AQS sensor
3. Measure resistance between terminal "5" of AQS sensor and chassis ground.
   A. Specification :Approx. 0 Ω
4. Is the measured resistance within specifications?

   YES

   1) Go to "Component Inspection " procedure.

   NO

   1) Check for open in ground harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Component Inspection

Check Ambient sensor

1. Engine "ON"
2. Connect AQS sensor
3. Measure voltage value between terminal "4" and "5" of AQS sensor
   A. Specification : Refer the specifications in fig3)
4. Is the measured voltage within specifications in fig3)?

   YES

   1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

1) Substitute with a AQS sensor and check for proper operation. If the problem is corrected, replace AQS sensor and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

YES

1) Go to the applicable troubleshooting procedure

NO

1) System is performing to specification at this time.

Heating,Ventilation, Air Conditioning > Controller > B1258 AQS Sensor Short(Low)

Component Location

General Description

AQS(Air Quality System) keeps air inside in the most suitable state for driver. In polluted area AQS detects hazardous gas and intercepts inflow automatically, Inversely, In fresh area it allows the inflow of air to prevent the shortage of air and the accumulation of carbon dioxide. AQS sensor is located at front side of condensor and once hazardous gas is detected, it delivers the voltage signal to ECU for closing intake door.

DTC Description

The ECM sets DTC B1258 if there is a short circuit in AQS sensor signal harness or the measured voltage value of the sensor is less than the threshold value

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	● Voltage check	● Short circuit in harness ● Faulty AQS sensor ● Faulty A/C Control Unit
Threshold value	● > 0.1V	
Detecting time	● 1sec	
FAIL SAFE	● AQS function OFF ● Intake door : return to previous state	

Specification

※ Voltage value of AQS sensor as a function of position of operating condition.

Operating condition	Voltage	Note
Right after IGN "ON"	2.5V ± 0.3V	Preheating(35 ± 2sec)
Normal	4.3V ± 0.3V	Intake door : REC
Gas detected	0.9V ± 0.3V	Intake door : FRE

Schematic Diagram

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the " AQS sensor " Parameter on the Scantool. While making hazardous gas such as tobacco fumes around the AQS sensor
4. Are the DTC B1258 present and is parameter of " AQS sensor " fixed?
   ※ Parameter of " AQS sensor" will be fixed even though hazardous gas is around AQS sensor, if there is any fault in AQS sensor

   YES

   1) Go to "Inspection & Repair" procedure

   NO

   1) Fault is intermittent caused by poor contact in the sensor’s and/or A/C control unit’s connector or was repaired and A/C control unit memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   1) Repair as necessary and go to "Verification of Vehicle Repair" procedure

   NO

   1) Go to "Signal Circuit Inspection" procedure

Signal Circuit Inspection

Check for short to ground in harness

1. Ignition "OFF"
2. Disconnect AQS sensor
3. Measure resistance between terminal "1" of AQS sensor and chassis ground
   A. Specification :Approx. ∞ Ω
4. Is the measured resistance within specifications?

   YES

   1) Go to "Component Inspection" procedure.

   NO

   1) Check for short to ground in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Component Inspection

Check Ambient sensor

1. Engine "ON"
2. Connect AQS sensor
3. Measure voltage value between terminal "4" and "5" of AQS sensor
   A. Specification : Refer the specifications in fig3)
4. Is the measured voltage within specifications in fig3)?

   YES

   1) Go to "Check A/C Control Unit" procedure.

NO

1) Substitute with a AQS sensor and check for proper operation. If the problem is corrected, replace AQS sensor and then go to "Verification of Vehicle Repair" procedure.

Check A/C Control Unit

1. Engine : "ON"
2. Disconnect AQS sensor.
3. Measure voltage between terminal "2" of A/C Control Unit and chassis ground
   A. Specification :Approx. 5V
4. Is the measured voltage within specifications?

YES

1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

1) Substitute with a known-good A/C Control Unit and check for proper operation.
If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

YES

1) Go to the applicable troubleshooting procedure

NO

1) System is performing to specification at this time.

Heating,Ventilation, Air Conditioning > Controller > B1259 AQS Sensor Fault

Component Location

General Description

AQS(Air Quality System) keeps air inside in the most suitable state for driver. In polluted area AQS detects hazardous gas and intercepts inflow automatically, Inversely, In fresh area it allows the inflow of air to prevent the shortage of air and the accumulation of carbon dioxide. AQS sensor is located at front side of condensor and once hazardous gas is detected, it delivers the voltage signal to ECU for closing intake door.

DTC Description

The ECM sets DTC B1259 if preheating time of AQS sensor is over 40sec or signal from AQS sensor is not within specifications

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	● Voltage/time check	● Poor connection of connected part ● Faulty AQS sensor
Threshold value	● Voltage : Preheating - 2.5V±0.3V Normal - 4.3V±0.3V Gas detected - 0.9V±0.3V	
Detecting time	-	
FAIL SAFE	● AQS function OFF ● Intake door : return to previous state	

Specification

※ Voltage value of AQS sensor as a function of position of operating condition.

Operating condition	Voltage	Note
Right after IGN "ON"	2.5V ± 0.3V	Preheating(35 ± 2sec)
Normal	4.3V ± 0.3V	Intake door : REC
Gas detected	0.9V ± 0.3V	Intake door : FRE

Schematic Diagram

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the " AQS sensor " Parameter on the Scantool. While making hazardous gas such as tobacco fumes around the AQS sensor
4. Are the DTC B1259 present and is parameter of " AQS sensor " fixed?
   ※ Parameter of " AQS sensor" will be fixed even though hazardous gas is around AQS sensor, if there is any fault in AQS sensor

   YES

   1) Go to "Inspection & Repair" procedure

   NO

   1) Fault is intermittent caused by poor contact in the sensor's and/or A/C control unit's connector or was repaired and A/C control unit memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   1) Repair as necessary and go to "Verification of Vehicle Repair" procedure

   NO

   1) Go to "Signal Circuit Inspection" procedure

Signal Circuit Inspection

Check for short to ground in harness

1. Ignition "ON"
2. Disconnect AQS sensor
3. Measure voltage value between terminal "6" of AQS sensor and chassis groundit
   A. Specification : 12V
4. Is the measured resistance within specifications?

   YES

   1) Go to "Component Inspection" procedure.

   NO

1) Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Component Inspection

Check Ambient sensor

1. Engine "ON"
2. Connect AQS sensor
3. Measure voltage value between terminal "4" and "5" of AQS sensor
   A. Specification : Refer the specifications in fig3)
4. Is the measured voltage within specifications in fig3)?

   YES

   1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

   NO

   1) Substitute with a AQS sensor and check for proper operation. If the problem is corrected, replace AQS sensor and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

   YES

   1) Go to the applicable troubleshooting procedure

   NO

   1) System is performing to specification at this time.

SPECIFICATION

Manual transaxle type		M5GF2
Recommanded transaxle oil		SAE75W/85 or API GL-4
Oil quantity		1.9 Liter
Oil inspection and supplement		Every one year
Replacement	Private use	No service required
		Every 100,000 Km
	Business use	Every 100,000 Km in severe use(1~4)
		1. Driving on rough road(bumpy road, gravel road, snowy road, unpaved road etc.)
		2. Driving on mountain road, ascent/descent
		3. Repetition of short distance driving
		4. More than 50% operation in heavy city traffic during hot weather above 32°C
Gear ratio	Engine type	2.4 DOHC
	1st	3.273
	2nd	1.794
	3rd	1.552
	4th	1.176
	5th	0.974
	Reverse	3.416
	Final reduction gear ratio	4.333
		3.250

LUBRICANTS

Item	Lubricant	Quantity
Transaxle input shaft spline	CASMOLY L9508	0.2 gr.
Concentric sleeve cylinder assembly	KLUBER 9R100	As required
Transaxle case gasket	LOCTITE 587	As required

TIGHTENING TORQUE

Item Nm		Kgf.cm	lb-ft
Concentric sleeve cylinder assembly	11.8~14.7	120~150	8.7~10.8
Magnetic plug	29.4~34.3	300~350	21.7~25.3
Shift control shaft folk and shaft guide	19.6~26.5	200~270	14.5~19.5
Oil filler plug	29.4~34.3	300~350	21.7~25.3
Idler shaft bolt	34.3~41.2	350~420	25.3~30.4
Back up lamp switch	29.4~34.3	300~350	21.7~25.3
Control shaft assembly	9.8~11.8	100~120	7.2~8.7
Select lever	42.2~53.9	430~550	31.1~39.8
Shift link assembly	42.2~53.9	430~550	31.1~39.8

Vehicle speed sensor	7.8~9.8	80~100	5.8~7.2
Transaxle mounting bracket assembly	63.7~83.4	650~850	47.0~61.5
Transaxle and engine mounting bolt	42.2~53.9	430~550	31.1~39.8
Cross member mounting	137.3~156.9	1400~1600	101.3~115.7
Stay mounting	44.1~58.8	450~600	32.5~43.4
Steering bar tierod mounting	23.5~33.3	240~340	17.4~24.6
Stabilizer bar link mounting	98.1~117.7	1000~1200	72.3~86.8
Lower arm ball joint and folk mounting	98.1~117.7	1000~1200	72.3~86.8
Lower arm ball joint and front axle mounting	98.1~117.7	1000~1200	72.3~86.8
Front/rear roll stopper assembly	49.0~63.7	500~650	36.2~47.0
Steering column bolt	17.7~24.5	180~250	13.0~18.1
Power steering pressure hose bolt	63.7~73.5	650~750	47.0~54.2

SERVICE STANDARD

Item Spec	ification [mm(inch)]
Differential end play	0.15T-0.20T (0.0059T~0.0079T)
Input shaft end play	0.05T-0 (0.0020T~0)
1st output shaft end play	0.05T-0.10T (0.0020T~0.0039T)
2nd output shaft end play	0.05T-0.10T (0.0020T~0.0039T)
1st gear end play	0.135T-0.435T (0.0053T~0.0171T)
2nd gear end play	0.230T-0.430T (0.0091T~0.0169T)
3rd gear end play	0.142T-0.472T (0.0056T~0.0186T)
4th gear end play	0.230T-0.430T (0.0091T~0.0169T)
5th gear end play	0.125T-0.305T (0.0049T~0.0120T)
Reverse gear end play	0.135T-0.345T (0.0053T~0.0136T)

SPACERS

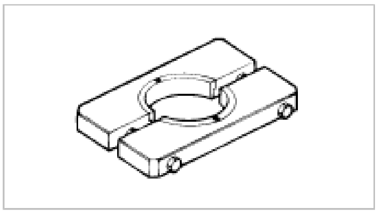
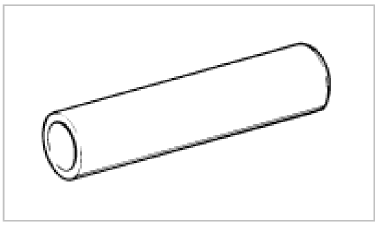
Part name	Thickness [mm(inch)]	Identification number
Spacer (For adjustment of input shaft rear bearing end play)	2.15 (0.0846)	15
	2.20 (0.0866)	20
	2.25 (0.0886)	25
	2.30 (0.0906)	30
	2.35 (0.0925)	35
	2.40 (0.0945)	40
	2.45 (0.0965)	45
	2.50 (0.0984)	50
	2.55 (0.1004)	55
	2.60 (0.1024)	60
	2.65 (0.1043)	65
	2.70 (0.1063)	70
	2.75 (0.1083)	75
	2.80 (0.1102)	80
	2.85 90.1122)	85
	2.30 (0.0906)	30

Spacer (For adjustment of 1st output shaft rear bearing end play)	2.35 (0.0925)	35
	2.40 (0.0945)	40
	2.45 (0.0965)	45
	2.50 (0.0984)	50
	2.55 (0.1004)	55
	2.60 (0.1024)	60
	2.65 (0.1043)	65
	2.70 (0.1063)	70
	2.75 (0.1083)	75
	2.80 (0.1102)	80
Spacer (For adjustment of 2nd output shaft rear bearing end play)	2.35 (0.0925)	35
	2.40 (0.0945)	40
	2.45 (0.0965)	45
	2.50 (0.0984)	50
	2.55 (0.1004)	55
	2.60 (0.1024)	60
	2.65 (0.1043)	65
	2.70 (0.1063)	70
	2.75 (0.1083)	75
	2.80 (0.1102)	80
Spacer (For adjustment of differential end play)	1.22 (0.0480)	22
	1.25 (0.0492)	25
	1.28 (0.0504)	28
	1.31 (0.0516)	31
	1.34 (0.0528)	34
	1.37 (0.0539)	37
	1.40 (0.0551)	40
	1.43 (0.0563)	43
	1.46 (0.0575)	46
	1.49 (0.0587)	49
	1.52 (0.0598)	52
	1.55 (0.0610)	55
	1.58 (0.0622)	58
	1.61 (0.0634)	61
	1.64 (0.0646)	64
	1.67 (0.0657)	67
	1.70 (0.0669)	70

Manual Transaxle System > General Information > Special Service Tools

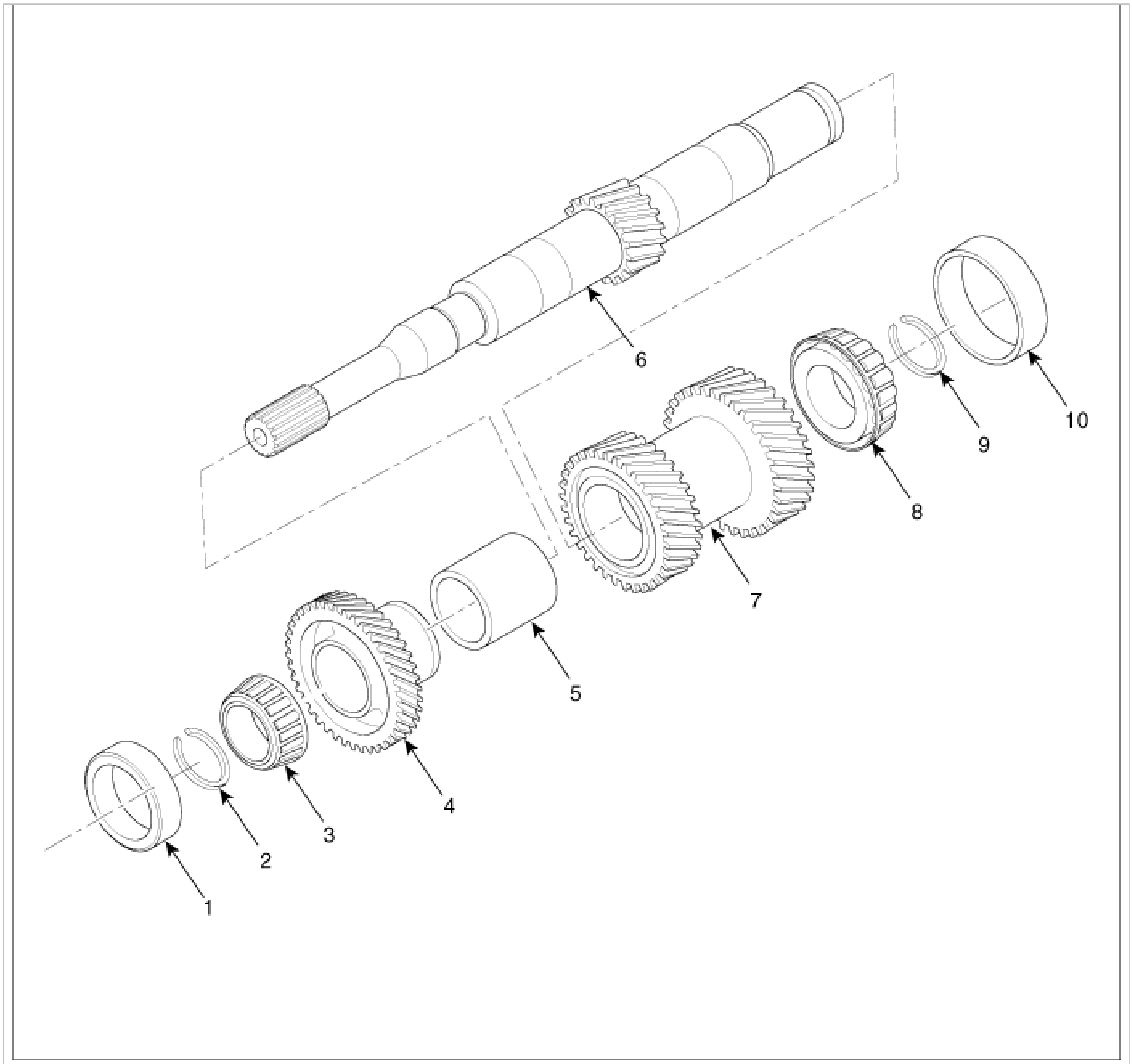
SPECIAL TOOLS

Tool (Number and name)	Illustration	Use
09527-4A000		Removal of the 1st output shaft front taper roller

Removing plate		bearing.
09432-3K000 Oil seal installer		Installation of an input shaft oil seal in a clutch housing.

Manual Transaxle System > Gear System > Input Shaft > Components and Components Location

COMPONENTS



1. Taper roller bearing outer race
2. Snap ring
3. Taper roller bearing
4. 5th Input gear
5. Spacer
6. Input gear
7. 3rd/4th Input gear
8. Taper roller bearing
9. Snap ring
10. Bearing outer race

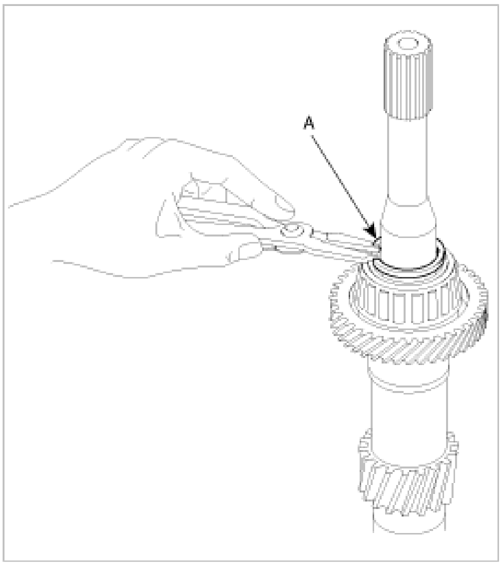
Manual Transaxle System > Gear System > Input Shaft > Repair procedures

DISASSEMBLY

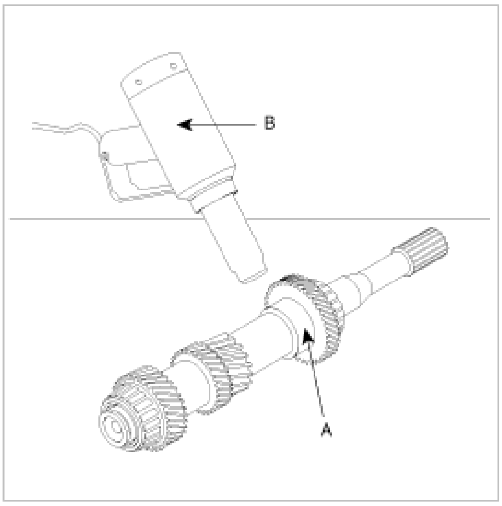
CAUTION

It is highly recommanded not to disassemble input shaft assembly.
If you have a problem with a part in the input shaft assembly, replace it with a new input shaft assembly.
The procedures below are just for reference.

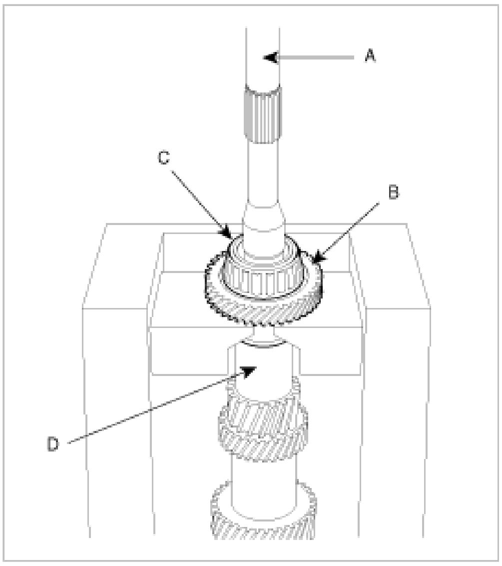
1. Disassemble the snap ring(A).



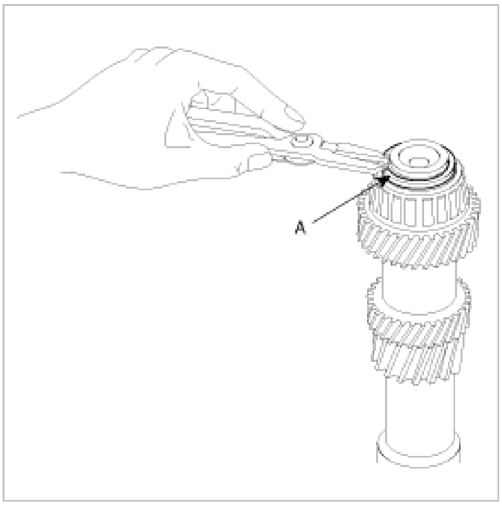
2. Heat the 5th input gear(A) with a heat gun(B).



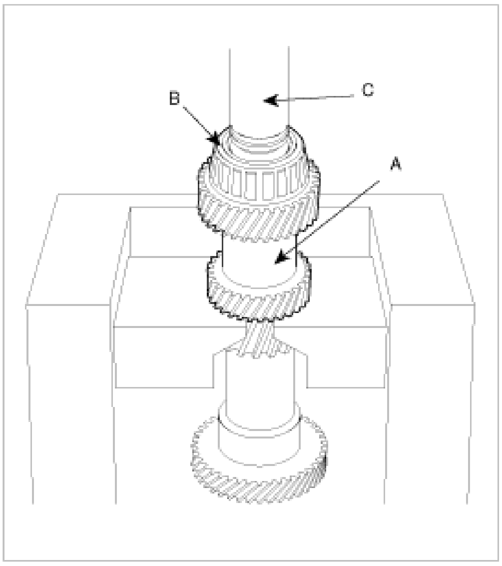
3. Using a press(A), separate the 5th input gear(B) and the front side taper roller bearing(C) at a time.



4. Remove the spacer(D).
5. Remove the rear side snap ring(A).

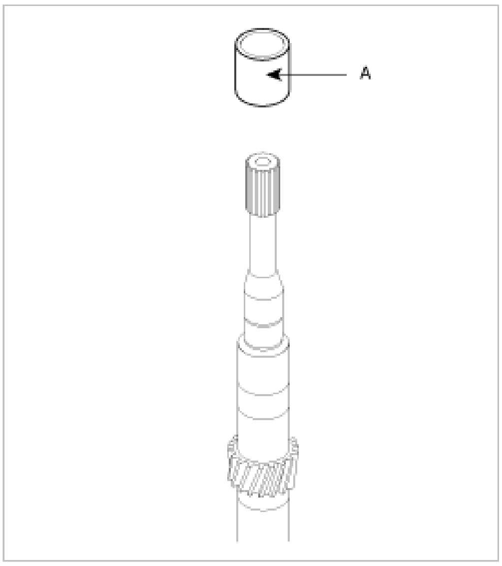


6. Heating the 3rd/4th gear(A) with a heat gun, install the gear(A) and the rear side taper roller bearing(B) with a press(C).

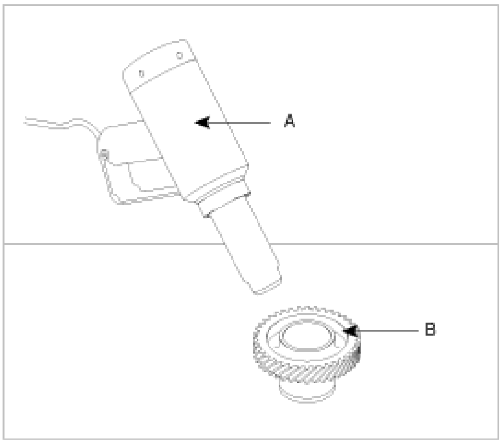


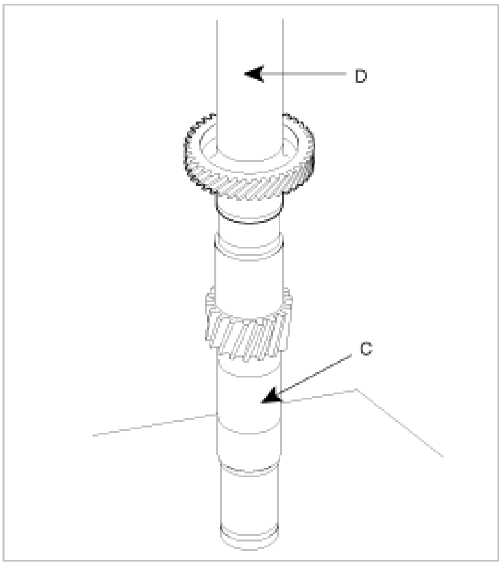
REASSEMBLY

1. Insert the input shaft into the spacer(A).

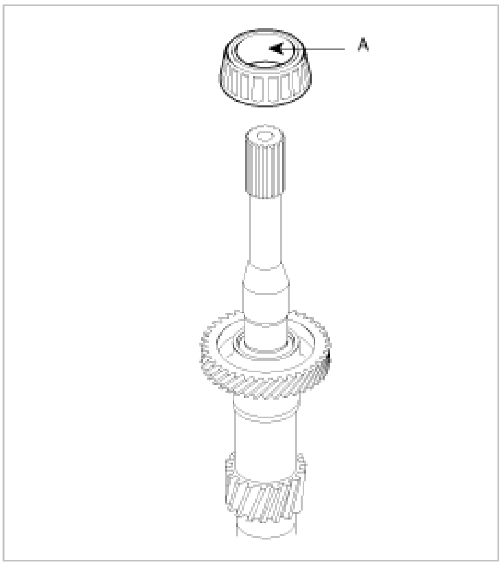


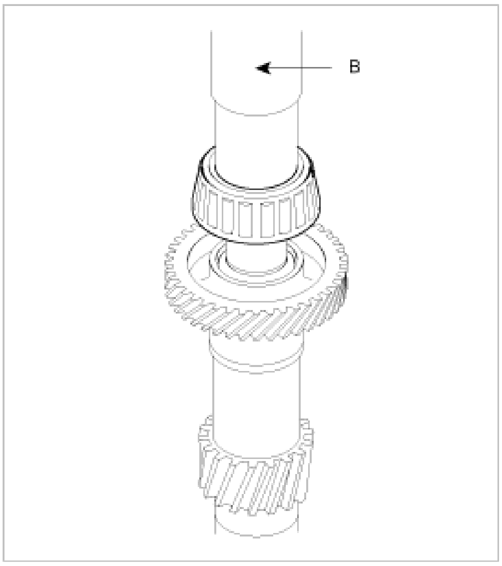
2. Heating the 5th input gear with a heat gun(A), insert the input shaft(C) into it with a press(D).



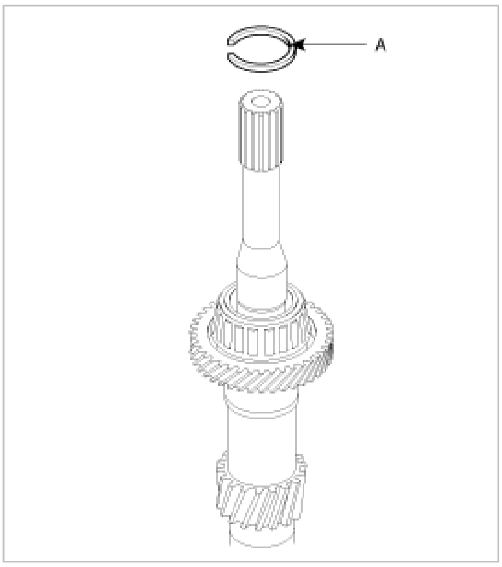


3. Using a press(B), do the same procedure as described above with the front side taper roller bearing(A) for its installation.

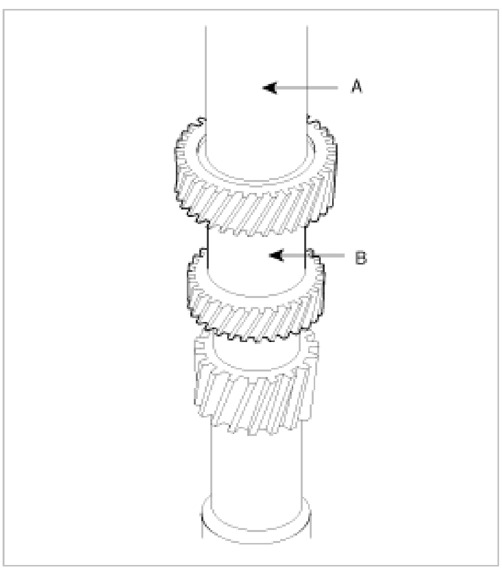




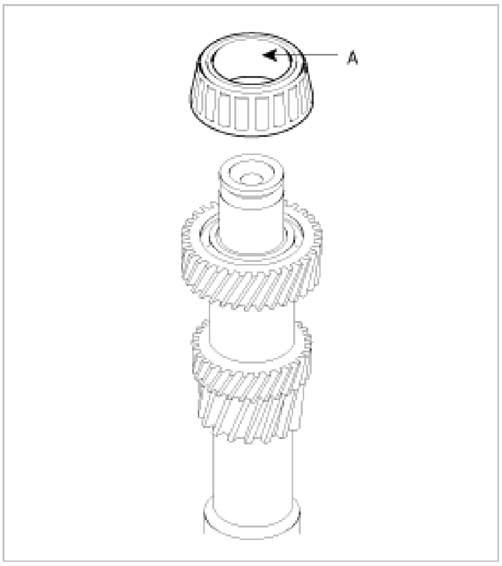
4. Select the front side snap ring(A) which makes the gap be 0~0.03mm(0.0012inch), and install it.

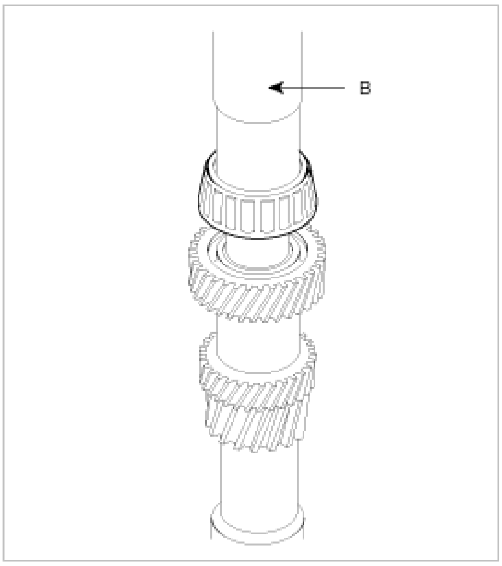


5. Heating the 3rd/4th gear(B) with a heat gun, insert the input shaft(rear side) into it with a press(A).

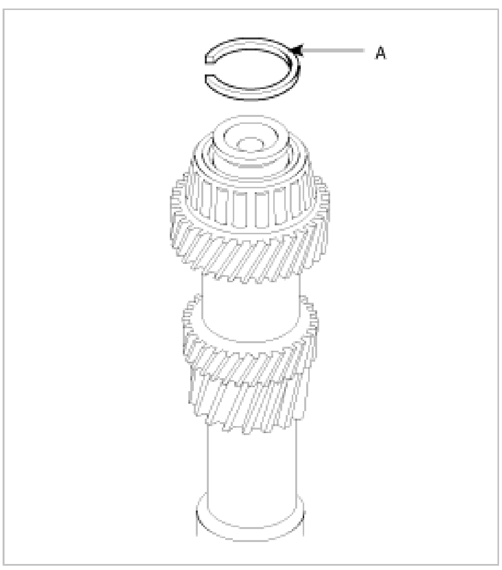


6. Using a press(B), do the same procedure as described above with the rear side taper roller bearing(A) for its installation.





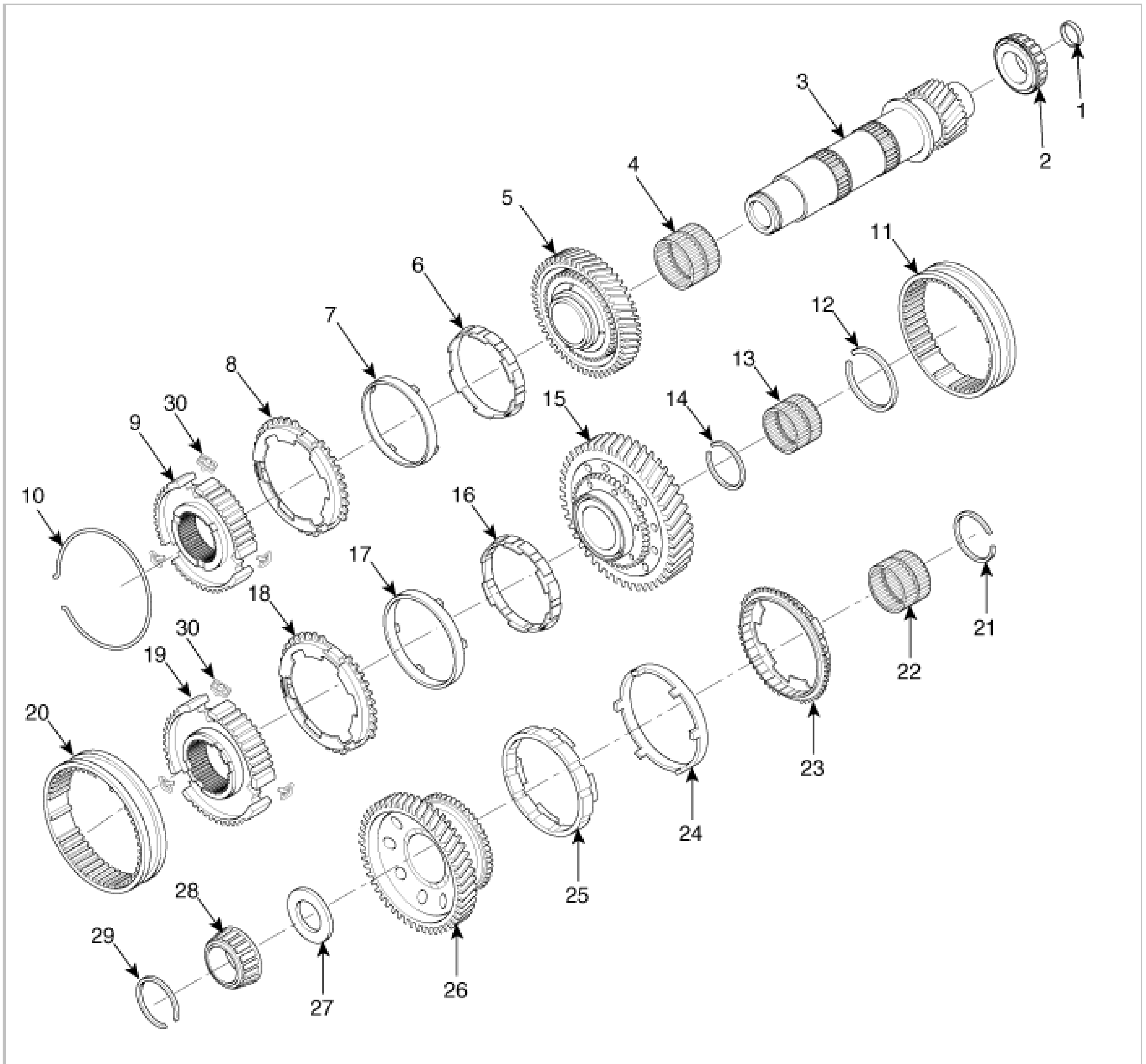
7. Select the rear side snap ring(A) which makes the gap be 0~0.03mm(0.0012inch), and install it.



Manual Transaxle System > Gear System > Output Shaft > Components and Components Location

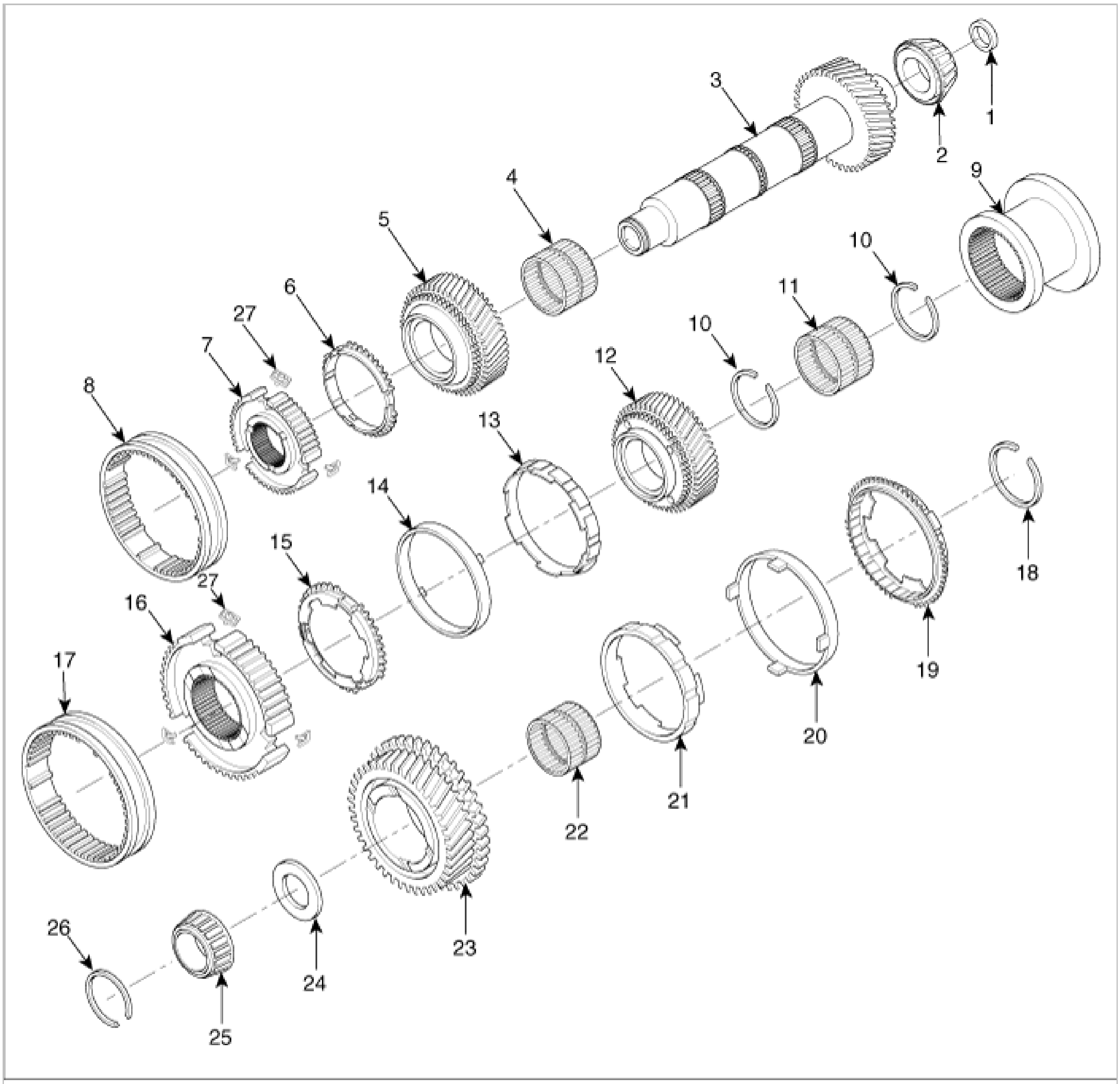
COMPONENTS

THE 1ST OUTPUT SHAFT



1. Oil guide ring	11. Reverse sleeve	21. Snap ring
2. Taper roller bearing	12. Snap ring	22. Needle roller bearing
3. 1st output shaft	13. Needle roller bearing	23. 2nd outer synchronizer ring
4. Needle roller bearing	14. Snap ring	24. 2nd synchronizer cone
5. Reverse driven gear	15. 1st output gear	25. 2nd inner synchronizer ring
6. Reverse inner synchronizer ring	16. 1st inner synchronizer ring	26. 2nd outer gear
7. Reverse synchronizer cone	17. 1st synchronizer cone	27. Spacer
8. Reverse outer synchronizer ring	18. 1st outer synchronizer ring	28. Taper roller bearing
9. Reverse hub	19. 1st/2nd hub	29. Snap ring
10. Synchronizer key stopper	20. 1st/2nd sleeve	30. Synchronizer key assembly

THE 2ND OUTPUT SHAFT



1. Oil guide ring	10. Snap ring	19. 4th outer synchronizer ring
2. Taper roller bearing	11. Needle roller bearing	20. 4th synchronizer cone
3. 2nd output shaft	12. 3rd output gear	21. 4th inner synchronizer ring
4. Needle roller bearing	13. 3rd inner synchronizer ring	22. Needle roller bearing
5. 5th output gear	14. 3rd synchronizer cone	23. 4th output gear
6. 5th synchronizer ring	15. 3rd outer synchronizer ring	24. Spacer
7. 5th hub	16. 3rd/4th hub	25. Taper roller bearing
8. 5th sleeve	17. 3rd/4th sleeve	26. Snap ring
9. Spacer	18. Snap ring	27. Synchronizer key assembly

Manual Transaxle System > Gear System > Output Shaft > Repair procedures

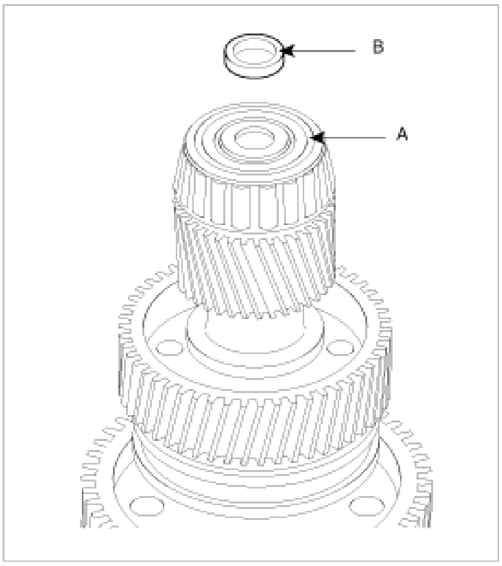
DISASSEMBLY

CAUTION

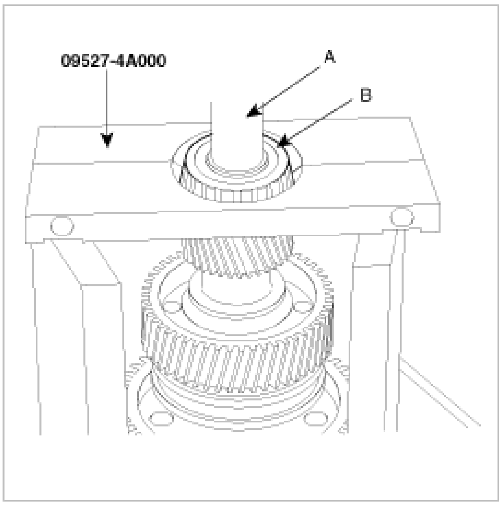
It is highly recommended not to disassemble output shaft assembly.
If you have a problem with a part in the input shaft assembly, replace it with a new input shaft assembly.
The procedures below are just for reference.

THE 1ST OUTPUT SHAFT

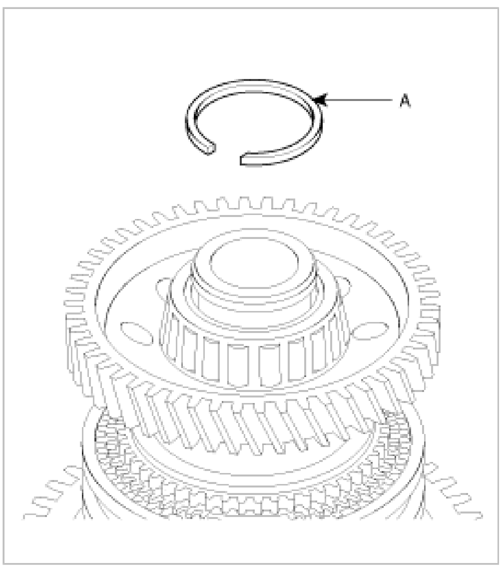
1. Remove the oil guide ring(B) from the front taper roller bearing(A).



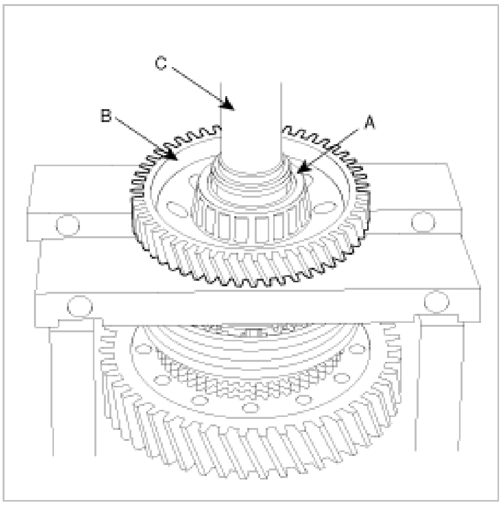
2. Using a press(A) and the SST(09527-4A000), remove the front side taper roller bearing(B).



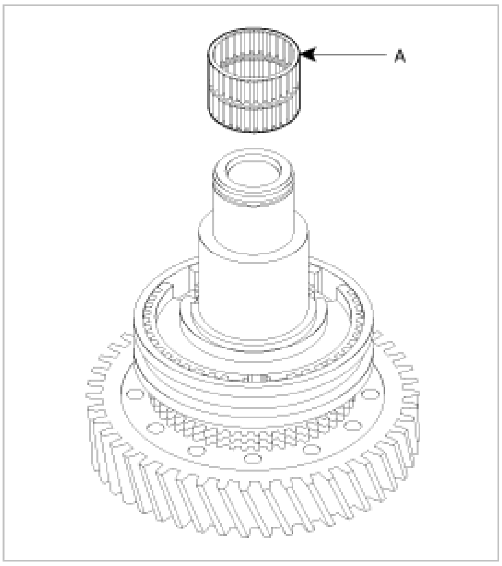
3. Remove the rear side snap ring(A).



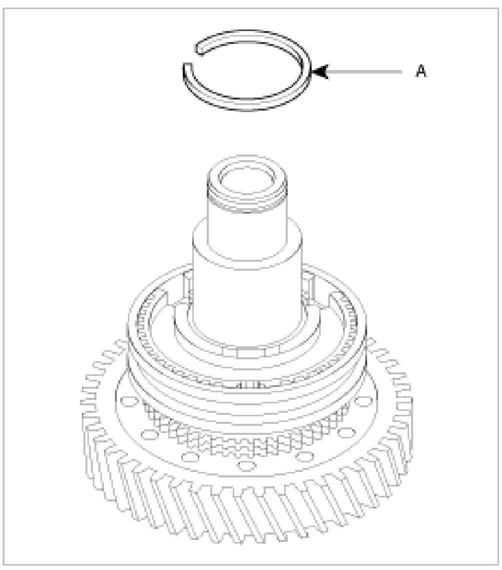
4. Using a press(C), remove the rear side taper roller bearing(A) and the 2nd output gear(B).



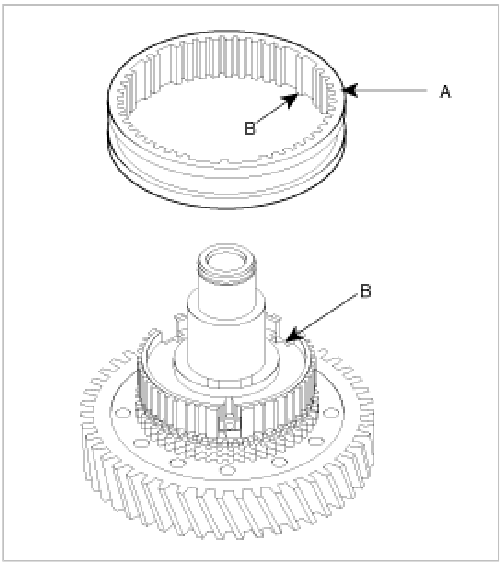
5. Remove the 2nd triple cone assembly.
6. Remove the needle roller bearing(A).



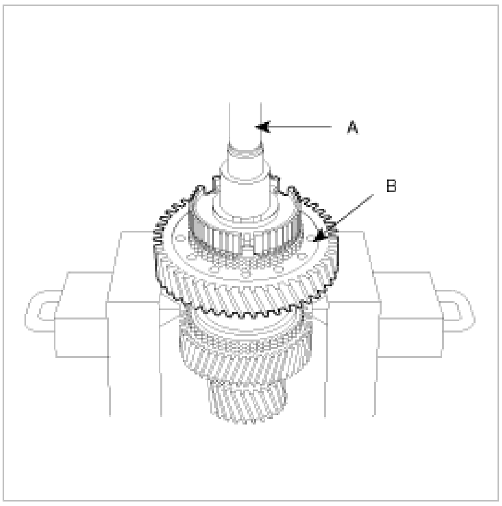
7. Remove the snap ring(A).



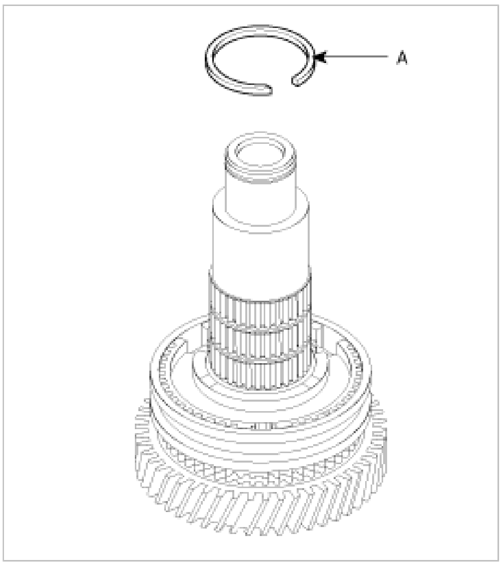
8. Remove the 1st/2nd sleeve(A).



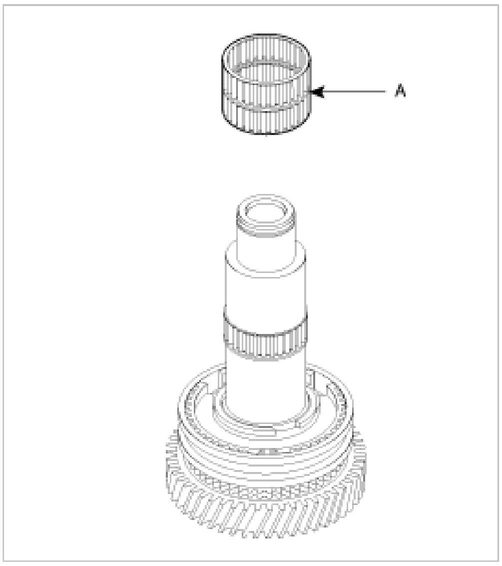
9. Disassemble the 1st synchronizer key assembly(3EA).
10. Using a press(A), remove the 1st output gear(B), synchronizer assembly and hub at a time.



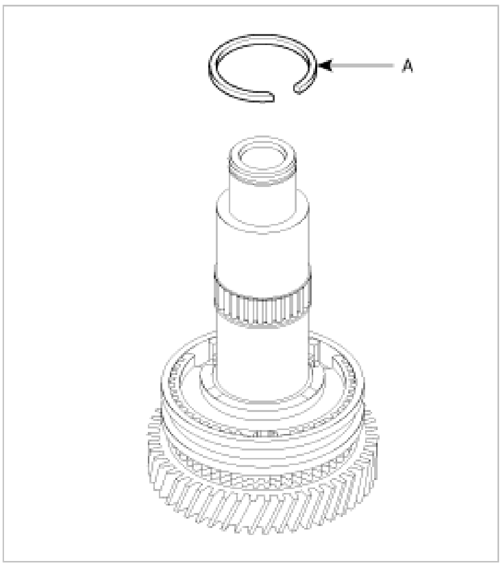
11. Remove the snap ring(A).



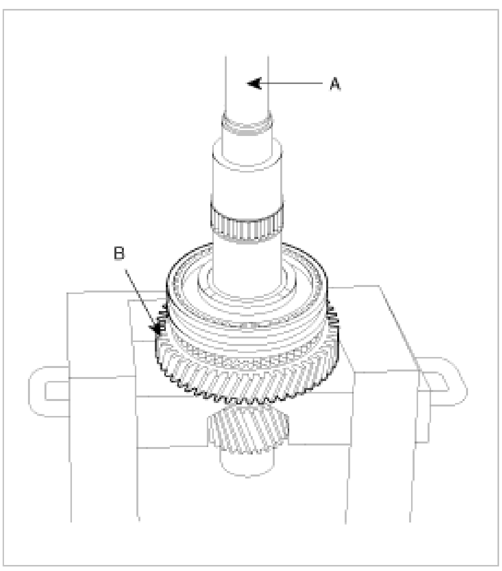
12. Remove the needle roller bearing(A).



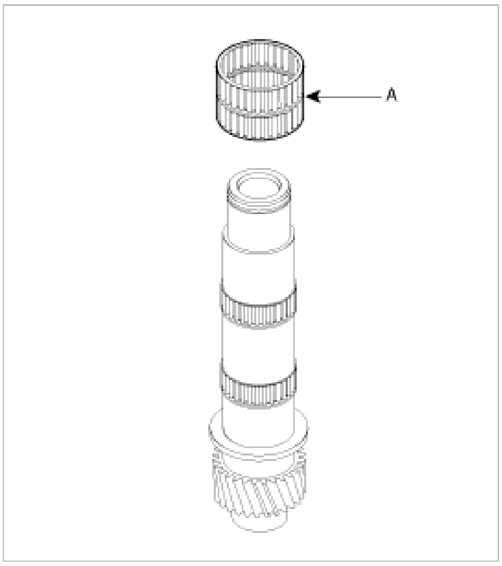
13. Remove the snap ring(A).



14. Using a press(A), remove the reverse gear(B), synchronizer assembly and hub.

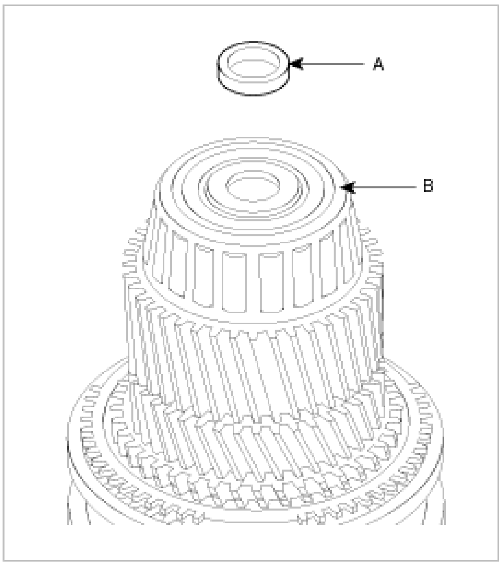


15. Remove the needle roller bearing(A).

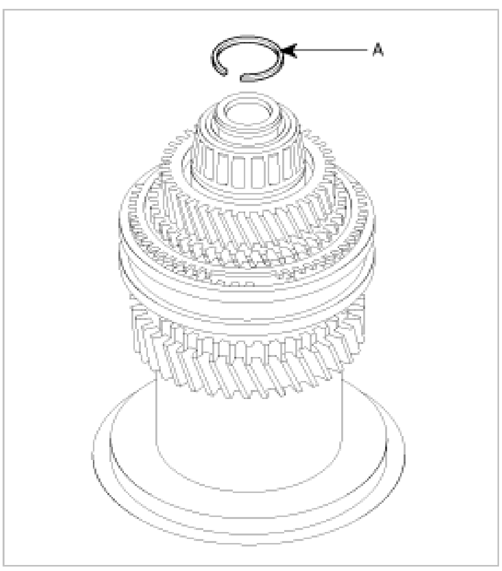


THE 2ND OUTPUT SHAFT

1. Remove the oil guide ring(A) from the front side taper roller bearing(B).

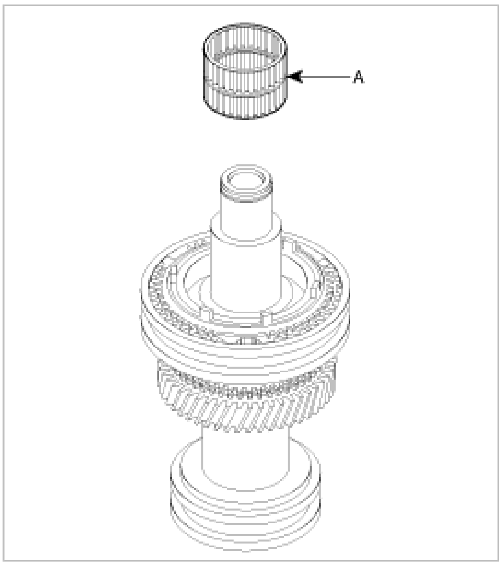


2. Using a press, remove the front side taper roller bearing.
3. Remove the rear side snap ring(A).

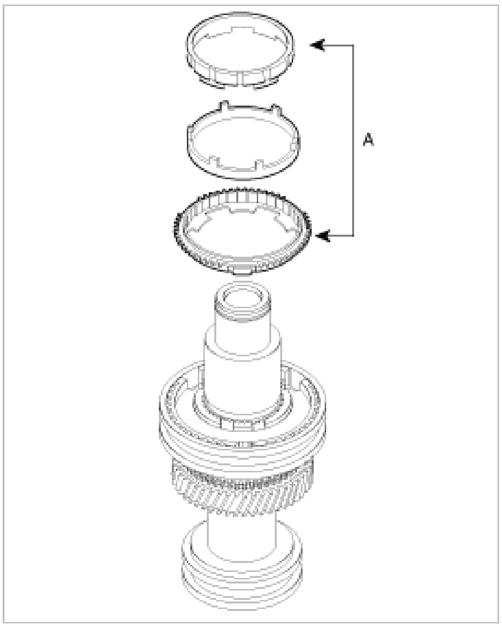


4. Setting a press up in the 3rd output gear, remove the assemblies at a time.

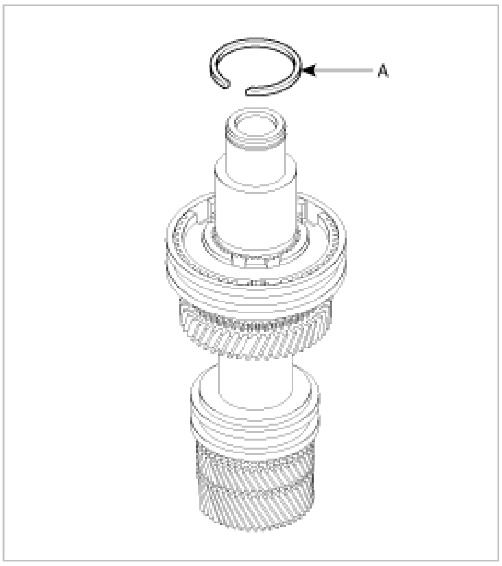
5. Remove the needle roller bearing(A).



6. Remove the 4th double cone ring assembly(A).

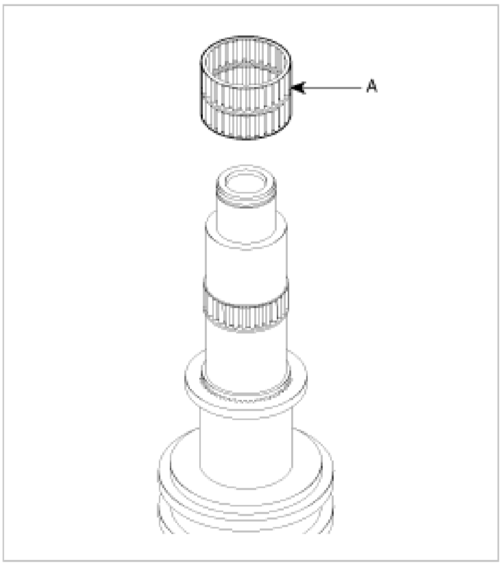


7. Remove the snap ring(A).

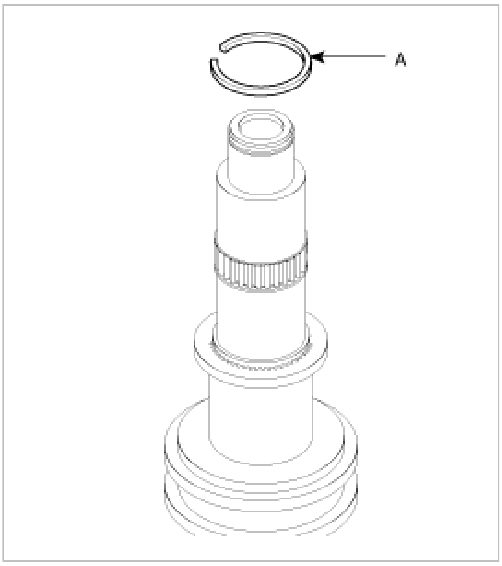


8. Setting a press up in the 4th output gear, remove the assemblies at a time.

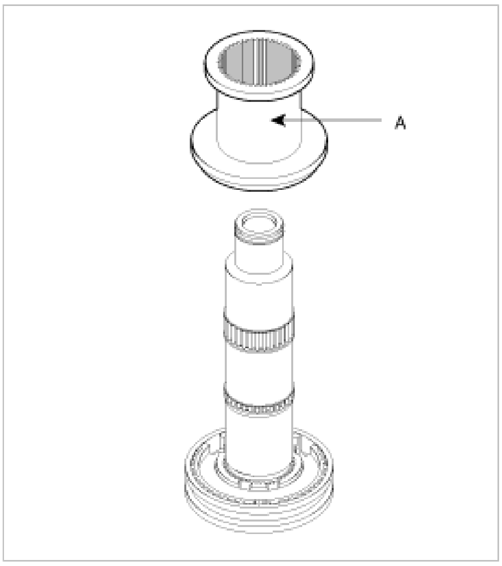
9. Remove the snap ring.
10. Remove the needle roller bearing(A).



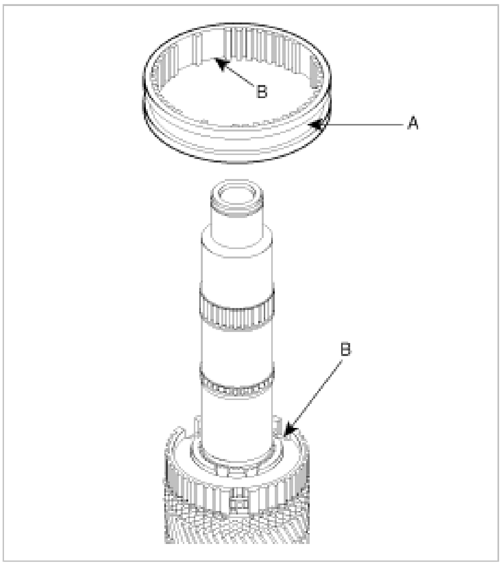
11. Remove the snap ring(A).



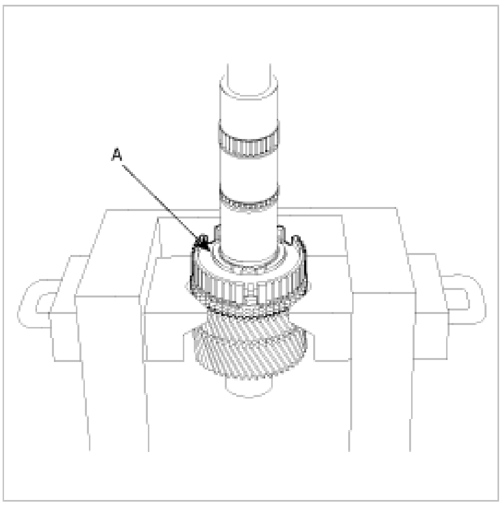
12. Remove the spacer(A).



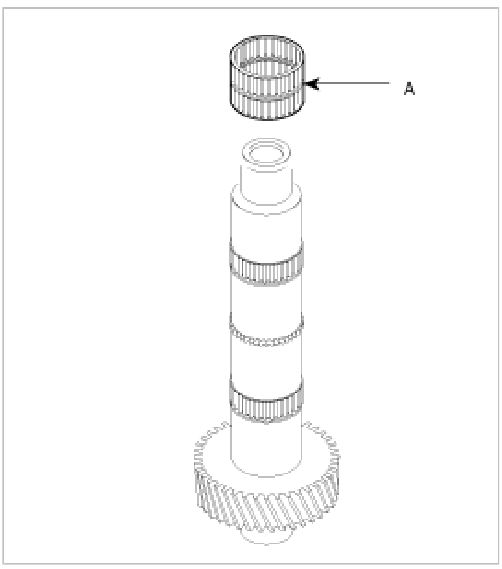
13. Remove the 5th sleeve(A).



14. After removing the 5th synchronizer keys, pull out the hub assembly(A) with a press.



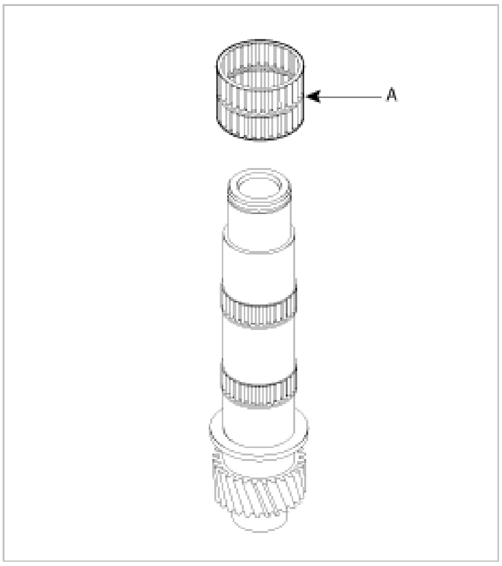
15. Remove the needle roller bearing(A).



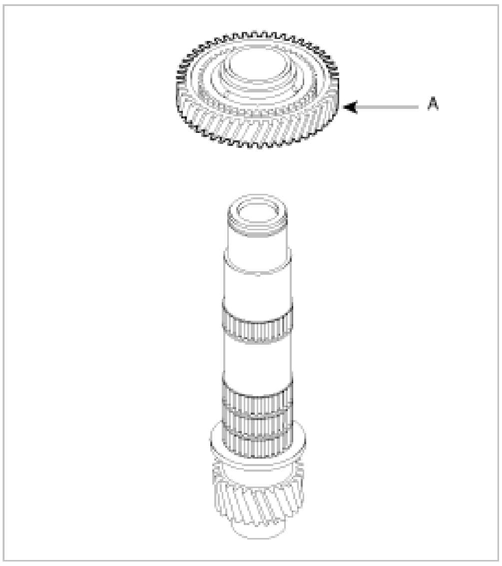
REASSEMBLY

THE 1ST OUTPUT SHAFT

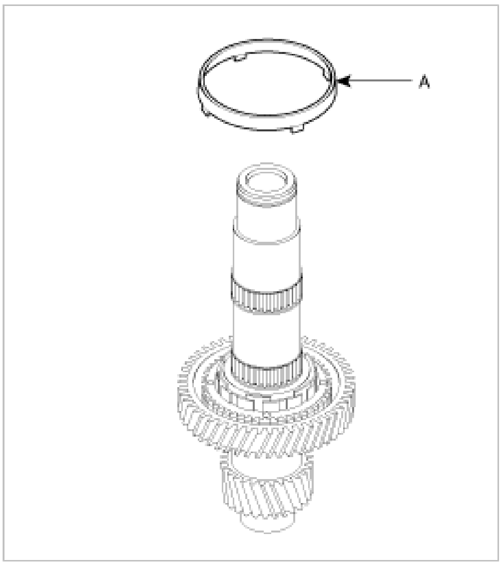
1. Installing the needle roller bearing(A), apply gear oil around.



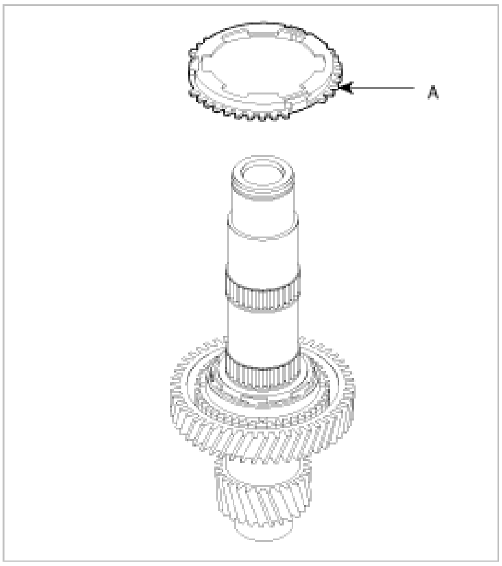
2. Install the reverse driven gear(A).



3. Install the reverse inner synchronizer ring with the reverse synchronizer cone(A).



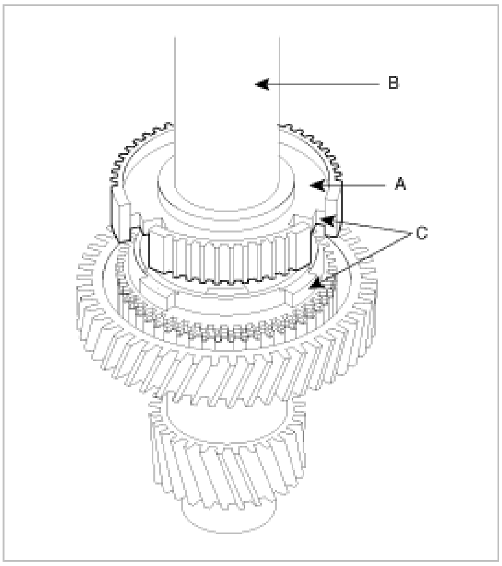
4. Assemble the reverse outer synchronizer ring (A)(triple cone type).



5. Install the reverse hub(A) with a press(B).

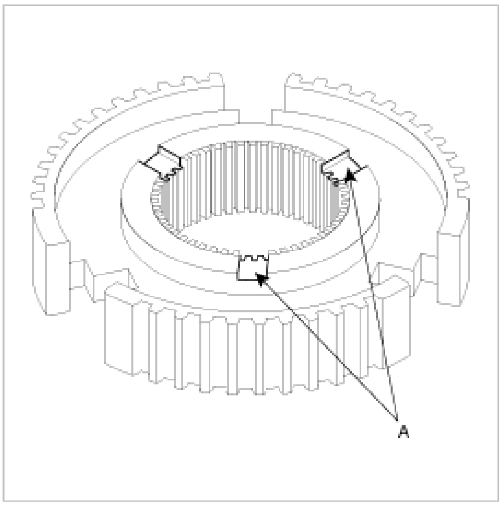
NOTE

Align the groove(C) of the reverse hub with the protrusion(C) of the output synchronizer ring.

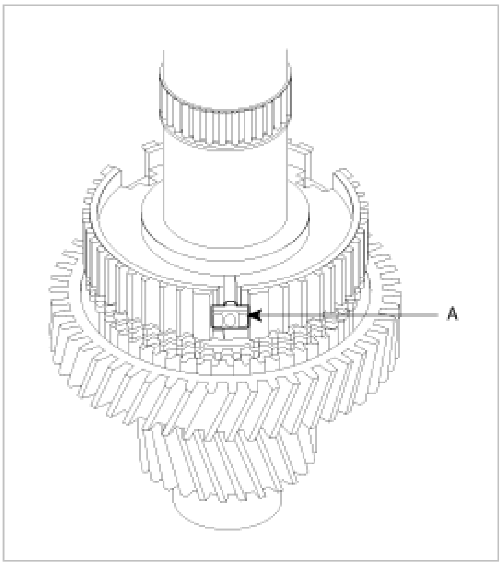


NOTE

The hub surface which has the three grooves(A) in triangle should face the 1st gear side.

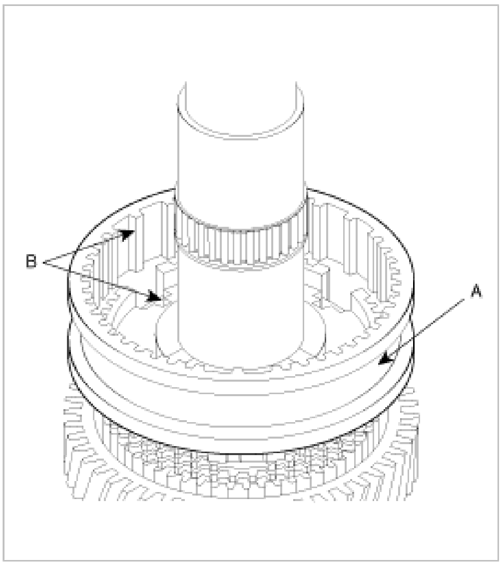


6. Insert the three synchronizer key assemblies(A).

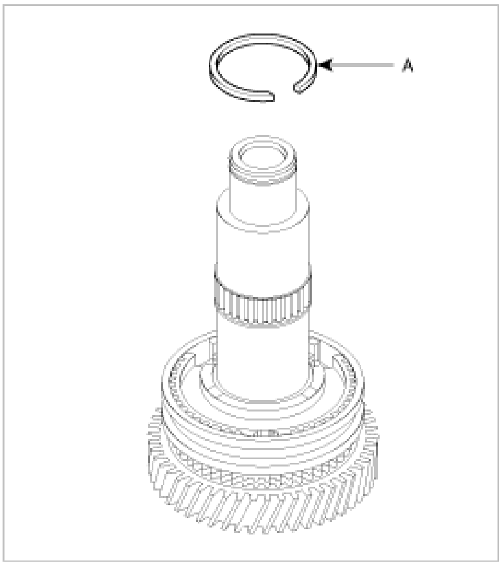


7. Insert the synchronizer key stopper.
8. Insert the three key assemblies in the reverse sleeve by pushing the balls.

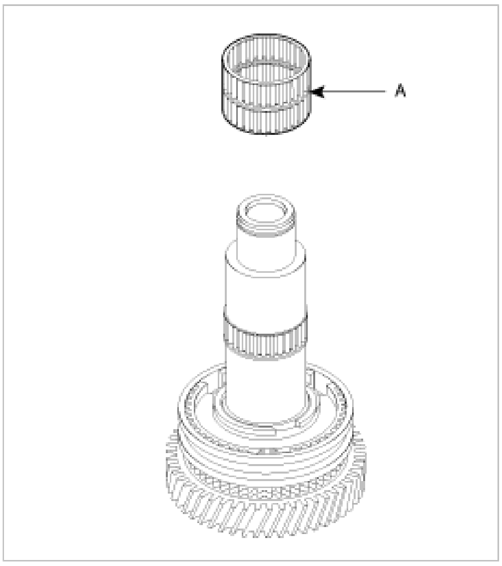
> NOTE
>
> Aligning the groove & protrusion(B), install the reverse sleeve(A).



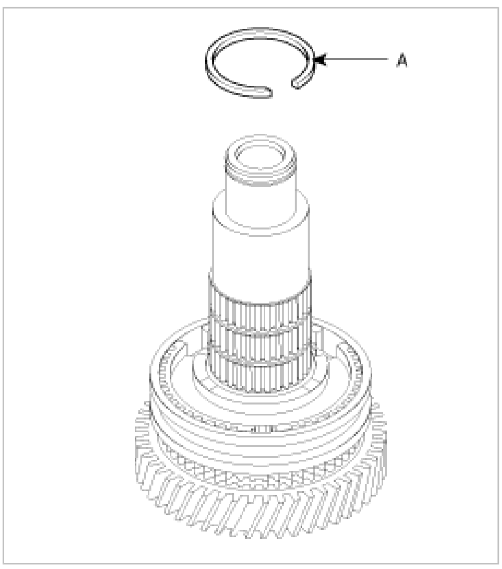
9. Selecting the snap ring(A) which makes the gap be 0~0.03mm(0.0012inch), install it.



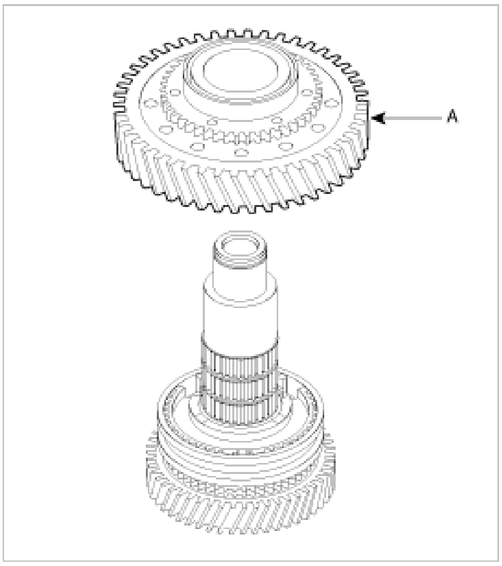
10. Installing the needle roller bearing(A), apply gear oil around.



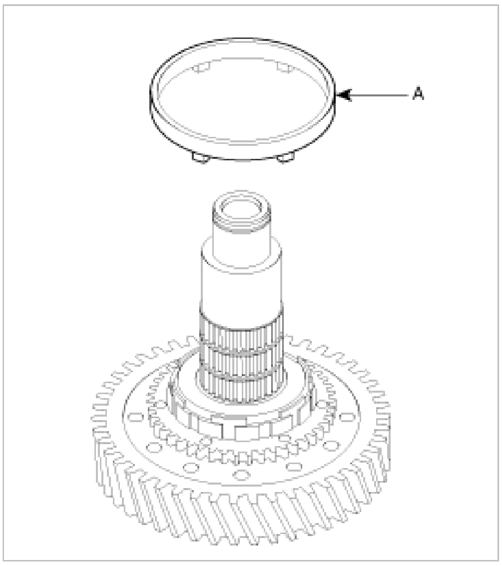
11. Install the snap ring(A) (thickness: 2.5mm or 0.0984inch).



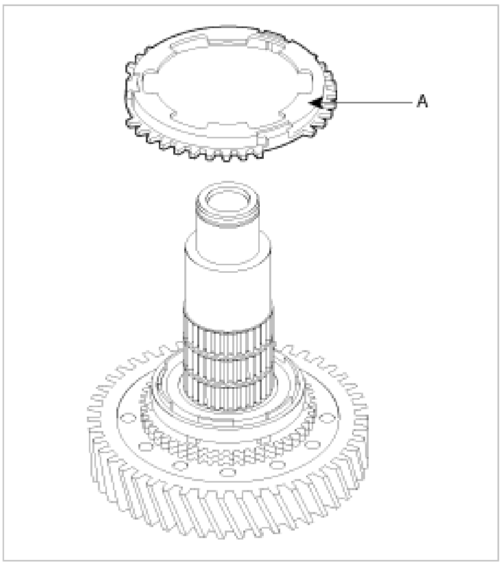
12. Install the 1st gear assembly(A).



13. Install the 1st inner synchronizer ring with the 1st synchronizer cone(A).



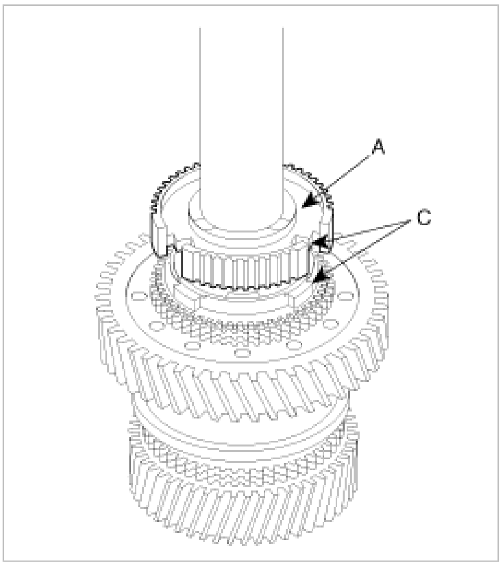
14. Assemble the 1st outer synchronizer ring(A)(triple cone type).



15. Using a press, install the 1st/2nd hub(A).

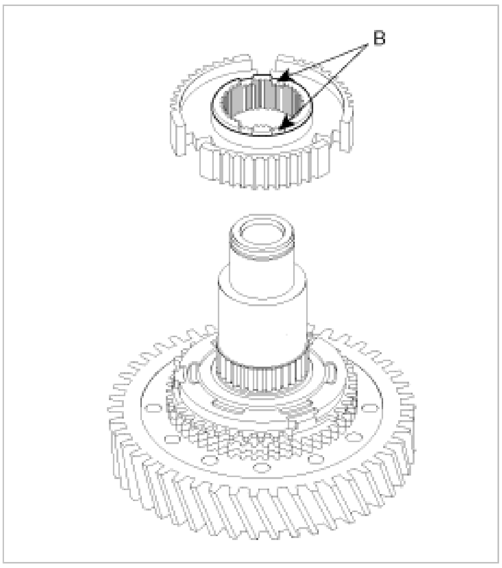
NOTE

Align the groove(C) of the hub with the protrusion(C) of the output synchronizer ring.

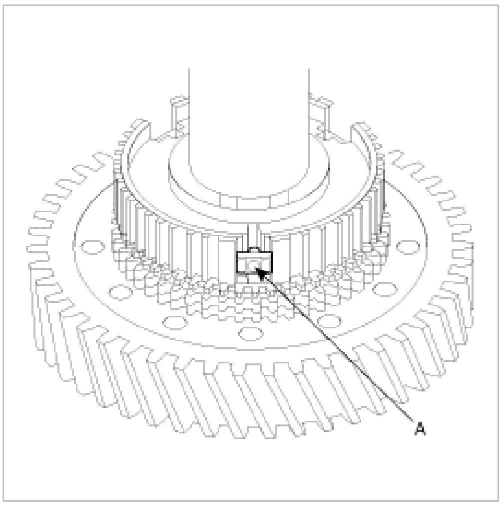


NOTE

The hub surface which has the four grooves(B) in parallel should face the 2nd gear side.



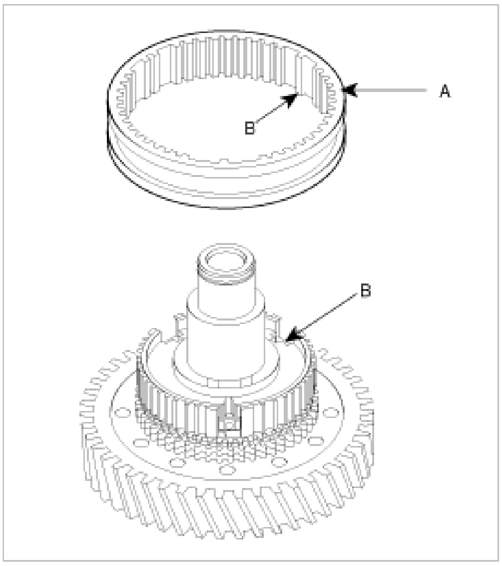
16. Insert the three 1st/2nd synchronizer key assemblies(A).



17. Install the 1st/2nd sleeve(A) by tapping softly with a rubber hammer.
    Insert the three key assemblies in the 1st/2nd sleeve by pushing them.

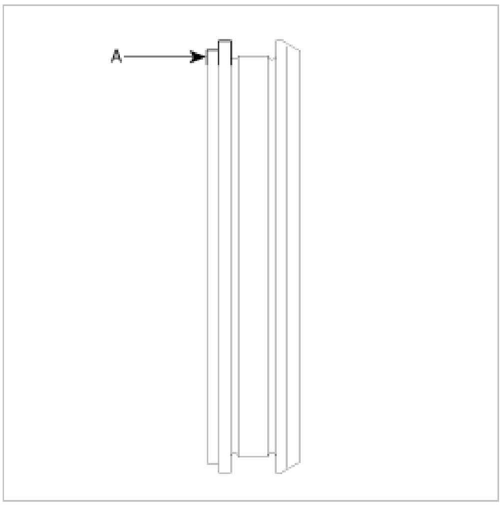
NOTE

Align the groove&protrusion(B), install the 1st/2nd sleeve(A).

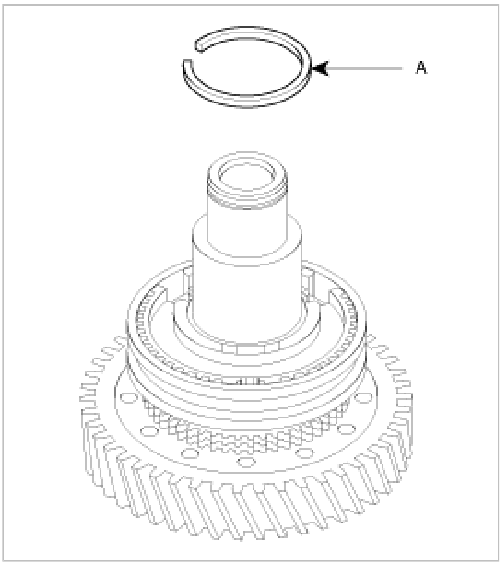


NOTE

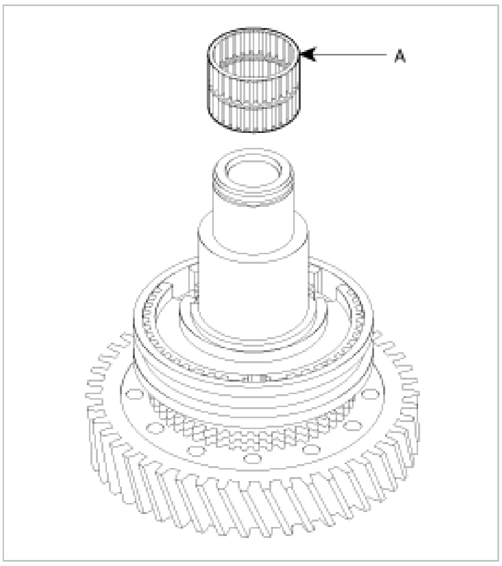
The sleeve surface which has the groove(A) should face the 1st gear side.



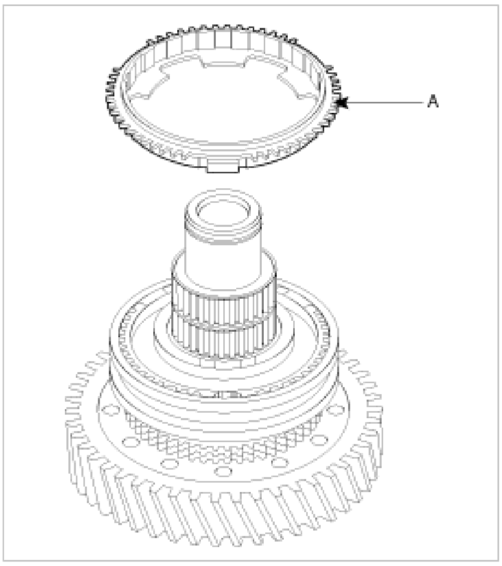
18. Selecting the snap ring(A) which makes the gap be 0~0.03mm(0.0012inch), install it.



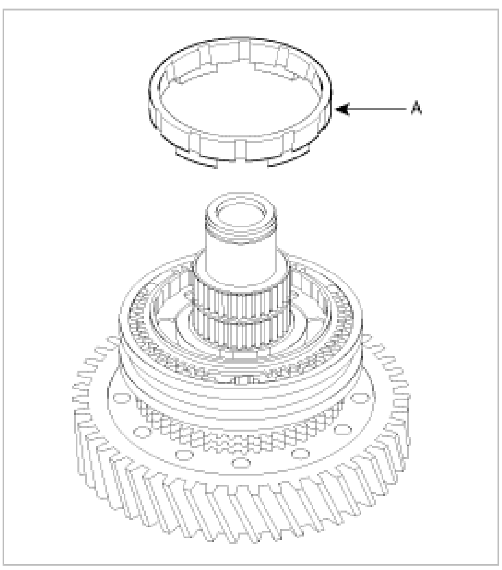
19. Installing the needle roller bearing(A), apply gear oil around.



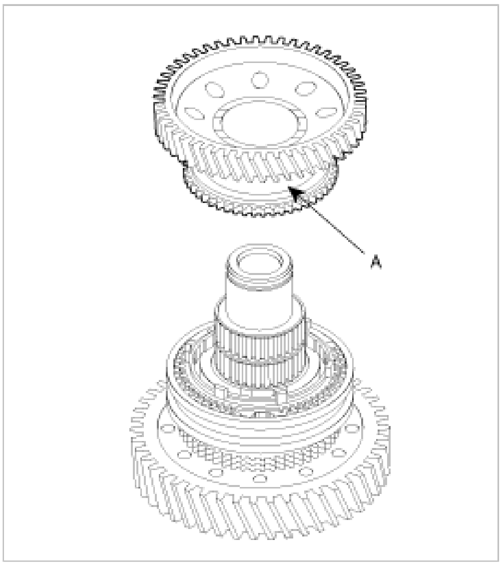
20. Install the 2nd outer synchronizer ring(A).



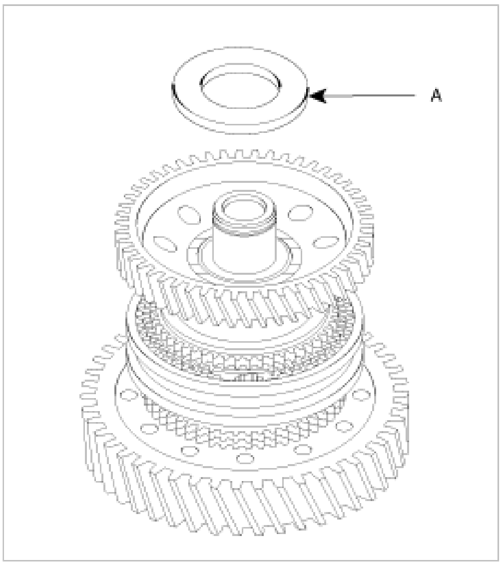
21. Install the 2nd synchronizer cone with the 2nd inner synchronizer ring(A)(triple cone type).



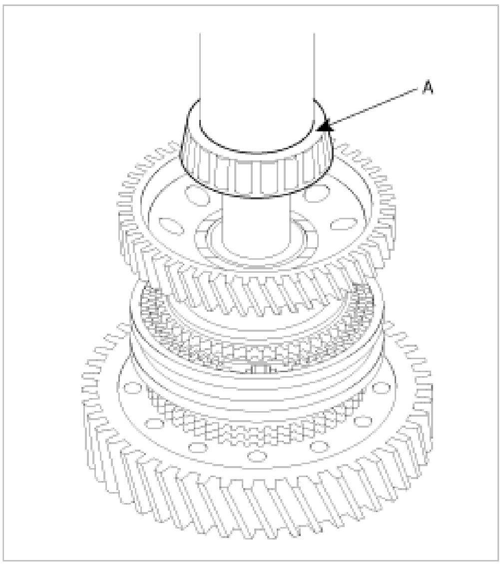
22. Assemble the 2nd output gear(A).



23. Assemble the spacer(A).



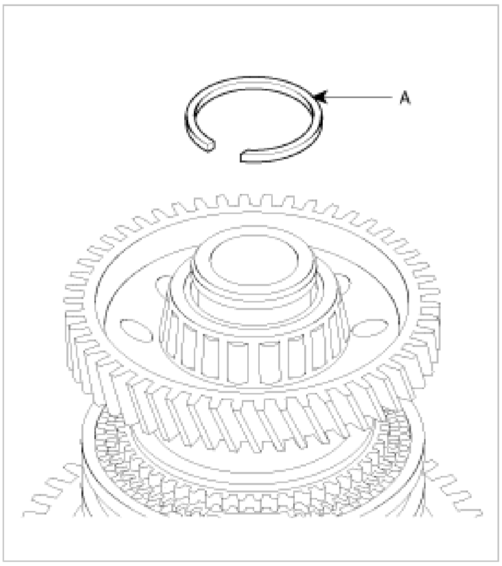
24. Using a press, assemble the rear side taper roller bearing(A).



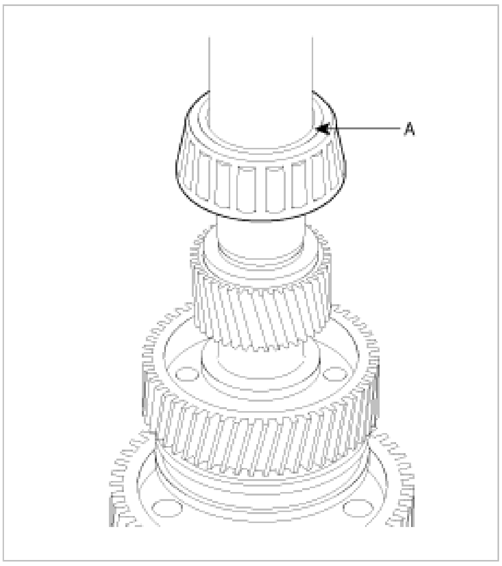
25. Assemble the snap ring(A).

NOTE

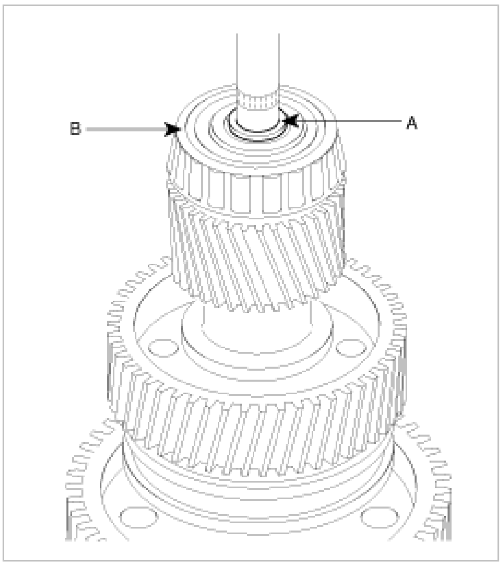
Selecting the snap ring which makes the gap be 0~0.03mm(0.0012inch), install it.



26. Using a press, assemble the front side taper roller bearing(A).

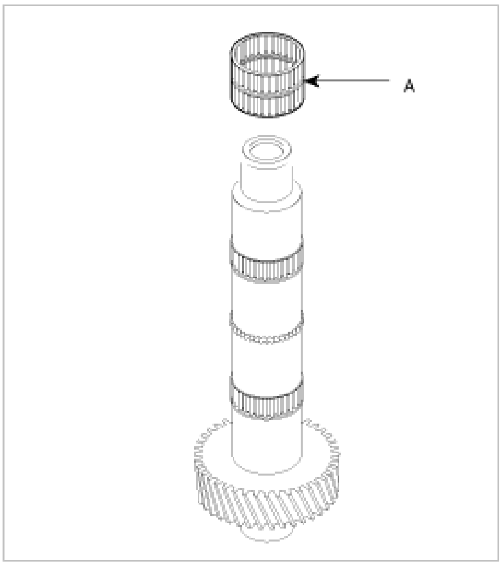


27. Using a press, insert the oil guide ring(A) into the front side taper roller bearing(B).

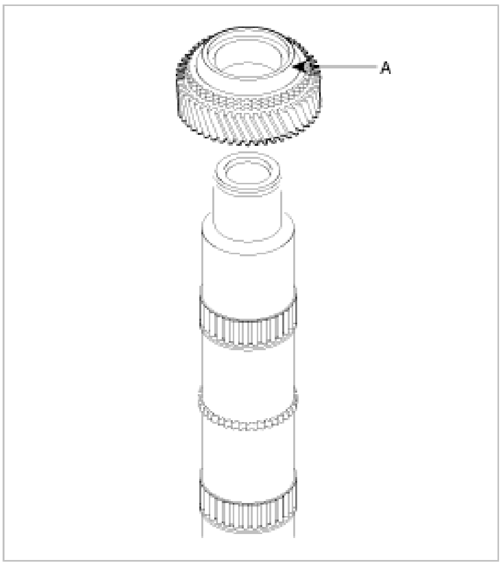


THE 2ND OUTPUT SHAFT

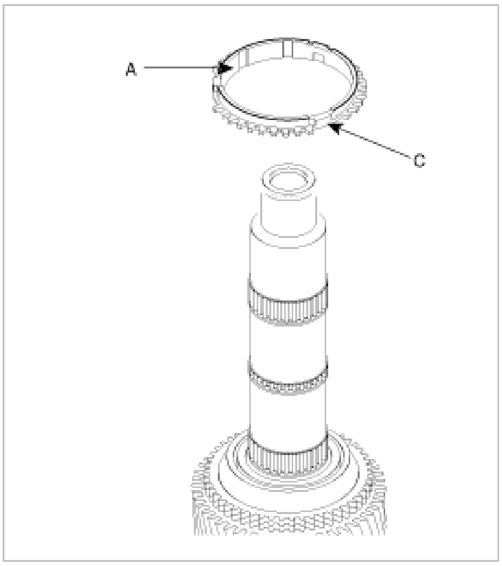
1. Assemble the needle roller bearing(A).



2. Assemble the 5th output gear(A).



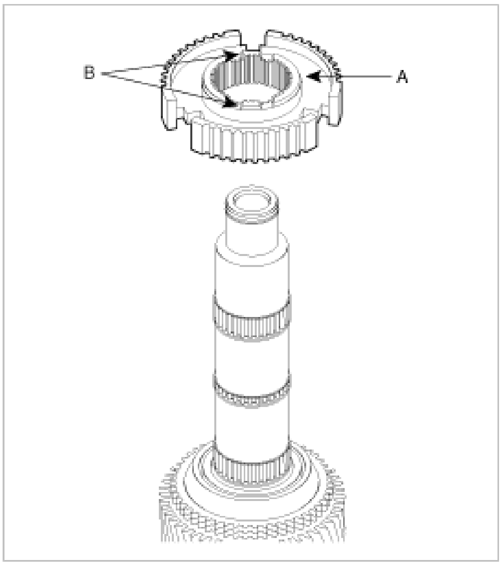
3. Assemble the 5th synchronizer ring(A).



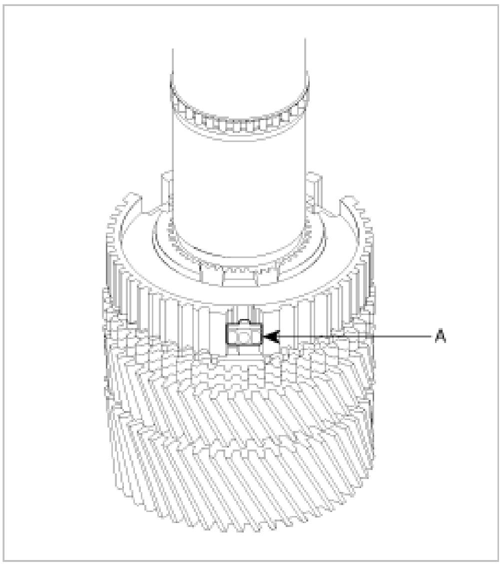
4. Using a press, assemble the 5th hub(A).

NOTE

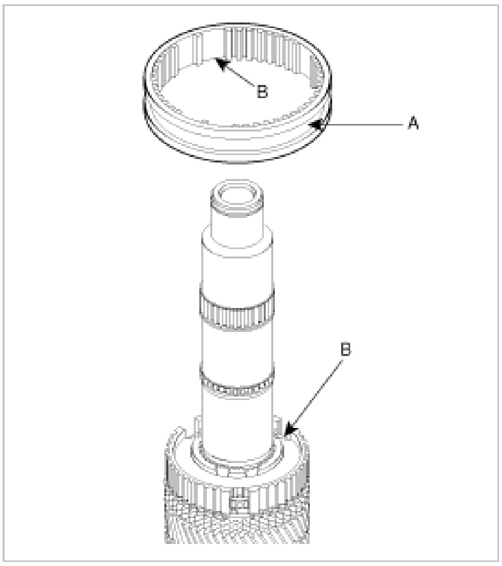
The hub surface which has the four grooves(B) in parallel should face the spacer.



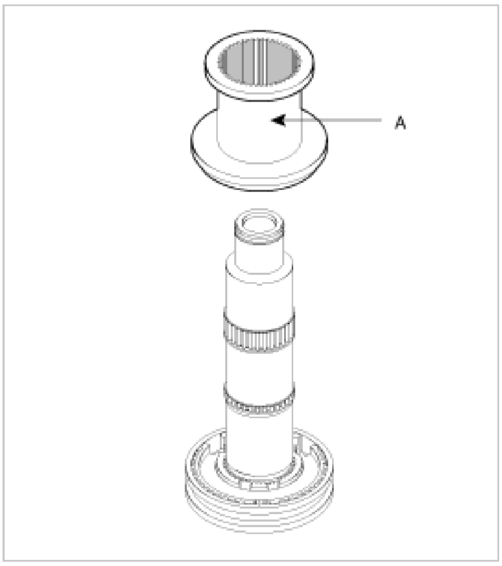
5. Insert the three 5th synchronizer key assemblies(A).



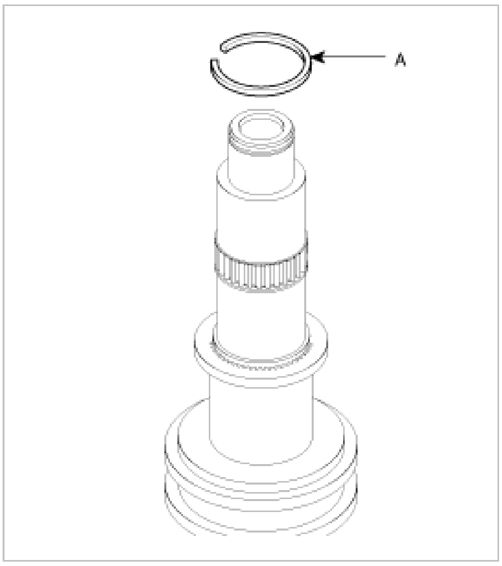
6. Taking care of the grooves(B), assemble the 5th sleeve(A).



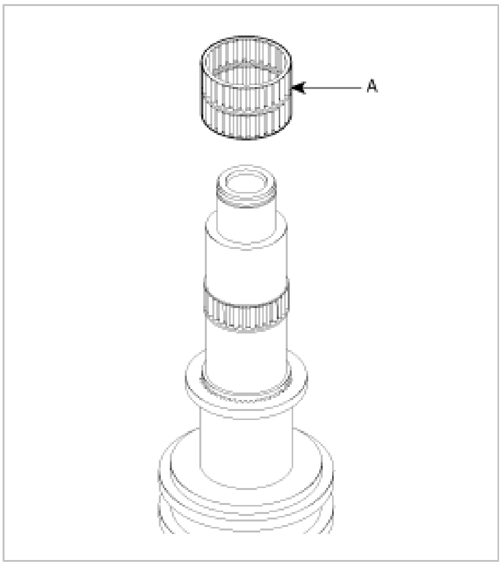
7. Insert the spacer(A).



8. Selecting the snap ring(A) which makes the gap be 0~0.03mm(0.0012inch), install it.

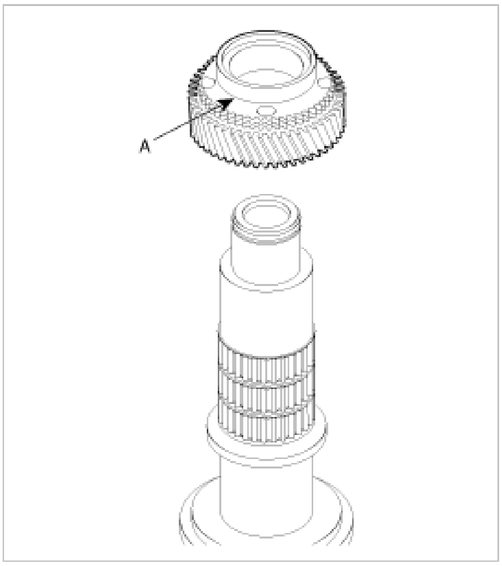


9. Assemble the needle roller bearing(A).

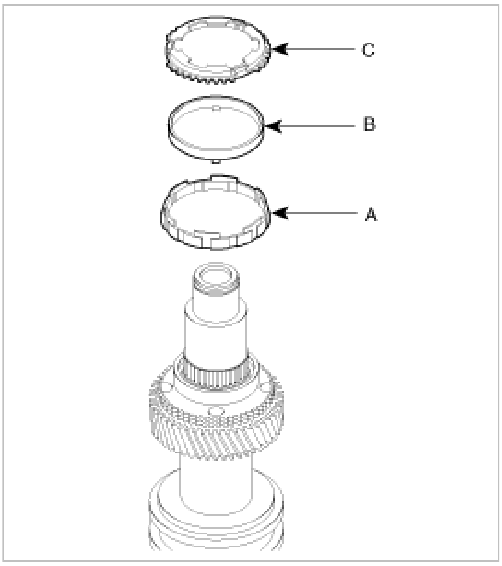


10. Install the snap ring(thickness: 2.5mm or 0.0984inch).

11. Assemble the 3rd output gear assembly(A).

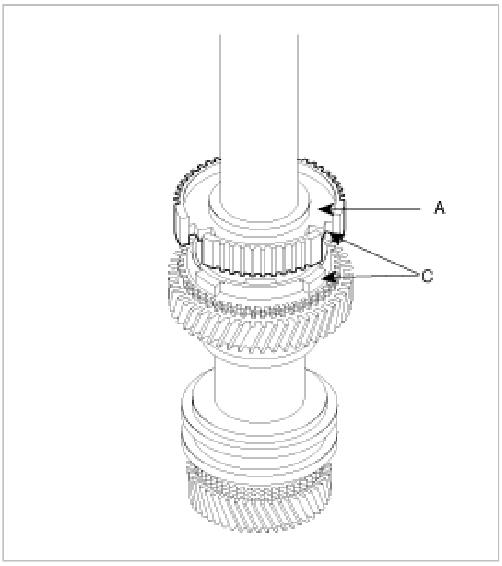


12. Assemble the 3rd inner synchronizer ring(A), synchronizer cone(B) and outer synchronizer ring(C). Apply gear oil around.

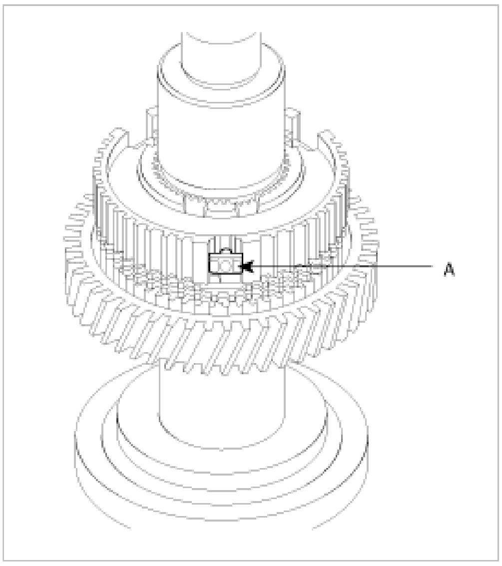


13. Using a press, install the 3rd/4th hub(A).

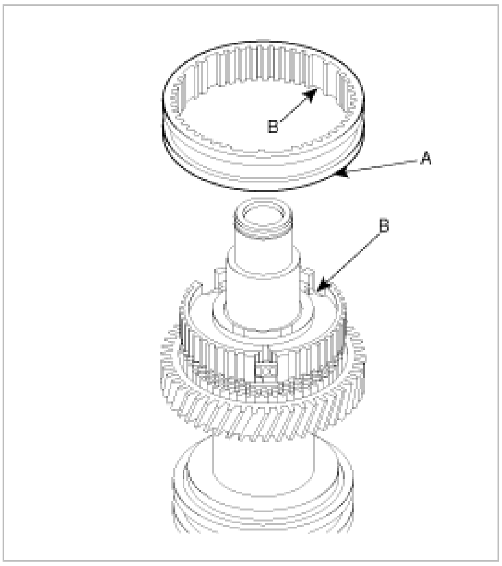
> **NOTE**
>
> - The hub surface which has the four grooves in parallel should face the rear side.
> - Assemble the hub, aligning the groove&protrusion(C).

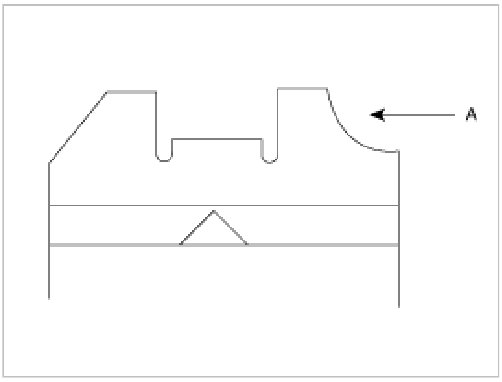


14. Insert the three 3rd/4th synchronizer key assemblies(A).

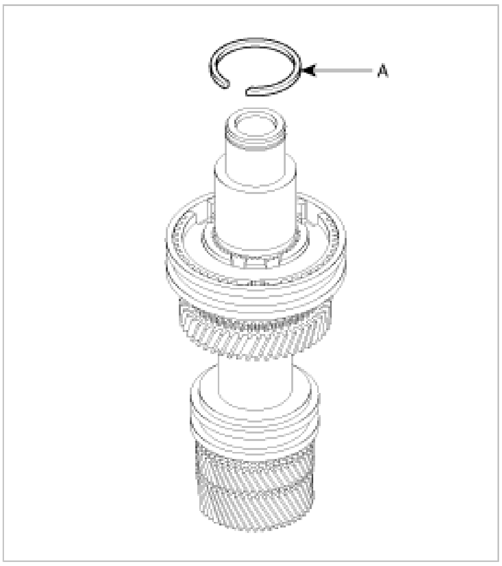


15. The sleeve surface which has the groove should face the 3rd gear side(A).
    Align the grooves(B) in the sleeve with the ones of the hub.

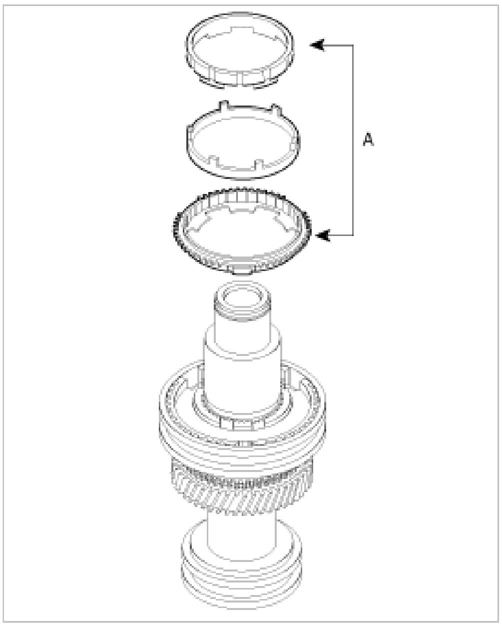




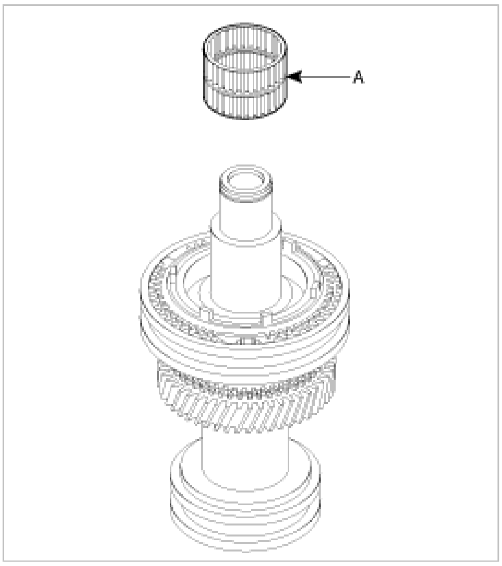
16. Selecting the snap ring(A) which makes the gap be 0~0.03mm(0.0012inch), install it.



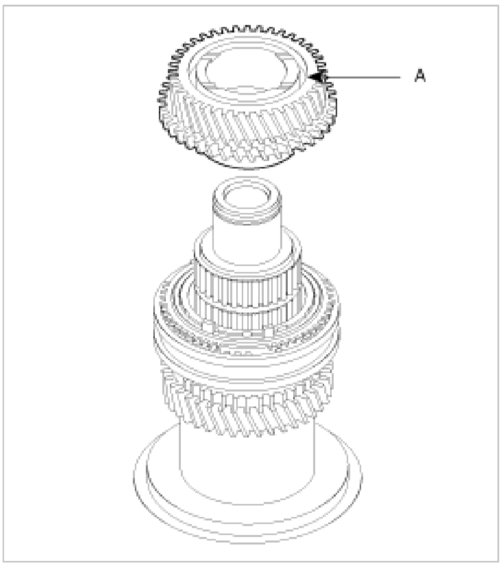
17. Assemble the 4th triple cone ring assembly(A).



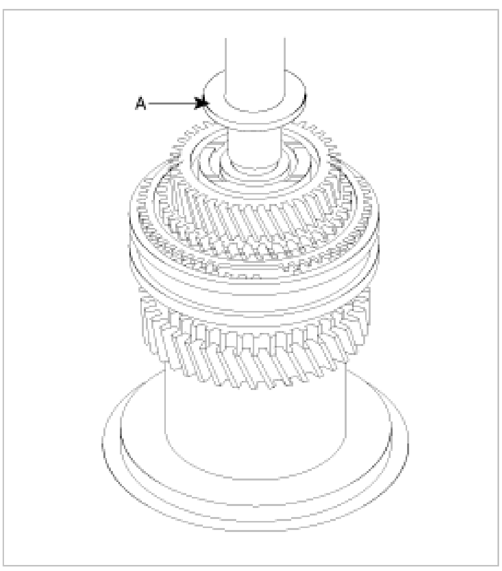
18. Insert the needle roller bearing(A).



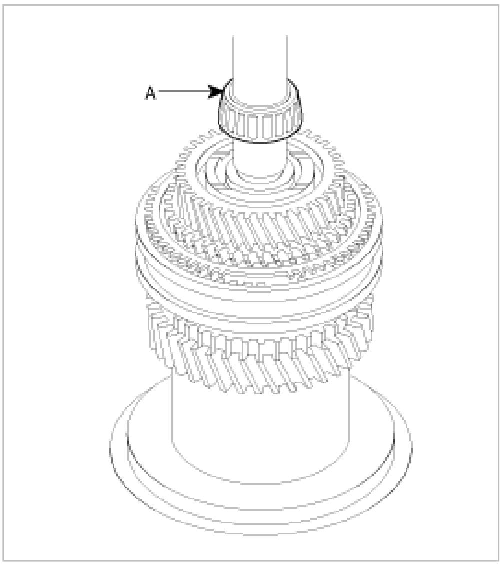
19. Insert the 4th output gear assembly(A).



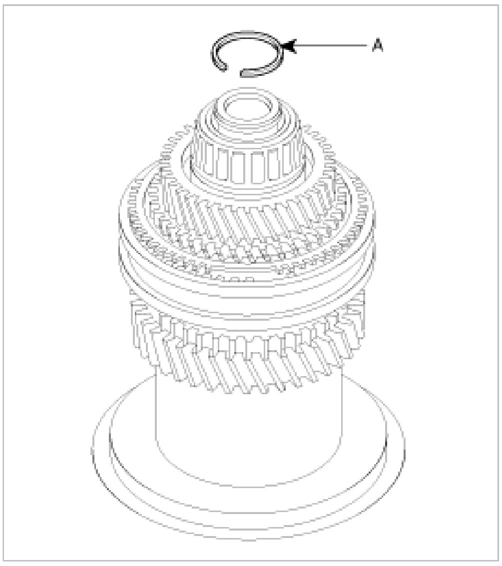
20. Using a press, assemble the spacer(A).



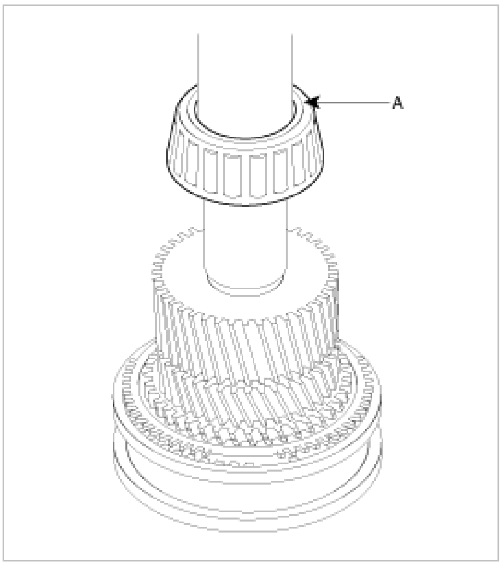
21. Using a press, install the taper roller bearing(A).



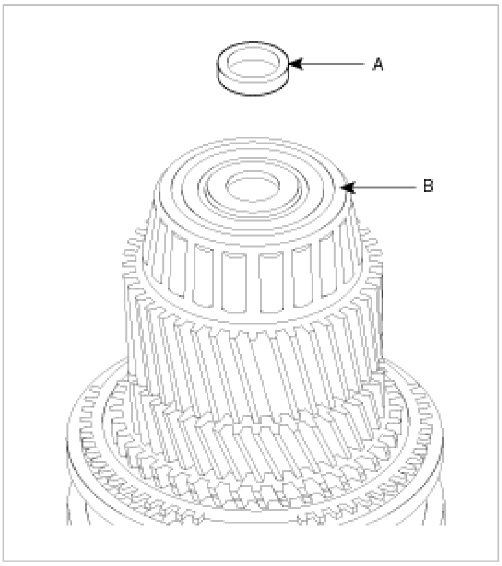
22. Selecting the snap ring(A) which makes the gap be 0~0.03mm(0.0012inch), install it.



23. Using a press, install the front side taper roller bearing(A).



24. Using a press, insert the oil guide ring(A) into the front side taper roller bearing(B).



Manual Transaxle System > Manual Transaxle System > Repair procedures

SERVICE ADJUSTMENT PROCEDURE

Transmission oil inspection and replacement

1. After parking the vehicle on a plain, stop the engine.
2. After removing the oil filler plug and washer, inspect the manual transaxle fluid condition and quantity.
3. If the manual transaxle fluid is contaminated, drain it out by removing the oil drain plug.
4. Tighten the new oil drain plug and feed manual transaxle fluid to a proper level.

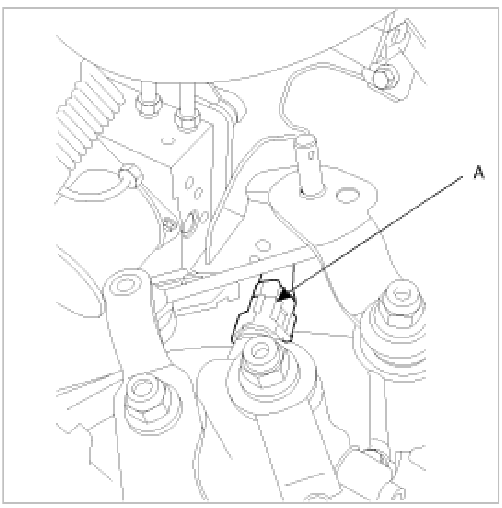
TORQUE:
29.4~34.4 Nm(300~350Kgf.cm, 21.7~25.3lb-ft)
Oil type: SAE75W/85
Oil quantity:
1.9 liter(2.0077 US qt, 1.6718 Imp qt)

5. Retighten the oil filler plug with a new washer.

TORQUE:
29.4~34.4 Nm(300~350Kgf.cm, 21.7~25.3lb-ft)

Back up lamp switch inspection

1. Disconnect the back up lamp switch connector(A).

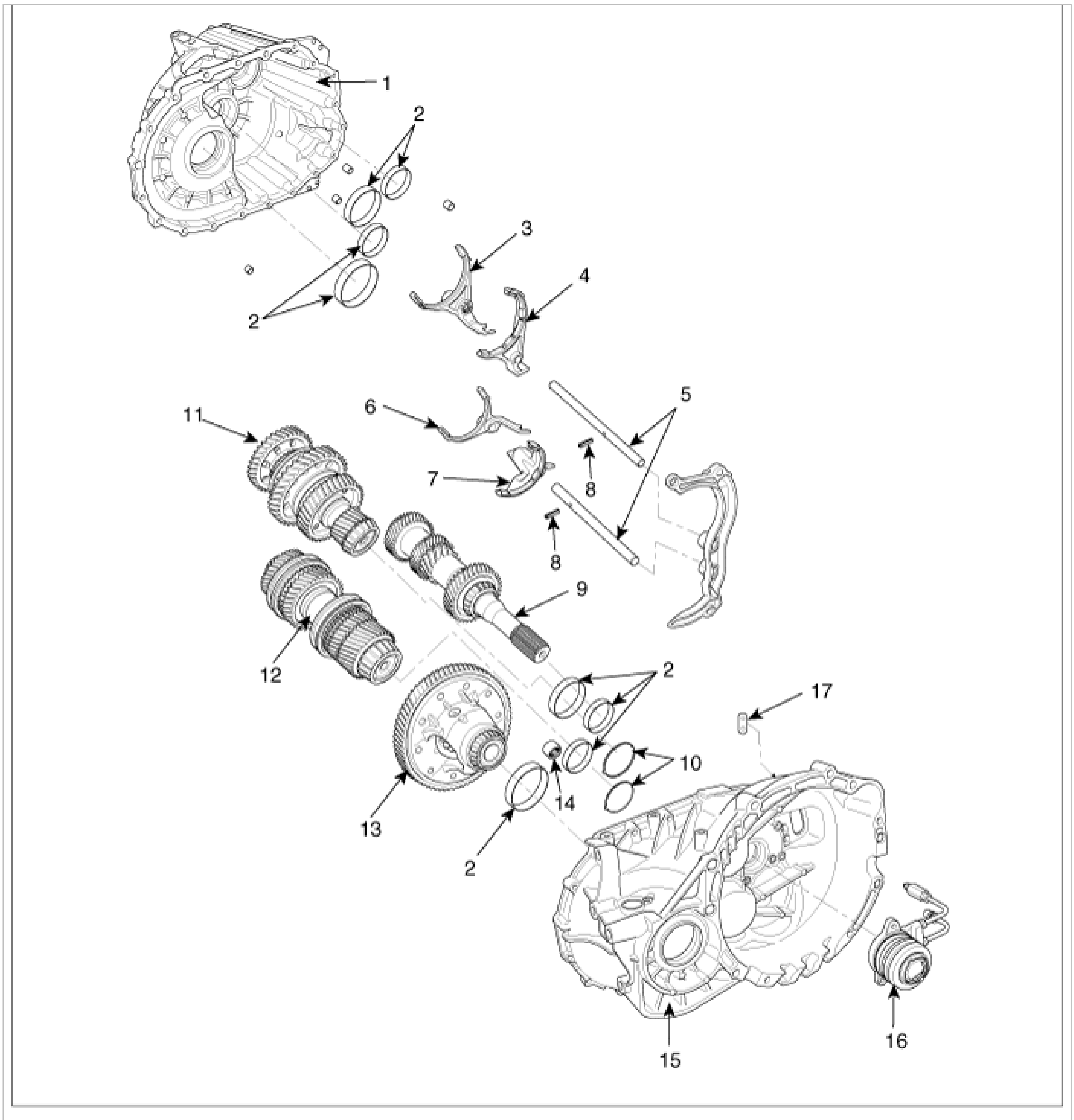


2. Inspect the continuity of the switch. When the shift lever is located in reverse range, it should be applied an electric current.
3. Replace the back up lamp switch, if necessary.

TORQUE:
29.4~34.4 Nm(300~350Kgf.cm, 21.7~25.3lb-ft)

Manual Transaxle System > Manual Transaxle System > Manual Transaxle > Components and Components Location

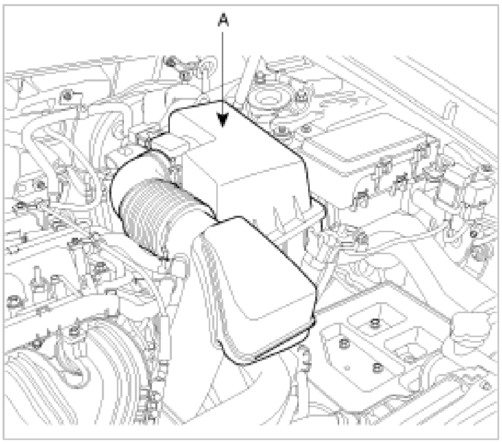
COMPONENTS



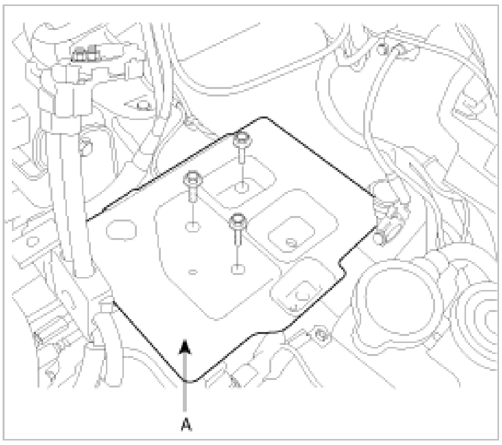
1. Transaxle case
2. Taper roller bearing outer race
3. 1st/2nd shift fork
4. Reverse shift fork
5. Shift rail
6. 3rd/4th shift fork
7. 5th/6th shift fork
8. Spring pin
9. Input shaft
10. Oil guide
11. 1st output shaft
12. 2nd output shaft
13. Differential assembly
14. Needle bearing
15. Clutch housing
16. Concentric slave cylinder assembly
17. Boot

REMOVAL

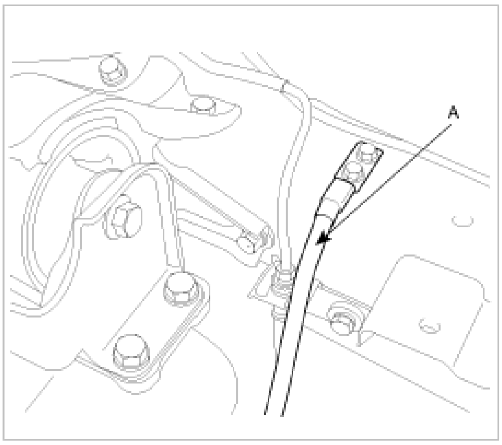
1. Remove the air duct.
2. Remove the battery.
3. Remove the air cleaner assembly(A).



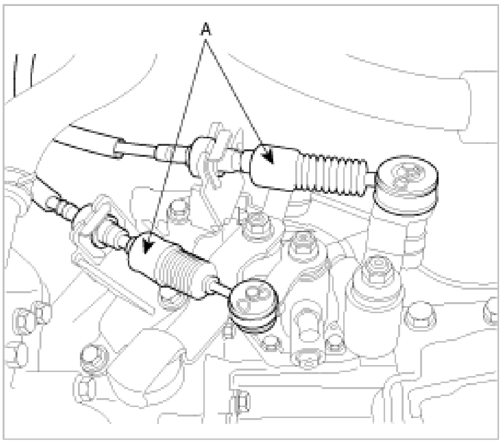
4. Remove the battery tray(A).



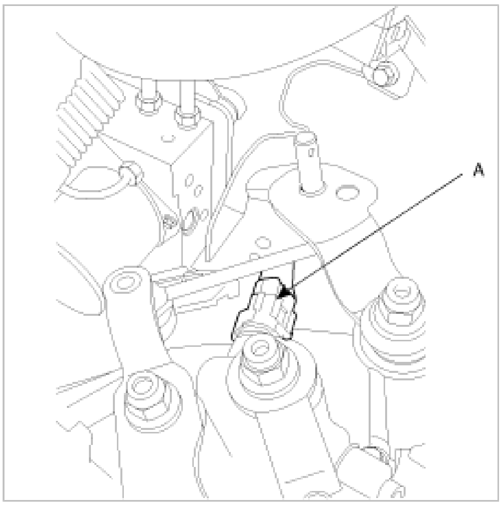
5. Disconnect the ground circuit line(A) from the transaxle.



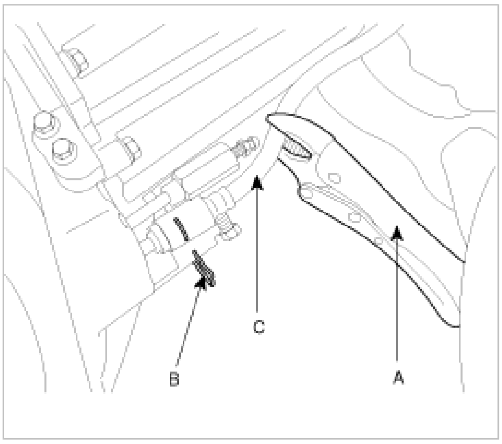
6. Disconnect the vehicle speed sensor.
7. Disconnect the shift cable assembly(A).



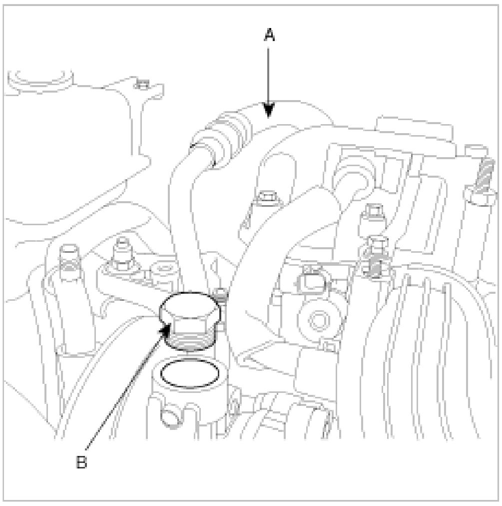
8. Disconnect the back up lamp switch(A).



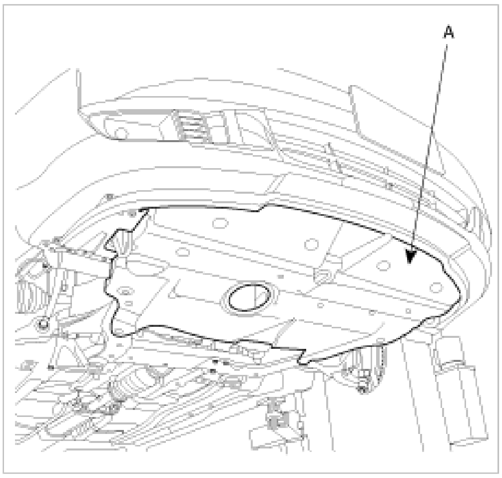
9. Disconnect the related connectors to transaxles.
10. After removing the clip(B) with clamping(A) the concentric slave cylinder tube, disconnect the tube(C).



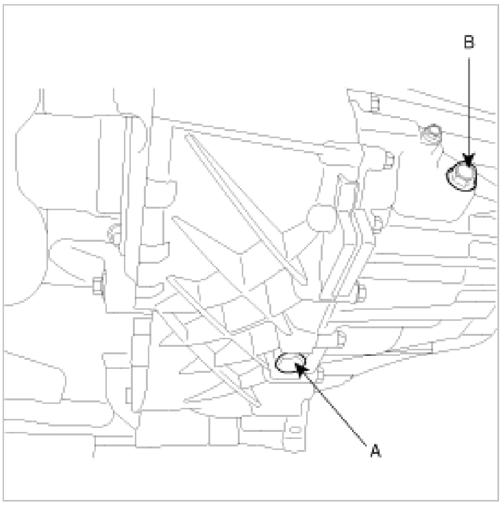
11. Drain the power steering fluid and disconnect the power steering pressure hose(A) bolt(B). (Refer to 'ST'-group)



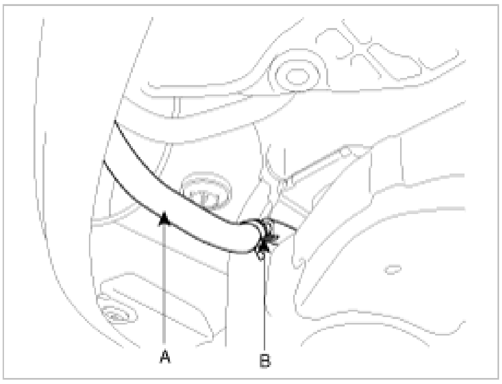
12. Remove the under shield cover(A).



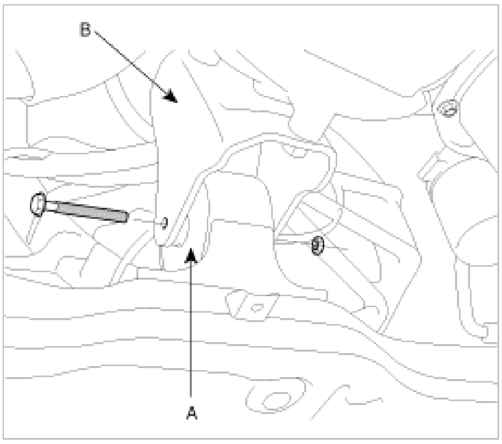
13. Drain the manual transaxle fluid after removing the transaxle drain plug(A). It can be easier when the oil filler plug(B) is removed.



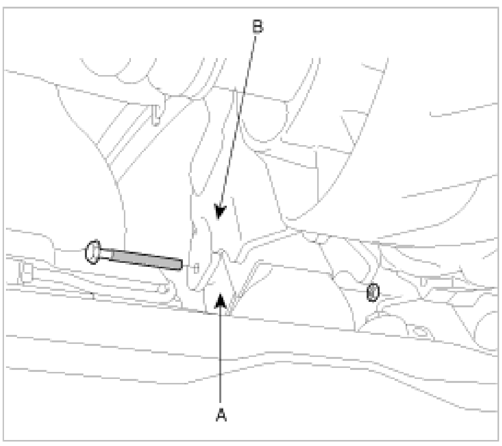
14. Disconnect the electronic power steering connector.
15. Remove the lower arm ball joint and folk mounting bolts. (Refer to 'SS'-group)
16. Remove the lower arm ball joint assembly mounting bolts. (Refer to 'SS'-group)
17. Remove the stabilizer bar link mounting bolts. (Refer to 'SS'-group)
18. After removing a split pin and nut from the steering bar tie rod, disconnect it. (Refer to 'ST'-group)
19. Loosening the power steering return hose(A) clamp(B), disconnect the hose.



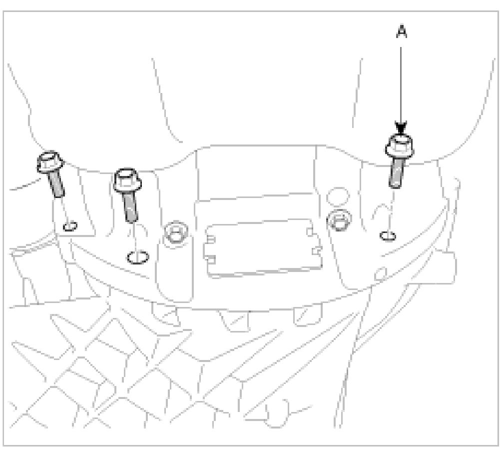
20. Disconnect the bracket(B) from the front roll stopper(A).

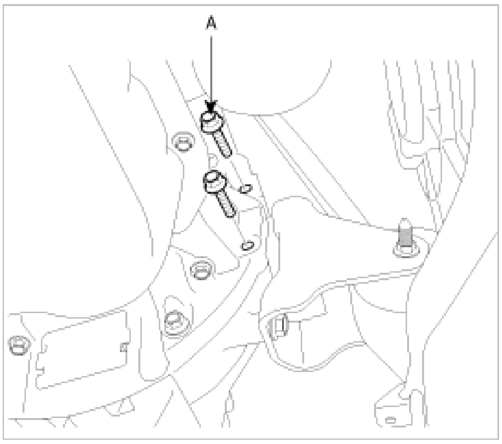


21. Disconnect the bracket(B) from the rear roll stopper(A).

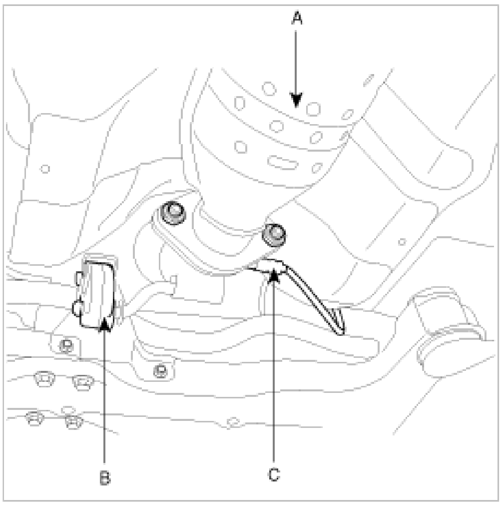


22. Remove the steering column bolt.
23. Remove the transaxle lower mounting bolts(A).

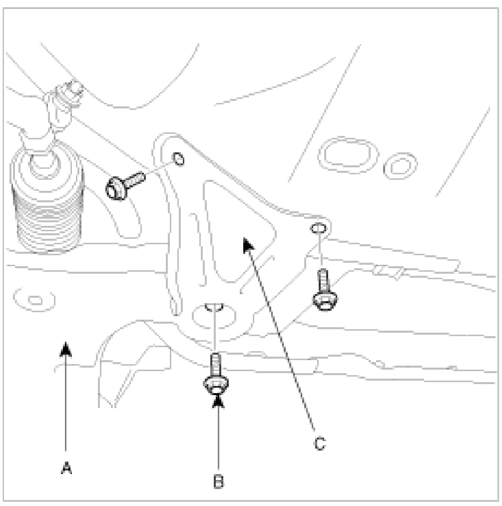


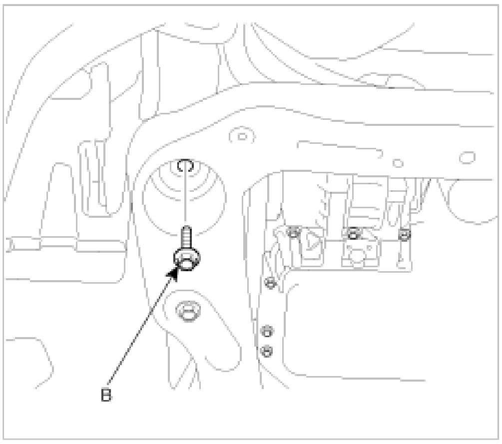


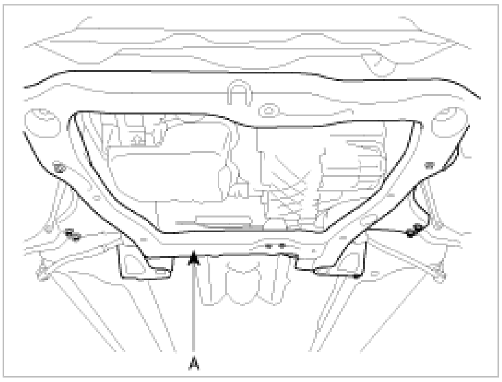
24. After disconnecting the exhaust pipe(A), disconnect the hanger(B) and the oxygen sensor connector(C).



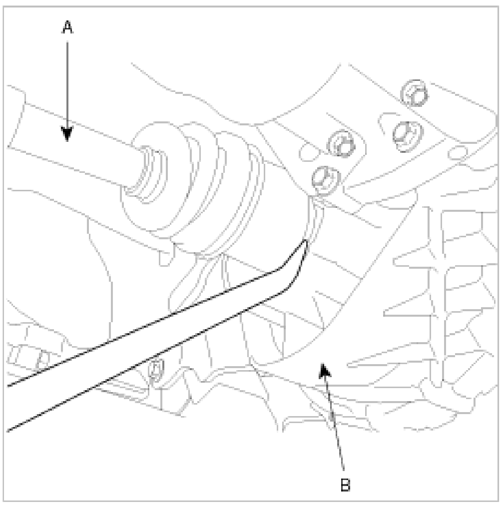
25. Supporting the cross member(A) with a jack, remove the stay(C) with the mounting bolts(B).



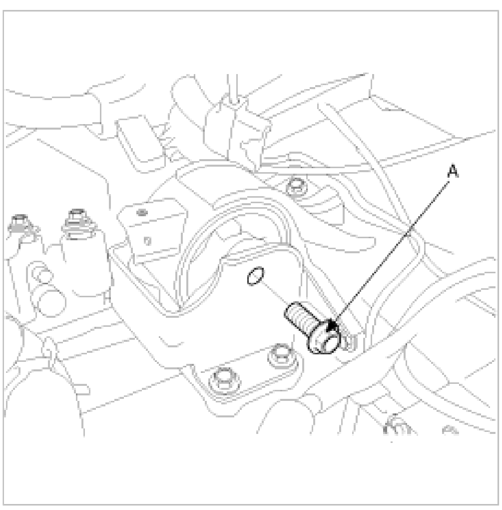


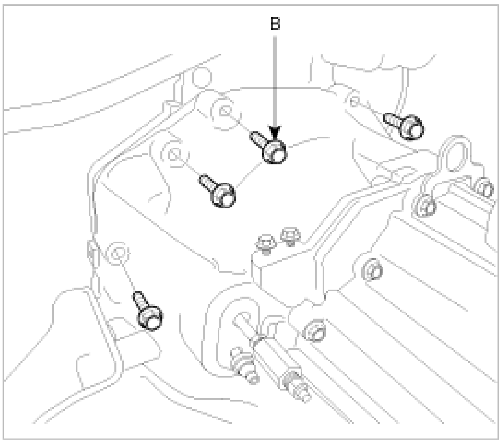


26. Disconnect the driveshafts(A) from the transaxle(B) (refer to 'DS'-group).



27. Supporting the transaxle with a jack, remove the transaxle support bracket(A) and the upper mounting bolts(B).



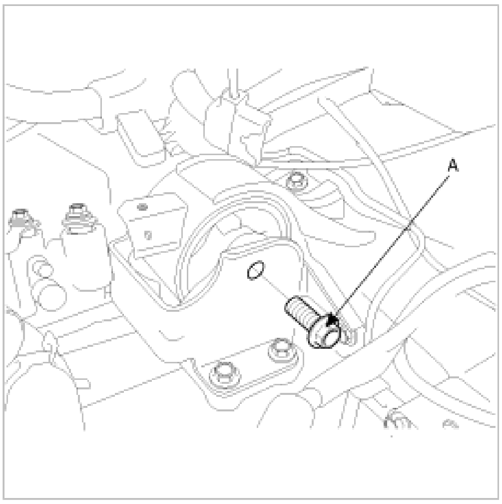


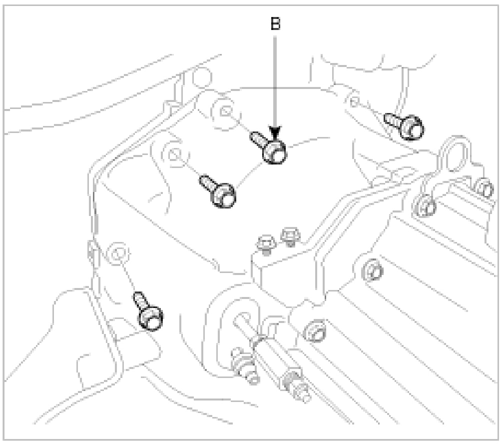
28. Lowering the jack slowly, remove the transaxle.

INSTALLATION

1. Raising the jack slowly, tighten the transaxle mounting bolts(A) and support bracket mounting bolts(B).

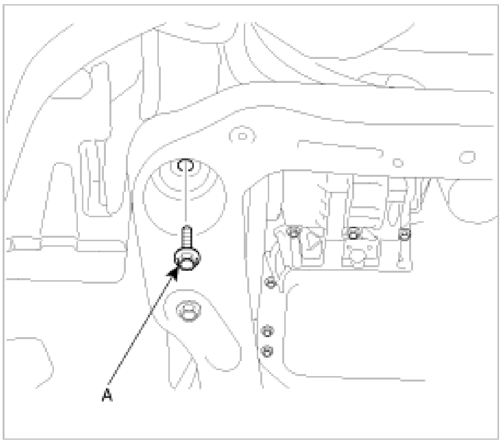
TORQUE :
42.2~53.9Nm (430~550kgf.cm, 31.1~39.8lb-ft) (Support bracket mounting)
63.7~83.4Nm (650~850kgf.cm, 47.0~61.5lb-ft) (Transaxle mounting bracket)



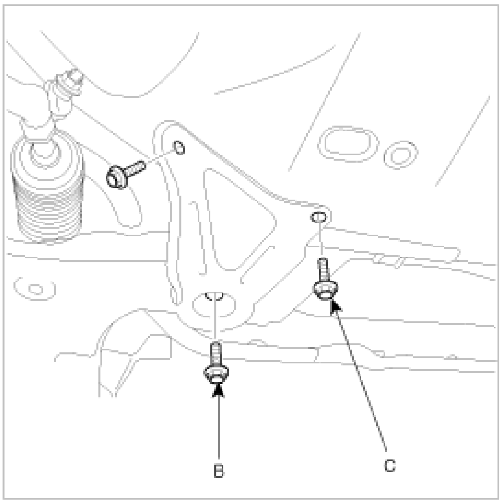


2. Tighten the transaxle lower mounting bolts.
3. Install the driveshafts(refer to 'DS'-group).
4. Lifting the cross member up with the jack slowly, tighten the mounting bolts.

TORQUE :
137.3~156.9Nm (1400~1600kgf.cm, 101.3~115.7lb-ft) (Front mounting)(A)



TORQUE :
137.3~156.9Nm (1400~1600kgf.cm, 101.3~115.7lb-ft) (Rear mounting)(B)
44.1~58.8Nm (450~600kgf.cm, 32.5~43.4lb-ft) (Stay mounting)(C)

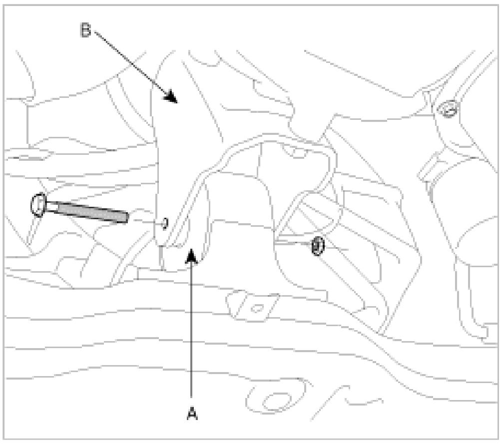


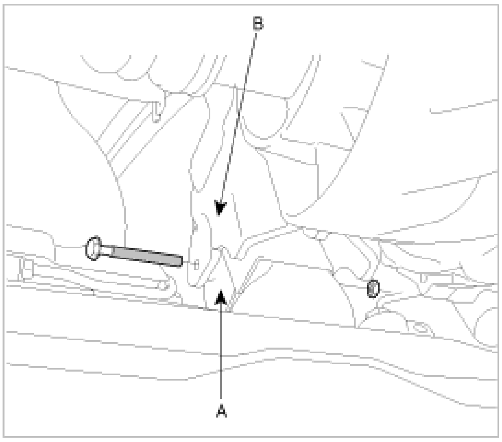
5. Tighten the steering column bolt.

TORQUE :
14.7~19.6Nm (150~200kgf.cm, 10.8~14.5lb-ft)

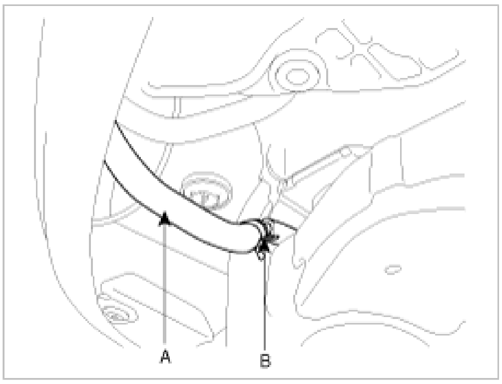
6. Assembling the exhaust pipe, connect the hanger and oxygen sensor connector.
7. Fix the front/rear roll stopper(A) to brackets(B) with the mounting bolts.

TORQUE :
49.0~63.7Nm (500~650kgf.cm, 36.2~47.0lb-ft)





8. Inserting the power steering return hose(A), fix it with a clamp(B).



9. Tightening the steering bar tie rod mounting nut, insert a new split pin. (refer to 'ST'-group)

TORQUE :
23.5~33.3Nm (240~340kgf.cm, 17.4~24.6lb-ft)

10. Tighten the stabilizer bar link mounting bolt. (refer to 'SS'-group)

TORQUE :
98.1~117.7Nm (1000~1200kgf.cm, 72.3~86.8lb-ft)

11. Tighten the lower arm ball joint and folk mounting bolt. (refer to 'SS'-group)

TORQUE :
98.1~117.7Nm (1000~1200kgf.cm, 72.3~86.8lb-ft)

12. Fix the lower arm ball joint assembly to the front axle. (refer to 'SS'-group).

TORQUE :
98.1~117.7Nm (1000~1200kgf.cm, 72.3~86.8lb-ft)

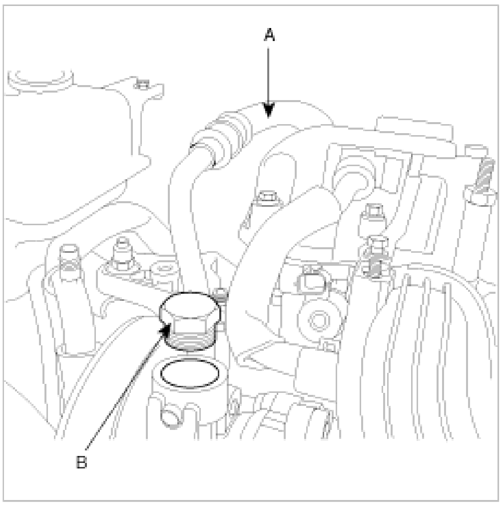
13. Connect the electronic power steering connector.
14. After tightening the transaxle drain plug and filling the manual transaxle fluid, tighten the oil filler plug.

TORQUE :
29.4~34.3Nm (300~350kgf.cm, 21.7~25.3lb-ft)

Maunual transaxle fluid: SAE 75W/85

15. Install the under shield cover.
16. After tightening the power steering pressure hose(A) bolt(B), fill the power steering fluid. (refer to 'ST'-group)

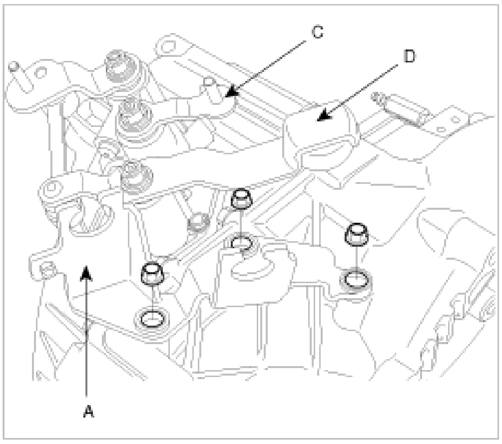
TORQUE :
63.7~73.5Nm (650~750kgf.cm, 47.0~54.2lb-ft)

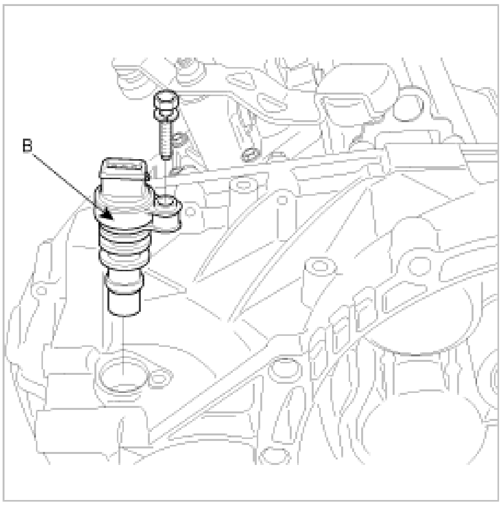


17. Install a pin on the concentric slave cylinder tube and push it till a 'click' sound is heard. Loosen the clamp.
18. Tighten the back up lamp switch.
19. Install the shift cable assembly.
20. Fix the vehicle speed sensor and the ground line.
21. Install the battery, air cleaner and air duct.

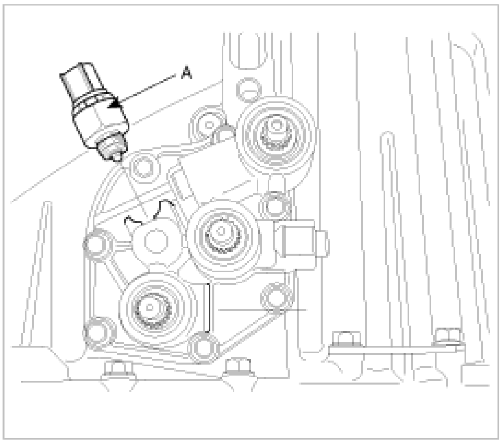
DISASSEMBLY

1. After removing the boot, disassemble the concentric slave cylinder assembly.
2. Remove the shift control cable bracket assembly(A) and the vehicle speed sensor(B).
3. Remove the select lever(C) and shift link assembly(D).

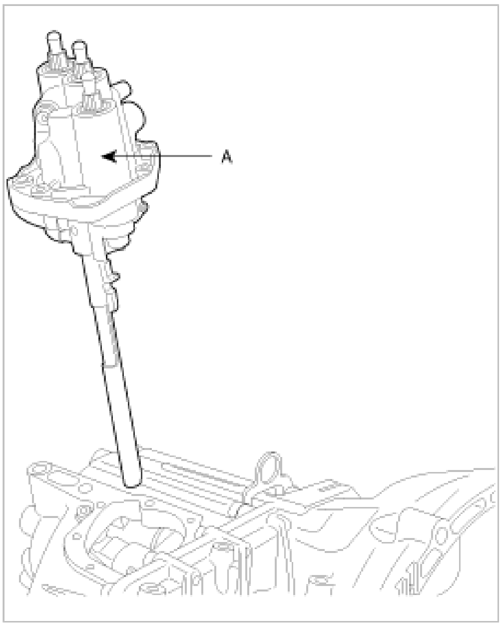




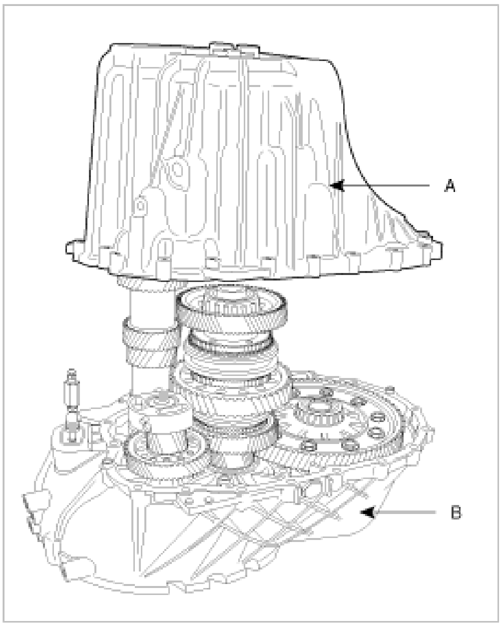
4. Remove the back up lamp switch(A).



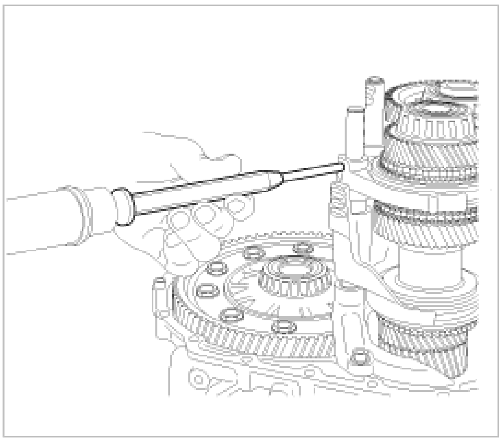
5. Remove the control shaft complete(A).



6. Disconnect the transaxle hanger.
7. Remove the oil filler plug and the idler shaft bolt.
8. Disconnect the clutch housing(B) from the transaxle case(A).



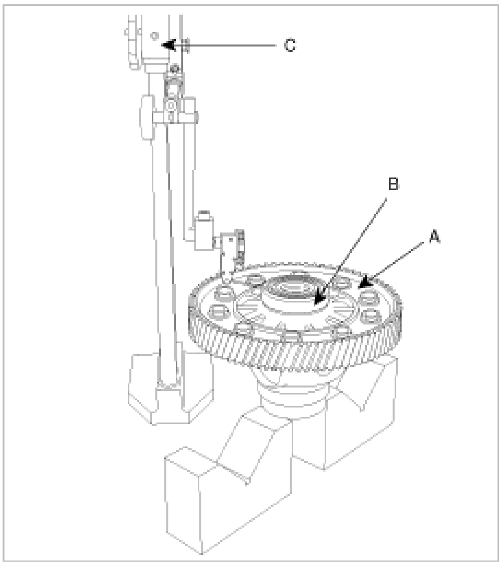
9. Remove the spring pins from the shift rail(3rd/4th & Reverse).



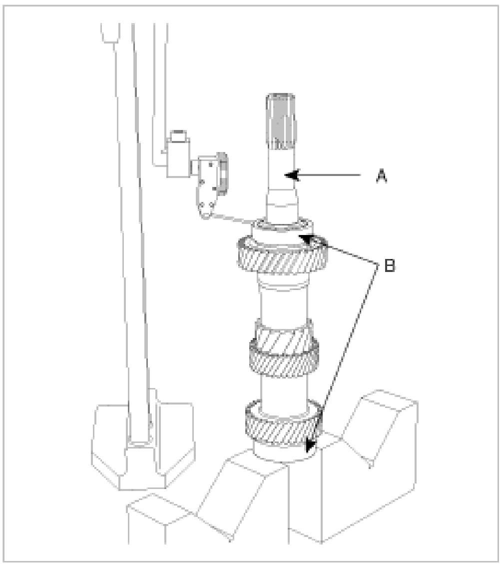
10. Remove the shift control shaft folks(4EA) and shafts(2EA) and rail support bracket.
11. Remove the parts in the order as shown below.
 2nd output shaft→input shaft→1st output shaft→differential assembly.
12. Remove the reverse idler gear assembly.
13. Remove the magnetic plug and the concentric slave cylinder.
14. Remove oil guides, bearing outer races, dowel pins and spacers from the clutch housing.
15. Remove oil seals and guides from the clutch housing.

REASSEMBLY

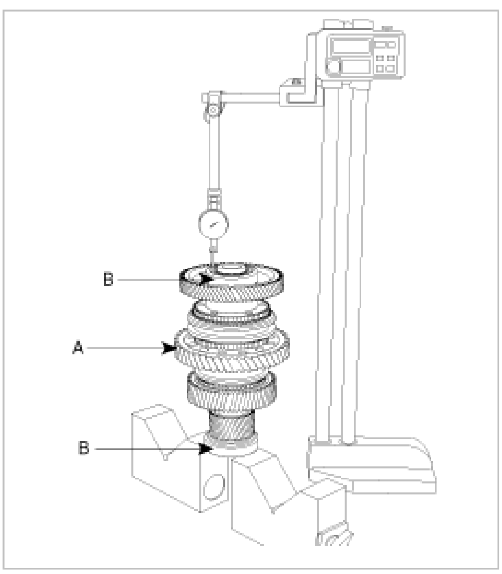
1. Assemble the reverse idler gear assembly.
2. Measure the height with a height gauge(C), after fixing the taper roller bearing outer race(B) to the differential assembly (A).



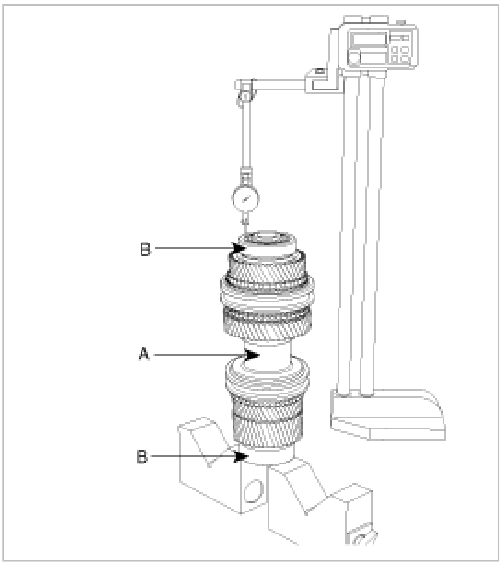
3. After installing the taper roller bearing outer race(B) to both sides of the input shaft(A), measure the height with a gauge.



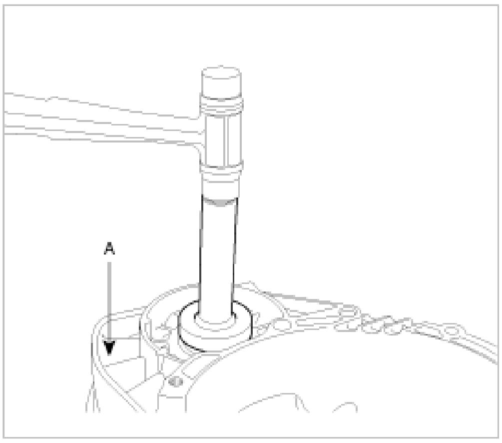
4. After installing the taper roller bearing outer race(B) to both sides of the 1st output shaft(A), measure the height with a gauge.

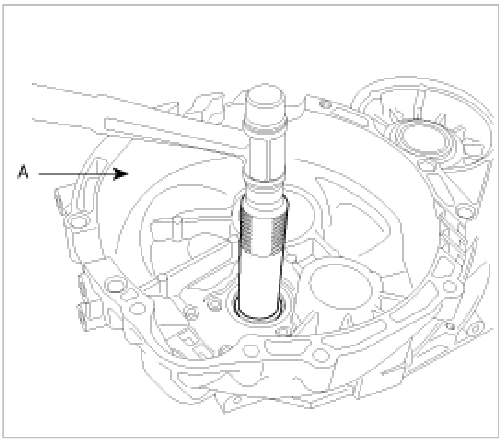


5. After installing the taper roller bearing outer race(B) to both sides of the 2nd output shaft(A), measure the height with a gauge.



6. Assemble oil seals and guides to the clutch housing(A).

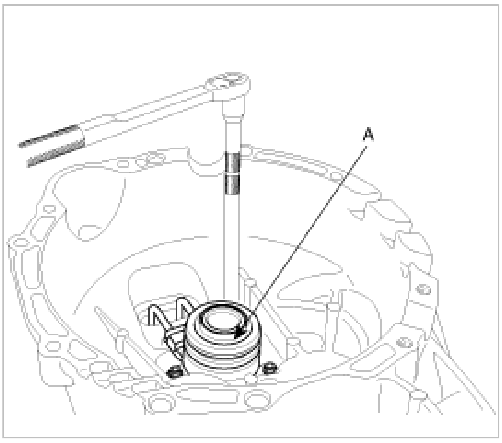




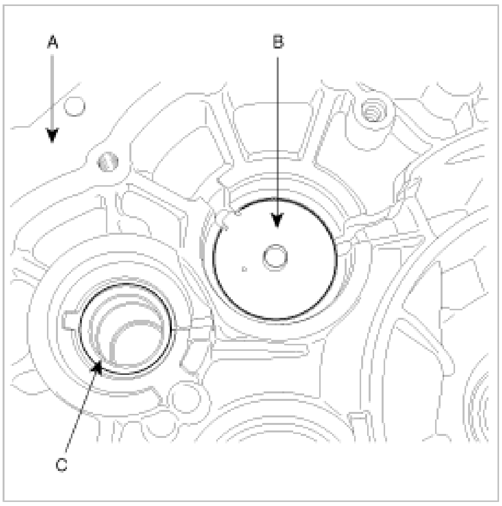
7. Install the concentric slave cylinder assembly(A).

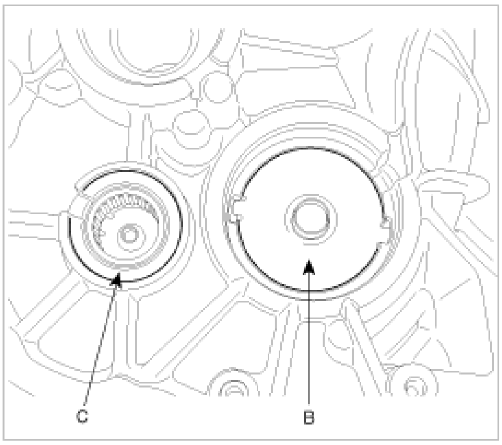
TORQUE:
11.8~14.7Nm (120~150kgf.cm, 8.7~10.8lb-ft)

Give it a series of tightenings.



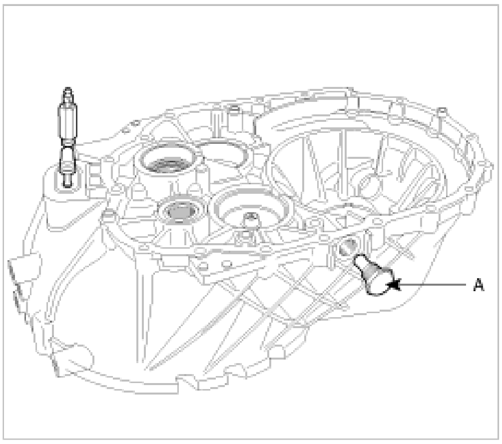
8. Fix the oil guides(B), bearing outer races, dowel pins and spacers(C) to the clutch housing(A).





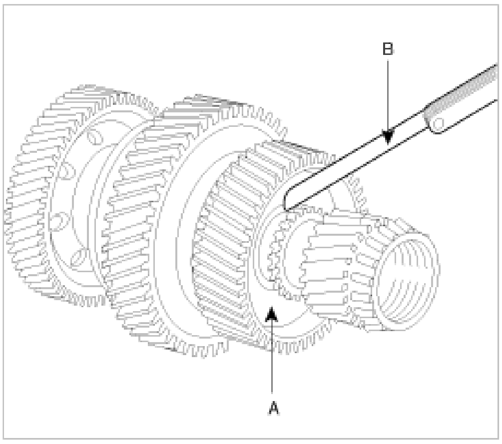
9. Insert a rubber bushing in the hole for the concentric slave cylinder.
10. Tighten the magnetic plug(A).

TORQUE:
29.4~34.3Nm (300~350kgf.cm, 21.7~25.3lb-ft)



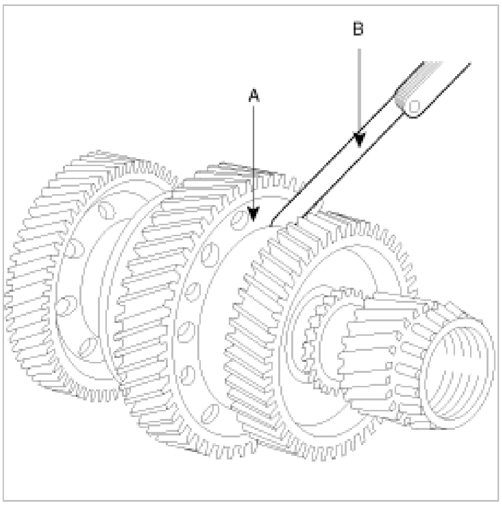
11. Measure the end play with a thickness gauge(B) in the reverse gear(A) of the 1st output shaft.

STANDARD VALUE : 0.135~0.345mm



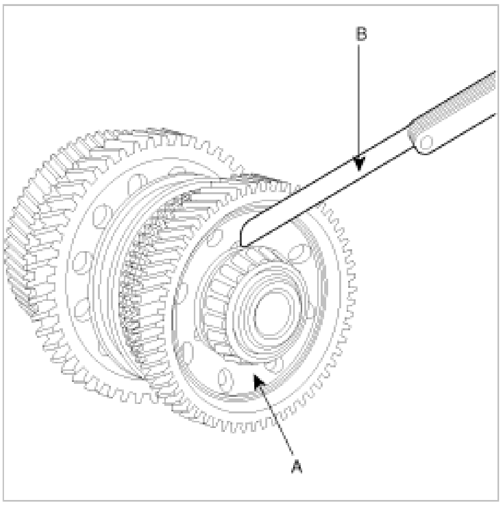
12. Measure the end play with a thickness gauge(B) in the 1st gear(A) of the 1st output shaft.

STANDARD VALUE : 0.230~0.430mm



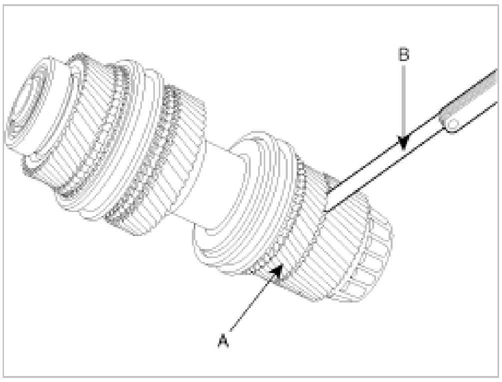
13. Measure the end play with a thickness gauge(B) in the 2nd gear(A) of the 1st output shaft.

STANDARD VALUE : 0.230~0.430mm



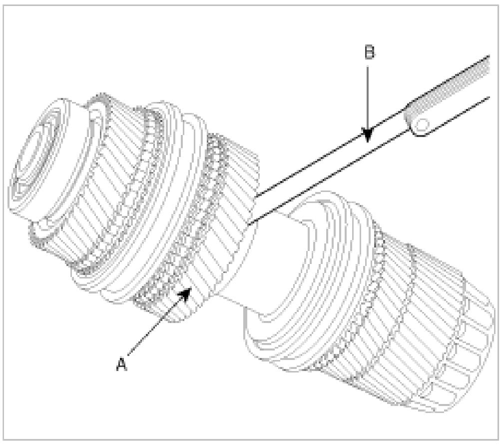
14. Measure the end play with a thickness gauge(B) in the 5th gear of the 2nd output shaft(A).

STANDARD VALUE : 0.125~0.305mm



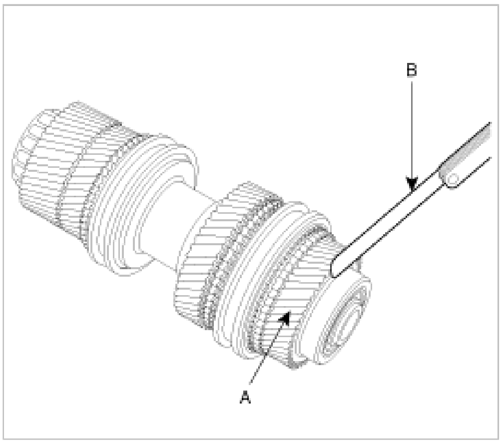
15. Measure the end play with a thickness gauge(B) in the 3rd gear(A) of the 2nd output shaft.

STANDARD VALUE : 0.142~0.472mm

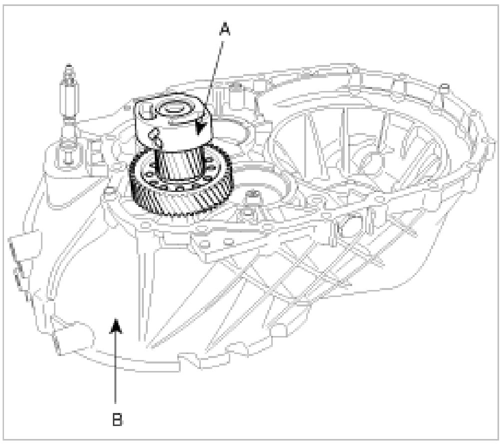


16. Measure the end play with a thickness gauge(B) in the 4th gear(A) of the 2nd output shaft.

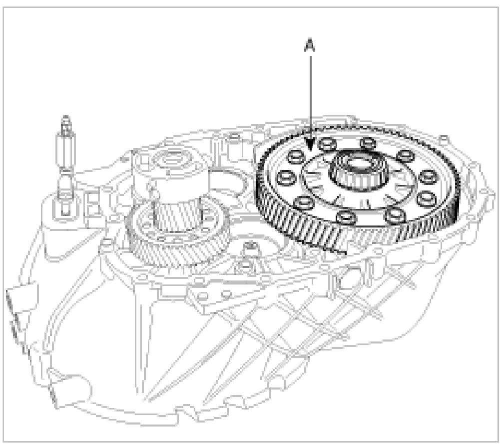
STANDARD VALUE : 0.230~0.430mm



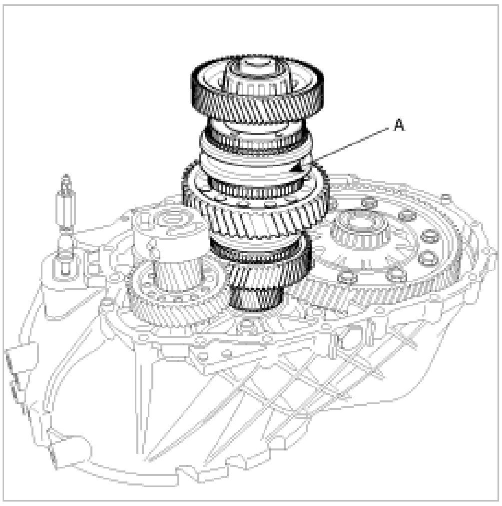
17. Install the reverse idler gear assembly(A) with a spacer in the clutch housing(B).



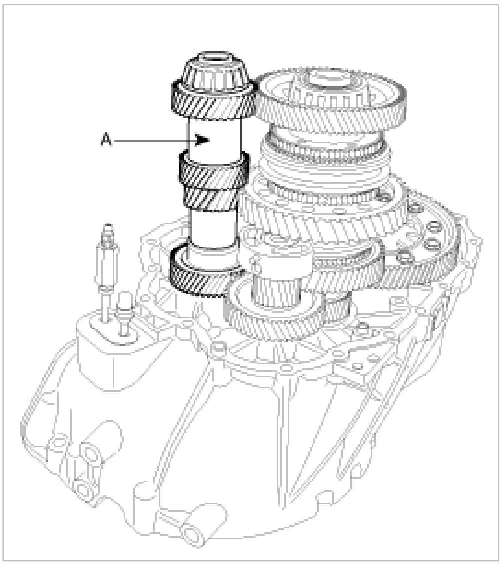
18. Install the differential assembly(A) with a spacer in the clutch housing.



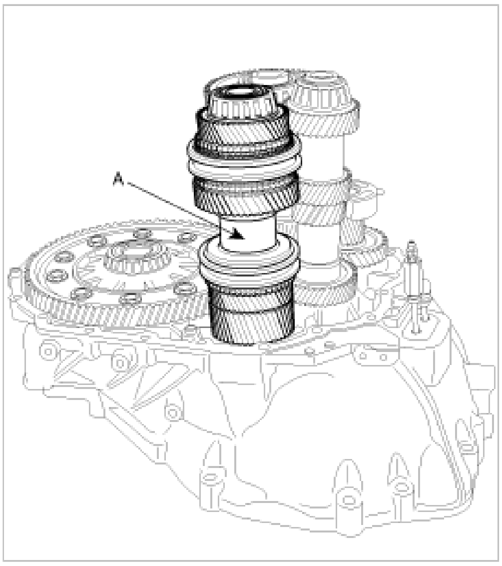
19. Install the 1st output shaft(A) with a spacer in the clutch housing.



20. Install the input shaft(A) with a spacer in the clutch housing.

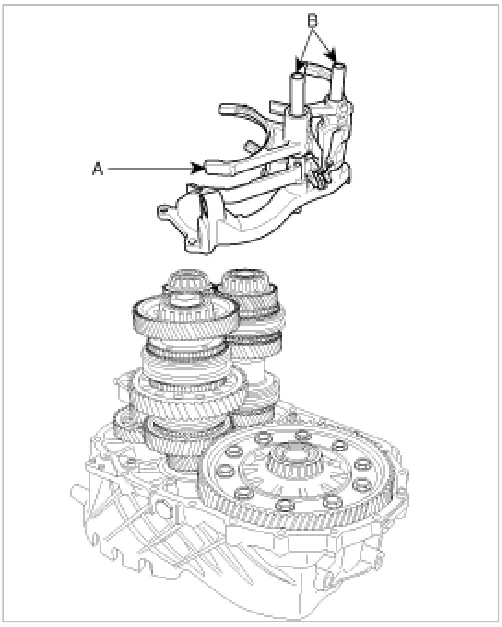


21. Install the 2nd output shaft(A) with a spacer in the clutch housing.



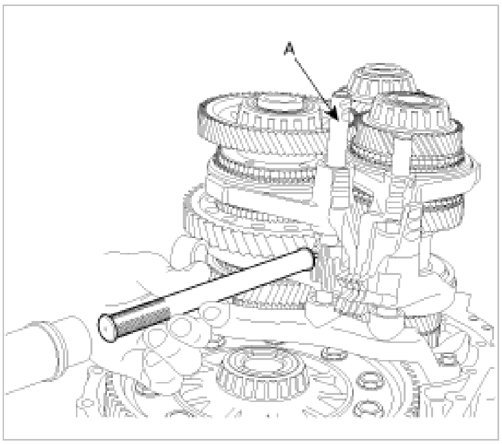
22. Install the shift control shift folk(4EA)(A) and shifts(2EA)(B) and rail support bracket.

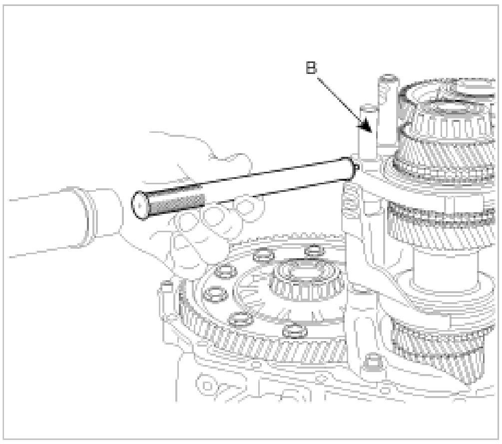
TORQUE :
19.6~26.5Nm (200~270kgf.cm, 14.5~19.5lb-ft) (3EA)



23. Fix them by inserting a pin into the shift rail(A, B).

> NOTE
>
> Strike the spring pins with slit facing front or rear side.





24. Insert spacers, bushings and bearing outer races in the transaxle case.

> NOTE
>
> Differential end play [mm(inch)]: 0.15T-0.20T (0.0059T~0.0079T)
> Input shaft end play [mm(inch)]: 0.05T-0 (0.0020T~0)
> 1st output shaft end play [mm(inch)]: 0.05T-0.10T (0.0020T~0.0039T)
> 2nd output shaft end play [mm(inch)]: 0.05T-0.10T (0.0020T~0.0039T)

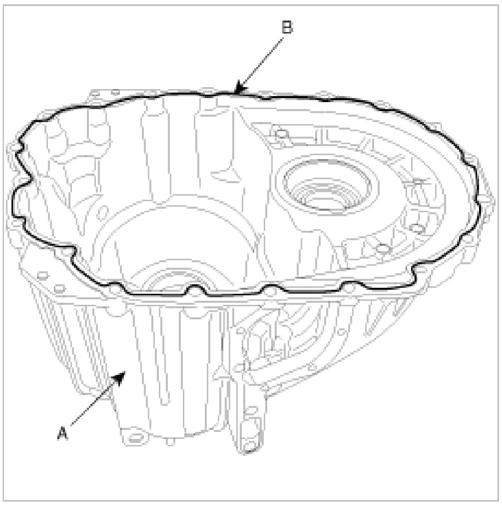
Spacer thickness[mm(inch)] = Clutch housing height[mm(inch)] + Transaxle case [mm(inch)] - Measured length [mm(inch)] + end play + tolerance value 0.05mm(0.0020inch)
When measuring the length of the output shaft, the outer races on both sides should be installed to the output shaft.
Measure the length at least 3 other points and take the average value for accuracy.
When measuring end play, take the average.
Tolerance means the applied value of shafts and differential length for the transaxle case weight.

Part name	Thickness [mm(inch)]	Identification number
Spacer (For adjustment of input shaft rear bearing end play)	2.15 (0.0846)	15
	2.20 (0.0866)	20
	2.25 (0.0886)	25
	2.30 (0.0906)	30
	2.35 (0.0925)	35
	2.40 (0.0945)	40
	2.45 (0.0965)	45
	2.50 (0.0984)	50
	2.55 (0.1004)	55
	2.60 (0.1024)	60
	2.65 (0.1043)	65
	2.70 (0.1063)	70
	2.75 (0.1083)	75
	2.80 (0.1102)	80
	2.85 90.1122)	85
Spacer (For adjustment of 1st output shaft rear bearing end play)	2.30 (0.0906)	30
	2.35 (0.0925)	35
	2.40 (0.0945)	40
	2.45 (0.0965)	45
	2.50 (0.0984)	50
	2.55 (0.1004)	55
	2.60 (0.1024)	60
	2.65 (0.1043)	65
	2.70 (0.1063)	70
	2.75 (0.1083)	75
	2.80 (0.1102)	80
Spacer (For adjustment of 2nd output shaft rear bearing end play)	2.35 (0.0925)	35
	2.40 (0.0945)	40
	2.45 (0.0965)	45
	2.50 (0.0984)	50
	2.55 (0.1004)	55
	2.60 (0.1024)	60
	2.65 (0.1043)	65
	2.70 (0.1063)	70
	2.75 (0.1083)	75
	2.80 (0.1102)	80

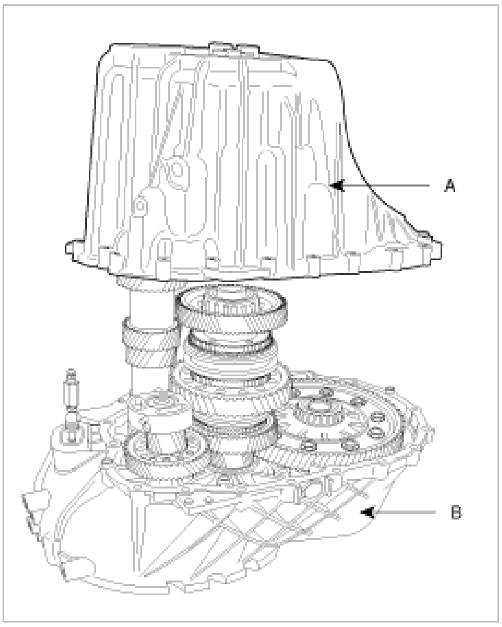
Spacer (For adjustment of differential end play)	1.22 (0.0480)	22
	1.25 (0.0492)	25
	1.28 (0.0504)	28
	1.31 (0.0516)	31
	1.34 (0.0528)	34
	1.37 (0.0539)	37
	1.40 (0.0551)	40
	1.43 (0.0563)	43
	1.46 (0.0575)	46
	1.49 (0.0587)	49
	1.52 (0.0598)	52
	1.55 (0.0610)	55
	1.58 (0.0622)	58
	1.61 (0.0634)	61
	1.64 (0.0646)	64
	1.67 (0.0657)	67
	1.70 (0.0669)	70

25. Apply the liquid gasket(B) on the transaxle case(A).

SPECIFICATION : LOCTITE 587

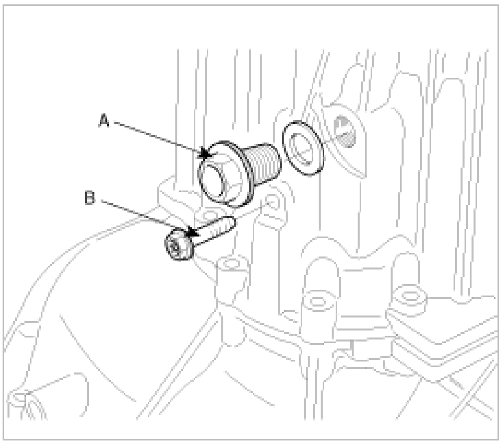


26. Align the pin position with the hole on the reverse idler gear damper.
27. Install the transaxle case(A) with the clutch housing(B).



28. Tighten the oil filler plug(A) and idler shaft bolt(B).

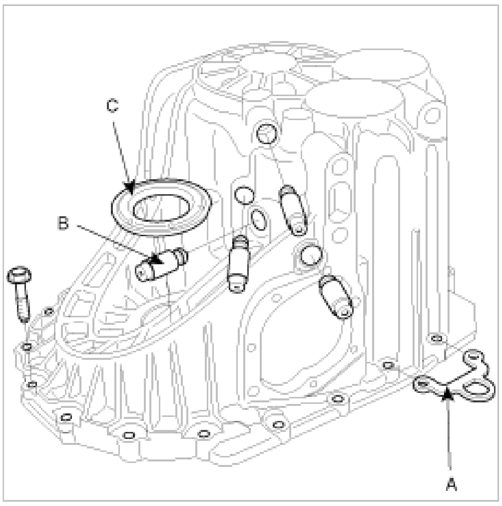
TORQUE
29.4~34.3Nm (300~350kgf.cm, 21.7~25.3lb-ft) (Oil filler plug)
19.6~26.5Nm (200~270kgf.cm, 14.5~19.5lb-ft) (Idler shaft bolt)



29. Fix the transaxle hanger(A), detent pins(4EA)(B) and oil seal(C).

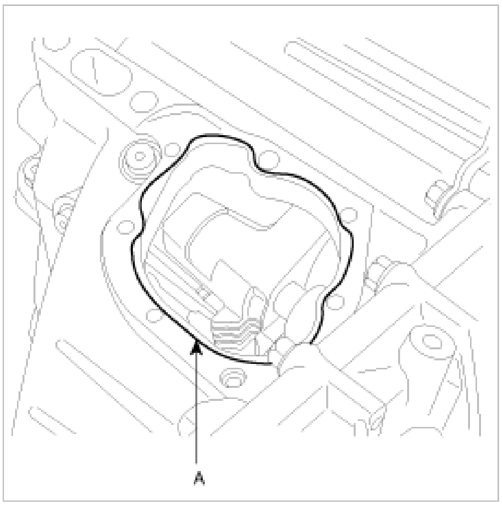
NOTE

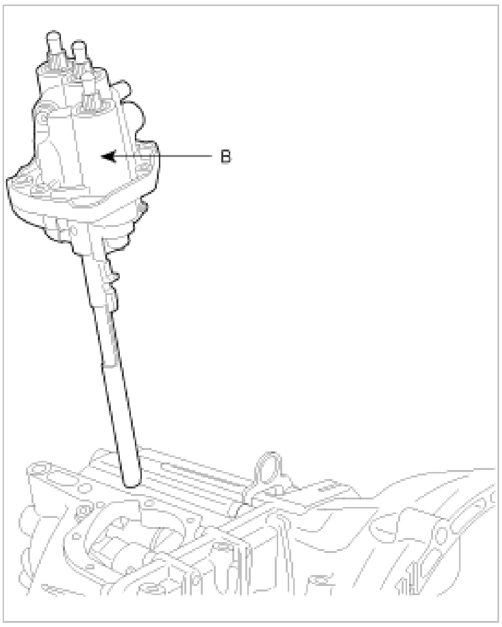
Press the detent pins for the step to be the same level as the surface on the transmission case(4 places).



30. Applying a liquid gasket(A) on the contacting surface of the control shaft complete(B), install it.

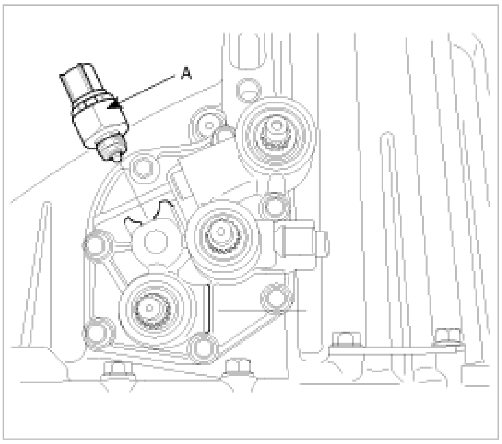
TORQUE :
9.8~11.8Nm (100~120kgf.cm, 7.2~8.7lb-ft) (7EA)





31. Tighten the back up lamp switch(A).

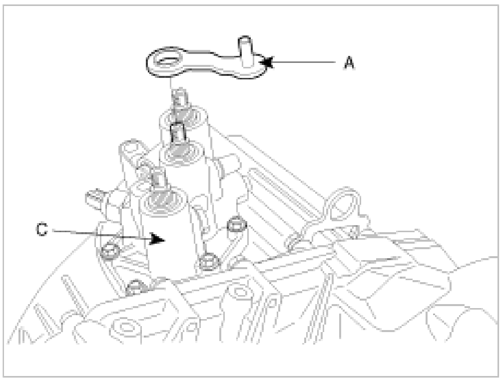
TORQUE :
29.4~34.3Nm (300~350kgf.cm, 21.7~25.3lb-ft)

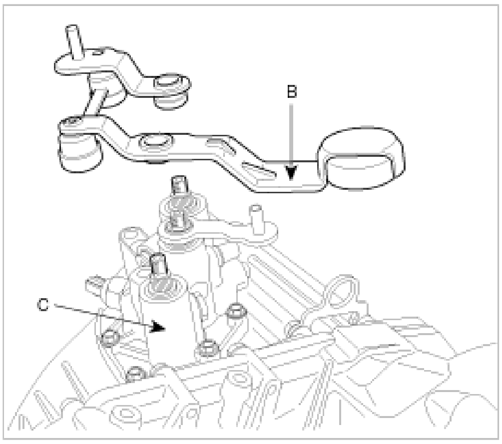


32. Install the select lever(A) and the shift link assembly(B) aligning their position with the identification mark(yellow) which

is on the control shaft complete(C).

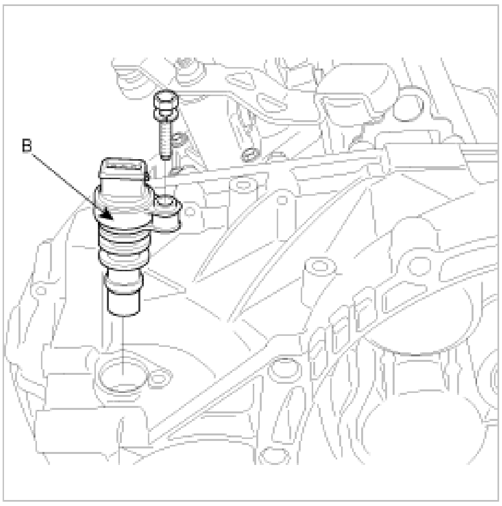
TORQUE :
42.2~53.9Nm (430~550kgf.cm, 31.1~39.8lb-ft) (3EA)





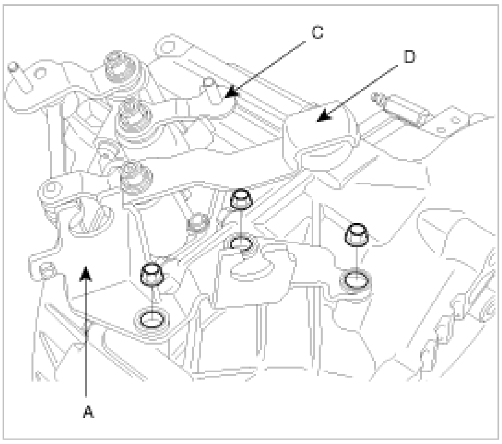
33. Tighten the vehicle speed sensor(B).

TORQUE :
7.8~9.8Nm (80~100kgf.cm, 5.8~7.2lb-ft)



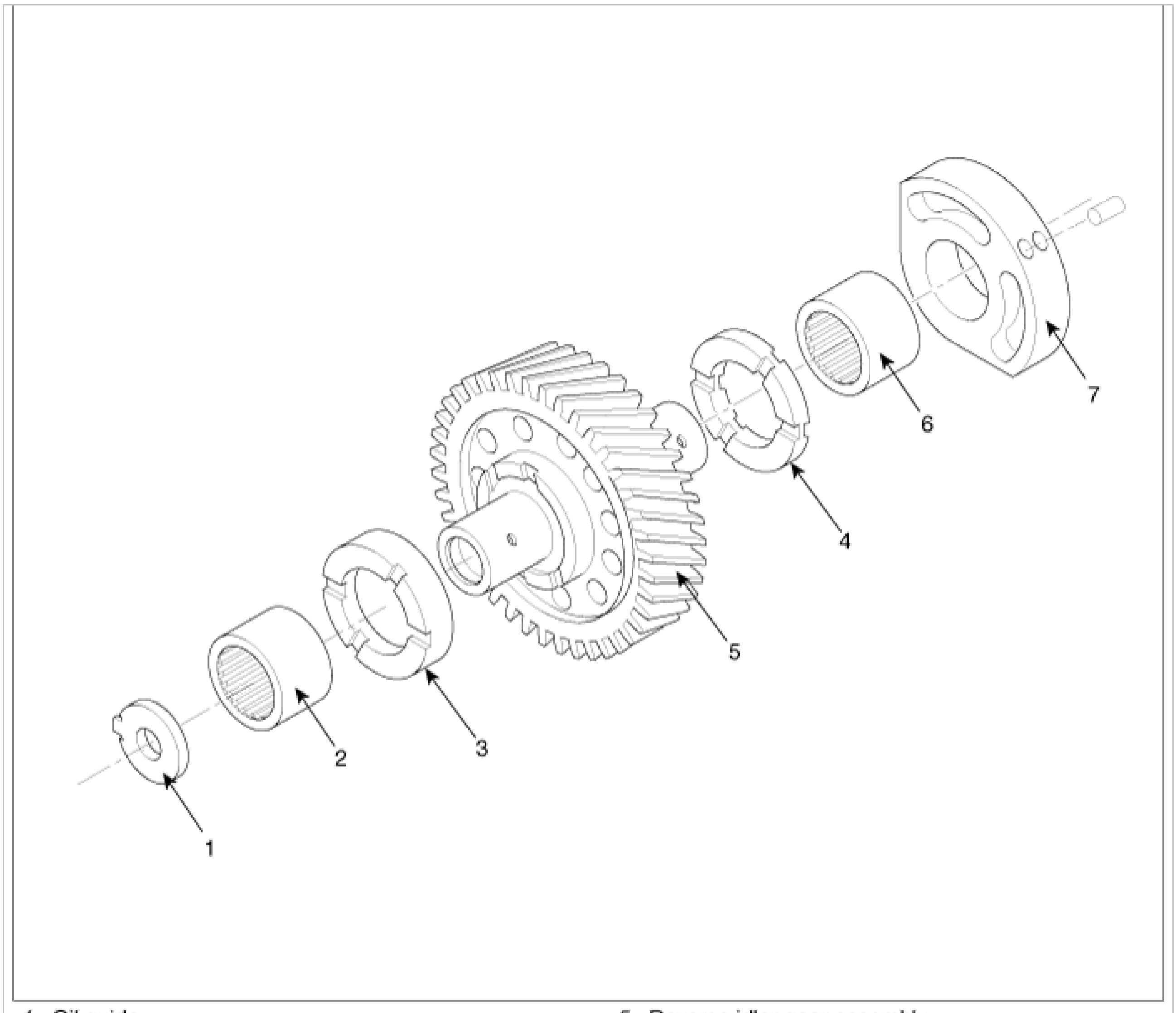
34. Install the shift control cable bracket assembly(A).

TORQUE :
14.7~19.6Nm (150~220kgf.cm, 10.8~14.5lb-ft)



Manual Transaxle System > Manual Transaxle Gear System > Reverse Idler Gear Assembly > Components and Components Location

COMPONENTS



1. Oil guide
2. Needle roller bearing
3. Reverse idler spacer A
4. Reverse idler spacer B
5. Reverse idler gear assembly
6. Needle roller bearing
7. Bearing retainer

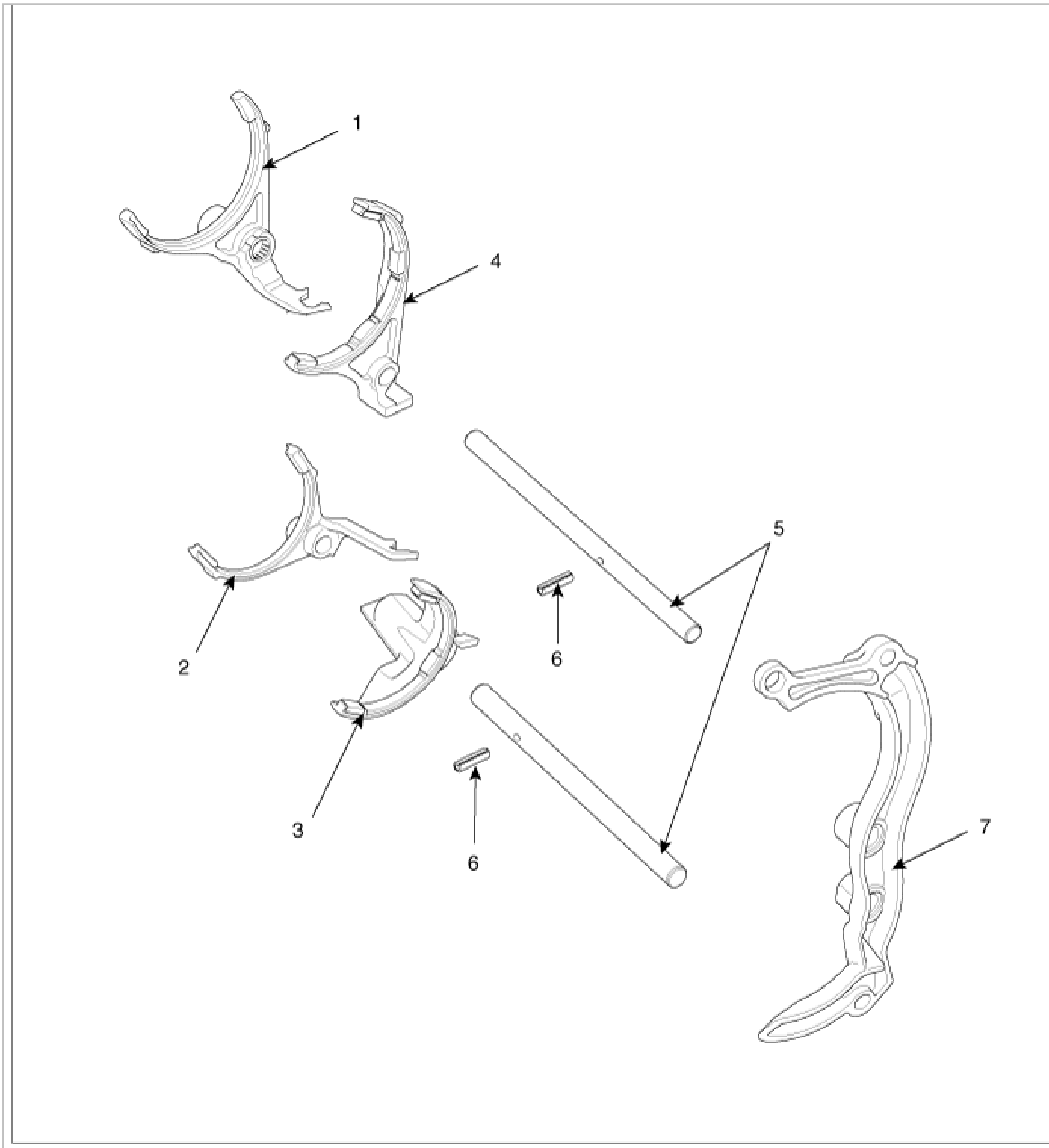
Manual Transaxle System > Manual Transaxle Gear System > Reverse Idler Gear Assembly > Repair procedures

REASSEMBLY

1. Insert the reverse idler spacers in the reverse idler gear assembly.
2. Insert the needle roller bearing into the bearing retainer by tapping.
3. Install the rest of the parts manually.

Manual Transaxle System > Manual Transaxle Control System > Shift Fork > Components and Components Location

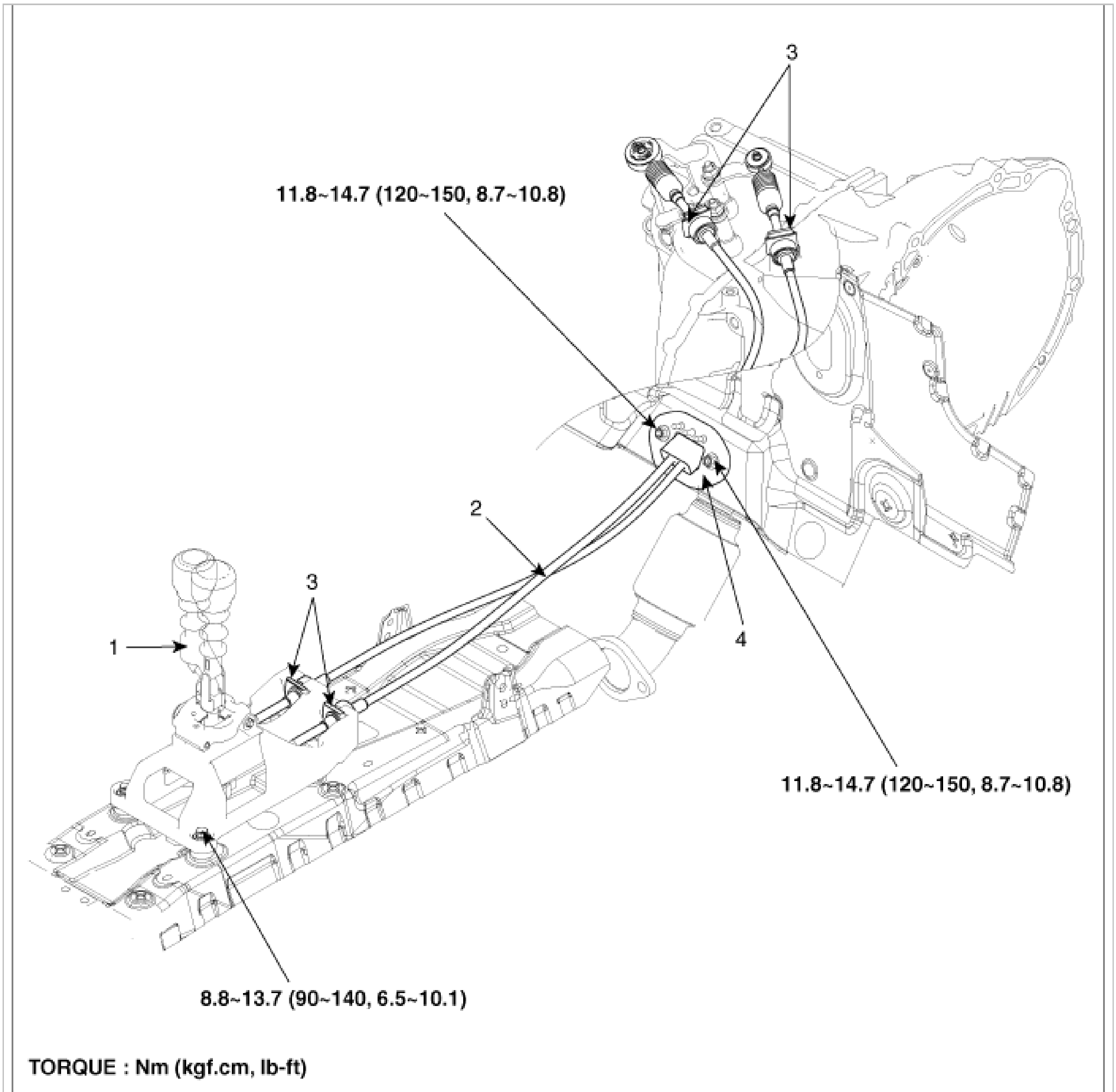
COMPONENTS



1. 1st/2nd shift fork
2. 3rd/4th shift fork
3. 5th/6th shift fork
4. Reverse shift fork
5. Shift rail
6. Spring pin
7. Rail support bracket

Manual Transaxle System > Manual Transaxle Control System > Manual Transaxle Shift Control > Components and Components Location

COMPONENTS



1. Lever assembly
2. Gear shift cable assembly
3. Clip
4. Retainer

Precautions

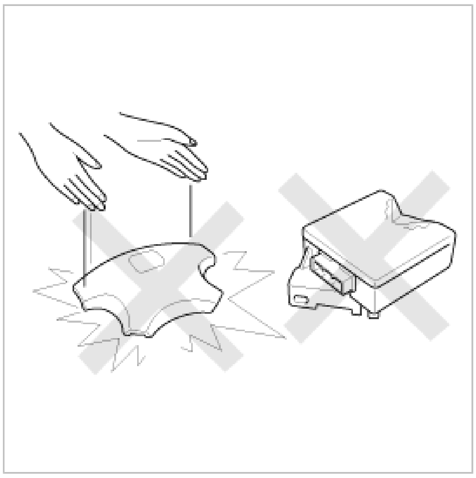
General Precautions

Please read the following precautions carefully before performing the airbag system service. Observe the instructions described in this manual, or the airbags could accidentally deploy and cause damage or injury.

- Except when performing electrical inspections, always turn the ignition switch OFF and disconnect the negative cable from the battery, and wait at least three minutes before beginning work.

> NOTE
>
> The contents in the SRSCM memory are not erased even if the ignition switch is turned OFF or the battery cables are disconnected from the battery.

- Use the replacement parts which are manufactured to the same standards as the original parts and quality.
  Do not install used SRS parts from another vehicle.
  Use only new parts when making SRS repairs.
- Carefully inspect any SRS part before you install it.
  Do not install any part that shows signs of having been dropped or improperly handled, such as dents, cracks or deformation.

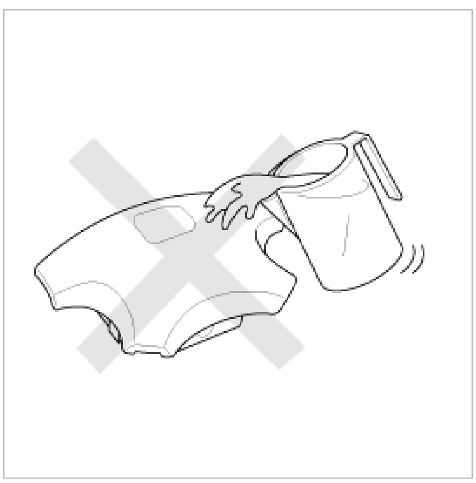


- Before removing any of the SRS parts (including the disconnection of the connectors), always disconnect the SRS connector.

Airbag Handling and Storage

Do not disassemble the airbags; They have no serviceable parts. Once an airbag has been deployed, it cannot be repaired or reused.
For temporary storage of the air bag during service, please observe the following precautions.

- Store the removed airbag with the pad surface up.
- Keep free from any oil, grease, detergent, or water to prevent damage to the airbag assembly.



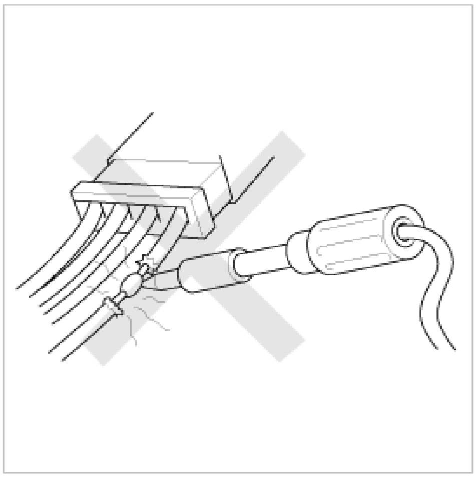
- Store the removed airbag on secure, flat surface away from high heat source (exceeding 200 °F / 93 °C).
- Never perform electrical inspections to the airbags, such as measuring resistance.
- Do not position yourself in front of the airbag assembly during removal, inspection, or replacement.

- Refer to the scrapping procedures for disposal of the damaged airbag.
- Be careful not to bump or impact the SRSCM or the side impact sensors whenever the ignition switch is ON, wait at least three minutes after the ignition switch is turned OFF before begin work.
- During installation or replacement, be careful not to bump (by impact wrench, hammer, etc.) the area around the SRSCM and the side impact sensor. The airbags could accidentally deploy and cause damage or injury.
- After a collision in which the airbags were deployed, replace the front airbags and the SRSCM. After a collision in which the side airbag was deployed, replace the side airbag, the front impact sensor and side impact sensor on the side where the side airbag deployed and the SRSCM. After a collision in which the airbags or the side air bags did not deploy, inspect for any damage or any deformation on the SRSCM and the side impact sensors. If there is any damage, replace the SRSCM, the front impact sensor and/or the side impact sensors.
- Do not disassemble the SRSCM, the front impact sensor or the side impact sensors
- Turn the ignition switch OFF, disconnect the battery negative cable and wait at least three minutes before beginning installation or replacement of the SRSCM.
- Be sure the SRSCM, the front impact sensor and side impact sensors are installed securely with the mounting bolts.
- Do not spill water or oil on the SRSCM,or the front impact sensor or the side impact sensors and keep them away from dust.
- Store the SRSCM, the front impact sensor and the side impact sensors in a cool (less than 104°F/40°C) and dry (less than 80% relative humidity, no moisture) area.

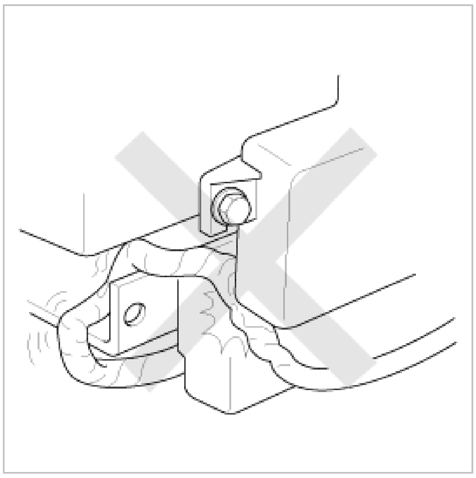
Wiring Precautions

SRS wiring can be identified by special yellow outer covering (except the SRS circuits under the front seats).
Observe the instructions described in this section.

- Never attempt to modify, splice, or repair SRS wiring.
  If there is an open or damage in SRS wiring, replace the harness.



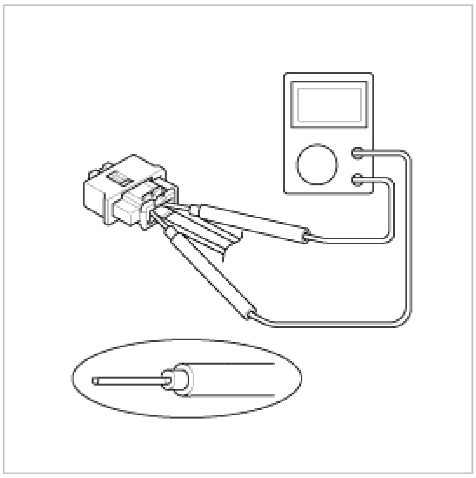
- Be sure to install the harness wires so that they are not pinched, or interfere with other parts.



- Make sure all SRS ground locations are clean, and grounds are securely fastened for optimum metal-to-metal contact. Poor grounding can cause intermittent problems that are difficult to diagnose.

Precautions for Electrical Inspections

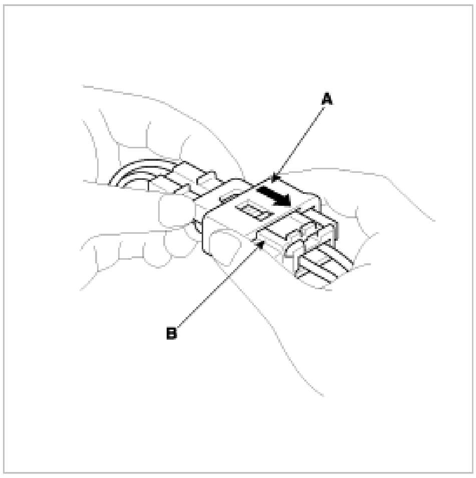
- When using electrical test equipment, insert the probe of the tester into the wire side of the connector.
  Do not insert the probe of the tester into the terminal side of the connector, and do not tamper with the connector.



- Use a u-shaped probe. Do not insert the probe forcibly.
- Use specificed service connectors for troubleshooting.
  Using improper tools could cause an error in inspection due to poor metal contact.

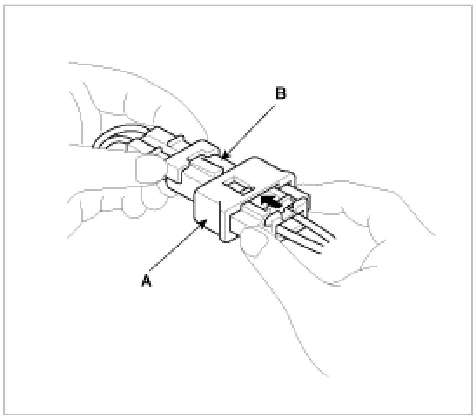
Spring-loaded Lock Connector

Airbag Connector(I)

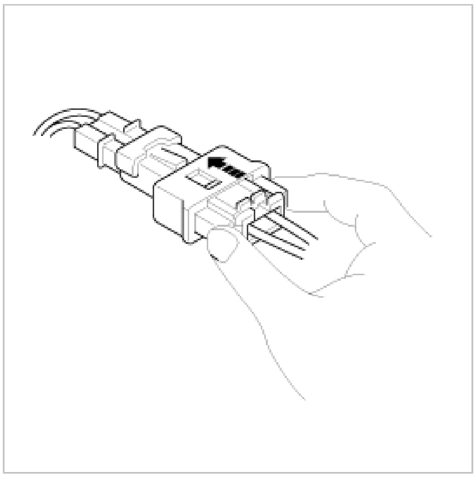


Connecting

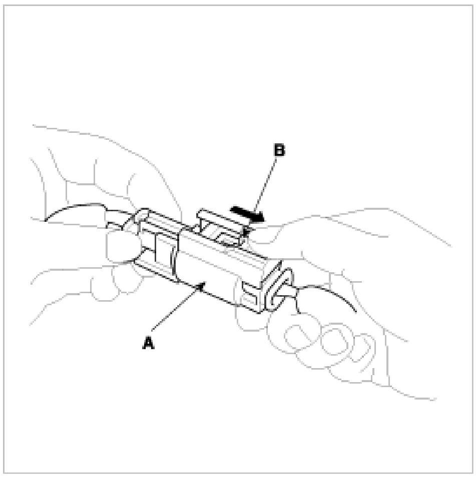
1. To reconnect, hold the pawl-side connector half, and press on the back of the sleeve-side connector half in the direction shown. As the two connectpr halves are pressed together, the sleeve (A) is pushed back by the pawl (B). Do not touch the sleeve.



2. When the connector halves are completely connected, the pawl is released, and the spring-loaded sleeve locks the connector.

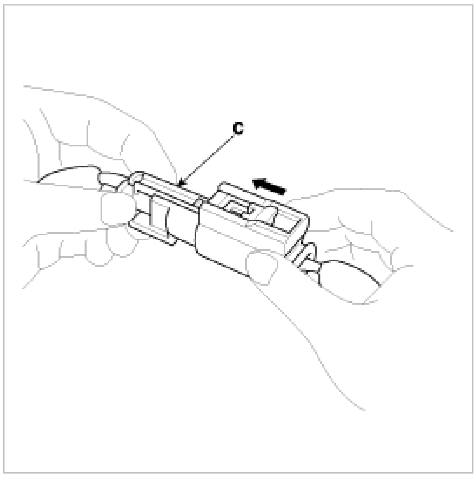


Airbag Connector(II)



Connecting

Hold both connector halves and press firmly until the projection (C) of the sleeve-side connector clicks to lock.



COMPONENT REPLACEMENT AFTER DEPLOYMENT

> NOTE
>
> Before doing any SRS repairs, use the Hi-Scan Pro to check for DTCs. Refer to the Diagnostic Trouble Code list for repairing of the related DTCs.

When the front airbag(s) deployed after a collision, replace the following items.

- SRSCM
- Deployed airbag(s)
- Seat belt pretensioner(s)
- Seat belt buckle pretensioner(s)

- Front impact sensors
- SRS wiring harnesses
- Clock spring (when Driver Airbag deployed)

hen the seat belt pretensioner(s) deployed after a collision, replace the following items.

- Seat belt pretensioner(s)
- Seat belt buckle pretensioner(s)
- SRSCM (if B1658 detected)
- Front impact sensors
- SRS wiring harnesses

hen the side/curtain airbag(s) deployed after a collision, replace the following items.

- SRSCM
- Deployed airbag(s)
- Side impact sensor(s) for the deployed side(s)
- SRS wiring harnesses

After the vehicle is completely repaired, confirm the SRS airbag system is OK.

- Turn the ignition switch ON, the SRS indicator should come on for about 6 seconds and then go off.

Restraint > General Information > General Information

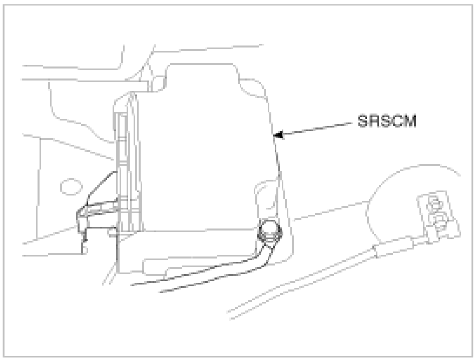
General

The supplemental restraint system (SRS) is designed to supplement the seat belt to help reduce the risk of severe injury to the driver and passenger by activating and deploying the driver, passenger, side airbag and belt pre-tensioner in certain frontal or side collisions. The SRS (Airbag) consists of : a driver side airbag module located in the center of the steering wheel, which contains the folded cushion and an inflator unit ; a passenger side airbag module located in the passenger side crash pad contains the folded cushion assembled with inflator unit ; side airbag modules located in the driver and passenger seat contains the folded cushion and an inflator unit ; curtain airbag modules located inside the headliner which contains folded cushions and inflator units. The Passenger Occupant classification System (OCS) utilizes a sensor mat placed between the passenger seat cover and cushion pad to measure the occupant's loading force on the vehicle seat. Seat Track Position Sensor (STPS) is located in the driver and passenger seat it, interfaces with the SRS Control module (SRSCM) and will help determine whether to suppress either stage of the multi-stage airbag system. SRSCM is located under the center console. The impact sensing function of the SRSCM is carried out by electronic accelerometer that continuously measures the vehicle's acceleration and delivers a corresponding signal through amplifying and filtering circuitry to the microprocessor.

SRSCM (SRS Control Module)

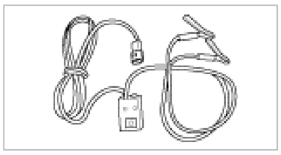
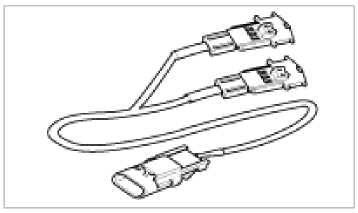
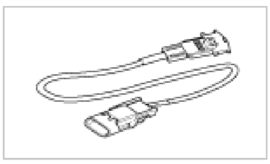
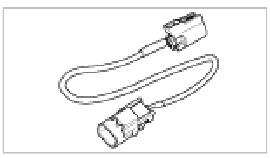
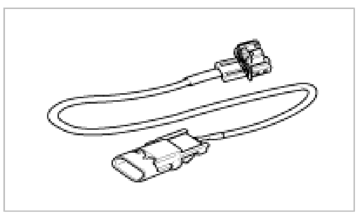
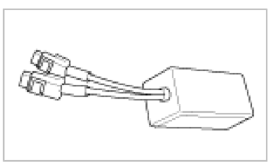
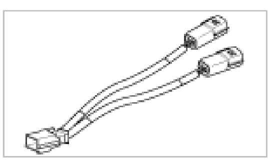
The SRS airbag system consists of electrical and electronic components. Be cautious of the airbag parts. The SRSCM will detect front impact with an inside sensor, side impact with a side impact sensor, airbag deployment request signal, and determine airbag module deployment.

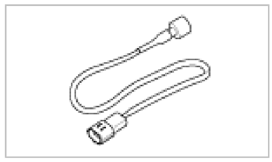
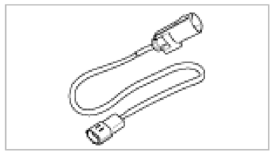
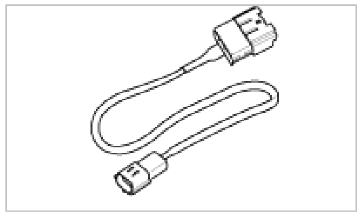
1. DC/DC converter: DC/DC converter in power supply unit includes up/down transformer converter, and provides ignition voltage for 2 front airbag ignition circuits and inside operation voltage. If inside operation voltage is below critical value setting, it will perform re-setting.
2. Safety sensor: The safety sensor is located in the airbag ignition circuit. The safety sensor will operate airbag circuit at any deployment condition and release airbag circuit safely at normal driving condition. The safety sensor is a double contact electro-mechanical switch that will close detecting deceleration above certain criteria.
3. Back up power supply: SRSCM has a separate back up power supply, it will supply deployment energy instantly in low voltage condition or upon power failure by front crash.
4. Self diagnosis: SRSCM will constantly monitor current SRS operation status and detect system failure when the vehicle power supply is on, system failure may be checked with trouble codes using the scan tool. (Hi-Scan)
5. Airbag warning lamp : Upon detecting error, the SRSCM will transmit a signal to the airbag warning lamp located in the cluster. The lamp will indicate SRS error. When the ignition key is on, the SRS lamp will be turned on for about 6 seconds, then will be turned off for a self check. If it remains on, the error is indicated.
6. Trouble code registration: Upon error occurrence in the system, the SRSCM will store a DTC corresponding to the error. DTC can be cleared only by Hi-Scan.
7. Self diagnostic connector: Data stored in SRSCM memory will be output to the Hi-Scan or other external output devices through the data link connector located below the driver side crash pad.
8. Once the airbag is deployed, the SRSCM should not be used again and replaced.
9. SRSCM will determine whether a passenger has put on a seat belt using built-in switch signal in the seat belt buckle, and deploy the front passenger seat airbag accordingly.
10. Side airbag deployment will be determined by SRSCM that will detect satellite sensor impact signal upon side crash, irrespective to seat belt condition.



Restraint > General Information > Special Service Tools

SPECIAL SERVICE TOOLS

Tool(Number and Name)	Illustration	Use
Deployment tool 0957A-34100A		Airbag deployment tool
Deployment adapter 0957A-38510		Use with deployment tool. (DAB,PAB)
Deployment adapter 0957A-38500		Use with deployment tool. (CAB,BPT,)
Deployment adapter 0957A-3F100		Use with deployment tool. (SAB)
Deployment adapter 0957A-2E210		Use with deployment tool. (BUPT)
Dummy load 0957A-38200		Simulator to check the resistance of each wiring harness
Dummy adapter 0957A-2D100		Use with dummy load (SAB)
Dummy adapter 0957A-1C000		Use with dummy load (DAB,CAB,BPT)

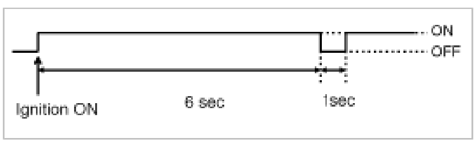
		
Dummy adapter 0957A-3F000		Use with dummy load (SAB)
Dummy adapter 0957A-2E200		Use with dummy load (BUPT)

DAB : Driver Airbag
PAB : Passenger Airbag
SAB : Side Airbag
CAB : Curtain Airbag
BPT : Belt Pretensioner
BUPT: Buckle Pretensioner

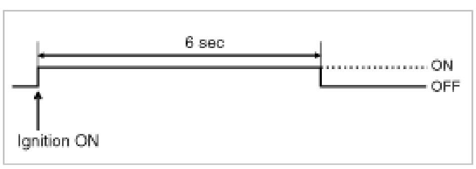
Restraint > General Information > Description and Operation

Warning Lamp Activation

1. Active fault or more than 10 faults are memorized
   A. warning lamp turns on continuously for 6 seconds after IG ON.
   B. warning lamp turns off for 1 second.
   C. warning lamp turns on continuously.



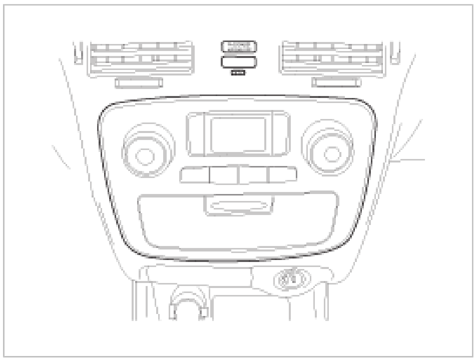
2. No current fault or Less than 10 faults are memorized
   A. warning lamp turns on continuously for 6 seconds after IG ON.
   B. warning lamp turns off continuously.



3. Failure recognition time table

	Active fault	Historical fault
internal fault	2sec.	4sec.
external fault	2sec.	4sec.
battery voltage high/low	10sec.	10sec.

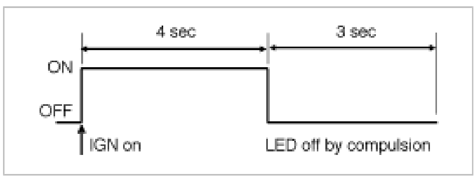
TELLTALE LAMP ACTIVATION



The Telltale Lamp indicates the Passenger Airbag(PAB) enable and disablestatus based on occupant status of passenger seat. If the passenger seat isempty or occupied with a child (or child seat), the Passenger Airbag is disabledand the Telltale Lamp is turned ON to inform the driver that the PAB is disabled.As soon as operating voltage is applied to the SRSCM ignition input, the SRSCMactivates the telltale lamp for 4 seconds. OCS will send an indeterminatestatus to the SRSCM as a default setting for the passenger airbag deployment duringthe prove out period. After a crash, if OCS gets reset and sends the indeterminate status,the telltale lamp will be ON as long as the occupant status is in the indeterminatestatus. Occupant status information and telltale ststus are as below table.

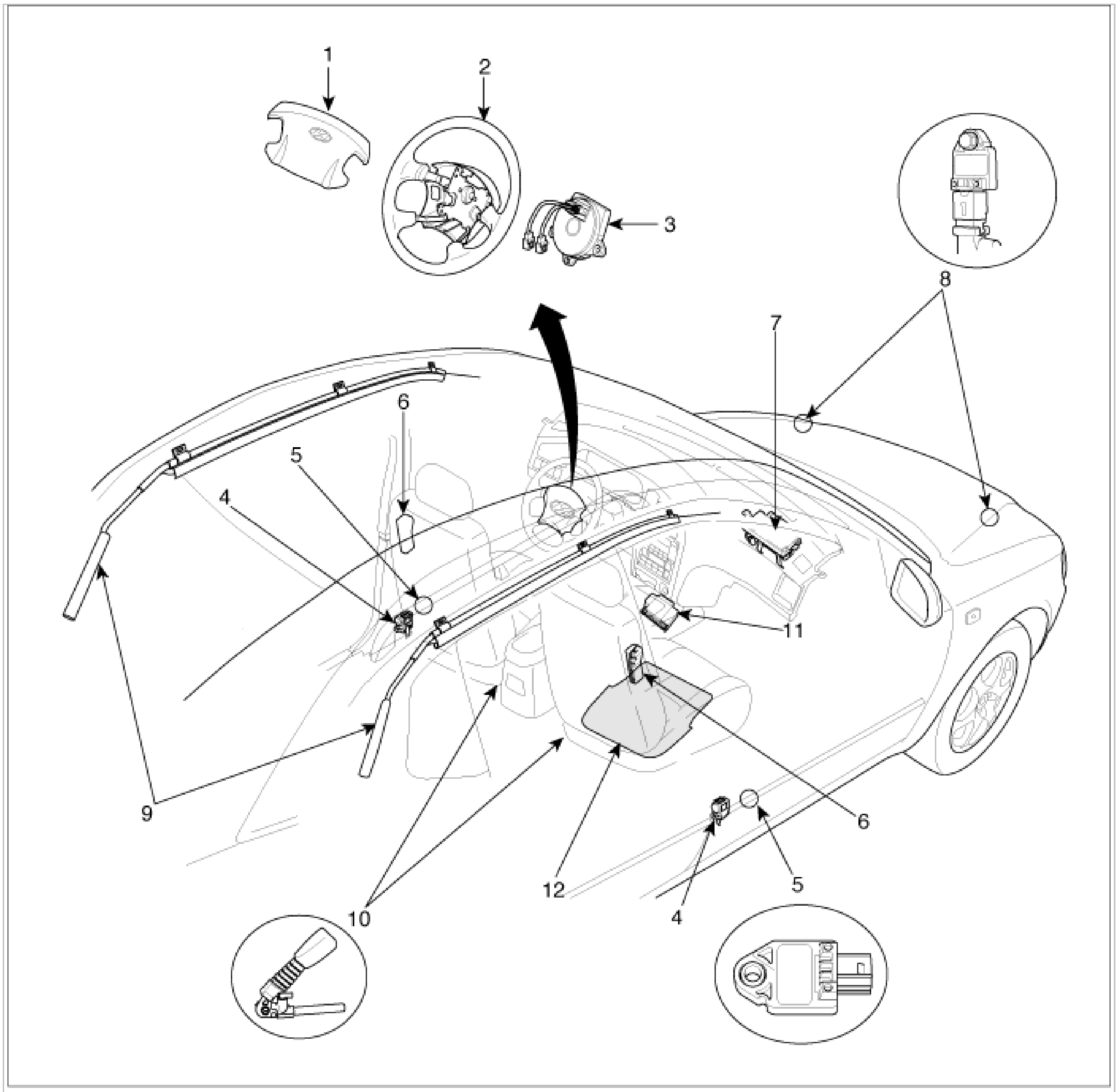
OCS statusresponse message	Tell-tale Lamp	Passenger Airbag	Belt pretensioner (Passenger)	Buckle pretensioner (Passenger)	Side airbag (Passenger)
Initial 4 seconds	ON→OFF	Default	Default	Default	Default
Class 0 = Empty	ON	Disabled	Disabled	Disabled	Disable
Class 1 = Child	ON	Disabled	Disabled	Disabled	Enable
Class 2 = Adult	OFF	Enable	Enable	Enable	Enable
Defect	Default	Default	Default	Default	Default

After turning the ignition on, the telltale lamp will turn on for 4 seconds and turn off for 3 seconds during the initialization phase and be turned off for 3 seconds until a message is received from OCS system.



Restraint > General Information > Components and Components Location

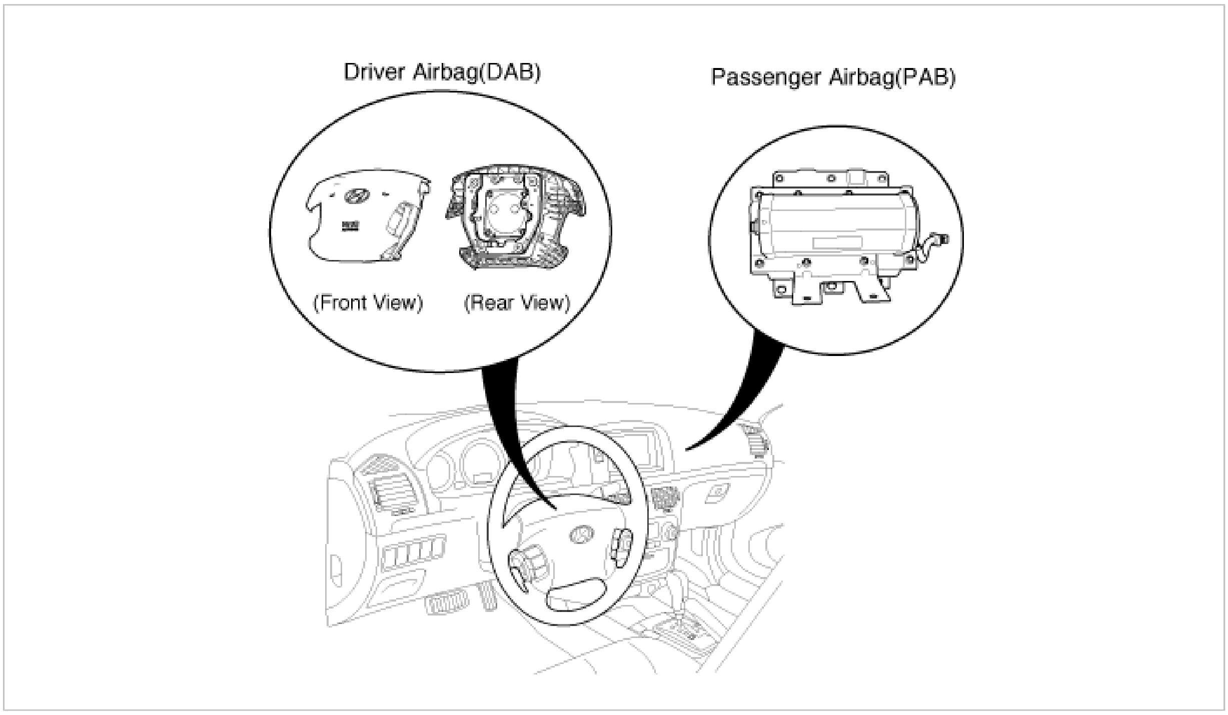
components



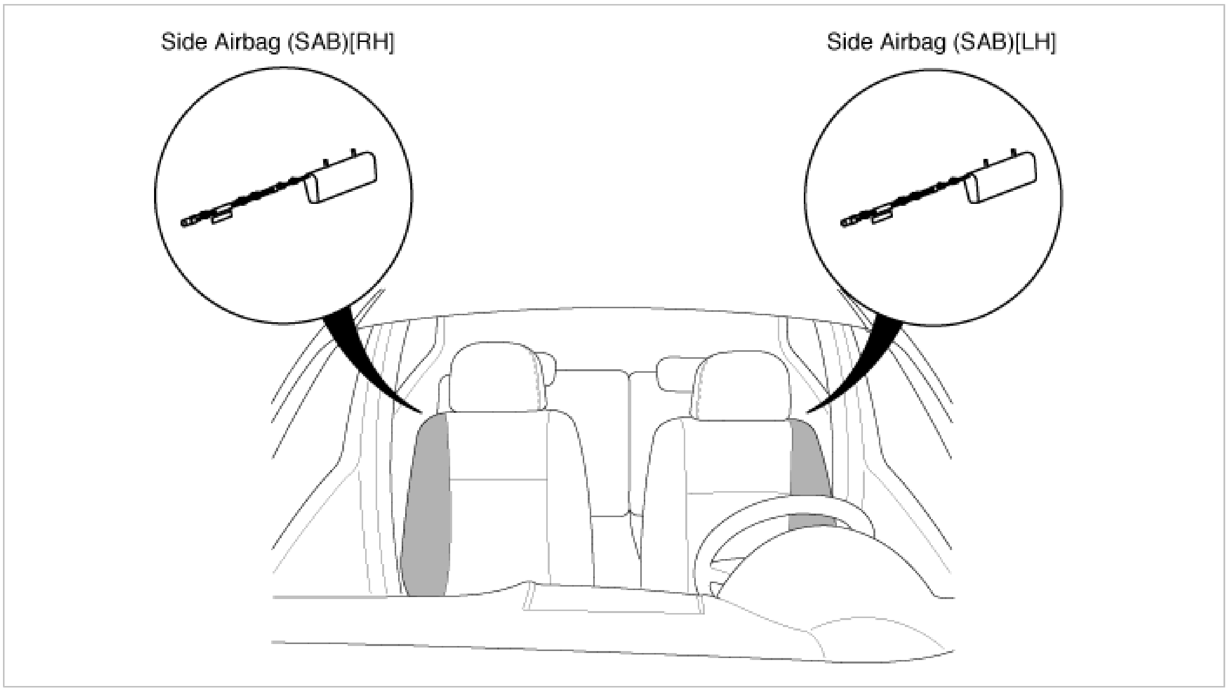
1. Driver Airbag (DAB)
2. Steering Wheel
3. Clock Spring
4. Seat Belt Pretensioner (BPT)
5. Side Impact Sensor (SIS)
6. Side Airbag (SAB)
7. Passenger Airbag (PAB)
8. Front Impact Sensor (FIS)
9. Curtain Airbag (CAB)
10. Buckle Pretensioner (BUPT)
11. Airbag Control Module (SRSCM)
12. Occupant Classification Sensor (OCS)

components location

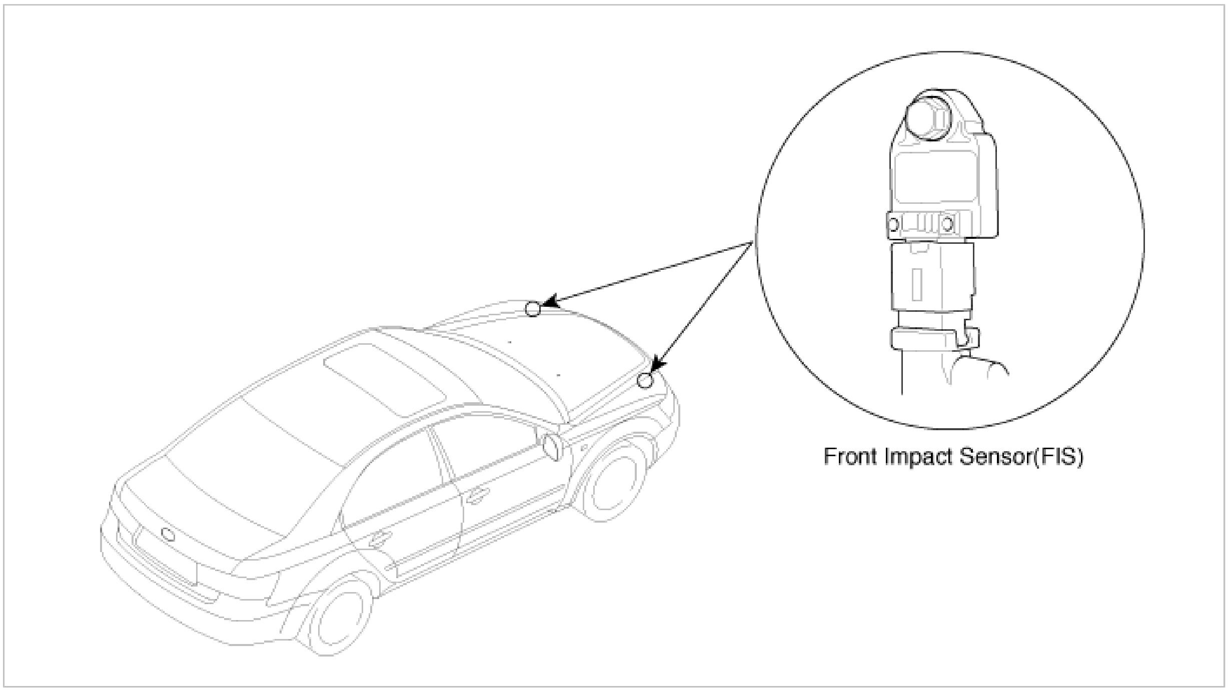
driver airbag(DAB)/passenger airbag(PAB)



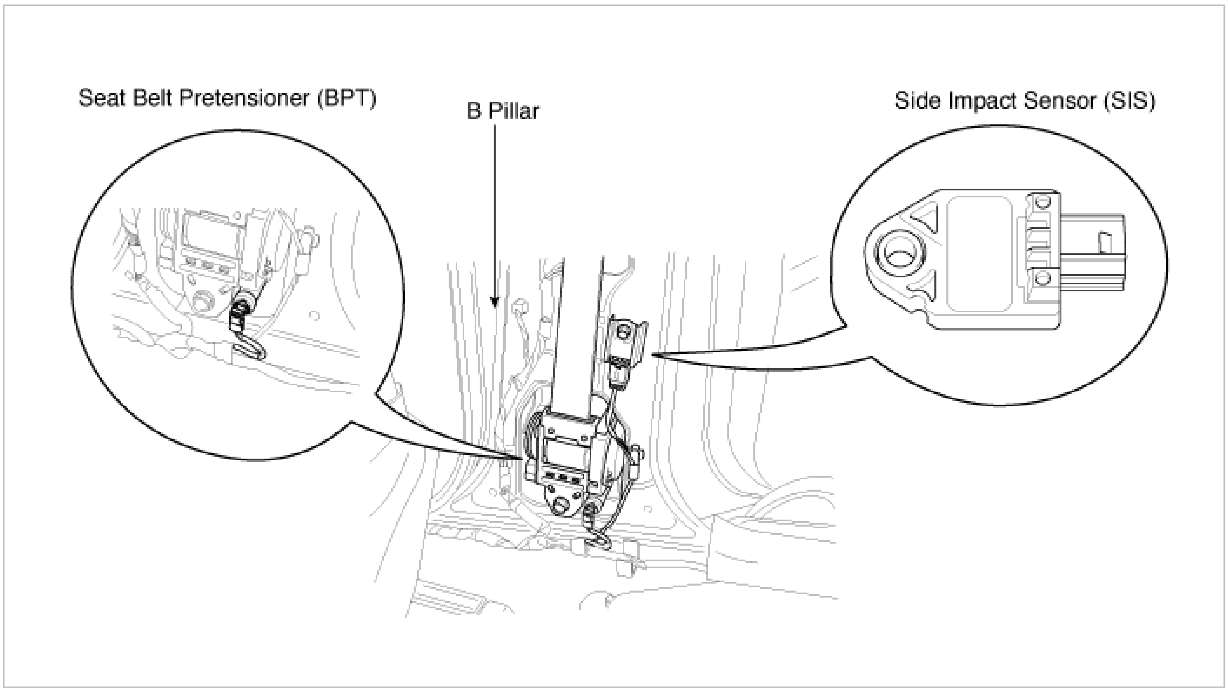
side airbag (SAB)



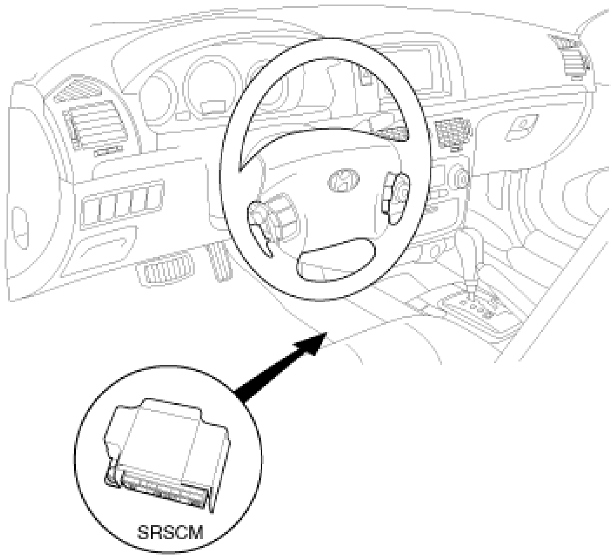
front impact sensor(fis)



seat belt pretensioner(bpt) / side impact sensor(sis)



srscm



Restraint > General Information > Specifications

SPECIFICATION

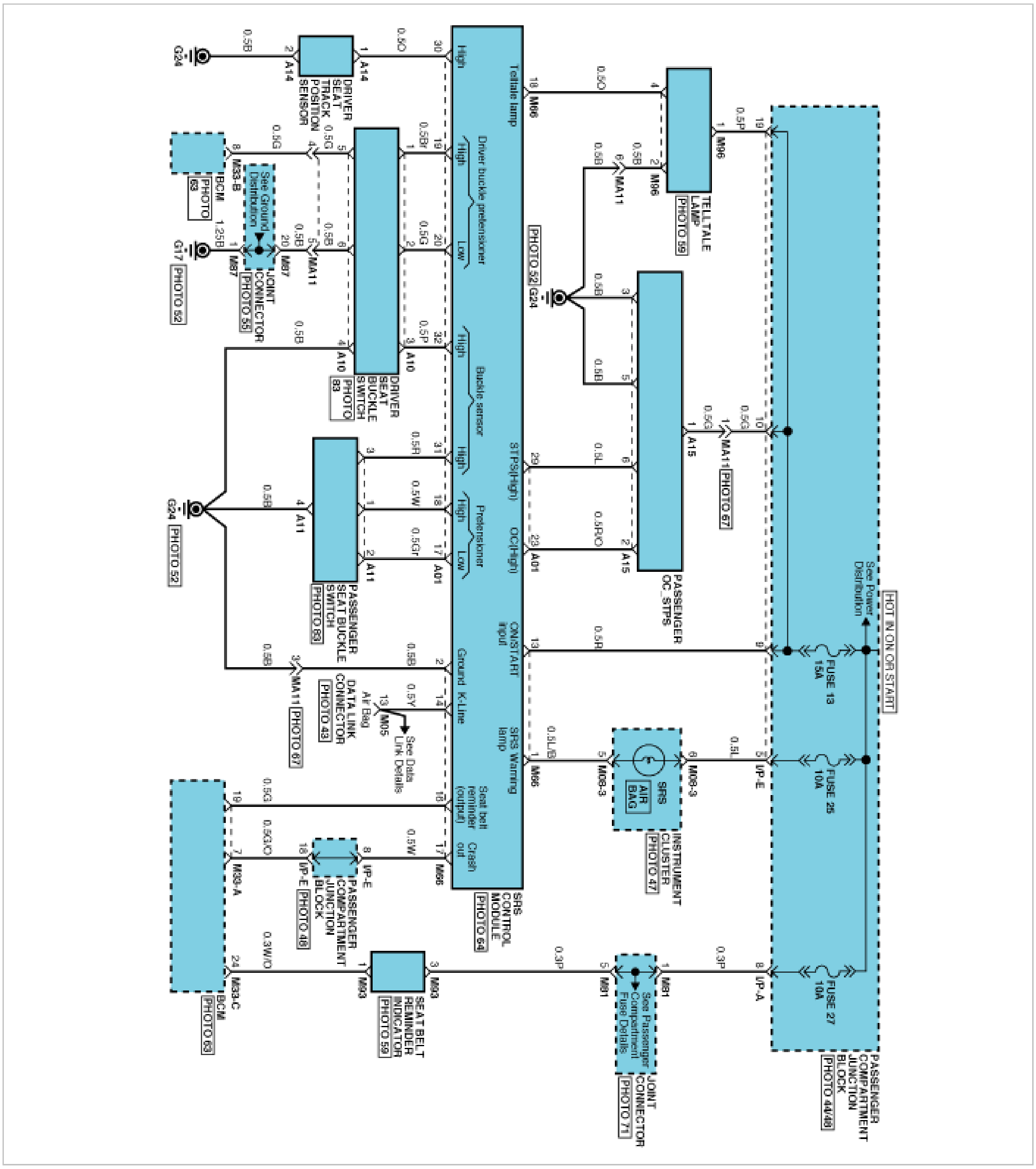
Item Spec	ification	
Driver Airbag (DAB)	Resistance(Ω)	1.925~3.074 Ω
Passenger Airbag(PAB)	Resistance(Ω)	1.878~2.442 Ω
Driver Side Airbag(DSAB)	Resistance(Ω)	1.804~2.568 Ω
Passenger Side Airbag(PSAB)	Resistance(Ω)	1.812~2.576 Ω
Driver Curtain Airbag(DCAB)	Resistance(Ω)	1.940~2.704 Ω
Passenger Curtain Airbag(PCAB)	Resistance(Ω)	1.948~2.712 Ω
Seat Belt Pretensioner (BPT)	Resistance(Ω)	1.943~2.806 Ω
Buckle Pretensioner (BUPT)	Resistance(Ω)	1.905~2.769 Ω

TIGHTENING TORQUES

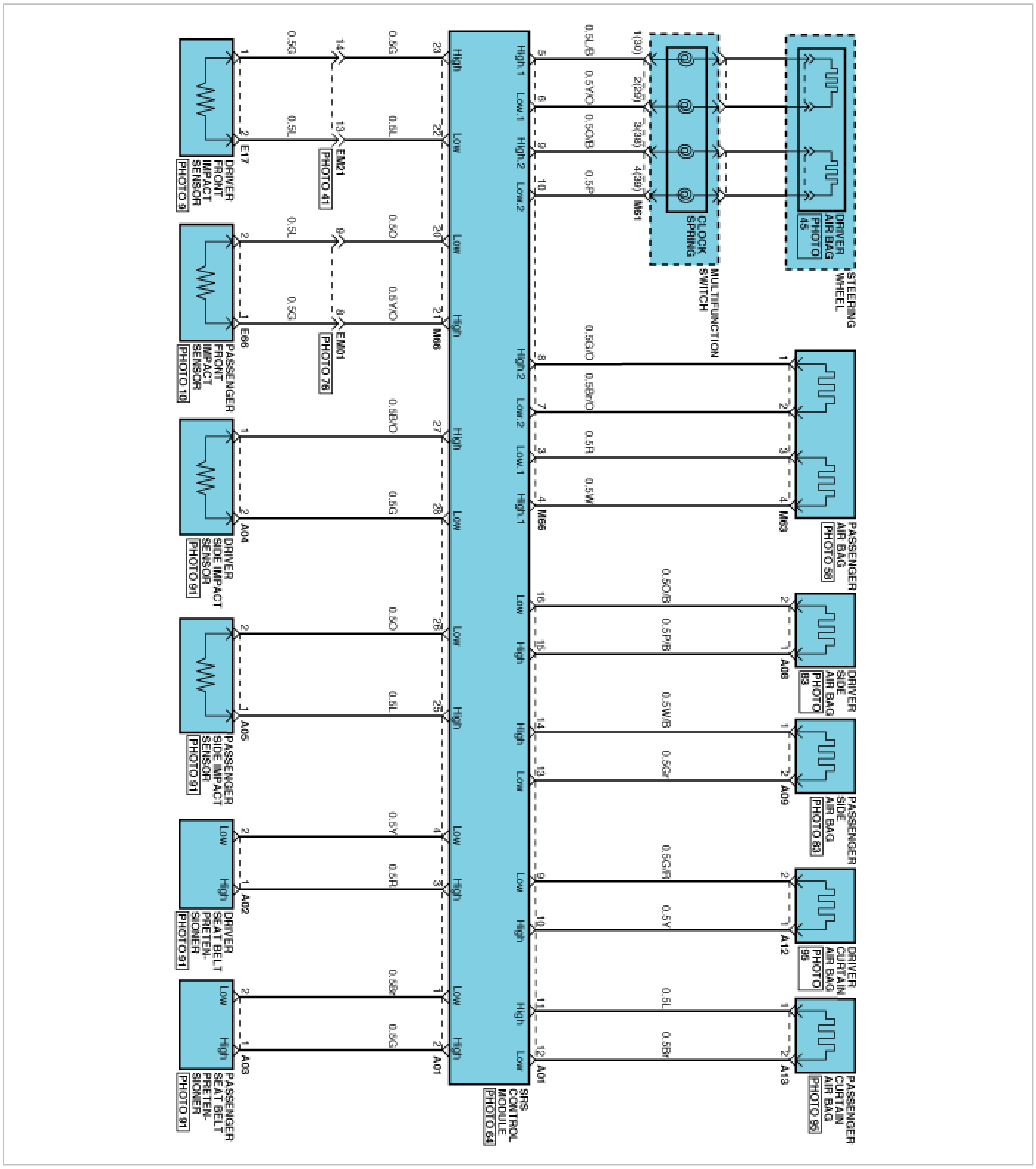
Item kgf	·m	Nm	lb-ft
Driver Airbag (DAB)	0.8 ~ 1.1	7.84 ~ 10.79	5.79 ~ 7.96
M12 Hex lock nut(PAB)	2.7 ~ 3.3	26.48 ~ 32.36	19.53 ~ 23.87
M6 Hex flange nut(PAB)	0.5 ~ 0.7	4.9 ~ 6.86	3.62 ~ 5.06
Curtain Airbag(CAB)	1.1 ~ 1.5	10.79 ~ 14.71	7.96 ~ 10.85
Seat Belt Lower Anchor Bolt (BPT)	4 ~ 5.5	39.23 ~ 53.94	28.93 ~ 39.78
SRSCM Mounting Bolt	0.97 ~ 1.39	9.5 ~ 13.6	7.0 ~ 10.03
Front Impact Sensor (FIS) Mounting Bolt	0.97 ~ 1.39	9.5 ~ 13.6	7.0 ~ 10.03
Side Impact Sensor (SIS) Mounting Bolt	0.97 ~ 1.39	9.5 ~ 13.6	7.0 ~ 10.03

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Schematic Diagrams

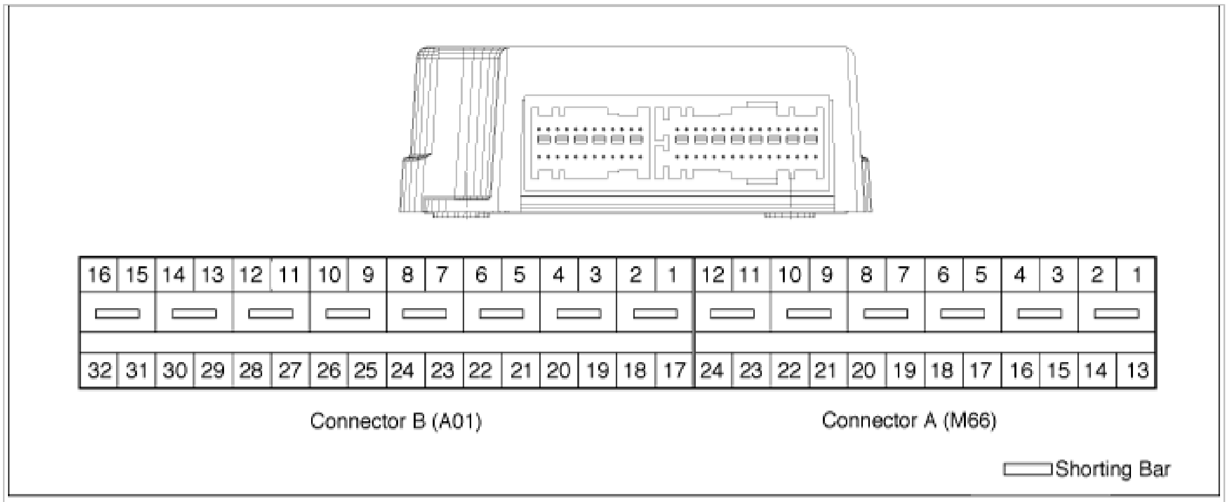
circuit diagram(1)



circuit diagram(2)



SRSCM CONNECTOR PIN LAYOUT(wiring harness side)



ACU PIN #	Connector A (M66)	ACU PIN #	Connector B (A01)
1	Airbag warning lamp	1	Passenger frontal pretensioner - low
2	GND	2	Passenger frontal pretensioner - high
3	Passenger 1st stage-low	3	Driver frontal pretensioner - high
4	Passenger 1st stage-high	4	Driver frontal pretensioner - low
5	Driver 1st stage-high	5	
6	Driver 1st stage-low	6	
7	Passenger 2nd stage-low	7	
8	Passenger 2nd stage-high	8	
9	Driver 2nd stage-high	9	Driver curtain airbag - low
10	Driver 2nd stage-low	10	Driver curtain airbag - high
11		11	Passenger curtain airbag - high
12		12	Passenger curtain airbag - low
13	Ignition	13	Passenger side airbag - low
14	ISO9141 (K-Line)	14	Passenger side airbag - high
15		15	Driver side airbag - high
16	Seat belt reminder	16	Driver side airbag - low
17	Crash out	17	Passenger buckle-pretensioner - low
18	Tell-tale lamp	18	Passenger buckle-pretensioner - high
19		19	Driver buckle-pretensioner - high
20	FIS passenger low	20	Driver buckle-pretensioner - low
21	FIS passenger high	21	
22	FIS driver low	22	
23	FIS driver high	23	OC
24		24	
		25	SIS Passenger high
		26	SIS Passenger low
		27	SIS Driver high
		28	SIS Driver low
		29	Passenger seat track position sensor
		30	Driver seat track position sensor
		31	Passenger buckle sensor
		32	Driver buckle sensor

* : Shorting Bar Switch

DIAGNOSTIC TROUBLE CODE (DTC) TABLE

Code F	ault description	Page
B1101	Ignition voltage high	
B1102	Ignition voltage low	
B1328	FIS Driver defect	
B1329	FIS Driver communication error	
B1333	FIS Passenger defect	
B1334	FIS Passenger communication error	
B1346	Driver airbag resistance too high	
B1347	Driver airbag resistance too low	
B1348	Driver airbag resistance circuit short to ground	

B1349	Driver airbag resistance circuit short to battery	
B1352	Passenger airbag resistance too high	
B1353	Passenger airbag resistance too low	
B1354	Passenger airbag resistance circuit short to ground	
B1355	Passenger airbag resistance circuit short to battery	
B1361	Pretensioner front-Driver resistance too high	
B1362	Pretensioner front-Driver resistance too low	
B1363	Pretensioner front-Driver resistance circuit short to ground	
B1364	Pretensioner front-Driver resistance circuit short to battery	
B1367	Pretensioner front-Passenger resistance too high	
B1368	Pretensioner front-Passenger resistance too low	
B1369	Pretensioner front-Passenger resistance circuit short to ground	
B1370	Pretensioner front-Passenger resistance circuit short to battery	
B1378	Side airbag front-Driver resistance too high	
B1379	Side airbag front-Driver resistance too low	
B1380	Side airbag front-Driver resistance circuit short to ground	
B1381	Side airbag front-Driver resistance circuit short to battery	
B1382	Side airbag front-Passenger resistance too high	
B1383	Side airbag front-Passenger resistance too low	
B1384	Side airbag front-Passenger resistance circuit short to ground	
B1385	Side airbag front-Passenger resistance circuit short to battery	
B1387	Driver side seat track position sensor short to ground	
B1388	Driver side seat track position sensor open to battery	
B1389	Driver side seat track position sensor defect	
B1390	Passenger side seat track position sensor short to ground	
B1391	Passenger side seat track position sensor open to battery	
B1392	Passenger side seat track position sensor defect	
B1395	Squib Interconnection Fault	
B1400	SIS front-Driver defect	
B1403	SIS front-Passenger defect	
B1409	SIS front-Driver communication error	
B1410	SIS front-Passenger communication error	
B1448	Passenger side occupant classification sensor defect	
B1449	Passenger side occupant classification system communication error	
B1450	Passenger side occupant classification system Wrong ID	
B1473	Inflatable Curtain-Driver resistance too high	
B1474	Inflatable Curtain-Driver resistance too low	
B1475	Inflatable Curtain-Driver resistance circuit short to ground	
B1476	Inflatable Curtain-Driver resistance circuit short to battery	
B1477	Inflatable Curtain-Pass resistance too high	
B1478	Inflatable Curtain-Pass resistance too low	
B1479	Inflatable Curtain-Pass resistance circuit short to ground	
B1480	Inflatable Curtain-Pass resistance circuit short to battery	
B1481	2nd Stage Driver airbag resistance too high	
B1482	2nd Stage Driver airbag resistance too low	
B1483	2nd Stage Driver airbag resistance circuit short to ground	

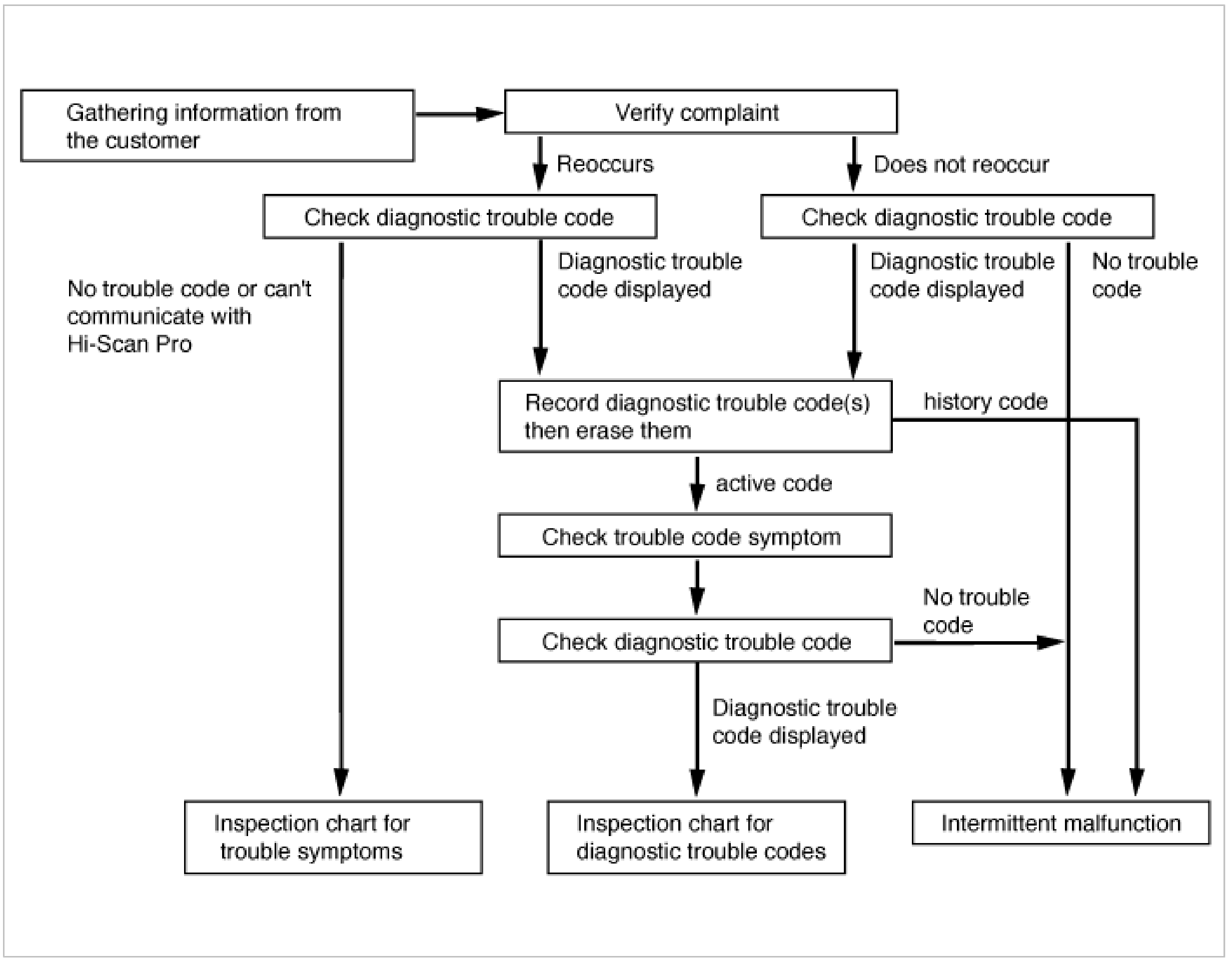
B1484	2nd Stage Driver airbag resistance circuit short to battery	
B1485	2nd Stage Passenger airbag resistance too high	
B1486	2nd Stage Passenger airbag resistance too low	
B1487	2nd Stage Passenger airbag resistance circuit leakag to ground	
B1488	2nd Stage Passenger airbag resistance circuit leakag to battery	
B1511	Driver seat buckle switch open or short to battery	
B1512	Driver seat buckle switch short or short to ground	
B1513	Passenger seat buckle switch open or short to battery	
B1514	Passenger seat buckle switch short or short to ground	
B1515	Driver seat buckle switch defect	
B1516	Passenger seat buckle switch defect	
B1517	Driver seat buckle switch instability	
B1518	Passenger seat buckle switch instability	
B1620	Internal fault- Replace the ACU	
B1650	Crash recorded in 1st Stage only	
B1651	Crash recorded Side Airbag front-Driver	
B1652	Crash recorded Side Airbag front-Passenger	
B1655	Crash recorded - Pass side with PAB inhibited (no deployment)	
B1657	Crash recorded - Belt pretensioner only	
B1658	Maximum belt pretensioner crash detection reached	
B1659	Rear impact detected	
B1670	Crash recorded in full stage	
B1701	Buckle Pretensioner front-Driver resistance too high	
B1702	Buckle Pretensioner front-Driver resistance too low	
B1703	Buckle Pretensioner front-Driver resistance circuit short to Ground	
B1704	Buckle Pretensioner front-Driver resistance circuit short to Battery	
B1706	Buckle Pretensioner front-Passenger resistance too high	
B1707	Buckle Pretensioner front-Passenger resistance too low	
B1708	Buckle Pretensioner front-Passenger resistance circuit short to Ground	
B1709	Buckle Pretensioner front-Passenger resistance circuit short to Battery	
B2500	SRS Warning lamp Failure	
B2502	Passenger airbag tell tale lamp fail	

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting

Hi-Scan check

1. Turn the ignition switch off.
2. Connect the Hi-Scan Pro connector to the datalink connector located under the crash pad.
3. Connect the Hi-Scan Pro power cable.
4. Turn the ignition switch on and power on the Hi-Scan Pro.
5. Read DTCs.
6. Find and repair the trouble, and clear the DTCs using Hi-Scan Pro.
7. Disconnect the Hi-Scan Pro.

DIAGNOSTIC TROUBLESHOOTING FLOW

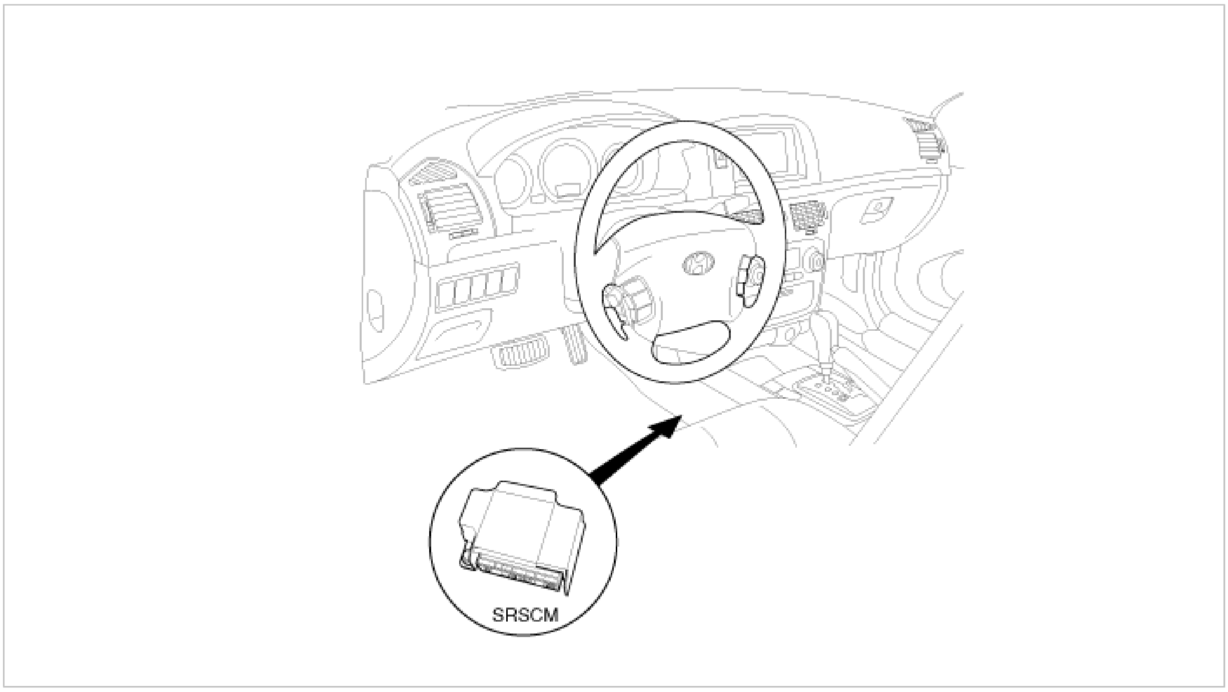


Restraint > Supplemental Restraint System Control Module (SRnodeM) > SRS Control Module (SRnodeM) > Description and Operation

DESCRIPTION

Restraint > Supplemental Restraint System Control Module (SRnodeM) > SRS Control Module (SRnodeM) > Components and Components Location

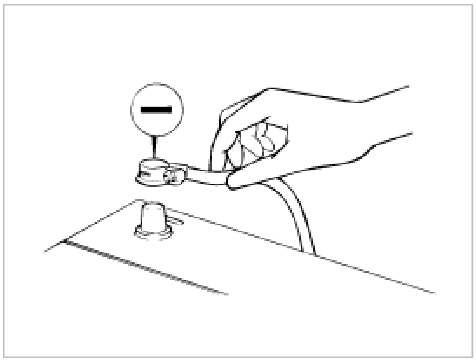
components



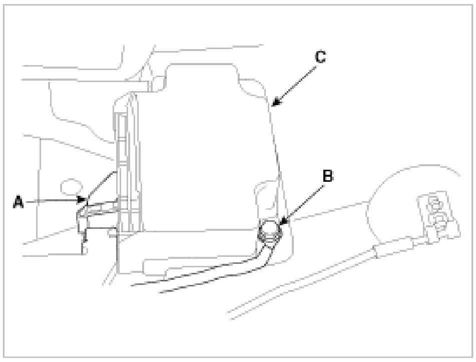
Restraint > Supplemental Restraint System Control Module (SRnodeM) > SRS Control Module (SRnodeM) > Repair procedures

REMOVAL

1. Disconnect the negative(-) cable from battery and wait for at least 3 minutes.



2. Remove ignition key from the vehicle.
3. Remove the center console.(Refer to "BD" group in this Workshop Manual).
4. Pull back the lever, then disconnect the SRSCM harness connector(A). Loosen the bolt(B), then remove the SRSCM(C).



SRSCM mounting bolt :
0.97~1.39 kgf.m(9.5 ~ 13.6 Nm ,7.0 ~ 10.03 lb-ft)

5. Installation is the reverse of removal.

NOTE

- Turn the ignition switch ON; the SRS indicator light should turn on for about six seconds and then go off.
- Always use new bolts when intalling the SRSCM.

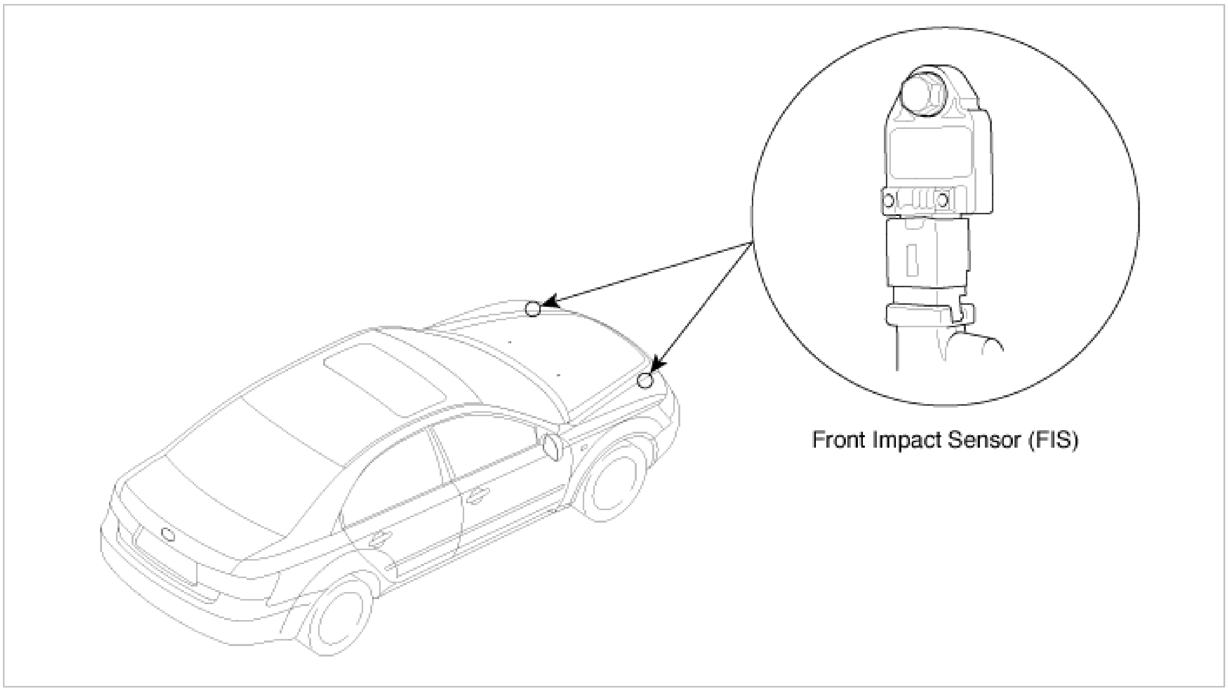
Restraint > Supplemental Restraint System Control Module (SRnodeM) > Front Impact Sensor (FIS) > Description and Operation

DESCRIPTION

The front impact sensors (FIS) are installed inside the member inner. They are remote sensors that detect acceleration due to collision at their mounting locations. The primary purpose of the Front Impact Sensor (FIS) is to provide an indication of a collition. the Front Impact Sensor(FIS) sends acceleration data to the SRSCM.

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Front Impact Sensor (FIS) > Components and Components Location

components



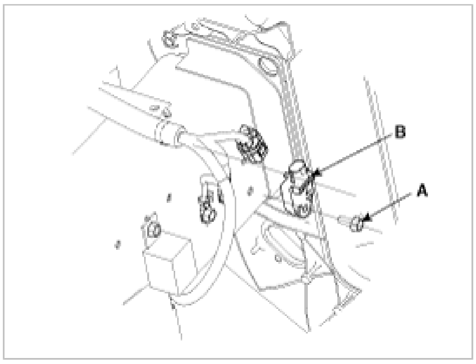
Restraint > Supplemental Restraint System Control Module (SRnodeM) > Front Impact Sensor (FIS) > Repair procedures

removal

CAUTION

- Removal of the airbag must be performed according to the precautions/ procedures described previously.
- Before disconnecting the front impact sensor connector, disconnect the front airbag connector(s).
- Do not turn the ignition switch ON and do not connect the battery cable while replacing the front impact sensor.

1. Disconnect the negative battery cable, and wait at least three minutes before beginning work.
2. Remove the bolt(A) then remove the front impact sensor(B).



3. Installation is the reverse of removal.

NOTE

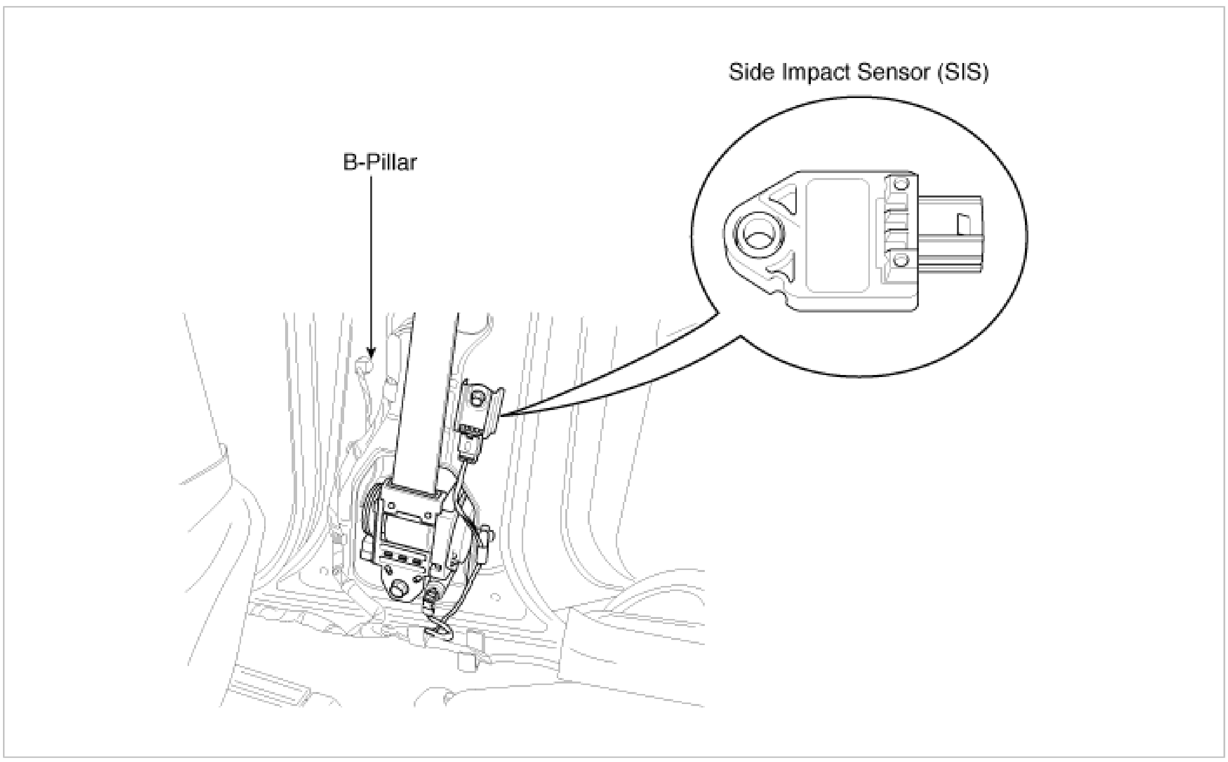
After installing the front impact sensor, confirm proper system operation: Turn the ignition switch ON: the SRS indicator light should turn on for about six seconds and then go off.

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Side Impact Sensor (SIS) > Description and Operation

DESCRIPTION

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Side Impact Sensor (SIS) > Components and Components Location

components



Restraint > Supplemental Restraint System Control Module (SRnodeM) > Side Impact Sensor (SIS) > Repair procedures

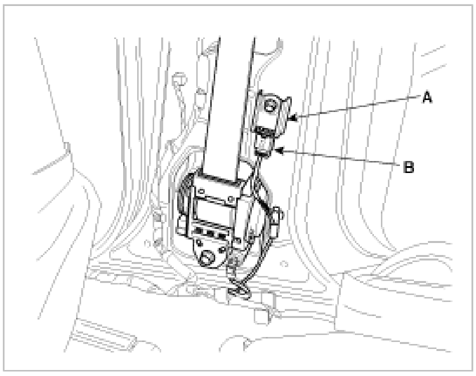
removal

CAUTION

- Removal of the airbag must be performed according to the precautions/procedures described previously.

- Before disconnecting the side impact sensor connector(s), disconnect the side airbag connector(s).
- Do not turn the ignition switch ON and do not connect the battery cable while replacing the side impact sensor.

1. Disconnect the negative battery cable, and wait at least three minutes before beginning work.
2. Remove the front door scuff trim (Refer to BD group - interior).
3. Remove the center pillar trim (Refer to BD group - interior).
4. Remove the bolt(A) then remove the side impact sensor (B).



Installation

CAUTION

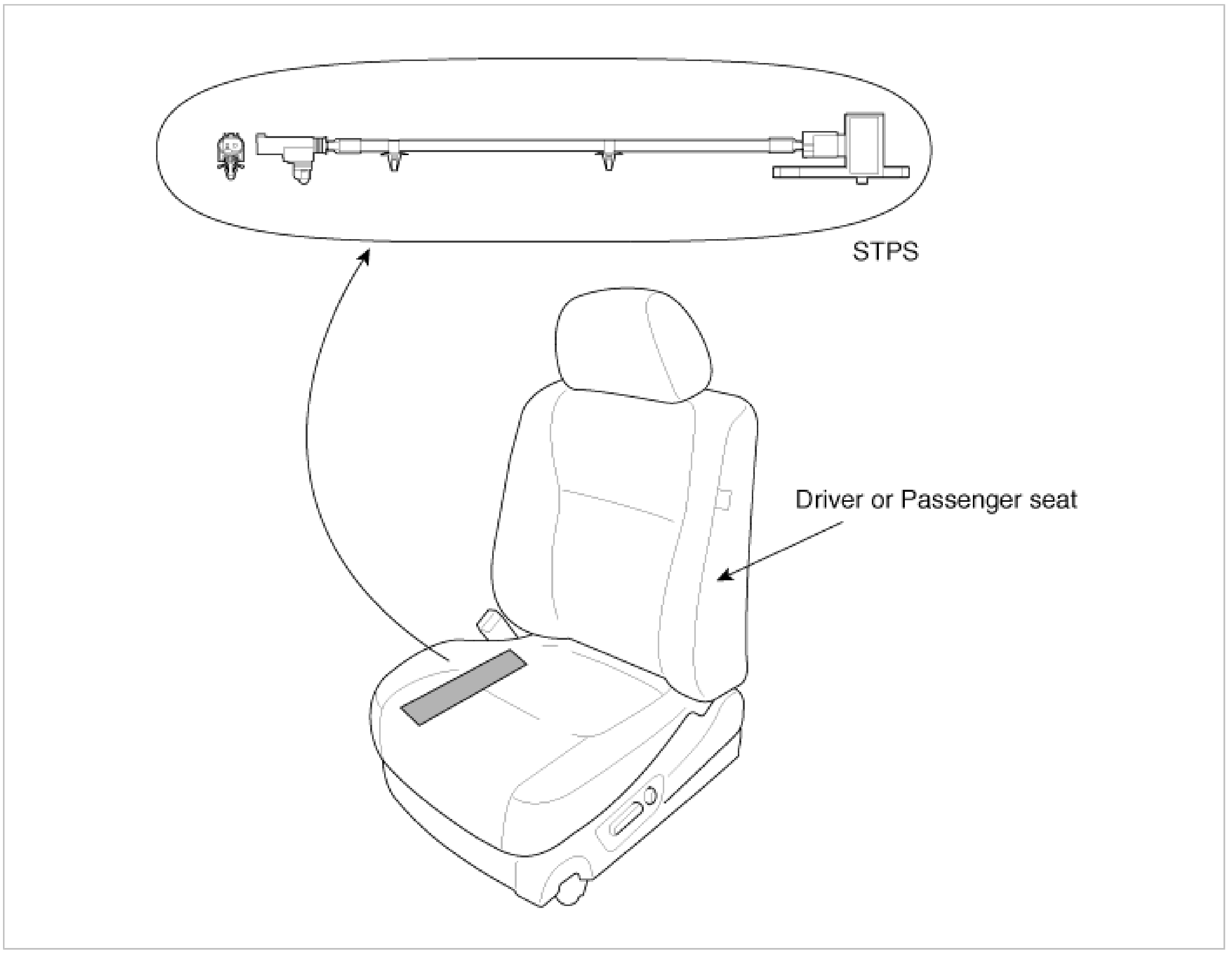
- Be sure to install the harness wires so that they are not pinched or interfere with other parts.
- Do not turn the ignition switch ON and do not connect the battery cable while replacing the side impact sensor.

1. Install the new side impact sensor with the bolt then connect the SRS harness connector to the side impact sensor.
2. Reinstall the belt pretensioner.
3. Reconnect the negative battery cable.
4. After installing the side impact sensor, confirm proper system operation: Turn the ignition switch ON: the SRS indicator light should turn on about six seconds and then go off.

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Seat Track Position Sensor (STPS) > Description and Operation

DESCRIPTION

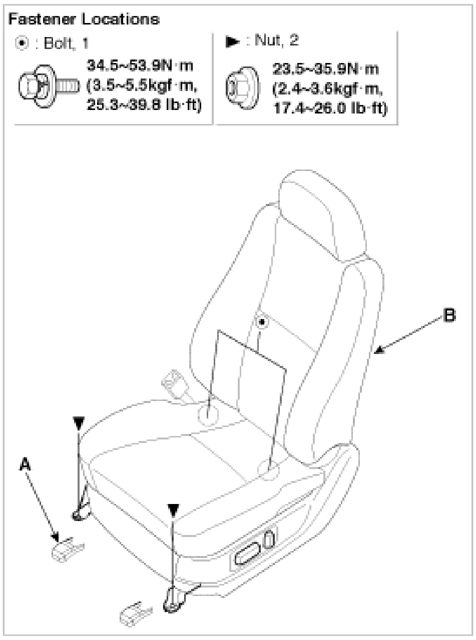
COMPONENTS



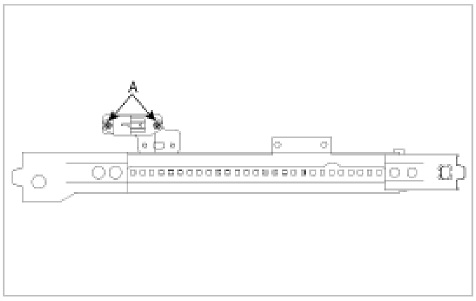
Restraint > Supplemental Restraint System Control Module (SRnodeM) > Seat Track Position Sensor (STPS) > Repair procedures

REPLACEMENT

1. Remove the seat assembly mounting cover (A).
2. After loosening the seat assembly mounting bolt and nut, remove the seat assembly (B).



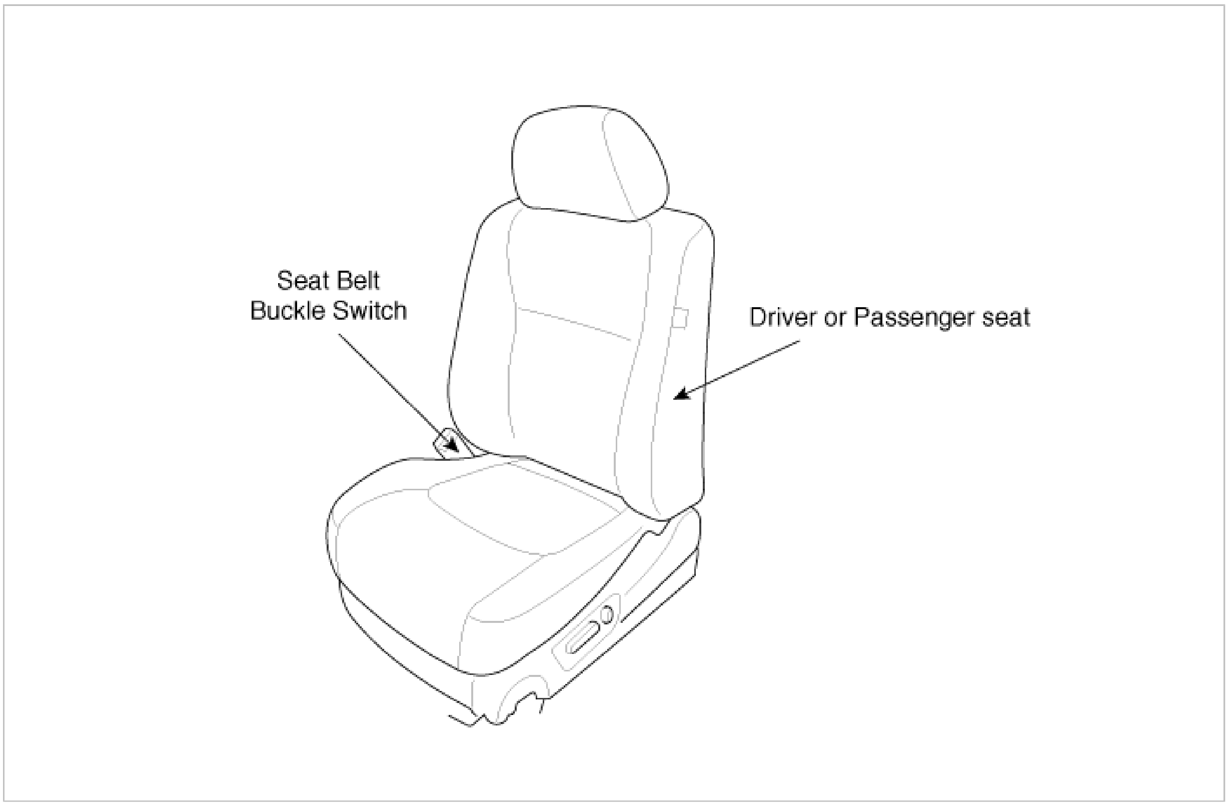
3. Disconnect the STPS connector and remove the mounting bolts(A).



Restraint > Supplemental Restraint System Control Module (SRnodeM) > Seat Belt Buckle Switch (BS) > Description and Operation

DESCRIPTION

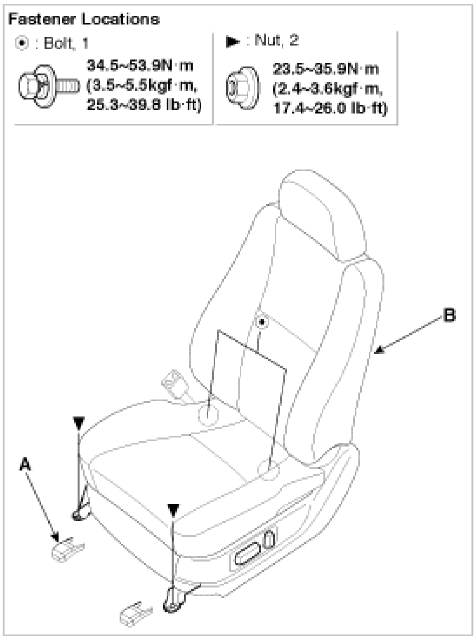
COMPONENTS



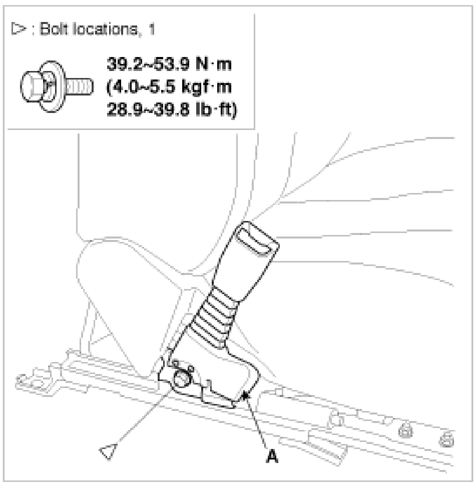
Restraint > Supplemental Restraint System Control Module (SRnodeM) > Seat Belt Buckle Switch (BS) > Repair procedures

REPLACEMENT

1. Remove the seat assembly mounting cover (A).
2. After loosening the seat assembly mounting bolt and nut, remove the seat assembly (B).



3. Remove the wire harness of buckle from seat.
4. Remove the seat belt buckle (A).



5. Installation is the reverse of removal.

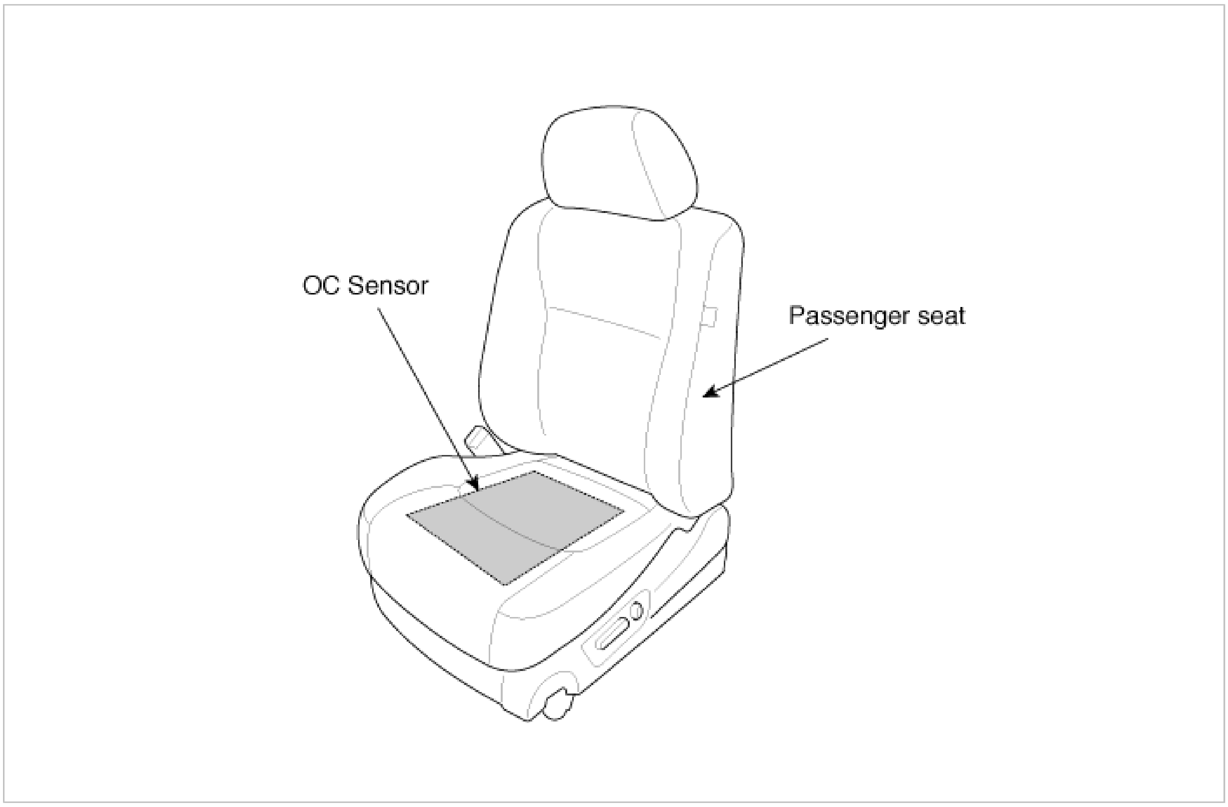
Restraint > Supplemental Restraint System Control Module (SRnodeM) > Occupant Classification Sensor (OCS) > Description and Operation

DESCRIPTION

The system is intended to classify the occupancy status of the front passenger seat in a motor vehicle based on the measured force on the bottom seat cushion.
The system also communicates to the SRSCM whether to allow or inhibit the deployment of the passenger airbags and/or pretensioner based upon this status.
The System also measures dynamic responses of the occupant. This information is used to idenitify when a child seat is cinched down tightly with the seat belt, and to also determine if the seat is unoccupied.
However, the dynamic measurements are not intended, nor capable of monitoring the seating position of the occupant, nor can they determine the proximity of the occupant to the inflator modules.
The system should not be confused with an occupant position recognition system, or any other occupant proximity sensor.

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Occupant Classification Sensor (OCS) > Components and Components Location

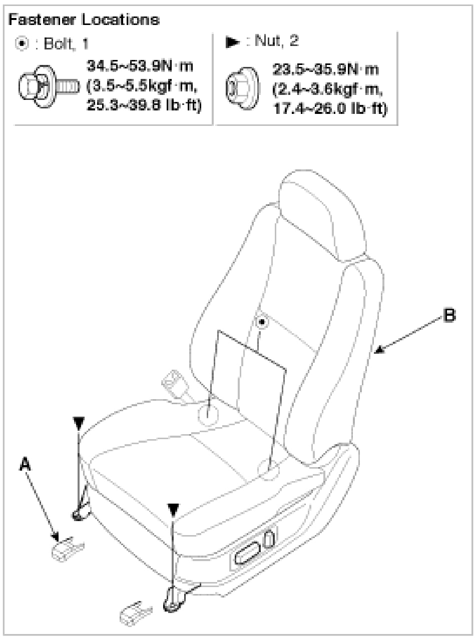
COMPONENTS



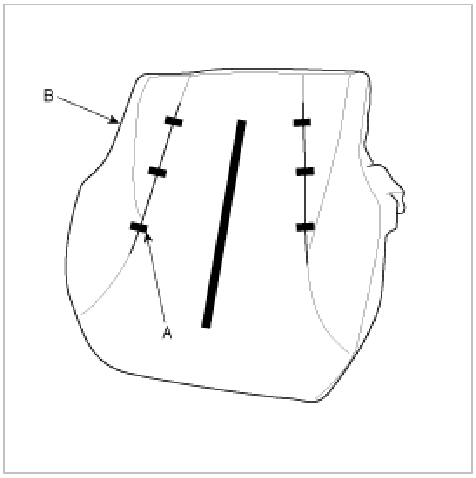
Restraint > Supplemental Restraint System Control Module (SRnodeM) > Occupant Classification Sensor (OCS) > Repair procedures

REPLACEMENT

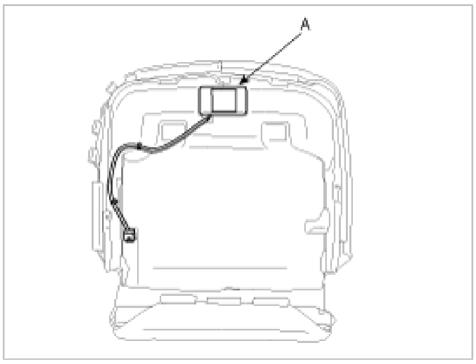
1. Remove the passenger seat assembly mounting cover (A).
2. After loosening the passenger seat assembly mounting bolt and nut, remove the seat assembly (B).



3. Remove the seat cushion. (Refer to BD-Seat)
4. After removing the hogring clip(A) on the front of seat cushion and remove the seat cushion cover(B).



5. Remove the OCS module(A).



Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1101

DTC Description

The SRSCM sets above DTC(s) if it detects that the battery voltage of restraints system is too high or too low. When the voltage returns to normal, the SRS warning light automatically goes off and a malfunction is no longer indicated.

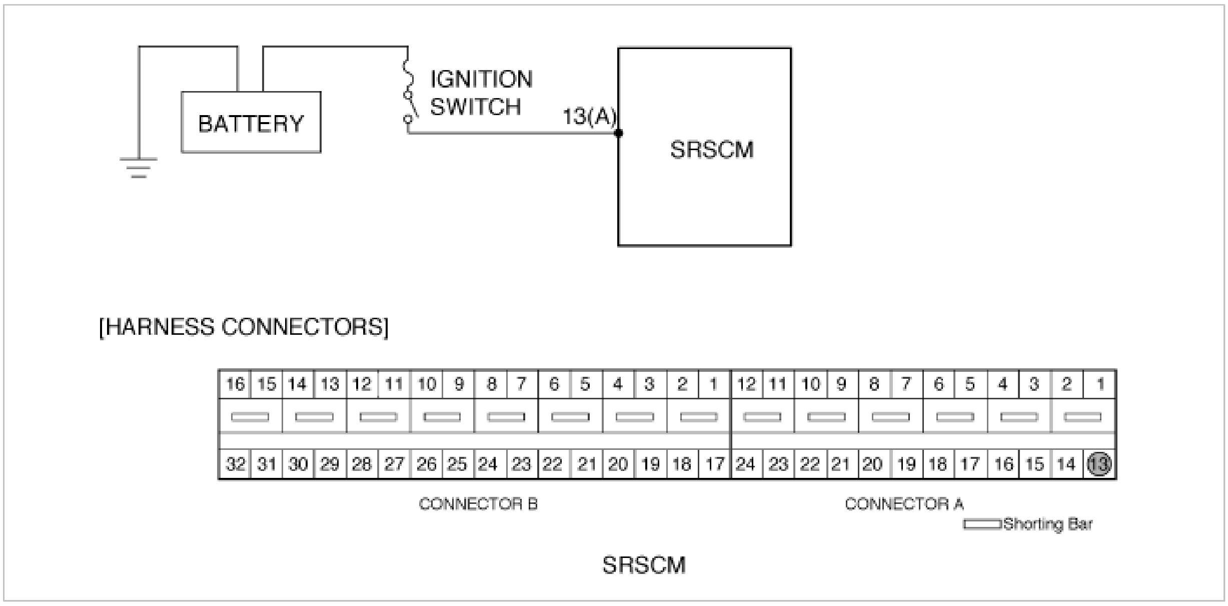
DTC Detecting Condition

DTC Condition		Probable cause
B1101	Battery Voltage > 16.0 V for 10 seconds after IG ON	• Battery • Alternator • Wiring Harness • SRSCM
B1102	Battery Voltage < 9.0 V for 10 seconds after IG ON	

Specification

Voltage : 9.0 ≤ V ≤ 16.0 V

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

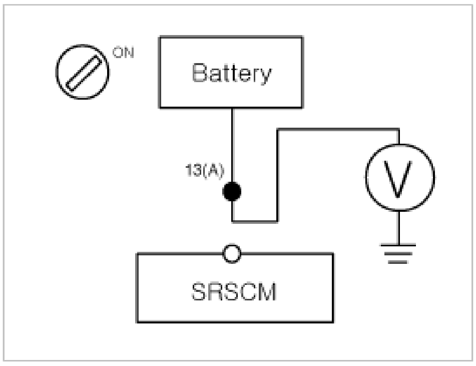
YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SOURCE VOLTAGE
   (1) Turn the ignition switch to ON.
   (2) Measure voltage between the terminal 13(A) of SRSCM harness connector and chassis ground.

specification(voltage) : $9.0 \le V \le 16.0$ V



Is the measured voltage within specification?

NO

▸ Check the battery.

YES

▸ Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

3. CHECK THE BATTERY
   (1) Check the battery.
   - Refer to "EE" group in this SERVICE MANUAL.

   Is the battery normal?

   YES

   ▸ Check the alternator.

   NO

   ▸ Repair or replace the battery(Refer to "EE" group in this SERVICE MANUAL).

4. CHECK ALTERNATOR
   (1) Check the altenator.
   - Refer to "EE" group in this SERVICE MANUAL.

   Is the alternator normal?

   YES

   ▸ Check wiring harness.

   NO

   ▸ Repair or replace the alternator(Refer to "EE" group in this SERVICE MANUAL).

5. CHECK WIRING HARNESS
   (1) Check the wiring harness between the battery and SRSCM.
   Check the wiring harness between the battery and chassis ground.
   Is the wiring harness normal?

   YES

   ▸ Check the DTC again.

   NO

   ▸ Repair or Replace the wiring harness.

6. CHECK THE DTC AGAIN
   (1) Turn the ignition switch to LOCK and wait for at least 30 seconds.

   > **CAUTION**
   >
   > Check again that the battery negative (-) terminal is disconnected from the battery.

   (2) Install the DAB module and connect the DAB connector.

   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (4) Connect the SRSCM connector.

   (5) Connect the negative (-) terminal to the battery.

   (6) Connect a Hi-Scan(Pro) to the data link connector.

   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC?

   YES

▸ Perform the troubleshooting procedures associated with those codes.

NO

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1102

DTC Description

The SRSCM sets above DTC(s) if it detects that the battery voltage of restraints system is too high or too low. When the voltage returns to normal, the SRS warning light automatically goes off and a malfunction is no longer indicated.

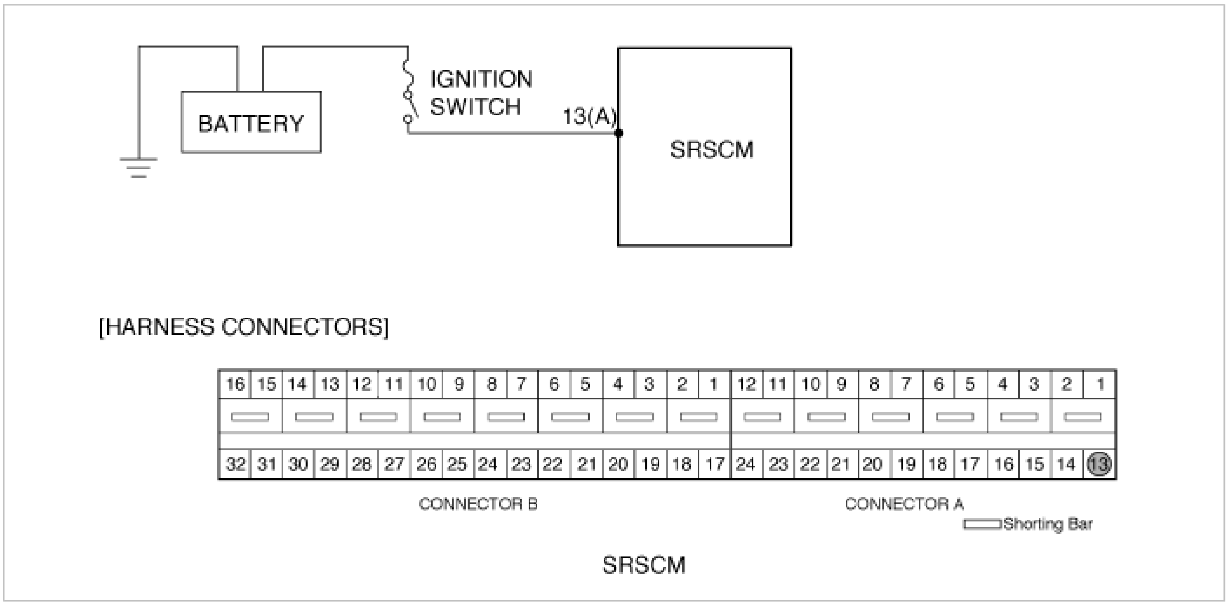
DTC Detecting Condition

DTC	Condition	Probable cause
B1101	Battery Voltage > 16.0 V for 10 seconds after IG ON	• Battery • Alternator • Wiring Harness • SRSCM
B1102	Battery Voltage < 9.0 V for 10 seconds after IG ON	

Specification

Voltage : 9.0 ≤ V ≤ 16.0 V

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> CAUTION
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

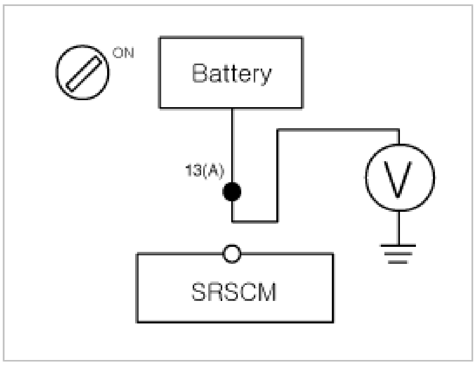
▶ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK SOURCE VOLTAGE
   (1) Turn the ignition switch to ON.
   (2) Measure voltage between the terminal 13(A) of SRSCM harness connector and chassis ground.

specification(voltage) : $9.0 \le V \le 16.0$ V



Is the measured voltage within specification?

NO

▶ Check the battery.

YES

▶ Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

3. CHECK THE BATTERY
   (1) Check the battery.
   ● Refer to "EE" group in this SERVICE MANUAL.
   Is the battery normal?

YES

▶ Check the alternator.

NO

▶ Repair or replace the battery(Refer to "EE" group in this SERVICE MANUAL).

4. CHECK ALTERNATOR
   (1) Check the altenator.
   ● Refer to "EE" group in this SERVICE MANUAL.
   Is the alternator normal?

YES

▶ Check wiring harness.

NO

▶ Repair or replace the alternator(Refer to "EE" group in this SERVICE MANUAL).

5. CHECK WIRING HARNESS
   (1) Check the wiring harness between the battery and SRSCM.
   Check the wiring harness between the battery and chassis ground.
   Is the wiring harness normal?

YES

▶ Check the DTC again.

NO

▸ Repair or Replace the wiring harness.

6. CHECK THE DTC AGAIN
   (1) Turn the ignition switch to LOCK and wait for at least 30 seconds.

   > **CAUTION**
   >
   > Check again that the battery negative (-) terminal is disconnected from the battery.

   (2) Install the DAB module and connect the DAB connector.

   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (4) Connect the SRSCM connector.

   (5) Connect the negative (-) terminal to the battery.

   (6) Connect a Hi-Scan(Pro) to the data link connector.

   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC?

YES

▸ Perform the troubleshooting procedures associated with those codes.

NO

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1328

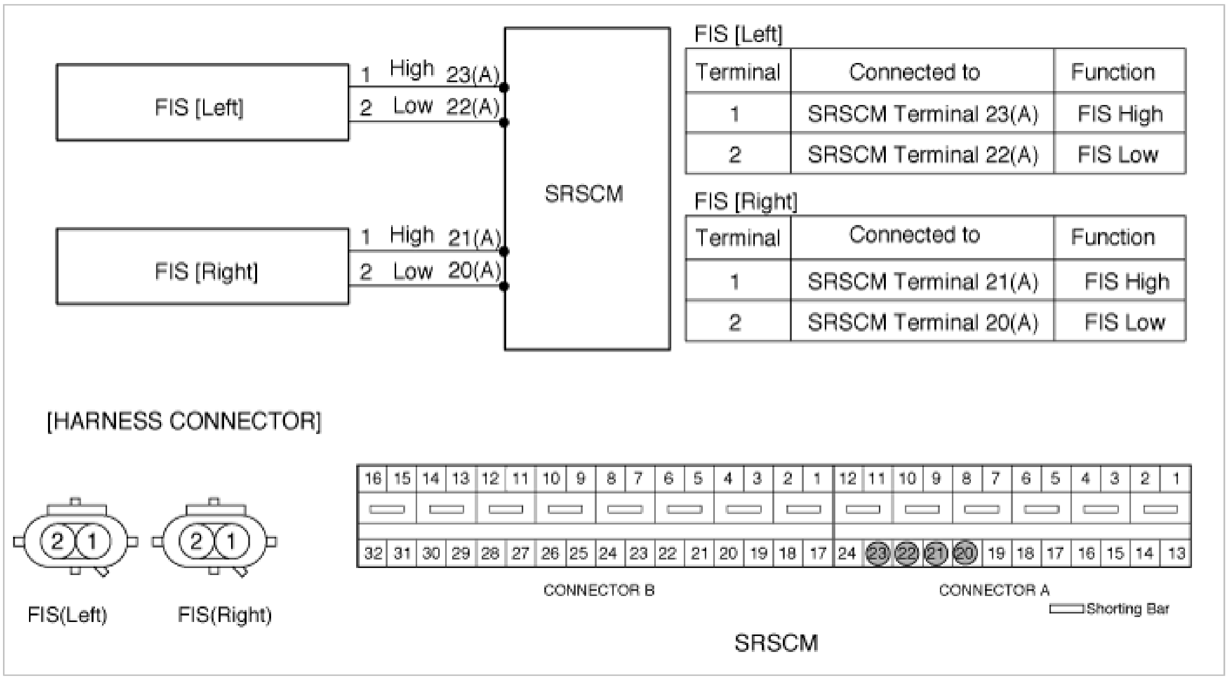
DTC Description

The detecting system for front crash consists of the SRSCM and two Front Impact Sensors (FIS). The SRSCM sets above DTC(s) if it detects that any FIS is defective or there is communication error between any FIS and the SRSCM.

DTC Detecting Condition

DTC	Condition	Probable cause
B1328 B1329 B1333 B1334	• Open between FIS and SRSCM • Front Impact Sensor(FIS) Malfunction • SRSCM Malfunction	• Wiring Harness • Front Impact Sensor(FIS) squib • SRSCM

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

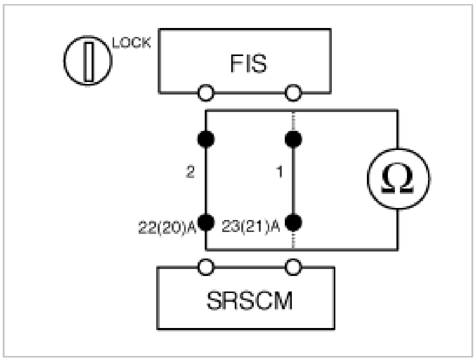
▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK FIS CIRCUIT
   (1) Disconnect the battery, wait 3 minutes.
   (2) Disconnect the FIS and SRSCM.
   (3) Measure the resistance between terminal 1 of the FIS harness connector and terminal A 23(21) of SRSCM harness connector.
   (4) Measure the resistance between terminal 2 of the FIS harness connector and terminal A 22(20) of SRSCM harness connector.

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

▸Check Front Impact Sensor.

NO

▸ Repair or replace the wiring harness between the FIS and the SRSCM.

3. CHECK FRONT IMPACT SENSOR
   (1) Replace the front impact sensor(FIS) with a new one.
   - Refer to "Front Impact Sensor(FIS)" section in this SERVICE MANUAL.

   (2) Install the DAB module and connect the DAB connector.

   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (4) Connect the SRSCM connector.

   (5) Connect the negative (-) terminal to the battery.

   (6) Connect a Hi-Scan(Pro) to the data link connector.

   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to FIS?

   YES

   ▸ Go to next step.

   NO

   ▸ Replace the Front Impact Sensor(FIS).

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.

   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (3) Connect the SRSCM connector.

   (4) Connect the negative (-) terminal to the battery.

   (5) Connect a Hi-Scan(Pro) to the data link connector.

   (6) Turn the ignition switch to ON .

   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

   (9) Turn the ignition switch to ON and wait for at least 30 seconds.

   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1329

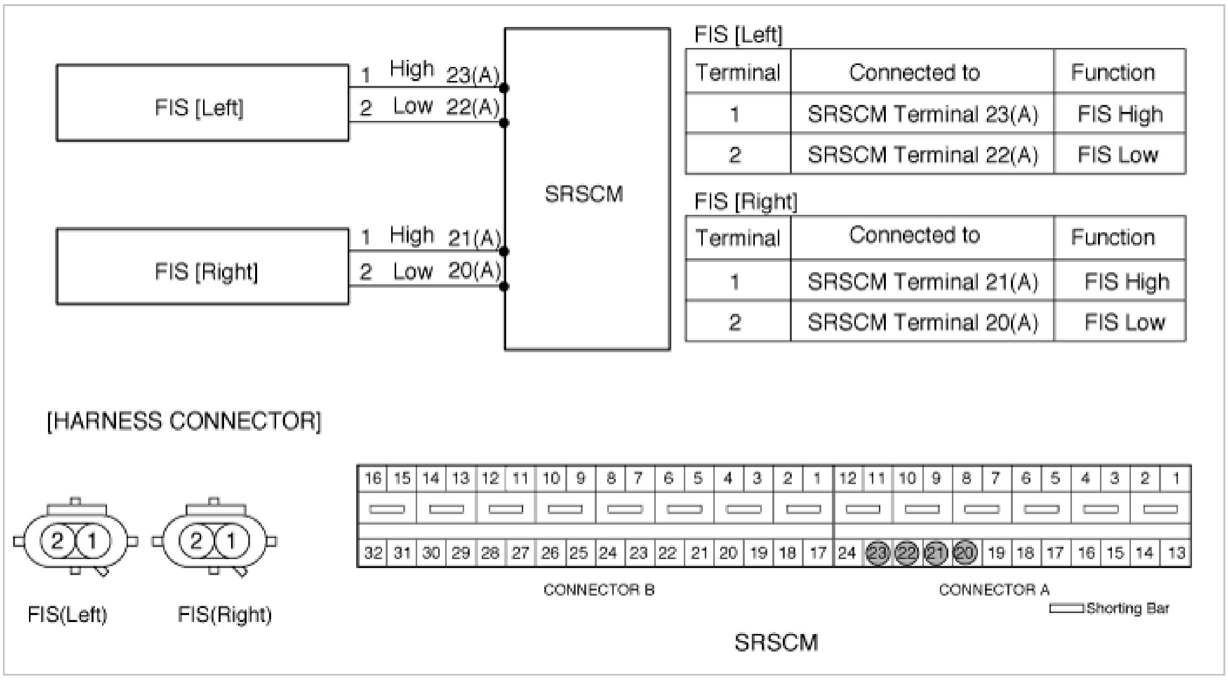
DTC Description

The detecting system for front crash consists of the SRSCM and two Front Impact Sensors (FIS). The SRSCM sets above DTC(s) if it detects that any FIS is defective or there is communication error between any FIS and the SRSCM.

DTC Detecting Condition

DTC	Condition	Probable cause
B1328 B1329 B1333 B1334	• Open between FIS and SRSCM • Front Impact Sensor(FIS) Malfunction • SRSCM Malfunction	• Wiring Harness • Front Impact Sensor(FIS) squib • SRSCM

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

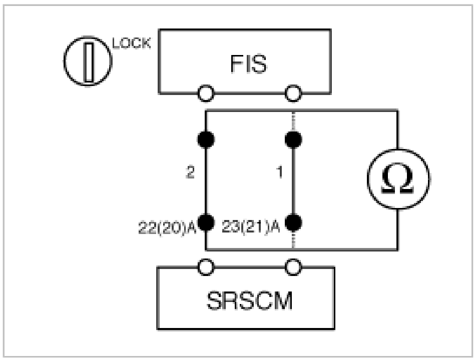
Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK FIS CIRCUIT
   (1) Disconnect the battery, wait 3 minutes.
   (2) Disconnect the FIS and SRSCM.

(3) Measure the resistance between terminal 1 of the FIS harness connector and terminal A 23(21) of SRSCM harness connector.

(4) Measure the resistance between terminal 2 of the FIS harness connector and terminal A 22(20) of SRSCM harness connector.

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

▸Check Front Impact Sensor.

NO

▸ Repair or replace the wiring harness between the FIS and the SRSCM.

3. CHECK FRONT IMPACT SENSOR

(1) Replace the front impact sensor(FIS) with a new one.

- Refer to "Front Impact Sensor(FIS)" section in this SERVICE MANUAL.

(2) Install the DAB module and connect the DAB connector.

(3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal to the battery.

(6) Connect a Hi-Scan(Pro) to the data link connector.

(7) Turn the ignition switch to ON and check the vehicle again.
Does Hi-Scan (Pro) indicate any DTC related to FIS?

YES

▸ Go to next step.

NO

▸ Replace the Front Impact Sensor(FIS).

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON .

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1333

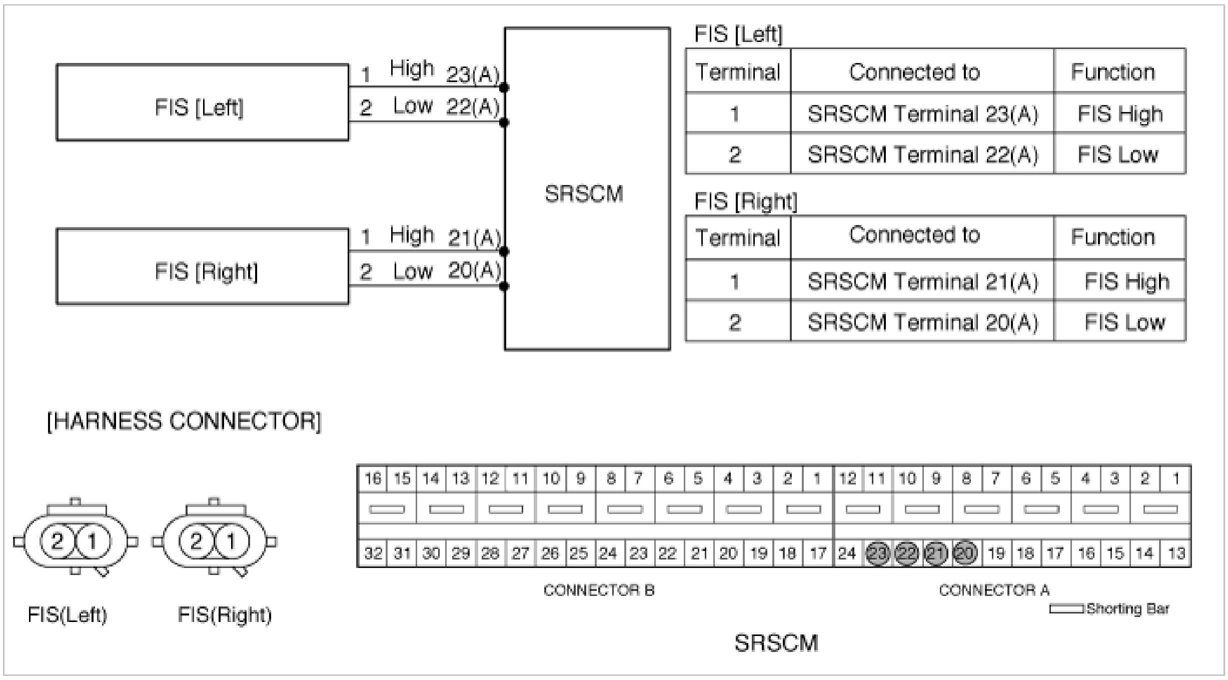
DTC Description

The detecting system for front crash consists of the SRSCM and two Front Impact Sensors (FIS). The SRSCM sets above DTC(s) if it detects that any FIS is defective or there is communication error between any FIS and the SRSCM.

DTC Detecting Condition

DTC	Condition	Probable cause
B1328 B1329 B1333 B1334	• Open between FIS and SRSCM • Front Impact Sensor(FIS) Malfunction • SRSCM Malfunction	• Wiring Harness • Front Impact Sensor(FIS) squib • SRSCM

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> CAUTION
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.

(3) Remove the DAB module and disconnect the DAB connector.

(4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

2. CHECK FIS CIRCUIT

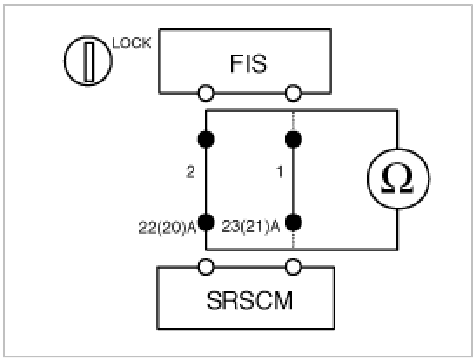
(1) Disconnect the battery, wait 3 minutes.

(2) Disconnect the FIS and SRSCM.

(3) Measure the resistance between terminal 1 of the FIS harness connector and terminal A 23(21) of SRSCM harness connector.

(4) Measure the resistance between terminal 2 of the FIS harness connector and terminal A 22(20) of SRSCM harness connector.

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

▸Check Front Impact Sensor.

NO

▸ Repair or replace the wiring harness between the FIS and the SRSCM.

3. CHECK FRONT IMPACT SENSOR

(1) Replace the front impact sensor(FIS) with a new one.

- Refer to "Front Impact Sensor(FIS)" section in this SERVICE MANUAL.

(2) Install the DAB module and connect the DAB connector.

(3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal to the battery.

(6) Connect a Hi-Scan(Pro) to the data link connector.

(7) Turn the ignition switch to ON and check the vehicle again.
Does Hi-Scan (Pro) indicate any DTC related to FIS?

YES

▸ Go to next step.

NO

▸ Replace the Front Impact Sensor(FIS).

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON .

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1334

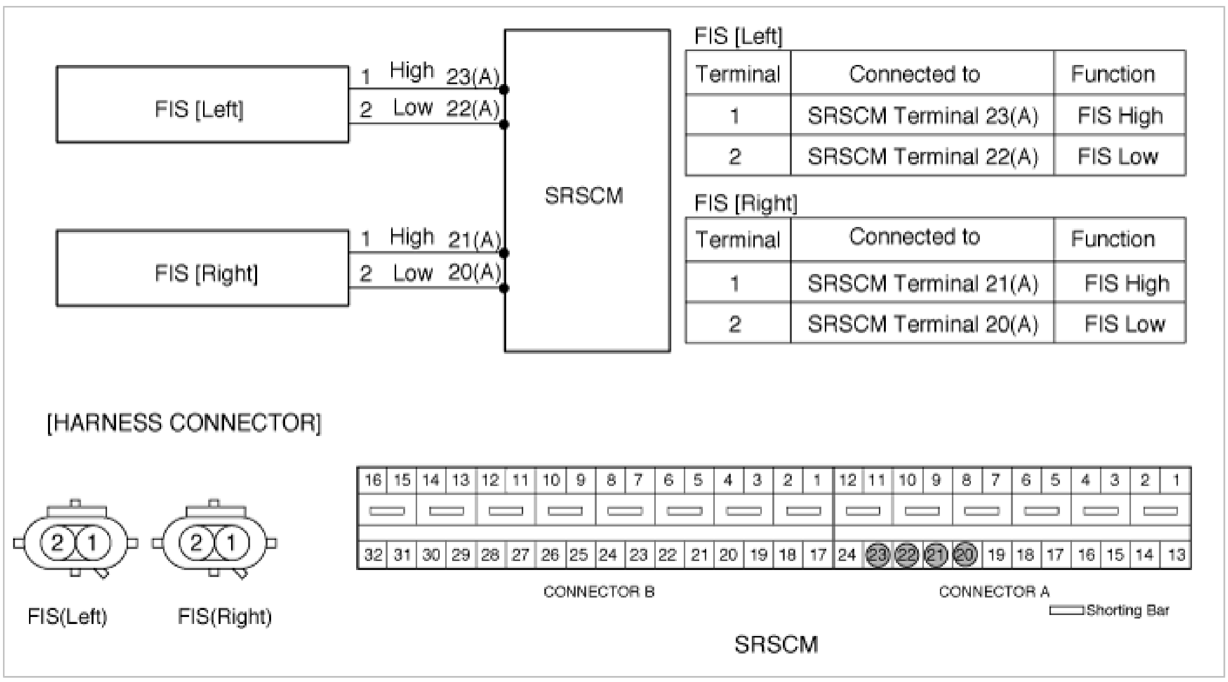
DTC Description

The detecting system for front crash consists of the SRSCM and two Front Impact Sensors (FIS). The SRSCM sets above DTC(s) if it detects that any FIS is defective or there is communication error between any FIS and the SRSCM.

DTC Detecting Condition

DTC	Condition	Probable cause
B1328 B1329 B1333 B1334	• Open between FIS and SRSCM • Front Impact Sensor(FIS) Malfunction • SRSCM Malfunction	• Wiring Harness • Front Impact Sensor(FIS) squib • SRSCM

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

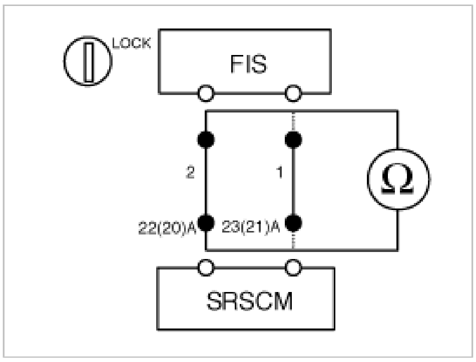
▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK FIS CIRCUIT
   (1) Disconnect the battery, wait 3 minutes.
   (2) Disconnect the FIS and SRSCM.
   (3) Measure the resistance between terminal 1 of the FIS harness connector and terminal A 23(21) of SRSCM harness connector.
   (4) Measure the resistance between terminal 2 of the FIS harness connector and terminal A 22(20) of SRSCM harness connector.

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

▸Check Front Impact Sensor.

NO

▸ Repair or replace the wiring harness between the FIS and the SRSCM.

3. CHECK FRONT IMPACT SENSOR
   (1) Replace the front impact sensor(FIS) with a new one.
   - Refer to "Front Impact Sensor(FIS)" section in this SERVICE MANUAL.
   (2) Install the DAB module and connect the DAB connector.
   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (4) Connect the SRSCM connector.
   (5) Connect the negative (-) terminal to the battery.
   (6) Connect a Hi-Scan(Pro) to the data link connector.
   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to FIS?

YES

▸ Go to next step.

NO

▸ Replace the Front Impact Sensor(FIS).

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON .

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1346

DTC Description

The Driver Airbag circuit consists of the SRSCM, Clockspring and the Driver Airbag (DAB) which has two squib circuits. The SRSCM sets above DTC(s) if it detects that the resistance of DAB squib is too high or low.

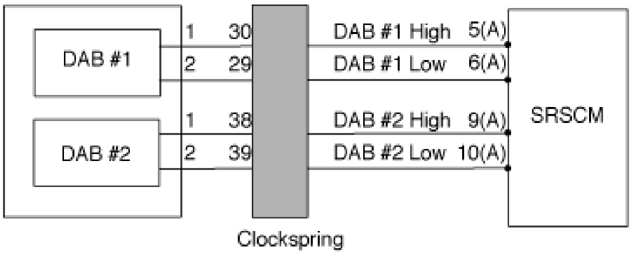
DTC Detecting Condition

DTC	Condition	Probable cause
B1346 B1347	• Too high or low resistance between DAB high(+) and DAB low (-) • Driver Airbag (DAB) Malfunction • Clockspring Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Driver Airbag (DAB) squib • Clockspring • SRSCM • Partially connected connector

Specification

DAB resistance : $1.9 \le R \le 3.0\ \Omega$

Schematic Diagram



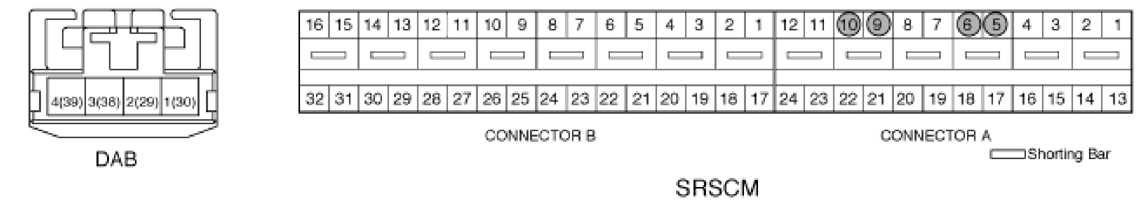
DAB #1

Pin	Connected to	Function
1	SRSCM terminal 5(A)	DAB #1 High
2	SRSCM terminal 6(A)	DAB #1 Low

DAB #2

Pin	Connected to	Function
1	SRSCM terminal 9(A)	DAB #2 High
2	SRSCM terminal 10(A)	DAB #2 Low

[HARNESS CONNECTOR]



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

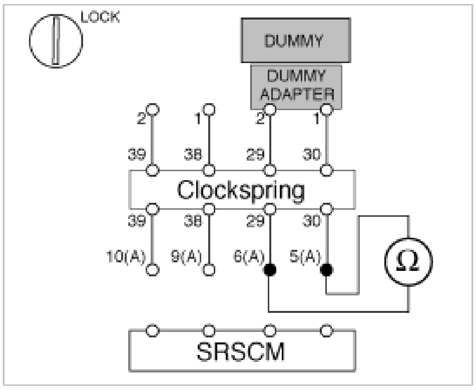
1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB,SAB,CAB,BPT,BUPT,FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK DAB RESISTANCE

> **CAUTION**
>
> Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

(1) Connect the Dummy and the Dummy Adapter on DAB harness connector.
●Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

(2) Measure resistance between the terminal 5 and 6 of SRSCM harness connector(A).

DAB resistance : $1.9 \le R \le 3.0\ \Omega$



(3) Is the measured resistance within specification?

NO

▸ Check open circuit.

YES

▸ Replace the Driver Airbag(DAB) module.

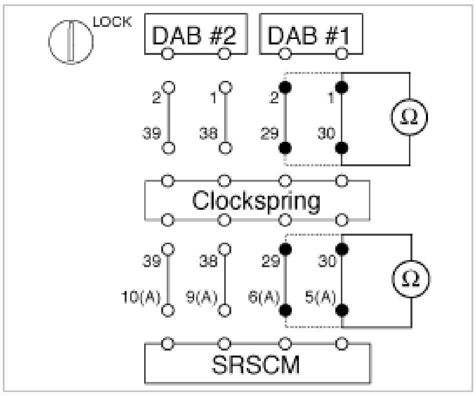
3. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 1 of DAB stage #1 harness connector and the terminal 30 of clockspring harness connector.

   (2) Measure resistance between the terminal 2 of DAB stage #1 harness connector and the terminal 29 of clockspring harness connector.

   (3) Measure resistance between the terminal 30 of clockspring harness connector and the terminal 5 of SRSCM harness connector(A).

   (4) Measure resistance between the terminal 29 of clockspring harness connector and the terminal 6 of SRSCM harness connector(A).

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

▸ Check short circuit.

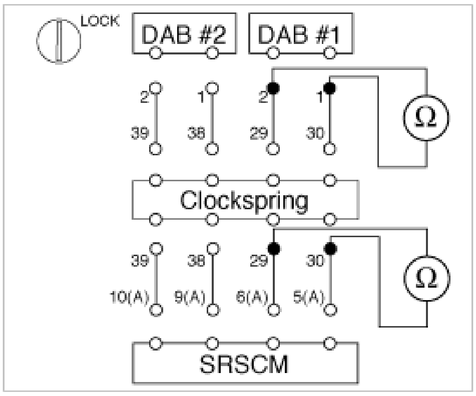
NO

▸ Repair or replace the wiring harness between the DAB and the clockspring or between the clockspring and the SRSCM.

4. CHECK SHORT CIRCUIT
   (1) Measure resistance between the terminal 1 and 2 of DAB stage #1 harness connector.

   (2) Measure resistance between the terminal 29 and 30 of clockspring harness connector.

specification(resistance) : ∞ Ω



Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair or replace the wiring harness between the DAB and the clockspring or between the clockspring and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON .
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1347

DTC Description

The Driver Airbag circuit consists of the SRSCM, Clockspring and the Driver Airbag (DAB) which has two squib circuits. The SRSCM sets above DTC(s) if it detects that the resistance of DAB squib is too high or low.

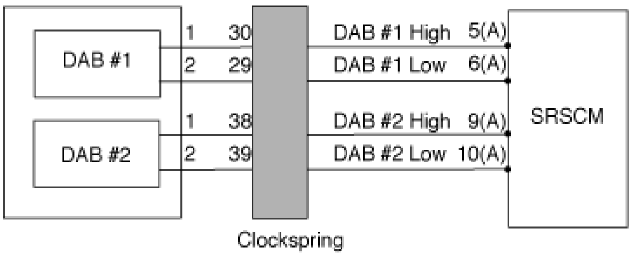
DTC Detecting Condition

DTC	Condition	Probable cause
B1346 B1347	• Too high or low resistance between DAB high(+) and DAB low (-) • Driver Airbag (DAB) Malfunction • Clockspring Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Driver Airbag (DAB) squib • Clockspring • SRSCM • Partially connected connector

Specification

DAB resistance : 1.9 ≤ R ≤ 3.0 Ω

Schematic Diagram



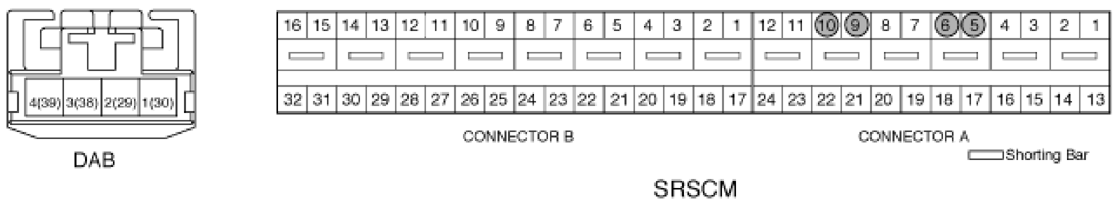
DAB #1

Pin	Connected to	Function
1	SRSCM terminal 5(A)	DAB #1 High
2	SRSCM terminal 6(A)	DAB #1 Low

DAB #2

Pin	Connected to	Function
1	SRSCM terminal 9(A)	DAB #2 High
2	SRSCM terminal 10(A)	DAB #2 Low

[HARNESS CONNECTOR]



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

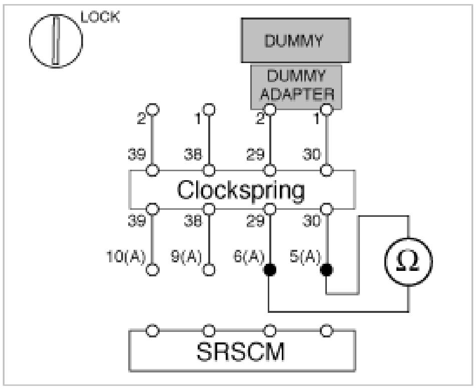
1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB,SAB,CAB,BPT,BUPT,FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK DAB RESISTANCE

> **CAUTION**
>
> Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

   (1) Connect the Dummy and the Dummy Adapter on DAB harness connector.
   ●Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.
   (2) Measure resistance between the terminal 5 and 6 of SRSCM harness connector(A).

DAB resistance : 1.9 ≤ R ≤ 3.0 Ω



(3) Is the measured resistance within specification?

NO

▸ Check open circuit.

YES

▸ Replace the Driver Airbag(DAB) module.

3. CHECK OPEN CIRCUIT

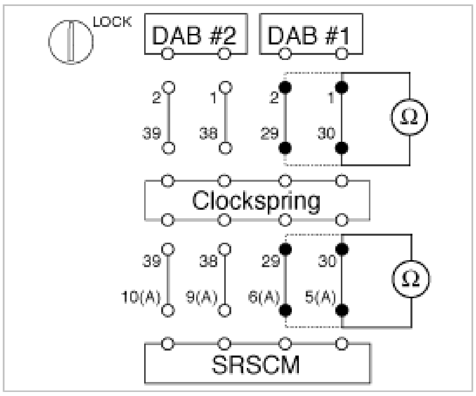
(1) Measure resistance between the terminal 1 of DAB stage #1 harness connector and the terminal 30 of clockspring harness connector.

(2) Measure resistance between the terminal 2 of DAB stage #1 harness connector and the terminal 29 of clockspring harness connector.

(3) Measure resistance between the terminal 30 of clockspring harness connector and the terminal 5 of SRSCM harness connector(A).

(4) Measure resistance between the terminal 29 of clockspring harness connector and the terminal 6 of SRSCM harness connector(A).

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

▸ Check short circuit.

NO

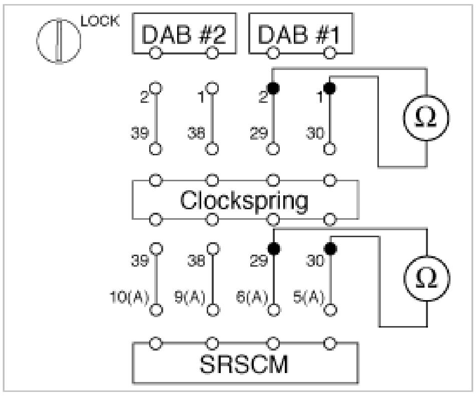
▸ Repair or replace the wiring harness between the DAB and the clockspring or between the clockspring and the SRSCM.

4. CHECK SHORT CIRCUIT

(1) Measure resistance between the terminal 1 and 2 of DAB stage #1 harness connector.

(2) Measure resistance between the terminal 29 and 30 of clockspring harness connector.

specification(resistance) : ∞ Ω



Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair or replace the wiring harness between the DAB and the clockspring or between the clockspring and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON .
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1348

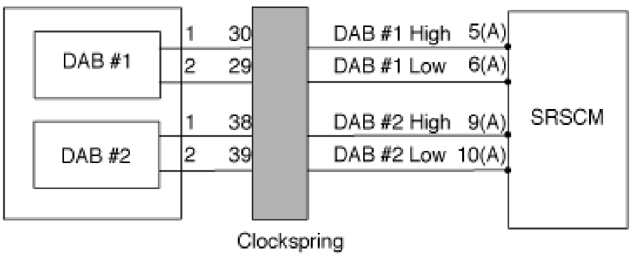
DTC Description

The Driver Airbag circuit consists of the SRSCM, Clockspring and the Driver Airbag (DAB) which has two squib circuits. The SRSCM sets above DTC(s) if it detects short to ground on the DAB circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1348 B1483	• Short to ground between DAB and clockspring • Short to ground between clockspring and SRSCM • Driver Airbag (DAB) Malfunction • Clockspring Malfunction • SRSCM Malfunction	• Short to ground circuit on wiring harness • Driver Airbag (DAB) squib • Clockspring • SRSCM

Schematic Diagram

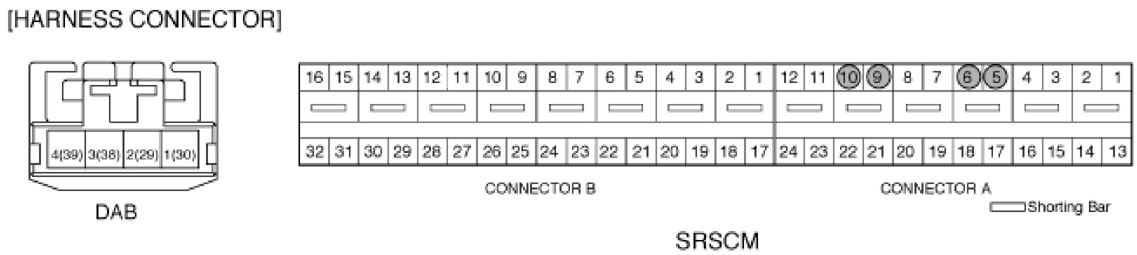


DAB #1

Pin	Connected to	Function
1	SRSCM terminal 5(A)	DAB #1 High
2	SRSCM terminal 6(A)	DAB #1 Low

DAB #2

Pin	Connected to	Function
1	SRSCM terminal 9(A)	DAB #2 High
2	SRSCM terminal 10(A)	DAB #2 Low



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

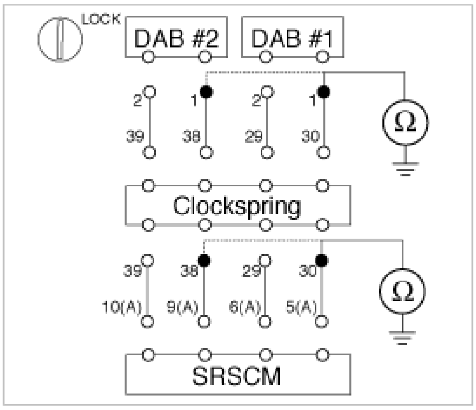
YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SHORT TO GROUND
   (1) Measure resistance between the terminal 1 of DAB stage #1 harness connector and chassis ground.(DAB stage #1)
   (2) Measure resistance between the terminal 1 of DAB stage #2 harness connector and chassis ground.(DAB stage #2)
   (3) Measure resistance between the terminal 30 of clockspring harness connector and chassis ground.(DAB stage #1)
   (4) Measure resistance between the terminal 38 of clockspring harness connector and chassis ground.(DAB stage #2)

specification(resistance) : infinite



(5) Is the measured resistance within specification?

YES

▸Check the DAB Module.

NO

▸ Repair or replace the wiring harness between the DAB and the clockspring or between the clockspring and the SRSCM.

3. CHECK THE DAB MODULE
   (1) Replace the Driver Airbag(DAB) with a new one.
   - Refer to "Driver Airbag(DAB)" section in this SERVICE MANUAL.

   (2) Install the DAB module and connect the DAB connector.

   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (4) Connect the SRSCM connector.

   (5) Connect the negative (-) terminal to the battery.

   (6) Connect a Hi-Scan(Pro) to the data link connector.

   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to DAB?

YES

▸Check the clockspring.

NO

▸Replace the Driver Airbag(DAB).

4. CHECK THE CLOCKSPRING
   (1) Check the clockspring.
   Is the clockspring normal?

YES

▸ Go to next step.

NO

▸ Replace the clockspring.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.

   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (3) Connect the SRSCM connector.

   (4) Connect the negative (-) terminal to the battery.

   (5) Connect a Hi-Scan(Pro) to the data link connector.

   (6) Turn the ignition switch to ON

   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

   (9) Turn the ignition switch to ON and wait for at least 30 seconds.

   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1349

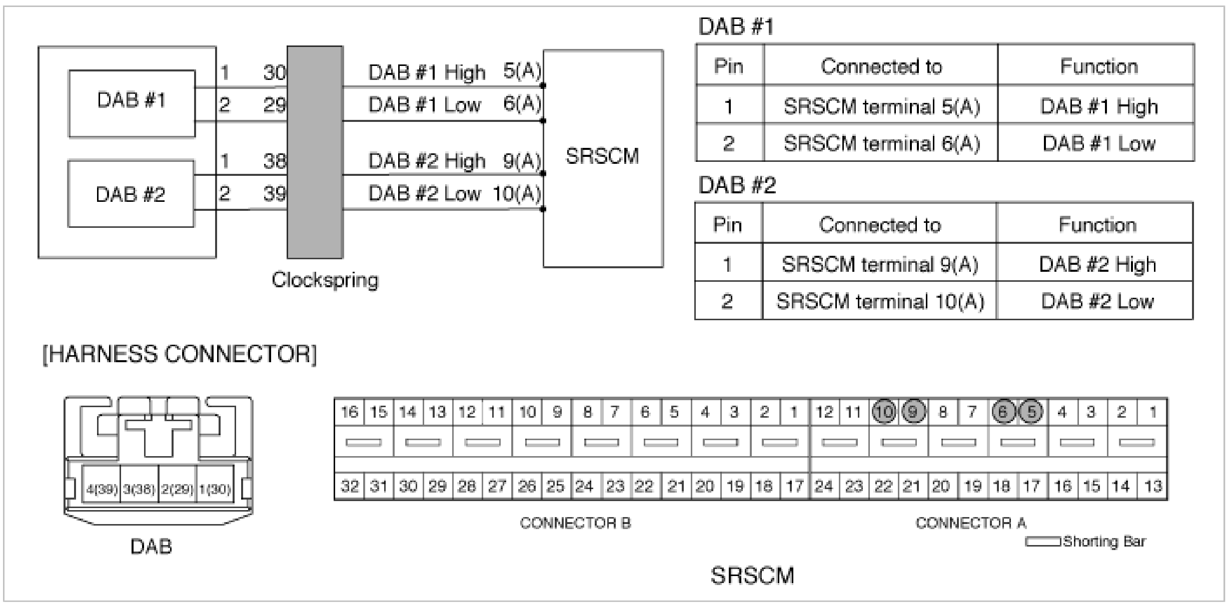
DTC Description

The Driver Airbag circuit consists of the SRSCM, Clockspring and the Driver Airbag (DAB) which has two squib circuits. The SRSCM sets above DTC(s) if it detects short to battery line on the DAB circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1349 B1484	• Short to battery line between DAB and clockspring • Short to battery line between clockspring and SRSCM • Driver Airbag (DAB) Malfunction • Clockspring Malfunction • SRSCM Malfunction	• Short to battery line on wiring harness • Driver Airbag (DAB) squib • Clockspring • SRSCM

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.

(3) Remove the DAB module and disconnect the DAB connector.

(4) Disconnect the connectors of the PAB,SAB,CAB,BPT,BUPT,FIS and SIS.

(5) Disconnect the SRSCM connector.

2. CHECK SHORT TO BATTERY LINE

(1) Connect the negative (-) terminal to the battery.

(2) Turn the ignition switch to ON.

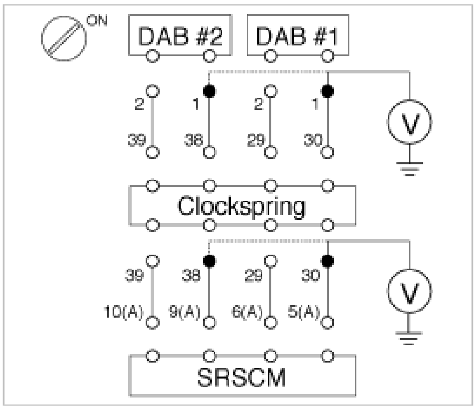
(3) Measure voltage between the terminal 1 of DAB stage #1 harness connector and chassis ground(-).(DAB stage #1)

(4) Measure voltage between the terminal 1 of DAB stage #2 harness connector and chassis ground(-).(DAB stage #2)

(5) Measure voltage between the terminal 30 of clockspring harness connector and chassis ground(-).(DAB stage #1)

(6) Measure voltage between the terminal 38 of clockspring harness connector and chassis ground(-).(DAB stage #2)

specification(voltage) : Approximately 0 V



Is the measured voltage within specification?

YES

▸Check the DAB module.

NO

▸ Repair or replace the wiring harness between the DAB and the clockspring or between the clockspring and the SRSCM.

3. CHECK THE DAB MODULE

(1) Replace the Driver Airbag(DAB) with a new one.

● "Refer to "Driver Airbag(DAB)" section in this SERVICE MANUAL.

(2) Install the DAB module and connect the DAB connector.

(3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal to the battery.

(6) Connect a Hi-Scan(Pro) to the data link connector.

(7) Turn the ignition switch to ON and check the vehicle again.

Does Hi-Scan (Pro) indicate any DTC related to DAB?

YES

▸Check the clockspring.

NO

▸Replace the Driver Airbag(DAB).

4. CHECK THE CLOCKSPRING

(1) Check the clockspring.

Is the clockspring normal?

YES

▸ Go to next step.

NO

▸ Replace the clockspring.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON.

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).

Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1352

DTC Description

The Passenger Airbag circuit consists of the SRSCM and the Passenger Airbag (PAB) which has two squib circuits. The SRSCM sets above DTC(s) if it detects that the resistance of PAB squib is too high or low.

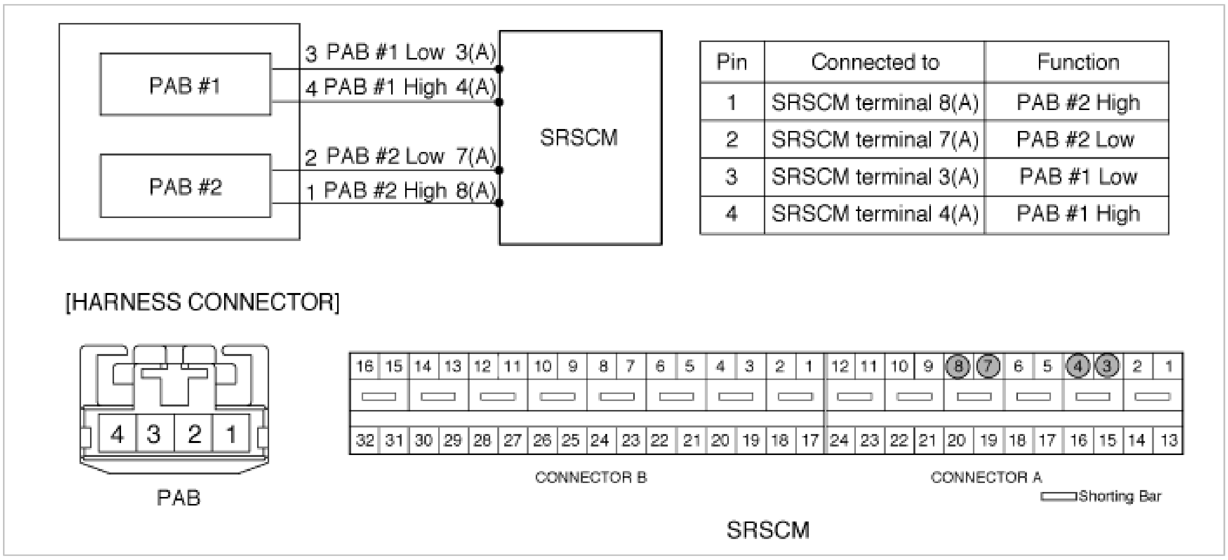
DTC Detecting Condition

DTC	Condition	Probable cause
B1352 B1353	• Too high or low resistance between PAB high(+) and PAB low (-) • Passenger Airbag (PAB) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Passenger Airbag (PAB) squib • SRSCM • Partially connected connector

Specification

PAB resistance : $1.8 \le R \le 2.4\ \Omega$

Schematic Diagram



Pin	Connected to	Function
1	SRSCM terminal 8(A)	PAB #2 High
2	SRSCM terminal 7(A)	PAB #2 Low
3	SRSCM terminal 3(A)	PAB #1 Low
4	SRSCM terminal 4(A)	PAB #1 High

Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

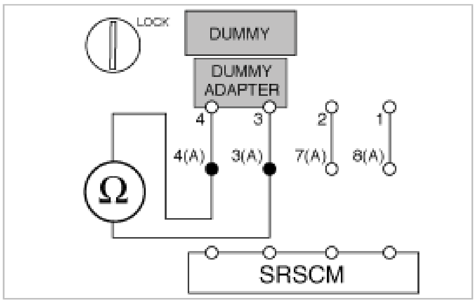
1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK PAB RESISTANCE

> **CAUTION**
>
> Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

   (1) Connect the Dummy and the Dummy Adapter on PAB harness connector.
   - Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

   (2) Measure resistance between the terminal 4 and 3 of SRSCM harness connector(A).

PAB resistance : $1.8 \le R \le 2.4\ \Omega$



(3) Is the measured resistance within specification?

YES

▶ Replace the Passenger Airbag(PAB) module.

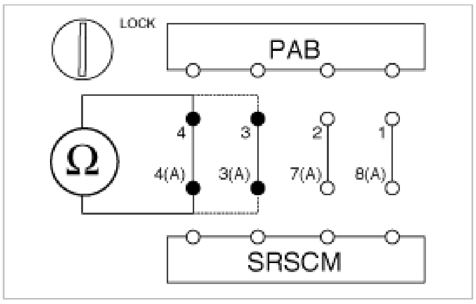
NO

▶ Check open circuit.

3. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 4 of PAB harness connector and the terminal 4 of SRSCM harness connector(A).

   (2) Measure resistance between the terminal 3 of PAB harness connector and the terminal 3 of SRSCM harness connector(A).

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

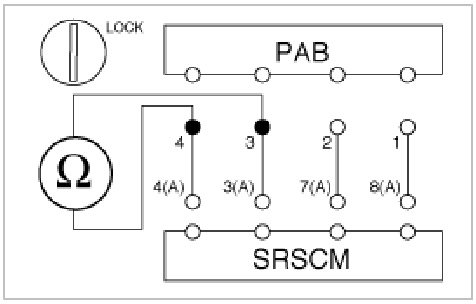
▶Check short circuit.

NO

▶Repair or replace the wiring harness between the PAB and the SRSCM.

4. CHECK SHORT CIRCUIT
   (1) Measure resistance between the terminal 4 and 3 of PAB harness connector.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▶ Go to next step.

NO

▶ Repair or replace the wiring harness between the PAB and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.

   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON.

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1353

DTC Description

The Passenger Airbag circuit consists of the SRSCM and the Passenger Airbag (PAB) which has two squib circuits. The SRSCM sets above DTC(s) if it detects that the resistance of PAB squib is too high or low.

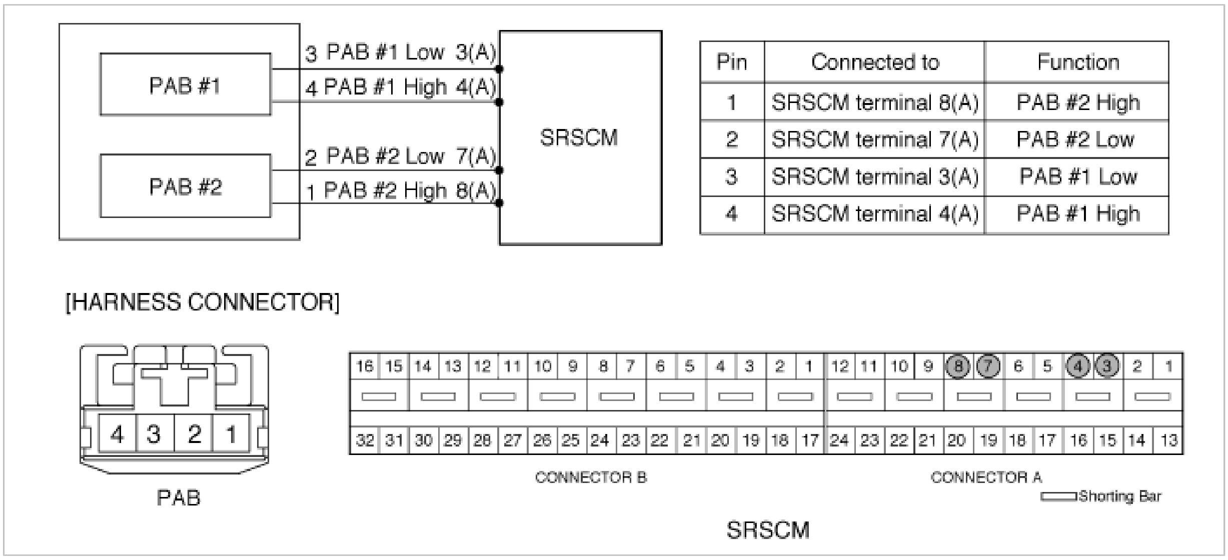
DTC Detecting Condition

DTC	Condition	Probable cause
B1352 B1353	• Too high or low resistance between PAB high(+) and PAB low (-) • Passenger Airbag (PAB) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Passenger Airbag (PAB) squib • SRSCM • Partially connected connector

Specification

PAB resistance : $1.8 \le R \le 2.4\ \Omega$

Schematic Diagram



Pin	Connected to	Function
1	SRSCM terminal 8(A)	PAB #2 High
2	SRSCM terminal 7(A)	PAB #2 Low
3	SRSCM terminal 3(A)	PAB #1 Low
4	SRSCM terminal 4(A)	PAB #1 High

Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

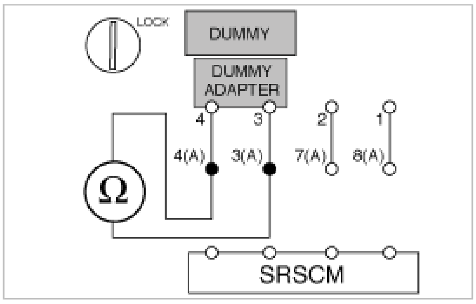
1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK PAB RESISTANCE

> **CAUTION**
>
> Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

   (1) Connect the Dummy and the Dummy Adapter on PAB harness connector.
   - Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

   (2) Measure resistance between the terminal 4 and 3 of SRSCM harness connector(A).

PAB resistance : $1.8 \leq R \leq 2.4\ \Omega$



(3) Is the measured resistance within specification?

YES

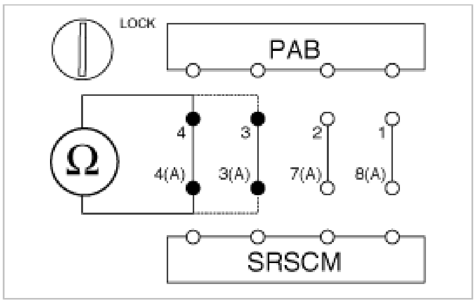
▸ Replace the Passenger Airbag(PAB) module.

NO

▸ Check open circuit.

3. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 4 of PAB harness connector and the terminal 4 of SRSCM harness connector(A).
   (2) Measure resistance between the terminal 3 of PAB harness connector and the terminal 3 of SRSCM harness connector(A).

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

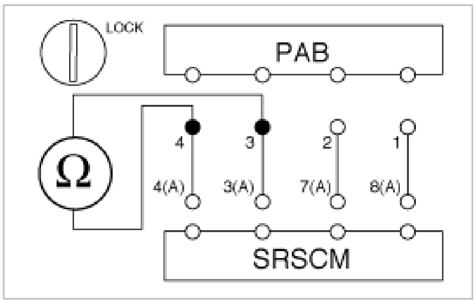
▸Check short circuit.

NO

▸Repair or replace the wiring harness between the PAB and the SRSCM.

4. CHECK SHORT CIRCUIT
   (1) Measure resistance between the terminal 4 and 3 of PAB harness connector.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair or replace the wiring harness between the PAB and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON.

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1354

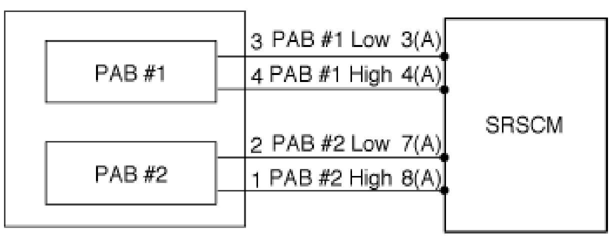
DTC Description

The Passenger Airbag circuit consists of the SRSCM and the Passenger Airbag (PAB) which has two squib circuits. The SRSCM sets above DTC(s) if it detects short to ground on the PAB circuit.

DTC Detecting Condition

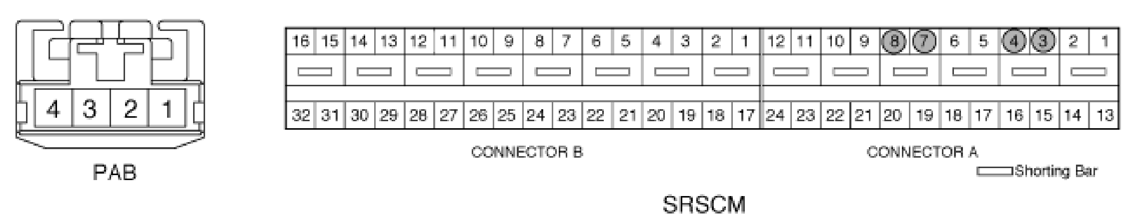
DTC	Condition	Probable cause
B1354 B1487	• Short to ground between PAB module and SRSCM • Passenger Airbag (PAB) Malfunction • SRSCM Malfunction	• Short to ground on wiring harness • Passenger Airbag (PAB) squib • SRSCM

Schematic Diagram



Pin	Connected to	Function
1	SRSCM terminal 8(A)	PAB #2 High
2	SRSCM terminal 7(A)	PAB #2 Low
3	SRSCM terminal 3(A)	PAB #1 Low
4	SRSCM terminal 4(A)	PAB #1 High

[HARNESS CONNECTOR]



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

CAUTION

Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

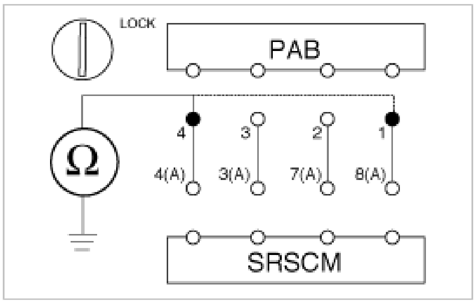
▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK SHORT TO GROUND
   (1) Measure resistance between the terminal 4 of PAB harness connector and chassis ground.(PAB stage #1)
   (2) Measure resistance between the terminal 1 of PAB harness connector and chassis ground.(PAB stage #2)

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸ Check the PAB Module.

NO

▸ Repair or replace the wiring harness between the PAB and the SRSCM.

3. CHECK THE PAB MODULE
   (1) Replace the Passenger Airbag (PAB) with a new one.
   - Refer to "Passenger Airbag (PAB)" section in this SERVICE MANUAL.
   (2) Install the DAB module and connect the DAB connector.
   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (4) Connect the SRSCM connector.
   (5) Connect the negative (-) terminal to the battery.
   (6) Connect a Hi-Scan(Pro) to the data link connector.
   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to PAB?

YES

▸ Go to next step.

NO

▸Replace PAB module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON .

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1355

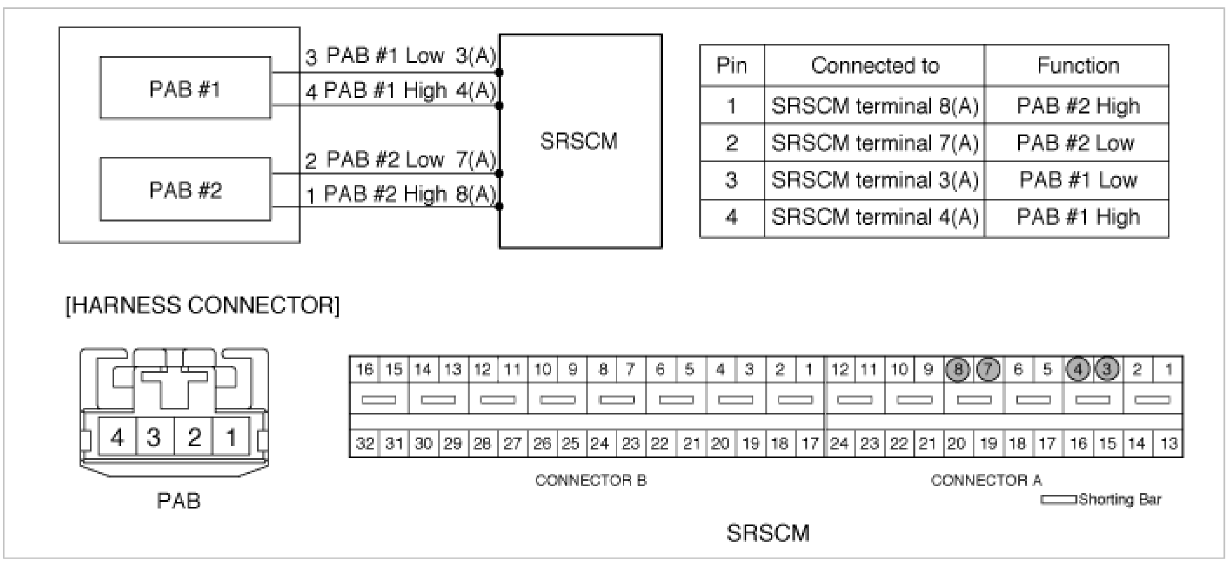
DTC Description

The Passenger Airbag circuit consists of the SRSCM and the Passenger Airbag (PAB) which has two squib circuits.The SRSCM sets above DTC(s) if it detects short to battery line on the PAB circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1355 B1488	• Short to battery line between PAB and SRSCM • Passenger Airbag (PAB) Malfunction • SRSCM Malfunction	• Short to battery line circuit on wiring harness • Passenger Airbag (PAB) squib • SRSCM

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

CAUTION

Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

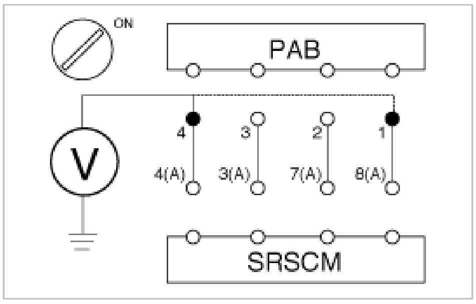
▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK SHORT TO BATTERY LINE
   (1) Connect the negative (-) terminal to the battery.
   (2) Turn the ignition switch to ON.
   (3) Measure voltage between the terminal 4 of PAB harness connector and chassis ground(-).(PAB stage #1)
   (4) Measure voltage between the terminal 1 of PAB harness connector and chassis ground(-).(PAB stage #2)

specification(voltage) : Approximately 0 V



Is the measured voltage within specification?

YES

▸ Check the PAB Module.

NO

▸ Repair the short to battery line circuit on wiring harness between the PAB and the SRSCM.

3. CHECK THE PAB MODULE
   (1) Replace the Passenger Airbag(PAB) with a new one.
   - Refer to "Passenger Airbag(PAB)" section in this SERVICE MANUAL.
   (2) Install the DAB module and connect the DAB connector.
   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (4) Connect the SRSCM connector.
   (5) Connect the negative (-) terminal to the battery.
   (6) Connect a Hi-Scan(Pro) to the data link connector.
   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to PAB?

YES

▸ Go to next step.

NO

▸Replace PAB module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON.

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1361

DTC Description

The Seat Belt Pretensioner circuit consists of the SRSCM and two Seat Belt Pretensioner (BPT).
The SRSCM sets above DTC(s) if it detects that the resistance of BPT squib is too high or low.

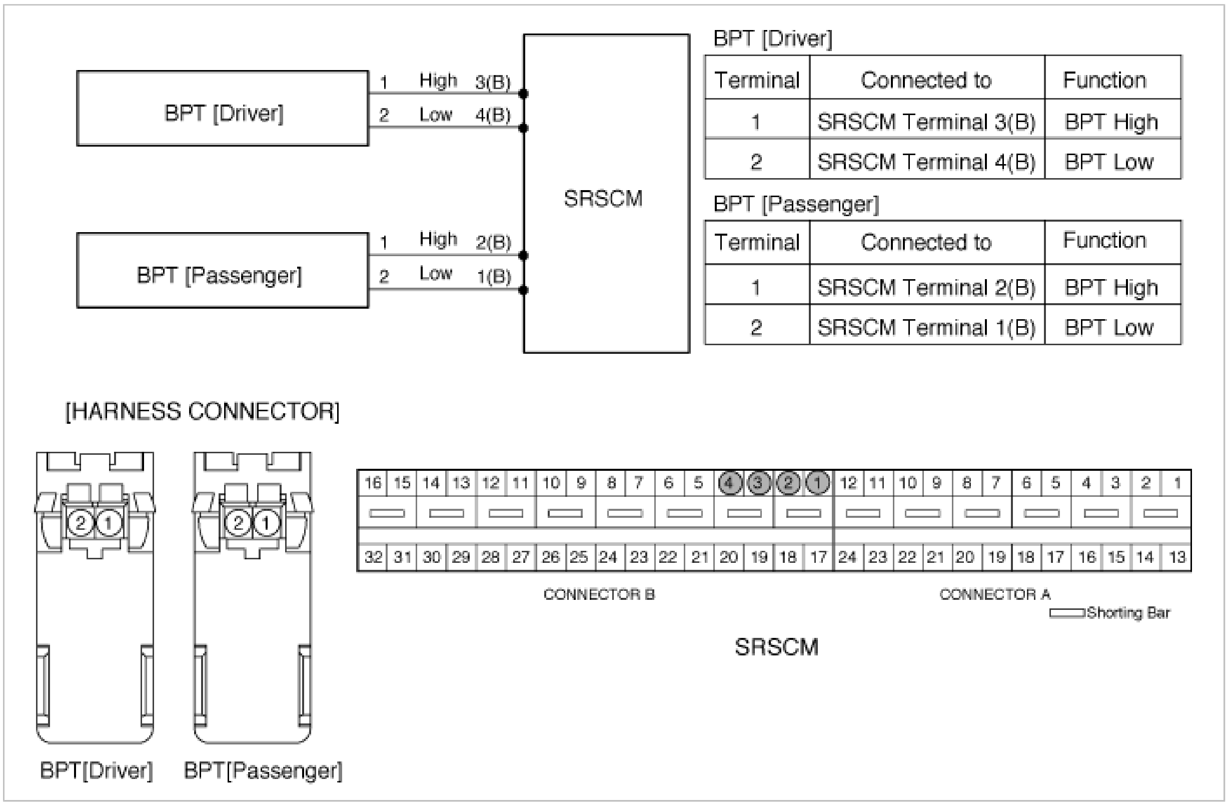
DTC Detecting Condition

DTC	Condition	Probable cause
B1361 B1362 B1367 B1368	• Too high or low resistance between BPT high(+) and BPT low (-) • Seat Belt Pretensioner (BPT) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Seat Belt Pretensioner (BPT) squib • SRSCM

Specification

BPT resistance : 1.9 ≤ R ≤2.8 Ω

Schematic Diagram



BPT [Driver]

Terminal	Connected to	Function
1	SRSCM Terminal 3(B)	BPT High
2	SRSCM Terminal 4(B)	BPT Low

BPT [Passenger]

Terminal	Connected to	Function
1	SRSCM Terminal 2(B)	BPT High
2	SRSCM Terminal 1(B)	BPT Low

Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

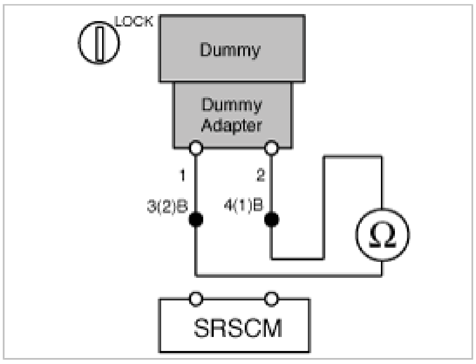
1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK BPT RESISTANCE

> **CAUTION**
>
> Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

   (1) Connect the Dummy and the Dummy Adapter on BPT harness connector.
   - Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

   (2) Measure resistance between the terminal 3(2) and 4(1) of SRSCM harness connector(B).

BPT resistance : $1.9 \le R \le 2.8\ \Omega$



Is the measured resistance within specification?

YES

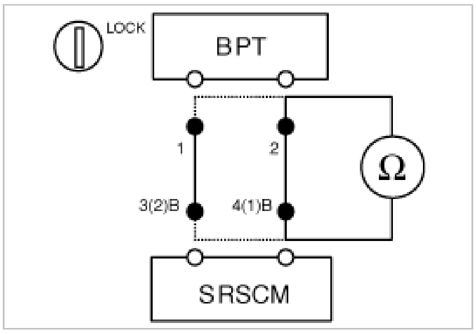
▸ Replace the Seat Belt Pretensioner(BPT) module.

NO

▸Check open circuit.

3. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 1 of BPT harness connector and the terminal 3(2) of SRSCM harness connector (B).
   (2) Measure resistance between the terminal 2 of BPT harness connector and the terminal 4(1) of SRSCM harness connector (B).

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

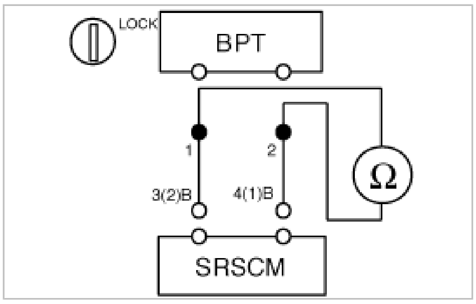
▸ Check short circuit.

NO

▸ Repair or replace the wiring harness between the BPT and the SRSCM.

4. CHECK SHORT CIRCUIT
   (1) Measure resistance between the terminal 1 and 2 of BPT harness connector.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair or replace the wiring harness between the BPT and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON.
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1362

DTC Description

The Seat Belt Pretensioner circuit consists of the SRSCM and two Seat Belt Pretensioner (BPT).
The SRSCM sets above DTC(s) if it detects that the resistance of BPT squib is too high or low.

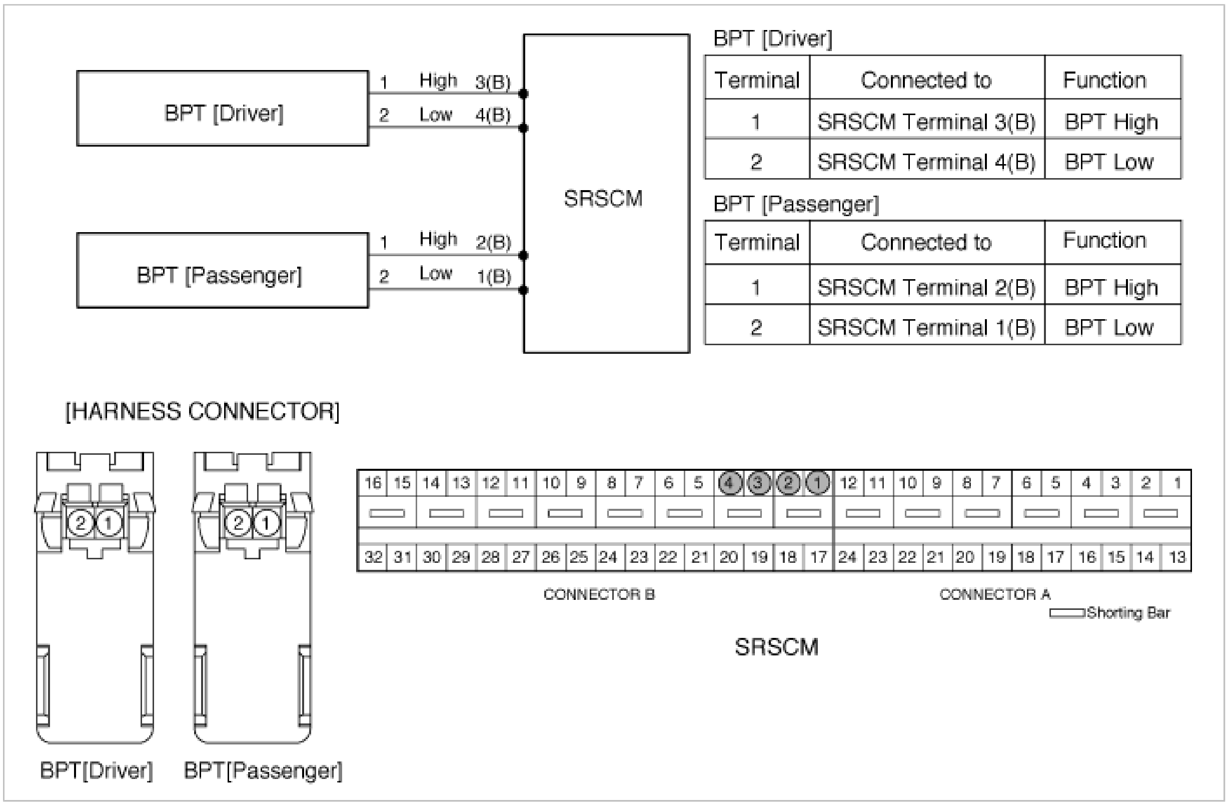
DTC Detecting Condition

DTC	Condition	Probable cause
B1361 B1362 B1367 B1368	• Too high or low resistance between BPT high(+) and BPT low (-) • Seat Belt Pretensioner (BPT) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Seat Belt Pretensioner (BPT) squib • SRSCM

Specification

BPT resistance : 1.9 ≤ R ≤2.8 Ω

Schematic Diagram



BPT [Driver]

Terminal	Connected to	Function
1	SRSCM Terminal 3(B)	BPT High
2	SRSCM Terminal 4(B)	BPT Low

BPT [Passenger]

Terminal	Connected to	Function
1	SRSCM Terminal 2(B)	BPT High
2	SRSCM Terminal 1(B)	BPT Low

Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

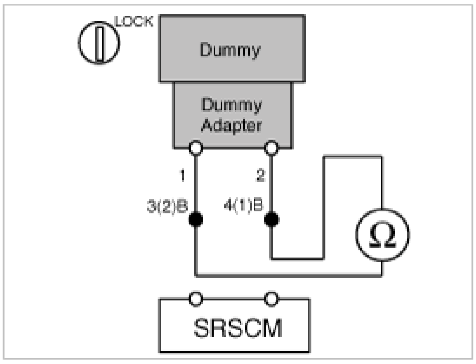
1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK BPT RESISTANCE

> **CAUTION**
>
> Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

(1) Connect the Dummy and the Dummy Adapter on BPT harness connector.
- Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

(2) Measure resistance between the terminal 3(2) and 4(1) of SRSCM harness connector(B).

BPT resistance : $1.9 \le R \le 2.8\ \Omega$



Is the measured resistance within specification?

YES

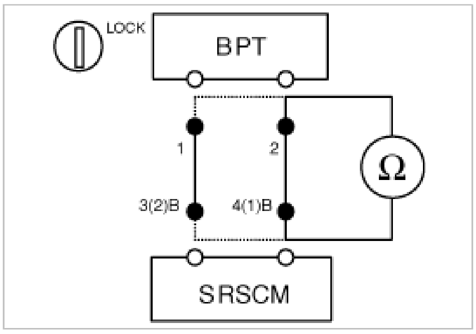
▸ Replace the Seat Belt Pretensioner(BPT) module.

NO

▸Check open circuit.

3. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 1 of BPT harness connector and the terminal 3(2) of SRSCM harness connector (B).
   (2) Measure resistance between the terminal 2 of BPT harness connector and the terminal 4(1) of SRSCM harness connector (B).

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

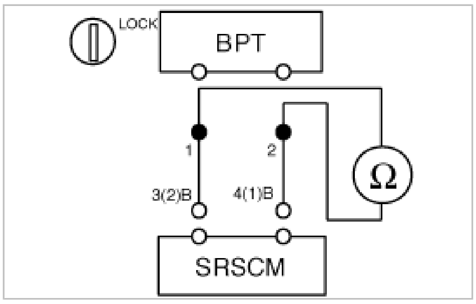
▸ Check short circuit.

NO

▸ Repair or replace the wiring harness between the BPT and the SRSCM.

4. CHECK SHORT CIRCUIT
   (1) Measure resistance between the terminal 1 and 2 of BPT harness connector.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair or replace the wiring harness between the BPT and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON.
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1363

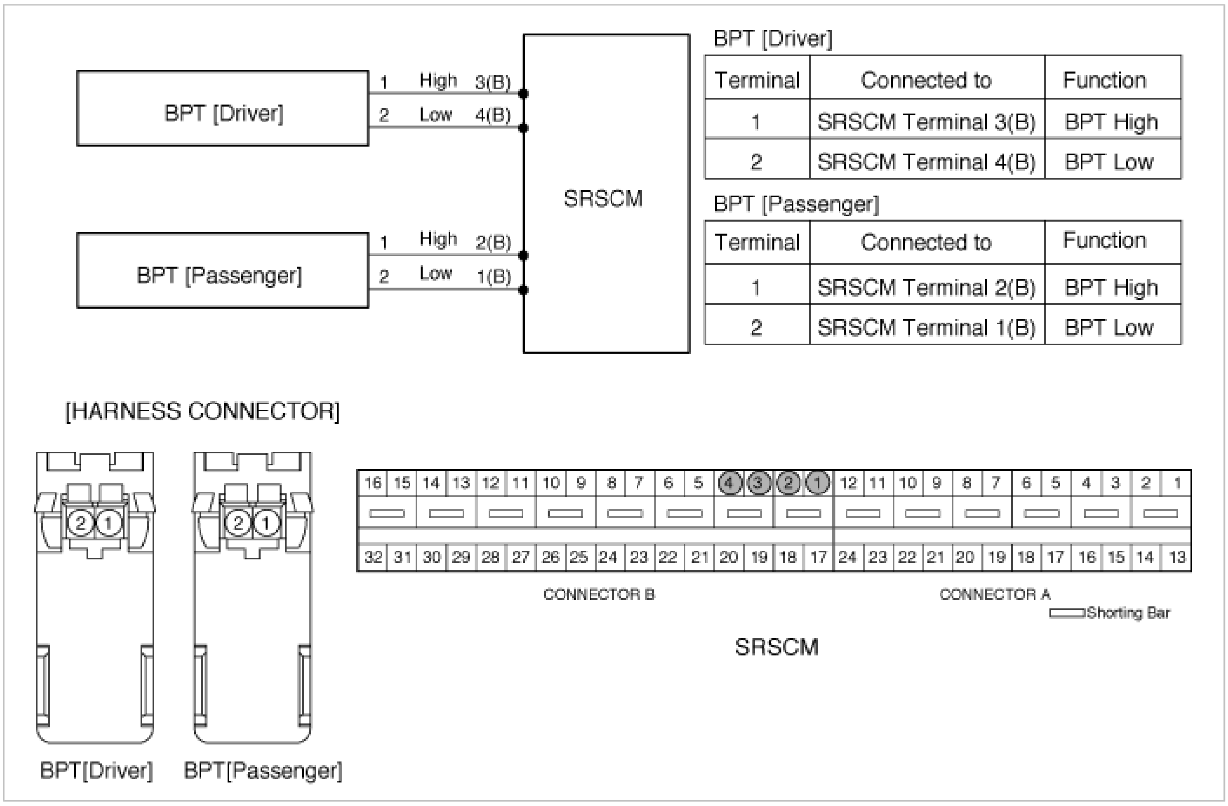
DTC Description

The Seat Belt Pretensioner consists of the SRSCM and two Seat Belt Pretensioner (BPT).The SRSCM sets above DTC(s) if it detects short to ground on the BPT circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1363 B1369	• Short to ground between BPT and SRSCM • Seat Belt Pretensioner (BPT) Malfunction • SRSCM Malfunction	• Short to ground circuit on wiring harness • Seat Belt Pretensioner (BPT) squib • SRSCM

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

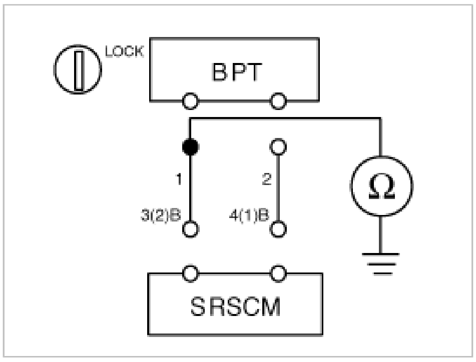
YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SHORT TO GROUND
   (1) Measure resistance between the terminal 1 of BPT harness connector and chassis ground.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸Check the BPT Module.

NO

▸ Repair or replace the wiring harness between the BPT and the SRSCM.

3. CHECK THE BPT MODULE
   (1) Replace the Belt Pretensioner (BPT) with a new one.
   - Refer to "Belt Pretensioner (BPT)" section in this SERVICE MANUAL.

   (2) Install the DAB module and connect the DAB connector.

   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (4) Connect the SRSCM connector.

   (5) Connect the negative (-) terminal to the battery.

   (6) Connect a Hi-Scan(Pro) to the data link connector.

   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to Belt Pretensioner (BPT)?

   YES

   ▸Go to next step.

   NO

   ▸Replace BPT module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.

   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (3) Connect the SRSCM connector.

   (4) Connect the negative (-) terminal to the battery.

   (5) Connect a Hi-Scan(Pro) to the data link connector.

   (6) Turn the ignition switch to ON.

   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

   (9) Turn the ignition switch to ON and wait for at least 30 seconds.

   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1364

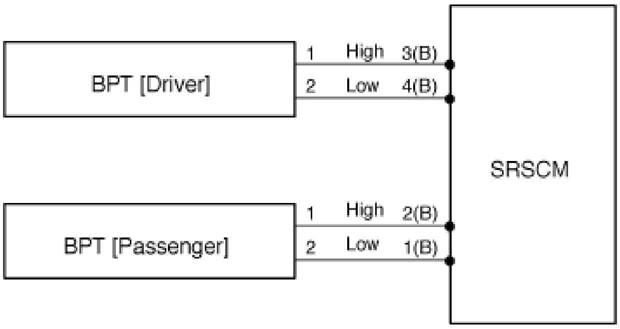
DTC Description

The Seat Belt Pretensioner consists of the SRSCM and two Seat Belt Pretensioner (BPT). The SRSCM sets above DTC(s) if it detects short to battery line on the BPT circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1364 B1370	• Short to battery line between BPT and SRSCM • Seat Belt Pretensioner (BPT) Malfunction • SRSCM Malfunction	• Short to battery line circuit on wiring harness • Seat Belt Pretensioner (BPT) squib • SRSCM

Schematic Diagram



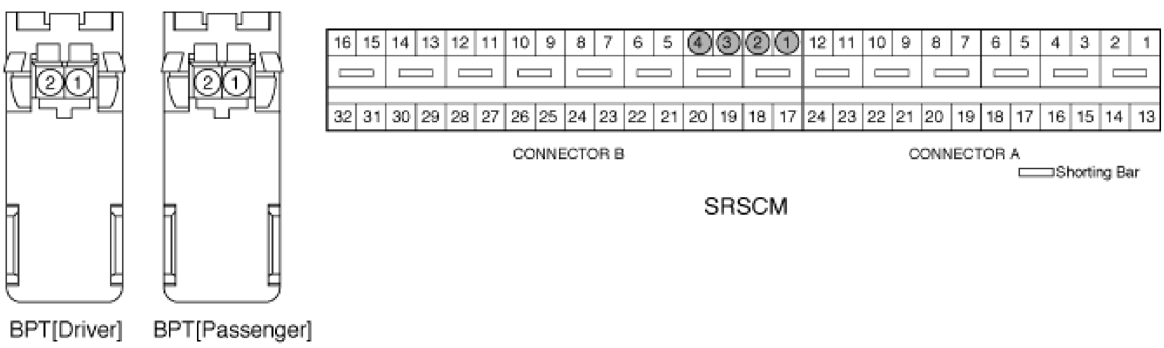
BPT [Driver]

Terminal	Connected to	Function
1	SRSCM Terminal 3(B)	BPT High
2	SRSCM Terminal 4(B)	BPT Low

BPT [Passenger]

Terminal	Connected to	Function
1	SRSCM Terminal 2(B)	BPT High
2	SRSCM Terminal 1(B)	BPT Low

[HARNESS CONNECTOR]



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▶ Go to next step.

YES

▶ After repairing the trouble part, check whether DTC occurs or not.

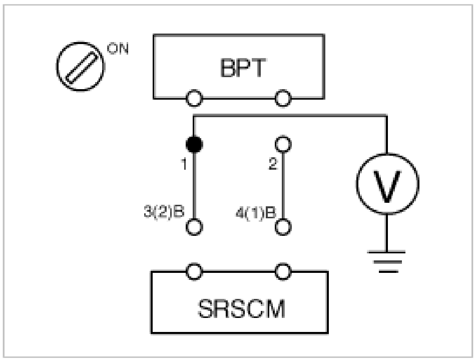
Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

2. CHECK SHORT TO BATTERY LINE
   (1) Connect the negative (-) terminal to the battery.
   (2) Turn the ignition switch to ON.
   (3) Measure voltage between the terminal 1 of BPT harness connector and chassis ground(-).

specification(voltage) : Approximately 0 V



Is the measured voltage within specification?

YES

▸Check the BPT Module.

NO

▸Repair the short to battery line circuit on wiring harness between the BPT and the SRSCM.

3. CHECK THE BPT MODULE
   (1) Replace the Belt Pretensioner (BPT) with a new one.
   - Refer to "Belt Pretensioner (BPT)" section in this SERVICE MANUAL.
   (2) Install the DAB module and connect the DAB connector.
   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (4) Connect the SRSCM connector.
   (5) Connect the negative (-) terminal to the battery.
   (6) Connect a Hi-Scan(Pro) to the data link connector.
   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to Belt Pretensioner (BPT)?

YES

▸ Go to next step.

NO

▸Replace BPT module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON .
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1367

DTC Description

The Seat Belt Pretensioner circuit consists of the SRSCM and two Seat Belt Pretensioner (BPT).
The SRSCM sets above DTC(s) if it detects that the resistance of BPT squib is too high or low.

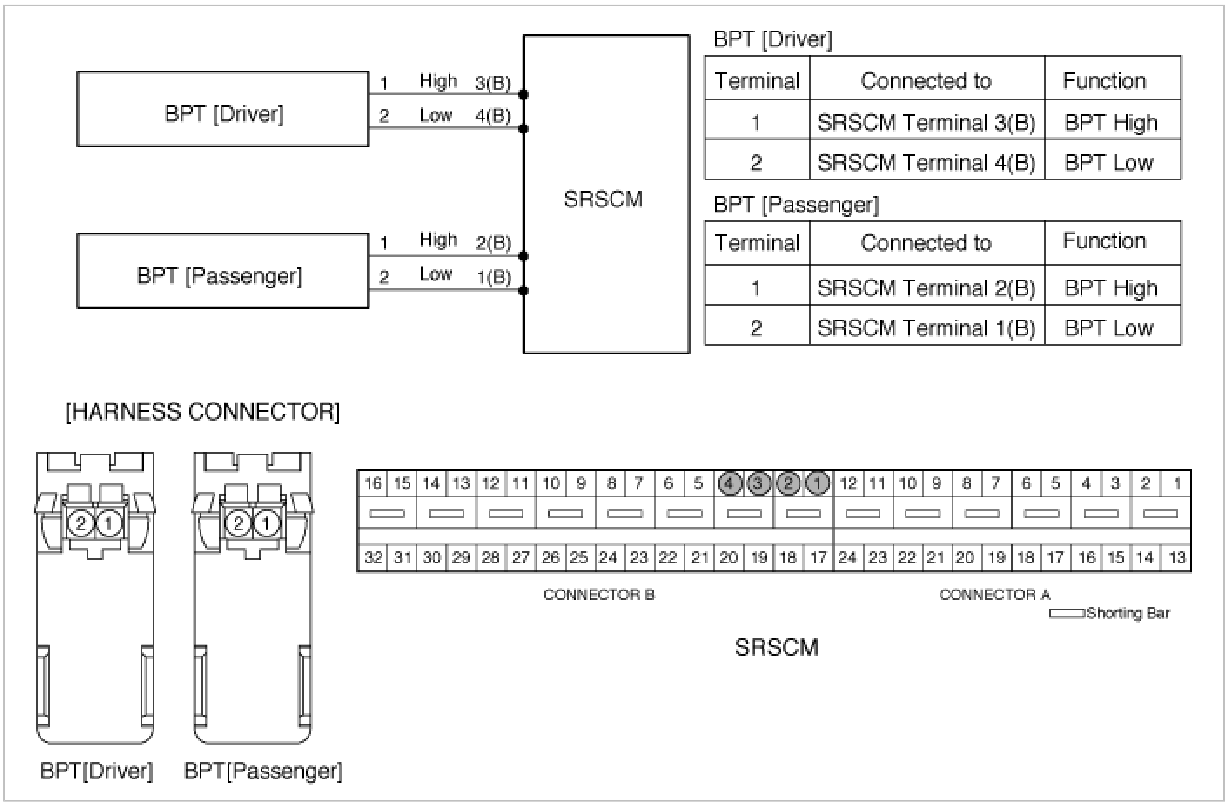
DTC Detecting Condition

DTC	Condition	Probable cause
B1361 B1362 B1367 B1368	• Too high or low resistance between BPT high(+) and BPT low (-) • Seat Belt Pretensioner (BPT) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Seat Belt Pretensioner (BPT) squib • SRSCM

Specification

BPT resistance : 1.9 ≤ R ≤2.8 Ω

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

CAUTION

Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK BPT RESISTANCE

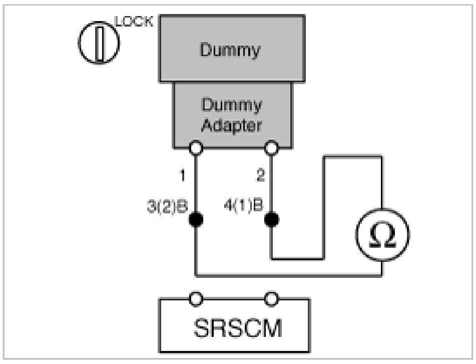
CAUTION

Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

   (1) Connect the Dummy and the Dummy Adapter on BPT harness connector.
   - Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

   (2) Measure resistance between the terminal 3(2) and 4(1) of SRSCM harness connector(B).

BPT resistance : 1.9 ≤ R ≤ 2.8 Ω



Is the measured resistance within specification?

YES

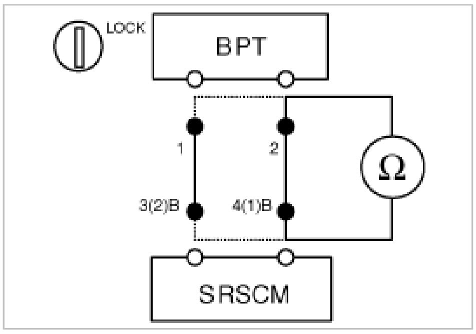
▸ Replace the Seat Belt Pretensioner(BPT) module.

NO

▸Check open circuit.

3. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 1 of BPT harness connector and the terminal 3(2) of SRSCM harness connector (B).
   (2) Measure resistance between the terminal 2 of BPT harness connector and the terminal 4(1) of SRSCM harness connector (B).

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

▸ Check short circuit.

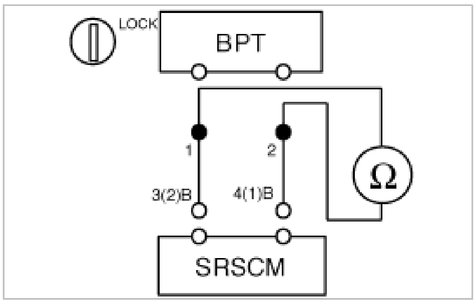
NO

▸ Repair or replace the wiring harness between the BPT and the SRSCM.

4. CHECK SHORT CIRCUIT

(1) Measure resistance between the terminal 1 and 2 of BPT harness connector.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair or replace the wiring harness between the BPT and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON.

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).

Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1368

DTC Description

The Seat Belt Pretensioner circuit consists of the SRSCM and two Seat Belt Pretensioner (BPT).
The SRSCM sets above DTC(s) if it detects that the resistance of BPT squib is too high or low.

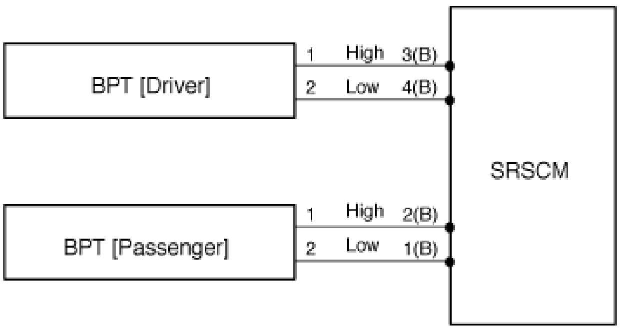
DTC Detecting Condition

DTC	Condition	Probable cause
B1361 B1362 B1367 B1368	• Too high or low resistance between BPT high(+) and BPT low (-) • Seat Belt Pretensioner (BPT) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Seat Belt Pretensioner (BPT) squib • SRSCM

Specification

BPT resistance : 1.9 ≤ R ≤2.8 Ω

Schematic Diagram



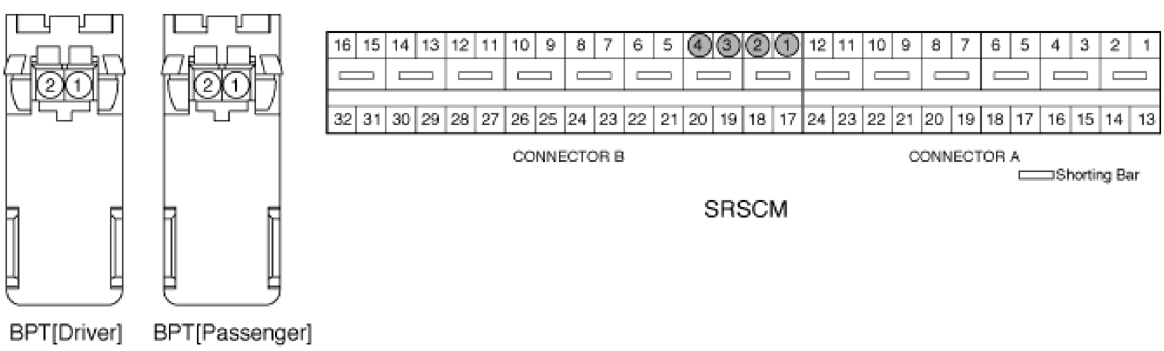
BPT [Driver]

Terminal	Connected to	Function
1	SRSCM Terminal 3(B)	BPT High
2	SRSCM Terminal 4(B)	BPT Low

BPT [Passenger]

Terminal	Connected to	Function
1	SRSCM Terminal 2(B)	BPT High
2	SRSCM Terminal 1(B)	BPT Low

[HARNESS CONNECTOR]



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

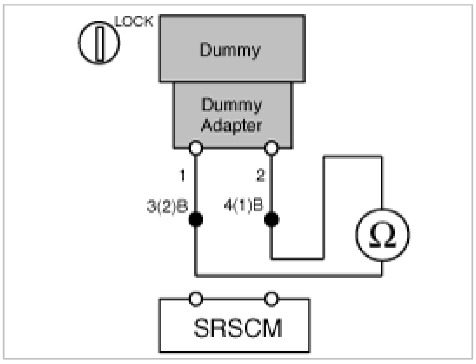
2. CHECK BPT RESISTANCE

CAUTION
Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

   (1) Connect the Dummy and the Dummy Adapter on BPT harness connector.
   - Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

   (2) Measure resistance between the terminal 3(2) and 4(1) of SRSCM harness connector(B).

BPT resistance : 1.9 ≤ R ≤ 2.8 Ω



Is the measured resistance within specification?

YES

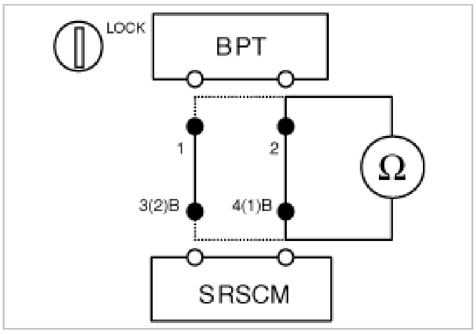
▶ Replace the Seat Belt Pretensioner(BPT) module.

NO

▶Check open circuit.

3. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 1 of BPT harness connector and the terminal 3(2) of SRSCM harness connector (B).
   (2) Measure resistance between the terminal 2 of BPT harness connector and the terminal 4(1) of SRSCM harness connector (B).

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

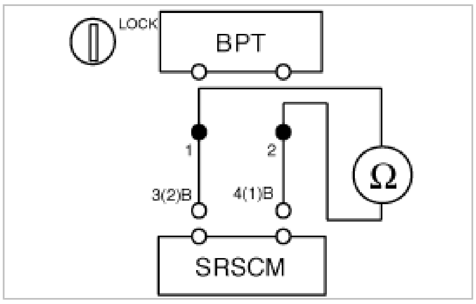
▶ Check short circuit.

NO

▸ Repair or replace the wiring harness between the BPT and the SRSCM.

4. CHECK SHORT CIRCUIT
   (1) Measure resistance between the terminal 1 and 2 of BPT harness connector.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair or replace the wiring harness between the BPT and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON.
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1369

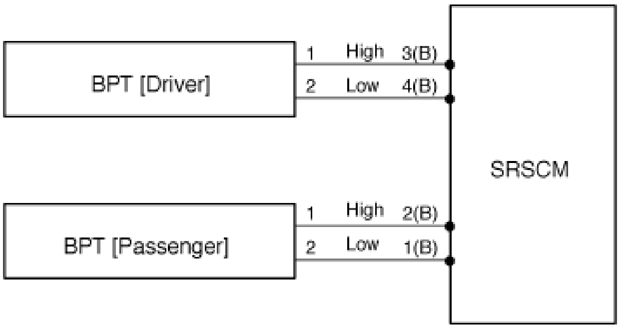
DTC Description

The Seat Belt Pretensioner consists of the SRSCM and two Seat Belt Pretensioner (BPT).The SRSCM sets above DTC(s) if it detects short to ground on the BPT circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1363 B1369	• Short to ground between BPT and SRSCM • Seat Belt Pretensioner (BPT) Malfunction • SRSCM Malfunction	• Short to ground circuit on wiring harness • Seat Belt Pretensioner (BPT) squib • SRSCM

Schematic Diagram



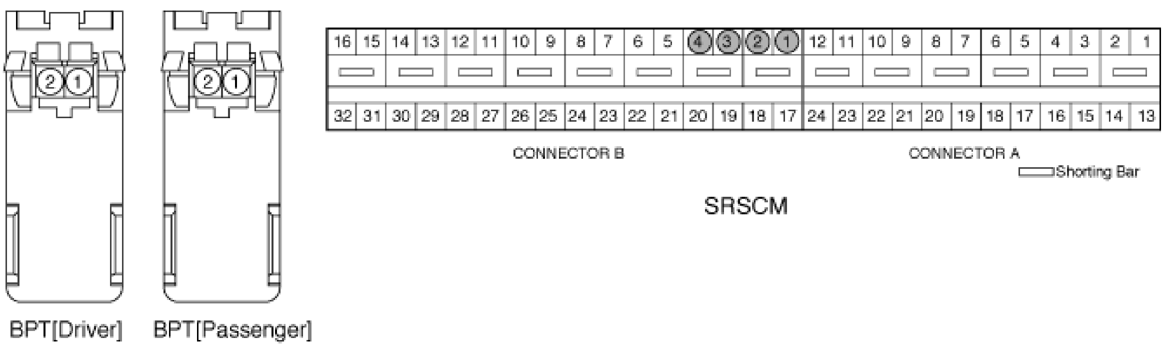
BPT [Driver]

Terminal	Connected to	Function
1	SRSCM Terminal 3(B)	BPT High
2	SRSCM Terminal 4(B)	BPT Low

BPT [Passenger]

Terminal	Connected to	Function
1	SRSCM Terminal 2(B)	BPT High
2	SRSCM Terminal 1(B)	BPT Low

[HARNESS CONNECTOR]



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

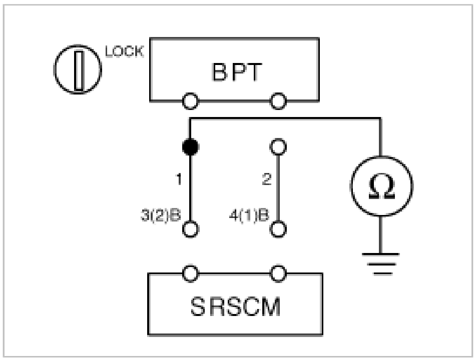
YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SHORT TO GROUND
   (1) Measure resistance between the terminal 1 of BPT harness connector and chassis ground.

   specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸Check the BPT Module.

NO

▸ Repair or replace the wiring harness between the BPT and the SRSCM.

3. CHECK THE BPT MODULE
   (1) Replace the Belt Pretensioner (BPT) with a new one.
   - Refer to "Belt Pretensioner (BPT)" section in this SERVICE MANUAL.

   (2) Install the DAB module and connect the DAB connector.

   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (4) Connect the SRSCM connector.

   (5) Connect the negative (-) terminal to the battery.

   (6) Connect a Hi-Scan(Pro) to the data link connector.

   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to Belt Pretensioner (BPT)?

   YES

   ▸Go to next step.

   NO

   ▸Replace BPT module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.

   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (3) Connect the SRSCM connector.

   (4) Connect the negative (-) terminal to the battery.

   (5) Connect a Hi-Scan(Pro) to the data link connector.

   (6) Turn the ignition switch to ON.

   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

   (9) Turn the ignition switch to ON and wait for at least 30 seconds.

   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1370

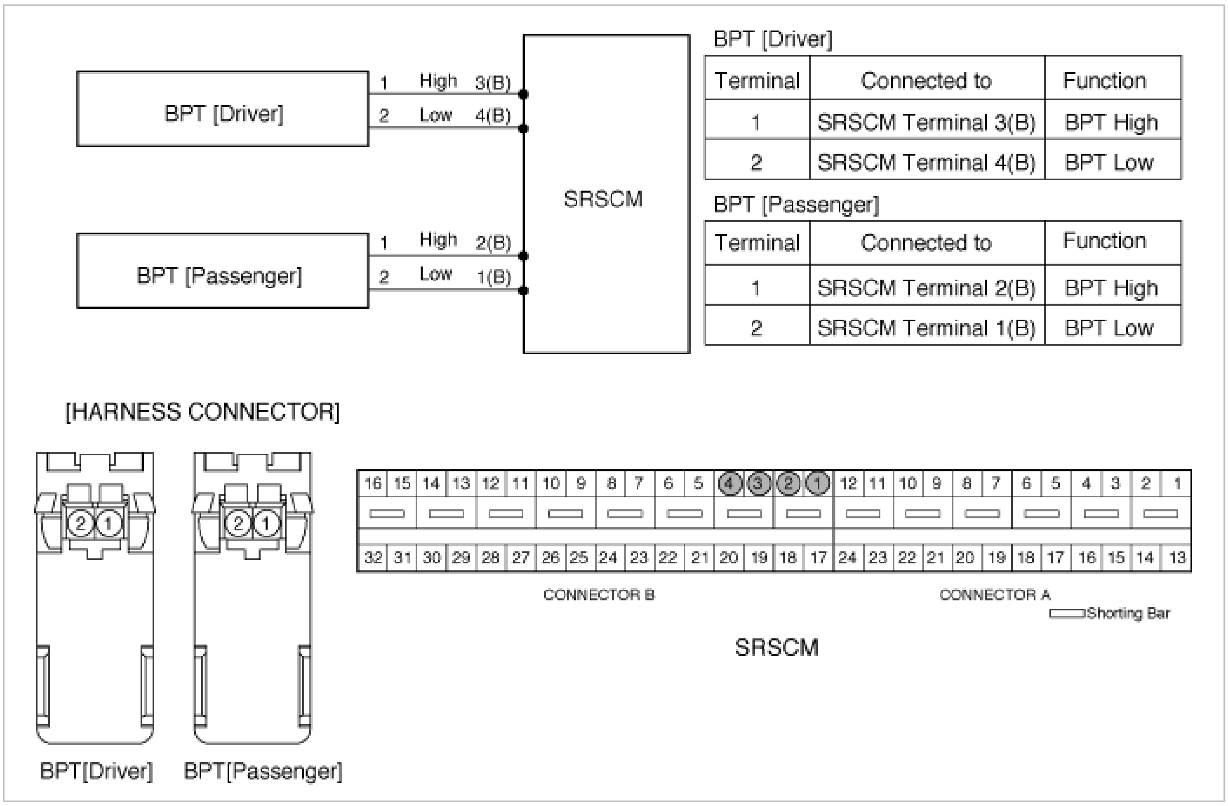
DTC Description

The Seat Belt Pretensioner consists of the SRSCM and two Seat Belt Pretensioner (BPT). The SRSCM sets above DTC(s) if it detects short to battery line on the BPT circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1364 B1370	• Short to battery line between BPT and SRSCM • Seat Belt Pretensioner (BPT) Malfunction • SRSCM Malfunction	• Short to battery line circuit on wiring harness • Seat Belt Pretensioner (BPT) squib • SRSCM

Schematic Diagram



BPT [Driver]

Terminal	Connected to	Function
1	SRSCM Terminal 3(B)	BPT High
2	SRSCM Terminal 4(B)	BPT Low

BPT [Passenger]

Terminal	Connected to	Function
1	SRSCM Terminal 2(B)	BPT High
2	SRSCM Terminal 1(B)	BPT Low

Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> CAUTION
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

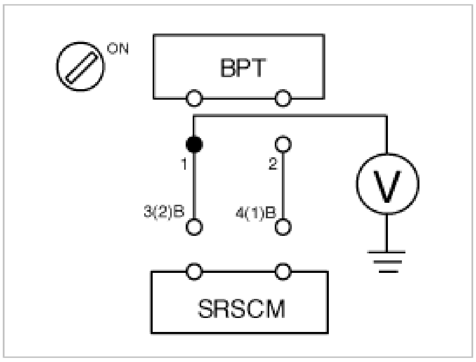
2. CHECK SHORT TO BATTERY LINE

(1) Connect the negative (-) terminal to the battery.

(2) Turn the ignition switch to ON.

(3) Measure voltage between the terminal 1 of BPT harness connector and chassis ground(-).

specification(voltage) : Approximately 0 V



Is the measured voltage within specification?

YES

▸Check the BPT Module.

NO

▸Repair the short to battery line circuit on wiring harness between the BPT and the SRSCM.

3. CHECK THE BPT MODULE

(1) Replace the Belt Pretensioner (BPT) with a new one.

● Refer to "Belt Pretensioner (BPT)" section in this SERVICE MANUAL.

(2) Install the DAB module and connect the DAB connector.

(3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal to the battery.

(6) Connect a Hi-Scan(Pro) to the data link connector.

(7) Turn the ignition switch to ON and check the vehicle again.
Does Hi-Scan (Pro) indicate any DTC related to Belt Pretensioner (BPT)?

YES

▸ Go to next step.

NO

▸Replace BPT module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON .

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1378

DTC Description

The Side Airbag circuit consists of the SRSCM and two Side Airbag (SAB). The SRSCM sets above DTC(s) if it detects that the resistance of SAB squib is too high or low.

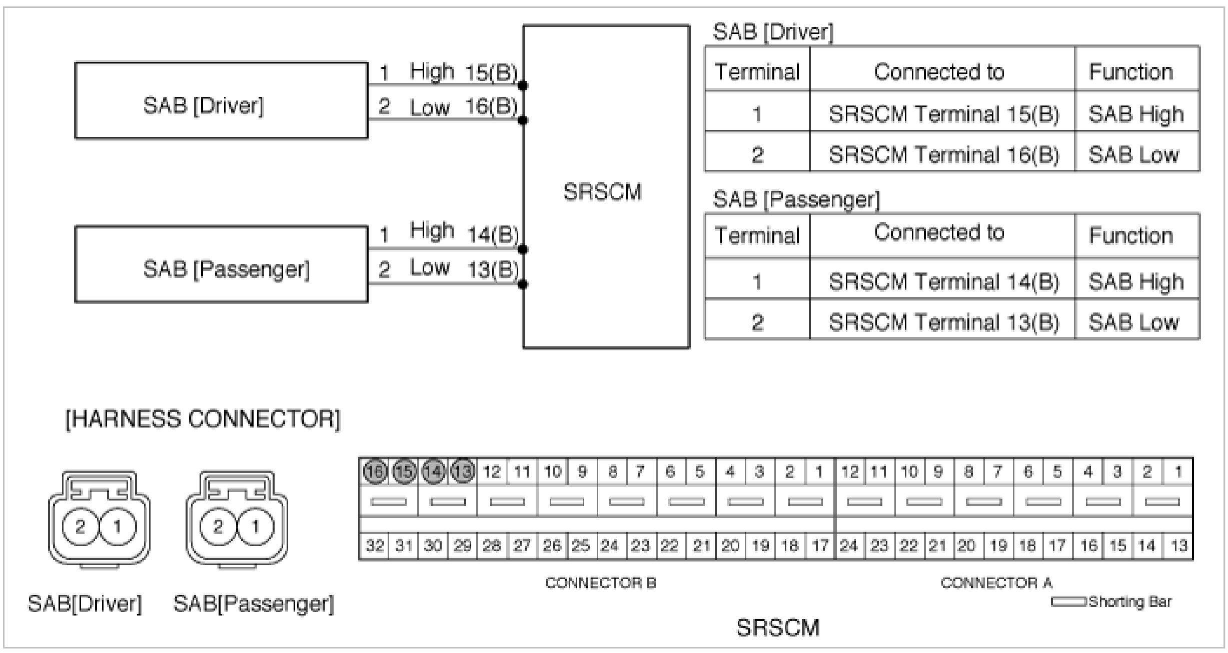
DTC Detecting Condition

DTC	Condition	Probable cause
B1378 B1379 B1382 B1383	• Too high or low resistance between SAB high(+) and SAB low (-) • Side Airbag (SAB) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Side Airbag (SAB) squib • SRSCM

Specification

SAB resistance : 1.8 ≤ R ≤ 2.6 Ω

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

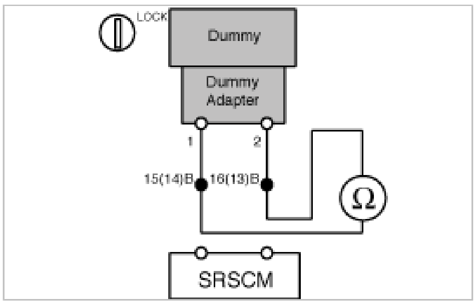
1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SAB RESISTANCE

> **CAUTION**
> Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

   (1) Connect the Dummy and the Dummy Adapter on SAB harness connector.
   - Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

   (2) Measure resistance between the terminal 15(14) and 16(13) of SRSCM harness connector(B).

SAB resistance : $1.8 \le R \le 2.6\ \Omega$



Is the measured resistance within specification?

YES

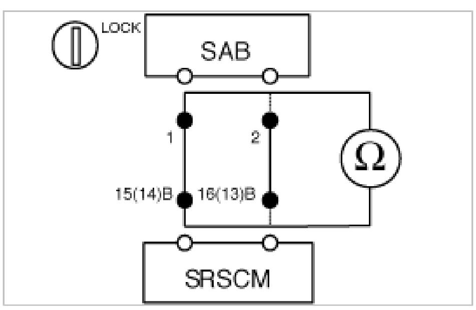
▸Replace the Side Airbag(SAB) module.

NO

▸Check open circuit.

3. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 1 of SAB harness connector and the terminal 15(14) of SRSCM harness connector(B).
   (2) Measure resistance between the terminal 2 of SAB harness connector and the terminal 16(13) of SRSCM harness connector(B).

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

▸Check short circuit.

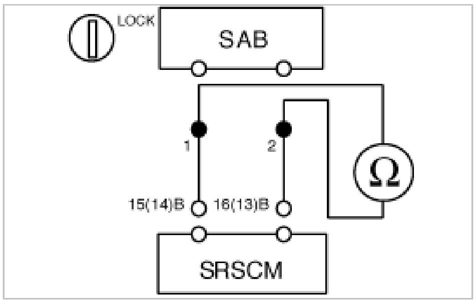
NO

▸Repair or replace the wiring harness between the SAB nd the SRSCM.

4. CHECK SHORT CIRCUIT

(1) Measure resistance between the terminal 1 and 2 of SAB harness connector.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair or replace the wiring harness between the SAB and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON.

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).

Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1379

DTC Description

The Side Airbag circuit consists of the SRSCM and two Side Airbag (SAB). The SRSCM sets above DTC(s) if it detects that the resistance of SAB squib is too high or low.

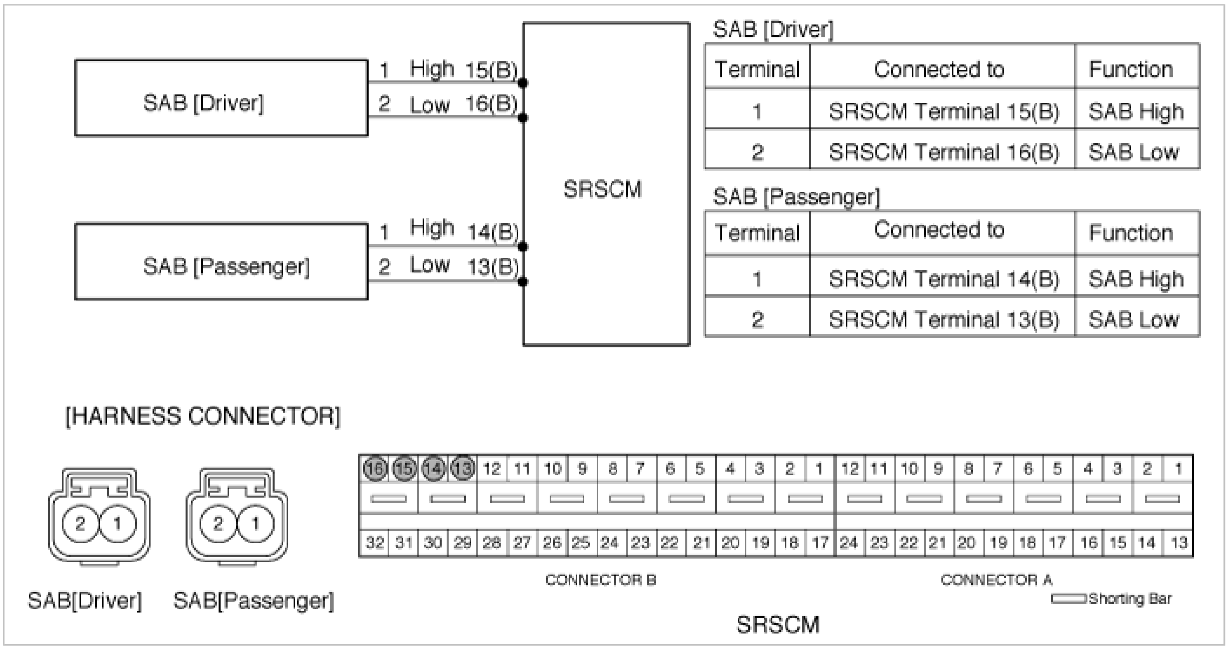
DTC Detecting Condition

DTC	Condition	Probable cause
B1378 B1379 B1382 B1383	• Too high or low resistance between SAB high(+) and SAB low (-) • Side Airbag (SAB) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Side Airbag (SAB) squib • SRSCM

Specification

SAB resistance : $1.8 \le R \le 2.6\ \Omega$

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> CAUTION
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

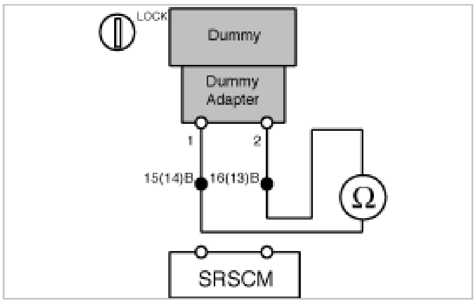
1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SAB RESISTANCE

> CAUTION
>
> Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

(1) Connect the Dummy and the Dummy Adapter on SAB harness connector.
- Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

(2) Measure resistance between the terminal 15(14) and 16(13) of SRSCM harness connector(B).

SAB resistance : 1.8 ≤ R ≤ 2.6 Ω



Is the measured resistance within specification?

YES

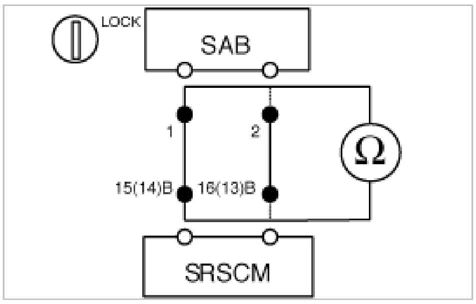
▸Replace the Side Airbag(SAB) module.

NO

▸Check open circuit.

3. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 1 of SAB harness connector and the terminal 15(14) of SRSCM harness connector(B).
   (2) Measure resistance between the terminal 2 of SAB harness connector and the terminal 16(13) of SRSCM harness connector(B).

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

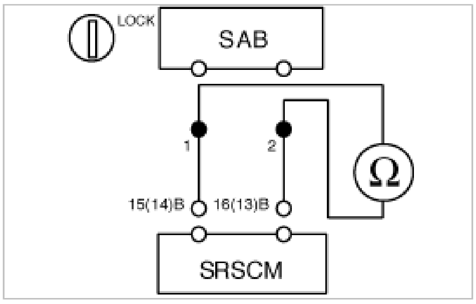
▸Check short circuit.

NO

▸Repair or replace the wiring harness between the SAB nd the SRSCM.

4. CHECK SHORT CIRCUIT
   (1) Measure resistance between the terminal 1 and 2 of SAB harness connector.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair or replace the wiring harness between the SAB and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON.

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1380

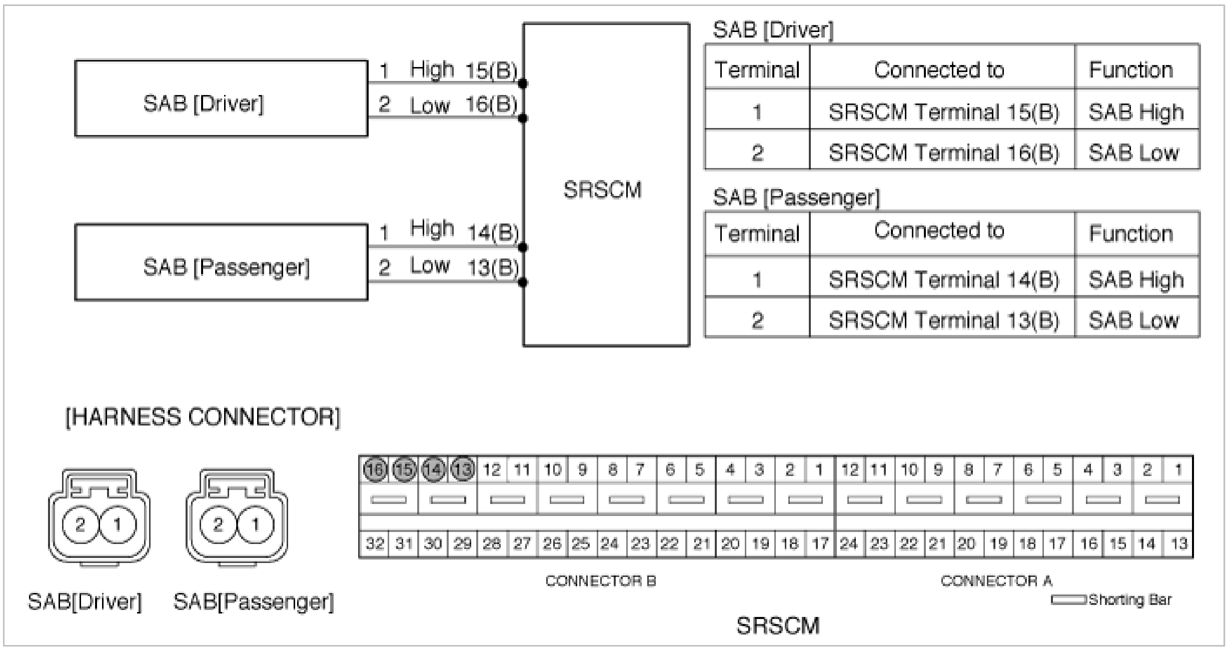
DTC Description

The Side Airbag circuit consists of the SRSCM and two Side Airbag (SAB). The SRSCM sets above DTC(s) if it detects short to ground on the SAB circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1380 B1384	• Short to ground between SAB and SRSCM • Side Airbag (SAB) Malfunction • SRSCM Malfunction	• Short to ground circuit on wiring harness • Side Airbag (SAB) squib • SRSCM

Schematic Diagram



SAB [Driver]

Terminal	Connected to	Function
1	SRSCM Terminal 15(B)	SAB High
2	SRSCM Terminal 16(B)	SAB Low

SAB [Passenger]

Terminal	Connected to	Function
1	SRSCM Terminal 14(B)	SAB High
2	SRSCM Terminal 13(B)	SAB Low

Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.

2. Inspect terminals for damage and corrosion.

CAUTION

Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

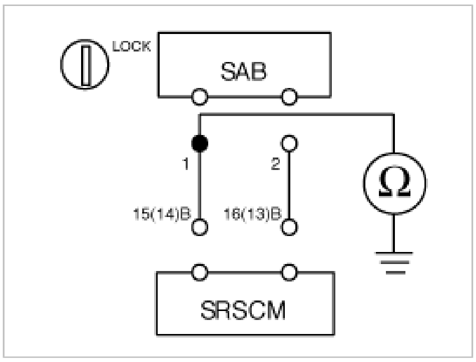
▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK SHORT TO GROUND
   (1) Measure resistance between the terminal 1 of SAB harness connector and chassis ground.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸ Check the SAB Module.

NO

▸ Repair or replace the wiring harness between the SAB and the SRSCM.

3. CHECK THE SAB MODULE
   (1) Replace the Side Airbag(SAB) with a new one.
   - Refer to "Side Airbag(SAB)" section in this SERVICE MANUAL.

   (2) Install the DAB module and connect the DAB connector.
   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (4) Connect the SRSCM connector.
   (5) Connect the negative (-) terminal to the battery.
   (6) Connect a Hi-Scan(Pro) to the data link connector.
   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to Side Airbag(SAB)?

YES

▸Go to next step.

NO

▸Replace SAB module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON.

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1381

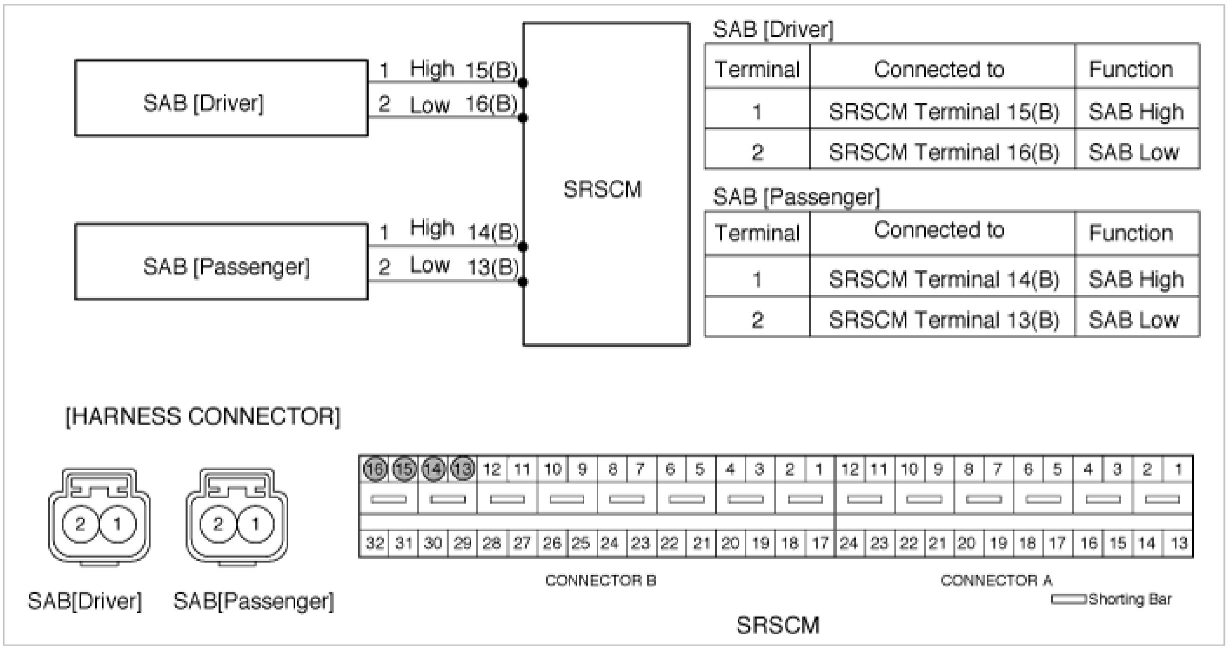
DTC Description

The Side Airbag circuit consists of the SRSCM and two Side Airbag (SAB).The SRSCM sets above DTC(s) if it detects short to battery line on the SAB circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1381 B1385	• Short to battery line between SAB and SRSCM • Side Airbag (SAB) Malfunction • SRSCM Malfunction	• Short to battery line circuit on wiring harness • Side Airbag (SAB) squib • SRSCM

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

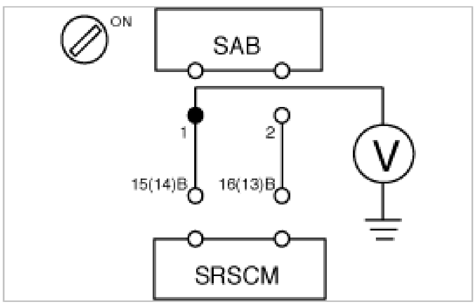
YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SHORT TO BATTERY LINE
   (1) Connect the negative (-) terminal to the battery.
   (2) Turn the ignition switch to ON.
   (3) Measure voltage between the terminal 1 of SAB harness connector and chassis ground(-).

specification(voltage) : Approximately 0 V



Is the measured voltage within specification?

YES

▸ Check the SAB Module.

NO

▸ Repair the short to battery line circuit on wiring harness between the SAB and the SRSCM.

3. CHECK THE SAB MODULE
   (1) Replace the Side Airbag(SAB) with a new one.
   - Refer to "Side Airbag(SAB)" section in this SERVICE MANUAL.

   (2) Install the DAB module and connect the DAB connector.
   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (4) Connect the SRSCM connector.
   (5) Connect the negative (-) terminal to the battery.
   (6) Connect a Hi-Scan(Pro) to the data link connector.
   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to Side Airbag(SAB)?

YES

▸ Go to next step.

NO

▸Replace SAB module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON.
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1382

DTC Description

The Side Airbag circuit consists of the SRSCM and two Side Airbag (SAB). The SRSCM sets above DTC(s) if it detects that the resistance of SAB squib is too high or low.

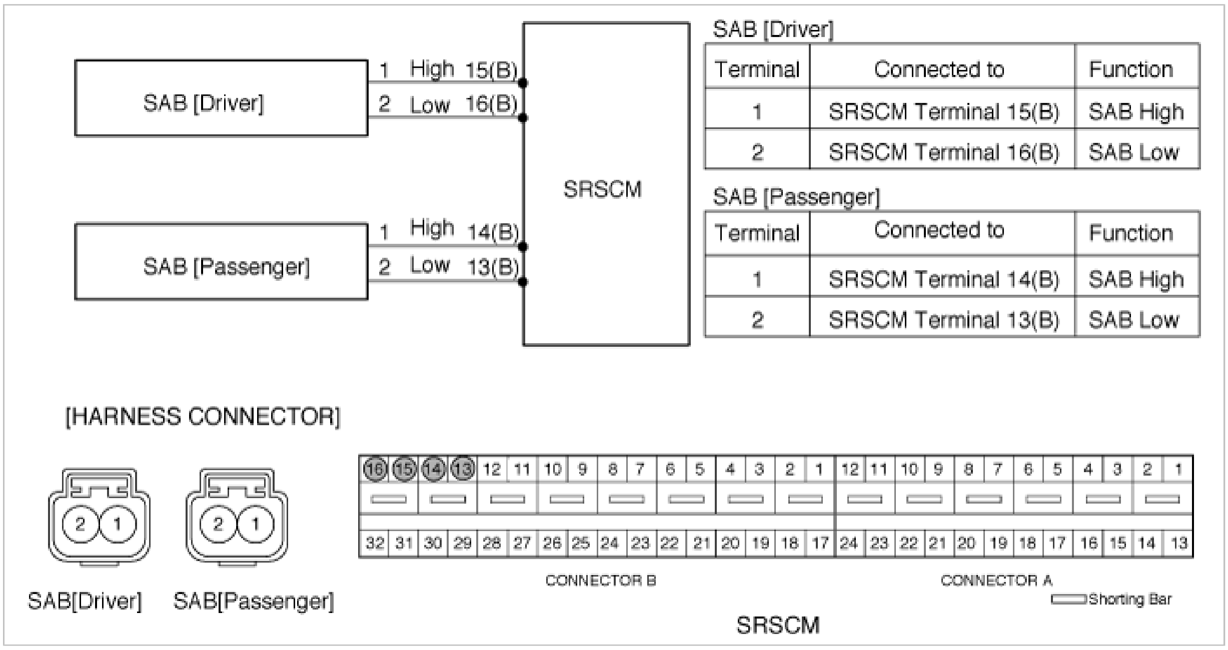
DTC Detecting Condition

DTC	Condition	Probable cause
B1378 B1379 B1382 B1383	• Too high or low resistance between SAB high(+) and SAB low (-) • Side Airbag (SAB) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Side Airbag (SAB) squib • SRSCM

Specification

SAB resistance : $1.8 \le R \le 2.6\ \Omega$

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

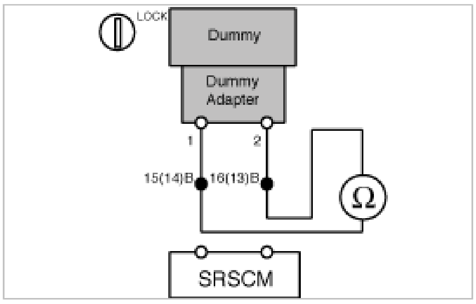
1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SAB RESISTANCE

> **CAUTION**
>
> Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

(1) Connect the Dummy and the Dummy Adapter on SAB harness connector.
- Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

(2) Measure resistance between the terminal 15(14) and 16(13) of SRSCM harness connector(B).

SAB resistance : $1.8 \le R \le 2.6\ \Omega$



Is the measured resistance within specification?

YES

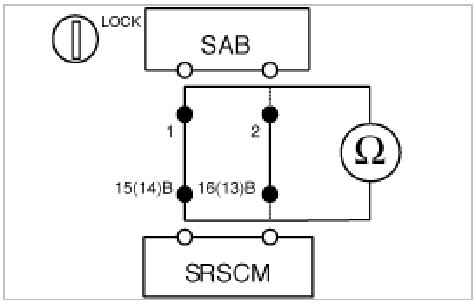
▸Replace the Side Airbag(SAB) module.

NO

▸Check open circuit.

3. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 1 of SAB harness connector and the terminal 15(14) of SRSCM harness connector(B).
   (2) Measure resistance between the terminal 2 of SAB harness connector and the terminal 16(13) of SRSCM harness connector(B).

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

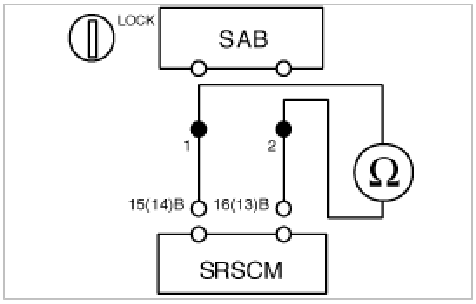
▸Check short circuit.

NO

▸Repair or replace the wiring harness between the SAB nd the SRSCM.

4. CHECK SHORT CIRCUIT
   (1) Measure resistance between the terminal 1 and 2 of SAB harness connector.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair or replace the wiring harness between the SAB and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON.

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1383

DTC Description

The Side Airbag circuit consists of the SRSCM and two Side Airbag (SAB). The SRSCM sets above DTC(s) if it detects that the resistance of SAB squib is too high or low.

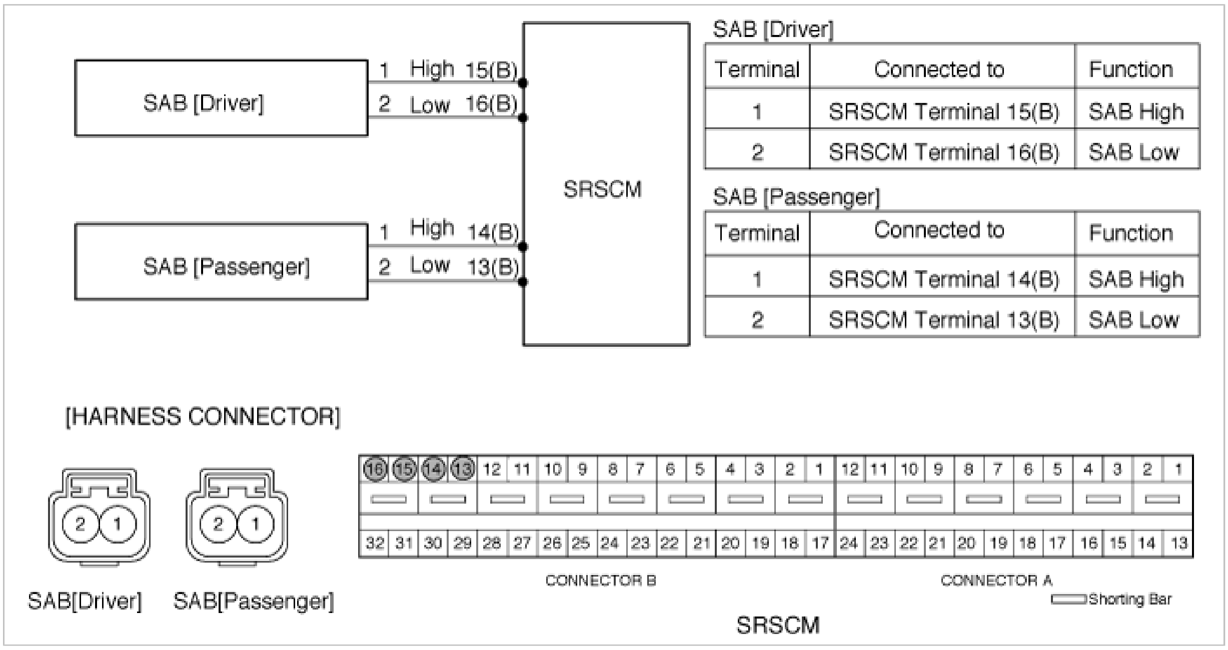
DTC Detecting Condition

DTC	Condition	Probable cause
B1378 B1379 B1382 B1383	• Too high or low resistance between SAB high(+) and SAB low (-) • Side Airbag (SAB) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Side Airbag (SAB) squib • SRSCM

Specification

SAB resistance : $1.8 \le R \le 2.6\ \Omega$

Schematic Diagram



SAB [Driver]

Terminal	Connected to	Function
1	SRSCM Terminal 15(B)	SAB High
2	SRSCM Terminal 16(B)	SAB Low

SAB [Passenger]

Terminal	Connected to	Function
1	SRSCM Terminal 14(B)	SAB High
2	SRSCM Terminal 13(B)	SAB Low

Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

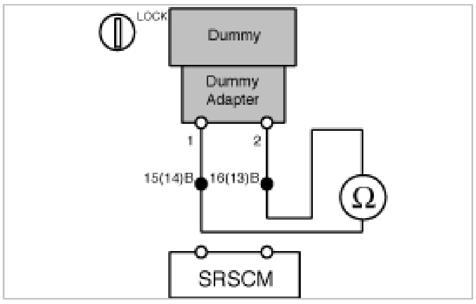
1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SAB RESISTANCE

> **CAUTION**
>
> Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

(1) Connect the Dummy and the Dummy Adapter on SAB harness connector.
- Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

(2) Measure resistance between the terminal 15(14) and 16(13) of SRSCM harness connector(B).

SAB resistance : $1.8 \le R \le 2.6\ \Omega$



Is the measured resistance within specification?

YES

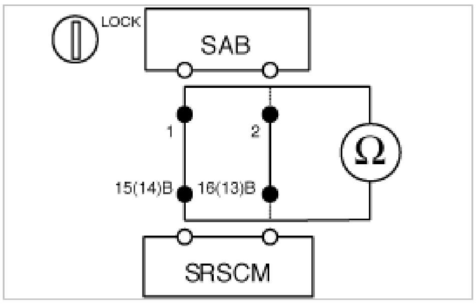
▸Replace the Side Airbag(SAB) module.

NO

▸Check open circuit.

3. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 1 of SAB harness connector and the terminal 15(14) of SRSCM harness connector(B).
   (2) Measure resistance between the terminal 2 of SAB harness connector and the terminal 16(13) of SRSCM harness connector(B).

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

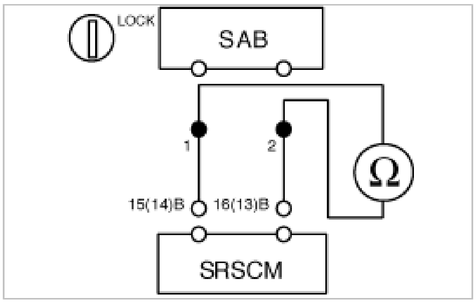
▸Check short circuit.

NO

▸Repair or replace the wiring harness between the SAB nd the SRSCM.

4. CHECK SHORT CIRCUIT
   (1) Measure resistance between the terminal 1 and 2 of SAB harness connector.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair or replace the wiring harness between the SAB and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON.

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1384

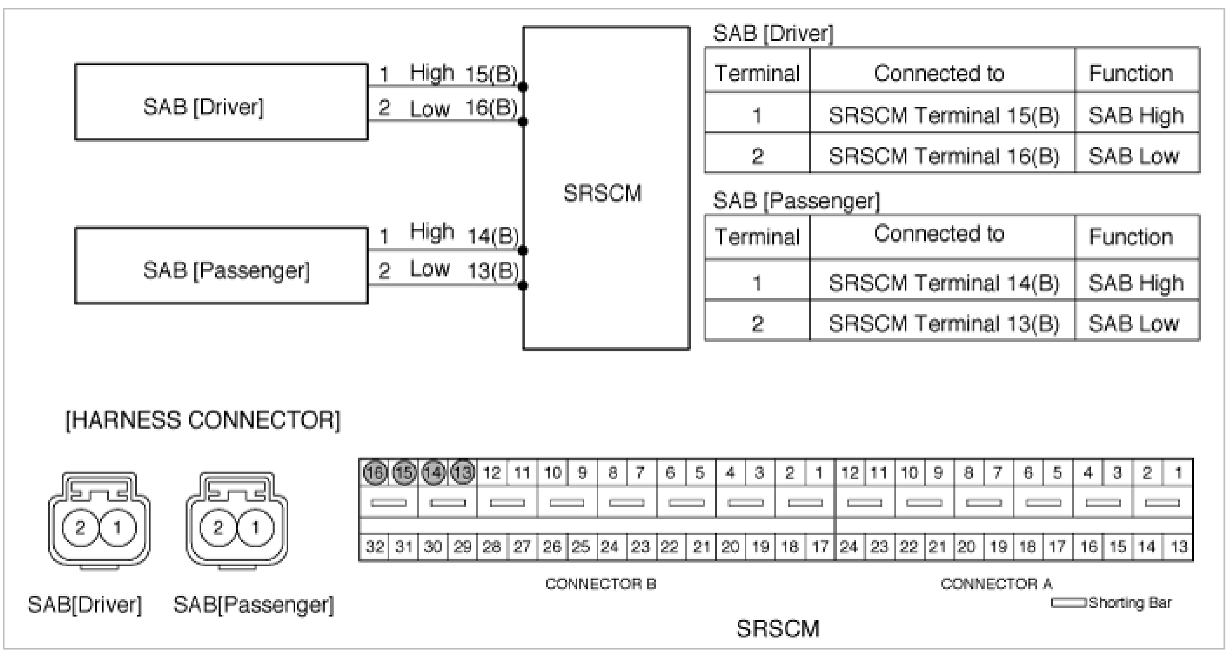
DTC Description

The Side Airbag circuit consists of the SRSCM and two Side Airbag (SAB). The SRSCM sets above DTC(s) if it detects short to ground on the SAB circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1380 B1384	• Short to ground between SAB and SRSCM • Side Airbag (SAB) Malfunction • SRSCM Malfunction	• Short to ground circuit on wiring harness • Side Airbag (SAB) squib • SRSCM

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.

2. Inspect terminals for damage and corrosion.

> CAUTION
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

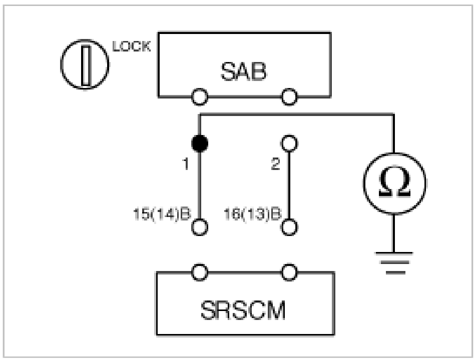
▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK SHORT TO GROUND
   (1) Measure resistance between the terminal 1 of SAB harness connector and chassis ground.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸ Check the SAB Module.

NO

▸ Repair or replace the wiring harness between the SAB and the SRSCM.

3. CHECK THE SAB MODULE
   (1) Replace the Side Airbag(SAB) with a new one.
   - Refer to "Side Airbag(SAB)" section in this SERVICE MANUAL.

   (2) Install the DAB module and connect the DAB connector.
   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (4) Connect the SRSCM connector.
   (5) Connect the negative (-) terminal to the battery.
   (6) Connect a Hi-Scan(Pro) to the data link connector.
   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to Side Airbag(SAB)?

YES

▸Go to next step.

NO

▸Replace SAB module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON.

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1385

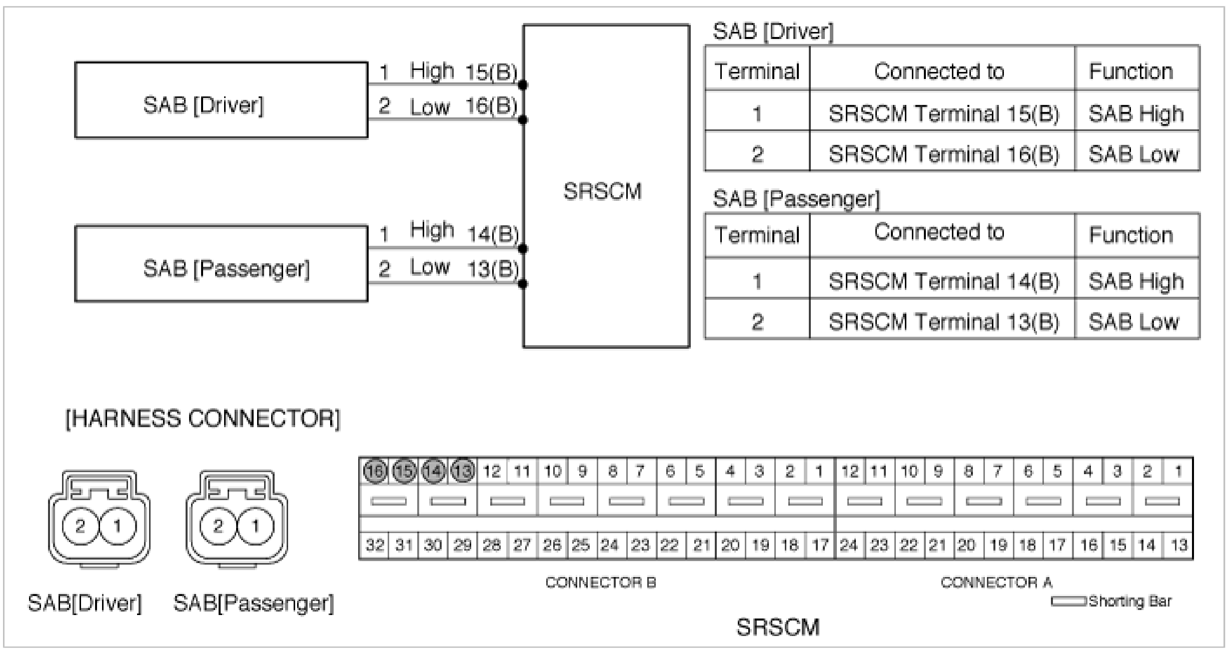
DTC Description

The Side Airbag circuit consists of the SRSCM and two Side Airbag (SAB).The SRSCM sets above DTC(s) if it detects short to battery line on the SAB circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1381 B1385	• Short to battery line between SAB and SRSCM • Side Airbag (SAB) Malfunction • SRSCM Malfunction	• Short to battery line circuit on wiring harness • Side Airbag (SAB) squib • SRSCM

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

CAUTION

Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

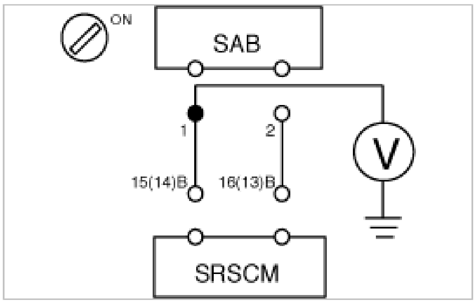
YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SHORT TO BATTERY LINE
   (1) Connect the negative (-) terminal to the battery.
   (2) Turn the ignition switch to ON.
   (3) Measure voltage between the terminal 1 of SAB harness connector and chassis ground(-).

specification(voltage) : Approximately 0 V



Is the measured voltage within specification?

YES

▸ Check the SAB Module.

NO

▸ Repair the short to battery line circuit on wiring harness between the SAB and the SRSCM.

3. CHECK THE SAB MODULE
   (1) Replace the Side Airbag(SAB) with a new one.
   - Refer to "Side Airbag(SAB)" section in this SERVICE MANUAL.

   (2) Install the DAB module and connect the DAB connector.
   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (4) Connect the SRSCM connector.
   (5) Connect the negative (-) terminal to the battery.
   (6) Connect a Hi-Scan(Pro) to the data link connector.
   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to Side Airbag(SAB)?

YES

▸ Go to next step.

NO

▸Replace SAB module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON.
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1387

DTC Description

The Seat Track Position Sensor (STPS) circuit consists of the SRSCM and two STPS. The SRSCM sets above DTC(s) if it detects open or short to ground on the STPS circuit. The "Seat Forward" status currently represents a seat position in which the deployment of the second stage airbag is prohibited.

DTC Detecting Condition

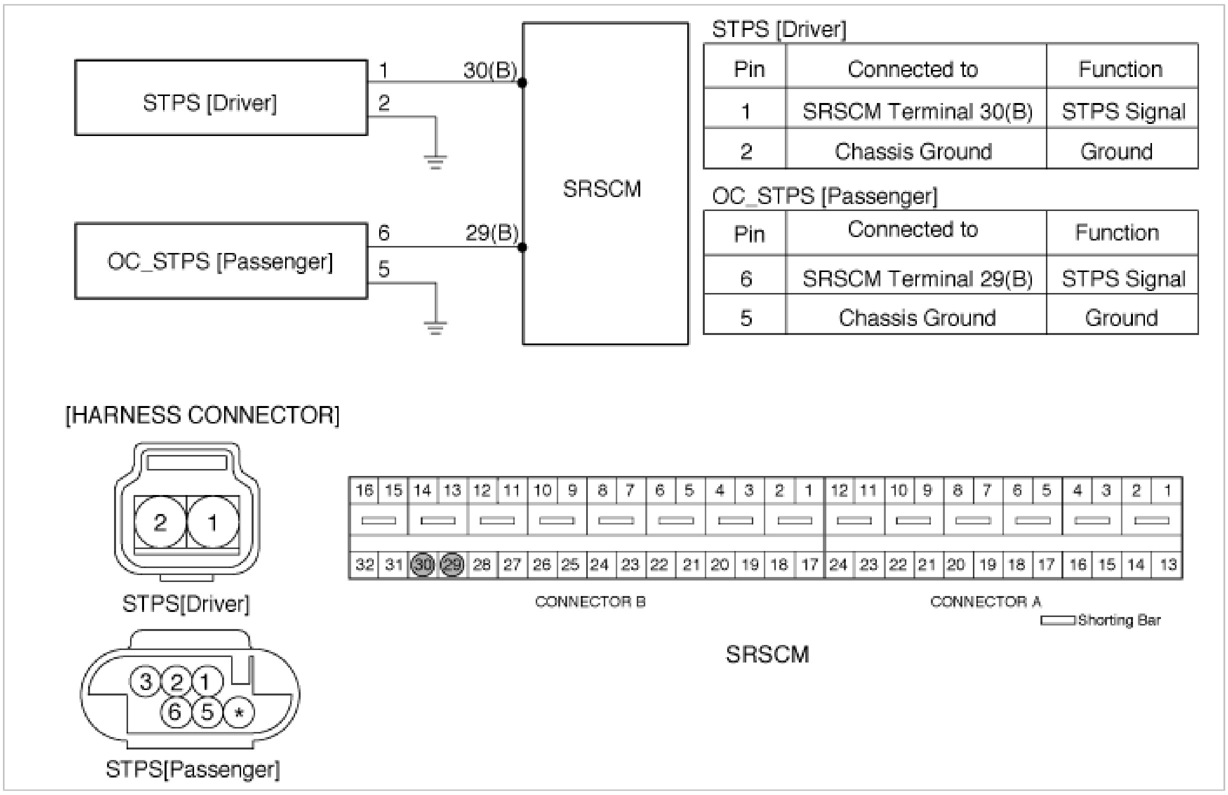
DTC	Condition	Probable cause
B1387 B1390	• Short between STPS and SRSCM • Short to ground between STPS and SRSCM • STPS Malfunction • SRSCM Malfunction	• Short or short to ground circuit on wiring harness • STPS • SRSCM

Specification

[Seat position diagnostic current limits]

Open/Short to Battery	Grey Zone	Forward	Grey Zone	Defect	Grey Zone	Rearward	Grey Zone	Short/Short to ground
< 3.98 mA	3.98 - 4.79 mA	4.79 - 7.16 mA	7.16 - 8.62 mA	8.62 - 9.94 mA	9.94 - 11.97 mA	11.97 - 17.29 mA	17.29 - 20.83 mA	> 20.83 mA

Schematic Diagram



STPS [Driver]

Pin	Connected to	Function
1	SRSCM Terminal 30(B)	STPS Signal
2	Chassis Ground	Ground

OC_STPS [Passenger]

Pin	Connected to	Function
6	SRSCM Terminal 29(B)	STPS Signal
5	Chassis Ground	Ground

Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

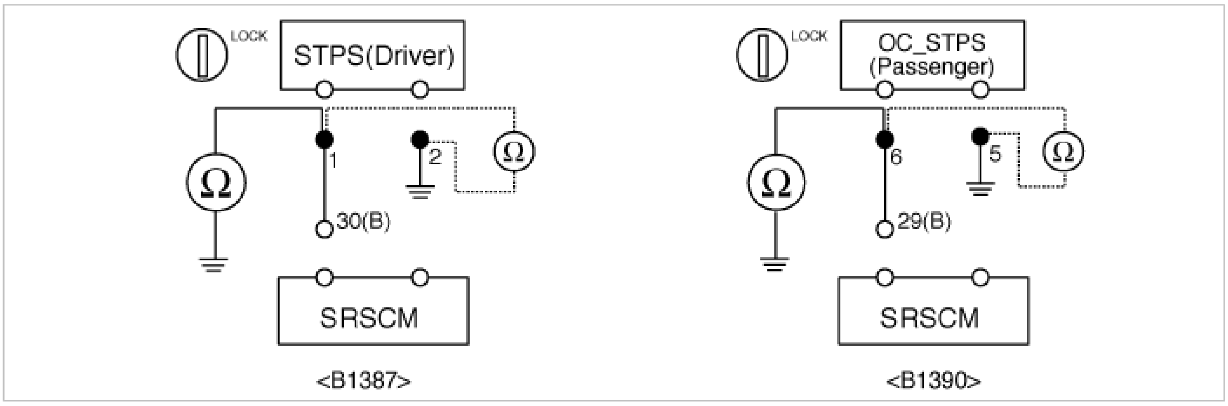
YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SHORT OR SHORT TO GROUND
   (1) Disconnect the STPS connector.
   (2) Measure resistance between the terminal 1(6) of STPS harness connector and chassis ground.
   (3) Measure resistance between the terminal 1(6) and 2(3) of STPS harness connector.

specification(resistance) : infinite



(4) Is the measured resistance within specification?

YES

▸ Check the STPS.

NO

▸ Repair or replace the wiring harness between the STPS and the SRSCM.

3. CHECK THE SEAT TRACK POSITION SENSOR (STPS)

(1) Measure current between the terminal 1(6) of STPS and 30(29) of SRSCM(B).

Specification(current) : 12 ~ 17 mA (Reward status), 5 ~ 7 mA (Forward status)

(2) Is the measured current within specification?

YES

▸ Goto next stop.

NO

▸ Replace the STPS.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON .

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1388

DTC Description

The Seat Track Position Sensor (STPS) circuit consists of the SRSCM and two STPS. The SRSCM sets above DTC(s) if it detects short or short to battery line on the STPS circuit. The "Seat Forward" status currently represents a seat position in which the deployment of the second stage airbag is prohibited.

DTC Detecting Condition

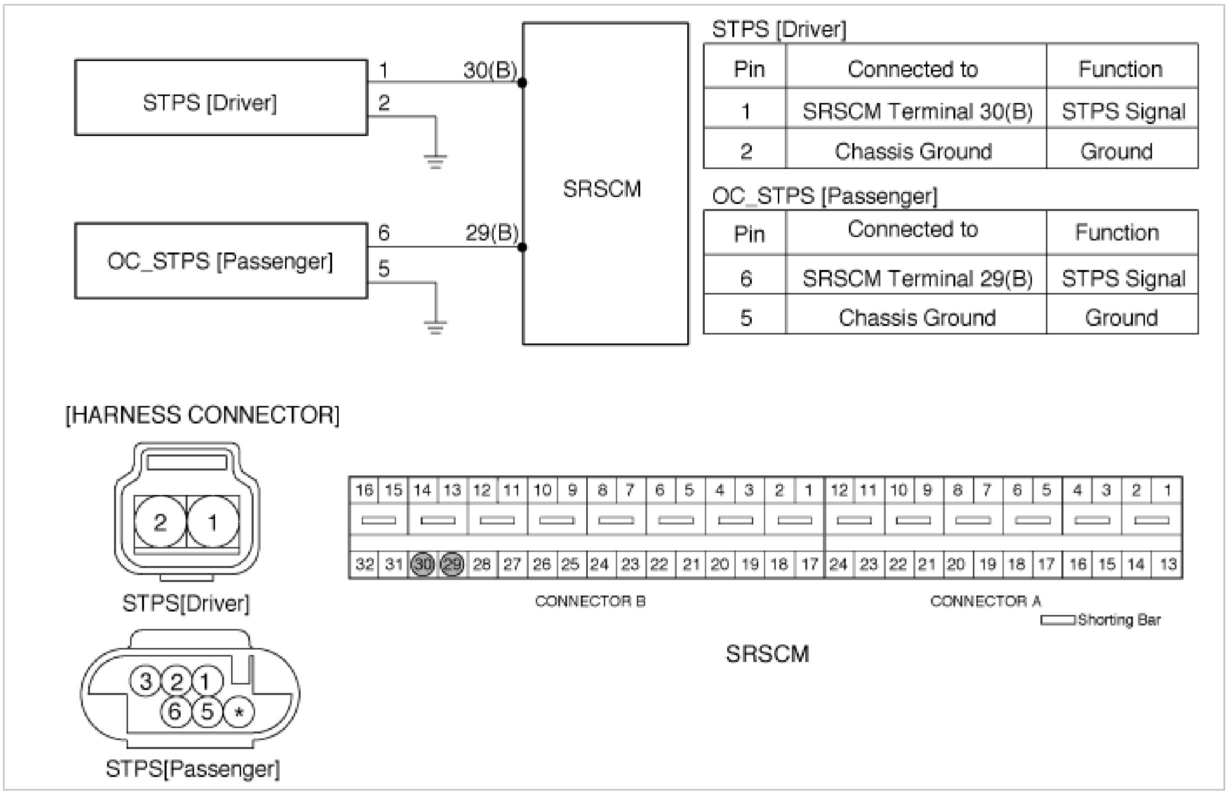
DTC	Condition	Probable cause
B1388 B1391	• Open between STPS and SRSCM • Short to battery line between STPS and SRSCM • STPS Malfunction • SRSCM Malfunction	• Open or short to battery line circuit on wiring harness • STPS • SRSCM

Specification

[Seat position diagnostic current limits]

Open/Short to Battery	Grey Zone	Forward	Grey Zone	Defect	Grey Zone	Rearward	Grey Zone	Short/Short to ground
< 3.98 mA	3.98 - 4.79 mA	4.79 - 7.16 mA	7.16 - 8.62 mA	8.62 - 9.94 mA	9.94 - 11.97 mA	11.97 - 17.29 mA	17.29 - 20.83 mA	> 20.83 mA

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> CAUTION
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

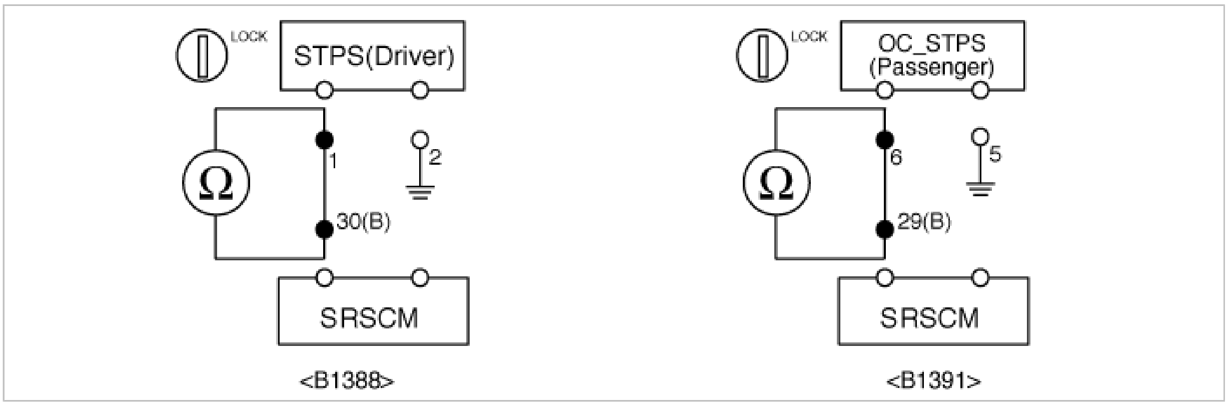
▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK OPEN CIRCUIT
   (1) Disconnect the STPS connector.
   (2) Measure resistance between the terminal 1 of STPS harness connector and the terminal 30 of SRSCM harness connector (B).<B1388>
   (3) Measure resistance between the terminal 6 of STPS harness connector and the terminal 29 of SRSCM harness connector (B).<B1391>

specification(resistance) : below 1 Ω



   (4) Is the measured resistance within specification?

YES

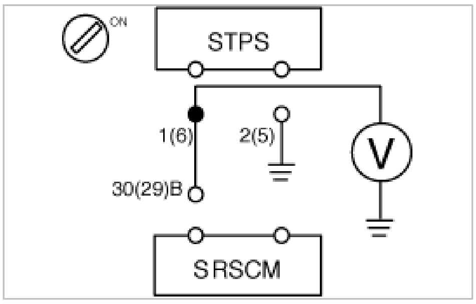
▸ Check short to ground.

NO

▸ Repair the open circuit on wiring harness between the STPS and the SRSCM.

3. CHECK SHORT TO BATTERY LINE
   (1) Connect the negative (-) terminal to the battery.
   (2) Turn the ignition switch to ON.
   (3) Measure voltage between the terminal 1(6) of STPS harness connector and chassis ground(-).

specification(voltage) : Approximately 0 V



   (4) Is the measured voltage within specification?

YES

▸ Check the STPS.

NO

▸ Repair the short to battery line circuit on wiring harness between the STPS and the SRSCM.

4. CHECK THE SEAT TRACK POSITION SENSOR (STPS)
   (1) Measure current between the terminal 1(6) of STPS and 30(29) of SRSCM(B).

   Specification(current) : 12 ~ 17 mA (Reward status), 5 ~ 7 mA (Forward status)

   (2) Is the measured current within specification?

   YES

   ▸ Goto next stop.

   NO

   ▸ Replace the STPS.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON .
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1389

DTC Description

The Seat Track Position Sensor (STPS) circuit consists of the SRSCM and two STPS. The SRSCM sets above DTC(s) if it detects the STPS fault. The "Seat Forward" status currently represents a seat position in which the deployment of the second stage airbag is prohibited.

DTC Detecting Condition

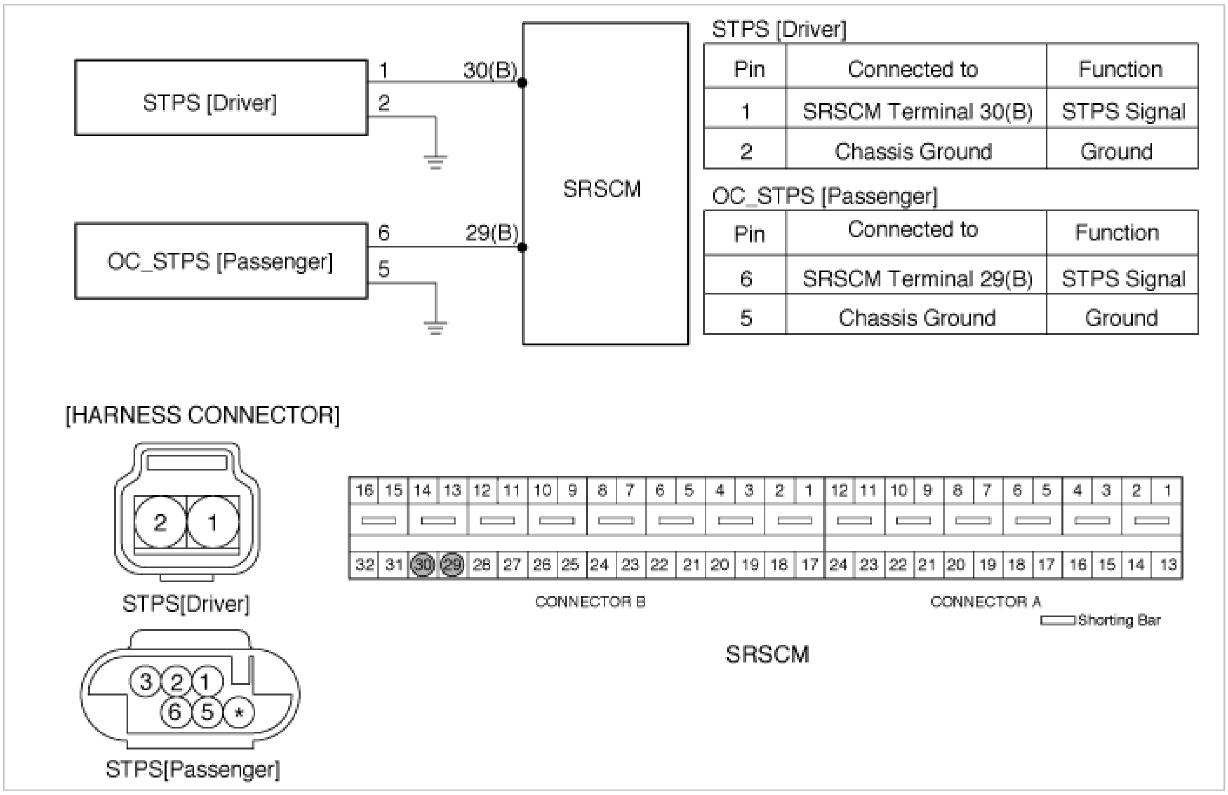
DTC	Condition	Probable cause
B1389 B1392	• STPS Malfunction • SRSCM Malfunction	• STPS • SRSCM

Specification

[Seat position diagnostic current limits]

Open/Short to Battery	Grey Zone	Forward	Grey Zone	Defect	Grey Zone	Rearward	Grey Zone	Short/Short to ground
< 3.98 mA	3.98 - 4.79 mA	4.79 - 7.16 mA	7.16 - 8.62 mA	8.62 - 9.94 mA	9.94 - 11.97 mA	11.97 - 17.29 mA	17.29 - 20.83 mA	> 20.83 mA

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK THE SEAT TRACK POSITION SENSOR (STPS)
   (1) Measure current between the terminal 1(6) of STPS and 30(29) of SRSCM(B).

   Specification(current) : 12 ~ 17 mA (Reward status), 5 ~ 7 mA (Forward status)

   (2) Is the measured current within specification?

   YES

   ▸ Goto next stop.

   NO

   ▸ Replace the STPS.

3. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON .
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1390

DTC Description

The Seat Track Position Sensor (STPS) circuit consists of the SRSCM and two STPS. The SRSCM sets above DTC(s) if it detects open or short to ground on the STPS circuit. The "Seat Forward" status currently represents a seat position in which the deployment of the second stage airbag is prohibited.

DTC Detecting Condition

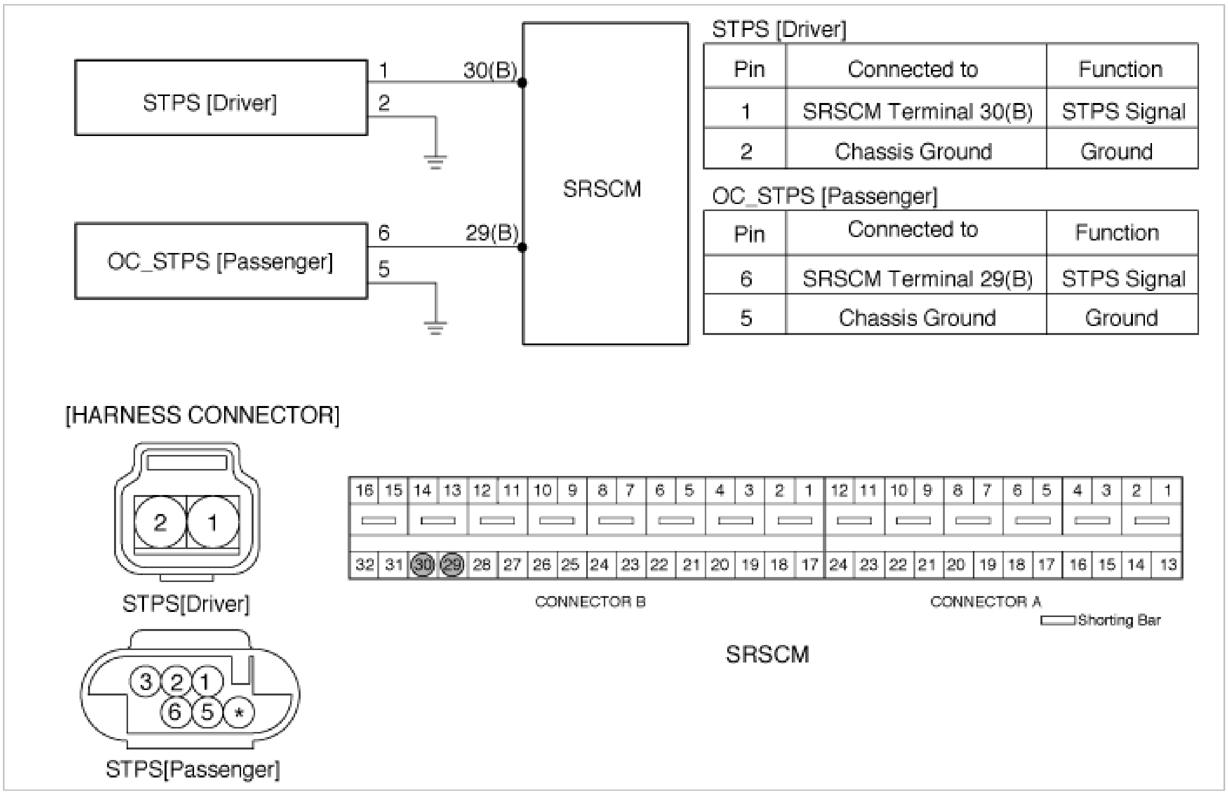
DTC	Condition	Probable cause
B1387 B1390	• Short between STPS and SRSCM • Short to ground between STPS and SRSCM • STPS Malfunction • SRSCM Malfunction	• Short or short to ground circuit on wiring harness • STPS • SRSCM

Specification

[Seat position diagnostic current limits]

Open/Short to Battery	Grey Zone	Forward	Grey Zone	Defect	Grey Zone	Rearward	Grey Zone	Short/Short to ground
< 3.98 mA	3.98 - 4.79 mA	4.79 - 7.16 mA	7.16 - 8.62 mA	8.62 - 9.94 mA	9.94 - 11.97 mA	11.97 - 17.29 mA	17.29 - 20.83 mA	> 20.83 mA

Schematic Diagram



STPS [Driver]

Pin	Connected to	Function
1	SRSCM Terminal 30(B)	STPS Signal
2	Chassis Ground	Ground

OC_STPS [Passenger]

Pin	Connected to	Function
6	SRSCM Terminal 29(B)	STPS Signal
5	Chassis Ground	Ground

Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

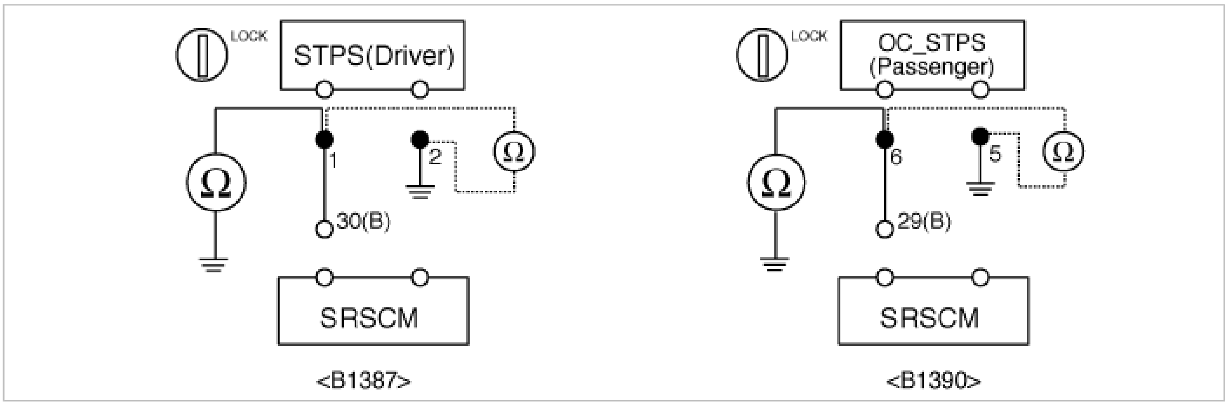
YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SHORT OR SHORT TO GROUND
   (1) Disconnect the STPS connector.
   (2) Measure resistance between the terminal 1(6) of STPS harness connector and chassis ground.
   (3) Measure resistance between the terminal 1(6) and 2(3) of STPS harness connector.

specification(resistance) : infinite



(4) Is the measured resistance within specification?

YES

▸ Check the STPS.

NO

▸ Repair or replace the wiring harness between the STPS and the SRSCM.

3. CHECK THE SEAT TRACK POSITION SENSOR (STPS)
   (1) Measure current between the terminal 1(6) of STPS and 30(29) of SRSCM(B).

   Specification(current) : 12 ~ 17 mA (Reward status), 5 ~ 7 mA (Forward status)

   (2) Is the measured current within specification?

   YES

   ▸ Goto next stop.

   NO

   ▸ Replace the STPS.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON .
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1391

DTC Description

The Seat Track Position Sensor (STPS) circuit consists of the SRSCM and two STPS. The SRSCM sets above DTC(s) if it detects short or short to battery line on the STPS circuit. The "Seat Forward" status currently represents a seat position in which the deployment of the second stage airbag is prohibited.

DTC Detecting Condition

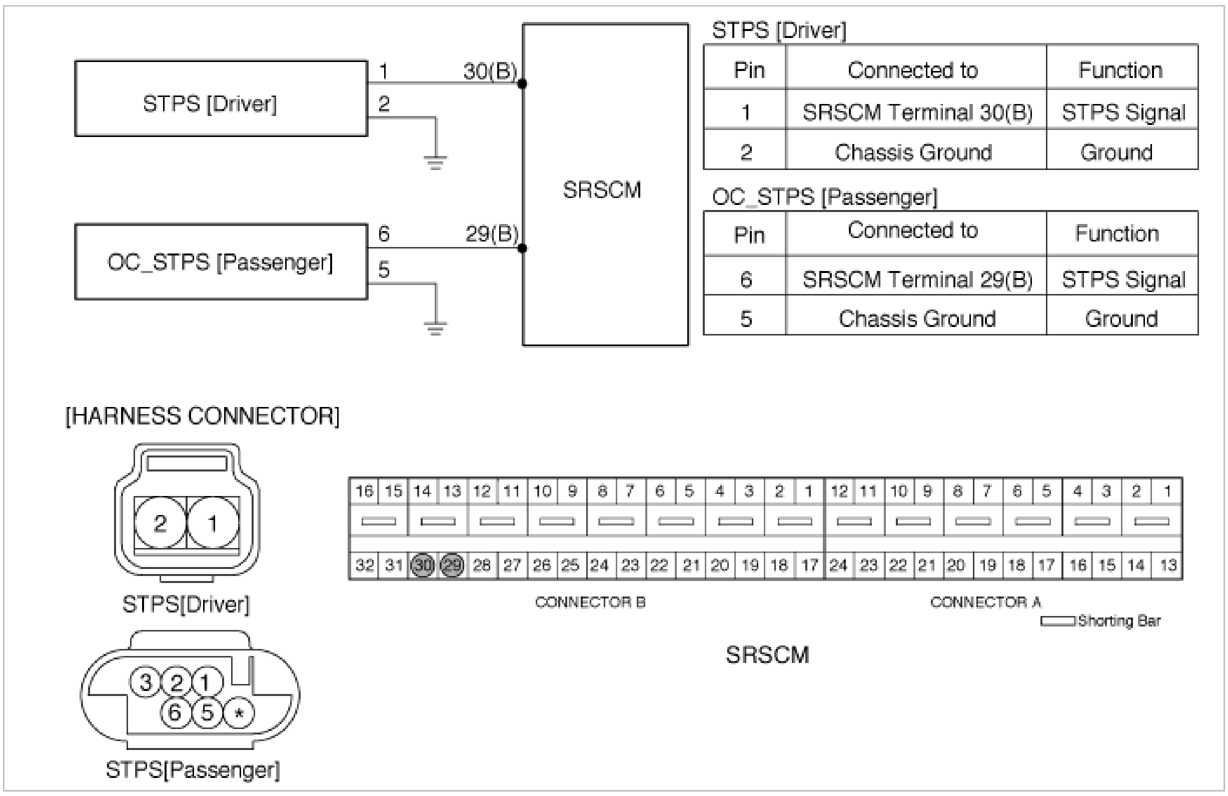
DTC	Condition	Probable cause
B1388 B1391	• Open between STPS and SRSCM • Short to battery line between STPS and SRSCM • STPS Malfunction • SRSCM Malfunction	• Open or short to battery line circuit on wiring harness • STPS • SRSCM

Specification

[Seat position diagnostic current limits]

Open/Short to Battery	Grey Zone	Forward	Grey Zone	Defect	Grey Zone	Rearward	Grey Zone	Short/Short to ground
< 3.98 mA	3.98 - 4.79 mA	4.79 - 7.16 mA	7.16 - 8.62 mA	8.62 - 9.94 mA	9.94 - 11.97 mA	11.97 - 17.29 mA	17.29 - 20.83 mA	> 20.83 mA

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> CAUTION
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

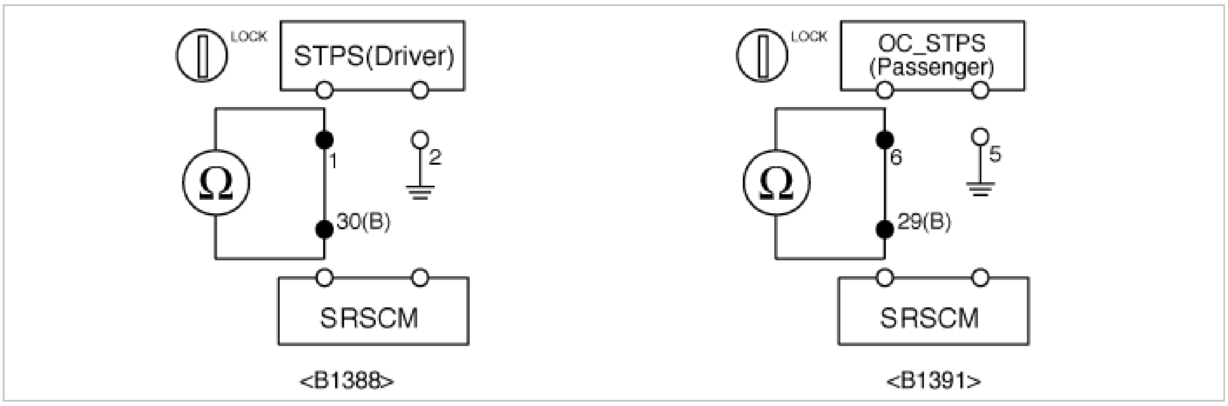
▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK OPEN CIRCUIT
   (1) Disconnect the STPS connector.
   (2) Measure resistance between the terminal 1 of STPS harness connector and the terminal 30 of SRSCM harness connector (B).<B1388>
   (3) Measure resistance between the terminal 6 of STPS harness connector and the terminal 29 of SRSCM harness connector (B).<B1391>

specification(resistance) : below 1 Ω



   (4) Is the measured resistance within specification?

YES

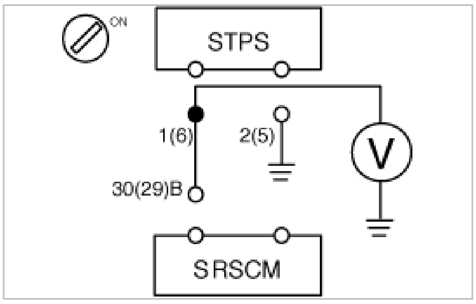
▸ Check short to ground.

NO

▸ Repair the open circuit on wiring harness between the STPS and the SRSCM.

3. CHECK SHORT TO BATTERY LINE
   (1) Connect the negative (-) terminal to the battery.
   (2) Turn the ignition switch to ON.
   (3) Measure voltage between the terminal 1(6) of STPS harness connector and chassis ground(-).

specification(voltage) : Approximately 0 V



   (4) Is the measured voltage within specification?

YES

▸ Check the STPS.

NO

▸ Repair the short to battery line circuit on wiring harness between the STPS and the SRSCM.

4. CHECK THE SEAT TRACK POSITION SENSOR (STPS)
(1) Measure current between the terminal 1(6) of STPS and 30(29) of SRSCM(B).

Specification(current) : 12 ~ 17 mA (Reward status), 5 ~ 7 mA (Forward status)

(2) Is the measured current within specification?

YES

▶ Goto next stop.

NO

▶ Replace the STPS.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
(1) Install the DAB module and connect the DAB connector.
(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
(3) Connect the SRSCM connector.
(4) Connect the negative (-) terminal to the battery.
(5) Connect a Hi-Scan(Pro) to the data link connector.
(6) Turn the ignition switch to ON .
(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
(9) Turn the ignition switch to ON and wait for at least 30 seconds.
(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▶ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▶Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1392

DTC Description

The Seat Track Position Sensor (STPS) circuit consists of the SRSCM and two STPS. The SRSCM sets above DTC(s) if it detects the STPS fault. The "Seat Forward" status currently represents a seat position in which the deployment of the second stage airbag is prohibited.

DTC Detecting Condition

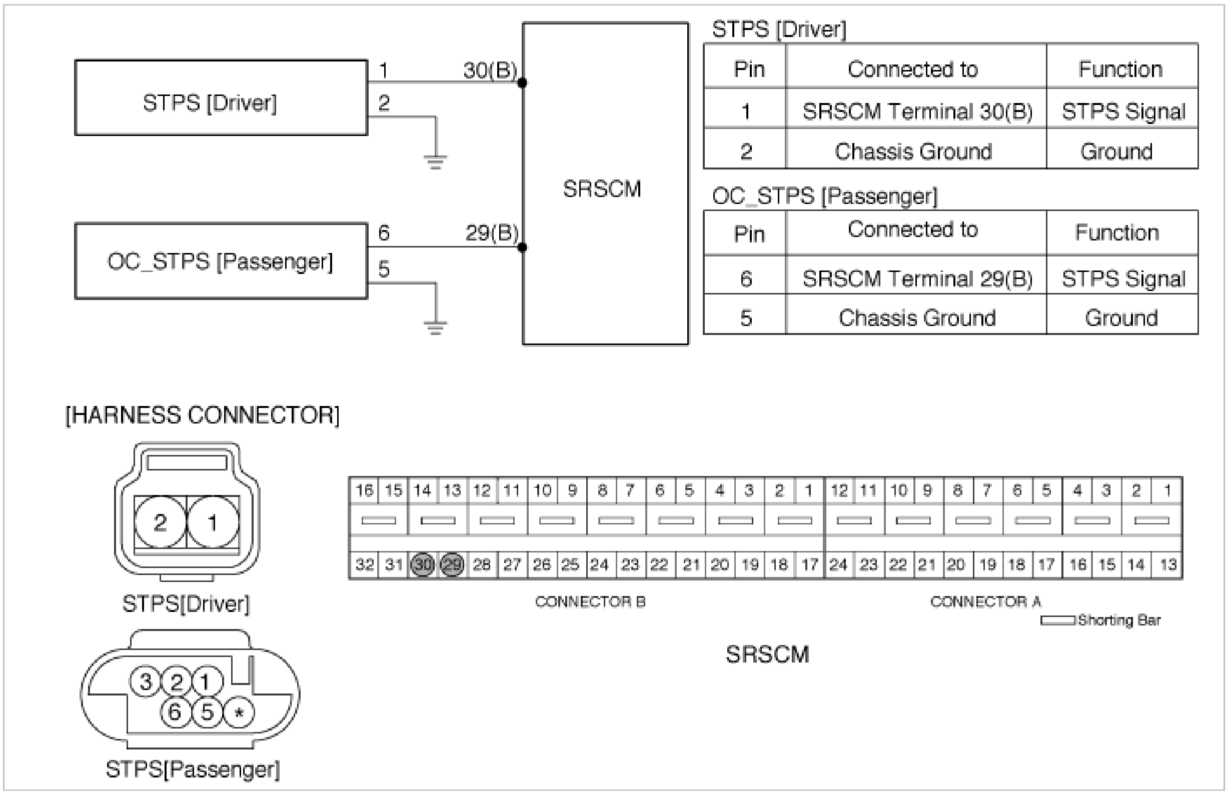
DTC	Condition	Probable cause
B1389 B1392	• STPS Malfunction • SRSCM Malfunction	• STPS • SRSCM

Specification

[Seat position diagnostic current limits]

Open/Short to Battery	Grey Zone	Forward	Grey Zone	Defect	Grey Zone	Rearward	Grey Zone	Short/Short to ground
< 3.98 mA	3.98 - 4.79 mA	4.79 - 7.16 mA	7.16 - 8.62 mA	8.62 - 9.94 mA	9.94 - 11.97 mA	11.97 - 17.29 mA	17.29 - 20.83 mA	> 20.83 mA

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK THE SEAT TRACK POSITION SENSOR (STPS)
   (1) Measure current between the terminal 1(6) of STPS and 30(29) of SRSCM(B).

   Specification(current) : 12 ~ 17 mA (Reward status), 5 ~ 7 mA (Forward status)

   (2) Is the measured current within specification?

   YES

   ▸ Goto next stop.

   NO

   ▸ Replace the STPS.

3. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON .
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES
   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO
   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1395

DTC Description

DTC code is detected when short is broken out between airbag module and the other module. And warning lamp operates after DTC is detected.

Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

   NO
   ▸ Go to next step.

   YES
   ▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. CHECK CIRCUIT
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
   (6) Measure resistance between airbag module wiring harness and the other wiring harness.(ex. DAB vs PAB, DAB vs SAB, DAB vs CAB, DAB vs BPT, DAB vs BUPT etc.)

   specification(resistance) : infinite

   Is the measured resistance within specification?

   YES
   ▸ Replace SRSCM, then go to " CLEAR THE DTC AND CHECK THE VEHICLE AGAIN ".

   NO

▸ Repair or replace the wiring harness, then go to " CLEAR THE DTC AND CHECK THE VEHICLE AGAIN ".

2. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON.
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1400

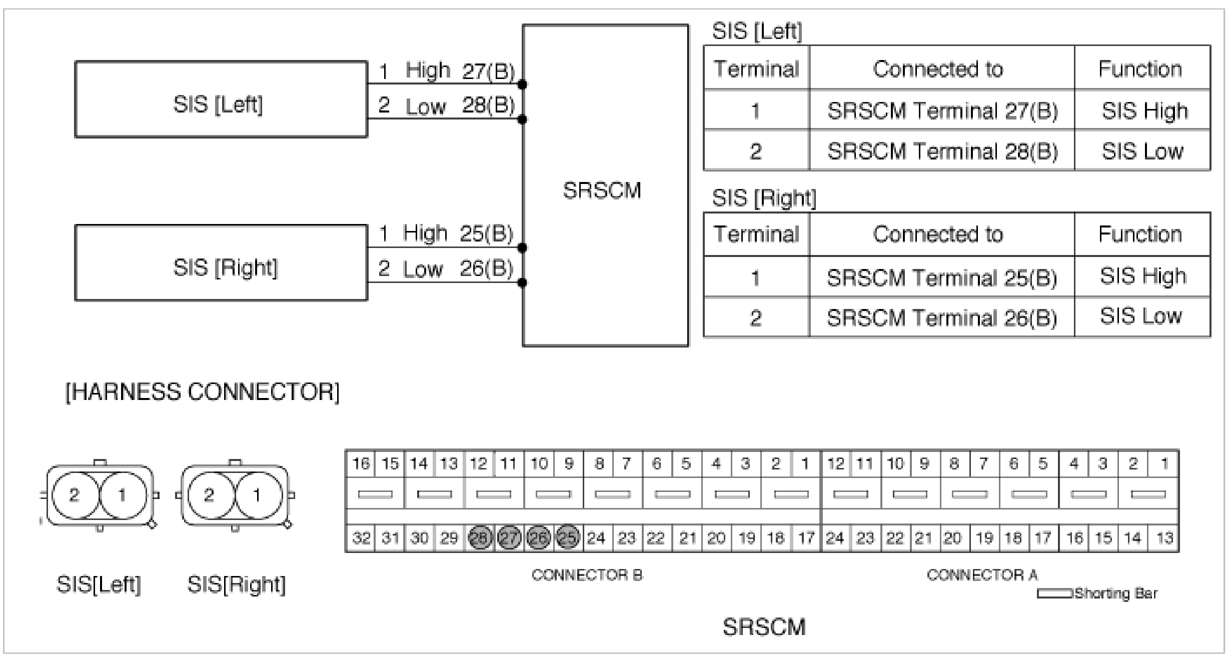
DTC Description

The detecting system for side crash consists of the SRSCM and two Side Impact Sensors (SIS).The SRSCM sets above DTC(s) if it detects that any SIS is defective or there is communication error between any front SIS and the SRSCM.

DTC Detecting Condition

DTC	Condition	Probable cause
B1400 B1403 B1409 B1410	• Open between SIS and SRSCM • Side Impact Sensor (SIS) Malfunction • SRSCM Malfunction	• Wiring Harness • Side Impact Sensor (SIS) squib • SRSCM

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> CAUTION
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

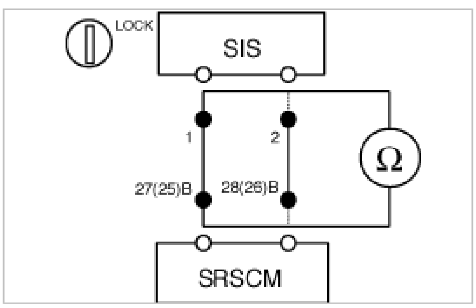
YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SIS CIRCUIT
   (1) Measure resistance between the terminal 1 of SIS harness connector and the terminal 27(25) of SRSCM harness connector(B).
   (2) Measure resistance between the terminal 2 of SIS harness connector and the terminal 28(26) of SRSCM harness connector(B).

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

▸Check Side Impact Sensor.

NO

▸ Repair or replace the wiring harness between the SIS and the SRSCM.

3. CHECK THE SIDE IMPACT SENSOR
   (1) Replace the Side Impact Sensor(SIS) with a new one.
   ● Refer to "Side Impact Sensor(SIS)" section in this SERVICE MANUAL.
   (2) Install the DAB module and connect the DAB connector.
   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (4) Connect the SRSCM connector.
   (5) Connect the negative (-) terminal to the battery.
   (6) Connect a Hi-Scan(Pro) to the data link connector.
   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to Side Impact Sensor(SIS)?

YES

▸ Go to next step.

NO

▸ Replace SIS.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON .
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1403

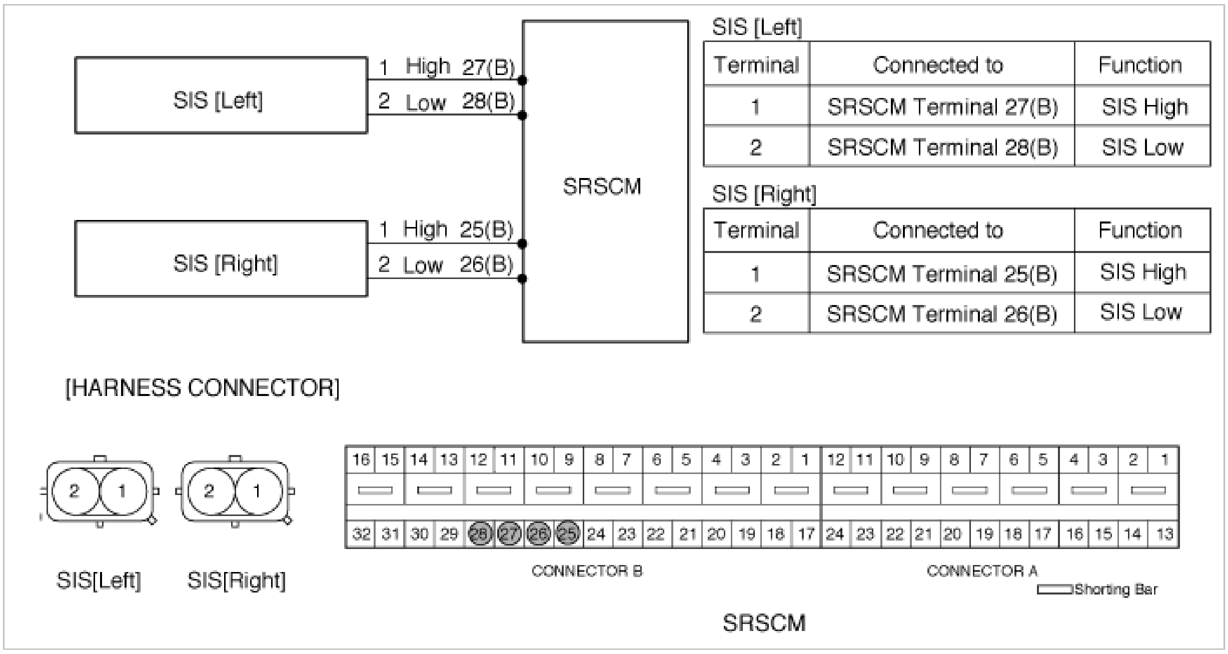
DTC Description

The detecting system for side crash consists of the SRSCM and two Side Impact Sensors (SIS).The SRSCM sets above DTC(s) if it detects that any SIS is defective or there is communication error between any front SIS and the SRSCM.

DTC Detecting Condition

DTC	Condition	Probable cause
B1400 B1403 B1409 B1410	• Open between SIS and SRSCM • Side Impact Sensor (SIS) Malfunction • SRSCM Malfunction	• Wiring Harness • Side Impact Sensor (SIS) squib • SRSCM

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

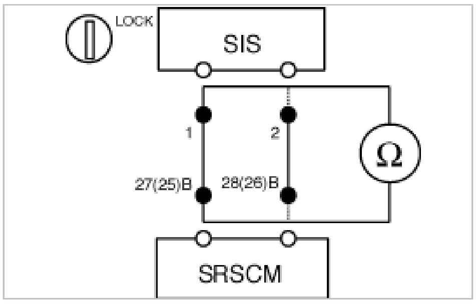
▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK SIS CIRCUIT
   (1) Measure resistance between the terminal 1 of SIS harness connector and the terminal 27(25) of SRSCM harness connector(B).
   (2) Measure resistance between the terminal 2 of SIS harness connector and the terminal 28(26) of SRSCM harness connector(B).

   specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

▸Check Side Impact Sensor.

NO

▸ Repair or replace the wiring harness between the SIS and the SRSCM.

3. CHECK THE SIDE IMPACT SENSOR
   (1) Replace the Side Impact Sensor(SIS) with a new one.
      ● Refer to "Side Impact Sensor(SIS)" section in this SERVICE MANUAL.

   (2) Install the DAB module and connect the DAB connector.

   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (4) Connect the SRSCM connector.

   (5) Connect the negative (-) terminal to the battery.

   (6) Connect a Hi-Scan(Pro) to the data link connector.

   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to Side Impact Sensor(SIS)?

   YES

   ▸ Go to next step.

   NO

   ▸ Replace SIS.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.

   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (3) Connect the SRSCM connector.

   (4) Connect the negative (-) terminal to the battery.

   (5) Connect a Hi-Scan(Pro) to the data link connector.

   (6) Turn the ignition switch to ON .

   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

   (9) Turn the ignition switch to ON and wait for at least 30 seconds.

   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1409

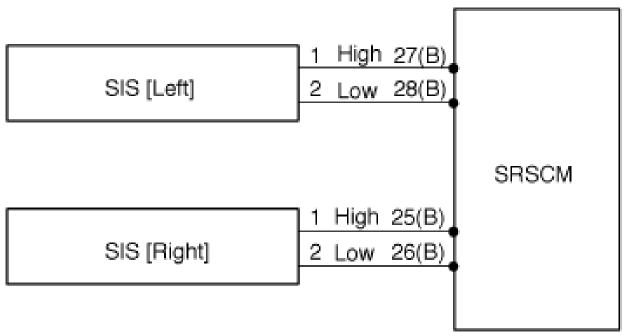
DTC Description

The detecting system for side crash consists of the SRSCM and two Side Impact Sensors (SIS).The SRSCM sets above DTC(s) if it detects that any SIS is defective or there is communication error between any front SIS and the SRSCM.

DTC Detecting Condition

DTC	Condition	Probable cause
B1400 B1403 B1409 B1410	• Open between SIS and SRSCM • Side Impact Sensor (SIS) Malfunction • SRSCM Malfunction	• Wiring Harness • Side Impact Sensor (SIS) squib • SRSCM

Schematic Diagram



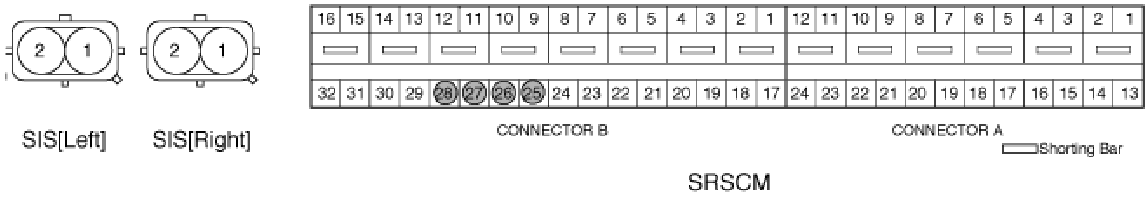
SIS [Left]

Terminal	Connected to	Function
1	SRSCM Terminal 27(B)	SIS High
2	SRSCM Terminal 28(B)	SIS Low

SIS [Right]

Terminal	Connected to	Function
1	SRSCM Terminal 25(B)	SIS High
2	SRSCM Terminal 26(B)	SIS Low

[HARNESS CONNECTOR]



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

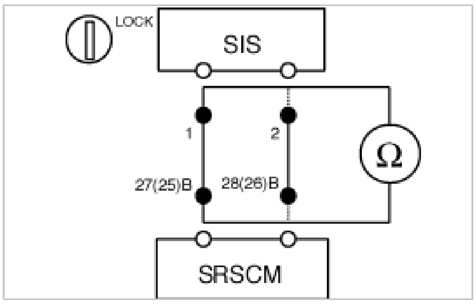
Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK SIS CIRCUIT
   (1) Measure resistance between the terminal 1 of SIS harness connector and the terminal 27(25) of SRSCM harness connector(B).
   (2) Measure resistance between the terminal 2 of SIS harness connector and the terminal 28(26) of SRSCM harness

connector(B).

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

▸Check Side Impact Sensor.

NO

▸ Repair or replace the wiring harness between the SIS and the SRSCM.

3. CHECK THE SIDE IMPACT SENSOR
   (1) Replace the Side Impact Sensor(SIS) with a new one.
   - Refer to "Side Impact Sensor(SIS)" section in this SERVICE MANUAL.

   (2) Install the DAB module and connect the DAB connector.

   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (4) Connect the SRSCM connector.

   (5) Connect the negative (-) terminal to the battery.

   (6) Connect a Hi-Scan(Pro) to the data link connector.

   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to Side Impact Sensor(SIS)?

   YES

   ▸ Go to next step.

   NO

   ▸ Replace SIS.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.

   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (3) Connect the SRSCM connector.

   (4) Connect the negative (-) terminal to the battery.

   (5) Connect a Hi-Scan(Pro) to the data link connector.

   (6) Turn the ignition switch to ON .

   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

   (9) Turn the ignition switch to ON and wait for at least 30 seconds.

   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1410

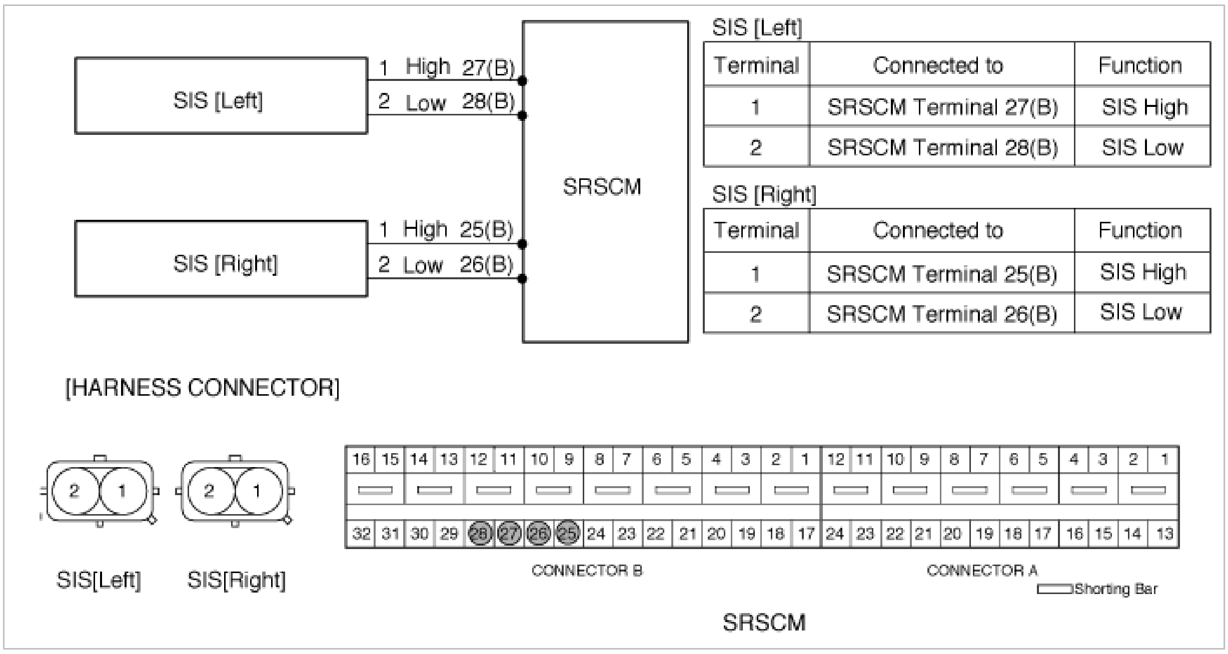
DTC Description

The detecting system for side crash consists of the SRSCM and two Side Impact Sensors (SIS).The SRSCM sets above DTC(s) if it detects that any SIS is defective or there is communication error between any front SIS and the SRSCM.

DTC Detecting Condition

DTC	Condition	Probable cause
B1400 B1403 B1409 B1410	• Open between SIS and SRSCM • Side Impact Sensor (SIS) Malfunction • SRSCM Malfunction	• Wiring Harness • Side Impact Sensor (SIS) squib • SRSCM

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

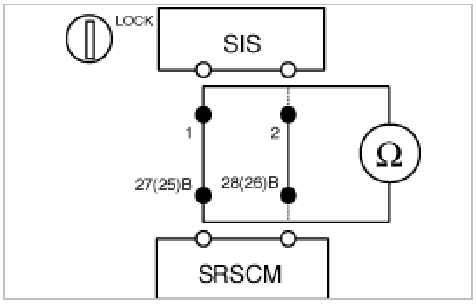
1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK SIS CIRCUIT
   (1) Measure resistance between the terminal 1 of SIS harness connector and the terminal 27(25) of SRSCM harness

connector(B).

(2) Measure resistance between the terminal 2 of SIS harness connector and the terminal 28(26) of SRSCM harness connector(B).

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

▸Check Side Impact Sensor.

NO

▸ Repair or replace the wiring harness between the SIS and the SRSCM.

3. CHECK THE SIDE IMPACT SENSOR
   (1) Replace the Side Impact Sensor(SIS) with a new one.
   - Refer to "Side Impact Sensor(SIS)" section in this SERVICE MANUAL.

   (2) Install the DAB module and connect the DAB connector.

   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (4) Connect the SRSCM connector.

   (5) Connect the negative (-) terminal to the battery.

   (6) Connect a Hi-Scan(Pro) to the data link connector.

   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to Side Impact Sensor(SIS)?

   YES

   ▸ Go to next step.

   NO

   ▸ Replace SIS.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.

   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (3) Connect the SRSCM connector.

   (4) Connect the negative (-) terminal to the battery.

   (5) Connect a Hi-Scan(Pro) to the data link connector.

   (6) Turn the ignition switch to ON .

   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

   (9) Turn the ignition switch to ON and wait for at least 30 seconds.

   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting >

B1448

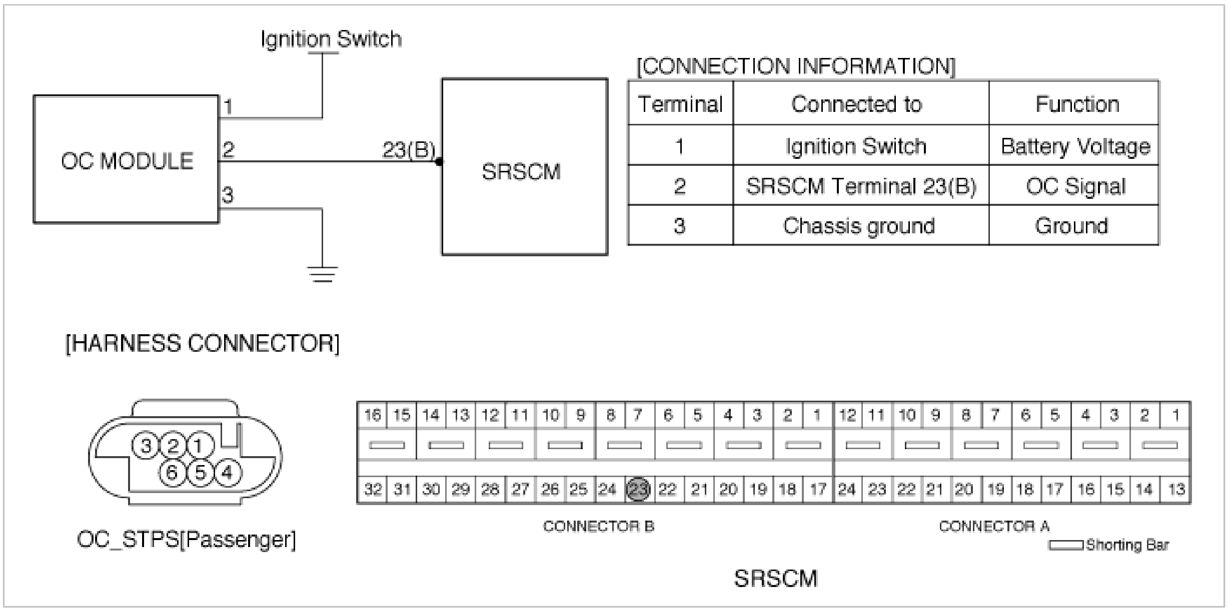
DTC Description

The passenger occupant classification system consists of the SRSCM and the OC module. The above DTC is recorded when a defect or communication error of the OC module is detected in the OC module circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1448 B1449 B1450	• OC module Malfunction • SRSCM Malfunction	• Wiring Harness • OC module • SRSCM

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

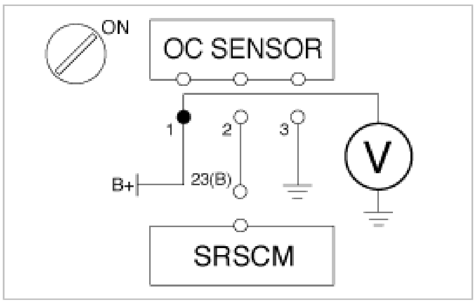
1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK POWER TO OC SENSOR

(1) Connect the negative (-) terminal to the battery.

(2) Turn the ignition switch to ON.

(3) Measure voltage between the terminal 1 of OC Sensor harness connector and chassis ground.

specification(voltage) : Battery voltage



(4) Is the measured voltage within specification?

YES

▸ Check short to battery line.

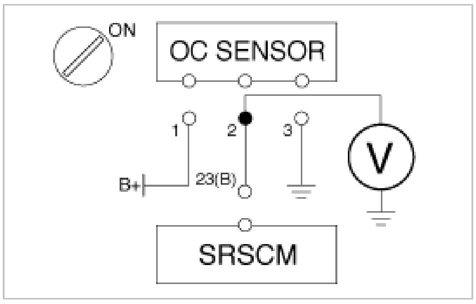
NO

▸ Repair or replace the wiring harness between the OC Sensor and ignition switch.

3. CHECK SHORT TO BATTERY LINE

(1) Measure voltage between the terminal 2 of OC Sensor harness connector and chassis ground.

specification(voltage) : Approximately 0 V



(2) Is the measured voltage within specification?

YES

▸ Check short to ground.

NO

▸ Repair the short to battery line circuit on wiring harness between the OC Sensor and the SRSCM.

4. CHECK SHORT TO GROUND

(1) Disconnect the negative(-) terminal from the battery.

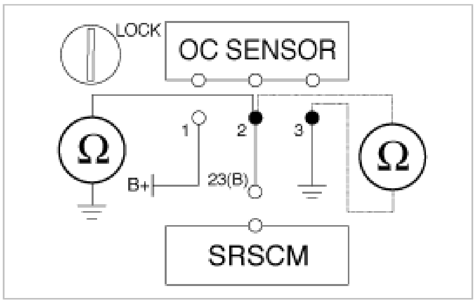
(2) Turn the ignition switch to LOCK.

(3) Disconnect the negative (-) terminal from the battery.

(4) Measure resistance between the terminal 2 of OC Sensor harness connector and chassis ground.

(5) Measure resistance between the terminal the terminal 2 and 3 of OC Sensor harness connector

Specification(resistance) : Infinite



(6) Is the measured resistance within specification?

YES

▸ Check OC Sensor Circuit.

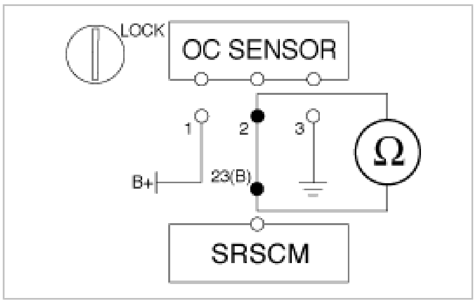
NO

▸ Repair or replace the wiring harness between the OC Sensor and the SRSCM.

5. CHECK OC SENSOR CIRCUIT

(1) Measure resistance between the terminal 2 of OC Sensor harness connector and the terminal 23 of the SRSCM harness connector(B).

specification(resistance) : below 1 Ω



(2) Is the measured resistance within specification?

YES

▸ Check OC Sensor.

NO

▸ Repair or replace the wiring harness between the OC Sensor and the SRSCM.

6. CHECK OC SENSOR

(1) Replace the OC Sensor with a new one.

- Refer to "OC SENSOR" section in this SERVICE MANUAL.

(2) Install the DAB module and connect the DAB connector.

(3) Connect the connectors of the PAB, SAB, CAB, BPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal to the battery.

(6) Connect the a Hi-Scan(Pro) the the data link connector.

(7) Turn the ignition switch to ON and check the vehicle again.

(8) Does Hi-Scan(Pro) indicate any DTC related to OC Sensor?

YES

▸ Go to next step.

NO

▸ Replace the OC Sensor.

7. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON .

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1449

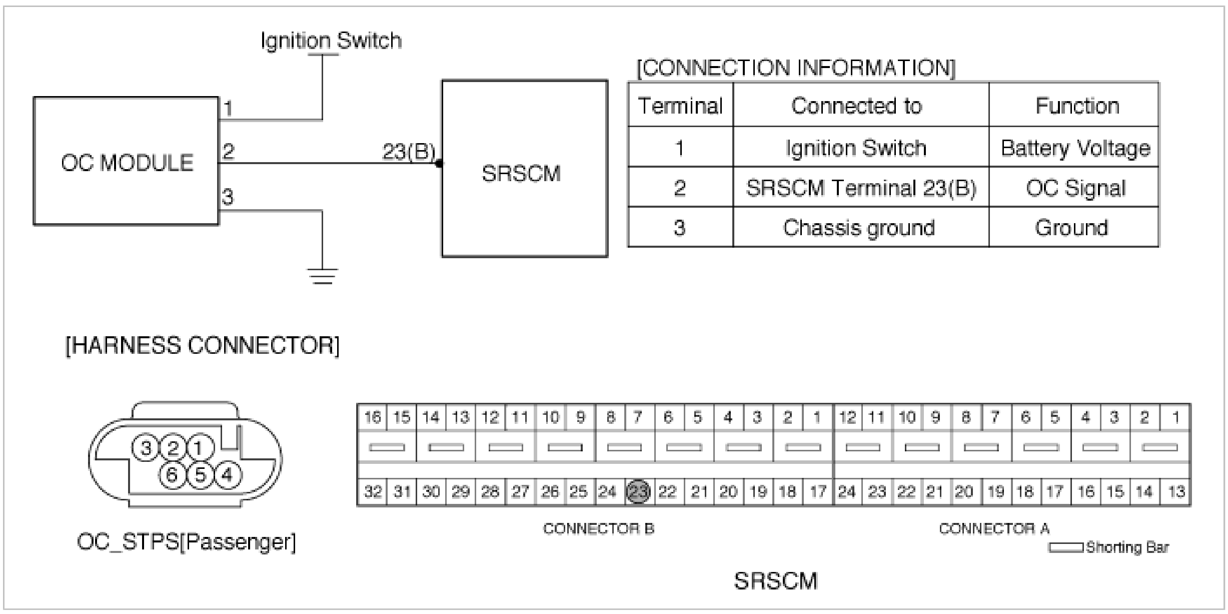
DTC Description

The passenger occupant classification system consists of the SRSCM and the OC module. The above DTC is recorded when a defect or communication error of the OC module is detected in the OC module circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1448 B1449 B1450	• OC module Malfunction • SRSCM Malfunction	• Wiring Harness • OC module • SRSCM

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

CAUTION

Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

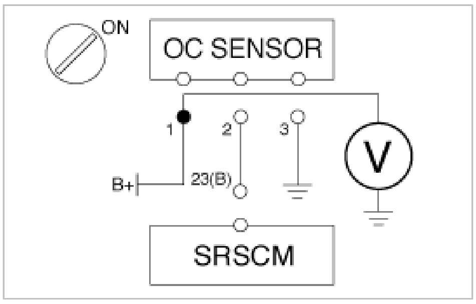
▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK POWER TO OC SENSOR
   (1) Connect the negative (-) terminal to the battery.
   (2) Turn the ignition switch to ON.
   (3) Measure voltage between the terminal 1 of OC Sensor harness connector and chassis ground.

specification(voltage) : Battery voltage



   (4) Is the measured voltage within specification?

YES

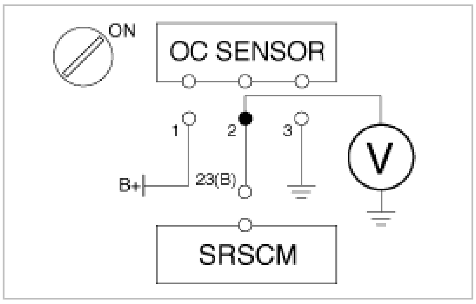
▸ Check short to battery line.

NO

▸ Repair or replace the wiring harness between the OC Sensor and ignition switch.

3. CHECK SHORT TO BATTERY LINE
   (1) Measure voltage between the terminal 2 of OC Sensor harness connector and chassis ground.

specification(voltage) : Approximately 0 V



   (2) Is the measured voltage within specification?

YES

▸ Check short to ground.

NO

▸ Repair the short to battery line circuit on wiring harness between the OC Sensor and the SRSCM.

4. CHECK SHORT TO GROUND

(1) Disconnect the negative(-) terminal from the battery.

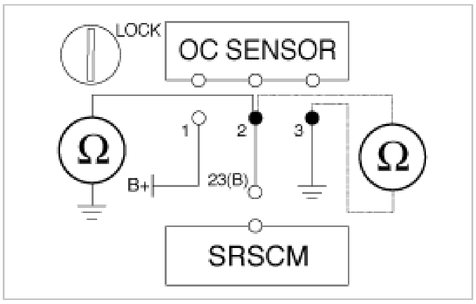
(2) Turn the ignition switch to LOCK.

(3) Disconnect the negative (-) terminal from the battery.

(4) Measure resistance between the terminal 2 of OC Sensor harness connector and chassis ground.

(5) Measure resistance between the terminal the terminal 2 and 3 of OC Sensor harness connector

Specification(resistance) : Infinite



(6) Is the measured resistance within specification?

YES

▸ Check OC Sensor Circuit.

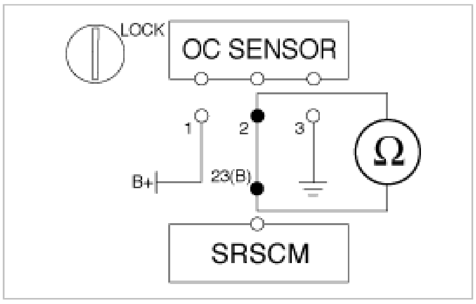
NO

▸ Repair or replace the wiring harness between the OC Sensor and the SRSCM.

5. CHECK OC SENSOR CIRCUIT

(1) Measure resistance between the terminal 2 of OC Sensor harness connector and the terminal 23 of the SRSCM harness connector(B).

specification(resistance) : below 1 Ω



(2) Is the measured resistance within specification?

YES

▸ Check OC Sensor.

NO

▸ Repair or replace the wiring harness between the OC Sensor and the SRSCM.

6. CHECK OC SENSOR

(1) Replace the OC Sensor with a new one.

- Refer to "OC SENSOR" section in this SERVICE MANUAL.

(2) Install the DAB module and connect the DAB connector.

(3) Connect the connectors of the PAB, SAB, CAB, BPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal to the battery.

(6) Connect the a Hi-Scan(Pro) the the data link connector.

(7) Turn the ignition switch to ON and check the vehicle again.

(8) Does Hi-Scan(Pro) indicate any DTC related to OC Sensor?

YES

▸ Go to next step.

NO

▸ Replace the OC Sensor.

7. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON .
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1450

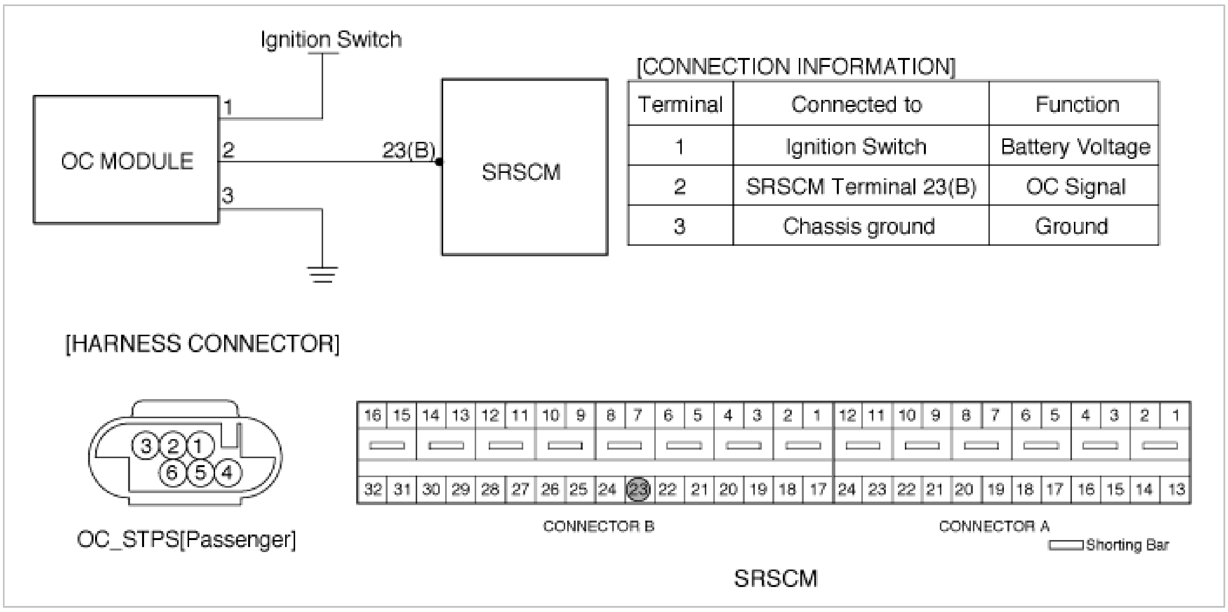
DTC Description

The passenger occupant classification system consists of the SRSCM and the OC module. The above DTC is recorded when a defect or communication error of the OC module is detected in the OC module circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1448 B1449 B1450	• OC module Malfunction • SRSCM Malfunction	• Wiring Harness • OC module • SRSCM

Schematic Diagram



[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	Ignition Switch	Battery Voltage
2	SRSCM Terminal 23(B)	OC Signal
3	Chassis ground	Ground

Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

CAUTION
Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

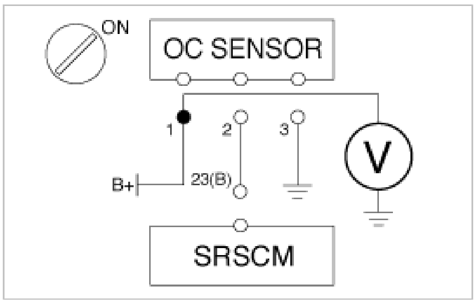
YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK POWER TO OC SENSOR
   (1) Connect the negative (-) terminal to the battery.
   (2) Turn the ignition switch to ON.
   (3) Measure voltage between the terminal 1 of OC Sensor harness connector and chassis ground.

   specification(voltage) : Battery voltage



   (4) Is the measured voltage within specification?

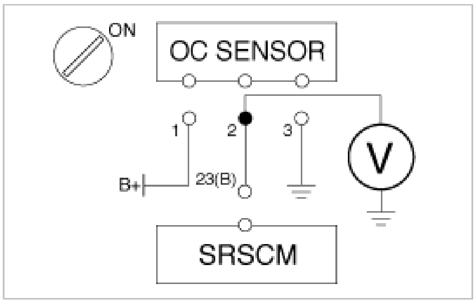
   YES

   ▸ Check short to battery line.

   NO

   ▸ Repair or replace the wiring harness between the OC Sensor and ignition switch.
3. CHECK SHORT TO BATTERY LINE
   (1) Measure voltage between the terminal 2 of OC Sensor harness connector and chassis ground.

   specification(voltage) : Approximately 0 V



(2) Is the measured voltage within specification?

YES

▸ Check short to ground.

NO

▸ Repair the short to battery line circuit on wiring harness between the OC Sensor and the SRSCM.

4. CHECK SHORT TO GROUND

(1) Disconnect the negative(-) terminal from the battery.

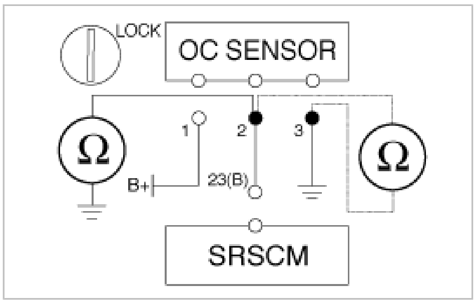
(2) Turn the ignition switch to LOCK.

(3) Disconnect the negative (-) terminal from the battery.

(4) Measure resistance between the terminal 2 of OC Sensor harness connector and chassis ground.

(5) Measure resistance between the terminal the terminal 2 and 3 of OC Sensor harness connector

Specification(resistance) : Infinite



(6) Is the measured resistance within specification?

YES

▸ Check OC Sensor Circuit.

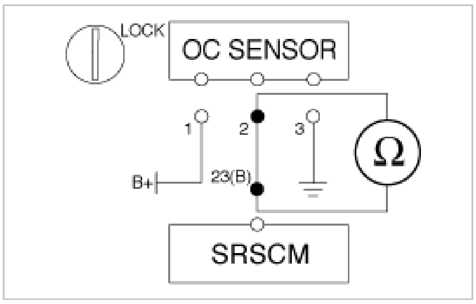
NO

▸ Repair or replace the wiring harness between the OC Sensor and the SRSCM.

5. CHECK OC SENSOR CIRCUIT

(1) Measure resistance between the terminal 2 of OC Sensor harness connector and the terminal 23 of the SRSCM harness connector(B).

specification(resistance) : below 1 Ω



(2) Is the measured resistance within specification?

YES

▸ Check OC Sensor.

NO

▸ Repair or replace the wiring harness between the OC Sensor and the SRSCM.

6. CHECK OC SENSOR
   (1) Replace the OC Sensor with a new one.
   ● Refer to "OC SENSOR" section in this SERVICE MANUAL.

   (2) Install the DAB module and connect the DAB connector.

   (3) Connect the connectors of the PAB, SAB, CAB, BPT, FIS and SIS.

   (4) Connect the SRSCM connector.

   (5) Connect the negative (-) terminal to the battery.

   (6) Connect the a Hi-Scan(Pro) the the data link connector.

   (7) Turn the ignition switch to ON and check the vehicle again.

   (8) Does Hi-Scan(Pro) indicate any DTC related to OC Sensor?

   YES

   ▸ Go to next step.

   NO

   ▸ Replace the OC Sensor.

7. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.

   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (3) Connect the SRSCM connector.

   (4) Connect the negative (-) terminal to the battery.

   (5) Connect a Hi-Scan(Pro) to the data link connector.

   (6) Turn the ignition switch to ON .

   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

   (9) Turn the ignition switch to ON and wait for at least 30 seconds.

   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1473

DTC Description

The CAB squib circuit consists of the SRSCM and CAB.It causes the SRS to deploy when the SRS deployment conditions are satisfied.The above DTC is recorded when the CAB resistance too high or low is detected in the CAB squib circuit.

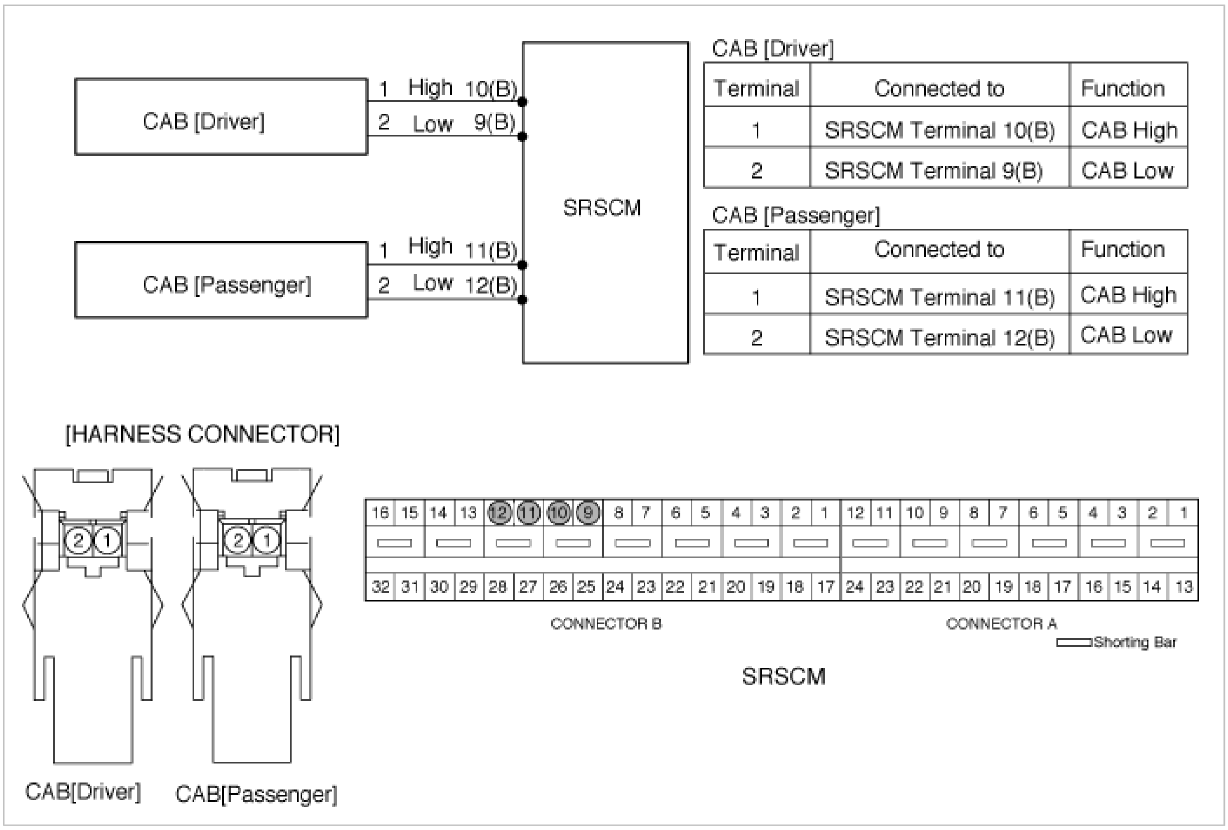
DTC Detecting Condition

DTC	Condition	Probable cause
B1473 B1474 B1477 B1478	• Too high or low resistance between CAB high(+) and CAB low (-) • Curtain Airbag (CAB) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Cirtain Airbag (CAB) squib • SRSCM • Partially connected connector

Specification

CAB resistance : 1.9 ≤ R ≤ 2.7 Ω

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> CAUTION
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

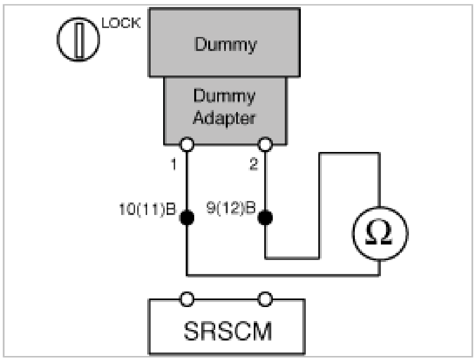
1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK CAB RESISTANCE

> CAUTION
>
> Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

(1) Connect the Dummy and the Dummy Adapter on CAB harness connector.
- Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

(2) Measure resistance between the terminal 10(11) and 9(12) of SRSCM harness connector(B).

CAB resistance : $1.9 \leq R \leq 2.7\ \Omega$



Is the measured resistance within specification?

YES

▸Replace the Curtain Airbag(CAB) module.

NO

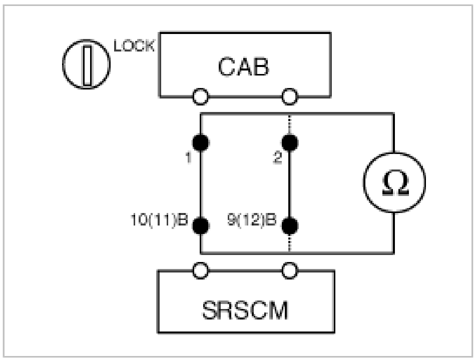
▸Check open circuit.

3. CHECK OPEN CIRCUIT

(1) Measure resistance between the terminal 1 of CAB harness connector and the terminal 10(11) of SRSCM harness connector(B).

(2) Measure resistance between the terminal 2 of CAB harness connector and the terminal 9(12) of SRSCM harness connector(B).

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

▸Check short circuit.

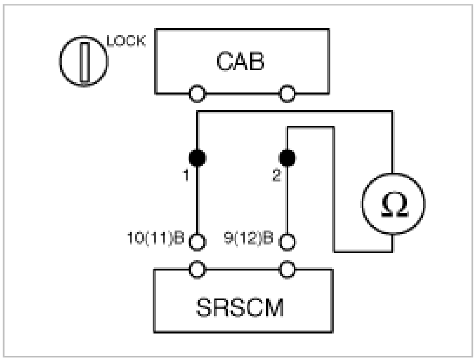
NO

▸Repair or replace the wiring harness between the CAB and the SRSCM.

4. CHECK SHORT CIRCUIT

(1) Measure resistance between the terminal 1 and 2 of CAB harness connector.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair or replace the wiring harness between the CAB and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON.
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1474

DTC Description

The CAB squib circuit consists of the SRSCM and CAB.It causes the SRS to deploy when the SRS deployment conditions are satisfied.The above DTC is recorded when the CAB resistance too high or low is detected in the CAB squib circuit.

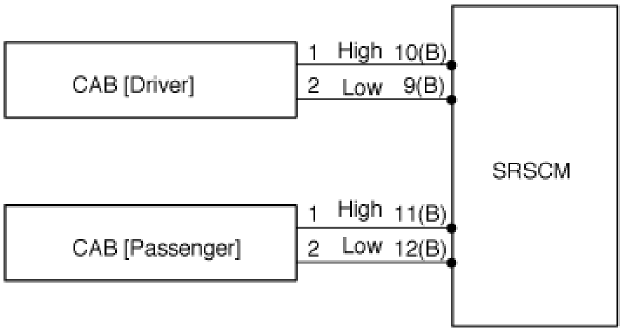
DTC Detecting Condition

DTC	Condition	Probable cause
B1473 B1474 B1477 B1478	• Too high or low resistance between CAB high(+) and CAB low (-) • Curtain Airbag (CAB) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Cirtain Airbag (CAB) squib • SRSCM • Partially connected connector

Specification

CAB resistance : $1.9 \le R \le 2.7\ \Omega$

Schematic Diagram

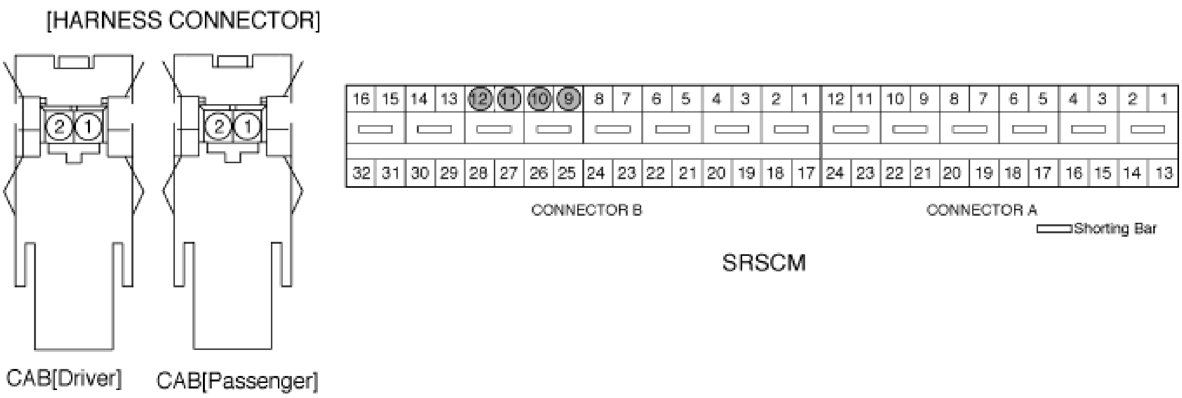


CAB [Driver]

Terminal	Connected to	Function
1	SRSCM Terminal 10(B)	CAB High
2	SRSCM Terminal 9(B)	CAB Low

CAB [Passenger]

Terminal	Connected to	Function
1	SRSCM Terminal 11(B)	CAB High
2	SRSCM Terminal 12(B)	CAB Low



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

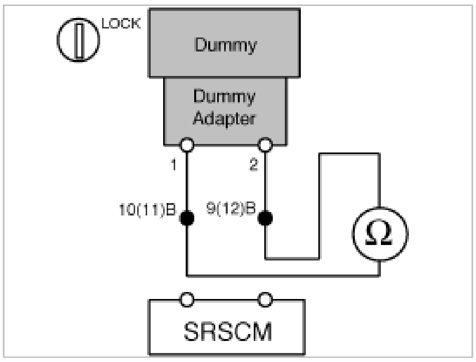
1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK CAB RESISTANCE

> **CAUTION**
>
> Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

   (1) Connect the Dummy and the Dummy Adapter on CAB harness connector.
   - Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

(2) Measure resistance between the terminal 10(11) and 9(12) of SRSCM harness connector(B).

CAB resistance : 1.9 ≤ R ≤ 2.7 Ω



Is the measured resistance within specification?

YES

▸Replace the Curtain Airbag(CAB) module.

NO

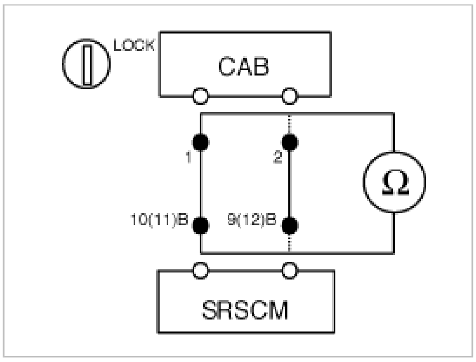
▸Check open circuit.

3. CHECK OPEN CIRCUIT

(1) Measure resistance between the terminal 1 of CAB harness connector and the terminal 10(11) of SRSCM harness connector(B).

(2) Measure resistance between the terminal 2 of CAB harness connector and the terminal 9(12) of SRSCM harness connector(B).

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

▸Check short circuit.

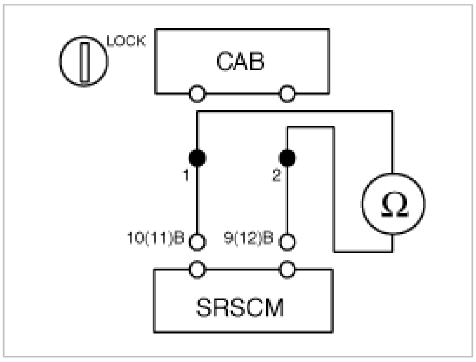
NO

▸Repair or replace the wiring harness between the CAB and the SRSCM.

4. CHECK SHORT CIRCUIT

(1) Measure resistance between the terminal 1 and 2 of CAB harness connector.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair or replace the wiring harness between the CAB and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON.
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1475

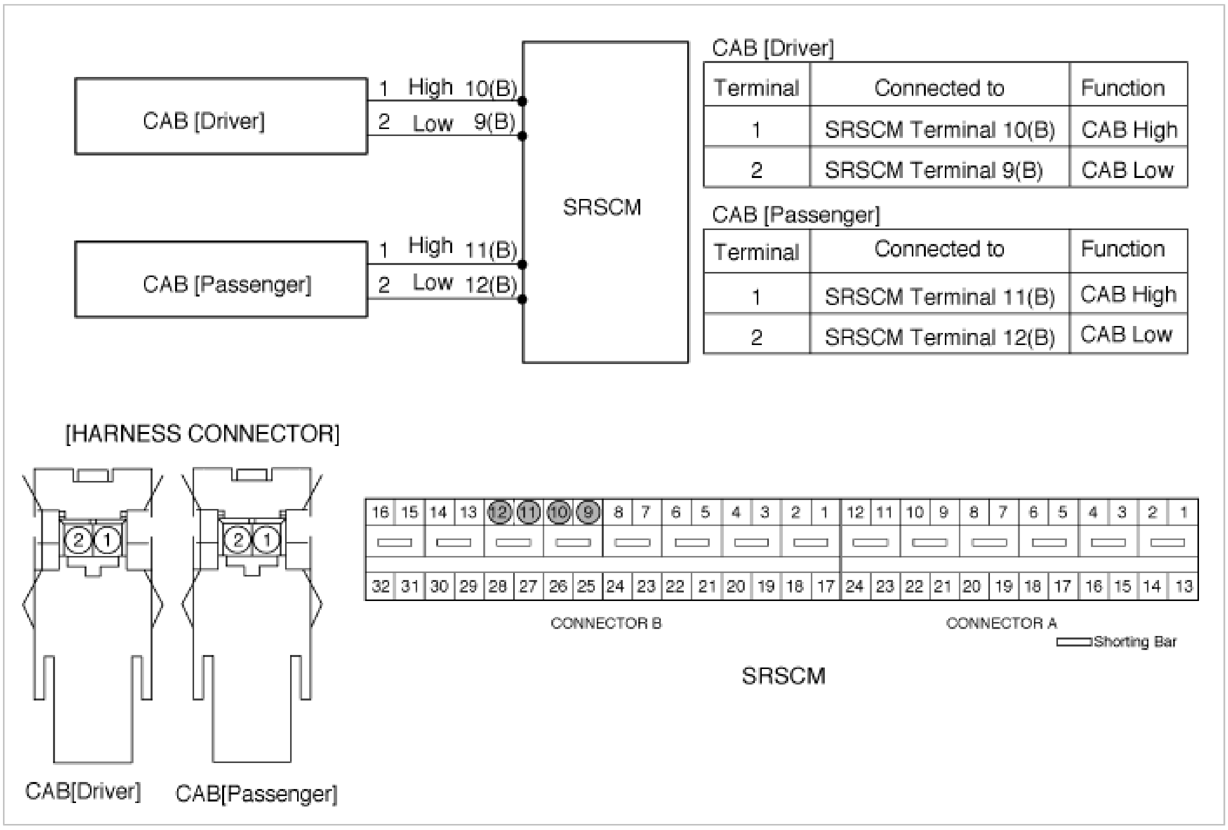
DTC Description

The CAB squib circuit consists of the SRSCM and CAB.It causes the SRS to deploy when the SRS deployment conditions are satisfied.The above DTC is recorded when short to ground is detected in the CAB squib circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1475 B1479	• Short to ground between CAB and SRSCM • Curtain Airbag (CAB) Malfunction • SRSCM Malfunction	• Short to ground circuit on wiring harness • Curtain Airbag (CAB) squib • SRSCM

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

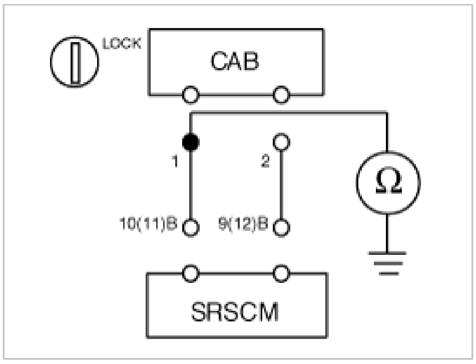
YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SHORT TO GROUND
   (1) Measure resistance between the terminal 1 of CAB harness connector and chassis ground.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸ Check the CAB Module.

NO

▸ Repair or replace the wiring harness between the CAB and the SRSCM.

3. CHECK THE CAB MODULE
   (1) Replace the Curtain Airbag(CAB) with a new one.
   - Refer to "Curtain Airbag(CAB)" section in this SERVICE MANUAL.

   (2) Install the DAB module and connect the DAB connector.

   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (4) Connect the SRSCM connector.

   (5) Connect the negative (-) terminal to the battery.

   (6) Connect a Hi-Scan(Pro) to the data link connector.

   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to Curtain Airbag(CAB)?

   YES

   ▸ Go to next step.

   NO

   ▸ Replace CAB module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.

   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (3) Connect the SRSCM connector.

   (4) Connect the negative (-) terminal to the battery.

   (5) Connect a Hi-Scan(Pro) to the data link connector.

   (6) Turn the ignition switch to ON .

   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

   (9) Turn the ignition switch to LOCK and wait for at least 30 seconds.

   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1476

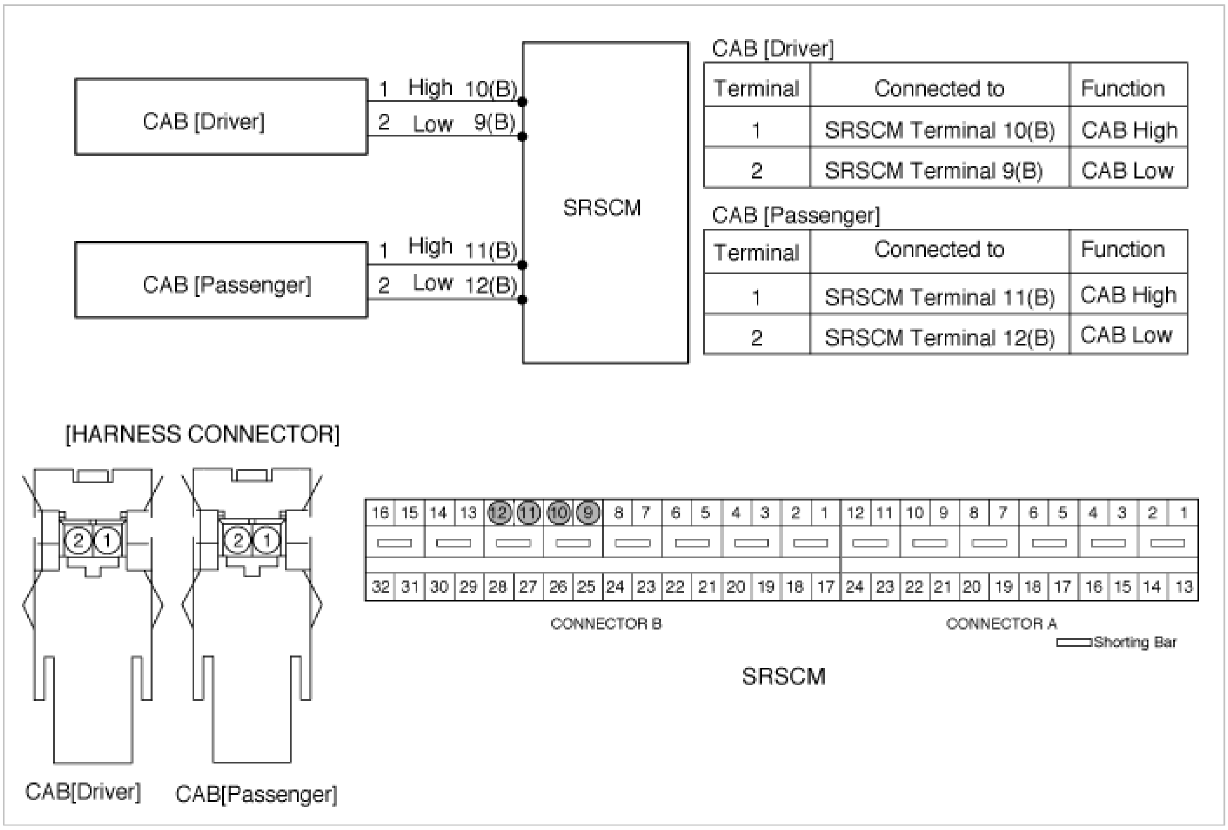
DTC Description

The CAB squib circuit consists of the SRSCM and CAB.It causes the SRS to deploy when the SRS deployment conditions are satisfied.The above DTC is recorded when short to battery is detected in the CAB squib circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1476 B1480	• Short to battery between CAB and SRSCM • Curtain Airbag (CAB) Malfunction • SRSCM Malfunction	• Short to battery line circuit on wiring harness • Curtain Airbag (CAB) squib • SRSCM

Schematic Diagram



CAB [Driver]

Terminal	Connected to	Function
1	SRSCM Terminal 10(B)	CAB High
2	SRSCM Terminal 9(B)	CAB Low

CAB [Passenger]

Terminal	Connected to	Function
1	SRSCM Terminal 11(B)	CAB High
2	SRSCM Terminal 12(B)	CAB Low

Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

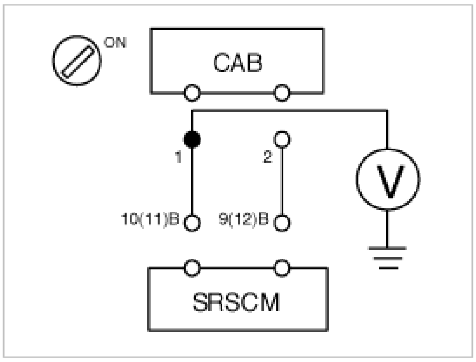
(5) Disconnect the SRSCM connector.

2. CHECK SHORT TO BATTERY LINE
   (1) Connect the negative (-) terminal to the battery.

   (2) Turn the ignition switch to ON.

   (3) Measure voltage between the terminal 1 of CAB harness connector and chassis ground(-).

   specification(voltage) : Approximately 0 V

   Is the measured voltage within specification?

   YES

   ▸ Check the CAB Module.

   NO

   ▸ Repair the short to battery line circuit on wiring harness between the CAB and the SRSCM.

3. CHECK THE CAB MODULE
   (1) Replace the Curtain Airbag(CAB) with a new one.
   - Refer to "Curtain Airbag(CAB)" section in this SERVICE MANUAL.

   (2) Install the DAB module and connect the DAB connector.

   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (4) Connect the SRSCM connector.

   (5) Connect the negative (-) terminal to the battery.

   (6) Connect a Hi-Scan(Pro) to the data link connector.

   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to Curtain Airbag(CAB)?

   YES

   ▸ Go to next step.

   NO

   ▸ Replace CAB module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.

   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (3) Connect the SRSCM connector.

   (4) Connect the negative (-) terminal to the battery.

   (5) Connect a Hi-Scan(Pro) to the data link connector.

   (6) Turn the ignition switch to ON .

   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

   (9) Turn the ignition switch to ON and wait for at least 30 seconds.

   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

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DTC Description

The CAB squib circuit consists of the SRSCM and CAB.It causes the SRS to deploy when the SRS deployment conditions are satisfied.The above DTC is recorded when the CAB resistance too high or low is detected in the CAB squib circuit.

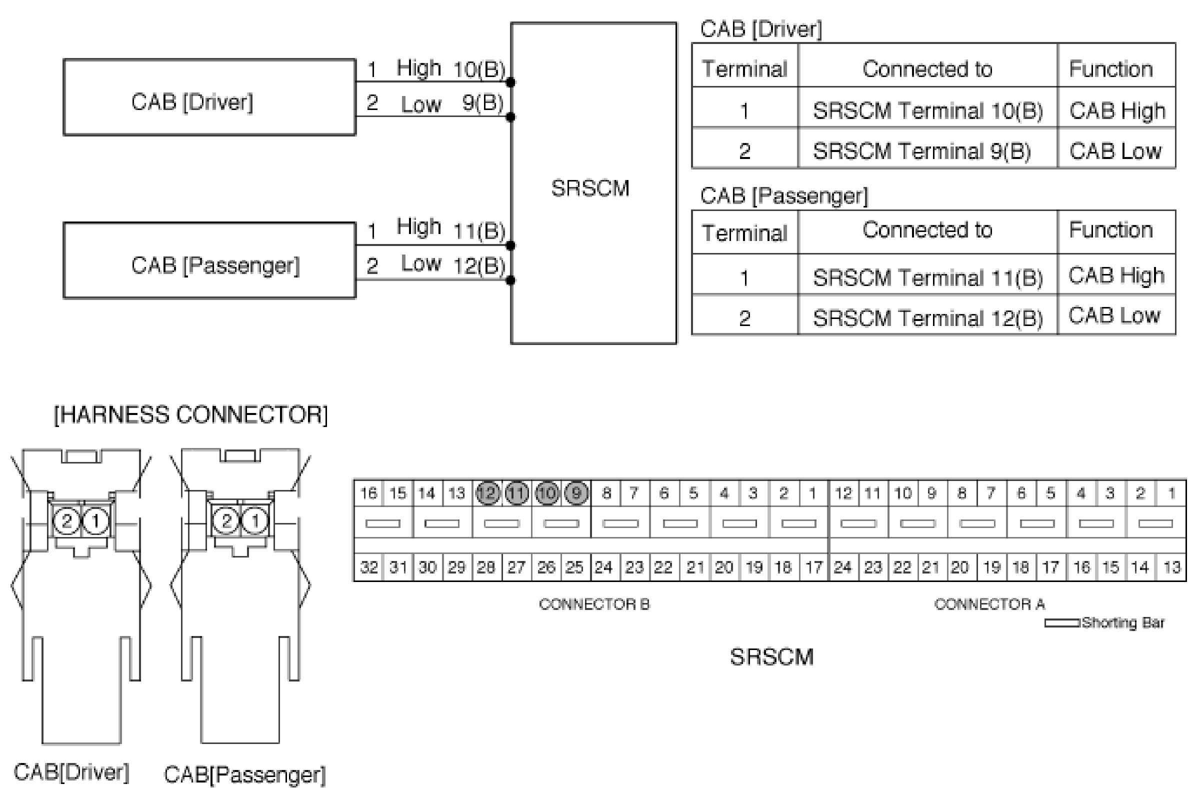
DTC Detecting Condition

DTC	Condition	Probable cause
B1473 B1474 B1477 B1478	• Too high or low resistance between CAB high(+) and CAB low (-) • Curtain Airbag (CAB) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Cirtain Airbag (CAB) squib • SRSCM • Partially connected connector

Specification

CAB resistance : 1.9 ≤ R ≤ 2.7 Ω

Schematic Diagram



CAB [Driver]

Terminal	Connected to	Function
1	SRSCM Terminal 10(B)	CAB High
2	SRSCM Terminal 9(B)	CAB Low

CAB [Passenger]

Terminal	Connected to	Function
1	SRSCM Terminal 11(B)	CAB High
2	SRSCM Terminal 12(B)	CAB Low

Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

CAUTION

Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK CAB RESISTANCE

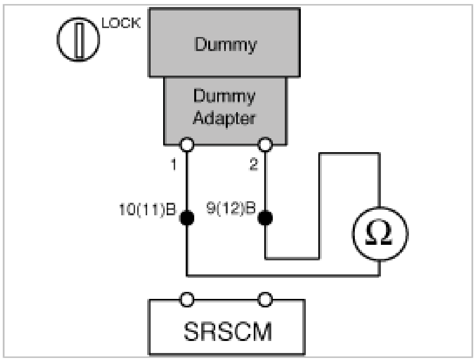
CAUTION

Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

   (1) Connect the Dummy and the Dummy Adapter on CAB harness connector.
   - Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

   (2) Measure resistance between the terminal 10(11) and 9(12) of SRSCM harness connector(B).

CAB resistance : $1.9 \leq R \leq 2.7\ \Omega$



Is the measured resistance within specification?

YES

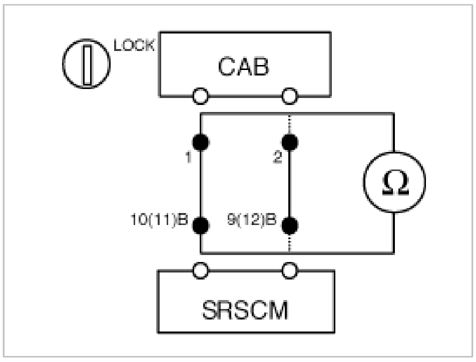
▸Replace the Curtain Airbag(CAB) module.

NO

▸Check open circuit.

3. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 1 of CAB harness connector and the terminal 10(11) of SRSCM harness connector(B).
   (2) Measure resistance between the terminal 2 of CAB harness connector and the terminal 9(12) of SRSCM harness connector(B).

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

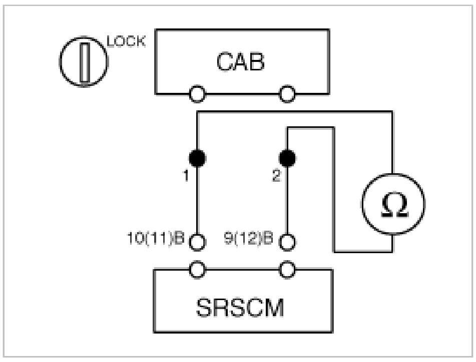
▸Check short circuit.

NO

▸Repair or replace the wiring harness between the CAB and the SRSCM.

4. CHECK SHORT CIRCUIT
   (1) Measure resistance between the terminal 1 and 2 of CAB harness connector.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair or replace the wiring harness between the CAB and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON.
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

DTC Description

The CAB squib circuit consists of the SRSCM and CAB.It causes the SRS to deploy when the SRS deployment conditions are satisfied.The above DTC is recorded when the CAB resistance too high or low is detected in the CAB squib circuit.

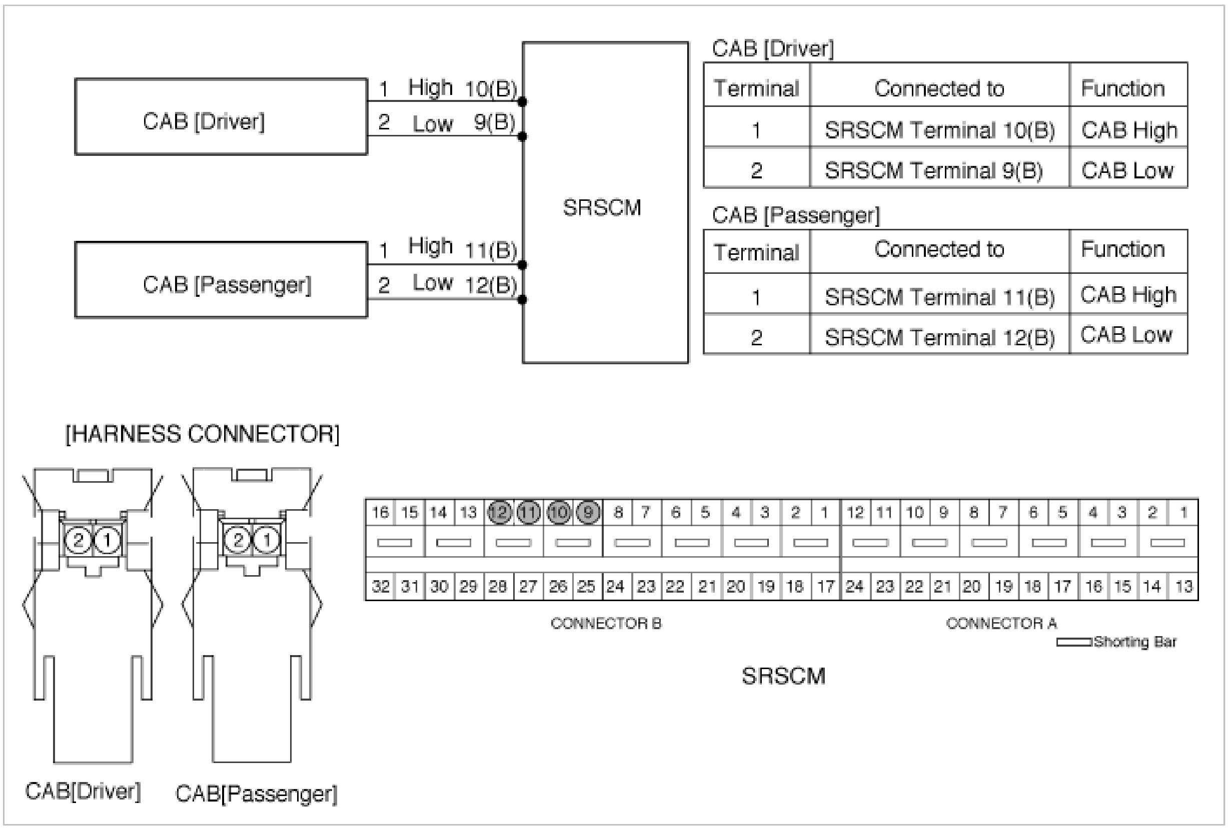
DTC Detecting Condition

DTC	Condition	Probable cause
B1473 B1474 B1477 B1478	• Too high or low resistance between CAB high(+) and CAB low (-) • Curtain Airbag (CAB) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Cirtain Airbag (CAB) squib • SRSCM • Partially connected connector

Specification

CAB resistance : 1.9 ≤ R ≤ 2.7 Ω

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> CAUTION
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

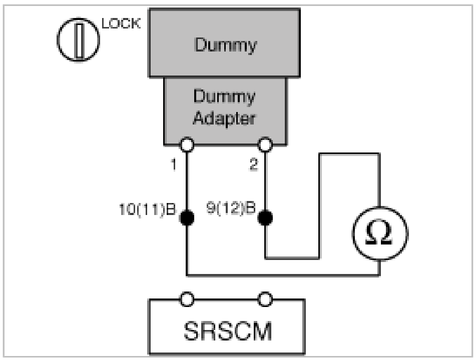
2. CHECK CAB RESISTANCE

> **CAUTION**
>
> Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

   (1) Connect the Dummy and the Dummy Adapter on CAB harness connector.
   - Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

   (2) Measure resistance between the terminal 10(11) and 9(12) of SRSCM harness connector(B).

CAB resistance : 1.9 ≤ R ≤ 2.7 Ω



Is the measured resistance within specification?

YES

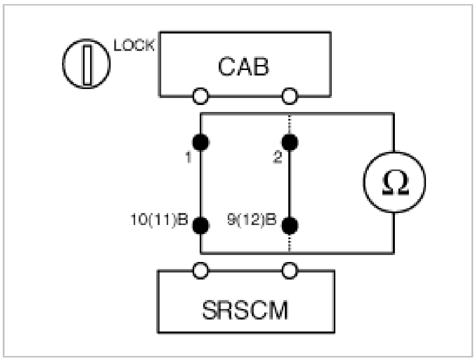
▸Replace the Curtain Airbag(CAB) module.

NO

▸Check open circuit.

3. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 1 of CAB harness connector and the terminal 10(11) of SRSCM harness connector(B).
   (2) Measure resistance between the terminal 2 of CAB harness connector and the terminal 9(12) of SRSCM harness connector(B).

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

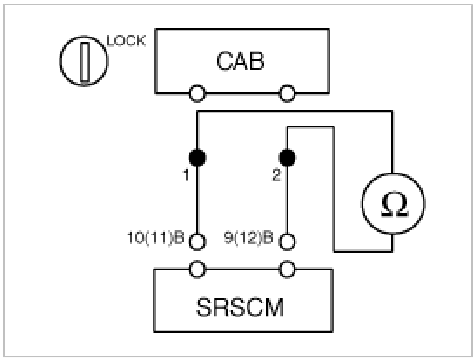
▸Check short circuit.

NO

▸Repair or replace the wiring harness between the CAB and the SRSCM.

4. CHECK SHORT CIRCUIT
   (1) Measure resistance between the terminal 1 and 2 of CAB harness connector.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair or replace the wiring harness between the CAB and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.

   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (3) Connect the SRSCM connector.

   (4) Connect the negative (-) terminal to the battery.

   (5) Connect a Hi-Scan(Pro) to the data link connector.

   (6) Turn the ignition switch to ON.

   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

   (9) Turn the ignition switch to ON and wait for at least 30 seconds.

   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

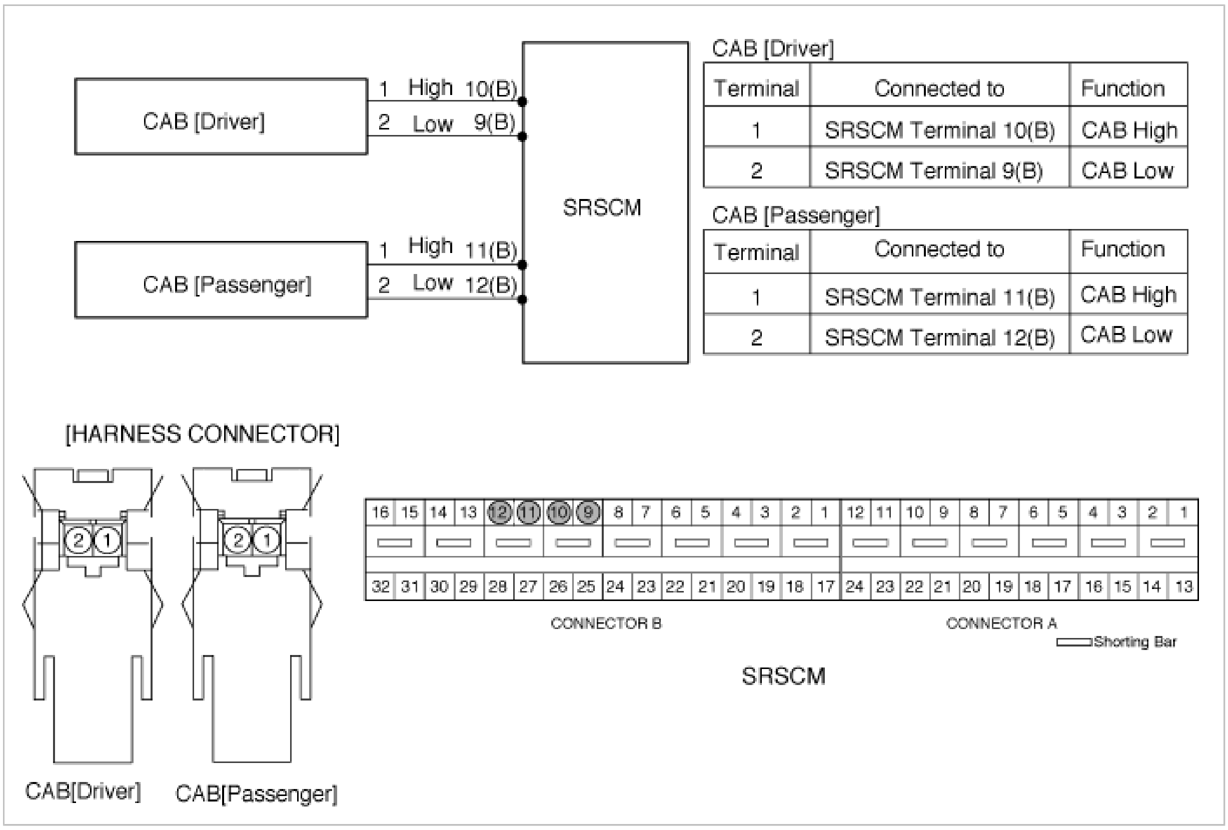
DTC Description

The CAB squib circuit consists of the SRSCM and CAB.It causes the SRS to deploy when the SRS deployment conditions are satisfied.The above DTC is recorded when short to ground is detected in the CAB squib circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1475 B1479	• Short to ground between CAB and SRSCM • Curtain Airbag (CAB) Malfunction • SRSCM Malfunction	• Short to ground circuit on wiring harness • Curtain Airbag (CAB) squib • SRSCM

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

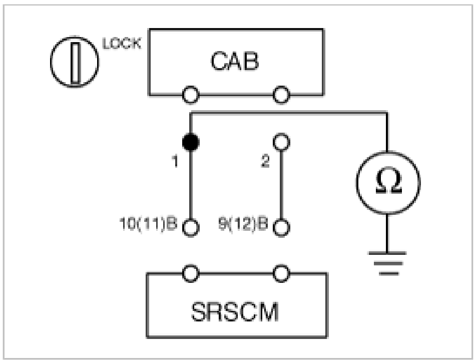
▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK SHORT TO GROUND
   (1) Measure resistance between the terminal 1 of CAB harness connector and chassis ground.

   specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸ Check the CAB Module.

NO

▸ Repair or replace the wiring harness between the CAB and the SRSCM.

3. CHECK THE CAB MODULE
   (1) Replace the Curtain Airbag(CAB) with a new one.
   - Refer to "Curtain Airbag(CAB)" section in this SERVICE MANUAL.
   (2) Install the DAB module and connect the DAB connector.
   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (4) Connect the SRSCM connector.
   (5) Connect the negative (-) terminal to the battery.
   (6) Connect a Hi-Scan(Pro) to the data link connector.
   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to Curtain Airbag(CAB)?

YES

▸ Go to next step.

NO

▸ Replace CAB module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON .
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1480

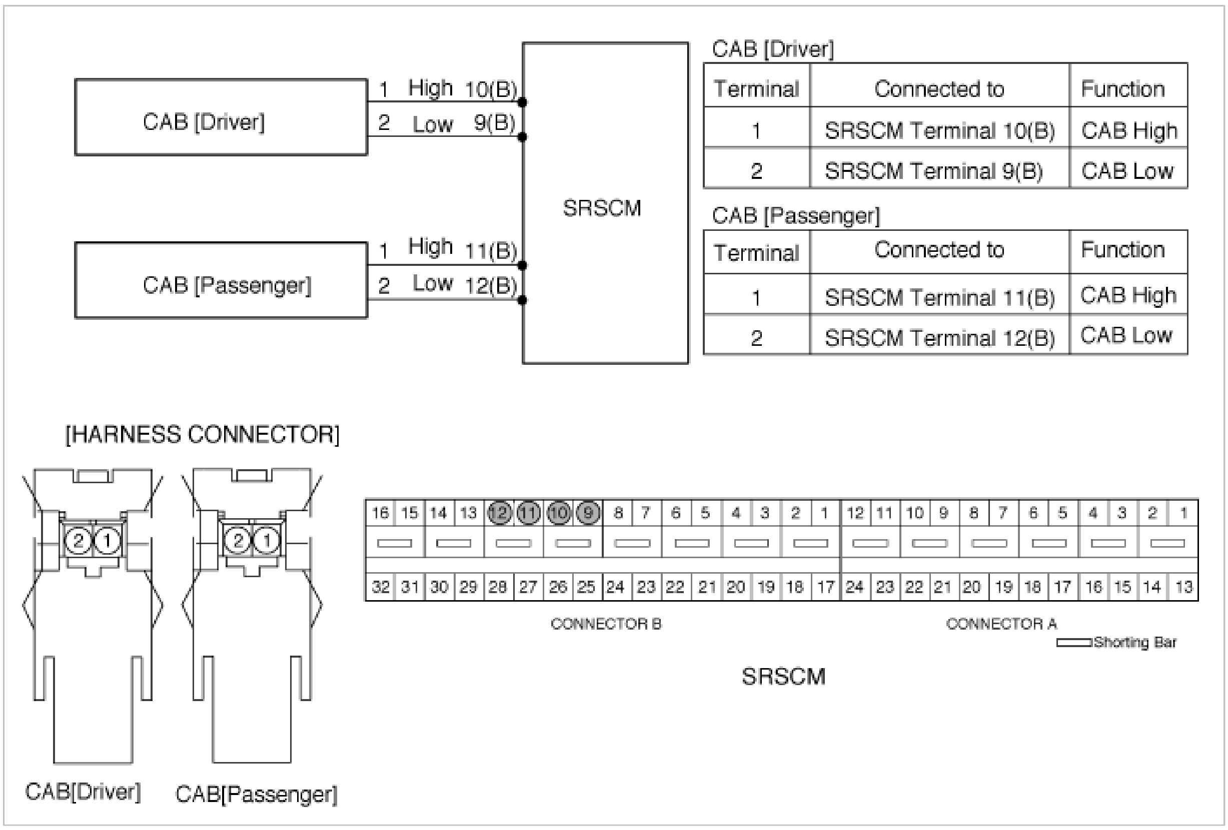
DTC Description

The CAB squib circuit consists of the SRSCM and CAB.It causes the SRS to deploy when the SRS deployment conditions are satisfied.The above DTC is recorded when short to battery is detected in the CAB squib circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1476 B1480	• Short to battery between CAB and SRSCM • Curtain Airbag (CAB) Malfunction • SRSCM Malfunction	• Short to battery line circuit on wiring harness • Curtain Airbag (CAB) squib • SRSCM

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

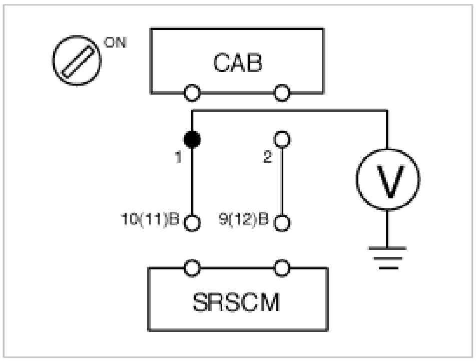
YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SHORT TO BATTERY LINE
   (1) Connect the negative (-) terminal to the battery.
   (2) Turn the ignition switch to ON.
   (3) Measure voltage between the terminal 1 of CAB harness connector and chassis ground(-).

specification(voltage) : Approximately 0 V



Is the measured voltage within specification?

YES

▸ Check the CAB Module.

NO

▸ Repair the short to battery line circuit on wiring harness between the CAB and the SRSCM.

3. CHECK THE CAB MODULE
   (1) Replace the Curtain Airbag(CAB) with a new one.
   - Refer to "Curtain Airbag(CAB)" section in this SERVICE MANUAL.

   (2) Install the DAB module and connect the DAB connector.
   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (4) Connect the SRSCM connector.
   (5) Connect the negative (-) terminal to the battery.
   (6) Connect a Hi-Scan(Pro) to the data link connector.
   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to Curtain Airbag(CAB)?

YES

▸ Go to next step.

NO

▸ Replace CAB module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON .

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1481

DTC Description

The Driver Airbag circuit consists of the SRSCM, Clockspring and the Driver Airbag (DAB) which has two squib circuits. The SRSCM sets above DTC(s) if it detects that the resistance of DAB squib is too high or low.

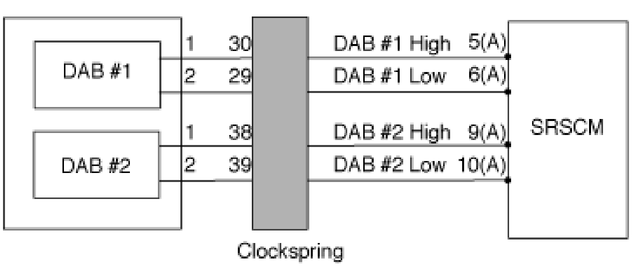
DTC Detecting Condition

DTC	Condition	Probable cause
B1481 B1482	• Too high or low resistance between DAB high(+) and DAB low (-) • Driver Airbag (DAB) Malfunction • Clockspring Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Driver Airbag (DAB) squib • Clockspring • SRSCM

Specification

DAB resistance : 1.9 ≤ R ≤ 3.0 Ω

Schematic Diagram



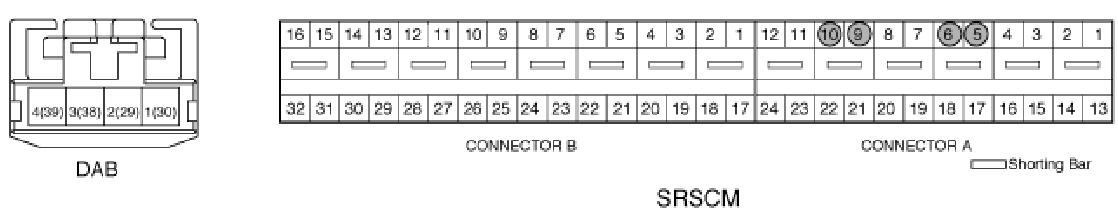
DAB #1

Pin	Connected to	Function
1	SRSCM terminal 5(A)	DAB #1 High
2	SRSCM terminal 6(A)	DAB #1 Low

DAB #2

Pin	Connected to	Function
1	SRSCM terminal 9(A)	DAB #2 High
2	SRSCM terminal 10(A)	DAB #2 Low

[HARNESS CONNECTOR]



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

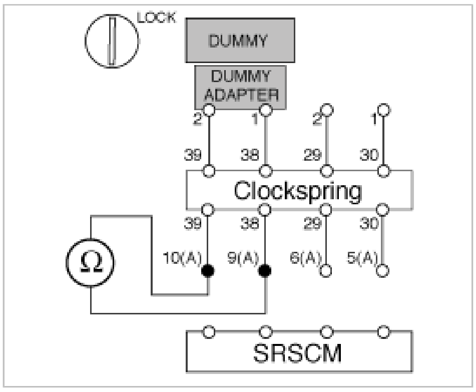
1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK DAB RESISTANCE

> **CAUTION**
>
> Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

   (1) Connect the Dummy and the Dummy Adapter on DAB harness connector.
   ●Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.
   (2) Measure resistance between the terminal 9(A) and 10(A) of SRSCM harness connector.

DAB resistance : 1.9 ≤ R ≤ 3.0 Ω



   (3) Is the measured resistance within specification?

NO

▸ Check open circuit.

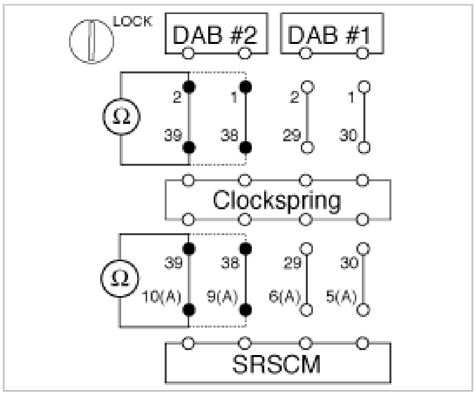
YES

▸ Replace the Driver Airbag(DAB) module.

3. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 1 of DAB stage #2 harness connector and the terminal 30 of Clockspring harness connector.
   (2) Measure resistance between the terminal 2 of DAB stage #2 harness connector and the terminal 29 of Clockspring harness connector.
   (3) Measure resistance between the terminal 38 of Clockspring harness connector and the terminal 9 of SRSCM harness connector(A).

(4) Measure resistance between the terminal 39 of Clockspring harness connector and the terminal 10 of SRSCM harness connector(A).

specification(resistance) : below 1 Ω



(5) Is the measured resistance within specification?

YES

▸ Check short circuit.

NO

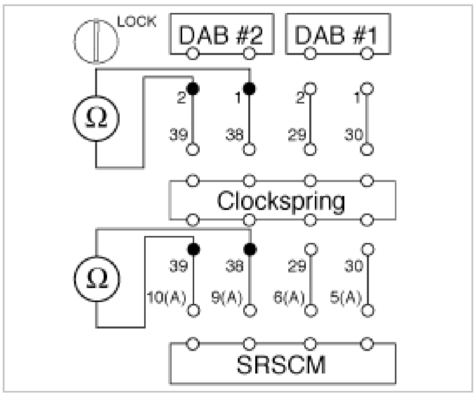
▸ Repair or replace the wiring harness between the DAB and the clockspring or between the clockspring and the SRSCM.

4. CHECK SHORT CIRCUIT

(1) Measure resistance between the terminal 1 and 2 of DAB stage #2 harness connector.

(2) Measure resistance between the terminal 38 and 39 of Clockspring harness connector.

specification(resistance) : ∞ Ω



(3) Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair or replace the wiring harness between the DAB and the clockspring or between the clockspring and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON .

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1482

DTC Description

The Driver Airbag circuit consists of the SRSCM, Clockspring and the Driver Airbag (DAB) which has two squib circuits. The SRSCM sets above DTC(s) if it detects that the resistance of DAB squib is too high or low.

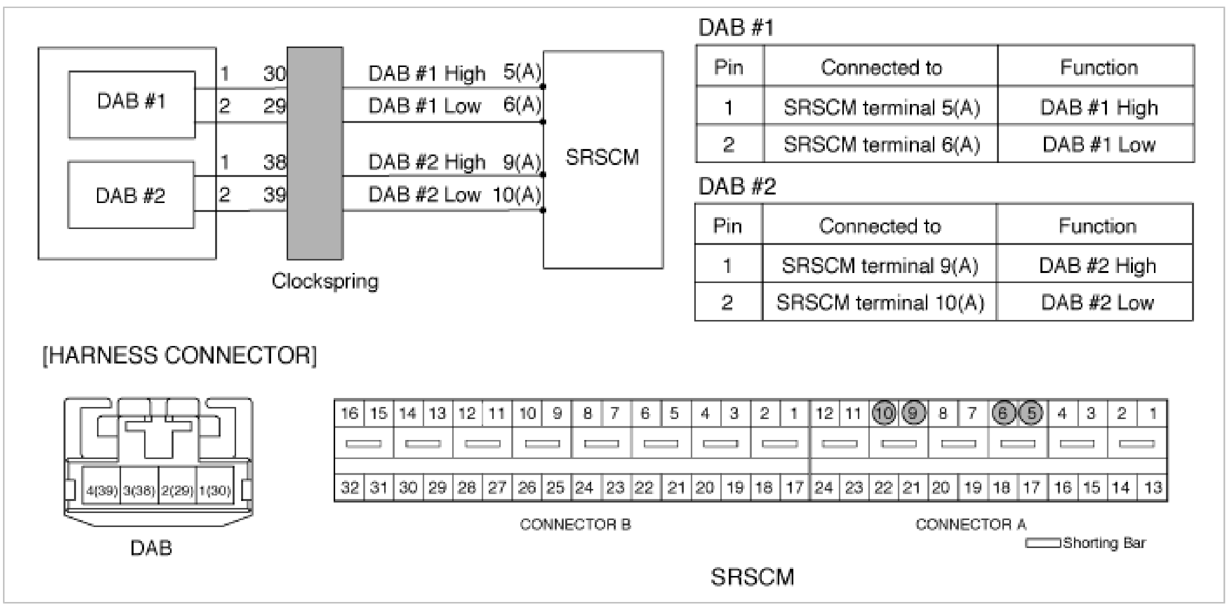
DTC Detecting Condition

DTC	Condition	Probable cause
B1481 B1482	• Too high or low resistance between DAB high(+) and DAB low (-) • Driver Airbag (DAB) Malfunction • Clockspring Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Driver Airbag (DAB) squib • Clockspring • SRSCM

Specification

DAB resistance : 1.9 ≤ R ≤ 3.0 Ω

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

CAUTION

Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

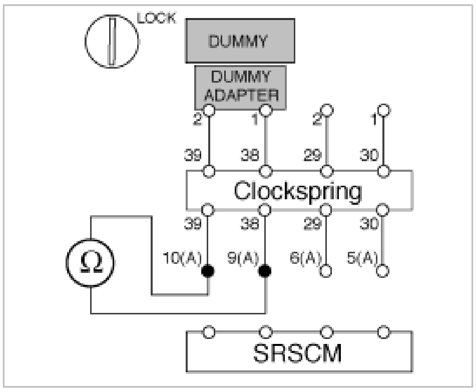
1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK DAB RESISTANCE

CAUTION
Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

   (1) Connect the Dummy and the Dummy Adapter on DAB harness connector.
   ●Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.
   (2) Measure resistance between the terminal 9(A) and 10(A) of SRSCM harness connector.

DAB resistance : 1.9 ≤ R ≤ 3.0 Ω



   (3) Is the measured resistance within specification?

NO

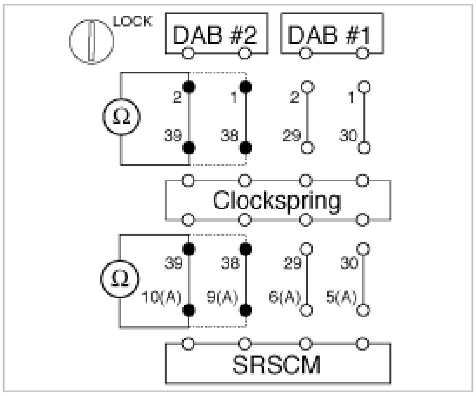
▸ Check open circuit.

YES

▸ Replace the Driver Airbag(DAB) module.

3. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 1 of DAB stage #2 harness connector and the terminal 30 of Clockspring harness connector.
   (2) Measure resistance between the terminal 2 of DAB stage #2 harness connector and the terminal 29 of Clockspring harness connector.
   (3) Measure resistance between the terminal 38 of Clockspring harness connector and the terminal 9 of SRSCM harness connector(A).
   (4) Measure resistance between the terminal 39 of Clockspring harness connector and the terminal 10 of SRSCM harness connector(A).

specification(resistance) : below 1 Ω



(5) Is the measured resistance within specification?

YES

▸ Check short circuit.

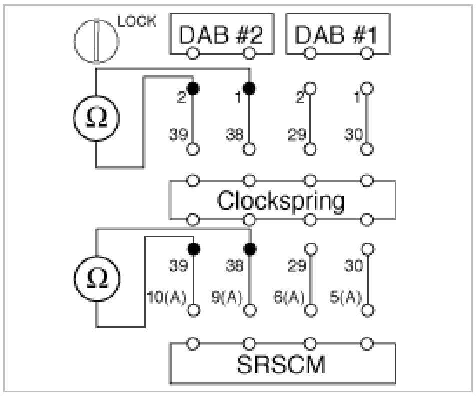
NO

▸ Repair or replace the wiring harness between the DAB and the clockspring or between the clockspring and the SRSCM.

4. CHECK SHORT CIRCUIT
   (1) Measure resistance between the terminal 1 and 2 of DAB stage #2 harness connector.

   (2) Measure resistance between the terminal 38 and 39 of Clockspring harness connector.

specification(resistance) : ∞ Ω



(3) Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair or replace the wiring harness between the DAB and the clockspring or between the clockspring and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.

   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (3) Connect the SRSCM connector.

   (4) Connect the negative (-) terminal to the battery.

   (5) Connect a Hi-Scan(Pro) to the data link connector.

   (6) Turn the ignition switch to ON .

   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

   (9) Turn the ignition switch to ON and wait for at least 30 seconds.

   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1483

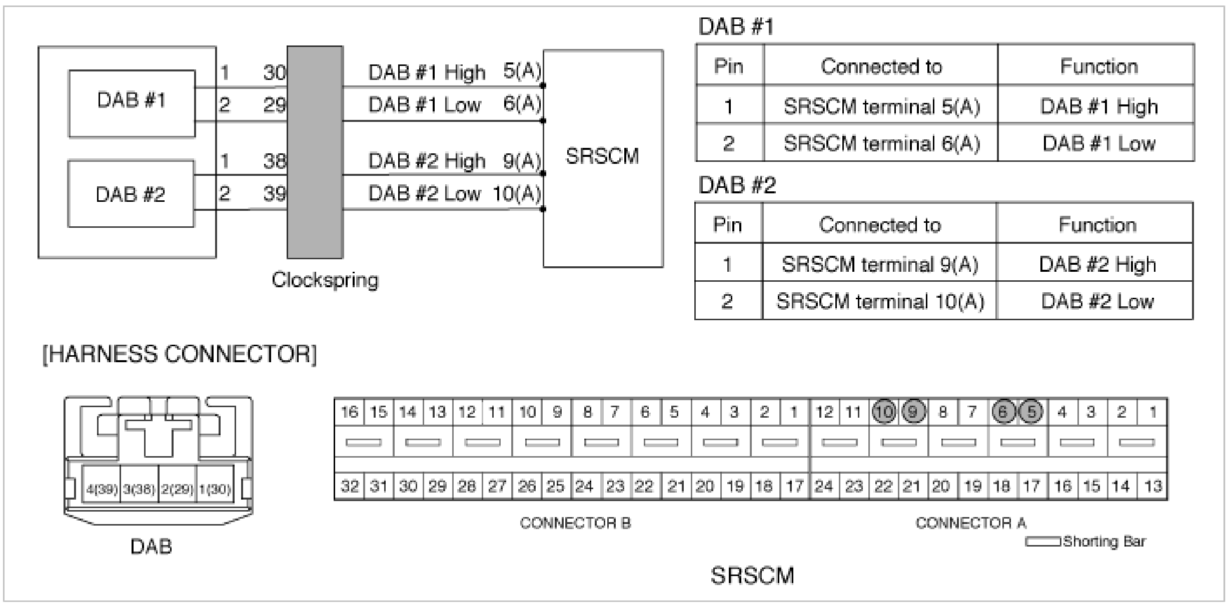
DTC Description

The Driver Airbag circuit consists of the SRSCM, Clockspring and the Driver Airbag (DAB) which has two squib circuits. The SRSCM sets above DTC(s) if it detects short to ground on the DAB circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1348 B1483	• Short to ground between DAB and clockspring • Short to ground between clockspring and SRSCM • Driver Airbag (DAB) Malfunction • Clockspring Malfunction • SRSCM Malfunction	• Short to ground circuit on wiring harness • Driver Airbag (DAB) squib • Clockspring • SRSCM

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

   CAUTION

   Avoid damaging connectors during the inspection process.

3. Are any problems found?

   NO

   ▸ Go to next step.

   YES

   ▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.

(3) Remove the DAB module and disconnect the DAB connector.

(4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

2. CHECK SHORT TO GROUND

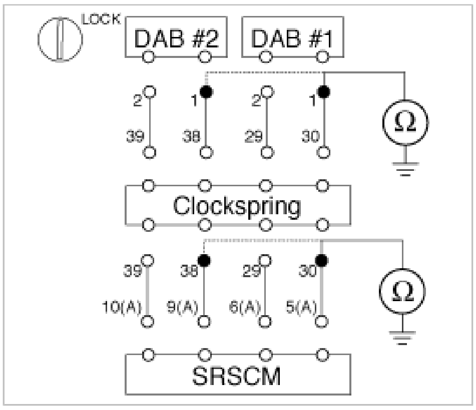
(1) Measure resistance between the terminal 1 of DAB stage #1 harness connector and chassis ground.(DAB stage #1)

(2) Measure resistance between the terminal 1 of DAB stage #2 harness connector and chassis ground.(DAB stage #2)

(3) Measure resistance between the terminal 30 of clockspring harness connector and chassis ground.(DAB stage #1)

(4) Measure resistance between the terminal 38 of clockspring harness connector and chassis ground.(DAB stage #2)

specification(resistance) : infinite



(5) Is the measured resistance within specification?

YES

▶Check the DAB Module.

NO

▶ Repair or replace the wiring harness between the DAB and the clockspring or between the clockspring and the SRSCM.

3. CHECK THE DAB MODULE

(1) Replace the Driver Airbag(DAB) with a new one.

● Refer to "Driver Airbag(DAB)" section in this SERVICE MANUAL.

(2) Install the DAB module and connect the DAB connector.

(3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal to the battery.

(6) Connect a Hi-Scan(Pro) to the data link connector.

(7) Turn the ignition switch to ON and check the vehicle again.
Does Hi-Scan (Pro) indicate any DTC related to DAB?

YES

▶Check the clockspring.

NO

▶Replace the Driver Airbag(DAB).

4. CHECK THE CLOCKSPRING

(1) Check the clockspring.
Is the clockspring normal?

YES

▶ Go to next step.

NO

▶ Replace the clockspring.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1484

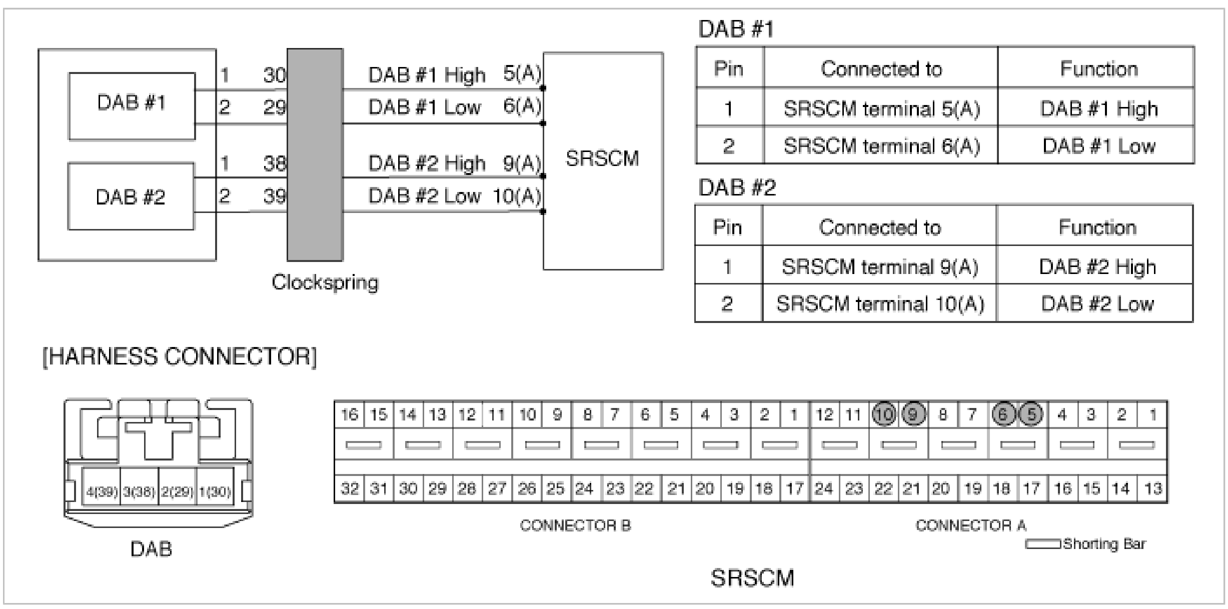
DTC Description

The Driver Airbag circuit consists of the SRSCM, Clockspring and the Driver Airbag (DAB) which has two squib circuits. The SRSCM sets above DTC(s) if it detects short to battery line on the DAB circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1349 B1484	• Short to battery line between DAB and clockspring • Short to battery line between clockspring and SRSCM • Driver Airbag (DAB) Malfunction • Clockspring Malfunction • SRSCM Malfunction	• Short to battery line on wiring harness • Driver Airbag (DAB) squib • Clockspring • SRSCM

Schematic Diagram



DAB #1

Pin	Connected to	Function
1	SRSCM terminal 5(A)	DAB #1 High
2	SRSCM terminal 6(A)	DAB #1 Low

DAB #2

Pin	Connected to	Function
1	SRSCM terminal 9(A)	DAB #2 High
2	SRSCM terminal 10(A)	DAB #2 Low

Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.

2. Inspect terminals for damage and corrosion.

CAUTION

Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

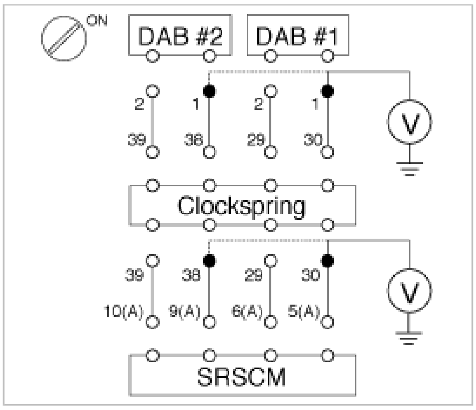
▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB,SAB,CAB,BPT,BUPT,FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK SHORT TO BATTERY LINE
   (1) Connect the negative (-) terminal to the battery.
   (2) Turn the ignition switch to ON.
   (3) Measure voltage between the terminal 1 of DAB stage #1 harness connector and chassis ground(-).(DAB stage #1)
   (4) Measure voltage between the terminal 1 of DAB stage #2 harness connector and chassis ground(-).(DAB stage #2)
   (5) Measure voltage between the terminal 30 of clockspring harness connector and chassis ground(-).(DAB stage #1)
   (6) Measure voltage between the terminal 38 of clockspring harness connector and chassis ground(-).(DAB stage #2)

specification(voltage) : Approximately 0 V



Is the measured voltage within specification?

YES

▸Check the DAB module.

NO

▸ Repair or replace the wiring harness between the DAB and the clockspring or between the clockspring and the SRSCM.

3. CHECK THE DAB MODULE
   (1) Replace the Driver Airbag(DAB) with a new one.
   - "Refer to "Driver Airbag(DAB)" section in this SERVICE MANUAL.

   (2) Install the DAB module and connect the DAB connector.
   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (4) Connect the SRSCM connector.
   (5) Connect the negative (-) terminal to the battery.
   (6) Connect a Hi-Scan(Pro) to the data link connector.

(7) Turn the ignition switch to ON and check the vehicle again.
Does Hi-Scan (Pro) indicate any DTC related to DAB?

YES

▸Check the clockspring.

NO

▸Replace the Driver Airbag(DAB).

4. CHECK THE CLOCKSPRING
   (1) Check the clockspring.
   Is the clockspring normal?

YES

▸ Go to next step.

NO

▸ Replace the clockspring.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON.
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1485

DTC Description

The Passenger Airbag circuit consists of the SRSCM and the Passenger Airbag (PAB) which has two squib circuits. The SRSCM sets above DTC(s) if it detects that the resistance of PAB squib is too high or low.

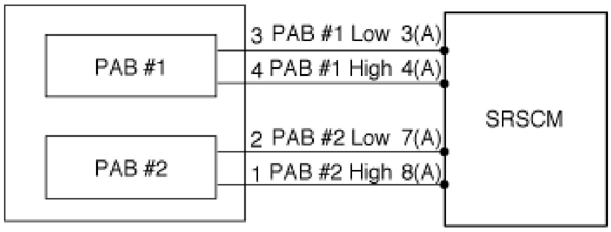
DTC Detecting Condition

DTC	Condition	Probable cause
B1485 B1486	• Too high or low resistance between PAB high(+) and PAB low (-) • Passenger Airbag (PAB) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Passenger Airbag (PAB) squib • SRSCM

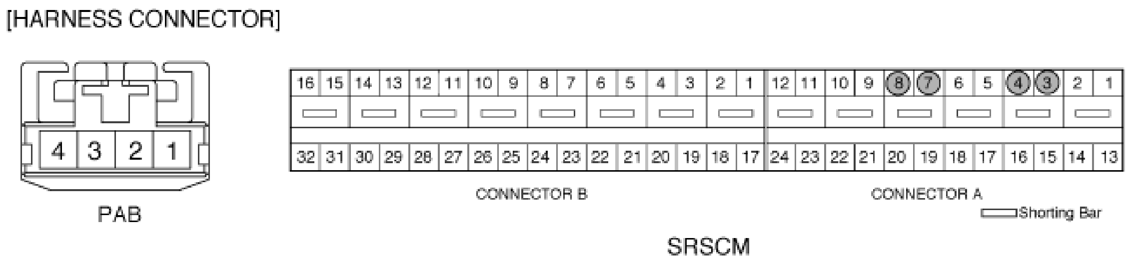
Specification

PAB resistance : $1.8 \leq R \leq 2.4\ \Omega$

Schematic Diagram



Pin	Connected to	Function
1	SRSCM terminal 8(A)	PAB #2 High
2	SRSCM terminal 7(A)	PAB #2 Low
3	SRSCM terminal 3(A)	PAB #1 Low
4	SRSCM terminal 4(A)	PAB #1 High



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

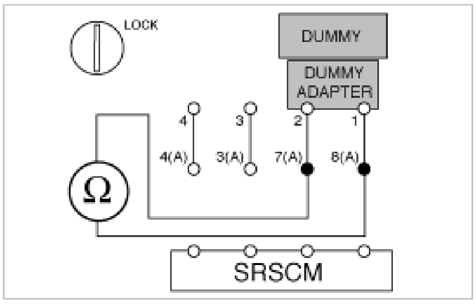
1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK PAB RESISTANCE

> **CAUTION**
>
> Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

   (1) Connect the Dummy and the Dummy Adapter on PAB harness connector.
   - Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

   (2) Measure resistance between the terminal 6 and 7 of SRSCM harness connector.

PAB resistance : $1.8 \le R \le 2.4\ \Omega$



(3) Is the measured resistance within specification?

YES

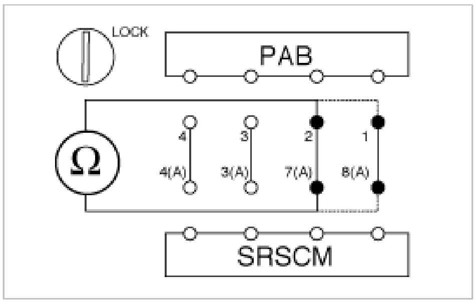
▸ Replace the Passenger Airbag(PAB) module.

NO

▸ Check open circuit.

3. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 1 of PAB harness connector and the terminal 8(A) of SRSCM harness connector.
   (2) Measure resistance between the terminal 2 of PAB harness connector and the terminal 7(A) of SRSCM harness connector.

specification(resistance) : below 1 Ω



(3) Is the measured resistance within specification?

YES

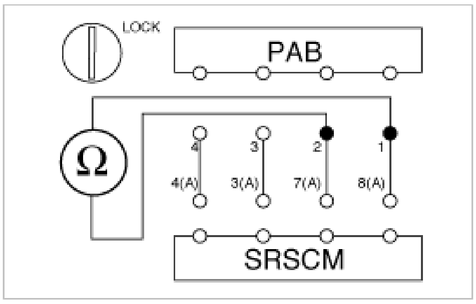
▸Check short circuit.

NO

▸Repair or replace the wiring harness between the PAB and the SRSCM.

4. CHECK SHORT CIRCUIT
   (1) Measure resistance between the terminal 1 and 2 of PAB harness connector.

specification(resistance) : infinite



(2) Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair or replace the wiring harness between the PAB and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON.

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1486

DTC Description

The Passenger Airbag circuit consists of the SRSCM and the Passenger Airbag (PAB) which has two squib circuits. The SRSCM sets above DTC(s) if it detects that the resistance of PAB squib is too high or low.

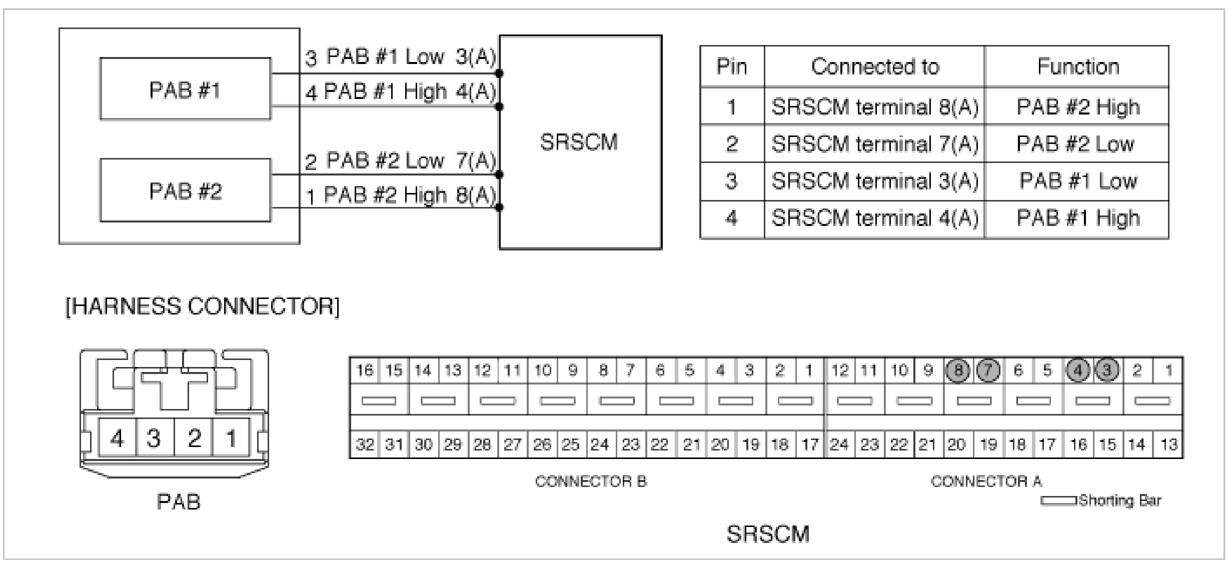
DTC Detecting Condition

DTC	Condition	Probable cause
B1485 B1486	• Too high or low resistance between PAB high(+) and PAB low (-) • Passenger Airbag (PAB) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Passenger Airbag (PAB) squib • SRSCM

Specification

PAB resistance : 1.8 ≤ R ≤ 2.4 Ω

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

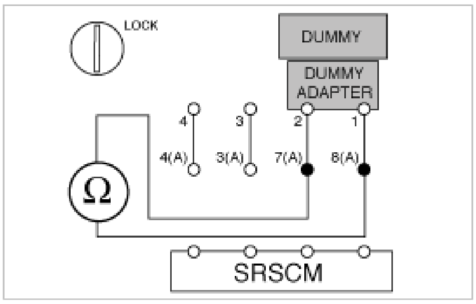
Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK PAB RESISTANCE

> **CAUTION**
>
> Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

   (1) Connect the Dummy and the Dummy Adapter on PAB harness connector.
   ● Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.
   (2) Measure resistance between the terminal 6 and 7 of SRSCM harness connector.

PAB resistance : 1.8 ≤ R ≤ 2.4 Ω



   (3) Is the measured resistance within specification?

YES

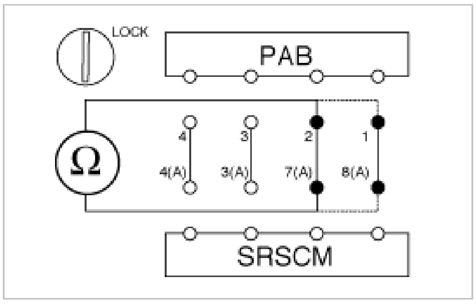
▸ Replace the Passenger Airbag(PAB) module.

NO

▸ Check open circuit.

3. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 1 of PAB harness connector and the terminal 8(A) of SRSCM harness connector.
   (2) Measure resistance between the terminal 2 of PAB harness connector and the terminal 7(A) of SRSCM harness connector.

specification(resistance) : below 1 Ω



(3) Is the measured resistance within specification?

YES

▸Check short circuit.

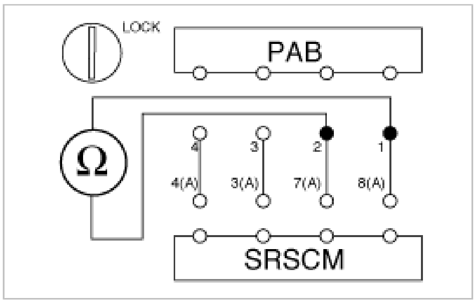
NO

▸Repair or replace the wiring harness between the PAB and the SRSCM.

4. CHECK SHORT CIRCUIT

(1) Measure resistance between the terminal 1 and 2 of PAB harness connector.

specification(resistance) : infinite



(2) Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair or replace the wiring harness between the PAB and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON.

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1487

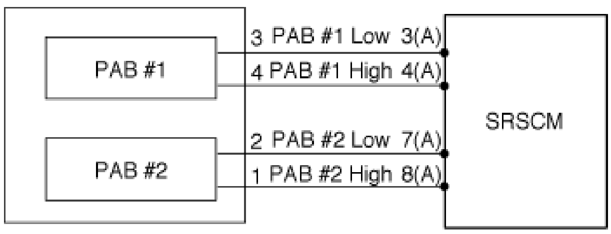
DTC Description

The Passenger Airbag circuit consists of the SRSCM and the Passenger Airbag (PAB) which has two squib circuits. The SRSCM sets above DTC(s) if it detects short to ground on the PAB circuit.

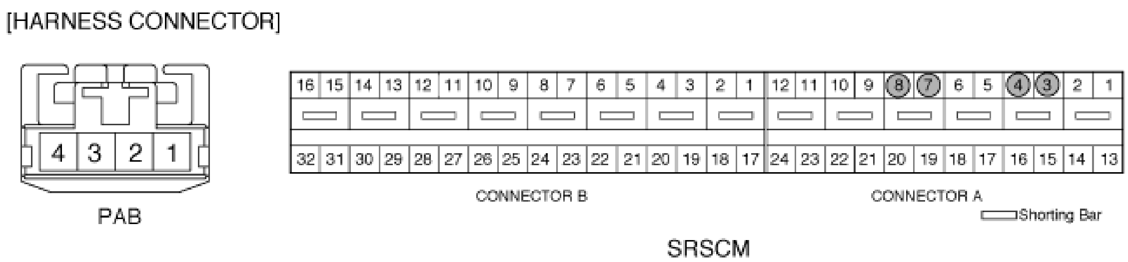
DTC Detecting Condition

DTC	Condition	Probable cause
B1354 B1487	• Short to ground between PAB module and SRSCM • Passenger Airbag (PAB) Malfunction • SRSCM Malfunction	• Short to ground on wiring harness • Passenger Airbag (PAB) squib • SRSCM

Schematic Diagram



Pin	Connected to	Function
1	SRSCM terminal 8(A)	PAB #2 High
2	SRSCM terminal 7(A)	PAB #2 Low
3	SRSCM terminal 3(A)	PAB #1 Low
4	SRSCM terminal 4(A)	PAB #1 High



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

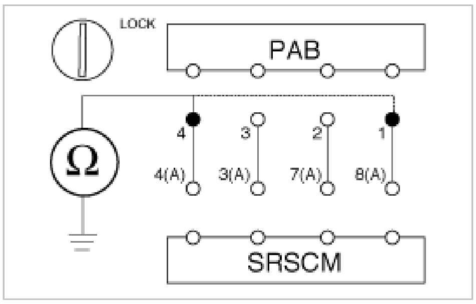
▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SHORT TO GROUND
   (1) Measure resistance between the terminal 4 of PAB harness connector and chassis ground.(PAB stage #1)

(2) Measure resistance between the terminal 1 of PAB harness connector and chassis ground.(PAB stage #2)

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸ Check the PAB Module.

NO

▸ Repair or replace the wiring harness between the PAB and the SRSCM.

3. CHECK THE PAB MODULE
   (1) Replace the Passenger Airbag (PAB) with a new one.
   - Refer to "Passenger Airbag (PAB)" section in this SERVICE MANUAL.

   (2) Install the DAB module and connect the DAB connector.

   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (4) Connect the SRSCM connector.

   (5) Connect the negative (-) terminal to the battery.

   (6) Connect a Hi-Scan(Pro) to the data link connector.

   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to PAB?

   YES

   ▸ Go to next step.

   NO

   ▸Replace PAB module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.

   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (3) Connect the SRSCM connector.

   (4) Connect the negative (-) terminal to the battery.

   (5) Connect a Hi-Scan(Pro) to the data link connector.

   (6) Turn the ignition switch to ON .

   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

   (9) Turn the ignition switch to ON and wait for at least 30 seconds.

   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1488

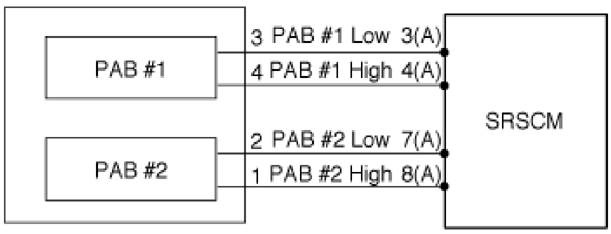
DTC Description

The Passenger Airbag circuit consists of the SRSCM and the Passenger Airbag (PAB) which has two squib circuits.The SRSCM sets above DTC(s) if it detects short to battery line on the PAB circuit.

DTC Detecting Condition

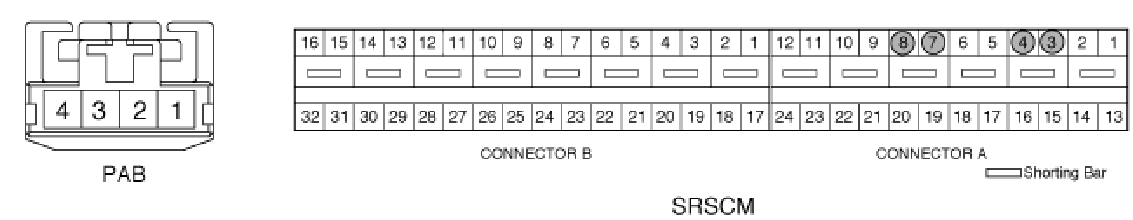
DTC	Condition	Probable cause
B1355 B1488	• Short to battery line between PAB and SRSCM • Passenger Airbag (PAB) Malfunction • SRSCM Malfunction	• Short to battery line circuit on wiring harness • Passenger Airbag (PAB) squib • SRSCM

Schematic Diagram



Pin	Connected to	Function
1	SRSCM terminal 8(A)	PAB #2 High
2	SRSCM terminal 7(A)	PAB #2 Low
3	SRSCM terminal 3(A)	PAB #1 Low
4	SRSCM terminal 4(A)	PAB #1 High

[HARNESS CONNECTOR]



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

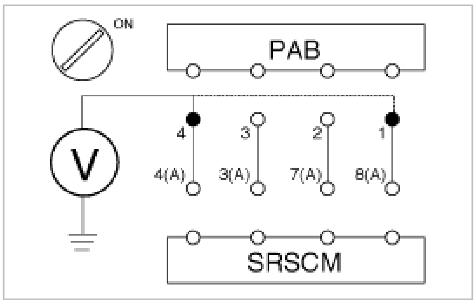
Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SHORT TO BATTERY LINE
   (1) Connect the negative (-) terminal to the battery.
   (2) Turn the ignition switch to ON.

(3) Measure voltage between the terminal 4 of PAB harness connector and chassis ground(-).(PAB stage #1)

(4) Measure voltage between the terminal 1 of PAB harness connector and chassis ground(-).(PAB stage #2)

specification(voltage) : Approximately 0 V



Is the measured voltage within specification?

YES

▸ Check the PAB Module.

NO

▸ Repair the short to battery line circuit on wiring harness between the PAB and the SRSCM.

3. CHECK THE PAB MODULE

(1) Replace the Passenger Airbag(PAB) with a new one.

- Refer to "Passenger Airbag(PAB)" section in this SERVICE MANUAL.

(2) Install the DAB module and connect the DAB connector.

(3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal to the battery.

(6) Connect a Hi-Scan(Pro) to the data link connector.

(7) Turn the ignition switch to ON and check the vehicle again.
Does Hi-Scan (Pro) indicate any DTC related to PAB?

YES

▸ Go to next step.

NO

▸Replace PAB module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON.

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1511

DTC Description

The Seat Belt Buckle Switch (BS) circuit consists of the SRSCM and two BS. The SRSCM sets above DTC(s) if it detects open or short to battery line on the BS circuit. This system decides whether the driver or passenger seat belt is locked or not.

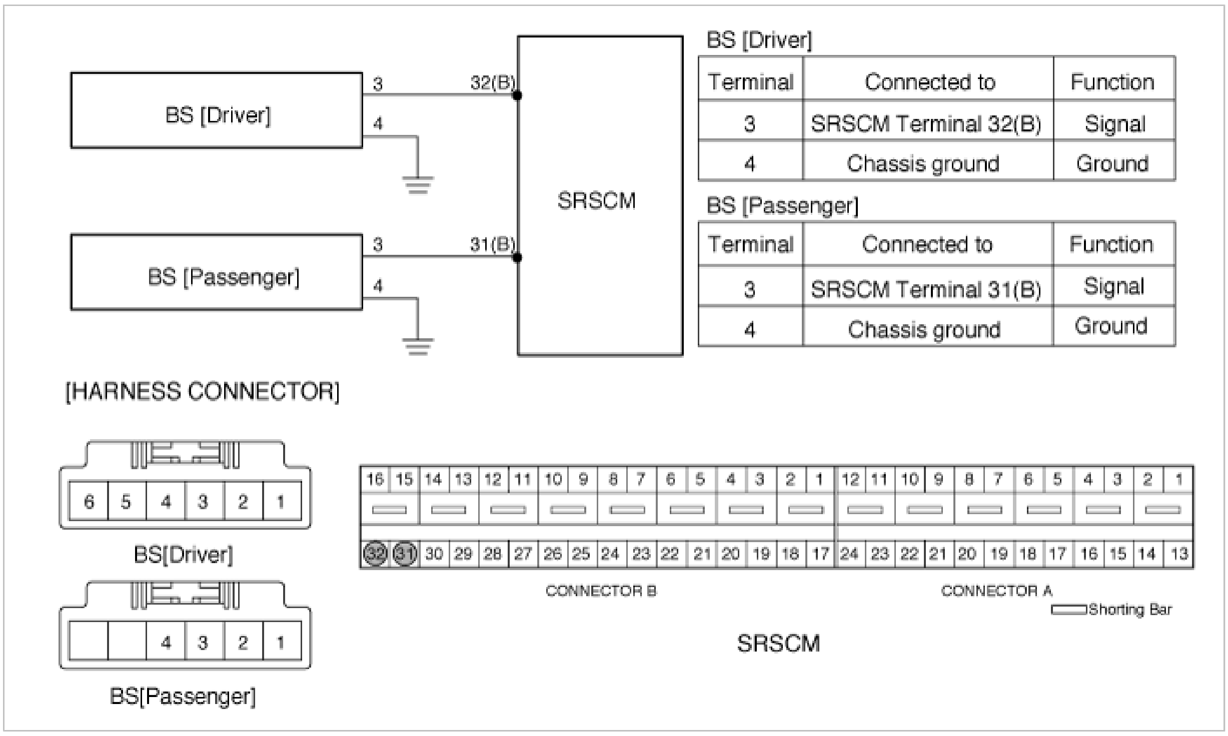
DTC Detecting Condition

DTC	Condition	Probable cause
B1511 B1513	• Open between BS and SRSCM (Current I < 2.98 mA). • Short to battery line between BS and SRSCM (Current I < 2.98 mA) • Seat Belt Buckle Switch (BS) Malfunction • SRSCM Malfunction	• Open or short to battery line circuit on wiring harness • Seat Belt Buckle Switch (BS) • SRSCM

Specification

Open/Short to Battery	Grey Zone	Unbuckled	Grey Zone	Defect	Grey Zone	Buckled	Grey Zone	Short/Shortto ground
< 2.98 mA	2.98 - 3.6 mA	3.6 - 7.4 mA	7.4 - 8.9 mA	8.9 - 9.7 mA	9.7 - 11.7 mA	11.7 - 18.3 mA	18.3 - 22.0 mA	> 22.0 mA

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

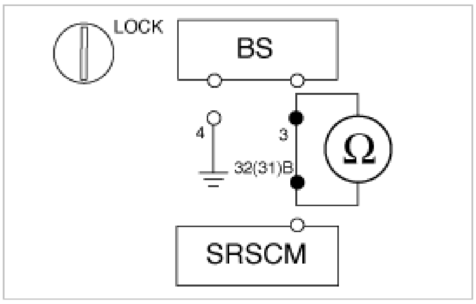
▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK OPEN CIRCUIT
   (1) Disconnect the BS connector.
   (2) Measure resistance between the terminal 3 of BS harness connector and the terminal 32(31) of SRSCM harness connector (B).

   specification(Resistance) : below 1 Ω



   (3) Is the measured resistance within specification?

   YES

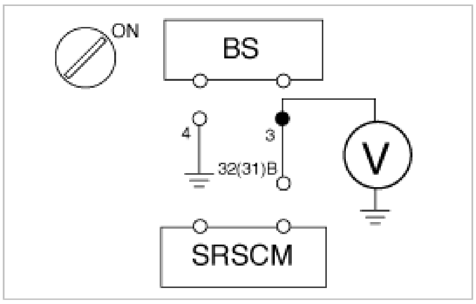
   ▸ Go to next step.

   NO

   ▸ Repair or replace the wiring harness between the BS and the SRSCM.

3. CHECK SHORT TO BATTERY LINE
   (1) Connect the negative (-) terminal to the battery.
   (2) Turn the ignition switch to ON.
   (3) Measure voltage between the terminal 3 of BS harness connector and chassis ground(-).

   specification(voltage) : Approximately 0 V



   (4) Is the measured voltage within specification?

   YES

   ▸ Check the Seat belt buckle switch(BS).

   NO

   ▸ Repair the short to battery line circuit on wiring harness between the BS and the SRSCM.

4. CHECK THE SEAT BELT BUCKLE SWITCH (BS)
   (1) Measure current between the terminal 3 of BS and 32(31) of SRSCM harness connector(B).

specification(current) : 12 ~ 18 mA (Buckled status) , 4 ~ 7 mA (Unbuckled status)

(2) Is the wiring harness normal?

YES

▸ Go to next stop.

NO

▸ Replace the BS.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON .

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1512

DTC Description

The Seat Belt Buckle Switch (BS) circuit consists of the SRSCM and two BS. The SRSCM sets above DTC(s) if it detects short or short to ground on the BS circuit. This system decides whether the driver or passenger seat belt is locked or not.

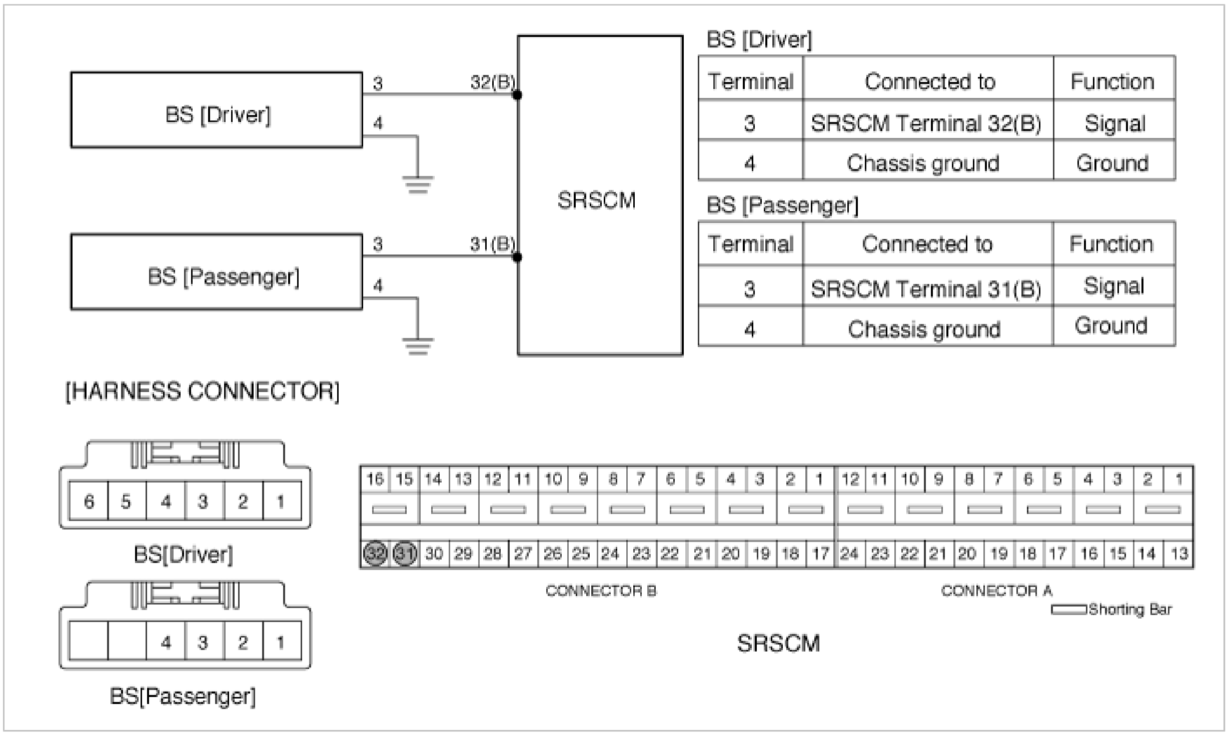
DTC Detecting Condition

DTC	Condition	Probable cause
B1512 B1514	• Short or Short to ground between BS and SRSCM (Current I < 22.0 mA) • Seat Belt Buckle Switch (BS) Malfunction • SRSCM Malfunction	• short or short to ground circuit on wiring harness • Seat Belt Buckle Switch (BS) • SRSCM

Specification

Open/Short to Battery	Grey Zone	Unbuckled	Grey Zone	Defect	Grey Zone	Buckled	Grey Zone	Short/Shortto ground
< 2.98 mA	2.98 - 3.6 mA	3.6 - 7.4 mA	7.4 - 8.9 mA	8.9 - 9.7 mA	9.7 - 11.7 mA	11.7 - 18.3 mA	18.3 - 22.0 mA	> 22.0 mA

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

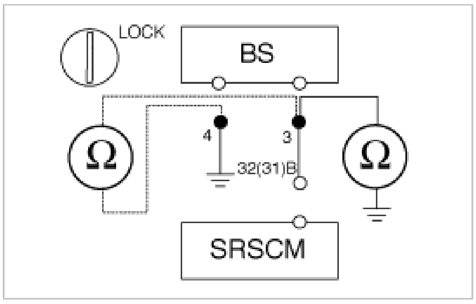
YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SHORT OR SHORT TO GROUND
   (1) Disconnect the BS connector.
   (2) Measure resistance between the terminal 3 of BS harness connector and chassis ground.
   (3) Measure resistance between the terminal 3 and 4 of BS harness connector.

specification(Resistance) : Infinite



(4) Is the measured resistance within specification?

YES

(5) ▸ Go to next step.

NO

▸ Repair the short or short to ground circuit on wiring harness between the BS and the SRSCM.

3. CHECK THE SEAT BELT BUCKLE SWITCH (BS)

(1) Measure current between the terminal 3 of BS and 32(31) of SRSCM harness connector(B).

specification(current) : 12 ~ 18 mA (Buckled status) , 4 ~ 7 mA (Unbuckled status)

(2) Is the wiring harness normal?

YES

▸ Go to next stop.

NO

▸ Replace the BS.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON .

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1513

DTC Description

The Seat Belt Buckle Switch (BS) circuit consists of the SRSCM and two BS. The SRSCM sets above DTC(s) if it detects open or short to battery line on the BS circuit. This system decides whether the driver or passenger seat belt is locked or not.

DTC Detecting Condition

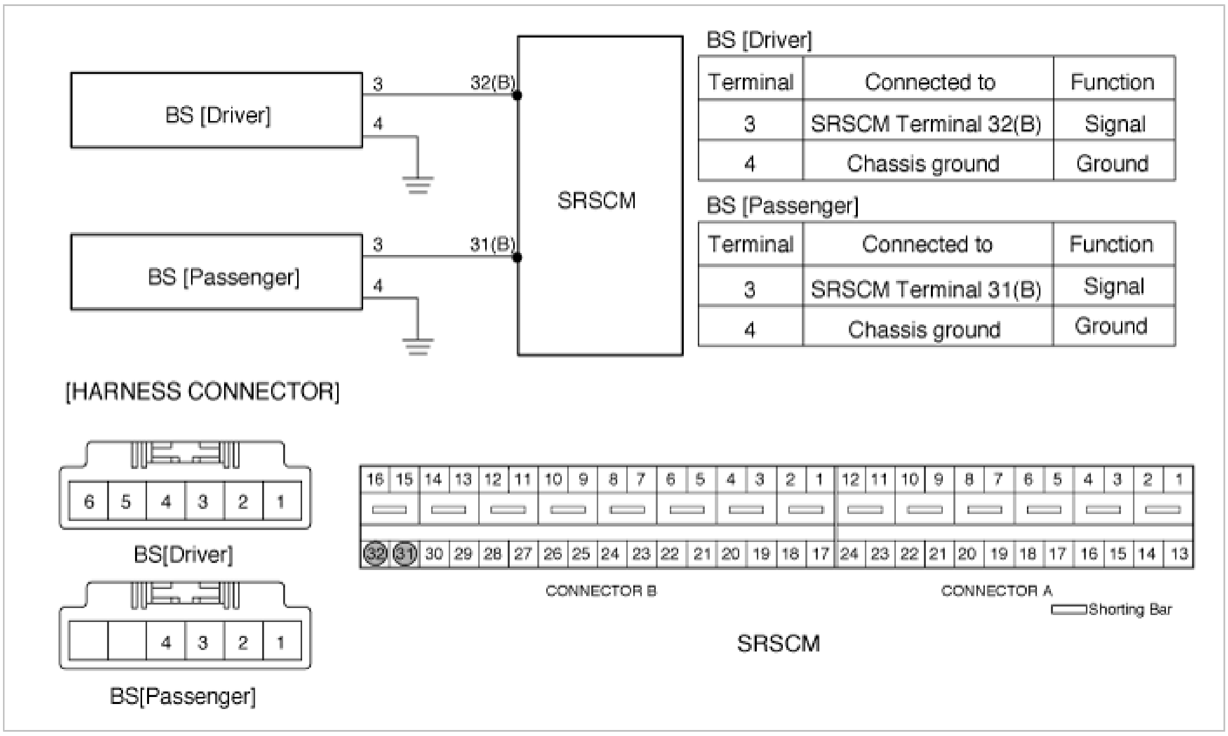
DTC	Condition	Probable cause
	• Open between BS and SRSCM (Current I < 2.98 mA).	• Open or short to battery line circuit on wiring

B1511 B1513	• Short to battery line between BS and SRSCM (Current I < 2.98 mA) • Seat Belt Buckle Switch (BS) Malfunction • SRSCM Malfunction	harness • Seat Belt Buckle Switch (BS) • SRSCM

Specification

Open/Short to Battery	Grey Zone	Unbuckled	Grey Zone	Defect	Grey Zone	Buckled	Grey Zone	Short/Shortto ground
< 2.98 mA	2.98 - 3.6 mA	3.6 - 7.4 mA	7.4 - 8.9 mA	8.9 - 9.7 mA	9.7 - 11.7 mA	11.7 - 18.3 mA	18.3 - 22.0 mA	> 22.0 mA

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> CAUTION
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.

(3) Remove the DAB module and disconnect the DAB connector.

(4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

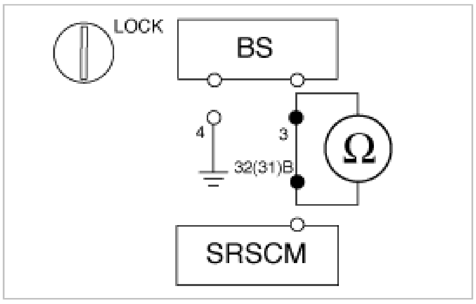
(5) Disconnect the SRSCM connector.

2. CHECK OPEN CIRCUIT

(1) Disconnect the BS connector.

(2) Measure resistance between the terminal 3 of BS harness connector and the terminal 32(31) of SRSCM harness connector (B).

specification(Resistance) : below 1 Ω



(3) Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair or replace the wiring harness between the BS and the SRSCM.

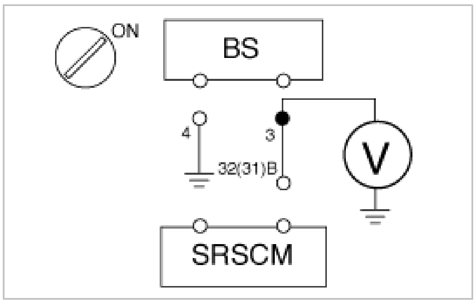
3. CHECK SHORT TO BATTERY LINE

(1) Connect the negative (-) terminal to the battery.

(2) Turn the ignition switch to ON.

(3) Measure voltage between the terminal 3 of BS harness connector and chassis ground(-).

specification(voltage) : Approximately 0 V



(4) Is the measured voltage within specification?

YES

▸ Check the Seat belt buckle switch(BS).

NO

▸ Repair the short to battery line circuit on wiring harness between the BS and the SRSCM.

4. CHECK THE SEAT BELT BUCKLE SWITCH (BS)

(1) Measure current between the terminal 3 of BS and 32(31) of SRSCM harness connector(B).

specification(current) : 12 ~ 18 mA (Buckled status) , 4 ~ 7 mA (Unbuckled status)

(2) Is the wiring harness normal?

YES

▸ Go to next stop.

NO

▸ Replace the BS.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON .

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1514

DTC Description

The Seat Belt Buckle Switch (BS) circuit consists of the SRSCM and two BS. The SRSCM sets above DTC(s) if it detects short or short to ground on the BS circuit. This system decides whether the driver or passenger seat belt is locked or not.

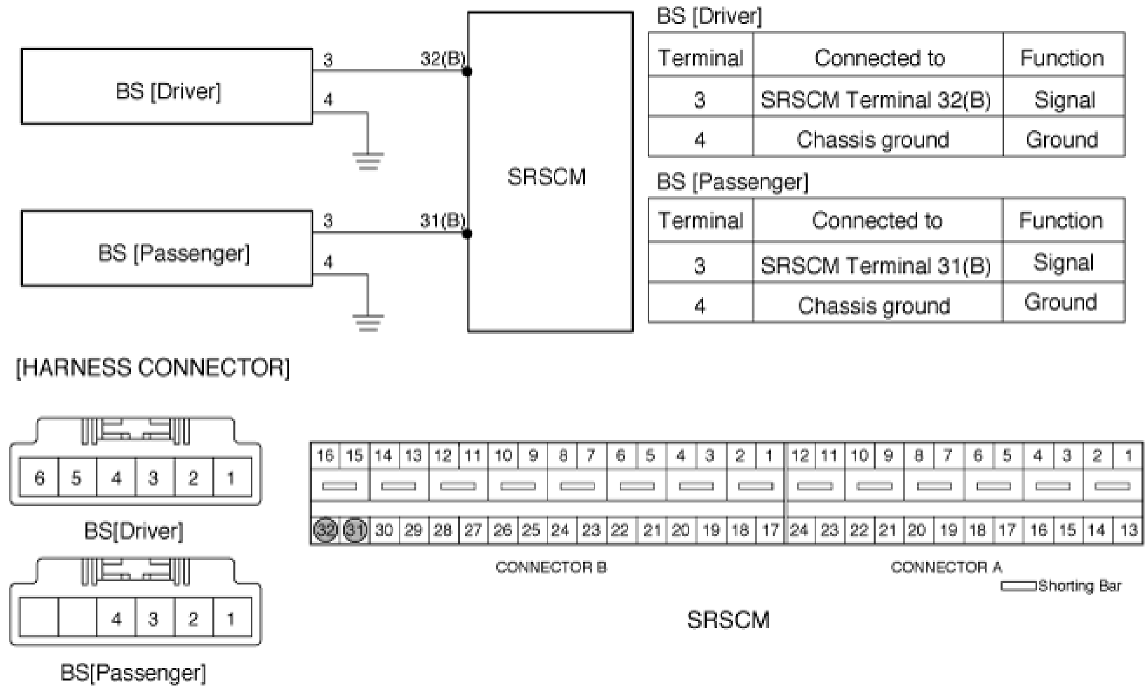
DTC Detecting Condition

DTC	Condition	Probable cause
B1512 B1514	• Short or Short to ground between BS and SRSCM (Current I < 22.0 mA) • Seat Belt Buckle Switch (BS) Malfunction • SRSCM Malfunction	• short or short to ground circuit on wiring harness • Seat Belt Buckle Switch (BS) • SRSCM

Specification

Open/Short to Battery	Grey Zone	Unbuckled	Grey Zone	Defect	Grey Zone	Buckled	Grey Zone	Short/Shortto ground
< 2.98 mA	2.98 - 3.6 mA	3.6 - 7.4 mA	7.4 - 8.9 mA	8.9 - 9.7 mA	9.7 - 11.7 mA	11.7 - 18.3 mA	18.3 - 22.0 mA	> 22.0 mA

Schematic Diagram



BS [Driver]

Terminal	Connected to	Function
3	SRSCM Terminal 32(B)	Signal
4	Chassis ground	Ground

BS [Passenger]

Terminal	Connected to	Function
3	SRSCM Terminal 31(B)	Signal
4	Chassis ground	Ground

Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

CAUTION

Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

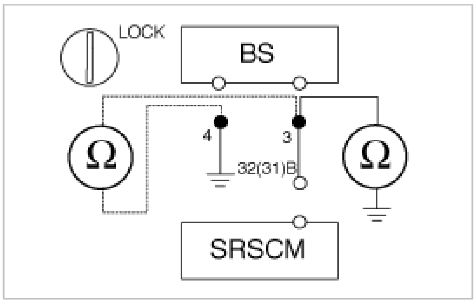
YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SHORT OR SHORT TO GROUND
   (1) Disconnect the BS connector.
   (2) Measure resistance between the terminal 3 of BS harness connector and chassis ground.
   (3) Measure resistance between the terminal 3 and 4 of BS harness connector.

specification(Resistance) : Infinite



(4) Is the measured resistance within specification?

YES

(5) ▸ Go to next step.

NO

▸ Repair the short or short to ground circuit on wiring harness between the BS and the SRSCM.

3. CHECK THE SEAT BELT BUCKLE SWITCH (BS)
   (1) Measure current between the terminal 3 of BS and 32(31) of SRSCM harness connector(B).

   specification(current) : 12 ~ 18 mA (Buckled status) , 4 ~ 7 mA (Unbuckled status)

   (2) Is the wiring harness normal?

   YES

   ▸ Go to next stop.

   NO

   ▸ Replace the BS.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON .
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1515

DTC Description

The Seat Belt Buckle Switch (BS) circuit consists of the SRSCM and two BS. The SRSCM sets above DTC(s) if it detects the BS faults. This system decides whether the driver or passenger seat belt is locked or not.

DTC Detecting Condition

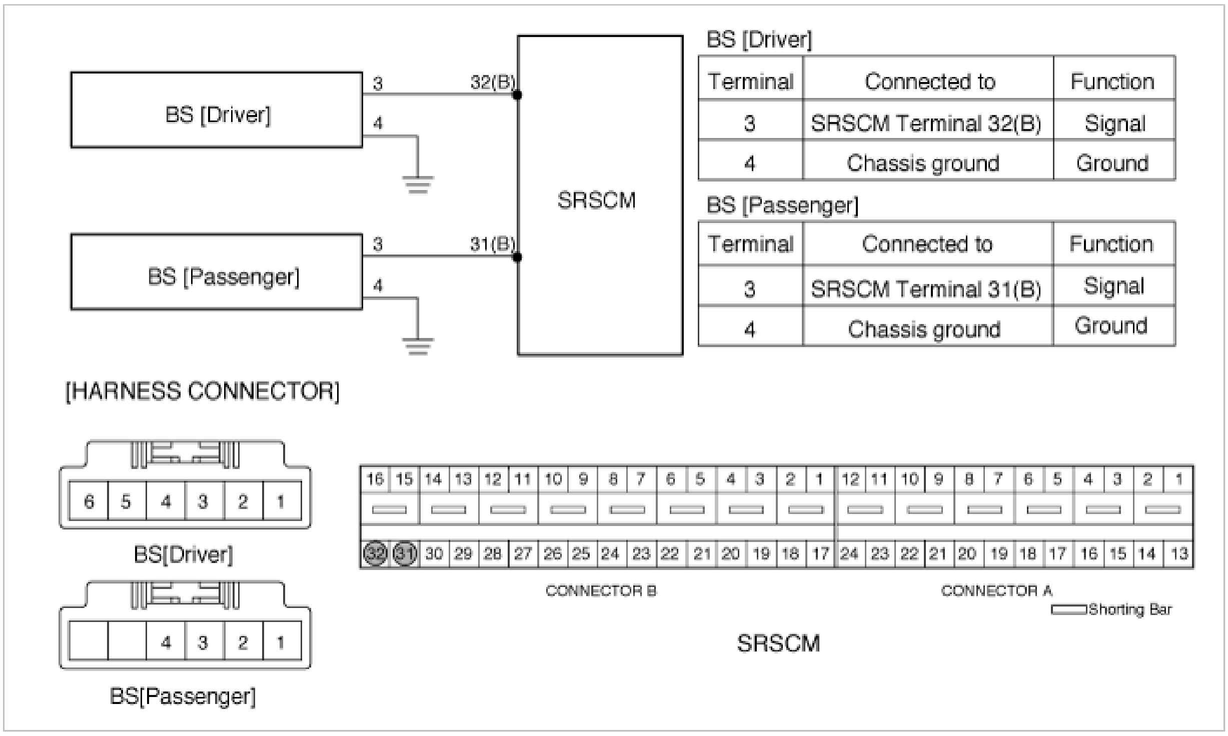
DTC	Condition	Probable cause
B1515 B1516	• Seat Belt Buckle Switch (BS) Malfunction	• Seat Belt Buckle Switch (BS)

B1517 B1518	• SRSCM Malfunction	• SRSCM

Specification

Open/Short to Battery	Grey Zone	Unbuckled	Grey Zone	Defect	Grey Zone	Buckled	Grey Zone	Short/Shortto ground
< 2.98 mA	2.98 - 3.6 mA	3.6 - 7.4 mA	7.4 - 8.9 mA	8.9 - 9.7 mA	9.7 - 11.7 mA	11.7 - 18.3 mA	18.3 - 22.0 mA	> 22.0 mA

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

2. CHECK THE SEAT BELT BUCKLE SWITCH (BS)
   (1) Measure current between the terminal 3 of BS and 32(31) of SRSCM harness connector(B).

   specification(current) : 12 ~ 18 mA (Buckled status) , 4 ~ 7 mA (Unbuckled status)

   (2) Is the wiring harness normal?

   YES

   ▸ Go to next stop.

   NO

   ▸ Replace the BS.

3. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON .
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1516

DTC Description

The Seat Belt Buckle Switch (BS) circuit consists of the SRSCM and two BS. The SRSCM sets above DTC(s) if it detects the BS faults. This system decides whether the driver or passenger seat belt is locked or not.

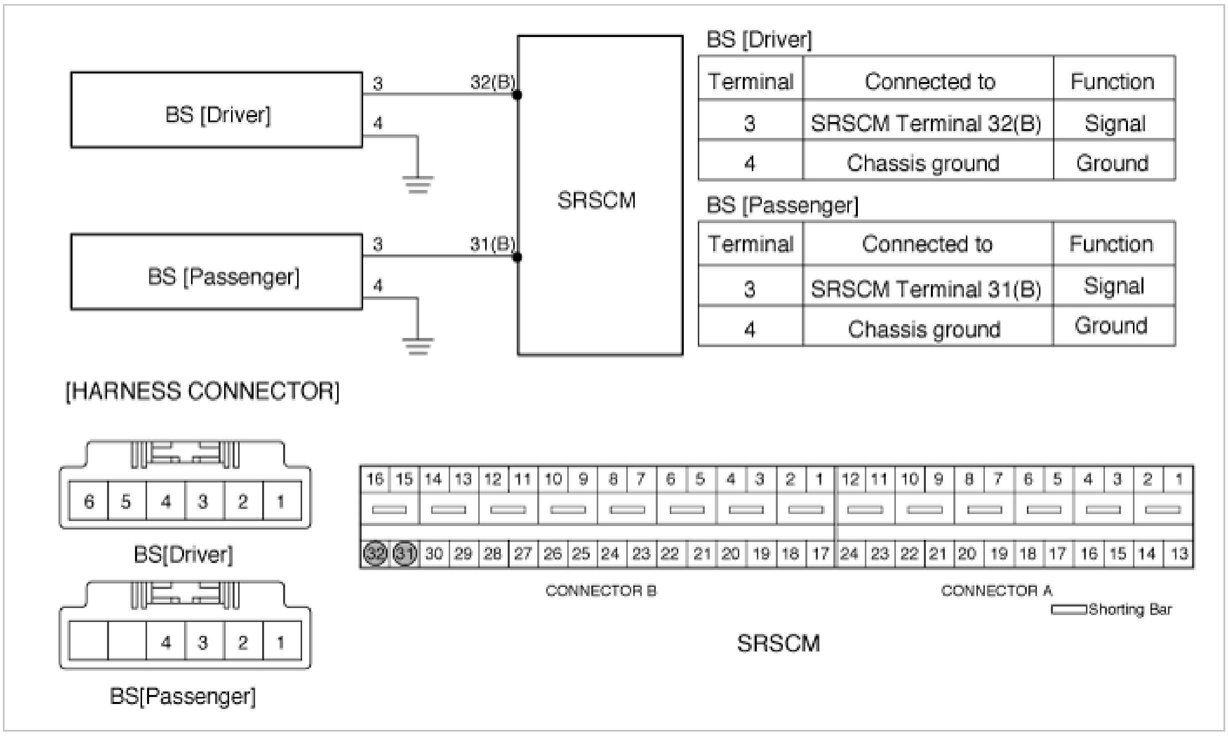
DTC Detecting Condition

DTC	Condition	Probable cause
B1515 B1516 B1517 B1518	• Seat Belt Buckle Switch (BS) Malfunction • SRSCM Malfunction	• Seat Belt Buckle Switch (BS) • SRSCM

Specification

Open/Short to Battery	Grey Zone	Unbuckled	Grey Zone	Defect	Grey Zone	Buckled	Grey Zone	Short/Shortto ground
< 2.98 mA	2.98 - 3.6 mA	3.6 - 7.4 mA	7.4 - 8.9 mA	8.9 - 9.7 mA	9.7 - 11.7 mA	11.7 - 18.3 mA	18.3 - 22.0 mA	> 22.0 mA

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK THE SEAT BELT BUCKLE SWITCH (BS)
   (1) Measure current between the terminal 3 of BS and 32(31) of SRSCM harness connector(B).

   specification(current) : 12 ~ 18 mA (Buckled status) , 4 ~ 7 mA (Unbuckled status)

   (2) Is the wiring harness normal?

   YES

   ▸ Go to next stop.

   NO

   ▸ Replace the BS.

3. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON .

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1517

DTC Description

The Seat Belt Buckle Switch (BS) circuit consists of the SRSCM and two BS. The SRSCM sets above DTC(s) if it detects the BS faults. This system decides whether the driver or passenger seat belt is locked or not.

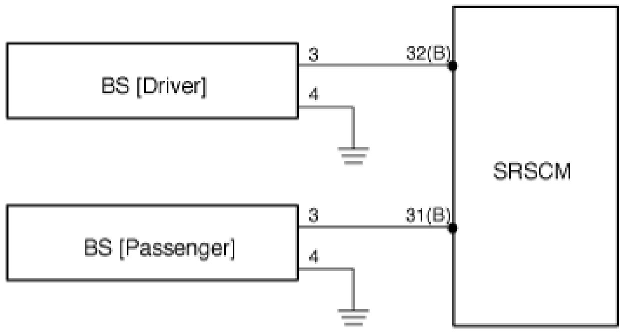
DTC Detecting Condition

DTC	Condition	Probable cause
B1515 B1516 B1517 B1518	• Seat Belt Buckle Switch (BS) Malfunction • SRSCM Malfunction	• Seat Belt Buckle Switch (BS) • SRSCM

Specification

Open/Short to Battery	Grey Zone	Unbuckled	Grey Zone	Defect	Grey Zone	Buckled	Grey Zone	Short/Shortto ground
< 2.98 mA	2.98 - 3.6 mA	3.6 - 7.4 mA	7.4 - 8.9 mA	8.9 - 9.7 mA	9.7 - 11.7 mA	11.7 - 18.3 mA	18.3 - 22.0 mA	> 22.0 mA

Schematic Diagram

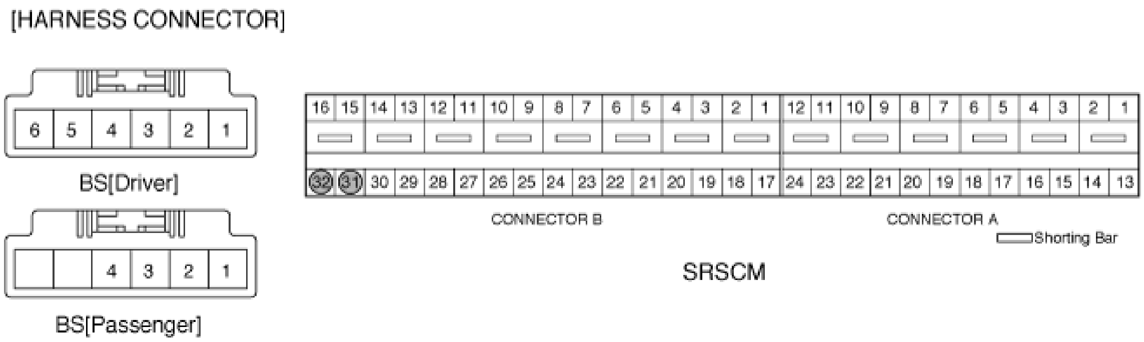


BS [Driver]

Terminal	Connected to	Function
3	SRSCM Terminal 32(B)	Signal
4	Chassis ground	Ground

BS [Passenger]

Terminal	Connected to	Function
3	SRSCM Terminal 31(B)	Signal
4	Chassis ground	Ground



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK THE SEAT BELT BUCKLE SWITCH (BS)
   (1) Measure current between the terminal 3 of BS and 32(31) of SRSCM harness connector(B).

   specification(current) : 12 ~ 18 mA (Buckled status) , 4 ~ 7 mA (Unbuckled status)

   (2) Is the wiring harness normal?

   YES

   ▸ Go to next stop.

   NO

   ▸ Replace the BS.

3. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON .

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▶ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▶Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1518

DTC Description

The Seat Belt Buckle Switch (BS) circuit consists of the SRSCM and two BS. The SRSCM sets above DTC(s) if it detects the BS faults. This system decides whether the driver or passenger seat belt is locked or not.

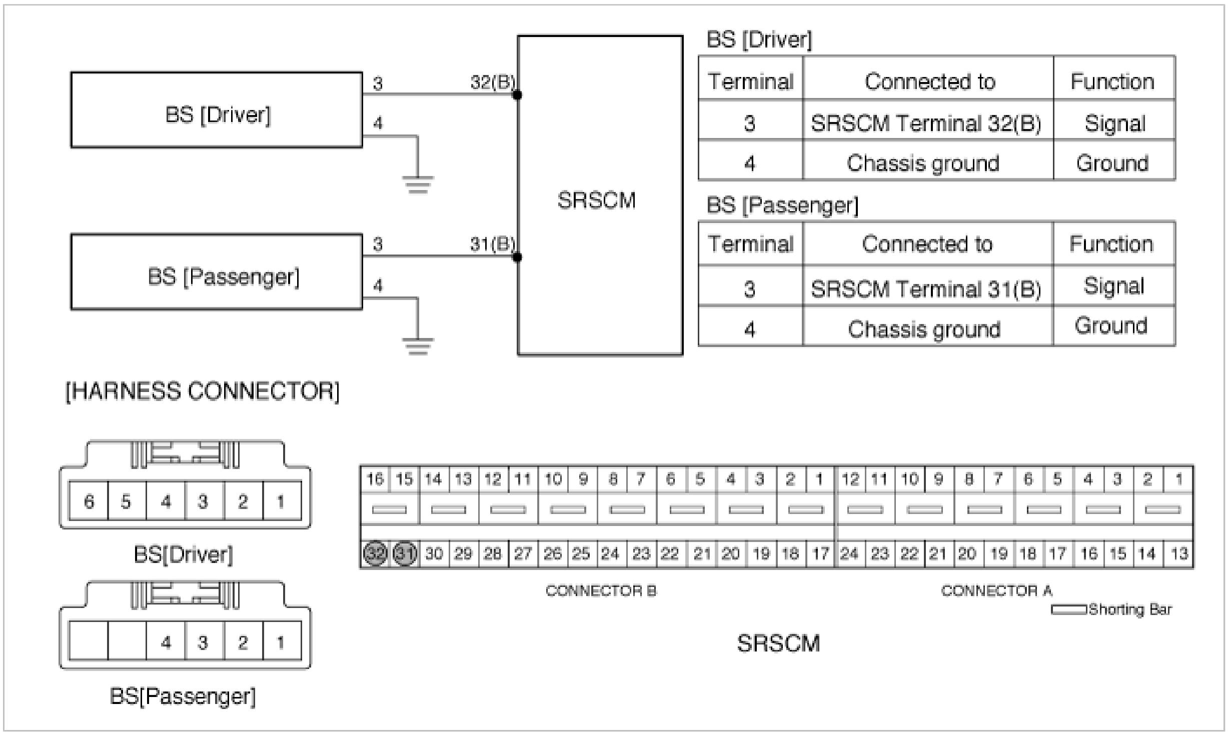
DTC Detecting Condition

DTC	Condition	Probable cause
B1515 B1516 B1517 B1518	• Seat Belt Buckle Switch (BS) Malfunction • SRSCM Malfunction	• Seat Belt Buckle Switch (BS) • SRSCM

Specification

Open/Short to Battery	Grey Zone	Unbuckled	Grey Zone	Defect	Grey Zone	Buckled	Grey Zone	Short/Shortto ground
< 2.98 mA	2.98 - 3.6 mA	3.6 - 7.4 mA	7.4 - 8.9 mA	8.9 - 9.7 mA	9.7 - 11.7 mA	11.7 - 18.3 mA	18.3 - 22.0 mA	> 22.0 mA

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK THE SEAT BELT BUCKLE SWITCH (BS)
   (1) Measure current between the terminal 3 of BS and 32(31) of SRSCM harness connector(B).

   specification(current) : 12 ~ 18 mA (Buckled status) , 4 ~ 7 mA (Unbuckled status)

   (2) Is the wiring harness normal?

   YES

   ▸ Go to next stop.

   NO

   ▸ Replace the BS.

3. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON .

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1620

General Description

SRSCM (Supplement Restraint System Control Module) decides to deploy the airbag module by sensing the frontal impact sensed by the sensor built in to the SRSCM.

1. DC/DC convertor : The DC/DC convertors of the power supply includes a step up and a step down converter, which provides the firing voltage for four firing circuits and the internal operating voltage. If the internal operatingvoltage falls below a defined threshold, a reset is executed.
2. Arming sensor/safing sensor : The arming/safing sensor built in to the airbag firing circuit has the function of arming the airbag circuit under all required deployment conditions and maintaining the airbag firing circuits unarmed under normal driving conditions. The safing sensor is a dual-contact electromechanical switch which closes if it experiences a deceleration exceedinga specified threshold
3. Back-up power : The SRSCM reserves an energy supply to provide deployment energy for a short second when the vehicle voltage is low or if lost in avehicle frontal crash.
4. Malfunction detection : The SRSCM continuously monitors the current SRS operation status while the ignition key is turned on and detects possible malfunction of the system. The malfunction can be displayed in the form of a diagnostic trouble code using Hi-Scan.
5. MIL (Malfunction Indication Lamp) notification : If any fault is detected, the SRSCM sends a signal to the indicator lamp on the cluster to warn thevehicle driver.The MIL indicator is the key item in notifying the driver of SRS faults. Verify lamp and SRSCM operation by flashing 6 times when the ignition switches first turned on.
6. Malfunction recording : Once a fault occurs in the system, the SRSCM records the fault in the memory in the form of DTC and the DTC can only beerased only by Hi-Scan.
7. Data link connector : Data stored in he SRSCM memory is read by Hi-Scan through the data link connector.
8. After firing the airbags once, the SRSCM cannot be used again and must be replaced.
9. Crash output : The crash output is used to control an external device which will unlock the doors in case of a crash event. The crash output is specified as follows : 0-200 μA in OFF mode and 200mA in ON mode. In case of the unlock command the switch is closed for 200 mS.

DTC Description

The SRSCM shall also cyclically monitor the following :

1. Functional readliness of the firing circuit activation transistors.
2. Adequacy of deployment energy reserves.
3. Safing sensor integtity : detection of faulty closure.
4. Plausibility of accelerometer signal.
5. Operation of SRSCM components.

DTC Detecting Condition

DTC	Condition	Probable cause
B1620	• Internal faults : accelerometer sensor fault, FLIC fault, energy back up capacitor fault, watch dog	• SRSCM

Verification of vehicle repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scan tool, clear the DTCs.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

▸ Go to the applicable troubleshooting procedure.

NO

▸ System is performing to specification at this time.

Inspection Procedure

1. Ignition "OFF" , connect scantool.
2. Ignition "ON" & engine "OFF", select "Diagnistic Trouble Codes(DTCs)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTCs.
5. Is DTC present problem?

YES

▸ Substitute with a known-good SRSCM and check for proper operation.If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Do not change the SRSCM, the SRSCM is OK at this moment.Fault is intermittent it has been repaired and SRSCM memory is not cleared yet. Thoroughly check SRSCM for looseness, bending, corrosion, contamination, deterioration, and/or damage.Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1650

General Description

SRSCM (Supplement Restraint System Control Module) decides to deploy the airbag module by sensing the frontal impact sensed by the sensor built in to the SRSCM.

1. DC/DC convertor : The DC/DC convertors of the power supply includes a step up and a step down converter, which provides the firing voltage for four firing circuits and the internal operating voltage. If the internal operatingvoltage falls below a defined threshold, a reset is executed.
2. Arming sensor/safing sensor : The arming/safing sensor built in to the airbag firing circuit has the function of arming the airbag circuit under all required deployment conditions and maintaining the airbag firing circuits unarmed under normal driving conditions. The safing sensor is a dual-contact electromechanical switch which closes if it experiences a deceleration exceedinga specified threshold
3. Back-up power : The SRSCM reserves an energy supply to provide deployment energy for a short second when the vehicle voltage is low or if lost in avehicle frontal crash.
4. Malfunction detection : The SRSCM continuously monitors the current SRS operation status while the ignition key is turned on and detects possible malfunction of the system. The malfunction can be displayed in the form of a diagnostic trouble code using Hi-Scan.
5. MIL (Malfunction Indication Lamp) notification : If any fault is detected, the SRSCM sends a signal to the indicator lamp on the cluster to warn thevehicle driver.The MIL indicator is the key item in notifying the driver of SRS faults. Verify lamp and SRSCM operation by flashing 6 times when the ignition switches first turned on.
6. Malfunction recording : Once a fault occurs in the system, the SRSCM records the fault in the memory in the form of DTC and the DTC can only beerased only by Hi-Scan.
7. Data link connector : Data stored in he SRSCM memory is read by Hi-Scan through the data link connector.

8. After firing the airbags once, the SRSCM cannot be used again and must be replaced.
9. Crash output : The crash output is used to control an external device which will unlock the doors in case of a crash event. The crash output is specified as follows : 0-200 μA in OFF mode and 200mA in ON mode. In case of the unlock commandthe switch is closed for 200 mS.

DTC Description

The frontal Crash recorded in the SRS Control module.

DTC Detecting Condition

DTC	Condition	Probable cause
B1650 B1657 B1658 B1670	• Crash recorded in the SRSCM	• SRSCM

Verification of vehicle repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scan tool, clear the DTCs.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

   YES

   ▸ Go to the applicable troubleshooting procedure.

   NO

   ▸ System is performing to specification at this time.

Inspection Procedure

1. Ignition "OFF", connect scantool.
2. Ignition "ON" & engine "OFF", select "Diagnistic Trouble Codes(DTCs)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTCs.
5. Is DTC present problem?

   YES

   ▸ The front crash is recorded. Replace SRS Control Module assy.(Except for B1657) Be able to reuse SRSCM 5 times, when B1657 is only monitored. And then goto next step.

   NO

   ▸ System is OK at this moment.

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1651

General Description

SRSCM (Supplement Restraint System Control Module) decides to deploy the airbag module by sensing the frontal impact sensed by the sensor built in to the SRSCM.

1. DC/DC convertor : The DC/DC convertors of the power supply includes a step up and a step down converter, which provides the firing voltage for four firing circuits and the internal operating voltage. If the internal operatingvoltage falls below a defined threshold, a reset is executed.
2. Arming sensor/safing sensor : The arming/safing sensor built in to the airbag firing circuit has the function of arming the airbag circuit under all required deployment conditions and maintaining the airbag firing circuits unarmed under normal driving conditions. The safing sensor is a dual-contact electromechanical switch which closes if it experiences a deceleration exceedinga specified threshold
3. Back-up power : The SRSCM reserves an energy supply to provide deployment energy for a short second when the vehicle voltage is low or if lost in avehicle frontal crash.

4. Malfunction detection : The SRSCM continuously monitors the current SRS operation status while the ignition key is turned on and detects possible malfunction of the system. The malfunction can be displayed in the form of a diagnostic trouble code using Hi-Scan.
5. MIL (Malfunction Indication Lamp) notification : If any fault is detected, the SRSCM sends a signal to the indicator lamp on the cluster to warn thevehicle driver.The MIL indicator is the key item in notifying the driver of SRS faults. Verify lamp and SRSCM operation by flashing 6 times when the ignition switches first turned on.
6. Malfunction recording : Once a fault occurs in the system, the SRSCM records the fault in the memory in the form of DTC and the DTC can only beerased only by Hi-Scan.
7. Data link connector : Data stored in he SRSCM memory is read by Hi-Scan through the data link connector.
8. After firing the airbags once, the SRSCM cannot be used again and must be replaced.
9. Crash output : The crash output is used to control an external device which will unlock the doors in case of a crash event. The crash output is specified as follows : 0-200 μA in OFF mode and 200mA in ON mode. In case of the unlock commandthe switch is closed for 200 mS.

DTC Description

The frontal Crash recorded in the SRS Control module.

DTC Detecting Condition

DTC	Condition	Probable cause
B1651 B1652	• Crash recorded in the SRSCM(side)	• SRSCM

Verification of vehicle repair

After a repair, it is essential to verify that the fault has been corrected.
1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scan tool, clear the DTCs.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

▸ Go to the applicable troubleshooting procedure.

NO

▸ System is performing to specification at this time.

Inspection Procedure

1. Ignition "OFF", connect scantool.
2. Ignition "ON" & engine "OFF", select "Diagnistic Trouble Codes(DTCs)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTCs.
5. Is DTC present problem?

YES

▸ The side crash is recorded. Replace SRS Control Module assy. And then goto next step.

NO

▸ System is OK at this moment.

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1652

General Description

SRSCM (Supplement Restraint System Control Module) decides to deploy the airbag module by sensing the frontal impact sensed by the sensor built in to the SRSCM.
1. DC/DC convertor : The DC/DC convertors of the power supply includes a step up and a step down converter, which provides the firing voltage for four firing circuits and the internal operating voltage. If the internal operatingvoltage falls below a defined

threshold, a reset is executed.

2. Arming sensor/safing sensor : The arming/safing sensor built in to the airbag firing circuit has the function of arming the airbag circuit under all required deployment conditions and maintaining the airbag firing circuits unarmed under normal driving conditions. The safing sensor is a dual-contact electromechanical switch which closes if it experiences a deceleration exceedinga specified threshold
3. Back-up power : The SRSCM reserves an energy supply to provide deployment energy for a short second when the vehicle voltage is low or if lost in avehicle frontal crash.
4. Malfunction detection : The SRSCM continuously monitors the current SRS operation status while the ignition key is turned on and detects possible malfunction of the system. The malfunction can be displayed in the form of a diagnostic trouble code using Hi-Scan.
5. MIL (Malfunction Indication Lamp) notification : If any fault is detected, the SRSCM sends a signal to the indicator lamp on the cluster to warn thevehicle driver.The MIL indicator is the key item in notifying the driver of SRS faults. Verify lamp and SRSCM operation by flashing 6 times when the ignition switches first turned on.
6. Malfunction recording : Once a fault occurs in the system, the SRSCM records the fault in the memory in the form of DTC and the DTC can only beerased only by Hi-Scan.
7. Data link connector : Data stored in he SRSCM memory is read by Hi-Scan through the data link connector.
8. After firing the airbags once, the SRSCM cannot be used again and must be replaced.
9. Crash output : The crash output is used to control an external device which will unlock the doors in case of a crash event. The crash output is specified as follows : 0-200 μA in OFF mode and 200mA in ON mode. In case of the unlock commandthe switch is closed for 200 mS.

DTC Description

The frontal Crash recorded in the SRS Control module.

DTC Detecting Condition

DTC	Condition	Probable cause
B1651 B1652	• Crash recorded in the SRSCM(side)	• SRSCM

Verification of vehicle repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scan tool, clear the DTCs.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

▸ Go to the applicable troubleshooting procedure.

NO

▸ System is performing to specification at this time.

Inspection Procedure

1. Ignition "OFF", connect scantool.
2. Ignition "ON" & engine "OFF", select "Diagnistic Trouble Codes(DTCs)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTCs.
5. Is DTC present problem?

YES

▸ The side crash is recorded. Replace SRS Control Module assy. And then goto next step.

NO

▸ System is OK at this moment.

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting >

B1655

General Description

SRSCM (Supplement Restraint System Control Module) decides to deploy the airbag module by sensing the frontal impact sensed by the sensor built in to the SRSCM.

1. DC/DC convertor : The DC/DC convertors of the power supply includes a step up and a step down converter, which provides the firing voltage for four firing circuits and the internal operating voltage. If the internal operatingvoltage falls below a defined threshold, a reset is executed.
2. Arming sensor/safing sensor : The arming/safing sensor built in to the airbag firing circuit has the function of arming the airbag circuit under all required deployment conditions and maintaining the airbag firing circuits unarmed under normal driving conditions. The safing sensor is a dual-contact electromechanical switch which closes if it experiences a deceleration exceedinga specified threshold
3. Back-up power : The SRSCM reserves an energy supply to provide deployment energy for a short second when the vehicle voltage is low or if lost in avehicle frontal crash.
4. Malfunction detection : The SRSCM continuously monitors the current SRS operation status while the ignition key is turned on and detects possible malfunction of the system. The malfunction can be displayed in the form of a diagnostic trouble code using Hi-Scan.
5. MIL (Malfunction Indication Lamp) notification : If any fault is detected, the SRSCM sends a signal to the indicator lamp on the cluster to warn thevehicle driver.The MIL indicator is the key item in notifying the driver of SRS faults. Verify lamp and SRSCM operation by flashing 6 times when the ignition switches first turned on.
6. Malfunction recording : Once a fault occurs in the system, the SRSCM records the fault in the memory in the form of DTC and the DTC can only beerased only by Hi-Scan.
7. Data link connector : Data stored in he SRSCM memory is read by Hi-Scan through the data link connector.
8. After firing the airbags once, the SRSCM cannot be used again and must be replaced.
9. Crash output : The crash output is used to control an external device which will unlock the doors in case of a crash event. The crash output is specified as follows : 0-200 μA in OFF mode and 200mA in ON mode. In case of the unlock commandthe switch is closed for 200 mS.

DTC Description

The frontal Crash recorded in the SRS Control module.

DTC Detecting Condition

DTC	Condition	Probable cause
B1650 B1657 B1658 B1670	• Crash recorded in the SRSCM	• SRSCM

Verification of vehicle repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scan tool, clear the DTCs.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

   YES

   ▸ Go to the applicable troubleshooting procedure.

   NO

   ▸ System is performing to specification at this time.

Inspection Procedure

1. Ignition "OFF", connect scantool.
2. Ignition "ON" & engine "OFF", select "Diagnistic Trouble Codes(DTCs)" mode.
3. Monitor diagnostic trouble code and present of trouble code.

4. Using a scan tool, clear the DTCs.
5. Is DTC present problem?

YES

▸ The crash is recorded.(Pass. side) Replace SRS Control Module assy. And then goto next step.

NO

▸ System is OK at this moment.

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1657

General Description

SRSCM (Supplement Restraint System Control Module) decides to deploy the airbag module by sensing the frontal impact sensed by the sensor built in to the SRSCM.

1. DC/DC convertor : The DC/DC convertors of the power supply includes a step up and a step down converter, which provides the firing voltage for four firing circuits and the internal operating voltage. If the internal operatingvoltage falls below a defined threshold, a reset is executed.
2. Arming sensor/safing sensor : The arming/safing sensor built in to the airbag firing circuit has the function of arming the airbag circuit under all required deployment conditions and maintaining the airbag firing circuits unarmed under normal driving conditions. The safing sensor is a dual-contact electromechanical switch which closes if it experiences a deceleration exceedinga specified threshold
3. Back-up power : The SRSCM reserves an energy supply to provide deployment energy for a short second when the vehicle voltage is low or if lost in avehicle frontal crash.
4. Malfunction detection : The SRSCM continuously monitors the current SRS operation status while the ignition key is turned on and detects possible malfunction of the system. The malfunction can be displayed in the form of a diagnostic trouble code using Hi-Scan.
5. MIL (Malfunction Indication Lamp) notification : If any fault is detected, the SRSCM sends a signal to the indicator lamp on the cluster to warn thevehicle driver.The MIL indicator is the key item in notifying the driver of SRS faults. Verify lamp and SRSCM operation by flashing 6 times when the ignition switches first turned on.
6. Malfunction recording : Once a fault occurs in the system, the SRSCM records the fault in the memory in the form of DTC and the DTC can only beerased only by Hi-Scan.
7. Data link connector : Data stored in he SRSCM memory is read by Hi-Scan through the data link connector.
8. After firing the airbags once, the SRSCM cannot be used again and must be replaced.
9. Crash output : The crash output is used to control an external device which will unlock the doors in case of a crash event. The crash output is specified as follows : 0-200 μA in OFF mode and 200mA in ON mode. In case of the unlock commandthe switch is closed for 200 mS.

DTC Description

The frontal Crash recorded in the SRS Control module.

DTC Detecting Condition

DTC	Condition	Probable cause
B1650 B1657 B1658 B1670	• Crash recorded in the SRSCM	• SRSCM

Verification of vehicle repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scan tool, clear the DTCs.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

▸ Go to the applicable troubleshooting procedure.

NO

▸ System is performing to specification at this time.

Inspection Procedure

1. Ignition "OFF", connect scantool.
2. Ignition "ON" & engine "OFF", select "Diagnistic Trouble Codes(DTCs)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTCs.
5. Is DTC present problem?

YES

▸ The front crash is recorded. Replace SRS Control Module assy.(Except for B1657) Be able to reuse SRSCM 5 times, when B1657 is only monitored. And then goto next step.

NO

▸ System is OK at this moment.

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1658

General Description

SRSCM (Supplement Restraint System Control Module) decides to deploy the airbag module by sensing the frontal impact sensed by the sensor built in to the SRSCM.

1. DC/DC convertor : The DC/DC convertors of the power supply includes a step up and a step down converter, which provides the firing voltage for four firing circuits and the internal operating voltage. If the internal operatingvoltage falls below a defined threshold, a reset is executed.
2. Arming sensor/safing sensor : The arming/safing sensor built in to the airbag firing circuit has the function of arming the airbag circuit under all required deployment conditions and maintaining the airbag firing circuits unarmed under normal driving conditions. The safing sensor is a dual-contact electromechanical switch which closes if it experiences a deceleration exceedinga specified threshold
3. Back-up power : The SRSCM reserves an energy supply to provide deployment energy for a short second when the vehicle voltage is low or if lost in avehicle frontal crash.
4. Malfunction detection : The SRSCM continuously monitors the current SRS operation status while the ignition key is turned on and detects possible malfunction of the system. The malfunction can be displayed in the form of a diagnostic trouble code using Hi-Scan.
5. MIL (Malfunction Indication Lamp) notification : If any fault is detected, the SRSCM sends a signal to the indicator lamp on the cluster to warn thevehicle driver.The MIL indicator is the key item in notifying the driver of SRS faults. Verify lamp and SRSCM operation by flashing 6 times when the ignition switches first turned on.
6. Malfunction recording : Once a fault occurs in the system, the SRSCM records the fault in the memory in the form of DTC and the DTC can only beerased only by Hi-Scan.
7. Data link connector : Data stored in he SRSCM memory is read by Hi-Scan through the data link connector.
8. After firing the airbags once, the SRSCM cannot be used again and must be replaced.
9. Crash output : The crash output is used to control an external device which will unlock the doors in case of a crash event. The crash output is specified as follows : 0-200 μA in OFF mode and 200mA in ON mode. In case of the unlock commandthe switch is closed for 200 mS.

DTC Description

The frontal Crash recorded in the SRS Control module.

DTC Detecting Condition

DTC	Condition	Probable cause
B1650 B1657 B1658 B1670	• Crash recorded in the SRSCM	• SRSCM

Verification of vehicle repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scan tool, clear the DTCs.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

▸ Go to the applicable troubleshooting procedure.

NO

▸ System is performing to specification at this time.

Inspection Procedure

1. Ignition "OFF", connect scantool.
2. Ignition "ON" & engine "OFF", select "Diagnistic Trouble Codes(DTCs)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTCs.
5. Is DTC present problem?

YES

▸ The front crash is recorded. Replace SRS Control Module assy.(Except for B1657) Be able to reuse SRSCM 5 times, when B1657 is only monitored. And then goto next step.

NO

▸ System is OK at this moment.

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1659

General Description

DTC is detected when a rear Crash is recorded in the SRS Control module .Although it is detected , any airbag doesn't inflate. And DTC code is only eliminated by using HI-scan.

Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> CAUTION
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK, remove battery(-) cable. wait for 1 min.
   (2) Connect battery(-) cable ,connect Hi-scan. Turn on the ignition , wait for 30 sec.
   (3) IGN ON, Engine off. select "Diagnostic Trouble Codes(DTCs)" mode.
   (4) Monitor diagnostic trouble code and present of trouble code.
   (5) Using a scan tool, clear the DTCs.
   Is a DTC monitored?

   YES

▸ If a DTC can,t be eliminated, replace the SRSCM. Then go to next step.

NO

▸ System is OK at this moment.

2. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON .
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1670

General Description

SRSCM (Supplement Restraint System Control Module) decides to deploy the airbag module by sensing the frontal impact sensed by the sensor built in to the SRSCM.

1. DC/DC convertor : The DC/DC convertors of the power supply includes a step up and a step down converter, which provides the firing voltage for four firing circuits and the internal operating voltage. If the internal operatingvoltage falls below a defined threshold, a reset is executed.
2. Arming sensor/safing sensor : The arming/safing sensor built in to the airbag firing circuit has the function of arming the airbag circuit under all required deployment conditions and maintaining the airbag firing circuits unarmed under normal driving conditions. The safing sensor is a dual-contact electromechanical switch which closes if it experiences a deceleration exceedinga specified threshold
3. Back-up power : The SRSCM reserves an energy supply to provide deployment energy for a short second when the vehicle voltage is low or if lost in avehicle frontal crash.
4. Malfunction detection : The SRSCM continuously monitors the current SRS operation status while the ignition key is turned on and detects possible malfunction of the system. The malfunction can be displayed in the form of a diagnostic trouble code using Hi-Scan.
5. MIL (Malfunction Indication Lamp) notification : If any fault is detected, the SRSCM sends a signal to the indicator lamp on the cluster to warn thevehicle driver.The MIL indicator is the key item in notifying the driver of SRS faults. Verify lamp and SRSCM operation by flashing 6 times when the ignition switches first turned on.
6. Malfunction recording : Once a fault occurs in the system, the SRSCM records the fault in the memory in the form of DTC and the DTC can only beerased only by Hi-Scan.
7. Data link connector : Data stored in he SRSCM memory is read by Hi-Scan through the data link connector.
8. After firing the airbags once, the SRSCM cannot be used again and must be replaced.
9. Crash output : The crash output is used to control an external device which will unlock the doors in case of a crash event. The crash output is specified as follows : 0-200 μA in OFF mode and 200mA in ON mode. In case of the unlock commandthe switch is closed for 200 mS.

DTC Description

The frontal Crash recorded in the SRS Control module.

DTC Detecting Condition

DTC	Condition	Probable cause
B1650 B1657 B1658 B1670	• Crash recorded in the SRSCM	• SRSCM

Verification of vehicle repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scan tool, clear the DTCs.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

   YES

   ▸ Go to the applicable troubleshooting procedure.

   NO

   ▸ System is performing to specification at this time.

Inspection Procedure

1. Ignition "OFF", connect scantool.
2. Ignition "ON" & engine "OFF", select "Diagnistic Trouble Codes(DTCs)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTCs.
5. Is DTC present problem?

   YES

   ▸ The front crash is recorded. Replace SRS Control Module assy.(Except for B1657) Be able to reuse SRSCM 5 times, when B1657 is only monitored. And then goto next step.

   NO

   ▸ System is OK at this moment.

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1701

DTC Description

The Buckle Pretensioner circuit consists of the SRSCM and two Buckle Pretensioner (BUPT). The SRSCM sets above DTC(s) if it detects that the resistance of BUPT squib is too high or low.

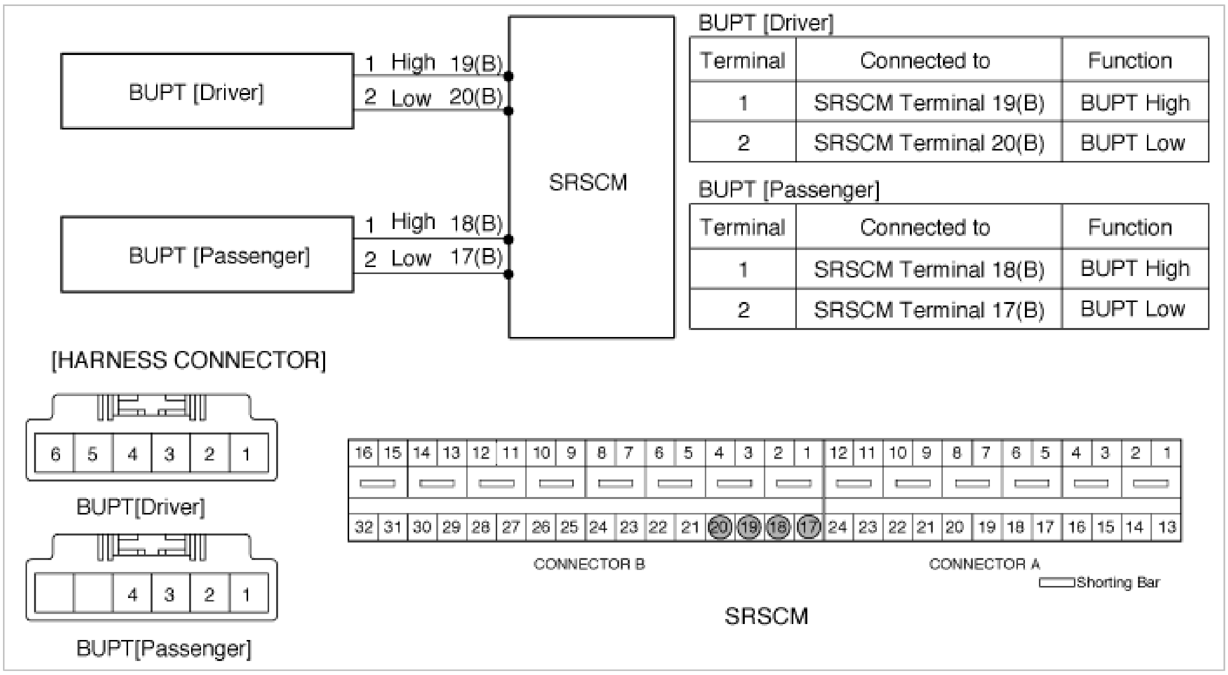
DTC Detecting Condition

DTC	Condition	Probable cause
B1701 B1702 B1706 B1707	• Too high or low resistance between BUPT high(+) and BUPT low (-) • Seat Buckle Pretensioner (BUPT) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Seat Buckle Pretensioner (BUPT) squib • SRSCM • Partially connected connector

Specification

BUPT resistance : $1.9 \le R \le 2.7\ \Omega$

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

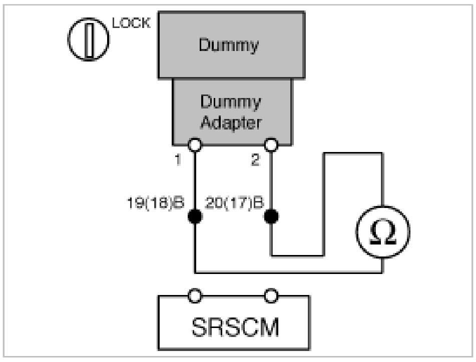
1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK BUPT RESISTANCE

> **CAUTION**
>
> Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

(1) Connect the Dummy and the Dummy Adapter on BUPT harness connector.
- Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

(2) Measure resistance between the terminal 19(18) and 20(17) of SRSCM harness connector(B).

BUPT resistance : $1.9 \le R \le 2.7\ \Omega$



Is the measured resistance within specification?

YES

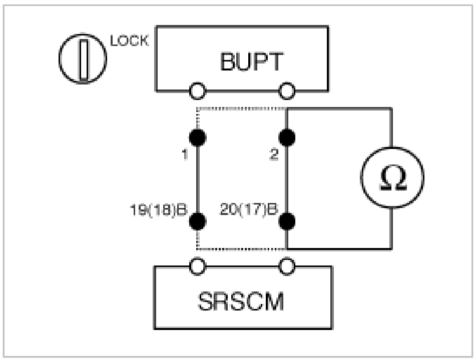
▸ Replace the Buckle Pretensioner(BUPT) module.

NO

▸ Check open circuit.

3. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 1 of BUPT harness connector and the terminal 19(18) of SRSCM harness connector(B).
   (2) Measure resistance between the terminal 2 of BUPT harness connector and the terminal 20(17) of SRSCM harness connector(B).

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

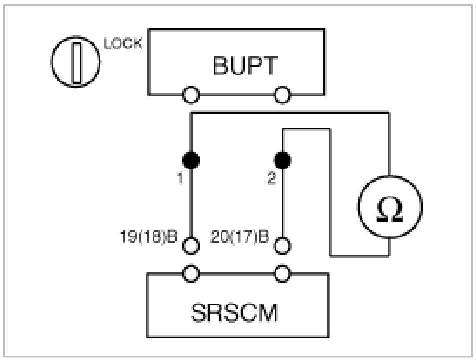
▸ Check short circuit.

NO

▸ Repair or replace the wiring harness between the BUPT and the SRSCM.

4. CHECK SHORT CIRCUIT
   (1) Measure resistance between the terminal 1 and 2 of BUPT harness connector.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair or replace the wiring harness between the BUPT and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON .
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehiclenormally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1702

DTC Description

The Buckle Pretensioner circuit consists of the SRSCM and two Buckle Pretensioner (BUPT). The SRSCM sets above DTC(s) if it detects that the resistance of BUPT squib is too high or low.

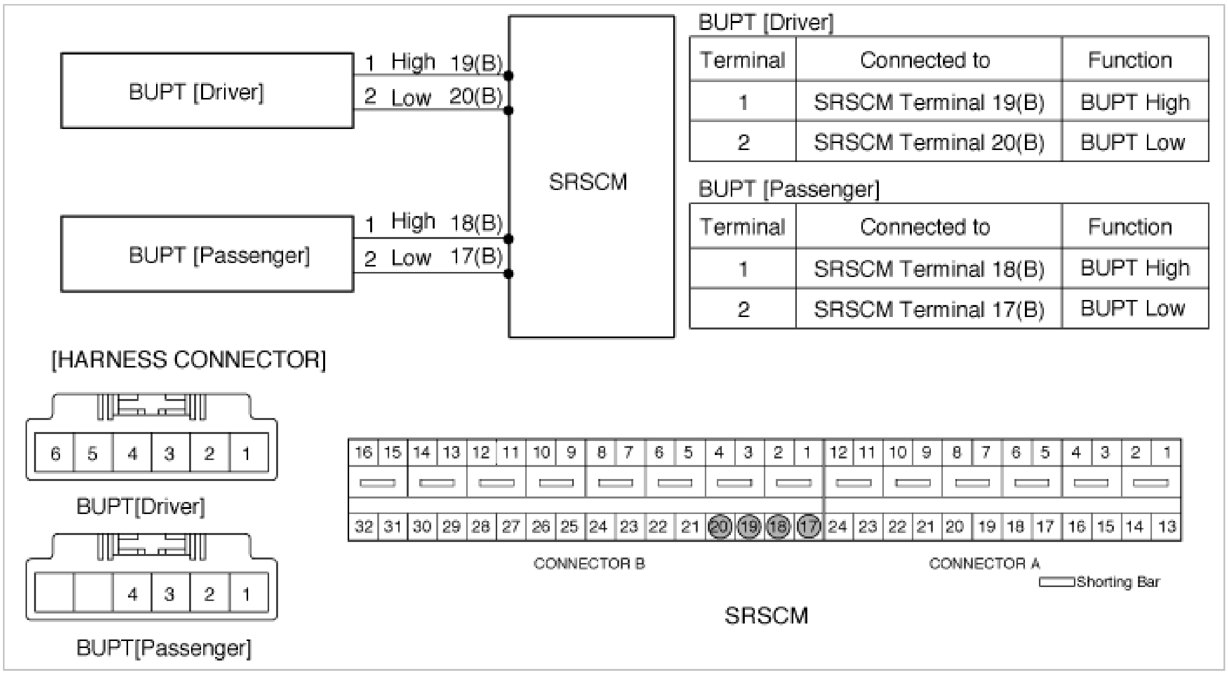
DTC Detecting Condition

DTC	Condition	Probable cause
B1701 B1702 B1706 B1707	• Too high or low resistance between BUPT high(+) and BUPT low (-) • Seat Buckle Pretensioner (BUPT) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Seat Buckle Pretensioner (BUPT) squib • SRSCM • Partially connected connector

Specification

BUPT resistance : 1.9 ≤ R ≤ 2.7 Ω

Schematic Diagram



BUPT [Driver]

Terminal	Connected to	Function
1	SRSCM Terminal 19(B)	BUPT High
2	SRSCM Terminal 20(B)	BUPT Low

BUPT [Passenger]

Terminal	Connected to	Function
1	SRSCM Terminal 18(B)	BUPT High
2	SRSCM Terminal 17(B)	BUPT Low

Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

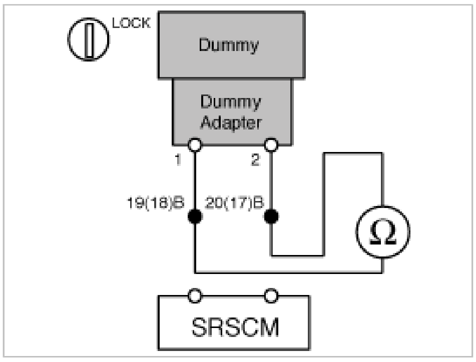
1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK BUPT RESISTANCE

> **CAUTION**
>
> Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

(1) Connect the Dummy and the Dummy Adapter on BUPT harness connector.
- Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

(2) Measure resistance between the terminal 19(18) and 20(17) of SRSCM harness connector(B).

BUPT resistance : $1.9 \le R \le 2.7\ \Omega$



Is the measured resistance within specification?

YES

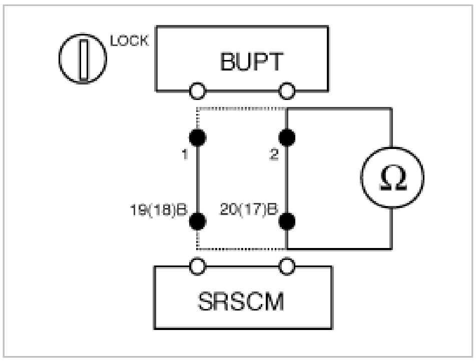
▸ Replace the Buckle Pretensioner(BUPT) module.

NO

▸ Check open circuit.

3. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 1 of BUPT harness connector and the terminal 19(18) of SRSCM harness connector(B).
   (2) Measure resistance between the terminal 2 of BUPT harness connector and the terminal 20(17) of SRSCM harness connector(B).

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

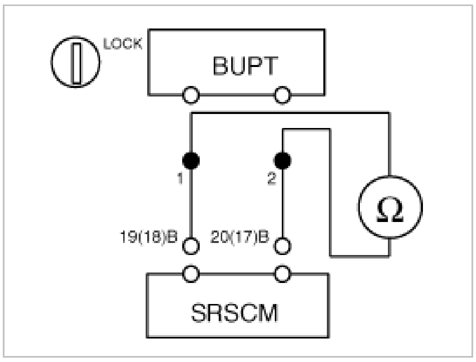
▸ Check short circuit.

NO

▸ Repair or replace the wiring harness between the BUPT and the SRSCM.

4. CHECK SHORT CIRCUIT
   (1) Measure resistance between the terminal 1 and 2 of BUPT harness connector.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair or replace the wiring harness between the BUPT and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON .
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehiclenormally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1703

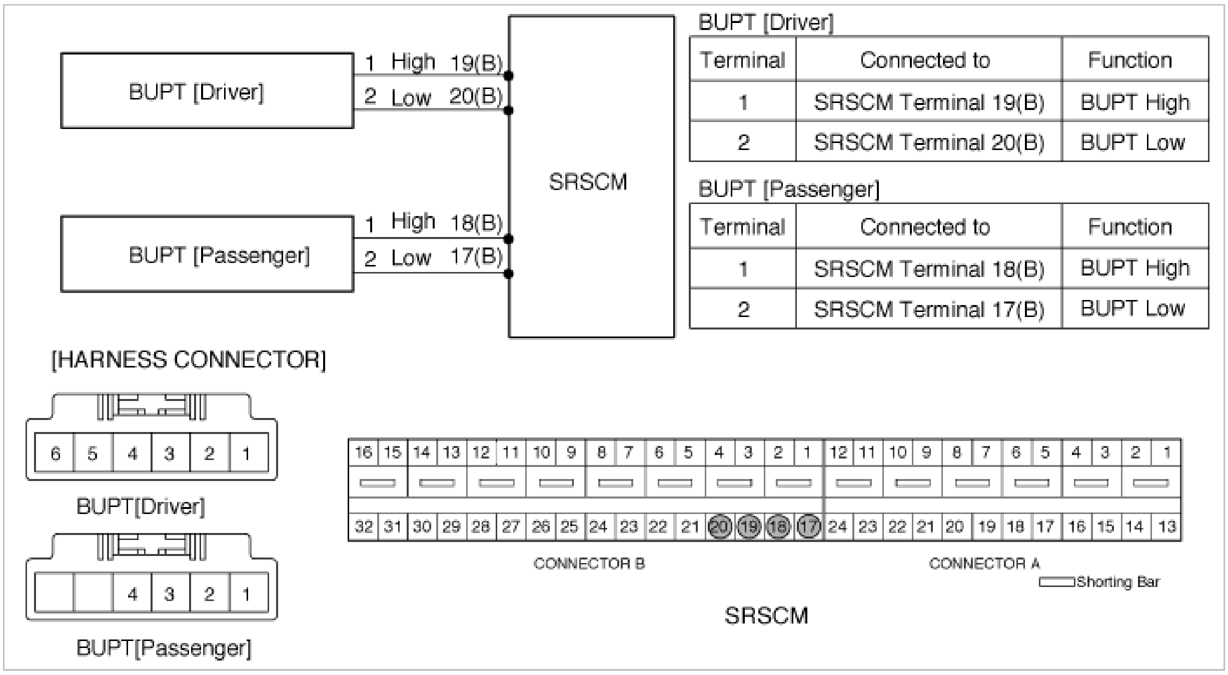
DTC Description

The Buckle Pretensioner circuit consists of the SRSCM and two Buckle Pretensioner (BUPT). The SRSCM sets above DTC(s) if it detects short to ground on the BUPT circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1703 B1708	• Short to ground between BUPT and SRSCM • Seat Buckle Pretensioner (BUPT) Malfunction • SRSCM Malfunction	• Short to ground circuit on wiring harness • Seat Buckle Pretensioner (BUPT) squib • SRSCM

Schematic Diagram



BUPT [Driver]

Terminal	Connected to	Function
1	SRSCM Terminal 19(B)	BUPT High
2	SRSCM Terminal 20(B)	BUPT Low

BUPT [Passenger]

Terminal	Connected to	Function
1	SRSCM Terminal 18(B)	BUPT High
2	SRSCM Terminal 17(B)	BUPT Low

Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

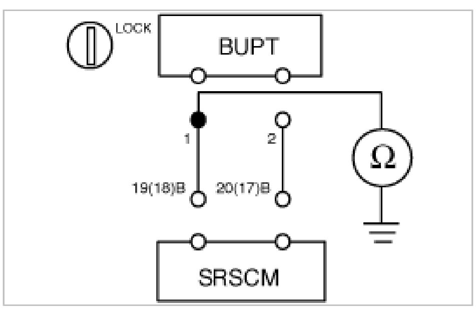
YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SHORT TO GROUND
   (1) Measure resistance between the terminal 1 of BUPT harness connector and chassis ground.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸ Check the BUPT Module.

NO

▸ Repair or replace the wiring harness between the BUPT and the SRSCM.

3. CHECK THE BUPT MODULE
   (1) Replace the Buckle Pretensioner(BUPT) with a new one.
   - Refer to "Buckle Pretensioner(BUPT)" section in this SERVICE MANUAL.

   (2) Install the DAB module and connect the DAB connector.

   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (4) Connect the SRSCM connector.

   (5) Connect the negative (-) terminal to the battery.

   (6) Connect a Hi-Scan(Pro) to the data link connector.

   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to Buckle Pretensioner(BUPT)?

   YES

   ▸ Go to next step.

   NO

   ▸ Replace BUPT module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.

   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (3) Connect the SRSCM connector.

   (4) Connect the negative (-) terminal to the battery.

   (5) Connect a Hi-Scan(Pro) to the data link connector.

   (6) Turn the ignition switch to ON .

   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

   (9) Turn the ignition switch to ON and wait for at least 30 seconds.

   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehiclenormally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1704

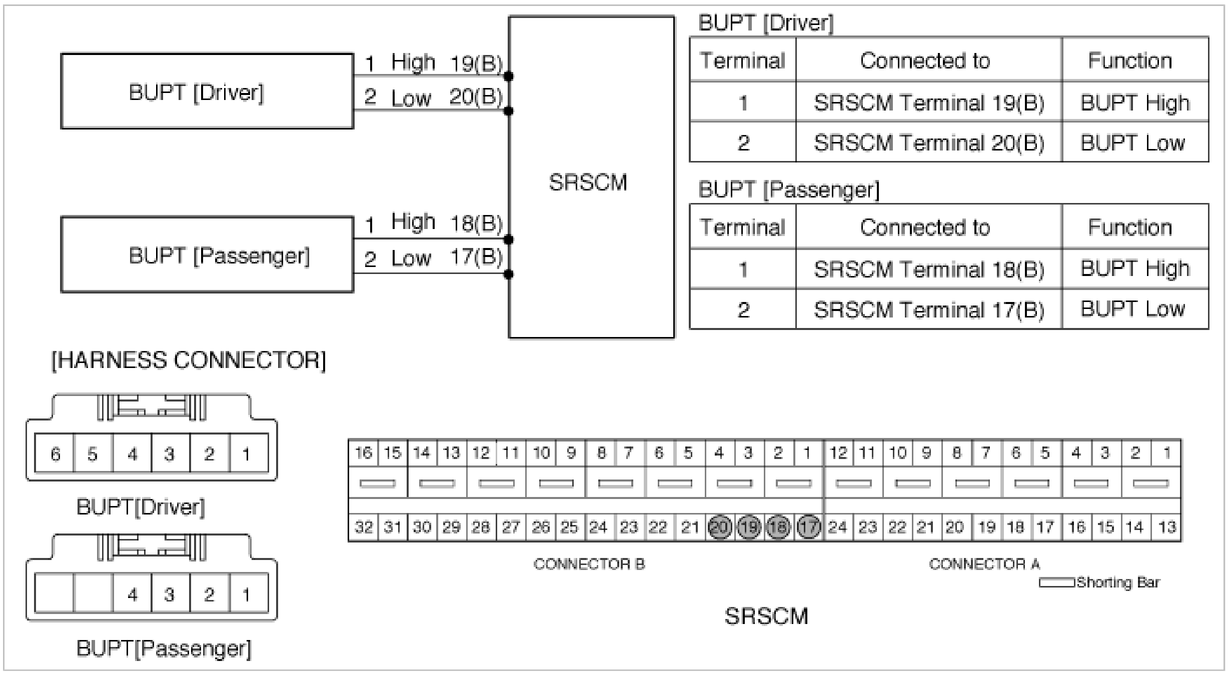
DTC Description

The Buckle Pretensioner circuit consists of the SRSCM and two Buckle Pretensioner (BUPT). The SRSCM sets above DTC(s) if it detects short to battery on the BUPT circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1704 B1709	• Short to battery between BUPT and SRSCM • Seat Buckle Pretensioner (BUPT) Malfunction • SRSCM Malfunction	• Short to battery line circuit on wiring harness • Buckle Pretensioner (BUPT) squib • SRSCM

Schematic Diagram



BUPT [Driver]

Terminal	Connected to	Function
1	SRSCM Terminal 19(B)	BUPT High
2	SRSCM Terminal 20(B)	BUPT Low

BUPT [Passenger]

Terminal	Connected to	Function
1	SRSCM Terminal 18(B)	BUPT High
2	SRSCM Terminal 17(B)	BUPT Low

Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

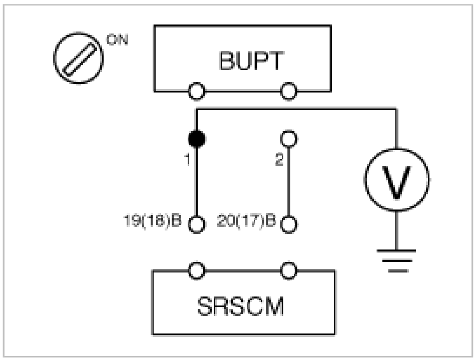
YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SHORT TO BATTERY LINE
   (1) Connect the negative (-) terminal to the battery.
   (2) Turn the ignition switch to ON.
   (3) Measure voltage between the terminal 1 of BUPT harness connector and chassis ground(-).

specification(voltage) : Approximately 0 V



Is the measured voltage within specification?

YES

▸ Check the BUPT Module.

NO

▸ Repair the short to battery line circuit on wiring harness between the BUPT and the SRSCM.

3. CHECK THE BUPT MODULE
   (1) Replace the Buckle Pretensioner(BUPT) with a new one.
   - Refer to "Buckle Pretensioner(BUPT)" section in this SERVICE MANUAL.

   (2) Install the DAB module and connect the DAB connector.

   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (4) Connect the SRSCM connector.

   (5) Connect the negative (-) terminal to the battery.

   (6) Connect a Hi-Scan(Pro) to the data link connector.

   (7) Connect a Hi-Scan(Pro) to the data link connector.
   Does Hi-Scan (Pro) indicate any DTC related to Buckle Pretensioner(BUPT)?

YES

▸ Go to next step.

NO

▸ Replace BUPT module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.

   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (3) Connect the SRSCM connector.

   (4) Connect the negative (-) terminal to the battery.

   (5) Connect a Hi-Scan(Pro) to the data link connector.

   (6) Turn the ignition switch to ON.

   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

   (9) Turn the ignition switch to ON and wait for at least 30 seconds.

   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸ Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehiclenormally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1706

DTC Description

The Buckle Pretensioner circuit consists of the SRSCM and two Buckle Pretensioner (BUPT). The SRSCM sets above DTC(s) if it detects that the resistance of BUPT squib is too high or low.

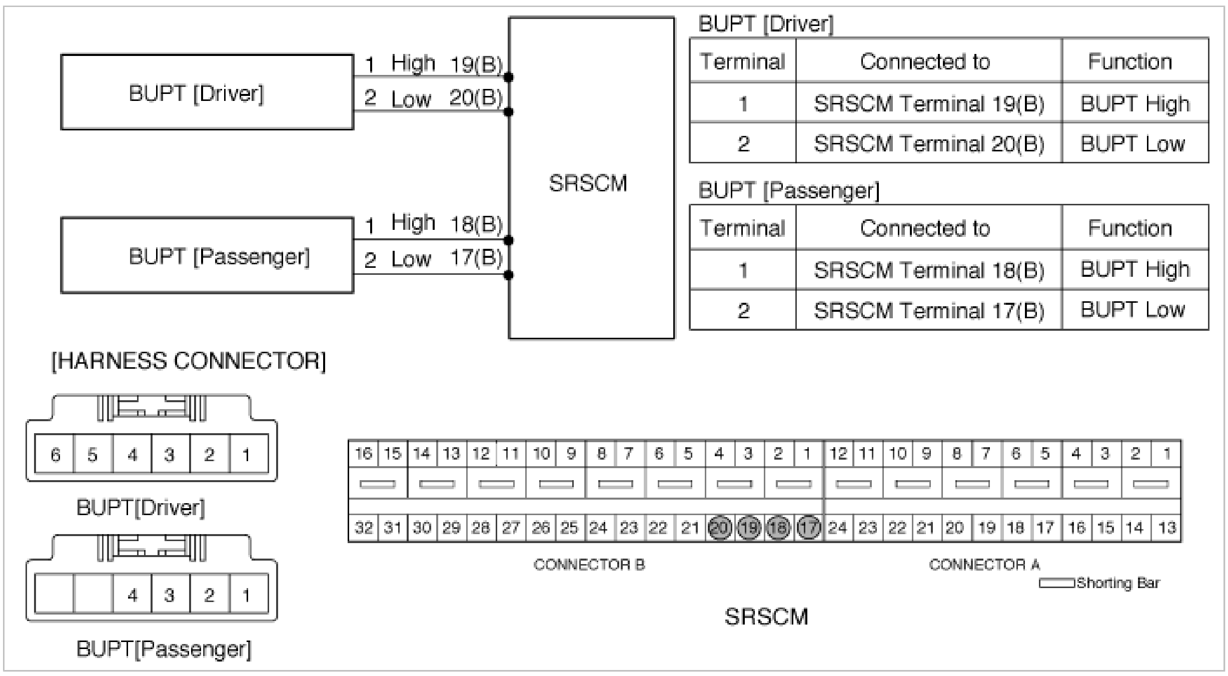
DTC Detecting Condition

DTC	Condition	Probable cause
B1701 B1702 B1706 B1707	• Too high or low resistance between BUPT high(+) and BUPT low (-) • Seat Buckle Pretensioner (BUPT) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Seat Buckle Pretensioner (BUPT) squib • SRSCM • Partially connected connector

Specification

BUPT resistance : 1.9 ≤ R ≤ 2.7 Ω

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.

(3) Remove the DAB module and disconnect the DAB connector.

(4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

2. CHECK BUPT RESISTANCE

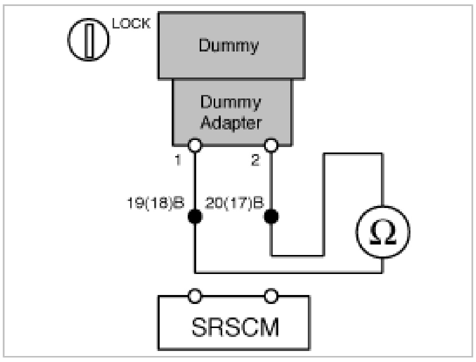
CAUTION

Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

(1) Connect the Dummy and the Dummy Adapter on BUPT harness connector.
- Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

(2) Measure resistance between the terminal 19(18) and 20(17) of SRSCM harness connector(B).

BUPT resistance : $1.9 \leq R \leq 2.7\ \Omega$



Is the measured resistance within specification?

YES

▸ Replace the Buckle Pretensioner(BUPT) module.

NO

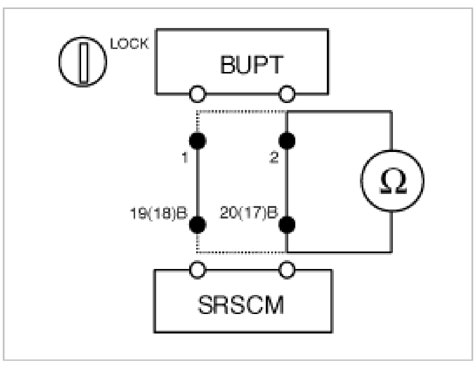
▸ Check open circuit.

3. CHECK OPEN CIRCUIT

(1) Measure resistance between the terminal 1 of BUPT harness connector and the terminal 19(18) of SRSCM harness connector(B).

(2) Measure resistance between the terminal 2 of BUPT harness connector and the terminal 20(17) of SRSCM harness connector(B).

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

▸ Check short circuit.

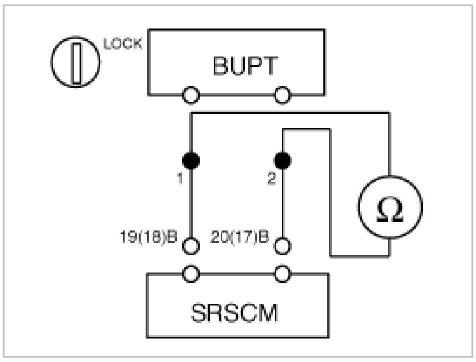
NO

▸ Repair or replace the wiring harness between the BUPT and the SRSCM.

4. CHECK SHORT CIRCUIT

(1) Measure resistance between the terminal 1 and 2 of BUPT harness connector.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair or replace the wiring harness between the BUPT and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON .
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehiclenormally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1707

DTC Description

The Buckle Pretensioner circuit consists of the SRSCM and two Buckle Pretensioner (BUPT). The SRSCM sets above DTC(s) if it detects that the resistance of BUPT squib is too high or low.

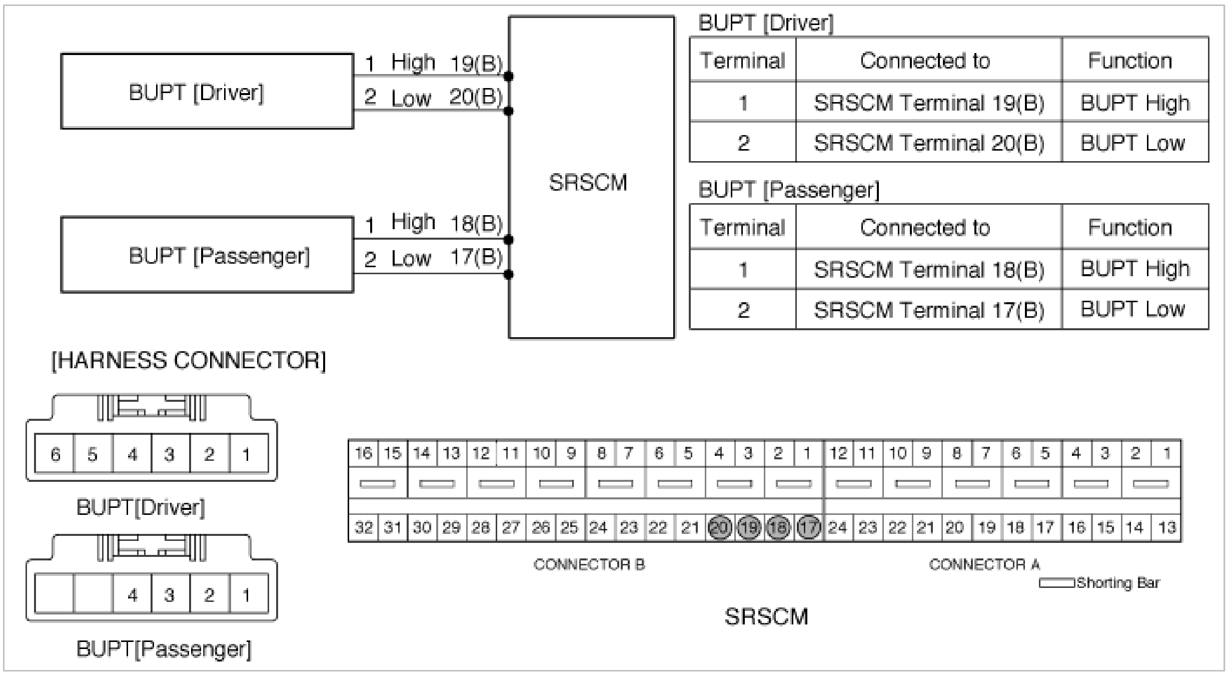
DTC Detecting Condition

DTC	Condition	Probable cause
B1701 B1702 B1706 B1707	• Too high or low resistance between BUPT high(+) and BUPT low (-) • Seat Buckle Pretensioner (BUPT) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Seat Buckle Pretensioner (BUPT) squib • SRSCM • Partially connected connector

Specification

BUPT resistance : 1.9 ≤ R ≤ 2.7 Ω

Schematic Diagram



BUPT [Driver]

Terminal	Connected to	Function
1	SRSCM Terminal 19(B)	BUPT High
2	SRSCM Terminal 20(B)	BUPT Low

BUPT [Passenger]

Terminal	Connected to	Function
1	SRSCM Terminal 18(B)	BUPT High
2	SRSCM Terminal 17(B)	BUPT Low

Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

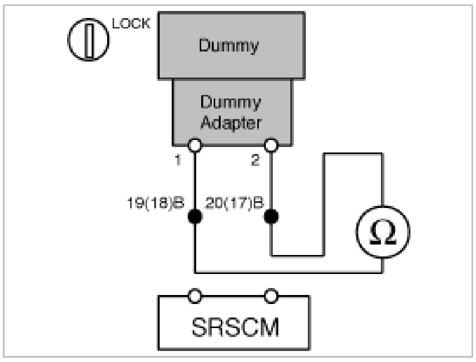
1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK BUPT RESISTANCE

> **CAUTION**
>
> Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

(1) Connect the Dummy and the Dummy Adapter on BUPT harness connector.
- Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

(2) Measure resistance between the terminal 19(18) and 20(17) of SRSCM harness connector(B).

BUPT resistance : 1.9 ≤ R ≤ 2.7 Ω



Is the measured resistance within specification?

YES

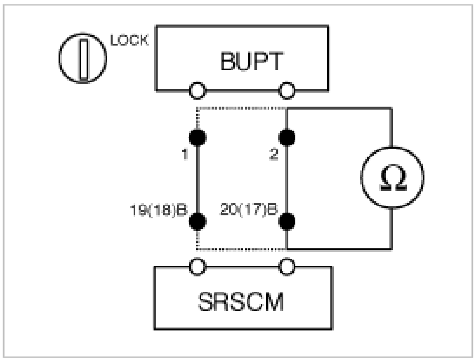
▸ Replace the Buckle Pretensioner(BUPT) module.

NO

▸ Check open circuit.

3. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 1 of BUPT harness connector and the terminal 19(18) of SRSCM harness connector(B).
   (2) Measure resistance between the terminal 2 of BUPT harness connector and the terminal 20(17) of SRSCM harness connector(B).

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

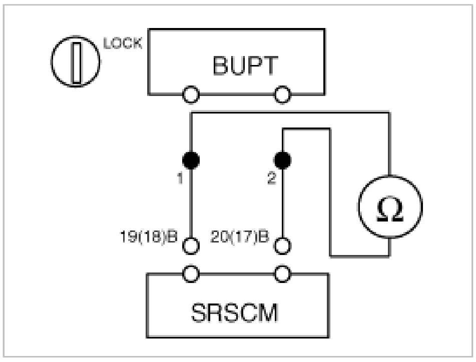
▸ Check short circuit.

NO

▸ Repair or replace the wiring harness between the BUPT and the SRSCM.

4. CHECK SHORT CIRCUIT
   (1) Measure resistance between the terminal 1 and 2 of BUPT harness connector.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair or replace the wiring harness between the BUPT and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON .
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehiclenormally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1708

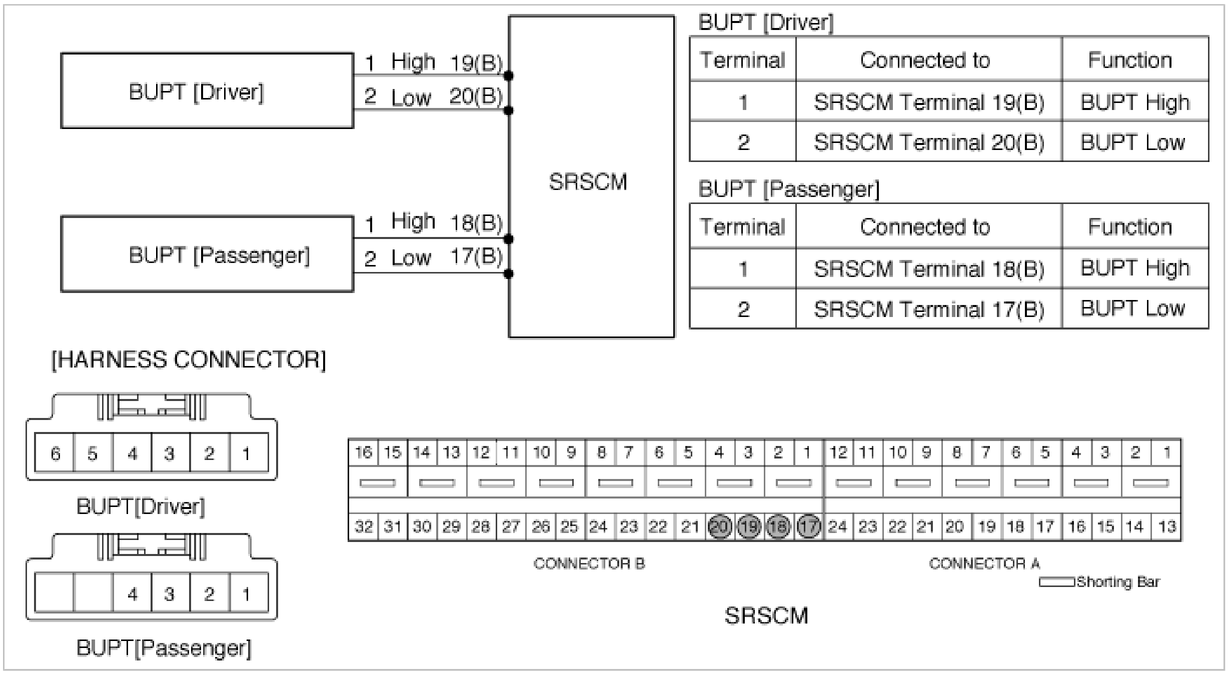
DTC Description

The Buckle Pretensioner circuit consists of the SRSCM and two Buckle Pretensioner (BUPT). The SRSCM sets above DTC(s) if it detects short to ground on the BUPT circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1703 B1708	• Short to ground between BUPT and SRSCM • Seat Buckle Pretensioner (BUPT) Malfunction • SRSCM Malfunction	• Short to ground circuit on wiring harness • Seat Buckle Pretensioner (BUPT) squib • SRSCM

Schematic Diagram



BUPT [Driver]

Terminal	Connected to	Function
1	SRSCM Terminal 19(B)	BUPT High
2	SRSCM Terminal 20(B)	BUPT Low

BUPT [Passenger]

Terminal	Connected to	Function
1	SRSCM Terminal 18(B)	BUPT High
2	SRSCM Terminal 17(B)	BUPT Low

Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

CAUTION

Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

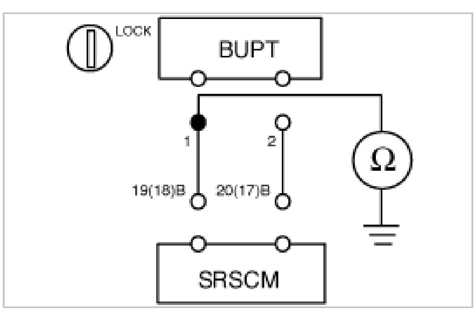
YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SHORT TO GROUND
   (1) Measure resistance between the terminal 1 of BUPT harness connector and chassis ground.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸ Check the BUPT Module.

NO

▸ Repair or replace the wiring harness between the BUPT and the SRSCM.

3. CHECK THE BUPT MODULE
   (1) Replace the Buckle Pretensioner(BUPT) with a new one.
   - Refer to "Buckle Pretensioner(BUPT)" section in this SERVICE MANUAL.

   (2) Install the DAB module and connect the DAB connector.

   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (4) Connect the SRSCM connector.

   (5) Connect the negative (-) terminal to the battery.

   (6) Connect a Hi-Scan(Pro) to the data link connector.

   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to Buckle Pretensioner(BUPT)?

   YES

   ▸ Go to next step.

   NO

   ▸ Replace BUPT module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.

   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (3) Connect the SRSCM connector.

   (4) Connect the negative (-) terminal to the battery.

   (5) Connect a Hi-Scan(Pro) to the data link connector.

   (6) Turn the ignition switch to ON .

   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

   (9) Turn the ignition switch to ON and wait for at least 30 seconds.

   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehiclenormally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1709

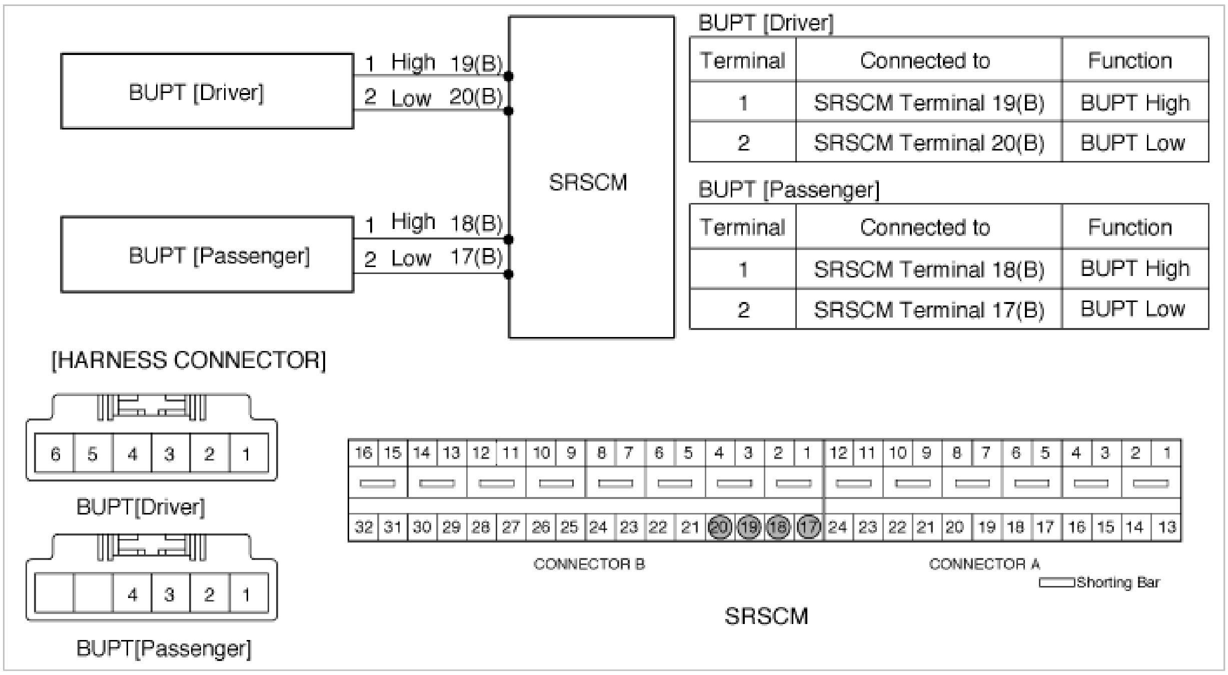
DTC Description

The Buckle Pretensioner circuit consists of the SRSCM and two Buckle Pretensioner (BUPT). The SRSCM sets above DTC(s) if it detects short to battery on the BUPT circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1704 B1709	• Short to battery between BUPT and SRSCM • Seat Buckle Pretensioner (BUPT) Malfunction • SRSCM Malfunction	• Short to battery line circuit on wiring harness • Buckle Pretensioner (BUPT) squib • SRSCM

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

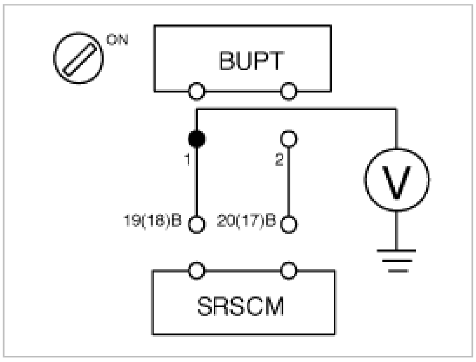
YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SHORT TO BATTERY LINE
   (1) Connect the negative (-) terminal to the battery.
   (2) Turn the ignition switch to ON.
   (3) Measure voltage between the terminal 1 of BUPT harness connector and chassis ground(-).

specification(voltage) : Approximately 0 V



Is the measured voltage within specification?

YES

▸ Check the BUPT Module.

NO

▸ Repair the short to battery line circuit on wiring harness between the BUPT and the SRSCM.

3. CHECK THE BUPT MODULE
   (1) Replace the Buckle Pretensioner(BUPT) with a new one.
       ● Refer to "Buckle Pretensioner(BUPT)" section in this SERVICE MANUAL.
   (2) Install the DAB module and connect the DAB connector.
   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (4) Connect the SRSCM connector.
   (5) Connect the negative (-) terminal to the battery.
   (6) Connect a Hi-Scan(Pro) to the data link connector.
   (7) Connect a Hi-Scan(Pro) to the data link connector.
   Does Hi-Scan (Pro) indicate any DTC related to Buckle Pretensioner(BUPT)?

   YES

   ▸ Go to next step.

   NO

   ▸ Replace BUPT module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON.
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸ Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehiclenormally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B2500

DTC Description

The SRS warning lamp is located in the cluster. When the airbag system is normal, the SRS SRI flashes for approx. 6 seconds after the ignition switch is turned " ON ", and then turns off automatically.If there is a malfunction in the airbag system, the SRS

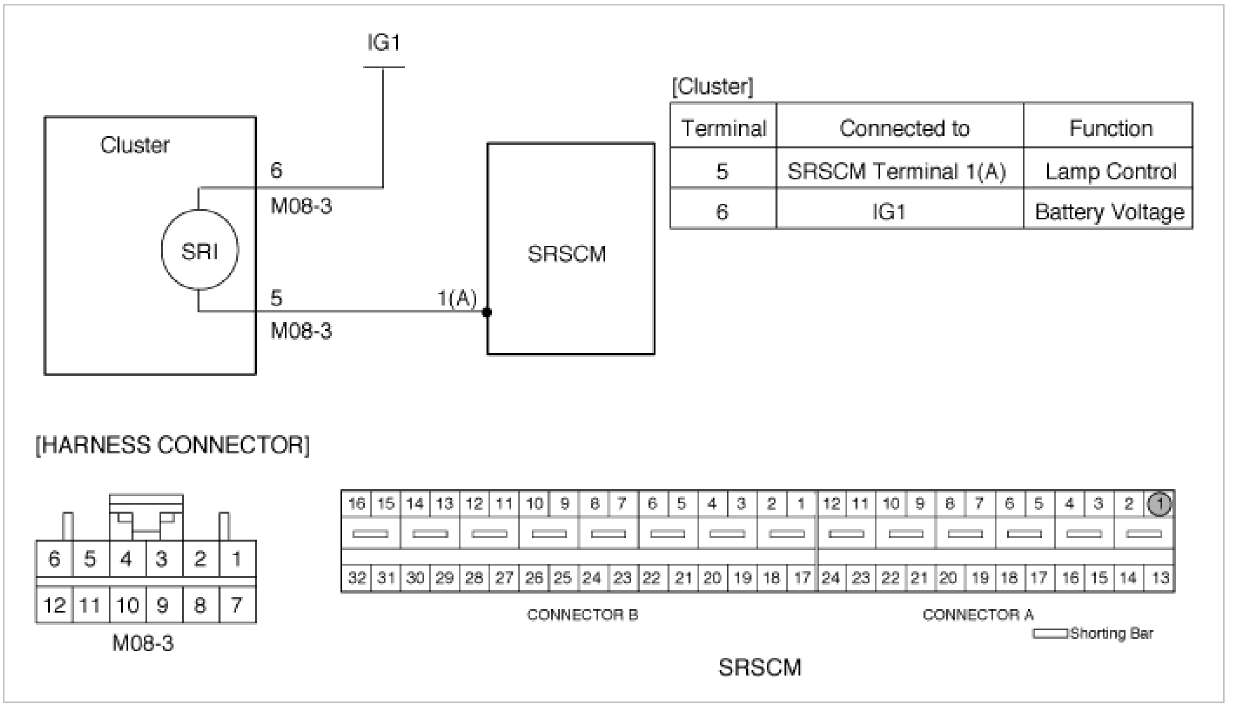
SRI lights up to inform the driver of the abnormality.The SRSCM shall measure the voltage at the SRS SRI output pin, both when the lamp is on and when the lamp is off, to detect whether the commanded state matches the actual state.

> **NOTE**
>
> The SRI will be continuously illuminated if the SRSCM is loose or disconnects.

DTC Detecting Condition

DTC	Condition	Probable cause
B2500	• Airbag fuse • Warning Lamp Bulb • Open between warning lamp and SRSCM • Short to ground or battery line between the warning lamp and SRSCM • SRSCM Malfunction	• Fuse • Warning lamp bulb • Wiring Harness • SRSCM

Schematic Diagram



Terminal	Connected to	Function
5	SRSCM Terminal 1(A)	Lamp Control
6	IG1	Battery Voltage

Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.

(3) Remove the DAB module and disconnect the DAB connector.

(4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

2. CHECK THE FUSE

(1) Remove the airbag fuse and the airbag warning lamp fuse from junction block.

(2) Inspect the fuses.

Are the fuses normal?

YES

▸ Check the warning lamp bulb.

NO

▸ Repair or replace the fuses.

3. CHECK THE WARNING LAMP BULB

(1) Remove the bulb from the instrument cluster.

(2) Inspect the bulb.

Is the bulb normal?

YES

▸Check source voltage.

NO

▸ Repair or replace the bulb.

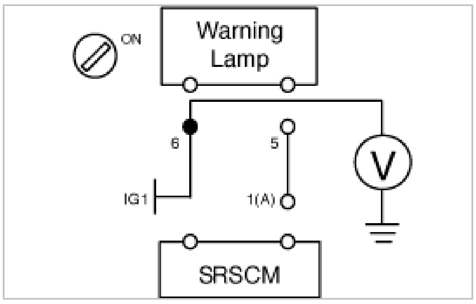
4. CHECK SOURCE VOLTAGE

(1) Connect the negative (-) terminal to the battery.

(2) Turn the ignition switch to ON.

(3) Measure voltage between the terminal 6 of the instrument Cluster harness connector and chassis ground(-).

specification(voltage) : 9 ~ 16 V



Is the measured voltage within specification?

YES

▸Check short to battery line.

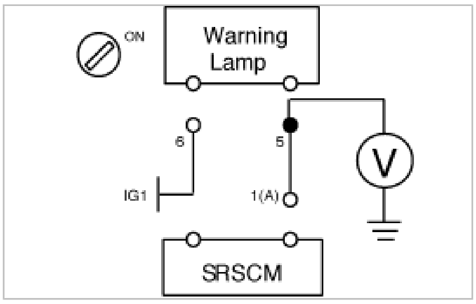
NO

▸Repair or replace the wiring harness between ignition switch and the Warning Lamp.

5. CHECK SHORT TO BATTERY LINE

(1) Measure voltage between the terminal 5 of the instrument Cluster harness connector and chassis ground(-).

specification(voltage) : Approximately 0 V



Is the measured voltage within specification?

YES

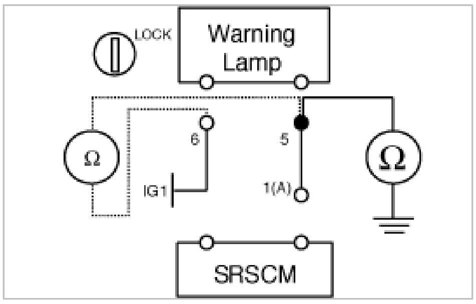
▸ Check short or short to ground.

NO

▸ Repair the short to battery line circuit on wiring harness between the SRSCM and the Warning Lamp.

6. CHECK SHORT OR SHORT TO GROUND
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative(-) terminal from the battery.
   (3) Measure resistance between the terminal 5 of the instrument cluster harness connector and chassis ground.
   (4) Measure resistance between the terminal 5 and 6 of the Instrument Cluster harness connector.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

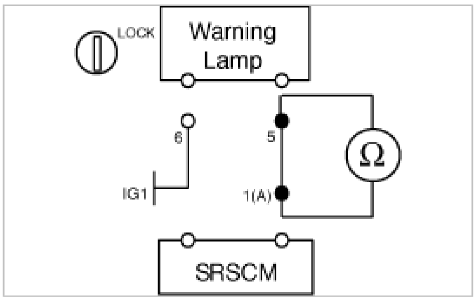
▸Check open circuit.

NO

▸ Repair the short or short to ground circuit on wiring harness between the SRSCM and the Warning Lamp.

7. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 5 of the Instrument Cluster connector and the terminal 1 of SRSCM harness connector(A).

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair the open circuit on wiring harness between the SRSCM and the Warning Lamp.

8. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON.
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▶ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▶Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B2502

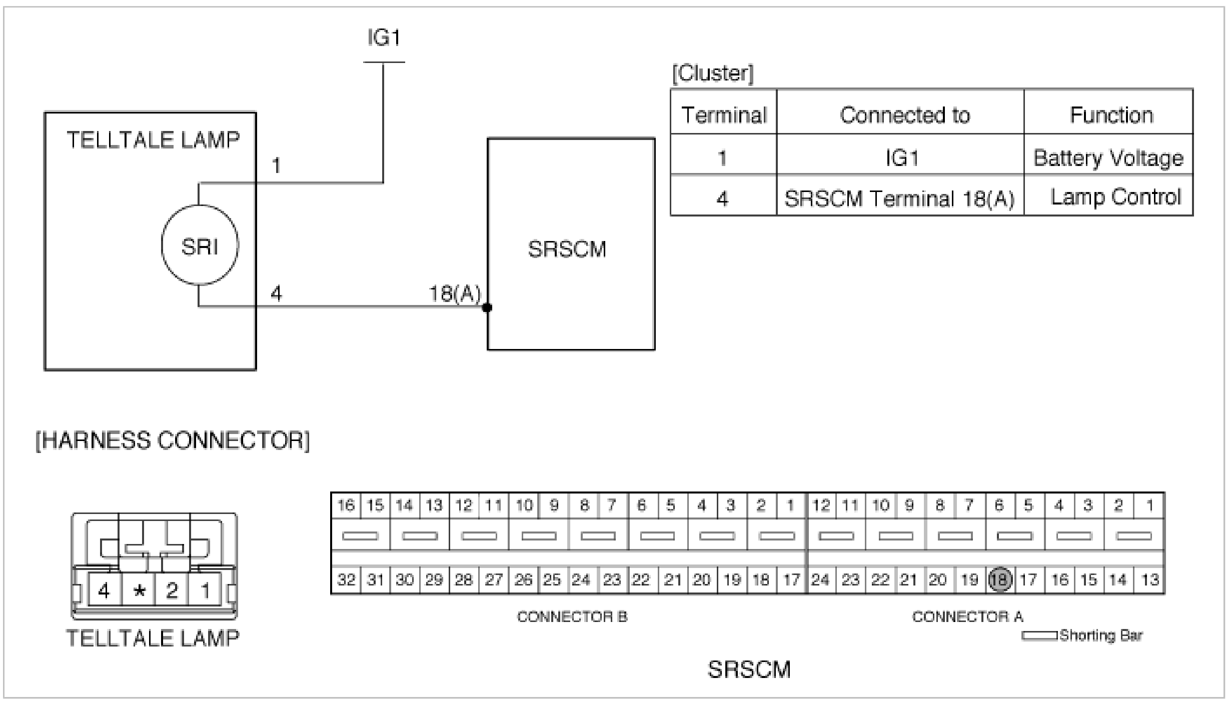
DTC Description

The Telltale Lamp circuit consisits of the Telltale Lamp and the SRSCM. SRSCM set the above DTC that the Telltale Lamp failure is detected.

DTC Detecting Condition

DTC	Condition	Probable cause
B2502	• Airbag fuse • Telltale Lamp Bulb • Open between Telltale Lamp and SRSCM • Short to ground or battery line between the Telltale Lamp and SRSCM • SRSCM Malfunction	• Fuse • Telltale Lamp Bulb • Wiring Harness • SRSCM

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

CAUTION

Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK THE FUSE
   (1) Remove the airbag fuse and the airbag telltale lamp fuse from junction block.
   (2) Inspect the fuses. Are the fuses normal?

   YES

   ▸ Check the telltale lamp bulb.

   NO

   ▸ Repair or replace the fuses.

3. CHECK THE TELLTALE LAMP BULB
   (1) Remove the bulb from the instrument cluster.
   (2) Inspect the bulb. Is the bulb normal?

   YES

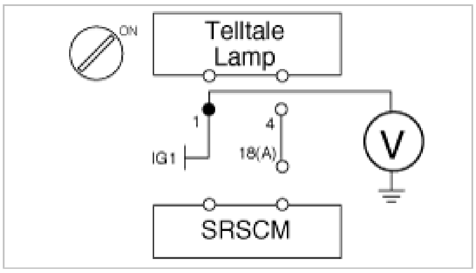
   ▸Check source voltage.

   NO

   ▸ Repair or replace the bulb.

4. CHECK SOURCE VOLTAGE
   (1) Connect the negative (-) terminal to the battery.
   (2) Turn the ignition switch to ON.
   (3) Measure voltage between the terminal 1 of the Telltale Lamp harness connector and chassis ground(-).

   specification(voltage) : 9 ~ 16 V

   (4) Is the measured voltage within specification?

   YES

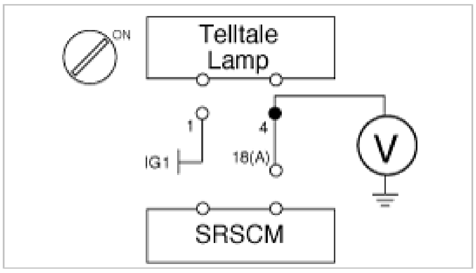
   ▸Check short to battery line.

   NO

   ▸Repair or replace the wiring harness between ignition switch and the Telltale Lamp.

5. CHECK SHORT TO BATTERY LINE
   (1) Measure voltage between the terminal 4 of the Telltale Lamp harness connector and chassis ground(-).

   specification(voltage) : Approximately 0 V



(2) Is the measured voltage within specification?

YES

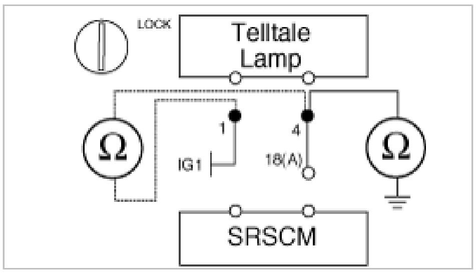
▸ Check short or short to ground.

NO

▸ Repair the short to battery line circuit on wiring harness between the SRSCM and the Telltale Lamp.

6. CHECK SHORT OR SHORT TO GROUND
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative(-) terminal from the battery.
   (3) Measure resistance between the terminal 4 of the Telltale Lamp harness connector and chassis ground.
   (4) Measure resistance between the terminal 1 and 4 of the Telltale Lamp harness connector.

specification(resistance) : infinite



(5) Is the measured resistance within specification?

YES

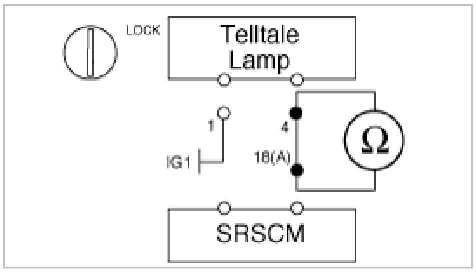
▸Check open circuit.

NO

▸ Repair the short or short to ground circuit on wiring harness between the SRSCM and the Telltale Lamp.

7. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 4 of the Telltale Lamp harness connector and the terminal 18(A) of SRSCM harness connector.

specification(resistance) : below 1 Ω



(2) Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair the open circuit on wiring harness between the SRSCM and the Telltale Lamp.

8. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON.

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Airbag Module > Description and Operation

AIRBAG DISPOSAL

Special Tool Required

Before scrapping any airbags or side airbags (including those in a whole vehicle to be scrapped), the airbags or side airbags must be deployed. If the vehicle is still within the warranty period, before deploying the airbags or side airbags, the Technical Manager must give approval and/or special instruction. Only after the airbags or side airbags have been deployed (as the result of vehicle collision, for example), can they be scrapped.

If the airbags or side airbags appear intact (not deployed), treat them with extreme caution. Follow this procedure.

Deploying Airbags In the vehicle

If a SRS equipped vehicle is to be entirely scrapped, its airbags or side airbags should be deployed while still in the vehicle. The airbags or side airbags should not be considered as salvageable parts and should never be installed in another vehicle.

1. Turn the ignition switch OFF, and disconnect the battery negative cable and wait at least three minutes.
2. Confirm that each airbag or side airbag are securely mounted.
3. Confirm that the special tool is functioning properly by following the check procedure.
   Driver's Airbag :
4. Remove the driver's airbag , then disconnect #1,#2 driver's airbag connector.
   Then install the SST(0957A-38510).
   Passenger's Airbag :
5. Remove the passenger's airbag, then disconnect passenger's airbag connector.
   Then install the SST(0957A-38510).
   Side Airbag :
6. Remove the side airbag, then disconnect side airbag connector.
   Then install the SST(0957A-3F100).
   Curtain Airbag :
7. Remove the curtain airbag, then disconnect curtain airbag connector.
   Then instal the SST(0957A-38500).
   Belt pretensioner :
8. Remove the belt pretensioner, then disconnect belt pretensioner connector.
   Then instal the SST(0957A-38500).
   Buckle pretensioner :
9. Remove the buckle pretensioner, then disconnect buckle pretensioner connector.
   Then install the SST(0957A-2E210).
10. Place the deployment tool at least thirty feet (10 meters) away from the airbag.
11. Connect a 12 volt battery to the tool.
12. Push the tool's deployment switch. The airbag should deploy. Repeat for 2nd circuit if deploying DAB or PAB. (deployment is both highly audible and visible: a loud noise and rapid inflation of the bag, followed by slow deflection)
13. Dispose of the complete airbag. No part of it can be reused. Place it in a sturdy plastic bag and seal it securely.

Deploying the Airbag Out of the vehicle

If an intact airbag has been removed from a scrapped vehicle, or has been found defective or damage during transit, storage or service, it should be deployed as follows :

1. Confirm that the special tool is functioning properly by following the check procedure on this page.
2. Position the airbag face up, outdoors on flat ground at least thirty feet (10meters) from any obstacles or people.

Disposal of Damaged Airbag

1. If installed in a vehicle, follow the removal procedure of driver's airbag, front passenger's and side airbag.
2. In all cases, make a short circuit by twisting together the two airbag inflator wires.
3. Package the airbag in exactly the same packing that the new replacement part come in.

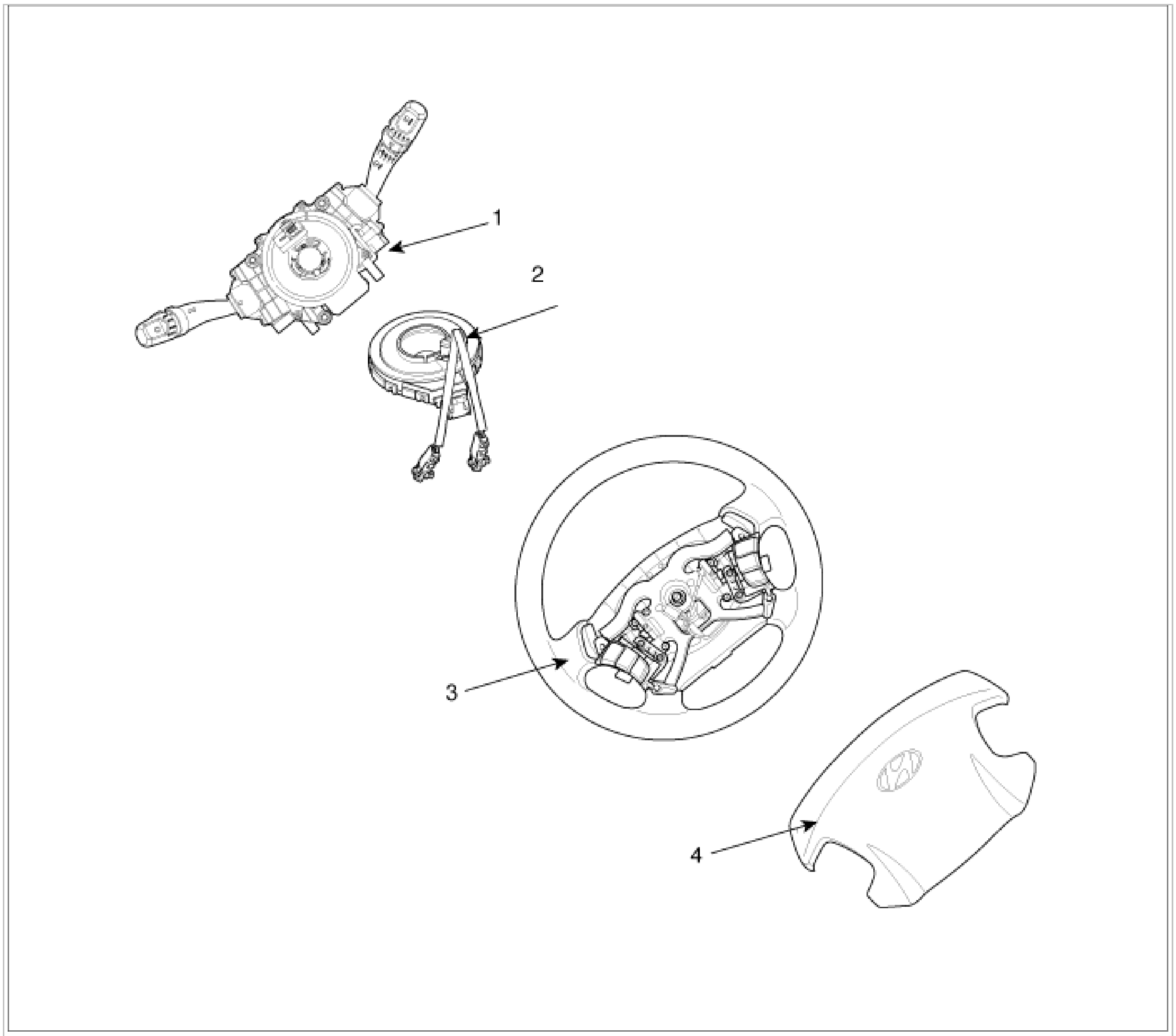
Restraint > Airbag Module > Driver Airbag (DAB) Module and Clock Spring > Description and Operation

DESCRIPTION

Driver Airbag (DAB) is installed in steering wheel and electrically connected to SRSCM via clockspring. It protects the driver from danger by deploying a bag when frontal crash occurs. The SRSCM determines deployment of Driver Airbag (DAB) by using the Front Impact Sensor (FIS) signal. The driver airbag is a two stage device. If the crash algorithm determines that only the first stage is to be activated, the second stage will be automatically disposed of after a programmable time has elapsed since the first stage deployment. The ACU shall be capable to deploy all firing loops for at least 150ms after IGN has been disconnected.

Restraint > Airbag Module > Driver Airbag (DAB) Module and Clock Spring > Components and Components Location

components



1. Multi-Function Switch
2. Clock Spring
3. Steering Wheel
4. Driver Airbag (DAB)

Restraint > Airbag Module > Driver Airbag (DAB) Module and Clock Spring > Repair procedures

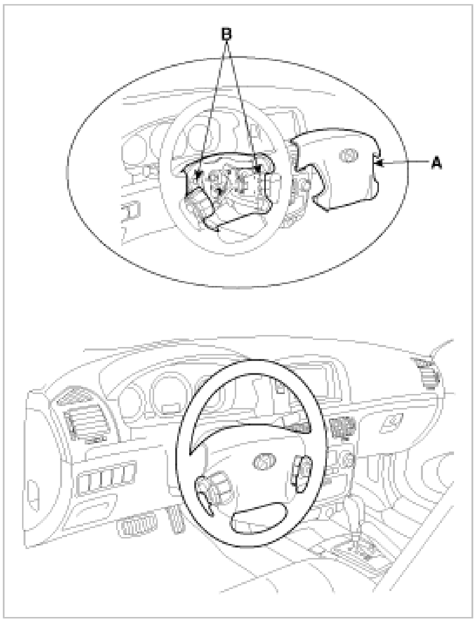
REMOVAL

DAB REMOVAL

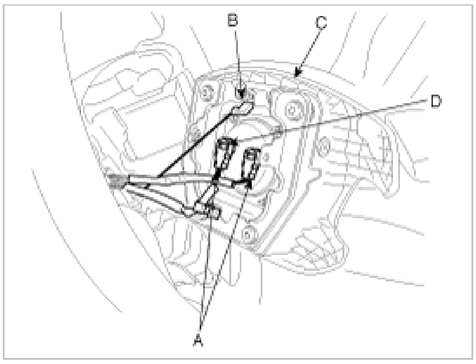
1. Disconnect the battery negative cable and wait at least three minutes before beginning work.
2. After removing the cover (A), loosen the two Torx bolt (B).

NOTE

- Use the magnetic tool, because the bolts(B) are not seperated completely.



3. Disconnect the connectors(A) after lifting up the pin(D) and the horn connector(B). Remove the driver's airbag(C) from the steering wheel.

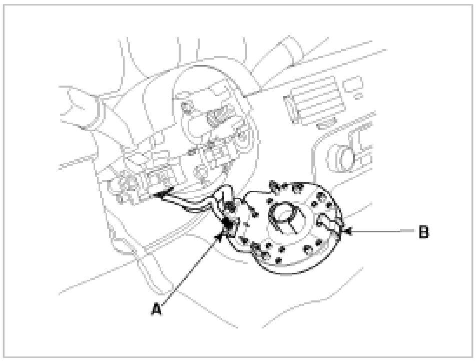


CAUTION

The removed airbag module should be stored in a clean and dry place with the pad cover face up.

CLOCK SPRING REMOVAL

1. Disconnect the negative battery cable, and wait at least 3 minutes before beginning work.
2. Remove the DAB.
3. Remove the steering wheel (Refer to ST- Steering wheel group).
4. Remove the steering column shroud.(Refer to ST-steering column and shaft)
5. Remove clock spring connector(A), then remove clock spring(B).



6. Verify front wheelS are pointed straight ahead.
7. Turn clockspring clockwise until it stopS. (softly, do not force)
   Turn it counter clockwise 3 truns until front wheel is pointed forward.
8. Install on to steering column.

9. Installation is the reverse of removal.

NOTE

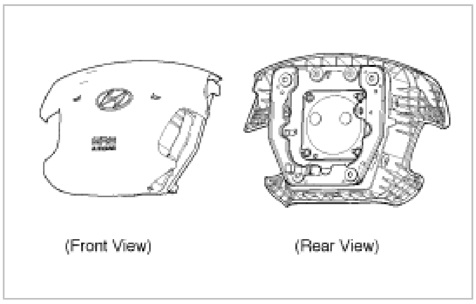
After installing the clock spring, confirm proper system operation; Turn the ignition switch ON: the SRS indicator light should turn on for about 6 seconds and then go off.

INSPECTION

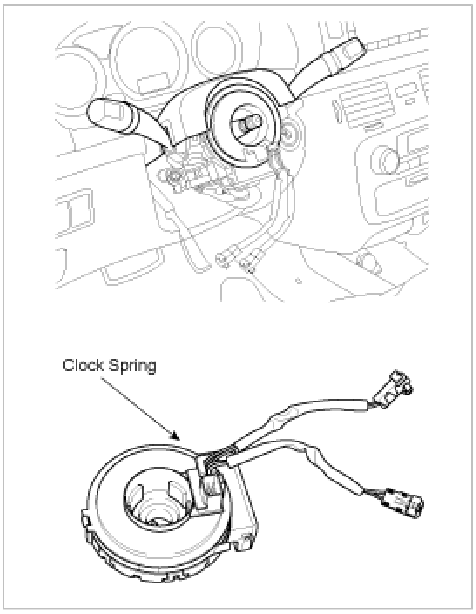
CAUTION

Never attempt to measure the circuit resistance of the airbag module (squib) even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental airbag deployment will result in serious personal injury.

1. Check pad cover for dents, cracks or deformities.
2. Check the airbag module for denting, cracking or deformation.
3. Check hooks and connectors for damage, terminals for deformities, and harness for binds.
4. Check airbag inflator case for dents, cracks or deformities.



5. Install the airbag module to the steering wheel to check for fit or alignment of the wheel.
   A. If, as a result of the following checks, even one abnormal point is discovered, replace the clock spring with a new one.
   B. Check connectors and protective tube for damage, and terminals for deformities.



Restraint > Airbag Module > Passenger Airbag (PAB) Module > Description and Operation

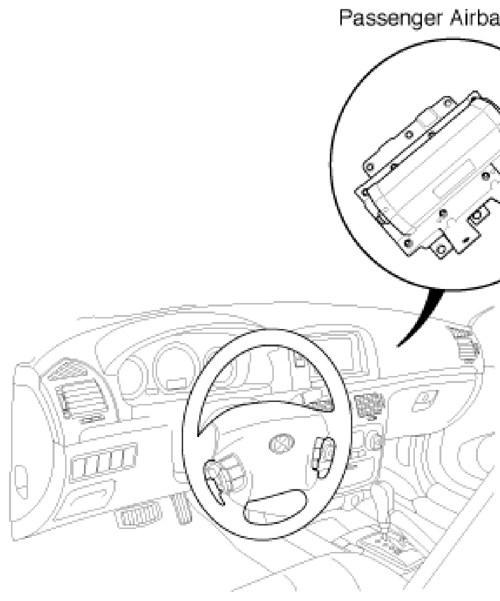
DESCRIPTION

The passenger Airbag (PAB) is installed inside the dash and protects the front passenger in the event of a frontal crash. The SRSCM determines if and when to deploy the PAB from the front impact sensor (FIS) signal. The PAB is a two-stage device; if the SRSCM determines that only the first stage should activate, the second stage will dispose after first-stage deployment. In case of loss of vehicle power, the driver firing loops have a 150 ms battery backup.

Restraint > Airbag Module > Passenger Airbag (PAB) Module > Components and Components

Location

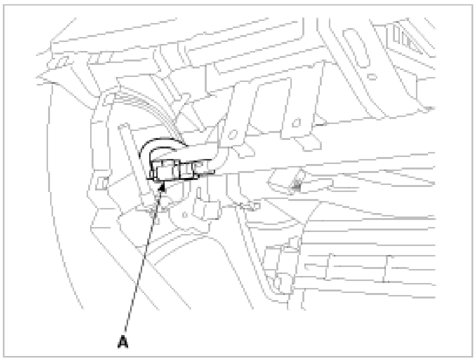
components



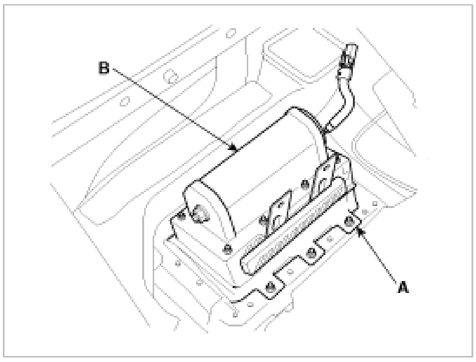
Restraint > Airbag Module > Passenger Airbag (PAB) Module > Repair procedures

REMOVAL

1. Disconnect the battery negative cable and wait at least three minutes before beginning work.
2. Remove the glove box (Refer to group - glove box) , then disconnect the connector(A).



3. Remove the crash pad. (Refer to BD group - crash pad)
4. Remove the mounting nuts (A) from the crash pad. Then remove the passenger's airbag (B).



5. Installation is the reverse of removal.

NOTE

After installing the clock spring, confirm proper system operation; Turn the ignition switch ON: the SRS indicator light should turn on for about 6 seconds and then go off.

Restraint > Airbag Module > Side Airbag (SAB) Module > Description and Operation

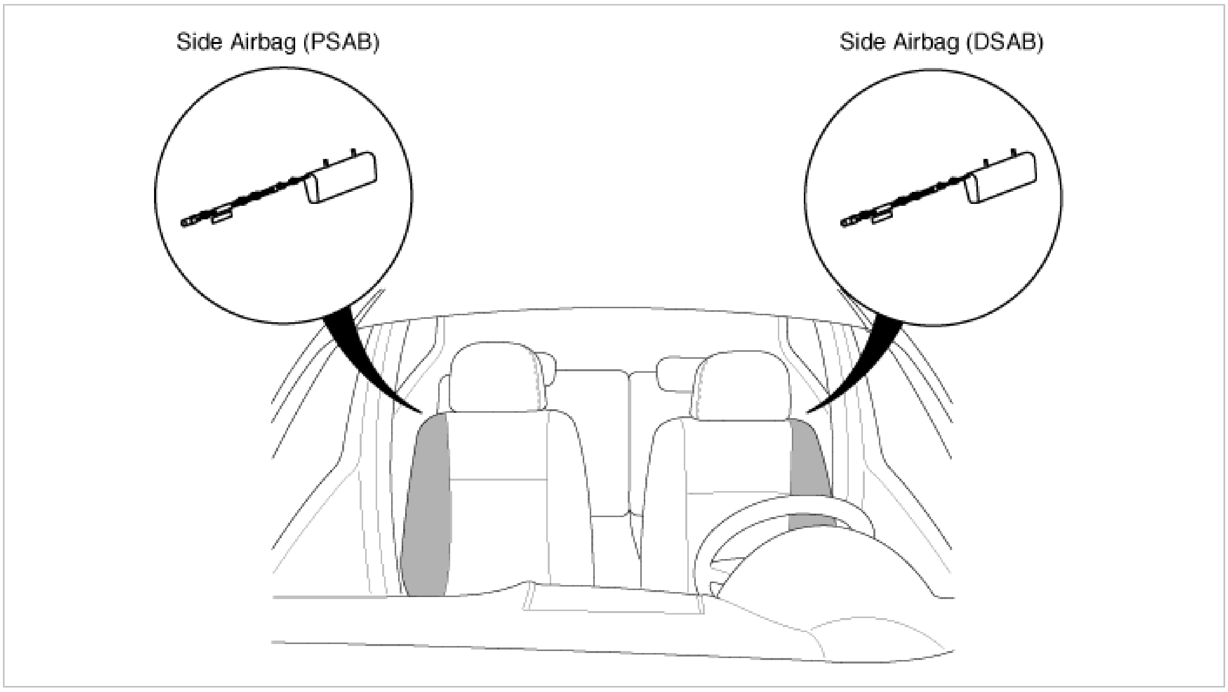
DESCRIPTION

CAUTION

Never attempt to measure the circuit resistance of the airbag module (squib) even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental airbag deployment may result in serious personal injury.

Restraint > Airbag Module > Side Airbag (SAB) Module > Components and Components Location

components



Restraint > Airbag Module > Side Airbag (SAB) Module > Repair procedures

REMOVAL

1. Disconnect the battery negative cable and wait at least 3 minutes before beginning work.
2. Remove the front seat assembly(Refer to BD-Front Seat)
3. Remove the seat-back assembly.(Refer to BD-Front Seat)
4. Installation is the reverse of removal.

NOTE

After installing the side airbag, confirm proper system operation: Turn the ignition switch ON; the SRS indicator light should turn on about six seconds and then go off.

Restraint > Airbag Module > Curtain Airbag (CAB) Module > Description and Operation

DESCRIPTION

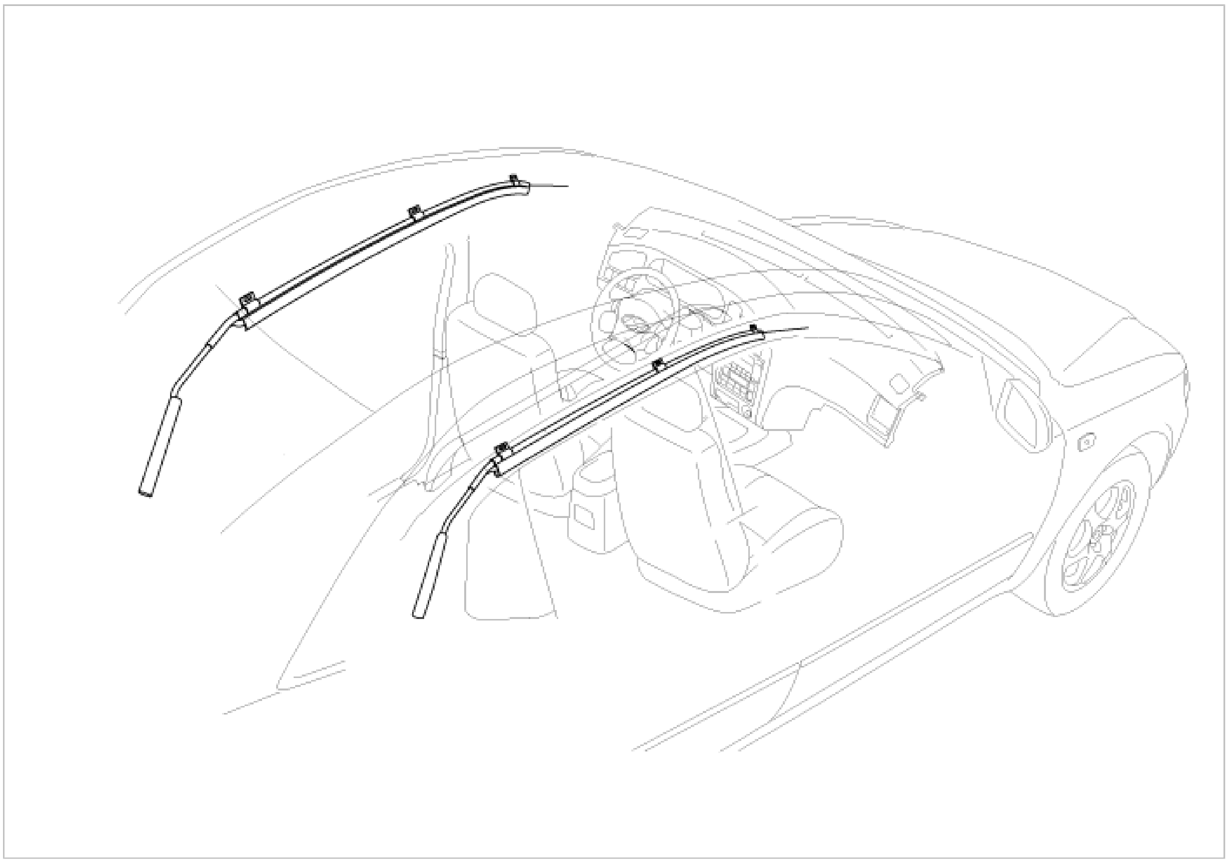
Curtain airbags are installed inside the headliner (LH and RH) and protect the driver and passanger from danger when side crash occurs. The SRSCM determines deployment of curtain airbag by using side impact sensor (SIS) signal.

CAUTION

Never attempt to measure the circuit resistance of the airbag module even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental airbag deployment will result in serious personal injury.

Restraint > Airbag Module > Curtain Airbag (CAB) Module > Components and Components Location

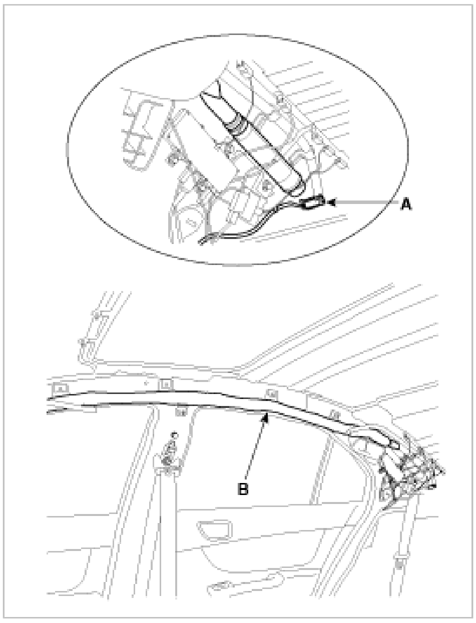
components



Restraint > Airbag Module > Curtain Airbag (CAB) Module > Repair procedures

removal

1. Disconnect the battery negative cable and wait at least 3 minutes before beginning work.
2. Remove the following parts (Refer to BD- group).
   A. Front and rear seat
   B. Interior trim
   C. Trunk trim
   D. Headlining
3. Disconnect the connector (A).
4. After loosening the mounting bolts, remove the curtain airbag (B).



5. Installation is the reverse of removal

NOTE

After installing the curtain airbag, confirm proper system operation: Turn the ignition switch ON; the SRS indicator light should turn on about seconds and then go off.

Restraint > Seat Belt Pretensioner > Seat Belt Retractor Pretensioner (BPT) > Description and Operation

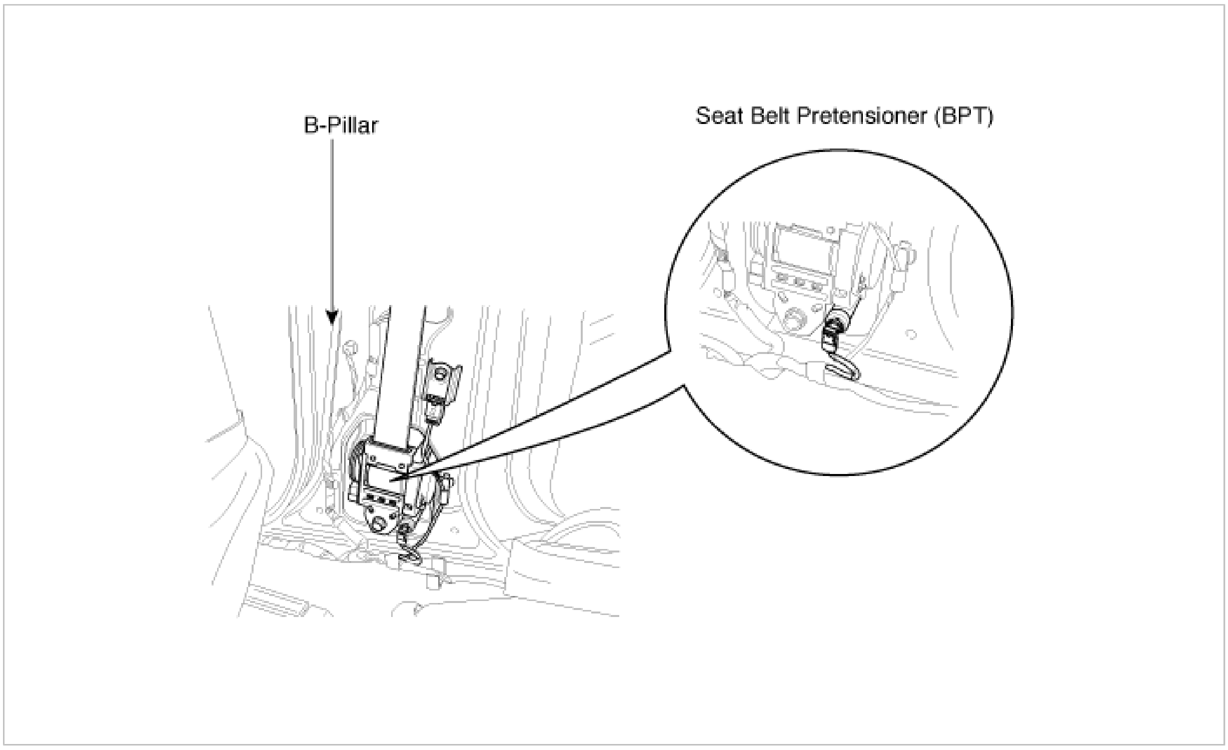
DESCRIPTION

CAUTION

- Never attempt to measure the circuit resistance of the Seat Belt Pretensioner (BPT) even if you are using the specified tester. If the circuit resistance is measured with a tester, the pretensioner will be ignited accidentally. This will result in serious personal injury.
- Both the seat belt and the seat belt buckle must be replaced if they worn during an accident, even if the pretensioners did not deploy.

Restraint > Seat Belt Pretensioner > Seat Belt Retractor Pretensioner (BPT) > Components and Components Location

components

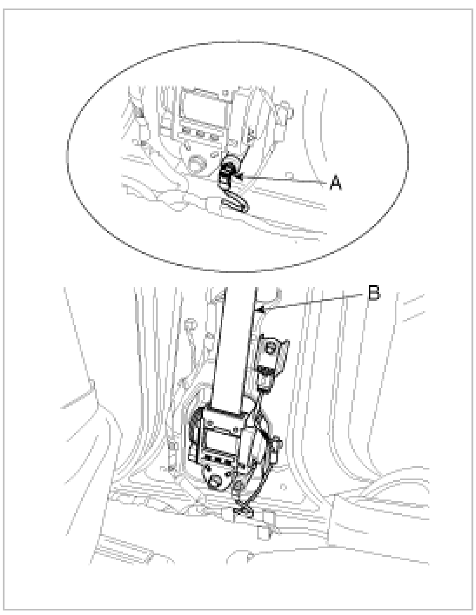


Restraint > Seat Belt Pretensioner > Seat Belt Retractor Pretensioner (BPT) > Repair procedures

removal

SEAT BELT PRETENSIONER

1. Disconnect the battery negative cable, and wait at least three minutes before beginning work.
2. Remove the front seat assembly (Refer to BD group - seat)
3. Remove the front door scuff trim (Refer to BD group - interior)
4. Remove the center pillar trim (Refer to BD group - interior)
5. Remove the lower anchor bolt (Refer to BD group - belt)
6. Remove the upper anchor bolt (Refer to BD group - belt)
7. Disconnect the connector (A).
8. Lossen the mounting bolt.
   Remove the pretensioner (B).

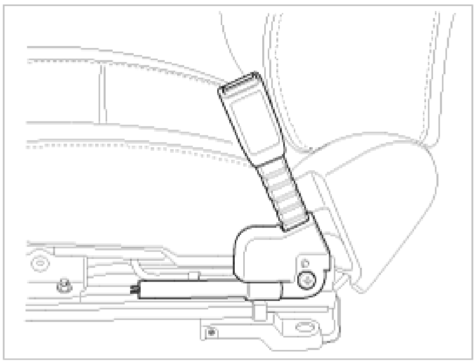
9. Installation is the reverse of removal.

NOTE

After installing the belt pretensioner, confirm proper system operation: Turn the ignition switch ON: the SRS indicator light should turn on about six seconds and then go off.

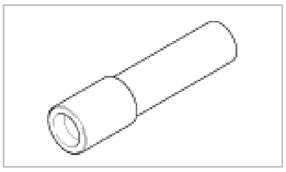
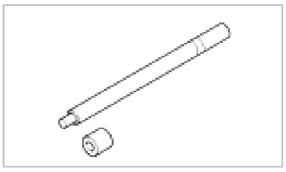
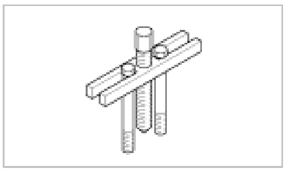
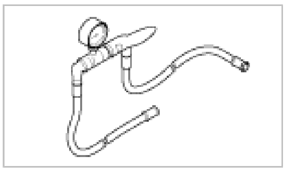
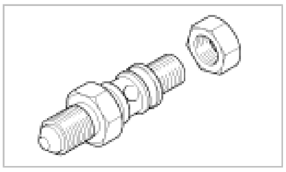
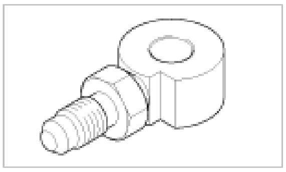
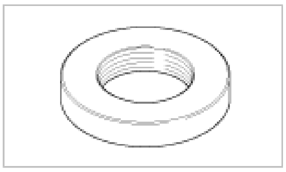
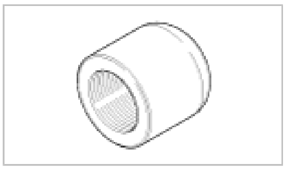
SEAT BELT BUCKLE PRETENSIONER

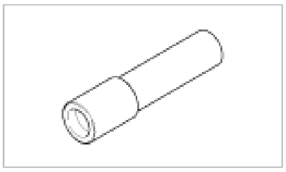
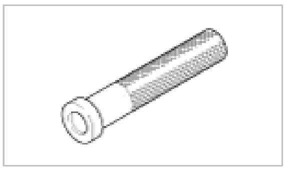
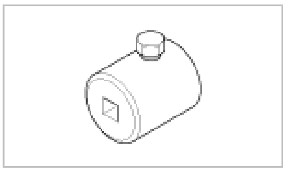
1. Disconnect the (-) battery cable and wait at least three minutes before beginning work.
2. Remove the front seat assembly(Refer to BD group - seat)
3. Remove the buckle pretensioner bolt.



4. Remove the seat belt buckle pretensioner.
5. Installation is the reverse of removal.

SPECIAL TOOLS

Tool (Number and Name)	Illustration	Use
09222-32100 Valve stem oil seal installer		Installation of the oil pump oil seal
09555-21000 Bar		Removal and installation of the oil seal (Use with 09573-33100, 09573-33000,09573-21000)
09561-11001 Steering wheel puller		Removal of steering wheel
09568-4A000 Tie rod end puller		Separation of the tie rod end bail joint
09572-21000 Oil pressure gauge		Measurement of the oil pressure (Use with 09572-22100, 09572-21200)
09572-21200 Oil pressure gauge adapter		Measurement of the oil pressure (Use with 09572-21000, 09572-22100)
09572-22100 Oil pressure gauge adapter		Measurement of the oil pressure (Use with 09572-21000, 09572-21200)
09573-33000 Oil seal installer		Installation of the back up washer and oil seal (Use with 09753-21000,09573-33100, 09555-21000)
09573-33100 Oil seal guide		Removal and installation of the oil seal (Use with 09573-21000, 09573-33000,09555-21000)
09573-21000		Installing the oil seal of the rack housing

Oil seal installer gauge		
09434-14200 Counter shaft bearing installer		Installing the gear box oil seal
09565-11100 Preload socket		Measuring the pinion shaft preload

Steering System > General Information > Troubleshooting

TROUBLESHOOTING

Symptom Pro	bable cause	Remedy
Excessive play in steering	Loose yoke plug	Retighten
	Loose steering gear mounting bolts	Retighten
	Loose or worn tie rod end	Retighten or replace as necessary
Steering wheel operation is not smooth (Insufficient power assist)	V-belt slippage	Readjust
	Damaged V-belt	Replace
	Low fluid level	Replenish
	Air in the fluid	Bleed air
	Twisted or damaged hoses	Correct the routing or replace
	Insufficient oil pump pressure	Repair or replace the oil pump
	Sticky flow control valve	Replace
	Excessive internal oil pump leakage	Replace the damaged parts
	Excessive oil leaks from rack and pinion in gear box	Replace the damaged parts
	Distorted or damaged gear box or valve body seals	Replace
Steering wheel does not return properly	Excessive turning resistance of tierod end	Replace
	Yoke plug excessively tight	Adjust
	Tie rod and/or ball joint cannot turn smoothly	Replace
	Loose mounting of gear box mounting bracket Worn steering shaft joint and/or	Retighten
	Worn steering shaft joint and/or body grommet	Correct or replace
	Distorted rack	Replace
	Damaged pinion bearing	Replace
	Twisted or damaged hoses	Reposition or replace
	Damaged oil pressure control valve	Replace

	Damaged oil pump input shaft bearing	Replace
Noise	Hissing Noise in Steering Gear There is some noise with all power steering systems. One of the most common is a hissing sound when the steering wheel is turned and the car is not moving. This noise will be most evident when turning the wheel while the brakes are being applied. There is no relationship between this noise and steering performance. Do not replace the valve unless the "hissing" noise becomes extreme. A replaced valve will also make a slight noise, and is not always a solution for the condition.	
Rattling or chucking noise in the rack and pinion	Interference with hoses from vehicle body	Reposition
	Loose gear box bracket	Retighten
	Loose tie rod end and/or ball joint	Retighten
	Worn tie rod and/or ball joint	Replace
Noise in the oil pump	Low fluid level	Replenish
	Air in the fluid	Bleed air
	Loose pump mounting bolts	Retighten

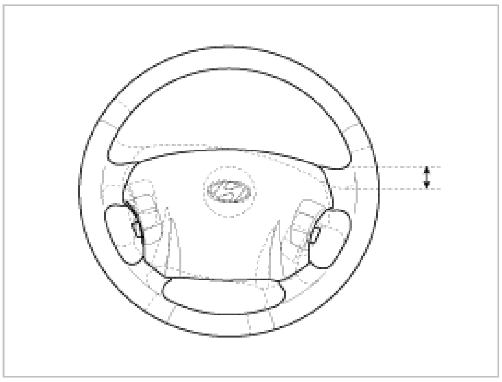
Steering System > General Information > Repair procedures

SERVICE ADJUSTMENT PROCEDURE

CHECKING STEERING WHEEL FREE PLAY

1. Start the engine and with the steering wheel in the straight ahead position.
2. Measure the play while turning the steering wheel to the left and right.

Standard value :
Steering wheel free play : 30 mm (1.1 in)



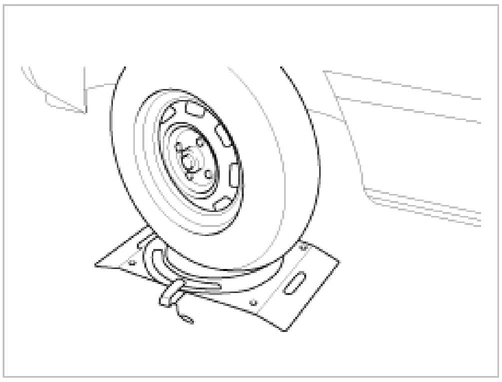
3. If the play exceeds the standard value, inspect the connection between the steering shaft and tie rod ends.

CHECKING STEERING ANGLE

1. Place the front wheel on a turning radius gauge and measure the steering angle.

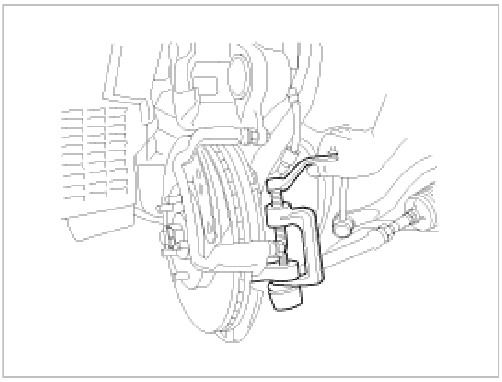
Standard value :	
Wheel angle	
Inside wheel	39.17°±2°
Outside wheel	31.56°

2. If the measured value is not within the standard value, adjust the toe and inspect again.



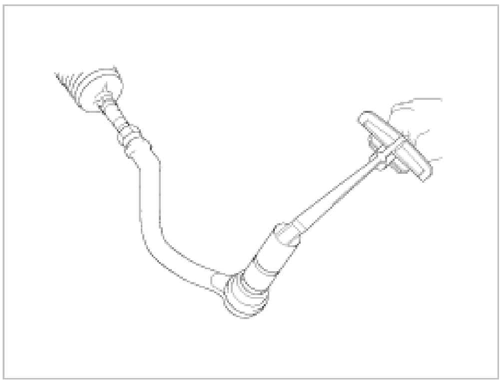
CHECKING THE TIE ROD END BALL JOINT STARTING TORQUE

1. Disconnect tie rod and knuckle with the special tool(09568-4A000).



2. Shake the ball joint stud several times to check for looseness.

Tie rod end ball joint starting torque :
30 kg·cm or less



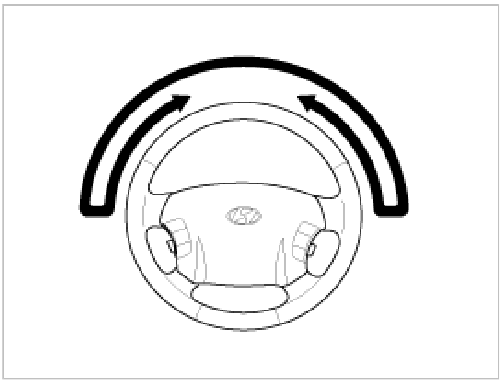
3. If the starting torque exceeds the upper limit of the standard value, replace the tie rod end.
4. Even if the starting torque is below the lower limit of the standard value, check the play of the ball joint and replace if necessary.

CHECKING STEERING WHEEL RETURN

1. The force required to turn the steering wheel and the wheel return should be the same for both moderate and sharp turns.
2. When the steering wheel is turned 90° and held for a couple of seconds while the vehicle is being driven at 20-30 kph (12-19 mph), the steering wheel should return at least 20° from its central position when it is released.

NOTE

If the steering wheel is turned very quickly, steering may be momentarily difficult. This is not a malfunction because the oil pump output will be somewhat decreased.



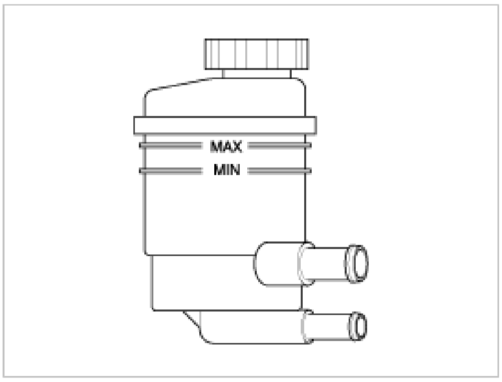
CHECKING POWER STEERING BELT TENSION

Refer to EM group(Timing system).

CHECKING POWER STEERING FLUID LEVEL

1. Position the vehicle on a level surface.
2. Start the engine. With the vehicle kept stationary, turn the steering wheel several times continuously to raise the fluid temperature to 50-60°C (122-140°F).
3. With the engine at idle, turn the steering wheel fully clockwise and counter-clockwise several times.
4. Make sure that there is no foaming or cloudiness in the reservoir fluid.
5. Stop the engine and check for any difference in fluid level between a stationary and a running engine.

> NOTE
>
> 1. If the fluid level varies 5 mm (0.2 in) or more, bleed the system again.
> 2. If the fluid level suddenly rises after stopping the engine, further bleeding is required.
> 3. Incomplete bleeding will produce a chattering sound in the pump and noise in the flow control valve, and lead to decreased durability of the pump.



REPLACING POWER STEERING FLUID

1. Jack up the front wheels and support them with jackstands.
2. Disconnect the return hose from the oil reservoir and plug the oil reservoir.
3. Connect a vinyl hose to the disconnected return hose, and drain the oil into a container.
4. Disconnect the high-tension cable at the ignition coil side. While operating the starter motor intermittently, turn the steering wheel all the way to the left and then to the right several times to drain the fluid.
5. Connect the return hoses, then fill the oil reservoir with the specified fluid.
6. Start the engine. Check for oil leakage.
7. Stop the engine.
8. Bleed the system.

Power steering fluid type : PSF-4
Total quantity : Approx 1.0 liter

AIR BLEEDING

1. Disconnect the high tension cable, and while operating the starting motor intermittently (for 15-20 seconds), turn the steering wheel all the way to the left and then to the right five or six times.

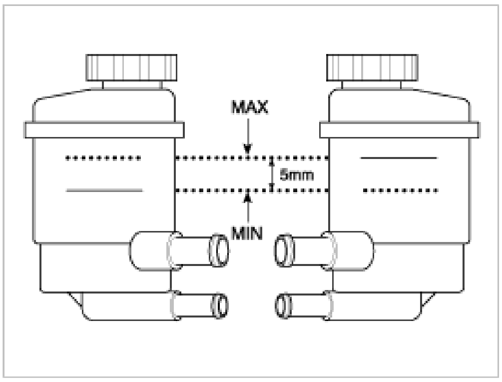
> NOTE
>
> 1. During air bleeding, replenish the fluid supply so that the level never falls below the lower position of the filter.
> 2. If air bleeding is done while the vehicle is idling, the air will be broken up and absorbed into the fluid. Be sure to do the bleeding only while cranking.

2. Connect the high tension cable, and start the engine(idling).
3. Turn the steering wheel to the left and the right until there are no air bubbles in the oil reservoir.

> CAUTION
>
> Do not hold the steering wheel turned all the way to either side for more than ten seconds.

4. Confirm that the fluid is not milky, and that the level is up to the position specified on the level gauge.
5. Confirm that there is little change in the surface o the fluid when the steering wheel is turned left and right.

> CAUTION
>
> 1. If the surface of the fluid changes considerably, air bleeding should be done again.
> 2. If the fluid level rises suddenly when the engine is stopped, it indicates that there is still air in the system.
> 3. If there is air in the system, a jingling noise may be heard from the pump and the control valve may also produce unusual noises.
>   Air in the system will shorten the life of the pump and other parts.



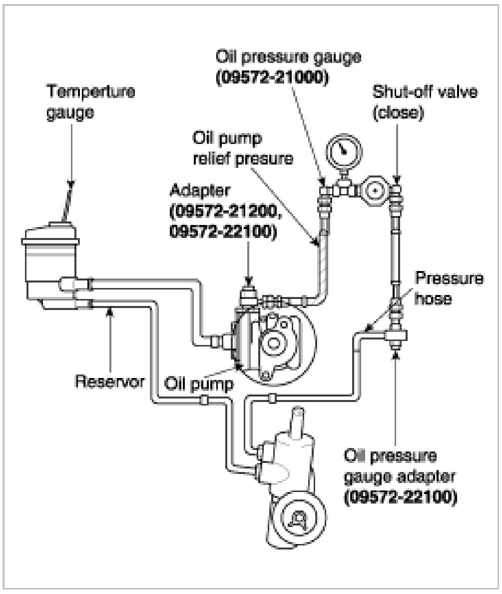
OIL PUMP PRESSURE TEST (OIL PUMP RELIEF PRESSURE)

1. Disconnect the pressure hose from the oil pump. Connect the special tool between the oil pump and pressure hose as illustrated.
2. Bleed the air, and then start the engine and turn the steering wheel several times so that the fluid temperature rises to approximately 50°C (122°F).
3. Set the engine speed to 1,000 rpm.
4. Close the shut-off valve of the special tool and measure the fluid pressure to confirm the it is within the range.

---

standard vaule :
Relief pressure: 90 +3/-2 kgf/cm^2

> CAUTION
>
> Don’t keep the shut-off valve on the pressure gauge closed for longer than 10 seconds.



5. Remove the special tools, and tighten the pressure hose to the specified torque.

Tightening torque :
55-65 Nm (5.5-6.5 kgf·m)

6. Bleed the system.

Steering System > General Information > Specifications

SPECIFICATIONS

Item			Specifications
Column and shaft	Shaft and joint type		Collapsible, crossjoint with tilt column
	Steering gear type		Rack and pinion
	Rack stroke mm		150
	Tilt stroke	Non electrical	±7°
Oil pump	Type		Vane type
	Displacement		10.5 cc/rev
	Relief pressure		90 +3/-2 kgf/cm²
Steering angle	Inner		39.17°±2°
	Outer		31.56°
	TIE ROD END BALL JOINTSTARTING TORQUE		30kg·cm or less

TIGHTENING TORQUE

Items		Nm	kgf·m	lb-ft
Steering column and shaft	Steering column to column member mounting (upper)	13 ~ 18	1.3 ~ 1.8	9.4 ~ 13
	Steering column shroud	4 ~ 6	0.4 ~ 0.6	2.8 ~ 4.3
	Steering column to column member mounting (lower)	13 ~ 18	1.3 ~ 1.8	9.4 ~ 13

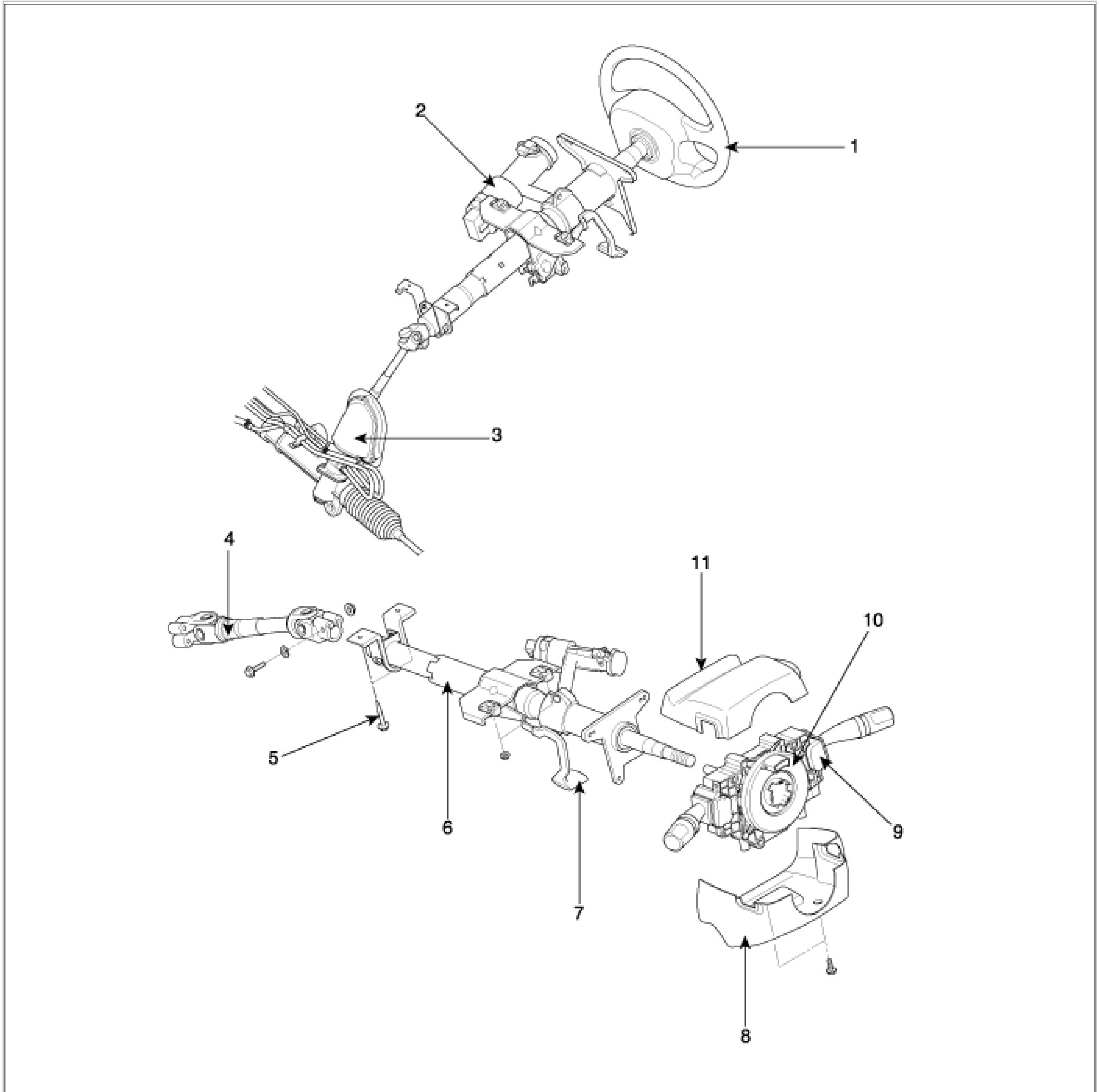
	Steering wheel lock nut	40 ~ 50	4 ~ 5	28.9 ~ 36.1
	Joint assembly	18 ~ 25	1.8 ~ 2.5	13 ~ 18
Steering gear box	Pressure hose to gear box	12 ~ 18	1.2 ~ 1.8	8.6 ~ 13
	Return tube to gear box	12 ~ 18	1.2 ~ 1.8	8.6 ~ 13
	Tie rod end lock nut	50 ~ 55	5 ~ 5.5	36.1 ~ 39.7
	Pinion and valve assembly to self locking nut	20 ~ 30	2 ~ 3	14.4 ~ 21.6
	lock nut	50 ~ 70	5 ~ 7	36.1 ~ 50.6
	Tie rod end self locking nut	24 ~ 34	2.4 ~ 3.4	17.3 ~ 24.5
	Mounting bracket to crossmember	60 ~ 80	6 ~ 8	43.3 ~ 57.8
Oil pump	Pressure hose to oil pump	55 ~ 65	5.5 ~ 6.5	39.7 ~ 47
	Oil pump mounting bolt(2.4)	17 ~ 26	1.7 ~ 2.6	12.2 ~ 18.8
	Oil pump mounting bolt(3.3)	35 ~ 50	3.5 ~ 5	25.3 ~ 36.1
	Pump cover to pump body	18 ~ 22	1.8 ~ 2.2	13 ~ 15.9
	Suction connector to oil pump body	6 ~ 10	0.6 ~ 1	4.3 ~ 7.2
	Flow control valve connector to pump body	65 ~ 75	6.5 ~ 7.5	47 ~ 54.2
Steering hoses and oil reservoir	Oil reservoir bracket mounting bolt	4 ~ 6	0.4 ~ 0.6	2.8 ~ 4.3
	Cooler tube clamp mounting bolt	4 ~ 6	0.4 ~ 0.6	2.8 ~ 4.3
	Tube clip and tube bracket	4 ~ 6	0.4 ~ 0.6	2.8 ~ 4.3
	Pressure hose bracket mounting bolt	4 ~ 6	0.4 ~ 0.6	2.8 ~ 4.3
	Hose clamp	4 ~ 6	0.4 ~ 0.6	2.8 ~ 4.3

LUBRICANTS

Items	Specified lubricant	Quantity
Steering column bearing	Multipurpose grease SAE J310a, NLGI No.2	As required
Steering gear box rack, pinion gear part	Multipurpose grease SAE J310a, NLGI No.2	As required
Bellows	Silicone grease	As required
Oil pump	Power steering fluid (PSF-4)	As required
Power steering fluid	Power steering fluid (PSF-4)	0.9(0.79 pts.) ~ 1.0 lit (0.88 qts.)

Steering System > Steering Column & Shaft > Steering Column/Shaft > Components and Components Location

COMPONENTS

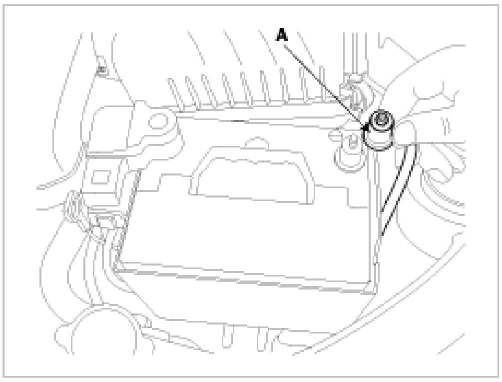


1. Steering wheel	7. Tilt lever
2. Key lock assembly	8. Steering column lower shroud
3. Dust cover assembly	9. Multifunction switch
4. Universal joint assembly	10. Clock spring
5. Steering column shaft mounting bolt	11. Steering column upper shroud
6. Steering colum shaft assembly	

Steering System > Steering Column & Shaft > Steering Column/Shaft > Repair procedures

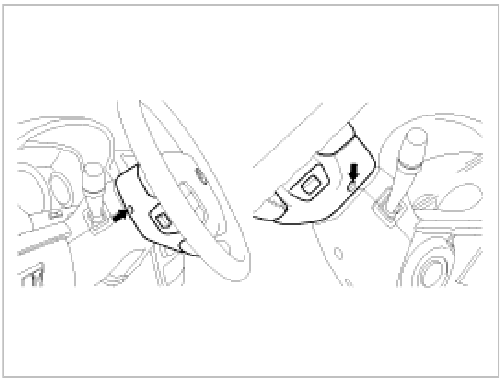
REMOVAL

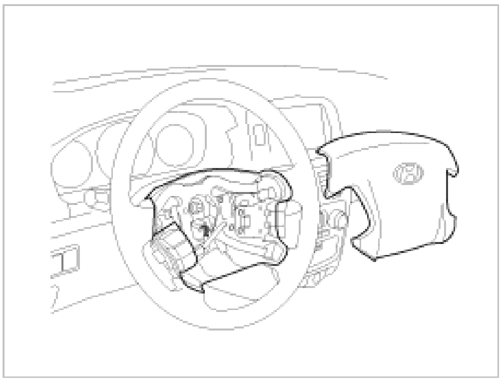
1. Disconnect the negative (-) terminal(A) from the battery.



2. Loosen the tapping screws and lift up the horn pad and remove it.
3. Remove the lock nut and the washer.

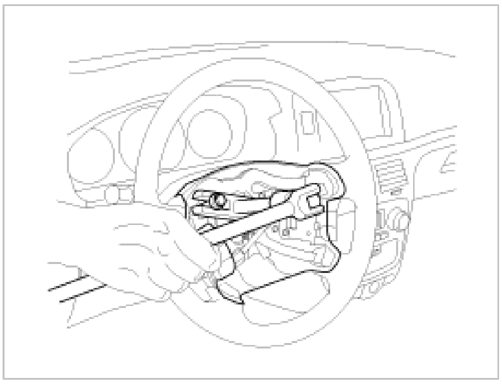
> CAUTION
>
> Before doing these procedures, see the SRS section (RT Group. Only for vehicles equipped with SRS).





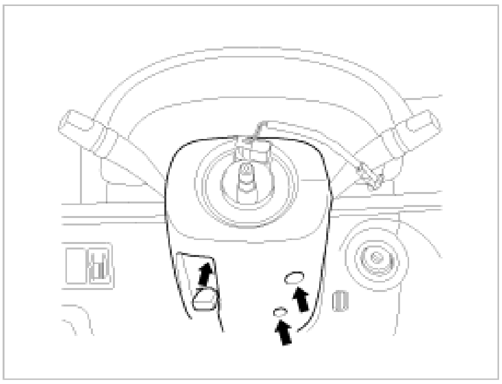
4. Remove the steering wheel with (09561-11001).

> CAUTION
>
> Do not hammer on the steering wheel to remove it doing so may damage the collapsible mechanism.

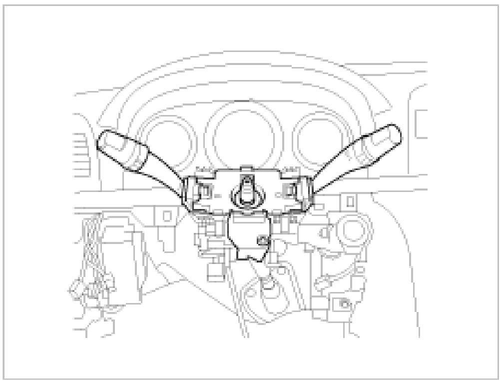


5. Remove the steering column lower and upper shrouds.

6. Remove the lower cover.



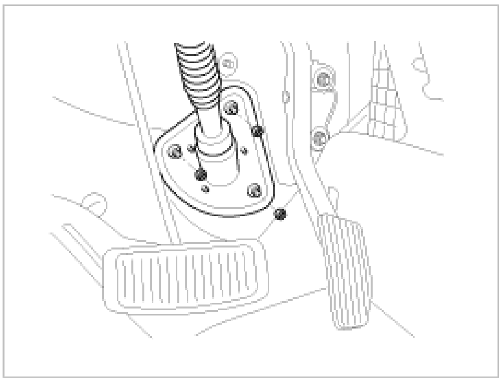
7. Disconnect the connectors and remove the multifunction switch.



8. Remove the bolts securing the coupling and universal joint. Pull out the universal joint from the gear box.

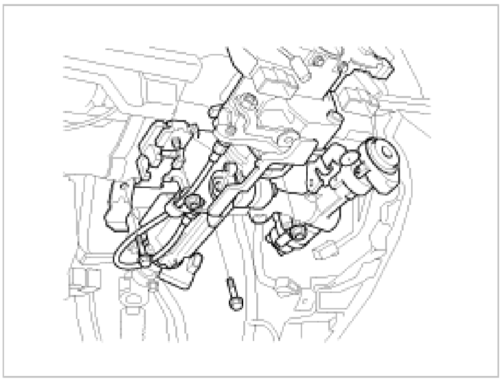
> CAUTION
>
> Keep the neutral-range to prevent the damage of the clock spring inner cable when you handlethe steering wheel.

9. Remove the dust cover mounting bolts.



10. Remove the steering column mounting bolts (4bolts).

11. Remove the steering column and shaft with the universal joint and cover.



INSTALLATION

1. Before installation, apply multipurpose grease to the groove inside the bearing and contracting surfaces of the boot and cover assembly.
2. Connect the steering lower shaft and joint assembly.

> NOTE
>
> When installing, mount the U-joint to the gear box first, then to the steering column shaft.

3. Install the dust cover to the column shaft assembly.
4. Install the steering column assembly to the column member assembly.
5. Install the multifunction switch and connect the connectors.

> CAUTION
>
> When installing the clock spring, refer the RT group to prevent the damage of clock spring inner cable.

6. Install the lower cover and steering column upper and lower shroud.
7. Install the steering wheel.

> NOTE
>
> When installing, do not use a hammer because the collapsible column shaft could be damaged.

INSPECTION

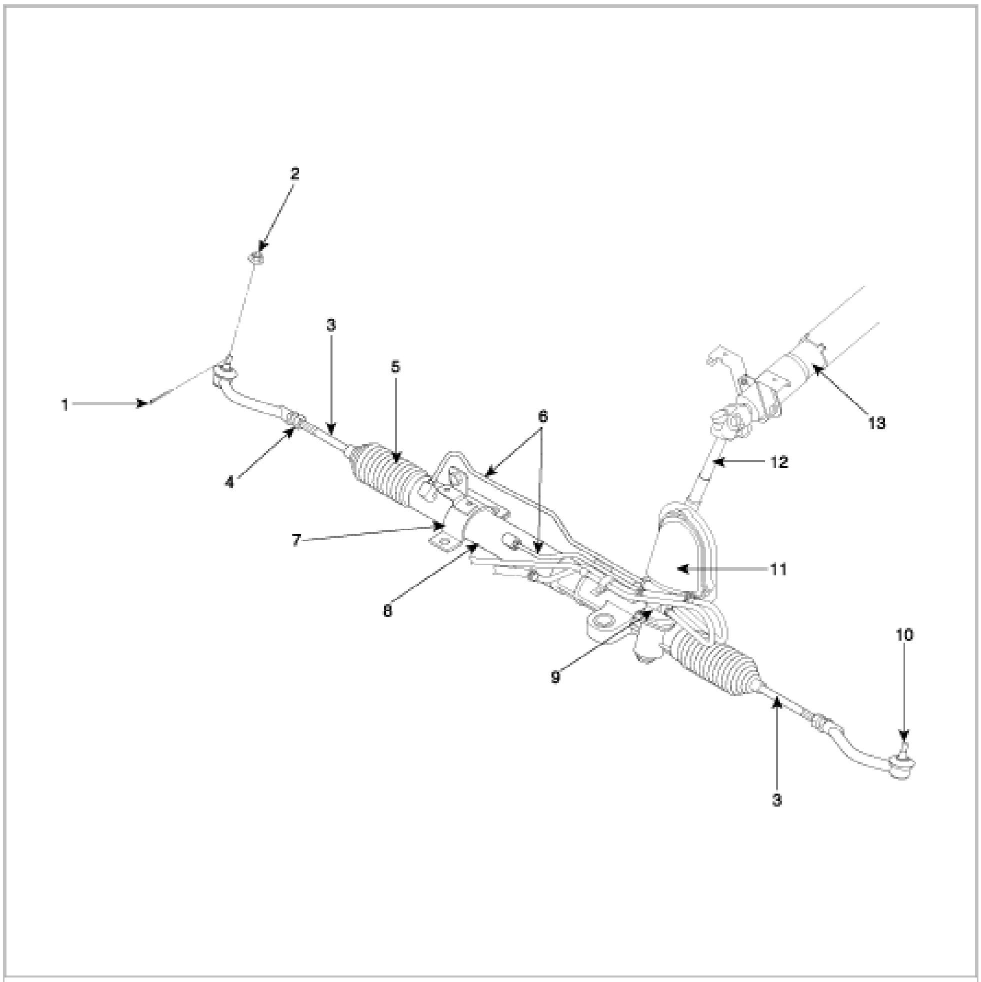
1. Check the steering shaft for damage, play and round movement.
2. Check the upper and lower bearing for wear or damage.
3. Check the joints for excessive play, damage or rough movement
4. Check the tilt bracket for cracks or damage.
5. Check the cover or boot for damage.
6. Check that the steering lock mechanism operates properly. If necessary, replace.

REASSEMBLY

1. Reassembly is reverse of the removal.
2. Make parallel the steering shaft's groove to the hook of the steering lock, when installing the steering lock assembly.

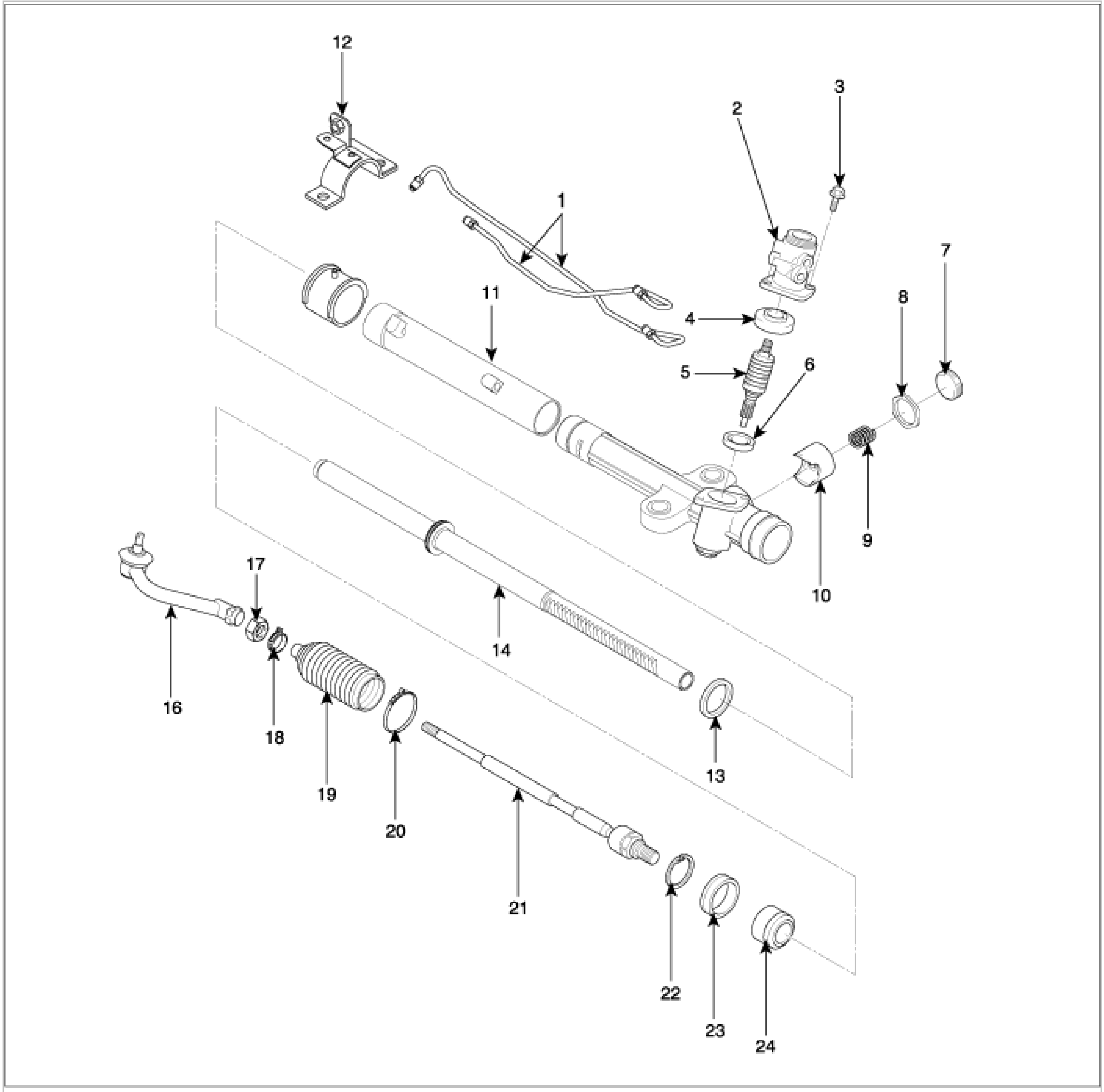
Steering System > Hydraulic Power Steering System > Power Steering Gear Box > Components and Components Location

COMPONENTS



1. Split pin	8. Rack housing
2. Slotted nut	9. Valve body assembly
3. Tie rod assembly	10. Tie rod end assembly
4. Lock nut	11. Dust cover
5. Bellows	12. Joint assembly
6. Feed tube	13. Steering column assembly
7. Power steering gear box mounting clamp	

DISSASSEMBLY AND ASSEMBLY



1. Feed tube
2. Valve body housing
3. Bolt
4. Oil seal
5. Pinion valve assembly
6. Oil seal
7. Yoke plug
8. Lock nut
9. Rack support spring
10. Rack support yoke
11. Rack housing
12. Power steering gear box mounting clamp
13. Oil seal
14. Rack
15. Tie rod end
16. Lock nut
17. Bellows clip
18. Bellows
19. Bellows band
20. Tie rod
21. Circlip
22. Oil seal
23. Rack stopper

Steering System > Hydraulic Power Steering System > Power Steering Gear Box > Repair procedures

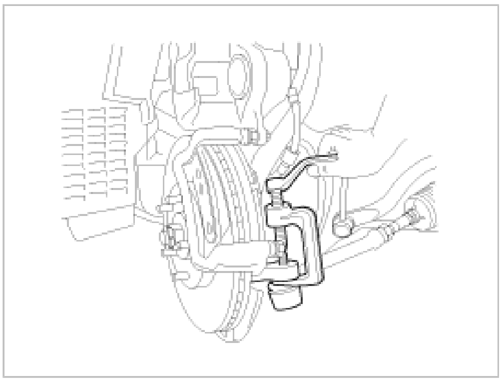
REMOVAL

1. Drain the power steering fluid.
2. Remove the joint assembly connecting bolt.

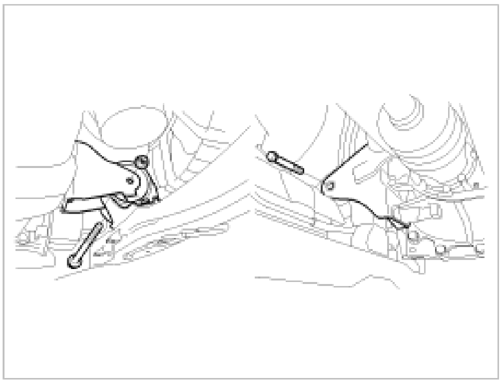
CAUTION

Keep the neutral-range to prevent the damage of the clock spring inner cable when you handlethe steering wheel.

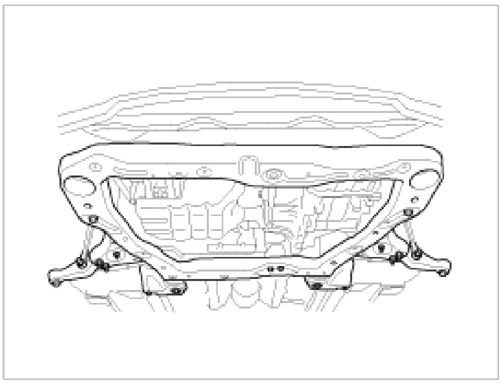
3. Using the special tool (09568-4A000), disconnect the tie rod end from the knuckle arm.



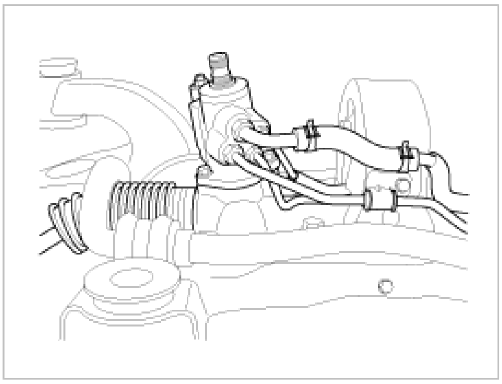
4. Remove the front fork and the knuckle ball joint from the front lower arm.
5. Remove the connecting bolts of front and rear roll stopper.



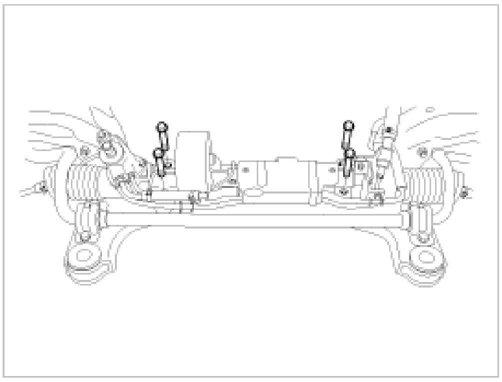
6. Remove the mounting bolts(10EA) of cross member complete assembly.



7. Disconnect the pressure hose and the return tube.

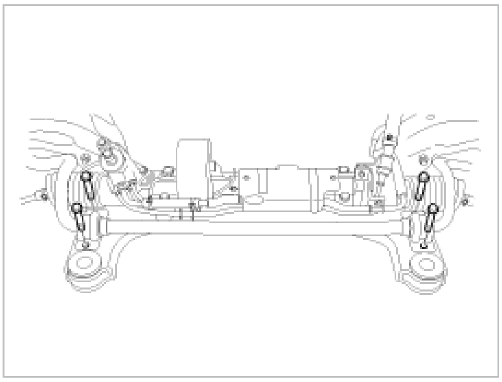


8. Remove the steering gear box mounting bolts and remove the steering gear box assembly and the mounting rubber.



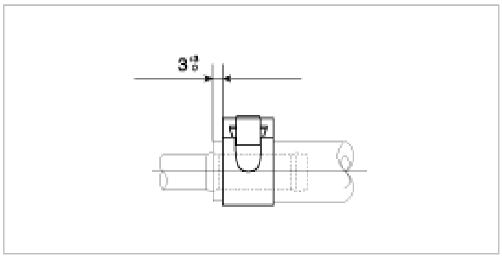
> **CAUTION**
>
> When removing the gear box, pull it out carefully and slowly to avoid damaging the boots.

9. Remove the stabilizer bar.



INSTALLATION

> **NOTE**
>
> Be sure to connect between a tube and a hose as shown in the illustration.



1. Installation is reverse of removal.

Tightening torque :

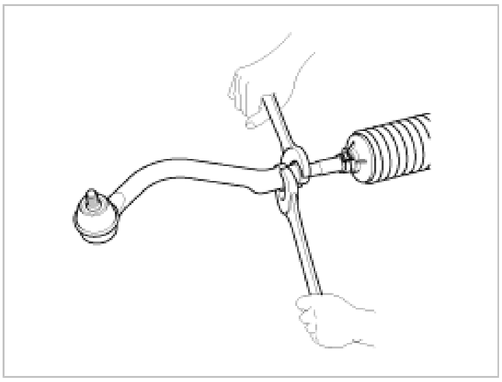
Items	Nm(kgf·m, lb-ft)

Pressure hose to gear box	12~18(1.2~1.8, 8.6~13)
Return tube to gear box	12~18(1.2~1.8, 8.6~13)
Tie rod end lock nut	50~55(5~5.5, 36.1~39.7)
Pinion and valve assembly to self locking nut	20~30(2~3, 14.4~21.6)
lock nut	50~70(5~7, 36.1~50.6)
Tie rod end self locking nut	24~34(2.4~3.4, 17.3~24.5)
Mounting bracket to crossmember	60~80(6~8, 43.3~57.8)

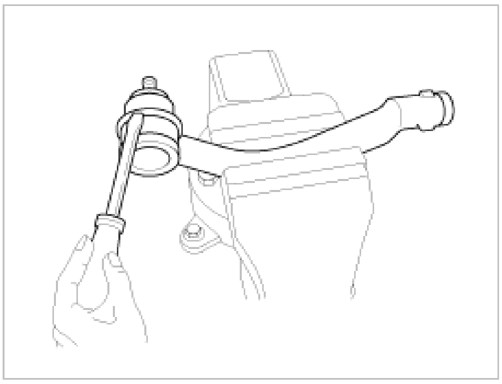
2. After installation, bleed the air in the power steering system(See page ST-11).

DISASSEMBLY

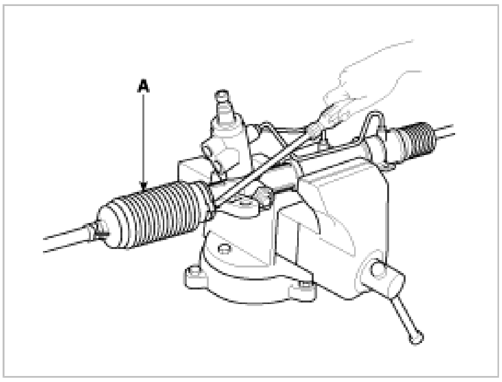
1. Remove the tie rod end from the tie rod.



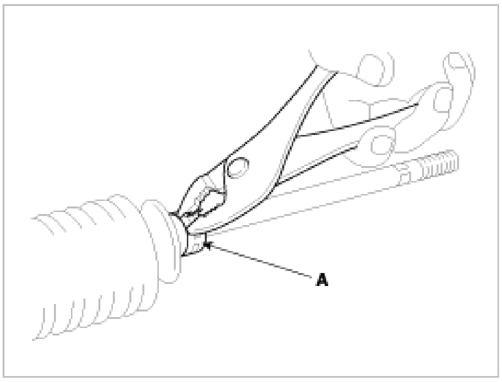
2. Remove the dust cover from the ball joint.



3. Remove the bellows band(A).



4. Remove the bellows clip(A).

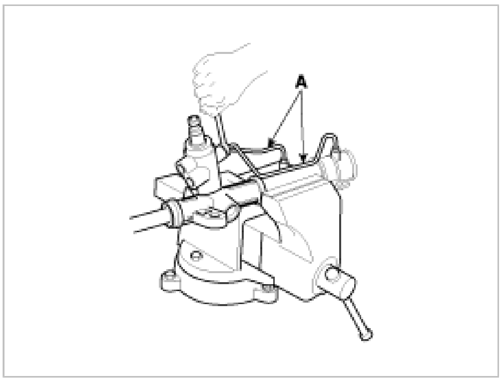


5. Pull the bellows out toward the tie rod.

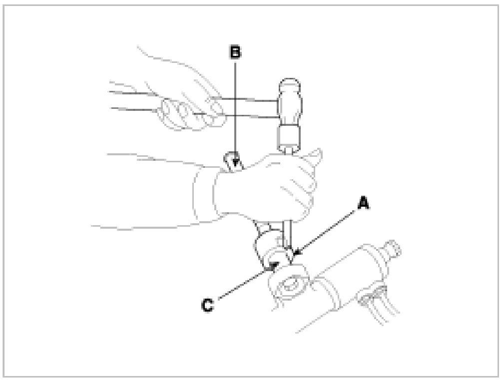
NOTE

Check for rust on the rack when the bellows are replaced.

6. Remove the feed tube(A) from the rack housing.



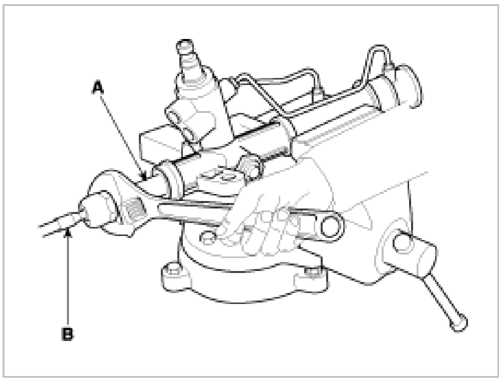
7. While moving the rack slowly, drain the fluid from the rack housing.
8. Unstake the tab washer(A) which fixes the tie rod(B) and rack(C) with a chisel.



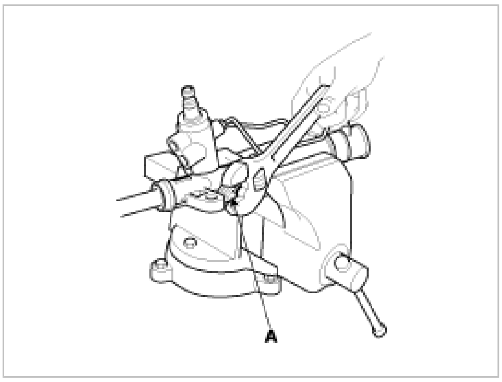
9. Remove the tie rod(B) from the rack(A).

CAUTION

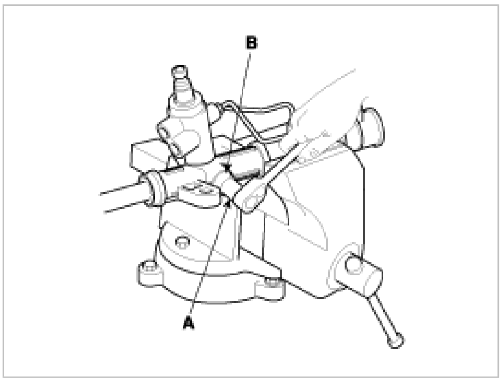
Remove the tie rod(B) from the rack(A), taking care not to twist the rack.



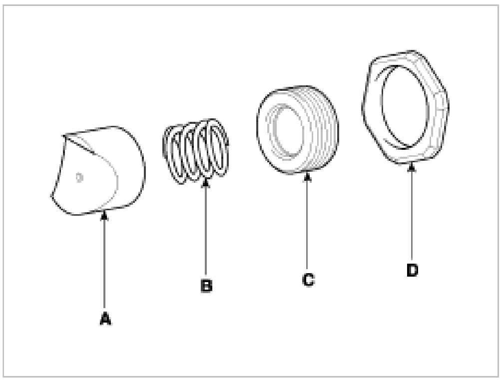
10. Remove the yoke plug locking nut(A).



11. Remove the yoke plug(B) with a 14mm socket(A).

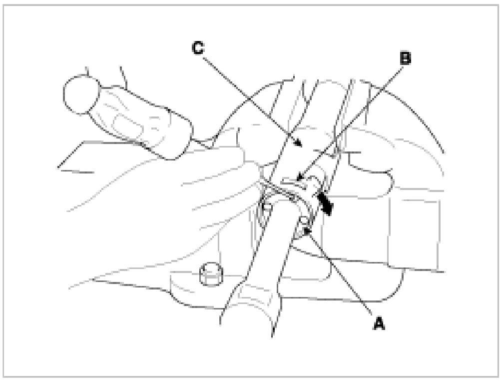


12. Remove the lock nut(D), yoke plug(C), rack support spring(B) and rack support yoke(A) from the gear box.

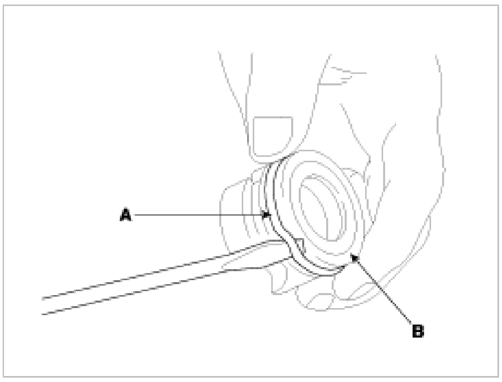


13. When the end of the circlip comes out of the notched hole of the housing rack cylinder, turn the rack stopper counterclockwise and remove the circlip.

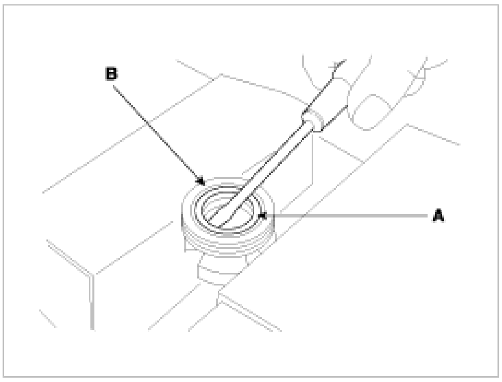
CAUTION
Be careful not to damage the rack.



14. Remove the rack bushing and rack from the rack housing.
15. Remove the O-ring(A) from the rack bushing(B).



16. Remove the oil seal(B) from the rack bushing(A).

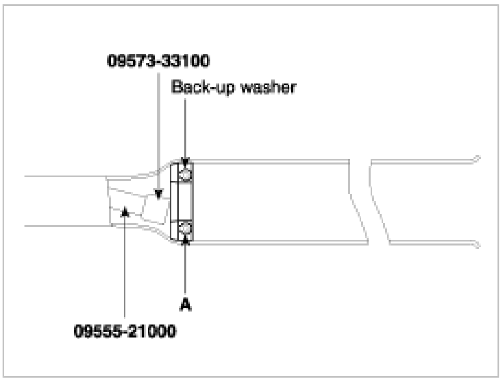


17. Remove the valve body from the valve body housing with a soft hammer.
18. Using the special tool, remove the oil seal and ball bearing from the valve body housing.
19. Remove the oil seal and O-ring from the rack housing.

> **CAUTION**
>
> Be careful not to damage the pinion valve cylinder inside of the rack housing.

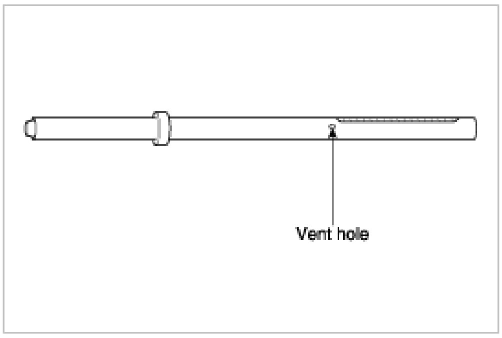
20. Using the special tool(09573-21200, 09555-33100), remove the oil seal(A) from the rack housing.

> **CAUTION**
>
> Be careful not to damage the rack cylinder inside of the rack housing.

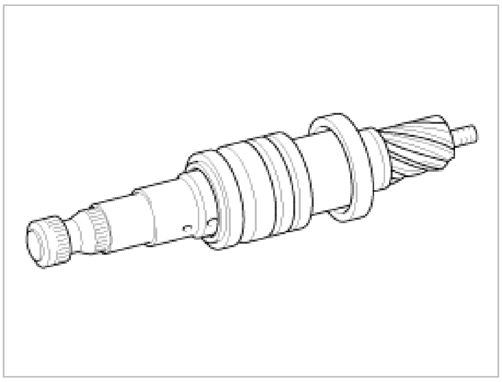


INSPECTION

1. Rack
   (1) Check for rack tooth face damage or wear.
   (2) Check for oil seal contact surface damage.
   (3) Check for rack bending or twisting.
   (4) Check for oil seal ring damage or wear.
   (5) Check for oil seal damage or wear.



2. Pinion valve
   (1) Check for pinion gear tooth face damage or wear.
   (2) Check for oil seal contact surface damage.
   (3) Check for seal ring damage or wear.
   (4) Check for oil seal damage or wear.



3. Bearing
   (1) Check for seizure or abnormal noise during a bearing rotation.
   (2) Check for excessive play.
   (3) Check for missing needle bearing rollers.

4. Others
   (1) Check for damage of the rack housing cylinder bore.

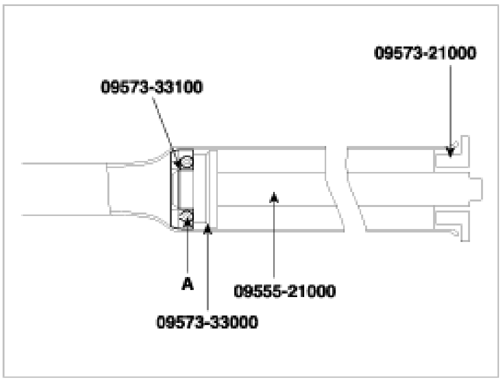
(2) Check for boot damage, cracking or aging.

REASSEMBLY

1. Apply the specified fluid to the entire surface of the rack oil seal.

Recommended fluid : PSF-4

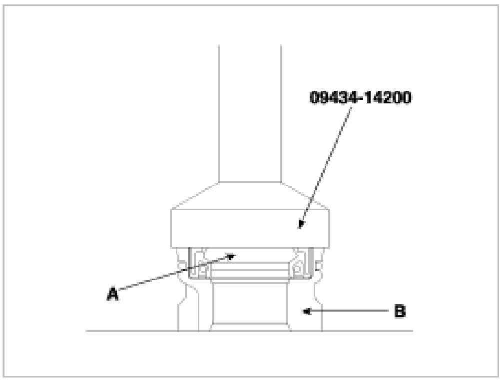
2. Install the backup washer and oil seal(A) to the specified position in the rack housing.



3. Apply the specified fluid to the entire surface of the rack bushing oil seal.

Recommended fluid : PSF-4

4. Install the oil seal(A) in the rack bushing(B).

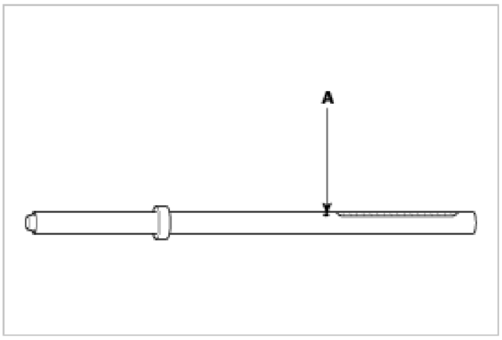


5. Apply the specified fluid to the entire surface of the O-ring and install it in the rack bushing.
6. Apply the specified grease to the rack teeth.

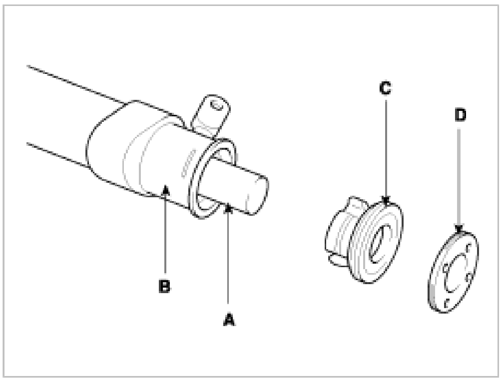
Recommended grease
Multipurpose grease SAE J310a NLGI No.2

NOTE

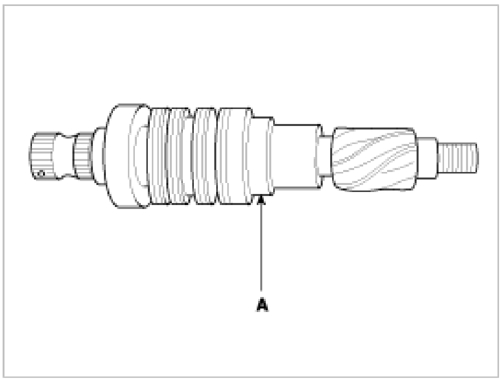
Do not plug the vent hole(A) in the rack with grease.



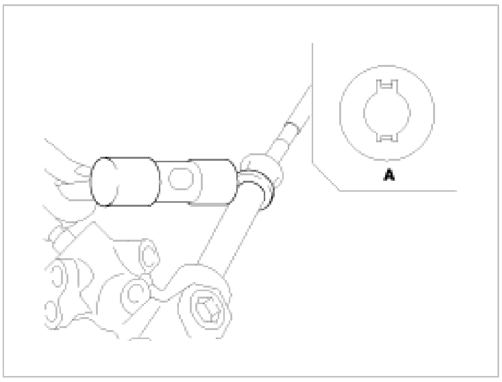
7. Insert the rack(A) into the rack housing(B) and install the rack bushing(C).



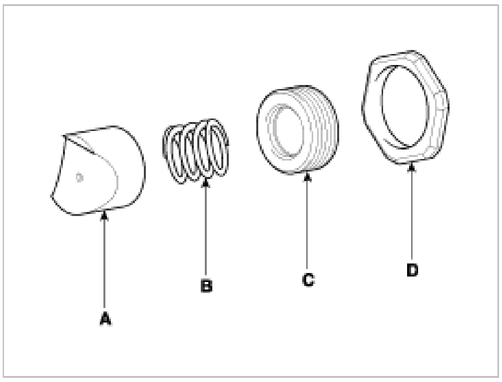
8. Using a special tool, install the oil seal and the ball bearing in the valve body housing.
9. After applying the specified fluid and grease to the pinion valve assembly(A), install it in the rack housing assembly.



10. Install the tie rod and punch on a point over the tie rod with a chisel.



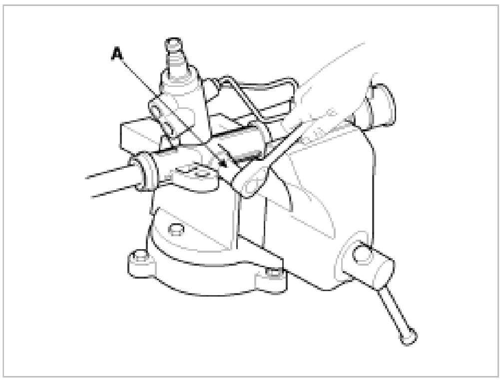
11. Install the rack support yoke(A), rack support spring(B), yoke plug(C) and lock nut(D) in the order shown in the illustration. Apply semi-drying sealant to the threaded section of the yoke plug before installation.



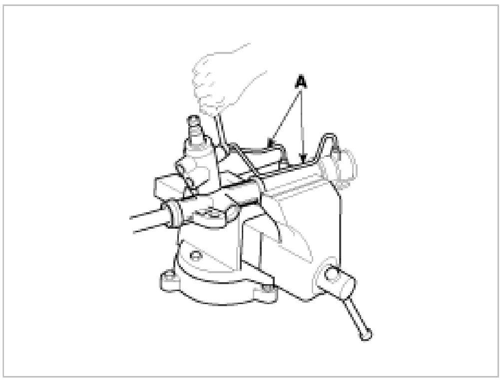
12. With the rack placed in the center position, attach the yoke plug to the rack housing. Tighten the yoke plug to 12 Nm (120 kg·cm, 8.9 lb·ft), with a 14mm socket(A). Loosen the yoke plug approximately from 30° to 60° and tighten the yoke nut to the specified torque.

Tightening torque

50 ~ 70 N·m (5 ~ 7 kgf·m, 37 ~ 52 lb-ft)

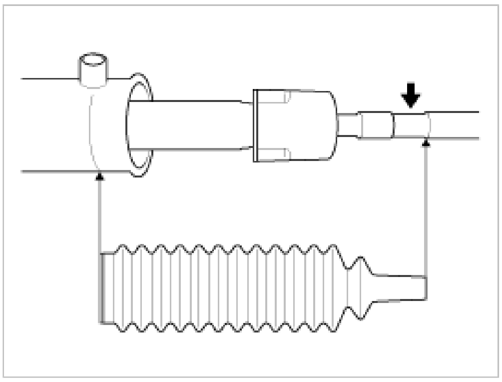


13. Tighten the feed tube(A) to the specified torque and install the mounting rubber using adhesive.



14. Apply the specified grease to the bellows mounting position (fitting groove) of the tie rod.

Recommended grease : Silicone grease

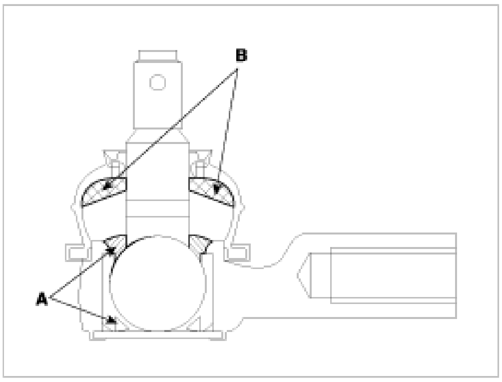


15. Install the new attaching band to the bellows.

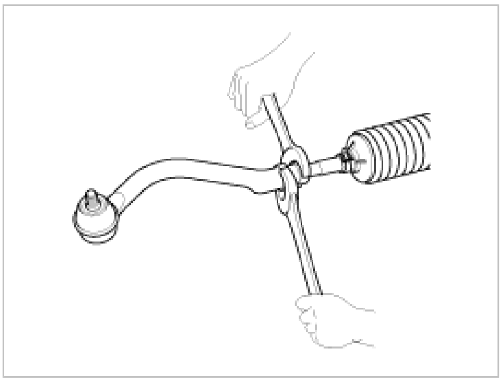
> NOTE
>
> When the bellows are installed, a new band must be used.

16. Install the bellows in position, taking care not to twist it.
17. Fill the dust cover inner side and lip with the specified grease, and fix the dust cover in position with the clip ring attached in the groove of the tie rod end.

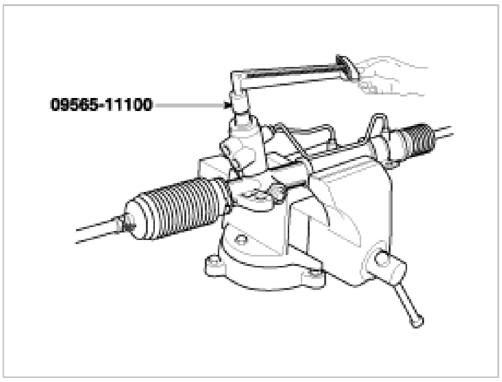
Recommended grease
A : POLY LUB GLY 801K or equivalent
B : SHOWA SUNLIGHT MB2 or equivalent
Dust cover inner side and lip : THREE BOND



18. Install the tie rod to the tie rod end.

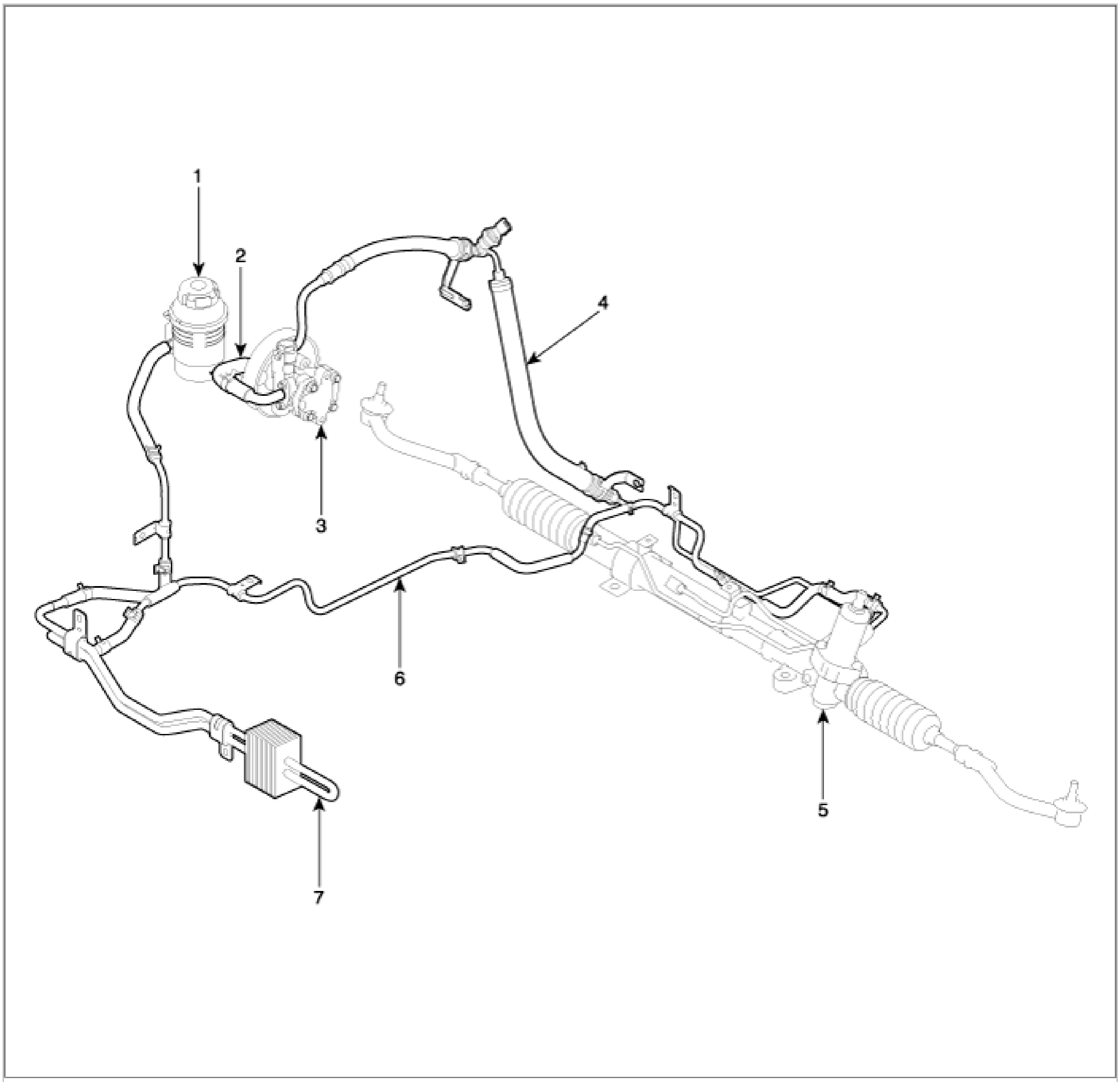


19. Check for total pinion preload.



Steering System > Hydraulic Power Steering System > Power Steering Hoses > Components and Components Location

COMPONENTS

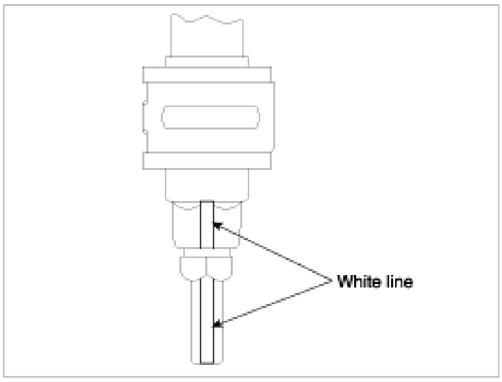


1. Power steering oil reservoir
2. Suction hose
3. Oil pump
4. Pressure hose
5. Power steering gear box
6. Return tube
7. Cooler tube

Steering System > Hydraulic Power Steering System > Power Steering Hoses > Repair procedures

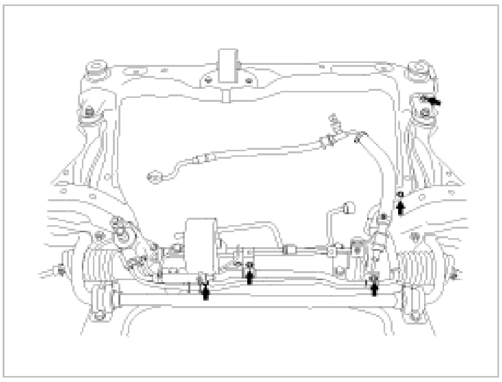
REMOVAL

While installing the tube and hose assembly, be sure to align white marks on each fitting.

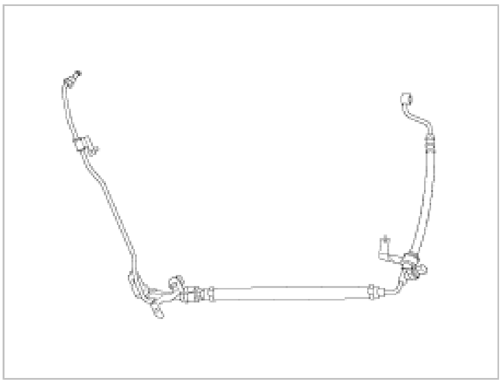


PRESSURE HOSE, TUBE AND RETURN TUBE, HOSE

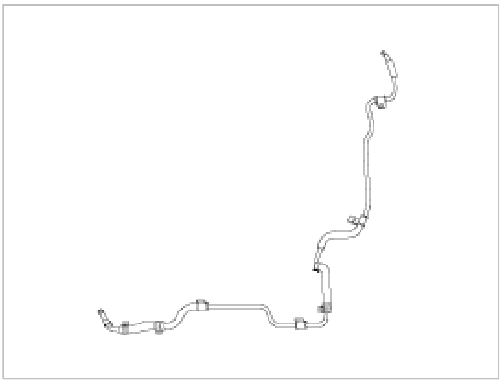
1. Remove the mounting clamps from the pressure tube and the return tube.



2. Remove the pitting of both the pressure tube and the return tube from the gear box.
3. Remove the pressure hose and tube.



4. Remove the return tube and hose.



INSTALLATION

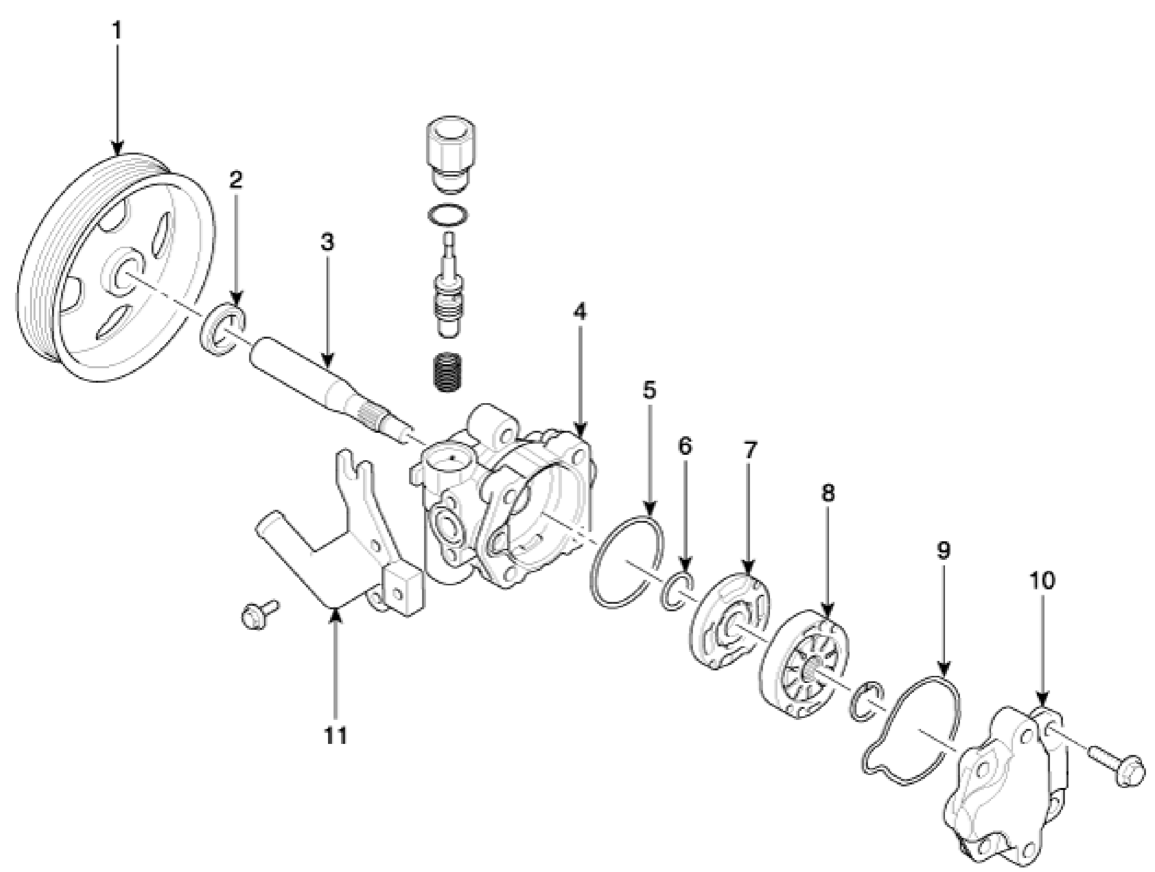
Installation is the reverse of removal.

NOTE

- Install the return tube and hoses so that they are not twisted and it does not come in contact with any other parts.
- After installation, air bleed the system.

Steering System > Hydraulic Power Steering System > Power Steering Oil Pump > Components and Components Location

COMPONENTS

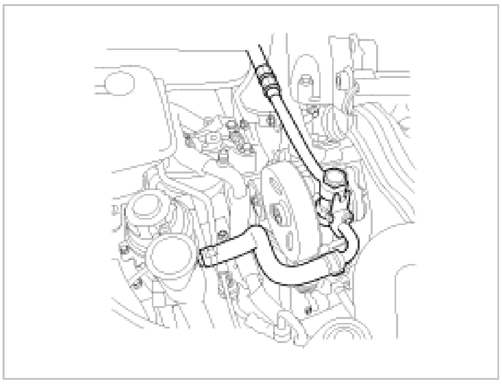


1. Pulley	5. O-ring (Outer)	9. Gasket
2. Dust spacer	6. O-ring (Inner)	10. Oil pump cover assembly
3. Pulley shaft	7. Front side plate	11. Suction pipe
4. Front housing	8. Cam ring	

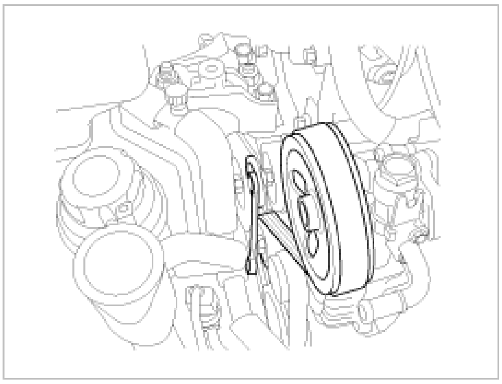
Steering System > Hydraulic Power Steering System > Power Steering Oil Pump > Repair procedures

REMOVAL

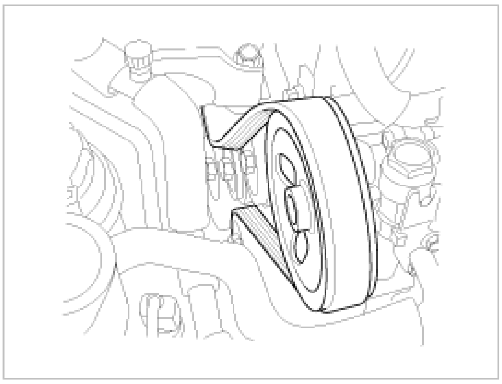
1. Remove the pressure hose from the oil pump and the suction hose from the suction pipe, then drain the powersteering oil.



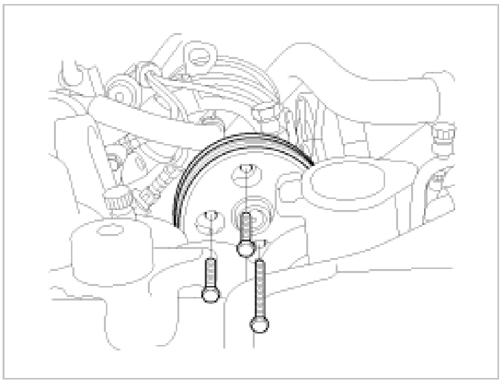
2. Release the tension of the powersteering V-type belt by lifting the auto-tensioner pulley.



3. Remove the V-type belt from the pulley of the powersteering oil pump.

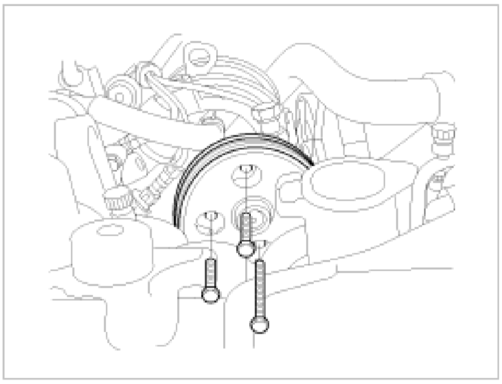


4. Remove the powersteering oil pump assembly by removing the three bolts as shown below.



INSTALLATION

1. Install the oil pump to the oil pump bracket.

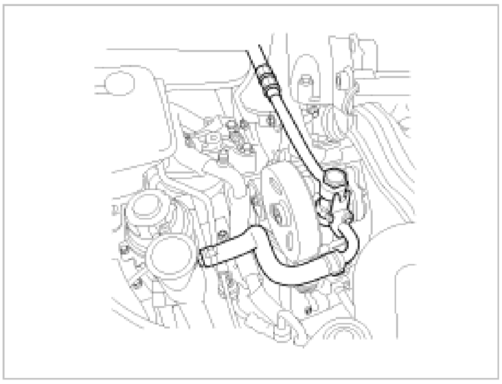


2. Install the "V"-type belt by pulling the auto tensioner.
3. Install the suction hose.

> **CAUTION**
>
> Install the pressure hose to the oil pump.

4. Install the pressure hose to the oil pump.

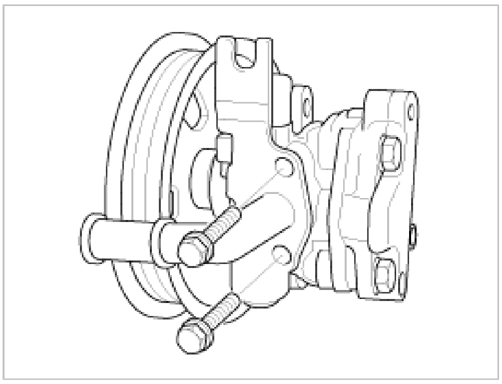
> **NOTE**
>
> Install the pressure hose being careful so that it does not twist and come in contact with other components.



5. Add power steering fluid (PSF-4).
6. Air bleed the system.
7. Check the oil pump pressure.

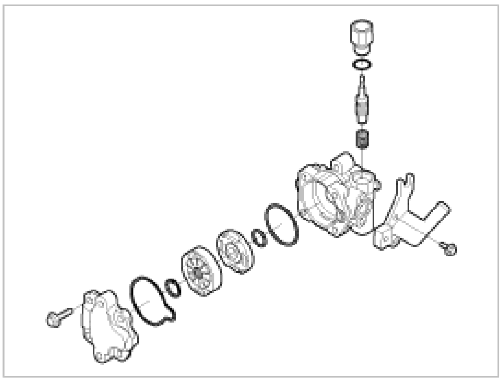
DISASSEMBLY

1. Remove the bolts from the oil pump body, and then remove the suction pipe and O-ring.

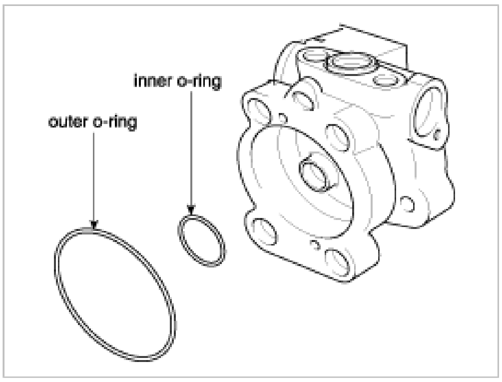


2. Loosen the four bolts and remove the oil pump cover assembly.
3. Remove the cam ring.
4. Remove the rotor and vanes.

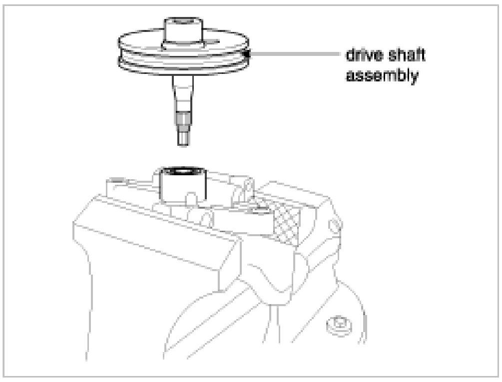
5. Remove the oil pump side plate.



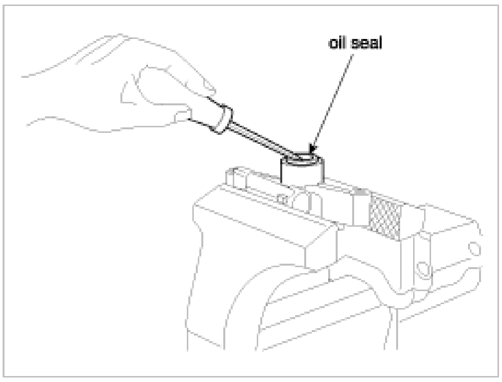
6. Remove the inner and outer O-ring.
7. Remove the inner O-ring and outer O-ring.



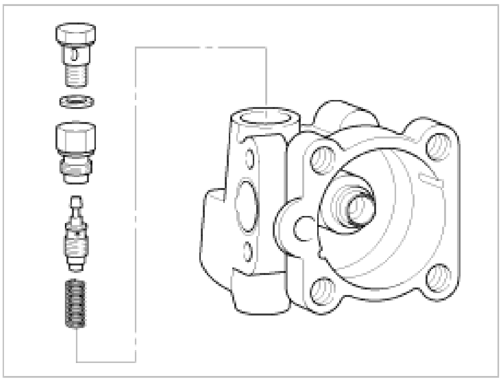
8. Remove the snap ring and take out the pulley and the drive shaft assembly.



9. Remove the oil seal from the oil pump body.



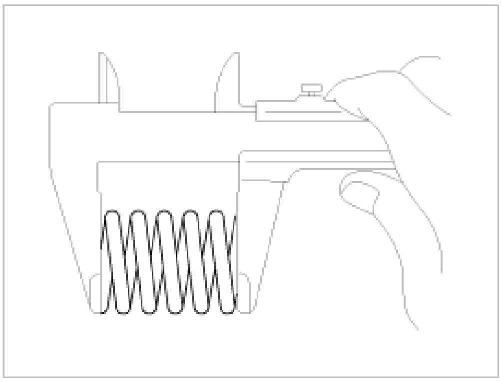
10. Remove the connector from the oil pump body, and take out the flow control valve and the flow control spring.



INSPECTION

1. Check the free length of the flow control spring.

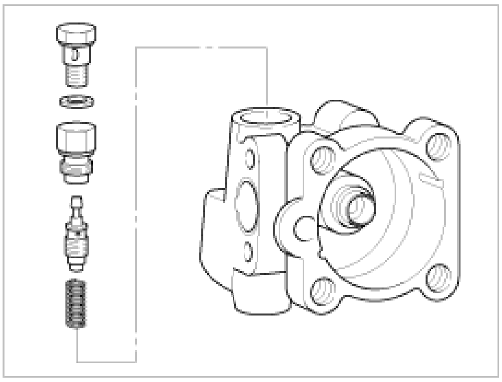
Free length of the flow control spring : 36.5mm



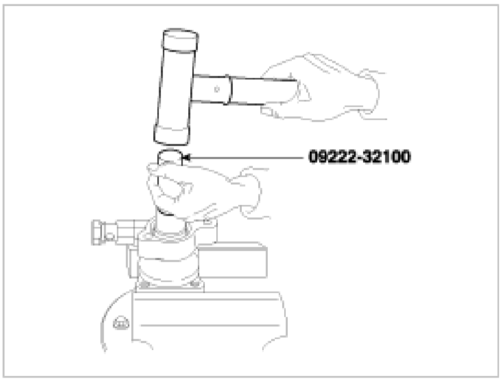
2. Check that the flow control valve is not bent.
3. Check the shaft for wear and damage.
4. Check the V-belt for wear and deterioration.
5. Check the grooves of the rotor and vanes for stratified abrasion.
6. Check the contact surface of the cam ring and vanes for stratified abrasion.
7. Check vanes for damage.
8. Check that there is no striped wear in the side plate or contacting part between the shaft and the pump cover surface.

REASSEMBLY

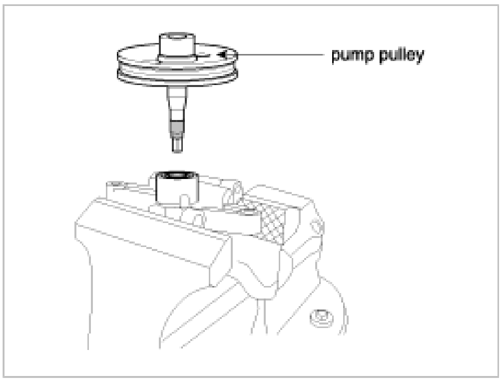
1. Install the flow control spring, the flow control valve and the connector in to the pump body.



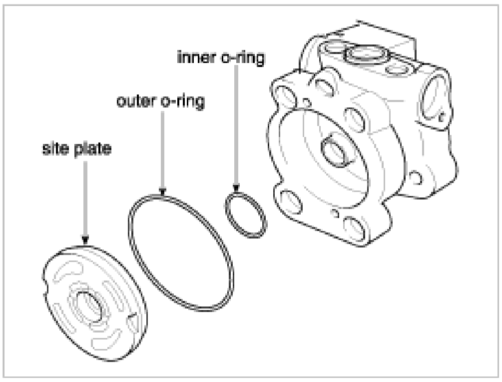
2. Install the oil seal in the pump body by using the special tool(09222-32100).



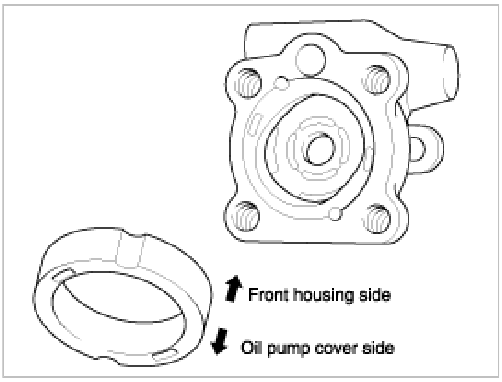
3. Install the pump pulley.



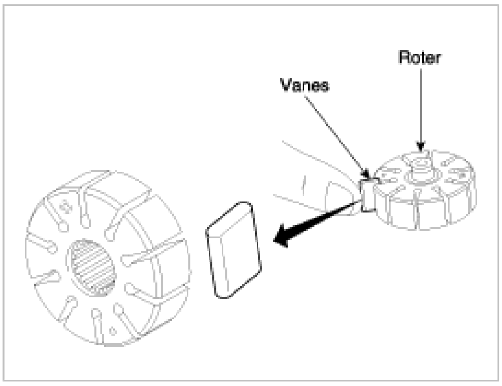
4. Assemble the inner O-ring and the outer O-ring and install the site plate.



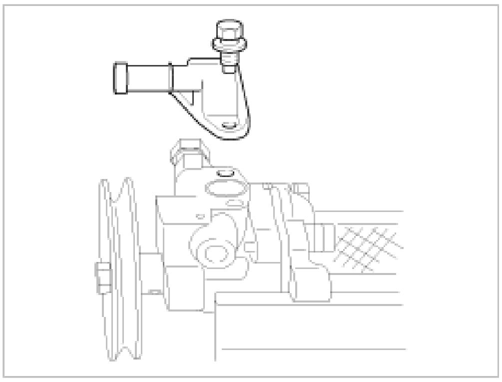
5. After inserting the lock pin into the groove of the front housing, install the camring attending to the direction.



6. Install the rotor.
7. Install the vanes.



8. Install the gasket and oil pump cover assembly.
9. Install the suction pipe and O-ring.



Specifications

Front Suspension System

Items			Specification
Type			Double Wishbone
Shock Absorber	Type		Gas
	Stroke mm(in)		96(3.78)
	Expansion mm(in)		424.0±3(16.69±0.118)
	Compression mm(in)		328.0 +3/-∞ (12.91+0.118/-∞)
	Damping force (0.3 m/s)	Expansion N(kgf)	2.4ℓ : 1060±160(106±16) 3.3ℓ : 1640±220(164±22)
		Compression N(kgf)	2.4ℓ : 440±90(44±9) 3.3ℓ : 690±130(69±13)
	I.D color		2.4ℓ : Gray, 3.3ℓ : Purple
Spring	2.4GSL	Free height mm(in)	380.1(14.96)
		I.D color	Pink - Yellow
	3.3GSL	Free height mm(in)	390.5(15.37)
		I.D color	Pink - Orange

Rear Suspension System

Items			Specification
Type			Multi Link
Shock Absorber	Type		Gas
	Stroke mm(in)		160.5(6.32)
	Expansion mm(in)		584.6±3(23.016±0.118)
	Compression mm(in)		424.1 +3/-∞ (16.697+0.118/-∞)
	Damping force (0.3 m/s)	Expansion N(kgf)	2.4ℓ : 680±110(68±11) 3.3ℓ : 840±130(84±13)
		Compression N(kgf)	2.4ℓ : 290±70(29±7) 3.3ℓ : 240±60(24±6)
	I.D color		2.4ℓ : Gray, 3.3ℓ : Purple
Spring	2.4GSL/3.3GSL	Free height mm(in)	355.4(13.20)
		I.D color	Green - Yellow

Wheels And Tires

Items		Specification
Tire Size		215/60 R16
		225/50 R17
Wheel Size	Steel	6.5J×16, OFFSET=46
	Aluminium	6.5J×16, OFFSET=46
		6.5J×17, OFFSET=46
Tire Pressure kPa(kg/cm²,psi)	All	210(2.1, 30)

Wheel Alignment

Items		Front	Rear
Camber		0° ± 0.5°	-0.5° ± 0.5°
Caster		4.8°± 4.75°	-
Toe-in	Total	0° ± 0.2°	0.2° ± 0.2°
	Individual	0° ± 0.1°	0.1° ± 0.1°
King pin angle		9.45°	-
Tread mm(in)		1565(61.61)	1550(61.02)

TIGHTENING TORQUE

FRONT SUSPENSION

Items	Nm	kgf·m	lb-ft
Front strut assembly mounting nut	45 ~ 60	4.5 ~ 6.0	32.5 ~ 43.4
Front strut assembly self-locking nut	20 ~ 25	2.0 ~ 2.5	14.5 ~ 18.1
Front shock absorber to fork nut	60 ~ 80	6 ~ 8	43.4 ~ 57.8
Front lower arm ball joint self-locking nut	75 ~ 90	7.5 ~ 9.0	54.2 ~ 65.1
Front lower arm ball joint mounting bolt	100 ~ 120	10 ~ 12	72.3 ~ 86.8
Front upper arm ball joint self-locking nut	35 ~ 45	3.5 ~ 4.5	25.3 ~ 32.5
Front upper arm mounting bolt	55 ~ 65	5.5 ~ 6.5	39.8 ~ 47.0
Front lower arm bushing(A) mounting bolt	140 ~ 160	14 ~ 16	101.2 ~ 115.7
Front lower arm bushing(G) mounting bolt	140 ~ 160	14 ~ 16	101.2 ~ 115.7
Front lower arm connector nut (to fork)	140 ~ 160	14 ~ 16	101.2 ~ 115.7
Front stabilizer link self-locking nut	100 ~ 120	10~12	72.3 ~ 86.8
Front stabilizer bar bracket mounting bolt(to Subframe)	45 ~ 55	4.5~ 5.5	32.5 ~ 39.8
Wheel nut	90 ~ 110	9 ~ 11	65.1 ~ 79.5

REAR SUSPENSION

Items	Nm	kgf·m	lb-ft
Rear strut assembly self-locking nut	20 ~ 25	2.0 ~ 2.5	14.5 ~ 18.1
Rear strut assembly bracket mounting bolt	50 ~ 65	5.0~ 6.5	36.2 ~ 47.0
Rear shock absorber nut (to rear axle assembly)	140 ~ 160	14 ~ 16	101.2 ~ 115.7
Rear upper arm ball joint nut (to rear axle assembly)	80 ~ 90	8 ~ 9	57.8 ~ 65.1
Rear upper arm self-locking nut (to cross member)	100 ~ 120	10 ~ 12	72.3 ~ 86.8
Rear lower arm mounting bolt (to rear axle assembly)	140 ~ 160	14 ~ 16	101.2 ~ 115.7
Rear lower arm mounting nut (to cross member)	110 ~ 120	11 ~ 12	79.5 ~ 86.8
Assist arm mounting bolt (to rear axle assembly)	140 ~ 160	14 ~ 16	101.2 ~ 115.7
Assist arm mounting nut (to cross member)	110 ~ 120	11 ~ 12	79.5 ~ 86.8
Trailing arm mounting nut (to body)	140 ~ 160	14 ~ 16	101.2 ~ 115.7
Trailing arm self-locking nut (to rear axle assembly)	140 ~ 160	14 ~ 16	101.2 ~ 115.7
Cross member mounting bolt	140~ 160	14 ~ 16	101.2 ~ 115.7
Rear stabilizer bar bracket mounting bolt	45 ~ 55	4.5 ~ 5.5	32.5 ~ 39.8
Rear stabilizer link self-locking nut	35 ~ 45	3.5 ~ 4.5	25.3 ~ 32.5

CAUTION

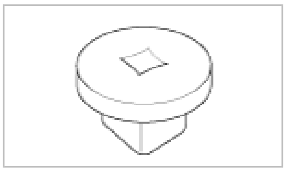
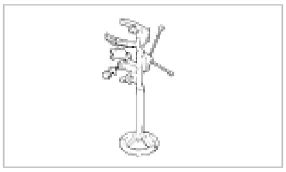
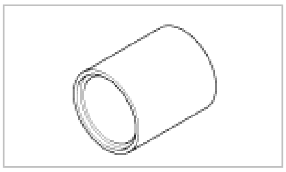
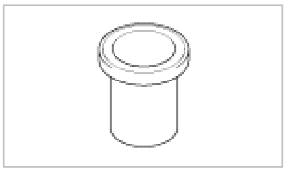
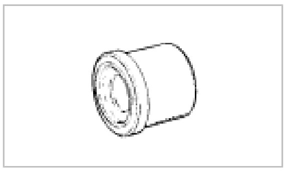
Replace the self-locking nuts with new ones after removal.

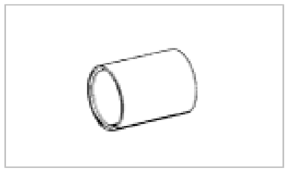
LUBRICANTS

Items	The recommended	Quantity
Front upper arm ball joint	LUBCHEM SB 6042M	As required
Front lower arm ball joint	LUBCHEM SB 6042M	As required
Rear upper arm ball joint	LUBCHEM SB 6042M	As required
Stabilizer link ball joint (Front and Rear)	BJM-2	1.2 ~ 1.7 g

Suspension System > General Information > Special Service Tools

SPECIAL SERVICE TOOLS

Tool (Number and Name)	Illustration	Use
09568-4A000 Ball joint remover		Removal of Ball joint (Front upper arm/lower arm, & Rear upper arm)
09532-11600 Preload socket		Measurement of the front lower arm ball joint starting torque. (Use with torque wrench)
09546-26000 Strut spring compressor		Compression of the coil spring
09214-32000 Mount bushing remover and installer		Removal & installation of lower arm bushing(G) (Use with 09216-21100)
09216-21100 Mount bushing remover and installer		Removal & installation of lower arm bushing(G) (Use with 09216-32000)
09216-21600 Mount bushing remover and installer arbor		Removal and installation of trailing arm bushing (Use with 09552-38100)
09552-38100 Rear trailing arm bushing remover and installer		Removal and installation of the rear trailing arm bushing (Use with 09216-21600)

Suspension System > General Information > Troubleshooting

TROUBLESHOOTING

Vehicle inspection

WHEEL/TIRE/CHECK :

Balance Check **Yes / No**

Maximum Runout Allowed :

Wheel : Radial ________ Lateral ________

Tire : Radial ________ Lateral ________

Measured Runout :

Tire/Wheel Radial : LF ______ LR ______ RF ______ RR ______

Lateral : LF ______ LR ______ RF ______ RR ______

Wheel Only Radial : LF ______ LR ______ RF ______ RR ______

Lateral : LF ______ LR ______ RF ______ RR ______

SUSPENSION INSPECTION :

Can Cause Shimmy ☐ Clunk ☐ Squeak ☐ Harshness ☐

Suspension Bushing : Loose ☐ Worn ☐ Missing ☐ OK ☐

Front stabilizer ☐ Rear stabilizer (sway bar) ☐ Rear trailing arm ☐

Front lower arm ☐ Rear suspension front ☐ Rear suspension rear arm ☐

Other ____________________

Suspension/Components : Loose Worm Missing OK

Ball Joint ☐ Shock absorbers F/R ☐ Springs F/R ☐ The rod ends/sleeve ☐

SYMPTOM CHART

Symptom	Suspect Area	Remedy (See page)
Squeak or grunt-noise from the front suspension, occurs more in cold ambient temperatures-more noticeable over rough roads or when turning	Front stabilizer bar	Under these conditions, the noise is acceptable.
Clunk-noise from the front suspension, occurs in and out of turns	Loose front struts or shocks	Inspect for loose nuts or bolts. Tighten to specifications. See page SS-26.
Clunk-noise from the rear suspension, occurs when shifting from reverse to drive	Loose rear suspension components	Inspect for loose or damaged rear suspension components. Repair or install new components as necessary. See page SS-41.
Click or pop-noise from the front suspension-more noticeable over rough roads or over bumps	Worn or damaged ball joints	Install new lower arm as necessary. See page SS-34.

Click or pop-noise occurs when vehicle is turning	Worn or damaged ball joints	Install new lower arm as necessary. See page SS-34.
Click or snap-occurs when accelerating around a corner	Damaged or worn Birfield joint	Repair or install a new Birfied joint as necessary. See DS group - driveshaft.
Front suspension noise-a squeak, creak or rattle noise-occurs mostly over bumps or rough roads	Steering components Loose or bent front struts or shock absorbers Damaged spring or spring mounts Damaged or worn arm bushings Worn or damaged stabilizer bar bushing or links	Go to detailed test A. See page SS-11.
Groaning or grinding-noise from the front strut, occurs when driving on bumpy roads or turning the vehicle	Uneven seating surface between the insulator and panel by the burrs around the strut insulator mounting bolts and the insulator boltes mounting holes	Repair or install a new parts as necessary. See page SS-29.
Rear suspension noise - a squeak, creak or rattle noise - occurs mostly over bumps or rough roads	Loose or bent rear shock absorbers Damaged spring or spring mounts Damaged or worn control arm bushings	Go to detailed test B. See page SS-12.
Shudder-occurs during acceleration from a slow speed or stop	Rear axle assembly mispositioned Damaged or worn front suspension components	Check the axle mounts and Rear suspension the rear suspension for damage or wear. Repair as necessary. Check for a loose stabilizer bar, damaged or loose strut/strut bushings or loose or worn ball joints. Inspect the steering linkage for wear or damage. Repair or Install new components as necessary.
Shimmy-most noticeable on coast/deceleration-also hard steering condition	Excessive positive caster	Check the caster alignment angle. Correct as necessary. See page SS-57.
Tire noise-hum/moan at constant speeds	Abnormal wear patterns	Spin the tire and Check for tire wear. Install a new tire as necessary. Inspect for damaged/worn suspension components. Carry out wheel alignment. See page SS-56, SS-61.
Tire noise-noise tone lowers as the vehicle speed is lowered	Out-of-balance tire	Balance the tire and road test. Install a new tire as necessary. See page SS-61.
Tire noise - ticking noise, change with speed	Nail puncture or stone in tire tread	Inspect the tire. Repair as necessary. See page SS-61.
Wheel and tire-vibration and noise concern is directly related to vehicle speed and is not affected by acceleration, coasting or decelerating	Damaged or worn tire	Go to detailed test C. See page SS-13.
Tire wobble or shudder - occurs at lower speeds	Damaged wheel bearings	Spin the tire and check for abnormal wheel bearing play or roughness. Adjust or Install new wheel bearings as necessary. See DS group - front/rear axle.
	Damaged wheel	Inspect the wheel for damage. Install a new wheel as necessary. See page SS-61.
	Damaged or worn suspension components	Inspect the suspension components for wear or damage. Repair as necessary.

		See page SS-43.
	Loosen wheel nuts	Check the wheel nuts. Tighten to specification. See page SS-61.
	Damaged or uneven tire wear	Spin the tire and Check for abnormal tire wear or damage. Install a new tire as necessary. See page SS-60.
Tire shimmy or shake - occurs at lower speeds	Wheel/tire out of balance	See page SS-56.
	Uneven tire wear	Check for abnormal tire wear. Install a new tire as necessary. See page SS-60.
	Excessive radial runout of wheel or tire	Carry out a radial runout test of the wheel and tire. Install a new tire as necessary. See page SS-61.
	Worn or damaged wheel studs or elongate stud holes	Inspect the wheel studs and wheels. Install new components as necessary. See page SS-61.
	Excessive lateral runout of the wheel or tire	Carry out a lateral runout test of the wheel and tire. Check the wheel, tire and hub. Repair or Install new components as necessary. See page SS-61.
	Foreign materal between the brake disc and hub.	Clean the mounting surfaces of the brake disc and hub. See DS group - front/rear axle.
High speed shake or shimmy-occurs at high speeds	Excessive wheel hub runout Damaged or worn tires Damaged or worn wheel bearings Worn or damaged suspension or steering linkage Brake disc or drum imbalance	Go to detailed test D. See page SS-16.
Drift left or right	Tires Steering linkage Alignment Base brake system	Go to detailed test E. See page SS-18.
Steering wheel	Alignment Steering linkage Front lower arm ball joint	Go to detailed test F. See page SS-19.
Tracks incorrectly	Rear suspension Caster	Go to detailed test G. See page SS-20.
Rough ride	Front strut and spring assembly Rear shock absor and spring assembly	Go to detailed test H. See page SS-21.
Excessive noise	Front or rear stabilizer bar components Springs Suspension components Shock absorbers	Go to detailed test I. See page SS-21.
Incorrect tire wear	Tire or unbalanced wheels Tire inflation Strut Alignment	Go to detailed test J. See page SS-22.
Vibration	Wheel/tire Front wheel drivshaft(s)	Go to detailed test K. See page SS-23.

	Steering system Strut and spring assembly Spring and strut mounting Front lower arm ball joint Front lower arm mounting bolt bushing Stabilizer bar bushings Wheel hubs and bearing Rear suspension arms and bushings	
Vehicle leans	Tire/wheel Vehicle load Suspension components Incorrect ride height	Inflate tires to specification. See page SS-60. Redistribute the load as necessary. Visually inspect the suspention system. Correct the ride height as necessary.
Poor returnability	High knuckle rotating torque Alignment	Go to detailed test E. See page SS-18.

DETAILED TEST A : FRONT SUSPENSION NOISE

CONDITIONS	DETAILS/RESULTS/ACTIONS
ROAD TEST THE VEHICLE	
	1. Test drive the vehicle. 2. During the road test, drive the vehicle over a rough road. Determine from which area/component the noise is originating. ● Is there a squeak, creak or rattle noise ? → **YES** Go to → **NO** The suspension system is OK. Conduct a diagnosis on other suspect systems.
INSPECT THE STEERING SYSTEM	
	1. Check the steering system for wear or damage. Carry out a steering linkage test. Inspect the tire wear pattern. See page SS-25. ● Are the steering components worn or damaged ? → **YES** Repair the steering system. Install new components as necessary. Test the system for normal operation. → **NO** Go to
FRONT SHOCK ABSORBER/STRUT CHECK	
	1. Check the front shock absorbers/strut mounts for loose bolts or nuts. 2. Check the front shock absorbers/struts for damage. Carry out a shock absorber check. ● Are the front shock absorbers/struts loose or damaged ? → **YES** Tighten to specifications if loose. Install new front shock absorbers/struts if damaged. Test the system for normal operation. → **NO** Go to
CHECK THE FRONT SPRINGS	
	Check the front spring and front spring mounts/brackets for wear or damage ● Are the front springs or spring mounts/brackets worn or damaged ? → **YES** Repair or Install new components as necessary. Test the system for normal

	operation. → **NO** Go to**A5.**
CHECK THE STABILIZER BAR	
	1. Check the stabilizer bar bushing and links for damage or wear. 2. Check the stabilizer bar for damage. 3. Check for loose or damaged stabilizer brackets. ● Are the stabilizer bar/track bar components loose, worn or damaged ? → **YES** Repair or Install new components as necessary. Test the system for normal operation. → **NO** Suspension system is OK. Conduct diagnosis on other suspect systems.

DETAILED TEST B : REAR SUSPENSION NOISE

CONDITIONS	DETAILS/RESULTS/ACTIONS
ROAD TEST THE VEHICLE	
	1. Test drive the vehicle. 2. During the road test, drive the vehicle over a rough road. Determine from which area/component the noise is originating. ● Is there a squeak, creak or rattle noise ? → **YES** Go to → **NO** The suspension system is OK. Conduct a diagnosis on other suspect systems.
REAR SHOCK ABSORBER/STRUT CHECK	
	1. Raise and support the vehicle. See GI group - lift support point. 2. Check the rear shock absorber/strut mounts for loose bolts or nuts. 3. Check the rear shock absorbers/strut for damage. Carry out a shock absorber check. ● Are the rear shock absorbers/struts loose or damaged ? → **YES** Tighten to specifications if loose. Install new rear shock absorbers/struts if damaged. Test the system for normal operation. → **NO** Go to
CHECK THE REAR SPRINGS	
	Check the rear springs and rear spring mounts/brackets for wear or damage. ● Are the rear springs or spring mounts/brackets worn or damaged ? → **YES** Repair or Install new components as necessary. Test the system for normal operation. → **NO** Go to**B4.**
CHECK THE TRAILING ARMS	
	1. Inspect the trailing arm bushings for wear or damage. Check for loose trailing arm bolts. 2. Inspect for twisted or bent trailing arms. ● Are the trailing arms loose, damaged or worn ?

	→ **YES** Repair or Install new components as necessary. Test the system for normal operation. → **NO** Suspension system is OK. Conduct diagnosis on other suspect systems.

DETAILED TEST C : WHEEL AND TIRE

CONDITIONS	DETAILS/RESULTS/ACTIONS
ROAD TEST THE VEHICLE	
	NOTE Wheel or tire vibrations felt in the steering wheel are most likely related to the front wheel or tire. Vibration felt through the seat are most likely related to the rear wheel or tire. This may not always be true, but it can help to isolate the problem to the front or rear of the vehicle. Test drive the vehicle at different speed ranges. During the road test, if the vibration can be eliminated by placing the vehicle in neutral or is affected by the speed of the engine, the cause is not the wheels or tires. ● Is there a vibration and noise ? → **YES** Go to**C2.** → **NO** The wheel and tires are OK. Conduct a diagnosis on other suspect systems.
CHECK THE FRONT WHEEL BEARINGS	
	Check the front wheel bearings. Refer to Wheel Bearing Check (See DS group - front axle). ● Are the wheel bearings OK ? → **YES** Go to**C3.** → **NO** Inspect the wheel bearings. Adjust or Repair as necessary. Test the system for normal operation.
INSPECT THE TIRES	
	1. Check the tires for missing weights. 2. Check the wheels for damage. 3. Inspect the tire wear pattern. See page SS-25. ● Do the tires have an abnormal wear pattern ? → **YES** Correct the condition that caused the abnormal wear. Install new tire(s). Test the system for normal operation. → **NO** Go to
TIRE ROTATION DIAGNOSIS	
	1. Spin the tires slowly and watch for signs of lateral runout. 2. Spin the tires slowly and watch for signs of radial runout.. ● Are there signs of visual runout ? → **YES** Go to

	→ **NO** Check the wheel and tire balance. Correct as necessary. Test the system for normal operation.
RADIAL RUNOUT CHECK ON THE TIRE	
	Measure the radial runout of the wheel and tire assembly. A typical specification for total radial runout is 1.15mm (0.059 inch). ● Is the radial runout within specifications ? → **YES** Go to**C8.** → **NO** Go to**C6.**
RADIAL RUNOUT CHECK ON THE WHEEL	
	Measure the radial runout of the wheel. A typical specification for total radial runout is 1.14mm (0.045 inch.). ● Is the radial runout within specifications ? → **YES** Install a new tire. Test the system for normal operation. → **NO** Go to**C7.**
CHECK THE HUB/BRAKE DISC OR DRUM PILOT RUNOUT OR BOLT CIRCLE RUNOUT	
	Measure the pilot or bolt circle runout. A typical specification for radial runout is : ● pilot runout - less than 0.15mm (0.006 inch.) ● bolt circle runout - less than 0.38 mm (0.015 inch.) ● Is the radial runout within specification ? → **YES** Install a new wheel. Test the system for normal operation. → **NO** Repair or Install new components as necessary. See page SS-28 for the front suspension or SS-43 for the rear suspension.
LATERAL RUNOUT CHECK ON THE TIRE	
	Measure the lateral runout of the wheel and tire assembly. A typical specification for total lateral runout is 2.5mm (0.098 inch). ● Is the lateral runout within specifications ? → **YES** Wheel and tires are OK. Conduct diagnosis on other suspect systems. → **NO** Go to**C9.**
LATERAL RUNOUT CHECK ON THE WHEEL	
	Measure the lateral runout of the wheel. A typical specification for total radial runout is 1.2mm (0.047 inch.) ● Is the lateral runout within specifications ? → **YES**

	Install a new tire. Test the system for normal operation. → **NO** Go to**C10.**
CHECK THE FLANGE FACE LATERAL RUNOUT	
	Measure the flange face lateral runout. A typical specification for lateral runout is : ● hub/brake disc - less than 0.13mm (0.005 inch) ● Is the lateral runout within specifications ? → **YES** Install a new wheel. Test the system for normal operation. → **NO** Repair or Install new components as necessary. See page SS-27 for the front suspension or SS-44 for the rear suspension.

DETAILED TEST D :

CONDITIONS	DETAILS/RESULTS/ACTIONS
CHECK FOR FRONT WHEEL BEARING ROUGHNESS	
	1. Raise and support the front end of the vehicle so that the front wheel and tire assemblies can spin. See GI group - lift support point. 2. Spin the front tires by hand. ● Do the wheel bearings feel rough ? → **YES** Inspect the wheel bearings. Repair as necessary. Test the system for normal operation. → **NO** Go to
CHECK THE END PLAY OF THE FRONT WHEEL BEARINGS	
	Check the end play of the front wheel bearings. ● Is the end play OK ? → **YES** Go to**D3.** → **NO** Adjust or Repair as necessary. Test the system for normal operation.
MEASURE THE LATERAL RUNOUT AND THE RADIAL RUNOUT OF THE FRONT WHEELS ON THE VEHICLE	
	Measure the lateral runout and the radial runout of the front wheels on the vehicle. Go to detailed test C. ● Are the measurements within specifications ? → **YES** Go to**D4.** → **NO** Install new wheels as necessary and Balance the assembly. Test the system for normal operation.
MEASURE THE LATERAL RUNOUT OF THE FRONT TIRES ON THE VEHICLE	
	Measure the lateral runout of the front tires on the vehicle. Go to detailed test

	C. ● Is the runout within specifications ? → **YES** Go to**D5.** → **NO** Install new tires as necessary and Balance the assembly. Test the system for normal operation.
MEASURE THE RADIAL RUNOUT OF THE FRONT TIRES ON THE VEHICLE	
	Measure the radial runout of the front tires on the vehicle. Go to detailed test C. ● Is the runout within specifications ? → **YES** Balance the front wheel and tire assemblies. If any tire cannot be balanced, Install a new tire. Test the system for normal operation. → **NO** Go to**D6.**
MATCH MOUNT THE TIRE AND WHEEL ASSEMBLY	
	Mark the high runout location on the tire and also on the wheel. Break the assembly down and rotate the tire 180 degrees (halfway around) on the wheel. Inflate the tire and measure the radial runout. ● Is the runout within specifications ? → **YES** Balance the assembly. Test the system for normal operation. → **NO** If the high spot is not within 101.6mm (4 inches) of the first high spot on the tire, Go to**D7.**
MEASURE THE WHEEL FLANGE RUNOUT	
	Dismount the tire and mount the wheel on a wheel balancer. Measure the runout on both wheel flanges. Go to detailed test C ● Is the runout within specifications ? → **YES** Locate and Mark the low spot on the wheel. Install the tire, matching the high spot on the tire with the low spot on the wheel. Balance the assembly. Test the system for normal operation. If the condition persists, Go to**D8.** → **NO** Install a new wheel. Check the runout on the new wheel. If the new wheel is within limits, locate and Mark the low spot. Install the tire, matching the high spot on the tire with the low spot on the wheel. Balance the assembly. Test the system for normal operation. If the condition persists, Go to**D8.**
CHECK FOR VIBRATION FROM THE FRONT OF THE VEHICLE	
	Spin the front wheel and tire assemblies with a wheel balancer while the vehicle is raised on a hoist. Feel for vibration in the front fender or while seated in the vehicle. ● Is the vibration persent ?

	→ **YES** Substitute known good wheel and tire assemblies as necessary. Test the system for normal operation. → **NO** Check the driveline components. Test the system for normal operation.

DETAILED TEST E : DRIFT LEFT OR RIGHT

CONDITIONS	DETAILS/RESULTS/ACTIONS
CHECK THE TIRES	
	Inspect the tires for excessive wear or damage. ● Are the tires excessively worn or damaged ? → **YES** Install new tires. → **NO** Go to**E2.**
CHECK THE STEERING LINKAGE	
	1. Raise and support the vehicle. 2. Check the steering components for indications of excessive wear or damage. See ST group - specification. ● Is there an indication of excessive wear or damage ? → **YES** Repair or Install new components as necessary. → **NO** Go to
CHECK THE VEHICLE ALIGNMENT	
	1. Place the vehicle on an alignment rack. Check the vehicle alignmnt. ● Is the alignment within specification ? → **YES** Go to → **NO** Adjust the alignment as necessary. See page SS-56 (wheel alignment).
BRAKE DRAG DIAGNOSIS	
	Apply the brakes while driving. ● Does drift or pull occur when the brakes are applied ? → **YES** See BR group - specification. → **NO** If the steering wheel is in the center, the vehicle is OK. If the steering wheel is off-center, Go to Detailed Test**F.**

DETAILED TEST F : STEERING WHEEL OFF-CENTER

CONDITIONS	DETAILS/RESULTS/ACTIONS
CHECK THE CLEAR VISION	
	Place the vehicle on an alignment rack.

	● Is the clear vision within specification ? → **YES** Go to**F2.** → **NO** Adjust the clear vision to specification.
INSPECT THE STEERING COMPONENTS	
	1. Raise and support the vehicle. 2. Inspect the steering components for excessive wear or damage. See ST group - specification. ● Are the steering components excessively worn or damaged ? → **YES** Repair or Install new components as necessary. → **NO** If it tracks corectly, vehicle is OK. If it tracks incorrectly, Go to Detailed Test

DETAILED TEST G : TRACKS INCORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
CHECK THE CASTER	
	Place the vehicle on an alignment rack. ● Is the caster within specification ? → **YES** Go to**G2.** →**NO** Replace bent or damaged parts.
CHECK THE REAR SUSPENSION	
	1. Measure the vehicle wheel base for LH and RH. 2. Compare the measurements. ● Are the measurements the same ? → **YES** If the ride is smooth, vehicle is OK. If the ride is rough, Go to Detailed Test → **NO** Inspect the rear suspension components for wear or damage. Repair or Install new components as necessary. See page SS-41 (rear suspension).

DETAILED TEST H : ROUGH RIDE

CONDITIONS	DETAILS/RESULTS/ACTIONS
CHECK THE FRONT SHOCK ABSORBER	
	1. Raise support the vehicle. 2. Inspect the front shock absorber for oil leaks or damage. ● Are the tires excessively worn or damaged ? → **YES** Install new front shock absorbers. See page SS-29 (front strut assembly). → **NO** Go to
CHECK THE REAR SHOCK ABSORBERS	

	Inspect the rear shock absorbers for oil leaks or damage. ● Are the rear shock absorbers leaking ? → **YES** Install new rear shock absorbers. See page SS-43 (rear strut assembly). → **NO** The vehicle is OK. Go to**TROUBLESHOOTING.**

DETAILED TEST I : EXCESSIVE NOISE

CONDITIONS	DETAILS/RESULTS/ACTIONS
INSPECT THE SUSPENSION	
	1. Raise and support the vehicle. 2. Inspect the shock absorber mounting bolts. ● Are the mounting bolts loose or broken ? → **YES** Tighten or Install new shock absorber mounting bolts. See page SS-29 and SS-43 (front/rear suspension) → **NO** Go to
INSPECT THE SPRING AND TORSION BARS	
	Inspect the springs and stabilizer bars for damage. ● Are the spring or stabilizer bars damaged ? → **YES** Install new spring and/or stabilizer bars. See page SS-48 and SS-55 (front/rear stabilizer bars). → **NO** Go to**I3.**
INSPECT THE FRONT SUSPENSION	
	Inspect the front suspension components for excessive wear or damage. ● Are the front suspension components worn or damaged ? → **YES** Install new front suspension components. See page SS-26 (front suspension). → **NO** The vehicle is OK. Go to**TROUBLESHOOTING.**

DETAILED TEST J : INCORRECT TIRE WEAR

CONDITIONS	DETAILS/RESULTS/ACTIONS
INSPECT THE TIRES	
	1. Raise and support the vehicle. 2. Inspect the tires for uneven wear on the inner or outer shoulder. ● Is there uneven tire wear ? → **YES** Align the vehicle. Install new tires if badly worn. → **NO** Go to

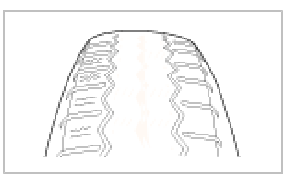
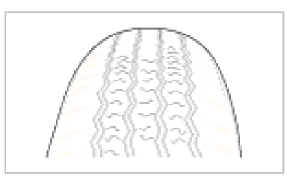
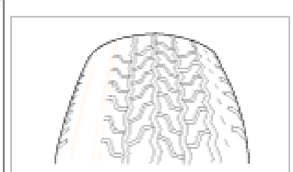
UNEVEN TIRE WEAR	
	Inspect the tires for a feathering pattern. ● Do the tires have a feathering pattern ? → **YES** Align the vehicle. Install new tires if badly worn. → **NO** Go to**J3.**
CHECK FOR CUPPED TIRE	
	Inspect the tires for cupping or dishing. ● Are the tires cupped or dished ? → **YES** Balance and Rotate the tires. → **NO** The vehicle is OK. Go to**TROUBLESHOOTING.**

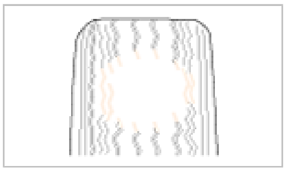
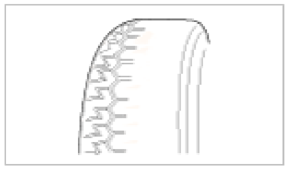
DETAILED TEST K : VIBRATION

CONDITIONS	DETAILS/RESULTS/ACTIONS
ROAD TEST	
	Accelerate the vehicle to the speed at which the customer indicated the vibration occured. ● Is the vibration present ? → **YES** Go to**K2.** → **NO** The vehicle is OK. Go to**TROUBLESHOOTING.**
INSPECT THE TIRES	
	1. Raise and support the vehicle with a frame contact hoist. 2. Inspect the tires for extreme wear or damage, cupping, or flat spots. ● Are the tires OK ? → **YES** Go to → **NO** Check the suspension components for misalignment, abnormal wear, or damage that may have contributed to the tire wear. Correct the suspension concerns and Install new tires.
INSPECT THE WHEEL BEARINGS	
	Spin the tires by hand to check for wheel bearing rougness. ● Is the front wheel bearing OK ? → **YES** Go to**K4.** → **NO** Install new front wheel bearings as necessary. See Ds group - front axle.
TIRE/WHEEL BALANCE	

	Check the tire/wheel balance. ● Are the tires balanced ? → **YES** Go to**K5.** → **NO** Balance the tires and wheels as necessary.
MEASURE THE RUNOUTS	
	For each wheel position measure, locate and mark the following items. See page SS-61 (wheel/tire). - High point of the tire/wheel assembly total radial runout - High point of the wheel radial runout - High point of the wheel lateral runout ● Are the runouts as specified ? → **YES** Go to**K7.** → **NO** Go to**K6.**
SUBSTITUTE THE WHEELS AND TIRE	
	1. Substitute a known good set of wheels and tires. 2. Carry out a road test. 3. If the vehicle still exhibits a shake or vibration, note the vehicle speed and/or engine rpm which it occurs. ● Is the vibration felt ? → **YES** Engine/transmission imbalance. See the specification of TR group, EM group, FL group and EC group. → **NO** Install the original tire/wheel assemblies one by one, Road testing at each step until the damaged tire(s)/wheel(s) as necessary. Test the system for normal operation.

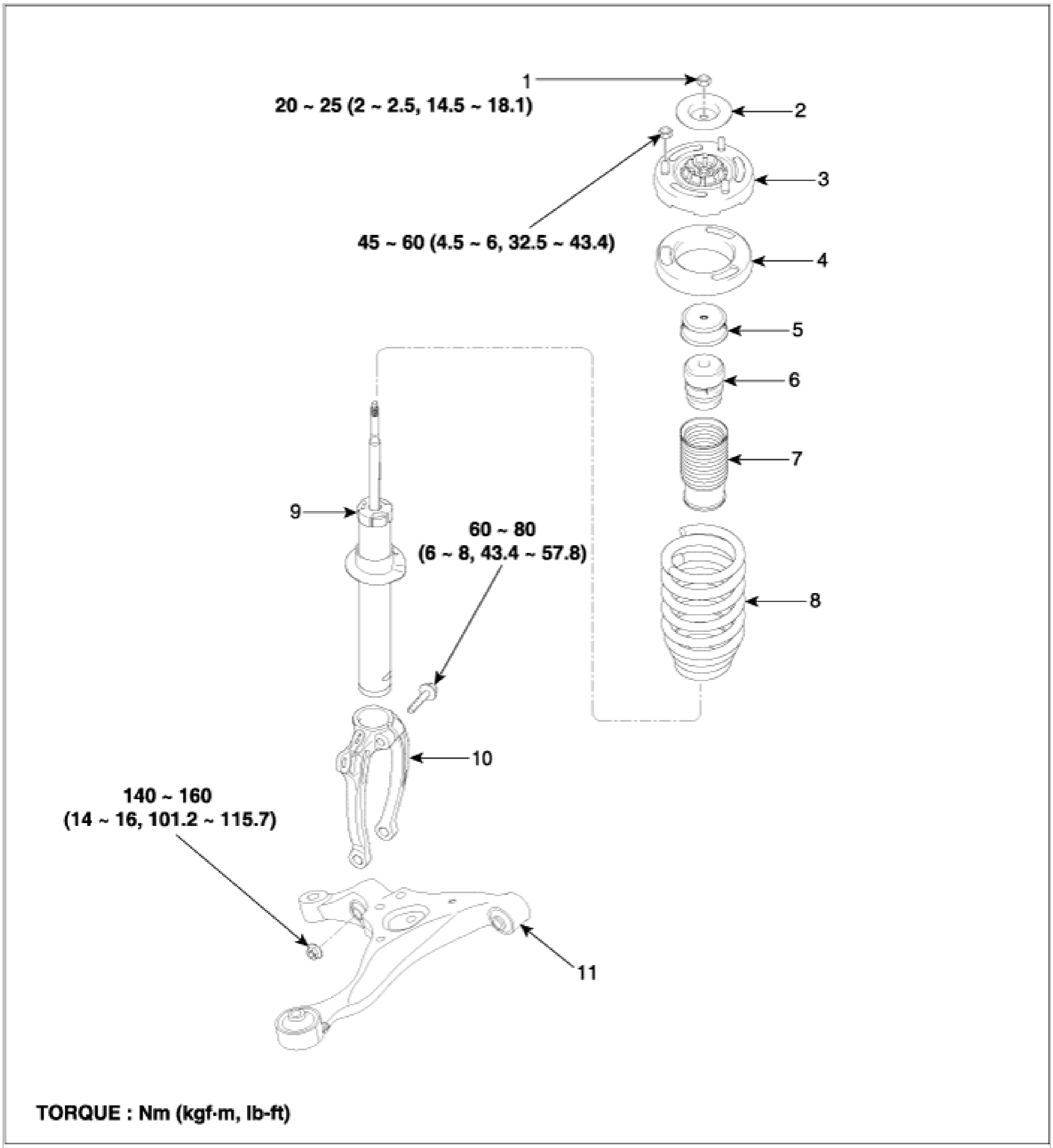
Wheel /tire noise, vibration and harshness concerns are directly related to vehicle speed and are not generally affected by acceleration, coasting or decelerating. Also, out-of-balance wheel and tires can vibrate at more than one speed. A vibration that is affected by the engine rpm, or is eliminated by placing the transmission in Neutral is not related to the tire and wheel. As a general rule, tire and wheel vibrations felt in the steering wheel are related to the front tire and wheel assemblies. Vibrations felt in the seat or floor are related to the rear tire and wheel assemblies. This can initially isolate a concern to the front or rear.
Careful attention must be paid to the tire and wheels. There are several symptoms that can be caused by damaged or worn tire and wheels. Carry out a careful visual inspection of the tires and wheel assemblies. Spin the tires slowly and watch for signs of lateral or radial runout. Refer to the tire wear chart to determine the tire wear conditions and actions

WHEEL AND TIRE DIAGNOSIS		
Rapid wear at the center	Rapid wear at both shoulders	Wear at one shoulder
		
• Center-tread down to fabric due to excessive over inflated tires • Lack of rotation	• Under-inflated tires • Worn suspension components • Excessive cornering speeds	• Toe adjustment out of specification • Camber out of specification • Damaged strut

• Excessive toe on drive wheels • Heavy acceleration on drive	• Lack of rotation	• Damaged lower arm
Partial wear	Feathered edge	Wear pattern
		
• Caused by irregular burrs on brake drums	• Toe adjustment out of specification • Damaged or worn tie rods • Damaged knuckle	• Excessive toe on non-drive wheels • Lack of rotation

Suspension System > Front Suspension System > Front Strut Assembly > Components and Components Location

COMPONENTS



1. Self-locking nut	4. Upper pad	7. Dust cover	10. Fork
2. Plate	5. Cup assembly	8. Spring	11. Front lower arm
3. Bracket	6. Urethane bumper	9. Shock absober	

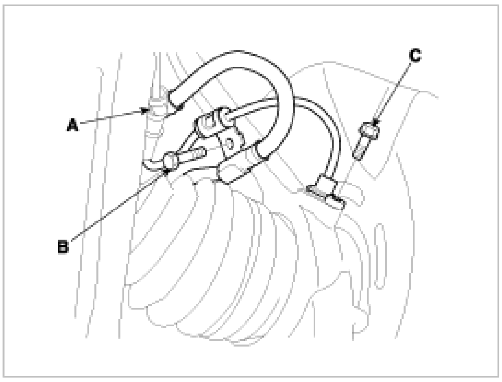
Suspension System > Front Suspension System > Front Strut Assembly > Repair procedures

REMOVAL

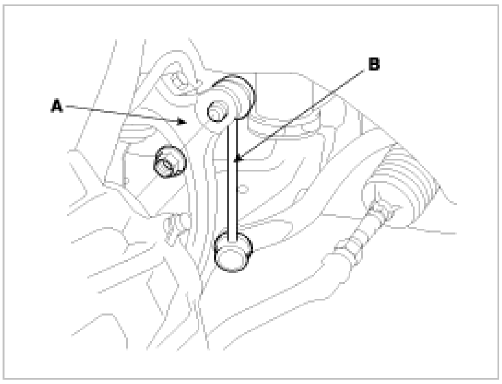
1. Loosen the wheel nuts slightly.
   Raise the front of the vehicle, and make sure it is securely supported.
2. Remove the front wheel and tire from front hub.

> **CAUTION**
>
> Be careful not to damage the hub bolts when removing the front wheel and tire.

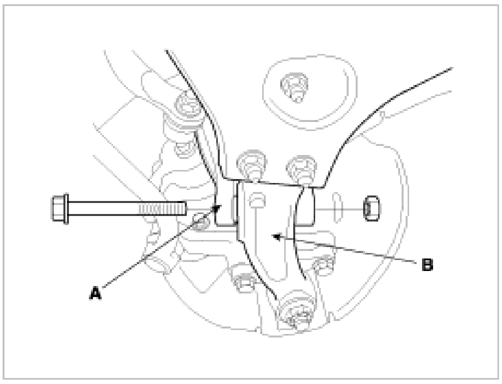
3. Remove the brake hose bracket(A) and speed sensor cable mounting bolt(B) from the front axle assembly.



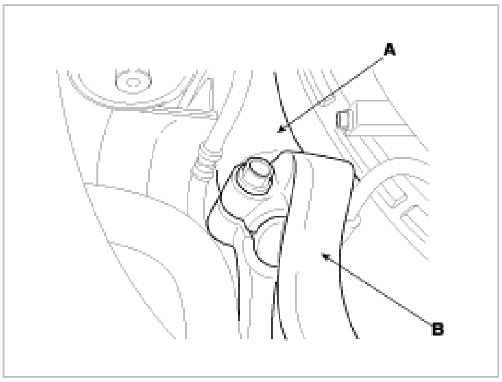
4. Remove the speed sensor bolt(C).
5. Remove the front stabilizer link(B) from the fork(A).



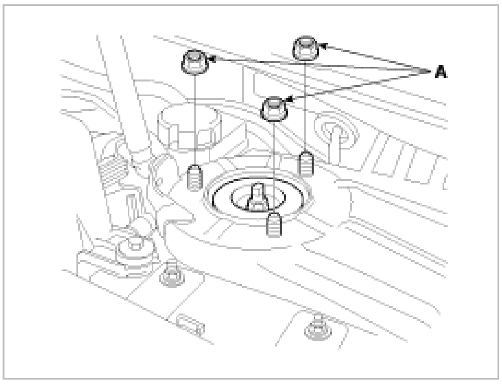
6. Remove the fork(A) from the front lower arm connector(B).



7. Remove the front strut assembly(A) from the fork(B).



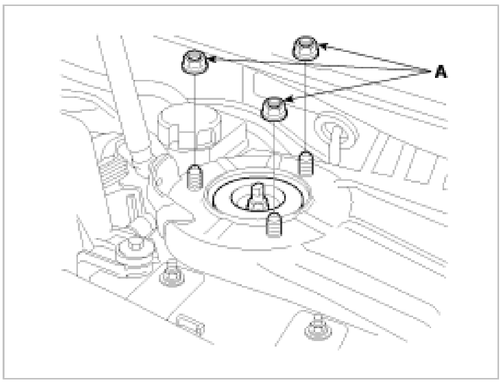
8. Remove the strut upper mounting nuts(A).



INSTALLATION

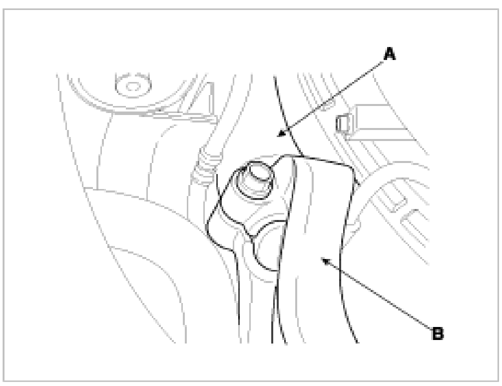
1. Install the strut assembly(B) and then install the strut lower mounting bolts(A).

Tightening torque Nm (kgf·m, lb-ft) :
45 ~ 60 (4.5 ~ 6.0, 32.5 ~ 43.4)



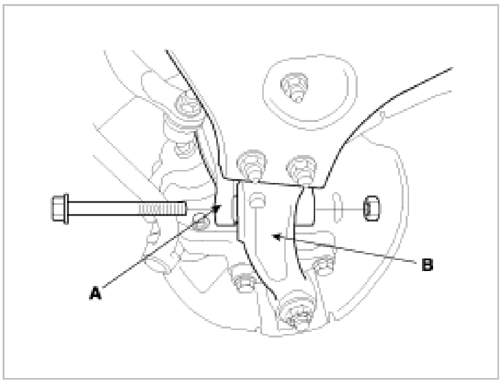
2. Install the fork(B) to the strut assembly(A) with the I.D. mark facing outward.

Tightening torque Nm (kgf·m, lb-ft) :
60 ~ 80 (6.0 ~ 8.0, 43.4 ~ 57.8)



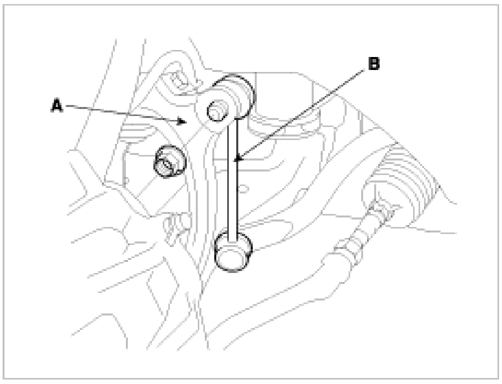
3. Install the fork(A) to the front lower arm connector(B).

Tightening torque Nm (kgf·m, lb-ft) :
140 ~ 160 (14~16, 101.2~115.7)

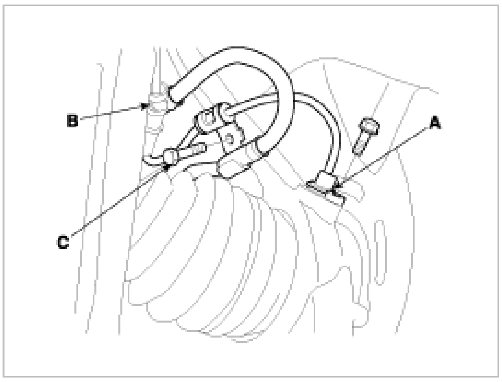


4. Install the front stabilizer link(B) to the fork(A).

Tightening torque Nm (kgf·m, lb-ft) :
100 ~ 120 (10 ~ 12, 72.3 ~ 86.8)



5. Install the speed sensor bolt(A).



6. Install the brake hose bracket(B) to the fork and speed sensor cable mounting bolt(C) to the axle assembly.
7. Install the wheel and the tire to the front hub.

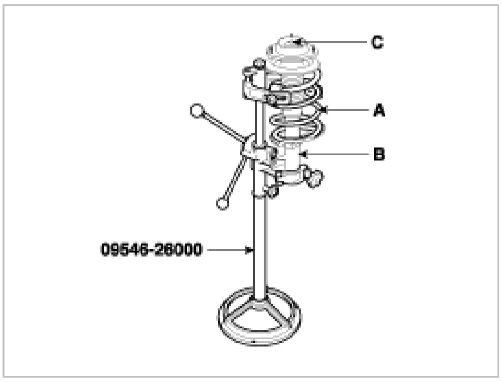
Tightening torque Nm (kgf·m, lb-ft) :
90 ~ 110 (9 ~ 11, 65.1 ~ 79.5)

CAUTION

Be careful not to damage the hub bolts when installing the front wheel and tire.

DISASSEMBLY

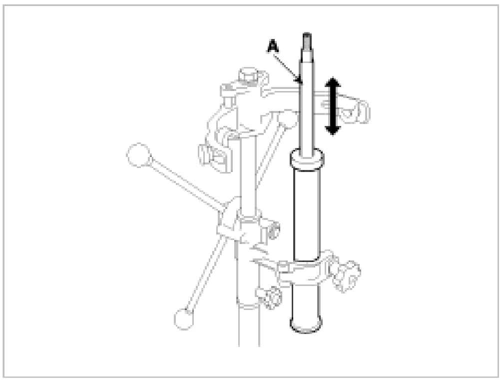
1. Using the special tool (09546-26000), compress the coil spring(A).



2. Remove the self-locking nut(C) from the strut assembly(B).
3. Remove the insulator, spring seat, coil spring and dust cover from the strut assembly.

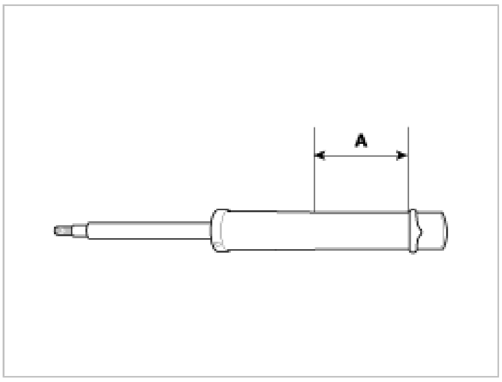
INSPECTION

1. Check the strut insulator for wear or damage.
2. Check rubber parts for damage or deterioration.
3. Compress and extend the piston rod(A) and check that there is no abnormal resistance or unusual sound during operation.



DISPOSAL

1. Fully extend the piston rod.
2. Drill a hole on the A section to remove gas from the cylinder.



> **CAUTION**
>
> The gas coming out is harmless, but be careful of chips that may fly when drilling.

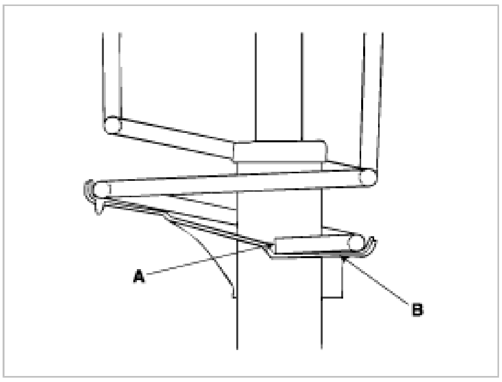
REASSEMBLY

1. Compress coil spring using special tool (09546- 26000).
   Install compressed coil spring onto shock absorber.

NOTE

1) There are two clolor marks on the coil spring. One corresponds to model option (see page SS-2), and the other corresponds to load classification. Ensure that the correct parts are being installed.
2) Install the coil spring with the identification mark directed toward the knuckle.

2. After fully extending the piston rod, install the spring upper seat and insulator assembly.
3. After seating the upper and lower ends of the coil spring(A) in the upper and lower spring seat grooves(B) correctly, tighten new self-locking nut temporarily.



4. Remove the special tool(09546-26000).
5. Tighten the self-locking nut to the specified torque.

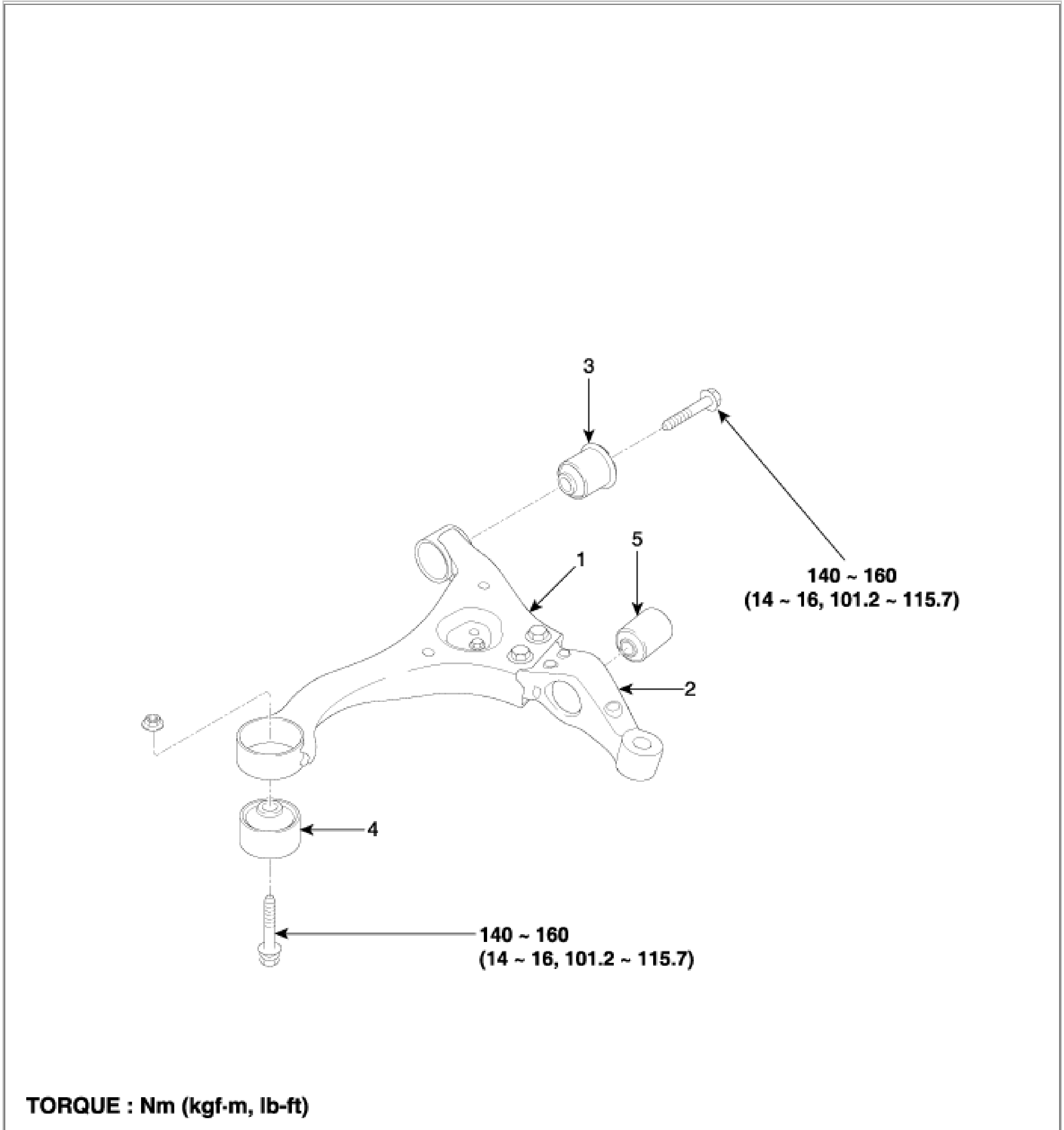
Tightening torque Nm (kgf·m, lb-ft) :
20 ~ 25 (2.0 ~ 2.5, 14.5 ~ 18.1)

CAUTION

Do not reuse the self-locking nut.

Suspension System > Front Suspension System > Front Lower Arm > Components and Components Location

COMPONENTS



1. Front lower arm	4. Bushing (G)
2. Connector	5. Bushing
3. Bushing (A)	

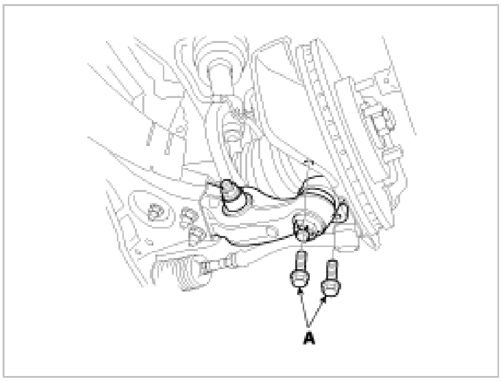
Suspension System > Front Suspension System > Front Lower Arm > Repair procedures

REMOVAL

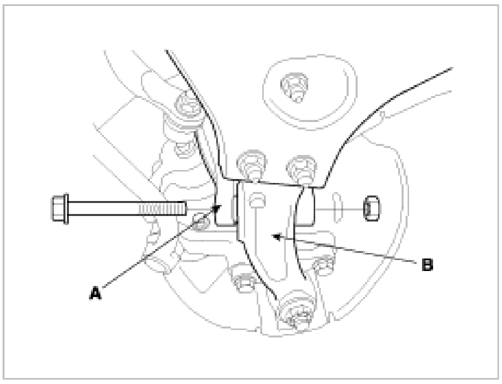
1. Loosen the wheel nuts slightly.
   Raise the front of the vehicle, and make sure it is securely supported.
2. Remove the front wheel and tire from front hub.

> CAUTION
>
> Be careful not to damage the hub bolts when removing the front wheel and tire.

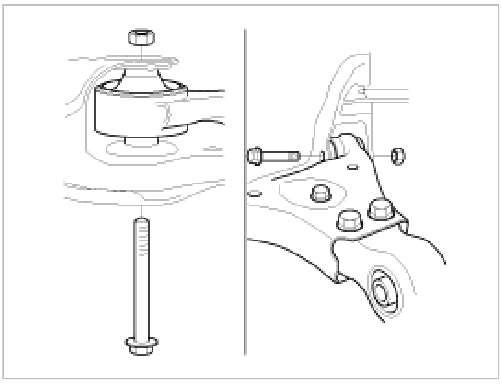
3. Remove the lower arm ball joint mounting bolts(A).



4. Remove the front lower arm connector(B) from the fork(A).

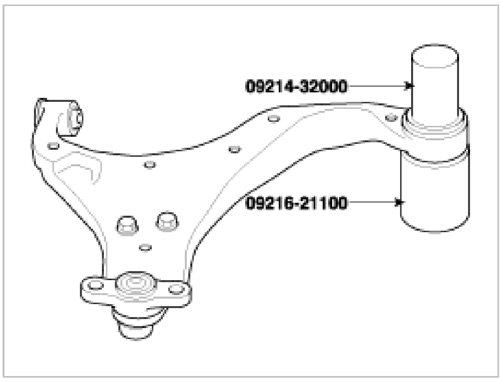


5. Remove the lower arm mounting bolts.

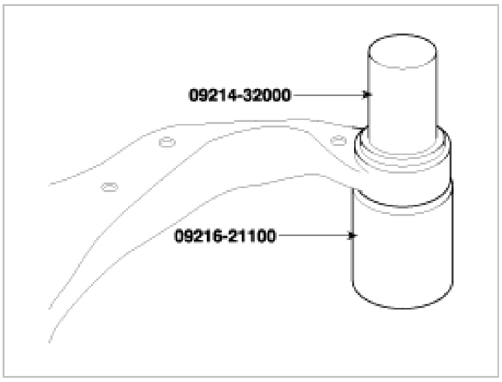


REPLACEMENT

1. Using the special tools(09214-32000 & 09216- 211000), remove the bushing from the lower arm.



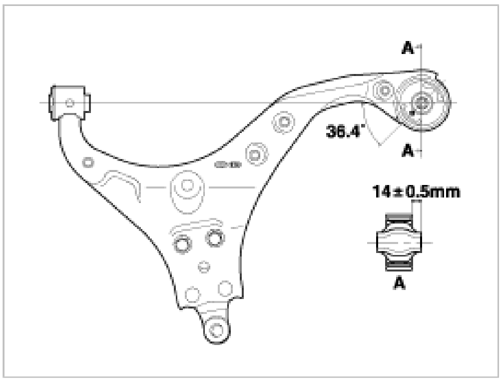
2. Apply soap solution to the following parts.
   A. Outer surface of the bushing.
   B. Inner surface of the lower bushing mounting part.
3. Using the special tools(09214-32000 & 09216-21100), install the busing on the lower arm.



CAUTION

Insert bushing in the direction shown in the illustration.

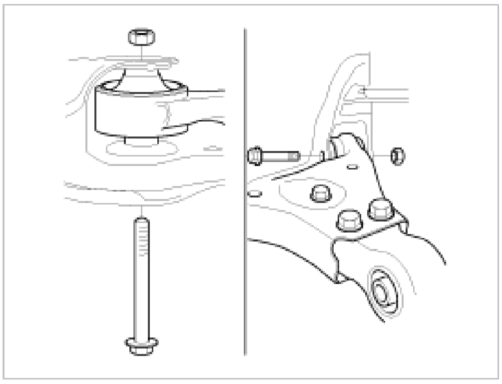
Separation force is over 800 Nm (800Kgf, 1763 lbf)



INSTALLATION

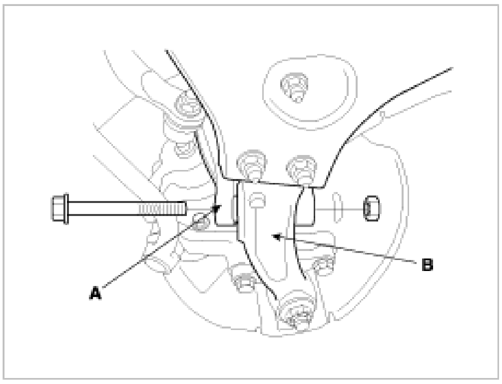
1. Install the lower arm mounting bolts.

Tightening torque Nm (kgf·m, lb-ft) :
Bushing(A) ; 140 ~ 160 (14 ~ 16, 101.2 ~ 115.7)
Bushing(G) ; 140 ~ 160 (14 ~ 16, 101.2 ~ 115.7)



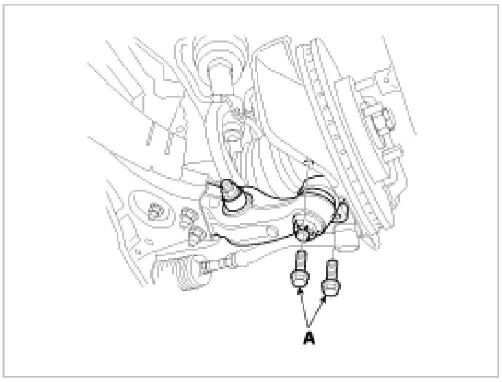
2. Install the lower arm connector(B) to the fork(A).

Tightening torque Nm (kgf·m, lb-ft) :
140~160 (14~16, 101.2~115.7)



3. Install the lower arm ball joint mounting bolts(A).

Tightening torque Nm (kgf·m, lb-ft) :
100 ~ 120 (10 ~ 12, 72.3 ~ 86.8)



4. Install the wheel and the tire to the front hub.

Tightening torque Nm (kgf·m, lb-ft) :
90 ~ 110 (9 ~ 11, 65.1 ~ 79.5)

CAUTION

Be careful not to damage the hub bolts when installing the front wheel and tire.

INSPECTION

1. Check the bushing for wear and deterioration.
2. Check the lower arm for bending or breakage.
3. Check the ball joint dust cover for cracks.
4. Check all bolts.
5. Check the lower arm ball joint for rotating torque.
   (1) If a crack is noted in the dust cover, replace the ball joint assembly.
   (2) Shake the ball joint stud several times.
   (3) Measure the ball joint rotating torque.

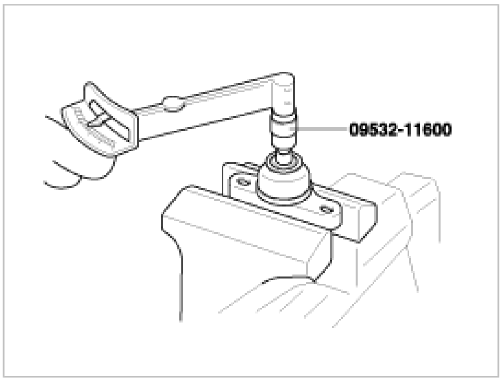
Standard value :
0.4 ~ 2 Nm (4 ~ 20 kgf·cm, 0.29 ~ 1.45 lb-ft)

NOTE

Measure torque using the special tool(09532-11600) and torque wrench at the range of 0.5 - 2 rpm after moving the ball joint stud at degree 3° several times at room temperature.

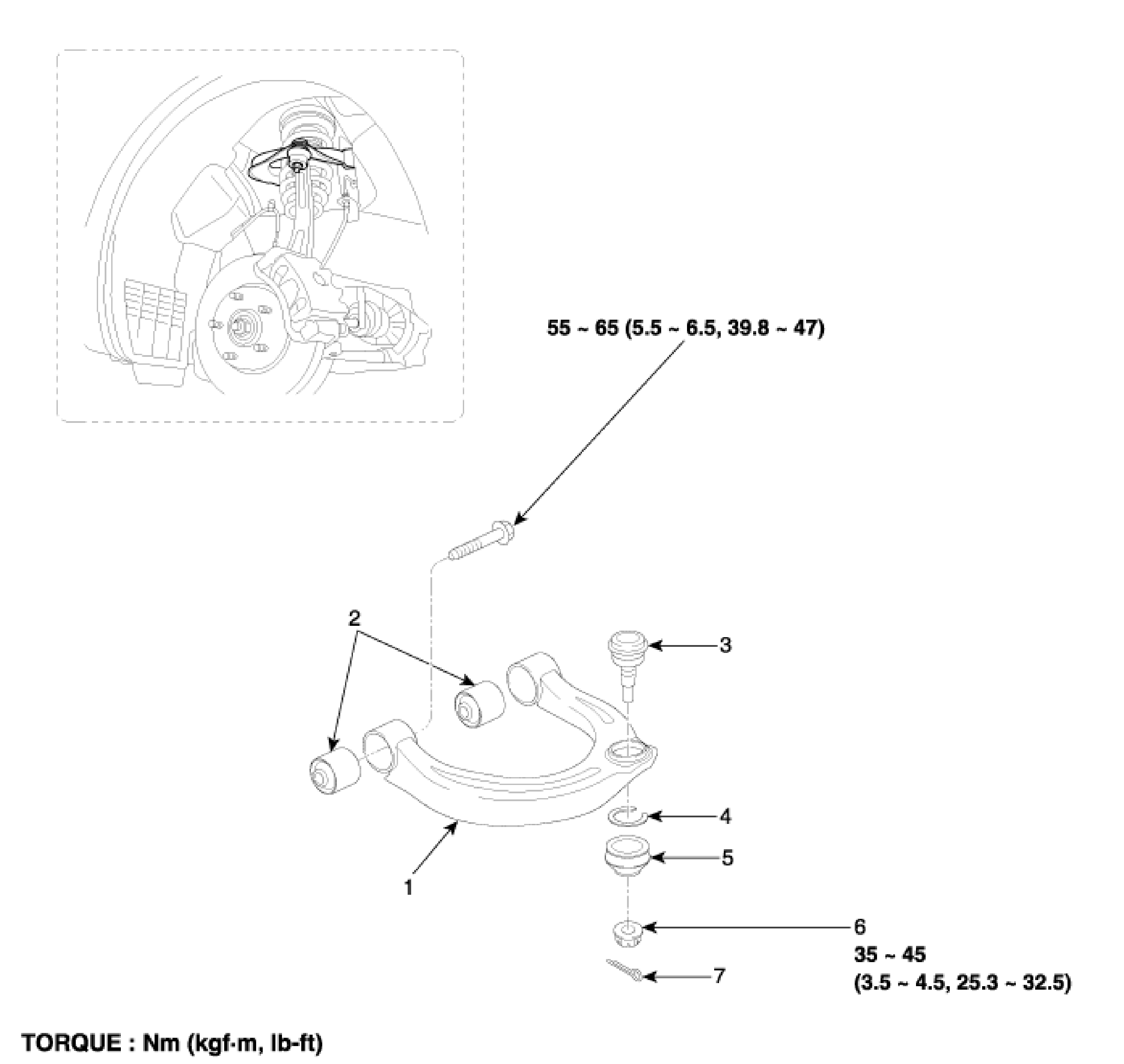
(4) If the rotating torque is below the lower limit of standard value, replace the ball joint assembly.

(5) Even if the rotating toque is below the lower limit of the standard value, the ball joint may be reused unless it has drag and excessive play.



Suspension System > Front Suspension System > Front Upper Arm > Components and Components Location

COMPONENTS



1. Front upper arm
2. Bushing
3. Ball joint
4. Snap ring
5. Boot
6. Self-locking nut
7. Split pin

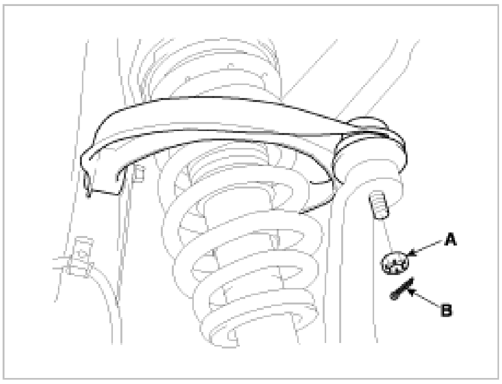
Suspension System > Front Suspension System > Front Upper Arm > Repair procedures

REMOVAL

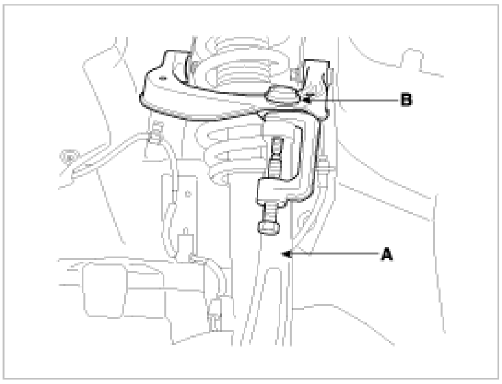
1. Loosen the wheel nuts slightly.
   Raise the front of the vehicle, and make sure it is securely supported.
2. Remove the front wheel and tire from front hub.

> CAUTION
>
> Be careful not to damage the hub bolts when removing the front wheel and tire.

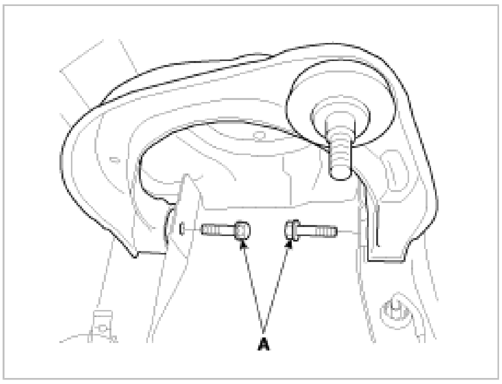
3. Remove the upper arm ball joint self-locking nut(A) and the split pin(B).



4. Using the special tools(09568-4A000), disconnect the upper arm ball joint from the knuckle.



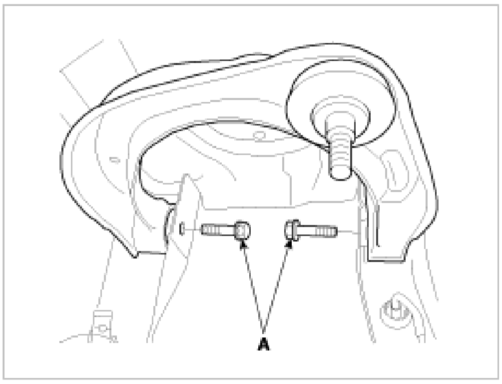
5. Remove the front strut assembly (Refer to SS-10).
6. Remove the two upper arm mounting bolts(A) from the body.



INSTALLATION

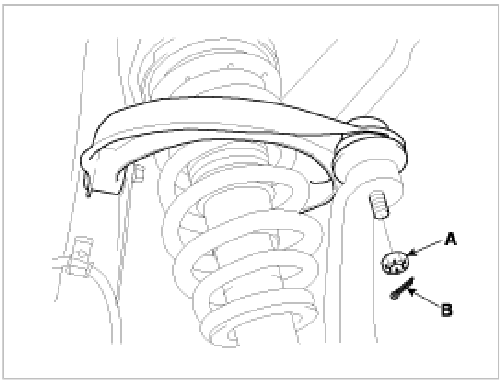
1. Install the two upper arm mounting bolts(A) to the body.

Tightening torque Nm (kgf·m, lb-ft) :
55 ~ 65 (5.5 ~ 6.5, 39.8 ~ 47.0)



2. Install the front strut assembly (Refer to SS-12).
3. Install the upper arm ball joint self-locking nut(A) and the split pin(B).

Tightening torque Nm (kgf·m, lb-ft) :
35 ~ 45 (3.5 ~ 4.5, 25.3 ~ 32.5)



4. Install the wheel and the tire to the front hub.

Tightening torque Nm (kgf·m, lb-ft) :
90 ~ 110 (9 ~ 11, 65.1 ~ 79.5)

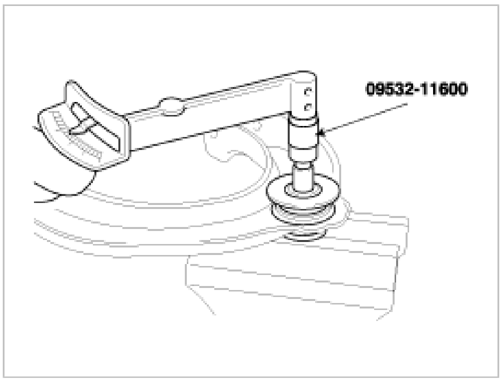
CAUTION

Be careful not to damage the hub bolts when installing the front wheel and tire.

INSPECTION

1. Check the bushing for wear and deterioration.
2. Check the upper arm for bending or breakage.
3. Check the ball joint for rotating torque.
   (1) If there is a crack in the dust cover, replace it and add grease.
   (2) Shake the stabilizer link ball joint stud several times.
   (3) Mount the self-locking nut on the ball joint, and then measure the ball joint rotating torque.

Standard value :
0.5 ~ 1.5 Nm (5 ~ 15 kgf·cm, 0.36 ~ 1.09 lb-ft)

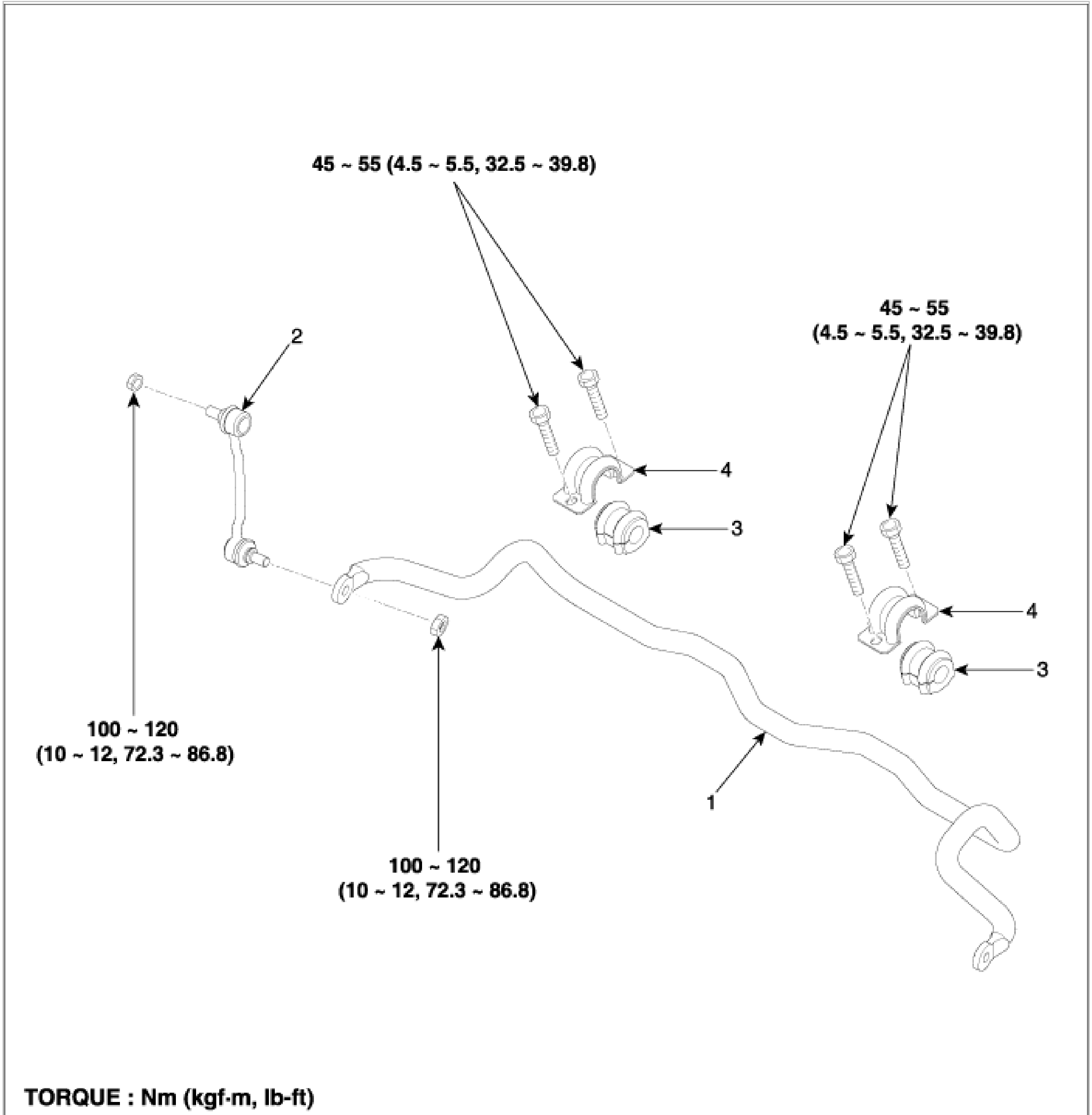


   (4) If the rotating torque exceeds the upper limit of standard value, replace the upper arm assembly.
   (5) Even if the rotating toque is below the lower limit of the standard value, the ball joint may be reused unless it has drag and excessive play.

Suspension System > Front Suspension System > Front Stabilizer Bar > Components and

Components Location

COMPONENTS



1. Front stabilizer bar	3. Bushing
2. Stabilizer link	4. Bracket

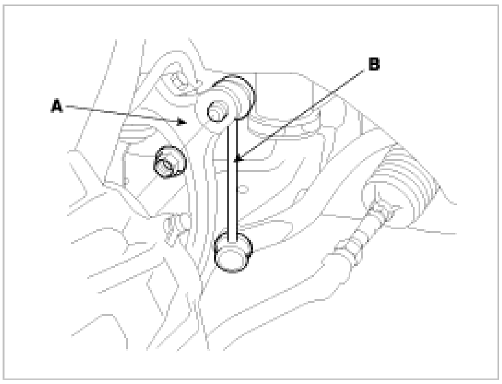
Suspension System > Front Suspension System > Front Stabilizer Bar > Repair procedures

REMOVAL

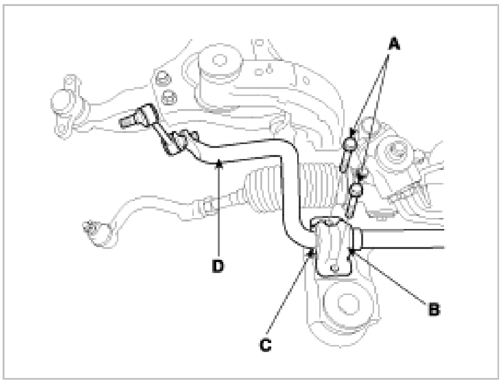
1. Loosen the wheel nuts slightly.
   Raise the front of the vehicle, and make sure it is securely supported.
2. Remove the front wheel and tire from front hub.

> CAUTION
>
> Be careful not to damage the hub bolts when removing the front wheel and tire.

3. Remove the stabilizer link(B) from the fork(A).



4. Remove the two mounting bolts of the rear side of the subframe, supporting the subframe with a jack.
5. Remove the rear mounting bolts(A) of subframe.

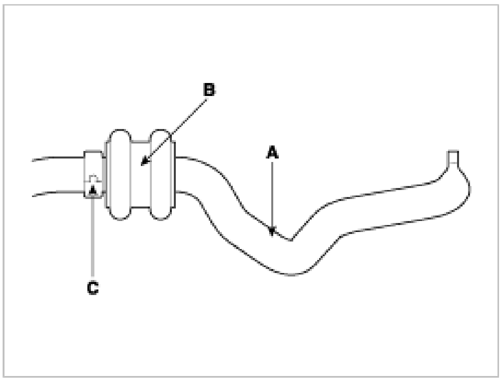


6. Remove the stabilizer bracket(B) and bushing(C).
7. Remove the stabilizer bar(D).

CAUTION
Be careful not to damage the pressure tube.

INSTALLATION

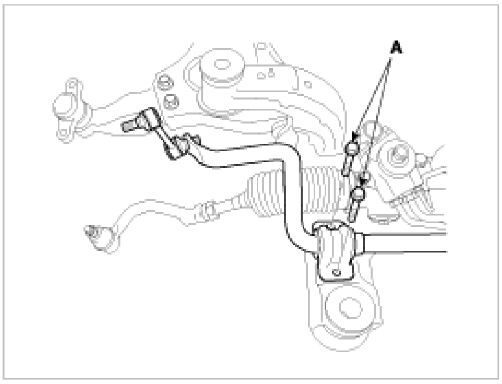
1. Install the bushing(B) on the stabilizer bar(A).



NOTE
Bring clamp(C) of stabilizer bar(A) into contact with bushing(B).

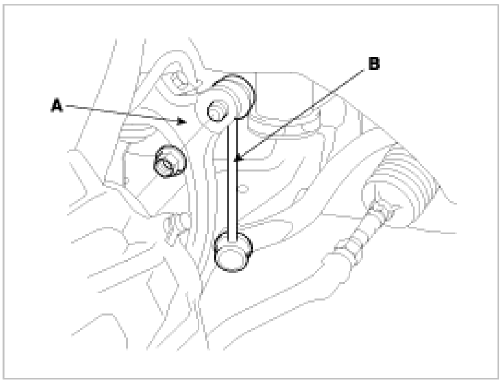
2. Install the bracket on the bushing(B).
3. After tightening the bolts of the bushing bracket temporarily, install the bushing bracket on the opposite side.
4. Install the rear stabilizer bark bracket mounting bolts(A) to the subframe.

Tightening torque Nm (kgf·m, lb-ft) :
45 ~ 55 (4.5 ~ 5.5, 32.5 ~ 39.8)



5. Install the stabilizer link(B) to the fork(A).

Tightening torque Nm (kgf·m, lb-ft) :
100 ~ 120 (10 ~ 12, 72.3 ~ 86.8)



6. Install the wheel and the tire to the front hub.

Tightening torque Nm (kgf·m, lb-ft) :
90 ~ 110 (9 ~ 11, 65.1 ~ 79.5)

CAUTION

Be careful not to damage the hub bolts when installing the front wheel and tire.

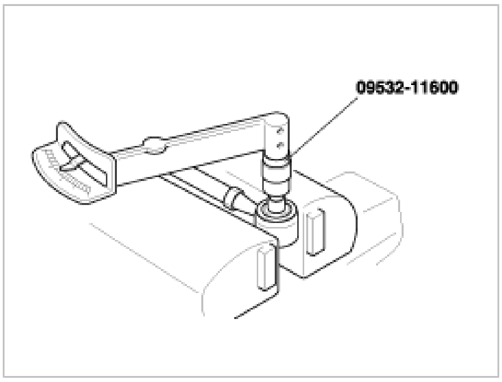
INSPECTION

1. Check the bushing for wear and deterioration.
2. Check the stabilizer bar for bending or breakage.
3. Check the ball joint for rotating torque.
   (1) If there is a crack in the dust cover, replace it and add grease.
   (2) Shake the stabilizer link ball joint stud several times.
   (3) Mount the self-locking nut on the ball joint, and then measure the ball joint rotating torque.

Standard value :
0.7 ~ 2 Nm (7 ~ 20 kgf·cm, 0.51 ~ 1.45 lb-ft)

NOTE

Measure torque using the special tool(09532-11600) and torque wrench at the range of 0.5 - 2 rpm after moving the ball joint stud at degree 3° several times at room temperature.

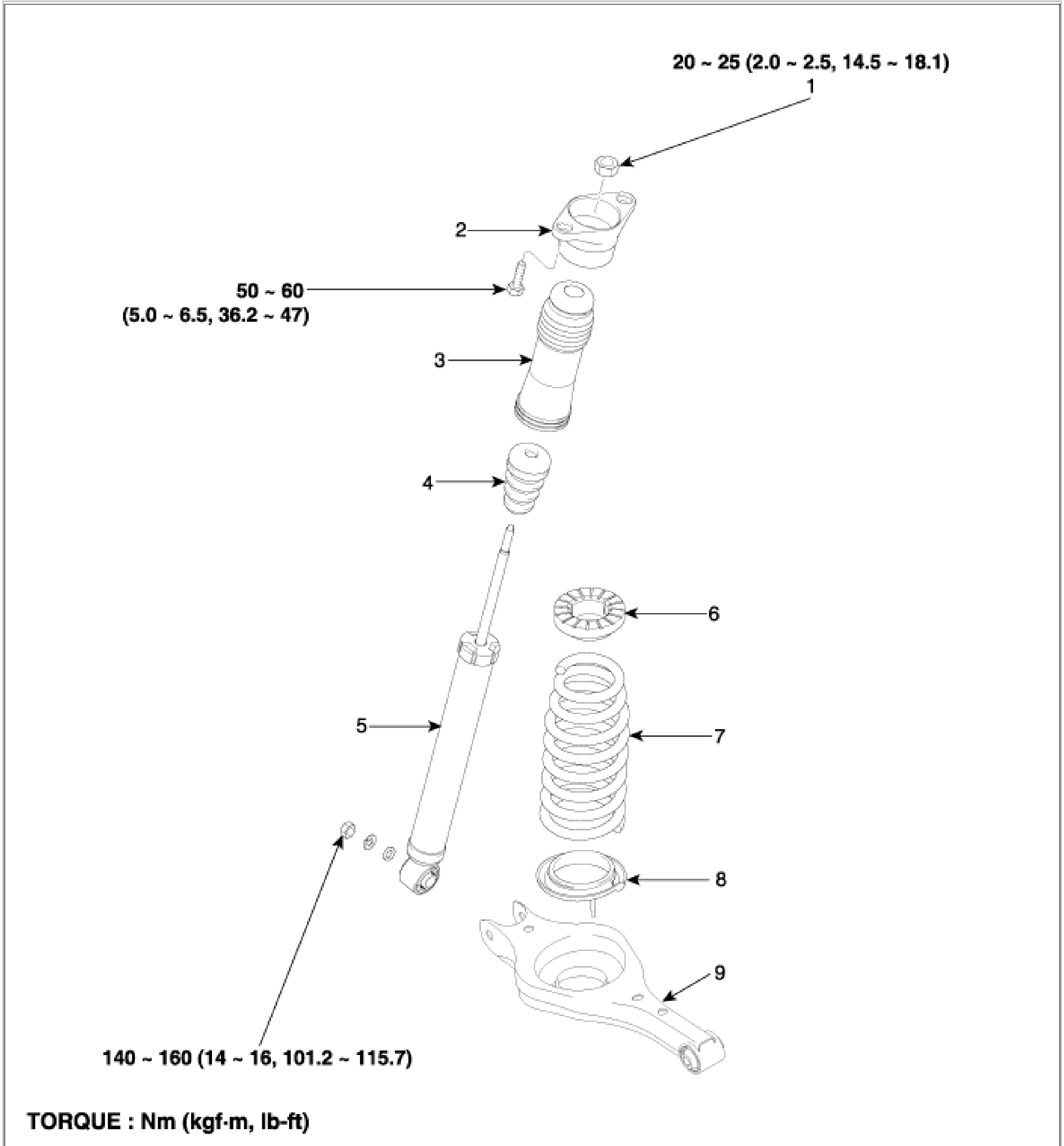


(4) If the rotating torque exceeds the upper limit of standard value, replace the upper arm assembly.

(5) Even if the rotating toque is below the lower limit of the standard value, the ball joint may be reused unless it has drag and excessive play.

Suspension System > Rear Suspension System > Rear Strut Assembly > Components and Components Location

COMPONENTS



1. Self-locking nut	4. Urethane bumper	7. Spring
2. Bracket	5. Shock absorber	8. Lower pad
3. Dust cover	6. Upper pad	9. Rear lower arm

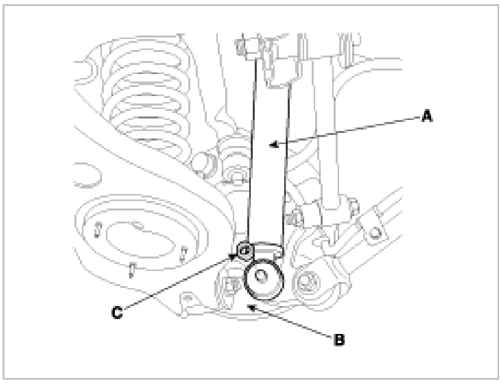
Suspension System > Rear Suspension System > Rear Strut Assembly > Repair procedures

REMOVAL

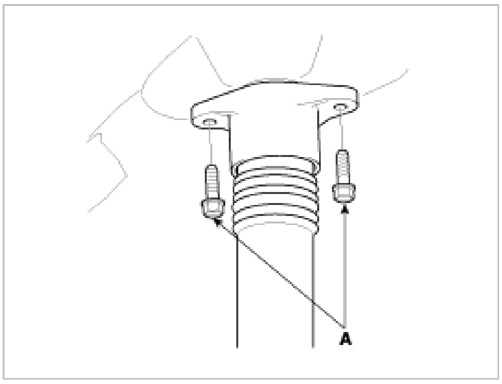
1. Loosen the wheel nuts slightly.
   Raise the rear of the vehicle, and make sure it is securely supported.
2. Remove the rear wheel and tire from rear hub.

> **CAUTION**
>
> Be careful not to damage the hub bolts when removing the rear wheel and tire.

3. Remove the rear shock absorber assembly bolts(C) from the rear axle assembly(B), then remove the shock absorber assembly(A).



4. Remove the two rear shock absorber assembly mounting bolts(A).

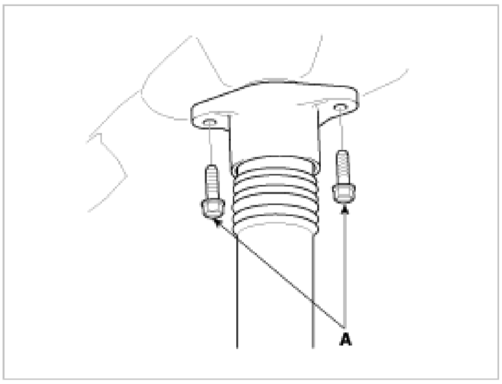


5. Disassembly the rubber bumper and the dust cover from the rear shock absorber.

INSTALLATION

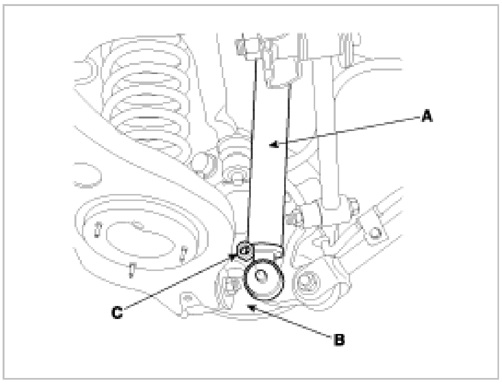
1. Assembly the rubber bumper and the dust cover to the rear shock absorber, after pulling the rod of the rear shock absorber completely.
2. Install the two rear shock absorber mounting bolts(A).

Tightening torque Nm (kgf·m, lb-ft) :
50 ~ 65 (5.0 ~ 6.5, 36.2 ~ 47.0)



3. Install the shock absorber assembly(A) to the rear axle assembly(B) with the specified torque.

Tightening torque Nm (kgf·m, lb-ft) :
140 ~ 160 (14~16, 101.2~115.7)



4. Install the wheel and the tire to the rear hub.

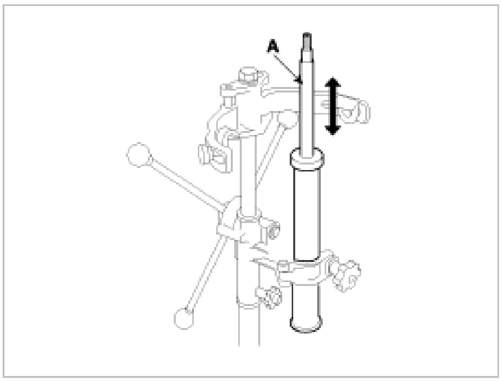
Tightening torque Nm (kgf·m, lb-ft) :
90 ~ 110 (9 ~ 11, 65.1 ~ 79.5)

CAUTION

Be careful not to damage the hub bolts when installing the rear wheel and tire.

INSPECTION

1. Check the rubber parts for damage or deterioration.
2. Check the shock absorber for abnormal resistance or unusual sounds.

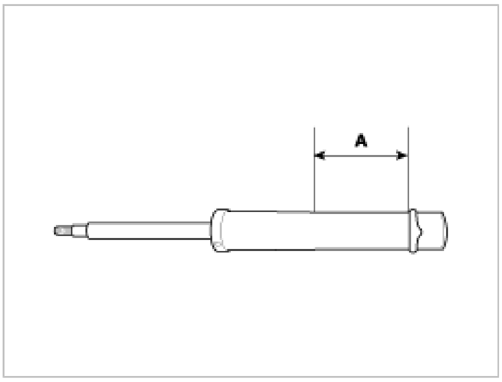


DISPOSAL

1. Fully extend the shock absorber rod.
2. Drill a hole to remove gas from the cylinder.

CAUTION

The gas coming out is harmless, but be careful of chips that may fly up when drilling. Be sure to use face shield and safety goggles.

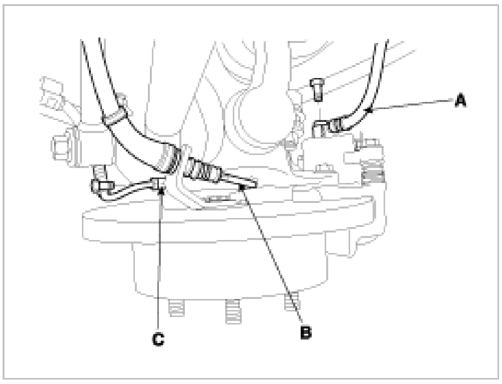


REMOVAL

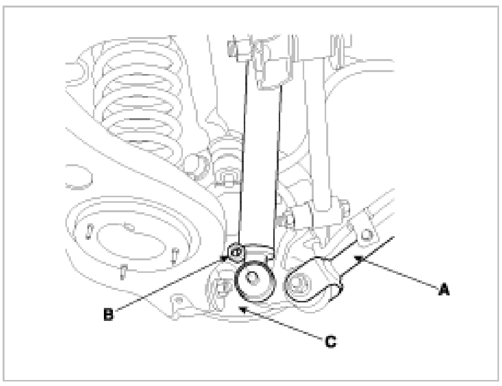
1. Loosen the wheel nuts slightly.
   Raise the rear of the vehicle, and make sure it is securely supported.
2. Remove the rear wheel and tire from rear hub.

> CAUTION
>
> Be careful not to damage the hub bolts when removing the rear wheel and tire.

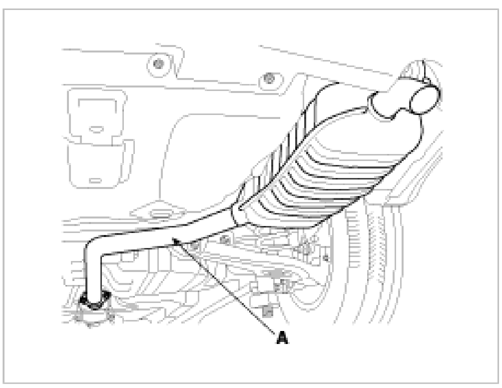
3. Remove the brake hose(A), the parking brake cable(B), and the wheel speed sensor(C).



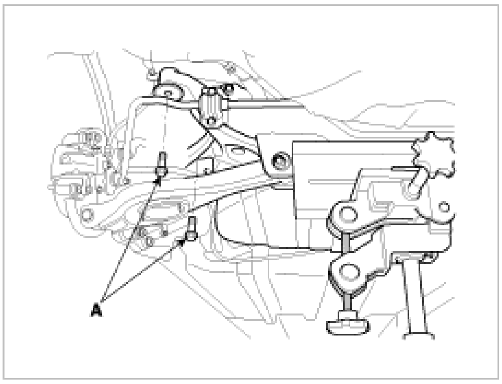
4. Remove the trailing arm(A) and the shock absorber(B) from the rear axle assembly(C), supporting with a jack.



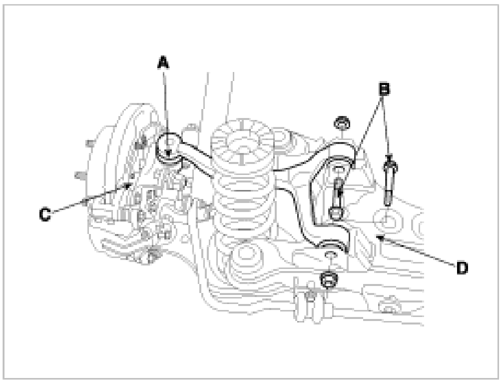
5. Remove the muffler(A).



6. Remove the four rear cross member mounting bolts(A), while supporting with a jack.



7. Remove the split pin and the upper arm ball joint self-locking nut(A).

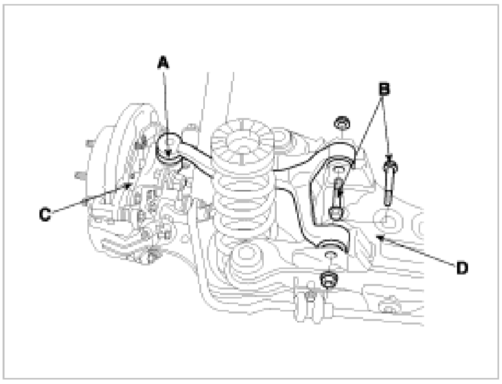


8. Remove the upper arm ball joint from the rear axle assembly(C) with special tool (09568-4A000).
9. Remove the two upper arm mounting bolts(B) from the cross member(D).

INSTALLATION

1. Install the upper arm to the cross member(D) with two mounting bolts(B).

Tightening torque Nm (kgf·m, lb-ft) :
100 ~ 120 (10 ~ 12, 72.3 ~ 86.8)

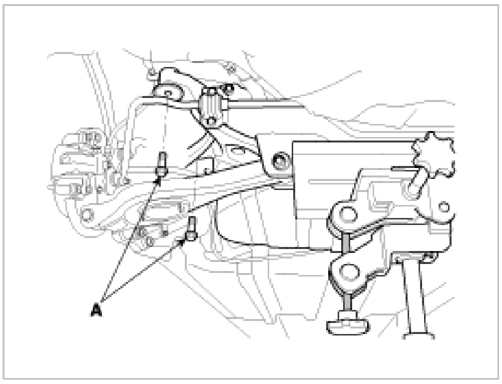


2. Install the upper arm ball joint self-locking nut(A) to the rear axle assembly(C) with a specified torque, and then install the split pin.

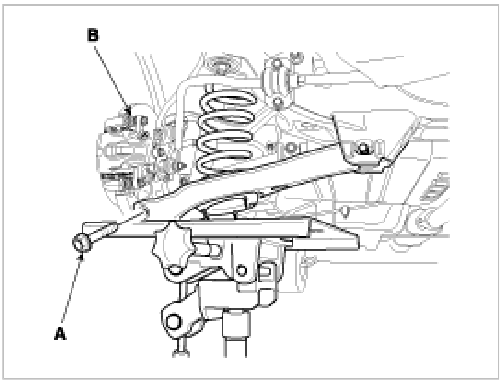
Tightening torque Nm (kgf·m, lb-ft) :
80 ~ 90 (8 ~ 9, 57.8 ~ 65.1)

3. Install the cross member(A).

Tightening torque Nm (kgf·m, lb-ft) :
140 ~ 160 (14~16, 101.2~115.7)

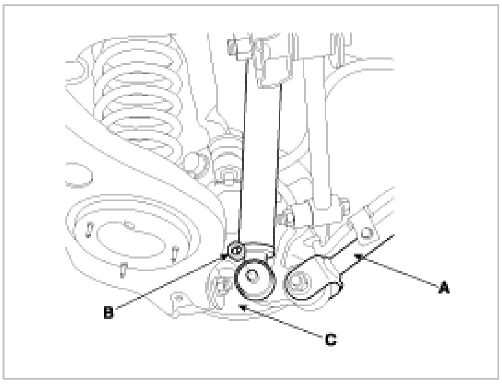


4. Install the spring, the lower seat, and the upper pad.
5. Install the lower arm bolt(A) to the axle assembly(B), while supporting with a jack.

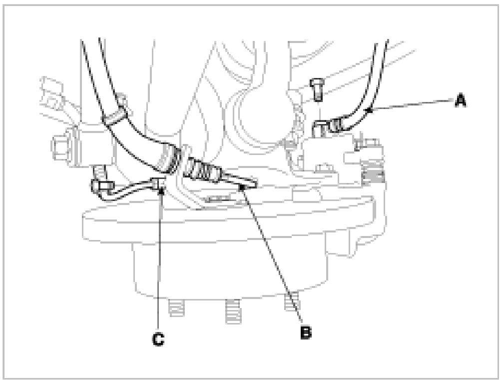


6. Install the trailing arm(A) and the shock absorber(B) to the rear axle assembly(C).

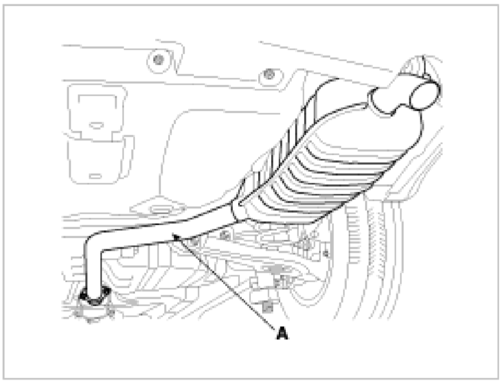
Tightening torque Nm (kgf·m, lb-ft) :
140 ~ 160 (14~16, 101.2~115.7)



7. Install the brake hose(A), the parking brake cable(B), and the wheel speed sensor(C).



8. Install the muffler(A).



9. Install the wheel and the tire to the rear hub.

Tightening torque Nm (kgf·m, lb-ft) :
90 ~ 110 (9 ~ 11, 65.1 ~ 79.5)

CAUTION

Be careful not to damage the hub bolts when installing the rear wheel and tire.

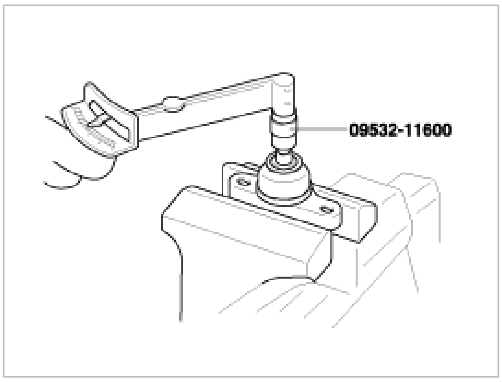
INSPECTION

1. Check the bushing for wear and deterioration.
2. Check the upper arm for bending or breakage.
3. Check the ball joint for rotating torque.
   (1) If there is a crack in the dust cover, replace it and add grease.
   (2) Shake the stabilizer link ball joint stud several times.
   (3) Mount the self-locking nut on the ball joint, and then measure the ball joint rotating torque.

   Specified torque :
   1 ~ 5 Nm (10 ~ 50 kgf·cm, 0.73 ~ 3.64 lb-ft)

   NOTE

   Measure torque using the special tool(09532-11600) and torque wrench at the range of 0.5 - 2 rpm after moving the ball joint stud at degree 3° several times at room temperature.



   (4) If the rotating torque exceeds the upper limit of standard value, replace the upper arm assembly.
   (5) Even if the rotating toque is below the lower limit of the standard value, the ball joint may be reused unless it has drag and excessive play.

Suspension System > Rear Suspension System > Rear Lower Arm > Repair procedures

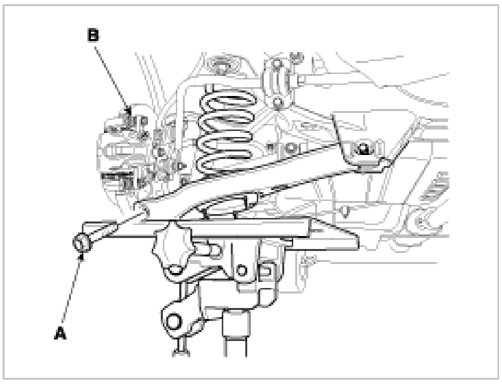
REMOVAL

1. Loosen the wheel nuts slightly.
   Raise the rear of the vehicle, and make sure it is securely supported.
2. Remove the rear wheel and tire from rear hub.

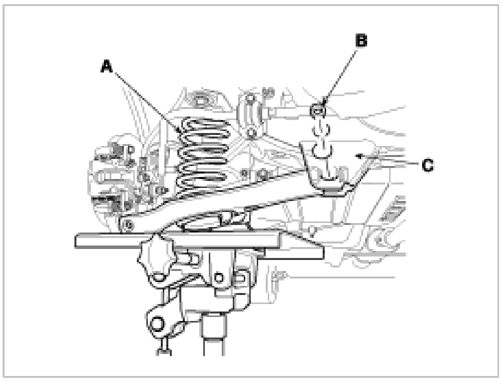
CAUTION

Be careful not to damage the hub bolts when removing the rear wheel and tire.

3. Remove the lower arm bolt(A) from the rear axle assembly(B), while supporting with a jack as shown below.



4. Remove the spring(A), the lower seat, and the upper pad.

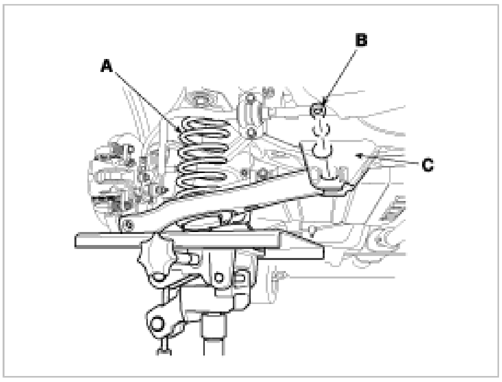


5. Remove the lower arm mounting bolts(B) from the cross member(C).

INSTALLATION

1. Install the lower arm mounting bolts(B) to the cross member(C) with a specified torque.

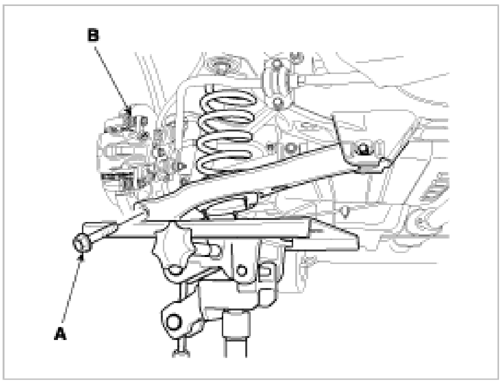
Tightening torque Nm (kgf·m, lb-ft) :
110 ~ 120 (11 ~ 12, 79.5 ~ 86.8)



2. Install the spring(A), the lower seat, and the upper pad.
3. Install the lower arm bolt(A) from the rear axle assembly(B) with a specified torque, while supporting with a jack as shown below.

Tightening torque Nm (kgf·m, lb-ft) :

140~160 (14 ~ 16, 101.2~115.7)



4. Install the wheel and the tire to the rear hub.

Tightening torque Nm (kgf·m, lb-ft) :
90 ~ 110 (9 ~ 11, 65.1 ~ 79.5)

CAUTION

Be careful not to damage the hub bolts when installing the rear wheel and tire.

INSPECTION

Rear lower arm

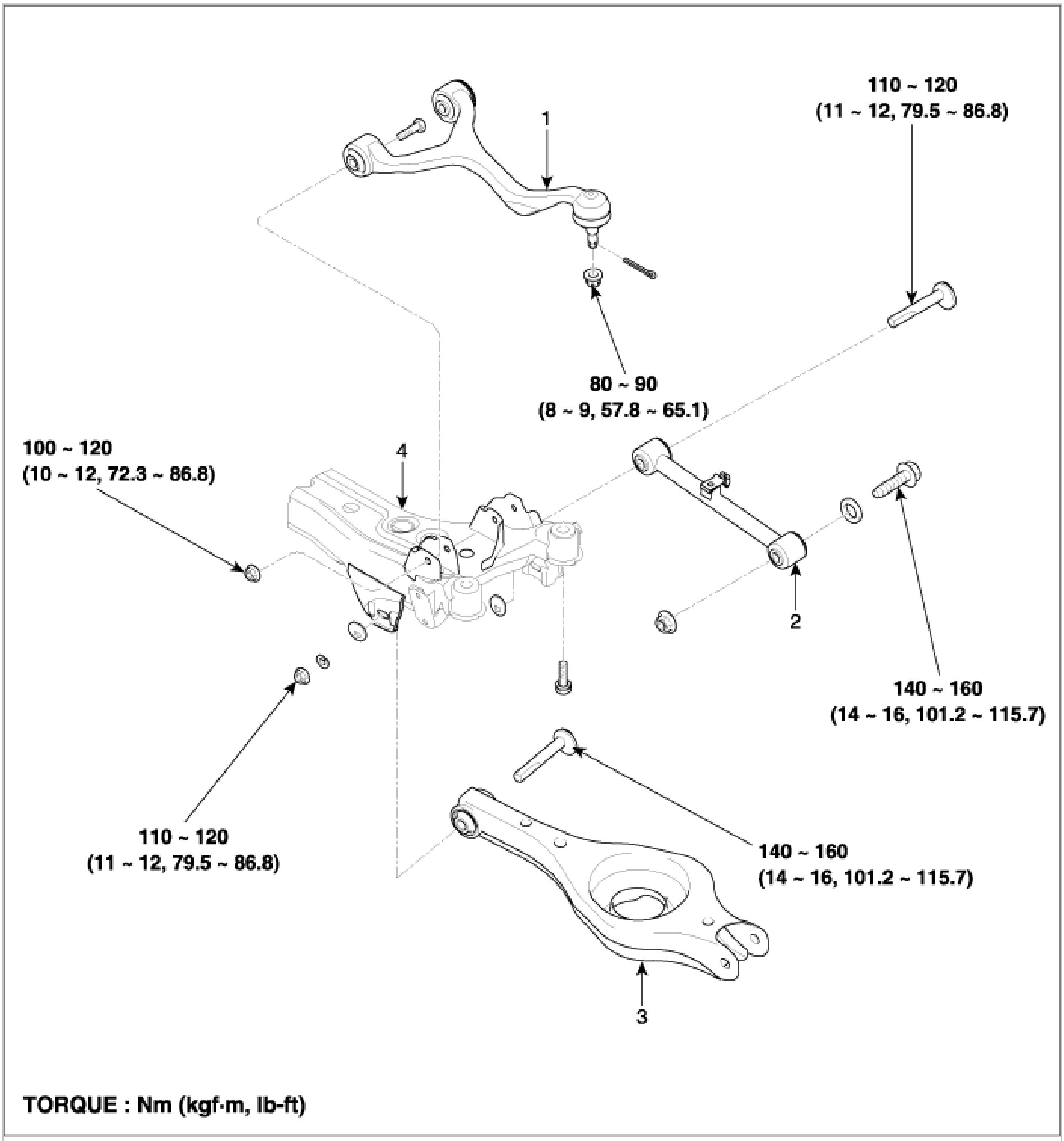
1. Check the bushing for wear and deterioration.
2. Check the center arm for bending or breakage.
3. Check the bolts for damage.

Spring

1. Check the spring for distortion, aging or damage.
2. Check the spring upper pad for aging or damage.

Suspension System > Rear Suspension System > Upper Arm, Lower Arm And Assist Link > Components and Components Location

COMPONENTS



1. Rear upper arm	3. Rear lower arm
2. Assist arm	4. Cross member

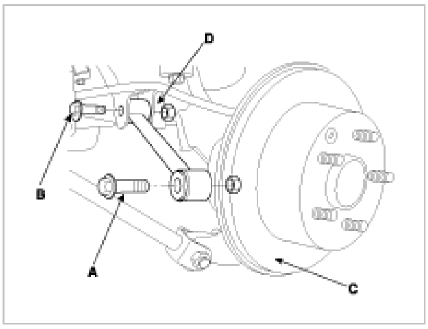
Suspension System > Rear Suspension System > Rear Assist Arm > Repair procedures

REMOVAL

1. Loosen the wheel nuts slightly.
   Raise the rear of the vehicle, and make sure it is securely supported.
2. Remove the rear wheel and tire from rear hub.

> CAUTION
>
> Be careful not to damage the hub bolts when removing the rear wheel and tire.

3. Remove the assist arm mounting bolt(A) from the rear axle assembly(C).

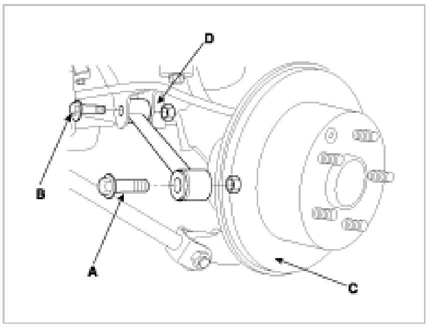


4. Remove the assist arm mounting bolt(B) from the cross member(D).

INSTALLATION

1. Install the assist arm mounting bolt(B) to the cross member(D).

Tightening torque Nm (kgf·m, lb-ft) :
110 ~ 120 (11 ~ 12, 79.5 ~ 86.8)



2. Install the assist arm mounting bolt(A) from the rear axle assembly(C).

Tightening torque Nm (kgf·m, lb-ft) :
140~160 (14~16, 101.2~115.7)

3. Install the wheel and the tire to the rear hub.

Tightening torque Nm (kgf·m, lb-ft) :
90 ~ 110 (9 ~ 11, 65.1 ~ 79.5)

CAUTION

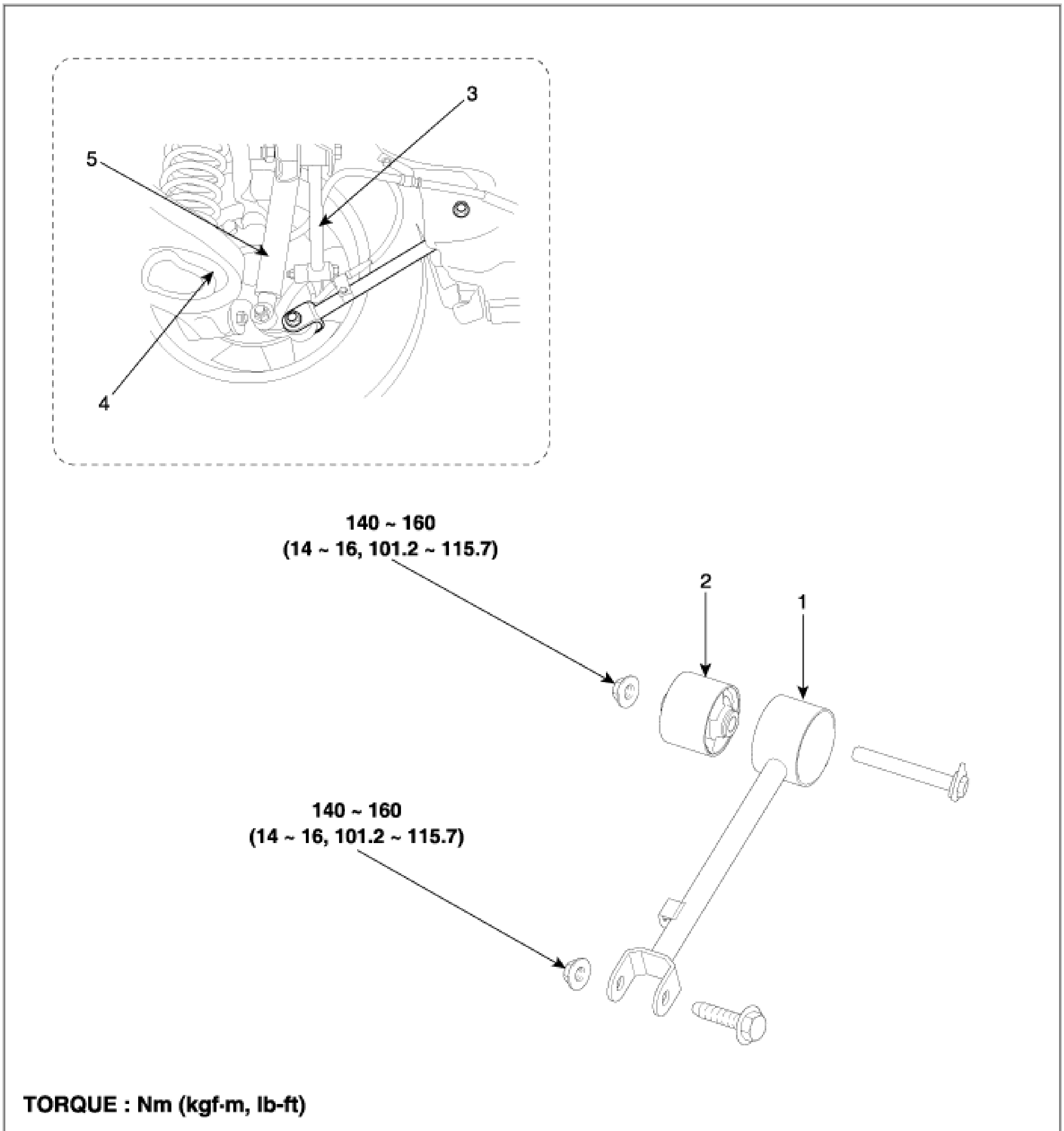
Be careful not to damage the hub bolts when installing the rear wheel and tire.

INSPECTION

1. Check the bushing for wear and deterioration.
2. Check the assist arm for bending or breakage.
3. Check all the bolts for damage.

Suspension System > Rear Suspension System > Trailing Arm > Components and Components Location

COMPONENTS

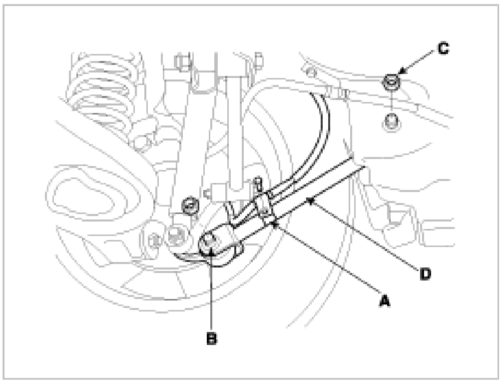


1. Trailing arm
2. Bushing
3. Assist arm
4. Rear lower arm
5. Rear strut assembly

Suspension System > Rear Suspension System > Trailing Arm > Repair procedures

REMOVAL

1. Remove the wheel speed sensor bracket(A).

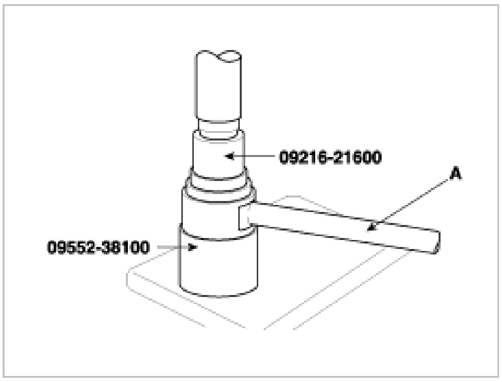


2. Remove the trailing arm mounting nut(B) from the rear axle assembly.
3. Remove the trailing arm mounting nut(C) from the body.
4. Remove the trailing arm(D).

REPLACEMENT

TRAILING ARM BUSHING

1. Using the special tools(09216-21600, 09552-38100), press-fit the bushing.



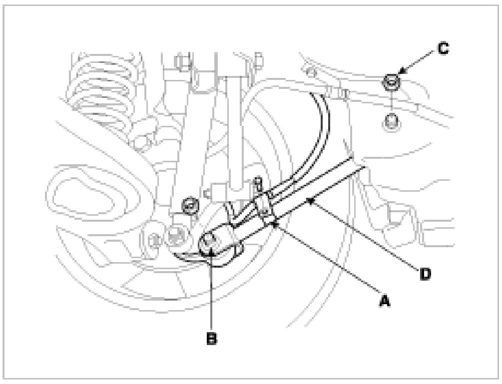
2. Remove the bushing from the trailing arm(A).
3. Using the special tool(09552-38000), replace the bushing.

over 100 kN (1000 kgf, 2204 lb)

> NOTE
>
> Be sure to press the bushing with the jut of the bushing aligned to the longitude of the trailing arm.

INSTALLATION

1. Place the trailing arm(D) as shown below.



2. Install the trailing arm nuts.

NOTE

Fully tighten the trailing arm mounting nuts with the vehicle on the ground in unloaded condition.

A. Install the trailing arm mounting nut(B).

Tightening torque Nm (kgf·m, lb-ft) :
140~160 (14~16, 101.2~115.7)

B. Install the trailing arm bracket mounting nut(C).

Tightening torque Nm (kgf·m, lb-ft) :
140~160 (14~16, 101.2~115.7)

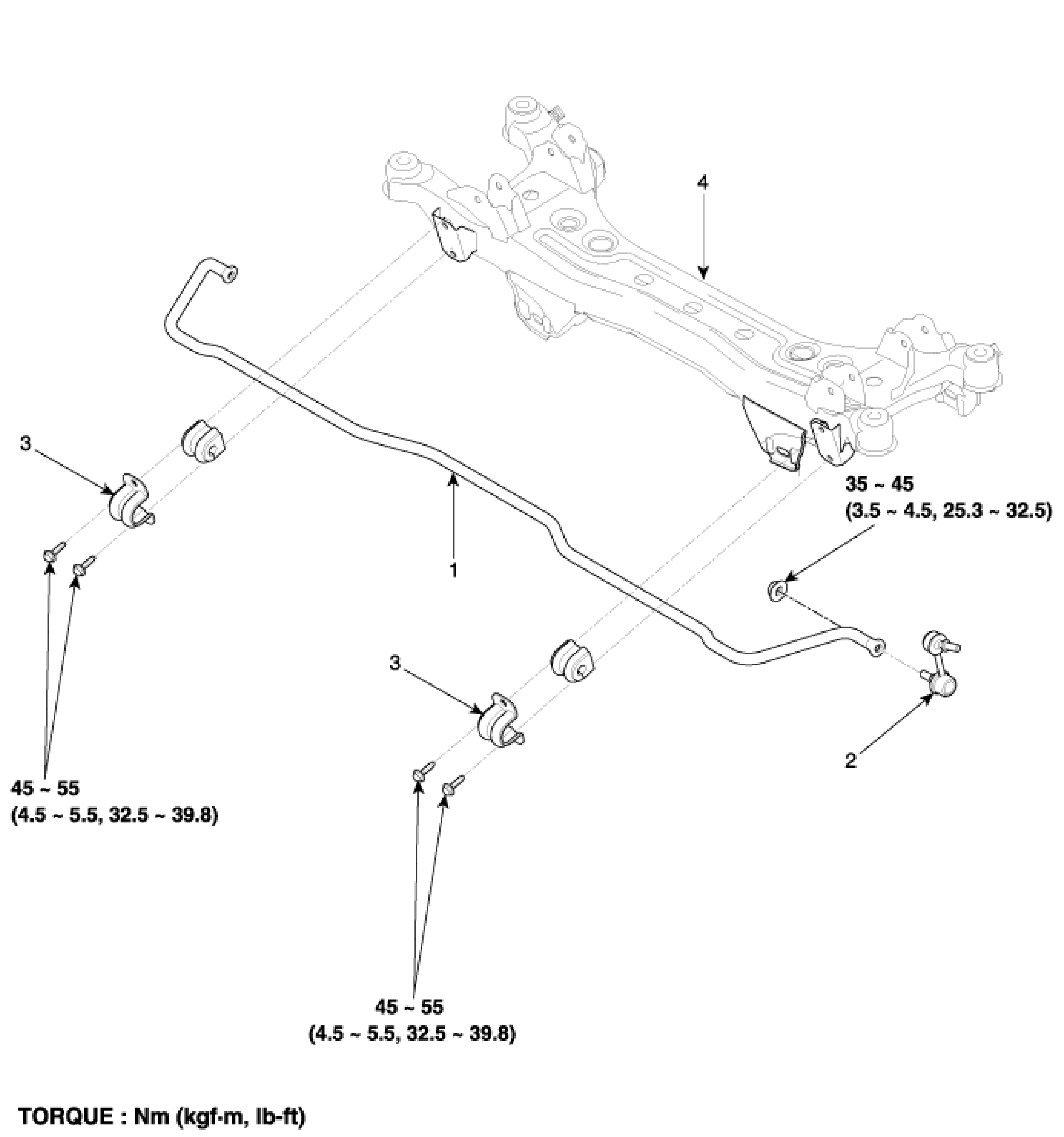
3. Install the wheel speed sensor bracket(A).

INSPECTION

1. Check the bushing for wear and deterioration.
2. Check the trailing arm for bending or breakage.
3. Check all the bolts for damage.

Suspension System > Rear Suspension System > Rear Stabilizer Bar > Components and Components Location

COMPONENTS



1. Rear stabilizer bar	3. Bracket
2. Stabilizer link	4. Cross member

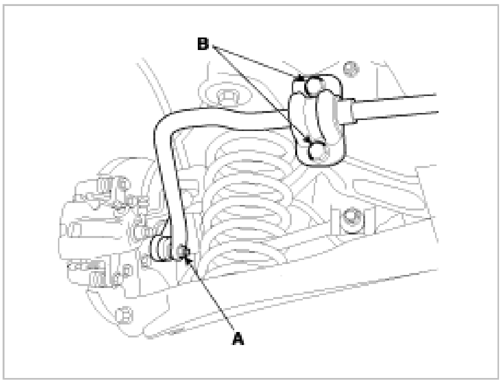
Suspension System > Rear Suspension System > Rear Stabilizer Bar > Repair procedures

REMOVAL

1. Loosen the wheel nuts slightly.
   Raise the rear of the vehicle, and make sure it is securely supported.
2. Remove the rear wheel and tire from rear hub.

> CAUTION
>
> Be careful not to damage the hub bolts when removing the rear wheel and tire.

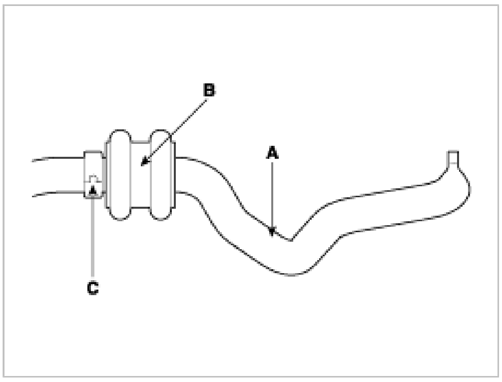
3. Remove the left/right nuts(A) of the rear stabilizer links.
4. Remove the left/right mounting nuts(B) of the rear stabilizer bar brackets.



5. Remove the rear stabilizer bar(C).

INSTALLATION

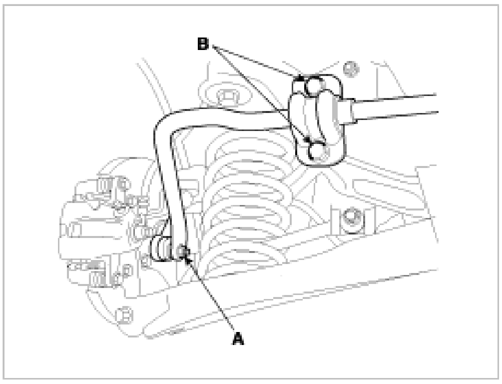
1. Install the bushing(B) on the stabilizer bar(A).



> NOTE
>
> Bring clamp(C) of stabilizer bar(A) into contact with bushing(B).

2. One side bracket should be temporarily tightened, and then install the bushing on the opposite side.
3. Install the stabilizer bracket bolt(B).

Tightening torque Nm (kgf·m, lb-ft) :
45 ~ 55 (4.5 ~ 5.5, 32.5 ~ 39.8)



4. Install the stabilizer link mounting nut(A).

Tightening torque Nm (kgf·m, lb-ft) :
35 ~ 45 (3.5 ~ 4.5, 25.3 ~ 32.5)

5. Repeat step 3 and 4 for the other side.
6. Install the wheel and the tire to the rear hub.

Tightening torque Nm (kgf·m, lb-ft) :
90 ~ 110 (9 ~ 11, 65.1 ~ 79.5)

CAUTION

Be careful not to damage the hub bolts when installing the rear wheel and tire.

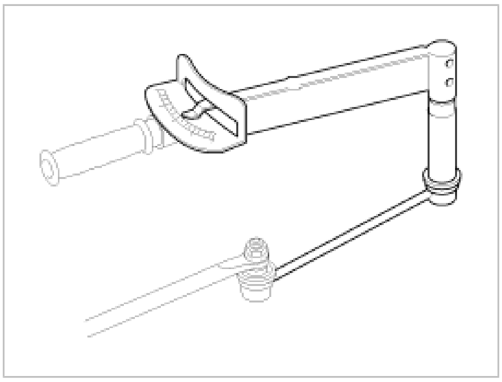
INSPECTION

1. Check the bushing for wear and deterioration.
2. Check the stabilizer bar for bending or breakage.
3. Check the ball joint for rotating torque.
   (1) If there is a crack in the dust cover, replace it and add grease.
   (2) Shake the stabilizer link ball joint stud several times.
   (3) Mount the self-locking nut on the ball joint, and then measure the ball joint rotating torque.

   Specified torque :
   0.7 ~ 2 Nm (7 ~ 20 kgf·m, 0.51 ~ 1.45 lb-ft)

   NOTE

   Measure torque using the special tool(09532-11600) and torque wrench at the range of 0.5 - 2 rpm after moving the ball joint stud at degree 3° several times at room temperature.



   (4) If the rotating torque exceeds the upper limit of standard value, replace the upper arm assembly.
   (5) Even if the rotating toque is below the lower limit of the standard value, the ball joint may be reused unless it has drag and excessive play.

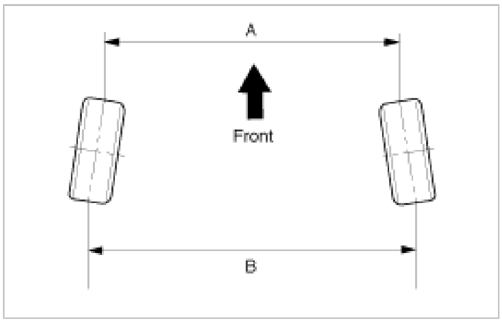
Suspension System > Tires/Wheels > Tire > Repair procedures

Wheel Alignment

When using commercially available computerized four wheel alignment equipment (caster, camber, toe) to inspect the front wheel alignment, always position the car on a level surface with the front wheels facing straight ahead.
Prior to inspection, make sure that the front suspension and steering system are in normal operating condition and that the wheels and tires face straight ahead and the tires are inflated to the specified pressure.

Toe

Toe is a measurement of how much the front of the wheels are turned in or out from the straight-ahead position.



Item	Description
A - B < 0	Positive (+) toe (toe in)
A - B > 0	Negative (-) toe (toe out)

When the wheels are turned in toward the front of the vehicle, toe is positive (+) (toe in). When the wheels are turned out toward the front of the vehicle, toe is negative(-) (toe out). Toe is measured in degrees, from side to side, and totaled.

[Front]

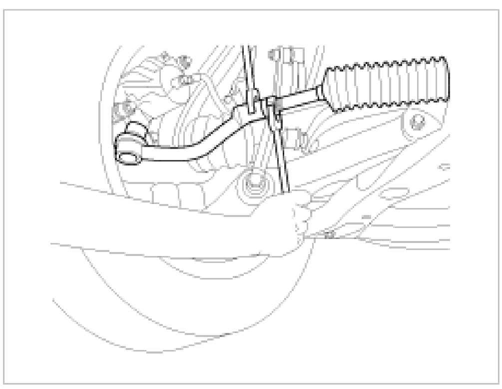
Toe-in(B-A or angle a+b) is adjusted by turning the tie rod turnbuckles. Toe-in on the left front wheel can be reduced by turning the tie rod toward the rear of the car. Toe- in change is adjusted by turning the tie rods for the right and left heels simultaneously at the same amount as follows.

Standard value :
Toe-in
Total : 0°±0.2°
Individual : 0°±0.1°

NOTE

- Toe-in adjustment should be made by turning the right and left tie rods at the same amount.
- When adjusting toe-in, loosen the outer bellows clip to prevent twisting the bellows.
- After the adjustment, tighten the tie rod end lock nuts firmly and reinstall the bellows clip.
- Adjust each toe-in to be the range of ±1°.

Tie rod(A) Specified torque :
50~55N.m (5~5.5kgf.m, 36.2~39.8lb-ft)



[Rear]

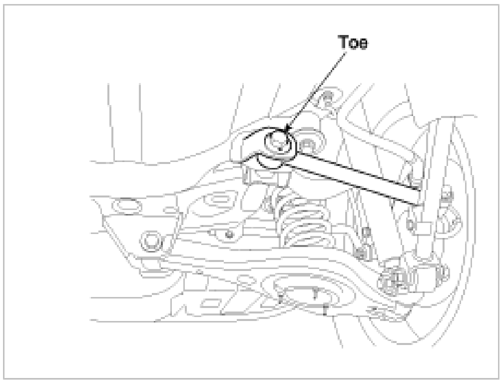
Standard value :
Toe-in
Total : 0.2°±0.2°
Individual : 0.1°±0.1°

Adjust the toe-in by turning the cambolt of the assist arm.

Left cambolt : Clockwise → toe-in
Right cambolt : Clockwise → toe-out
The variation of toe by a rotation of the cambolt :
About 0.4°

CAUTION

- Each toe should be within 0.1° ± 0.1° .
  If the difference between right and left is not within +0.2° , repeat adjustment.
- After adjusting the cambolt, tighten the nut to the specified torque.

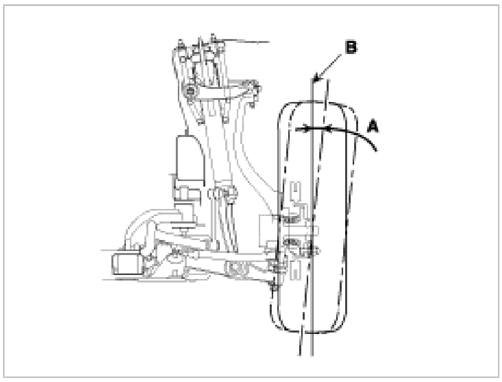


Specified torque
110 ~ 120N.m (11 ~ 12kgf.m, 79.5 ~ 86.8lb-ft)

Camber

[Front]

Camber is the inward or outward tilting of the wheels at the top.



Item	Description
A	Positive camber angle
B	True vertical

When the wheel tilts out at the top, then the camber is positive(+).
When the wheel tilts in at the top, then the camber is negative(-).

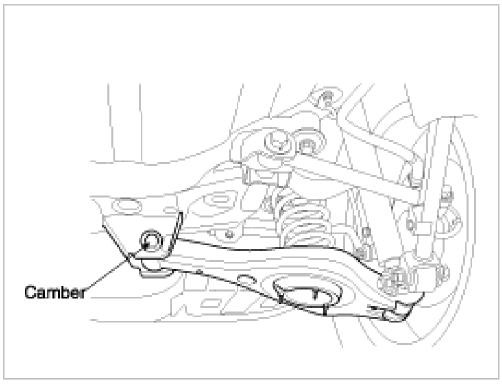
Standard value : -0°±0.5°
Difference between right and left angle is within 0.5°

NOTE

Camber is pre-set at the factory and doesn't need to be adjusted. If the camber is not within the standard value, replace the bent or damaged parts.

[Rear]

Standard value : -0.5°±0.5°
Difference between right and left angle is within 0.5°



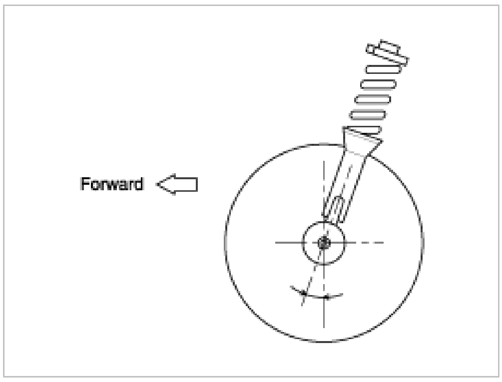
Adjust the camber by turning the cambolt of the rear lower arm.

Left cambolt : Clockwise → camber(+)
Right cambolt : Clockwise →camber(-)
The variation of camber by a rotation of the cambolt :
About 0.2°

Caster

Caster is the tilting of the strut axis either forward or backward from vertical. A backward tilt is positive (+) and a forward tilt is negative (-).
Caster is pre-set at the factory and doesn't need to be adjusted. If the caster is not within the standard value, replace the bent or damaged parts.

Caster : 4.8°±0.75°



NOTE

- The worn loose or damaged parts of the front suspension assembly must be replaced prior to measuring front wheel alignment.
- Camber and caster are pre-set to the specified value at the factory and don't need to be adjusted.
- If the camber and caster are not within specifications, replace bent or damaged parts.
- The difference of left and right wheels about the camber and the caster must be within the range of 0° ± 0.5°.

TIRE WEAR

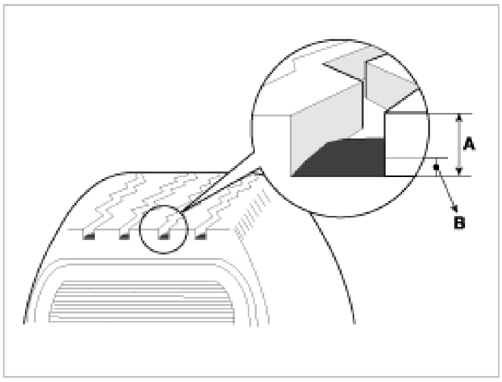
1. Measure the tread depth of the tires.

   Tread depth [limit] : 1.6 mm (0.063 in)

2. If the remaining tread(A) depth is less than the limit, replace the tire.

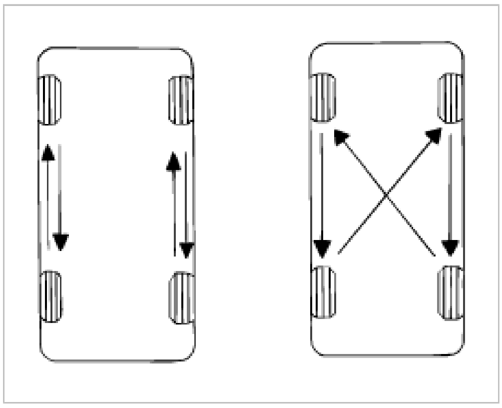
NOTE

When the tread depth of the tires is less than 1.6 mm (0.063 in), the wear indicators(B) will appear.



TIRE ROTATION

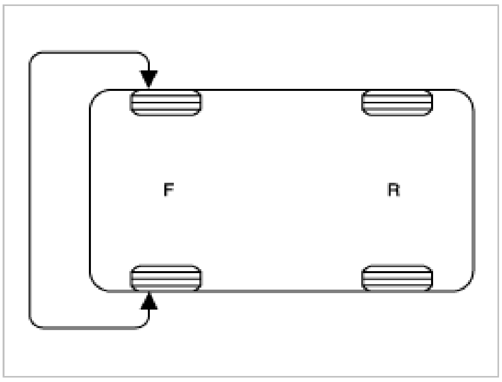
Rotate the tires in the pattern illustrated.



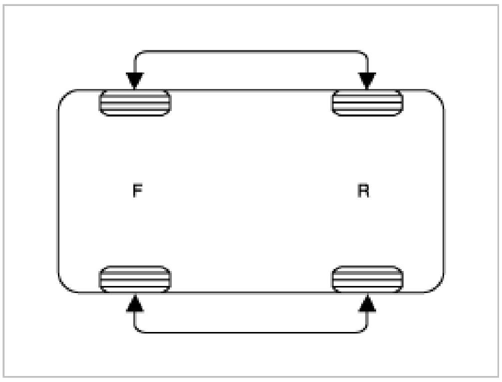
CHECKING FOR PULL AND WANDER

If the steering pulls to one side, rotate the tires according to the following wheel rotation procedure.

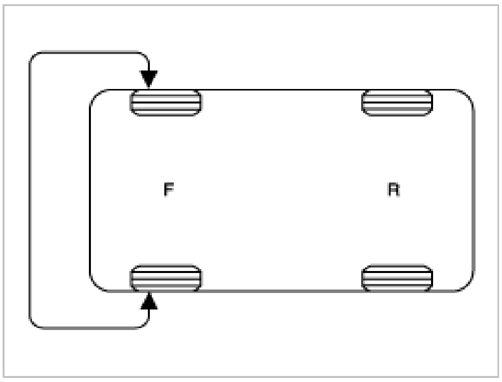
1. Rotate the front right and front left tires, and perform a road test in order to confirm vehicle stability.



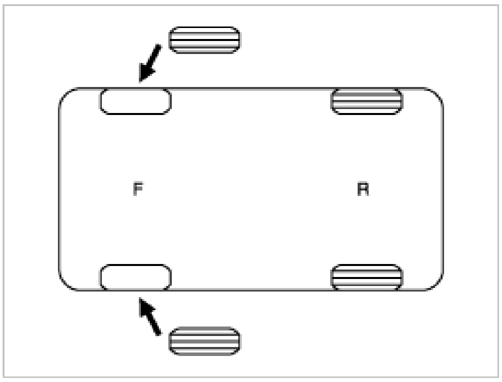
2. If the steering pulls to the opposite side, rotate the front and rear tires, and perform a road test again.



3. If the steering continues to pull to one side, rotate the front right and left tires again, and perform a road test.



4. If the steering continues to pull to the opposite side, replace the front wheels with new ones.

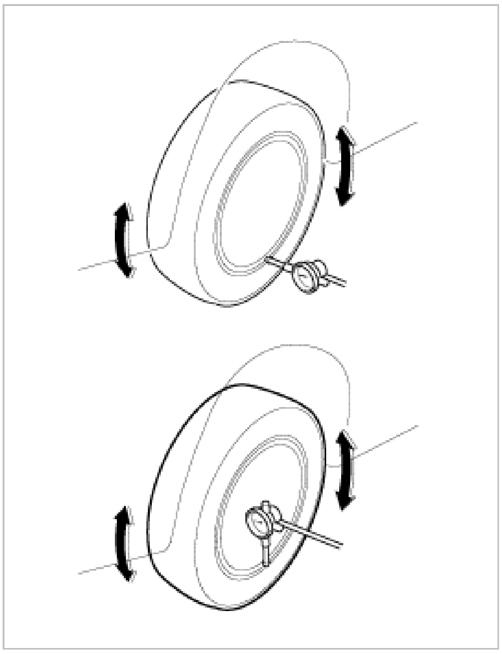


Suspension System > Tires/Wheels > Wheel > Repair procedures

WHEEL RUNOUT

1. Jack up the vehicle and support it with jack stands.
2. Measure the wheel runout with a dial indicator as illustrated.
3. Replace the wheel if the wheel runout exceeds the limit.

Limit		Radial	Axial
Runout mm(in)	Steel	0.9	1.4
	Aluminium	0.3	0.3



WHEEL NUT TIGHTENING

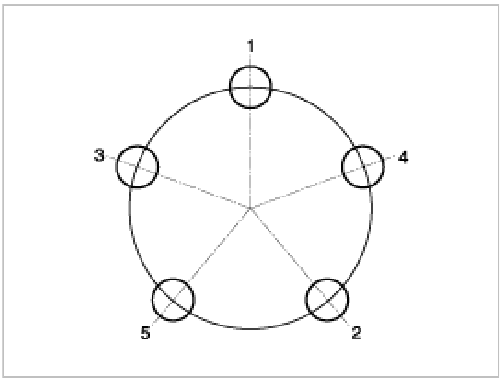
1. Tightening torque.

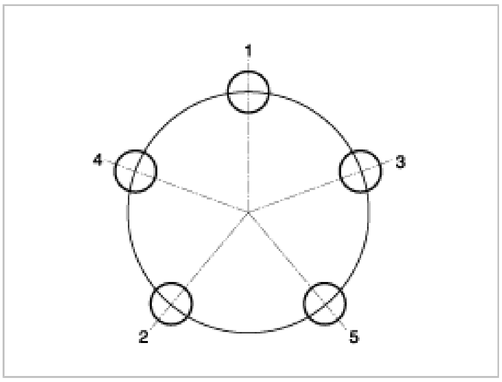
Tightening torque Nm (kgf·m, lb-ft) :
90 ~ 110 (9 ~ 11, 65.1 ~ 79.5)

CAUTION

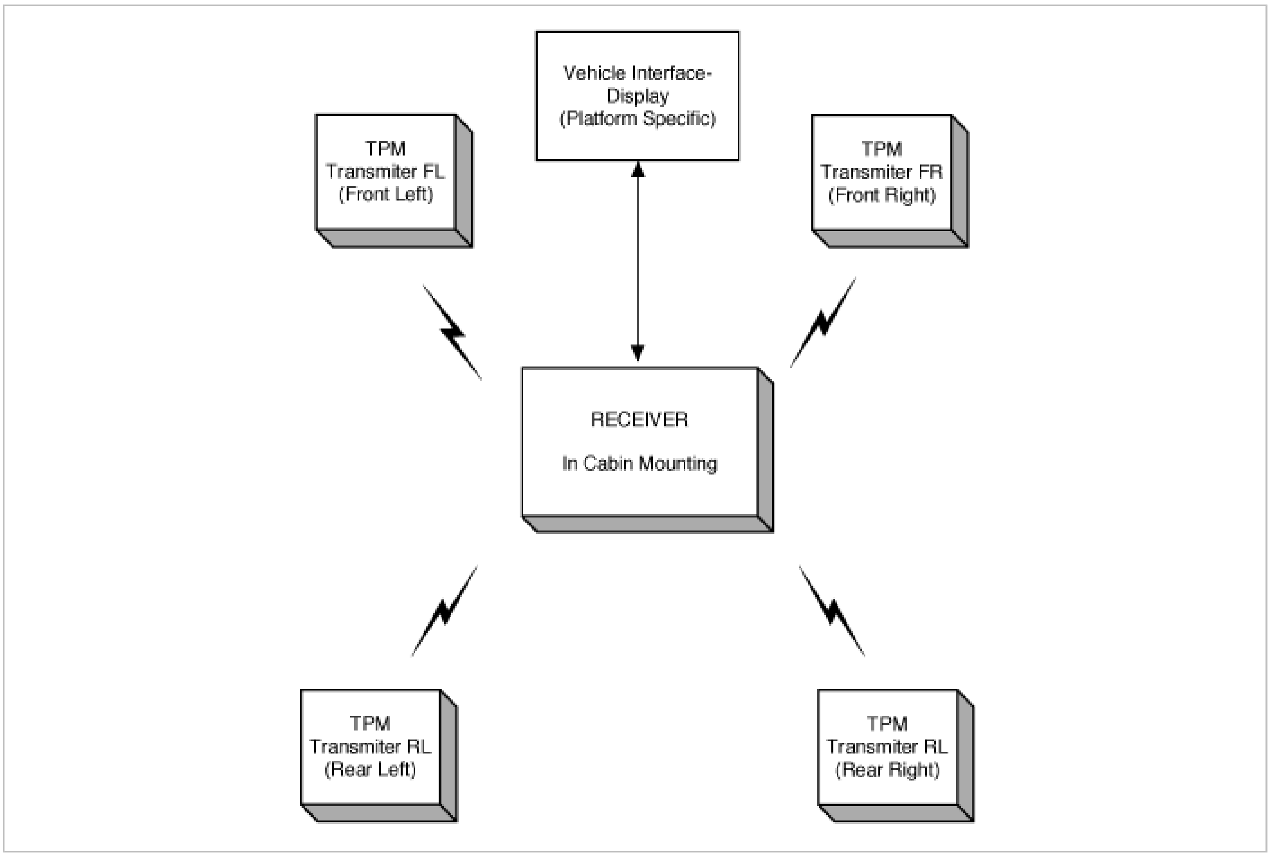
When using an impact gun, final tightening torque should be checked using a torque wrench.

2. Tightening order.
   Check the torque again after tightening the wheel nuts diagonally.

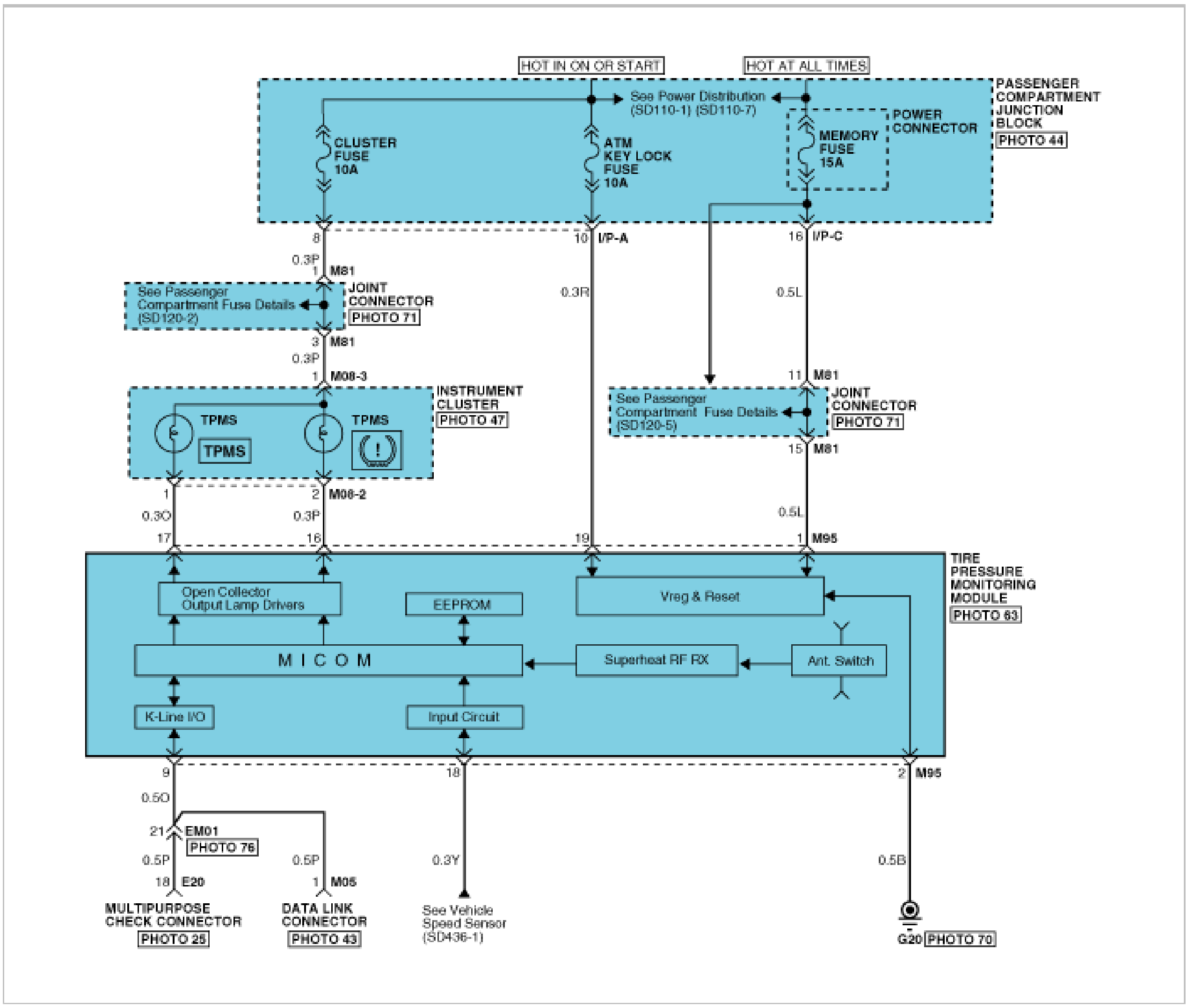




SCHEMATIC DIAGRAM



circuit diagram



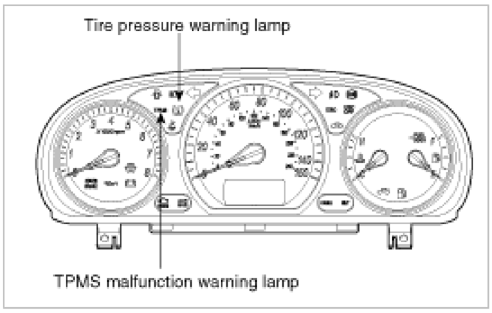
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

NO	PIN-OUT ASSIGNMENT	NO	PIN-OUT ASSIGNMENT
1	Battery	11	-
2	Ground(TPMS receiver)	12	-
3	-	13	-
4	-	14	-
5	-	15	-
6	-	16	TREAD lamp
7	-	17	Diagnostic lamp (TPMS)
8	-	18	Speed signal
9	K-LINE	19	Ignition 1(+)
10	-	20	-

Suspension System > Tire Pressure Monitoring System > Description and Operation

DESCRIPTION

WARNING LAMPS



TREAD Lamp

- Tire Under Inflation / Leak Warning.

1. Turn on condition
   A. When tire pressure is below allowed threshold
   B. When rapid leak is detected by the sensor.
   C. Indicates that tire needs to be re-inflated to placard pressure / repaired.
2. Turn off condition
   A. Under-inflation ; When tire pressure is above (warning threshold + hysteresis).
   B. Rapid Leak ; When tire pressure is above (leak warning threshold).

DTC Warning

TPMS

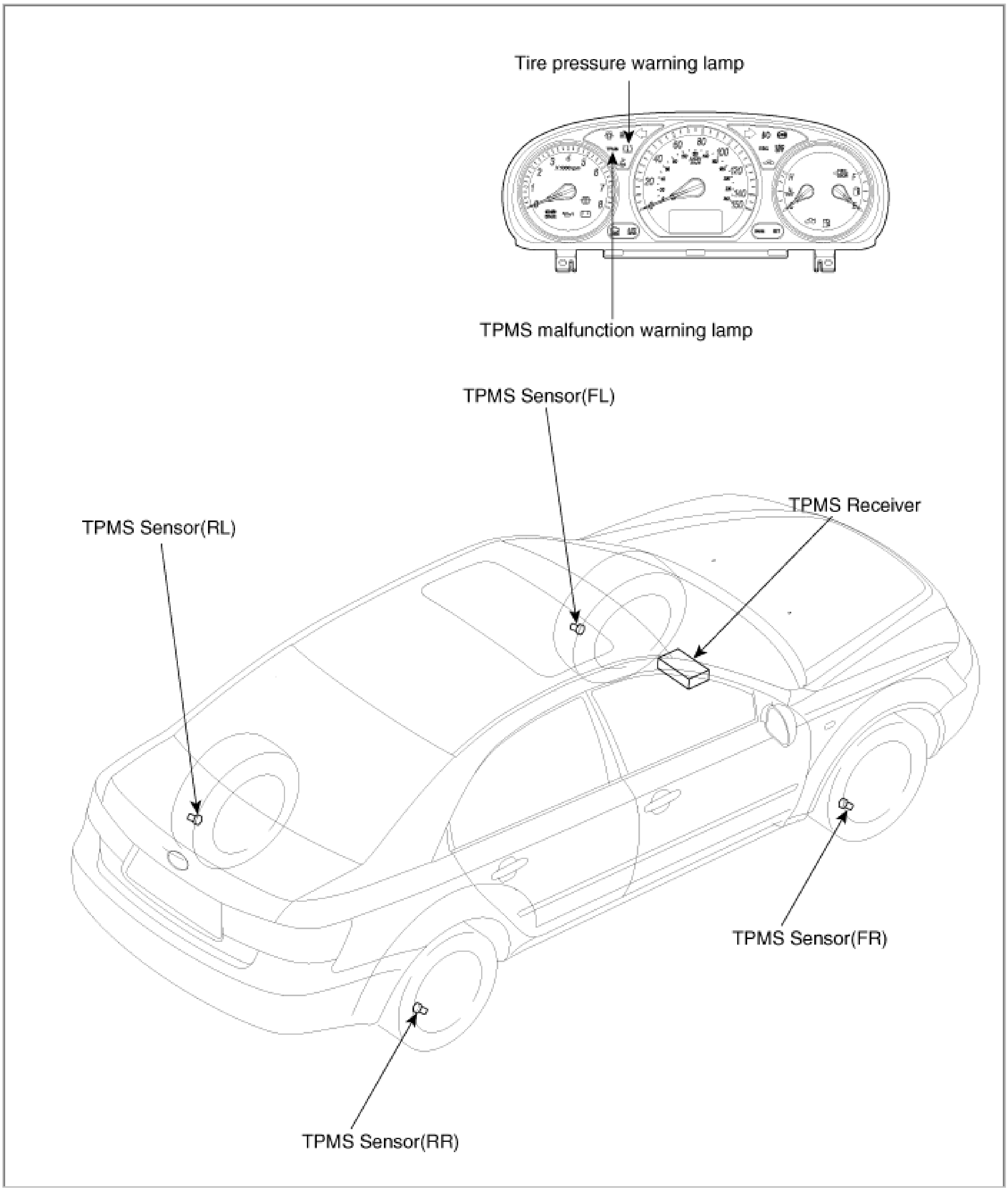
1. Turn on condition
   A. When the system detects a fault that is external to the receiver/ sensor.
   B. When the system detects a receiver fault.
   C. When the system detects a sensor fault.
2. Turn off condition
   A. If the fault is considered as 'critical', then the lamp is held on throughout the current Ignition cycle (even if the DTC has been demoted). This is because it is important to bring the problem to the drivers attention. On the following Ignition cycle, the demotion conditions will be re-checked. If the demotion conditions occur, the lamp will be turned off. It will be held on until DTC demotion checking is completed.
   B. 'Non critical' faults are those that can occur temporarily e.g. vehicle battery under voltage. The lamp is therefore turned off when the DTC demotion condition occurs.

SYSTEM FAULT

1. General Function
   A. The system monitors a number of inputs across time in order to determine that a fault exists.
   B. Faults are prioritized according to which has the most likely cause.
   C. Maximum fault store is equal to 15.
   D. Certain faults are not covered through DTC. The main ones are:
      1) Speed input. This is important since it is required for Auto-Learn & DTC. Requires diagnostic check of speed while driving vehicle to diagnose.
      2) Sensor thermal shutdown (over 257°F/125°C).
      3) Control module Micro-controller lock up ; requires observation of lamps at Ignition ON to diagnose.
      4) Ignition Line stuck ; requires observation of lamps at Ignition ON to diagnose.

Suspension System > Tire Pressure Monitoring System > Components and Components Location

components



Suspension System > Tire Pressure Monitoring System > Troubleshooting

TROUBLESHOOTING

- the lamp check should occur and then all lamps / LED's should turn off.
- **If the lamp test does not occur:**
  - Check connectors and fuse/harnessing - open / short circuits.
  - Check DTC's.
  - If diagnostics cannot be entered, replace the receiver with a known good one (follow configuration & learning procedure).

TREAD warnings

- **Information to ascertain (TREAD Lamp):**

- Was puncture repair fluid used (it should not be)?
  - This can cause the sensor pressure port to block and incorrect warning to occur.
- What temperature were tires last inflated at?
  At what temperature did warnings occur?
  - Pressure change is approx. 1.5psi / 10°C increase.
- Have the tires been checked / inflated since the lamp first came on?

- **If the TREAD Lamp is on:**
  - Check for short circuits.
  - Enter Diagnostics and read TREAD Warnings Local Identifier Data.
  - Check to see if warning type is under inflation or leak.
  - If the warning is for under inflation, then:
    a. Re-inflate the wheel with the matching sensor ID to it's desired Placard pressure.
    b. Check to make sure that the TREAD lamp turns off (this may take up to 4 minutes if the tire is not rapidly re-inflated).
  - If the warning is for a leak, then:
    a. Fix any puncture and re-inflate the tire to the desired Placard pressure.
    b. Wait up to 4 minutes and make sure that the TREAD lamp turns off and the lamp does not turn on again.
    c. If lamp comes on again:
    d. Re-check pressure for signs of a puncture and Re-Check TREAD Warnings Local Identifier Data.
- **If the Placard pressure is OK and the TREAD lamp still does not turn off:**
  - Turn wheel a quarter turn and again wait 4 minutes (the sensor may be in an RF null).
  - If the lamp still does not turn off:
    check for loose receiver wiring and replace the receiver with a known good one if necessary (follow configuration & learning procedure).
    - If the problem still exists, replace sensor.
    - Ensure that all tires are inflated to their correct Placard pressures.
    - Clear TREAD warnings.
    - Test drive the vehicle and ensure that the TREAD lamp does not come back on.

DTC's

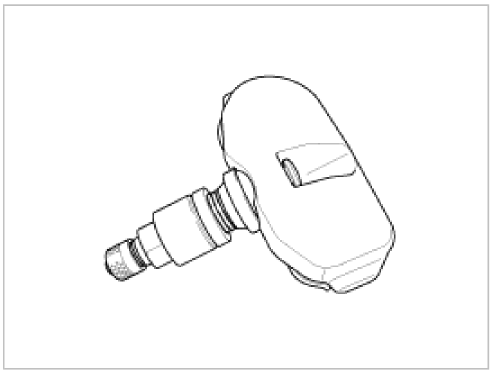
- Information to ascertain (DTC Lamp):
  - At what temperature did the DTC occur? Under certain conditions (approx.-40°C/F), a RF channel missing / hardware failure DTC may occur. This is due to the battery behavior.
- DTC's should be retrieved by using Hi-Scan diagnostic tool.
- The fault should then be diagnosed and rectified.
- DTC's should then be cleared.

DTC	Warning Type	Trouble Description	Diagnostic Lamp
C1121	Battery Level	Sensor 1 Battery Low.	Permanent during detection.
C1122		Sensor 2 Battery Low.	
C1123		Sensor 3 Battery Low.	
C1124		Sensor 4 Battery Low.	
C1126		Vehicle / TPMS receiver Battery Low.	
C1127		Vehicle / TPMS receiver Battery High.	
C1300	LF / RF External Interference	LF/RF Interference Failure.	Permanent during detection.
C1306	RF Internal Interference	Internal vehicle RF source e.g. scanner.	Permanent
C1312	Individual RF channel failure.	Sensor 1 / Front Left RF Failure.	Permanent
C1313		Sensor 2 / Front Right RF Failure.	
C1314		Sensor 3 / Rear Left RF Failure.	
C1315		Sensor 4 / Rear Right RF Failure.	
C1322	Sensor over Temperature	Sensor 1 / Front Left Sensor over 230°F(110°C).	Permanent
C1323		Sensor 2 / Front Right Sensor over	

		230°F(110°C).	
C1324		Sensor 3 / Rear Left Sensor over 230°F(110°C).	
C1325		Sensor 4 / Rear Right Sensor over 230°F(110°C).	
C1332	Sensor Failure	Sensor 1 / Front Left Sensor Fault.	Permanent
C1333		Sensor 2 / Front Right Sensor Fault.	
C1334		Sensor 3 / Rear Left Sensor Fault.	
C1335		Sensor 4 / Rear Right Sensor Fault.	
C1660	System Hardware	TPMS receiver RF circuit.	Permanent
C1661	EEPROM Failure	TPMS receiver EEPROM Failure.	Permanent
C1668	Micro controller error	Repeated Watchdog Reset / Internal failure detection.	Permanent
C2510	Lamp Short Circuit	TREAD lamp short circuit to 12 V.	Permanent
C2511		Diagnostic lamp short circuit to 12 V.	Permanent

Suspension System > Tire Pressure Monitoring System > TPMS Sensor > Description and Operation

DESCRIPTION



1. MODE
   (1) Configuration State
      A. All sensors should be in the Low Line (Base) state.
      B. In Low Line (Base) configuration, sensor transmissions occur every 3 minutes 20 seconds (nominal) and pressure is measured every 20 seconds.
   (2) Normal Fixed Base State
      A. Sensor transmissions continue at the Low Line (Base) configuration defined rates until the state is either changed by LF command or by the sensor detecting a condition that requires a temporary change to another state.
      B. The LF command to this state must contain the sensors ID.
   (3) Storage Base State:
      A. This state is a Low current consumption state.
      B. Sensors are in this state when they first arrive at the dealership (either on the vehicle or as replacement spares).
      C. In this state, the sensor does not measure pressure / temperature / battery level.
      D. The sensor will not transmit in this state unless requested to do so by the initiate command.
   (4) Alert State:
      A. The sensor automatically enters this state if the measured temperature exceeds 230 °F(110 °C) and over temperature shutdown is likely.
      B. In this state, pressure is measured every 4 seconds and RF data transmitted every 4 seconds.
      C. The state lasts for 1 minute if it is pressure triggered.
      D. After state is alse entered when a 3 psi change in pressure from the last RF transmission occurs.

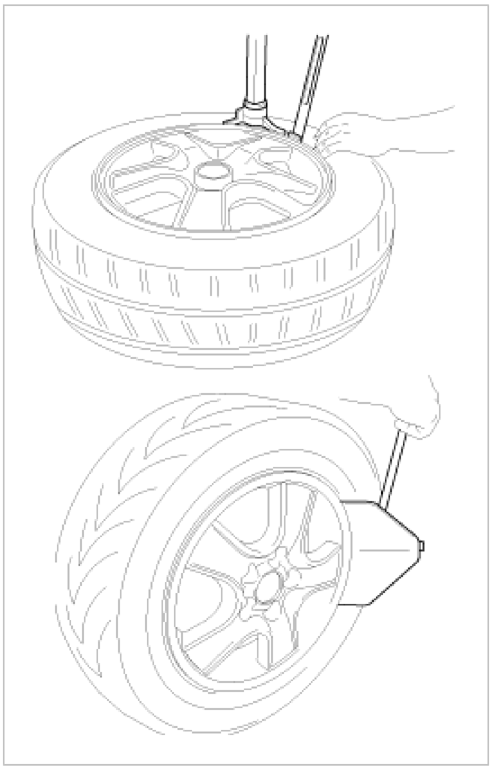
REMOVAL

Tire Removal

1. Deflate tire & remove balance weights.

CAUTION

- The tire bead should be broken approx. 90° from the valve side of the wheel. The bead breaker should not be set too deep.
- Avoid tire/tool contact with the valve on dismount.
- Dismount should end near the valve.

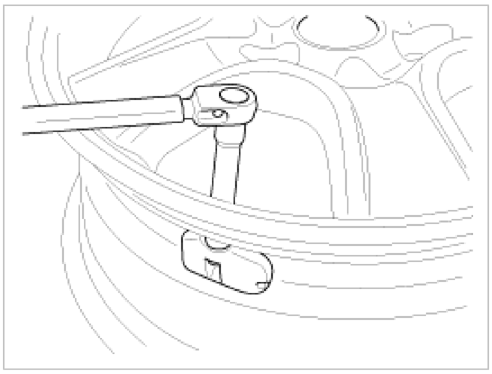


Sensor Removal

CAUTION

Handle the sensor with care.

1. Remove the valve nut.



CAUTION

The valve nut should not be re-used.

2. Discard the valve assembly.

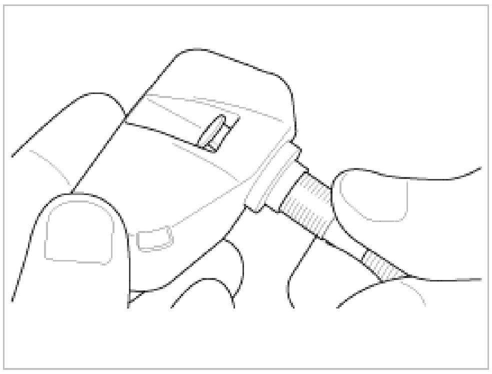
INSTALLATION

Sensor Fit

CAUTION

- Handle the sensor with care.
- Avoid lubricant contact if possible.

1. Assemble valve to sensor and turn valve 3 times with the square part of the screw in the slot.



CAUTION

- The fit should not be tight i.e. it should still be possible to easily adjust valve angle.
- Ensure that the wheel to be fitted is designed for sensor mount. There should normally be a mark to indicate this.
- Ensure that the valve hole and mating face of the wheel are clean.

2. Mount assembly to wheel.

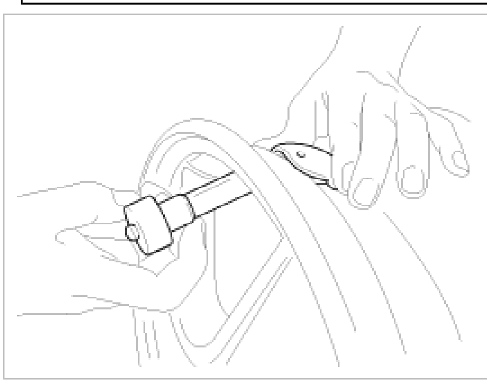
CAUTION

Ensure sensor feet are against the wheel throughout the remainder of the assembly process.

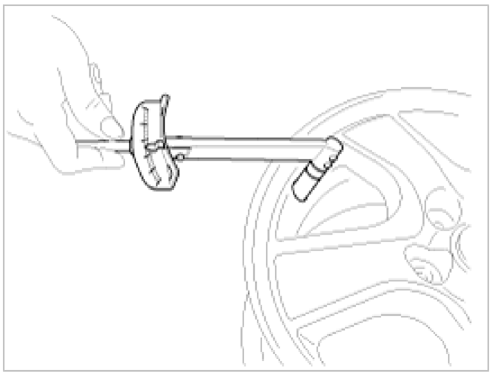
3. Tighten washer and nut by hand until the valve thread meets the nut built-in calibrated stop.

CAUTION

Ensure that the grommet remains in contact with the wheel.



4. Using a torque wrench, tighten the nut to 2.95±0.37 lb-ft (4.0±0.5 Nm) It is normal to feel a break as the 1.7 lb-ft (2.3Nm) calibrated stop in the nut snaps and the torque falls.



CAUTION

- Increase torque smoothly in order to achieve a clean break of the stop.
- Do not exceed allowed torque.
- Do not use electric or pneumatic tools.

Tire Fit

CAUTION

Only use wheels designed to accommodate the TPMS sensor.

1. Lubricate the tire bead not the rim. Excessive lubrication should not be applied.
2. Start tire mounting approx. 5.9 in(15 cm) from valve.
3. Move the mounting tool away from the valve.

   CAUTION

   Avoid tire / tool contact with the valve.

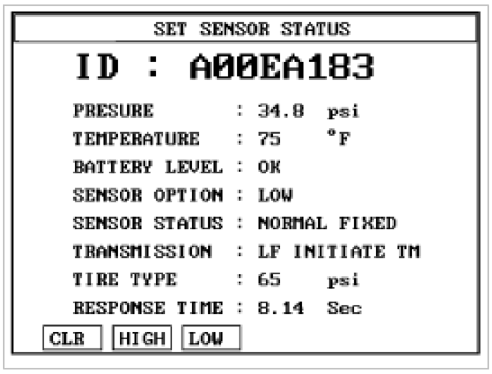
4. Finish with mounting tool near to valve.
5. Carry out inflation / pressure correction and then fit valve cap.

Sensor Initiating Procedure

NOTE

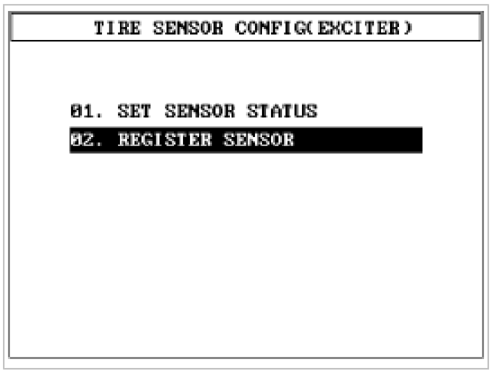
The sensor's default state will be Storage Auto (High Line).

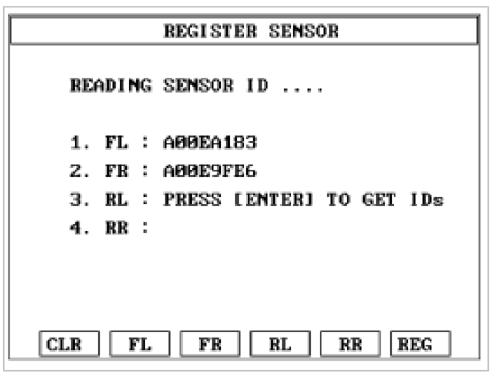
1. Change the sensor mode to Normal Fixed Base(Low Line) with the 'TPMS exciter'.



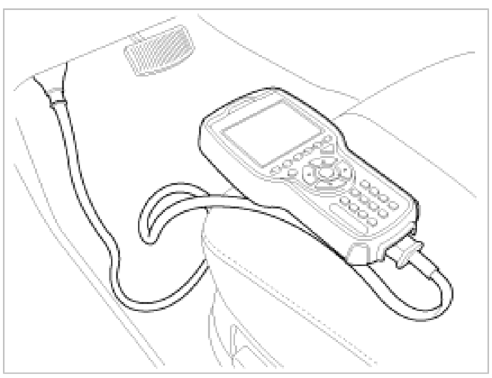
2. Read the four sensor's ids starting with sensor 1 (1 normally front left, 2 front right, 3 rear left, 4 rear right).

> NOTE
>
> Note that sensors which were already configured as Base (Low Line) will take longer to read.

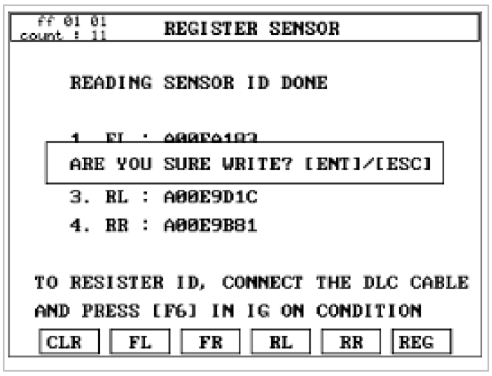


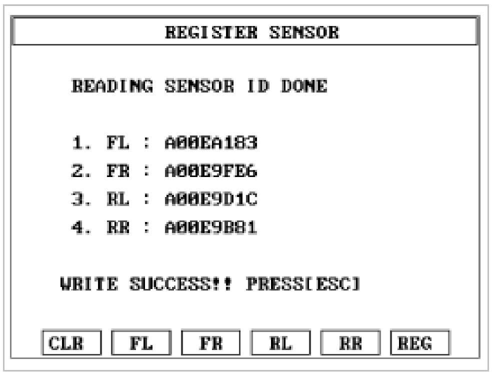


3. Connect 'TPMS exciter' to the diagnostic connector.



4. Register the four sensor's ids to the receiver.

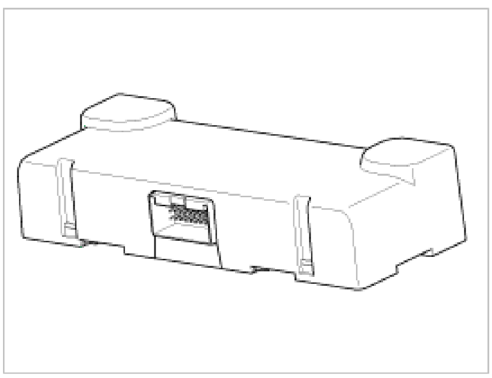




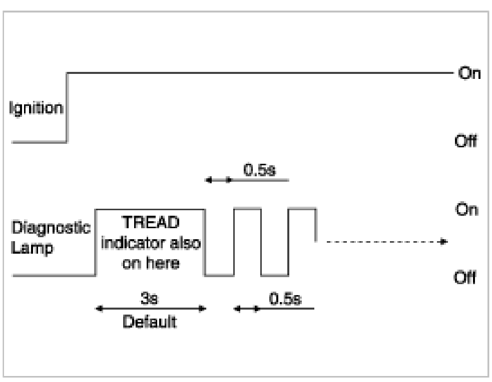
5. Cycle Ignition, wait 4 minutes and check that Normal Receiver State is now indicated (see SS-).

Suspension System > Tire Pressure Monitoring System > TPMS Receiver > Description and Operation

DESCRIPTION



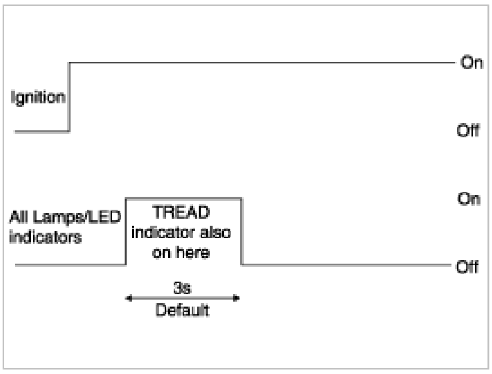
1. **Mode**
   (1) Virgin State
      A. The receiver as a sole part is shipped in this state. Replacement parts should therefore arrive in this state.
      B. In this state, there is no sensor monitoring and no DTC monitoring.
      C. The state indicates that platform specific parameters must be written to the receiver and that sensors are un-learned.



(2) Normal State

A. In order for tire inflation state and DTC monitoring to occur, the receiver must be in this state.

B. In this state, automatic sensor learning is enabled.



2. **Overview**
   A. Receives RF data from sensor.
   B. Uses sensor data to decide whether to turn on TREAD Lamp.
   C. Uses sensor information, distance traveled, background noise levels, Auto-learn status, short circuit output status, vehicle battery level, internal receiver states to determine if there is a system or a vehicle fault.

OPERATION

1. General Function
   A. Auto-learn takes place only once per Ignition cycle.
   B. On successful completion, 4 road wheel sensor ID's are latched into memory for monitoring.
   C. Until Auto-learn completes, previously learned sensors are monitored for under inflation / leak warnings.
2. General Conditions to Learn New Sensors:
   A. Receiver must determine that it is confident that sensor is not temporary:
      1) Uses vehicle speed.
      2) Uses confidence reduction of previously learned sensors.
   B. Typical time at driving over 12.4 mph(20 kph) to learn a new sensor is up to 20 minutes.
3. General Conditions to Un-Learn a sensor that is removed:
   A. It takes less than 20 minutes at 12.4~18.6 mph(20~30kph).
   B. Confidence reduction is dependent on vehicle speed greater than or equal to 12.4 mph(12 kph).

Suspension System > Tire Pressure Monitoring System > TPMS Receiver > Repair procedures

REPLACEMENT

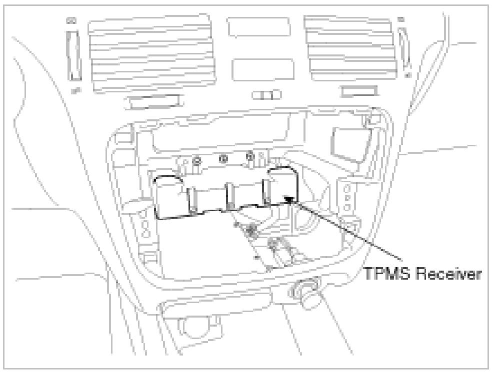
NOTE

When the receiver first arrives for replacement:
1) It will be in Virgin State.
2) It will not be configured for any specific platform.
3) It will not have any sensor ID's memorized.

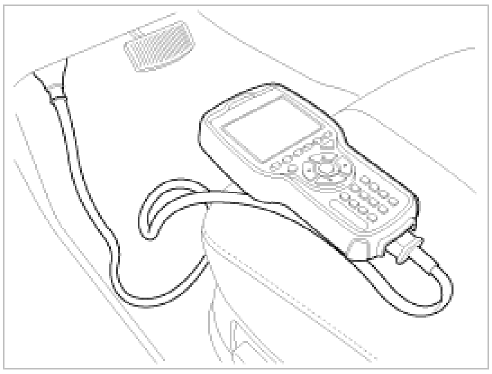
CAUTION

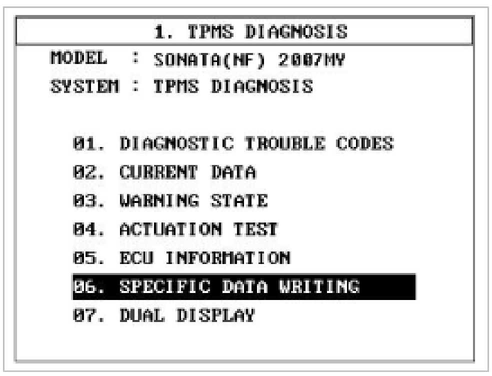
It is important to make sure that the correct receiver is used to replace the faulty part i.e. it must be Low Line (PN 95800-2E500) and not High Line (PN 95800-26000) in order to have the correct inflation warning thresholds set.

1. Disconnect vehicle battery.
2. Remove faulty part and fit bracket assembly to new part.



3. Secure new part to vehicle and fit connector.
4. Re-connect battery and turn Ignition on.
5. Check that DTC flash rate matches Virgin State indication (see SS-).
6. Connect 'TPMS exciter' to the diagnostic connector.



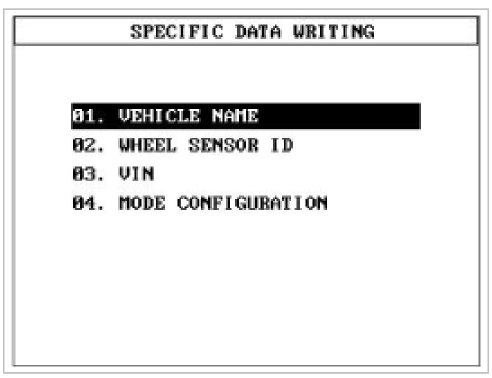

1. TPMS DIAGNOSIS

MODEL : SONATA(NF) 2007MY

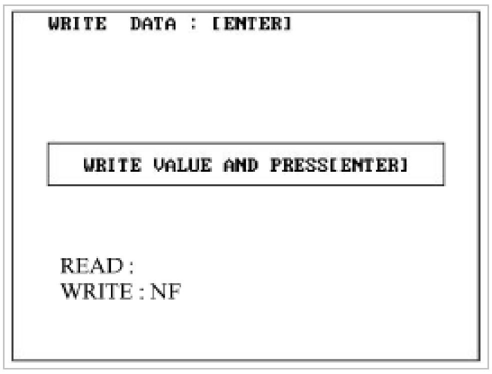
SYSTEM : TPMS DIAGNOSIS

01. DIAGNOSTIC TROUBLE CODES
02. CURRENT DATA
03. WARNING STATE
04. ACTUATION TEST
05. ECU INFORMATION
06. SPECIFIC DATA WRITING
07. DUAL DISPLAY

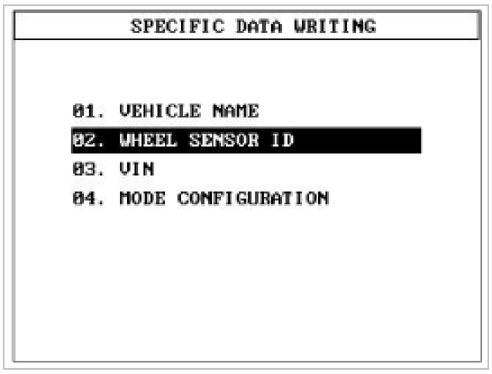
7. Write vehicle name to receiver. receiver will now automatically update monitoring parameters.

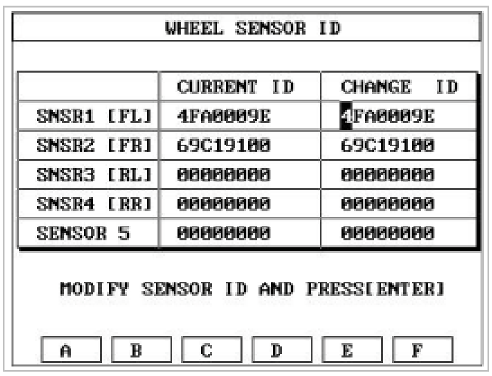

SPECIFIC DATA WRITING

01. VEHICLE NAME
02. WHEEL SENSOR ID
03. VIN
04. MODE CONFIGURATION

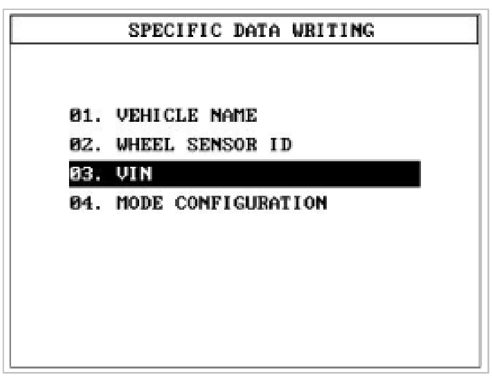


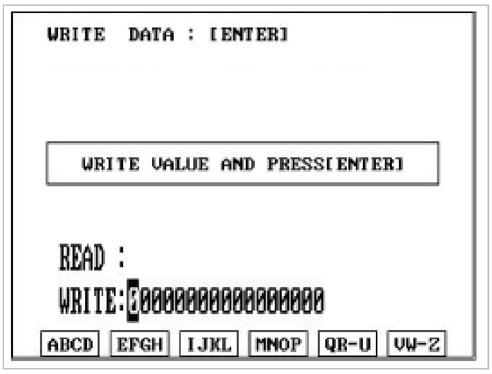
8. Read sensor's ids with the 'TPMS exciter'.
   (Refer to 'SENSOR INITIATING PROCEDURE')
9. Register sensor's ids to receiver.



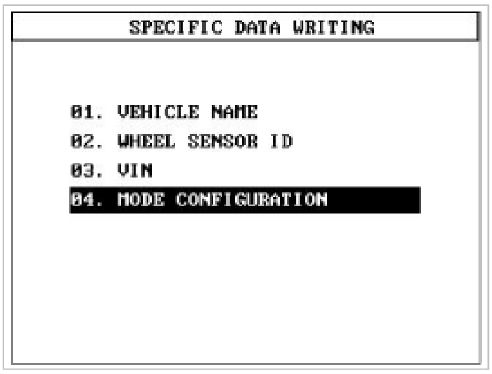


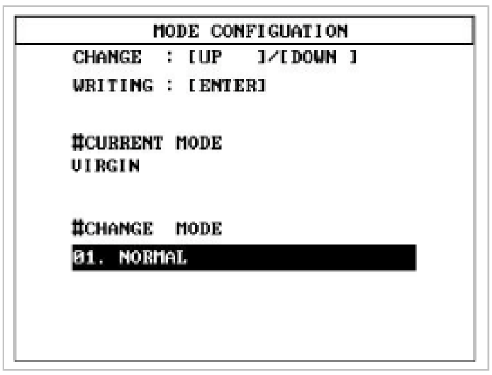
10. Register VIN number of the vehicle.(17 digits)





11. Change receiver state from Virgin to Normal.

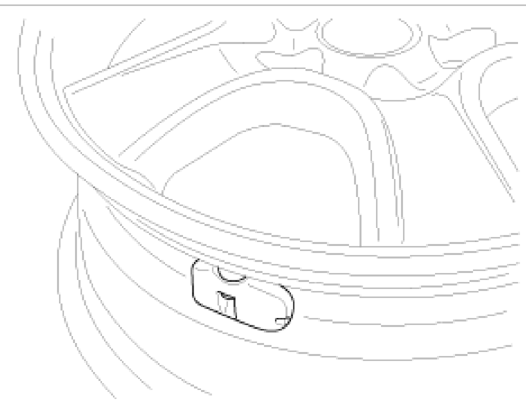




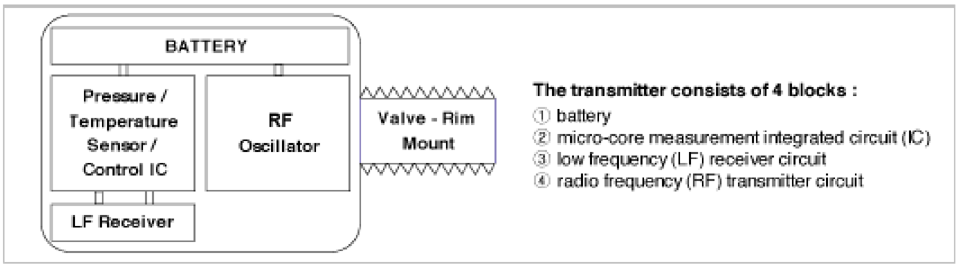
12. Disconnect diagnostic link.
13. Turn ignition off for approximately 10 seconds then turn it back on and check that Normal State is now indicated (see SS-).

Suspension System > Troubleshooting > C1121

Component Location



General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere due to transmission. Wheel sensors shall support usage on steel or aluminum rims.
Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 248 °F(40 to 120 °C). Transmitter shall enter thermal shutdown once the measured temperature is greater than or equal to 257 °F(125 °C). The accuracy of the sensor is 23 to 44.6 °F(-5 to 7 °C)at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 212 °F(100 °C). The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit..

【Tire Pressure Monitoring】

When 4 sensors have been learned as road wheels, it shall not be possible to learn new road wheel sensors on the same Ignition cycle. In normal mode low line, tire pressure and temperature shall be transmitted every 3 minutes 20 s nominally independent of vehicle operation. Monitoring shall be every 20 s. If sensor detects rapid deflation, then RF messages will be transmitted every 4 s for 1 minute duration. Communication from wheel sensors shall be via RF at a frequency of 315 MHz, 5 kBaud. Tire pressure measurement tolerance shall be ±7 kPa from 32 to 122 °F(0 to 50 °C) and ±17.5 kPa from -40 to 248 °F (-40 to 120°C) with a range of 100 to 450 kPa. Tire temperature measurement tolerance shall be ±37.4 °F(±3 °C) from -4 to 158 °F(-20 to 70 °C) and to ±41 °F(±5 °C) from -40 to 248 °F(40 to 120 °C)..

DTC Description

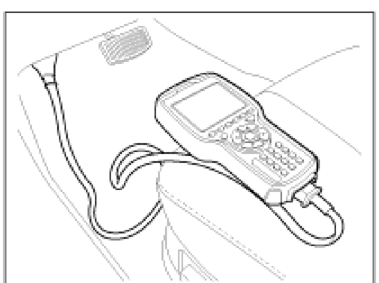
This DTC indicates that the sensor battery voltage level is Low. The most likely cause is battery passing it's expected life / excessively Low temperatures / sensor failure.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Sensor battery check	• Sensor temperature low • Sensor battery low • Faulty TPMS sensor
Enable conditions	• Latest Lowest sensor Temp. > -4 °F(-20 °C) • Distance travelled during 12 min. > 4 km	
Threshold value	• Sensor voltage <2.2 V	
Diagnosis time	• 12 ~13 minutes	

Monitor Scantool Data

1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).


Connect the DLC for 'TPMS exciter'

3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mod of "CURRENT DATA" function.
5. Monitor the parameter of SENSOR 1 on the 'TPMS exciter' or scantool after 13 minutes.

Specification : 'Sensor Temp.' is more than -68 °F(-20 °C)and 'Sensor battery value' is 'Normal'.

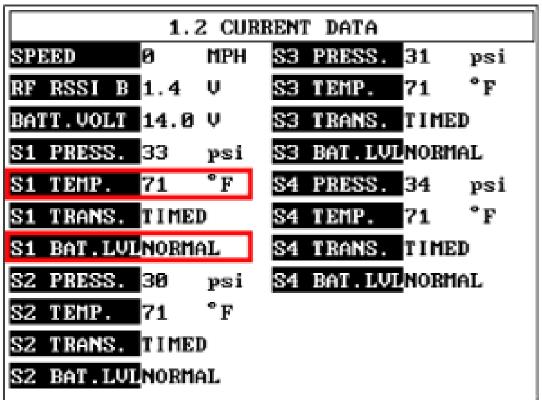


Fig 1 Sensor current data (normal)

6. Is parameter within specifications?

YES

▸ Fault is intermittent. It has been repaired and TPMS receiver module memory is not cleared yet.
▸ Go to "Verification of vehicle Repair" procedure.

NO

▸ Go to "Component Inspection" procedure.

Component Inspection

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
3. Execute "SET SENSOR STATUS" of each wheel.

Specification : 'Sensor battery value' is 'Normal' and 'Sensor Temp.' is more than -68 °F(-20 °C).

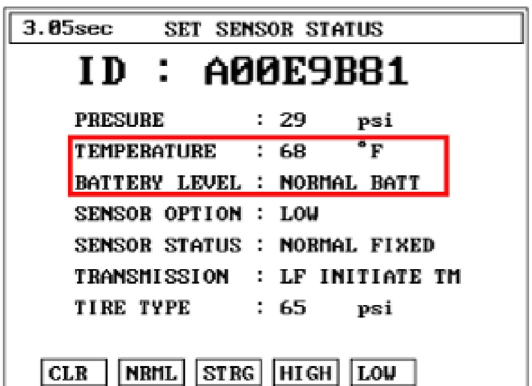


Fig 1 Sensor status (normal)


Executing "SET SENSOR STATUS"

4. Is any sensor data outside specification?

YES

▸ The sensor which displays data above the specification is SENSOR 1.
▸ Check wheel / tire where abnormal sensor data was detected. Check for tire / wheel damage and overheated brake condition.
▸ Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure.
▸ If it is OK, go to "Check wheel / tire" as follows.

NO

▸ Check for sensor if unable to retrieve data with 'TPMS exciter'.
▸ Replace TPMS sensor if necessary and register sensor ID with 'TPMS exciter'.
▸ Go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

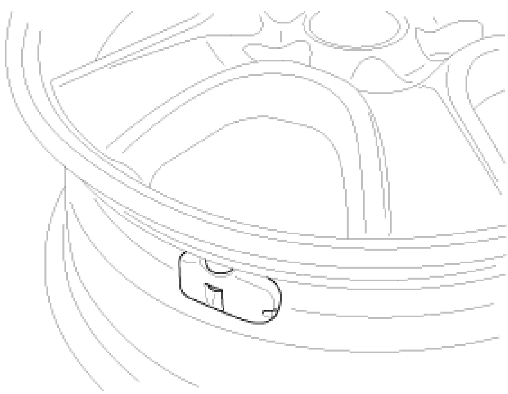
▸ Go to the applicable troubleshooting procedure.

NO

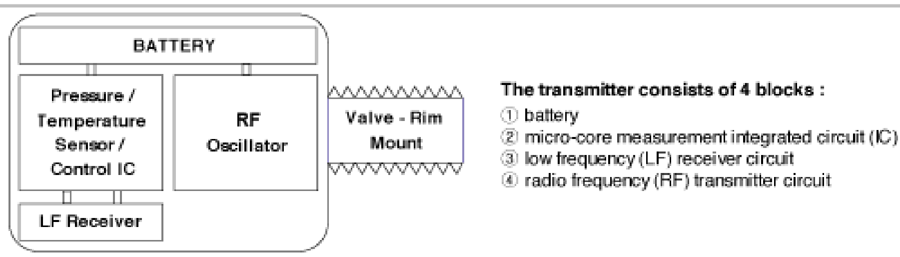
▸ System performing to specification at this time.

Suspension System > Troubleshooting > C1122

Component Location



General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere due to transmission. Wheel sensors shall support usage on steel or aluminum rims.
Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 248 °F(40 to 120 °C). Transmitter shall enter thermal shutdown once the measured temperature is greater than or equal to 257 °F(125 °C). The accuracy of the sensor is 23 to 44.6 °F(-5 to 7 °C)at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 212 °F(100 °C). The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit..

【Tire Pressure Monitoring】

When 4 sensors have been learned as road wheels, it shall not be possible to learn new road wheel sensors on the same Ignition cycle. In normal mode low line, tire pressure and temperature shall be transmitted every 3 minutes 20 s nominally independent of vehicle operation. Monitoring shall be every 20 s. If sensor detects rapid deflation, then RF messages will be transmitted every 4 s for 1 minute duration. Communication from wheel sensors shall be via RF at a frequency of 315 MHz, 5 kBaud. Tire pressure measurement tolerance shall be ±7 kPa from 32 to 122 °F(0 to 50 °C) and ±17.5 kPa from -40 to 248 °F (-40 to 120°C) with a range of 100 to 450 kPa. Tire temperature measurement tolerance shall be ±37.4 °F(±3 °C) from -4 to 158 °F(-20 to 70 °C) and to ±41 °F(±5 °C) from -40 to 248 °F(40 to 120 °C)..

DTC Description

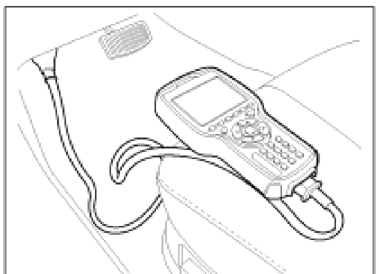
This DTC indicates that the sensor battery voltage level is Low. The most likely cause is battery passing it's expected life / excessively Low temperatures / sensor failure.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Sensor battery check	• Sensor temperature low • Sensor battery low • Faulty TPMS sensor
Enable conditions	• Latest Lowest sensor Temp. > -4 °F(-20 °C) • Distance travelled during 12 min. > 4 km	
Threshold value	• Sensor voltage <2.2 V	
Diagnosis time	• 12 ~13 minutes	

Monitor Scantool Data

1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



Connect the DLC for 'TPMS exciter'

3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mod of "CURRENT DATA" function.
5. Monitor the parameter of SENSOR 1 on the 'TPMS exciter' or scantool after 13 minutes.

Specification : 'Sensor Temp.' is more than -68 °F(-20 °C)and 'Sensor battery value' is 'Normal'.

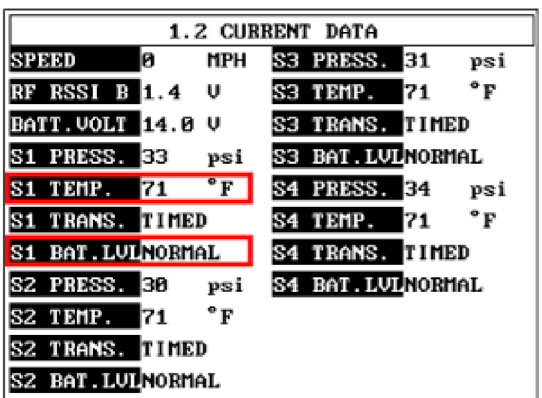


Fig 1 Sensor current data (normal)

6. Is parameter within specifications?

YES

▸ Fault is intermittent. It has been repaired and TPMS receiver module memory is not cleared yet.

▸ Go to "Verification of vehicle Repair" procedure.

NO

▸ Go to "Component Inspection" procedure.

Component Inspection

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
3. Execute "SET SENSOR STATUS" of each wheel.

Specification : 'Sensor battery value' is 'Normal' and 'Sensor Temp.' is more than -68 °F(-20 °C).

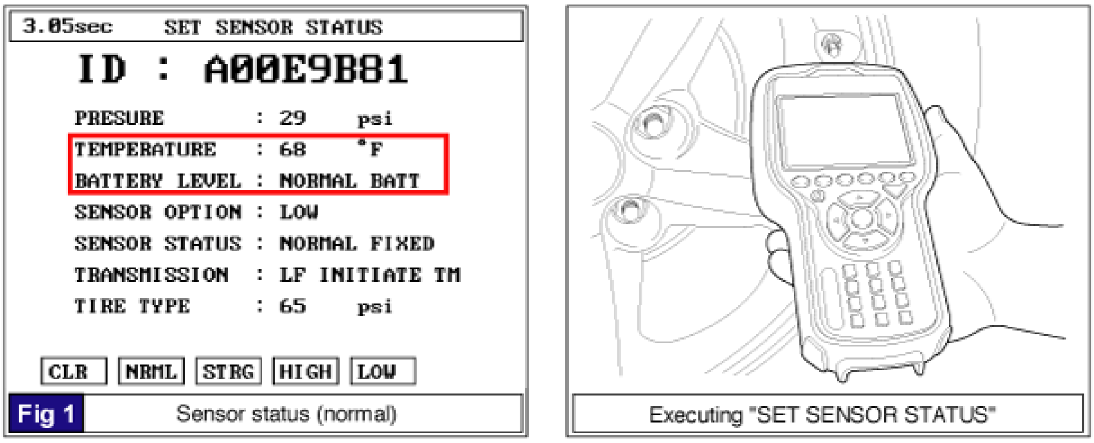


Fig 1 Sensor status (normal)

Executing "SET SENSOR STATUS"

4. Is any sensor data outside specification?

YES

▸ The sensor which displays data above the specification is SENSOR 1.
▸ Check wheel / tire where abnormal sensor data was detected. Check for tire / wheel damage and overheated brake condition.
▸ Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure.
▸ If it is OK, go to "Check wheel / tire" as follows.

NO

▸ Check for sensor if unable to retrieve data with 'TPMS exciter'.
▸ Replace TPMS sensor if necessary and register sensor ID with 'TPMS exciter'.
▸ Go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

▸ Go to the applicable troubleshooting procedure.

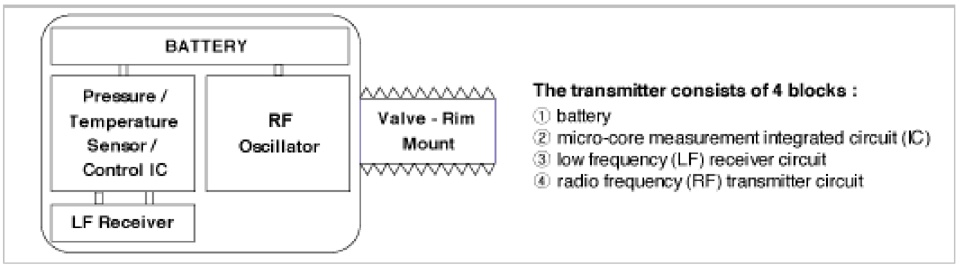
NO

▸ System performing to specification at this time.

Suspension System > Troubleshooting > C1123

Component Location

General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere due to transmission. Wheel sensors shall support usage on steel or aluminum rims.
Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 248 °F(40 to 120 °C). Transmitter shall enter thermal shutdown once the measured temperature is greater than or equal to 257 °F(125 °C). The accuracy of the sensor is 23 to 44.6 °F(-5 to 7 °C)at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 212 °F(100 °C). The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit..

【Tire Pressure Monitoring】

When 4 sensors have been learned as road wheels, it shall not be possible to learn new road wheel sensors on the same Ignition cycle. In normal mode low line, tire pressure and temperature shall be transmitted every 3 minutes 20 s nominally independent of vehicle operation. Monitoring shall be every 20 s. If sensor detects rapid deflation, then RF messages will be transmitted every 4 s for 1 minute duration. Communication from wheel sensors shall be via RF at a frequency of 315 MHz, 5 kBaud. Tire pressure measurement tolerance shall be ±7 kPa from 32 to 122 °F(0 to 50 °C) and ±17.5 kPa from -40 to 248 °F (-40 to 120°C) with a range of 100 to 450 kPa. Tire temperature measurement tolerance shall be ±37.4 °F(±3 °C) from -4 to 158 °F(-20 to 70 °C) and to ±41 °F(±5 °C) from -40 to 248 °F(40 to 120 °C)..

DTC Description

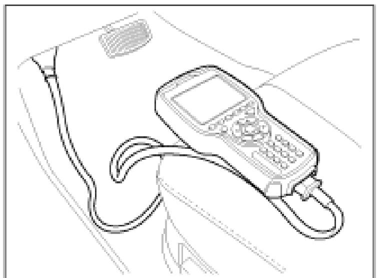
This DTC indicates that the sensor battery voltage level is Low. The most likely cause is battery passing it's expected life / excessively Low temperatures / sensor failure.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Sensor battery check	• Sensor temperature low • Sensor battery low • Faulty TPMS sensor
Enable conditions	• Latest Lowest sensor Temp. > -4 °F(-20 °C) • Distance travelled during 12 min. > 4 km	
Threshold value	• Sensor voltage <2.2 V	
Diagnosis time	• 12 ~13 minutes	

Monitor Scantool Data

1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



Connect the DLC for 'TPMS exciter'

3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mod of "CURRENT DATA" function.
5. Monitor the parameter of SENSOR 1 on the 'TPMS exciter' or scantool after 13 minutes.

Specification : 'Sensor Temp.' is more than -68 °F(-20 °C)and 'Sensor battery value' is 'Normal'.

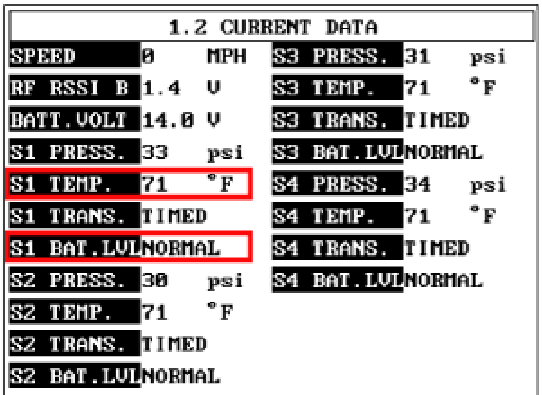


Fig 1 Sensor current data (normal)

6. Is parameter within specifications?

YES

- Fault is intermittent. It has been repaired and TPMS receiver module memory is not cleared yet.
- Go to "Verification of vehicle Repair" procedure.

NO

- Go to "Component Inspection" procedure.

Component Inspection

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
3. Execute "SET SENSOR STATUS" of each wheel.

Specification : 'Sensor battery value' is 'Normal' and 'Sensor Temp.' is more than -68 °F(-20 °C).

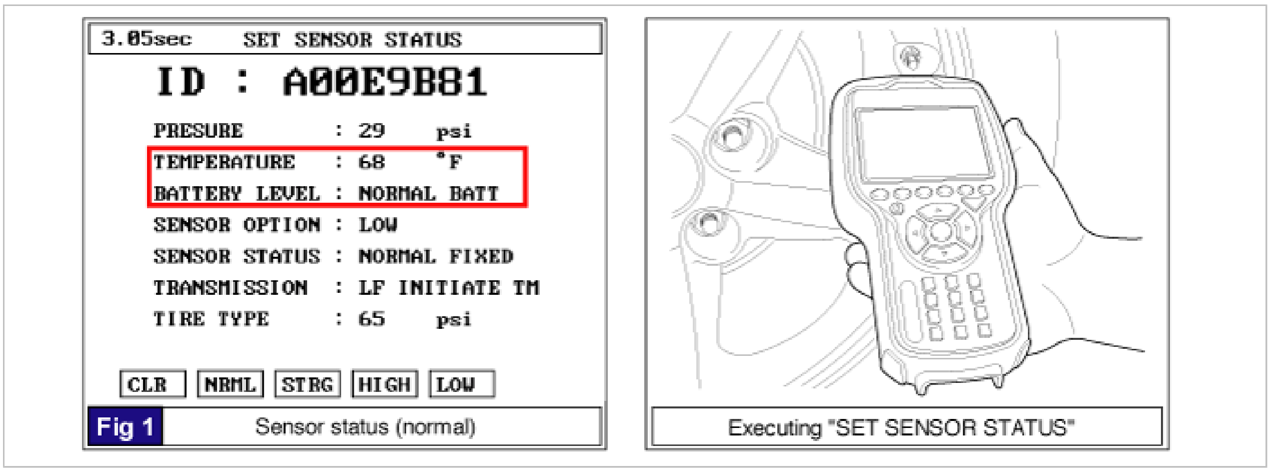


Fig 1 Sensor status (normal)

Executing "SET SENSOR STATUS"

4. Is any sensor data outside specification?

YES

▸ The sensor which displays data above the specification is SENSOR 1.

▸ Check wheel / tire where abnormal sensor data was detected. Check for tire / wheel damage and overheated brake condition.

▸ Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure.

▸ If it is OK, go to "Check wheel / tire" as follows.

NO

▸ Check for sensor if unable to retrieve data with 'TPMS exciter'.

▸ Replace TPMS sensor if necessary and register sensor ID with 'TPMS exciter'.

▸ Go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

▸ Go to the applicable troubleshooting procedure.

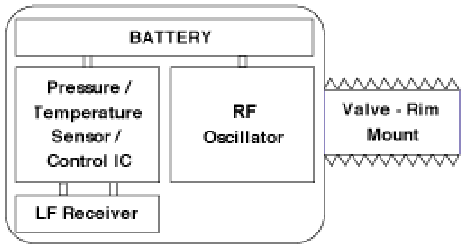
NO

▸ System performing to specification at this time.

Suspension System > Troubleshooting > C1124

Component Location

General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere due to transmission. Wheel sensors shall support usage on steel or aluminum rims.
Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 248 °F(40 to 120 °C). Transmitter shall enter thermal shutdown once the measured temperature is greater than or equal to 257 °F(125 °C). The accuracy of the sensor is 23 to 44.6 °F(-5 to 7 °C)at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 212 °F(100 °C). The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit..

【Tire Pressure Monitoring】

When 4 sensors have been learned as road wheels, it shall not be possible to learn new road wheel sensors on the same Ignition cycle. In normal mode low line, tire pressure and temperature shall be transmitted every 3 minutes 20 s nominally independent of vehicle operation. Monitoring shall be every 20 s. If sensor detects rapid deflation, then RF messages will be transmitted every 4 s for 1 minute duration. Communication from wheel sensors shall be via RF at a frequency of 315 MHz, 5 kBaud. Tire pressure measurement tolerance shall be ±7 kPa from 32 to 122 °F(0 to 50 °C) and ±17.5 kPa from -40 to 248 °F (-40 to 120°C) with a range of 100 to 450 kPa. Tire temperature measurement tolerance shall be ±37.4 °F(±3 °C) from -4 to 158 °F(-20 to 70 °C) and to ±41 °F(±5 °C) from -40 to 248 °F(40 to 120 °C)..

DTC Description

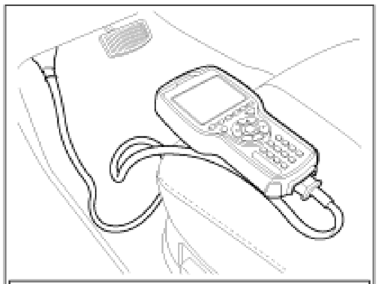
This DTC indicates that the sensor battery voltage level is Low. The most likely cause is battery passing it's expected life / excessively Low temperatures / sensor failure.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Sensor battery check	• Sensor temperature low • Sensor battery low • Faulty TPMS sensor
Enable conditions	• Latest Lowest sensor Temp. > -4 °F(-20 °C) • Distance travelled during 12 min. > 4 km	
Threshold value	• Sensor voltage <2.2 V	
Diagnosis time	• 12 ~13 minutes	

Monitor Scantool Data

1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



Connect the DLC for 'TPMS exciter'

3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mod of "CURRENT DATA" function.
5. Monitor the parameter of SENSOR 1 on the 'TPMS exciter' or scantool after 13 minutes.

Specification : 'Sensor Temp.' is more than -68 °F(-20 °C)and 'Sensor battery value' is 'Normal'.

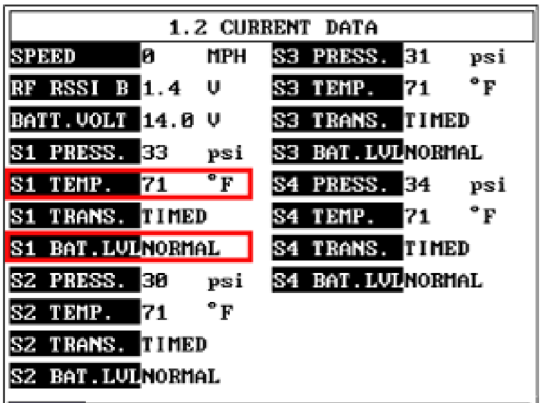


Fig 1 Sensor current data (normal)

6. Is parameter within specifications?

YES

▸ Fault is intermittent. It has been repaired and TPMS receiver module memory is not cleared yet.
▸ Go to "Verification of vehicle Repair" procedure.

NO

▸ Go to "Component Inspection" procedure.

Component Inspection

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
3. Execute "SET SENSOR STATUS" of each wheel.

Specification : 'Sensor battery value' is 'Normal' and 'Sensor Temp.' is more than -68 °F(-20 °C).

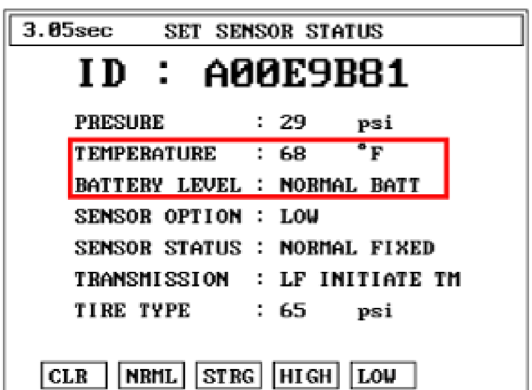


Fig 1 Sensor status (normal)


Executing "SET SENSOR STATUS"

4. Is any sensor data outside specification?

YES

▸ The sensor which displays data above the specification is SENSOR 1.
▸ Check wheel / tire where abnormal sensor data was detected. Check for tire / wheel damage and overheated brake condition.
▸ Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure.
▸ If it is OK, go to "Check wheel / tire" as follows.

NO

▸ Check for sensor if unable to retrieve data with 'TPMS exciter'.
▸ Replace TPMS sensor if necessary and register sensor ID with 'TPMS exciter'.
▸ Go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

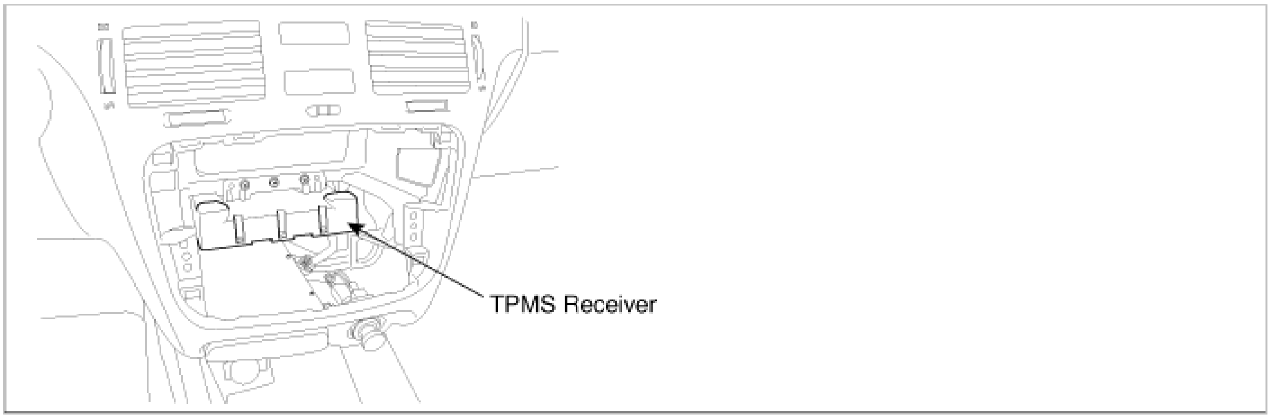
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Suspension System > Troubleshooting > C1126

Component Location



General Description

TPM Receiver is integrated with the TPM module installed at the bottom of the console. The operating battery of TPM module is supplied from the vehicle battery. Data such as Tire pressure, Tire Temperature, TPM sensor battery status and TPM sensor valve ID from TPM sensors are transmitted to TPM receiver in the form of RF signal. TPM module accomplishes Tire Monitoring and Warning Logic with received data.

DTC Description

This indicates that the receiver battery level is Low. The most likely cause is battery / harness / receiver input / A-D failure.

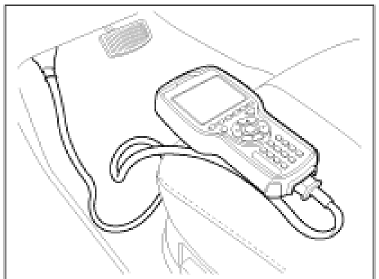
DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Battery level check	• Faulty charging system • Vehicle battery low • Faulty TPMS Receiver
Enable conditions	• Battery voltage level low	
Threshold value	• Battery voltage < 9V	
Diagnosis time	• 2 sec.	

Monitor Scantool Data

1. Start engine and turn headight and rear defroster.

2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



Connect the DLC for 'TPMS exciter'

3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mode of "CURRENT DATA" function.
5. Maintaining ENG. RPM at 2,500RPM(idle) over 2 minutes.
6. Monitor the parameter of BATT. VOLT on the 'TPMS exciter' or scantool

Specification : 'BATT. VOLT' is more than 10 V

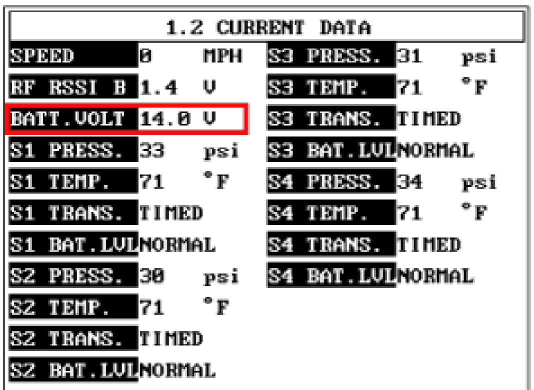


Fig 1 Sensor current data (normal)

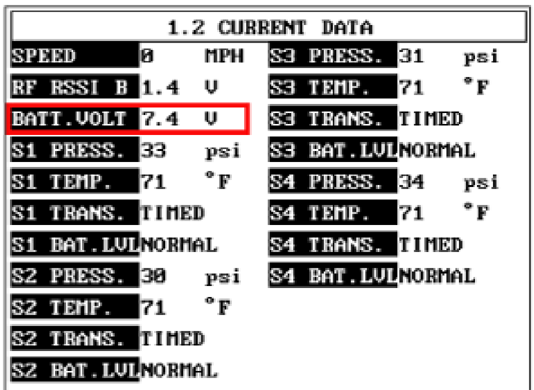


Fig 2 BATT. VOLT low

7. Is parameter normal?

YES

▸ Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.
▸ Go to "Verification of vehicle Repair" procedure.

NO

▸ Go to "Inspection/Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminal condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/or damage.
3. Has a problem been found?

YES

▸ Repair if necessary and then go to "Verification of Vehicle Repair" procedure.

NO

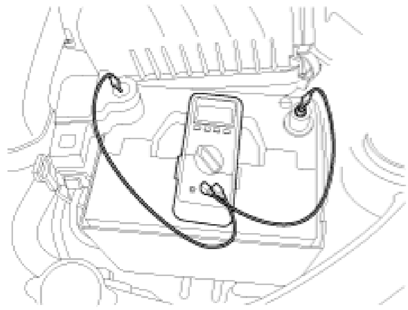
▸ Go to "Charging System Inspection" procedure.

Charging System Inspection

1. Engine "ON".
2. headight and rear defroster "ON".

3. Measure voltage between terminal (+) and (-) of battery maintaining ENG. RPM at 2,500 RPM(idle) over 2 minutes.

Specification : more than 10 V



4. Is the measured voltage within specifications?

YES

▸ Substitute with a known-good TPM receiver and check for proper operation.
▸ If the problem is corrected, replace TPM receiver and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Check for fault in charging system and check for tension of generator drive belt, ENG.idle rpm or open/short in harness from battery to generator.
▸ Repair if necessary and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

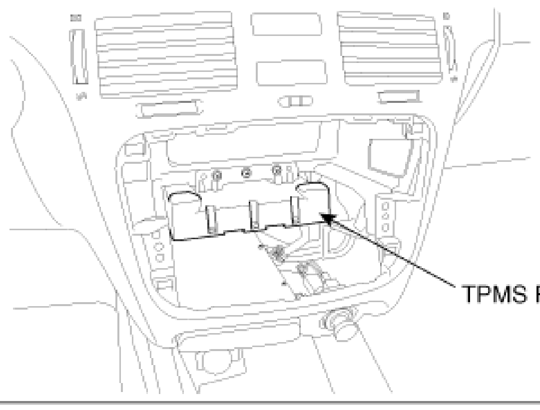
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Suspension System > Troubleshooting > C1127

Component Location



General Description

TPM Receiver is integrated with the TPM module installed at the bottom of the steering column. The operating battery of TPM module is supplied from the vehicle battery. Data such as Tire pressure, Tire Temperature, TPM sensor battery status and TPM sensor valve ID from TPM sensors are transmitted to TPM receiver in the form of RF signal. TPM module accomplishes Tire Monitoring and Warning Logic with received data.

DTC Description

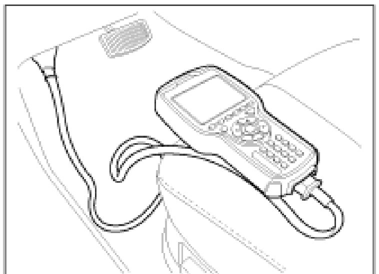
This indicates that the receiver battery level is High. The most likely cause is receiver input / A-D failure.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Battery level check	• Faulty charging system • Vehicle battery high • Faulty TPMS Receiver
Enable conditions	• Battery voltage level high	
Threshold value	• Battery voltage > 17.5 V	
Diagnosis time	• 2 sec.	

Monitor Scantool Data

1. Start engine and turn headight and heatwire on.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



Connect the DLC for 'TPMS exciter'

3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mode of "CURRENT DATA" function.
5. Maintaining ENG. RPM at 2,500RPM(idle) over 2 minutes.
6. Monitor the parameter of BATT. VOLT on the 'TPMS exciter' or scantool.

Specification : 'BATT. VOLT' is less than 16.5 V

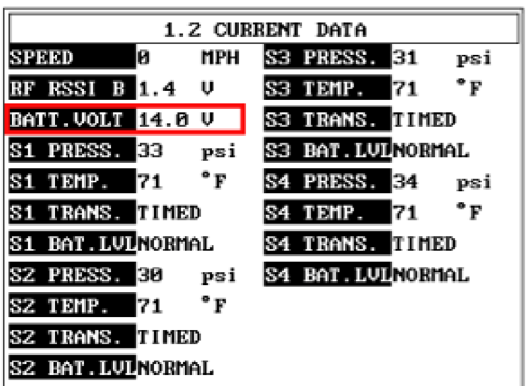


Fig 1 Sensor current data (normal)

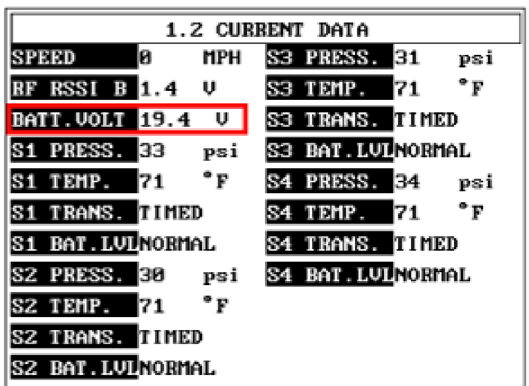


Fig 2 BATT. VOLT high

7. Is parameter normal?

YES

▸ Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.
▸ Go to "Verification of vehicle Repair" procedure.

NO

▸ Go to "Inspection/Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminal condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/or damage.
3. Has a problem been found?

YES

▸ Repair if necessary and then go to "Verification of Vehicle Repair" procedure.

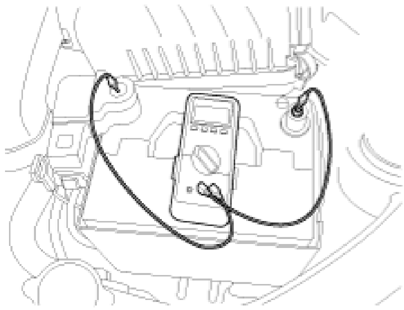
NO

▸ Go to "Charging System Inspection" procedure.

Charging System Inspection

1. Engine "ON".
2. headight and rear defroster "ON".
3. Measure voltage between terminal (+) and (-) of battery maintaining ENG. RPM at 2,500 RPM(idle) over 2 minutes.

Specification : less than 16.5 V



4. Is the measured voltage within specifications?

YES

▸ Substitute with a known-good TPM receiver and check for proper operation.
▸ If the problem is corrected, replace TPM receiver and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Check for fault in charging system and thoroughly check all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/or damage.
Repair or replace if necessary and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

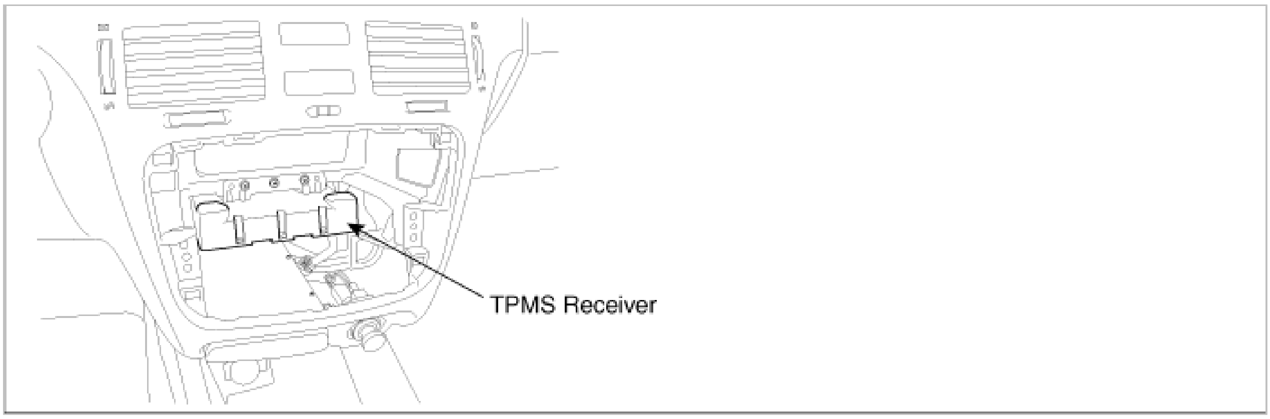
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Suspension System > Troubleshooting > C1300

Component Location



General Description

TPM Receiver is integrated with the TPM module installed at the bottom of the steering column. The operating battery of TPM module is supplied from the vehicle battery. Data such as Tire pressure, Tire Temperature, TPM sensor battery status and TPM sensor valve ID from TPM sensors are transmitted to TPM receiver in the form of RF signal. TPM module accomplishes Tire Monitoring and Warning Logic with received data.

DTC Description

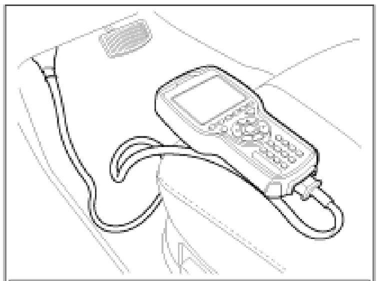
This DTC indicates that system is not functioning due to High interference levels from external sources.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• LF/RF check	• LF/RF Interference from external sources(unless C1306 also exists as historic. If this is the case then interference source is likely to be internal to the vehicle)
Enable conditions	• System not functioning due to High RF interference levels	
Threshold value	• No valid RF data for 8 min from any sensor • Distance travelled during 8 minutes ≤ 1.68 mile(2.7 km)	
Diagnosis time	• 8 - 9 minutes	

Monitor Scantool Data

1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



Connect the DLC for 'TPMS exciter'

3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mode of "CURRENT DATA" function.
5. Monitor the parameter of RF RSSI background on the 'TPMS exciter' or scantool after 9 minutes.

Specification : "RSSI background" is less than 1.9 V

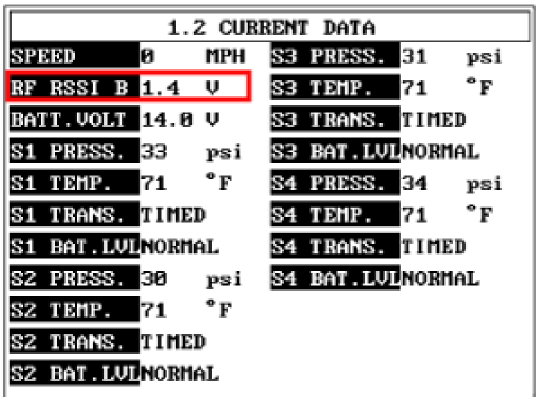


Fig 1 Sensor current data (normal)

6. Is parameter within specifications?

YES

▸ Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.
▸ Go to "Verification of vehicle Repair" procedure.

NO

▸ Substitute with a known-good TPM receiver module and check for proper operation.
▸ If the problem is corrected, replace TPM receiver module and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

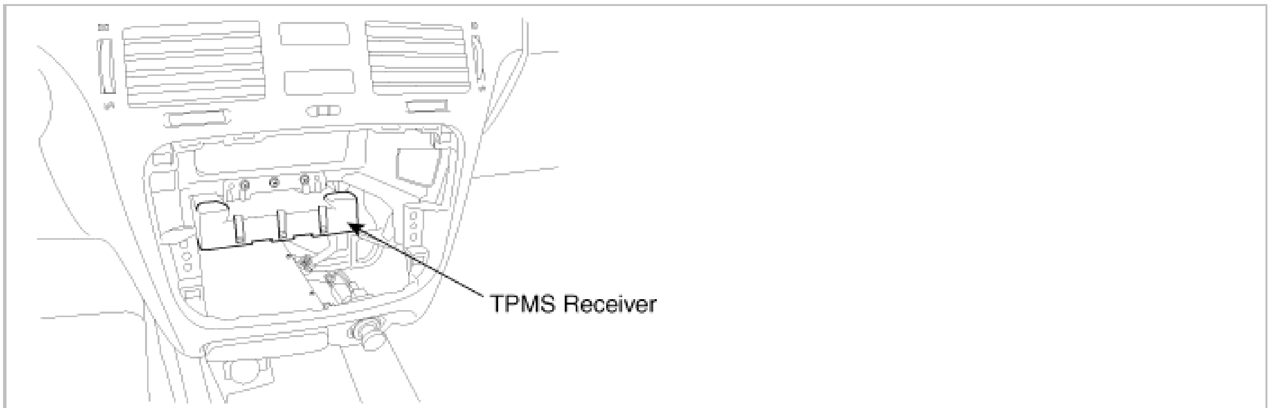
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Suspension System > Troubleshooting > C1306

Component Location



General Description

TPM Receiver is integrated with the TPM module installed at the bottom of the steering column. The operating battery of TPM module is supplied from the vehicle battery. Data such as Tire pressure, Tire Temperature, TPM sensor battery status and TPM sensor valve ID from TPM sensors are transmitted to TPM receiver in the form of RF signal. TPM module accomplishes Tire Monitoring and Warning Logic with received data.

DTC Description

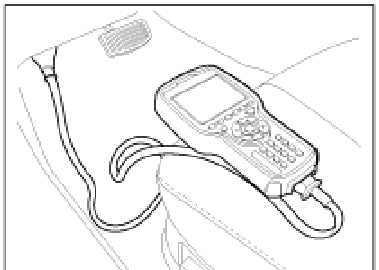
This DTC indicates that system is not functioning due to High interference levels, which are most likely being generated in the vehicle.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• LF/RF check	• Internal vehicle noise source
Enable conditions	• System not functioning due to High RF interference (Internal) levels	
Threshold value	• No valid RF data for 8 min from any sensor • Distance travelled during 8 minutes > 1.68 mile(2.7 km)	
Diagnosis time	• 8 - 9 minutes	

Monitor Scantool Data

1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



Connect the DLC for 'TPMS exciter'

3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mode of "CURRENT DATA" function.
5. Monitor the parameter of RF RSSI background on the 'TPMS exciter' or scantool after 9 minutes..

Specification : "RSSI background" is less than 1.9V

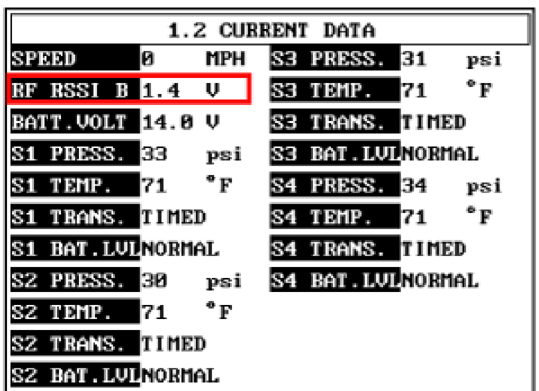


Fig 1 Sensor current data (normal)

6. Is parameter within specifications?

YES

▸ Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.
▸ Go to "Verification of vehicle Repair" procedure.

NO

▸ Substitute with a known-good TPM receiver module and check for proper operation.
▸ If the problem is corrected, replace TPM receiver module and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

▸ Go to the applicable troubleshooting procedure.

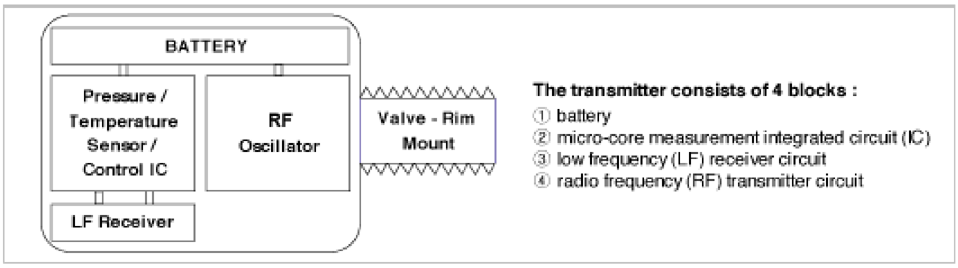
NO

▸ System performing to specification at this time.

Suspension System > Troubleshooting > C1312

Component Location

General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere such as due to the simultaneous transmission. Wheel sensors shall support usage on steel or aluminum rims.
Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 120 °C. Transmitter shall enter thermal shutdown once the measured temperature is greater than or equal to 125 °C. The accuracy of the sensor is ± 5°C at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 100 °C. The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit.

【Tire Pressure Monitoring】

When 4 sensors have been learned as road wheels, it shall not be possible to learn new road wheel sensors on the same Ignition cycle. In normal mode low line, tire pressure and temperature shall be transmitted every 3 minutes 20 s nominally independent of vehicle operation. Monitoring shall be every 20 s. If sensor detects rapid deflation, then RF messages will be transmitted every 4 s for 1 minute duration. Communication from wheel sensors shall be via RF at a frequency of 315 MHz, 5 kBaud. Tire pressure measurement tolerance shall be ±7 kPa from 0 to 50 °C and ±17.5 kPa from -40 to 120°C with a range of 100 to 450 kPa. Tire temperature measurement tolerance shall be ±3 °C from -20 to 70 °C and to ±5 °C from -40 to 120 °C.

DTC Description

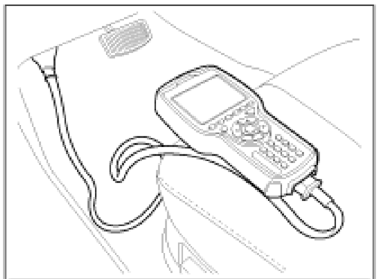
This DTC indicates that the sensor has either failed to learn OR has successfully learned and the receiver did not receive messages from the learned sensor for 12 minutes.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• RF message from sensor1 check	• Incorrectly configured TPMS sensor e.g.Low Line vehicle with High Line sensors. • Low Line vehicle sensors in storage state. • Wrong receiver type fitted e.g. Low Line receiver to a High Line vehicle. • Shielding in vehicle. • Un-approved wheels/tires i.e. a vehicle set up that has not been approved for good RF performance. • Incorrectly fitted sensor / receiver. • Faulty TPMS sensor
Enable conditions	• 2.48 mile < Distance travelled during 12 min. < 24.85 mile	
Threshold value	• Failure to Learn Sensors1 Correctly. • No RF message received from sensor1 over 12 min.	
Diagnosis time	• 12 ~ 20 minutes.	

Monitor Scantool Data

1. Connect "TPMS exciter' or scantool to Data Link Connector(DLC).



Connect the DLC for 'TPMS exciter'

2. Select "TPMS DIAGNOSIS" mode.
3. Select the "FULL" mode of "CURRENT DATA" function.
4. Monitor the parameter of SENSOR 1 on the 'TPMS exciter' or scantool after 20 minutes.

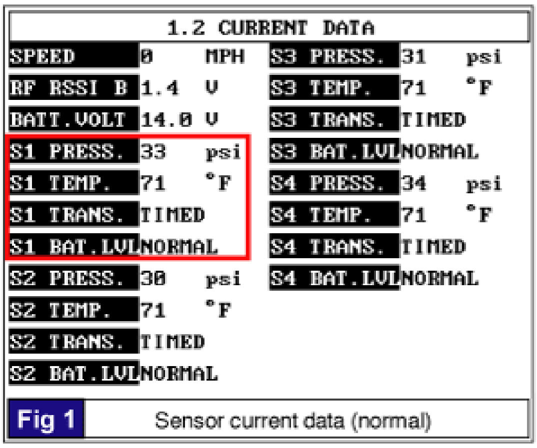


Fig 1 Sensor current data (normal)

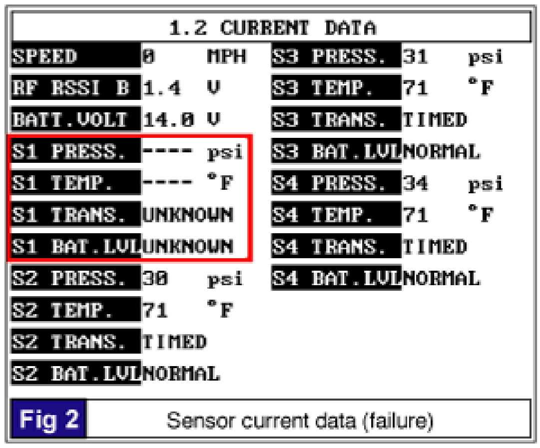


Fig 2 Sensor current data (failure)

5. Is parameter normal?

YES

▸ Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.
▸ Go to "Verification of vehicle Repair" procedure.

NO

▸ Go to "Component Inspection" procedure.

Component Inspection

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
3. Execute "SET SENSOR STATUS" of each wheel.

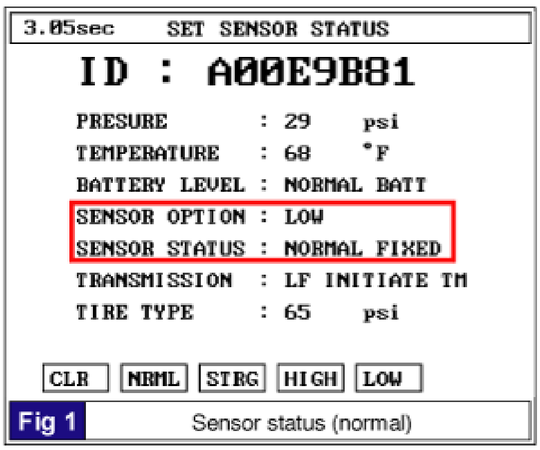
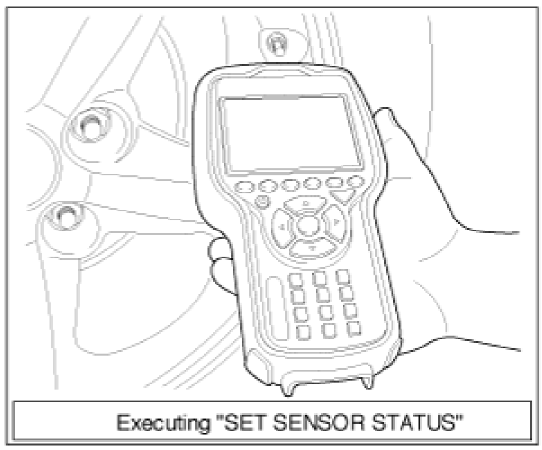


Fig 1 Sensor status (normal)


Executing "SET SENSOR STATUS"

4. Is data unable to be retrieved for any sensor?

YES

▸ Replace affected TPM sensor and register sensor ID with 'TPMS exciter'.
▸ Go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known-good TPM receiver module and check for proper operation.
▸ If the problem is corrected, replace TPM receiver module and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

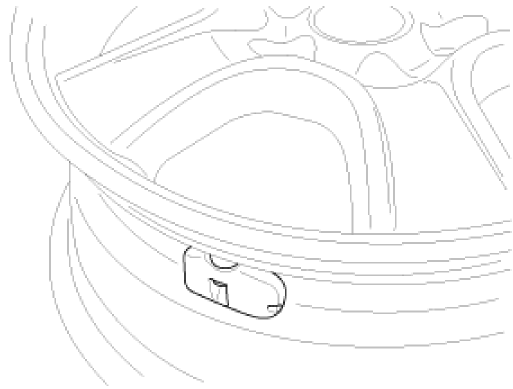
▸ Go to the applicable troubleshooting procedure.

NO

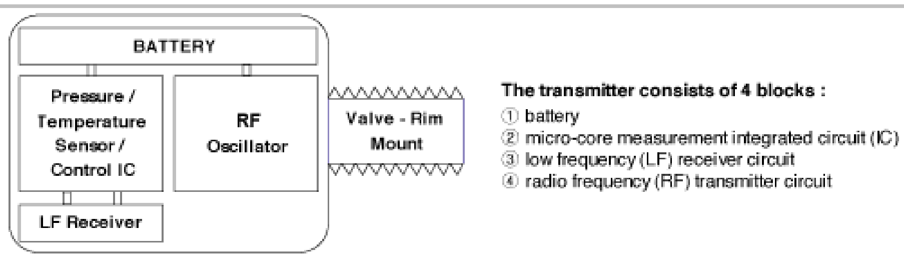
▸ System performing to specification at this time.

Suspension System > Troubleshooting > C1313

Component Location



General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere such as due to the simultaneous transmission. Wheel sensors shall support usage on steel or aluminum rims.
Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 120 °C. Transmitter shall enter thermal shutdown once the measured temperature is greater than or equal to 125 °C. The accuracy of the sensor is ± 5°C at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 100 °C. The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit.

【Tire Pressure Monitoring】

When 4 sensors have been learned as road wheels, it shall not be possible to learn new road wheel sensors on the same Ignition cycle. In normal mode low line, tire pressure and temperature shall be transmitted every 3 minutes 20 s nominally independent of vehicle operation. Monitoring shall be every 20 s. If sensor detects rapid deflation, then RF messages will be transmitted every 4 s for 1 minute duration. Communication from wheel sensors shall be via RF at a frequency of 315 MHz, 5 kBaud. Tire pressure measurement tolerance shall be ±7 kPa from 0 to 50 °C and ±17.5 kPa from -40 to 120°C with a range of 100 to 450 kPa. Tire temperature measurement tolerance shall be ±3 °C from -20 to 70 °C and to ±5 °C from -40 to 120 °C.

DTC Description

This DTC indicates that the sensor has either failed to learn OR has successfully learned and the receiver did not receive messages from the learned sensor for 12 minutes.

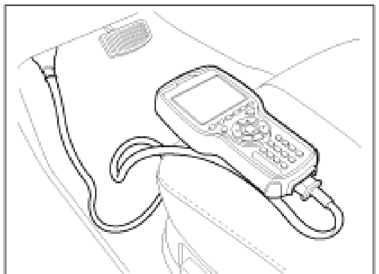
DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• RF message from sensor1 check	• Incorrectly configured TPMS sensor e.g.Low

Enable conditions	• 2.48 mile < Distance travelled during 12 min. < 24.85 mile	Line vehicle with High Line sensors. • Low Line vehicle sensors in storage state. • Wrong receiver type fitted e.g. Low Line receiver to a High Line vehicle. • Shielding in vehicle. • Un-approved wheels/tires i.e. a vehicle set up that has not been approved for good RF performance. • Incorrectly fitted sensor / receiver. • Faulty TPMS sensor
Threshold value	• Failure to Learn Sensors1 Correctly. • No RF message received from sensor1 over 12 min.	
Diagnosis time	• 12 ~ 20 minutes.	

Monitor Scantool Data

1. Connect "TPMS exciter' or scantool to Data Link Connector(DLC).



Connect the DLC for 'TPMS exciter'

2. Select "TPMS DIAGNOSIS" mode.
3. Select the "FULL" mode of "CURRENT DATA" function.
4. Monitor the parameter of SENSOR 1 on the 'TPMS exciter' or scantool after 20 minutes.

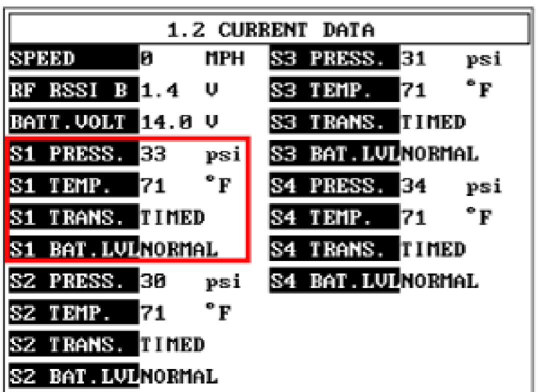


Fig 1 Sensor current data (normal)

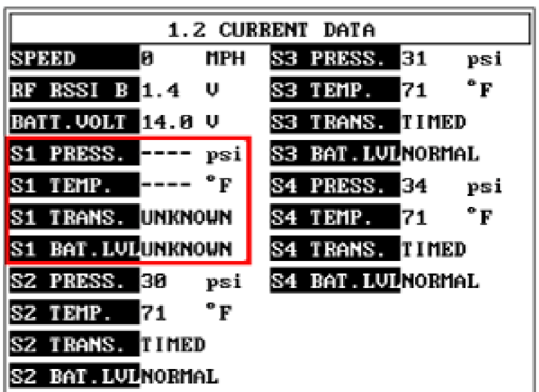


Fig 2 Sensor current data (failure)

5. Is parameter normal?

YES

▸ Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.
▸ Go to "Verification of vehicle Repair" procedure.

NO

▸ Go to "Component Inspection" procedure.

Component Inspection

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
3. Execute "SET SENSOR STATUS" of each wheel.

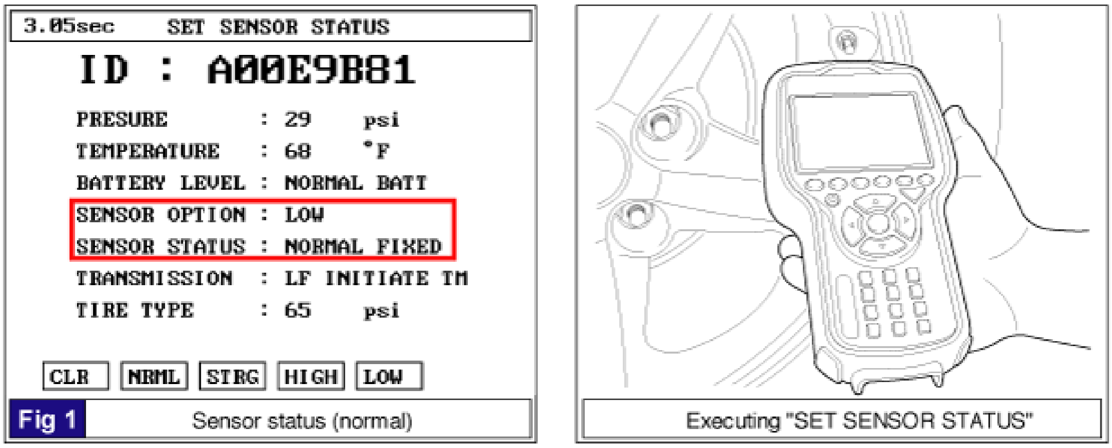


Fig 1 Sensor status (normal)

Executing "SET SENSOR STATUS"

4. Is data unable to be retrieved for any sensor?

YES

▸ Replace affected TPM sensor and register sensor ID with 'TPMS exciter'.
▸ Go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known-good TPM receiver module and check for proper operation.
▸ If the problem is corrected, replace TPM receiver module and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

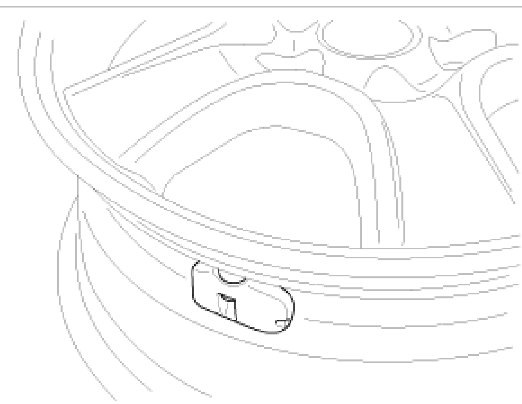
▸ Go to the applicable troubleshooting procedure.

NO

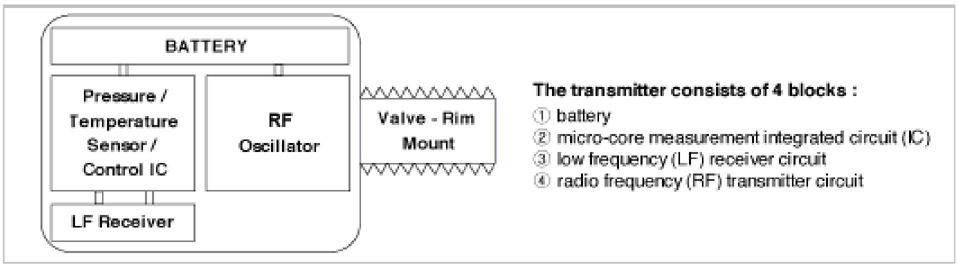
▸ System performing to specification at this time.

Suspension System > Troubleshooting > C1314

Component Location



General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere such as due to the simultaneous transmission. Wheel sensors shall support usage on steel or aluminum rims.
Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 120 °C. Transmitter shall enter thermal shutdown once the measured temperature is greater than or equal to 125 °C. The accuracy of the sensor is ± 5°C at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 100 °C. The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit.

【Tire Pressure Monitoring】

When 4 sensors have been learned as road wheels, it shall not be possible to learn new road wheel sensors on the same Ignition cycle. In normal mode low line, tire pressure and temperature shall be transmitted every 3 minutes 20 s nominally independent of vehicle operation. Monitoring shall be every 20 s. If sensor detects rapid deflation, then RF messages will be transmitted every 4 s for 1 minute duration. Communication from wheel sensors shall be via RF at a frequency of 315 MHz, 5 kBaud. Tire pressure measurement tolerance shall be ±7 kPa from 0 to 50 °C and ±17.5 kPa from -40 to 120°C with a range of 100 to 450 kPa. Tire temperature measurement tolerance shall be ±3 °C from -20 to 70 °C and to ±5 °C from -40 to 120 °C.

DTC Description

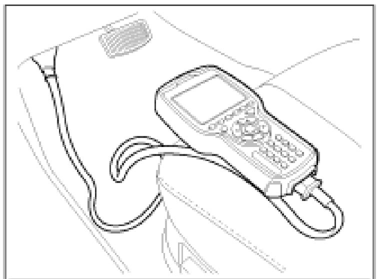
This DTC indicates that the sensor has either failed to learn OR has successfully learned and the receiver did not receive messages from the learned sensor for 12 minutes.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• RF message from sensor1 check	• Incorrectly configured TPMS sensor e.g.Low Line vehicle with High Line sensors. • Low Line vehicle sensors in storage state. • Wrong receiver type fitted e.g. Low Line receiver to a High Line vehicle. • Shielding in vehicle. • Un-approved wheels/tires i.e. a vehicle set up that has not been approved for good RF performance. • Incorrectly fitted sensor / receiver. • Faulty TPMS sensor
Enable conditions	• 2.48 mile < Distance travelled during 12 min. < 24.85 mile	
Threshold value	• Failure to Learn Sensors1 Correctly. • No RF message received from sensor1 over 12 min.	
Diagnosis time	• 12 ~ 20 minutes.	

Monitor Scantool Data

1. Connect ''TPMS exciter' or scantool to Data Link Connector(DLC).



Connect the DLC for 'TPMS exciter'

2. Select "TPMS DIAGNOSIS" mode.
3. Select the "FULL" mode of "CURRENT DATA" function.
4. Monitor the parameter of SENSOR 1 on the 'TPMS exciter' or scantool after 20 minutes.

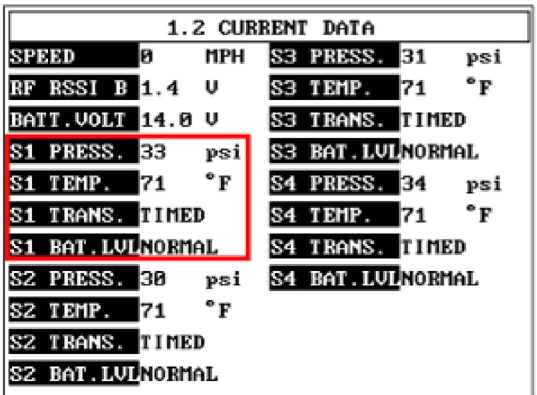


Fig 1 Sensor current data (normal)

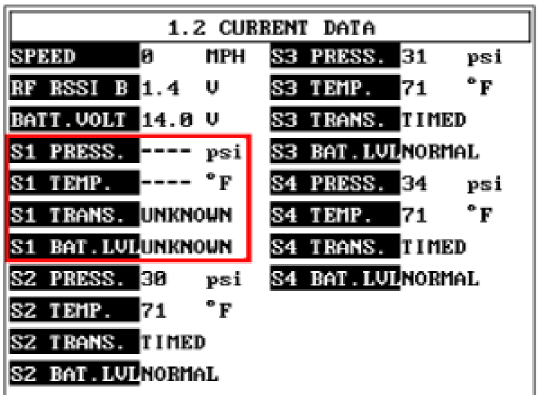


Fig 2 Sensor current data (failure)

5. Is parameter normal?

YES

▸ Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.
▸ Go to "Verification of vehicle Repair" procedure.

NO

▸ Go to "Component Inspection" procedure.

Component Inspection

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
3. Execute "SET SENSOR STATUS" of each wheel.

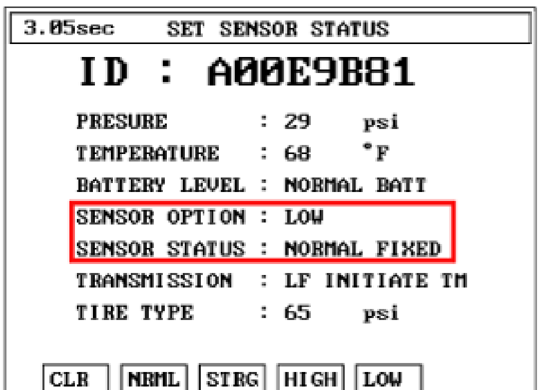


Fig 1 Sensor status (normal)

Executing "SET SENSOR STATUS"

4. Is data unable to be retrieved for any sensor?

YES

▸ Replace affected TPM sensor and register sensor ID with 'TPMS exciter'.
▸ Go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known-good TPM receiver module and check for proper operation.
▸ If the problem is corrected, replace TPM receiver module and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

▸ Go to the applicable troubleshooting procedure.

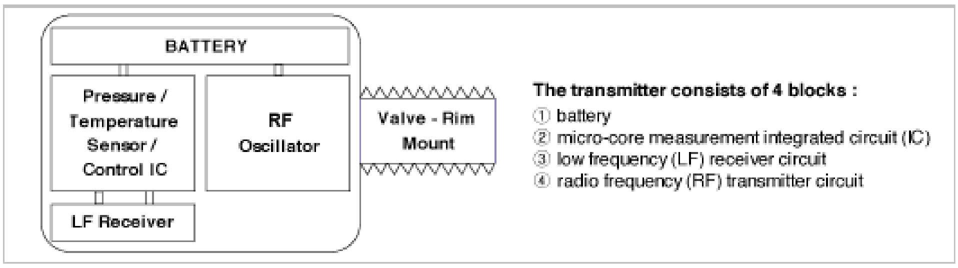
NO

▸ System performing to specification at this time.

Suspension System > Troubleshooting > C1315

Component Location

General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere such as due to the simultaneous transmission. Wheel sensors shall support usage on steel or aluminum rims.
Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 120 °C. Transmitter shall enter thermal shutdown once the measured temperature is greater than or equal to 125 °C. The accuracy of the sensor is ± 5°C at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 100 °C. The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit.

【Tire Pressure Monitoring】

When 4 sensors have been learned as road wheels, it shall not be possible to learn new road wheel sensors on the same

Ignition cycle. In normal mode low line, tire pressure and temperature shall be transmitted every 3 minutes 20 s nominally independent of vehicle operation. Monitoring shall be every 20 s. If sensor detects rapid deflation, then RF messages will be transmitted every 4 s for 1 minute duration. Communication from wheel sensors shall be via RF at a frequency of 315 MHz, 5 kBaud. Tire pressure measurement tolerance shall be ±7 kPa from 0 to 50 °C and ±17.5 kPa from -40 to 120°C with a range of 100 to 450 kPa. Tire temperature measurement tolerance shall be ±3 °C from -20 to 70 °C and to ±5 °C from -40 to 120 °C.

DTC Description

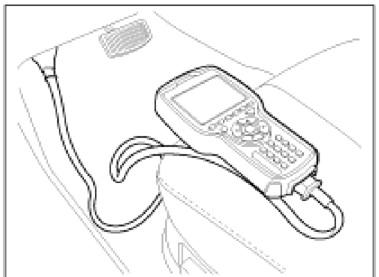
This DTC indicates that the sensor has either failed to learn OR has successfully learned and the receiver did not receive messages from the learned sensor for 12 minutes.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• RF message from sensor1 check	• Incorrectly configured TPMS sensor e.g.Low Line vehicle with High Line sensors. • Low Line vehicle sensors in storage state. • Wrong receiver type fitted e.g. Low Line receiver to a High Line vehicle. • Shielding in vehicle. • Un-approved wheels/tires i.e. a vehicle set up that has not been approved for good RF performance. • Incorrectly fitted sensor / receiver. • Faulty TPMS sensor
Enable conditions	• 2.48 mile < Distance travelled during 12 min. < 24.85 mile	
Threshold value	• Failure to Learn Sensors1 Correctly. • No RF message received from sensor1 over 12 min.	
Diagnosis time	• 12 ~ 20 minutes.	

Monitor Scantool Data

1. Connect "TPMS exciter' or scantool to Data Link Connector(DLC).



Connect the DLC for 'TPMS exciter'

2. Select "TPMS DIAGNOSIS" mode.
3. Select the "FULL" mode of "CURRENT DATA" function.
4. Monitor the parameter of SENSOR 1 on the 'TPMS exciter' or scantool after 20 minutes.

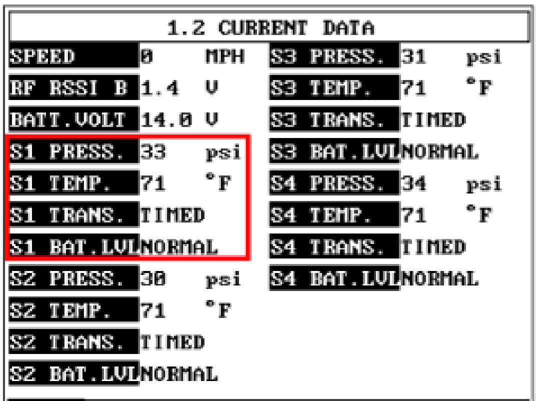


Fig 1 Sensor current data (normal)

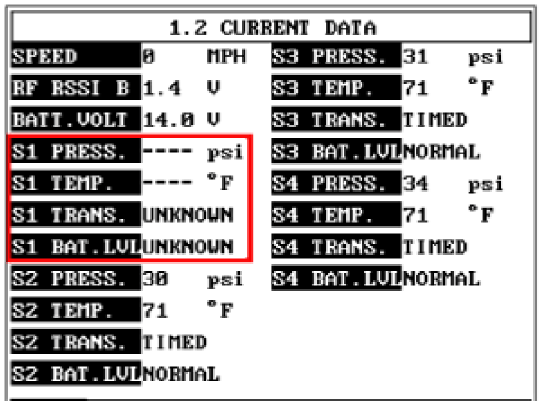


Fig 2 Sensor current data (failure)

5. Is parameter normal?

YES

- Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.
- Go to "Verification of vehicle Repair" procedure.

NO

- Go to "Component Inspection" procedure.

Component Inspection

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
3. Execute "SET SENSOR STATUS" of each wheel.

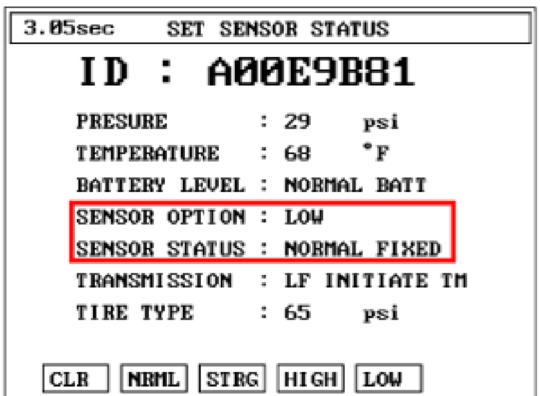


Fig 1 Sensor status (normal)


Executing "SET SENSOR STATUS"

4. Is data unable to be retrieved for any sensor?

YES

- Replace affected TPM sensor and register sensor ID with 'TPMS exciter'.
- Go to "Verification of Vehicle Repair" procedure.

NO

- Substitute with a known-good TPM receiver module and check for proper operation.
- If the problem is corrected, replace TPM receiver module and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

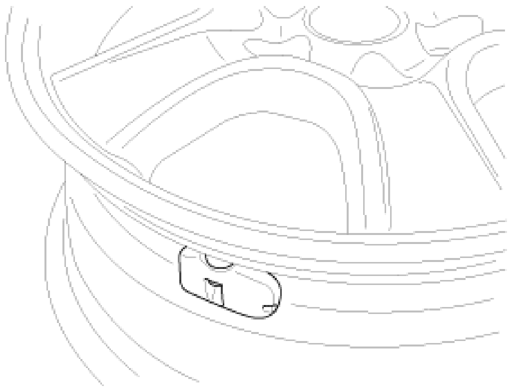
▸ Go to the applicable troubleshooting procedure.

NO

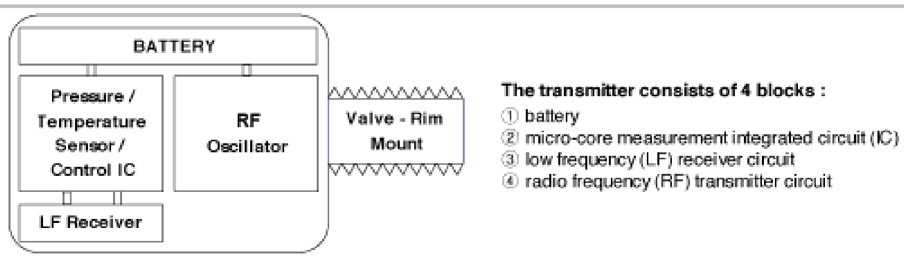
▸ System performing to specification at this time.

Suspension System > Troubleshooting > C1322

Component Location



General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere such as due to the simultaneous transmission. Wheel sensors shall support usage on steel or aluminum rims.
Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 120 °C. Transmitter shall enter thermal shutdown once the measured temperature is greater than or equal to 125 °C. The accuracy of the sensor is ± 5°C at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 100 °C. The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit.

【Tire Pressure Monitoring】

When 4 sensors have been learned as road wheels, it shall not be possible to learn new road wheel sensors on the same Ignition cycle. In normal mode low line, tire pressure and temperature shall be transmitted every 3 minutes 20 s nominally independent of vehicle operation. Monitoring shall be every 20 s. If sensor detects rapid deflation, then RF messages will be transmitted every 4 s for 1 minute duration. Communication from wheel sensors shall be via RF at a frequency of 315 MHz, 5 kBaud. Tire pressure measurement tolerance shall be ±7 kPa from 0 to 50 °C and ±17.5 kPa from -40 to 120°C with a range of 100 to 450 kPa. Tire temperature measurement tolerance shall be ±3 °C from -20 to 70 °C and to ±5 °C from -40 to 120 °C.

DTC Description

This DTC indicates that the sensor has seen a temperature in excess of 110°C. At 125°C, the sensor will shut down and the warning is therefore so that the driver knows that there is a problem with the vehicle that may affect tire performance.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Temperature of sensor check	• Damaged tire

Enable conditions	• 2 consecutive Alert State temperature > 230°F(110°C)	• Excessive braking • Driving while the parking brake is on.
Threshold value	• Sensor temperature > 230°F(110°C)	
Diagnosis time	• < 10 sec.	

Monitor Scantool Data

1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).
3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mode of "CURRENT DATA" function.
5. Monitor the parameter of SENSOR 1 temperature on the 'TPMS exciter' or scantool after 4 minutes.

Specification : Less than 230 °F(110 °C)

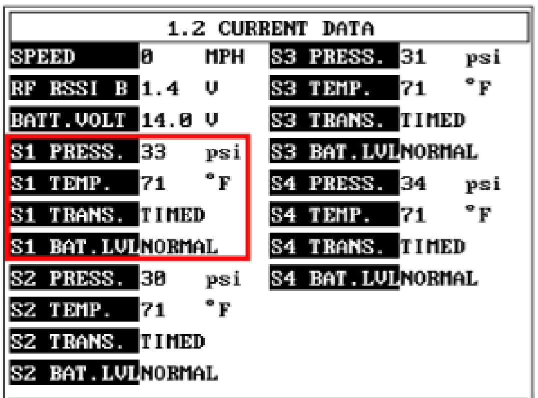
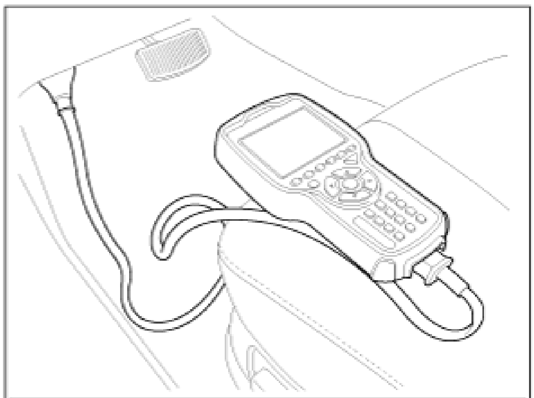


Fig 1 Sensor current data (normal)


Connect the DLC for 'TPMS exciter'

6. Is parameter within specifications?

YES

▸ Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.
▸ Go to "Verification of vehicle Repair" procedure.

NO

▸ Go to "Component Inspection" procedure.

Component Inspection

【Check TPM SENSOR 1】

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
   Execute "SET SENSOR STATUS" of each wheel.
3. Monitor the parameter of each sensor temperature on the 'TPMS exciter'.

Specification : Less than 230 °F(110 °C)

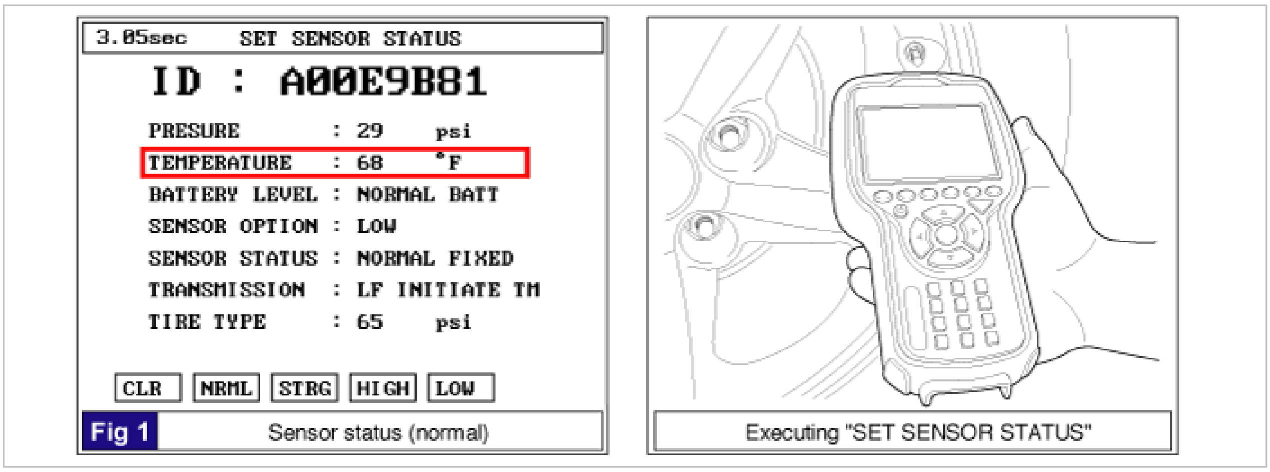


Fig 1 Sensor status (normal)

Executing "SET SENSOR STATUS"

4. Is any sensor data outside specification?

YES

- ▸ The sensor which displays data above the specification is SENSOR 1.
- ▸ Check wheel / tire of SENSOR 1 if Damaged tire, Excessive braking, Driving while the parking brake is on is detected.
- ▸ Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure.
- ▸ If it is OK, go to "Check wheel / tire" as fellows.

NO

- ▸ Substitute with a known-good TPMS receiver module and check proper operation.
- ▸ If the problem is corrected, replace TPMS receiver module and go to "Verification of Vehicle Repair" procedure.

【Check wheel / tire】

1. Cool the heat of the SENSOR 1 wheel / tire.
2. IG OFF & IG ON.
3. Monitor the parameter of sensor 1 temperature on the 'TPMS exciter' or scantool after 4 minutes.

Specification : Less than 230 °F(110 °C)

YES

- ▸ Fault can be because of temporary overheating.
- ▸ Go to "Verification of vehicle Repair" procedure.

NO

- ▸ Replace TPMS sensor and register sensor ID with 'TPMS exciter'.
- ▸ Go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

- ▸ Go to the applicable troubleshooting procedure.

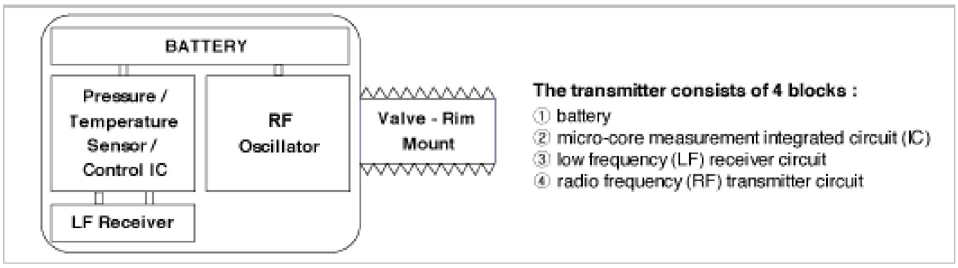
NO

- ▸ System performing to specification at this time.

Suspension System > Troubleshooting > C1323

Component Location

General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere such as due to the simultaneous transmission. Wheel sensors shall support usage on steel or aluminum rims.
Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 120 °C. Transmitter shall enter thermal shutdown once the measured temperature is greater than or equal to 125 °C. The accuracy of the sensor is ± 5°C at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 100 °C. The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit.
【Tire Pressure Monitoring】
When 4 sensors have been learned as road wheels, it shall not be possible to learn new road wheel sensors on the same Ignition cycle. In normal mode low line, tire pressure and temperature shall be transmitted every 3 minutes 20 s nominally independent of vehicle operation. Monitoring shall be every 20 s. If sensor detects rapid deflation, then RF messages will be transmitted every 4 s for 1 minute duration. Communication from wheel sensors shall be via RF at a frequency of 315 MHz, 5 kBaud. Tire pressure measurement tolerance shall be ±7 kPa from 0 to 50 °C and ±17.5 kPa from -40 to 120°C with a range of 100 to 450 kPa. Tire temperature measurement tolerance shall be ±3 °C from -20 to 70 °C and to ±5 °C from -40 to 120 °C.

DTC Description

This DTC indicates that the sensor has seen a temperature in excess of 110°C. At 125°C, the sensor will shut down and the warning is therefore so that the driver knows that there is a problem with the vehicle that may affect tire performance.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Temperature of sensor check	• Damaged tire • Excessive braking • Driving while the parking brake is on.
Enable conditions	• 2 consecutive Alert State temperature > 230°F(110°C)	
Threshold value	• Sensor temperature > 230°F(110°C)	
Diagnosis time	• < 10 sec.	

Monitor Scantool Data

1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).
3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mode of "CURRENT DATA" function.
5. Monitor the parameter of SENSOR 1 temperature on the 'TPMS exciter' or scantool after 4 minutes.

Specification : Less than 230 °F(110 °C)

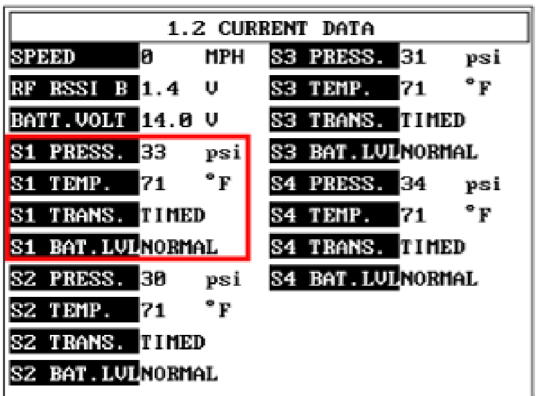
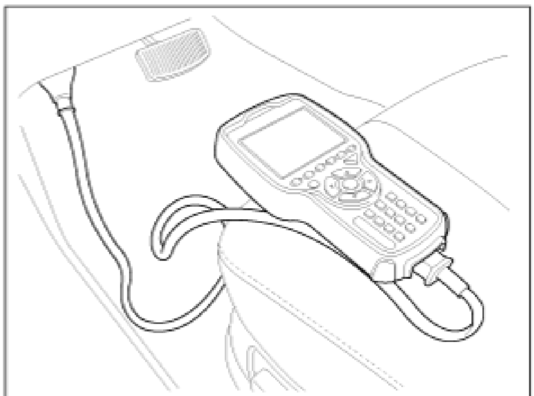


Fig 1 Sensor current data (normal)


Connect the DLC for 'TPMS exciter'

6. Is parameter within specifications?

YES

▸ Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.
▸ Go to "Verification of vehicle Repair" procedure.

NO

▸ Go to "Component Inspection" procedure.

Component Inspection

【Check TPM SENSOR 1】

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
   Execute "SET SENSOR STATUS" of each wheel.
3. Monitor the parameter of each sensor temperature on the 'TPMS exciter'.

Specification : Less than 230 °F(110 °C)

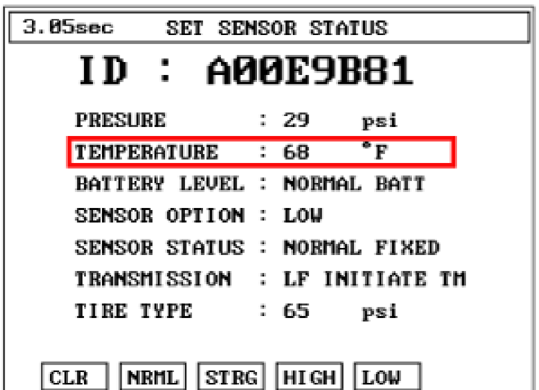


Fig 1 Sensor status (normal)


Executing "SET SENSOR STATUS"

4. Is any sensor data outside specification?

YES

▸ The sensor which displays data above the specification is SENSOR 1.

▸ Check wheel / tire of SENSOR 1 if Damaged tire, Excessive braking, Driving while the parking brake is on is detected.
▸ Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure.
▸ If it is OK, go to "Check wheel / tire" as fellows.

NO

▸ Substitute with a known-good TPMS receiver module and check proper operation.
▸ If the problem is corrected, replace TPMS receiver module and go to "Verification of Vehicle Repair" procedure.

【Check wheel / tire】

1. Cool the heat of the SENSOR 1 wheel / tire.
2. IG OFF & IG ON.
3. Monitor the parameter of sensor 1 temperature on the 'TPMS exciter' or scantool after 4 minutes.

Specification : Less than 230 °F(110 °C)

YES

▸ Fault can be because of temporary overheating.
▸ Go to "Verification of vehicle Repair" procedure.

NO

▸ Replace TPMS sensor and register sensor ID with 'TPMS exciter'.
▸ Go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

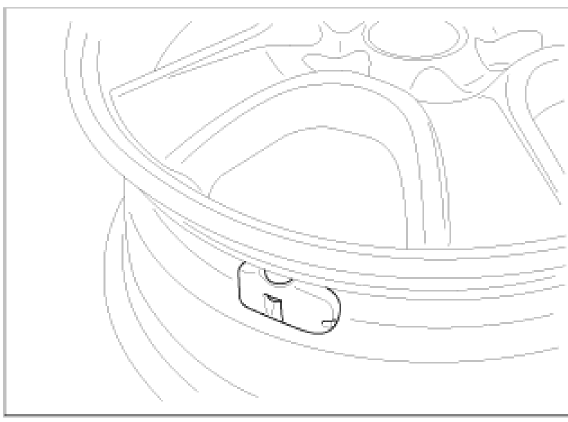
▸ Go to the applicable troubleshooting procedure.

NO

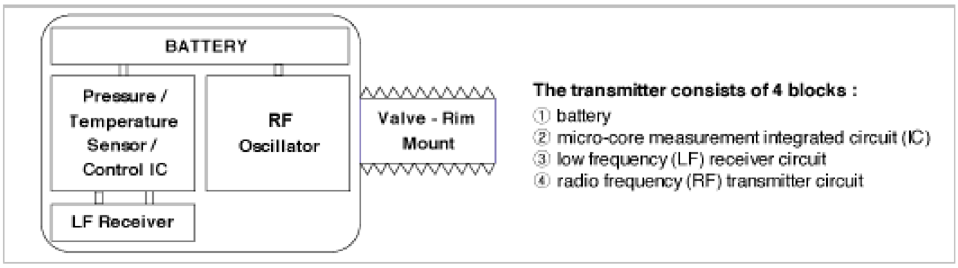
▸ System performing to specification at this time.

Suspension System > Troubleshooting > C1324

Component Location



General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere such as due to the simultaneous transmission. Wheel sensors shall support usage on steel or aluminum rims.
Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 120 °C. Transmitter shall enter thermal shutdown once the measured temperature is greater than or equal to 125 °C. The accuracy of the sensor is ± 5°C at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 100 °C. The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit.

【Tire Pressure Monitoring】

When 4 sensors have been learned as road wheels, it shall not be possible to learn new road wheel sensors on the same Ignition cycle. In normal mode low line, tire pressure and temperature shall be transmitted every 3 minutes 20 s nominally independent of vehicle operation. Monitoring shall be every 20 s. If sensor detects rapid deflation, then RF messages will be transmitted every 4 s for 1 minute duration. Communication from wheel sensors shall be via RF at a frequency of 315 MHz, 5 kBaud. Tire pressure measurement tolerance shall be ±7 kPa from 0 to 50 °C and ±17.5 kPa from -40 to 120°C with a range of 100 to 450 kPa. Tire temperature measurement tolerance shall be ±3 °C from -20 to 70 °C and to ±5 °C from -40 to 120 °C.

DTC Description

This DTC indicates that the sensor has seen a temperature in excess of 110°C. At 125°C, the sensor will shut down and the warning is therefore so that the driver knows that there is a problem with the vehicle that may affect tire performance.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Temperature of sensor check	• Damaged tire • Excessive braking • Driving while the parking brake is on.
Enable conditions	• 2 consecutive Alert State temperature > 230°F(110°C)	
Threshold value	• Sensor temperature > 230°F(110°C)	
Diagnosis time	• < 10 sec.	

Monitor Scantool Data

1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).
3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mode of "CURRENT DATA" function.
5. Monitor the parameter of SENSOR 1 temperature on the 'TPMS exciter' or scantool after 4 minutes.

Specification : Less than 230 °F(110 °C)

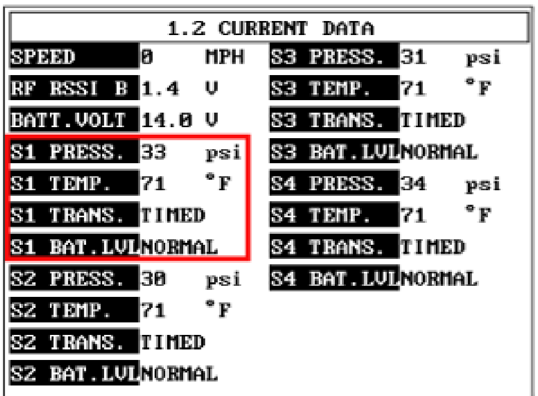
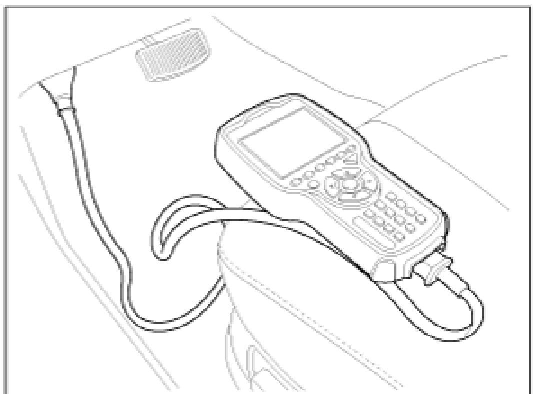


Fig 1 Sensor current data (normal)



Connect the DLC for 'TPMS exciter'

6. Is parameter within specifications?

YES

▸ Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.
▸ Go to "Verification of vehicle Repair" procedure.

NO

▸ Go to "Component Inspection" procedure.

Component Inspection

【Check TPM SENSOR 1】

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
   Execute "SET SENSOR STATUS" of each wheel.
3. Monitor the parameter of each sensor temperature on the 'TPMS exciter'.

Specification : Less than 230 °F(110 °C)

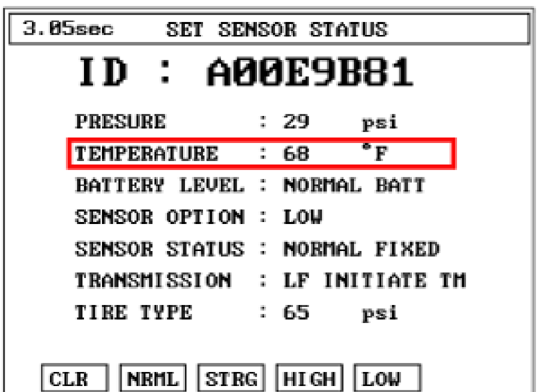


Fig 1 Sensor status (normal)

Executing "SET SENSOR STATUS"

4. Is any sensor data outside specification?

YES

▸ The sensor which displays data above the specification is SENSOR 1.
▸ Check wheel / tire of SENSOR 1 if Damaged tire, Excessive braking, Driving while the parking brake is on is detected.
▸ Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure.
▸ If it is OK, go to "Check wheel / tire" as fellows.

NO

▸ Substitute with a known-good TPMS receiver module and check proper operation.
▸ If the problem is corrected, replace TPMS receiver module and go to "Verification of Vehicle Repair" procedure.

【Check wheel / tire】

1. Cool the heat of the SENSOR 1 wheel / tire.

2. IG OFF & IG ON.
3. Monitor the parameter of sensor 1 temperature on the 'TPMS exciter' or scantool after 4 minutes.

Specification : Less than 230 °F(110 °C)

YES

- Fault can be because of temporary overheating.
- Go to "Verification of vehicle Repair" procedure.

NO

- Replace TPMS sensor and register sensor ID with 'TPMS exciter'.
- Go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

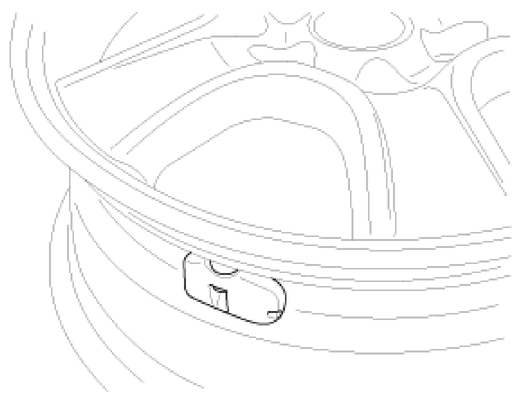
- Go to the applicable troubleshooting procedure.

NO

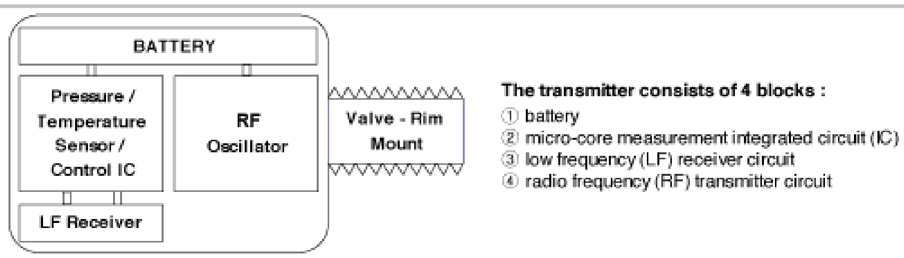
- System performing to specification at this time.

Suspension System > Troubleshooting > C1325

Component Location



General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere such as due to the simultaneous transmission. Wheel sensors shall support usage on steel or aluminum rims.
Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 120 °C. Transmitter shall enter thermal shutdown once the

measured temperature is greater than or equal to 125 °C. The accuracy of the sensor is ± 5°C at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 100 °C. The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit.

【Tire Pressure Monitoring】

When 4 sensors have been learned as road wheels, it shall not be possible to learn new road wheel sensors on the same Ignition cycle. In normal mode low line, tire pressure and temperature shall be transmitted every 3 minutes 20 s nominally independent of vehicle operation. Monitoring shall be every 20 s. If sensor detects rapid deflation, then RF messages will be transmitted every 4 s for 1 minute duration. Communication from wheel sensors shall be via RF at a frequency of 315 MHz, 5 kBaud. Tire pressure measurement tolerance shall be ±7 kPa from 0 to 50 °C and ±17.5 kPa from -40 to 120°C with a range of 100 to 450 kPa. Tire temperature measurement tolerance shall be ±3 °C from -20 to 70 °C and to ±5 °C from -40 to 120 °C.

DTC Description

This DTC indicates that the sensor has seen a temperature in excess of 110°C. At 125°C, the sensor will shut down and the warning is therefore so that the driver knows that there is a problem with the vehicle that may affect tire performance.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Temperature of sensor check	• Damaged tire • Excessive braking • Driving while the parking brake is on.
Enable conditions	• 2 consecutive Alert State temperature > 230°F(110°C)	
Threshold value	• Sensor temperature > 230°F(110°C)	
Diagnosis time	• < 10 sec.	

Monitor Scantool Data

1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).
3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mode of "CURRENT DATA" function.
5. Monitor the parameter of SENSOR 1 temperature on the 'TPMS exciter' or scantool after 4 minutes.

Specification : Less than 230 °F(110 °C)

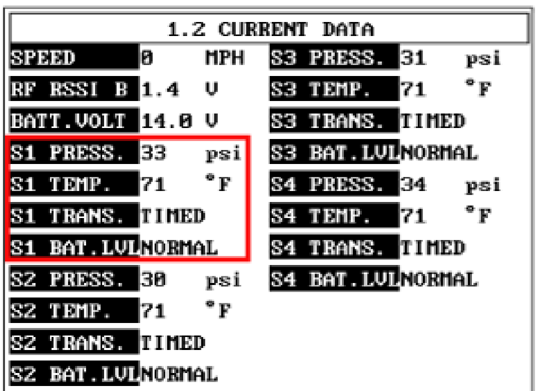
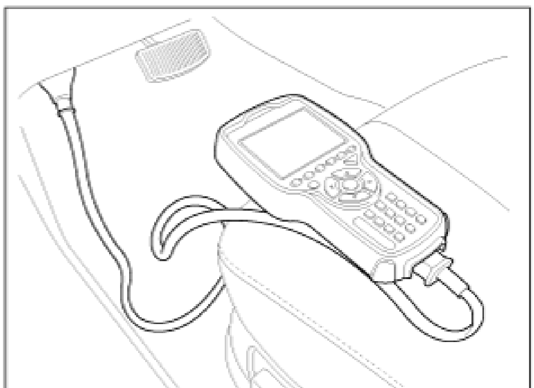


Fig 1 Sensor current data (normal)



Connect the DLC for 'TPMS exciter'

6. Is parameter within specifications?

YES

▸ Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.
▸ Go to "Verification of vehicle Repair" procedure.

NO

▸ Go to "Component Inspection" procedure.

Component Inspection

【Check TPM SENSOR 1】

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
   Execute "SET SENSOR STATUS" of each wheel.
3. Monitor the parameter of each sensor temperature on the 'TPMS exciter'.

Specification : Less than 230 °F(110 °C)

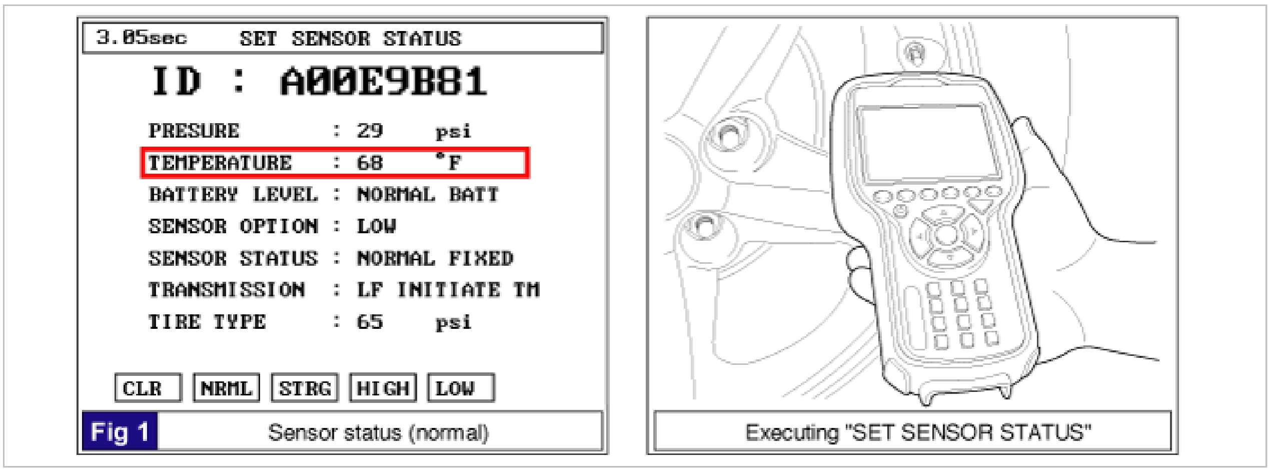


Fig 1 Sensor status (normal)

Executing "SET SENSOR STATUS"

4. Is any sensor data outside specification?

YES

- The sensor which displays data above the specification is SENSOR 1.
- Check wheel / tire of SENSOR 1 if Damaged tire, Excessive braking, Driving while the parking brake is on is detected.
- Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure.
- If it is OK, go to "Check wheel / tire" as fellows.

NO

- Substitute with a known-good TPMS receiver module and check proper operation.
- If the problem is corrected, replace TPMS receiver module and go to "Verification of Vehicle Repair" procedure.

【Check wheel / tire】

1. Cool the heat of the SENSOR 1 wheel / tire.
2. IG OFF & IG ON.
3. Monitor the parameter of sensor 1 temperature on the 'TPMS exciter' or scantool after 4 minutes.

Specification : Less than 230 °F(110 °C)

YES

- Fault can be because of temporary overheating.
- Go to "Verification of vehicle Repair" procedure.

NO

- Replace TPMS sensor and register sensor ID with 'TPMS exciter'.
- Go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

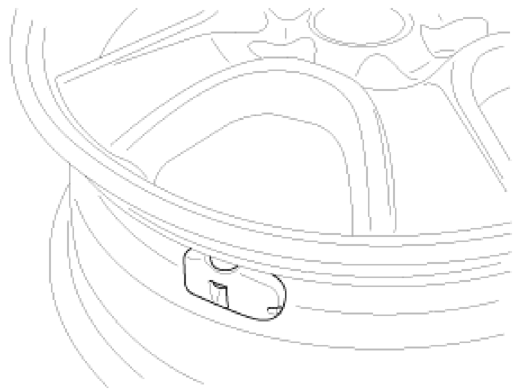
▸ Go to the applicable troubleshooting procedure.

NO

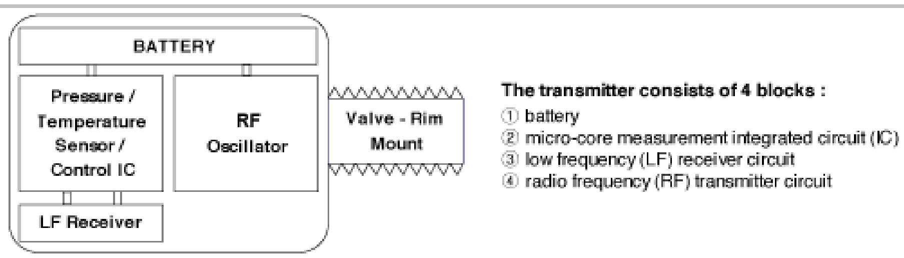
▸ System performing to specification at this time.

Suspension System > Troubleshooting > C1332

Component Location



General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere such as due to the simultaneous transmission. Wheel sensors shall support usage on steel or aluminum rims.
Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 120 °C. Transmitter shall enter thermal shutdown once the measured temperature is greater than or equal to 125 °C. The accuracy of the sensor is ± 5°C at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 100 °C. The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit.

【Tire Pressure Monitoring】

When 4 sensors have been learned as road wheels, it shall not be possible to learn new road wheel sensors on the same Ignition cycle. In normal mode low line, tire pressure and temperature shall be transmitted every 3 minutes 20 s nominally independent of vehicle operation. Monitoring shall be every 20 s. If sensor detects rapid deflation, then RF messages will be transmitted every 4 s for 1 minute duration. Communication from wheel sensors shall be via RF at a frequency of 315 MHz, 5 kBaud. Tire pressure measurement tolerance shall be ±7 kPa from 0 to 50 °C and ±17.5 kPa from -40 to 120°C with a range of 100 to 450 kPa. Tire temperature measurement tolerance shall be ±3 °C from -20 to 70 °C and to ±5 °C from -40 to 120 °C.

DTC Description

This DTC indicates that the sensor has detected that it has an internal fault. The most likely cause is sensor failure.

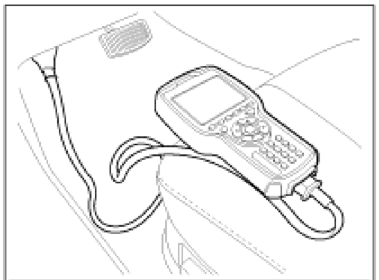
DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Sensor check	• Damage to sensor
Enable	• An internal fault in the TPMS sensor	

conditions		• Faulty TPMS sensor
Threshold value	• TPMS sensor fault	
Diagnosis time	• < 9 minutes	

Monitor Scantool Data

1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



Connect the DLC for 'TPMS exciter'

3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mode of "CURRENT DATA" function.
5. Monitor each sensor's temperature parameter on the 'TPMS exciter' or scantool after 9 minutes.

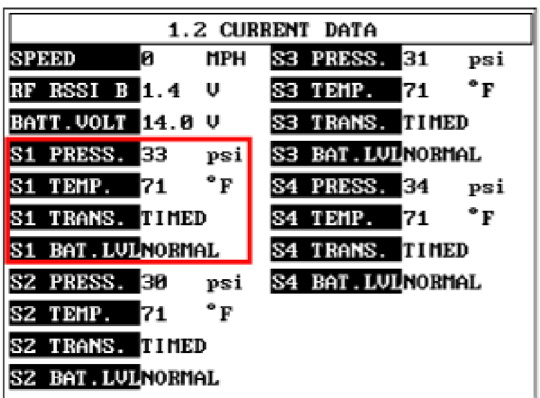


Fig 1 Sensor current data (normal)

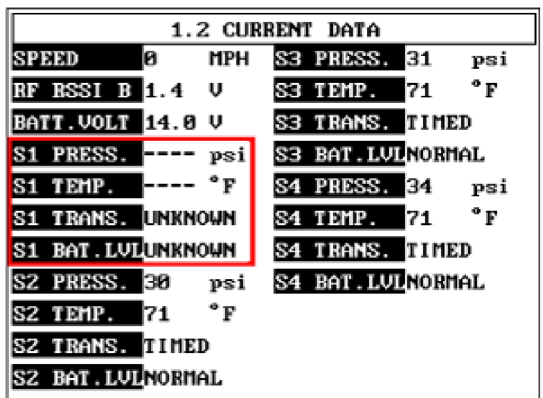


Fig 2 Sensor current data (failure)

6. Is parameter normal?

YES

▸ Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.
▸ Go to "Verification of vehicle Repair" procedure.

NO

▸ Go to "Component Inspection" procedure.

Component Inspection

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
3. Execute "SET SENSOR STATUS" of each wheel.

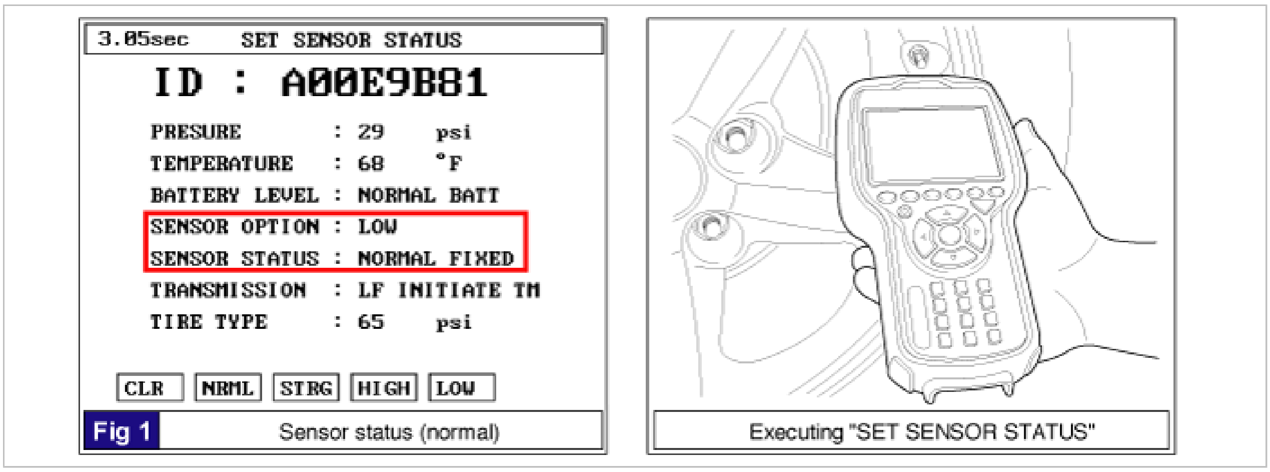


Fig 1 Sensor status (normal)

Executing "SET SENSOR STATUS"

4. Is data unable to be retrieved for any sensor?

YES

- Check for damaged of TPMS sensor on affected wheel.
- Replace TPMS sensor if necessary and register sensor ID with 'TPMS exciter'.
- Go to "Verification of Vehicle Repair" procedure.

NO

- Substitute with a known-good TPM receiver module and check for proper operation.
- If the problem is corrected, replace TPM receiver module and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

- Go to the applicable troubleshooting procedure.

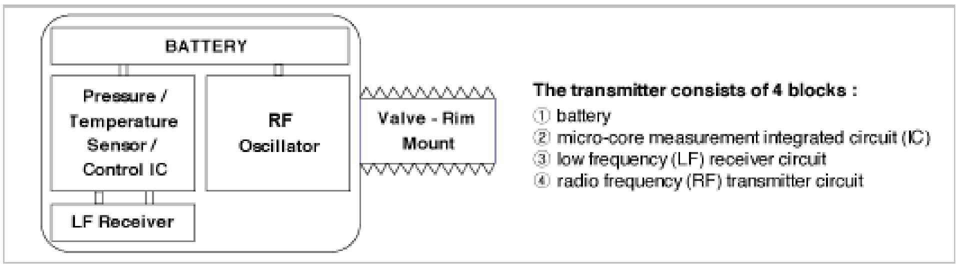
NO

- System performing to specification at this time.

Suspension System > Troubleshooting > C1333

Component Location

General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere such as due to the simultaneous transmission. Wheel sensors shall support usage on steel or aluminum rims.
Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 120 °C. Transmitter shall enter thermal shutdown once the measured temperature is greater than or equal to 125 °C. The accuracy of the sensor is ± 5°C at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 100 °C. The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit.

【Tire Pressure Monitoring】

When 4 sensors have been learned as road wheels, it shall not be possible to learn new road wheel sensors on the same Ignition cycle. In normal mode low line, tire pressure and temperature shall be transmitted every 3 minutes 20 s nominally independent of vehicle operation. Monitoring shall be every 20 s. If sensor detects rapid deflation, then RF messages will be transmitted every 4 s for 1 minute duration. Communication from wheel sensors shall be via RF at a frequency of 315 MHz, 5 kBaud. Tire pressure measurement tolerance shall be ±7 kPa from 0 to 50 °C and ±17.5 kPa from -40 to 120°C with a range of 100 to 450 kPa. Tire temperature measurement tolerance shall be ±3 °C from -20 to 70 °C and to ±5 °C from -40 to 120 °C.

DTC Description

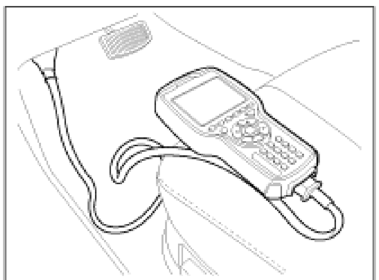
This DTC indicates that the sensor has detected that it has an internal fault. The most likely cause is sensor failure.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Sensor check	• Damage to sensor • Faulty TPMS sensor
Enable conditions	• An internal fault in the TPMS sensor	
Threshold value	• TPMS sensor fault	
Diagnosis time	• < 9 minutes	

Monitor Scantool Data

1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



Connect the DLC for 'TPMS exciter'

3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mode of "CURRENT DATA" function.

5. Monitor each sensor's temperature parameter on the 'TPMS exciter' or scantool after 9 minutes.

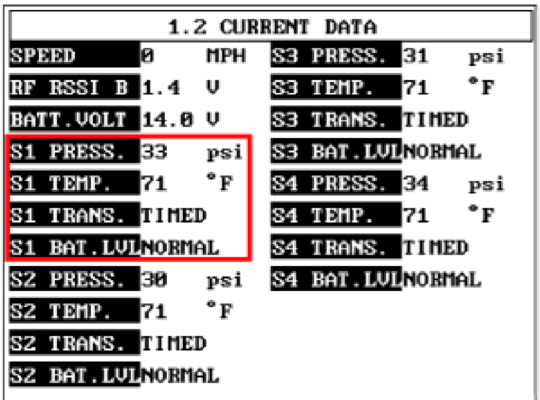


Fig 1 Sensor current data (normal)

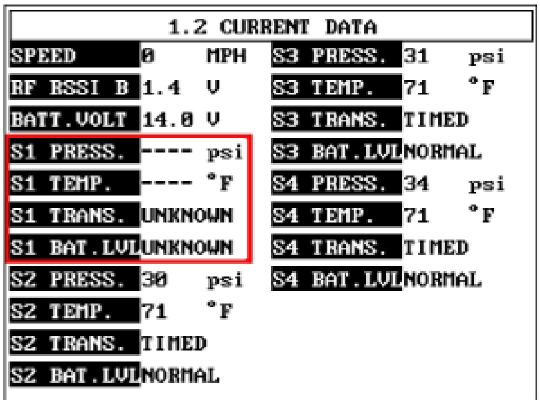


Fig 2 Sensor current data (failure)

6. Is parameter normal?

YES

▸ Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.
▸ Go to "Verification of vehicle Repair" procedure.

NO

▸ Go to "Component Inspection" procedure.

Component Inspection

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
3. Execute "SET SENSOR STATUS" of each wheel.

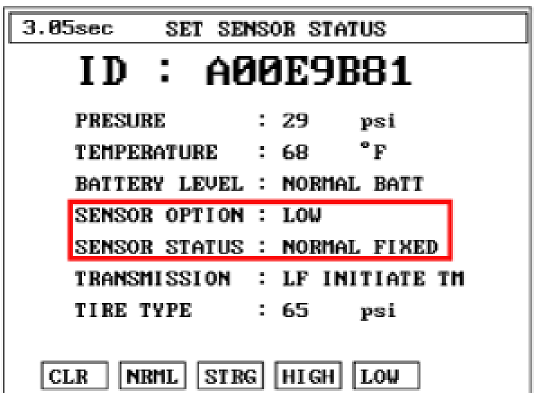


Fig 1 Sensor status (normal)


Executing "SET SENSOR STATUS"

4. Is data unable to be retrieved for any sensor?

YES

▸ Check for damaged of TPMS sensor on affected wheel.
▸ Replace TPMS sensor if necessary and register sensor ID with 'TPMS exciter'.
▸ Go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known-good TPM receiver module and check for proper operation.
▸ If the problem is corrected, replace TPM receiver module and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.

4. Are any DTCs present ?

YES

▸ Go to the applicable troubleshooting procedure.

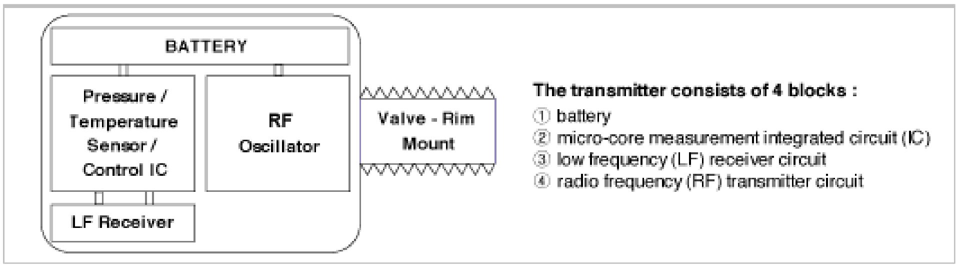
NO

▸ System performing to specification at this time.

Suspension System > Troubleshooting > C1334

Component Location

General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere such as due to the simultaneous transmission. Wheel sensors shall support usage on steel or aluminum rims.
Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 120 °C. Transmitter shall enter thermal shutdown once the measured temperature is greater than or equal to 125 °C. The accuracy of the sensor is ± 5°C at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 100 °C. The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit.

【Tire Pressure Monitoring】

When 4 sensors have been learned as road wheels, it shall not be possible to learn new road wheel sensors on the same Ignition cycle. In normal mode low line, tire pressure and temperature shall be transmitted every 3 minutes 20 s nominally independent of vehicle operation. Monitoring shall be every 20 s. If sensor detects rapid deflation, then RF messages will be transmitted every 4 s for 1 minute duration. Communication from wheel sensors shall be via RF at a frequency of 315 MHz, 5 kBaud. Tire pressure measurement tolerance shall be ±7 kPa from 0 to 50 °C and ±17.5 kPa from -40 to 120°C with a range of 100 to 450 kPa. Tire temperature measurement tolerance shall be ±3 °C from -20 to 70 °C and to ±5 °C from -40 to 120 °C.

DTC Description

This DTC indicates that the sensor has detected that it has an internal fault. The most likely cause is sensor failure.

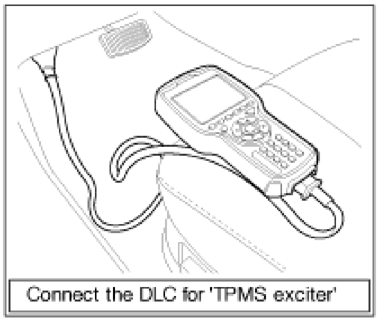
DTC Detecting Condition

Item	Detecting Condition	Possible cause

DTC strategy	• Sensor check	• Damage to sensor • Faulty TPMS sensor
Enable conditions	• An internal fault in the TPMS sensor	
Threshold value	• TPMS sensor fault	
Diagnosis time	• < 9 minutes	

Monitor Scantool Data

1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mode of "CURRENT DATA" function.
5. Monitor each sensor's temperature parameter on the 'TPMS exciter' or scantool after 9 minutes.

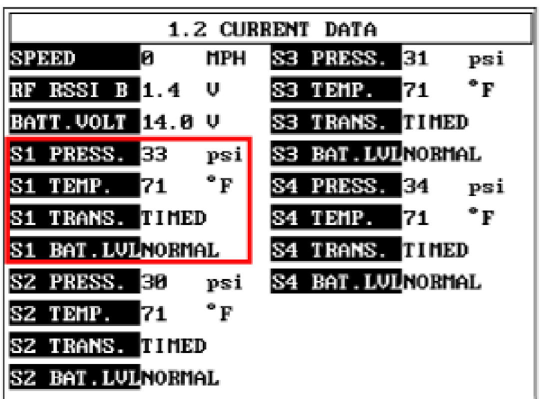


Fig 1 Sensor current data (normal)

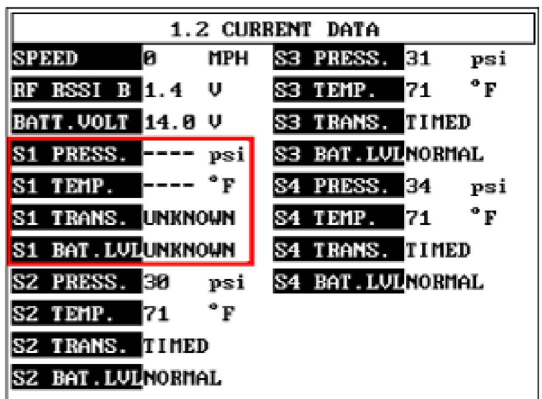


Fig 2 Sensor current data (failure)

6. Is parameter normal?

YES

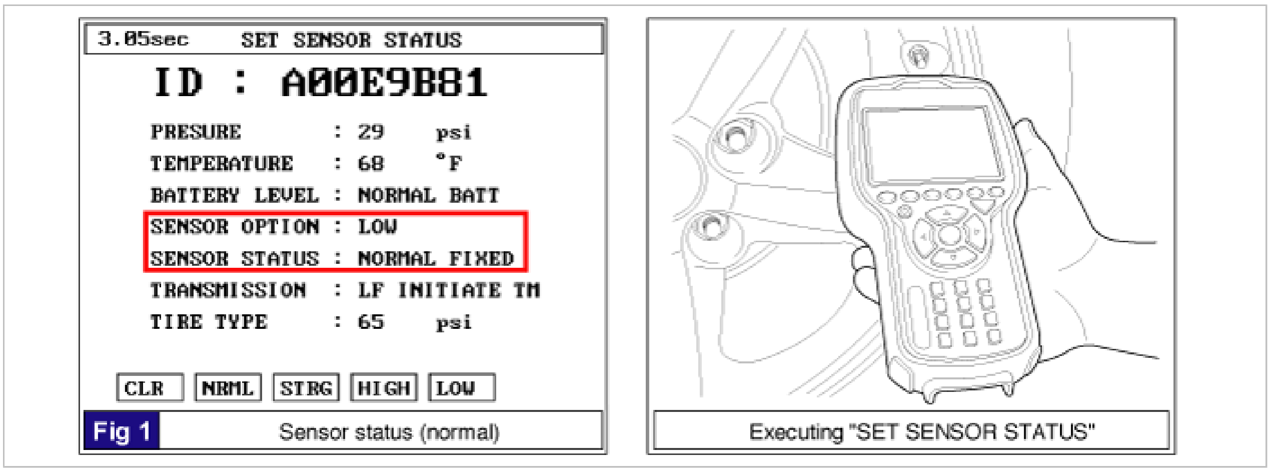
▸ Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.
▸ Go to "Verification of vehicle Repair" procedure.

NO

▸ Go to "Component Inspection" procedure.

Component Inspection

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
3. Execute "SET SENSOR STATUS" of each wheel.



Sensor status (normal)

Executing "SET SENSOR STATUS"

4. Is data unable to be retrieved for any sensor?

YES

- Check for damaged of TPMS sensor on affected wheel.
- Replace TPMS sensor if necessary and register sensor ID with 'TPMS exciter'.
- Go to "Verification of Vehicle Repair" procedure.

NO

- Substitute with a known-good TPM receiver module and check for proper operation.
- If the problem is corrected, replace TPM receiver module and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

- Go to the applicable troubleshooting procedure.

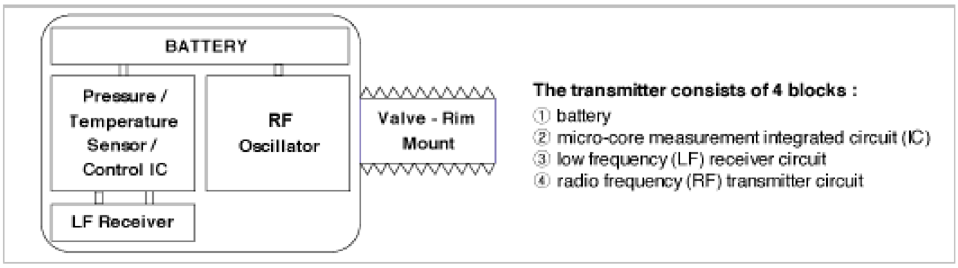
NO

- System performing to specification at this time.

Suspension System > Troubleshooting > C1335

Component Location

General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere such as due to the simultaneous transmission. Wheel sensors shall support usage on steel or aluminum rims.

Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 120 °C. Transmitter shall enter thermal shutdown once the measured temperature is greater than or equal to 125 °C. The accuracy of the sensor is ± 5°C at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 100 °C. The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit.

【Tire Pressure Monitoring】

When 4 sensors have been learned as road wheels, it shall not be possible to learn new road wheel sensors on the same Ignition cycle. In normal mode low line, tire pressure and temperature shall be transmitted every 3 minutes 20 s nominally independent of vehicle operation. Monitoring shall be every 20 s. If sensor detects rapid deflation, then RF messages will be transmitted every 4 s for 1 minute duration. Communication from wheel sensors shall be via RF at a frequency of 315 MHz, 5 kBaud. Tire pressure measurement tolerance shall be ±7 kPa from 0 to 50 °C and ±17.5 kPa from -40 to 120°C with a range of 100 to 450 kPa. Tire temperature measurement tolerance shall be ±3 °C from -20 to 70 °C and to ±5 °C from -40 to 120 °C.

DTC Description

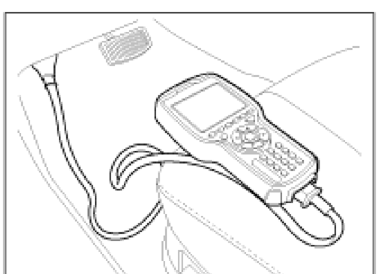
This DTC indicates that the sensor has detected that it has an internal fault. The most likely cause is sensor failure.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Sensor check	• Damage to sensor • Faulty TPMS sensor
Enable conditions	• An internal fault in the TPMS sensor	
Threshold value	• TPMS sensor fault	
Diagnosis time	• < 9 minutes	

Monitor Scantool Data

1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



Connect the DLC for 'TPMS exciter'

3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mode of "CURRENT DATA" function.

5. Monitor each sensor's temperature parameter on the 'TPMS exciter' or scantool after 9 minutes.

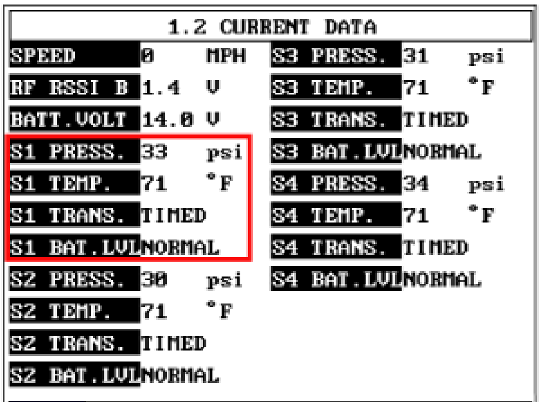


Fig 1 Sensor current data (normal)

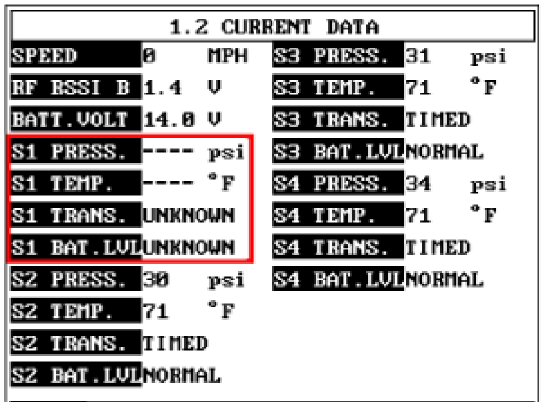


Fig 2 Sensor current data (failure)

6. Is parameter normal?

YES

▸ Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.
▸ Go to "Verification of vehicle Repair" procedure.

NO

▸ Go to "Component Inspection" procedure.

Component Inspection

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
3. Execute "SET SENSOR STATUS" of each wheel.

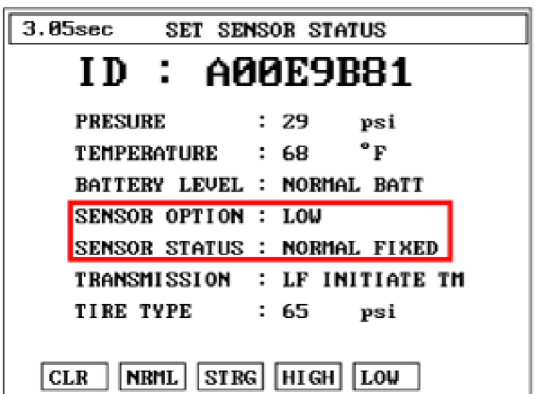


Fig 1 Sensor status (normal)


Executing "SET SENSOR STATUS"

4. Is data unable to be retrieved for any sensor?

YES

▸ Check for damaged of TPMS sensor on affected wheel.
▸ Replace TPMS sensor if necessary and register sensor ID with 'TPMS exciter'.
▸ Go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known-good TPM receiver module and check for proper operation.
▸ If the problem is corrected, replace TPM receiver module and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.

4. Are any DTCs present ?

YES

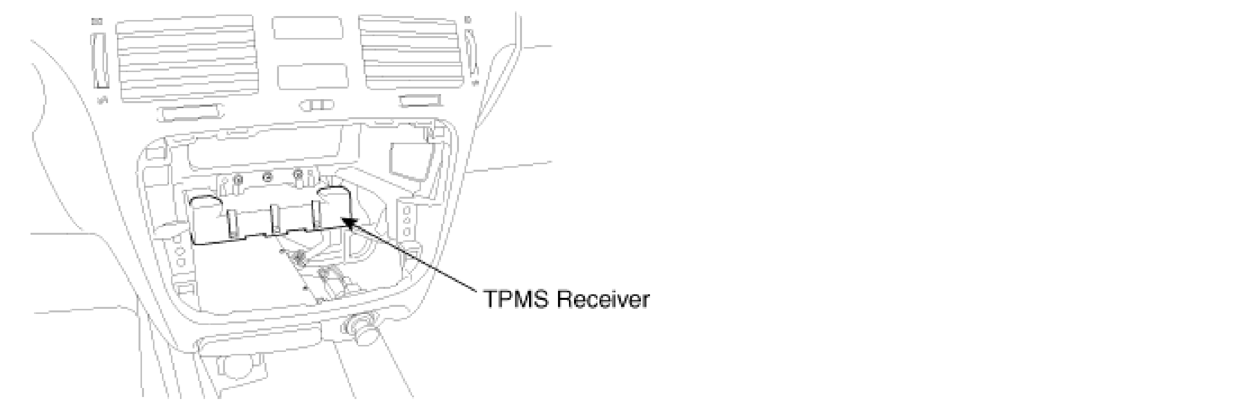
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Suspension System > Troubleshooting > C1660

Component Location



General Description

TPM Receiver is integrated with the TPM module installed at the bottom of the steering column. The operating battery of TPM module is supplied from the vehicle battery. Data such as Tire pressure, Tire Temperature, TPM sensor battery status and TPM sensor valve ID from TPM sensors are transmitted to TPM receiver in the form of RF signal. TPM module accomplishes Tire Monitoring and Warning Logic with received data.

DTC Description

This DTC indicates that the receiver has not received any RF messages. The most likely cause is receiver RF circuit failure / RF screening.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Internal RF circuit check of Receiver module	• Low Line - all sensors in storage state and no other RF transmissions received • Low Line - receiver RF shielding • Faulty TPMS Receiver module
Enable conditions	• No valid RF data for 12 min from any sensor • RF messages and the signal levels are unexpected	
Threshold value	• Internal RF circuit fault	
Diagnosis time	• 12 ~13 minutes	

Component Inspection

【Check status of all TPM sensor】

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
   Execute "SET SENSOR STATUS" of each wheel.

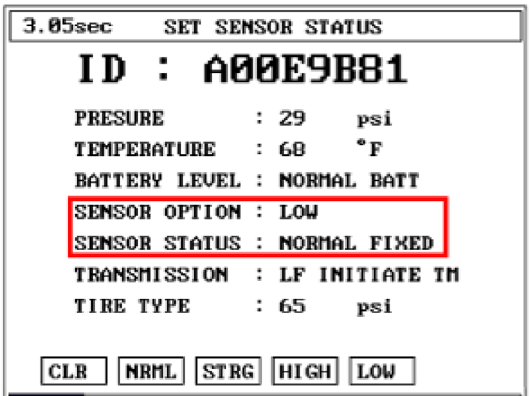
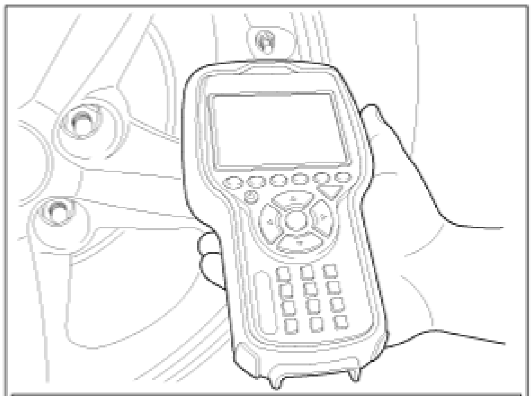


Fig 1 Sensor status (normal)


Executing "SET SENSOR STATUS"

3. Are status of all sensors "normal"?

YES

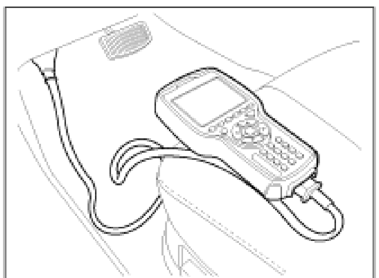
- Check TPM receiver RF shielding.
- If it is OK, go to "Check TPM receiver" as fellows.
- Repair if necessary and go to "Verification of Vehicle Repair" procedure.

NO

- Change status of all TPM sensors into "normal" status with 'TPMS exciter'.
- Go to "Verification of Vehicle Repair" procedure.

【Check TPM receiver】

1. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).


Connect the DLC for 'TPMS exciter'

2. Clear DTC.
3. IG OFF & IG ON. Wait 4 minutes.
4. Execute "Diagnostic Trouble Codes(DTCs)".
5. Is 'C1660' present ?

YES

- Substitute with a known-good TPM Receiver module and check for proper operation.
- If the problem is corrected, replace TPM Receiver module and go to "Verification of vehicle Repair" procedure.

NO

- TPM receiver complete successful Auto-Learn.
- System is OK.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

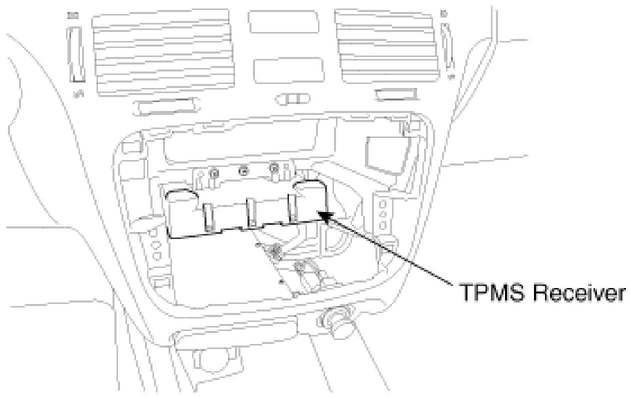
- Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Suspension System > Troubleshooting > C1661

Component Location



General Description

TPM Receiver is integrated with the TPM module installed at the bottom of the steering column. The operating battery of TPM module is supplied from the vehicle battery. Data such as Tire pressure, Tire Temperature, TPM sensor battery status and TPM sensor valve ID from TPM sensors are transmitted to TPM receiver in the form of RF signal. TPM module accomplishes Tire Monitoring and Warning Logic with received data.

DTC Description

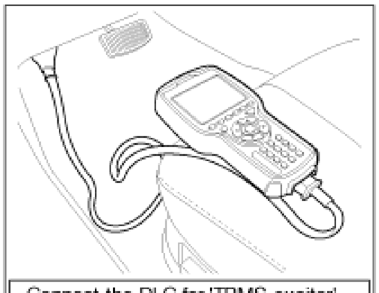
This DTC indicates that the receiver has a problem reading or writing to EEPROM.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Receiver module check	• Transient over voltage due to vehicle fault (fault would typically recover) • Faulty TPMS Receiver
Enable conditions	• Reading or writing problem to EEPROM	
Threshold value	• EEPROM in the receiver module fault	
Diagnosis time	• < 10 sec.	

Component Inspection

1. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



Connect the DLC for 'TPMS exciter'

2. Clear DTC.
3. IG OFF & IG ON. Wait 4 minutes.
4. Execute "Diagnostic Trouble Codes(DTCs)".

5. Is 'C1661' present ?

YES

▶ Substitute with a known-good TPM Receiver module and check for proper operation.
▶ If the problem is corrected, replace TPM Receiver module and go to "Verification of vehicle Repair" procedure.

NO

▶ TPM receiver complete successful Auto-Learn.
▶ System is OK.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

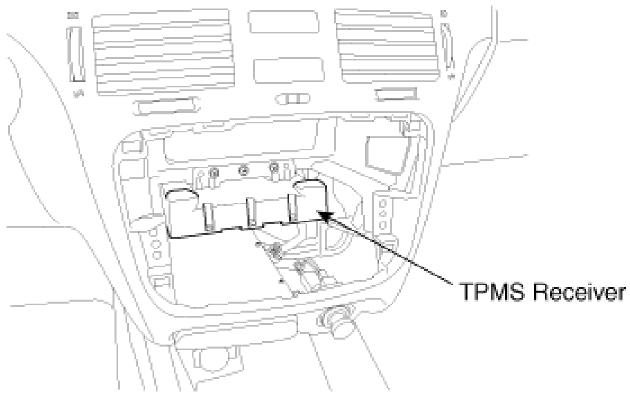
▶ Go to the applicable troubleshooting procedure.

NO

▶ System performing to specification at this time.

Suspension System > Troubleshooting > C1668

Component Location



General Description

TPM Receiver is integrated with the TPM module installed at the bottom of the steering column. The operating battery of TPM module is supplied from the vehicle battery. Data such as Tire pressure, Tire Temperature, TPM sensor battery status and TPM sensor valve ID from TPM sensors are transmitted to TPM receiver in the form of RF signal. TPM module accomplishes Tire Monitoring and Warning Logic with received data.

DTC Description

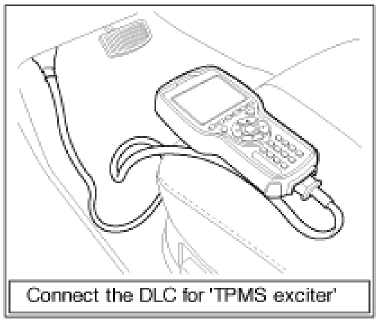
This DTC indicates that the receiver has detected an internal error.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Receiver module check	• Transient over voltage due to vehicle fault (fault would typically recover) • Faulty TPMS Receiver
Enable conditions	• An Internal error	
Threshold value	• TPMS Receiver module fault	
Diagnosis time	• < 3 sec. - Carried out once at Ignition ON	

Component Inspection

1. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



2. Clear DTC.
3. IG OFF & IG ON. Wait 4 minutes.
4. Execute "Diagnostic Trouble Codes(DTCs)".
5. Is 'C1668' present ?

YES

- Substitute with a known-good TPM Receiver module and check for proper operation.
- If the problem is corrected, replace TPM Receiver module and go to "Verification of vehicle Repair" procedure.

NO

- TPM receiver complete successful Auto-Learn.
- System is OK.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

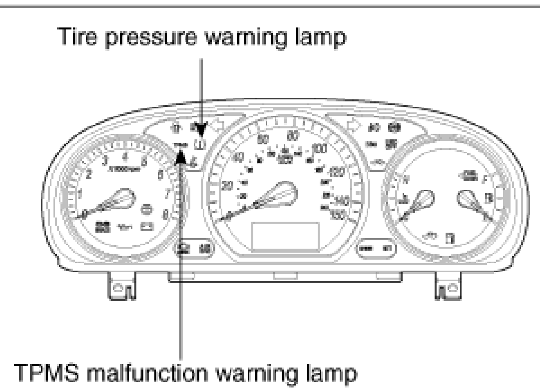
- Go to the applicable troubleshooting procedure.

NO

- System performing to specification at this time.

Suspension System > Troubleshooting > C2510

Component Location



General Description

The TPMS receiver unit must provide two outputs continuously to drive the indicator lamps. One of the output turn the TREAD indicator lamp on when pressure in one or more tires associated with the TPMS receiver unit have reported a pressure below the warning level threshold. The other output turn the TPMS Warning indicator bulb on when the TPMS receiver unit has detected a system fault.

【Turn the TREAD indicator lamp on】

1. When tire pressure is below allowed threshold.
2. When rapid leak is detected by the sensor.
3. Indicates that tire needs to be re-inflated to placard pressure / repaired.

【Turn the TREAD indicator lamp off】

1. Under-inflation : When tire pressure is above (warning threshold + hysteresis).
2. Leak : When tire pressure is above (leak warning threshold) OR on Ignition cycle off to on.

DTC Description

This DTC indicates that the TREAD(Tire Under Inflation / Leak Warning) / DTC Warning lamp is short circuit and therefore cannot be turned on. The most likely failure is harness / instrument cluster / connector / receiver short circuit.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Input lamp current check	• Short circuit to 12 V between lamp and TPMS receiver
Enable conditions	• TREAD / Diagnostic lamp circuit short to 12 V	
Threshold value	• TREAD / Diagnostic lamp - 200 mA allowed each (after in rush time). 50 mA margin built in.	
Diagnosis time	• < 3s	

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminal condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/or damage.
3. Has a problem been found?

YES

▸ Repair if necessary and then go to "Verification of Vehicle Repair" procedure.

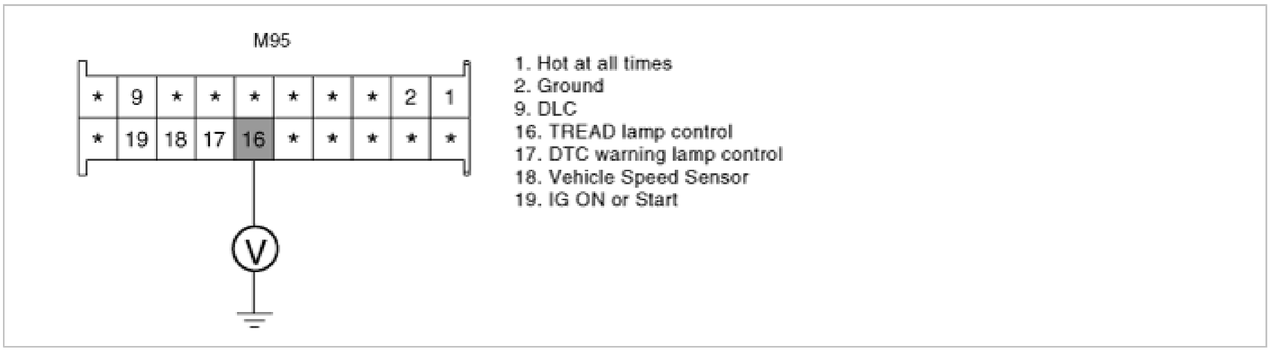
NO

▸ Go to "Control Circuit Inspection" procedure.

Control Circuit Inspection

1. Engine "OFF".
2. Disconnect instrument cluster connector and TPM receiver connector.
3. Engine "ON".
4. Measure voltage between terminal "16" of TPMS receiver harness connector and chassis ground.

Specification : 0 V



5. Is the measured voltage within specifications?

YES

- Substitute with a known-good TPM receiver and check for proper operation.
- If the problem is corrected, replace TPM receiver and then go to "Verification of Vehicle Repair" procedure.

NO

- Check for short to power in control harness.
- Repair if necessary and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

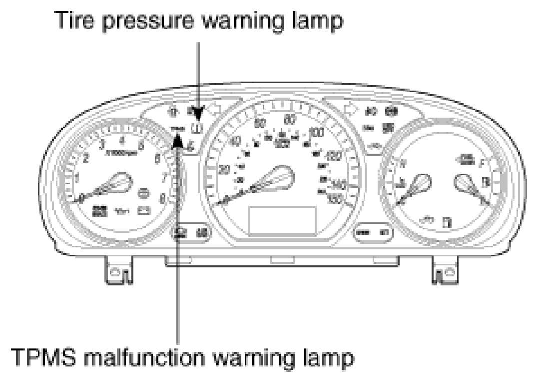
- Go to the applicable troubleshooting procedure.

NO

- System performing to specification at this time.

Suspension System > Troubleshooting > C2511

Component Location



General Description

The TPMS receiver unit must provide two outputs continuously to drive the indicator lamps. One of the output turn the TREAD indicator lamp on when pressure in one or more tires associated with the TPMS receiver unit have reported a pressure below the warning level threshold. The other output turn the TPMS Warning indicator bulb on when the TPMS receiver unit has detected a system fault.

【Turn the TPMS DTC Warning indicator lamp on】

1. When the system detects a fault that is external to the receiver / sensor.
2. When the system detects a receiver fault.
3. When the system detects a sensor fault.

【Turn the TPMS DTC Warning indicator lamp off】

1. If the fault is considered as 'critical', then the lamp is held on throughout the current Ignition cycle (even if the DTC has been demoted). This is because it is important to bring the problem to the drivers attention. On the following Ignition cycle, the demotion conditions will be re-checked. If the demotion conditions occur, the lamp will be turned off. It will be held on until DTC demotion checking is completed.
2. 'Non critical' faults are those that can occur temporarily e.g. vehicle battery under voltage. The lamp is therefore turned off when the DTC demotion condition occurs.

DTC Description

This DTC indicates that the TREAD(Tire Under Inflation / Leak Warning) / DTC Warning lamp is short circuit and therefore cannot be turned on. The most likely failure is harness / instrument cluster / connector / receiver short circuit.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Input lamp current check	• Short circuit to 12 V between lamp and TPMS receiver
Enable conditions	• TREAD / Diagnostic lamp circuit short to 12 V	
Threshold value	• TREAD / Diagnostic lamp - 200 mA allowed each (after in rush time). 50 mA margin built in.	
Diagnosis time	• < 3s	

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminal condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/or damage.
3. Has a problem been found?

YES

▸ Repair if necessary and then go to "Verification of Vehicle Repair" procedure.

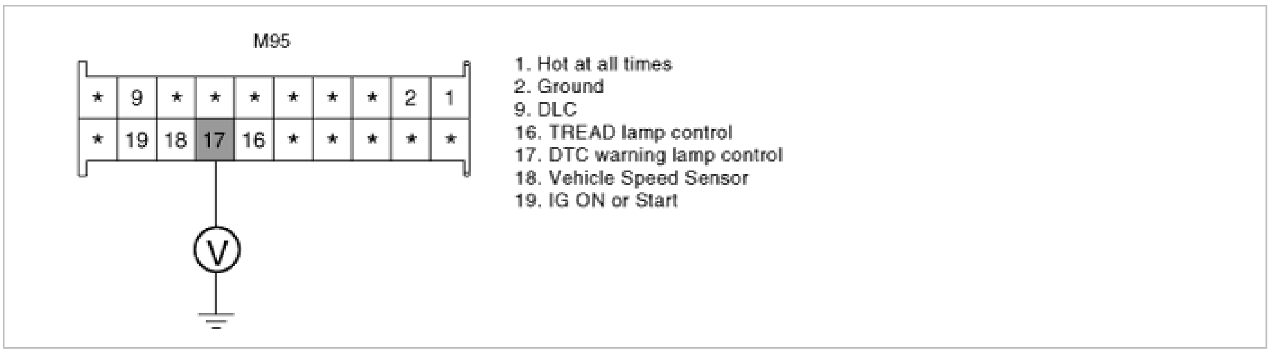
NO

▸ Go to "Control Circuit Inspection" procedure.

Control Circuit Inspection

1. Engine "OFF".
2. Disconnect instrument cluster connector and TPM receiver connector.
3. Engine "ON".
4. Measure voltage between terminal "17" of TPMS receiver harness connector and chassis ground.

Specification : 0 V



5. Is the measured voltage within specifications?

YES

▸ Substitute with a known-good TPM receiver and check for proper operation.
▸ If the problem is corrected, replace TPM receiver and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Check for short to power in control harness.
▸ Repair if necessary and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.

3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

SPECIFICATION

Automatic transaxle type		A5HF1
Recommanded transaxle oil		Diamond ATF SP III or SK ATF SP III
Oil quantity		10.9 Liter (Only for the reference)
Oil inspection and supplement		Every one year or every 24,000 km
Replacement	Private use (Normal use)	No service required
	Private use (Severe use)	Every 48,000 Km in severe use(1~4)
	Business use	1. Driving on rough road(bumpy road, gravel road, snowy road, unpaved road etc.) 2. Driving on mountain road, ascent/descent 3. Repetition of short distance driving 4. More than 50% operation in heavy city traffic during hot weather above 32°C 5. Police, Taxi. Commercial type operation
Engine type		3.3 DOHC
Gear ratio	1st	3.789
	2nd	2.064
	3rd	1.421
	4th	1.034
	5th	0.728
	Reverse	3.808
	Final reduction gear ratio	3.333

SERVICE STANDARD

ITEM	VALUE (mm/inch)
Input shaft end play	0.7~1.45 / 0.0276~0.0571
Low & Reverse brake pressure plate end play	1.65~2.11 / 0.0650~0.0831
Reaction plate snap end play	0~0.16 / 0~0.0063
2ND brake pressure plate end play	1.09~1.55 / 0.0429~0.0610
Underdrive sun gear end play	0.25~0.45 / 0.0098~0.0177
Differential bearing spacer end play	0.045~0.105 / 0.0018~0.0041
Underdrive clutch snap ring end play	1.6~1.8 / 0.0630~0.0709
Direct clutch reaction plate snap ring end play	0.6~0.8 / 0.0236~0.0315
Reverse clutch snap ring end play	0~0.09 / 0~0.0035
Overdrive clutch snap ring end play	1.0~1.2 / 0.0394~0.0472
Reverse clutch reaction plate snap ring end play	1.5~1.7 / 0.0591~0.0669

TIGHTENING TORQUE

ITEM	Nm	Kgf.cm	lb-ft
Transfer drive gear	31.4~36.3	320.0~370.0	23.1~26.8
Rear cover	19.6~25.5	200.0~260.0	14.5~18.8
Anchor plug	83.4~112.8	850.0~1150.0	61.5~83.2
Oil pump pipe	9.8~11.8	100.0~120.0	7.2~8.7
Oil pump	19.6~25.5	200.0~260.0	14.5~18.8
Torque converter housing	42.0~54.0	428.0~551.0	31.0~39.9

Valve body	9.8~11.8	100.0~120.0	7.2~8.7
VFS reservoir	9.8~11.8	100.0~120.0	7.2~8.7
Detent spring	4.9~6.9	50.0~70.0	3.6~5.1
Valve body cover	9.8~11.8	100.0~120.0	7.2~8.7
Vehicle speed sensor	3.9~5.9	40.0~60.0	2.9~4.3
Inhibiter switch	9.8~11.8	100.0~120.0	7.2~8.7
Manual control lever	17.7~24.5	180.0~250.0	13.0~18.1
Input/Output speed sensors	9.8~11.8	100.0~120.0	7.2~8.7
Reduction brake piston rod fixing nut	14.7~24.5	150.0~250.0	10.8~18.1
Sub frame bracket	88.3~107.9	900.0~1100.0	65.1~79.6
Valve body inside seperating plate	4.9~6.9	50.0~70.0	3.6~5.1
Valve body cover seperating plate	9.8~11.8	100.0~120.0	7.2~8.7
Direct planetary carrier lock nut	156.9~176.5	1600.0~1800.0	115.7~130.2

SEALANTS

Rear cover liquid gasket	Specified sealant
Rear cover liquid gasket	Threebond 1281B or LOCTITE FMD-546
Torque converter housing liquid gasket	
Valve body liquid gasket	

Snap rings, spacers, thrust washers&races and pressure plates for adjusting

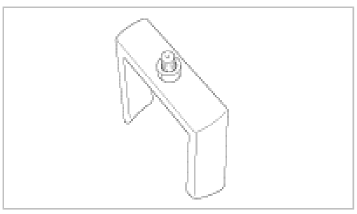
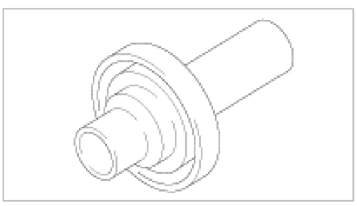
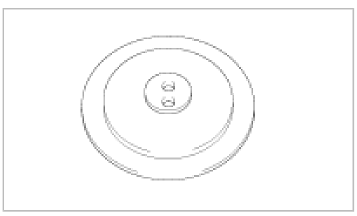
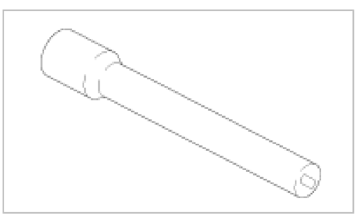
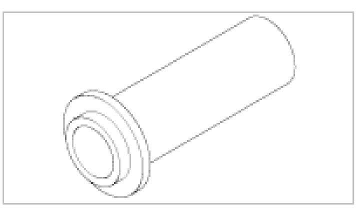
Part name	Part No.	Thickness[mm(inch)]	Identification
Thrust washer (for input shaft end play)	45544-39180	1.8 (0.0709)	
	45544-39200	2.0 (0.0787)	
	45544-39220	2.2 (0.0866)	
	45544-39240	2.4 (0.0945)	
	45544-39260	2.6 (0.1024)	
	45544-39280	2.8 (0.1102)	
Spacer (for differential bearing end play)	45849-39883	0.83 (0.0327)	83
	45849-39886	0.86 (0.0339)	86
	45849-39889	0.89 (0.0350)	89
	45849-39892	0.92 (0.0362)	92
	45849-39895	0.95 (0.0374)	95
	45849-39898	0.98 (0.0386)	98
	45849-39801	1.01 (0.0398)	01
	45849-39804	1.04 (0.0409)	04
	45849-39807	1.07 (0.0421)	07
	45849-39810	1.10 (0.0433)	10
	45849-39813	1.13 (0.0445)	13
	45849-39816	1.16 (0.0457)	16
	45849-39819	1.19 (0.0469)	19
	45849-39822	1.22 (0.0480)	22
	45849-39825	1.25 (0.0492)	25
	45849-39828	1.28 (0.0504)	28
	45849-39831	1.31 (0.0516)	31
	45849-39834	1.34 (0.0528)	34

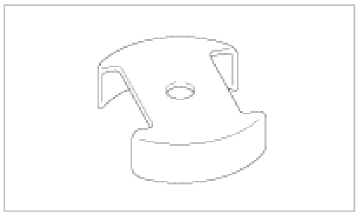
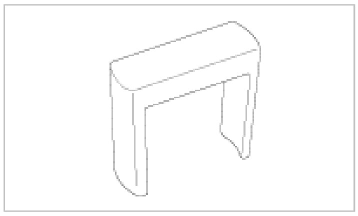
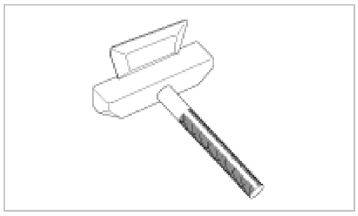
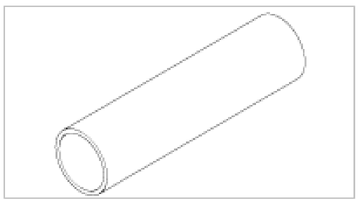
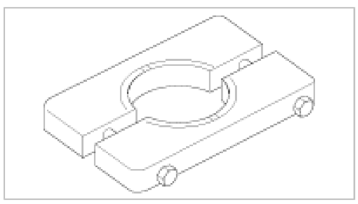
	45849-39837	1.37 (0.0539)	37
Snap ring (for underdrive clutch snap ring end play)	45427-39520	2.0 (0.0787)	
	45427-39521	2.1 (0.0827)	
	45427-39522	2.2 (0.0866)	
	45427-39523	2.3 (0.0906)	
	45427-39524	2.4 (0.0945)	
	45427-39525	2.5 (0.0984)	
	45427-39526	2.6 (0.1024)	
	45427-39527	2.7 (0.1063)	
	45427-39528	2.8 (0.1102)	
	45427-39529	2.9 (0.1142)	
	45427-39530	3.0 (0.1181)	
	45427-39519	1.9 (0.0748)	
	45427-39516	1.6 (0.0630)	
	45427-39517	1.7 (0.0669)	
	45427-39518	1.8 (0.0709)	
Snap ring (for direct clutch snap ring end play)	45556-39520	2.0 (0.0787)	
	45556-39521	2.1 (0.0827)	
	45556-39522	2.2 (0.0866)	
	45556-39523	2.3 (0.0906)	
	45556-39524	2.4 (0.0945)	
	45556-39525	2.5 (0.0984)	
	45556-39526	2.6 (0.1024)	
	45556-39527	2.7 (0.1063)	
	45556-39528	2.8 (0.1102)	
	45556-39529	2.9 (0.1142)	
	45556-39530	3.0 (0.1181)	
	45556-39519	1.9 (0.0748)	
Snap ring (for reverse clutch snap ring end play)	45443-39148		
	45853-39153		
	45459-39158		
	45853-39163		
Snap ring (for overdrive clutch snap ring end play)	45427-39520	2.0 (0.0787)	
	45427-39521	2.1 (0.0827)	
	45427-39522	2.2 (0.0866)	
	45427-39523	2.3 (0.0906)	
	45427-39524	2.4 (0.0945)	
	45427-39525	2.5 (0.0984)	
	45427-39526	2.6 (0.1024)	
	45427-39527	2.7 (0.1063)	
	45427-39528	2.8 (0.1102)	
	45427-39529	2.9 (0.1142)	
	45427-39530	3.0 (0.1181)	
	45427-39519	1.9 (0.0748)	
	45427-39516	1.6 (0.0630)	
	45427-39517	1.7 (0.0669)	

	45427-39518	1.8 (0.0709)	
Snap ring (for reverse clutch reaction plate snap ring end play)	45432-39518	1.8 (0.0709)	
	45432-39517	1.7 (0.0669)	
	45432-39516	1.6 (0.0630)	
	45432-39519	1.9 (0.0748)	
	45432-39528	2.8 (0.1102)	
	45432-39527	2.7 (0.1063)	
	45432-39526	2.6 (0.1024)	
	45432-39525	2.5 (0.0984)	
	45432-39524	2.4 (0.0945)	
	45432-39523	2.3 (0.0906)	
	45432-39522	2.2 (0.0866)	
	45432-39521	2.1 (0.0827)	
	45432-39520	2.0 (0.0787)	

Automatic Transaxle System > General Information > Special Service Tools

SPECIAL TOOLS

Tool (Number and name)	Illustration	Use
09453-3A110 Spring compressor		- Removal and installation of one way clutch inner race snap ring
09431-39000 Oil seal installer		- Installation of differential bearing output race
09456-39100 Clearance dummy plate		- Installation of brake pressure plate
09454-3A110 Reduction socket		- Adjustment of reduction brake piston rod
09452-21200 Oil pump oil seal installer		- Installation of oil seal in a oil pump

09453-24000 Snap ring compressor		- Removal and installation of under drive clutch snap ring
09453-4C400 Spring compressor		- Removal and installation of direct clutch snap ring - Removal and installation of reverse&over drive clutch spring retainer snap ring
09215-3C000 Oil fan remover		- Removal of valve body cover
09455-21100 Bearing installer		- Installation of the ball bearing and the transfer drive gear
09457-22000 Removing plate		- Removal of the differential bearing, the transfer shaft bearing and drive gear bearing

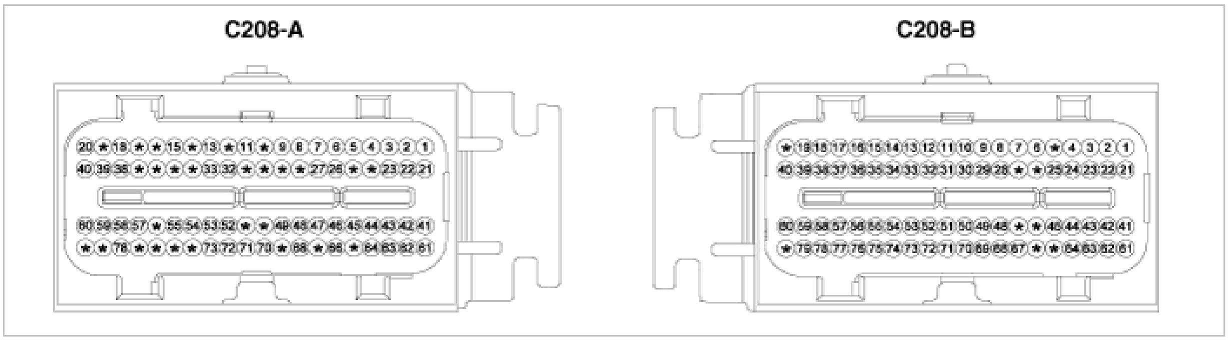
Automatic Transaxle System > Automatic Transaxle System > Troubleshooting

INSPECTION CHART FOR DIAGNOSIS TROUBLE CODES (DTC)

No.	Code	Item	MIL	Remark
1	P0707	Transaxle range switch circuit - LOW input	ON	ATa-9
2	P0708	Transaxle range switch circuit - HIGH input	ON	ATa-15
3	P0711	Transaxle Fluid Temperature Sensor Rationality	ON	ATa-18
4	P0712	Fluid(Oil) Temperature Sensor Circuit - Low	ON	ATa-24
5	P0713	Fluid(Oil) Temperature Sensor Circuit - High	ON	ATa-27
6	P0717	Input Speed Sensor Circuit - No Signal	ON	ATa-29
7	P0722	Output Speed Sensor Circuit - No Signal	ON	ATa-37
8	P0731	Gear 1 Incorrect Ratio	ON	ATa-43
9	P0732	Gear 2 Incorrect Ratio	ON	ATa-51
10	P0733	Gear 3 Incorrect Ratio	ON	ATa-59
11	P0734	Gear 4 Incorrect Ratio	ON	ATa-67
12	P0735	Gear 5 Incorrect Ratio	ON	ATa-74
13	P0736	Reverse Gear Incorrect Ratio	ON	ATa-81
14	P0741	Torque Converter Clutch Circuit - Stuck off	ON	ATa-89

15	P0742	Torque Converter Clutch Circuit - Stuck on	ON	ATa-93
16	P0743	Torque Converter Clutch Circuit - Electrical	ON	ATa-94
17	P0746	Pressure Control Solenoid Valve A - Performance or Stuck Off	OFF	ATa-100
18	P0748	Pressure Control Solenoid Valve A - Electrical	OFF	ATa-106
19	P0750	Shift Control Solenoid Valve A Circuit Malfunction (LR)	ON	ATa-108
20	P0755	Shift Control Solenoid Valve B Circuit Malfunction (UD)	ON	ATa-114
21	P0760	Shift Control Solenoid Valve C Circuit Malfunction (2ND)	ON	ATa-120
22	P0765	Shift Control Solenoid Valve D Circuit Malfunction (OD)	ON	ATa-126
23	P0770	Shift Control Solenoid Valve E Circuit Malfunction (RED)	ON	ATa-131
24	P0885	A/T Relay Circuit Malfunction	ON	ATa-136
25	P0890	AT Relay - Low Circuit	ON	ATa-142
26	P0891	AT Relay - open Circuit	ON	ATa-144

INPUT/OUTPUT SIGNAL VOLTAGE CHECK SHEET



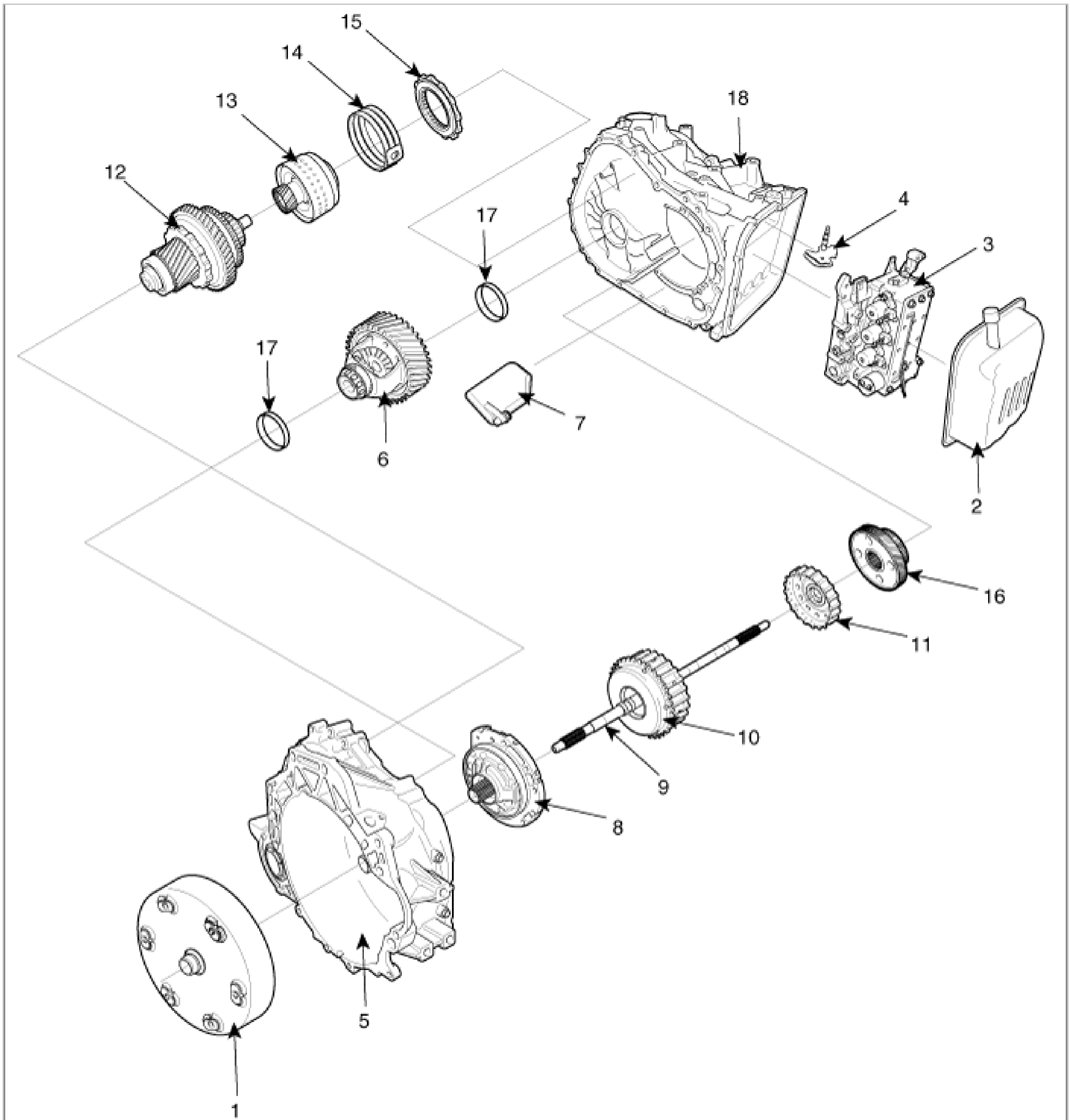
PIN No.	Check item	Condition	Input/Output value		Remarks
			Type	Level	
A01	2nd CAN_HI	-	-	-	-
A02	2nd CAN_LO	-	-	-	-
A03	P Range Selection	P Position Otherwise	DC Voltage	V_BAT Max. 1.0V	
A04	R Range Selection	R Position Otherwise	DC Voltage	V_BAT Max. 1.0V	
A05	N Range Selection	N Position Otherwise	DC Voltage	V_BAT Max. 1.0V	
A06	D Range Selection	D Position Otherwise	DC Voltage	V_BAT Max. 1.0V	
A07	Select Position	-	DC Voltage	V_BAT Max. 1.0V	
A08	Up Position	-	DC Voltage	V_BAT Max. 1.0V	
A09	Down Position	-	DC Voltage	V_BAT Max. 1.0V	
A12	N.A	-	-	-	
A14	N.A	-	-	-	
A19	N.A	-	-	-	
A20	A/T Control Relay	Relay On Relay Off	DC Voltage	V_BAT Max. 1.0V Vpeak : Max. 70V Resistance : 680 Ohm	
		W/H Open		DTC Spec : P0890	
				At transmitting	

A27	Diagnosis "K"	Communicated with GST	Pulse	HI : V_BAT* 80%↑ LO : V_BAT * 20%↓ AT receiving HI : V_BAT* 70%↑ LO : V_BAT*30%↓	V_BAT : 13.2V
A31	N.A	-	-	-	
A32	A/C Pressure Analog	-	-	-	-
A34	N.A	-	-	-	
A36	N.A	-	-	-	
A37	N.A	-	-	-	
A41	CAN_HI	Recessive Dominant	Pulse	2.0 ~ 3.0 V 2.75 ~ 4.5 V	
A42	CAN_LO	Recessive Dominant	Pulse	2.0 ~ 3.0 V 0.5 ~ 2.25 V	
A60	A/T PWR Source	IG Off IG On IG. Key On IG. Key Off Idle Key Off from Idle Fuse 1/2/3 Removal Condition	DC Voltage	Max. 0.5 V V_BAT MAX. +/- 75V (ECU GND) MAX. +/- 75V (ECU GND) MAX. +/- 75V (ECU GND) MAX. +/- 75V (ECU GND) MAX. +/- 75V (ECU GND)	
		W/H Open		DTC Spec : P0888	
A73	Shift Position Signal(To Cluster)	Running 1 gear 2 gear 3 gear 4 gear 5 gear	Pulse Duty ↑ ↑ ↑ ↑	HI : V_BAT LO : Max. 1.0V Freq.: 50±2Hz (Reference) 12.5±2% 27.5±2% 42.5±2% 57.5±2% 72.5±2%	Sports mode
B03	UD Solenoid	Shifting	Pulse	HI : V_BAT LO : Max. 1.0V Vpeak : Max. 70V	
		W/H Open		DTC Spec : P0755	
B05	N.A	-	-	-	
B06	Oil temperature sensor_ATM	Idle	Analog	0.5V ~ 4.5V	16Hz
B09	Output speed sensor	30kph	Pulse	HI : Min. 4.0V LO : Max. 1.0V	
		W/H Open		DTC Spec : P0722	
B10	Input speed sensor	Idle	Pulse	HI : Min. 4.0V LO : Max. 1.0V	630Hz
		W/H Open		DTC Spec : P0717	
B20	N.A	-	-	-	
B22	LR Solenoid	Shifting	Pulse	HI : V_BAT LO : Max. 1.0V Vpeak : Max. 70V	
		W/H Open		DTC Spec : P0750	
B26	N.A	-	-	-	
B27	N.A	-	-	-	
		Idle		Max. 50 mV	WTS &

B33	GND_Sensor	W/H Open	DC Voltage	DTC Spec : P0118/1115	OTS_ATM
B42	OD Solenoid	Shifting	Pulse	HI : V_BAT LO : Max. 1.0V Vpeak : Max. 70V	
		W/H Open		DTC Spec : P0765	
B43	DCC solenoid	Lock_Up on	Pulse	HI : V_BAT LO : Max. 1.0V Vpeak : Max. 70V	
		W/H Open		DTC Spec : P0743	
B44	RED Solenoid	Shifting	Pulse	HI : V_BAT LO : Max. 1.0V Vpeak : Max. 70V	
		W/H Open		DTC Spec : P0770	
B45	2ND Solenoid	Shifting	Pulse	HI : V_BAT LO : Max. 1.0V Vpeak : Max. 70V	
		W/H Open		DTC Spec : P0760	
B46	N.A	-	-	-	
B47	N.A	-	-	-	
B59	Variable Solenoid (-)	Idle	Pulse	HI : V_BAT LO : Max. 1.0V Vpeak : Max. 70V	600Hz
		W/H Open		DTC Spec : P0748	
B65	N.A	-	-	-	
B66	N.A	-	-	-	
B75	Variable Solenoid (+)	Idle	Pulse	HI : V_BAT LO : Max. 1.0V Vpeak : Max. 70V	
		W/H Open		DTC Spec : P0748	
B80	N.A	-	-	-	

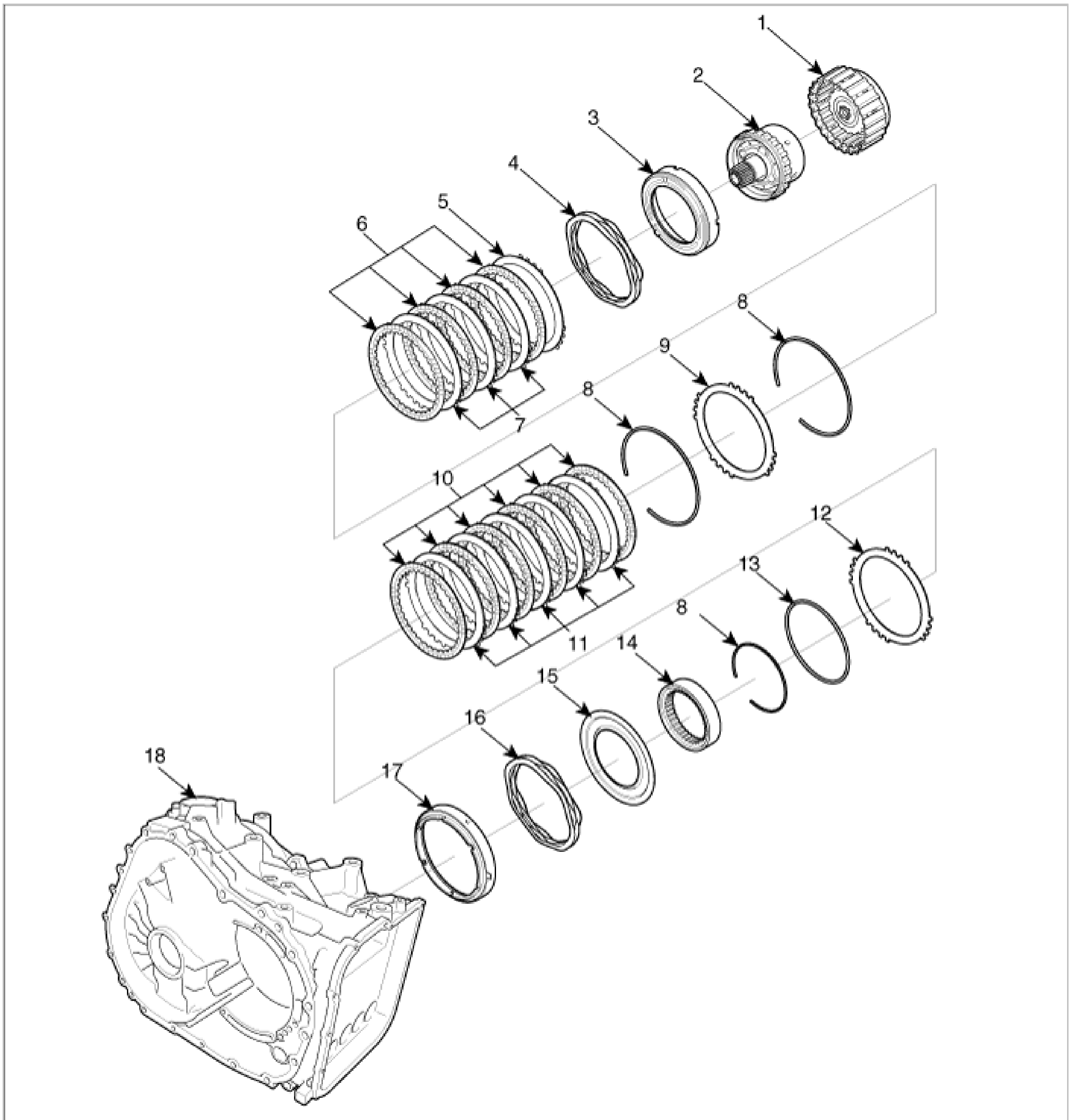
Automatic Transaxle System > Automatic Transaxle System > Automatic Transaxle > Components and Components Location

COMPONENTS(1)



1. Torque converter
2. Valve body cover
3. Valve body assembly
4. Manual control shaft assembly
5. Converter housing
6. Differential assembly
7. Main oil filter
8. Oil pump
9. Input shaft
10. Underdrive clutch assembly
11. Underdrive clutch hub
12. Direct planetary carrier assembly
13. Direct clutch assembly
14. Reduction brake bend
15. One way clutch
16. Transfer drive gear
17. Differential bearing race
18. Transaxle case

COMPONENTS(2)



1. Reverse sun gear
2. Planetary gear assembly
3. 2nd brake retainer
4. 2nd brake return spring
5. 2nd brake pressure plate
6. 2nd brake discs
7. 2nd brake plates
8. Snap ring
9. Brake reaction plate
10. Brake discs
11. Brake plates
12. Low&Reverse brake pressure plate
13. Wave spring
14. Oneway clutch inner race
15. Brake spring retainer
16. Low&Reverse brake return spring
17. Low&Reverse brake piston
18. Transaxle case

Automatic Transaxle System > Automatic Transaxle System > Automatic Transaxle > Repair procedures

REMOVAL

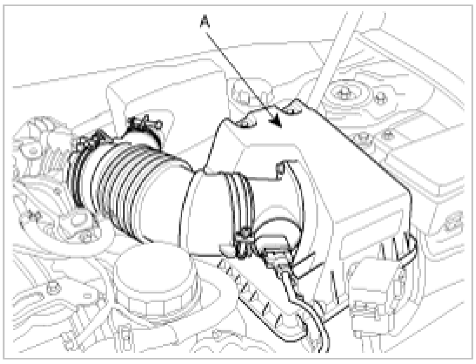
CAUTION

- Use fender covers to avoid damaging painted surfaces.
- To avoid damage, unplug the wiring connectors carefully while holding the connector portion.

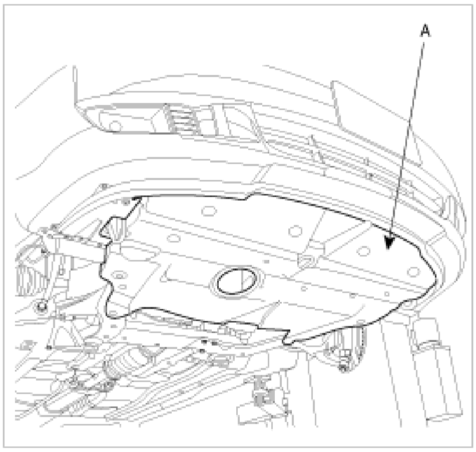
NOTE

- Mark all wiring and hoses to avoid misconnection.
- Turn the crankshaft pulley so that the No.1 piston is at top dead center. (See "EM" group)

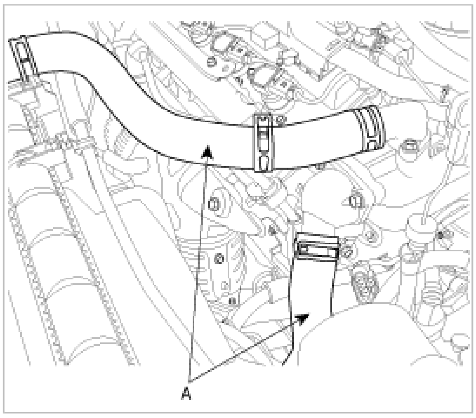
1. Disconnect the negative terminal from the battery.
2. Remove the engine cover.
3. Remove the air duct.
4. Remove the intake air hose and air cleaner assembly.
   (1) Disconnect the AFS connector.
   (2) Disconnect the breather hose from air cleaner hose.
   (3) Disconnect the PCM connectors. (See FL group)
   (4) Remove the intake air hose and air cleaner (A).



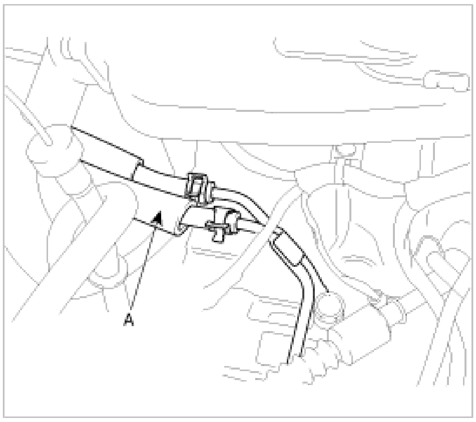
5. Remove the front wheels.
6. Remove the under cover(A).



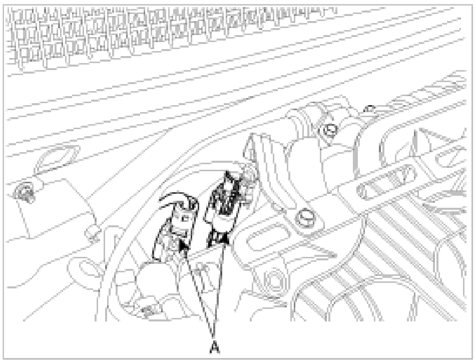
7. Drain the engine coolant and remove the radiator cap to speed up draining.
8. Remove the upper radiator hose and the lower radiator hose(A).



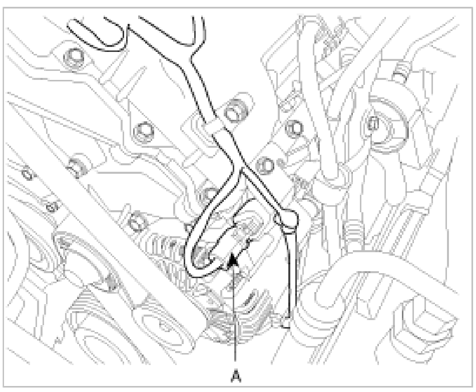
9. Remove transaxle oil cooler hose(A).



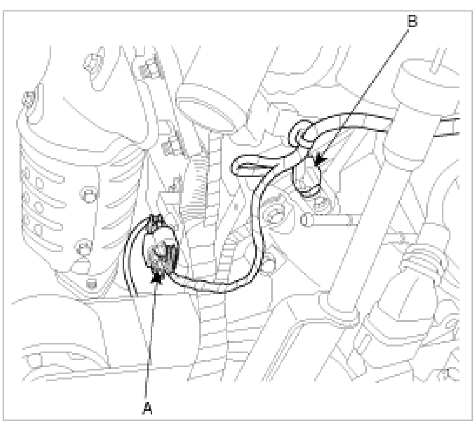
10. Remove engine wiring.
    (1) Disconnect RH oxygen sensor connector(A).



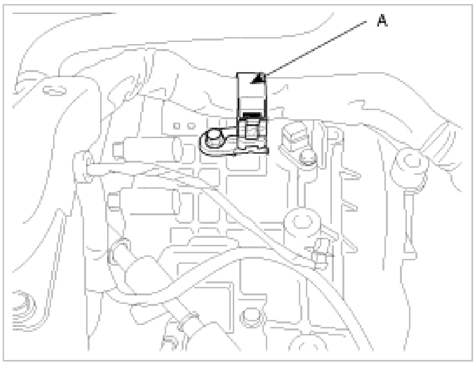
    (2) Disconnect LH front oxygen sensor connector(A).

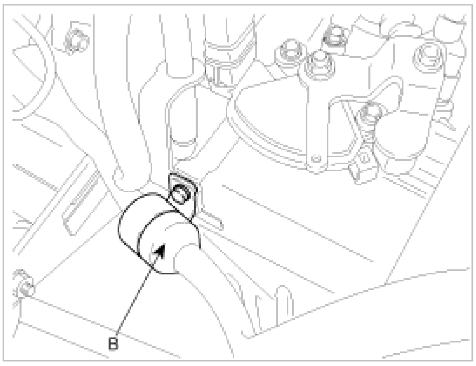


    (3) Disconnect LH rear oxygen sensor connector(A) and CPS connector(B).

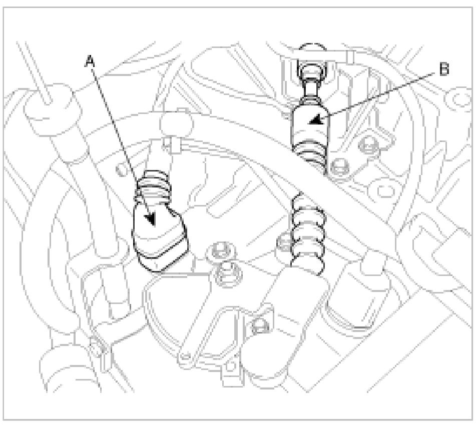


11. Disconnect the transaxle wire harness connector and remove transaxle control cable.
    (1) Remove the wiring brackets(A, B).

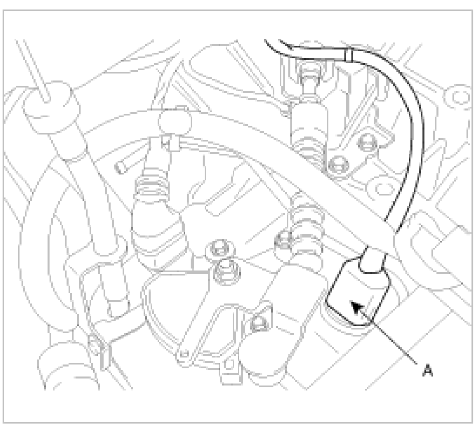




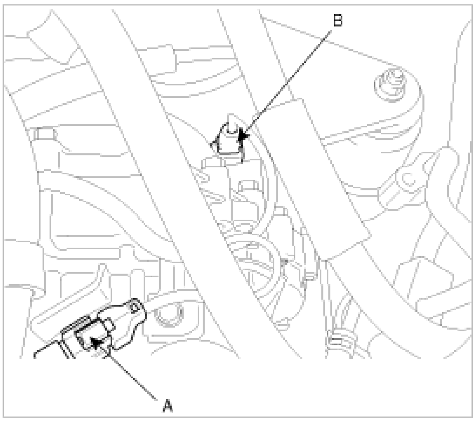
(2) Remove the inhibiter switch connector(A) and shift cable(B).



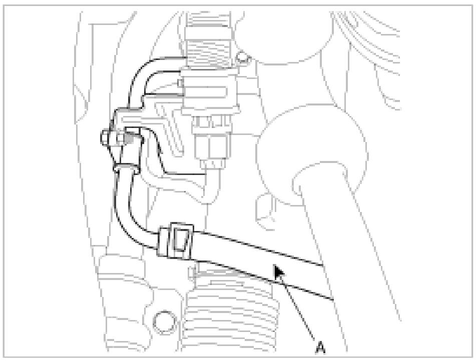
(3) Remove the solenoid valve connector(A).



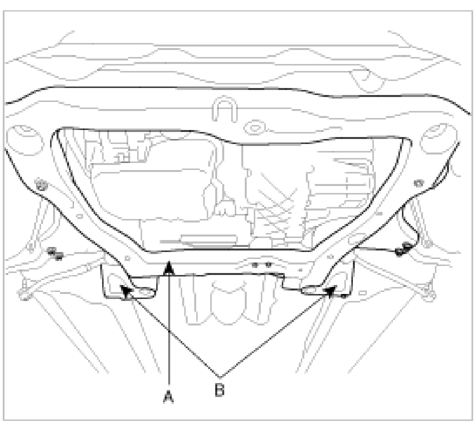
(4) Remove the input speed sensor, output speed sensor(A) and vehicle speed sensor connector(B).



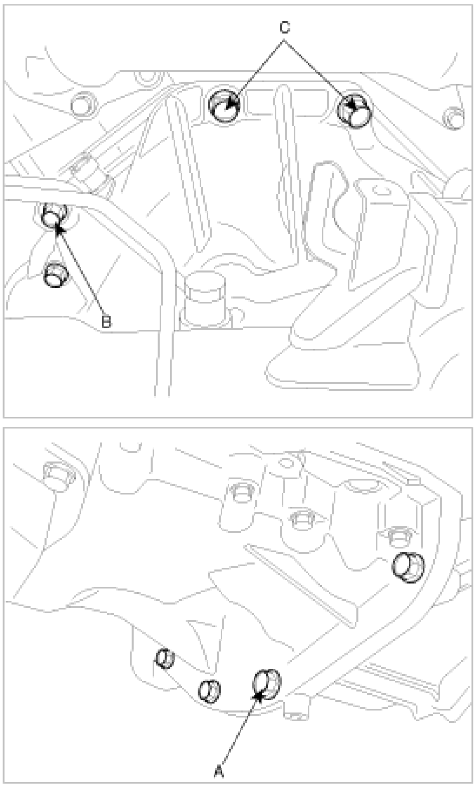
12. Disconnect EPS connector.
13. Remove power steering pump hose(A).



14. Using the SST(09200-38001), hold the engine and transaxle assembly safely.
15. Drain transaxle oil.
16. Remove lower arm ball joint. (See 'DS' group)
17. Remove tie rod end ball joint. (See 'DS' group)
18. Remove stabilizer bar link. (See 'SS' group)
19. After removing a split pin and nut from the steering bar tie rod, disconnect it. (Refer to 'ST'-group)
20. Remove front roll stopper mounting bolt.
21. Remove rear roll stopper mounting bolt.
22. Remove steering u-joint mounting (See 'ST' group)
23. Remove front exhaust pipe.
24. Supporting the cross member(A) with a jack, remove the stays(B) with the mounting bolts.



25. Remove the cross member.
26. Remove drive shaft from transaxle. (See 'DS' group)
27. Install a jack for supporting the transaxle assembly.
28. Remove the transaxle mounting bolts(A, B, C).



29. Lower the vehicle and remove the transaxle mounting bracket.
30. Jack up the vehicle and disassemble the transaxle assembly.

INSTALLATION

Installation is in the reverse order of removal.
Perform the following :

- Adjust the shift cable.
- Adjust the throttle cable.
- Refill the engine with engine oil.
- Refill the transaxle with fluid.
- Refill the radiator with engine coolant.
- Bleed air from the cooling system with the heater valve open.
- Clean the battery posts and cable terminals with sandpaper, assemble them, and apply grease to prevent corrosion.
- Inspect for fuel leakage.

After assembling the fuel line, turn on the ignition switch (do not operate the starter) so that the fuel pump runs for approximately two seconds and fuel line pressurizes.
Repeat this operation two or three times, then check for fuel leakage at any point in the fuel line.

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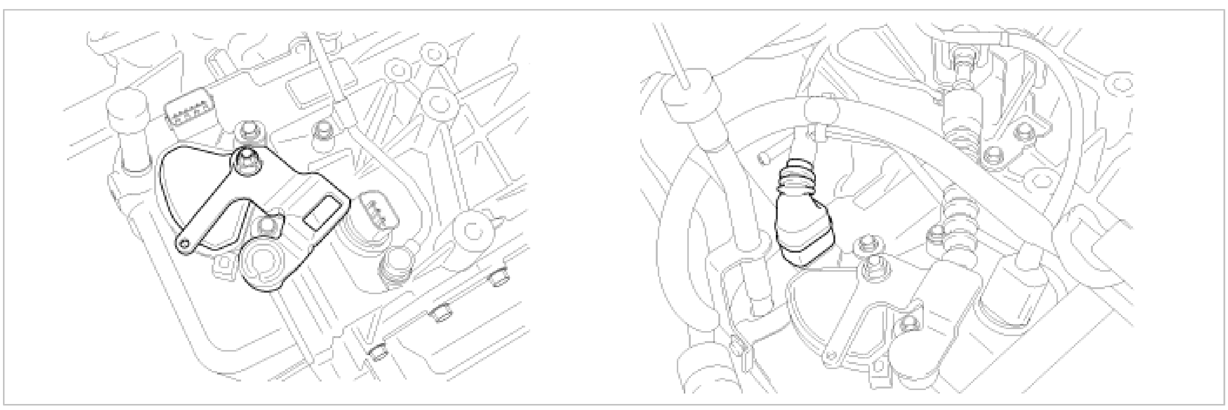
COMPONENT LOCATION



GENERAL DESCRIPTION

Transaxle range switch sends information of the shift lever position to the PCM by using 12V(the battery voltage). By detecting the position of the transaxle range, to start the engine is possible only when the gear position is in the parking or neutral position and the back up lamp is on only in reverse position.

DTC DESCRIPTION

The PCM sets this code when the transaxle range switch has no output signal for more than 30 seconds.

DTC DETECTING CONDITION

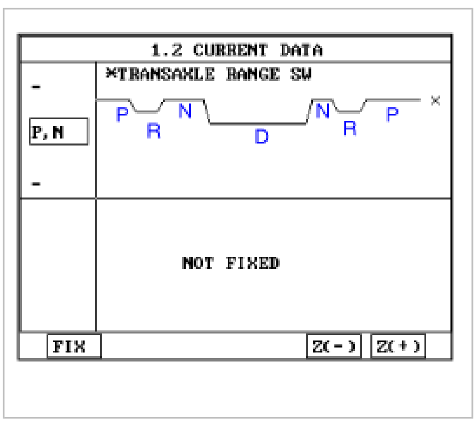
Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check for no signal	• Open or short in circuit • Faulty TRANSAXLE RANGE SWITCH • Faulty PCM
Enable Conditions	• Engine state=Run • PRNDL Diag disabling fault present flag=FALSE • Battery Voltage>11V and<16 V • Throttle position≥ 3%	
Threshold value	• No signal detected	
Diagnostic Time	• More than 30sec	
Fail Safe	• If there are no or multiple signals from the transaxle range switch, the PCM will continue to control with the signal which is detected just before DTC occurs.	

SPECIFICATION

Inspection condition		Reference value
* IG KEY : ON or Engine stall	Shift lever : P	P,N
	Shift lever : R	R
	Shift lever : N	P,N
	Shift lever : D	D

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Ignition "ON" & Engine "OFF".
3. Monitor the "TRANSAXLE RANGE SWITCH" parameter on the scantool.
4. Move selector lever from "P" range to other range.



5. Does "TRANSAXLE RANGE SWITCH" follow the reference data?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification vehicle repair" procedure.

NO

▸ Go to "Terminal&connector inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification vehicle Repair" procedure.

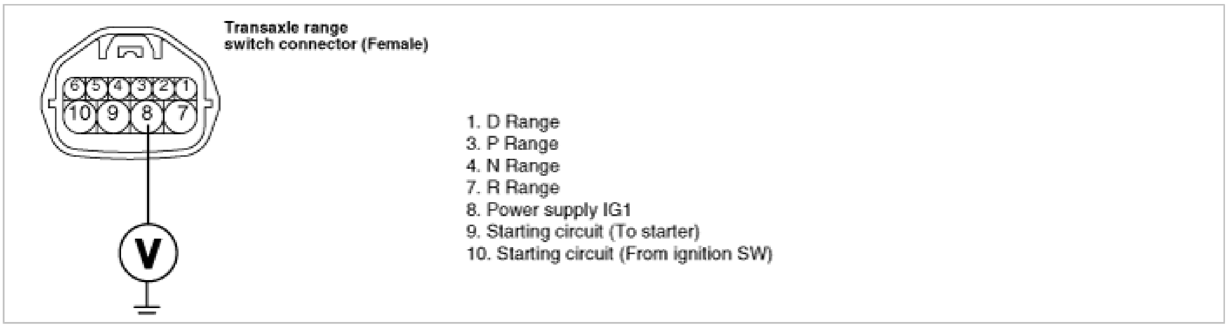
NO

▸ Go to "Power supply circuit inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. CHECK POWER TO RANGE SWITCH
   (1) Disconnect "TRANSAXLE RANGE SWITCH" connector.
   (2) Ignition "ON" & Engine "OFF".
   (3) Measure voltage between teminal "8" of the sensor harness connector and chassis ground.

   Specification : approx. B+



   (4) Is voltage within specifications?

YES

▸ Go to "Signal circuit inspection" procedure.

NO

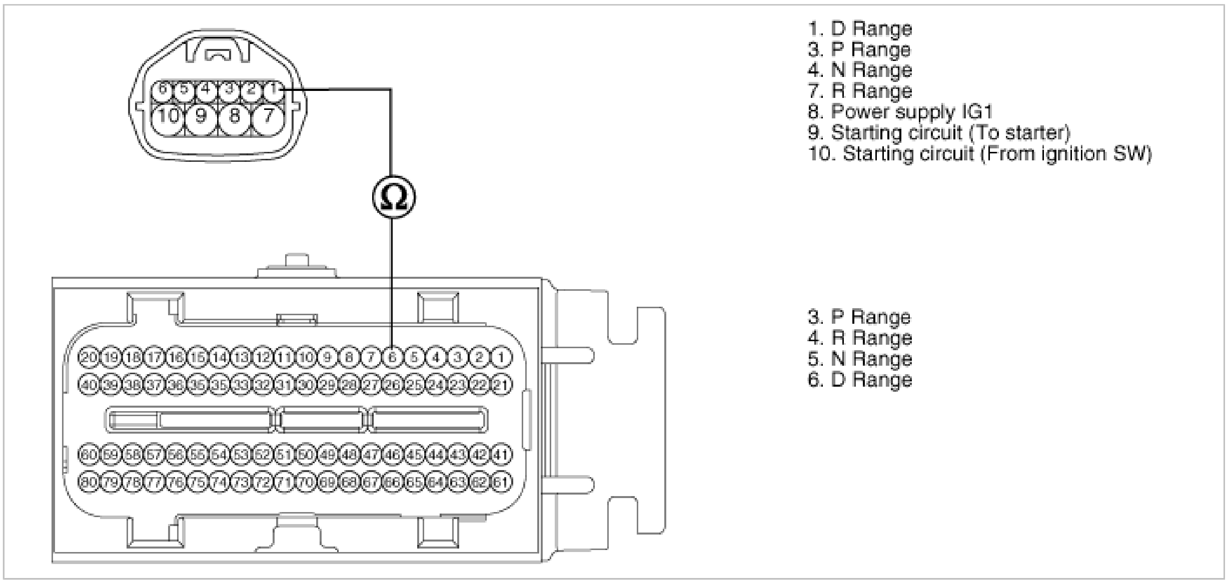
▸ Check that Fuse 10A is installed or not blown.
▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect "TRANSAXLE RANGE SWITCH" and "PCM" connector.
3. Measure resistance between each teminal of the sensor harness connector and PCM harness connector as below.

Specification : Shown below

Pin No of "TRANSAXLE RANGE SWITCH"	No.1	No.3	No.4	No.7
Pin No of "PCM" harness	A-No.6	A-No.3	A-No.5	A-No.4
Specification	0Ω	0Ω	0Ω	0Ω



4. Is resistance within specifications?

YES

▸ Go to "Component inspection" procedure.

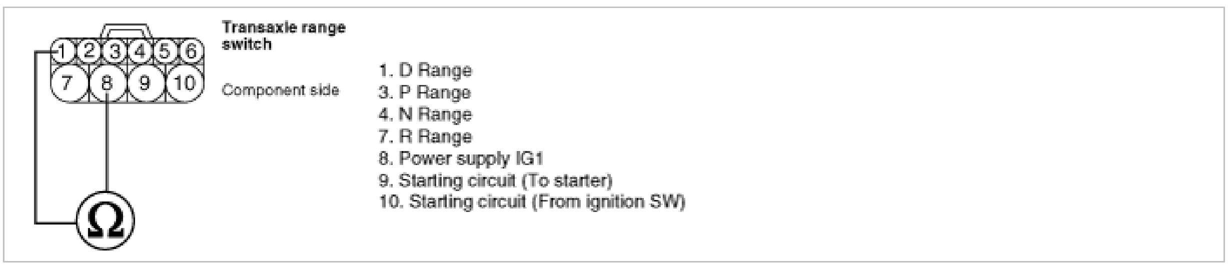
NO

▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Remove "TRANSAXLE RANGE SWITCH".
3. Measure the resistance between each terminal of the sensor.

Specification : approx. 0 Ω



Range	Terminal Number									
	1	2	3	4	5	6	7	8	9	10
P			O					O	O	O
R							O	O		
N				O				O	O	O
D	O							O		

[RANGE SWITCH continuity check table]

4. Is resistance within specifications?

YES

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected, replace PCM as necessary and then go to "Verification of vehicle repair" procedure.

NO

▸ Replace "TRANSAXLE RANGE SWITCH" as necessary and go to "Verification vehicle repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present?

YES

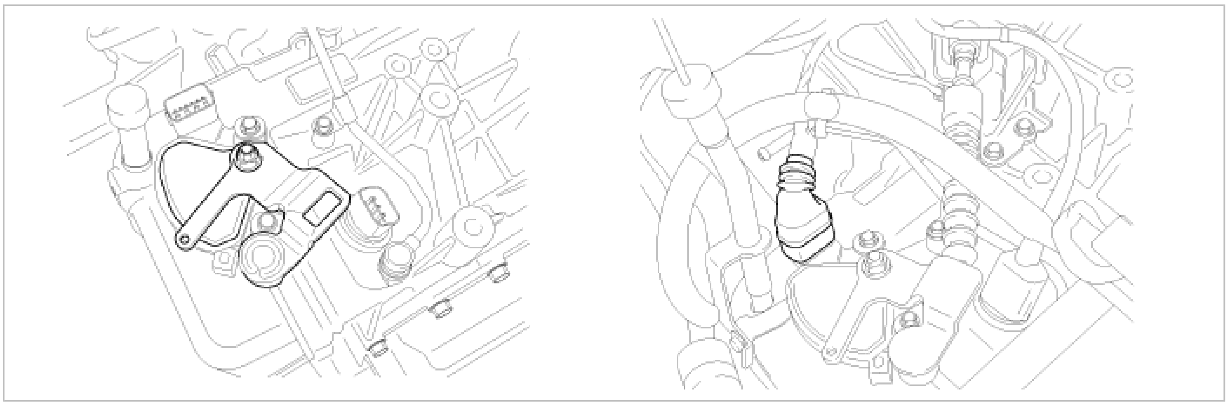
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P0708

COMPONENT LOCATION



GENERAL DESCRIPTION

Transaxle range switch sends information of the shift lever position to the PCM by using 12V(the battery voltage). By detecting the position of the transaxle range, to start the engine is possible only when the gear position is in the parking or neutral position and the back up lamp is on only in reverse position.

DTC DESCRIPTION

The PCM sets this code when the transaxle range switch has two or more output signals for more than 30 seconds.

DTC DETECTING CONDITION

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check for No signal	• Open or short in TRANSAXLE RANGE SWITCH • Faulty TRANSAXLE RANGE SWITCH • Faulty PCM
Enable Conditions	• Engine state=Run • Battery Voltage>11V and<16 V	
Threshold value	• Multiple signal	
Diagnostic Time	• More than 30sec	
Fail Safe	• If there are no or multiple signals from the transaxle range switch, the PCM will continue to control with the signal which is detected just before DTC occurs.	

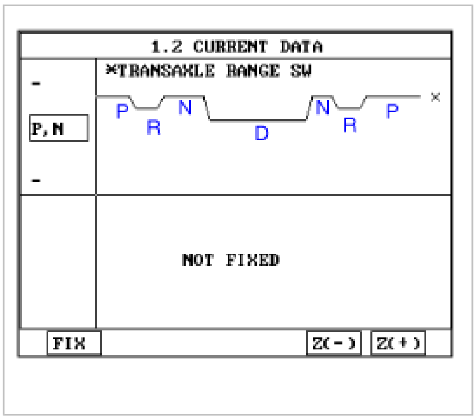
SPECIFICATION

Inspection condition		Reference value
* IG KEY : ON or Engine stall	Shift lever : P	P,N
	Shift lever : R	R
	Shift lever : N	P,N

	Shift lever : D	D

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Ignition "ON" & Engine "OFF".
3. Monitor the "TRANSAXLE RANGE SWITCH" parameter on the scantool.
4. Move selector lever from "P" range to other range.



5. Does "TRANSAXLE RANGE SWITCH" follow the reference data?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification vehicle repair" procedure.

NO

▸ Go to "Terminal&connector inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification vehicle repair" procedure.

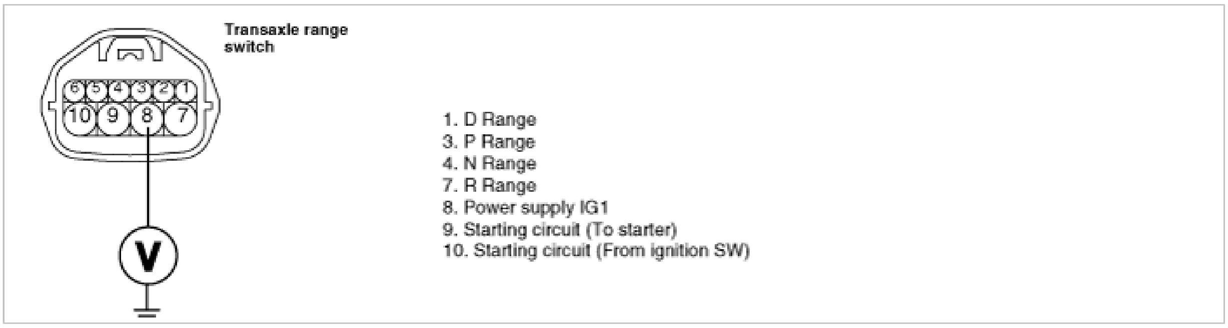
NO

▸ Go to "Power supply circuit inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. CHECK POWER TO RANGE SWITCH
   (1) Disconnect "TRANSAXLE RANGE SWITCH" connector.
   (2) Ignition "ON" & Engine "OFF".
   (3) Measure voltage between teminal "8" of the sensor harness connector and chassis ground.

Specification : approx. B+



(4) Is voltage within specifications?

YES

▸ Go to "Signal circuit inspection" procedure.

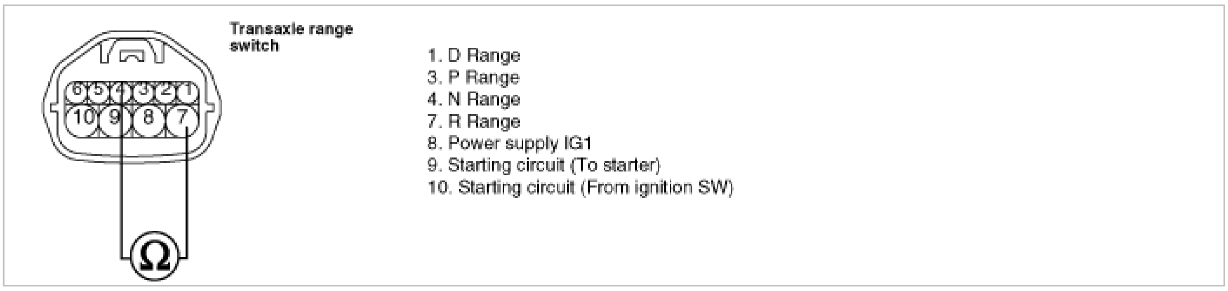
NO

▸ Check for Short in harness. Repair as necessary and Go to "Verification Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect "TRANSAXLE RANGE SWITCH" and "PCM" connector.
3. Measure resistance between each terminals of the sensor harness to check for short.

Specification : Infinite



4. Is resistance within specifications?

YES

▸ Go to "Component inspection" procedure.

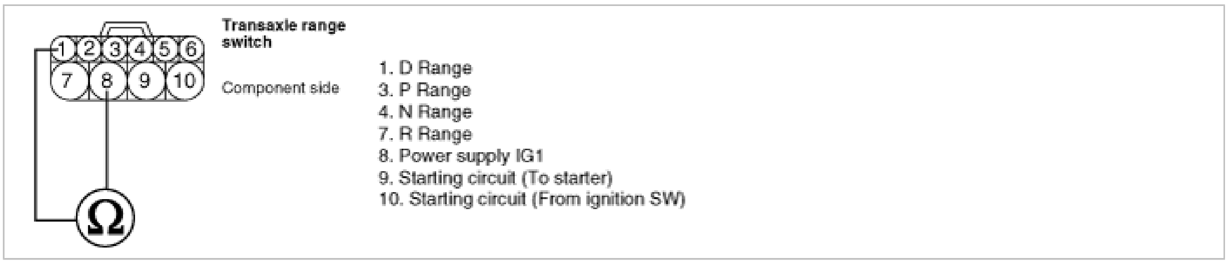
NO

▸ Check for open in harness. Repair as necessary and Go to "Verification Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Remove "TRANSAXLE RANGE SWITCH".
3. Measure the resistance between each terminal of the sensor.

Specification : approx. 0 Ω



Range	Terminal Number									
	1	2	3	4	5	6	7	8	9	10
P			○					○	○	○
R							○	○		
N				○				○	○	○
D	○							○		

[RANGE SWITCH continuity check table]

4. Is resistance within specifications?

YES

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected, replace PCM as necessary and then go to "Verification of vehicle repair" procedure.

NO

▸ Replace "TRANSAXLE RANGE SWITCH" as necessary and go to "Verification vehicle repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present?

YES

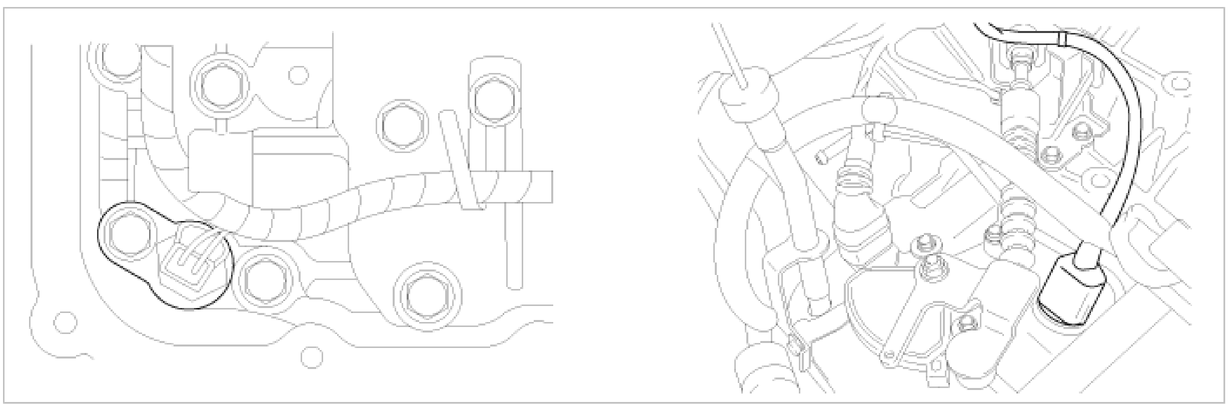
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P0711

COMPONENT LOCATION



GENERAL DESCRIPTION

The oil temperature sensor is installed in the valve body and uses a thermistor that resistance changes by temperature change. PCM offers 5V as a reference voltage and the output voltage changes according to the ATF's temperature. The oil temperature sensor signal is important information in detecting torque converter clutch operation or non-operation area, the oil temperature sensor's variable controlling and oil pressure's controlling at shifting.

DTC DESCRIPTION

PCM displays this code if it detects the condition below for more than 1 second. PCM regards that the ATF's oil temperature is 85°C(185°F) since this code is sensed.

DTC DETECTING CONDITION

Item		Detecting Condition & Fail Safe	Possible cause
DTC Strategy		• Check rationality	• Sensor signal circuit is short to ground • Faulty sensor • Faulty PCM
Enable Conditions	Case 1	• Intake air temperature(IAT)>-25°C(-13°F) • Engine state=Run • No errors in relative sensors • Engine should be cool enough	
	Case 2	• Intake air temperature(IAT)>-25°C(-13°F) • Engine state=Run • No errors in relative sensors • Engine should be cool enough	
Threshold value	Case 1	• Temperature difference between TM oil temp and coolant temp >20°C(68°F) • TM oil temp >coolant temp	
	Case 2	• Temperature difference between TM oil temp and coolant temp >20°C(68°F) • TM oil temp >coolant temp • Absolute value of temperature difference between minimum IAT and coolant temp at key on< 10°C(50°F) • Absolute value of temperature difference between maximum IAT and coolant temp at key on< 10°C(50°F)	
Diagnostic Time		• 1 second	
Fail Safe		• Fluid temperature is regarded as 85°C(185°F)	

SPECIFICATION

Temp.[°C(°F)]	Resistance(kΩ)	Temp.[°C(°F)]	Resistance(kΩ)
-40(-40)	139.5	80(176)	1.08
-20(-4)	47.7	100(212)	0.63
0(32)	18.6	120(248)	0.38
20(68)	8.1	140(284)	0.25
40(104)	3.8	160(320)	0.16
60(140)	1.98		

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification vehicle repair" procedure.

NO

▸ Go to "Component inspection" procedure.

COMPONENT INSPECTION

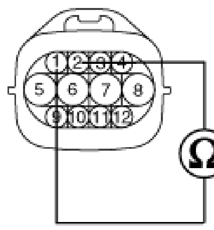
1. CHECK "TRANSAXLE FLUID TEMPERATURE SENSOR"
   (1) Ignition "OFF".
   (2) Disconnect the "TRANSAXLE FLUID TEMPERATURE SENSOR" connector.

(3) Measure the resistance between terminals "1" and "2" of the "TRANSMISSION FLUID TEMPERATURE SENSOR".

Specification : Refer to "Reference data"

[REFERENCE DATA]

Temp.[°C(°F)]	Resistance(kΩ)	Temp.[°C(°F)]	Resistance(kΩ)
-40(-40)	139.5	80(176)	1.08
-20(-4)	47.7	100(212)	0.63
0(32)	18.6	120(248)	0.38
20(68)	8.1	140(284)	0.25
40(104)	3.8	160(320)	0.16
60(140)	1.98		



(4) Is resistance within specifications?

YES

▸ Go to "CHECK PCM" as below.

NO

▸ Replace "TRANSAXLE FLUID TEMPERATURE SENSOR" as necessary and go to "Verification vehicle repair" procedure.

2. CHECK PCM

(1) Ignition "ON" & Engine "OFF".

(2) Connect "TRANSAXLE FLUID TEMPERATURE SENSOR" connector.

(3) Install scantool and select a SIMU-SCAN.

(4) Simulate voltage (0→5V) to "TRANSMISSION FLUID TEMPERATURE SENSOR" signal circuit.

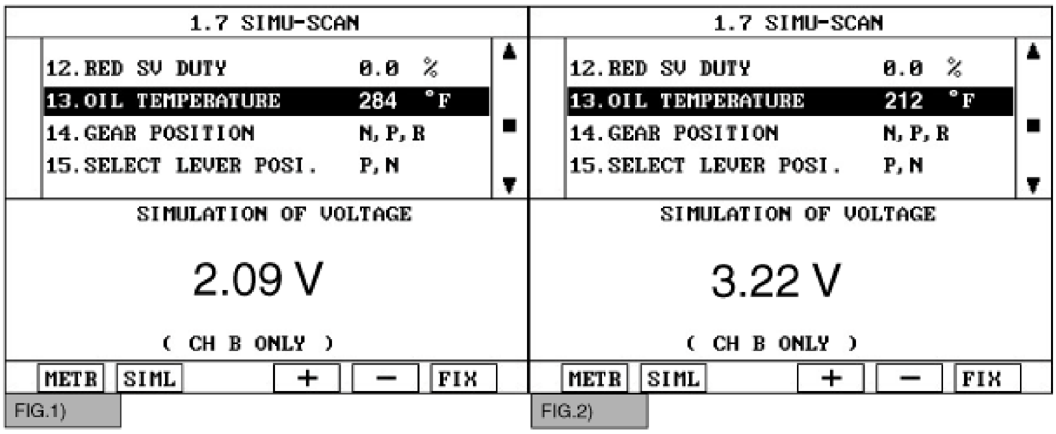


FIG.1) INPUT 2.09V → 140°C(284°F)
FIG.2) INPUT 3.22V → 100°C(212°F)

※ The values are subject to change according to vehicle model

(5) Is FLUID TEMP. SENSOR signal value changed according to simulation voltage?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of vehicle repair" procedure.

NO

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected, replace PCM as necessary and then go to "Verification of vehicle repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present?

YES

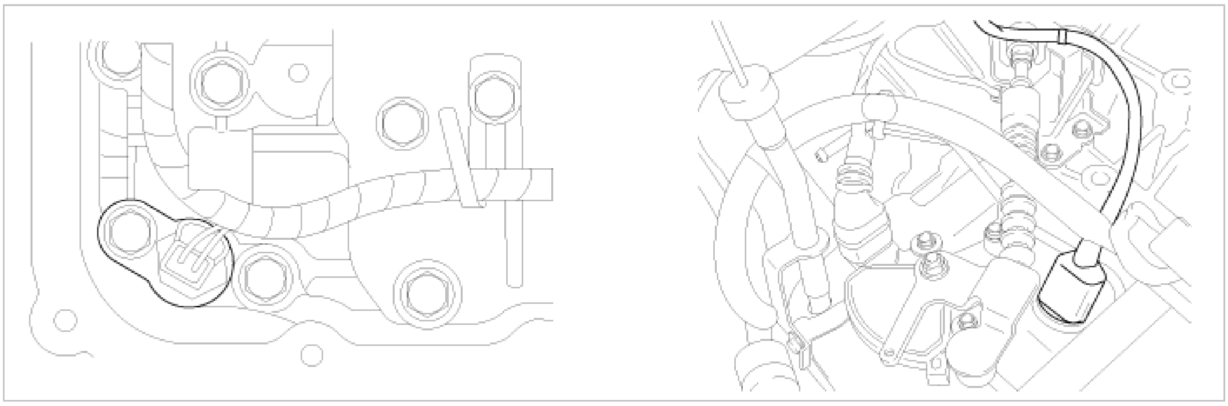
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P0712

COMPONENT LOCATION



GENERAL DESCRIPTION

The oil temperature sensor is installed in the valve body and uses a thermistor that resistance changes by temperature change. PCM offers 5V as a reference voltage and the output voltage changes according to the ATF's temperature. The oil temperature sensor signal is important information in detecting torque converter clutch operation or non-operation area, the oil temperature sensor's variable controlling and oil pressure's controlling at shifting.

DTC DESCRIPTION

PCM displays this code if it detects the condition below for more than 10 seconds. PCM recognizes that the oil temperature is 85°C(185°F) since this code is sensed.

DTC DETECTING CONDITION

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check for ground short	• Sensor signal circuit is short to ground • Faulty sensor • Faulty PCM
Enable Conditions	• Engine state=Run	
Threshold value	• Temperature Input A/D value< 1.4%	
Diagnostic Time	• More than 10 seconds	
Fail Safe	• Fluid temperature is regarded as 85°C(185°F)	

SPECIFICATION

Temp.[°C(°F)]	Resistance(kΩ)	Temp.[°C(°F)]	Resistance(kΩ)
-40(-40)	139.5	80(176)	1.08
-20(-4)	47.7	100(212)	0.63

0(32)	18.6	120(248)	0.38
20(68)	8.1	140(284)	0.25
40(104)	3.8	160(320)	0.16
60(140)	1.98		

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Engine "ON".
3. Monitor the "TRANSAXLE FLUID TEMPERATURE SENSOR" parameter on the scantool.

Specification : Increasing gradually

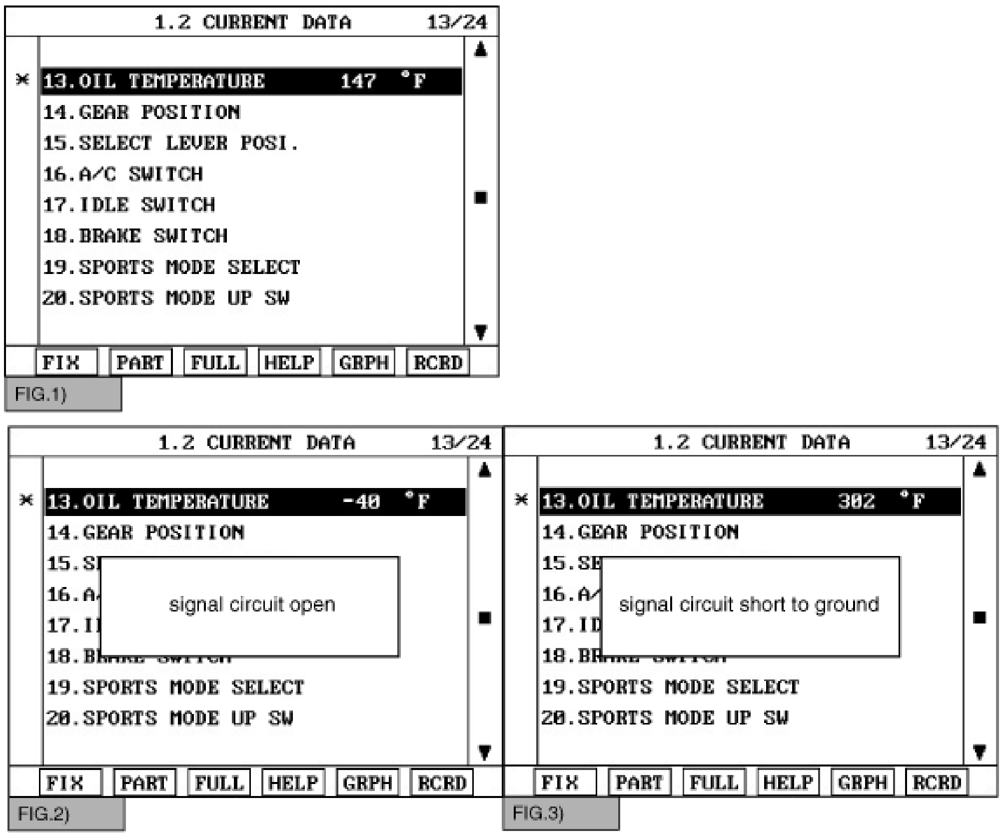


FIG.1) Normal
FIG.2) Signal harness Open
FIG.3) Signal harness Short

4. Does "TRANSAXLE FLUID TEMPERATURE SENSOR " follow the reference data?

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification vehicle repair" procedure.

NO

▶ Go to "Terminal&connector inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification vehicle repair" procedure.

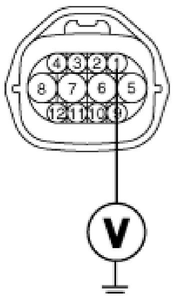
NO

▸ Go to "Component inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Disconnect the "TRANSAXLE FLUID TEMPERATURE SENSOR" connector.
3. Measure the voltage between terminal "1" of the "TRANSMISSION FLUID TEMPERATURE SENSOR" harness connector and chassis ground.

Specification : Approx. 5V



4. Is voltage within specifications?

YES

▸ Go to "Component inspection" procedure.

NO

▸ Check for short to ground in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

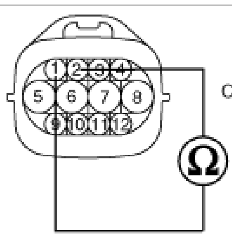
COMPONENT INSPECTION

1. CHECK "TRANSAXLE FLUID TEMPERATURE SENSOR"
   (1) Ignition "OFF".
   (2) Disconnect the "TRANSAXLE FLUID TEMPERATURE SENSOR" connector.
   (3) Measure the resistance between terminals "1" and "2" of the "TRANSMISSION FLUID TEMPERATURE SENSOR".

Specification : Refer to "Reference data"

[REFERENCE DATA]

Temp.[°C(°F)]	Resistance(kΩ)	Temp.[°C(°F)]	Resistance(kΩ)
-40(-40)	139.5	80(176)	1.08
-20(-4)	47.7	100(212)	0.63
0(32)	18.6	120(248)	0.38
20(68)	8.1	140(284)	0.25
40(104)	3.8	160(320)	0.16
60(140)	1.98		



(4) Is resistance within specifications?

YES

▸ Go to "CHECK PCM" as below.

NO

▸ Replace "TRANSAXLE FLUID TEMPERATURE SENSOR" as necessary and go to "Verification vehicle repair" procedure.

2. CHECK PCM
   (1) Ignition "ON" & Engine "OFF".
   (2) Connect "TRANSAXLE FLUID TEMPERATURE SENSOR" connector.
   (3) Install scantool and select a SIMU-SCAN.
   (4) Simulate voltage (0→5V) to "TRANSMISSION FLUID TEMPERATURE SENSOR" signal circuit.

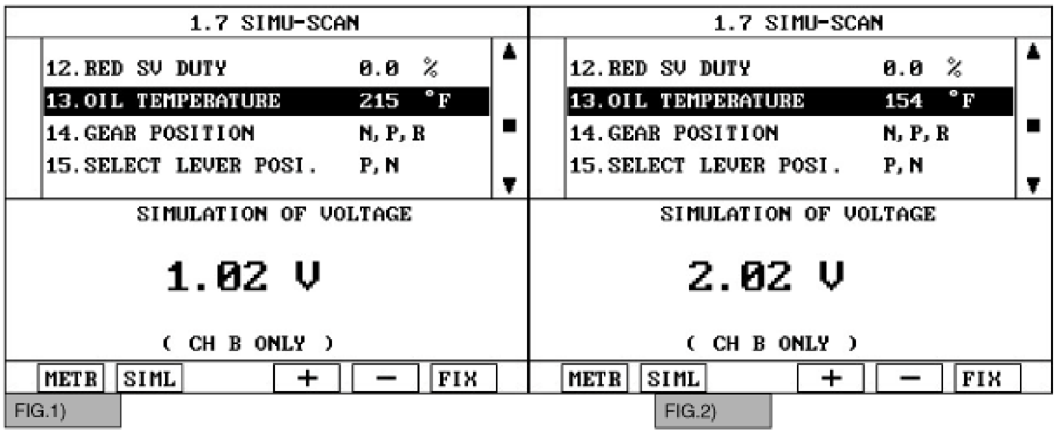


FIG.1) INPUT 1.02V → 215°F
FIG.2) INPUT 2.02V → 154°F

※ The values are subject to change according to vehicle model

   (5) Is FLUID TEMP. SENSOR signal value changed according to simulation voltage?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of vehicle repair" procedure.

NO

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected, replace PCM as necessary and then go to "Verification of vehicle repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present?

YES

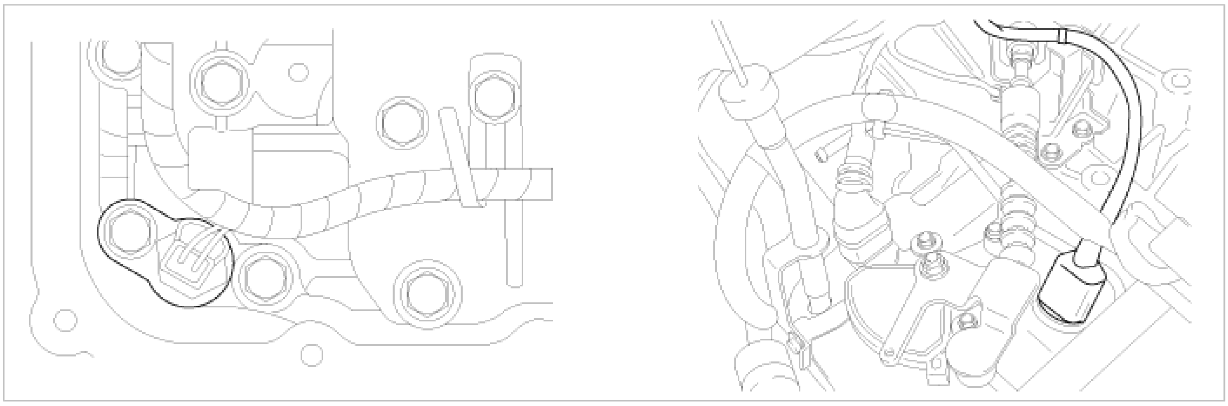
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P0713

COMPONENT LOCATION



GENERAL DESCRIPTION

The oil temperature sensor is installed in the valve body and uses a thermister that resistance changes by temperature change. PCM offers 5V as a reference voltage and the output voltage changes according to the ATF's temperature. The oil temperature sensor signal is important information in detecting torque converter clutch operation or non-operation area, the oil temperature sensor's variable controlling and oil pressure's controlling at shifting.

DTC DESCRIPTION

PCM displays this code if it detects the condition below for more than 1 second. PCM regards that the ATF's oil temperature is 85°C(185°F) since this code is sensed.

DTC DETECTING CONDITION

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check for voltage range	• Sensor signal circuit is short to ground • Faulty sensor • Faulty PCM
Enable Conditions	• Intake air temperature(IAT)>-25°C(-13°F) • Engine state=Run • No errors in relative sensors	
Threshold value	• Temperature Input A/D value >98% • No rise in oil temperature after enough time passed	
Diagnostic Time	• More than 1 sec	
Fail Safe	• Fluid temperature is regarded as 85°C(185°F)	

SPECIFICATION

Temp.[°C(°F)]	Resistance(kΩ)	Temp.[°C(°F)]	Resistance(kΩ)
-40(-40)	139.5	80(176)	1.08
-20(-4)	47.7	100(212)	0.63
0(32)	18.6	120(248)	0.38
20(68)	8.1	140(284)	0.25
40(104)	3.8	160(320)	0.16
60(140)	1.98		

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Engine "ON".
3. Monitor the "TRANSAXLE FLUID TEMPERATURE SENSOR" parameter on the scantool.

Specification : Increasing gradually

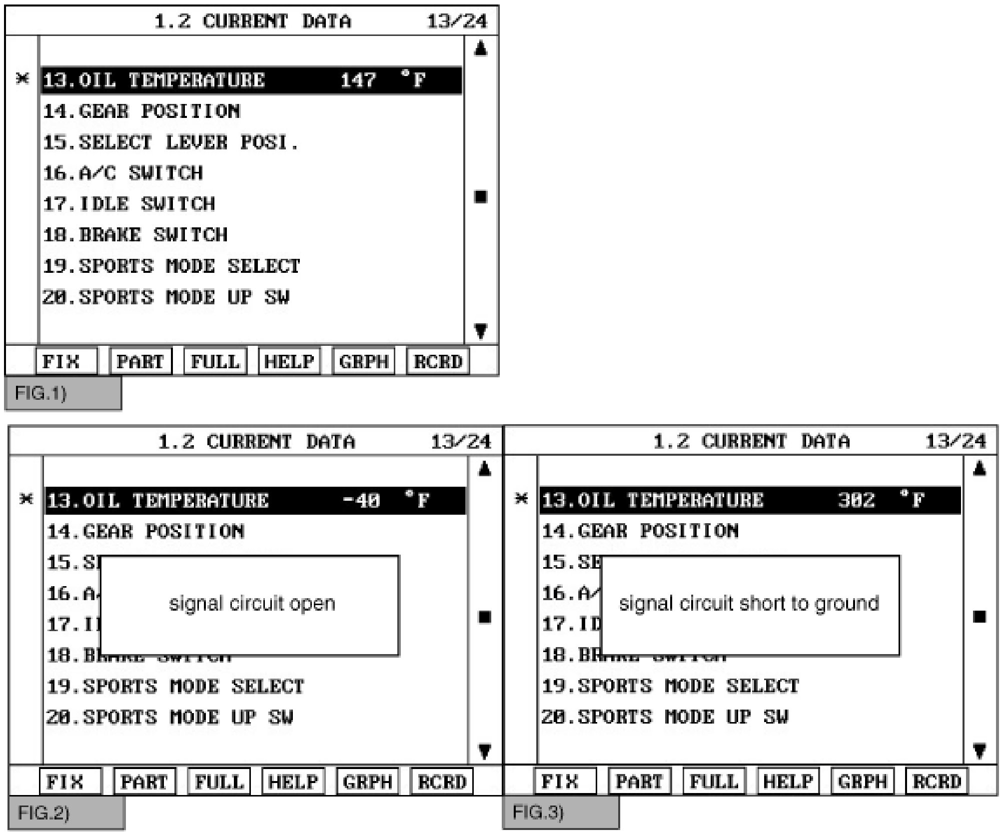


FIG.1) Normal
FIG.2) Signal harness Open
FIG.3) Signal harness Short

4. Does "TRANSAXLE FLUID TEMPERATURE SENSOR " follow the reference data?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification vehicle repair" procedure.

NO

▸ Go to "Terminal&connector inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification vehicle repair" procedure.

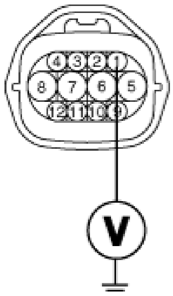
NO

▸ Go to "Component inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Disconnect the "TRANSAXLE FLUID TEMPERATURE SENSOR" connector.
3. Measure the voltage between terminal "1" of the "TRANSMISSION FLUID TEMPERATURE SENSOR" harness connector and chassis ground.

Specification : Approx. 5V



4. Is voltage within specifications?

YES

▸ Go to "Component inspection" procedure.

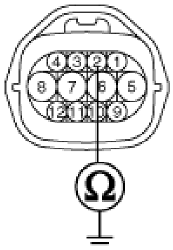
NO

▸ Check for short to ground in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

GROUND CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect the "TRANSAXLE FLUID TEMPERATURE SENSOR" connector.
3. Measure the resistance between terminal "2" of the "TRANSMISSION FLUID TEMPERATURE SENSOR" harness connector and chassis ground.

Specification : Approx. 0 Ω



4. Is resistance within specifications?

YES

▸ Go to "Component inspection" procedure.

NO

▸ Check for open in harness. Repair as necessary and Go to "Verification vehicle repair" procedure.

COMPONENT INSPECTION

1. CHECK "TRANSAXLE FLUID TEMPERATURE SENSOR"
   (1) Ignition "OFF".
   (2) Disconnect the "TRANSAXLE FLUID TEMPERATURE SENSOR" connector.
   (3) Measure the resistance between terminals "1" and "2" of the "TRANSMISSION FLUID TEMPERATURE SENSOR".

Specification : Refer to "Reference data"

[REFERENCE DATA]

Temp.[°C(°F)]	Resistance(kΩ)	Temp.[°C(°F)]	Resistance(kΩ)
-40(-40)	139.5	80(176)	1.08
-20(-4)	47.7	100(212)	0.63
0(32)	18.6	120(248)	0.38
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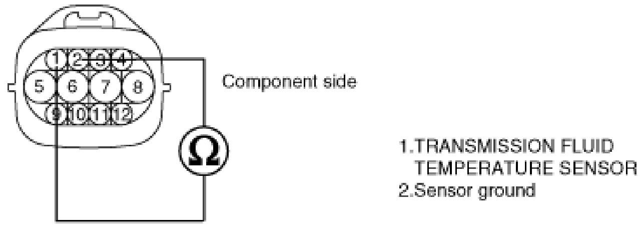


(4) Is resistance within specifications?

YES

▸ Go to "CHECK PCM" as below.

NO

▸ Replace "TRANSAXLE FLUID TEMPERATURE SENSOR" as necessary and go to "Verification vehicle repair" procedure.

2. CHECK PCM
   (1) Ignition "ON" & Engine "OFF".
   (2) Connect "TRANSAXLE FLUID TEMPERATURE SENSOR" connector.
   (3) Install scantool and select a SIMU-SCAN.
   (4) Simulate voltage (0→5V) to "TRANSMISSION FLUID TEMPERATURE SENSOR" signal circuit.

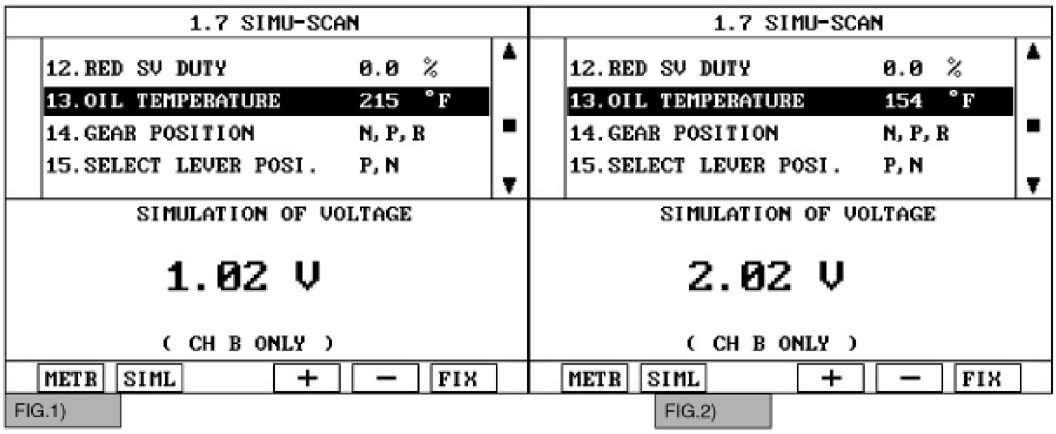


FIG.1) INPUT 1.02V → 215°F
FIG.2) INPUT 2.02V → 154°F

※ The values are subject to change according to vehicle model

(5) Is FLUID TEMP. SENSOR signal value changed according to simulation voltage?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of vehicle repair" procedure.

NO

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected, replace PCM as necessary and then go to "Verification of vehicle repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present?

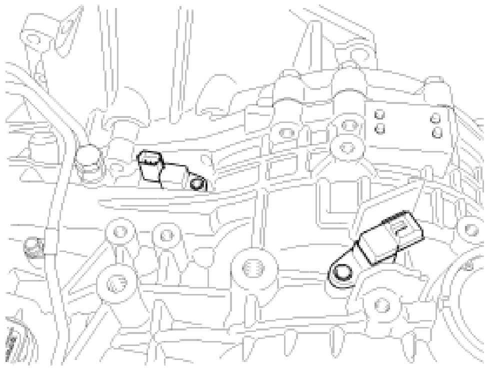
YES

▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

COMPONENT LOCATION



GENERAL DESCRIPTION

The input(turbine) speed sensor outputs pulse-signals according to the revolutions of the input shaft of the transmission. The PCM determines the input shaft speed by counting the frequency of the pulses. This value is mainly used to control the optimum fluid pressure during shifting.

DTC DESCRIPTION

The PCM sets this code if an output pulse-signal is not detected from the input speed sensor, when the vehicle is running faster than 30 km/h. The Fail-Safe function will be set by the PCM if this code is detected.

DTC DETECTING CONDITION

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Speed rationality check	• Signal circuit is open or short • Sensor power circuit is open • Sensor ground circuit is open • Faulty INPUT SPEED SENSOR • Faulty PCM
Enable Conditions	• Engine state=Run • Vehicle Speed >30km/h • Engine RPM at current gear 1 or 2 or Non conditional VRPM when gear is not 1 or 2 >1000rpm • Battery voltage >11V and <16 V • AT oil temp. ≥ -23°C(-9.4°F) • No error in speed sensors	
Threshold value	• No signal	
Diagnostic Time	• More than 1sec	
Fail Safe	• The gear shift position is recognized as follows. 'P' range → realization as 'N' range1 'R' range → realization as 'R' range1 'N' range → realization as 'N' range 'D' range → realization as 3 range SPT mode → CAN shift 2~3 range	

SIGNAL WAVEFORM

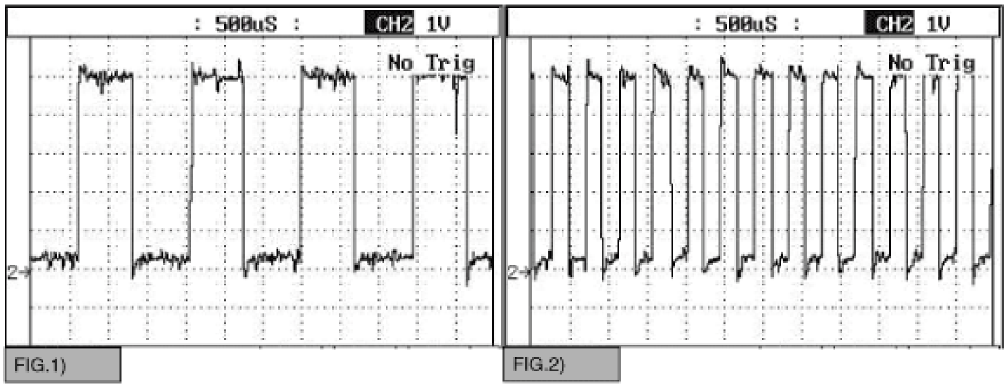
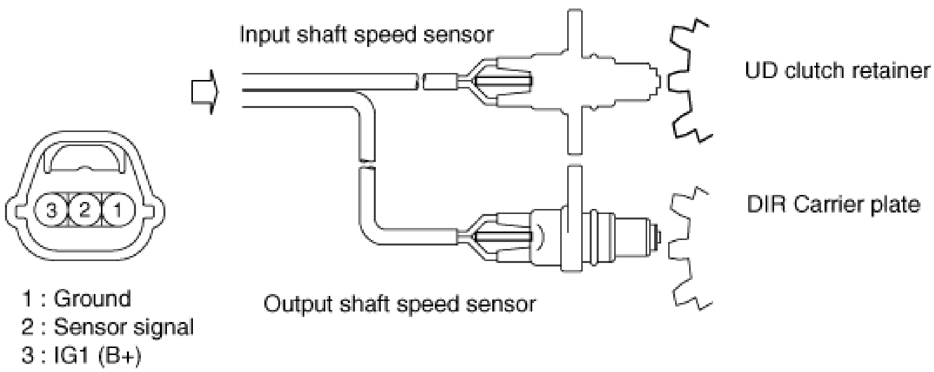


FIG.1) Idling
FIG.2) Accelerating

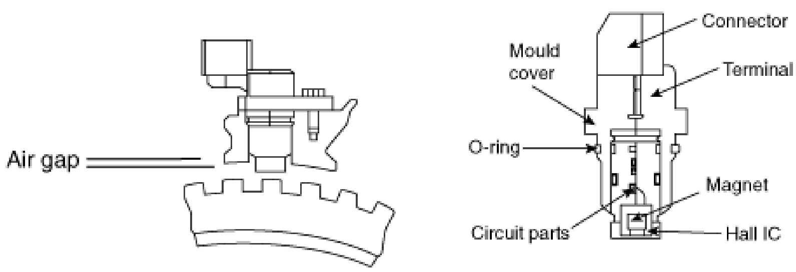
SPECIFICATION

Input shaft & Output shaft speed sensor

- Type : Hall sensor
- Current consumption : 22mA(MAX)
- Sensor body and sensor connector have been unified as one.



Air gap (mm)	Input shaft speed sensor	1.3
	Output shaft speed sensor	0.85
Insulation Resistance	Input shaft speed sensor	over 1MΩ
	Output shaft speed sensor	over 1MΩ
Peak-Peak Voltage	High	more than 4.8V
	Low	less than 0.8V



MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Engine "ON" .
3. Monitor the "INPUT SPEED SENSOR" parameter on the scantool
4. Driving at speed of over 30 Km/h(19 mph).

Specification : Increasing Gradually

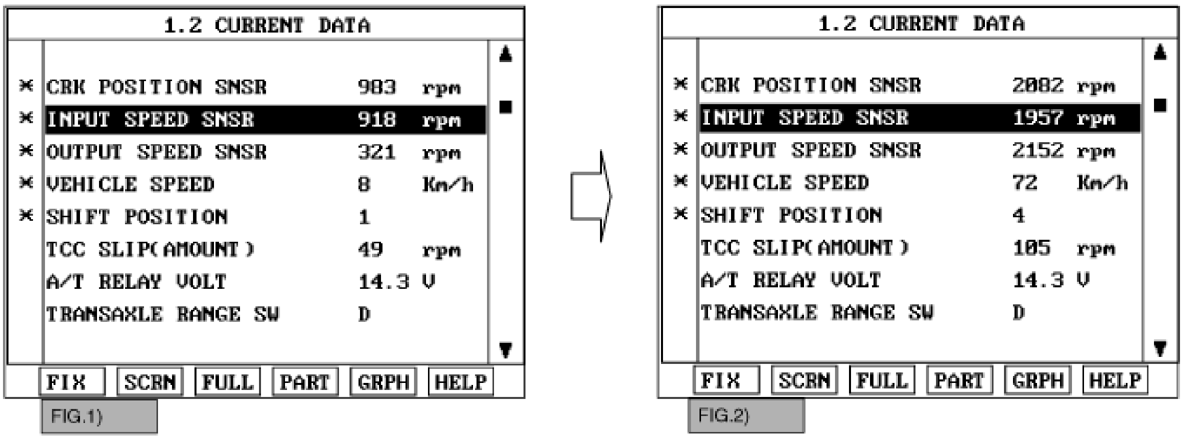


FIG.1) Idling
FIG.2) Accelerating

5. Does "input speed sensor " follow the reference data?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification vehicle repair" procedure.

NO

▸ Go to "Terminal&connector inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system may be caused from poor harness and terminals. These faults can be caused by interference from other electrical systems and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification vehicle repair" procedure.

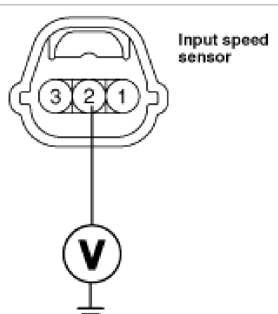
NO

▸ Go to "Signal circuit inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Disconnect the "INPUT SPEED SENSOR" connector.
3. Measure voltage between terminal "2" of the INPUT SPEED SENSOR harness connector and chassis ground.

Specification : approx. 5V



1. Sensor ground
2. Input speed sensor
3. Power supply IG1

4. Is voltage within specification?

YES

▸ Go to "Power supply circuit inspection" procedure.

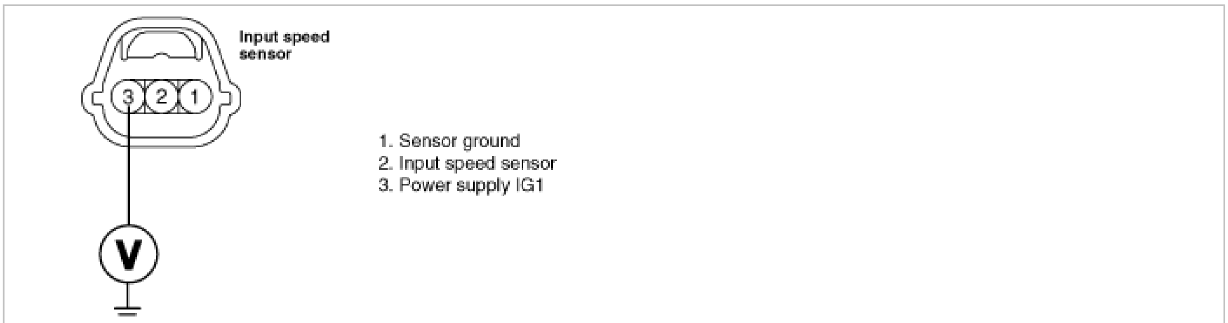
NO

- Check for open or short in harness. Repair as necessary and Go to "Verification vehicle repair" procedure.
- If signal circuit in harness is OK, go to "Check PCM" of the "Component inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Disconnect the "INPUT SPEED SENSOR" connector.
3. Measure voltage between terminal "3" of the INPUT SPEED SENSOR harness connector and chassis ground.

Specification : approx. B+



4. Is voltage within specification ?

YES

- Go to "Ground circuit inspection" procedure.

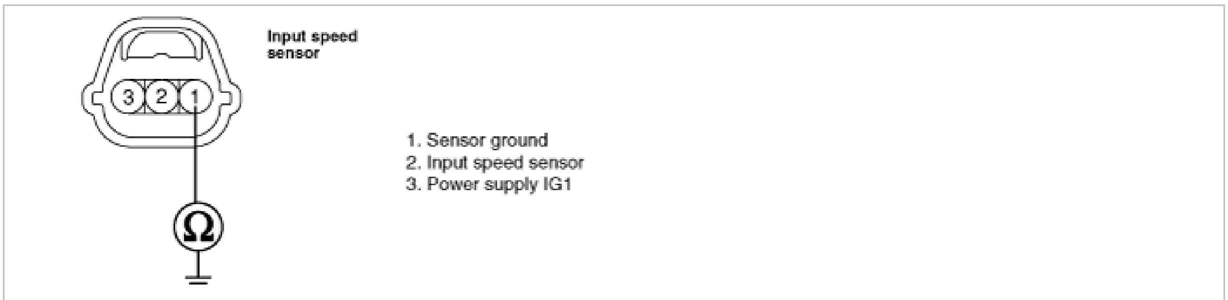
NO

- Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

GROUND CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Disconnect the "INPUT SPEED SENSOR" connector.
3. Measure resistance between terminal "1" of the INPUT SPEED SENSOR harness connector and chassis ground.

Specification : approx. 0 Ω



4. Is resistance within specification ?

YES

- Go to "Component inspection" procedure.

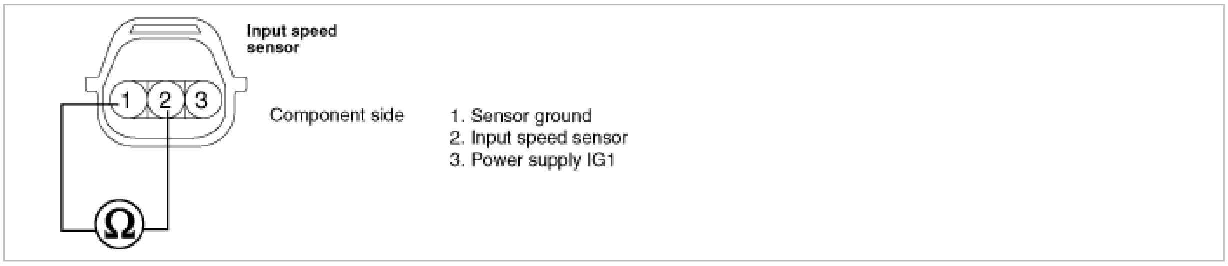
NO

- Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.
- If ground circuit in harness is OK, go to "Check PCM" of the "Component inspection" procedure.

COMPONENT INSPECTION

1. Check "INPUT SPEED SENSOR"
   (1) Ignition "OFF".
   (2) Disconnect the "INPUT SPEED SENSOR" connector.
   (3) Measure resistance between terminal "1","2" and "2","3" and "1","3" of the "INPUT SPEED SENSOR" connector.

Specification : Refer to "Reference data"



(4) Is resistance within specifications?

[REFERENCE DATA]

Air gap (mm)	Input shaft speed sensor	1.3
	Output shaft speed sensor	0.85
Insulation Resistance	Input shaft speed sensor	over 1MΩ
	Output shaft speed sensor	over 1MΩ
Peak-Peak Voltage	High	more than 4.8V
	Low	less than 0.8V

YES

▸ Go to "CHECK PCM" as below.

NO

▸ Replace "INPUT SPEED SENSOR" as necessary and go to "Verification vehicle repair" procedure.

2. CHECK PCM

(1) Ignition "ON" & Engine "OFF".

(2) Connect "INPUT SPEED SENSOR" connector.

(3) Install scantool and select a SIMU-SCAN.

(4) Simulate frequency to INPUT SPEED SENSOR signal circuit.

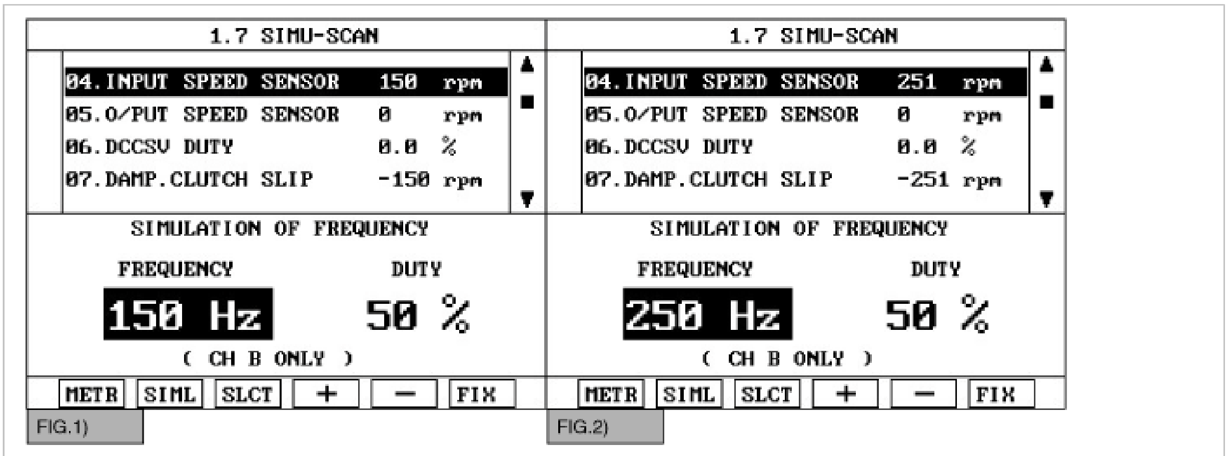


FIG.1) INPUT 150Hz → 150rpm
FIG.2) INPUT 250Hz → 251rpm

(5) Is "INPUT SPEED SENSOR" signal value changed according to simulation frequency?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of vehicle repair" procedure.

NO

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected, replace PCM as necessary and then go to "Verification of vehicle repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Is resistance within specification ?

YES

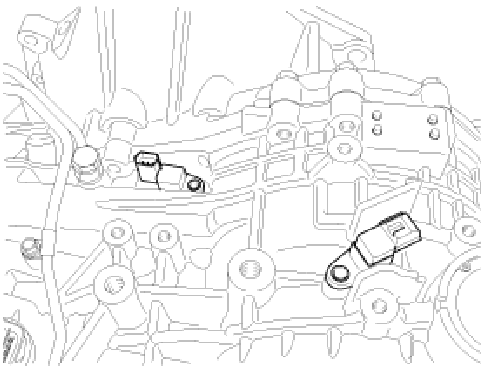
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P0722

COMPONENT LOCATION



GENERAL DESCRIPTION

The output speed sensor calculates the number of rotations of the transfer drive gear, which means that the sensor calculates the frequency of electric signal that is occurred at the transfer drive gear's rotating. The signal is inputted to the PCM and is used as the main signal which decides the optimum gear position with TPS signal.

DTC DESCRIPTION

The PCM sets this code if the calculated value of the pulse-signal from the output speed sensor is noticeably different from the calculated value from vehicle speed sensor, when the vehicle is running faster than 30 km/h. The PCM will initiate the fail safe function if this code is detected.

DTC DETECTING CONDITION

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Speed rationality check	• Signal circuit is open or short • Sensor power circuit is open • Sensor ground circuit is open • Faulty OUTPUT SPEED SENSOR • Faulty PCM
Enable Conditions	• Engine state=Run • Vehicle Speed >30km/h • Engine RPM at current gear 1 or 2 or Non conditional VRPM when gear is not 1 or 2 >1000rpm • Battery voltage >11V and< 16 V • AT oil temp. ≥ -23°C(-9.4°F) • No error in speed sensors	
Threshold value	• Vehicle speed caliculated from TM output speed sensor ≤ 50% × the vehicle speed from vehicle speed sensor	
Diagnostic Time	• More than 1sec	
Fail Safe	• Not in shifting process: The output speed sensor value have been received by calculation from the input speed sensor signal. • In shifting process: Instead of the output speed sensor signal, the vehicle speed sensor signal is used.	

SIGNAL WAVEFORM

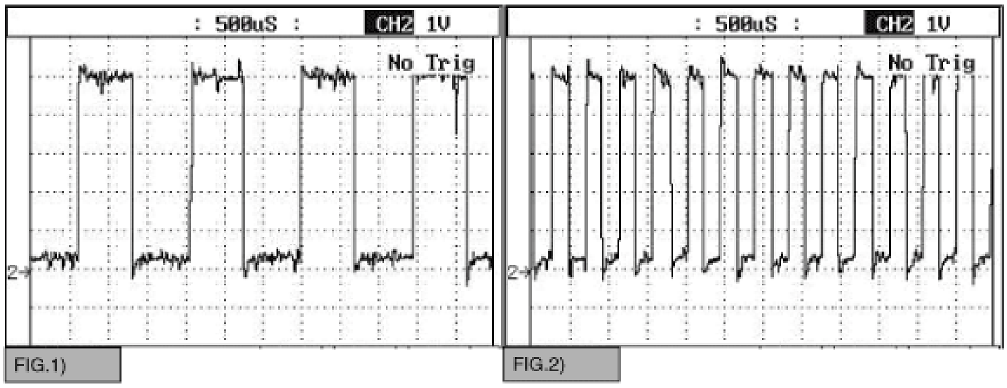
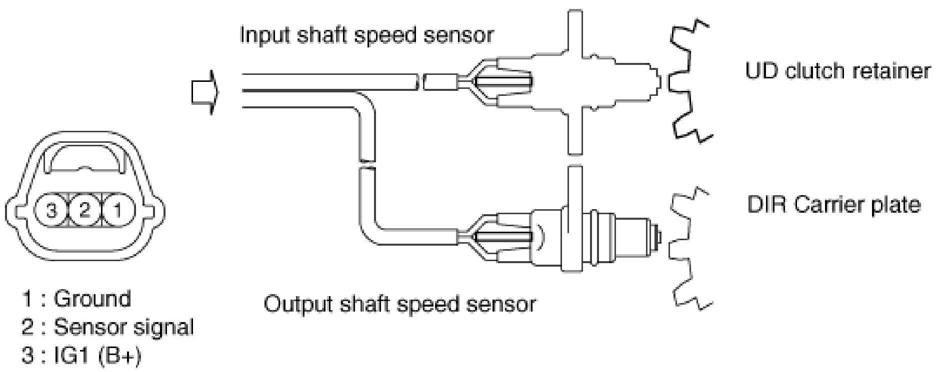


FIG.1) Idling
FIG.2) Accelerating

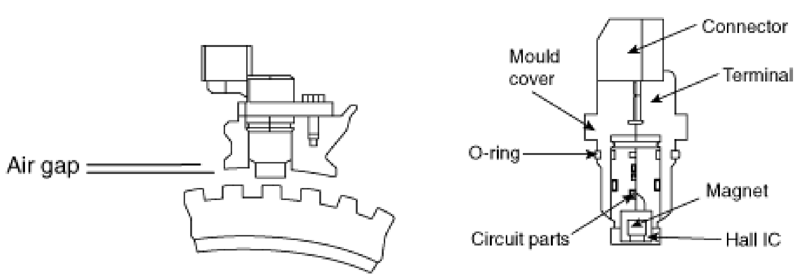
SPECIFICATION

Input shaft & Output shaft speed sensor

- Type : Hall sensor
- Current consumption : 22mA(MAX)
- Sensor body and sensor connector have been unified as one.



Air gap (mm)	Input shaft speed sensor	1.3
	Output shaft speed sensor	0.85
Insulation Resistance	Input shaft speed sensor	over 1MΩ
	Output shaft speed sensor	over 1MΩ
Peak-Peak Voltage	High	more than 4.8V
	Low	less than 0.8V



MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Engine "ON".
3. Monitor the "OUTPUT SPEED SENSOR" parameter on the scantool.

4. Driving at speed of over 30 Km/h(19 mph).

Specification : Increasing Gradually

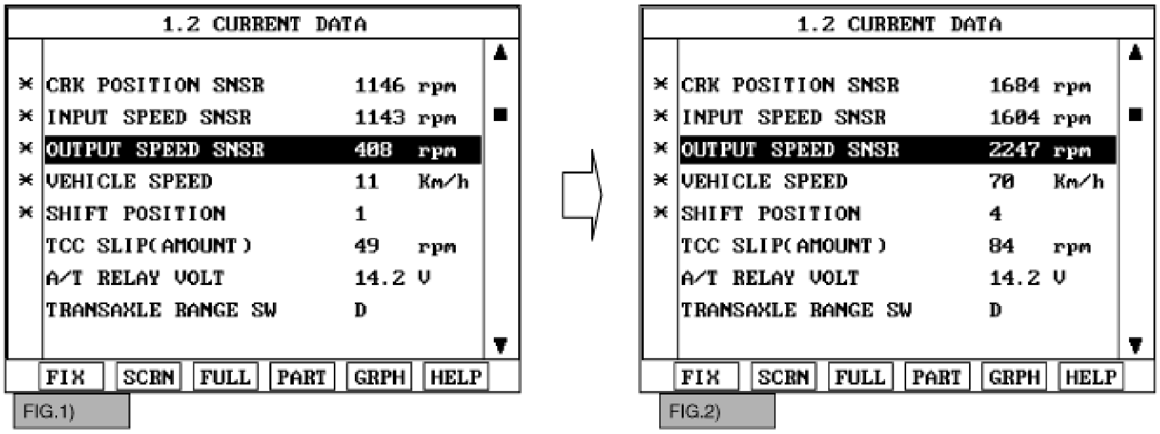


FIG.1) Low-speed
FIG.2) High-speed

5. Does "Output speed sensor" follow the reference data?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification vehicle repair" procedure.

NO

▸ Go to "Terminal&connector inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system may be caused from poor harness and terminals. These faults can be caused by interference from other electrical systems and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification vehicle Repair" procedure.

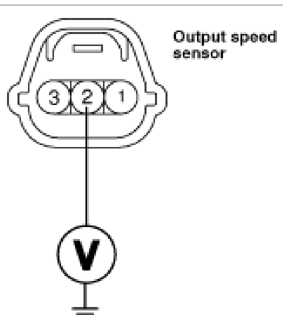
NO

▸ Go to "Signal circuit inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Disconnect the "OUTPUT SPEED SENSOR" connector.
3. Measure voltage between terminal "2" of the OUTPUT SPEED SENSOR harness connector and chassis ground.

Specification : approx. 5V



1. Sensor ground
2. Output speed sensor
3. Power supply IG1

4. Is voltage within specification?

YES

▸ Go to "Power supply circuit inspection" procedure.

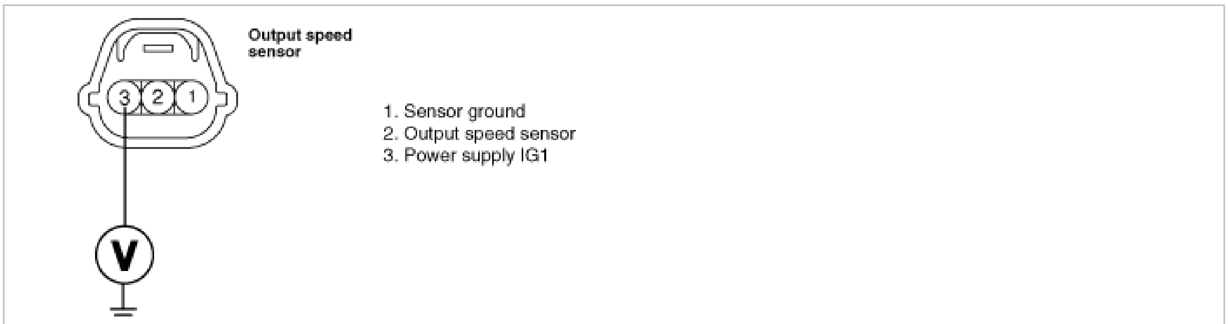
NO

▸ Check for open or short in harness. Repair as necessary and go to "Verification vehicle repair" procedure.
▸ If signal circuit in harness is OK, go to "Check PCM" of the "Component inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Disconnect the "OUTPUT SPEED SENSOR" connector.
3. Measure voltage between terminal "3" of the OUTPUT SPEED SENSOR harness connector and chassis ground.

Specification : approx. B+



4. Is voltage within specification?

YES

▸ Go to "Ground circuit inspection" procedure.

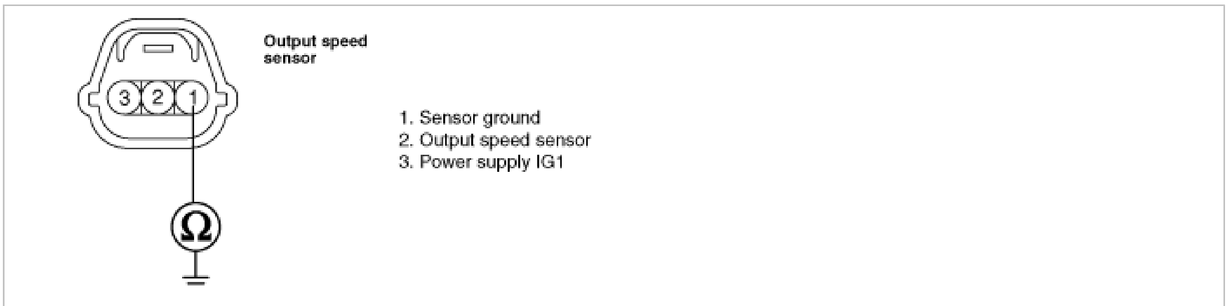
NO

▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

GROUND CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Disconnect the "OUTPUT SPEED SENSOR" connector.
3. Measure resistance between terminal "1" of the OUTPUT SPEED SENSOR harness connector and chassis ground.

Specification : approx. 0 Ω



4. Is resistance within specification?

YES

▸ Go to "Component inspection" procedure.

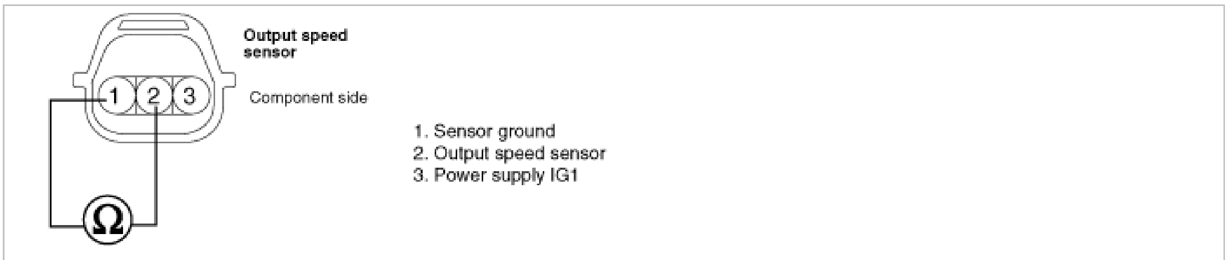
NO

▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.
▸ If ground circuit in harness is OK, go to "Check PCM" of the "Component inspection" procedure.

COMPONENT INSPECTION

1. Check "OUTPUT SPEED SENSOR"
   (1) Ignition "OFF".
   (2) Disconnect the "OUTPUT SPEED SENSOR" connector.
   (3) Measure resistance between terminal "1","2" and "2","3" and "1","3" of the "OUTPUT SPEED SENSOR" connector.

Specification : Refer to "Reference data"



(4) Is resistance within specifications?

[REFERENCE DATA]

Air gap (mm)	Input shaft speed sensor	1.3
	Output shaft speed sensor	0.85
Insulation Resistance	Input shaft speed sensor	over 1MΩ
	Output shaft speed sensor	over 1MΩ
Peak-Peak Voltage	High	more than 4.8V
	Low	less than 0.8V

YES

▸ Go to "CHECK PCM" as below.

NO

▸ Replace "OUTPUT SPEED SENSOR" as necessary and go to "Verification vehicle repair" procedure.

2. CHECK PCM

(1) Ignition "ON" & Engine "OFF".

(2) Connect "OUTPUT SPEED SENSOR" connector.

(3) Install scantool and select a SIMU-SCAN.

(4) Simulate frequency to OUTPUT SPEED SENSOR signal circuit.

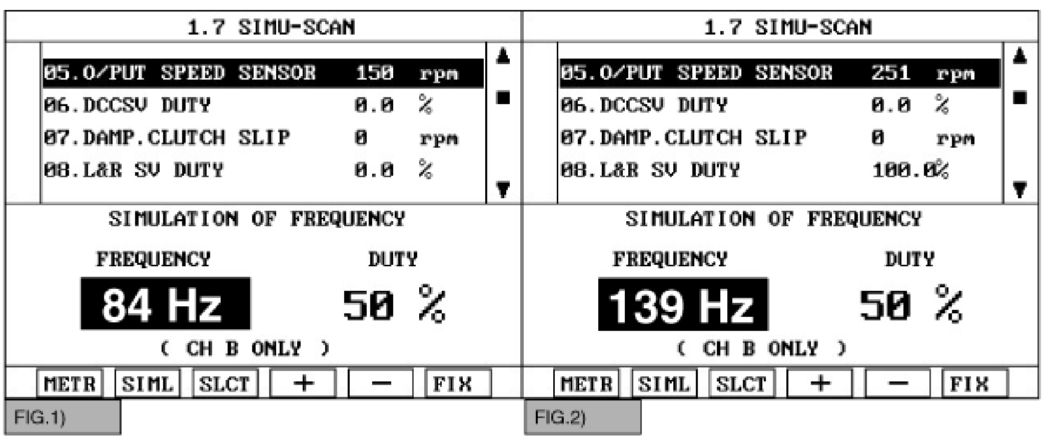


FIG.1) OUTPUT 84Hz → 150rpm
FIG.2) OUTPUT 139Hz → 251rpm

(5) Is "OUTPUT SPEED SENSOR" signal value changed according to simulation frequency?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of vehicle repair" procedure.

NO

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected, replace PCM as necessary and then go to "Verification of vehicle repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Is resistance within specification ?

YES

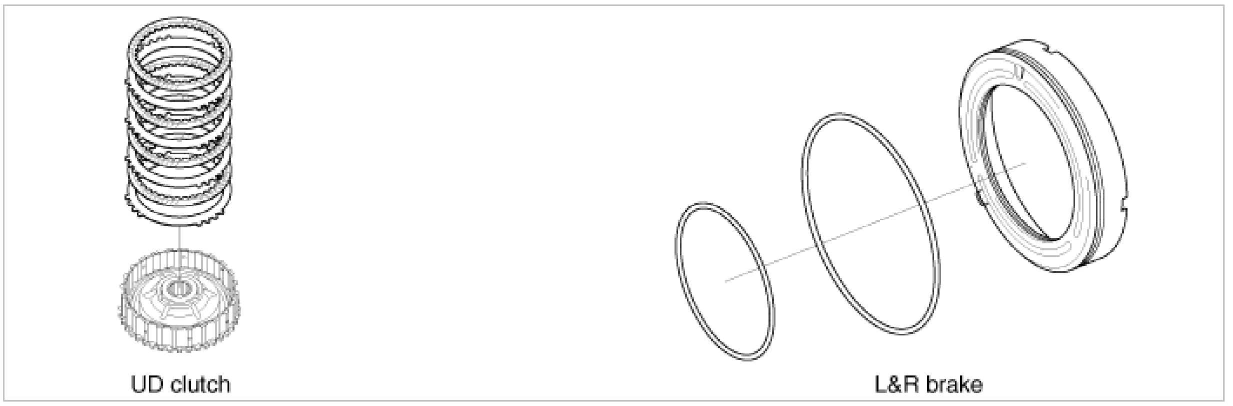
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P0731

COMPONENT LOCATION



GENERAL DESCRIPTION

The input shaft speed in gear 1 range should be the similar to the value that is what the gear 1 ratio and the output shaft speed are multipled. For example, if the output shaft speed is 1,000 rpm and the gear 1 ratio is 3.789, the input shaft speed may be about 3,789 rpm.

DTC DESCRIPTION

This code is displayed if the input shaft speed does not conform with the value which is what the output shaft speed and the gear 1 ratio are multipled. This is more probably caused by a mechanical defect of adherence of control valves or a breakdown of solenoid controlled valves etc. than a electrical defect.

DTC DETECTING CONDITION

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• 1st gear incorrect ratio	• Faulty input speed sensor • Faulty output speed sensor • Faulty UD clutch or LR brake or Oneway clutch
Enable Conditions	• Engine state=Run • Battery Voltage >11V and< 16 V • TM oil temperature >-23°C(-9.4°F) • Engine speed >450rpm • TM output speed >150rpm • TM Input speed≠ 0rpm • Current gear= 1st • Gear shifting is completed • No PRNDL fail • No error in speed sensors	
Threshold value	• │Measured input speed - calculated input speed│ >200 rpm	
Diagnostic Time	• More than 1sec	
Fail Safe	• Locked into 3rd gear.	

SIGNAL WAVEFORM

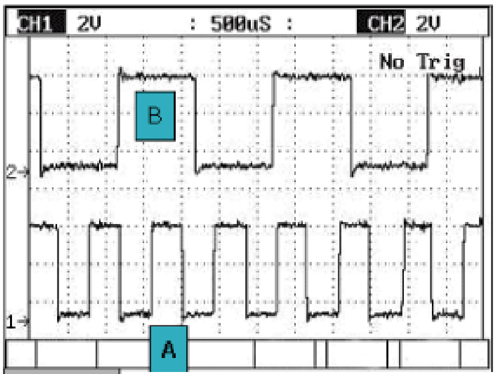


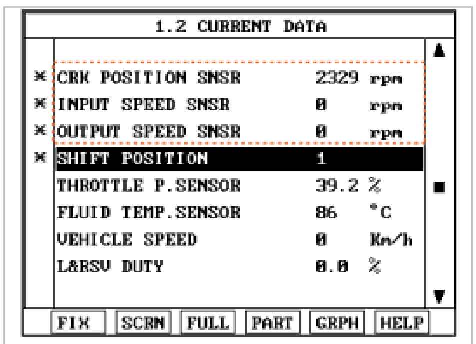
FIG.1)

A : INPUT SPEED SENSOR
B : OUTPUT SPEED SENSOR

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Engine "ON".
3. Monitor the "ENGINE SPEED, INPUT SPEED SENSOR, OUTPUT SPEED SENSOR, GEAR POSITION" parameter on the scantool.
4. Perform the "STALL TEST" with gear position "1"

Specification : 2700~2900 engine rpm



OPERATING ELEMENT OF EACH SHIFTING RANGE

Range		UD clutch	OD clutch	2ND brake	LR brake	REV clutch	RED clutch	DIR clutch	OWC	OWC1
P		-	-	-	O	-	O	-	-	-
R		-	-	-	O	O	O	-	-	-
N		-	-	-	O	-	O	-	-	-
D	1st	O	-	-	O	-	O	-	O	O
	2nd	O	-	O	-	-	O	-	O	-
	3rd	O	O	-	-	-	O	-	O	-
	4th	-	O	O	-	-	O	-	O	-
	5th	-	O	O	-	-	-	O	-	-

UD/C : Underdrive clutch
OD/C : Overdrive clutch
2ND/B : 2ND brake
LR/B : Low&Reverse brake
REV/C: Reverse clutch
RED/B: Reduction brake
DIR/C: Direct clutch

OWC : One way clutch for sub gear shifting
OWC1 : One way clutch for main gear shifting
Stall test procedure in D1 and reason
Procedure

A. Warm up the engine
B. After positioning the select lever in "D", depress the foot brake pedal fully. After that, depress the accelerator pedal to the maximum
   * The slippage of 1st gear operating parts can be detected by stall test in D.

Reason for stall test

A. If there is no mechanical defaults in A/T, all slippage occurs in torque converter.
B. Therfore, engine revolution is output, but input and output speed revolution must be "zero" due to wheel's lock.
C. If 1st gear operating part has faults, input speed revolution will be out of specification.
D. If output speed revolution is output. It means that the foot brake force is not applied fully. Remeasuring is required.

5. Is "STALL TEST " within specification?

YES

▸ Go to "Signal circuit inspection" procedure.

NO

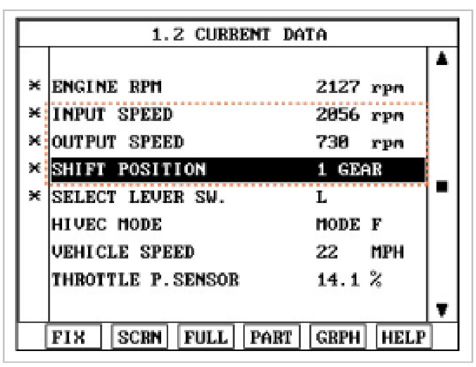
▸ Go to "Component inspection" procedure.

> **CAUTION**
>
> ● Do not let anybody stand in front of or behind the vehicle while this test is being carried out.
> ● Check the A/T fluid level and temperature and the engine coolant temperature.
>   - Fluid level : At the hot mark on the oil level gauge.
>   - Fluid temperature : 80~100°C(176°F~ 212°F).
>   - Engine coolant temperature : 80~100°C(176°F~ 212°F).
> ● Check both rear wheel(left and right).
> ● Pull the parking brake lever on with the brake pedal fully depressed.
> ● The throttle should not be left fully open for more than eight second.
> ● If carrying out the stall test two or more time, move the select lever to the "N" position and run the engine at 1,000 rpm to let the A/T fluid cool down before carrying out subsequent.

SIGNAL CIRCUIT INSPECTION

1. Connect Scantool.
2. Engine "ON".
3. Monitor the "INPUT&OUTPUT SPEED SENSOR" parameter on the scantool.
4. Accelerate the Engine speed until about 2000 rpm in the 1st gear.

Specification : INPUT SPEED - (OUTPUT SPEED × GEAR RATIO) ≤ 200 RPM



5. Are "INPUT & OUTPUT SPEED SENSOR" within specifications?

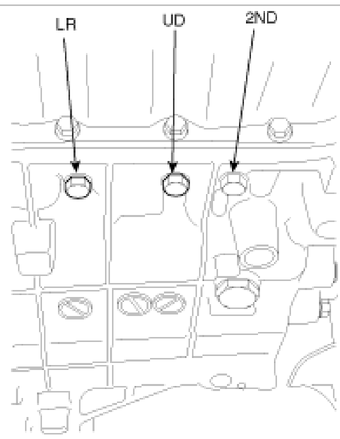
YES

▸ Go to "Component inspection" procedure.

NO

▸ Check for electrical niose of circuit in INPUT & OUTPUT SPEED SENSOR or Replace INPUT & OUTPUT SPEED SENSOR. Repair as necessary and Go to "Verification vehicle repair" procedure.

COMPONENT INSPECTION



1. Connect oil pressure gauge to "UD" and "L/R" ports.
2. Engine "ON".
3. Drive a car with gear position 1 in "SPORTS MODE".
4. Compare it with referance data as below.

Specification : shown below

*1 Each case of increasing and decreasing speed.
* 2 Only for 5 speed A/T.

Manual valve position	VFS current [mA]	RPM	Operation (Duty rate %)						Oil pressure MPa {kgf/cm²}	
			LR	2ND	UD	OD	DCC	RED*2	UD CLUTCH	LR BRAKE
D	200	2500	0	100	0	100	0	0	1.03±0.02 {10.5±0.2}	1.03±0.02 {10.5±0.2}
			100	0	0	100	0	0	1.03±0.02 {10.5±0.2}	-
R	250		0	100	100	100	0	0	-	1.55±0.25 {15.8±2.5}

Manual valve position (Oil pressure)	VFS current [mA]	RPM	Operation (Duty rate %)						Oil pressure MPa {kgf/cm²}		
			LR	2ND	UD	OD	DCC	RED*2	4000	1500 (Decreasing)	600 (Decreasing)
D (LR)	200	600→ 4500→ 600	0	100	0	100	0	0	MAX. 1.11 {MAX. 11.3}	-	MIN. 0.55 {MIN. 5.6}
D (UD)			0	100	0	100	0	0	MAX. 1.11 {MAX. 11.3}	-	MIN. 0.55 {MIN. 5.6}
D (UD)			100	0	0	100	0	0	MAX. 1.11 {MAX. 11.3}	-	MIN. 0.55 {MIN. 5.6}
R (LR)	250		0	100	100	100	0	0	MAX. 1.96 {MAX. 20.0}	MIN. 1.14*1 {MIN. 11.6}	MIN. 0.55*1 {MIN. 5.6}

Manual valve position (Oil pressure)	VFS current [mA]	RPM	Operation (Duty rate %)						Oil pressure MPa {kgf/cm²}		
			LR	2ND	UD	OD	DCC	RED*2	VFS current : 200mA	VFS current : 600mA	VFS current : 1100mA
D (UD)	200→ 1100→ 200	2500	100	100	0	0	100	0	1.03±0.02 {10.5±0.2}	0.69±0.03 {7.0±0.3}	0.36±0.03 {3.7±0.3}

Manual valve position	VFS current [mA]	RPM	Operation (Duty rate %)						ELEMENT	P (MPa)
			LR	2ND	UD	OD	DCC	RED*[2]		
D	200	2500	0	100	0	100	0	0	LR	1.03±0.02
			60	↑	↑	↑	↑	↑		0.45±0.04
			75	↑	↑	↑	↑	↑		0.19±0.04
			100	↑	↑	↑	↑	↑		0
			100	0	0	100	↑	0	2ND	1.03±0.02
			↑	60	↑	↑	↑	↑		0.50±0.05
			↑	75	↑	↑	↑	↑		0.20±0.05
			↑	100	↑	↑	↑	↑		0
			100	100	0	0	↑	0	OD	1.02±0.02
			↑	↑	↑	60	↑	↑		0.46±0.04
			↑	↑	↑	75	↑	↑		0.19±0.04
			↑	↑	↑	100	↑	↑		0
			100	100	0	0	↑	0	UD	1.03±0.02
			↑	↑	60	↑	↑	↑		0.44±0.05
			↑	↑	75	↑	↑	↑		0.18±0.04
			↑	↑	100	↑	↑	↑		0
			100	0	100	0	↑	0▼	RED	1.03±0.02
			↑	↑	↑	↑	↑	60		0.49±0.04
			↑	↑	↑	↑	↑	75		0.24±0.04
			↑	↑	↑	↑	↑	100		0
			100▼	0	100	0	↑	100	DIR	0
			75	↑	↑	↑	↑	↑		0.25±0.04
			60	↑	↑	↑	↑	↑		0.51±0.04
			0	↑	↑	↑	↑	↑		1.03±0.02

Each case of increasing (0→100%) and decreasing (100→0%) of duty rate to be satisfied.(Except the mark ▼)

Manual valve position (Oil pressure)	VFS current [mA]	RPM	Operation (Duty rate %)						Damper Apply Pressure※ (MPa)	Damper Release Pressure (MPa)
			LR	2ND	UD	OD	DCC	RED*[2]		
D	200	2500	100	100	0	0	0	0	0.25~0.45	0.50~0.70
			↑	↑	↑	↑	50	↑	0.20~0.45	0
			↑	↑	↑	↑	100	↑	0.96~1.04	0
	900		100	100	0	0	0	0	0.12~0.22	0.25~0.45
			↑	↑	↑	↑	100	↑	MIN. 0.29	0

※ Each case of increasing and decreasing of DCC solenoid duty rate to be satisfied.
● The values are subject to change according to vehicle model or condition.

5. Is oil pressure value within specification?

YES

▸ Repair AUTO TRANSAXLE(Clutch or brake) as necessary and go to "Verification vehicle repair" procedure.

NO

▸ Replace AUTO TRANSAXLE (BODY CONTROL VALVE faulty) as necessary and go to "Verification vehicle repair " procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

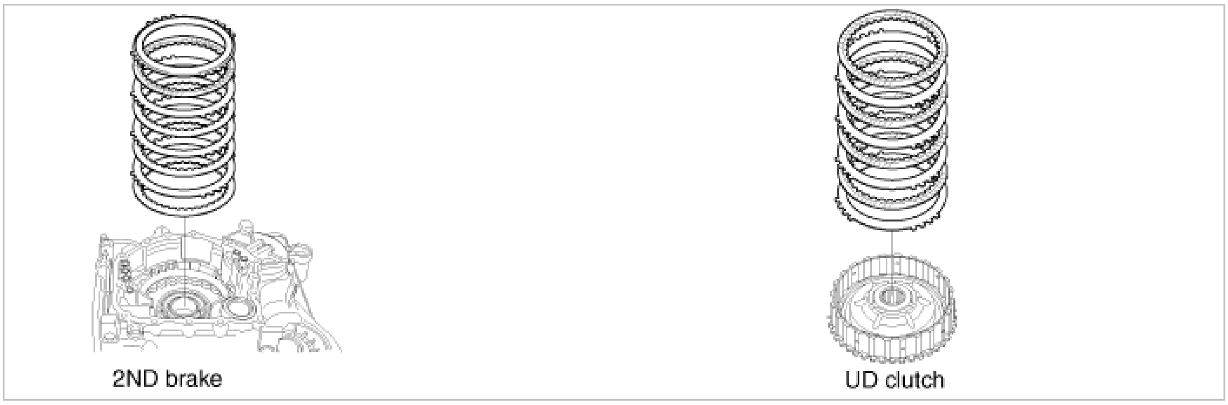
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P0732

COMPONENT LOCATION



GENERAL DESCRIPTION

The input shaft speed in gear 2 range should be the similar to the value that is what the gear 2 ratio and the output shaft speed are multipled. For example, if the output shaft speed is 1,000 rpm and the gear 2 ratio is 2.064, the input shaft speed may be about 2,064 rpm.

DTC DESCRIPTION

This code is displayed if the input shaft speed does not conform with the value which is what the output shaft speed and the gear 2 ratio are multipled. This is mainer caused by a mechanical defect of adherence of control valves or a breakdown of solenoid controlled valves etc. than a electrical defect.

DTC DETECTING CONDITION

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• 2nd gear incorrect ratio	• Faulty input speed sensor • Faulty output speed sensor • Faulty UD clutch or 2nd brake
Enable Conditions	• Engine state= Run • Battery Voltage >11V and< 16 V • TM oil temperature >-23°C(-9.4°F) • Engine speed >450rpm • TM output speed >300rpm • TM Input speed ≠ 0rpm • Current gear= 2nd • Gear shifting is completed • No PRNDL fail • No error in speed sensors	
Threshold value	• │Measured input speed - calculated input speed│ >200 rpm	
Diagnostic Time	• More than 1sec	
Fail Safe	• Locked into 3 rd gear.	

SIGNAL WAVEFORM

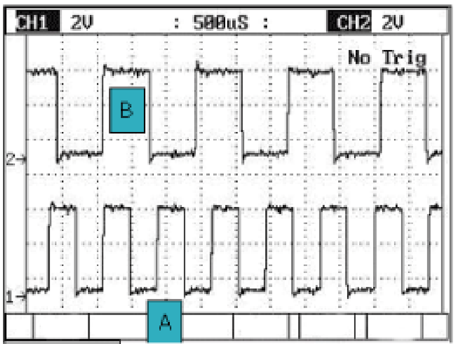


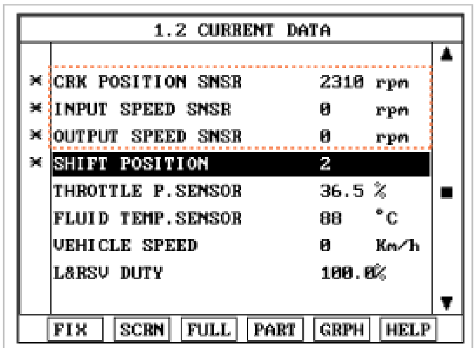
FIG.1)

A : INPUT SPEED SENSOR
B : OUTPUT SPEED SENSOR

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Engine "ON".
3. Monitor the "ENGINE SPEED, INPUT SPEED SENSOR, OUTPUT SPEED SENSOR, GEAR POSITION" parameter on the scantool.
4. Perform the "STALL TEST" with gear position "2".

Specification : 2700~2900 engine rpm



OPERATING ELEMENT OF EACH SHIFTING RANGE

Range		UD clutch	OD clutch	2ND brake	LR brake	REV clutch	RED clutch	DIR clutch	OWC	OWC1
P		-	-	-	O	-	O	-	-	-
R		-	-	-	O	O	O	-	-	-
N		-	-	-	O	-	O	-	-	-
D	1st	O	-	-	O	-	O	-	O	O
	2nd	O	-	O	-	-	O	-	O	-
	3rd	O	O	-	-	-	O	-	O	-
	4th	-	O	O	-	-	O	-	O	-
	5th	-	O	O	-	-	-	O	-	-

UD/C : Underdrive clutch
OD/C : Overdrive clutch
2ND/B : 2ND brake
LR/B : Low&Reverse brake
REV/C: Reverse clutch
RED/B: Reduction brake
DIR/C: Direct clutch

OWC : One way clutch for sub gear shifting
OWC1 : One way clutch for main gear shifting
Stall test procedure in D2 and reason
Procedure
A. Warm up the engine
B. After positioning the select lever in "D", depress the foot brake pedal fully after that, depress the accelerator pedal to the maximum
* The slippage of 1st gear operating parts can be detected by stall test in D2
Reason for stall test
A. If there is are mechanical defaults in A/T, all slippage occurs in the torque converter.
B. Therfore, engine revolution is output, but input and output speed revolution must be "zero" due to wheel's lock.
C. If 2nd brake system(2nd gear operating part) has faults, input speed revolution will be out of specification.
D. If wheels pin occurs, the applied brake force is not adequate. Retry using more brake force.

5. Is "STALL TEST " within specification?

YES

▸ Go to "Signal circuit inspection" procedure.

NO

▸ Go to "Component inspection" procedure.

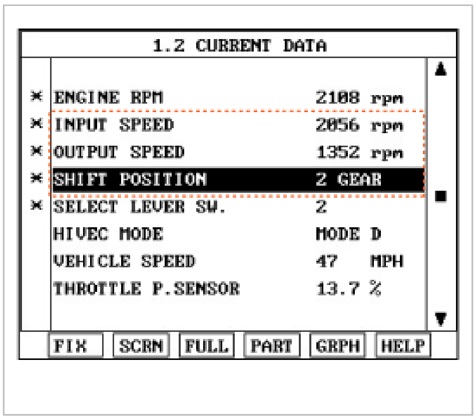
CAUTION

● Do not let anybody stand in front of or behind the vehicle while this test is being carried out.
● Check the A/T fluid level and temperature and the engine coolant temperature.
- Fluid level : At the hot mark on the oil level gauge.
- Fluid temperature : 80~100°C(176°F~ 212°F).
- Engine coolant temperature : 80~100°C(176°F~ 212°F).
● Check both rear wheel(left and right).
● Pull the parking brake lever on with the brake pedal fully depressed.
● The throttle should not be left fully open for more than eight second.
● If carrying out the stall test two or more time, move the select lever to the "N" position and run the engine at 1,000 rpm to let the A/T fluid cool down before carrying out subsequent.

SIGNAL CIRCUIT INSPECTION

1. Connect Scantool.
2. Engine "ON".
3. Monitor the "INPUT & OUTPUT SPEED SENSOR" parameter on the scantool.
4. Accelerate the Engine speed until about 2000 rpm in the 2nd gear.

Specification : INPUT SPEED - (OUTPUT SPEED × GEAR RATIO) ≤ 200 RPM



5. Are "INPUT &OUTPUT SPEED SENSOR" within specifications?

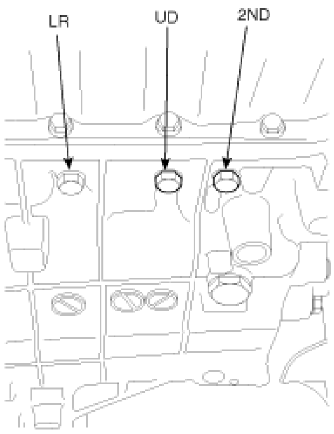
YES

▸ Go to "Component inspection" procedure.

NO

▸ Check for electrical niose of circuit in INPUT & OUTPUT SPEED SENSOR or replace INPUT & OUTPUT SPEED SENSOR. Repair as necessary and go to "Verification vehicle repair" procedure.

COMPONENT INSPECTION



1. Connect oil pressure gauge to "UD" and "2nd" ports.
2. Engine "ON".
3. Drive a car with gear position 2 in "SPORTS MODE".
4. Compare it with referance data as below.

Specification : shown below

*1 Each case of increasing and decreasing speed.
* 2 Only for 5 speed A/T.

Manual valve position	VFS current [mA]	RPM	Operation (Duty rate %)						Oil pressure MPa {kgf/cm²}	
			LR	2ND	UD	OD	DCC	RED*2	UD CLUTCH	LR BRAKE
D	200	2500	0	100	0	100	0	0	1.03±0.02 {10.5±0.2}	1.03±0.02 {10.5±0.2}
			100	0	0	100	0	0	1.03±0.02 {10.5±0.2}	-
R	250		0	100	100	100	0	0	-	1.55±0.25 {15.8±2.5}

Manual valve position (Oil pressure)	VFS current [mA]	RPM	Operation (Duty rate %)						Oil pressure MPa {kgf/cm²}		
			LR	2ND	UD	OD	DCC	RED*2	4000	1500 (Decreasing)	600 (Decreasing)
D (LR)	200	600→ 4500→ 600	0	100	0	100	0	0	MAX. 1.11 {MAX. 11.3}	-	MIN. 0.55 {MIN. 5.6}
D (UD)			0	100	0	100	0	0	MAX. 1.11 {MAX. 11.3}	-	MIN. 0.55 {MIN. 5.6}
D (UD)			100	0	0	100	0	0	MAX. 1.11 {MAX. 11.3}	-	MIN. 0.55 {MIN. 5.6}
R (LR)	250		0	100	100	100	0	0	MAX. 1.96 {MAX. 20.0}	MIN. 1.14*1 {MIN. 11.6}	MIN. 0.55*1 {MIN. 5.6}

Manual valve position (Oil pressure)	VFS current [mA]	RPM	Operation (Duty rate %)						Oil pressure MPa {kgf/cm²}		
			LR	2ND	UD	OD	DCC	RED*2	VFS current : 200mA	VFS current : 600mA	VFS current : 1100mA
D (UD)	200→ 1100→	2500	100	100	0	0	100	0	1.03±0.02 {10.5±0.2}	0.69±0.03 {7.0±0.3}	0.36±0.03 {3.7±0.3}

	200										

Manual valve position	VFS current [mA]	RPM	Operation (Duty rate %)						ELEMENT	P (MPa)
			LR	2ND	UD	OD	DCC	RED*2		
D	200	2500	0	100	0	100	0	0	LR	1.03±0.02
			60	↑	↑	↑	↑	↑		0.45±0.04
			75	↑	↑	↑	↑	↑		0.19±0.04
			100	↑	↑	↑	↑	↑		0
			100	0	0	100	↑	0	2ND	1.03±0.02
			↑	60	↑	↑	↑	↑		0.50±0.05
			↑	75	↑	↑	↑	↑		0.20±0.05
			↑	100	↑	↑	↑	↑		0
			100	100	0	0	↑	0	OD	1.02±0.02
			↑	↑	↑	60	↑	↑		0.46±0.04
			↑	↑	↑	75	↑	↑		0.19±0.04
			↑	↑	↑	100	↑	↑		0
			100	100	0	0	↑	0	UD	1.03±0.02
			↑	↑	60	↑	↑	↑		0.44±0.05
			↑	↑	75	↑	↑	↑		0.18±0.04
			↑	↑	100	↑	↑	↑		0
			100	0	100	0	↑	0▼	RED	1.03±0.02
			↑	↑	↑	↑	↑	60		0.49±0.04
			↑	↑	↑	↑	↑	75		0.24±0.04
			↑	↑	↑	↑	↑	100		0
			100▼	0	100	0	↑	100	DIR	0
			75	↑	↑	↑	↑	↑		0.25±0.04
			60	↑	↑	↑	↑	↑		0.51±0.04
			0	↑	↑	↑	↑	↑		1.03±0.02

Each case of increasing (0→100%) and decreasing (100→0%) of duty rate to be satisfied.(Except the mark ▼)

Manual valve position (Oil pressure)	VFS current [mA]	RPM	Operation (Duty rate %)						Damper Apply Pressure※ (MPa)	Damper Release Pressure (MPa)
			LR	2ND	UD	OD	DCC	RED*2		
D	200	2500	100	100	0	0	0	0	0.25~0.45	0.50~0.70
			↑	↑	↑	↑	50	↑	0.20~0.45	0
			↑	↑	↑	↑	100	↑	0.96~1.04	0
	900		100	100	0	0	0	0	0.12~0.22	0.25~0.45
			↑	↑	↑	↑	100	↑	MIN. 0.29	0

※ Each case of increasing and decreasing of DCC solenoid duty rate to be satisfied.
● The values are subject to change according to vehicle model or condition.

5. Is oil pressure value within specification?

YES

▸ Repair AUTO TRANSAXLE(Clutch or brake) as necessary and go to "Verification vehicle repair" procedure.

NO

▸ Replace AUTO TRANSAXLE (BODY CONTROL VALVE faulty) as necessary and go to "Verification vehicle repair " procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P0733

COMPONENT LOCATION

GENERAL DESCRIPTION

The input shaft speed in gear 3 range should be the similar to the value that is what the gear 3 ratio and the output shaft speed are multipled. For example, if the output shaft speed is 1,000 rpm and the gear 3 ratio is 1.421, the input shaft speed will be about 1,421 rpm.

DTC DESCRIPTION

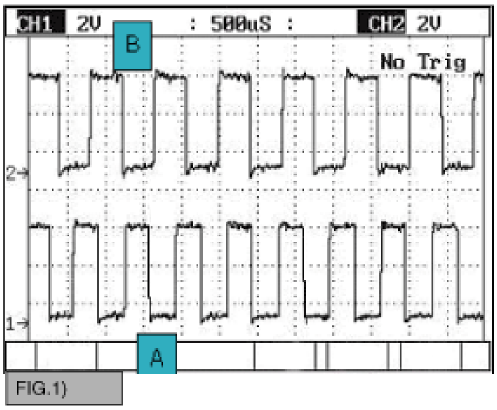
This code is displayed if the input shaft speed does not conform with the value which is what the output shaft speed and the gear 3 ratio are multipled. This is most likely caused by a mechanical defect of adherence of control valves or a breakdown of solenoid controlled valves etc. than a electrical defect.

DTC DETECTING CONDITION

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• 3rd gear incorrect ratio	• Faulty Input speed sensor • Faulty output speed sensor • Faulty UD clutch or OD clutch
Enable Conditions	• Engine state=Run • Battery Voltage >11V and< 16 V • TM oil temperature >-23°C(-9.4°F) • Engine speed >450rpm • TM output speed >300rpm • TM Input speed≠ 0rpm • Current gear=3rd • Gear shifting is completed • No PRNDL fail • No error in speed sensors	
Threshold value	• │Measured input speed - calculated input speed│>200 rpm	
Diagnostic Time	• More than 1sec	

Fail Safe	• Locked into 3rd gear.	

SIGNAL WAVEFORM

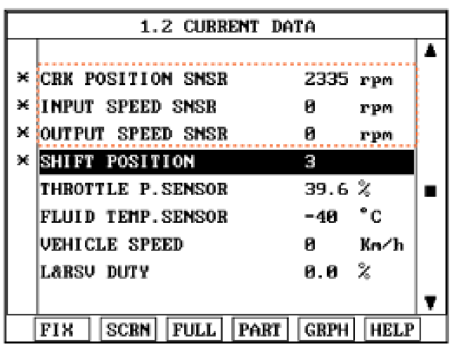


A : INPUT SPEED SENSOR
B : OUTPUT SPEED SENSOR

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Engine "ON".
3. Monitor the "ENGINE SPEED, INPUT SPEED SENSOR, OUTPUT SPEED SENSOR, GEAR POSITION" parameter on the scantool.
4. Disconnect the solenoide valve connector and perform the "STALL TEST".

Specification : 2700~2900 engine rpm



OPERATING ELEMENT OF EACH SHIFTING RANGE

Range		UD clutch	OD clutch	2ND brake	LR brake	REV clutch	RED clutch	DIR clutch	OWC	OWC1
P		-	-	-	O	-	O	-	-	-
R		-	-	-	O	O	O	-	-	-
N		-	-	-	O	-	O	-	-	-
D	1st	O	-	-	O	-	O	-	O	O
	2nd	O	-	O	-	-	O	-	O	-
	3rd	O	O	-	-	-	O	-	O	-
	4th	-	O	O	-	-	O	-	O	-
	5th	-	O	O	-	-	-	O	-	-

UD/C : Underdrive clutch

OD/C : Overdrive clutch
2ND/B : 2ND brake
LR/B : Low&Reverse brake
REV/C: Reverse clutch
RED/B: Reduction brake
DIR/C: Direct clutch
OWC : One way clutch for sub gear shifting
OWC1 : One way clutch for main gear shifting

Stall test procedure in D3 and reason

Procedure

A. Warm up the engine
B. Set 3rd gear hold by disconnecting the solenoid valve connector. Fully depress the brake pedal, then place the transaxle gear lever into "D" range. Press and hold the accelerator pedal to the floor for no more than eight seconds while observing the engine, input speed,
   and output speed RPM values.
   * The slippage of 3rd gear operating parts can be detected by stall test in D3.

Reason for stall test

A. If there are no mechanical defaults in A/T, all slippage occurs in torque converter.
B. Therfore, engine revolution is output, but input and output speed revolution must be "zero" due to wheel's lock.
C. If OD clutch system(3rd gear operating part) has faults, input speed revolution will be out of specification.
D. If output speed revolution is output. It means that the foot brake force is not applied fully. Retesting using greater braking force is required.

5. Is "STALL TEST " within specification?

YES

▸ Go to "Signal circuit inspection" procedure.

NO

▸ Go to "Component inspection" procedure.

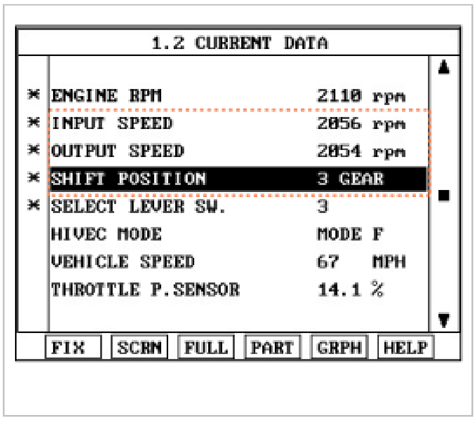
CAUTION

● Do not let anybody stand in front of or behind the vehicle while this test is being carried out.
● Check the A/T fluid level and temperature and the engine coolant temperature.
  - Fluid level : At the hot mark on the oil level gauge.
  - Fluid temperature : 80~100°C(176°F~ 212°F).
  - Engine coolant temperature : 80~100°C(176°F~ 212°F).
● Check both rear wheel(left and right).
● Pull the parking brake lever on with the brake pedal fully depressed.
● The throttle should not be left fully open for more than eight seconds.
● If carrying out the stall test two or more times, move the select lever to the "N" position and run the engine at 1,000 rpm to let the A/T fluid cool down before carrying out subsequent tests.

SIGNAL CIRCUIT INSPECTION

1. Connect Scantool.
2. Engine "ON".
3. Monitor the "INPUT & OUTPUT SPEED SENSOR" parameter on the scantool.
4. Accelerate the Engine speed until about 2000 rpm in the 3rd gear.

Specification : INPUT SPEED - (OUTPUT SPEED × GEAR RATIO) ≤ 200 RPM



5. Are "INPUT & OUTPUT SPEED SENSOR" within specifications?

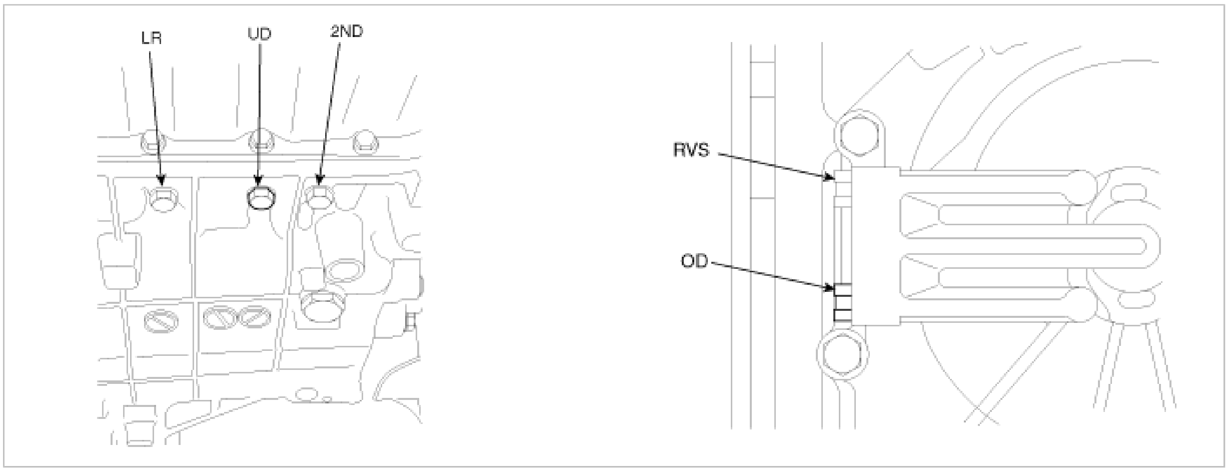
YES

▸ Go to "Component inspection" procedure.

NO

▸ Check for electrical niose of circuit in INPUT & OUTPUT SPEED SENSOR or replace INPUT & OUTPUT SPEED SENSOR. Repair as necessary and go to "Verification vehicle repair" procedure.

COMPONENT INSPECTION



1. Connect Oil pressure gauge to "UD" and "OD" ports.
2. Engine "ON".
3. Drive a car with gear position 3 in "SPORTS MODE".
4. Compare it with referance data as below.

Specification : shown below

*1 Each case of increasing and decreasing speed.
* 2 Only for 5 speed A/T.

Manual valve position	VFS current [mA]	RPM	Operation (Duty rate %)						Oil pressure MPa {kgf/cm²}	
			LR	2ND	UD	OD	DCC	RED*²	UD CLUTCH	LR BRAKE
D	200	2500	0	100	0	100	0	0	1.03±0.02 {10.5±0.2}	1.03±0.02 {10.5±0.2}
			100	0	0	100	0	0	1.03±0.02 {10.5±0.2}	-
R	250		0	100	100	100	0	0	-	1.55±0.25 {15.8±2.5}

Manual valve	VFS		Operation (Duty rate %)	Oil pressure MPa {kgf/cm²}

position (Oil pressure)	current [mA]	RPM	LR	2ND	UD	OD	DCC	RED*2	4000	1500 (Decreasing)	600 (Decreasing)
D (LR)	200	600→ 4500→ 600	0	100	0	100	0	0	MAX. 1.11 {MAX. 11.3}	-	MIN. 0.55 {MIN. 5.6}
D (UD)			0	100	0	100	0	0	MAX. 1.11 {MAX. 11.3}	-	MIN. 0.55 {MIN. 5.6}
D (UD)			100	0	0	100	0	0	MAX. 1.11 {MAX. 11.3}	-	MIN. 0.55 {MIN. 5.6}
R (LR)	250		0	100	100	100	0	0	MAX. 1.96 {MAX. 20.0}	MIN. 1.14*1 {MIN. 11.6}	MIN. 0.55*1 {MIN. 5.6}

Manual valve position (Oil pressure)	VFS current [mA]	RPM	Operation (Duty rate %)						Oil pressure MPa {kgf/cm²}		
			LR	2ND	UD	OD	DCC	RED*2	VFS current : 200mA	VFS current : 600mA	VFS current : 1100mA
D (UD)	200→ 1100→ 200	2500	100	100	0	0	100	0	1.03±0.02 {10.5±0.2}	0.69±0.03 {7.0±0.3}	0.36±0.03 {3.7±0.3}

Manual valve position	VFS current [mA]	RPM	Operation (Duty rate %)						ELEMENT	P (MPa)
			LR	2ND	UD	OD	DCC	RED*2		
D	200	2500	0	100	0	100	0	0	LR	1.03±0.02
			60	↑	↑	↑	↑	↑		0.45±0.04
			75	↑	↑	↑	↑	↑		0.19±0.04
			100	↑	↑	↑	↑	↑		0
			100	0	0	100	↑	0	2ND	1.03±0.02
			↑	60	↑	↑	↑	↑		0.50±0.05
			↑	75	↑	↑	↑	↑		0.20±0.05
			↑	100	↑	↑	↑	↑		0
			100	100	0	0	↑	0	OD	1.02±0.02
			↑	↑	↑	60	↑	↑		0.46±0.04
			↑	↑	↑	75	↑	↑		0.19±0.04
			↑	↑	↑	100	↑	↑		0
			100	100	0	0	↑	0	UD	1.03±0.02
			↑	↑	60	↑	↑	↑		0.44±0.05
			↑	↑	75	↑	↑	↑		0.18±0.04
			↑	↑	100	↑	↑	↑		0
			100	0	100	0	↑	0▼	RED	1.03±0.02
			↑	↑	↑	↑	↑	60		0.49±0.04
			↑	↑	↑	↑	↑	75		0.24±0.04
			↑	↑	↑	↑	↑	100		0
			100▼	0	100	0	↑	100	DIR	0
			75	↑	↑	↑	↑	↑		0.25±0.04
			60	↑	↑	↑	↑	↑		0.51±0.04
			0	↑	↑	↑	↑	↑		1.03±0.02

Each case of increasing (0→100%) and decreasing (100→0%) of duty rate to be satisfied.(Except the mark ▼)

Manual					

valve position (Oil pressure)	VFS current [mA]	RPM	Operation (Duty rate %)						Damper Apply Pressure※ (MPa)	Damper Release Pressure (MPa)
			LR	2ND	UD	OD	DCC	RED*²		
D	200	2500	100	100	0	0	0	0	0.25~0.45	0.50~0.70
			↑	↑	↑	↑	50	↑	0.20~0.45	0
			↑	↑	↑	↑	100	↑	0.96~1.04	0
	900		100	100	0	0	0	0	0.12~0.22	0.25~0.45
			↑	↑	↑	↑	100	↑	MIN. 0.29	0

※ Each case of increasing and decreasing of DCC solenoid duty rate to be satisfied.
● The values are subject to change according to vehicle model or condition.

5. Is oil pressure value within specification?

YES

▸ Repair AUTO TRANSAXLE(Clutch or brake) as necessary and go to "Verification vehicle repair" procedure.

NO

▸ Replace AUTO TRANSAXLE (BODY CONTROL VALVE faulty) as necessary and go to "Verification vehicle repair " procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

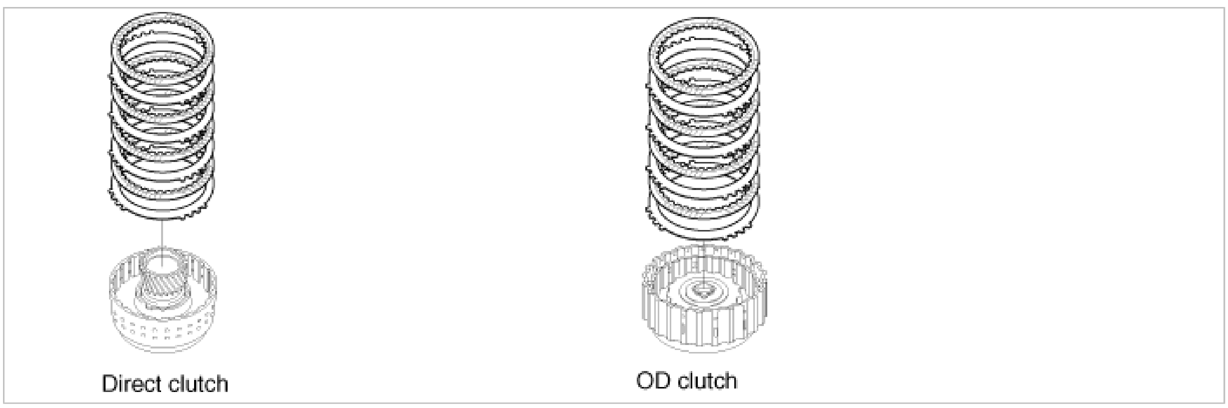
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P0734

COMPONENT LOCATION



GENERAL DESCRIPTION

The input shaft speed in gear 4 range should be the similar to the value that is what the gear 4 ratio and the output shaft speed are multipled. For example, if the output shaft speed is 1,000 rpm and the gear 4 ratio is 1.034, the input shaft speed may be about 1,034 rpm.

DTC DESCRIPTION

This code is displayed if the input shaft speed does not conform with the value which is what the output shaft speed and the gear 4 ratio are multipled. This is most likely caused by a mechanical defect of adherence of control valves or a breakdown of solenoid controlled valves etc. than a electrical defect.

DTC DETECTING CONDITION

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• 4th gear incorrect ratio	• Faulty input speed sensor • Faulty output speed sensor • Faulty direct clutch or OD clutch
Enable Conditions	• Engine state=Run • Battery Voltage >11V and< 16 V • TM oil temperature >-23°C(-9.4°F) • Engine speed >450rpm • TM output speed >300rpm • TM Input speed≠0rpm • Current gear=4th • Gear shifting is completed • No PRNDL fail • No error in speed sensors	
Threshold value	• │Measured input speed - calculated input speed│>200 rpm	
Diagnostic Time	• More than 1sec	
Fail Safe	• Locked into 3rd gear.	

SIGNAL WAVEFORM

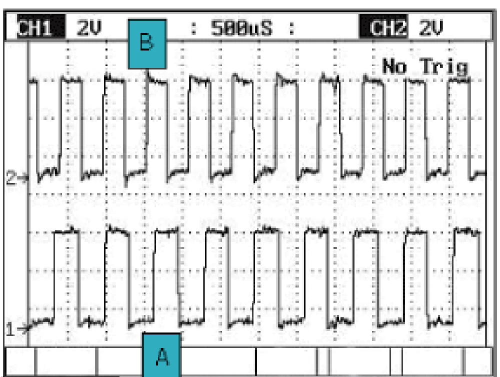


FIG.1)

A : INPUT SPEED SENSOR
B : OUTPUT SPEED SENSOR

MONITOR SCANTOOL DATA

※ It is difficult to "STALL TEST" in 4th gear, therefore Go to "W/Harness Inspection" procedure.

OPERATING ELEMENT OF EACH SHIFTING RANGE

Range		UD clutch	OD clutch	2ND brake	LR brake	REV clutch	RED clutch	DIR clutch	OWC	OWC1
P		-	-	-	O	-	O	-	-	-
R		-	-	-	O	O	O	-	-	-
N		-	-	-	O	-	O	-	-	-
D	1st	O	-	-	O	-	O	-	O	O
	2nd	O	-	O	-	-	O	-	O	-
	3rd	O	O	-	-	-	O	-	O	-
	4th	-	O	O	-	-	O	-	O	-
	5th	-	O	O	-	-	-	O	-	-

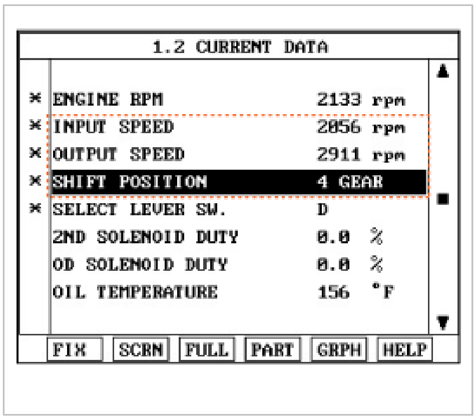
UD/C : Underdrive clutch
OD/C : Overdrive clutch

2ND/B : 2ND brake
LR/B : Low&Reverse brake
REV/C: Reverse clutch
RED/B: Reduction brake
DIR/C: Direct clutch
OWC : One way clutch for sub gear shifting
OWC1 : One way clutch for main gear shifting

SIGNAL CIRCUIT INSPECTION

1. Connect Scantool.
2. Engine "ON".
3. Monitor the "INPUT & OUTPUT SPEED SENSOR" parameter on the scantool.
4. Accelerate the Engine speed until about 2000 rpm in the 4th gear while driving the vehicle on a level road.

Specification : INPUT SPEED - (OUTPUT SPEED × GEAR RATIO) ≤ 200 RPM



5. Doed "INPUT & OUTPUT SPEED SENSOR" within specifications?

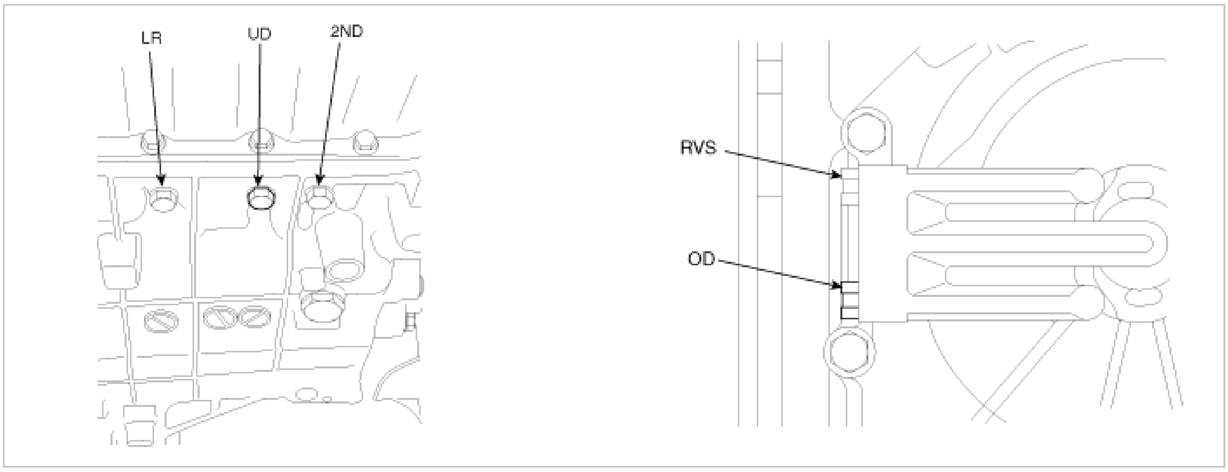
YES

▸ Go to "Component inspection" procedure.

NO

▸ Check for electrical niose of circuit in INPUT & OUTPUT SPEED SENSOR or Replace INPUT & OUTPUT SPEED SENSOR. Repair as necessary and Go to "Verification vehicle repair" procedure.

COMPONENT INSPECTION



1. Connect oil pressure gauge to "UD" and "OD" ports.
2. Engine "ON".
3. Drive a car with gear position "4".
4. Compare it with referance data as below.

Specification : shown below

*1 Each case of increasing and decreasing speed.
* 2 Only for 5 speed A/T.

Manual valve position	VFS current [mA]	RPM	Operation (Duty rate %)						Oil pressure MPa {kgf/cm²}	
			LR	2ND	UD	OD	DCC	RED*2	UD CLUTCH	LR BRAKE
D	200	2500	0	100	0	100	0	0	1.03±0.02 {10.5±0.2}	1.03±0.02 {10.5±0.2}
			100	0	0	100	0	0	1.03±0.02 {10.5±0.2}	-
R	250		0	100	100	100	0	0	-	1.55±0.25 {15.8±2.5}

Manual valve position (Oil pressure)	VFS current [mA]	RPM	Operation (Duty rate %)						Oil pressure MPa {kgf/cm²}		
			LR	2ND	UD	OD	DCC	RED*2	4000	1500 (Decreasing)	600 (Decreasing)
D (LR)	200	600→ 4500→ 600	0	100	0	100	0	0	MAX. 1.11 {MAX. 11.3}	-	MIN. 0.55 {MIN. 5.6}
D (UD)			0	100	0	100	0	0	MAX. 1.11 {MAX. 11.3}	-	MIN. 0.55 {MIN. 5.6}
D (UD)			100	0	0	100	0	0	MAX. 1.11 {MAX. 11.3}	-	MIN. 0.55 {MIN. 5.6}
R (LR)	250		0	100	100	100	0	0	MAX. 1.96 {MAX. 20.0}	MIN. 1.14*1 {MIN. 11.6}	MIN. 0.55*1 {MIN. 5.6}

Manual valve position (Oil pressure)	VFS current [mA]	RPM	Operation (Duty rate %)						Oil pressure MPa {kgf/cm²}		
			LR	2ND	UD	OD	DCC	RED*2	VFS current : 200mA	VFS current : 600mA	VFS current : 1100mA
D (UD)	200→ 1100→ 200	2500	100	100	0	0	100	0	1.03±0.02 {10.5±0.2}	0.69±0.03 {7.0±0.3}	0.36±0.03 {3.7±0.3}

Manual valve position	VFS current [mA]	RPM	Operation (Duty rate %)						ELEMENT	P (MPa)
			LR	2ND	UD	OD	DCC	RED*2		
D	200	2500	0	100	0	100	0	0	LR	1.03±0.02
			60	↑	↑	↑	↑	↑		0.45±0.04
			75	↑	↑	↑	↑	↑		0.19±0.04
			100	↑	↑	↑	↑	↑		0
			100	0	0	100	↑	0	2ND	1.03±0.02
			↑	60	↑	↑	↑	↑		0.50±0.05
			↑	75	↑	↑	↑	↑		0.20±0.05
			↑	100	↑	↑	↑	↑		0
			100	100	0	0	↑	0	OD	1.02±0.02
			↑	↑	↑	60	↑	↑		0.46±0.04
			↑	↑	↑	75	↑	↑		0.19±0.04
			↑	↑	↑	100	↑	↑		0
			100	100	0	0	↑	0	UD	1.03±0.02
			↑	↑	60	↑	↑	↑		0.44±0.05
			↑	↑	75	↑	↑	↑		0.18±0.04

			↑	↑	100	↑	↑	↑		0
			100	0	100	0	↑	0▼	RED	1.03±0.02
			↑	↑	↑	↑	↑	60		0.49±0.04
			↑	↑	↑	↑	↑	75		0.24±0.04
			↑	↑	↑	↑	↑	100		0
			100▼	0	100	0	↑	100	DIR	0
			75	↑	↑	↑	↑	↑		0.25±0.04
			60	↑	↑	↑	↑	↑		0.51±0.04
			0	↑	↑	↑	↑	↑		1.03±0.02

Each case of increasing (0→100%) and decreasing (100→0%) of duty rate to be satisfied.(Except the mark ▼)

Manual valve position (Oil pressure)	VFS current [mA]	RPM	Operation (Duty rate %)						Damper Apply Pressure※ (MPa)	Damper Release Pressure (MPa)
			LR	2ND	UD	OD	DCC	RED*2		
D	200	2500	100	100	0	0	0	0	0.25~0.45	0.50~0.70
			↑	↑	↑	↑	50	↑	0.20~0.45	0
			↑	↑	↑	↑	100	↑	0.96~1.04	0
	900		100	100	0	0	0	0	0.12~0.22	0.25~0.45
			↑	↑	↑	↑	100	↑	MIN. 0.29	0

※ Each case of increasing and decreasing of DCC solenoid duty rate to be satisfied.

● The values are subject to change according to vehicle model or condition.

5. Is oil pressure value within specification?

YES

▸ Repair AUTO TRANSAXLE(Clutch or brake) as necessary and go to "Verification vehicle repair" procedure.

NO

▸ Replace AUTO TRANSAXLE (BODY CONTROL VALVE faulty) as necessary and go to "Verification vehicle repair " procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

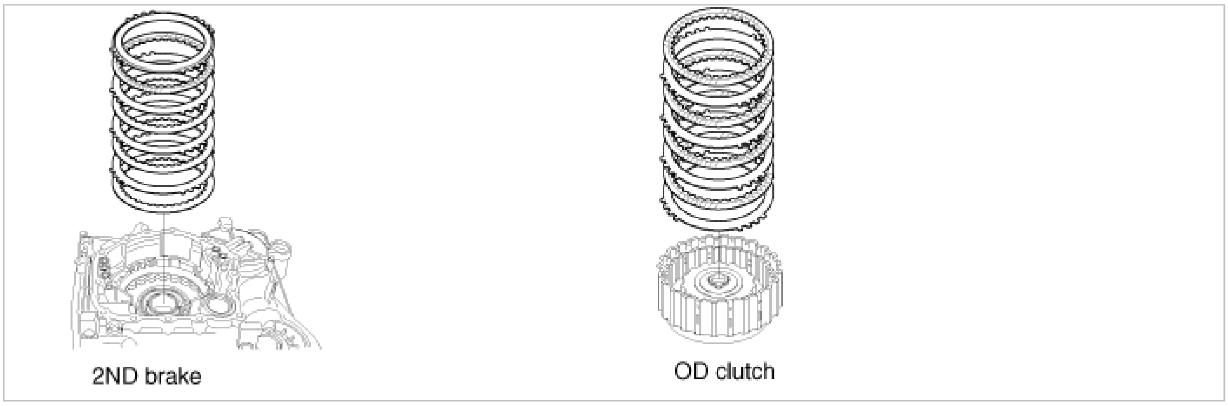
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P0735

COMPONENT LOCATION



GENERAL DESCRIPTION

The input shaft speed in gear 5 range should be the similar to the value that is what the gear 5 ratio and the output shaft speed are multipled. For example, if the output shaft speed is 1,000 rpm and the gear 5 ratio is 0.728, the input shaft speed may be about 728 rpm.

DTC DESCRIPTION

This code is displayed if the input shaft speed does not conform with the value which is what the output shaft speed and the gear 5 ratio are multipled. This is most likely caused by a mechanical defect of adherence of control valves or a breakdown of solenoid controlled valves etc. than a electrical defect.

DTC DETECTING CONDITION

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• 5th gear incorrect ratio	• Faulty input speed sensor • Faulty output speed sensor • Faulty 2nd brake or OD clutch
Enable Conditions	• Engine state=Run • Battery Voltage >11V and< 16 V • TM oil temperature >-23°C(-9.4°F) • Engine speed >450rpm • TM output speed >300rpm • TM Input speed≠0rpm • Current gear=5th • Gear shifting is completed • No PRNDL fail • No error in speed sensors	
Threshold value	• │Measured input speed - calculated input speed│>200 rpm	
Diagnostic Time	• More than 1sec	
Fail Safe	• Locked into 3rd gear.	

SIGNAL WAVEFORM

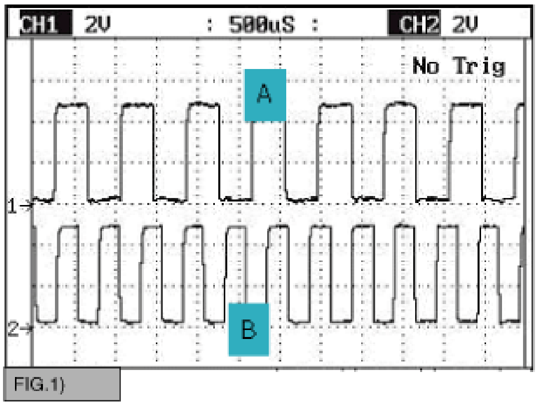


FIG.1)

A: INPUT SPEED SENSOR
B : OUTPUT SPEED SENSOR

MONITOR SCANTOOL DATA

※ It is difficult to "STALL TEST" in 5th gear, therefore Go to "W/Harness inspection" procedure.

OPERATING ELEMENT OF EACH SHIFTING RANGE

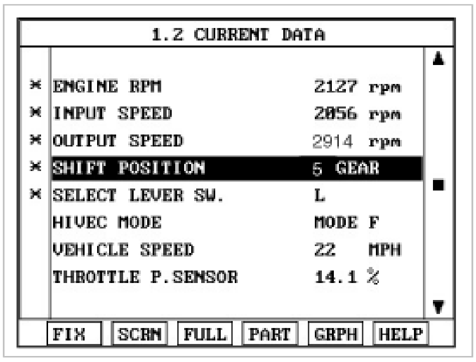
Range		UD clutch	OD clutch	2ND brake	LR brake	REV clutch	RED clutch	DIR clutch	OWC	OWC1
P		-	-	-	O	-	O	-	-	-
R		-	-	-	O	O	O	-	-	-
N		-	-	-	O	-	O	-	-	-
D	1st	O	-	-	O	-	O	-	O	O
	2nd	O	-	O	-	-	O	-	O	-
	3rd	O	O	-	-	-	O	-	O	-
	4th	-	O	O	-	-	O	-	O	-
	5th	-	O	O	-	-	-	O	-	-

UD/C : Underdrive clutch
OD/C : Overdrive clutch
2ND/B : 2ND brake
LR/B : Low&Reverse brake
REV/C: Reverse clutch
RED/B: Reduction brake
DIR/C: Direct clutch
OWC : One way clutch for sub gear shifting
OWC1 : One way clutch for main gear shifting

SIGNAL CIRCUIT INSPECTION

1. Connect Scantool.
2. Engine "ON".
3. Monitor the "INPUT & OUTPUT SPEED SENSOR" parameter on the scantool.
4. Accelerate the Engine speed until about 2000 rpm in the 5th gear while driving the vehicle on a level road.

Specification : INPUT SPEED - (OUTPUT SPEED × GEAR RATIO) ≤ 200 RPM



5. Are "INPUT & OUTPUT SPEED SENSOR" within specifications?

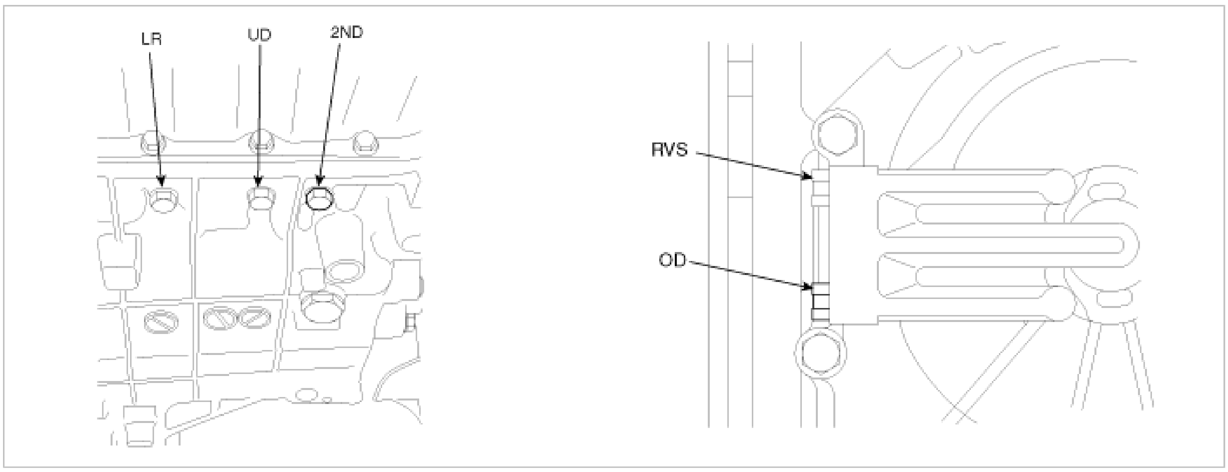
YES

▸ Go to "Component inspection" procedure.

NO

▸ Check for electrical niose of circuit in INPUT & OUTPUT SPEED SENSOR or Replace INPUT & OUTPUT SPEED SENSOR. Repair as necessary and Go to "Verification vehicle repair" procedure.

COMPONENT INSPECTION



1. Connect oil pressure gauge to "2nd" and "OD" ports.
2. Engine "ON".
3. Drive a car with gear position "5".
4. Compare it with referance data as below.

Specification : shown below

*1 Each case of increasing and decreasing speed.
* 2 Only for 5 speed A/T.

Manual valve position	VFS current [mA]	RPM	Operation (Duty rate %)						Oil pressure MPa {kgf/cm²}	
			LR	2ND	UD	OD	DCC	RED*2	UD CLUTCH	LR BRAKE
D	200	2500	0	100	0	100	0	0	1.03±0.02 {10.5±0.2}	1.03±0.02 {10.5±0.2}
			100	0	0	100	0	0	1.03±0.02 {10.5±0.2}	-
R	250		0	100	100	100	0	0	-	1.55±0.25 {15.8±2.5}

Manual valve position (Oil	VFS current [mA]	RPM	Operation (Duty rate %)						Oil pressure MPa {kgf/cm²}		
			LR	2ND	UD	OD	DCC	RED*2	4000	1500	600

pressure)										(Decreasing)	(Decreasing)
D (LR)	200	600→ 4500→ 600	0	100	0	100	0	0	MAX. 1.11 {MAX. 11.3}	-	MIN. 0.55 {MIN. 5.6}
D (UD)			0	100	0	100	0	0	MAX. 1.11 {MAX. 11.3}	-	MIN. 0.55 {MIN. 5.6}
D (UD)			100	0	0	100	0	0	MAX. 1.11 {MAX. 11.3}	-	MIN. 0.55 {MIN. 5.6}
R (LR)	250		0	100	100	100	0	0	MAX. 1.96 {MAX. 20.0}	MIN. 1.14*¹ {MIN. 11.6}	MIN. 0.55*¹ {MIN. 5.6}

Manual valve position (Oil pressure)	VFS current [mA]	RPM	Operation (Duty rate %)						Oil pressure MPa {kgf/cm²}		
			LR	2ND	UD	OD	DCC	RED*²	VFS current : 200mA	VFS current : 600mA	VFS current : 1100mA
D (UD)	200→ 1100→ 200	2500	100	100	0	0	100	0	1.03±0.02 {10.5±0.2}	0.69±0.03 {7.0±0.3}	0.36±0.03 {3.7±0.3}

Manual valve position	VFS current [mA]	RPM	Operation (Duty rate %)						ELEMENT	P (MPa)
			LR	2ND	UD	OD	DCC	RED*²		
D	200	2500	0	100	0	100	0	0	LR	1.03±0.02
			60	↑	↑	↑	↑	↑		0.45±0.04
			75	↑	↑	↑	↑	↑		0.19±0.04
			100	↑	↑	↑	↑	↑		0
			100	0	0	100	↑	0	2ND	1.03±0.02
			↑	60	↑	↑	↑	↑		0.50±0.05
			↑	75	↑	↑	↑	↑		0.20±0.05
			↑	100	↑	↑	↑	↑		0
			100	100	0	0	↑	0	OD	1.02±0.02
			↑	↑	↑	60	↑	↑		0.46±0.04
			↑	↑	↑	75	↑	↑		0.19±0.04
			↑	↑	↑	100	↑	↑		0
			100	100	0	0	↑	0	UD	1.03±0.02
			↑	↑	60	↑	↑	↑		0.44±0.05
			↑	↑	75	↑	↑	↑		0.18±0.04
			↑	↑	100	↑	↑	↑		0
			100	0	100	0	↑	0▼	RED	1.03±0.02
			↑	↑	↑	↑	↑	60		0.49±0.04
			↑	↑	↑	↑	↑	75		0.24±0.04
			↑	↑	↑	↑	↑	100		0
			100▼	0	100	0	↑	100	DIR	0
			75	↑	↑	↑	↑	↑		0.25±0.04
			60	↑	↑	↑	↑	↑		0.51±0.04
			0	↑	↑	↑	↑	↑		1.03±0.02

Each case of increasing (0→100%) and decreasing (100→0%) of duty rate to be satisfied.(Except the mark ▼)

Manual valve position	VFS current	RPM	Operation (Duty rate %)						Damper Apply Pressure※	Damper Release

(Oil pressure)	[mA]		LR	2ND	UD	OD	DCC	RED*²	(MPa)	Pressure (MPa)
D	200	2500	100	100	0	0	0	0	0.25~0.45	0.50~0.70
			↑	↑	↑	↑	50	↑	0.20~0.45	0
			↑	↑	↑	↑	100	↑	0.96~1.04	0
	900		100	100	0	0	0	0	0.12~0.22	0.25~0.45
			↑	↑	↑	↑	100	↑	MIN. 0.29	0

※ Each case of increasing and decreasing of DCC solenoid duty rate to be satisfied.
● The values are subject to change according to vehicle model or condition.

5. Is oil pressure value within specification?

YES

▸ Repair AUTO TRANSAXLE(Clutch or brake) as necessary and go to "Verification vehicle repair" procedure.

NO

▸ Replace AUTO TRANSAXLE (BODY CONTROL VALVE faulty) as necessary and go to "Verification vehicle repair " procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

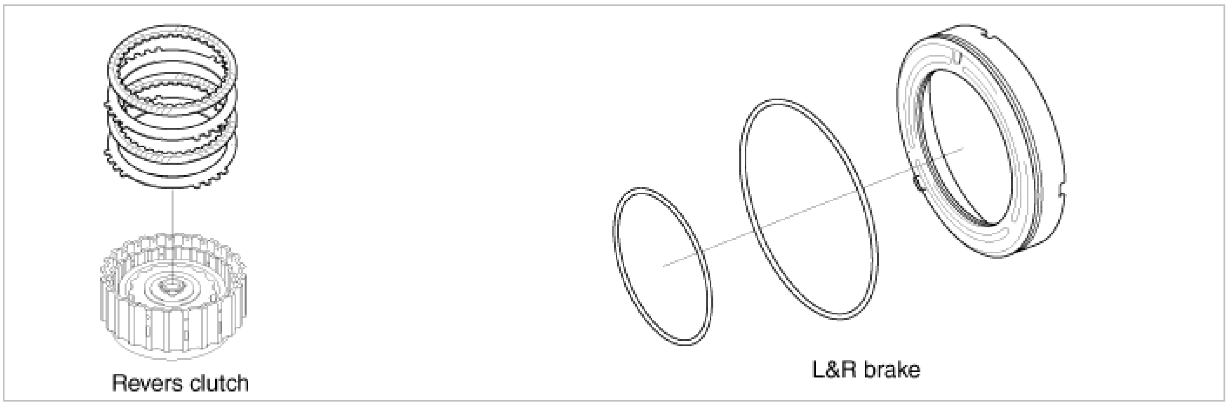
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P0736

COMPONENT LOCATION



GENERAL DESCRIPTION

The input shaft speed in gear reverse range should be the similar to the value that is what the gear reverse ratio and the output shaft speed are multipled. For example, if the output shaft speed is 1,000 rpm and the gear reverse ratio is 3.808, the input shaft speed may be about 3,808 rpm.

DTC DESCRIPTION

This code is displayed if the input shaft speed does not conform with the value which is what the output shaft speed and the gear reverse ratio are multipled. This is most likely caused by a mechanical defect of adherence of control valves or a breakdown of solenoid controlled valves etc. than a electrical defect.

DTC DETECTING CONDITION

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Reverse gear incorrect ratio	• Faulty input speed sensor • Faulty output speed sensor • Faulty RVS clutch or L/R brake
Enable Conditions	• Engine state=Run • Battery Voltage >11V and< 16 V • TM oil temperature>-23°C(-9.4°F) • Engine speed >450rpm • TM output speed >100rpm • TM Input speed≠0rpm • Current gear=reverse • Gear shifting is completed • No PRNDL fail • No error in speed sensors	
Threshold value	• │Measured input speed - calculated input speed│>200 rpm	
Diagnostic Time	• More than 1sec	
Fail Safe	• Locked into 3rd gear.	

SIGNAL WAVEFORM

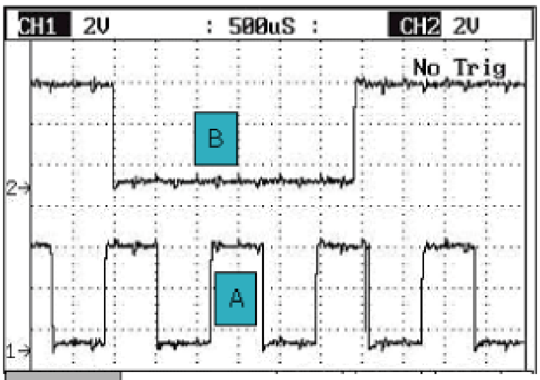


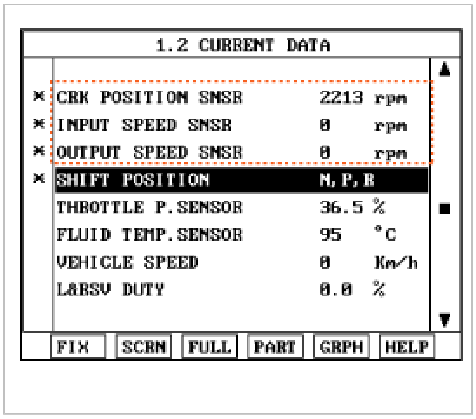
FIG.1)

A : INPUT SPEED SENSOR
B : OUTPUT SPEED SENSOR

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Engine "ON".
3. Monitor the "ENGINE SPEED, INPUT SPEED SENSOR, OUTPUT SPEED SENSOR, GEAR POSITION" parameter on the scantool.
4. Perform the "STALL TEST" with gear position "R".

Specification : 2700~2900 engine rpm



OPERATING ELEMENT OF EACH SHIFTING RANGE

Range		UD clutch	OD clutch	2ND brake	LR brake	REV clutch	RED clutch	DIR clutch	OWC	OWC1
P		-	-	-	O	-	O	-	-	-
R		-	-	-	O	O	O	-	-	-
N		-	-	-	O	-	O	-	-	-
D	1st	O	-	-	O	-	O	-	O	O
	2nd	O	-	O	-	-	O	-	O	-
	3rd	O	O	-	-	-	O	-	O	-
	4th	-	O	O	-	-	O	-	O	-
	5th	-	O	O	-	-	-	O	-	-

UD/C : Underdrive clutch
OD/C : Overdrive clutch
2ND/B : 2ND brake
LR/B : Low&Reverse brake
REV/C: Reverse clutch
RED/B: Reduction brake
DIR/C: Direct clutch
OWC : One way clutch for sub gear shifting
OWC1 : One way clutch for main gear shifting

Stall test procedure in Reverse and reason

Procedure

A. Warm up the engine
B. Fully depress the brake pedal, then place the transaxle gear lever into "R" range. Press and hold the accelerator pedal to the floor for no more than eight seconds while observing the engine, input speed, and output speed RPM values.
   * The slippage of REVERSE clutch and L/R brake can be detected by stall test in R range.

Reason for stall test

A. If there is no mechanical defaults in A/T, all slippage occurs in the torque converter.
B. Therfore, engine revolution is output, but input and output speed revolution must be "zero" due to wheel's lock.
C. If reverse clutch and L/R brake system(reverse gear operating parts) has faults, input speed revolution will be out of specification.
D. If output speed revolution is output. It means that the foot brake force is not applied fully. Remeasuring is required.

5. Is "STALL TEST " within specification?

YES

▸ Go to "Signal circuit inspection" procedure.

NO

▸ Go to "Component inspection" procedure.

CAUTION

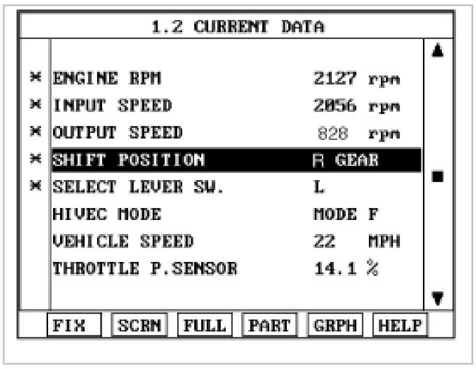
- Do not let anybody stand in front of or behind the vehicle while this test is being carried out.
- Check the A/T fluid level and temperature and the engine coolant temperature.
  - Fluid level : At the hot mark on the oil level gauge.
  - Fluid temperature : 80~100°C (176~212°F).

- Engine coolant temperature : 80~100°C (176~212°F).
● Check both rear wheel(left and right).
● Pull the parking brake lever on with the brake pedal fully depressed.
● The throttle should not be left fully open for more than eight seconds.
● If carrying out the stall test two or more time, move the select lever to the "N" position and run the engine at 1,000 rpm to let the A/T fluid cool down before carrying out subsequent tests.

SIGNAL CIRCUIT INSPECTION

1. Connect Scantool.
2. Engine "ON".
3. Monitor the "INPUT & OUTPUT SPEED SENSOR" parameter on the scantool.
4. Accelerate the Engine speed until about 2000 rpm in the "R" gear.

Specification : INPUT SPEED - (OUTPUT SPEED × GEAR RATIO) ≤ 200 RPM



5. Are "INPUT&OUTPUT SPEED SENSOR" within specifications?

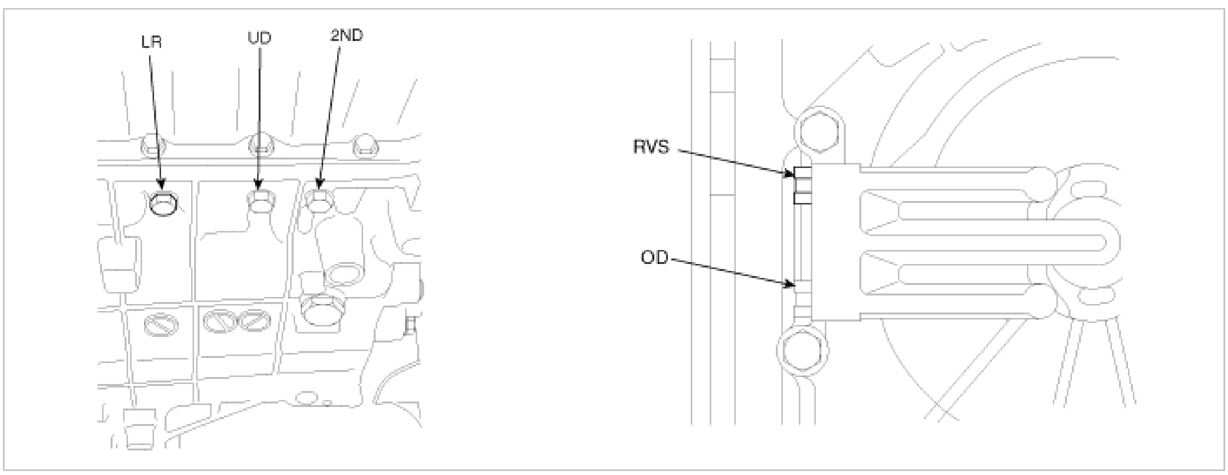
YES

▸ Go to "Component inspection" procedure.

NO

▸ Check for electrical niose of circuit in INPUT & OUTPUT SPEED SENSOR or replace INPUT & OUTPUT SPEED SENSOR. Repair as necessary and go to "Verification vehicle repair" procedure.

COMPONENT INSPECTION



1. Connect oil pressure gauge to "RVS" and "L/R" ports.
2. Engine "ON".
3. Drive a car with gear position R.
4. Compare it with referance data as below.

Specification : shown below

*1 Each case of increasing and decreasing speed.

* 2 Only for 5 speed A/T.

Manual valve position	VFS current [mA]	RPM	Operation (Duty rate %)						Oil pressure MPa {kgf/cm²}	
			LR	2ND	UD	OD	DCC	RED*²	UD CLUTCH	LR BRAKE
D	200	2500	0	100	0	100	0	0	1.03±0.02 {10.5±0.2}	1.03±0.02 {10.5±0.2}
			100	0	0	100	0	0	1.03±0.02 {10.5±0.2}	-
R	250		0	100	100	100	0	0	-	1.55±0.25 {15.8±2.5}

Manual valve position (Oil pressure)	VFS current [mA]	RPM	Operation (Duty rate %)						Oil pressure MPa {kgf/cm²}		
			LR	2ND	UD	OD	DCC	RED*²	4000	1500 (Decreasing)	600 (Decreasing)
D (LR)	200	600→ 4500→ 600	0	100	0	100	0	0	MAX. 1.11 {MAX. 11.3}	-	MIN. 0.55 {MIN. 5.6}
D (UD)			0	100	0	100	0	0	MAX. 1.11 {MAX. 11.3}	-	MIN. 0.55 {MIN. 5.6}
D (UD)			100	0	0	100	0	0	MAX. 1.11 {MAX. 11.3}	-	MIN. 0.55 {MIN. 5.6}
R (LR)	250		0	100	100	100	0	0	MAX. 1.96 {MAX. 20.0}	MIN. 1.14*¹ {MIN. 11.6}	MIN. 0.55*¹ {MIN. 5.6}

Manual valve position (Oil pressure)	VFS current [mA]	RPM	Operation (Duty rate %)						Oil pressure MPa {kgf/cm²}		
			LR	2ND	UD	OD	DCC	RED*²	VFS current : 200mA	VFS current : 600mA	VFS current : 1100mA
D (UD)	200→ 1100→ 200	2500	100	100	0	0	100	0	1.03±0.02 {10.5±0.2}	0.69±0.03 {7.0±0.3}	0.36±0.03 {3.7±0.3}

Manual valve position	VFS current [mA]	RPM	Operation (Duty rate %)						ELEMENT	P (MPa)
			LR	2ND	UD	OD	DCC	RED*²		
D	200	2500	0	100	0	100	0	0	LR	1.03±0.02
			60	↑	↑	↑	↑	↑		0.45±0.04
			75	↑	↑	↑	↑	↑		0.19±0.04
			100	↑	↑	↑	↑	↑		0
			100	0	0	100	↑	0	2ND	1.03±0.02
			↑	60	↑	↑	↑	↑		0.50±0.05
			↑	75	↑	↑	↑	↑		0.20±0.05
			↑	100	↑	↑	↑	↑		0
			100	100	0	0	↑	0	OD	1.02±0.02
			↑	↑	↑	60	↑	↑		0.46±0.04
			↑	↑	↑	75	↑	↑		0.19±0.04
			↑	↑	↑	100	↑	↑		0
			100	100	0	0	↑	0	UD	1.03±0.02
			↑	↑	60	↑	↑	↑		0.44±0.05
			↑	↑	75	↑	↑	↑		0.18±0.04

			↑	↑	100	↑	↑	↑		0
			100	0	100	0	↑	0▼	RED	1.03±0.02
			↑	↑	↑	↑	↑	60		0.49±0.04
			↑	↑	↑	↑	↑	75		0.24±0.04
			↑	↑	↑	↑	↑	100		0
			100▼	0	100	0	↑	100	DIR	0
			75	↑	↑	↑	↑	↑		0.25±0.04
			60	↑	↑	↑	↑	↑		0.51±0.04
			0	↑	↑	↑	↑	↑		1.03±0.02

Each case of increasing (0→100%) and decreasing (100→0%) of duty rate to be satisfied.(Except the mark ▼)

Manual valve position (Oil pressure)	VFS current [mA]	RPM	Operation (Duty rate %)						Damper Apply Pressure※ (MPa)	Damper Release Pressure (MPa)
			LR	2ND	UD	OD	DCC	RED*2		
D	200	2500	100	100	0	0	0	0	0.25~0.45	0.50~0.70
			↑	↑	↑	↑	50	↑	0.20~0.45	0
			↑	↑	↑	↑	100	↑	0.96~1.04	0
	900		100	100	0	0	0	0	0.12~0.22	0.25~0.45
			↑	↑	↑	↑	100	↑	MIN. 0.29	0

※ Each case of increasing and decreasing of DCC solenoid duty rate to be satisfied.

● The values are subject to change according to vehicle model or condition.

5. Is oil pressure value within specification?

YES

▸ Repair AUTO TRANSAXLE(Clutch or brake) as necessary and go to "Verification vehicle repair" procedure.

NO

▸ Replace AUTO TRANSAXLE (BODY CONTROL VALVE faulty) as necessary and go to "Verification vehicle repair " procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P0741

GENERAL DESCRIPTION

The PCM controls the locking or unlocking of the Torque Converter Clutch (or Damper Clutch) by appling hydraulic pressure. The main purpose of the TCC control is to save fuel by decreasing the hydraulic load inside the torque converter. The PCM outputs duty pulses to control the torque converter clutch control solenoid valve and hydraulic pressure is applied to the torque converter according to the torque converter clutch duty ratio value. When the duty ratio is high, high pressure is applied and the torque converter clutch is locked. The normal operating range of the torque converter clutch control duty ratio value is from 30% (unlocked) to 85%(locked).

DTC DESCRIPTION

The PCM increases the duty ratio to engage the torque converter clutch, monitoring the slip rpms (difference beteween engine speed and turbine speed). To decrease the slip of the torque converter clutch, the PCM applies more hydraulic pressure by increasing the duty ratio. When the slip rpm does not drop down below the specification with 100% duty ratio, the PCM determines that the torque converter clutch is stuck OFF and sets this code.

DTC DETECTING CONDITION

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Stuck "OFF"	※ TORQUE CONVERTER (DAMPER) CLUTCH : TCC • Faulty TCC or oil pressure system • Faulty TCC solenoid valve • Faulty body control valve • Faulty PCM
Enable Conditions	• TCC Duty cycle≠0 or TCC Abnormal slip counters ≥ 4	
Threshold value	• TCC slip counter ≥4 counts	
Diagnostic Time	• 1 second	
Fail Safe	• Stop the torque converter clutch control	

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Engine "ON".
3. Sellect "D RANGE" and drive vehicle.
4. Monitor the "TORQUE CONVERTER(DAMPER) CLUTCH" parameter on the scantool.

Specification : TCC SLIP<160RPM(In condition that TCC SOL. DUTY > 80%)

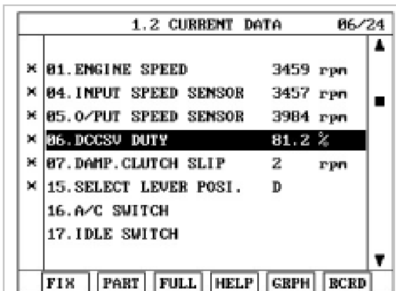


FIG.1)

FIG.1) : Normal status

5. Are "TCC SOLENOID DUTY and TCC SLIP" within specifications?

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Throughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification vehicle repair" procedure.

NO

▶ Go to "Component inspection" procedure.

COMPONENT INSPECTION

1. CHECK TORQUE CONVERTER CLUTCH SOLENOID VALVE
   (1) Connect scantool to data link connector(DLC).
   (2) Ignition "ON" & Engine "OFF".
   (3) Select A/T solenoid valve actuator test and operate actuator test.
   (4) Can you hear operating tone for using TCC SOLENOID VALVE actuator testing function?

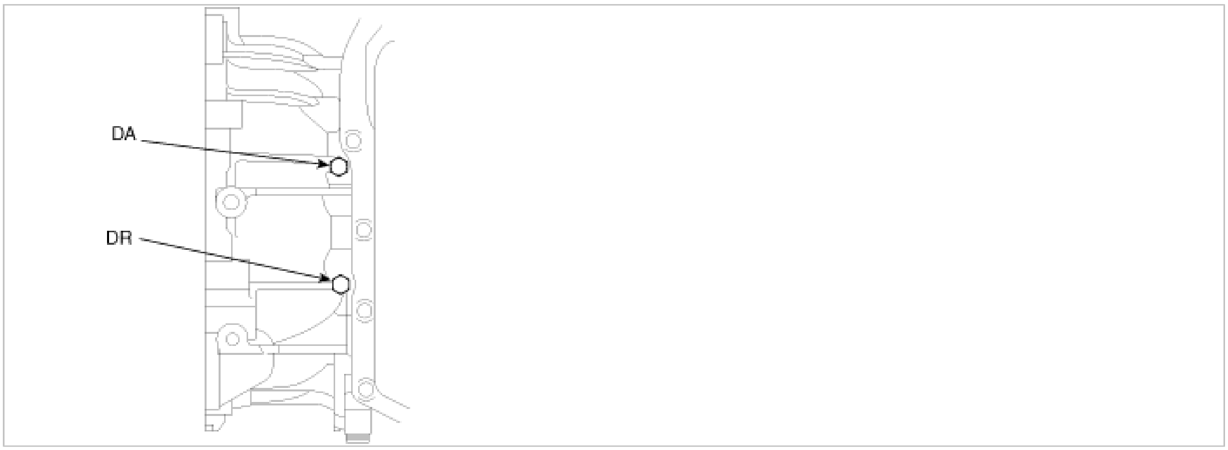
   YES

   ▶ Go to "CHECK OIL PRESSURE" as below.

   NO

   ▶ Replace "TCC SOLENOID VALVE" as necessary and go to "Verification vehicle repair" procedure.

2. CHECK OIL PRESSURE



(1) Connect oil pressure gauge to "DA" and "DR" ports.

(2) Ignition "ON" & Engine "OFF".

(3) After connecting Scantool and monitor the "TCC SOLENIOD VALVE DUTY" parameter on the scantool data list.

(4) Select the "D" range and accelerate engine speed to 2500 rpm.

(5) Measure oil pressure.

Specification :

Manual valve position	VFS current (mA)	RPM	Operation (Duty rate %)						Damper Apply Pressure※ (MPa)	Damper Release Pressure (MPa)
			LR	2ND	UD	OD	DCC	RED*		
D	200	2500	100	100	0	0	0	0	0.25~0.45	0.50~0.70
			↑	↑	↑	↑	50	↑	0.20~0.45	0
			↑	↑	↑	↑	100	↑	0.96~1.04	0
	900		100	100	0	0	0	0	0.12~0.22	0.25~0.45
			↑	↑	↑	↑	100	↑	MIN. 0.29	0

※ Each case of increasing and decreasing of DCC solenoid duty rate to be satisfied.

(6) Is oil pressure value within specification?

YES

▸ Repair TORQUE CONVERTER CLUTCH(REPLACE Torque Converter) as necessary and go to "Verification vehicle repair " procedure.

NO

▸ Replace A/T assembly (or valve body assembly) as necessary and go to "Verification vehicle repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P0742

GENERAL DESCRIPTION

The PCM controls the locking or unlocking of the Torque Converter Clutch (or Damper Clutch) by appling hydraulic pressure. The main purpose of the TCC control is to save fuel by decreasing the hydraulic load inside the torque converter. The PCM outputs duty pulses to control the torque converter clutch control solenoid valve and hydraulic pressure is applied to the torque converter according to the torque converter clutch duty ratio value. When the duty ratio is high, high pressure is applied and the torque converter clutch is locked. The normal operating range of the torque converter clutch control duty ratio value is from 30% (unlocked) to 85%(locked).

DTC DESCRIPTION

The PCM sets this code when the absolute value of RPM difference between engine speed and input shaft speed is less than 20 RPM.

DTC DETECTING CONDITION

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Stuck "ON"	※ TORQUE CONVERTER (DAMPER) CLUTCH : TCC • Faulty TCC or oil pressure system • Faulty TCC solenoid valve • Faulty body control valve • Faulty PCM
Enable Conditions	• Engine state=Run • Throttle position sensor value ≥ 20% • TM output speed ≥ 500 rpm • Manifold air pressure >60 kPa • Current gear = 1 or 2 or 3 or 4 or 5	
Threshold value	• Absolute value of RPM difference between engine and TM input speed≤ 20 rpm	
Diagnostic Time	• 1 second	
Fail Safe	• Stop the torque converter clutch control	

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Engine "ON".
3. Sellect "D RANGE" and drive vehicle.
4. Monitor the "TORQUE CONVERTER(DAMPER) CLUTCH" parameter on the scantool.

Specification : TCC SLIP<160RPM(In condition that TCC SOL. DUTY > 80%)

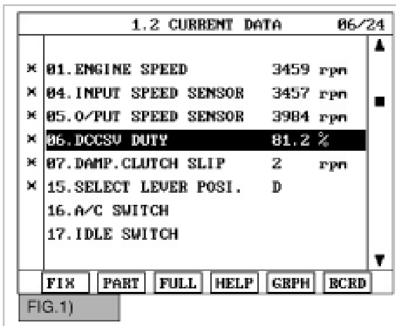


FIG.1) : Normal status

5. Are "TCC SOLENOID DUTY and TCC SLIP" within specifications?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Throughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification vehicle repair" procedure.

NO

▸ Go to "Component inspection" procedure.

COMPONENT INSPECTION

1. CHECK TORQUE CONVERTER CLUTCH SOLENOID VALVE
   (1) Connect scantool to data link connector(DLC).

(2) Ignition "ON" & Engine "OFF".

(3) Select A/T solenoid valve actuator test and operate actuator test.

(4) Can you hear operating tone for using TCC SOLENOID VALVE actuator testing function?

YES

▸ Go to "CHECK OIL PRESSURE" as below.

NO

▸ Replace "TCC SOLENOID VALVE" as necessary and go to "Verification vehicle repair" procedure.

2. CHECK OIL PRESSURE

(1) Connect oil pressure gauge to "DA" and "DR" ports.

(2) Ignition "ON" & Engine "OFF".

(3) After connecting Scantool and monitor the "TCC SOLENIOD VALVE DUTY" parameter on the scantool data list.

(4) Select the "D" range and accelerate engine speed to 2500 rpm.

(5) Measure oil pressure.

Specification :

Manual valve position	VFS current (mA)	RPM	Operation (Duty rate %)						Damper Apply Pressure※ (MPa)	Damper Release Pressure (MPa)
			LR	2ND	UD	OD	DCC	RED*		
D	200	2500	100	100	0	0	0	0	0.25~0.45	0.50~0.70
			↑	↑	↑	↑	50	↑	0.20~0.45	0
			↑	↑	↑	↑	100	↑	0.96~1.04	0
	900		100	100	0	0	0	0	0.12~0.22	0.25~0.45
			↑	↑	↑	↑	100	↑	MIN. 0.29	0

※ Each case of increasing and decreasing of DCC solenoid duty rate to be satisfied.

(6) Is oil pressure value within specification?

YES

▸ Repair TORQUE CONVERTER CLUTCH(REPLACE Torque Converter) as necessary and go to "Verification vehicle repair " procedure.

NO

▸ Replace A/T assembly (or valve body assembly) as necessary and go to "Verification vehicle repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

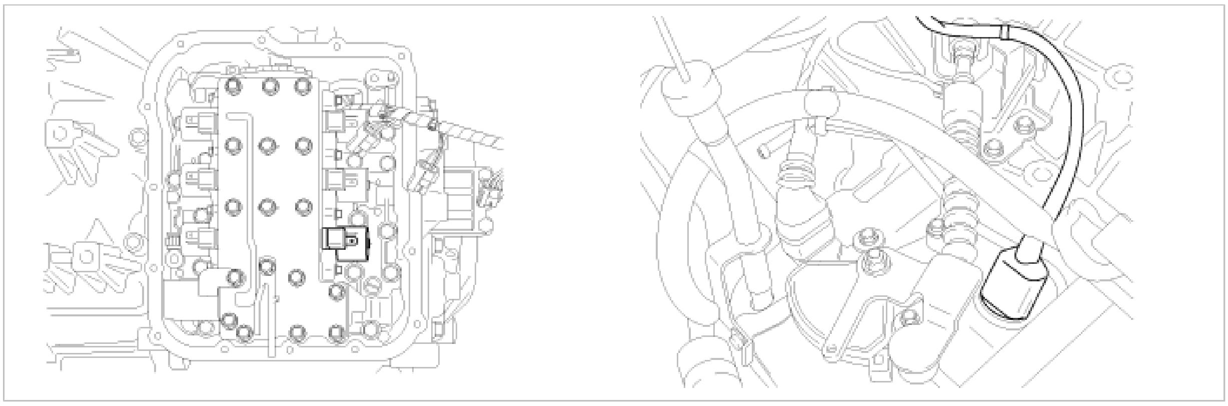
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P0743

COMPONENT LOCATION



GENERAL DESCRIPTION

The PCM controls the locking or unlocking of the Torque Converter Clutch (or Damper Clutch) by appling hydraulic pressure. The main purpose of the TCC control is to save fuel by decreasing the hydraulic load inside the torque converter. The PCM outputs duty pulses to control the torque converter clutch control solenoid valve and hydraulic pressure is applied to the torque converter according to the torque converter clutch duty ratio value. When the duty ratio is high, high pressure is applied and the torque converter clutch is locked. The normal operating range of the torque converter clutch control duty ratio value is from 30% (unlocked) to 85%(locked).

DTC DESCRIPTION

The PCM checks the torque converter clutch control signal by monitoring the feedback signal from the solenoid valve drive circuit. If an unexpected signal is monitored (for example, high voltage is detected when low voltage is expected, or low voltage is detected when high voltage is expected), the PCM judges that the torque converter clutch solenoid valve circuit is malfunctioning and sets this code.

DTC DETECTING CONDITION

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check voltage range	※ TORQUE CONVERTER (DAMPER) CLUTCH : TCC • Open or short in circuit • Faulty TCC SOLENOID VALVE • Faulty PCM
Enable Conditions	• Engine state=Run • Engine runtime >0.5 secs • Battery voltage >11V and 16 V • Transmission relay state : Relay on • Gear shifting is completed	
Threshold value	• When the PCM detects electric or electronic abnormalness such as short circuit or out of range voltage.	
Diagnostic Time	• More than 5 seconds	
Fail Safe	• Locked in 3rd gear.(Control relay off)	

SPECIFICATION

Solenoid Valve for Pressure Control

- Sensor type : Normal open 3-way
- Operating temperature : -22~266°F(-30°C~130°C)
- Frequency :

- LR, 2ND, UD, OD, RED : 61.27Hz (at the ATF temp. -20°C above)
- DCC : 30.64Hz
- VFS : 600 ± 20Hzs

• Internal resistance :
- 2.6~3.4Ω(68°F or 20°C) - LR, 2ND, UD, OD, RED, DCC
- 4.0~4.7Ω(68°F or 20°C) - VFS

• Surge voltage : 56 V(except VFS)

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC)
2. Engine "ON".
3. Monitor the "TCC SOL. VALVE" parameter on the scantool
4. Sellect "D RANGE" and Operate "TCC SOLENOID DUTY" more than 85%

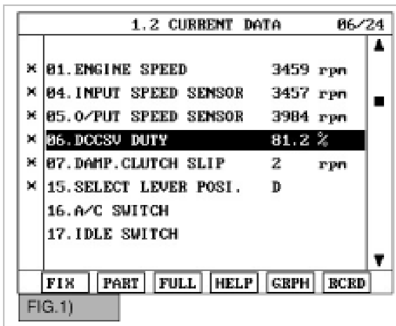


FIG.1) : Normal status

1. Does "TCC SOLENOID DUTY " follow the reference data?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification vehicle repair" procedure.

NO

▸ Go to "Terminal&connector inspection " procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and then go to "Verification of vehicle repair" procedure.

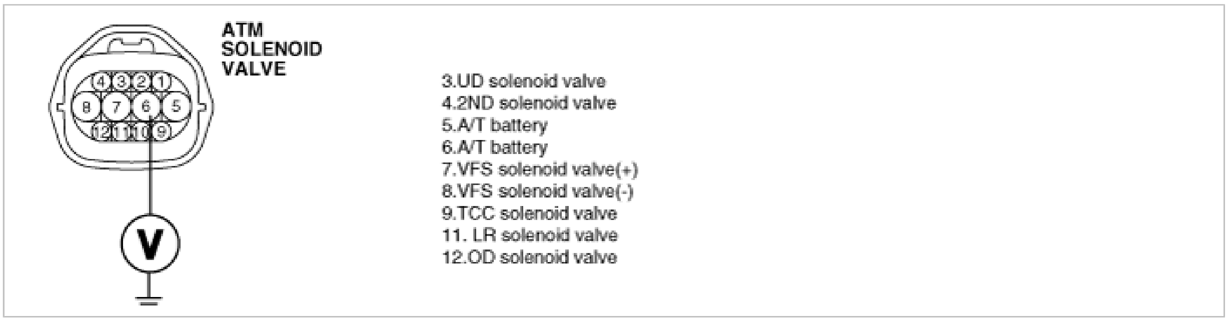
NO

▸ Go to "Power supply circuit inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Disconnect "A/T SOLENOID VALVE" connector.
2. Measure voltage between teminal "6" of the sensor harness connector and chassis ground.
3. Turn ignition switch OFF → ON

Specification: 12V is measured only for approx. 0.5sec



4. Is voltage within specifications?

YES

▸ Go to "Signal circuit inspection" procedure.

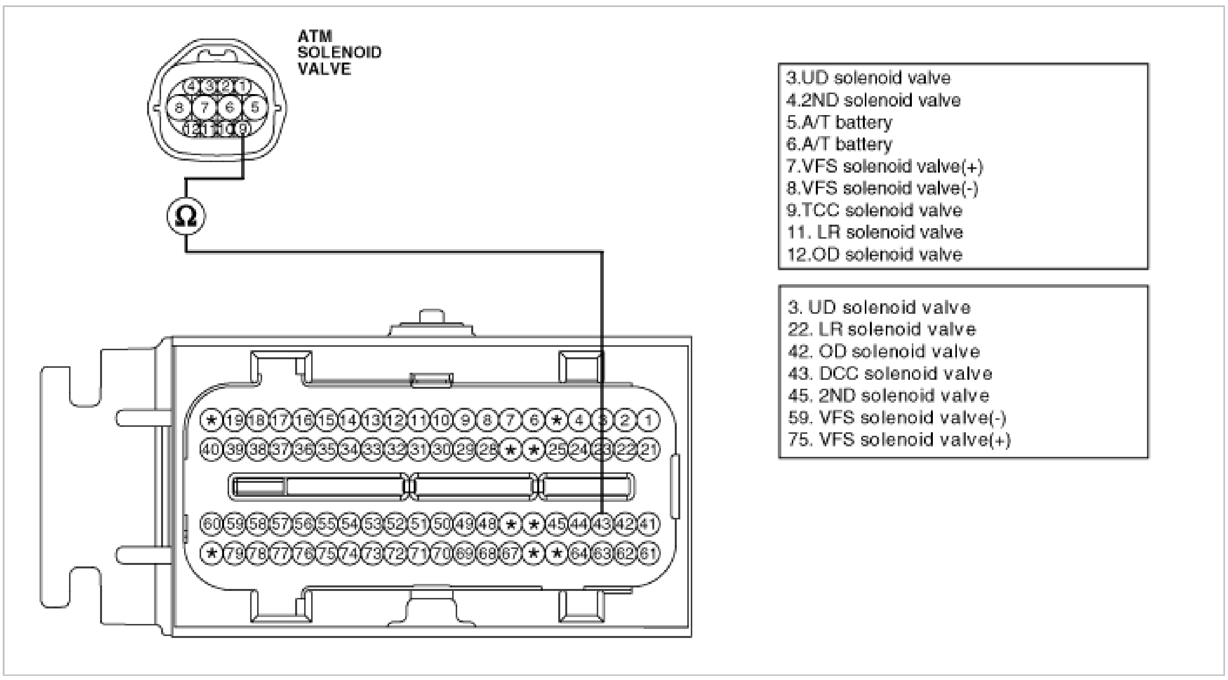
NO

▸ Check that A/T-20A fuse in engine room junction is installed or not blown.
▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check signal circuit open inspection.
   (1) Ignition "OFF".
   (2) Disconnect "A/T SOLENOID VALVE" connector and "PCM" connector.
   (3) Measure resistance between terminal "9" of the ATM SOLENOID VALVE harness connector and terminal "43" of the PCM harness connector B.

   Specification: approx. 0 Ω



   (4) Is resistance within specifications?

   YES

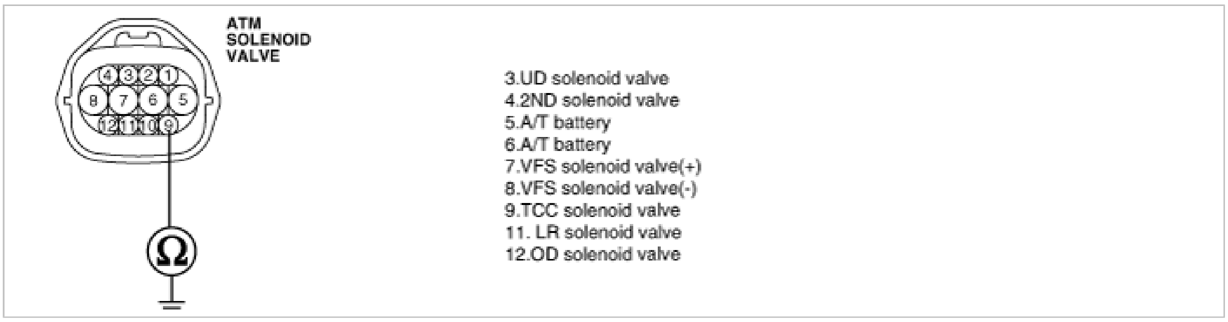
   ▸ Go to "Check signal circuit short inspection" procedure.

   NO

   ▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

2. Check signal circuit short inspection
   (1) Ignition "OFF".
   (2) Disconnect "A/T SOLENOID VALVE" connector and "PCM" connector.
   (3) Measure resistance between terminal "9" of the ATM SOLENOID VALVE harness and chassis ground.

   Specification: Infinite



(4) Is resistance within specifications?

YES

▸ Go to "Component inspection" procedure.

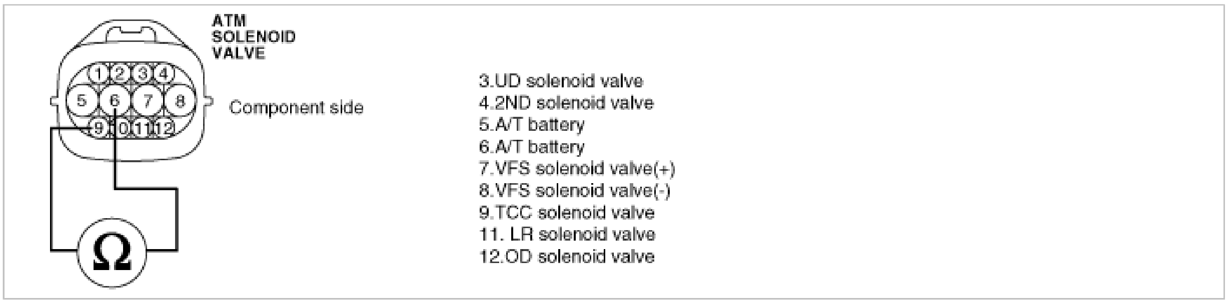
NO

▸ Check for short to ground in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

COMPONENT INSPECTION

1. CHECK SOLENOID VELVE
   (1) Ignition "OFF".
   (2) Disconnect "A/T SOLENOID VALVE" connector.
   (3) Measure resistance between terminal "9" and terminal "6" of the ATM SOLENOID VALVE harness connector.

Specification: Approximately 2.6~3.4 Ω [20°C(68°F)]



(4) Is resistance within specification?

YES

▸ Go to "CHECK PCM" as below.

NO

▸ Replace TCC SOLENOID VALVE as necessary and go to "Verification vehicle repair" procedure.

2. CHECK PCM
   (1) Connect scantool to data link connector(DLC).
   (2) Ignition "ON" & Engine "OFF".
   (3) Select A/T solenoid valve actuator test and operate actuator test.
   (4) Can you hear operating sound for TCC SOLENOID VALVE actuator testing function?

YES

▸ Go to "Verification vehicle repair" procedure.

NO

▸ Replace PCM as necessary and go to "Verification vehicle repair" procedure.

ACTUATOR TEST CONDITION

A. IG SWITCH ON
B. TRANSAXLE RANGE SWITCH is normal
C. P RANGE
D. Vehicle Speed 0km/h
E. Throttle position sensor< 1V
F. IDLE SWITCH ON

G. ENGINE RPM 0

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present?

YES

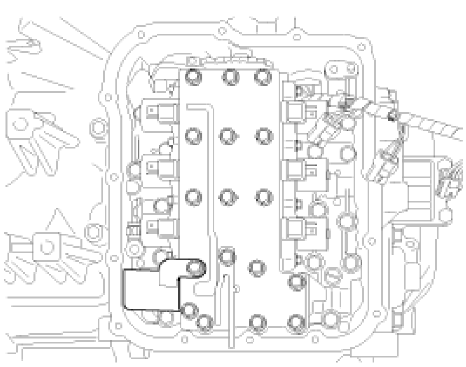
▸ Go to the applicable troubleshooting procedure.

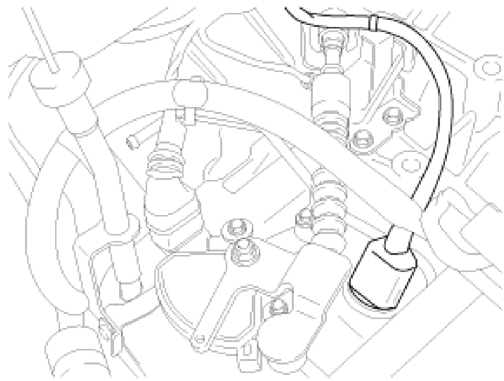
NO

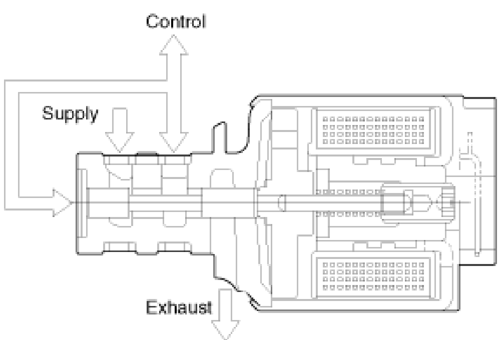
▸ System performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P0746

COMPONENT LOCATION







GENERAL DESCRIPTION

In order to control the optimum line pressure and improve the efficiency of power according to the maximum efficiency of an oil pump, VFS (Variable Force Solenoid) valve has been added in the valve body hydraulic circuit.
VFS(Variable Force Solenoid): It can be said as a linear solenoid and makes detailed spool contorl available with the closer duty (600 ± 20Hz) than PWM(Pulse Width Modulation-60Hz). PWM repeats ON/OFF signals and decides the operation flux according to the 'ON' time. But, VFS decides the operation flux according to the degree that the spool jams water course.

DTC DETECTING CONDITION

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check oil pressure and feedback current value	• Open or short in circuit • Faulty VFS SOLENOID VALVE • Faulty PCM
Enable Conditions	• Engine state=Run • VFS is enabled	
Threshold value	• Current operating state of VFS : Locked off until reset	
Diagnostic Time	• More than 1 second	

Fail Safe	• Stop the VFS control	

SPECIFICATION

Solenoid Valve for Pressure Control

- Sensor type : Normal open 3-way
- Operating temperature : -22~266°F(-30°C~130°C)
- Frequency :
  - LR, 2ND, UD, OD, RED : 61.27Hz (at the ATF temp. -20°C above)
  - DCC : 30.64Hz
  - VFS : 600 ± 20Hz
- Internal resistance :
  - 2.6~3.4Ω(68°F or 20°C) - LR, 2ND, UD, OD, RED, DCC
  - 4.0~4.7Ω(68°F or 20°C) - VFS
- Surge voltage : 56 V(except VFS)

Type: 3 way VFS valve for hydraulic control
Dither Frequency : 600±20 Hz
Sweep time : 20 sec
VFS Control pressurs

Input Current(mA)	Control Pressure (No line pressure)			
	Increasing Current			Decreasing Current
	MAX. (Kgf/cm^2) [Kpa]	MIN. (Kgf/cm^2) [Kpa]	Δ (Kgf/cm^2) [Kpa]	MIN. (Kgf/cm^2) [Kpa]
100	6.52 [639]	5.87 [575]	[64]	
200	6.23 [611]	5.70 [559]	[52]	5.43 [532]
300	5.76 [564]	5.24 [514]	[50]	4.49 [484]
400	5.08 [498]	4.59 [450]	[48]	4.30 [421]
500	4.24 [416]	3.78 [370]	[46]	3.52 [345]
700	2.29 [224]	1.82 [178]	[46]	1.51 [148]
800	1.41 [138]	0.09 [88]	[50]	0.58 [57]
900	0.65 [64]	0.14 [14]	[50]	0 [0]
1,000	0.24 [24]	0 [0]	[24]	
1,100	0.24 [24]	0 [0]	[24]	

*Test condition
Ps : Supply Pressure (Ps = 7.1±0.3 KGf/cm^2)
Pc : Control Pressure
Pex : Exhaust Pressure (Atmosphere pressure)
ATF : DIAMOND ATF SP-III
ATF temperature : 30±3°C (86°F)
- Coil resistance : 4.35±35Ω
- Dither freauency : 600±20Hz

In case of VFS solenoid valve, the relation between duty and oil pressure can't be expressed.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   ▸ Repair as necessary and then go to "Verification of vehicle repair" procedure.

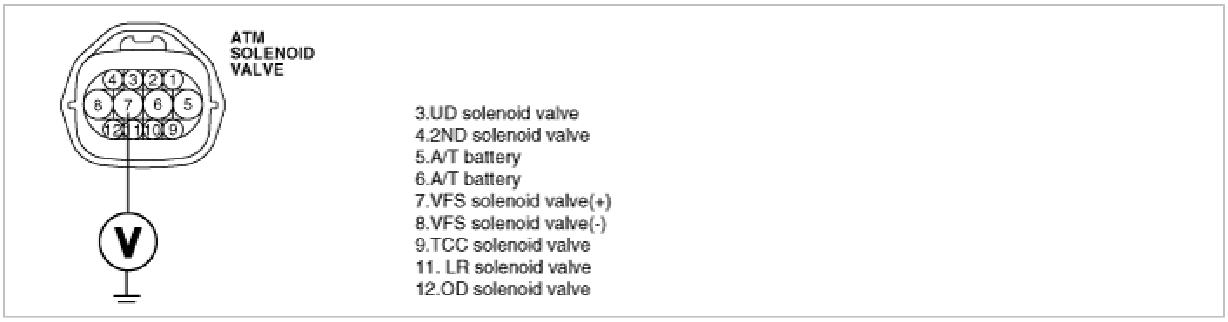
   NO

   ▸ Go to "Power supply circuit inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Disconnect "A/T SOLENOID VALVE" connector.
2. Measure voltage between teminal "7" of the sensor harness connector and chassis ground.
3. Turn ignition switch OFF → ON

Specification: 12V is measured only for approx. 0.5sec



4. Is voltage within specifications?

YES

▸ Go to "Signal circuit inspection" procedure.

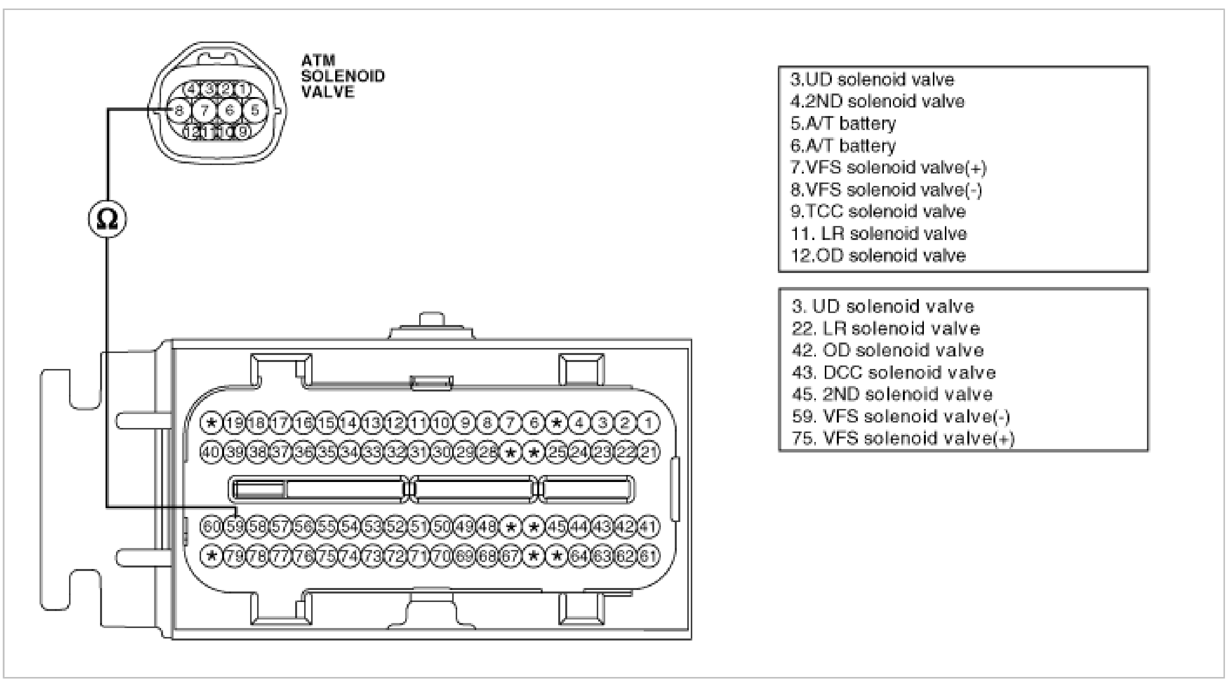
NO

▸ Check that A/T-20A fuse in engine room junction is installed or not blown.
▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check signal circuit open inspection.
   (1) Ignition "OFF".
   (2) Disconnect "ATM SOLENOID VALVE" connector and "PCM" connector.
   (3) Measure resistance between terminal "8" of the ATM SOLENOID VALVE harness connector and terminal "59" of the PCM harness connector.

   Specification: approx. 0 Ω



   (4) Is resistance within specifications?

YES

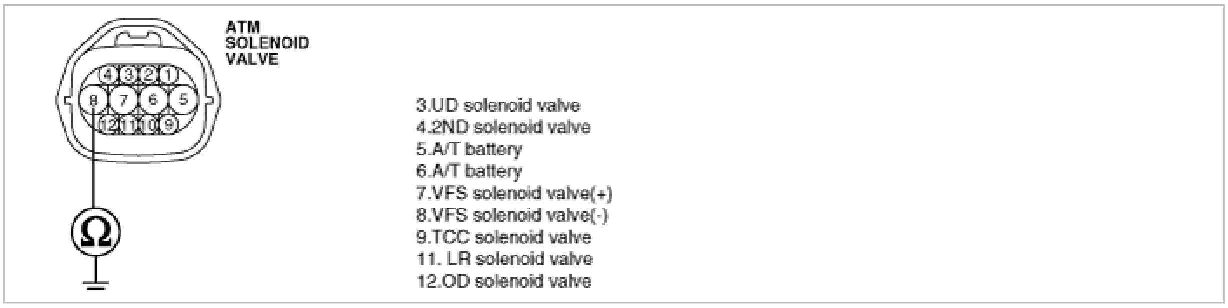
▸ Go to "Check signal circuit short inspection" procedure.

NO

▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

2. Check signal circuit short inspection
   (1) Ignition "OFF".
   (2) Disconnect "ATM SOLENOID VALVE" connector and "PCM" connector
   (3) Measure resistance between terminal "8" of the ATM SOLENOID VALVE harness and chassis ground.

Specification: Infinite



   (4) Is resistance within specifications?

YES

▸ Go to "Component inspection" procedure.

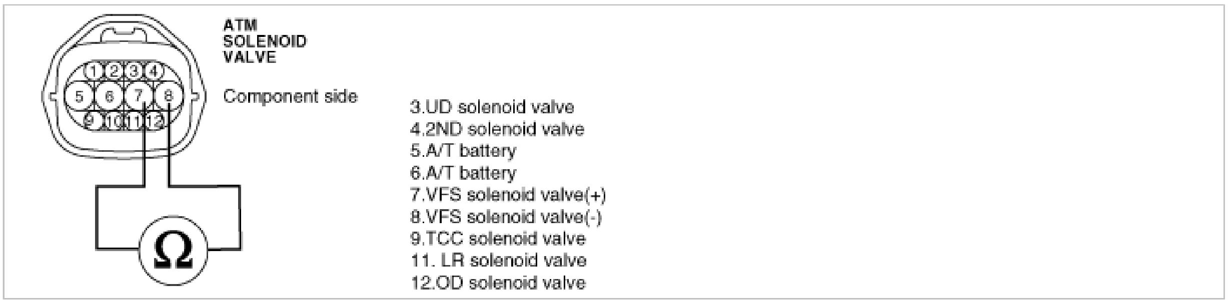
NO

▸ Check for short to ground in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

COMPONENT INSPECTION

1. CHECK SOLENOID VELVE
   (1) Ignition "OFF".
   (2) Disconnect "ATM SOLENOID VALVE" connector.
   (3) Measure resistance between terminal "7" and terminal "8" of the ATM SOLENOID VALVE harness connector.

Specification: Approximately 4.0~4.7 Ω [20°C(68°F)]



   (4) Is resistance within specification?

YES

▸ Go to "CHECK PCM" as below.

NO

▸ Replace VFS SOLENOID VALVE as necessary and go to "Verification vehicle repair" procedure.

2. CHECK PCM
   (1) Connect scantool to data link connector(DLC).
   (2) Ignition "ON" & Engine "OFF".
   (3) Select A/T Solenoid valve Actuator test and Operate Actuator test.
   (4) Can you hear operating sound for VFS SOLENOID VALVE actuator testing function?

YES

▸ Go to "Verification vehicle repair" procedure.

NO

▸ Replace PCM as necessary and go to "Verification vehicle repair" procedure.

ACTUATOR TEST CONDITION

A. IG SWITCH ON
B. TRANSAXLE RANGE SWITCH is normal
C. P RANGE
D. Vehicle Speed 0km/h
E. Throttle position sensor< 1V
F. IDLE SWITCH ON
G. ENGINE RPM 0

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present?

YES

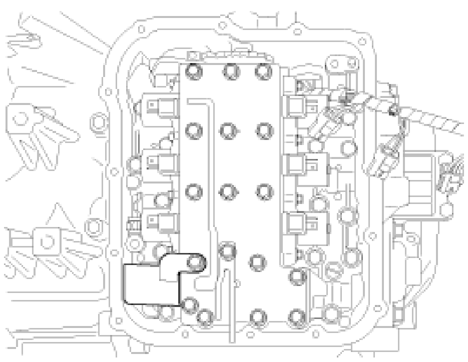
▸ Go to the applicable troubleshooting procedure.

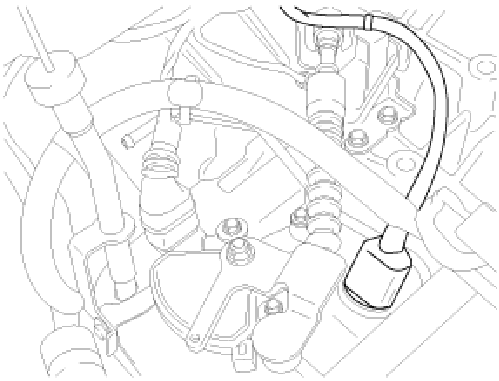
NO

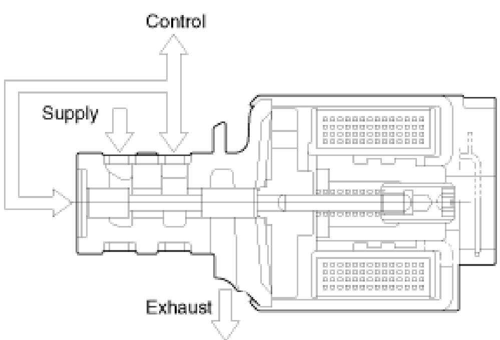
▸ System performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P0748

COMPONENT LOCATION







GENERAL DESCRIPTION

In order to control the optimum line pressure and improve the efficiency of power according to the maximum efficiency of an oil pump, VFS (Variable Force Solenoid) valve has been added in the valve body hydraulic circuit.
VFS(Variable Force Solenoid): It can be said as a linear solenoid and makes detailed spool contorl available with the closer duty (600 ± 20Hz) than PWM(Pulse Width Modulation-60Hz). PWM repeats ON/OFF signals and decides the operation flux according to the 'ON' time. But, VFS decides the operation flux according to the degree that SPOOL jams water course.

DTC DESCRIPTION

PCM inspects VFS by monitoring the feedback signal from the solenoid controlled valves. When such malfunction as case that, for example, low voltage should be inputted but High voltage is inputted and vice versa), PCM decides that VFS is malfunctioning and gives this code.

DTC DETECTING CONDITION

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check oil pressure and feedback current value	• Open or short in circuit • Faulty VFS SOLENOID VALVE • Faulty PCM
Enable Conditions	• Engine state=Run • Engine runtime >0.5 secs • Battery voltage>11V and 16V • Transmission relay state : Relay on • Gear shifting is completed	
Threshold value	• When the PCM detects electric or electronic abnormalness such as short circuit or out of range voltage	
Diagnostic Time	• More than 5 seconds	
Fail Safe	• Stop the VFS control	

SPECIFICATION

Solenoid Valve for Pressure Control

- Sensor type : Normal open 3-way
- Operating temperature : -22~266°F(-30°C~130°C)
- Frequency :
  - LR, 2ND, UD, OD, RED : 61.27Hz (at the ATF temp. -20°C above)
  - DCC : 30.64Hz
  - VFS : 600 ± 20Hz
- Internal resistance :
  - 2.6~3.4Ω(68°F or 20°C) - LR, 2ND, UD, OD, RED, DCC
  - 4.0~4.7Ω(68°F or 20°C) - VFS
- Surge voltage : 56 V(except VFS)

Type: 3 way VFS valve for hydraulic control
Dither Frequency : 600±20 Hz
Sweep time : 20 sec
VFS Control pressurs

Input Current(mA)	Control Pressure (No line pressure)			
	Increasing Current			Decreasing Current
	MAX. (Kgf/cm²) [Kpa]	MIN. (Kgf/cm²) [Kpa]	Δ (Kgf/cm²) [Kpa]	MIN. (Kgf/cm²) [Kpa]
100	6.52 [639]	5.87 [575]	[64]	
200	6.23 [611]	5.70 [559]	[52]	5.43 [532]
300	5.76 [564]	5.24 [514]	[50]	4.49 [484]
400	5.08 [498]	4.59 [450]	[48]	4.30 [421]
500	4.24 [416]	3.78 [370]	[46]	3.52 [345]
700	2.29 [224]	1.82 [178]	[46]	1.51 [148]
800	1.41 [138]	0.09 [88]	[50]	0.58 [57]
900	0.65 [64]	0.14 [14]	[50]	0 [0]
1,000	0.24 [24]	0 [0]	[24]	
1,100	0.24 [24]	0 [0]	[24]	

*Test condition
Ps : Supply Pressure (Ps = 7.1±0.3 KGf/cm²)
Pc : Control Pressure
Pex : Exhaust Pressure (Atmosphere pressure)

ATF : DIAMOND ATF SP-III
ATF temperature : 30±3°C (86°F)
- Coil resistance : 4.35±35Ω
- Dither freauency : 600±20Hz
In case of VFS solenoid valve, the relation between duty and oil pressure can't be expressed.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and then go to "Verification of vehicle repair" procedure.

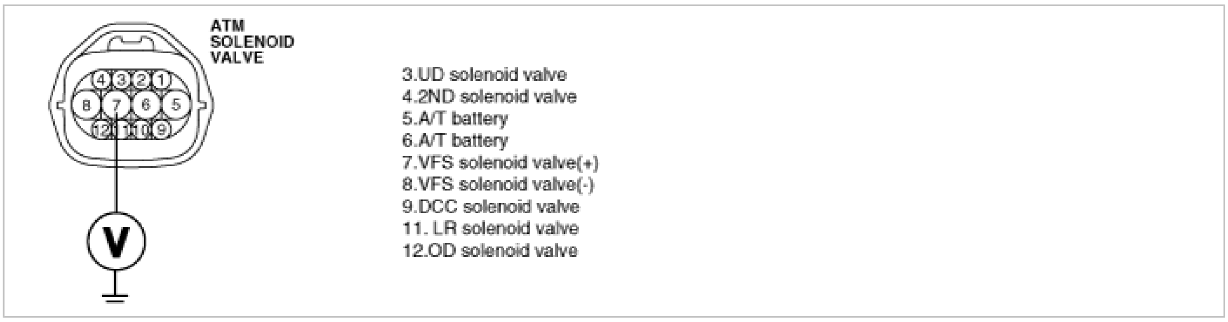
NO

▸ Go to "Power supply circuit inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Disconnect "ATM SOLENOID VALVE" connector.
2. Measure voltage between teminal "7" of the sensor harness connector and chassis ground.
3. Turn ignition switch OFF → ON

Specification: 12V is measured only for approx. 0.5sec



4. Is voltage within specifications?

YES

▸ Go to "Signal circuit inspection" procedure.

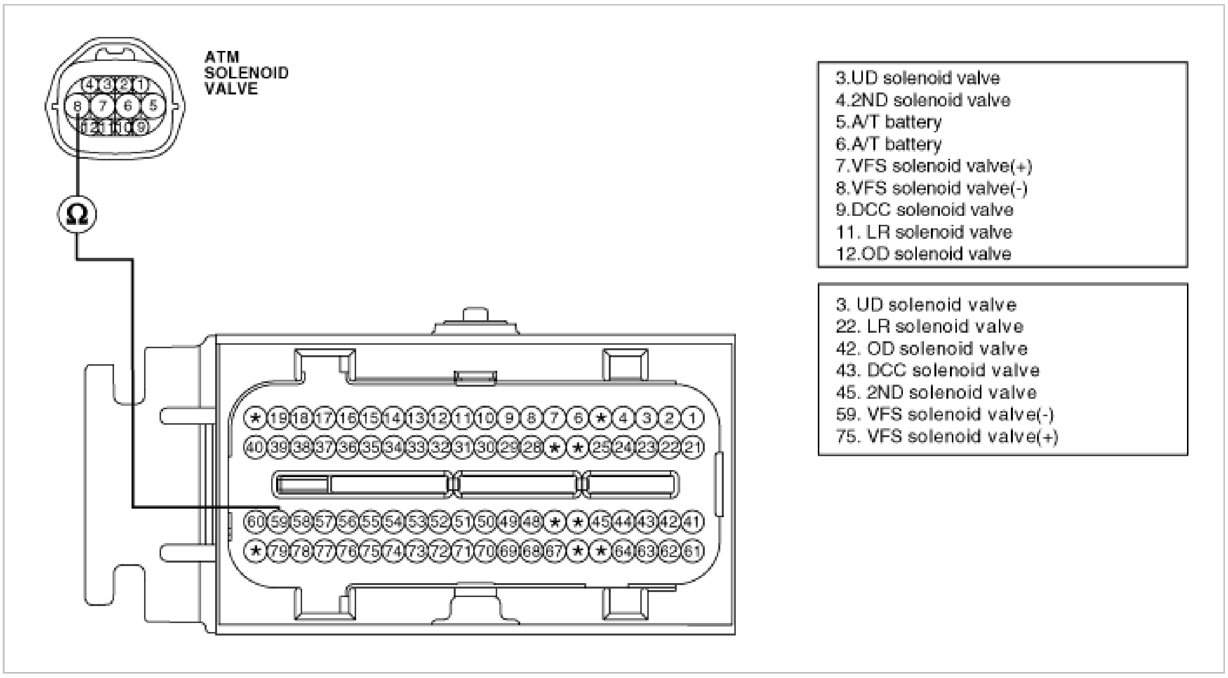
NO

▸ Check that A/T-20A fuse in engine room junction is installed or not blown.
▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check signal circuit open inspection.
   (1) Ignition "OFF".
   (2) Disconnect "ATM SOLENOID VALVE" connector and "PCM" connector.
   (3) Measure resistance between terminal "8" of the ATM SOLENOID VALVE harness connector and terminal "59" of the PCM harness connector.

   Specification: approx. 0 Ω



(4) Is resistance within specifications?

YES

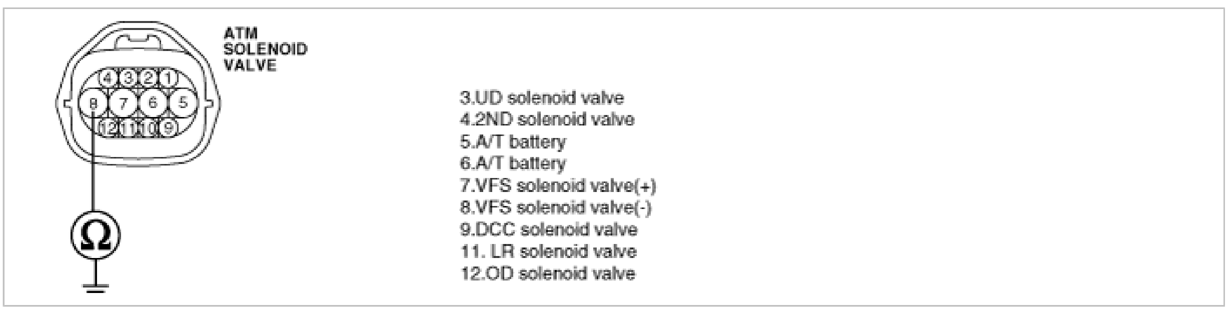
▸ Go to "Check signal circuit short inspection" procedure.

NO

▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

2. Check signal circuit short inspection
   (1) Ignition "OFF".
   (2) Disconnect "ATM SOLENOID VALVE" connector and "PCM" connector
   (3) Measure resistance between terminal "8" of the ATM SOLENOID VALVE harness and chassis ground.

Specification: Infinite



(4) Is resistance within specifications?

YES

▸ Go to "Component inspection" procedure.

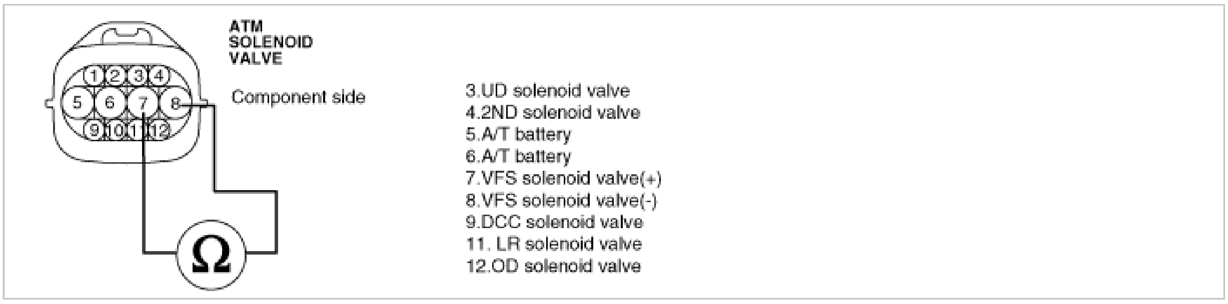
NO

▸ Check for short to ground in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

COMPONENT INSPECTION

1. CHECK SOLENOID VELVE
   (1) Ignition "OFF".
   (2) Disconnect "ATM SOLENOID VALVE" connector.
   (3) Measure resistance between terminal "7" and terminal "8" of the ATM SOLENOID VALVE harness connector.

Specification: Approximately 4.0~4.7 Ω [20°C(68°F)]



(4) Is resistance within specification?

YES

▸ Go to "CHECK PCM" as below.

NO

▸ Replace VFS SOLENOID VALVE as necessary and go to "Verification vehicle repair" procedure.

2. CHECK PCM
   (1) Connect scantool to data link connector(DLC).

   (2) Ignition "ON" & Engine "OFF".

   (3) Select A/T Solenoid valve Actuator test and Operate Actuator test.

   (4) Can you hear operating sound for VFS SOLENOID VALVE actuator testing function?

   YES

   ▸ Go to "Verification vehicle repair" procedure.

   NO

   ▸ Replace PCM as necessary and go to "Verification vehicle repair" procedure.

   ACTUATOR TEST CONDITION

   A. IG SWITCH ON
   B. TRANSAXLE RANGE SWITCH is normal
   C. P RANGE
   D. Vehicle Speed 0km/h
   E. Throttle position sensor< 1V
   F. IDLE SWITCH ON
   G. ENGINE RPM 0

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present?

YES

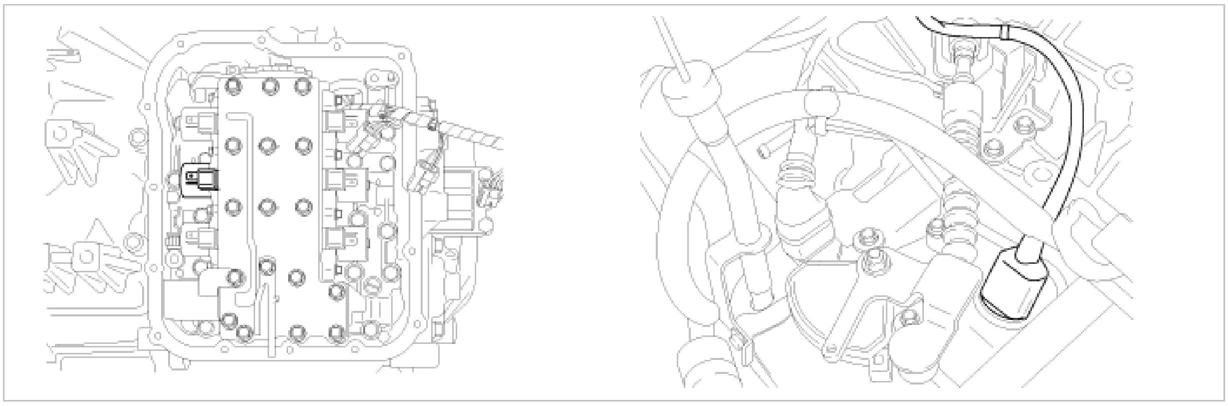
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P0750

COMPONENT LOCATION



GENERAL DESCRIPTION

The Automatic transmission changes the gear position of the transmission by utilizing a combination of clutches and brakes, which are controlled by solenoid valves. This automatic transmission consists of a: LR (Low and Reverse Brake), 2ND (2nd Brake), UD (Under Drive Clutch), OD (Over Drive Clutch), REV (Reverse Clutch), and a RED (Reduction Brake, only for 5 speed transmissions). The LR brake is engaged in the 1st gear and P/R/N gear positions.

DTC DESCRIPTION

The PCM checks the low and reverse control signal by monitoring the feedback signal from the solenoid valve drive circuit. If an unexpected signal is monitored (for example, high voltage is detected when low voltage is expected, or low voltage is detected when high voltage is expected), the PCM judges that the low and reverse control solenoid circuit is malfunctioning and sets this code.

DTC DETECTING CONDITION

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check voltage range	• Open or short in circuit • Faulty LR SOLENOID VALVE • Faulty PCM
Enable Conditions	• Engine state=Run • Engine runtime >0.5 secs • Battery voltage >11V and 16 V • Transmission relay state : Relay on • Gear shifting is completed	
Threshold value	• When the PCM detects electric or electronic abnormalness such as short circuit or out of range voltage.	
Diagnostic Time	• More than 5 seconds	
Fail Safe	• Locked in 3rd gear.(Control relay off)	

SPECIFICATION

Solenoid Valve for Pressure Control

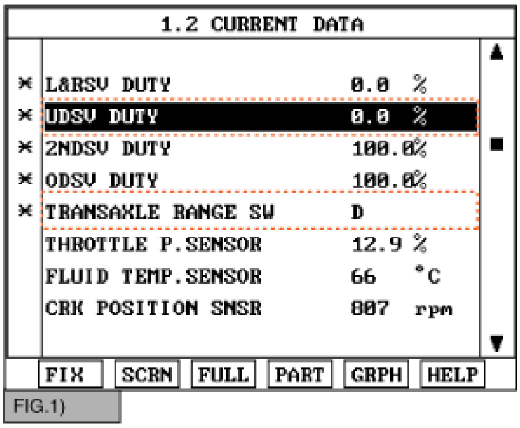
- Sensor type : Normal open 3-way
- Operating temperature : -22~266°F(-30°C~130°C)
- Frequency :
  - LR, 2ND, UD, OD, RED : 61.27Hz (at the ATF temp. -20°C above)
  - DCC : 30.64Hz
  - VFS : 600 ± 20Hzs
- Internal resistance :
  - 2.6~3.4Ω(68°F or 20°C) - LR, 2ND, UD, OD, RED, DCC
  - 4.0~4.7Ω(68°F or 20°C) - VFS
- Surge voltage : 56 V(except VFS)

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).

2. Engine "ON".
3. Monitor the "LR SOL. VALVE" parameter on the scantool.
4. Shift gear position 1st to 2nd.

Specification: 1st → 0%, 2nd → 100%



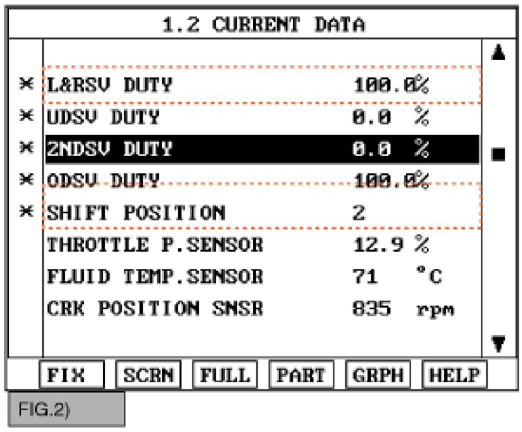


FIG. 1) 1st gear
FIG. 2) 2nd gear

5. Does "LR SOLENOID DUTY " follow the reference data?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification vehicle repair" procedure.

NO

▸ Go to "Terminal&connector inspection " procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and then go to "Verification of vehicle repair" procedure.

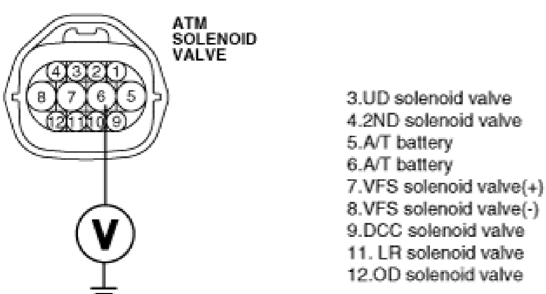
NO

▸ Go to "Power supply circuit inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Disconnect "ATM SOLENOID VALVE" connector.
2. Measure voltage between terminal "6" of the sensor harness connector and chassis ground.
3. Turn ignition switch OFF → ON.

Specification: 12V is measured only for approx. 0.5sec



4. Is voltage within specifications?

YES

▸ Go to "Signal circuit inspection" procedure.

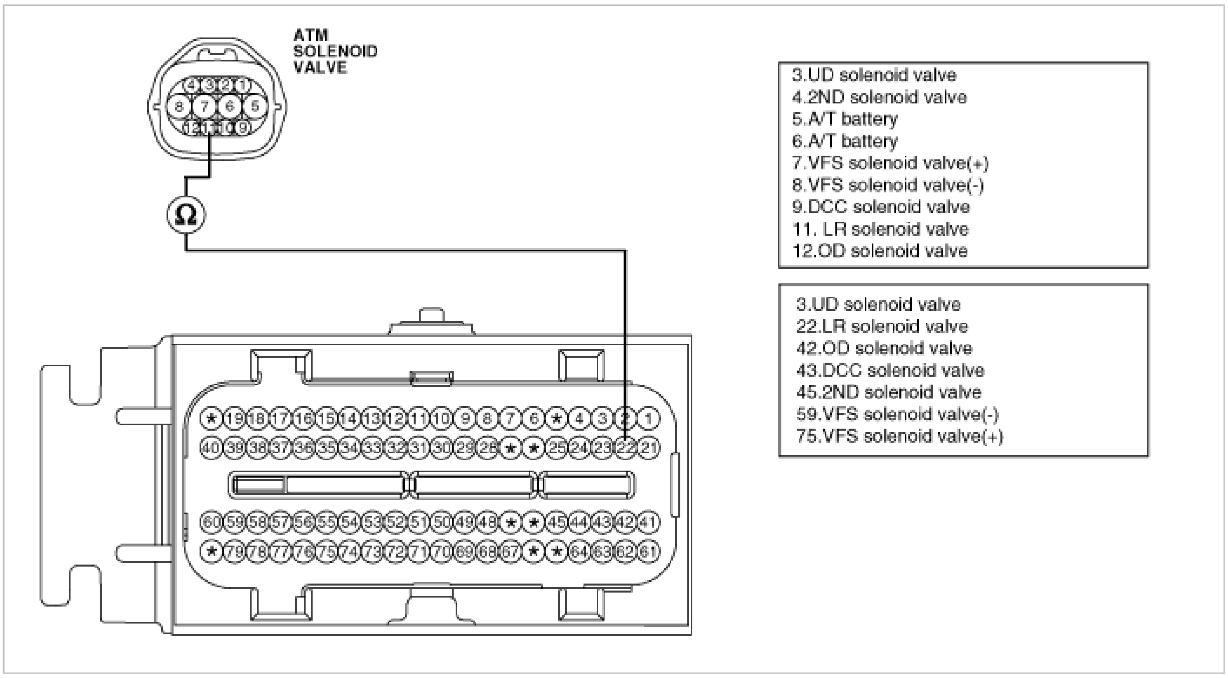
NO

▸ Check that A/T-20A fuse in engine room junction is installed or not blown.
▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check signal circuit open inspection
   (1) Ignition "OFF".
   (2) Disconnect "ATM SOLENOID VALVE" connector and "PCM" connector.
   (3) Measure resistance between terminal "11" of the ATM SOLENOID VALVE harness connector and terminal "22" of the PCM harness connector B.

   Specification: approx. 0 Ω



   (4) Is resistance within specifications?

   YES

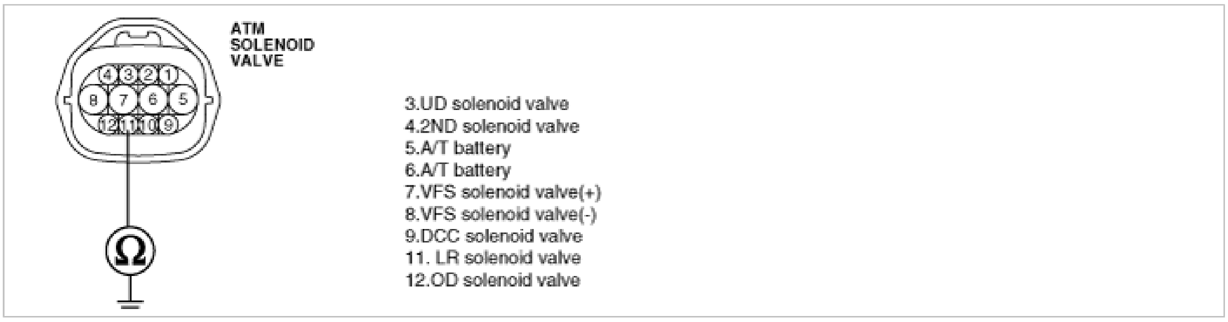
   ▸ Go to "Check signal circuit short inspection" procedure.

   NO

   ▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

2. Check signal circuit short inspection
   (1) Ignition "OFF".
   (2) Disconnect "ATM SOLENOID VALVE" connector and "PCM" connector.
   (3) Measure resistance between terminal "11" of the ATM SOLENOID VALVE harness and chassis ground.

   Specification: Infinite



(4) Is resistance within specifications?

YES

▸ Go to "Component inspection" procedure.

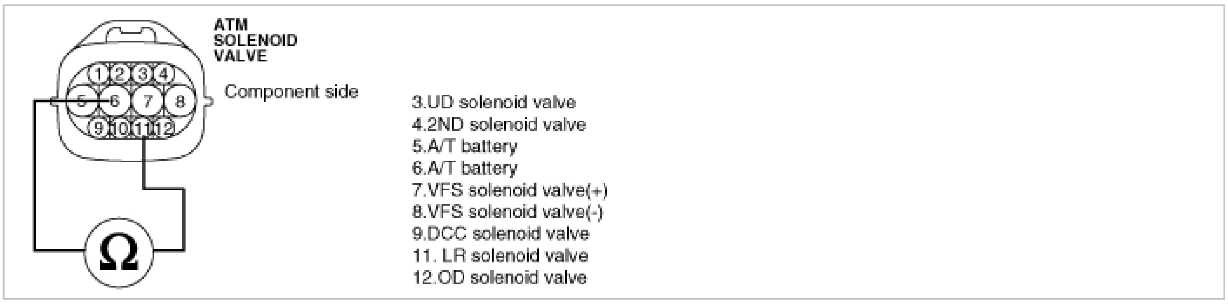
NO

▸ Check for short to ground in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

COMPONENT INSPECTION

1. CHECK SOLENOID VELVE
   (1) Ignition "OFF".
   (2) Disconnect "ATM SOLENOID VALVE" connector.
   (3) Measure resistance between terminal "11" and terminal "6" of the ATM SOLENOID VALVE harness connector.

Specification: Approximately 2.6~3.4 Ω [20°C(68°F)]



(4) Is resistance within specification?

YES

▸ Go to "CHECK PCM" as below.

NO

▸ Replace LR SOLENOID VALVE as necessary and go to "Verification vehicle repair" procedure.

2. CHECK PCM
   (1) Connect scantool to data link connector(DLC).
   (2) Ignition "ON" & Engine "OFF".
   (3) Select A/T solenoid valve actuator test and operate actuator test.
   (4) Can you hear operating sound for LR SOLENOID VALVE actuator testing function?

YES

▸ Go to "Verification vehicle repair" procedure.

NO

▸ Replace PCM as necessary and go to "Verification vehicle repair" procedure.

ACTUATOR TEST CONDITION

A. IG SWITCH ON
B. TRANSAXLE RANGE SWITCH is normal
C. P RANGE
D. Vehicle Speed 0km/h
E. Throttle position sensor < 1V
F. IDLE SWITCH ON
G. ENGINE RPM 0

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

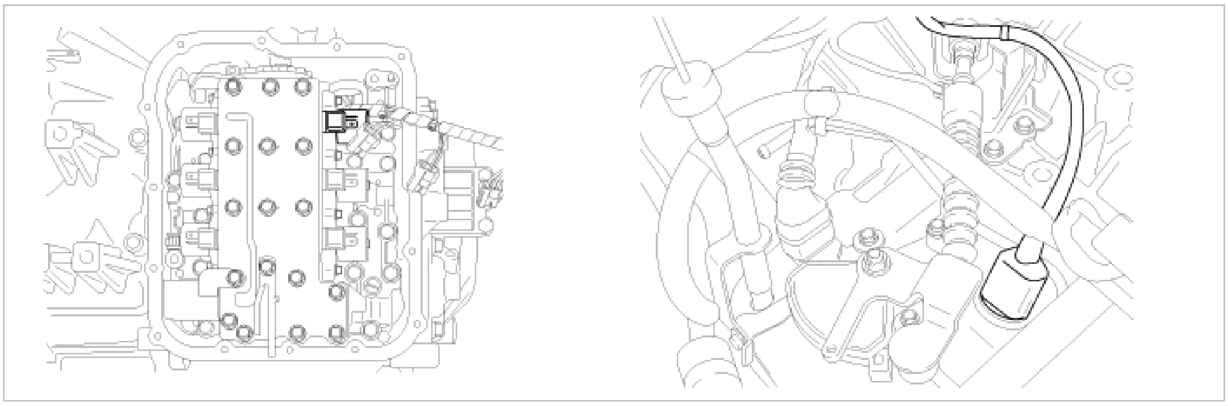
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P0755

COMPONENT LOCATION



GENERAL DESCRIPTION

The Automatic transmission changes the gear position of the transmission by utilizing a combination of clutches and brakes, which are controlled by solenoid valves. This automatic transmission consists of a: LR (Low and Reverse Brake), 2ND (2nd Brake), UD (Under Drive Clutch), OD (Over Drive Clutch), REV (Reverse Clutch), and a RED (Reduction Brake, only for 5 speed transmissions).
The UD clutch is engaged in the 1st/2nd/3rd/4th gear positions.

DTC DESCRIPTION

The PCM checks the UD clutch control signal by monitoring the feedback signal from the solenoid valve drive circuit. If an unexpected signal is monitored (for example, high voltage is detected when low voltage is expected, or low voltage is detected when high voltage is expected), the PCM judges that the UD clutch control solenoid circuit is malfunctioning and sets this code.

DTC DETECTING CONDITION

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check voltage range	• Open or short in circuit • Faulty UD SOLENOID VALVE • Faulty PCM
Enable Conditions	• Engine state=Run • Engine runtime >0.5 secs • Battery voltage >11V and 16 V • Transmission relay state : Relay on • Gear shifting is completed	
Threshold value	• When the PCM detects electric or electronic abnormalness such as short circuit or out of range voltage.	
Diagnostic Time	• More than 5 seconds	
Fail Safe	• Locked in 3rd gear.(Control relay off)	

SPECIFICATION

Solenoid Valve for Pressure Control

- Sensor type : Normal open 3-way
- Operating temperature : -22~266°F(-30°C~130°C)
- Frequency :
  - LR, 2ND, UD, OD, RED : 61.27Hz (at the ATF temp. -20°C above)
  - DCC : 30.64Hz
  - VFS : 600 ± 20Hzs
- Internal resistance :
  - 2.6~3.4Ω(68°F or 20°C) - LR, 2ND, UD, OD, RED, DCC
  - 4.0~4.7Ω(68°F or 20°C) - VFS
- Surge voltage : 56 V(except VFS)

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC)
2. Engine "ON".
3. Monitor the "UD SOL. VALVE" parameter on the scantool.
4. Shift gear position "N" to "D".

Specification: P/N → 100%, D → 0.0%

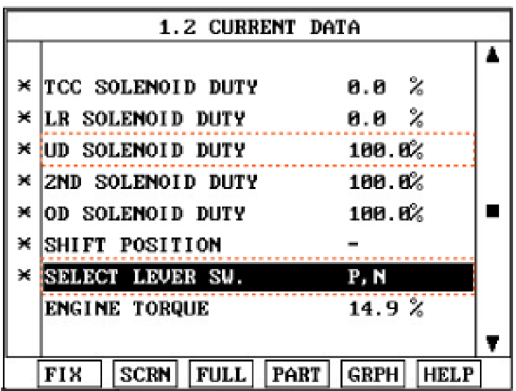


FIG.1)

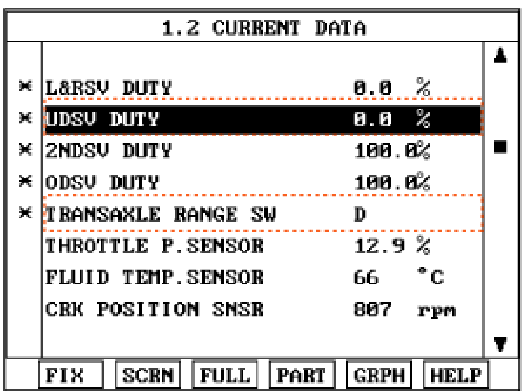


FIG.2)

FIG. 1) P/N Range
FIG. 2) D Range

5. Does "UD SOLENOID DUTY " follow the reference data?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification vehicle repair" procedure.

NO

▸ Go to "Terminal&connector inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and then go to "Verification of vehicle repair" procedure.

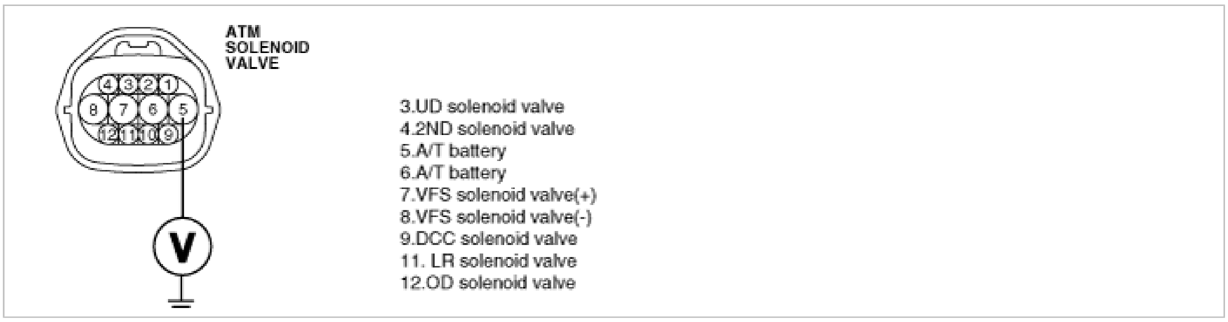
NO

▸ Go to "Power supply circuit inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Disconnect "ATM SOLENOID VALVE" connector.
2. Measure voltage between terminal "5" of the sensor harness connector and chassis ground.
3. Turn ignition switch OFF → ON.

Specification: 12V is measured only for approx. 0.5sec



4. Is voltage within specifications?

YES

▸ Go to "Signal circuit inspection" procedure.

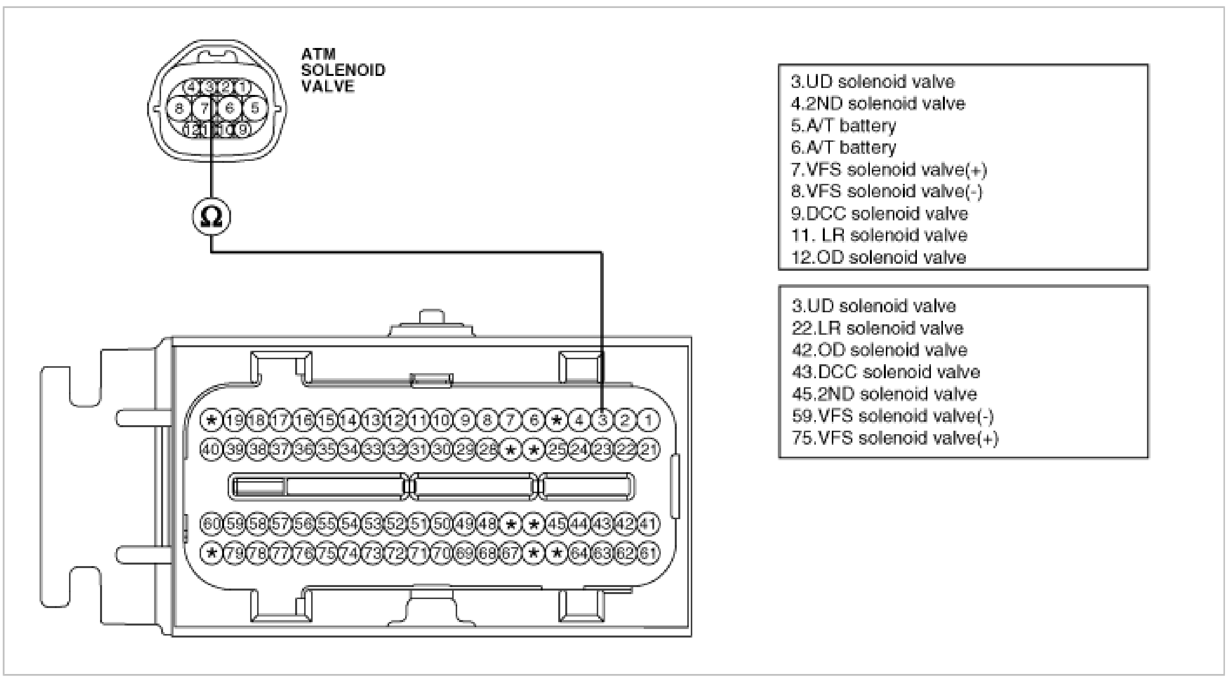
NO

▸ Check that A/T-20A fuse in engine room junction is installed or not blown.
▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check signal circuit open inspection
   (1) Ignition "OFF".
   (2) Disconnect "ATM SOLENOID VALVE" connector and "PCM" connector.
   (3) Measure resistance between terminal "3" of the ATM SOLENOID VALVE harness connector and terminal "3" of the PCM harness connector B.

   Specification: approx. 0 Ω



   (4) Is resistance within specifications?

YES

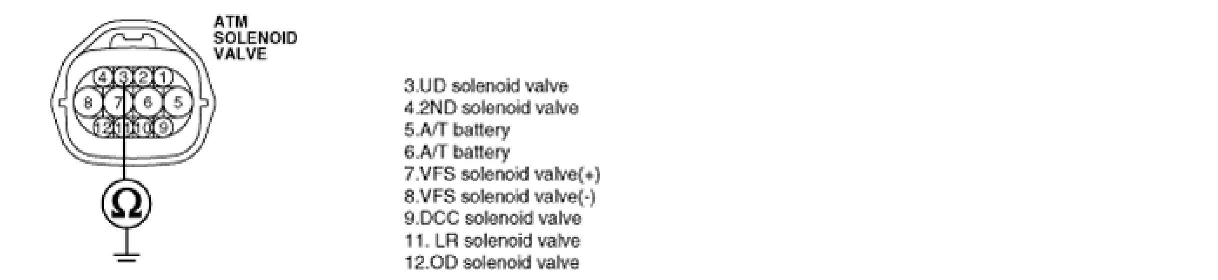
▸ Go to "Check signal circuit short inspection" procedure.

NO

▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

2. Check signal circuit short inspection
   (1) Ignition "OFF".
   (2) Disconnect "ATM SOLENOID VALVE" connector and "PCM" connector.
   (3) Measure resistance between terminal "3" of the ATM SOLENOID VALVE harness and chassis ground.

Specification: Infinite



   (4) Is resistance within specifications?

YES

▸ Go to "Component inspection" procedure.

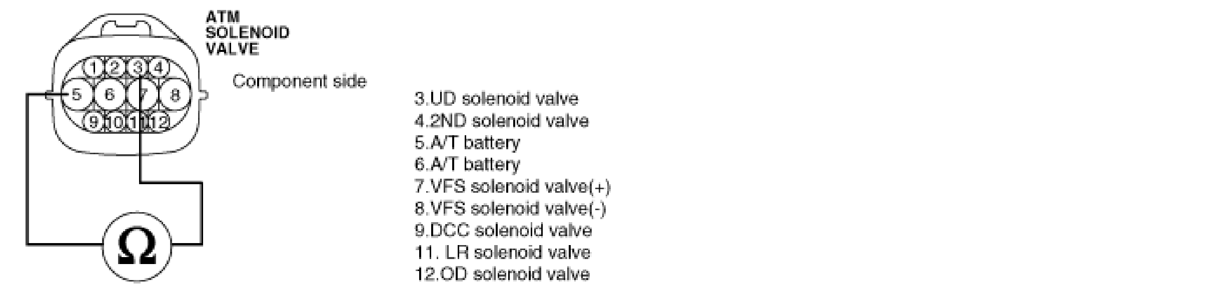
NO

▸ Check for short to ground in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

COMPONENT INSPECTION

1. CHECK SOLENOID VELVE
   (1) Ignition "OFF".
   (2) Disconnect "ATM SOLENOID VALVE" connector.
   (3) Measure resistance between terminal "3" and terminal "5" of the ATM SOLENOID VALVE harness connector.

Specification: Approximately 2.6~3.4 Ω [20°C(68°F)]



   (4) Is resistance within specification?

YES

▸ Go to "CHECK PCM" as below.

NO

▸ Replace UD SOLENOID VALVE as necessary and go to "Verification vehicle repair" procedure.

2. CHECK PCM
   (1) Connect scantool to data link connector(DLC).
   (2) Ignition "ON" & Engine "OFF".
   (3) Select ATM solenoid valve actuator test and operate actuator test.
   (4) Can you hear operating sound for UD SOLENOID VALVE actuator testing function?

YES

▸ Go to "Verification vehicle repair" procedure.

NO

▸ Replace PCM as necessary and go to "Verification vehicle repair" procedure.

ACTUATOR TEST CONDITION

A. IG SWITCH ON

B. TRANSAXLE RANGE SWITCH is normal
C. P RANGE
D. Vehicle Speed 0km/h
E. Throttle position sensor < 1V
F. IDLE SWITCH ON
G. ENGINE RPM 0

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

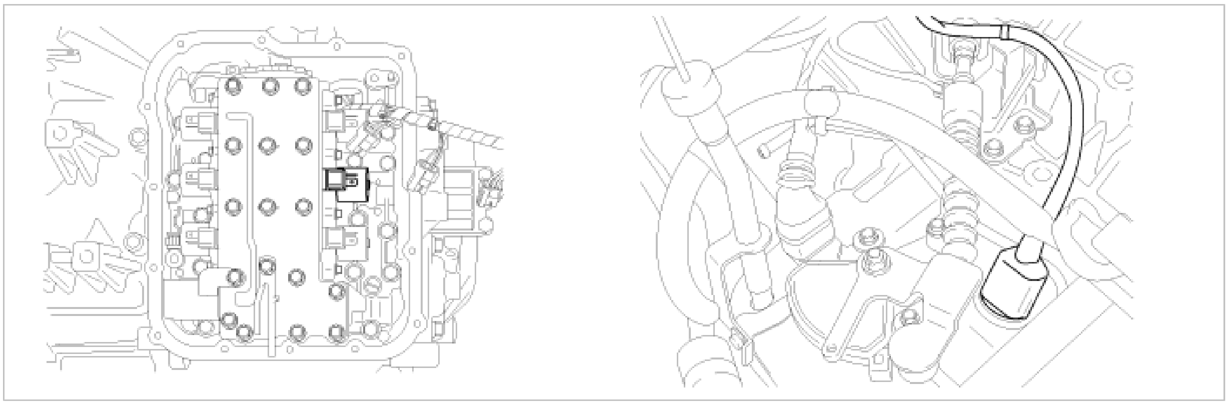
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P0760

COMPONENT LOCATION



GENERAL DESCRIPTION

The Automatic transmission changes the gear position of the transmission by utilizing a combination of clutches and brakes, which are controlled by solenoid valves. This automatic transmission consists of a: LR (Low and Reverse Brake), 2ND (2nd Brake), UD (Under Drive Clutch), OD (Over Drive Clutch), REV (Reverse Clutch), and a RED (Reduction Brake, only for 5 speed transmissions).
The 2ND brake is engaged in the 2nd and 5th gear positions.

DTC DESCRIPTION

The PCM checks the 2ND brake control signal by monitoring the feedback signal from the solenoid valve drive circuit. If an unexpected signal is monitored (for example, high voltage is detected when low voltage is expected, or low voltage is detected when high voltage is expected), the PCM judges that the 2ND brake control solenoid circuit is malfunctioning and sets this code.

DTC DETECTING CONDITION

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check voltage range	• Open or short in circuit • Faulty 2nd SOLENOID VALVE • Faulty PCM
Enable Conditions	• Engine state=Run • Engine runtime >0.5 secs • Battery voltage >11V and 16 V • Transmission relay state : Relay on • Gear shifting is completed	

Threshold value	• When the PCM detects electric or electronic abnormalness such as short circuit or out of range voltage.	
Diagnostic Time	• More than 5 seconds	
Fail Safe	• Locked in 3rd gear.(Control relay off)	

SPECIFICATION

Solenoid Valve for Pressure Control

- Sensor type : Normal open 3-way
- Operating temperature : -22~266°F(-30°C~130°C)
- Frequency :
  - LR, 2ND, UD, OD, RED : 61.27Hz (at the ATF temp. -20°C above)
  - DCC : 30.64Hz
  - VFS : 600 ± 20Hzs
- Internal resistance :
  - 2.6~3.4Ω(68°F or 20°C) - LR, 2ND, UD, OD, RED, DCC
  - 4.0~4.7Ω(68°F or 20°C) - VFS
- Surge voltage : 56 V(except VFS)

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC)
2. Engine "ON".
3. Monitor the "2nd SOL. VALVE" parameter on the scantool.
4. Shift gear position 1st to 2nd.

Specification: 1st gear → 100%, 2nd gear → 0.0%

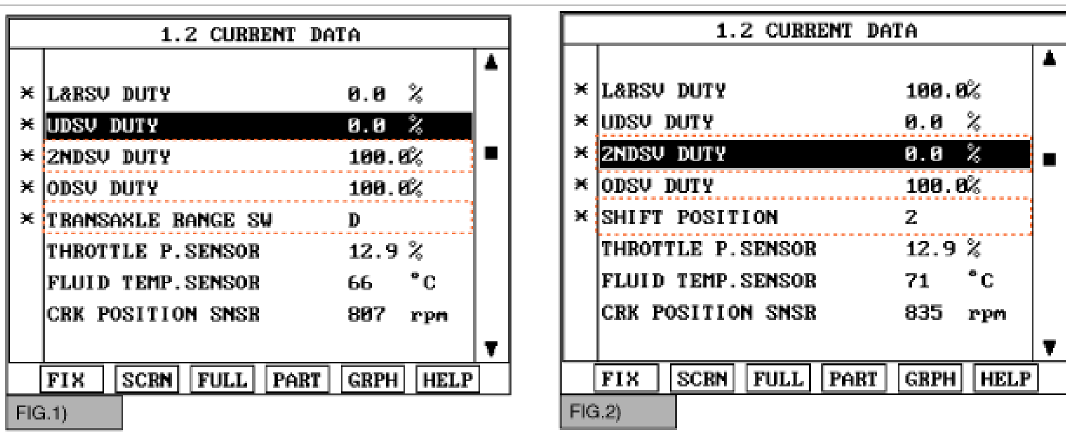


FIG. 1) 1st gear
FIG. 2) 2nd gear

5. Does "2nd SOLENOID DUTY " follow the reference data?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification vehicle repair" procedure.

NO

▸ Go to "Terminal&connector inspection " procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

YES

- Repair as necessary and then go to "Verification of vehicle repair" procedure.

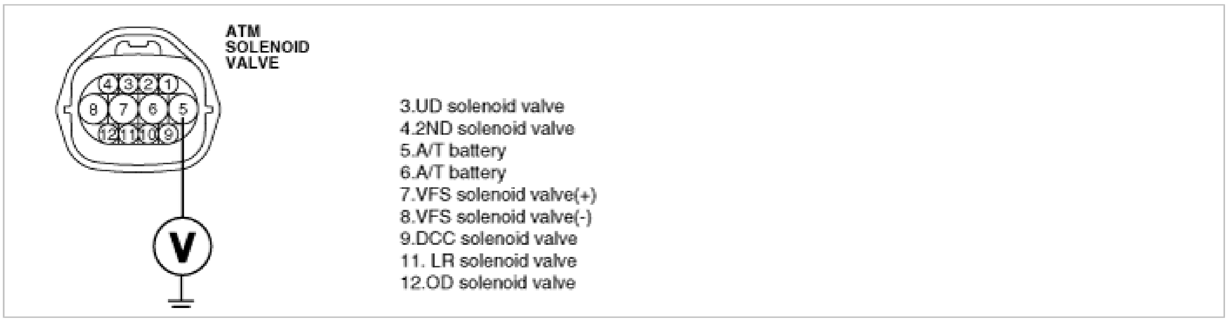
NO

- Go to "Power supply circuit inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Disconnect "ATM SOLENOID VALVE" connector.
2. Measure voltage between terminal "5" of the sensor harness connector and chassis ground.
3. Turn ignition switch OFF → ON.

Specification: 12V is measured only for approx. 0.5sec



4. Is voltage within specifications?

YES

- Go to "Signal circuit inspection" procedure.

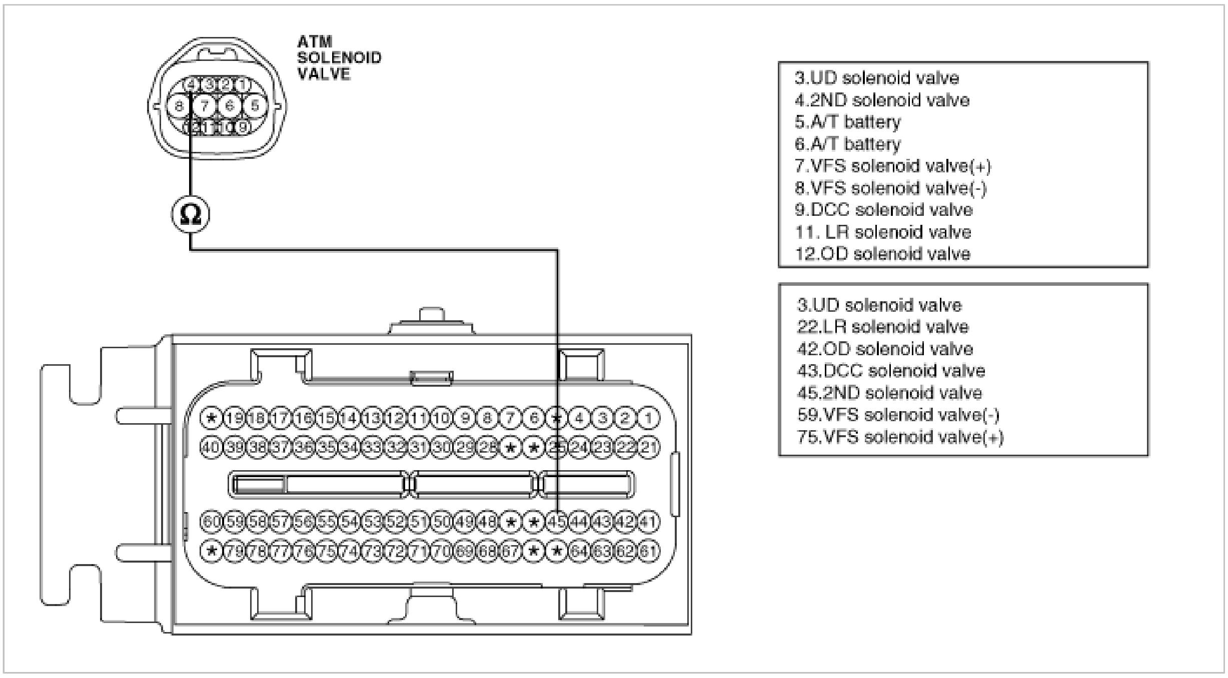
NO

- Check that A/T-20A fuse in engine room junction is installed or not blown.
- Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check signal circuit open inspection
   (1) Ignition "OFF".
   (2) Disconnect "ATM SOLENOID VALVE" connector and "PCM" connector.
   (3) Measure resistance between terminal "4" of the ATM SOLENOID VALVE harness connector and terminal "45" of the PCM harness connector B.

   Specification: approx. 0 Ω



(4) Is resistance within specifications?

YES

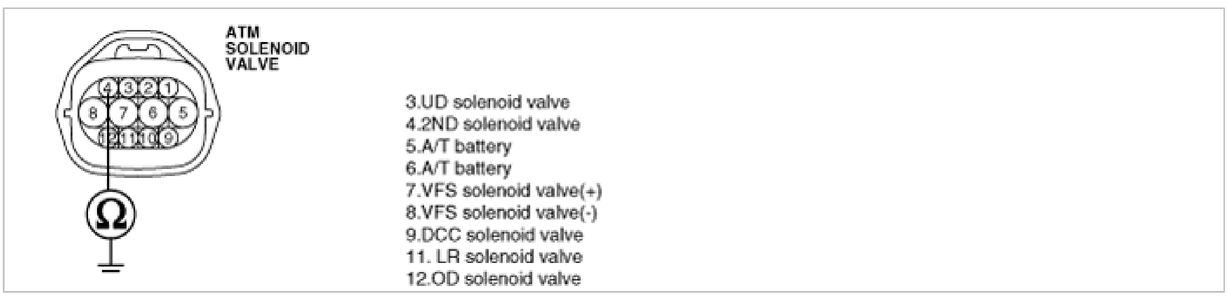
▸ Go to "Check signal circuit short inspection" procedure.

NO

▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

2. Check signal circuit short inspection
   (1) Ignition "OFF".
   (2) Disconnect "ATM SOLENOID VALVE" connector and "PCM" connector.
   (3) Measure resistance between terminal "4" of the ATM SOLENOID VALVE harness and chassis ground.

Specification: Infinite



(4) Is resistance within specifications?

YES

▸ Go to "Component inspection" procedure.

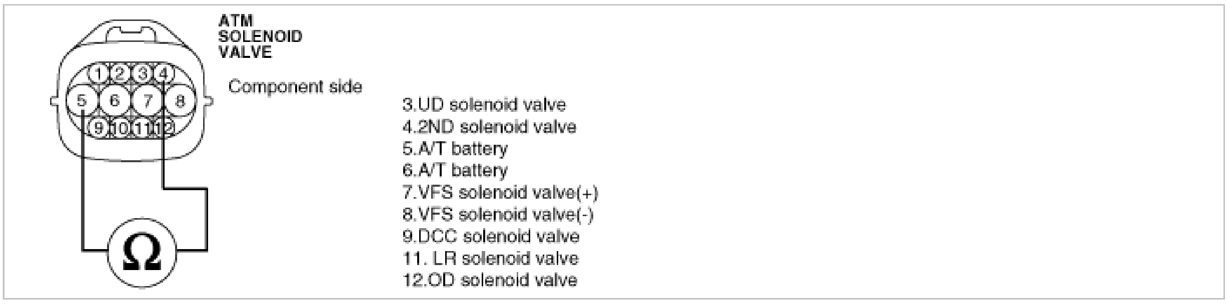
NO

▸ Check for short to ground in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

COMPONENT INSPECTION

1. CHECK SOLENOID VELVE
   (1) Ignition "OFF".
   (2) Disconnect "ATM SOLENOID VALVE" connector.
   (3) Measure resistance between terminal "4" and terminal "5" of the ATM SOLENOID VALVE harness connector.

Specification: Approximately 2.6~3.4 Ω [20°C(68°F)]



(4) Is resistance within specification?

YES

▸ Go to "CHECK PCM" as below.

NO

▸ Replace 2nd SOLENOID VALVE as necessary and go to "Verification vehicle repair" procedure.

2. CHECK PCM
   (1) Connect scantool to data link connector(DLC).
   (2) Ignition "ON" & Engine "OFF".
   (3) Select A/T solenoid valve actuator test and operate actuator test.
   (4) Can you hear operating sound for 2nd SOLENOID VALVE actuator testing function?

YES

▸ Go to "Verification vehicle repair" procedure.

NO

▸ Replace PCM as necessary and go to "Verification vehicle repair" procedure.

ACTUATOR TEST CONDITION

A. IG SWITCH ON
B. TRANSAXLE RANGE SWITCH is normal
C. P RANGE
D. Vehicle Speed 0km/h
E. Throttle position sensor < 1V
F. IDLE SWITCH ON
G. ENGINE RPM 0

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

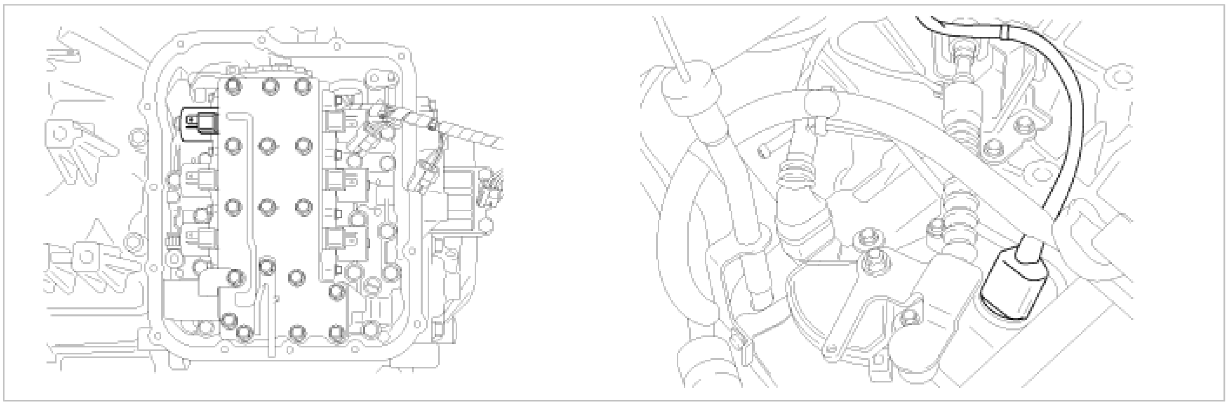
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P0765

COMPONENT LOCATION



GENERAL DESCRIPTION

The Automatic transmission changes the gear position of the transmission by utilizing a combination of clutches and brakes, which are controlled by solenoid valves. This automatic transmission consists of a: LR (Low and Reverse Brake), 2ND (2nd Brake), UD (Under Drive Clutch), OD (Over Drive Clutch), REV (Reverse Clutch), and a RED (Reduction Brake, only for 5 speed transmissions).
The OD clutch is engaged in the 3rd/4th/5th gear positions.

DTC DESCRIPTION

The PCM checks the OD clutch control signal by monitoring the feedback signal from the solenoid valve drive circuit. If an unexpected signal is monitored (for example, high voltage is detected when low voltage is expected, or low voltage is detected when high voltage is expected), the PCM judges that the OD clutch control solenoid circuit is malfunctioning and sets this code.

DTC DETECTING CONDITION

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check voltage range	• Open or short in circuit • Faulty OD SOLENOID VALVE • Faulty PCM
Enable Conditions	• Engine state=Run • Engine runtime >0.5 secs • Battery voltage >11V and 16 V • Transmission relay state : Relay on • Gear shifting is completed	
Threshold value	• When the PCM detects electric or electronic abnormalness such as short circuit or out of range voltage.	
Diagnostic Time	• More than 5 seconds	
Fail Safe	• Locked in 3rd gear.(Control relay off)	

SPECIFICATION

Solenoid Valve for Pressure Control

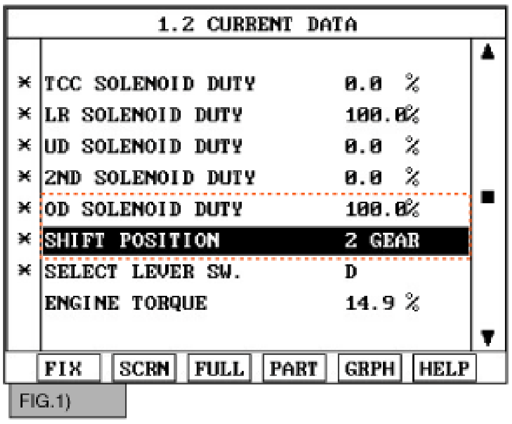
- Sensor type : Normal open 3-way
- Operating temperature : -22~266°F(-30°C~130°C)
- Frequency :
  - LR, 2ND, UD, OD, RED : 61.27Hz (at the ATF temp. -20°C above)
  - DCC : 30.64Hz
  - VFS : 600 ± 20Hzs
- Internal resistance :
  - 2.6~3.4Ω(68°F or 20°C) - LR, 2ND, UD, OD, RED, DCC
  - 4.0~4.7Ω(68°F or 20°C) - VFS
- Surge voltage : 56 V(except VFS)

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).

2. Engine "ON".
3. Monitor the "OD SOL. VALVE" parameter on the scantool.
4. Shift gear position 2nd to 3rd.

Specification: 2nd gear → 100%, 3rd gear → 0.0%



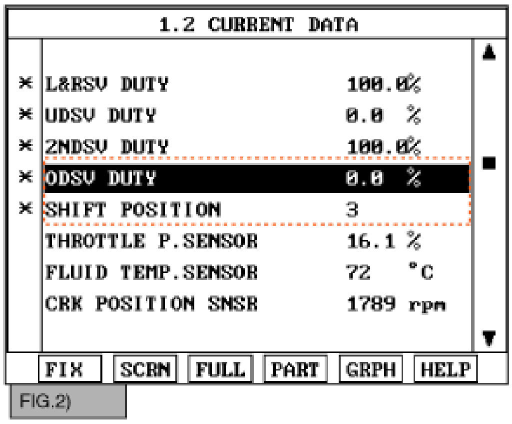


FIG. 1) 2nd gear
FIG. 2) 3rd gear

Does "OD SOLENOID DUTY " follow the reference data?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification vehicle repair" procedure.

NO

▸ Go to "Terminal&connector inspection " procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and then go to "Verification of vehicle repair" procedure.

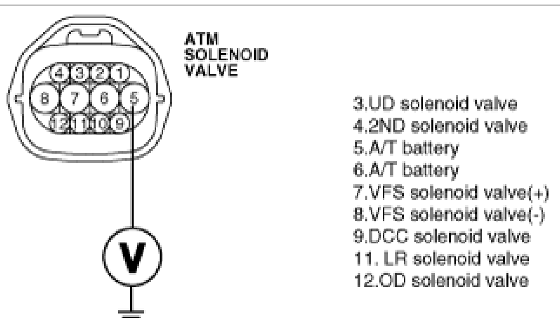
NO

▸ Go to "Power supply circuit inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Disconnect "ATM SOLENOID VALVE" connector.
2. Measure voltage between terminal "5" of the sensor harness connector and chassis ground.
3. Turn ignition switch OFF → ON.

Specification: 12V is measured only for approx. 0.5sec



4. Is voltage within specifications?

YES

▸ Go to "Signal circuit inspection" procedure.

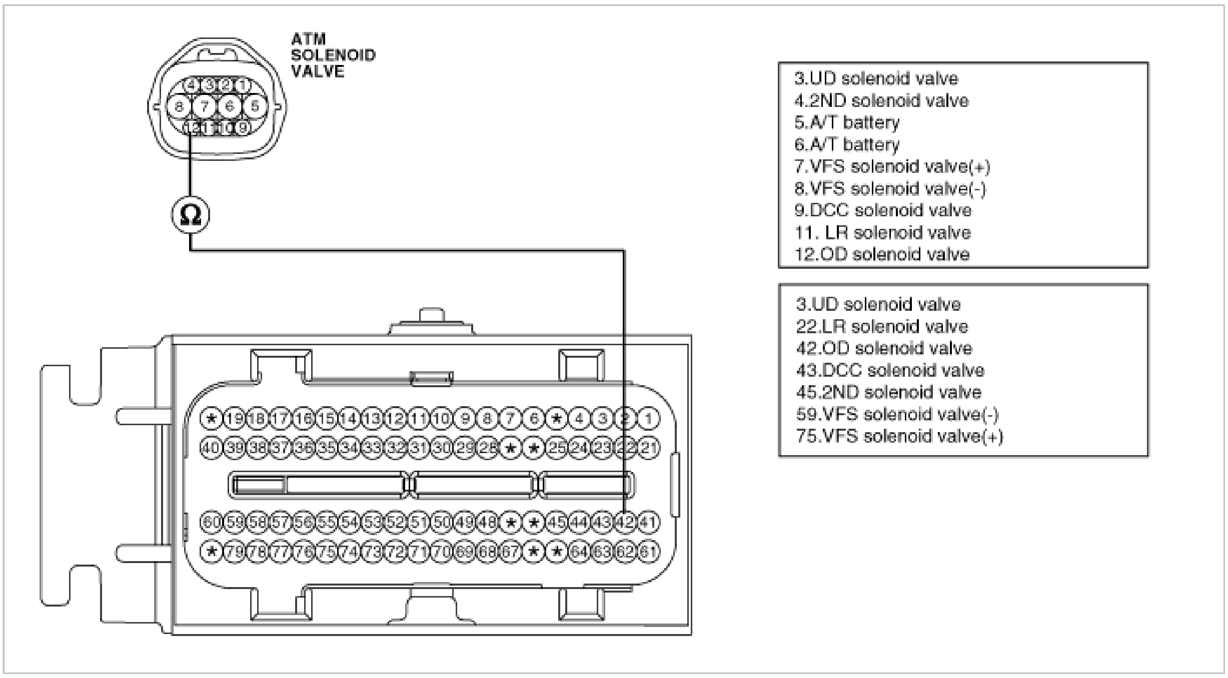
NO

▸ Check that A/T-20A fuse in engine room junction is installed or not blown.
▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check signal circuit open inspection
   (1) Ignition "OFF".
   (2) Disconnect "ATM SOLENOID VALVE" connector and "PCM" connector.
   (3) Measure resistance between terminal "12" of the ATM SOLENOID VALVE harness connector and terminal "42" of the PCM harness connector B.

   Specification: approx. 0 Ω



   (4) Is resistance within specifications?

   YES

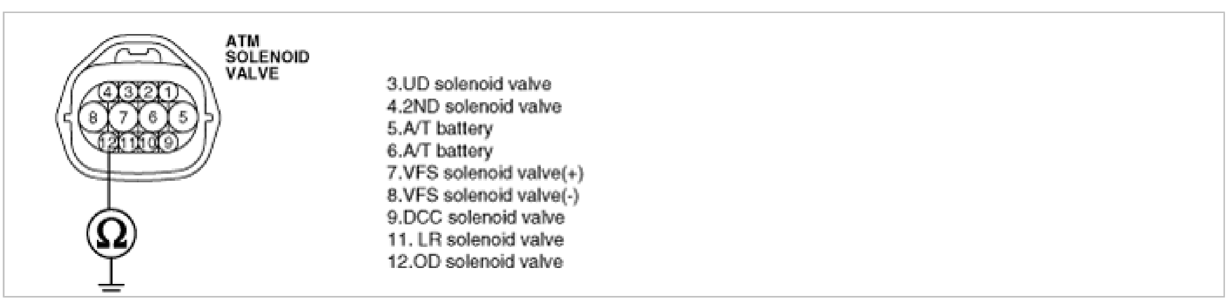
   ▸ Go to "Check signal circuit short inspection" procedure.

   NO

   ▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

2. Check signal circuit short inspection
   (1) Ignition "OFF".
   (2) Disconnect "ATM SOLENOID VALVE" connector and "PCM" connector.
   (3) Measure resistance between terminal "12" of the ATM SOLENOID VALVE harness and chassis ground.

   Specification: Infinite



   (4) Is resistance within specifications?

YES

▸ Go to "Component inspection" procedure.

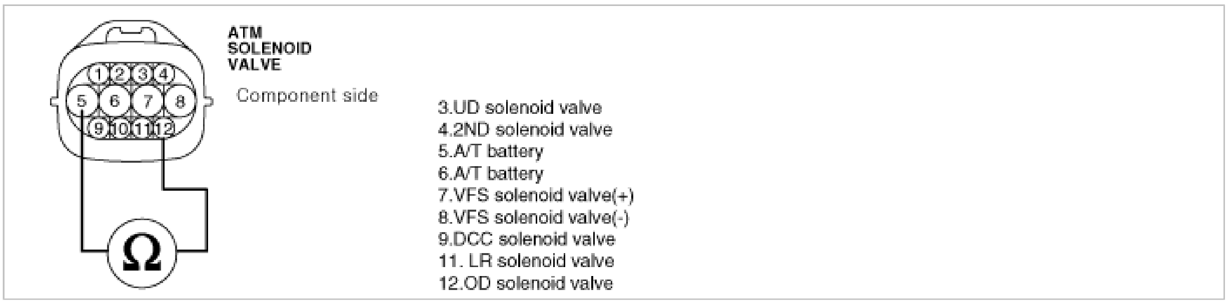
NO

▸ Check for short to ground in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

COMPONENT INSPECTION

1. CHECK SOLENOID VELVE
   (1) Ignition "OFF".
   (2) Disconnect "ATM SOLENOID VALVE" connector.
   (3) Measure resistance between terminal "12" and terminal "5" of the ATM SOLENOID VALVE harness connector.

   Specification: Approximately 2.6~3.4 Ω [20°C(68°F)]



   (4) Is resistance within specification?

YES

▸ Go to "CHECK PCM" as below.

NO

▸ Replace OD SOLENOID VALVE as necessary and go to "Verification vehicle repair" procedure.

2. CHECK PCM
   (1) Connect scantool to data link connector(DLC).
   (2) Ignition "ON" & Engine "OFF".
   (3) Select A/T solenoid valve actuator test and operate actuator test.
   (4) Can you hear operating sound for OD SOLENOID VALVE actuator testing function?

YES

▸ Go to "Verification vehicle repair" procedure.

NO

▸ Replace PCM as necessary and go to "Verification vehicle repair" procedure.

ACTUATOR TEST CONDITION

A. IG SWITCH ON
B. TRANSAXLE RANGE SWITCH is normal
C. P RANGE
D. Vehicle Speed 0km/h
E. Throttle position sensor < 1V
F. IDLE SWITCH ON
G. ENGINE RPM 0

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

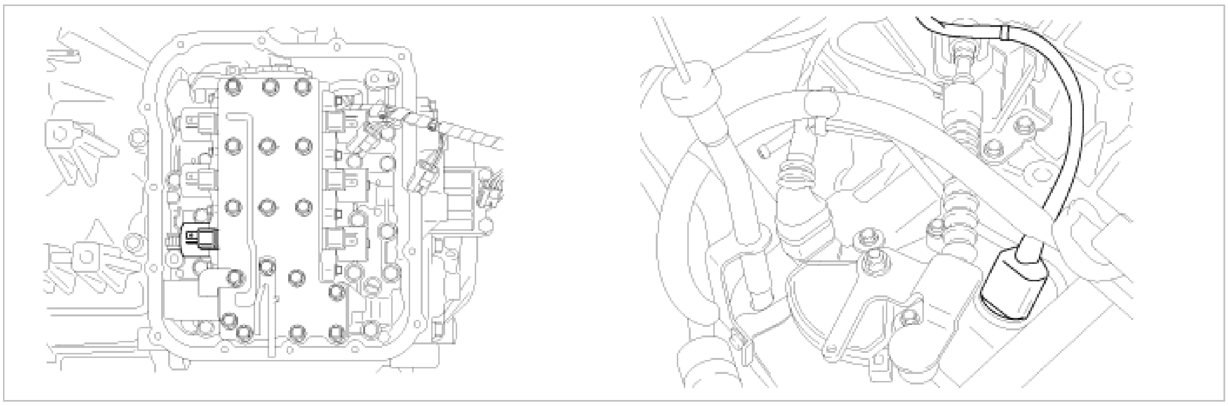
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P0770

COMPONENT LOCATION



GENERAL DESCRIPTION

The Automatic transmission changes the gear position of the transmission by utilizing a combination of clutches and brakes, which are controlled by solenoid valves. This automatic transmission consists of a: LR (Low and Reverse Brake), 2ND (2nd Brake), UD (Under Drive Clutch), OD (Over Drive Clutch), REV (Reverse Clutch), and a RED (Reduction Brake, only for 5 speed transmissions).
The RED clutch is engaged in the P/R/N/1st/2nd/3rd gear positions.

DTC DESCRIPTION

The PCM checks the RED clutch control signal by monitoring the feedback signal from the solenoid valve drive circuit. If an unexpected signal is monitored (for example, high voltage is detected when low voltage is expected, or low voltage is detected when high voltage is expected), the PCM judges that the RED clutch control solenoid circuit is malfunctioning and sets this code.

DTC DETECTING CONDITION

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check voltage range	• Open or short in circuit • Faulty RED SOLENOID VALVE • Faulty PCM
Enable Conditions	• Engine state=Run • Engine runtime >0.5 secs • Battery voltage >11V and 16 V • Transmission relay state : Relay on • Gear shifting is completed	
Threshold value	• When the PCM detects electric or electronic abnormalness such as short circuit or out of range voltage.	
Diagnostic Time	• More than 5 seconds	
Fail Safe	• Locked in 3rd gear.(Control relay off)	

SPECIFICATION

Solenoid Valve for Pressure Control

- Sensor type : Normal open 3-way
- Operating temperature : -22~266°F(-30°C~130°C)
- Frequency :
  - LR, 2ND, UD, OD, RED : 61.27Hz (at the ATF temp. -20°C above)
  - DCC : 30.64Hz
  - VFS : 600 ± 20Hzs
- Internal resistance :

- 2.6~3.4Ω(68°F or 20°C) - LR, 2ND, UD, OD, RED, DCC
- 4.0~4.7Ω(68°F or 20°C) - VFS

• Surge voltage : 56 V(except VFS)

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Engine "ON".
3. Monitor the "RED SOL. VALVE" parameter on the scantool.
4. Shift gear position 3nd to 4th.

Specification: 3rd gear → 0%, 4th gear → 100%

Does "RED SOLENOID DUTY " follow the reference data?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification vehicle repair" procedure.

NO

▸ Go to "Terminal&connector inspection " procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and then go to "Verification of vehicle repair" procedure.

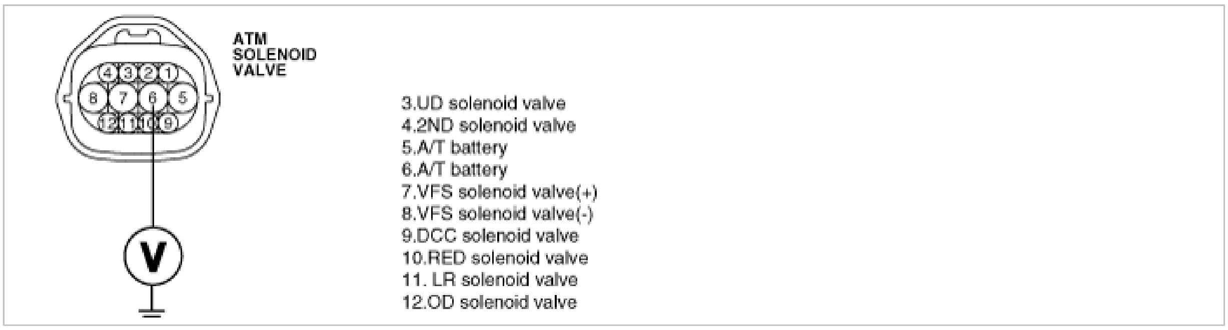
NO

▸ Go to "Power supply circuit inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Disconnect "ATM SOLENOID VALVE" connector.
2. Measure voltage between terminal "6" of the sensor harness connector and chassis ground.
3. Turn ignition switch OFF → ON.

Specification: 12V is measured only for approx. 0.5sec



4. Is voltage within specifications?

YES

▸ Go to "Signal circuit inspection" procedure.

NO

▸ Check that A/T-20A fuse in engine room junction is installed or not blown.
▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

SIGNAL CIRCUIT INSPECTION

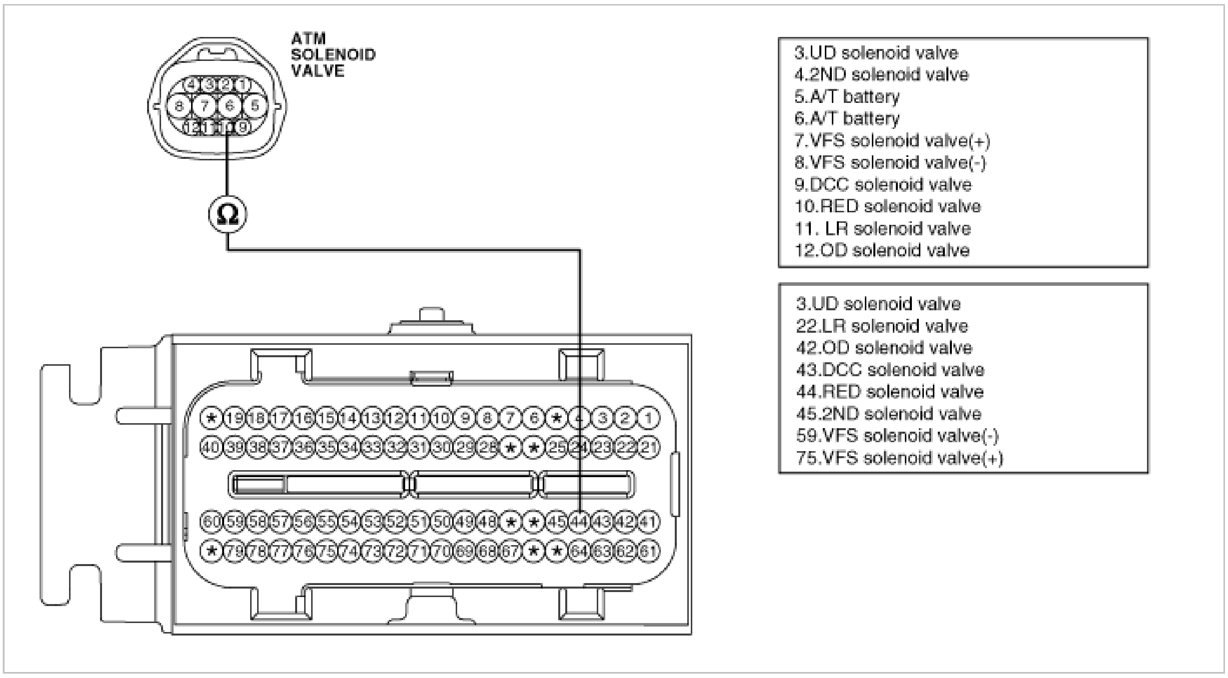
1. Check signal circuit open inspection

(1) Ignition "OFF".

(2) Disconnect "ATM SOLENOID VALVE" connector and "PCM" connector.

(3) Measure resistance between terminal "10" of the ATM SOLENOID VALVE harness connector and terminal "44" of the PCM harness connector B.

Specification: approx. 0 Ω



(4) Is resistance within specifications?

YES

▸ Go to "Check signal circuit short inspection" procedure.

NO

▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

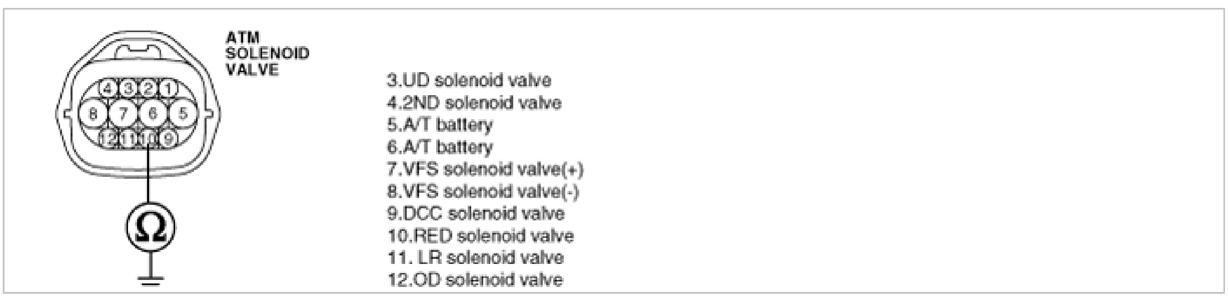
2. Check signal circuit short inspection

(1) Ignition "OFF".

(2) Disconnect "ATM SOLENOID VALVE" connector and "PCM" connector.

(3) Measure resistance between terminal "10" of the ATM SOLENOID VALVE harness and chassis ground.

Specification: Infinite



(4) Is resistance within specifications?

YES

▸ Go to "Component inspection" procedure.

NO

▸ Check for short to ground in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

COMPONENT INSPECTION

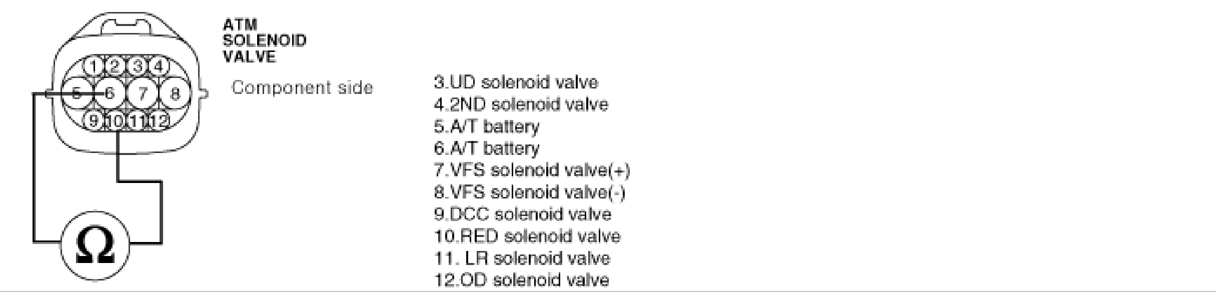
1. CHECK SOLENOID VELVE

(1) Ignition "OFF".

(2) Disconnect "ATM SOLENOID VALVE" connector.

(3) Measure resistance between terminal "6" and terminal "10" of the ATM SOLENOID VALVE harness connector.

Specification: Approximately 2.6~3.4 Ω [20°C(68°F)]



(4) Is resistance within specification?

YES

▸ Go to "CHECK PCM" as below.

NO

▸ Replace RED SOLENOID VALVE as necessary and go to "Verification vehicle repair" procedure.

2. CHECK PCM
   (1) Connect scantool to data link connector(DLC).

   (2) Ignition "ON" & Engine "OFF".

   (3) Select A/T solenoid valve actuator test and operate actuator test.

   (4) Can you hear operating sound for RED SOLENOID VALVE actuator testing function?

   YES

   ▸ Go to "Verification vehicle repair" procedure.

   NO

   ▸ Replace PCM as necessary and go to "Verification vehicle repair" procedure.

   ACTUATOR TEST CONDITION

   A. IG SWITCH ON
   B. TRANSAXLE RANGE SWITCH is normal
   C. P RANGE
   D. Vehicle Speed 0km/h
   E. Throttle position sensor < 1V
   F. IDLE SWITCH ON
   G. ENGINE RPM 0

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

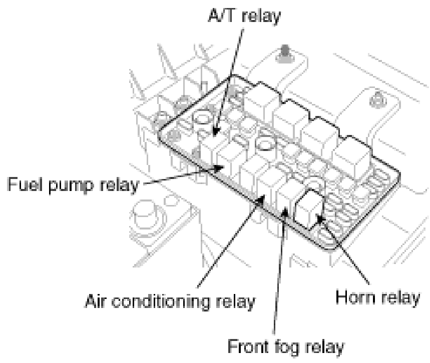
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P0885

COMPONENT LOCATION



GENERAL DESCRIPTION

The automatic transmission supplies power to the solenoid valves by way of a control relay. When the PCM sets the relay to ON, the relay operates and the battery power is supplied to all the sonenoid valves. When the PCM sets the relay to OFF, all solenoid valve power is shut off and the transmission is held in the 3rd gear position. (Fail Safe Mode)

DTC DESCRIPTION

The PCM checks the A/T control relay signal by monitoring the control signal. If, after the iginiton key is turned on, an unexpected voltage value, which is quite a bit lower than battery voltage, is detected, the PCM sets this code.
This code can also be set when the battery power fuse in the ignition switch has been shorted.

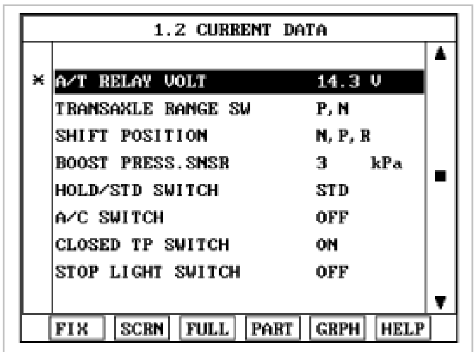
DTC DETECTING CONDITION

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check voltage range	• Open or short in circuit • Faulty A/T control relay • Faulty PCM
Enable Conditions	• Engine state=Run • Engine runtime >0.5 secs • Battery voltage >11V and 16 V • Transmission relay state : Relay on • Gear shifting is completed	
Threshold value	• PCM detects abnormally low voltage	
Diagnostic Time	• 2.375 second	
Fail Safe	• Locked in 3rd gear.(Control relay off)	

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Ignition "ON" & Engine "OFF".
3. Monitor the "A/T CON. RELAY VOLT" parameter on the scantool.

Specification : Approx. B+



4. Is A/T RELAY VOLT within specifications?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification vehicle repair" procedure.

NO

▸ Go to "Terminal&connector inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and then go to "Verification of vehicle repair" procedure.

NO

▸ Replace the PCM.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

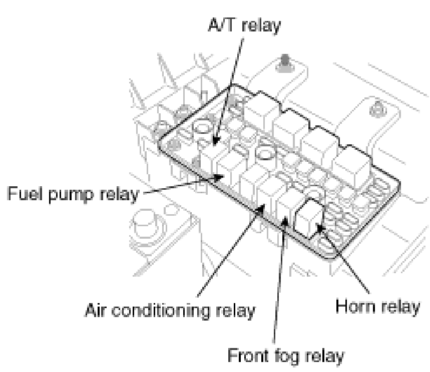
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P0890

COMPONENT LOCATION



GENERAL DESCRIPTION

The automatic transmission supplies power to the solenoid valves by way of a control relay. When the PCM sets the relay to ON, the relay operates and the battery power is supplied to all the sonenoid valves. When the PCM sets the relay to OFF, all solenoid valve power is shut off and the transmission is held in the 3rd gear position. (Fail Safe Mode)

DTC DESCRIPTION

The PCM checks the A/T control relay signal by monitoring the control signal. If, the voltage applied to A/T solenoids is lower than 0.5V, the PCM sets this code.

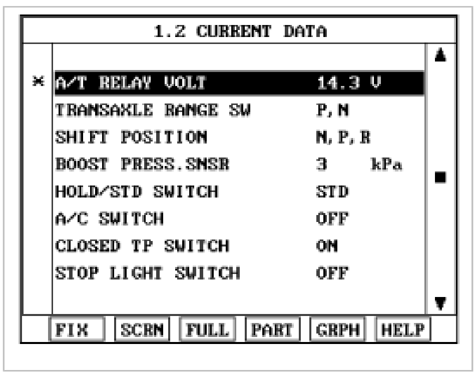
DTC DETECTING CONDITION

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check voltage range	• Open or short in circuit • Faulty A/T control relay • Faulty PCM
Enable Conditions	• Engine state≠Power off relay or engine shutdown process • Battery voltage>11V and<16V • A/T power relay is enabled • No TCM power relay diag fail	
Threshold value	• Voltage applied to A/T solenoids<= 0.5 V	
Diagnostic Time	• 2 seconds	
Fail Safe	• Locked in 3rd gear.(Control relay off)	

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Ignition "ON" & Engine "OFF".
3. Monitor the "A/T CON. RELAY VOLT" parameter on the scantool.

Specification : Approx. B+



4. Is A/T RELAY VOLT within specifications?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification vehicle repair" procedure.

NO

▸ Go to "Terminal&connector inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and then go to "Verification of vehicle repair" procedure.

NO

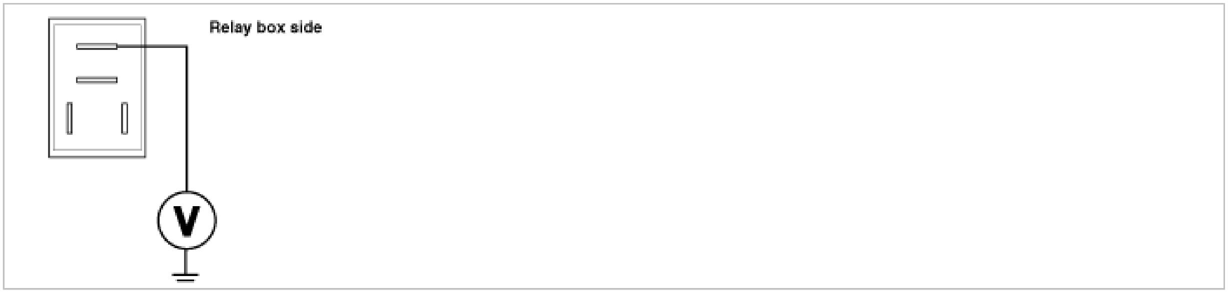
▸ Go to "Power supply circuit inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Disconnect the "A/T CONTROL RELAY" connector.
3. Measure the voltage between the power terminal of the "A/T CONTROL RELAY" in the engine room relay box and chassis

ground.

Specification : Approx. B+



4. Is voltage within specifications?

YES

▸ Go to "Signal circuit inspection" procedure.

NO

▸ Check that A/T-20A fuse in engine room junction is installed or not blown.
▸ Check for Open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. CHECK A/T control relay harness
   (1) Ignition "OFF".
   (2) Disconnect the "ATM CONTROL RELAY" connector.
   (3) Measure the voltage between terminal "60" of the "PCM" harness connector A and chassis ground.
   (4) Turn ignition switch OFF → ON.

   Specification: 12V is measured only for approx. 0.5sec

   (5) Is voltage within specifications?

   YES

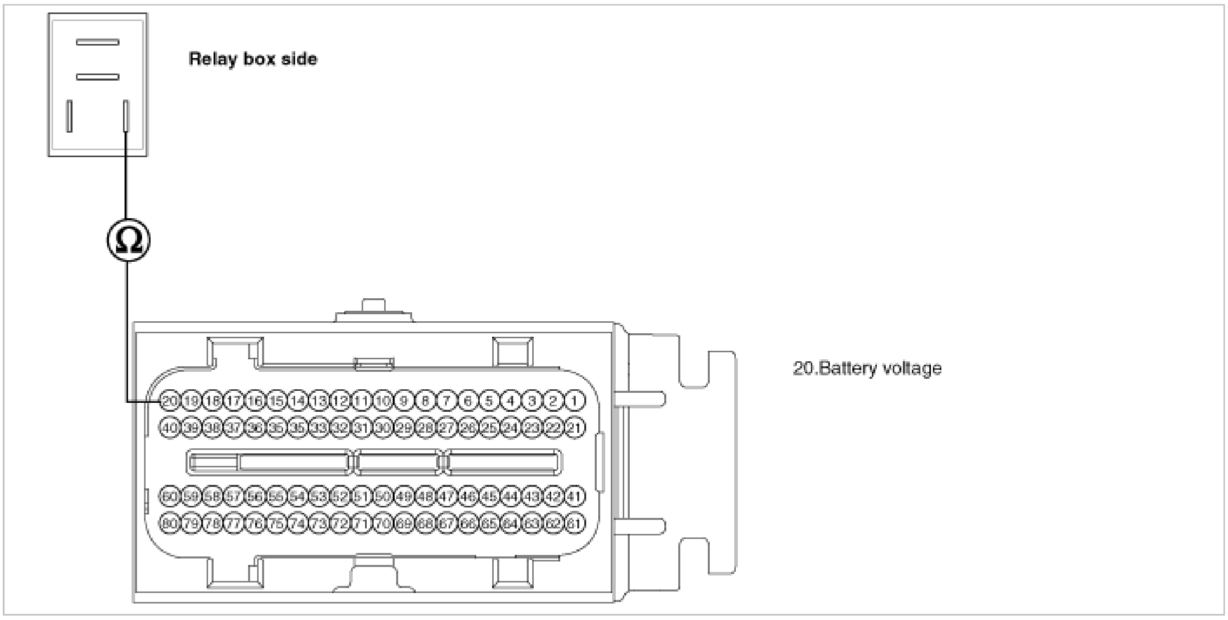
   ▸ Go to "Check supplying power to solenoid valve" procedure.

   NO

   ▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure
   ▸ If signal circuit is OK, Substitute with a known-good PCM and check for proper operation. If the problem is corrected, replace PCM and then go to "Verification of vehicle repair" procedure.

2. CHECK supplying power to solenoid valve harness
   (1) Ignition "OFF".
   (2) Disonnect the "ATM CONTROL RELAY" and PCM connector.
   (3) Measure the resistance between the terminal shown below of the "A/T CONTROL RELAY" in the engine room relay box and terminal "20" of the PCM harness connector A.

   Specification : Approx. 0 Ω



(4) Is resistance within specifications?

YES

▸ Go to "Ground circuit inspection" procedure.

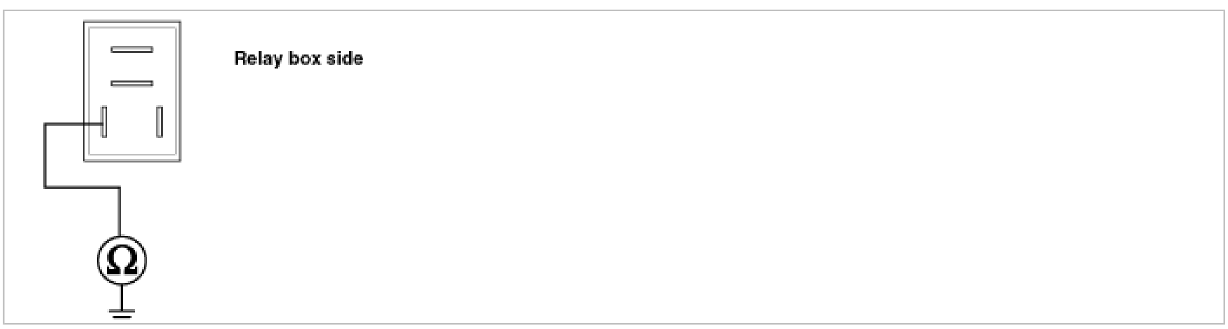
NO

▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

GROUND CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect the "A/T CONTROL RELAY" connector.
3. Measure the resistance between the terminal shown below of the "A/T CONTROL RELAY" in the engine room relay box and chassis ground.

Specification : Approx. 0 Ω



4. Is resistance within specifications?

YES

▸ Go to "Component inspection" procedure.

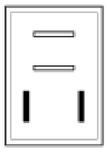
NO

▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Remove "A/T CONTROL RELAY"
3. Measure the resistance between each terminal of the sensor.

Specification: ∞ except between those two terminals below



4. Is resistance with in specification?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of vehicle repair" procedure.

NO

▸ Replace ATM CONTROL RELAY and then go to "Verification of vehicle repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

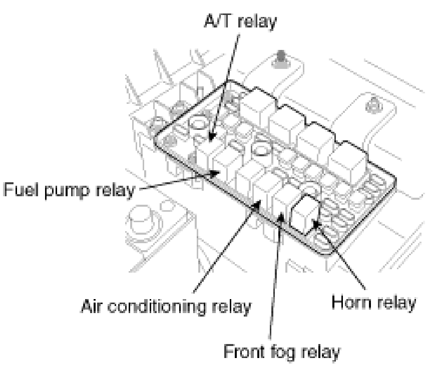
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P0891

COMPONENT LOCATION



GENERAL DESCRIPTION

The automatic transmission supplies power to the solenoid valves by way of a control relay. When the PCM sets the relay to ON, the relay operates and the battery power is supplied to all the sonenoid valves. When the PCM sets the relay to OFF, all solenoid valve power is shut off and the transmission is held in the 3rd gear position. (Fail Safe Mode)

DTC DESCRIPTION

The PCM checks the A/T control relay signal by monitoring the control signal. If, the voltage applied to A/T solenoids is higher than 20V, the PCM sets this code.

DTC DETECTING CONDITION

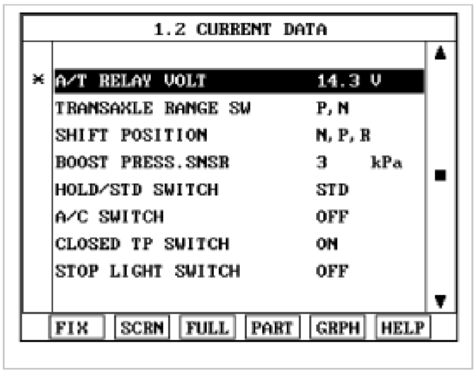
Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check voltage range	• Open or short in circuit • Faulty A/T control relay • Faulty PCM
	• Engine state≠Power off relay or engine shutdown process	

Enable Conditions	• Engine runtime >0.5 secs • Battery voltage >11V and 16 V • Transmission relay state : Relay on • Gear shifting is completed	
Threshold value	• Voltage applied to A/T solenoids>= 20 V	
Diagnostic Time	• 2 seconds	
Fail Safe	• Locked in 3rd gear.(Control relay off)	

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Ignition "ON" & Engine "OFF".
3. Monitor the "A/T CON. RELAY VOLT" parameter on the scantool.

Specification : Approx. B+



4. Is A/T RELAY VOLT within specifications?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification vehicle repair" procedure.

NO

▸ Go to "Terminal&connector inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and then go to "Verification of vehicle repair" procedure.

NO

▸ Go to "Power supply circuit inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Disconnect the "A/T CONTROL RELAY" connector.
3. Measure the voltage between the power terminal of the "A/T CONTROL RELAY" in the engine room relay box and chassis ground.

Specification : Approx. B+

4. Is voltage within specifications?

YES

▸ Go to "Signal circuit inspection" procedure.

NO

▸ Check that A/T-20A fuse in engine room junction is installed or not blown.
▸ Check for Open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. CHECK A/T control relay harness
   (1) Ignition "OFF".
   (2) Disconnect the "ATM CONTROL RELAY" connector.
   (3) Measure the voltage between terminal "60" of the "PCM" harness connector A and chassis ground.
   (4) Turn ignition switch OFF → ON.

   Specification: 12V is measured only for approx. 0.5sec

   (5) Is voltage within specifications?

   YES

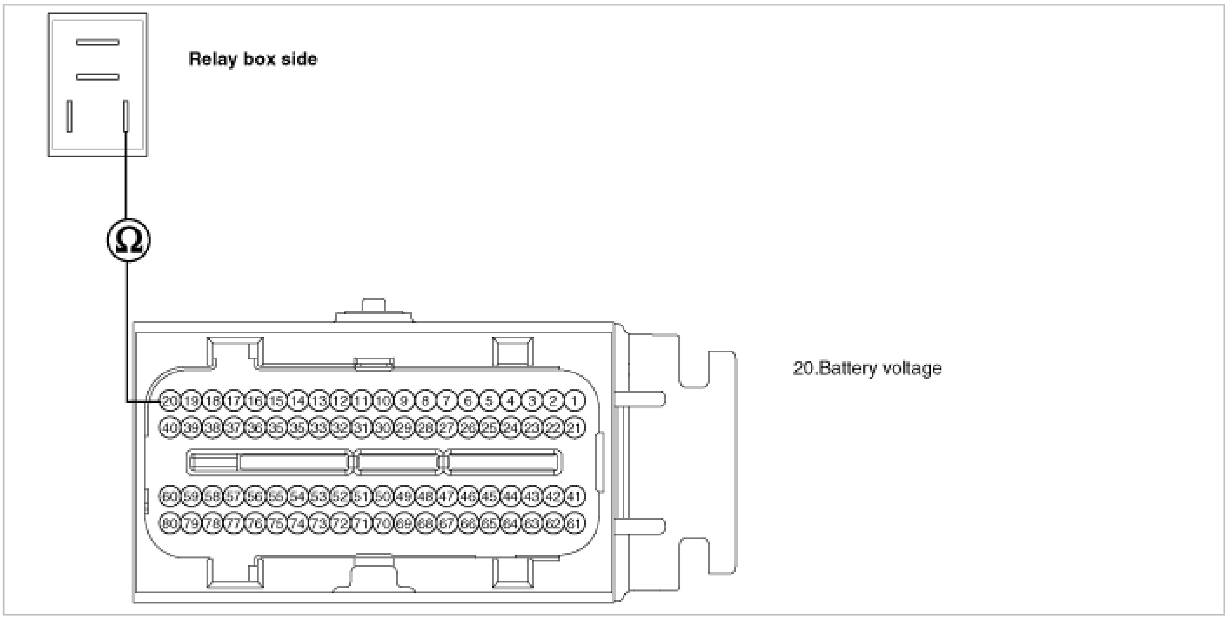
   ▸ Go to "Check supplying power to solenoid valve" procedure.

   NO

   ▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure
   ▸ If signal circuit is OK, Substitute with a known-good PCM and check for proper operation. If the problem is corrected, replace PCM and then go to "Verification of vehicle repair" procedure.

2. CHECK supplying power to solenoid valve harness
   (1) Ignition "OFF".
   (2) Disonnect the "ATM CONTROL RELAY" and PCM connector.
   (3) Measure the resistance between the terminal shown below of the "A/T CONTROL RELAY" in the engine room relay box and terminal "20" of the PCM harness connector A.

   Specification : Approx. 0 Ω



(4) Is resistance within specifications?

YES

▸ Go to "Ground circuit inspection" procedure.

NO

▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

GROUND CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect the "A/T CONTROL RELAY" connector.
3. Measure the resistance between the terminal shown below of the "A/T CONTROL RELAY" in the engine room relay box and chassis ground.

Specification : Approx. 0 Ω

4. Is resistance within specifications?

YES

▸ Go to "Component inspection" procedure.

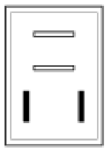
NO

▸ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Remove "A/T CONTROL RELAY"
3. Measure the resistance between each terminal of the sensor.

Specification: ∞ except between those two terminals below



AT relay component side

4. Is resistance with in specification?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of vehicle repair" procedure.

NO

▸ Replace ATM CONTROL RELAY and then go to "Verification of vehicle repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

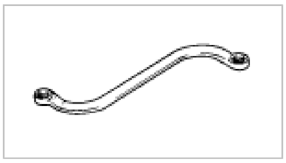
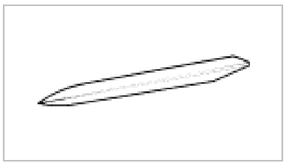
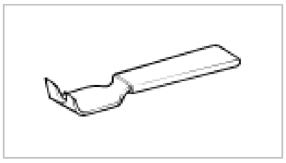
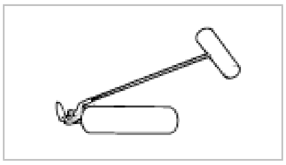
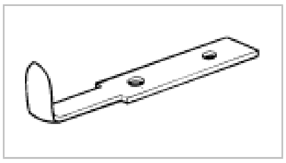
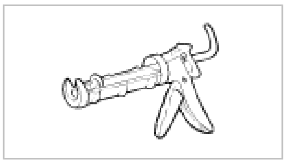
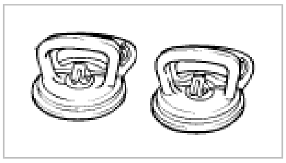
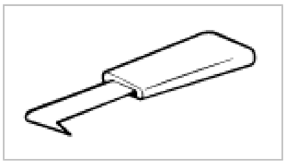
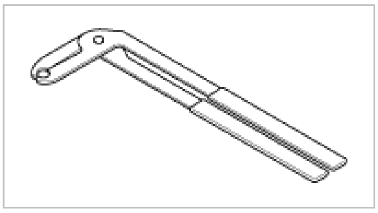
YES

▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

SPECIAL TOOLS

Tool (Number and name)	Illustration	Use
09793-21000 Door hinge adjusting wrench		Adjustment, removal and installationOf the door hinge
09800-21000 Ornament remover		Trim removal
09853-31000 Headliner clip remover		Removal of the headliner clips
09861-31100 Sealant cut-out tool		Cutting the sealant of the windshield (Use with 09861-31200)
09861-31200 Sealant cutting blade		Cutting the sealant of the windshield (Use with 09861-31100)
09861-31300 Sealant gun		Application of the sealant to the windshield
09861-31400 Glass holder		Removal and installation of the windshield
09861-31000 Windshield moulding remover		Removal of the windshield moulding
09880-4F000 Hogring clip installer		Installation of the hogring clip

Body (Interior and Exterior) > General Information > Troubleshooting

TROUBLESHOOTING

Symptom	Suspect Area	Remedy
Water leaks from sunroof	Dirt accumulated in drain tube	Clear dirt inside of drain
	Clogged drain tube	Blow air into drain to remove dirt
	Broken or dislocated drain tube, defectiveOr cracked clip	Check tube installation and Flange contact
	Deteriorated roof lid weatherstrip	Replace
	Excessive roof lid-to-body clearance and Improperly fitted weatherstrip	Adjust
Wind noise around sunroof	Loose or deformed deflector, gaps In body work	Retighten adjust or replace
Sunroof lid makes a noise when move	Foreign particles lodged in guide rail	Check drive cable and guide Rails for foreign particles
	Loose guide rails and lid	Retighten
Motor runs but sunroof Does not move or moves only partially	Foreign particles lodged in guide rail	Check drive cable and guide Rails for foreign particles
	Incorrect engagement of motor pinion With drive cable	Check for loose motor installation And damaged pinion
	Decrease in motor`s clutch slipping force	Adjust
	Increased sunroof sliding resistance Or interference of sunroof with drive Cables, weatherstrip, etc. due to Maladjustment of sunroof	Adjust or replace
Noise in motor clutch slipping Noise from motor when sunroof Is fully opened or closed is not An unusual noise	Incorrect engagement of motor pinion With drive cable	Check pinion installation and Retighten motor
	Worn out or damaged motor pinion bearing	Replace motor assembly
	Worn out or deformed drive cable	Replace
Door glass fails to operate Up and down	Incorrect window glass installation	Adjust position
	Damaged or faulty regulator arm or regulator	Correct or replace
Door does not open or close completely	Incorrect door installation	Adjust position
	Defective door check assembly	Correct or replace
	Door hinge requires grease	Apply grease
Hood does not open or close completely	Striker and latch not properly aligned	Adjust
	Incorrectly installed hood	Adjust
	Incorrect hood bumper height	Adjust
Water leak through windshield end rear window	Defective seal	Fill with sealant
	Defective flange	Correct

Body (Interior and Exterior) > General Information > Specifications

SPECIFICATIONS

HOOD	

Type	Rear hinged, gas lifter type
FRONT DOOR Construction Regulator system Locking system	 Front hinged, full door construction Wire drum type Pin-fork system
REAR DOOR Construction Regulator system Locking system	 Front hinged, full door construction Wire drum type Pin-fork system
TRUNK LID Type	 Inner hinged, gas lifter type
GLASS THICKNESS Windshield glass Front door glass Rear door glass Rear window glass	Laminated clear, tinted 5mm 4mm 4mm 3.5mm
SEAT BELTS Front Rear	 3 point type with Emergency Locking Retractor (E.L.R) 3 point type with Emergency Locking Retractor (E.L.R) 2 point type

TIGHTENING TORQUE

Items	N·m	Kgf·m	lb·ft
Front and rear doors Door hinge to body Door hinge to door	 12.7~25.5 12.7~25.5	 1.3~2.6 1.3~2.6	 9.4~18.8 9.4~18.8
Trunk lid Trunk lid lift to trunk lid Trunk lid latch to trunk lid	 6.9~10.8 6.9~10.8	 0.7~1.1 0.7~1.1	 5.1~8.0 5.1~8.0
Hood Hood hinge to body Hood hinge to hood Hood latch to body Gas lifter seat mounting bolts	 21.6~26.5 21.6~26.5 6.9~8.8 6.9~8.8	 2.2~2.7 2.2~2.7 0.7~0.9 2.2~2.7	 15.9~19.5 15.9~19.5 5.1~6.5 15.9~19.5
Seat Front seat mounting bolts Front seat mounting nut Rear seat mounting bolts	 34.3~53.9 23.5~35.3 9.8~14.7	 3.5~5.5 2.4~3.6 1.0~1.5	 25.3~39.8 17.4~26.0 7.2~10.8
Seat belt Front seat bet height adjuster Front seat belt buckle mounting bolt Front seat belt anchor mounting bolt Front seat belt lower anchor Front seat belt upper anchor Rear seat belt anchor attaching bolt Rear seat belt retractor mounting bolt	 39.2~53.9 39.2~53.9 39.2~53.9 39.2~53.9 39.2~53.9 39.2~53.9 39.2~53.9	 4.0~5.5 4.0~5.5 4.0~5.5 4.0~5.5 4.0~5.5 4.0~5.5 4.0~5.5	 28.9~39.8 28.9~39.8 28.9~39.8 28.9~39.8 28.9~39.8 28.9~39.8 28.9~39.8

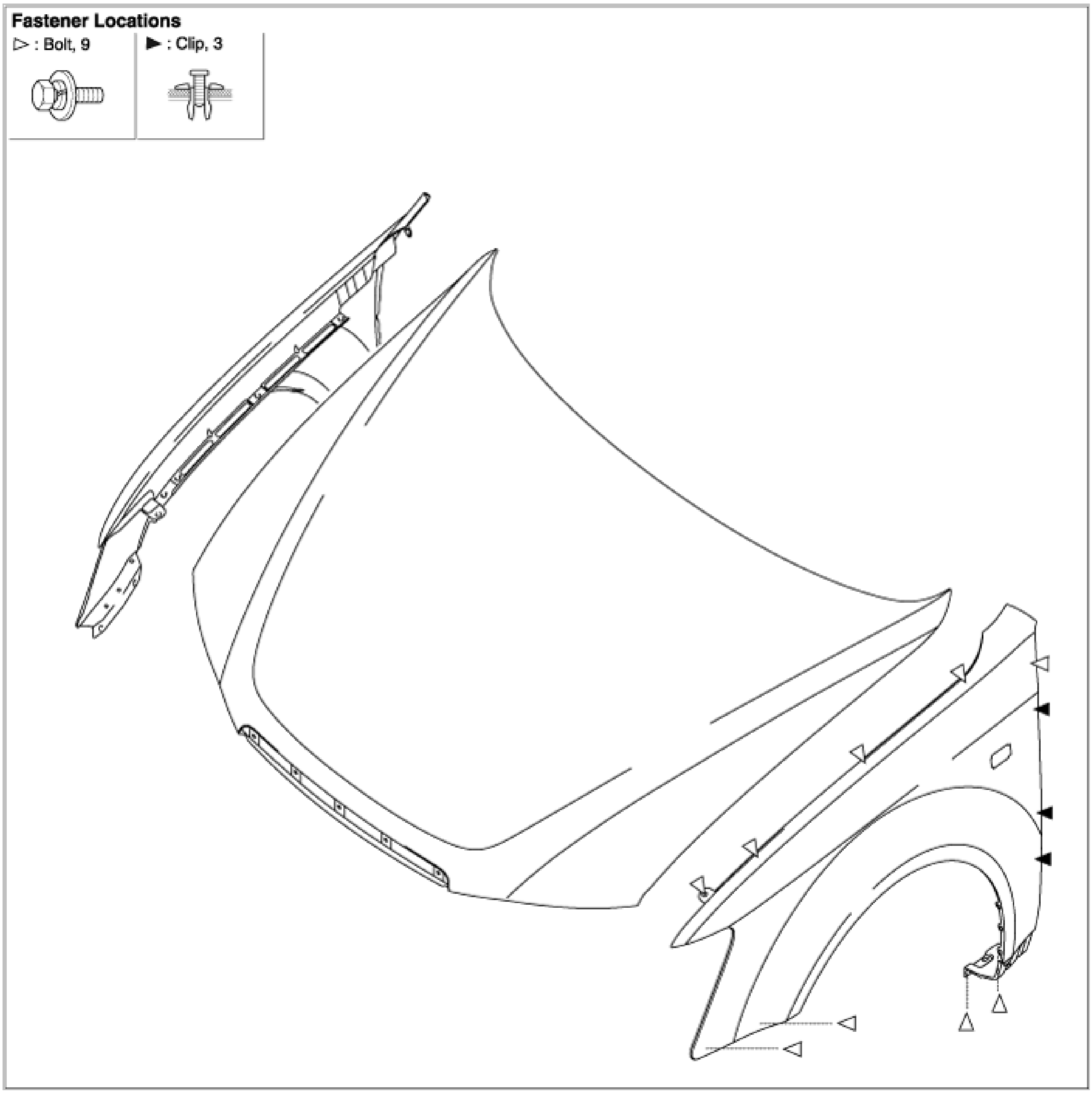
Body (Interior and Exterior) > Exterior > fender > Repair procedures

REPLACEMENT

NOTE

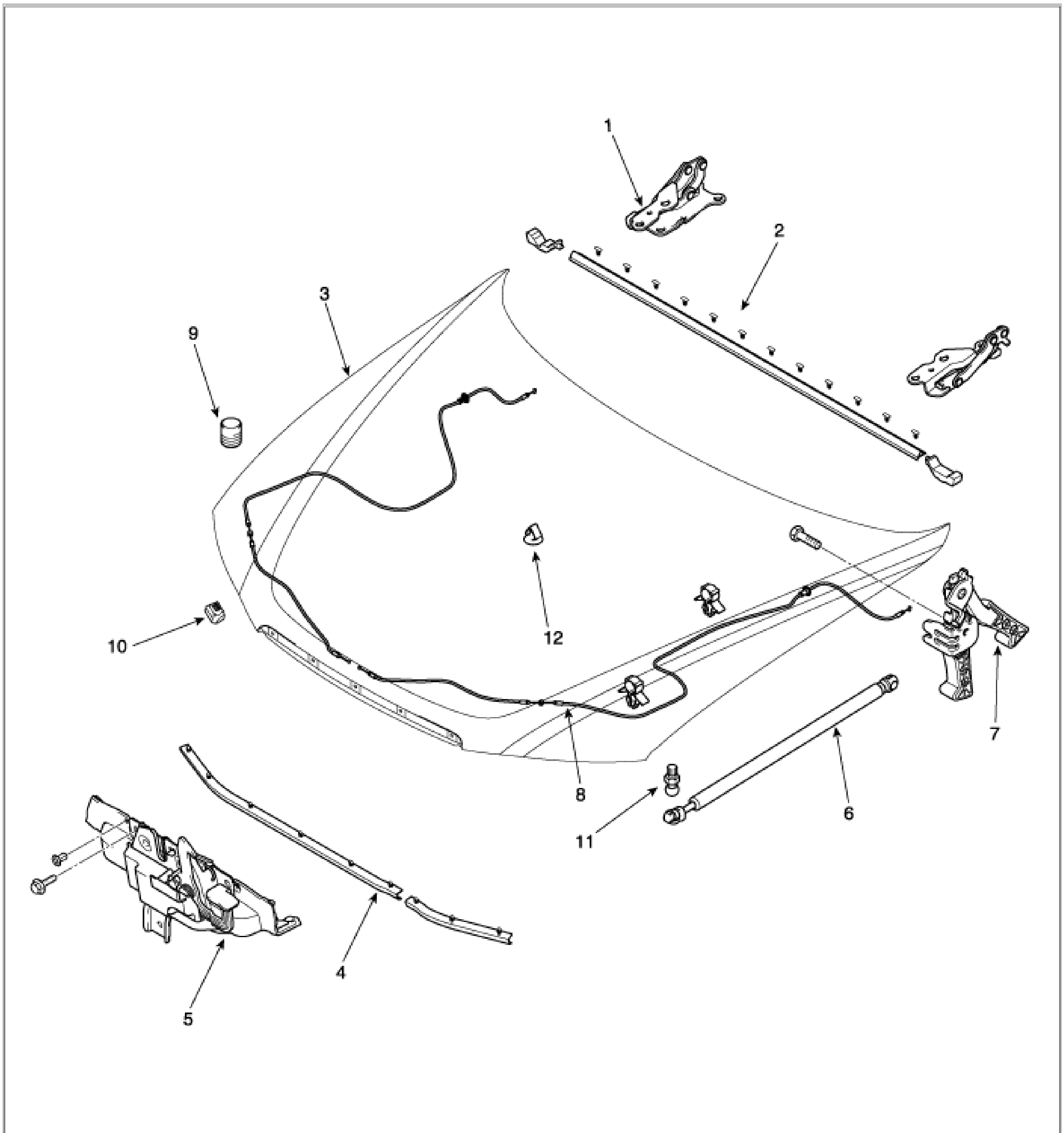
- When prying with a flat-tip screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Put on gloves to protect your hands.
- Take care not to scratch the body surface.

1. Remove the following items.
   A. Side garnish.
   B. Front bumper.
   C. Wheel guard.
   D. Headlamp.
2. Installation is the reverse of removal.



Body (Interior and Exterior) > Exterior > hood > Components and Components Location

COMPONENTS



1. Hood hinge	5. Hood latch	9. Hood overslam bumper
2. Hood weatherstrip	6. Hood lift	10. Hood stop bumper
3. Hood	7. Hood release handle	11. Bal l joint
4. Hood seal weatherstrip	8. Hood release cable	12. Mounting clip

Body (Interior and Exterior) > Exterior > hood > Repair procedures

REPLACEMENTS

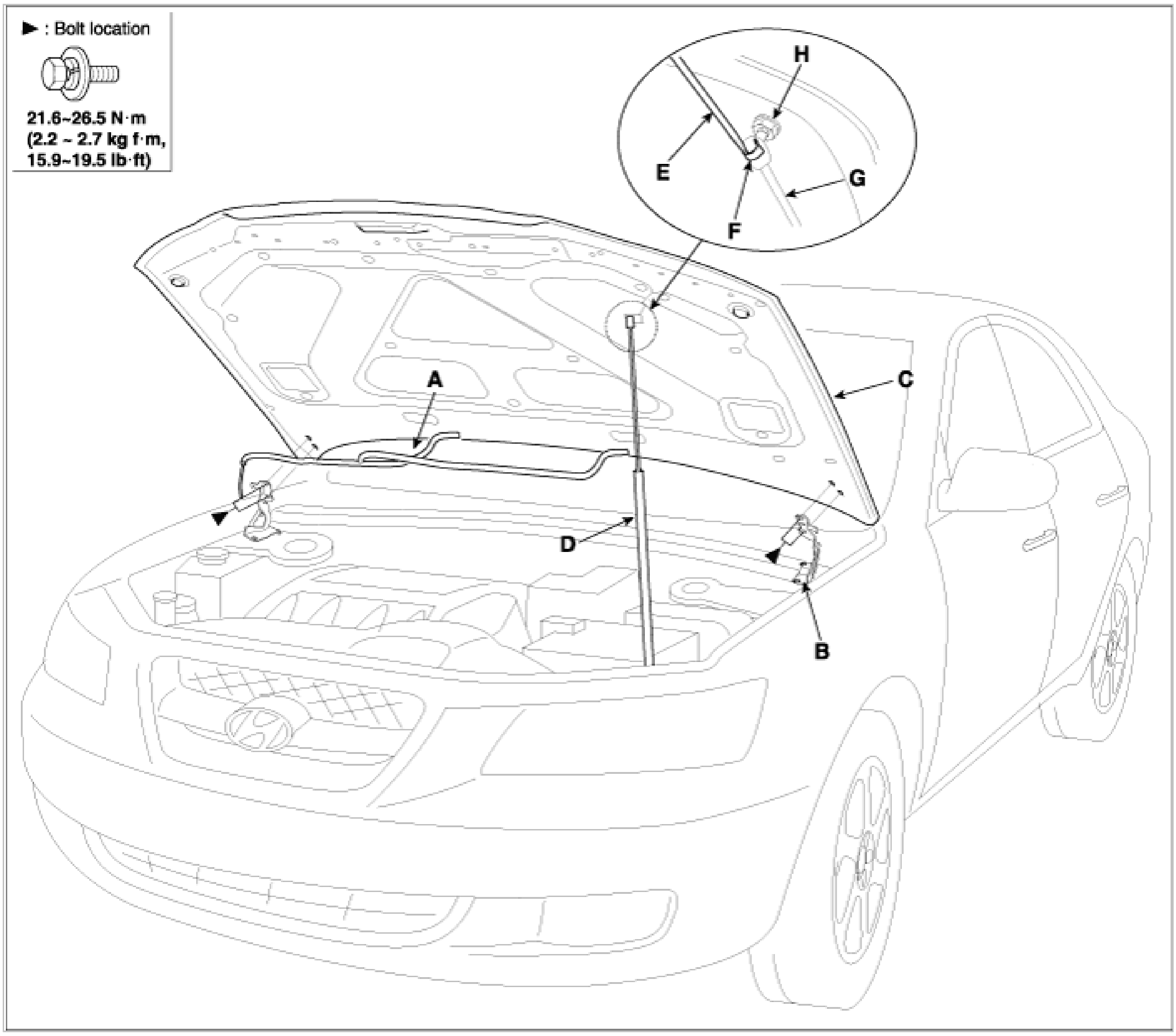
HOOD ASSEMBLY REPLACEMENT

NOTE

- When removing and installing the hood, an assistant is necessary.
- Take care not to damage the hood and body.
- When removing the clips, use a clip remover.

1. Disconnect the windshield washer nozzle connecting tube (A).
2. After loose the hood hinge (B) mounting bolts, remove the hood (C).
3. Using a screwdriver (E), lift up slightly the socket clips (F) of both ends on the lifer (G), and then remove the lifter from the bracket (H).
4. Installation is the reverse of removal.

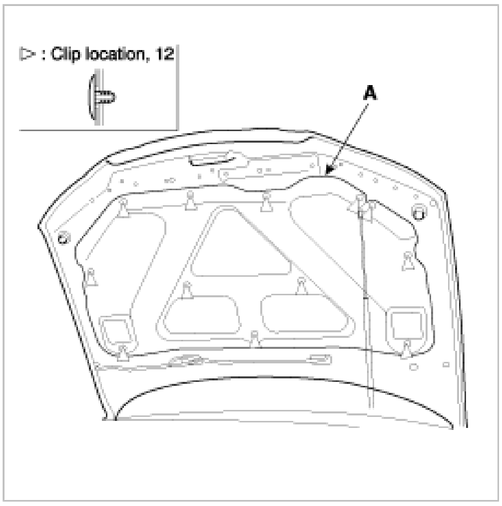
> NOTE
>
> - Make sure the hood opens properly and locks securely.
> - Adjust the hood alignment.



HOOD INSULATOR REPLACEMENT

1. Using a clip remover, detach the clips, and remove the hood insulator (A).

> NOTE
>
> - Take care not to scratch the hood panel.



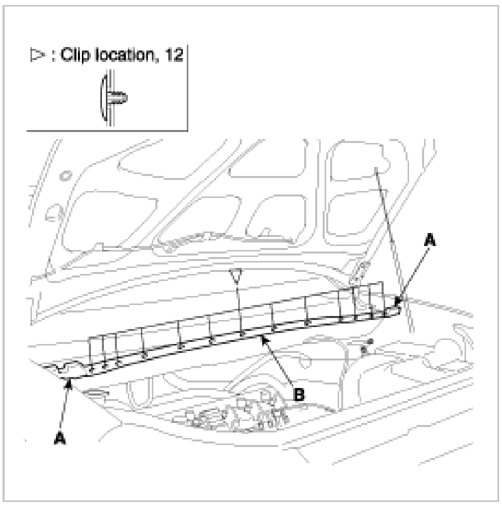
2. Installation is the reverse of removal.

NOTE

- Replace any damaged clips.

HOOD SEAL WEATHERSTRIP REPLACEMENT

1. Detach the clips, then remove the hood weatherstrip(A).
   Take care not to scratch the hood.



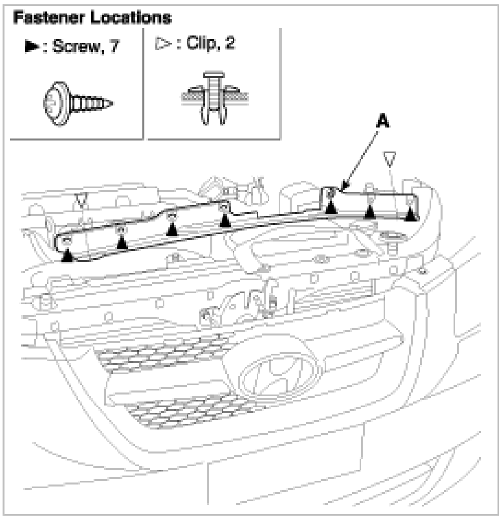
2. Installation is the reverse of removal.

NOTE

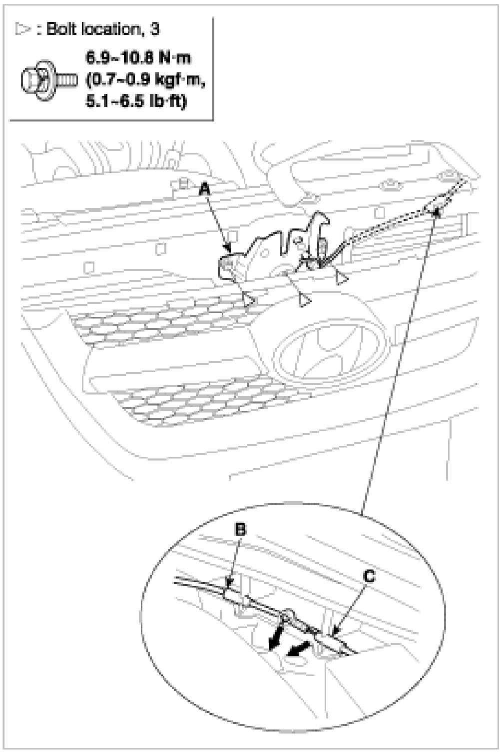
- Replace any damaged clips.

HOOD LATCH REPLACEMENT

1. Remove the radiator guard (A).



2. Remove the hood latch (A) mounting bolts.
3. Disconnect the hood latch cable (B) and release cable (C).

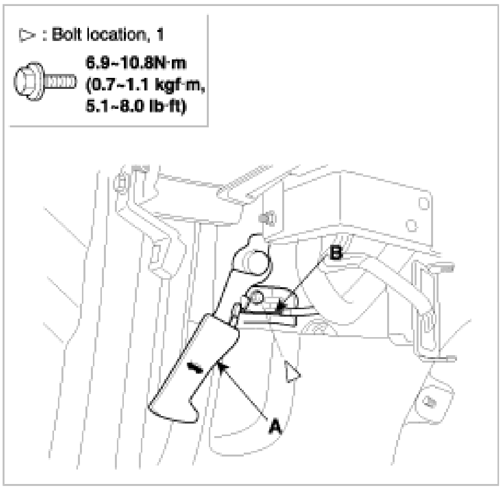


4. Installation is the reverse of removal.

> **NOTE**
>
> - Make sure the hood latch cable is connected properly.
> - Make sure the hood locks securely.

HOOD RELEASE HANDLE REPLACEMENT

1. Remove the mounting bolt, then remove the hood release handle (A).
2. Disconnect the hood latch cable (B) from the hood release handle. Take care not to bend the cable.



3. Installation is the reverse of removal.

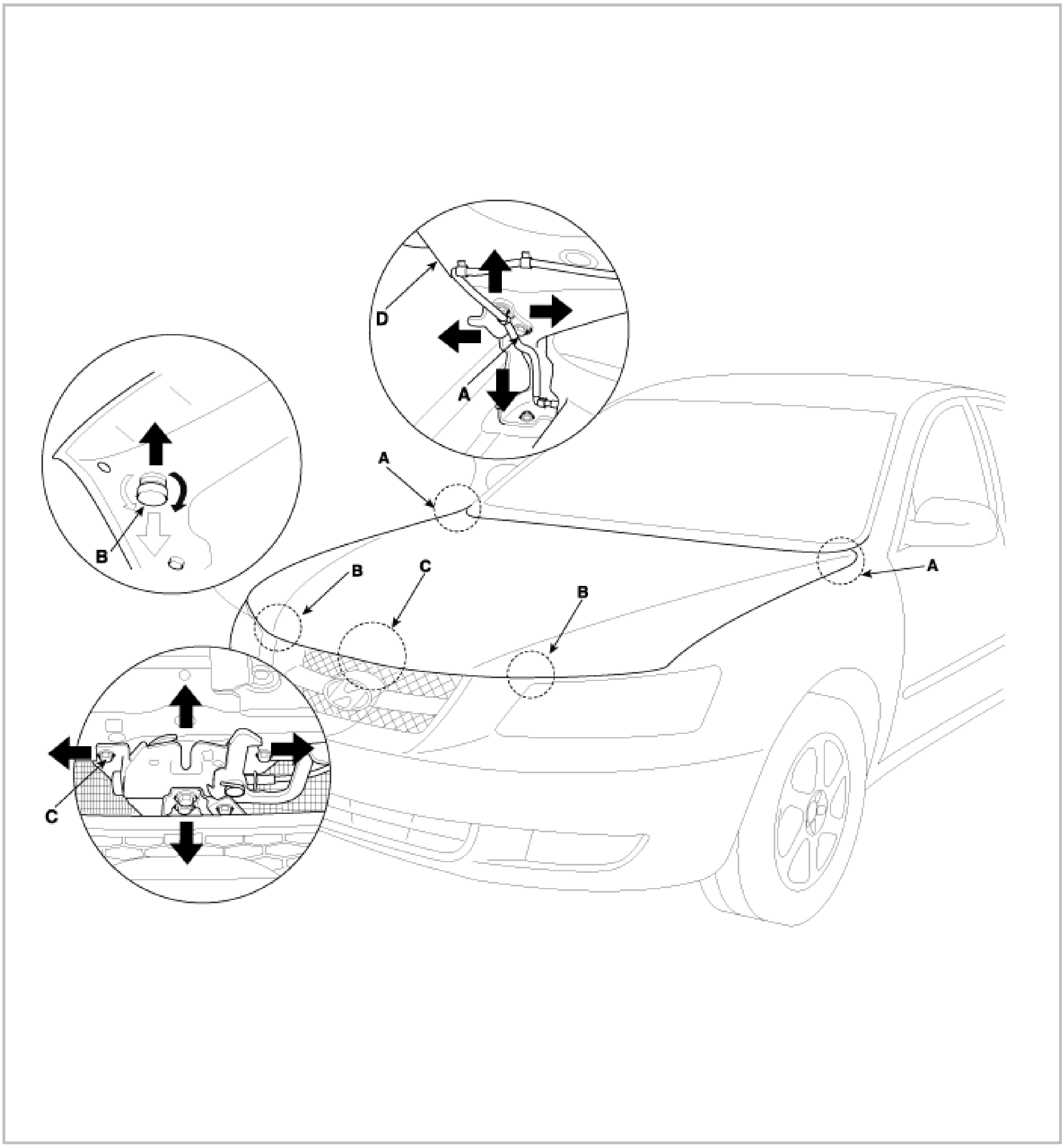
NOTE

- Make sure the hood latch cable is connected properly.
- Make sure the hood locks securely.

ADJUSTMENT

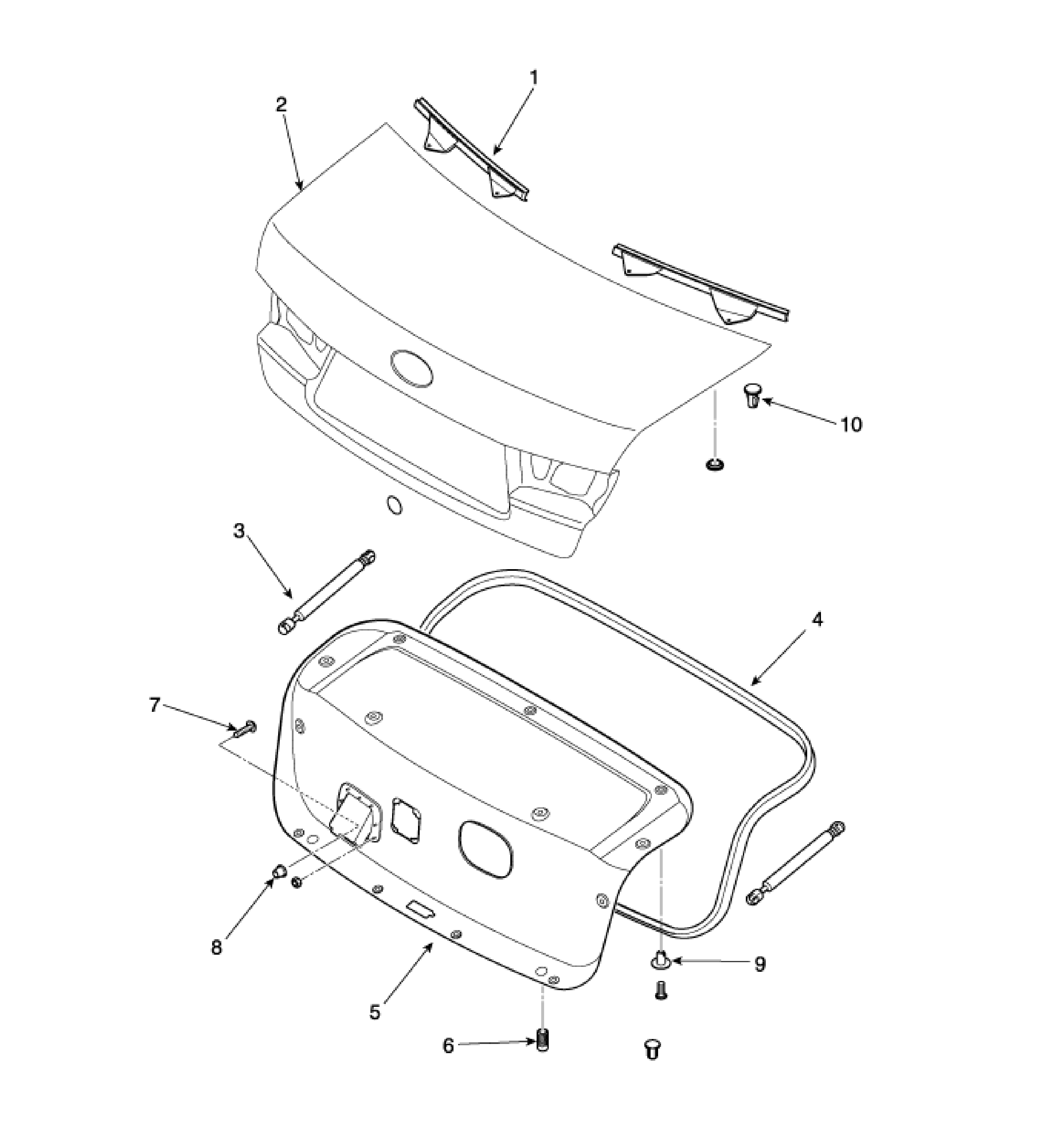
ADJUST HOOD

1. After loosening the hinge (A) mounting bolt, adjust the hood (D) by moving it up or down, or right or left.
2. Adjust the hood height by turning the hood overslam bumpers (B).
3. After loosening the hood latch (C) mounting bolts, adjust the latch by moving it up or down, or right or left.



Body (Interior and Exterior) > Exterior > trunk lid > Components and Components Location

COMPONENTS



1. Trunk seal	4. Trunk lid weatherstrip	7. Screw
2. Trunk lid	5. Trunk lid trim	8. Screw glow bet
3. Lift	6. Overslam bumper	9. Bumper cover mounting retainer
		10. Trunk lid hinge stop clip

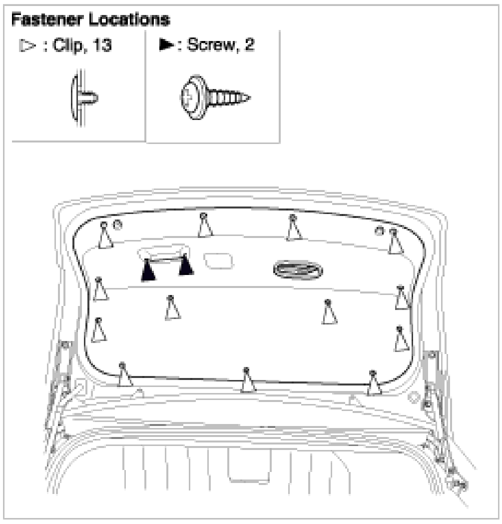
Body (Interior and Exterior) > Exterior > trunk lid > Repair procedures

REPLACEMENT

TRUNK LID TRIM REPLACEMENT

NOTE

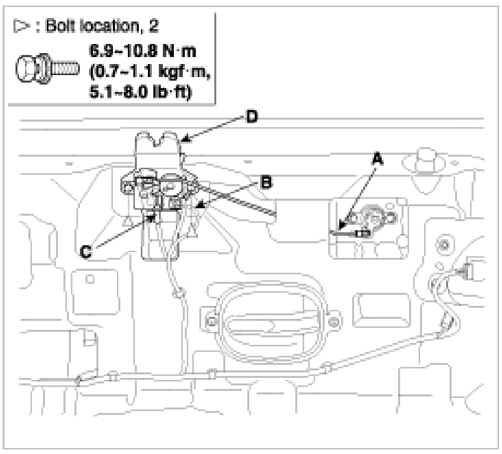
- When removing and installing the trunk lid, an assistant is necessary.
- Wear gloves to protect hands from injury.



1. Installation is the reverse of removal.

TRUNK LID LATCH REPLACEMENT

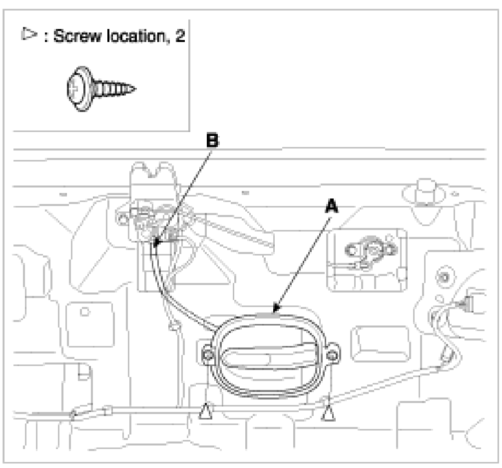
1. Remove the trunk lid trim.
2. Disconnect the key cylinder (A), connector (B) and cable (C).
3. After loosening the mounting bolt, then remove the latch assembly (D).



4. Installation is the reverse of removal.

TRUNK LID INSIDE HANDLE

1. Disconnect the inside handle cable (B).
2. After loosening the inside handle mounting screws, then remove the inside handle (A).

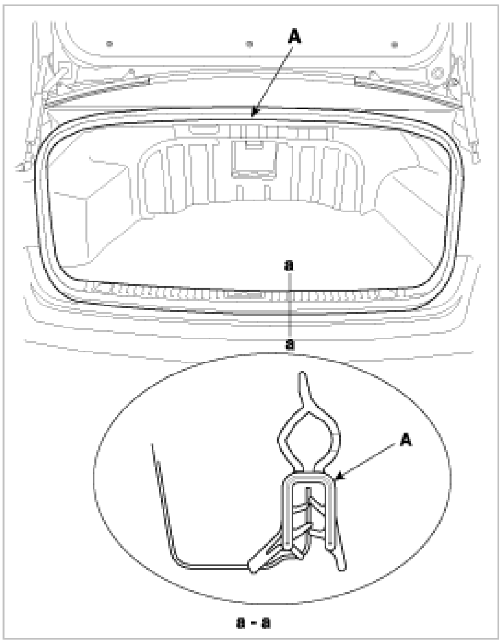


3. Installation is the reverse of removal.

> NOTE
>
> - Make sure the trunk lid latch cable is connected properly.
> - Make sure the trunk lid opens properly and locks securely.

TRUNK LID WEATHERSTRIP REPLACEMENT

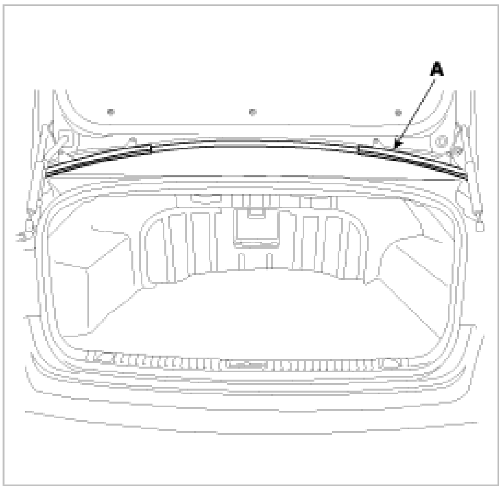
1. Remove the trunk lid weatherstrip (A).



2. Installation is the reverse of removal.

TRUNK LID SEAL WEATHERSTRIP REPLACEMENT

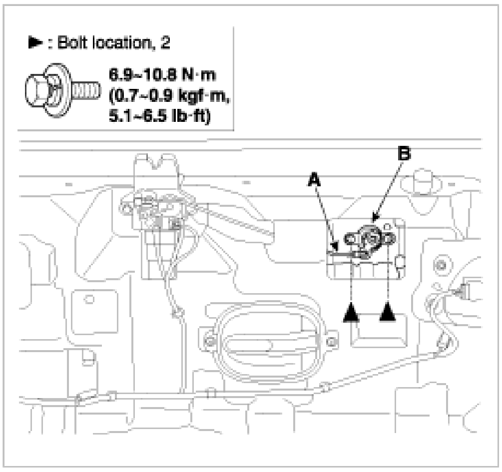
1. Detach the clips, then remove the trunk lid weatherstrip (A).



2. Installation is the reverse of removal.

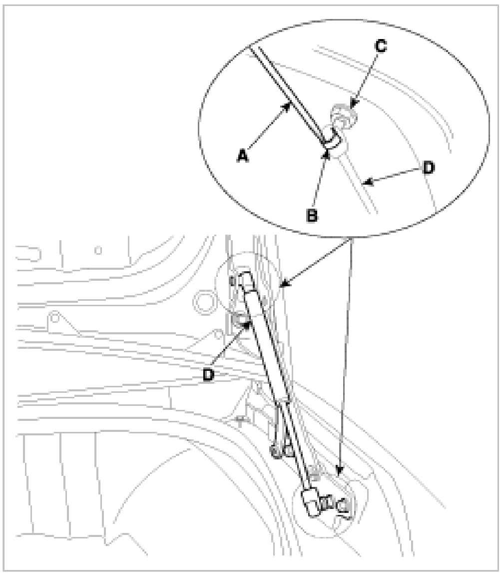
KEY HOLDER REPLACEMENT

1. Remove the trunk lid trim.
2. After loosening the mounting bolts, disconnect the connector (A).
3. Remove key holder (B).



TRUNK LID LIFT REPLACEMENT

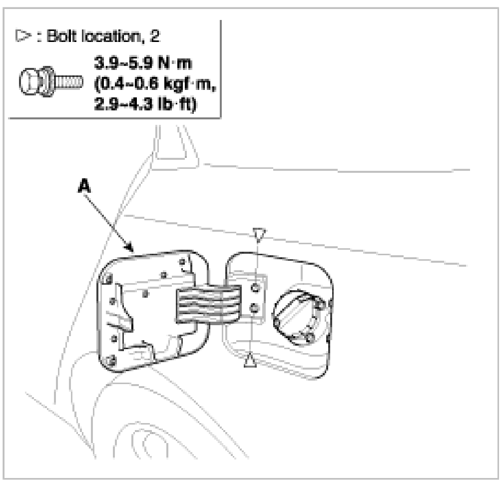
1. Using a screwdriver (A), lift up slightly the socket clips (B) of both ends on the lifter (C), and then remove the lifter from the bracket (D).



2. Push the socket of the lifter into the bracket for installation.

FUEL FILL DOOR REPLACEMENT

1. Loosen the bolts, then remove the fuel filler door (A).

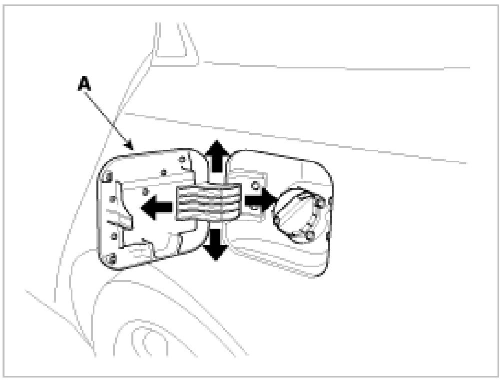


2. Installation is the reverse of removal.

NOTE

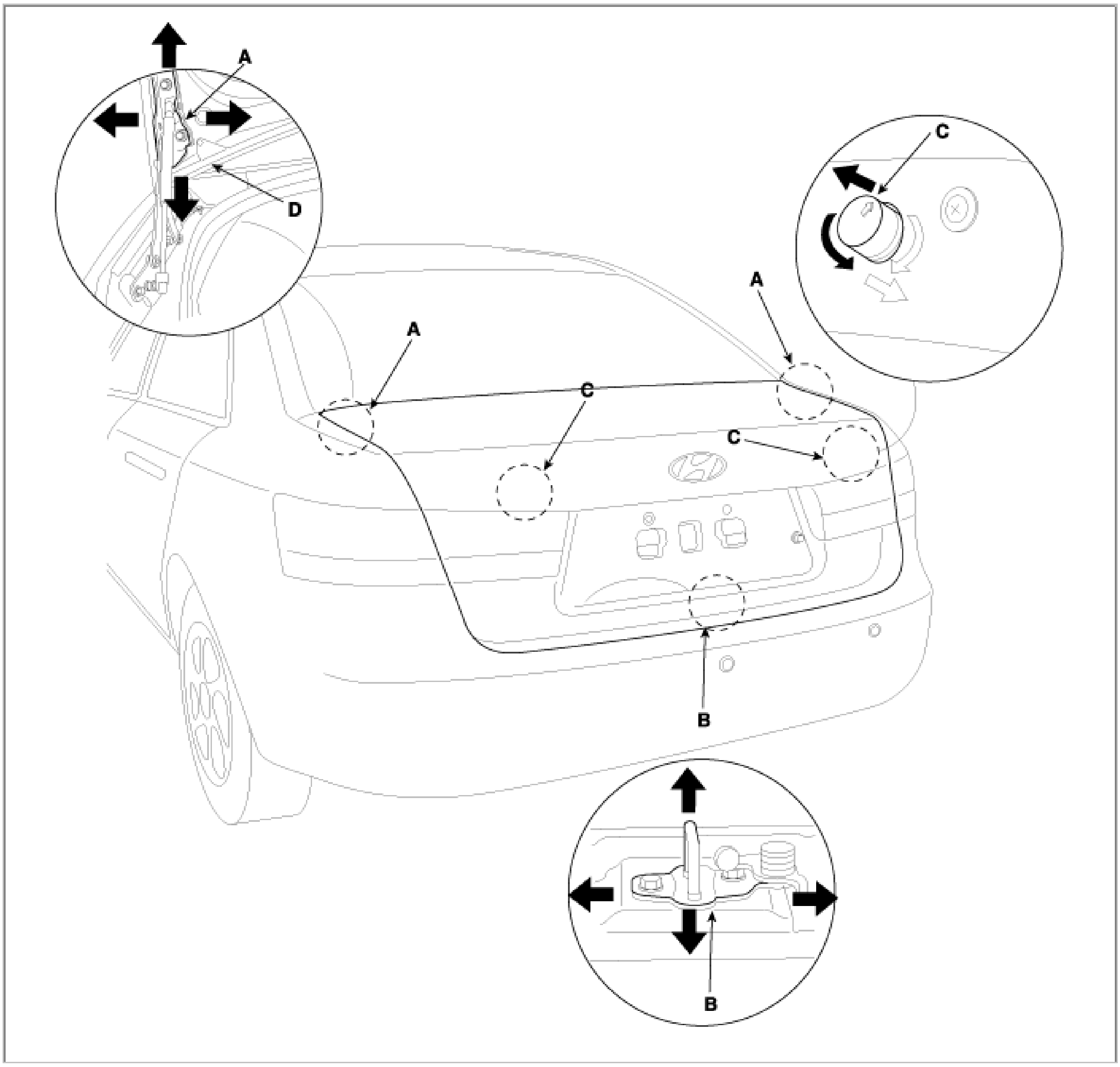
- Make sure the fuel fill door opens properly and locks securely.

3. Check that the fuel fill door (A) fits flush against the body.
   If necessary, adjust it.



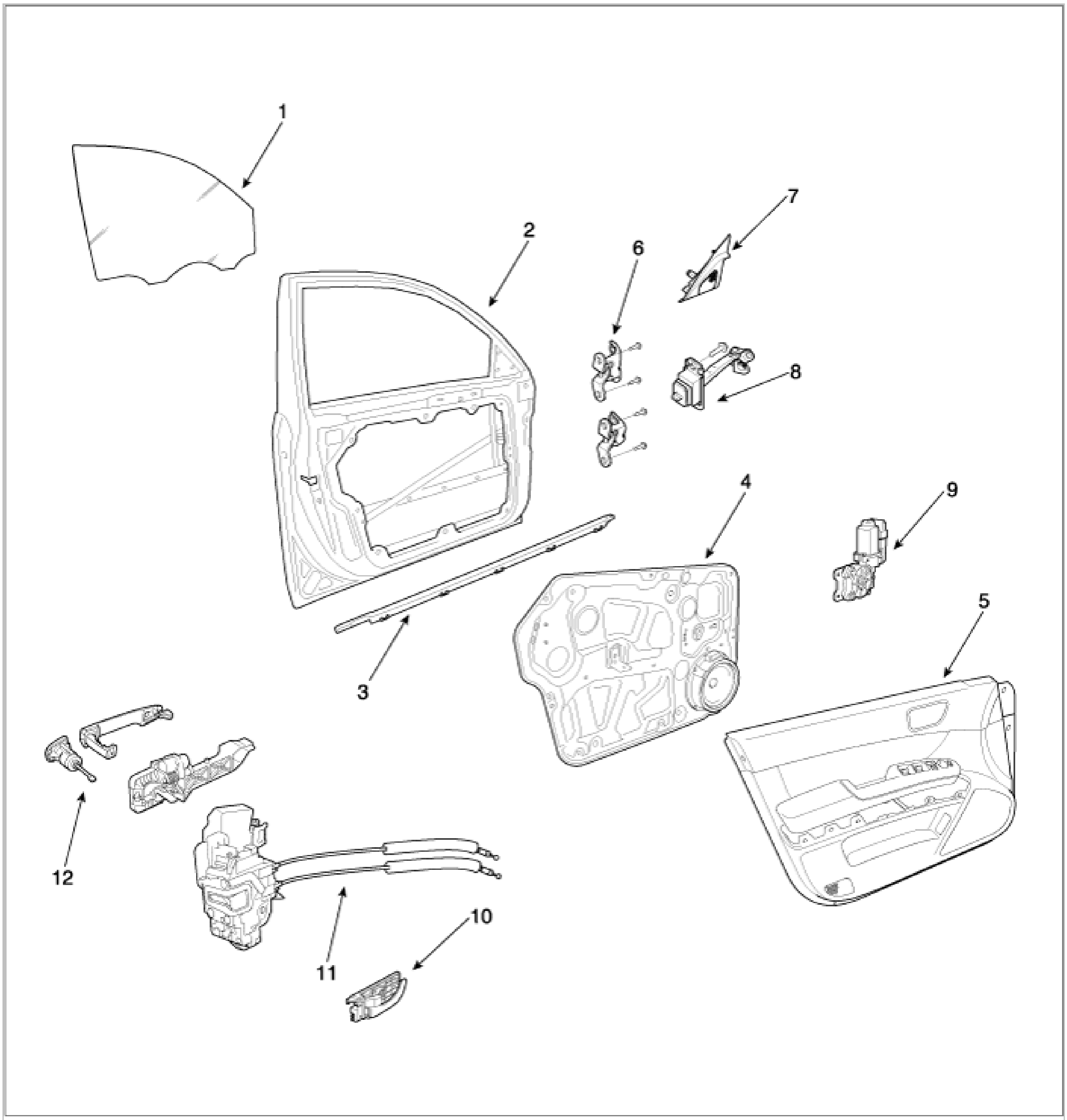
ADJUSTMENT

1. After loosening the trunk lid hinge (A) mounting bolt, adjust the hood (D) by moving it up or down, or right or left.
2. Adjust the trunk lid height by turning the trunk lid overslam bumpers (C).
3. After loosening the trunk lid latch (B) mounting bolts, adjust the trunk lid latch by moving it up or down, or right or left.



Body (Interior and Exterior) > Exterior > front door > Components and Components Location

COMPONENTS



1. Front door glass
2. Front door panel
3. Door belt weatherstrip
4. Front door module
5. Front door trim
6. Door hinge
7. Quadrant inner cover
8. Front door checker
9. Power window motor
10. Inside handle
11. Latch assemble
12. Key cylinder

Body (Interior and Exterior) > Exterior > front door > Repair procedures

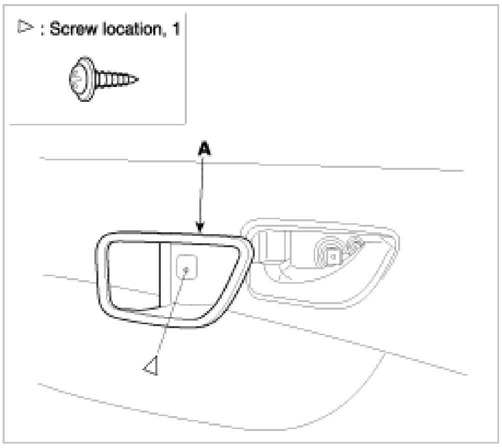
REPLACEMENT

FRONT DOOR TRIM REPLACEMENT

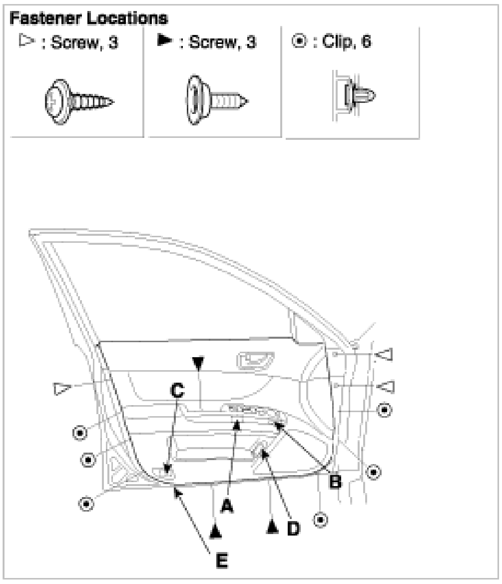
NOTE

- Take care not to scratch the door trim and other parts.
- Put on gloves to protect your hands.

1. Remove the quadrant inner cover.
2. Remove the inside handle cover (A).



3. Loosen the door trim (E) mounting screws. Release the clips that hold the door trim, then remove the door trim by pulling it upward. Disconnect the power window switch connector(A), power mirror connector (B), and door courtesy lamp connector(C), trunk lid connector (D).



4. Installation is the reverse of removal.

NOTE

- Make sure of connectors is plugged in properly and each rod is connected securely.
- Make sure the door lock and opens properly.

GLASS REPLACEMENT

NOTE

- Put on gloves to protect your hands.

1. Remove the front door trim.

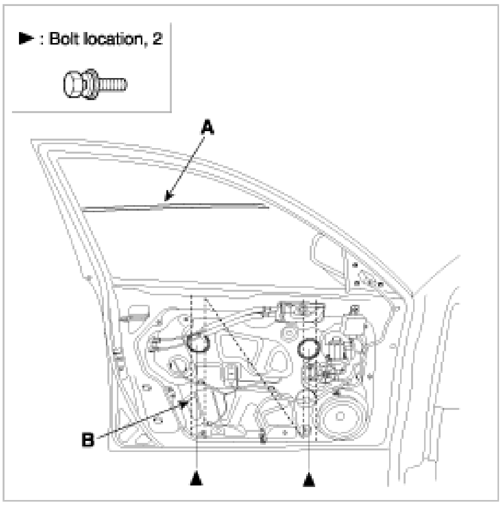
NOTE

- Use the door switch to align the mounting hole with the hole on the door glass.
- If it is impossible, align the hole with hands after removing the motor.

2. Carefully move the glass (A) until you can see the bolts, then loosen them. Separate the glass from the glass run and carefully pull the glass out through the window slot (B).

CAUTION

- Take care not to drop to glass and scratch the glass surface.

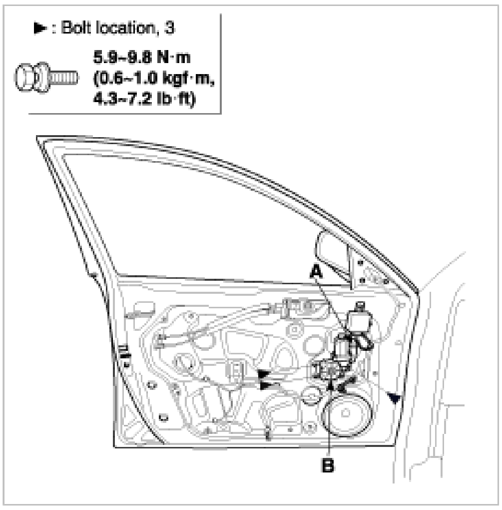


3. Installation is the reverse of removal.

> NOTE
>
> - Roll the glass up down to see if it move freely without binding.
> - Adjust the position of the glass as necessary.

POWER WINDOW MOTOR REPLACEMENT

1. Remove the front door trim.
2. After disconnecting the connector (A), remove the power window motor (B).

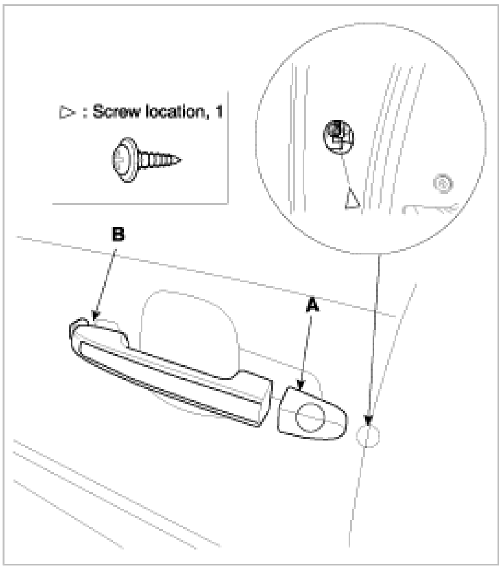


3. Installation is the reverse of removal.

> NOTE
>
> - Roll the glass up down to see if it move freely without binding.

OUT SIDE HANDLE REPLACEMENT

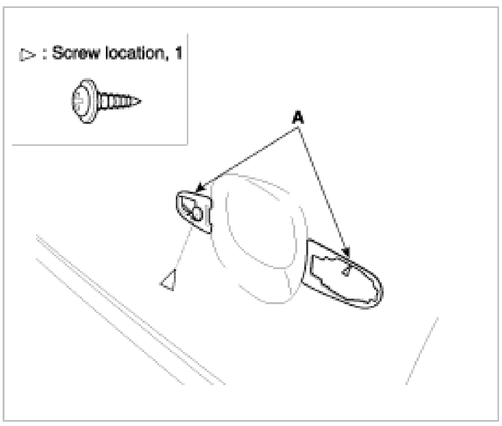
1. Remove the following parts.
   A. Remove the front door trim.
   B. Remove the glass.
   C. Remove inside handle.
2. After disconnecting the cover (A), remove the outside handle base (B).



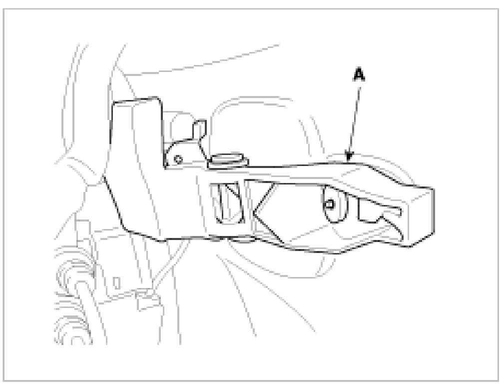
3. Remove door module.
4. Installation is the reverse of removal.

FRONT DOOR LATCH REPLACEMENT

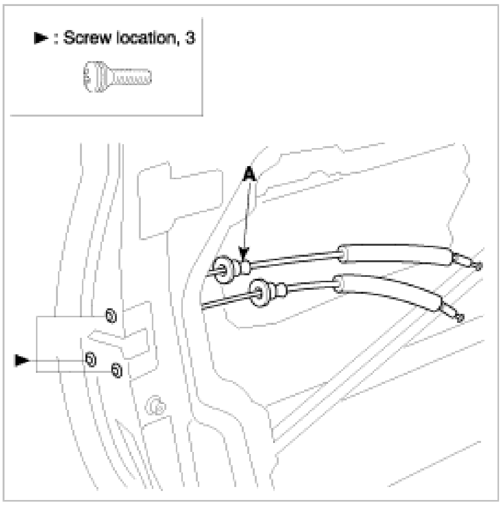
1. Remove the following parts.
   A. Remove the front door trim.
   B. Remove the glass.
   C. Remove the inside handle.
   D. Remove the door module.
2. Remove the outside handle.
3. Remove the outside handle pad (A).



4. Remove the outside handle base (A).



5. After loose the latch mounting bolts, remove the front door latch (A).

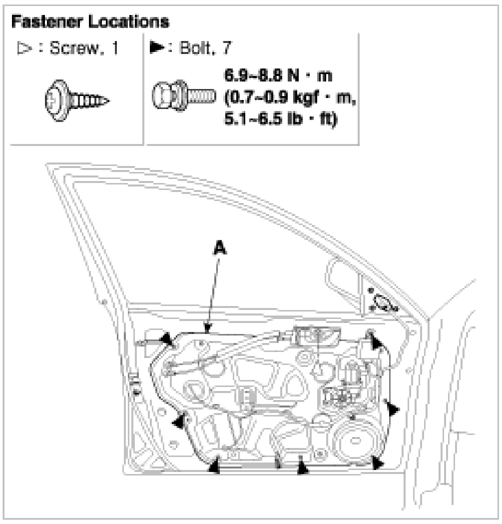


6. Installation is the reverse the removal.

> NOTE
>
> - Make sure the door locks and opens properly.

FRONT DOOR MODULE

1. Remove the front door trim.
2. Remove the glass.
3. Remove the inside handle.
4. Remove the outside handle.
5. After loose the door module mounting bolts, remove the door module (A).

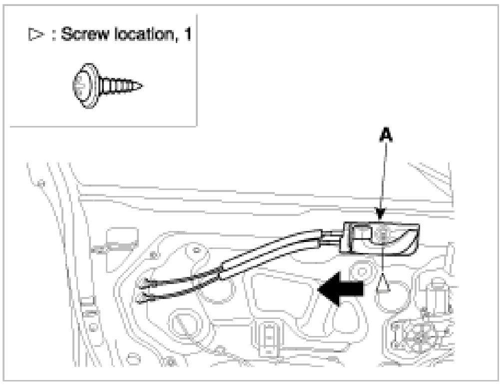


6. Installation is the reverse of removal.

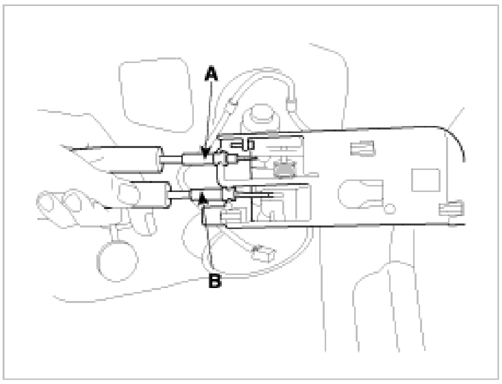
> NOTE
>
> - Make sure the connector is plugged in properly and each rod is connected securely.
> - Make sure the door lock and open properly.

INSIDE HANDLE REPLACEMENT

1. Remove the front door trim.
2. Loose the inside handle (A) mounting screw.
   Push the inside handle rearward to disconnect from the door module.



3. Disconnect the lock cable and (A) inside connect cable (B).

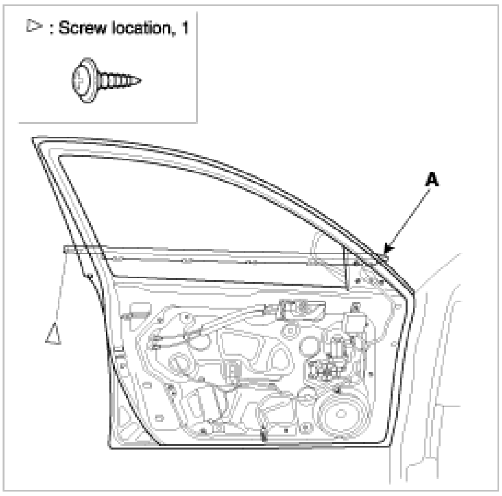


4. Installation is the reverse of removal.

> NOTE
>
> - Make sure the door lock and open properly.

DOOR BELT WEATHERSTRIP REPLACEMENT

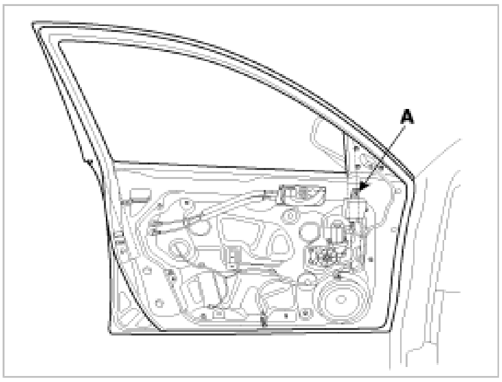
1. Remove the front door trim.
2. Release the hook (A), and then remove the door belt weatherstrip (B).



3. Installation is the reverse of removal.

GLASS RUN REPLACEMENT

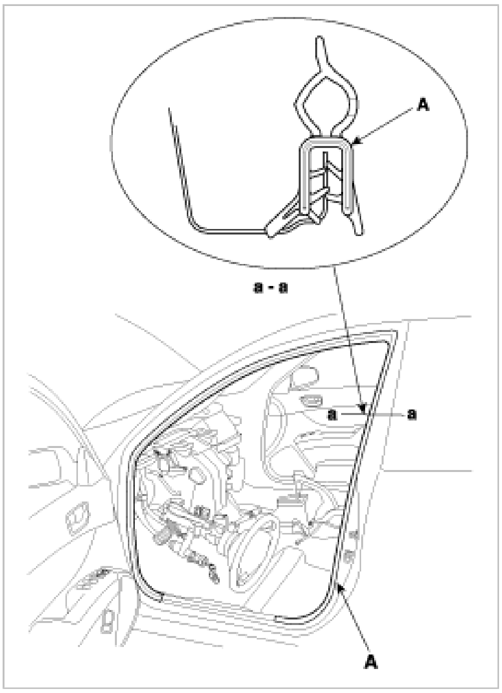
1. Remove the front door trim.
2. Remove the glass.
3. Remove the glass run channel (A) front the lower part.



4. Installation is the reverse of removal.

BODY WEATHHERSTRIP REPLACEMENT

1. Release the clips then remove the body weatherstrip(A).



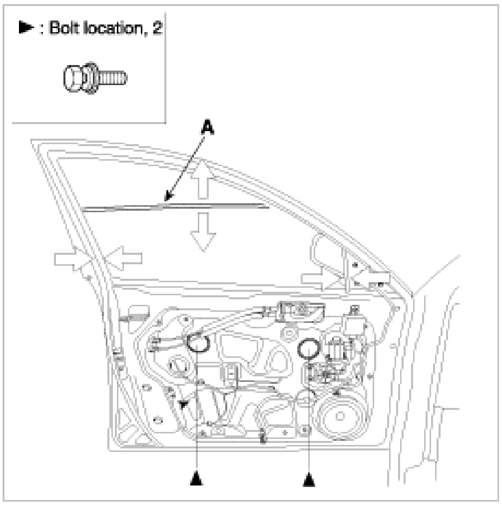
2. Installation is the reverse the removal.

ADJUSTMENT

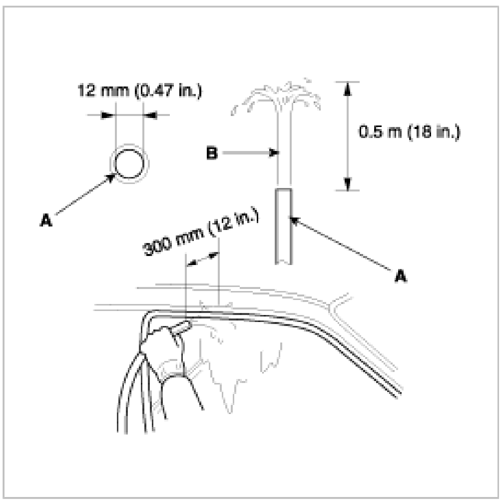
GLASS ADJUSTMENT

> NOTE
>
> - Check the glass run channel for damage or deterioration, and replace them necessary.

1. Remove the following parts.
   A. Quadrant cover.
   B. Door trim.
2. Carefully move the glass (A) until you can see the glass mounting bolts(B), then loosen them.



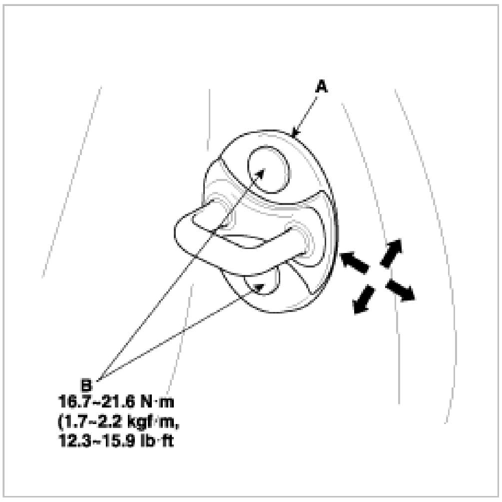
3. Push the glass (A) against the channel (C), then tighten the glass mounting bolts.
4. Check that the glass moves smoothly.
5. Raise the glass fully, and check for gaps.
   Check that the glass contacts the glass run channel evenly.
6. Check for water leaks. Run water over the roof and on the sealing area as shown, and note these items:
   A. Use a 12mm (1/2lin.) diameter hose (A).
   B. Adjust the rate of water flow as shown (B).
   C. Do not use a nozzle.
   D. Hold the hose about 300mm(12in.) away from the door (C).



DOOR STRIKER ADJUSTMENT

Make sure the door latches securely without slamming it. If necessary, adjust the striker (A): The strike nuts are fixed. The strike can be fine adjusted up or down, and in or out.

1. Loosen the screws (B), then insert a shop towel between the body and striker.



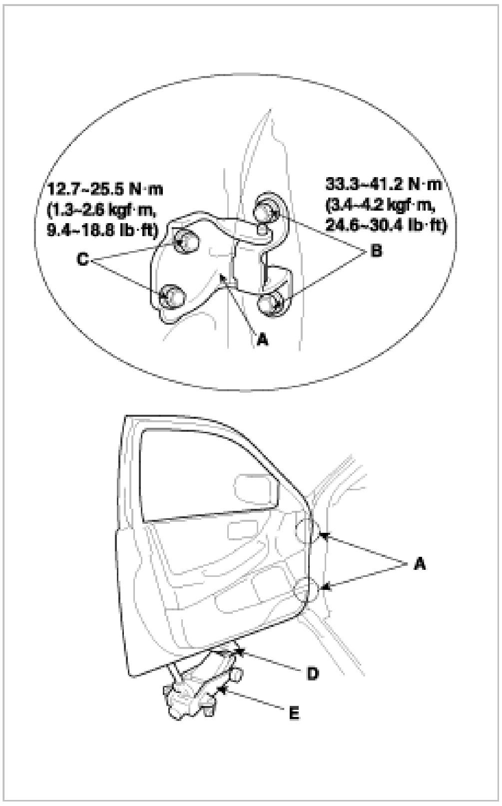
2. Lightly tighten the screws.
3. Wrap the striker with a shop towel, then adjust the striker by tapping it with a plastic hammer.
   Do not tap the striker too hard.
4. Loosen the screws and remove the shop towel.
5. Lightly tighten the screws.
6. Hold the outer handle out, and push the door against the body to be sure the striker allows a flush fit. If the door latches properly, tighten the screwsand recheck.

DOOR POSITION ADJUSTMENT

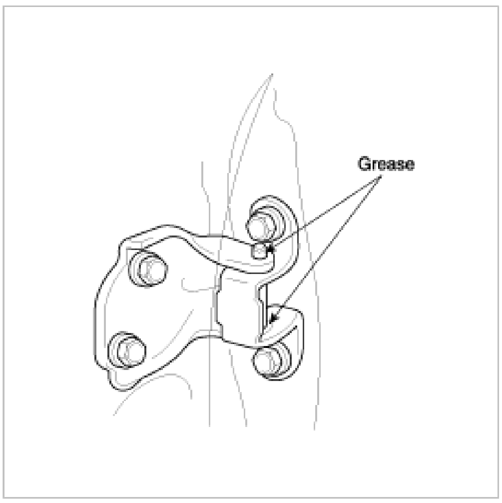
NOTE

After installing the door, check for a flush fit with the Body, then check for equal gaps between the front, rear, and bottom, door edges and the body. Check that the door and body edges are parallel. before adjusting, replace the mounting bolts.

1. Place the vehicle on a firm, level surface when adjusting the doors.
2. Adjust at the hinges (A):
   A. Loosen the door mounting bolts (B) slightly, and move the door IN or OUT until it aligns flush with the body.
   B. Loosen the hinge mounting bolts (C) slightly, and move the door BACKWARD or FORWARD, UP or DOWN as necessary to equalize the gaps.
   C. Place a shop towel (D) on the jack (E) to prevent damage to the door when adjusting the door.
3. Check that the door and body edges are parallel.



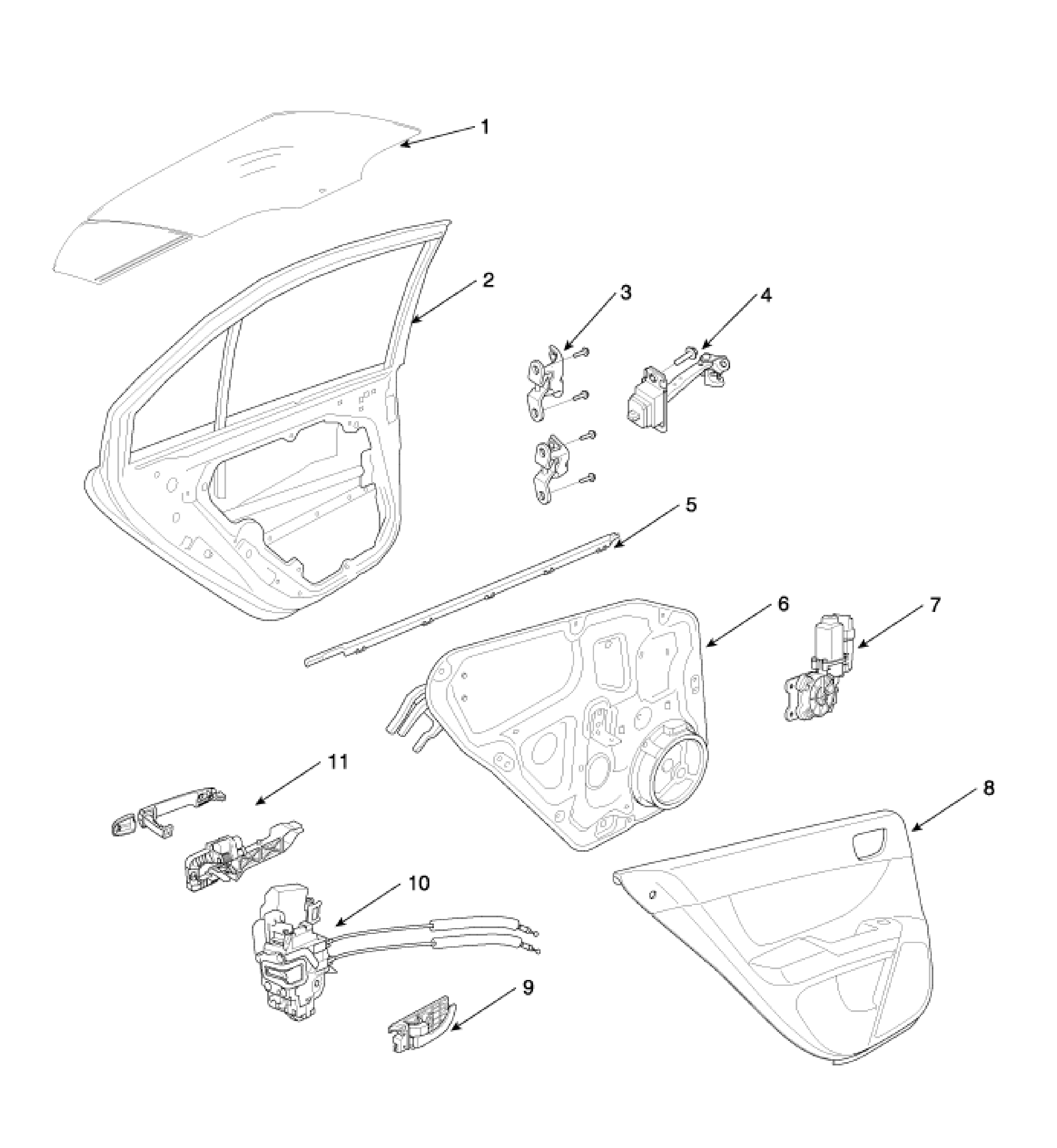
4. Grease the pivot portions of the hinges indicated by the arrows.



5. Check for water leaks.

Body (Interior and Exterior) > Exterior > rear door > Components and Components Location

COMPONENTS



1. Door grass	5. Door belt weatherstrip	9. Inside handle
2. Rear door panel	6. Door module	10. Latch assemble
3. Door hinge	7. Power window motor	11. Out side handle
4. Door checker	8. Door trim	

Body (Interior and Exterior) > Exterior > rear door > Repair procedures

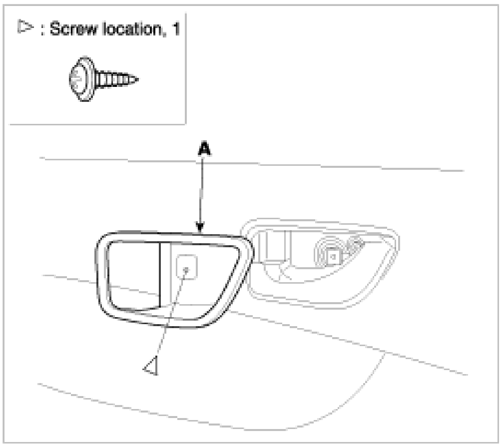
REPLACEMENT

REAR DOOR TRIM REPLACEMENT

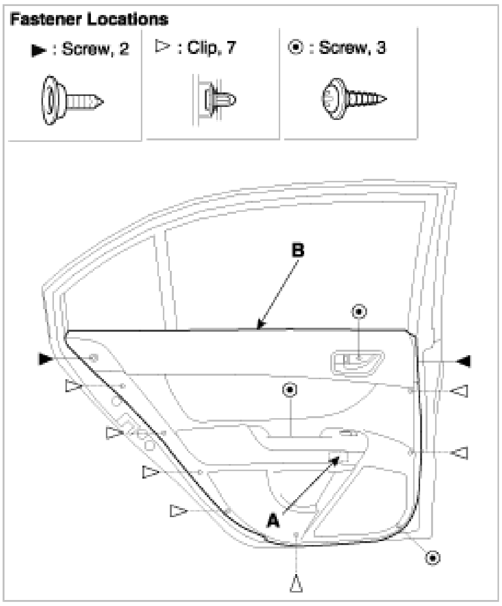
NOTE

- Take care not to scratch the door trim and other parts.
- Put on gloves to protect your hands.

1. Remove the inside handle cover (A).



2. Loosen the door trim (B) mounting screws. Release the clips that hold the door trim, then remove the door trim by pulling it upward. Disconnect the power window switch connector(A).



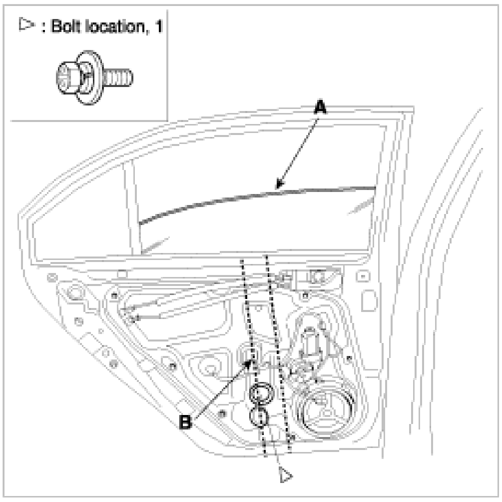
3. Installation is the reverse of removal.

> NOTE
>
> - Make sure of connectors is plugged in properly and each rod is connected securely.
> - Make sure the door lock and opens properly.

GLASS REPLACEMENT

> NOTE
>
> - Put on gloves to protect your hands.

1. Remove the rear door trim.
2. Carefully move the glass (A) until you can see the bolts, then loosen them. Separate the glass from the glass run and carefully pull the glass out through the window slot (B).



CAUTION

Take care not to drop to glass and scratch the glass surface.

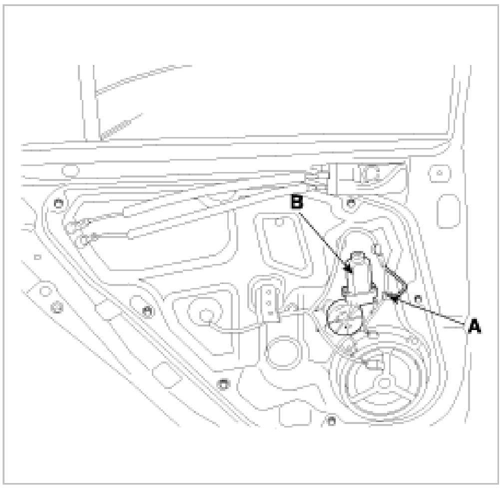
3. Installation is the reverse of removal.

NOTE

- Roll the glass up down to see if it move freely without binding.
- Adjust the position of the glass as necessary.

POWER WINDOW MOTOR REPLACEMENT

1. Remove the rear door trim.
2. After disconnecting the connector (A), remove the power window motor(B).



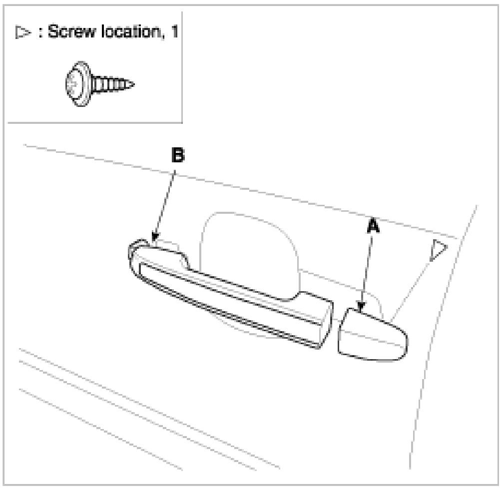
3. Installation is the reverse of removal.

NOTE

- Roll the glass up down to see if it move freely without binding.

OUT SIDE HANDLE REPLACEMENT

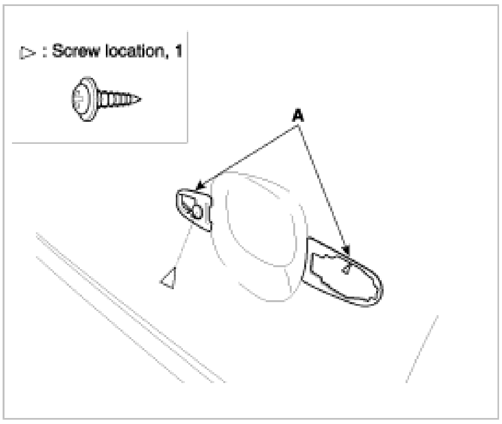
1. Remove the rear door trim.
2. Remove the glass.
3. Remove inside handle.
4. After disconnecting the cover (A), remove the outside handle base(B).



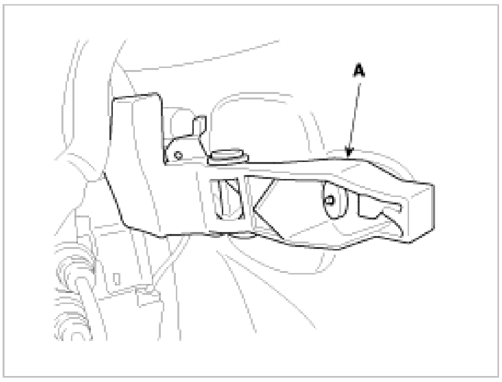
5. Remove rear door module.
6. Installation is the reverse of removal.

REAR DOOR LATCH REPLACEMENT

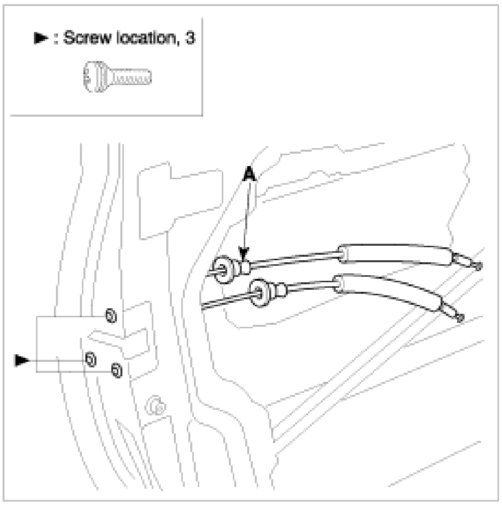
1. Remove the rear door trim.
2. Remove the glass.
3. Remove the inside handle.
4. Remove the door module.
5. Remove the out side handle.
6. Remove the out side handle pad (A).



7. Remove the out side handle base (A).



8. After loose the latch mounting bolts, remove the rear door latch(A).

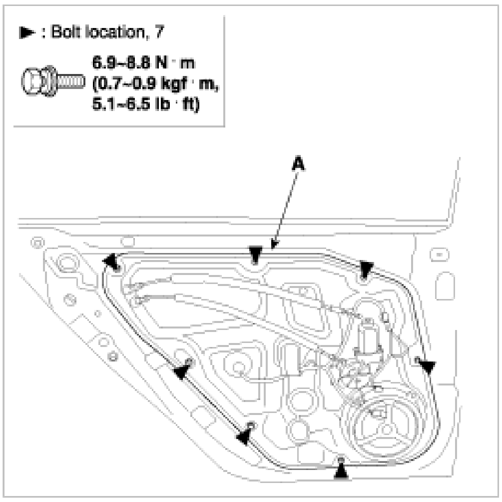


9. Installation is the reverse the removal.

> NOTE
>
> - Make sure the door lock and opens properly.

REAR DOOR MODULE REPLACEMENT

1. Remove the rear door trim.
2. Remove the glass.
3. Remove the inside handle.
4. Remove the out side handle.
5. After loose the door module mounting bolts, remove the door module (A).

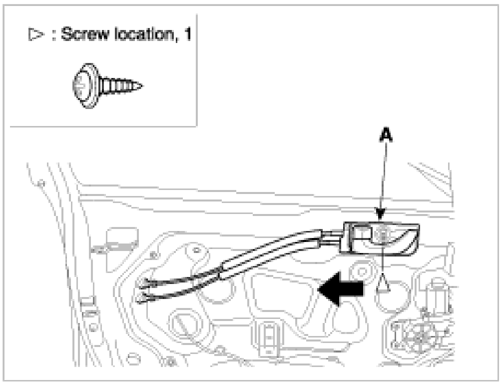


6. Installation is the reverse of removal.

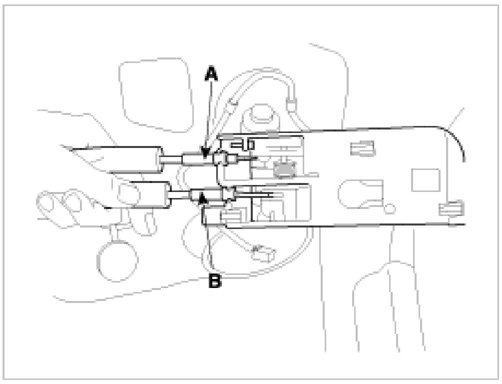
> NOTE
>
> - Make sure the connector is plugged in properly and each rod is connected securely.
> - Make sure the door locks and opens properly.

INSIDE HANDLE REPLACEMENT

1. Remove the rear door trim.
2. Loose the inside handle (A) mounting screw.
   Push the inside handle rearward to disconnect from the door module.



3. Disconnect the lock cable and (A) inside connect cable (B).



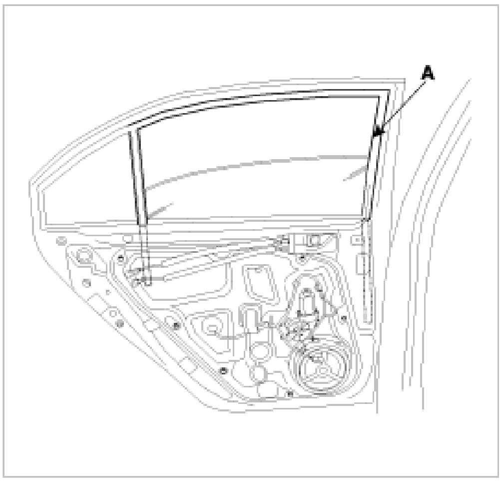
4. Installation is the reverse of removal.

> NOTE
>
> - Make sure the door lock and open properly.

DOOR BELT WEATHERSTRIP REPLACEMENT

GLASS RUN REPLACEMENT

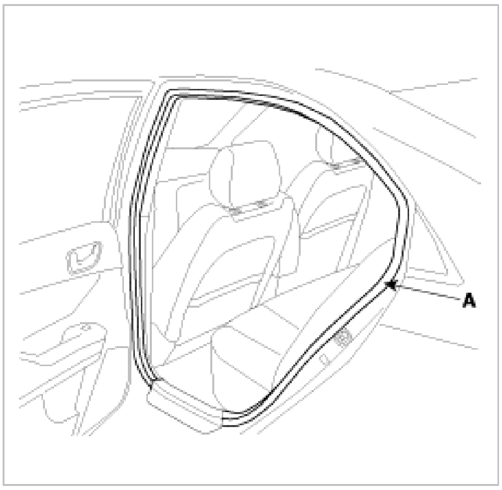
1. Remove the rear door trim.
2. Remove the glass.
3. Remove the glass run channel (A) front the lower part.



4. Installation is the reverse of removal.

BODY WEATHHERSTRIP REPLACEMENT

1. Release the clips then remove the body weatherstrip (A).



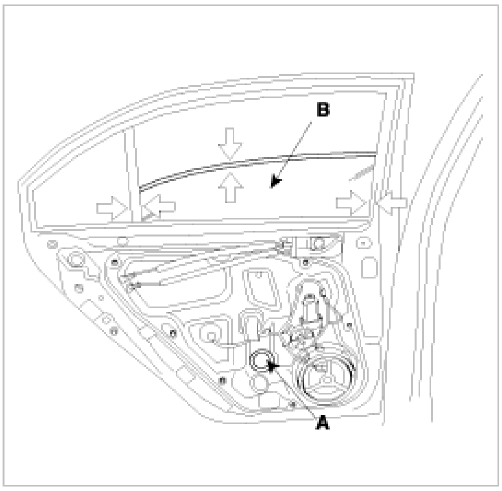
2. Installation is the reverse the removal.

ADJUSTMENT

GLASS ADJUSTMENT

> NOTE
>
> - Check the glass run channel for damage or deterioration, and replace them necessary.

1. Remove the following parts.
   A. Door trim.
2. Carefully move the glass (A) until you can see the glass mounting bolts(B), then loosen them.

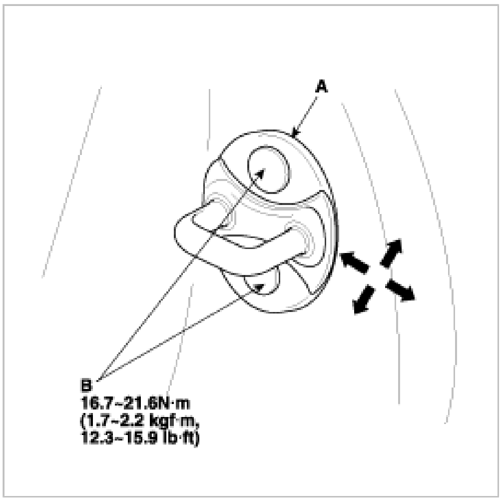


3. Push the glass (A) against the channel (C), then tighten the glass mounting bolts.
4. Check that the glass moves smoothly.
5. Raise the glass fully, and check for gaps.
   Check that the glass contacts the glass run channel evenly.
6. Check for water leaks. Run water over the roof and on the sealing area as shown, and note these items:
   A. Use a 12mm (1/2in.) diameter hose (A).
   B. Adjust the rate of water flow as shown (B).
   C. Do not use a nozzle.
   D. Hold the hose about 300mm(12in.) away from The door (C).

DOOR STRIKER ADJUSTMENT

Make sure the door latches securely without slamming It. If necessary, adjust the striker (A): The strike nuts are fixed. The strike can be fine adjusted up or down, and in or out.

1. Loosen the screws (B), then insert a shop towel between the body and striker.



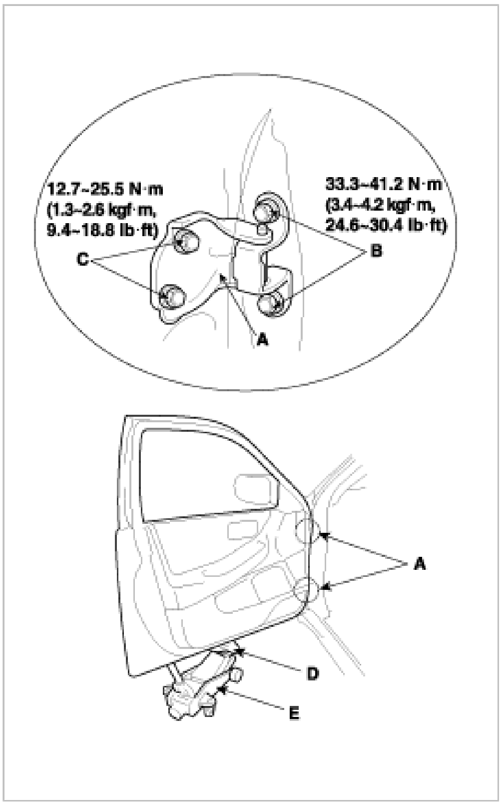
2. Lightly tighten the screws.
3. Wrap the striker with a shop towel, then adjust the striker by tapping it with a plastic hammer.
   Do not tap the striker too hard.
4. Loosen the screws and remove the shop towel.
5. Lightly tighten the screws.
6. Hold the outer handle out, and push the door against the body to be sure the striker allows a flush fit. If the door latches properly, tighten the screws and recheck.

DOOR POSITION ADJUSTMENT

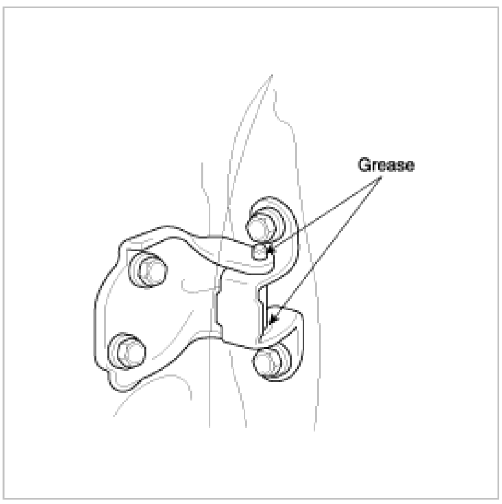
NOTE

After installing the door, check for a flush fit with the body, then check for equal gaps between the front, rear, and bottom, door edges and the body. Check that the door and body edges are parallel. before a djusting, replace the mounting bolts.

1. Place the vehicle on a firm, level surface when adjusting the doors.
2. Adjust at the hinges (A):
   A. Loosen the door mounting bolts (B) slightly, and move the door IN or OUT until it aligns flush with the body.
   B. Loosen the hinge mounting bolts (C) slightly, and move the door BACKWARD or FORWARD, UP or DOWN as necessary to equalize the gaps.
   C. Place a shop towel (D) on the jack (E) to prevent damage to the door when adjusting the door.
3. Check that the door and body edges are parallel.



4. Grease the pivot portions of the hinges indicated by the arrows.



5. Check for water leaks.

Body (Interior and Exterior) > Exterior > body side moldings > Repair procedures

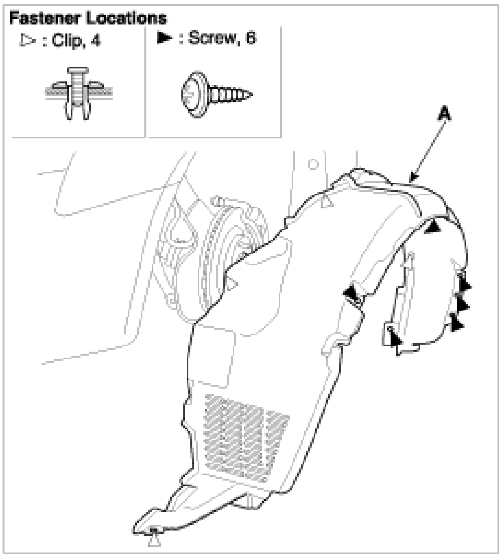
REPLACEMENT

FRONT MUD GUARD AND WHEEL GUARD

NOTE

- When prying with tip screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Put on gloves to protect your hands.
- Take care not to scratch the body surface.

1. Remove the wheel guard (A).



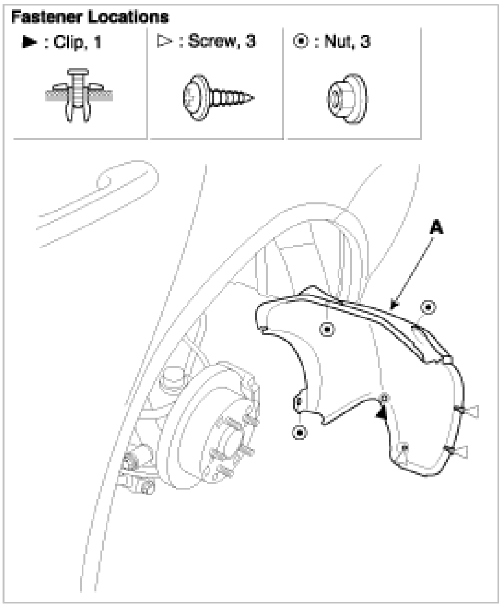
2. Installation is the reverse of removal.

REAR MUD GUARD AND WHEEL GUARD

NOTE

- When prying with tip screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Put on gloves to protect your hands.
- Take care not to scratch the body surface.

1. Remove the wheel guard (A).

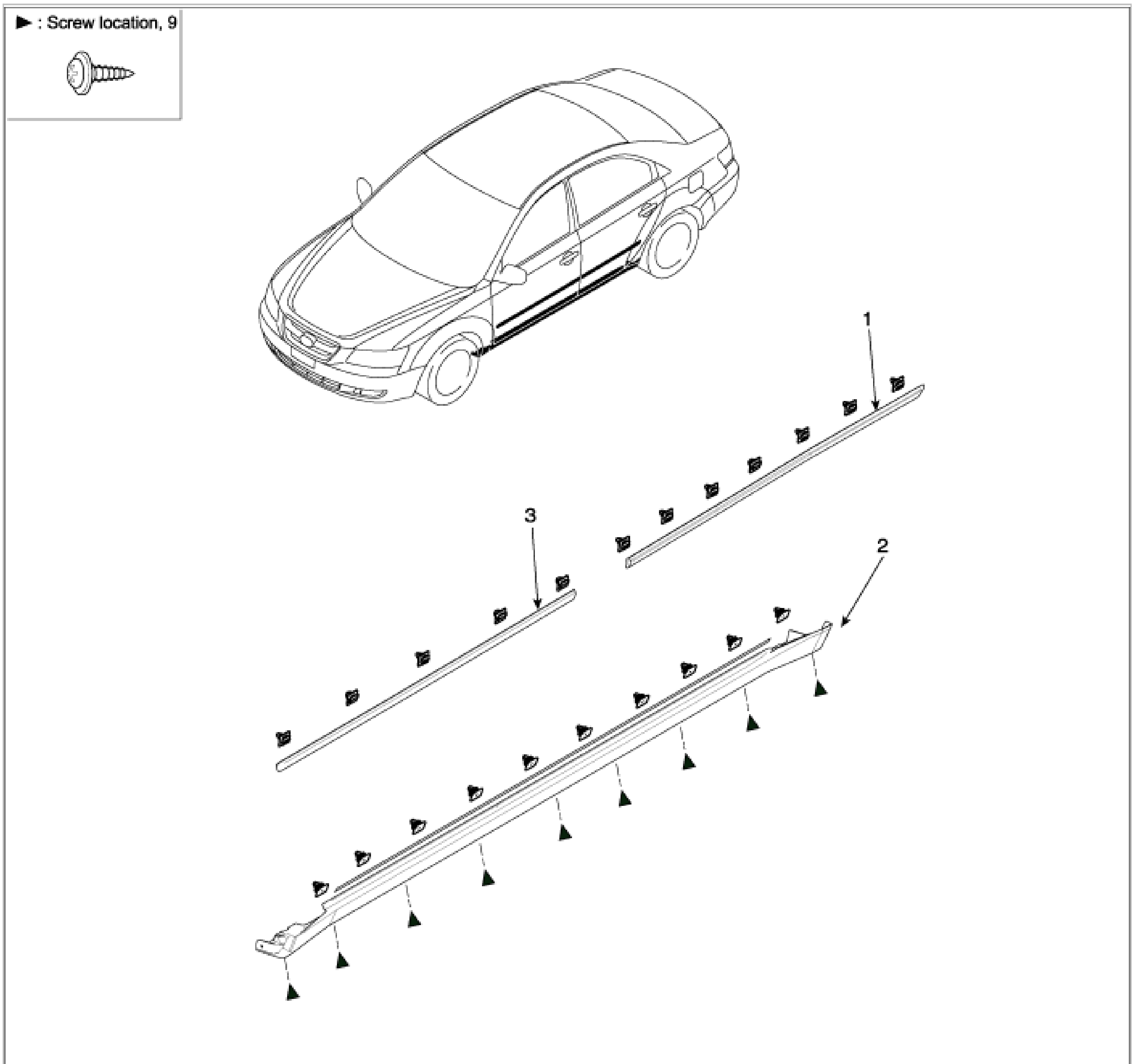


2. Installation is the reverse of removal.

SIDE GARNISH AND SIDE SILL REPLACEMENT

NOTE

- When prying with a flat-tip screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Put on gloves to protect your hands.
- Take care not to scratch the body surface.

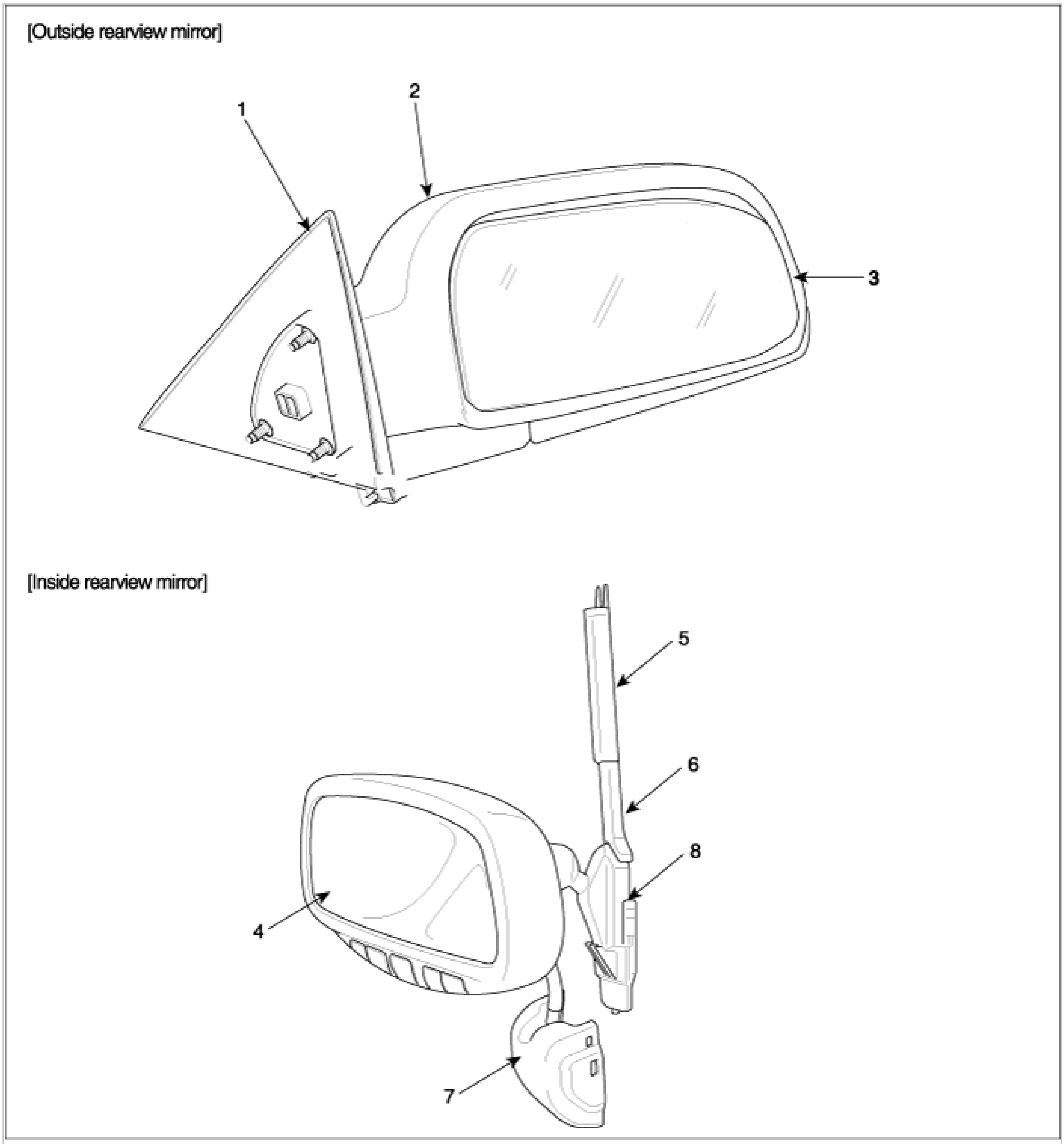


1. Rear door molding
2. Side seal molding

3. Front door molding

Body (Interior and Exterior) > Exterior > mirror > Components and Components Location

COMPONENETS



1. Base	4. Mirror	7. cover
2. Housing	5. Wire home link cover	8. Base
3. Mirror	6. Wire home link	

Body (Interior and Exterior) > Exterior > mirror > Repair procedures

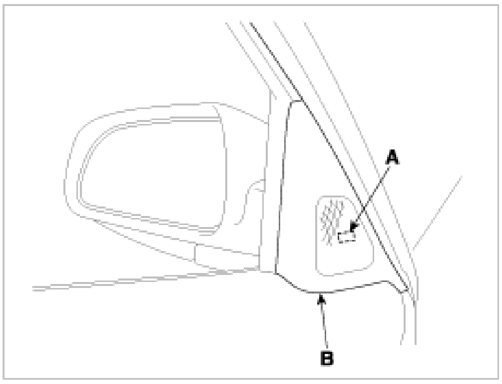
REPLACEMENT

OUTSIDE REAR VIEW MIRROR RELPLACEMENT

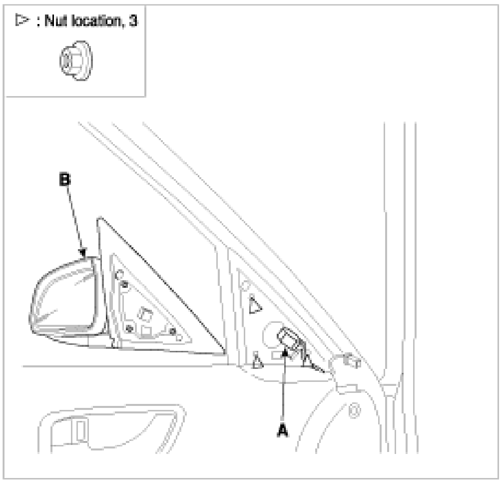
NOTE

- When prying with tip screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Put on gloves to protect your hands.

1. Remove the quadrant inner cover (A), then disconnect the connector (B).



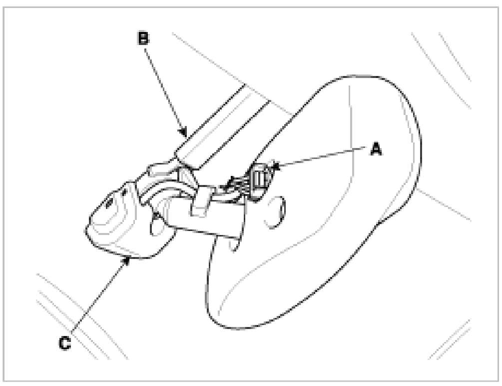
2. After disconnecting the connector (A), remove the outside rear view mirror (B).



3. Installation is the reverse of removal.

ECM MIRROR REPLACEMENT

1. Remove the connector (A) and cover (B,C).

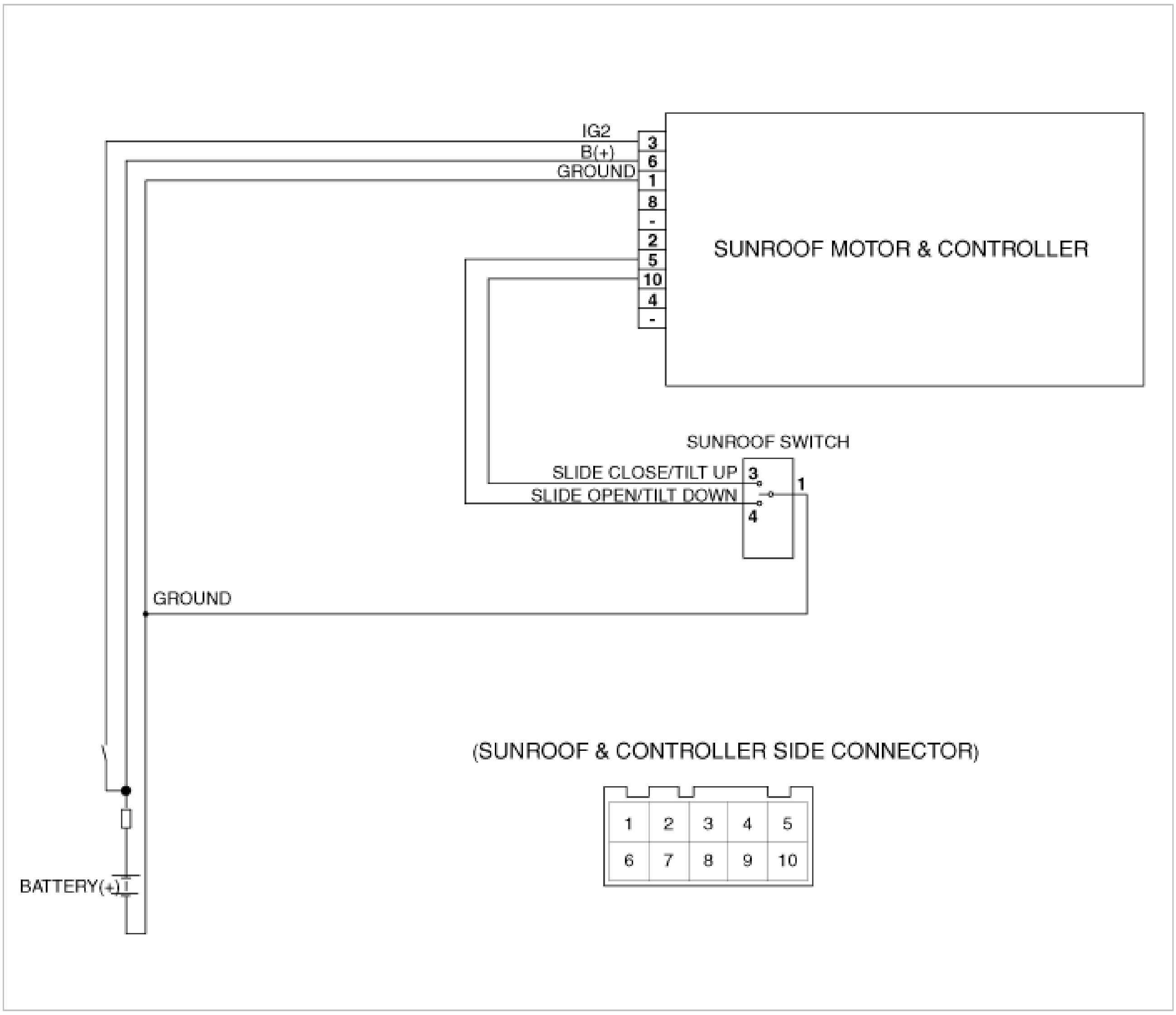


2. Loesen the mounting screw. Push the ECM mirror base up to remove the ECM mirror assembly (A).

3. Installation is the reverse of removal.

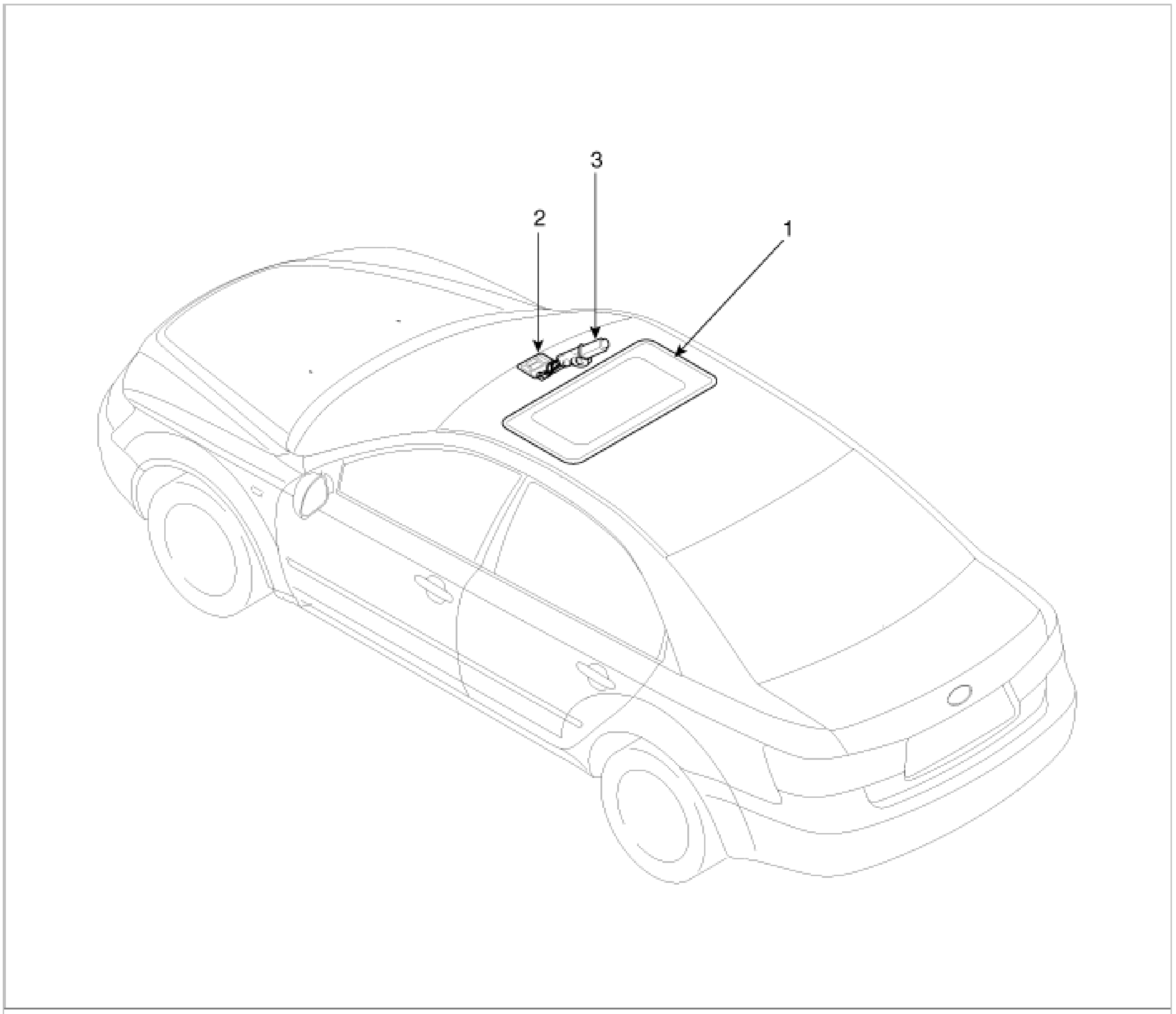
Body (Interior and Exterior) > Sun Roof > Schematic Diagrams

CIRCUIT DIAGRAM



Body (Interior and Exterior) > Sun Roof > Components and Components Location

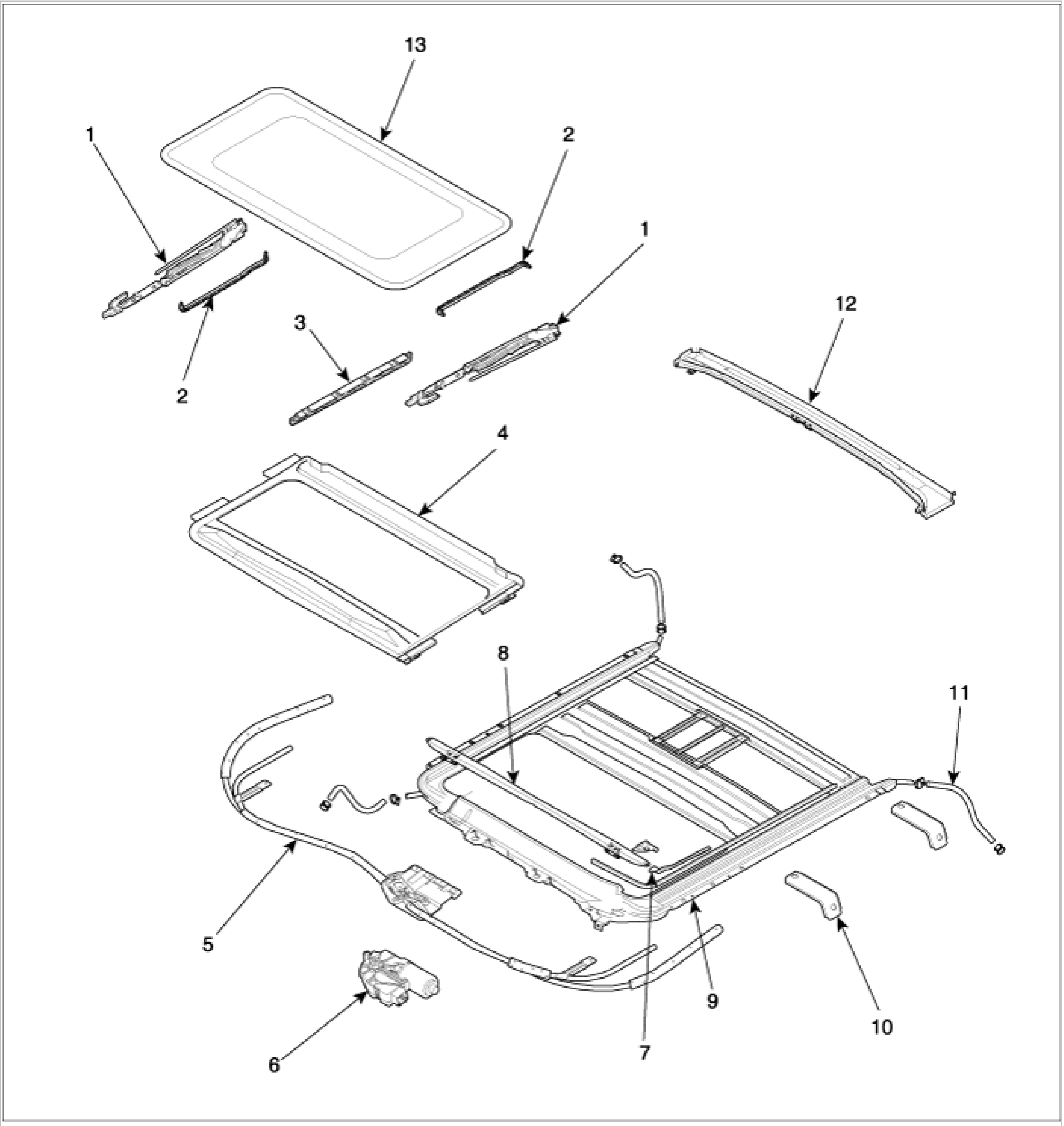
COMPONENT LOCATION



1. Sunroof	3. Sunroof motor & controller
2. Sunroof switch	

Body (Interior and Exterior) > Sun Roof > sun roof assembly > Components and Components Location

COMPONENTS



1. Guide assembly	6. Motor	11. Drain tube
2. Drip link	7. Defector link	12. Drip rail
3. Decoration cover	8. Defector	13. Glass
4. Sunshade	9. Frame	
5. Drive unit	10. Set bracket	

Body (Interior and Exterior) > Sun Roof > sun roof assembly > Repair procedures

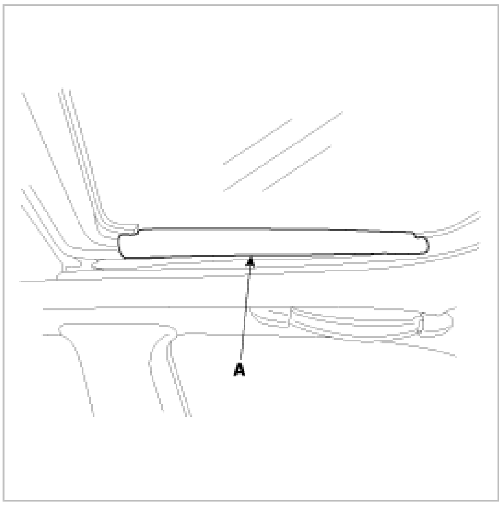
REPLACEMENT

GLASS REPLACEMENT

NOTE

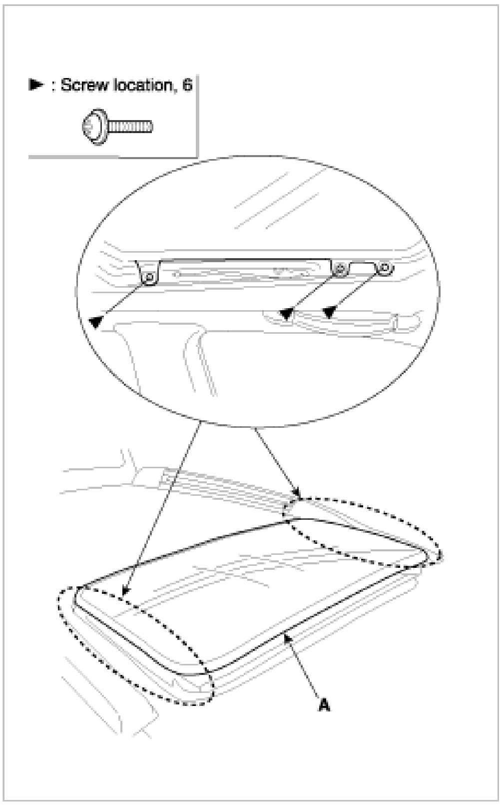
- Put on glove to protect your hands.

1. Remove both decoration cover (A).



2. Remove the glass (A) by lifting it up.

> NOTE
>
> - Do not damage the roof panel



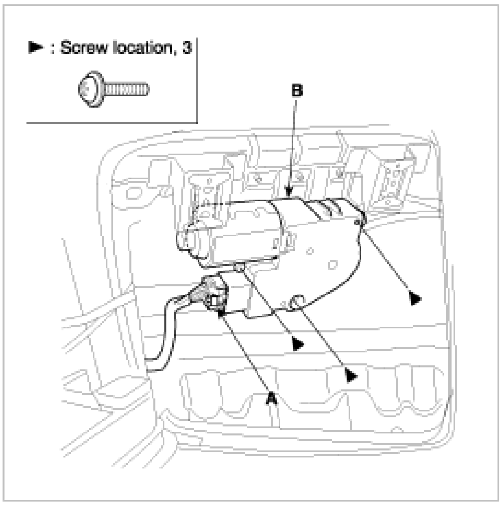
3. Installation is the reverse of removal.

MOTOR REPLACEMENT

1. Remove the over head console.

> NOTE
>
> - Confirm the position of guide whether it is closed or not when you remove the motor.

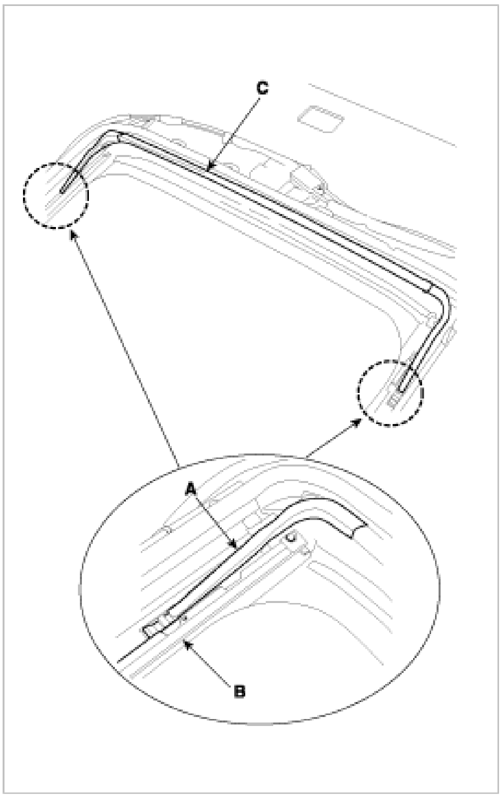
2. Disconnect the motor connector (A), remove the screws and then remove the motor (B).



3. Installation is the reverse of removal.

DEFLECTOR REPLACEMENT

1. Open the glass fully.
2. Disconnect the deflector link (A) from the frame (B), and then remove the deflector (C).



3. Installation is the reverse of removal.

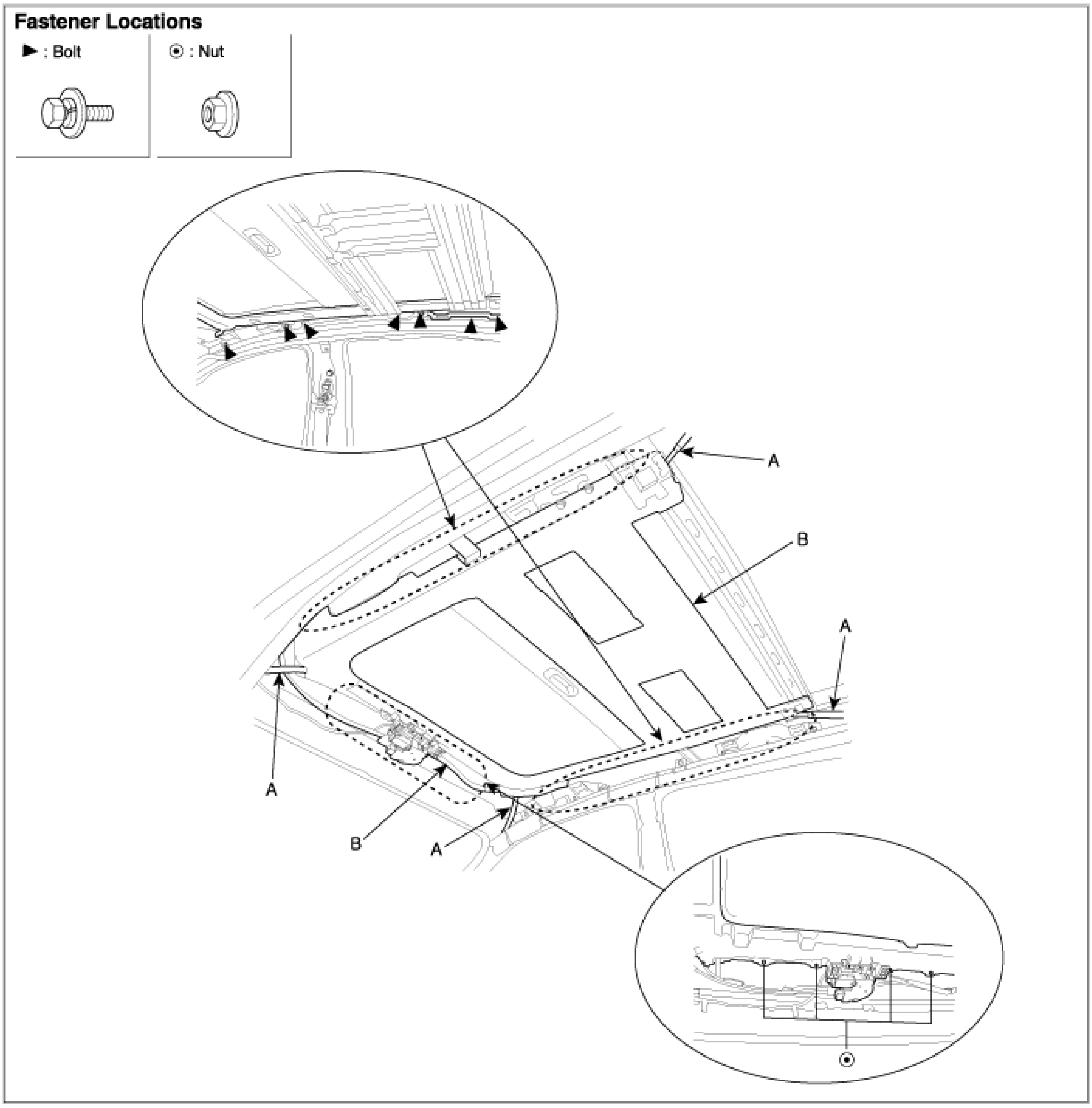
SUNROOF ASSEMBLY REPLACEMENT

1. Remove the follows parts.
   A. Front and door scuff trim.
   B. Front, center and rear pillar trim.
   C. Headlining.
   D. Sunroof glass.
2. Disconnect the drain tubes (A).
3. After loosening the mounding bolts and nuts, remove the sunroof assembly (B).

NOTE

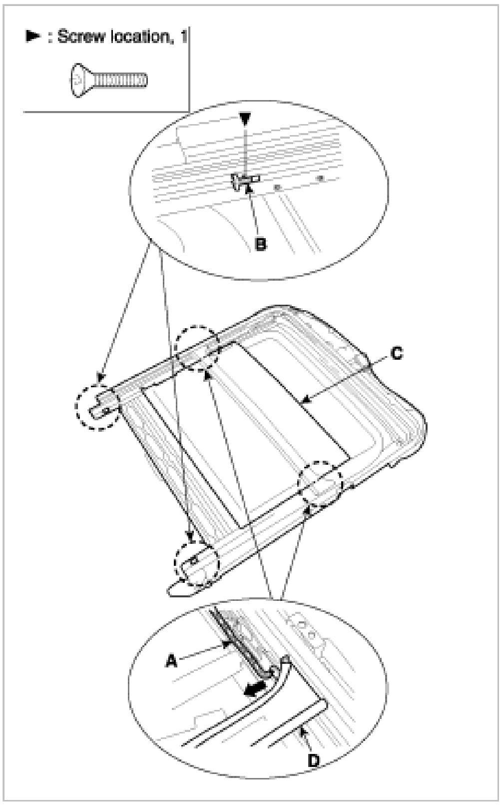
- Take care not to scratch the interior trims and other parts.

4. Installation is the reverse of removal.



SUNSHADE AND DRIP RAIL REPLACEMENT

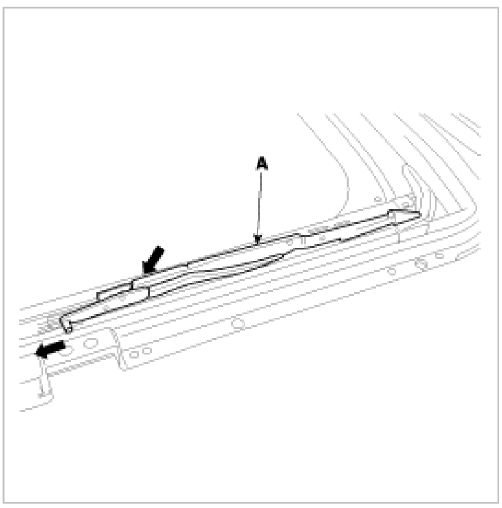
1. Remove the sunroof assembly.
2. Remove the drip link (A) and sunshade stopper (B).
3. Remove the sunshade (C) and drip rail (D).



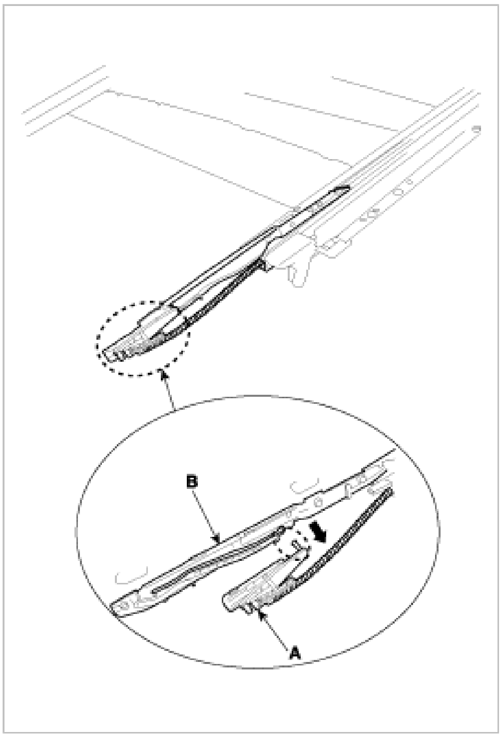
4. Installation is the reverse of removal.

GUIDE ASSEMBLY REPLACEMENT

1. Remove the sunroof assembly.
2. Remove a guide assembly (A) after lowering a guide thoroughly by pushing a slide (B) to rear.



3. Remove the guide (A) and slide (B).



4. Installation is the reverse of removal.

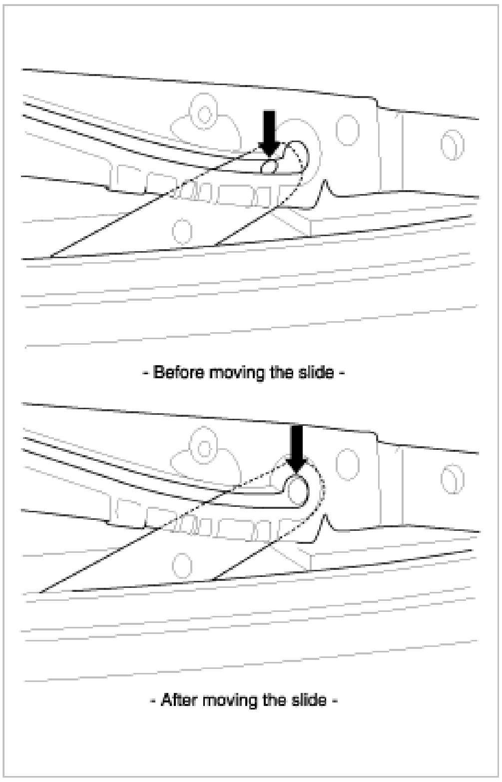
NOTE

- Make sure to align the slide with the center of “A” and “B”
- Make sure to initialize the motor.

ADJUSTMENT

HOW TO INITIALIZE

1. Check that the glass has been installed.
   A. Finished height adjustment.
2. Push the up switch. (Keep on pushing the switch)
   A. The slide moved 5mm forward after 15 seconds.



3. After moving the slide 5mm forward, turn OFF the switch and push the UP switch (Keeping on pushing the switch with continuous operation).
   A. If the operation above is normal condition, the sunroof once and closes.
4. When the sunroof is closed completely, turn OFF the UP switch initialize the motor completely.

WHEN TO INITIALIZE THE MOTOR

1. First operation the vehicle after manufacture it.
2. Initial value is erased or damaged because of short power electric discharge during operation.
3. After using the manual handle.

OPERATING THE SUNROOF EMERGENCY HANDLE

1. Use the sunroof emergency handle to close and open the sunroof manually for the following case only.
   A. To close the sunroof before driving a vehicle in a rainy day or on the highway if the sunroof cannot be closed due to failure of the sunroof motor or controller.
2. Operating method.
   A. Remove the overhead console.
   B. Push the emergency handle up into the hexagonal drive (A) of the sunroof motor. You must push hard enough to disengage the motor clutch; otherwise the emergency handle will slip due to incomplete fit in the motor.
   C. Carefully turn the emergency handle clockwise to close the sunroof.
   D. After closing the sunroof, wiggle the handle back and forth as you remove the tool from the motor, to ensure the motor clutch reengages.
   E. A 5mm hex socket may be used in place of the emergency handle, with a" Speeder" type handle.

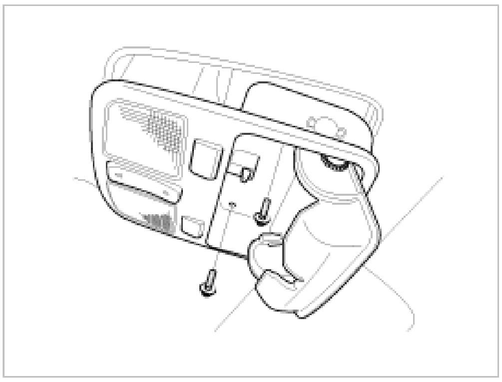
> **CAUTION**
>
> Do not use power tools to operate the sunroof.
> Damage to the components may occur.

Body (Interior and Exterior) > Sun Roof > sun roof switch > Repair procedures

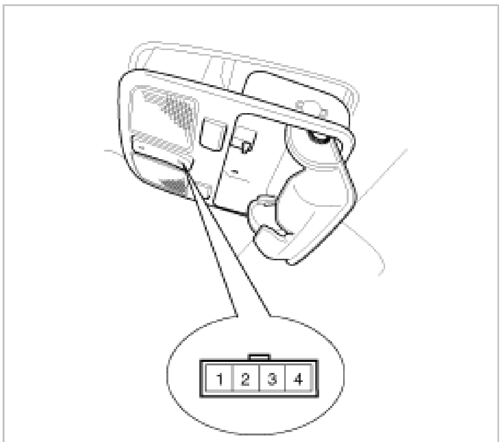
INSPECTION

1. Disconnect the negative (-) battery terminal.

2. Open the sunglass case cover from the overhead console then remove the 2 screws (B) holding the overhead console.



3. Disconnect the connector then remove the overhead console lamp assembly from the headliner. Check for continuity between the terminals. If the continuity is not as specified, replace the sunroof switch.



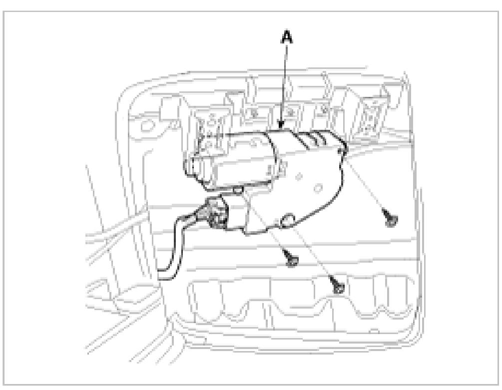
[Switch side connector]

Terminal / position	1	3	4
Slide open	O	─	O
Tilt down	O	─	O
Tilt up	O	O	

Body (Interior and Exterior) > Sun Roof > sun roof moter > Repair procedures

REPLACEMENT

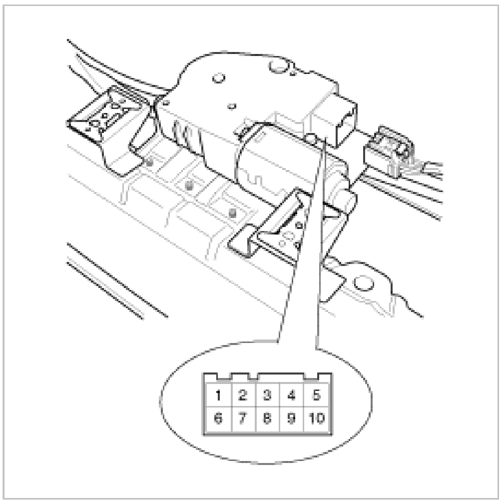
1. Disconnect the negative (-) battery terminal.
2. Open the sunglass case cover from the overhead console then remove the 2 screws holding the overhead console. Disconnect the connector then remove the overhead console lamp assembly from the headliner.
3. Remove the head lining. (Refer to Body group - sunroof)
4. Remove the sunroof motor (A) after removing 3 screws and disconnect.



5. Installation is the reverse of removal.

INSPECTION

1. Disconnect the negative (-) battery terminal.
2. Apply the battery voltage to terminal 3, 6 and ground the terminal 1.



3. Ground the terminals as below table, and check that the sunroof unit operates as below table.

position \ Terminal	3	4	5	10
Slide close/Tilt up	⊕			⊖
Slide open/Tilt down	⊕		⊖	

4. Make these input tests at the connector
   If any test indicates a problem, find and correct the cause, then recheck the system.
   If all the input tests prove OK, the sunroof motor must be faulty; replace it.

Terminal	Test condition	Test: Desired result
3	IG2 ON	Check for voltage to ground: There should be battery voltage.
1	Under all conditions	Check for continuity to ground: There should be continuity.
6	Under all conditions	Check for voltage to ground: There should be battery voltage.

RESETTING THE SUNROOF

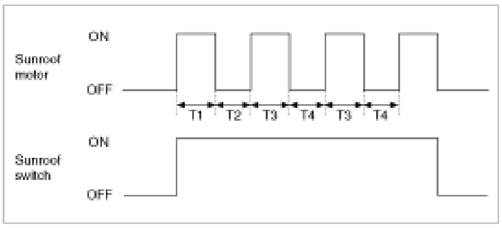
Whenever the vehicle battery is disconnected or discharged, or you use the emergency handle to operate the sunroof, you have to reset your sunroof system as follows:.

1. Turn the ignition key to the ON position.
2. According to the position of the sunroof, do as follows.
   (1) In case that the sunroof has closed completely or been tilted :
   Press the TILT UP button until the sunroof has tilted upward completely.
   (2) In case that the sunroof has slide-opened:
   Press and hold the CLOSE button for more than 5 seconds until the sunroof has closed completely.
   Press and hold the CLOSE button for more than 5 seconds after the sunroof has closed completely. Press the TILT UP button until the sunroof has tilted upward completely.
3. Release the TILT UP button.
4. Press and hold the TILT UP button once again until the sunroof has returned to the original position of TILT UP after it is raised a little higher than the maximum TILT UP position.
   When this is complete, the sunroof system is reset.

PROTECTING THE OVERHEATED MOTOR

In order to protect the overheated sunroof motor by continuous motor operation, the sunroof ECU controls the Run-time and Cool-time of motor as followings;

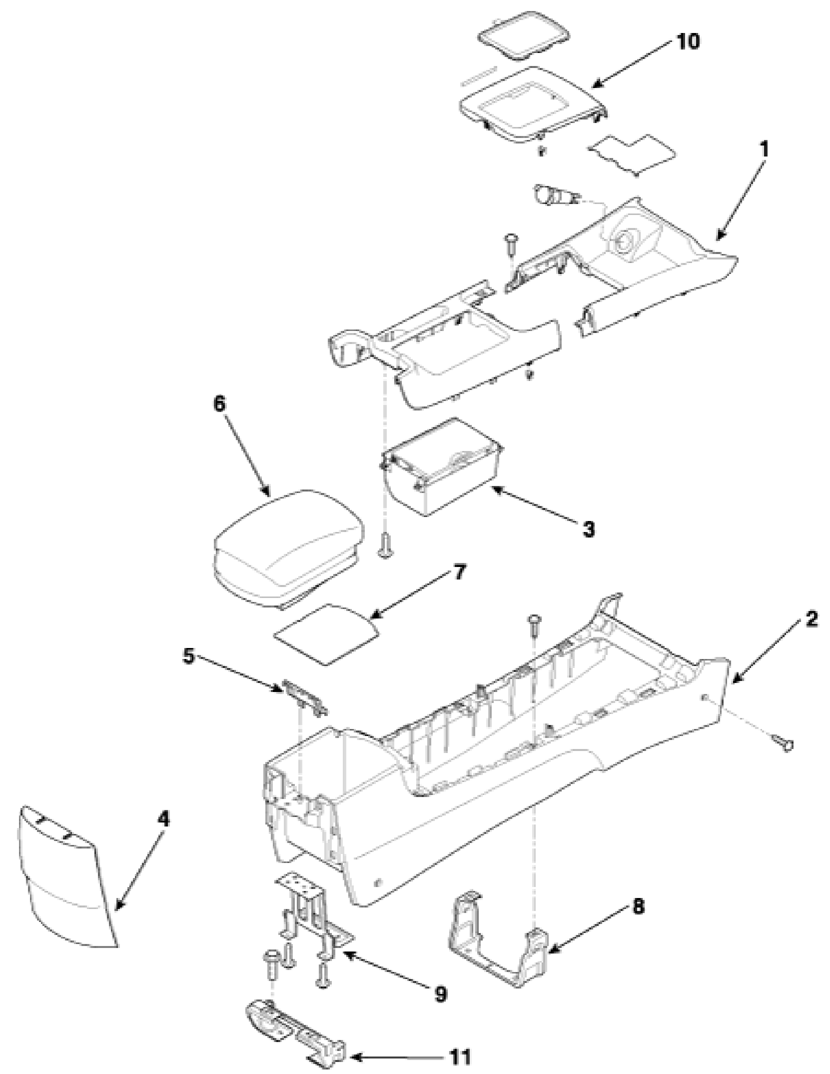
1. The Sunroof ECU detects the Run- time of motor
2. Motor can be operated continuously for the 1st Run-time(120 ± 10sec.).
3. The continuously operated motor stops operating after the 1st Run-time(120 ± 10sec.).
4. And then Motor is not operated for the 1st Cool-time(18 ± 2sec.).
5. Motor is operated for the 2nd Run-time(10 ± 2sec.) at the continued motor operation after 1st Cool-time(18 ± 2sec.)
6. The continuously operated motor stops operating after the 2st Run-time(120 ± 10sec.)
7. Motor is not operated for the 2st Cool-time(18 ± 2sec.).
8. Motor repeats the 2nd Run-time and 2nd Cool-time at the continued motor operation.
    A. In case that motor is not operated continuously, the Run-time which is limited for protecting the overheated motor is increased.
    B. The Run-Time of motor is initialized to "0" if the battery or fuse is reconnected after being disconnected, discharged or blown.



T1 : 120 ± 10 sec., T2 : 18 ± 2 sec.,
T3 : 10 ± 2 sec., T4 : 18 ± 2 sec.

Body (Interior and Exterior) > Interior > console > Components and Components Location

COMPONENTS



1. Upper cover	5. Armrest ballank	9. Armrest
2. Floor console	6. Armrest	10. Center cover
3. Strage box	7. Floor console pad	11. Rear mounting bracket
4. Rear console cover	8. Armrest center mounting bracket	

Body (Interior and Exterior) > Interior > console > Repair procedures

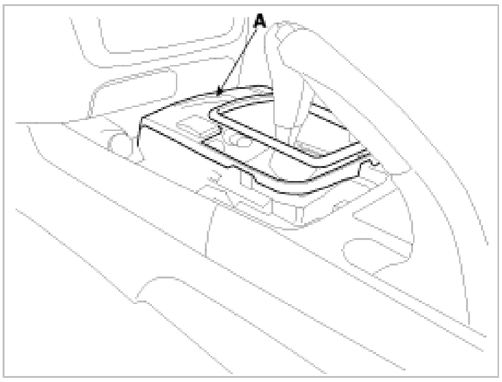
REPLACEMENT

FLOOR CONSOLE REPLACEMENT

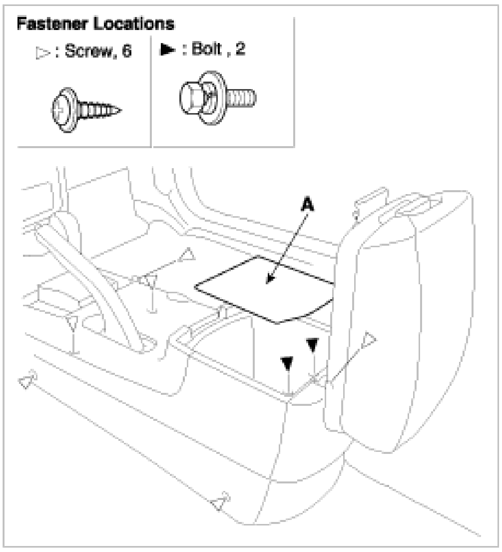
NOTE

- When prying with tip screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Put on gloves to protect your hands.

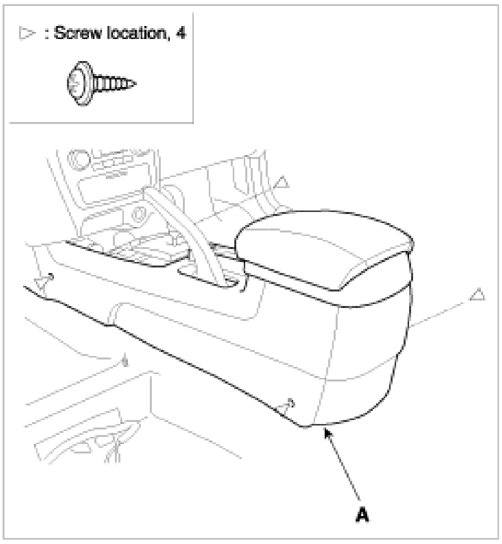
1. Remove the front seat.
2. After remove the center cover (A), disconnect the connector (B).



3. Remove the floor console pad (A).



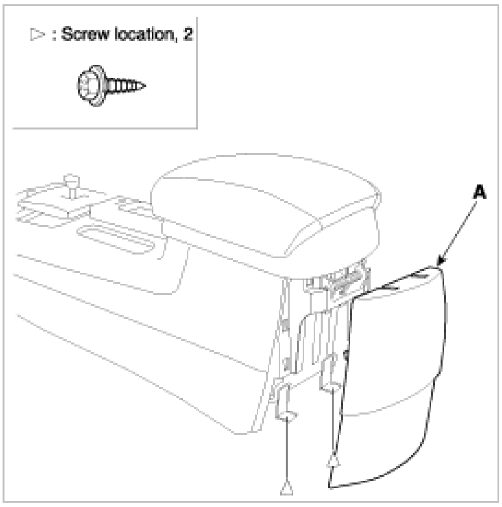
4. After loosening the console mounting screw, remove the floor console assembly(A).



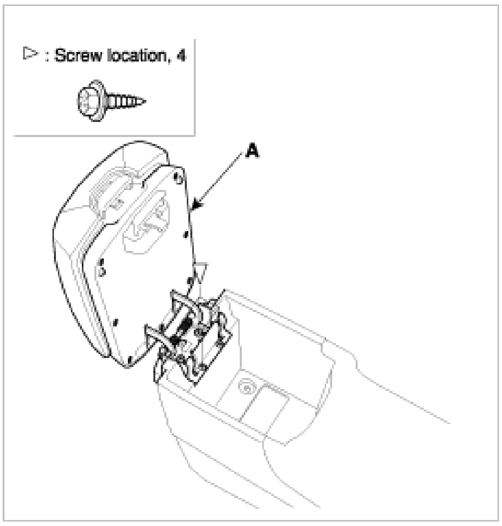
5. Installation is the reverse of removal.

ARMREST REPLACEMENT

1. Remove the console assembly.
2. Remove rear cover (A).



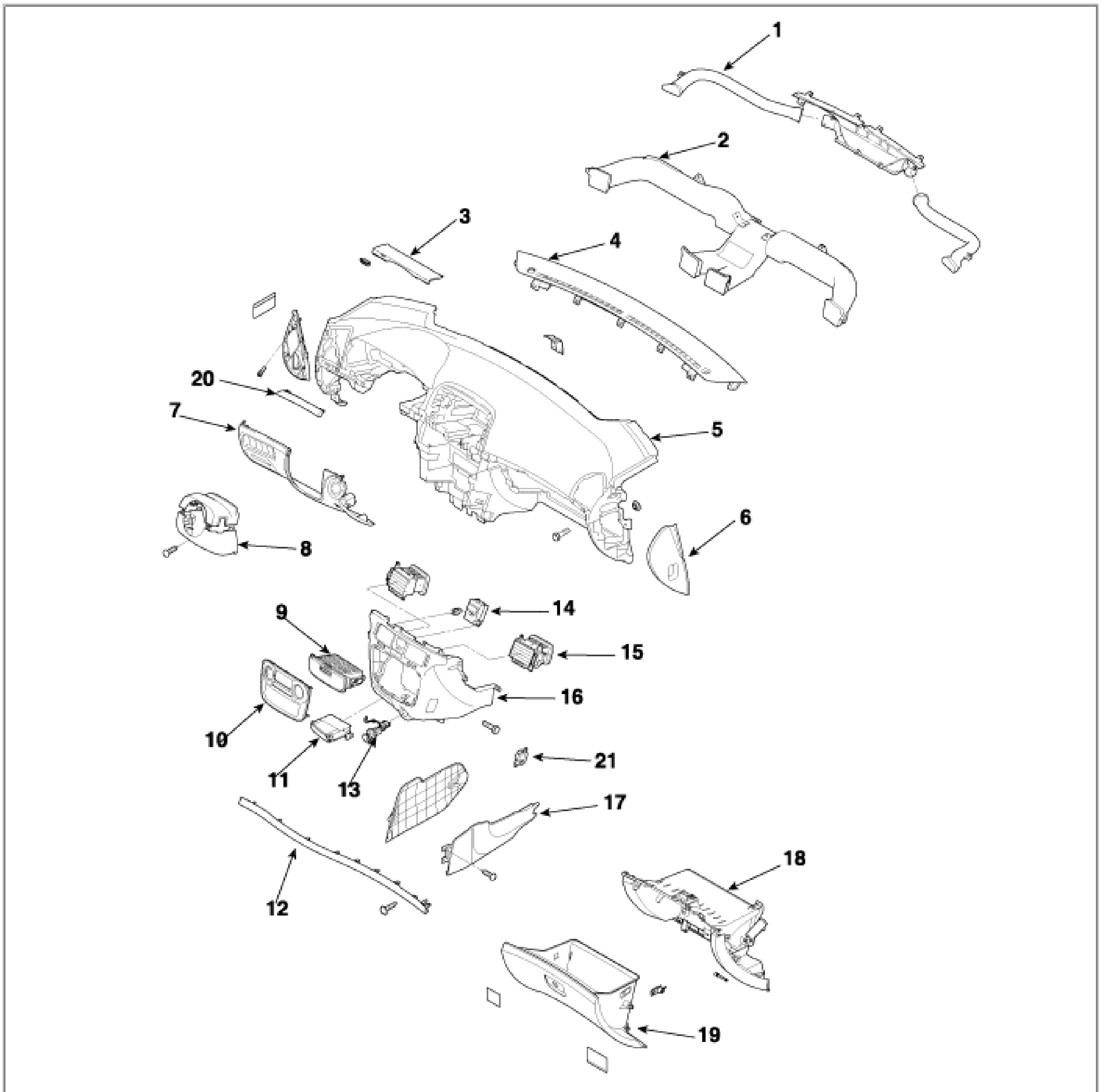
3. After loosening the armrest mounting screw, remove the armrest (A).



4. Installation is the reverse of removal.

Body (Interior and Exterior) > Interior > crash pad > Components and Components Location

CONPONENTS

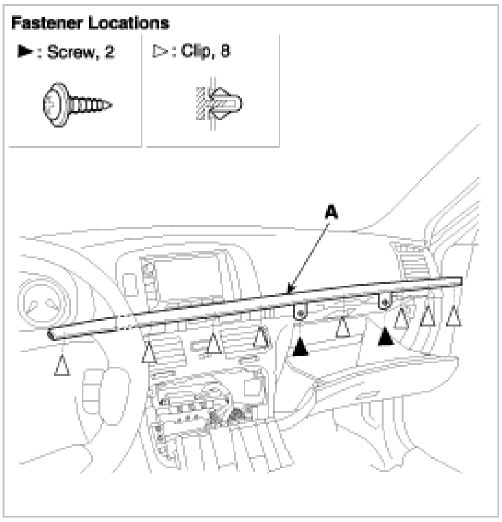


1. Defroster hose
2. Air vent
3. Cluster facia panel
4. Center
5. Main crash pad
6. Side cover
7. Crash pad lower panel
8. Steering column shroud
9. Center facia
10. Center facia lower panel
11. Ashtay
12. Center guarsh
13. Cigar lighter
14. Digtal clock
15. Air vent
16. Center crash pad panel
17.Center lower cover
18. Lower crash pad panel
19. Glove box
20. Side cover
21. hanger

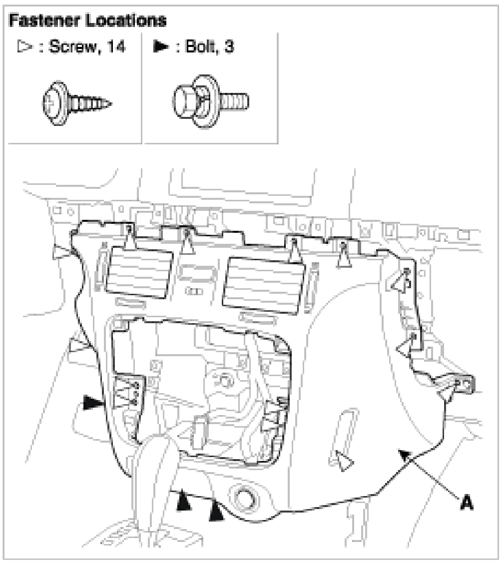
REPLACEMENT

CRASH PAD CENTER PANEL REPLACEMENT

1. Remove floor console assembly.
2. Remove the center garnish (A).
3. Remove the glove box.
4. Remove the center facia upper panel.



5. After loosening the crash pad lower panel mounting screw, then crash pad lower panel (A).

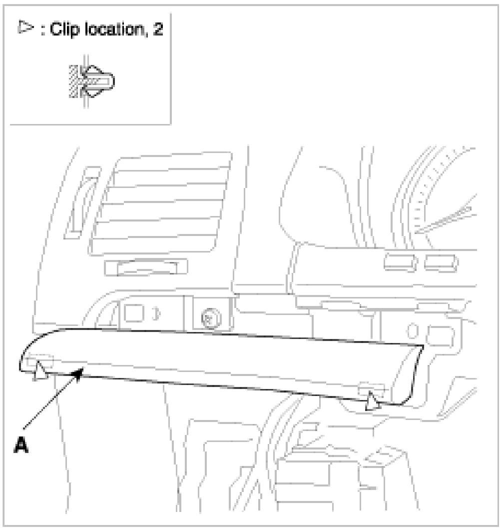


6. Installation is the reverse of removal.

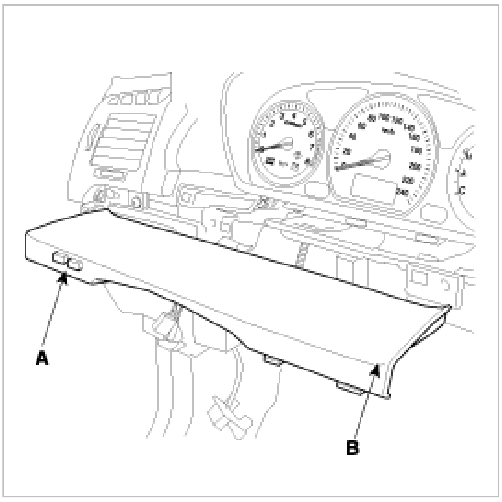
CLUSTER FACIA PANEL REPLACEMENT

> NOTE
>
> - When prying with tip screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
> - Put on gloves to protect your hands.

1. Tilt the steering column down.
2. Remove the center garnish (A).



3. After disconnecting the trip sensor connector (A), remove the cluster facia panel (B).



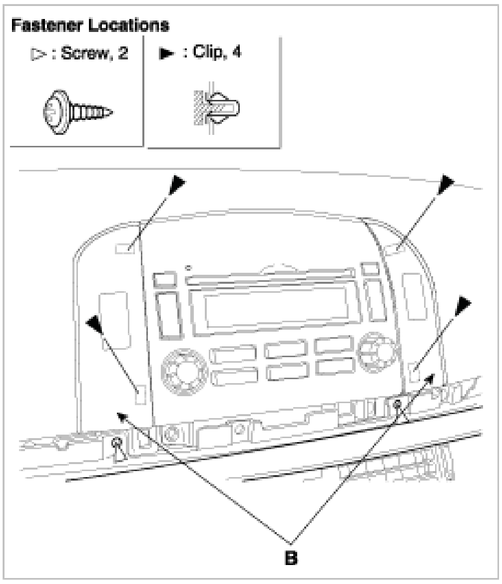
4. Installation is the reverse of removal.

> NOTE
>
> - Make sure the connector is plugged in properly.

CENTER FACIA PANEL REPLACEMENT

1. After disconnecting the connector (A), remove the center facia panel (B).

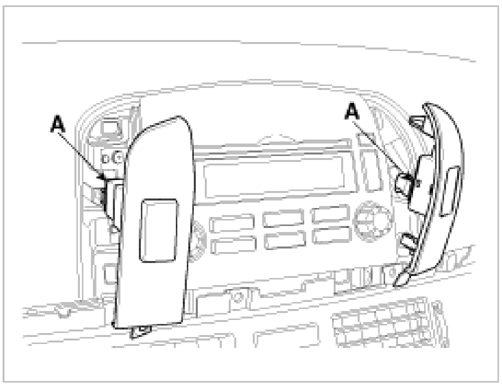
> NOTE
>
> - When prying with tip screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
> - Put on gloves to protect your hands.



2. Installation is the reverse of removal.

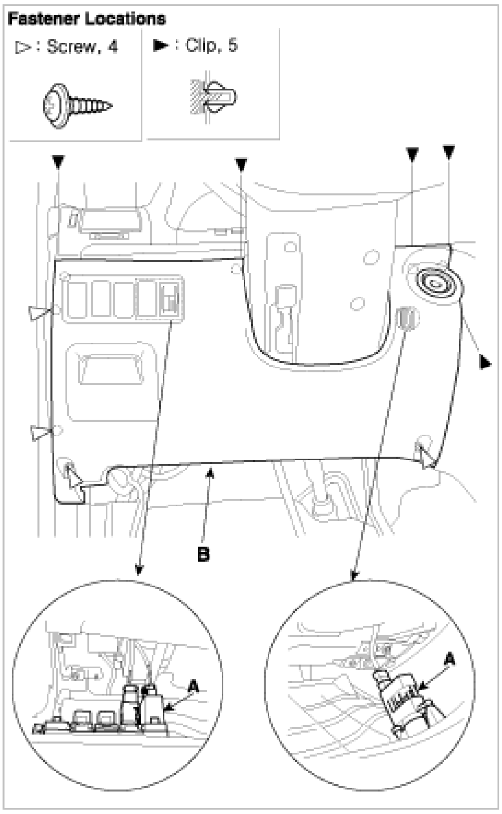
NOTE

- Make sure the connector is plugged in properly.



LOWER CRASH PAD PANEL REPLACEMENT

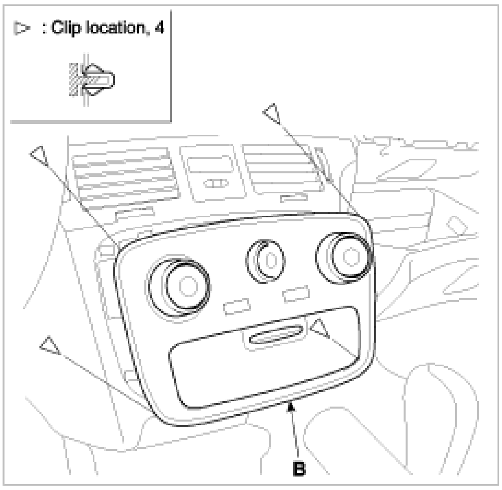
1. Remove the center garnish.
2. Loosening the crash pad lower panel mounting screw.
3. After Disconnecting the connector(A), remove lower panel (B).

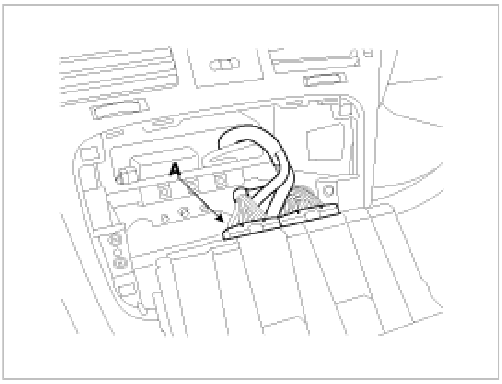


4. Installation is the reverse of removal.

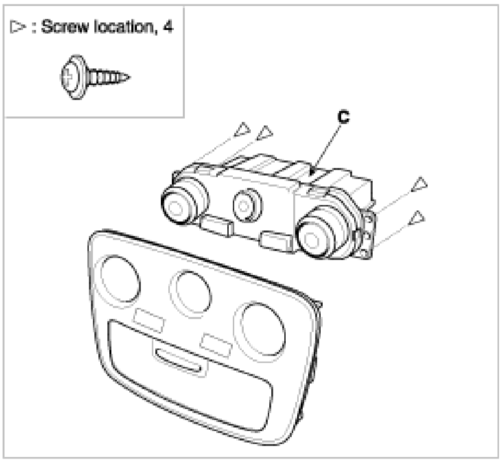
HEATER CONTROL UNIT REPLACEMENT

1. After disconnecting the connector (A), remove the center facia lower panel (B).





2. Loosening the heater control mounting screw, remove heater control unit (C).

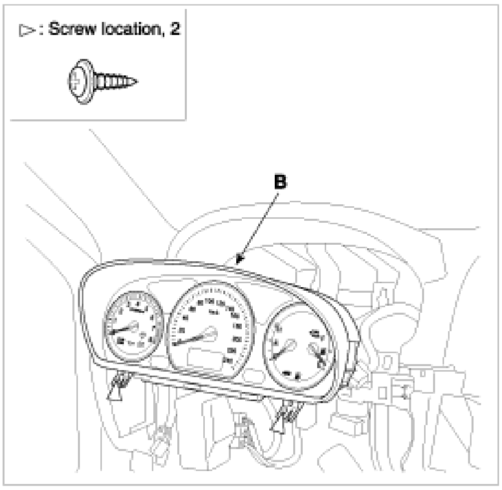


3. Installation is the reverse of removal.

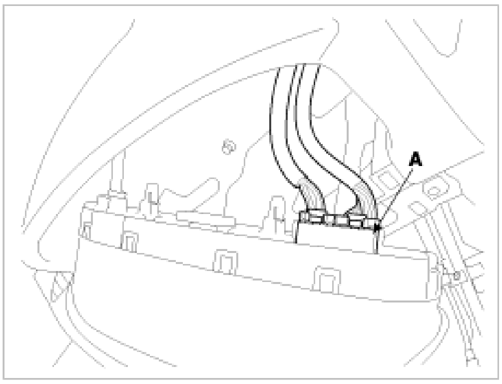
> NOTE
>
> - Make sure the connector is plugged in properly.

CLUSTER REPLACEMENT

1. Remove the cluster facia panel.
2. Loosen the screws.



3. Disconnect the cluster connector (A), then remove the cluster (B).

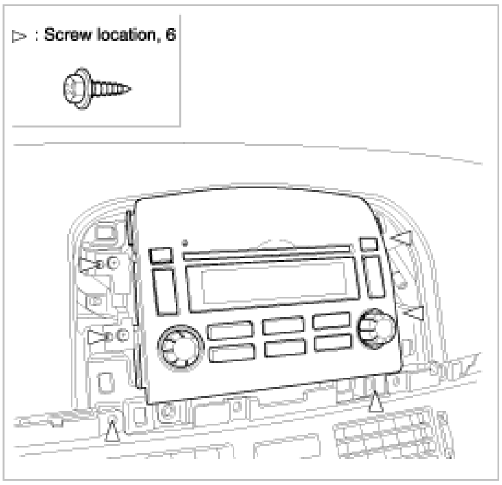


4. Installation is the reverse of removal.

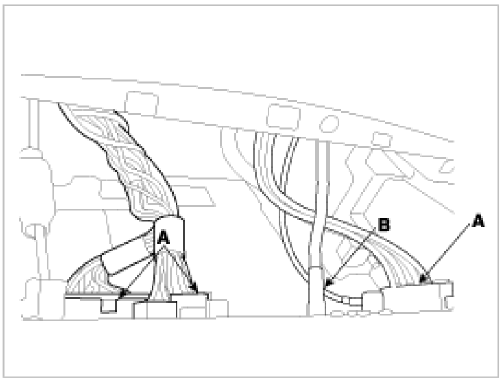
> NOTE
>
> - Make sure the connector is plugged in properly.

AUDIO ASSEMBLY REPLACEMENT

1. Remove the center facia panel.
2. Loosen the screws.



3. Disconnect the audio connector (A) and antenna cable (B), then remove the audio assembly (C).

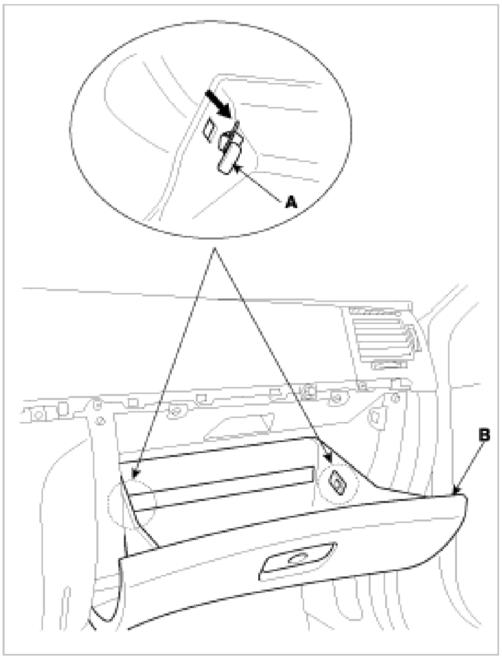


4. Installation is the reverse of removal.

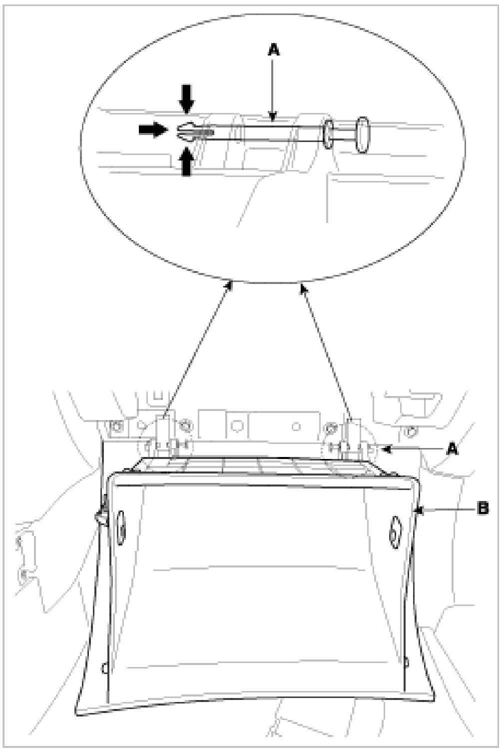
> NOTE
>
> - Make sure the connector is plugged in properly.

GLOVE BOX REPLACEMENT

1. Disconnect the damper (A) from the glove box (B).



2. Disconnect the pine (A), then remove the glove box (C).

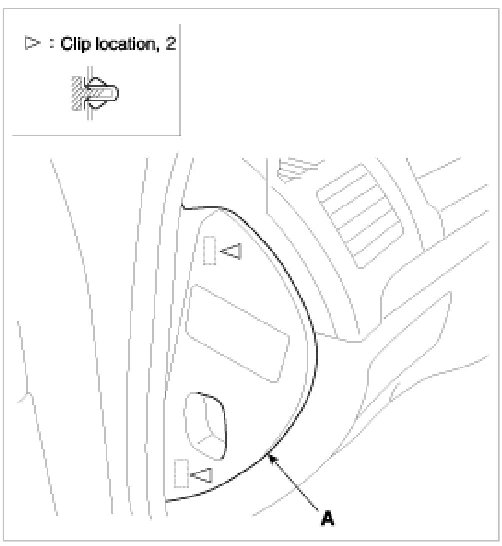


3. Installation is the reverse of removal.

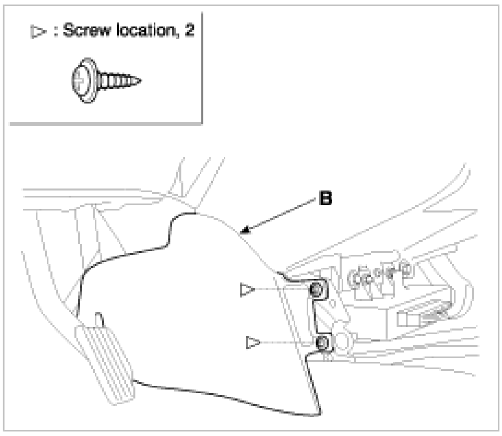
COVER REPLACEMENT

> **NOTE**
>
> - When prying with tip screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
> - Put on gloves to protect your hands.

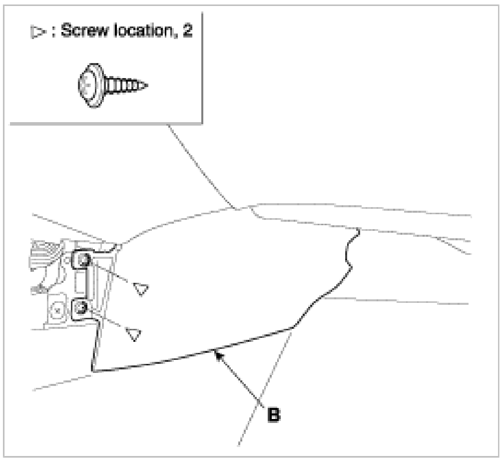
1. Remove the crash pad side cover (A), crash pad center under cover (B).
   A. Crash pad side cover.



   B. Front crash pad center under cover, LH
      - Remove the console assembly.



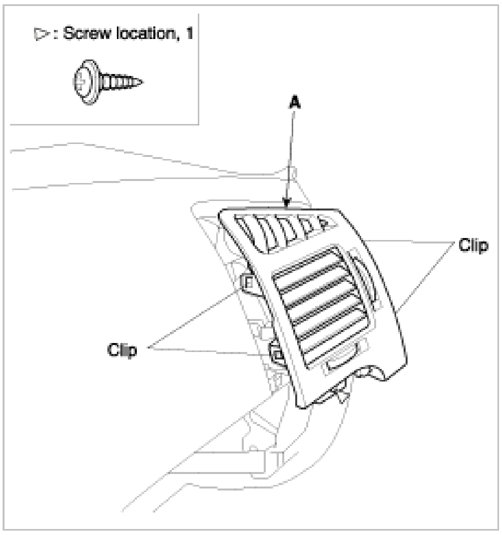
C. Front crash pad center under cover, RH
   - Remove the console assembly.



AIR VENT REPLACEMENT

> NOTE
>
> - When prying with tip screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
> - Put on gloves to protect your hands.

1. Remove the air vent (A) by detaching the clips.



2. Installation is the reverse of removal.

CRASH PAD REPLACEMENT

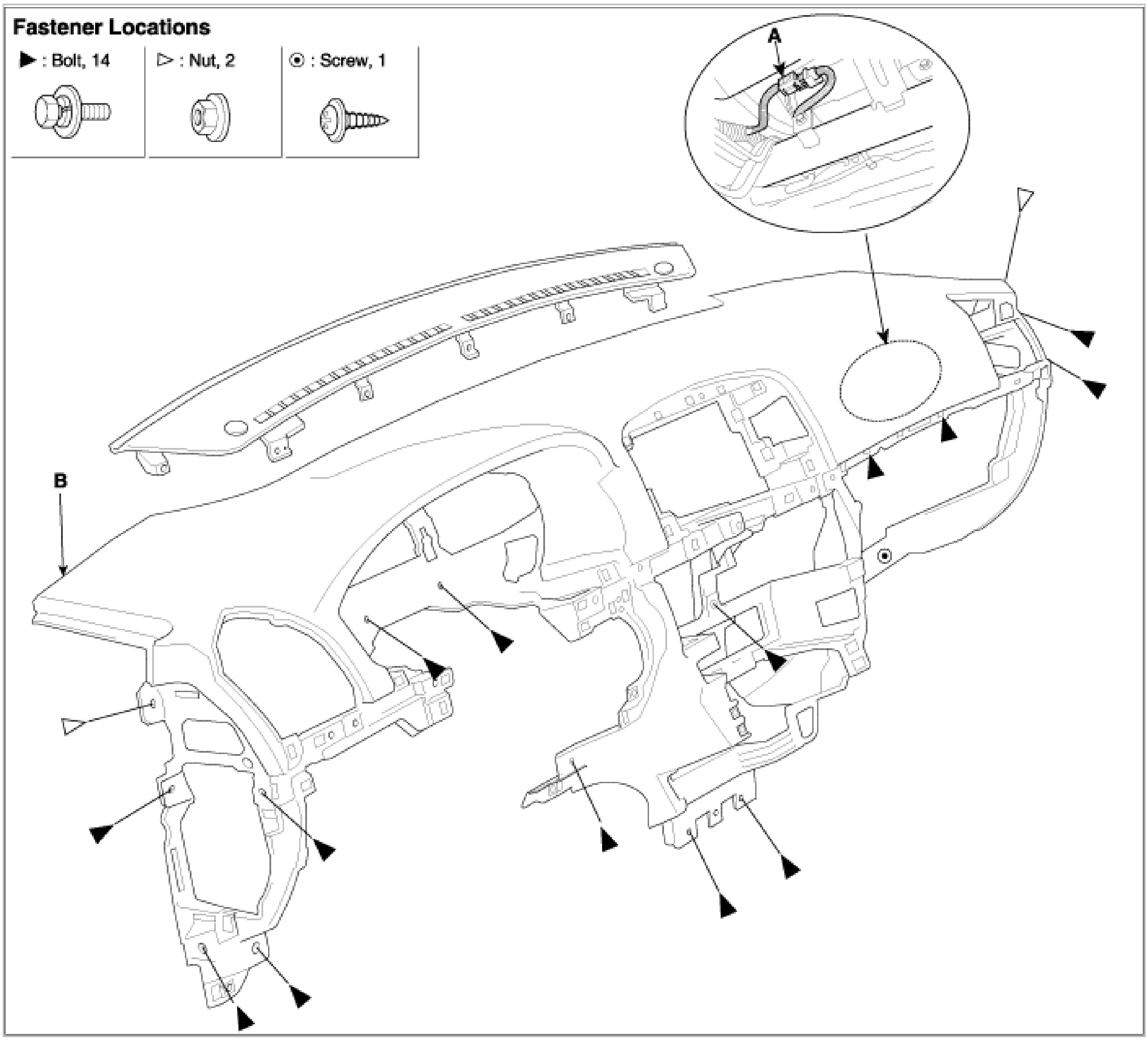
NOTE

- When prying with tip screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Put on gloves to protect your hands.

1. Remove the following items.
   A. Front seat.
   B. Cluster facia panel, cluster.
   C. Audio assembly.
   D. Glove box.
   E. Side cover, center under cover.
   F. Front pillar trim.
2. Disconnect the passenger`s air bag connector (A).
   Loosen the bolt and nut, then remove the crash pad (B).
3. Installation is the reverse of removal.

NOTE

- Make sure the crash pad fits onto the guide pins correctly.
- Before tightening the bolts, make sure the crash pad wire harnesses are not pinched.
- Make sure the connectors are plugged in properly, and the antenna lead is connected properly,
- Enter the anti- theft code for the radio, then enter the customer`s radio station presets.



Body (Interior and Exterior) > Interior > interior trim > Repair procedures

REPLACEMENT

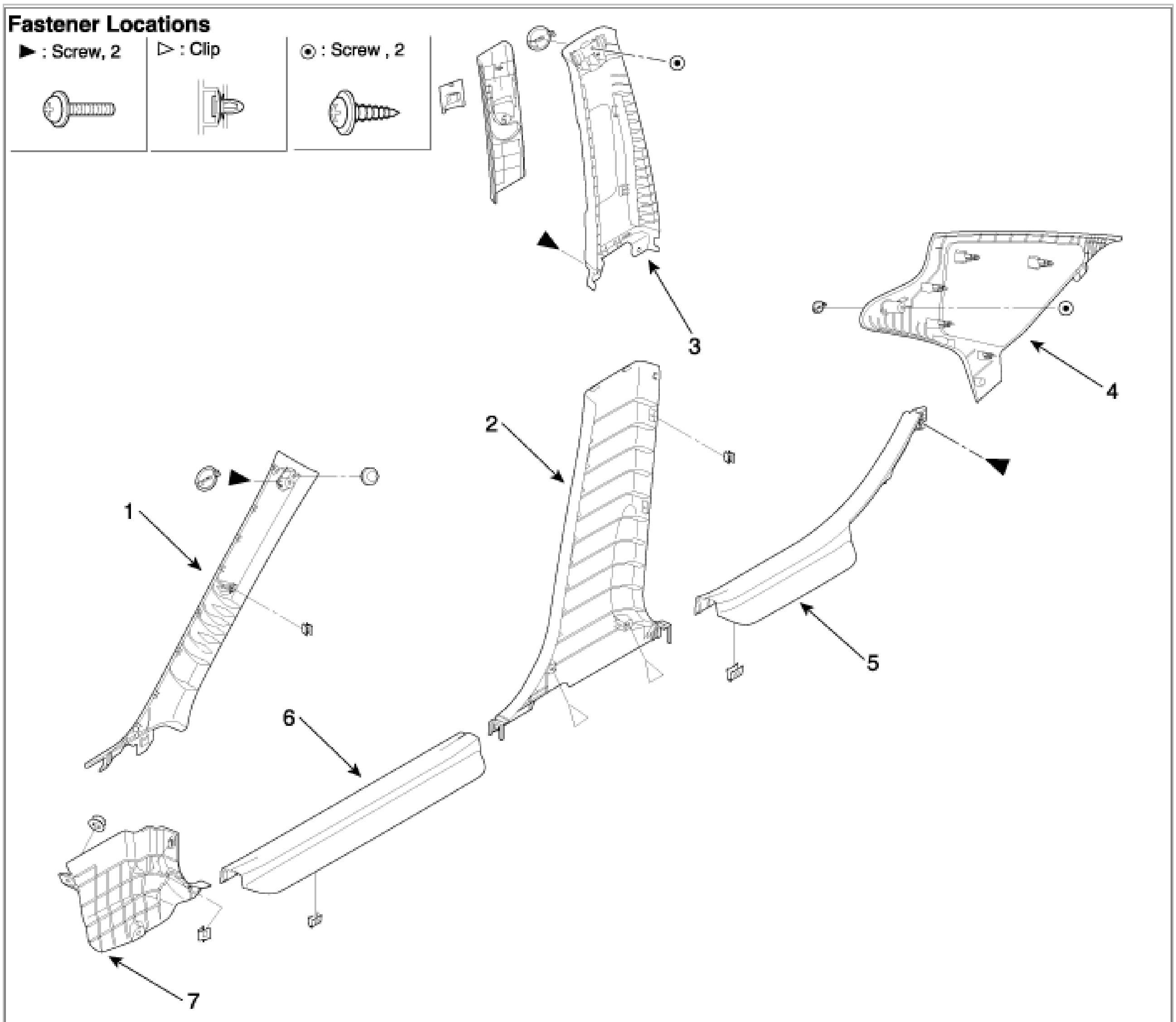
FLOOR AND SIDE TRIM

1. Remove the trim.

> NOTE
>
> - Put on gloves to protect your hands.
> - When prying with a flat-tip screwdriver, wrap it with protective tape to prevent damage.
> - Take care not to bend or scratch the trim and panels.

2. Installation is the reverse of removal.

> NOTE
>
> - Replace any damage clips.



1. Front pillar
2. Center lower pillar trim
3. Center upper pillar trim
4. Rear pillar trim
5. Rear door scuff trim
6. Front door scuff trim
7. Cowl side trim

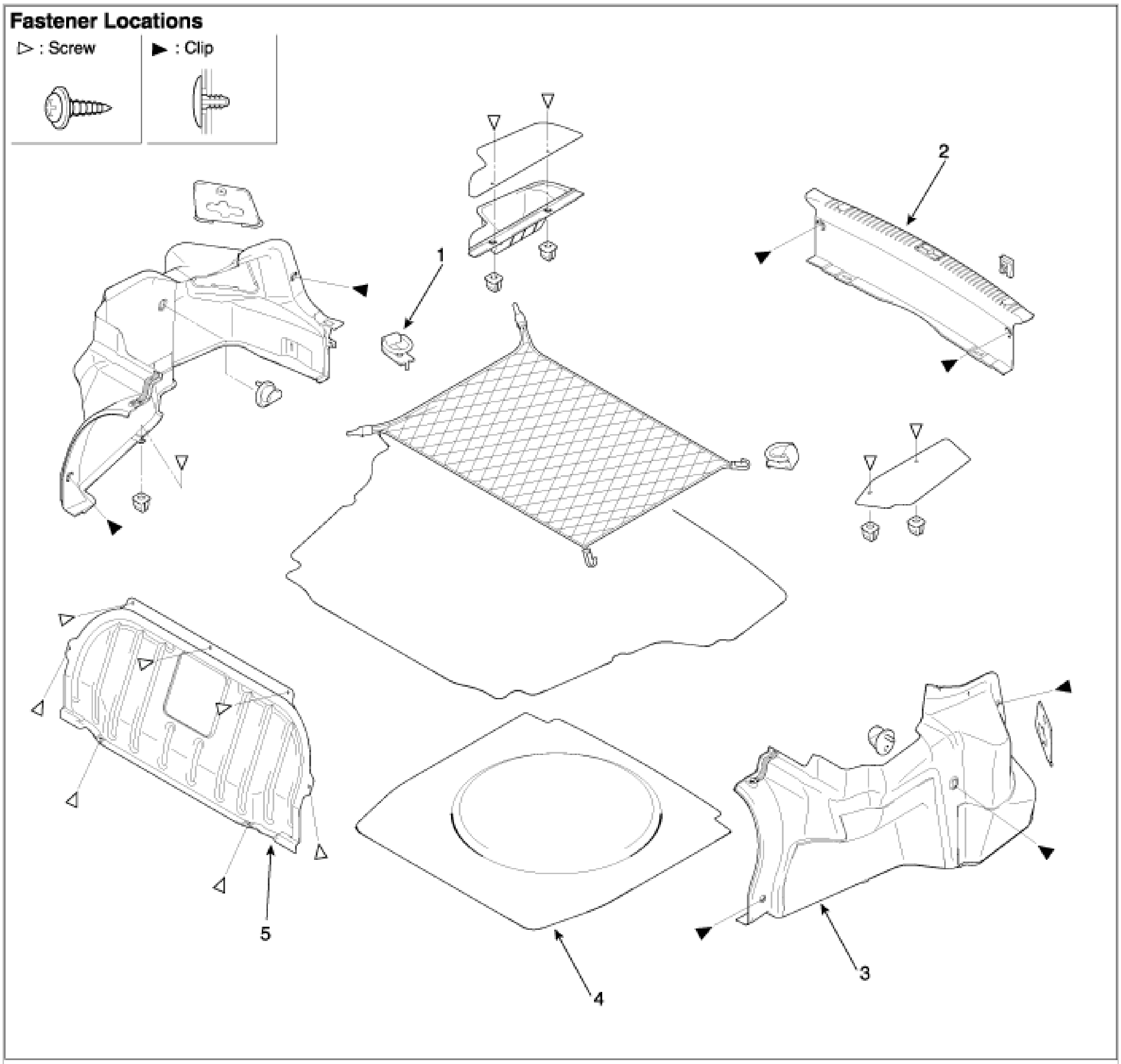
TRUNK TRIM

1. Remove the trim.

> NOTE
>
> - Put on gloves to protect your hands.
> - When prying with a flat-tip screwdriver, wrap it with protective tape to prevent damage.
> - Take care not to bend or scratch the trim and panels.

2. Installation is the reverse of removal.

> NOTE
>
> - Replace any damage clips.



1. Luggage flower hook
2. Rear transverse trim
3. Luggage side trim
4. Luggage cover met
5. Luggage partition trim

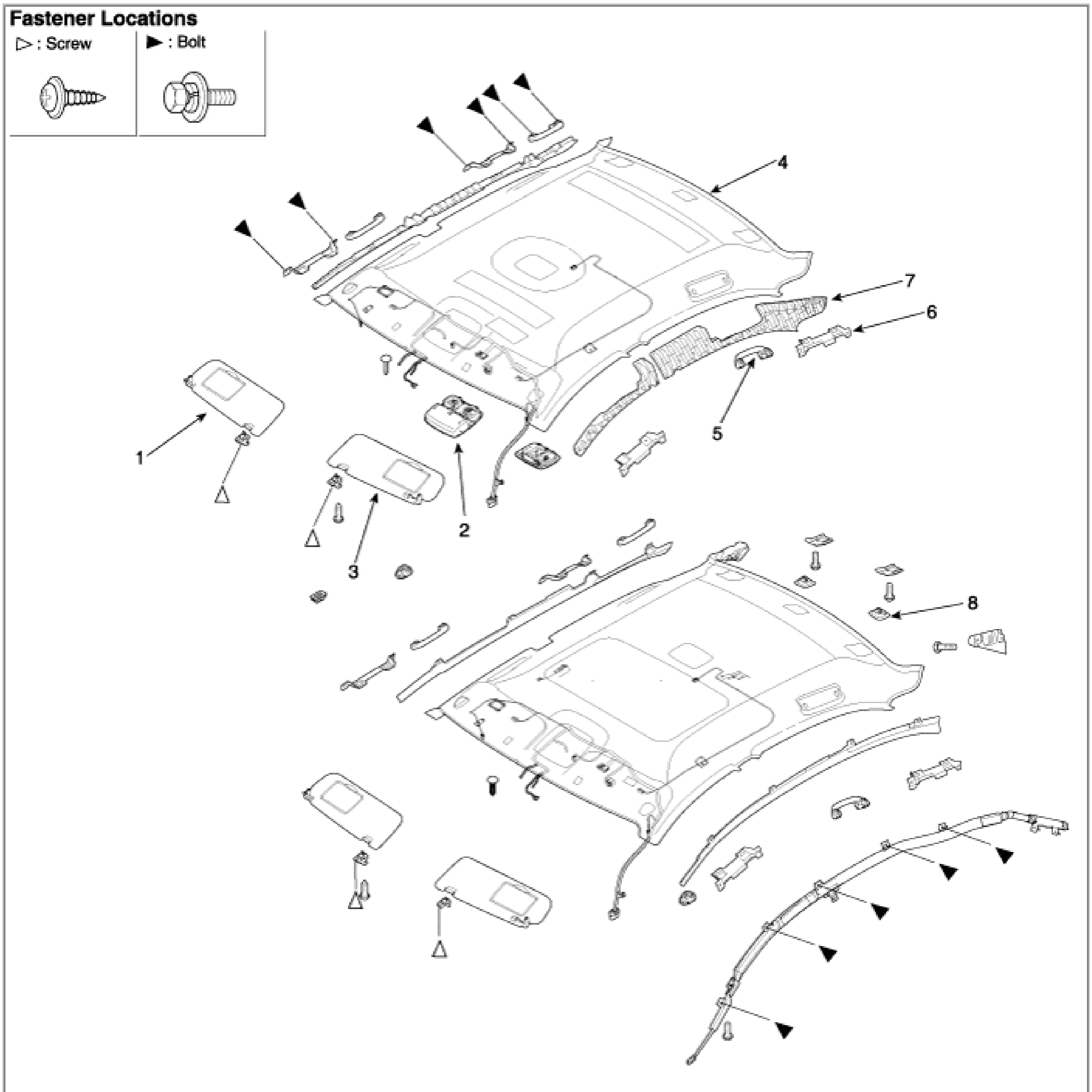
ROOF TRIM

1. Remove the trim.

> NOTE
>
> - Put on gloves to protect your hands.
> - When prying with a flat-tip screwdriver, wrap it with protective tape to prevent damage.
> - Take care not to bend or scratch the trim and panels.

2. Installation is the reverse of removal.

> NOTE
>
> - Replace any damage clips.



1. Sunvisor
2. Over head console lamp
3. Sunvisor retainer
4. Head lining
5. Assist handle
6. Assist handle bracket
7. Roof absorber
8. Coat hook

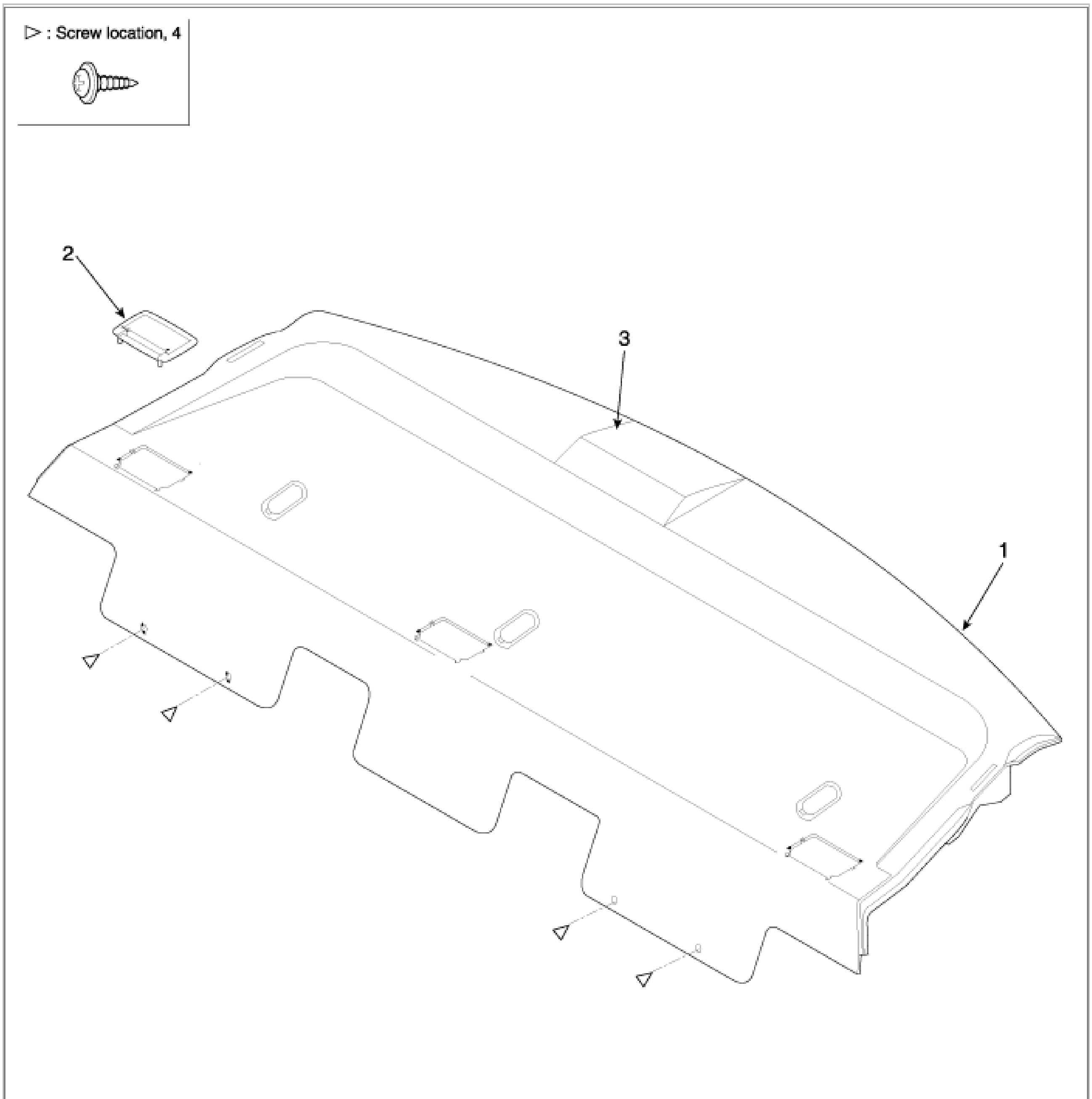
PACKAGE TRAY

1. Remove the trim.

> NOTE
>
> - Put on gloves to protect your hands.
> - When prying with a flat-tip screwdriver, wrap it with protective tape to prevent damage.
> - Take care not to bend or scratch the trim and panels.

2. Installation is the reverse of removal.

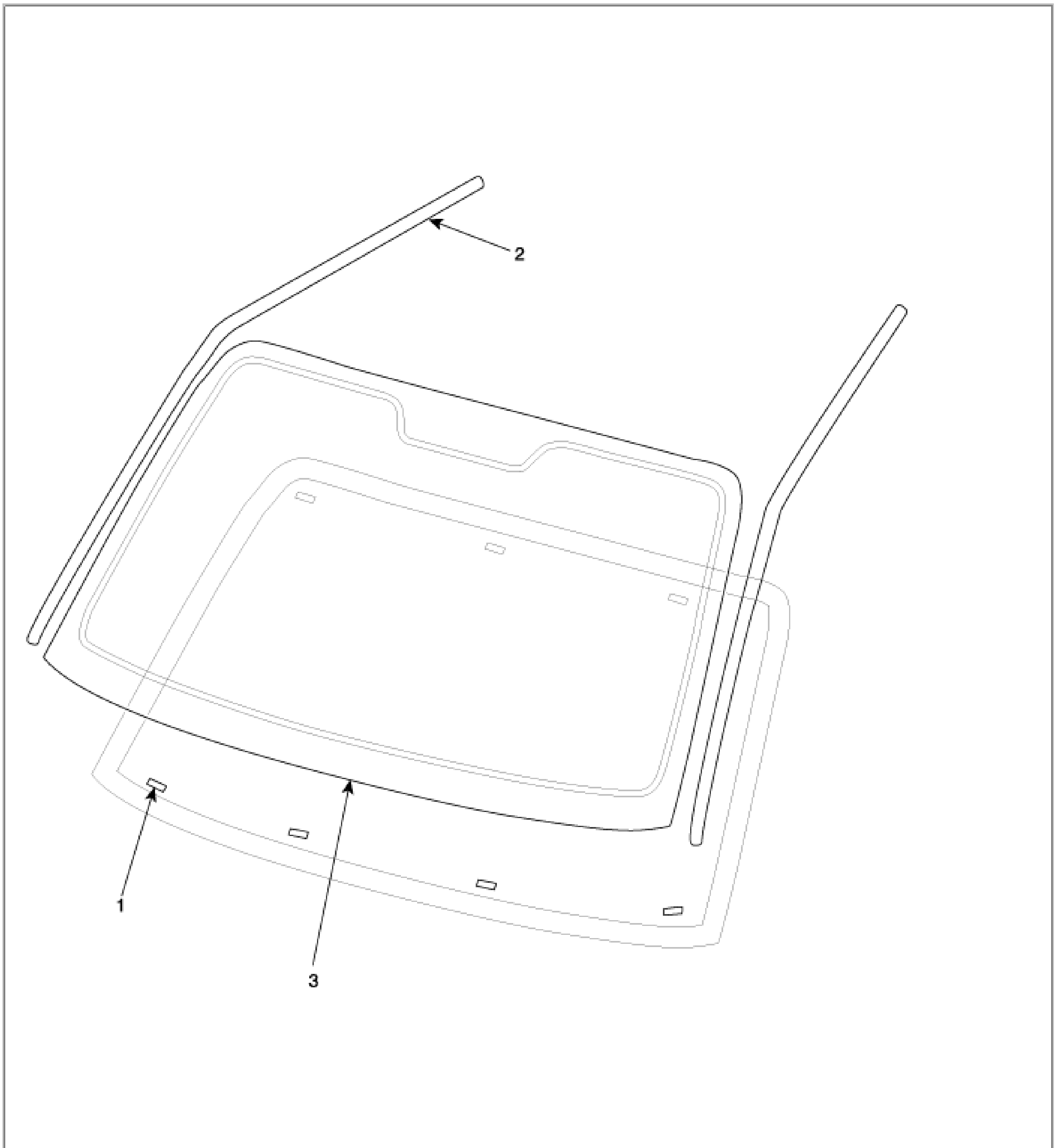
> NOTE
>
> - Replace any damage clips.



1. Package tray
2. Rear seat belt guide
3. High mount stop lamp

Body (Interior and Exterior) > Interior > windshield glass > Components and Components Location

COMPONENTS



1. Glass pad
2. Wind shield molding
3. Wind shield glass

Body (Interior and Exterior) > Interior > windshield glass > Repair procedures

REPLACEMENT

REMOVAL

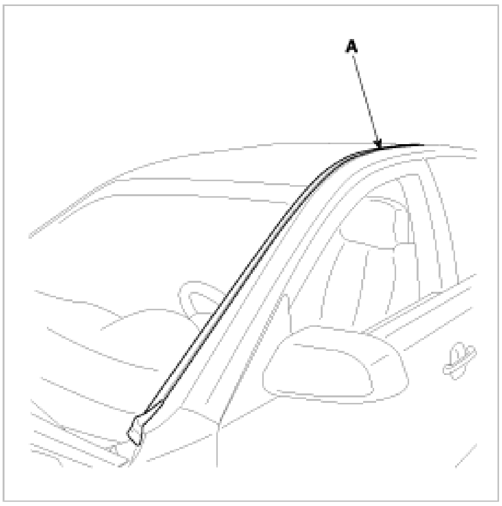
NOTE

- Put on gloves to protect your hands.
- Use seat covers to avoid damaging any surfaces.

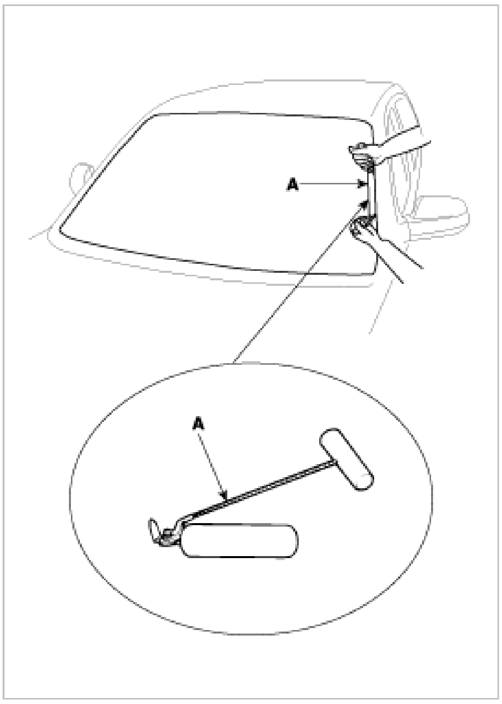
1. Remove the following items.
   A. Inside rear view mirror.
   B. Sun visors and holders, both side, overhead console, grab handles, both sides.

C. Front pillar trim, both sides.
D. Windshield wiper arms and cowl cover.

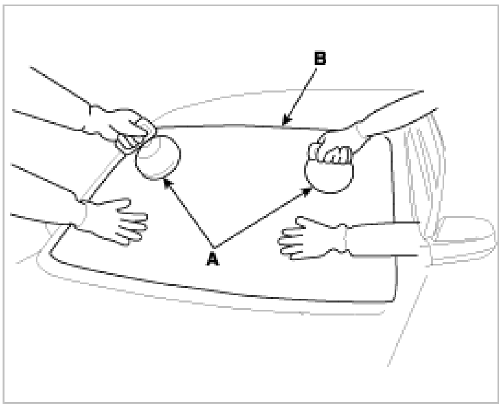
2. Remove the windshield glass side molding (A).



3. Pull down the front portion of the headliner. Take care not to bend the headliner excessively, or you may crease or break it.
4. Cut out the sealant using the sealant cutting tooln (A)(09861-31100).

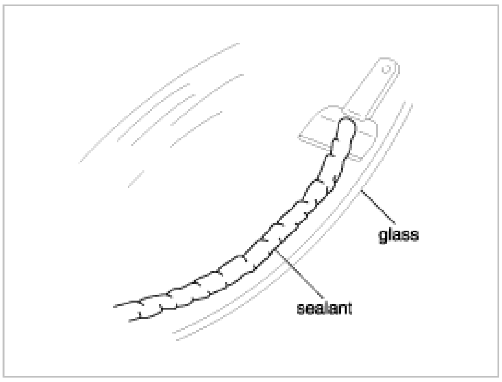


5. Remove the windshield (A) carefully using the glassholder (B)(09861-31100).

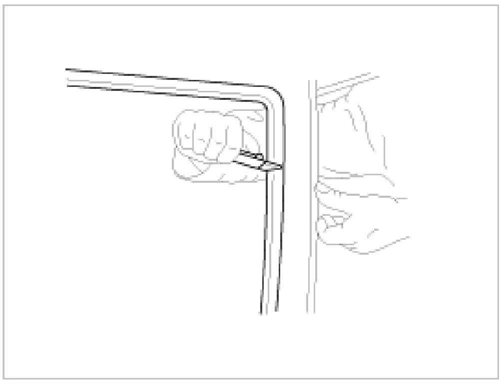


INSTALLTION

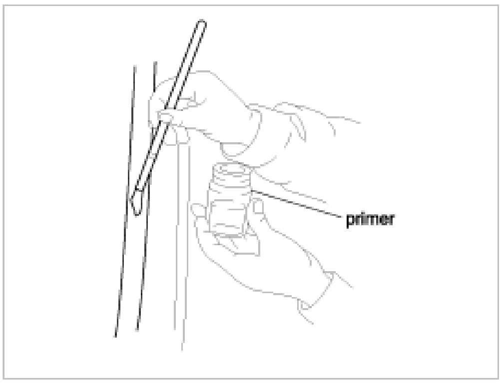
1. Remove the excess sealant from the glass with a window scraper.



2. Remove the excess sealant and foam dam from the body with a knife.



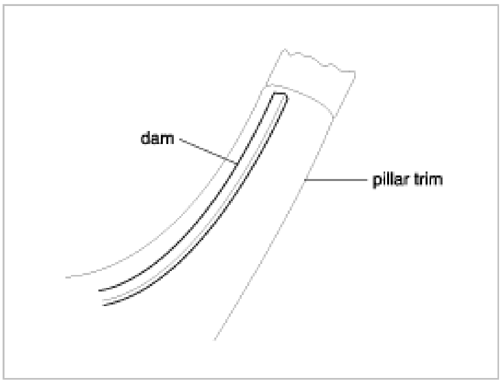
3. Clean the inside of the glass with commercial glass cleaner and a lint-free cloth.
4. Prime an area approximately 20 mm(3/4 inch) wide around the complete perimerter of the glass.
5. Prime the contact area on the body.



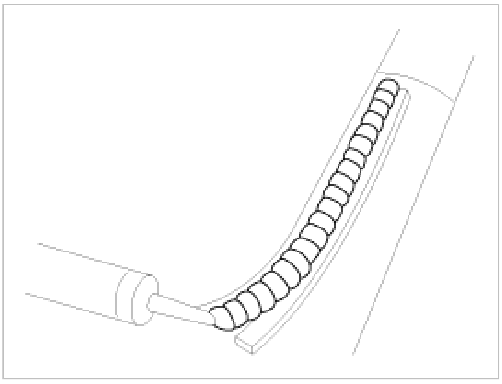
6. Reprime the same area on the inside surface of the glass.

> **CAUTION**
>
> Do not permit any primed surface to becom contaminated with dirt, water, oil, etc.
> Do not touch primed surfaces with your hands.
> Contamination will affect adhesion.

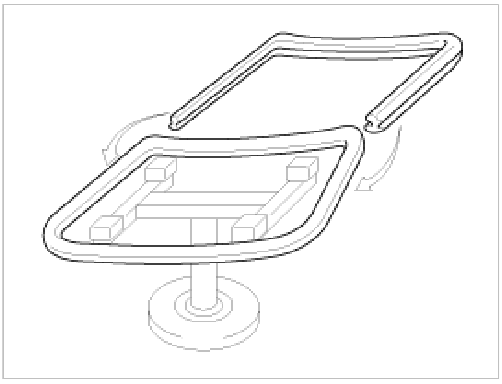
7. Install the self-adhesive foam dam to the body where the original dam had been.



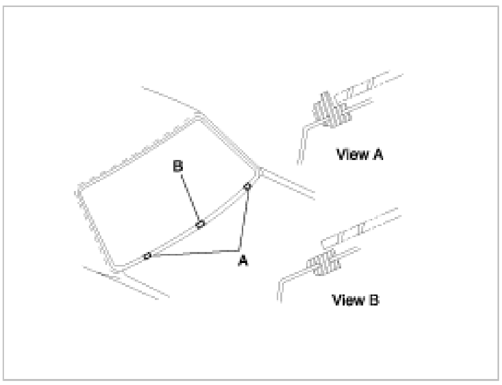
8. Apply the sealant bead to the body just outside the dam. The bead should be slightly higher than the dam.



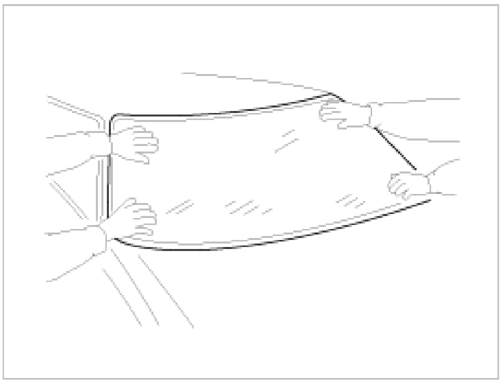
9. Install molding on the glass.

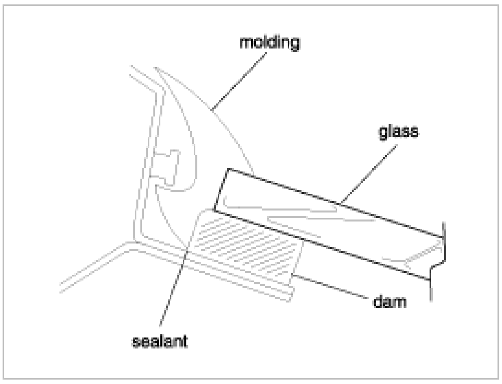


10. Install the glass into the body making sure the glass rests upon the two spacers at the bottom of the windshield.



11. Press glass firmly into place.





CAUTION

Lower both front door windows and leave them in that condition until the vehicle can be put back into service. If the vehicle were completelyclosed, quickly closing a door could break the seal.

12. Remove excess sealant, if any.
13. Press molding molding firmly into place.
14. Perform water leak test immediately.
15. Clean the outside of the windshield.
16. Install both of the front pillar trim.
17. Install the inside rearview mirror.
18. Install the cowl top cover with three fasteners.
19. Install both wiper arm assemblies with one nut eatch.

Body (Interior and Exterior) > Bumper > front bumper > Repair procedures

REPLACEMENT

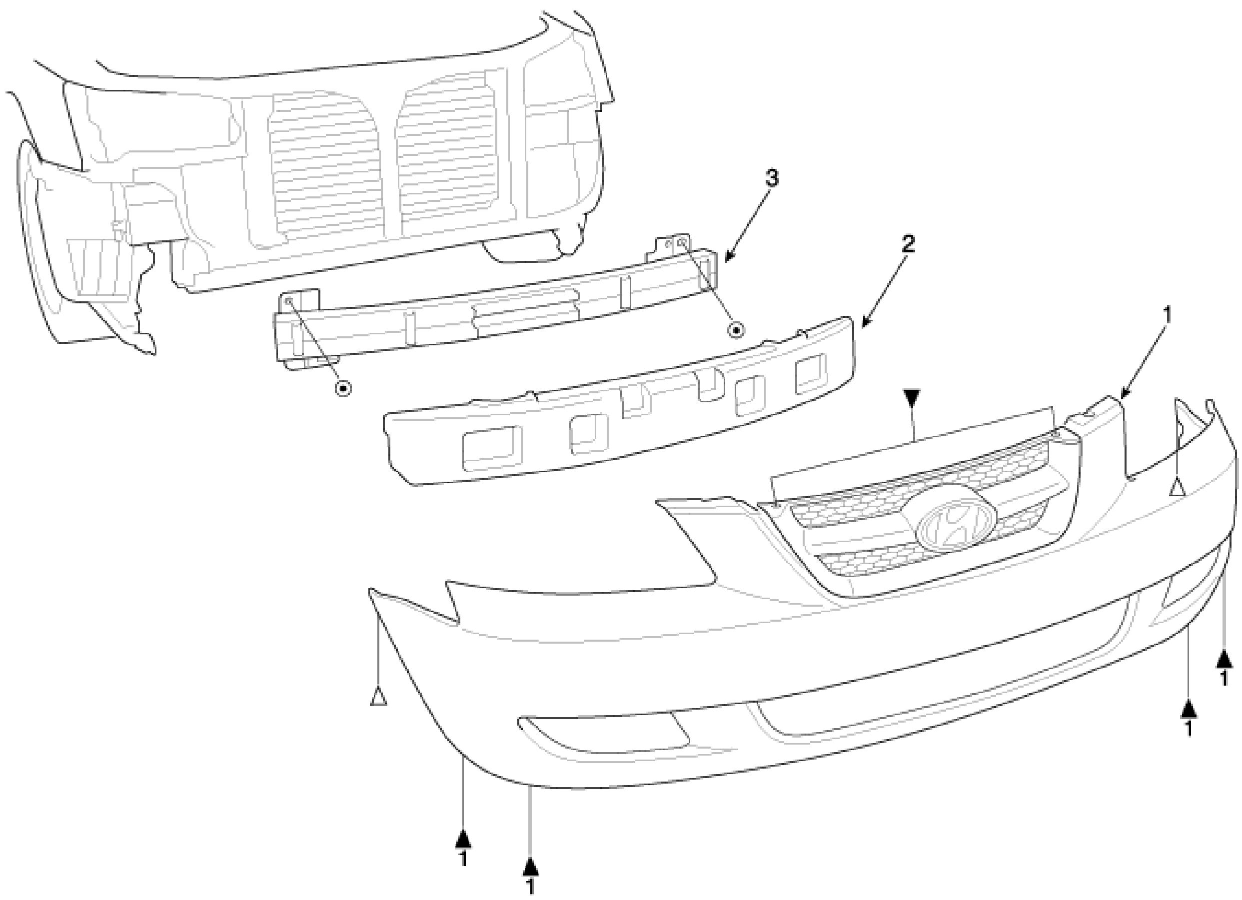
1. Remove the radiator upper cover.
2. Remove the headlamp.

NOTE

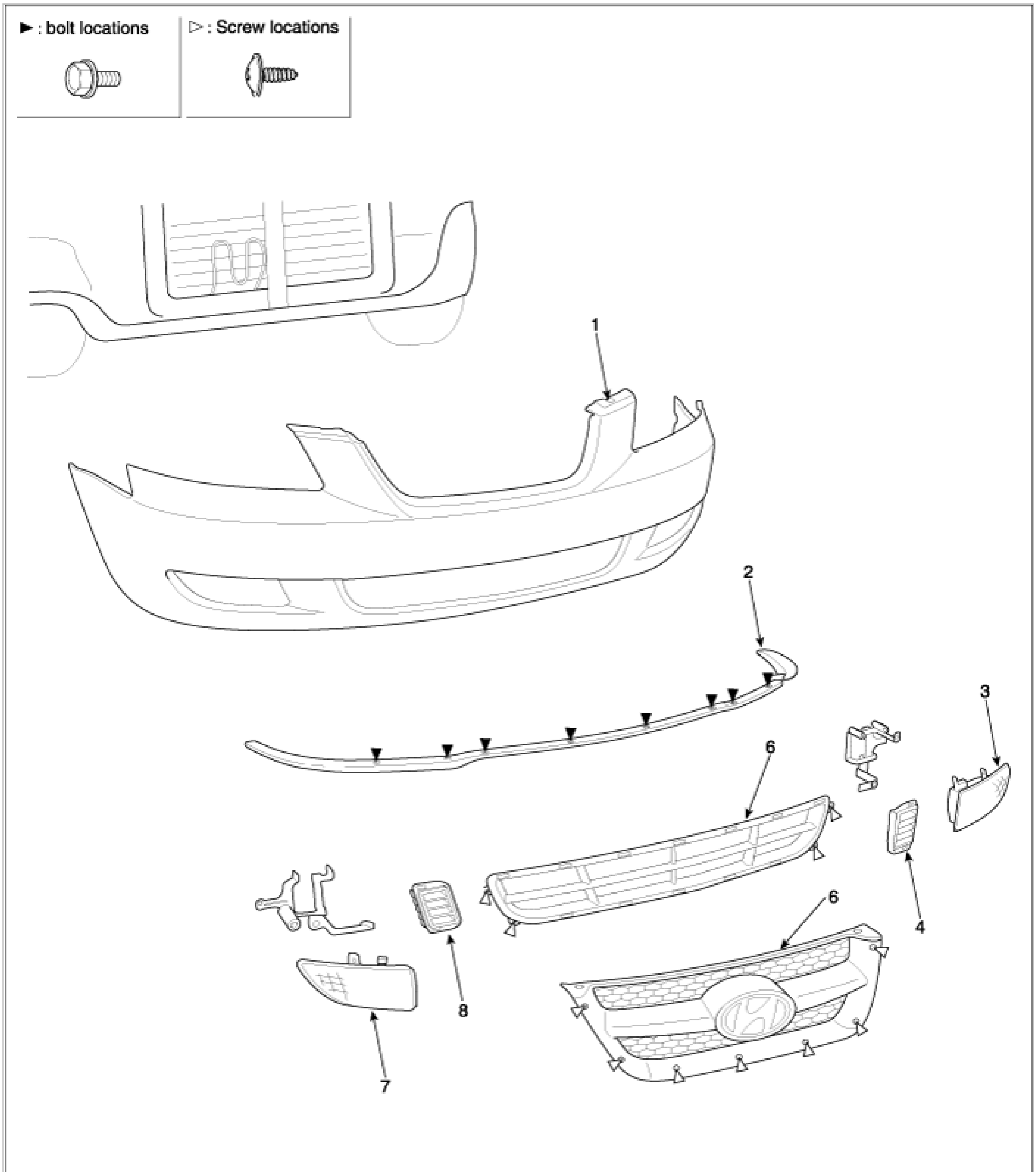
- Put on gloves to protect your hands.
- When prying with tip screwdriver, wrap it with protective tape to prevent damage.

Fastener Locations

⦿ : Nut	► : Bolt	►1 : Clip	▷ : Screw



1. Front bumper cover
2. Front bumper energy absorber foam
3. Front bumper rail



1. Front bumper cover
2. Front bumper lip
3. Fog lamp
4. Fog grille
5. Radiator grille
6. Bumper grille
7. Fog lamp
8. Fog grille

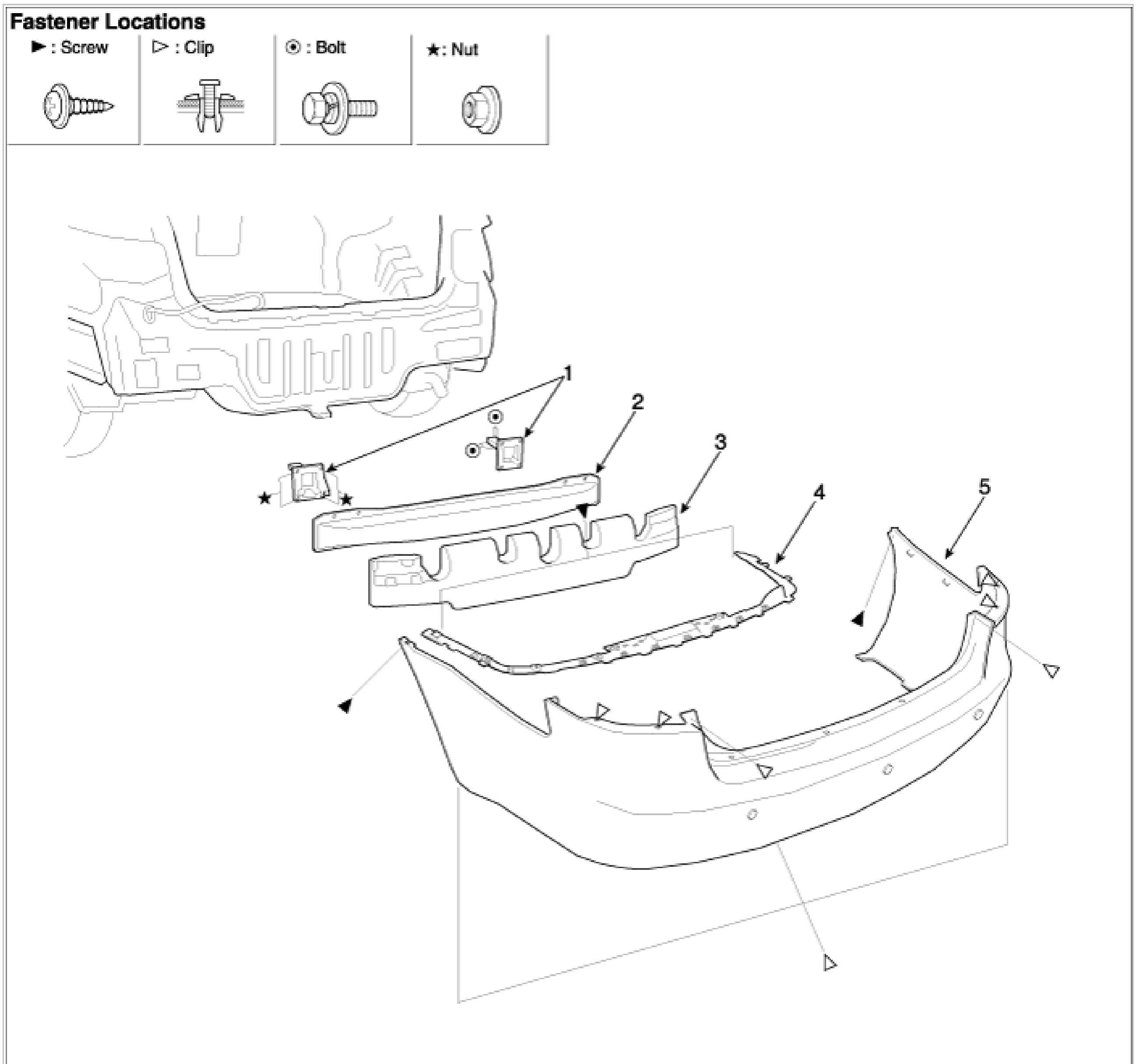
Body (Interior and Exterior) > Bumper > rear bumper > Repair procedures

REPLACEMENT

NOTE

- After remove the rear combination lamp.
- When prying with tip screwdriver, wrap it with protective tape , and apply protective tape around the related parts your hands.
- Put on gloves to protect your hands.

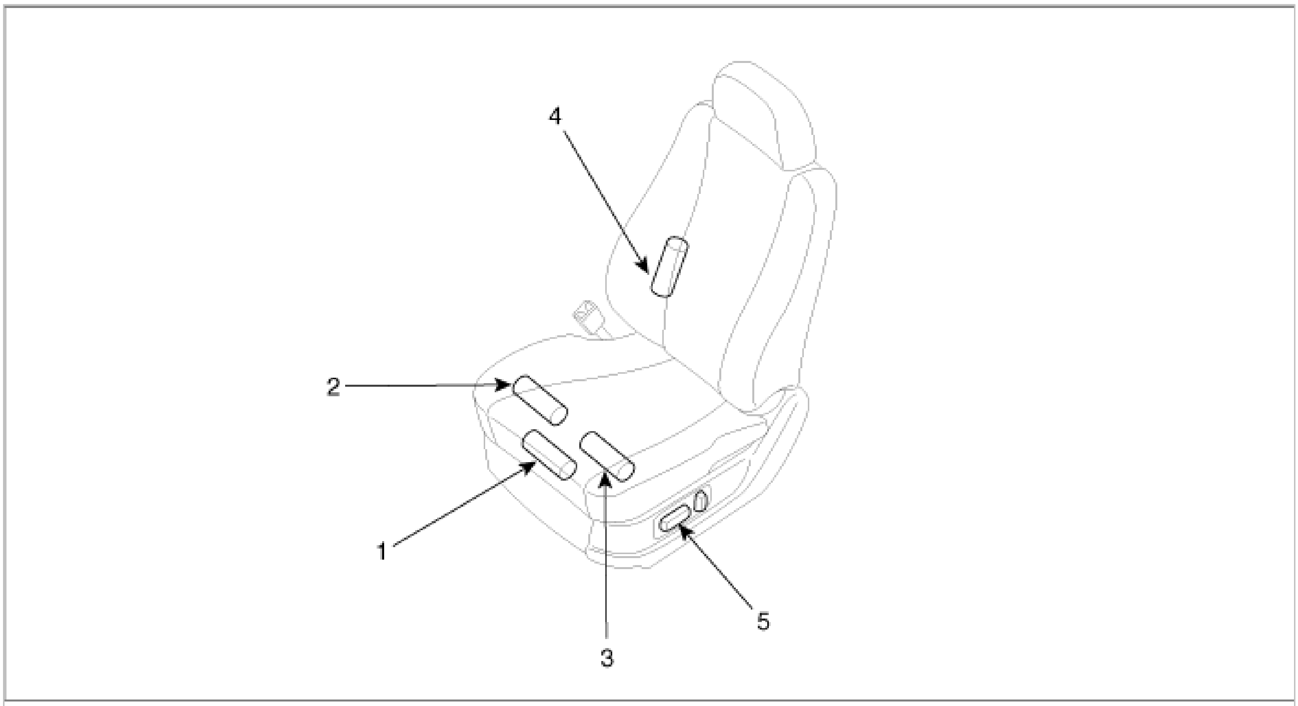
- Take care not bend or scratch the cover and other parts.
- Replace any damage clips.



1. Rear bumper stuy
2. Rear bumper beam
3. Energy absorber
4. Under cover
5. Rear bumper cover

Body (Interior and Exterior) > Seat & Power Seat > Components and Components Location

COMPONENT LOCATION



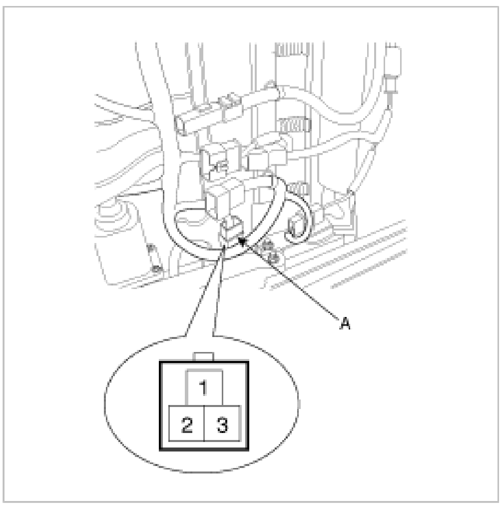
1. Slide motor
2. Front height motor
3. Rear height motor
4. Reclining motor
5. Power seat switch

Body (Interior and Exterior) > Seat & Power Seat > power seat moter > Repair procedures

INSPECTION

SLIDE MOTOR LIMIT SWITCH

1. Disconnect the limit switch (A) and operate the limit switch.
2. Check for continuity between the terminals.
3. Make sure that the seat operation is normal in the reverse after the maximum operation.
4. If there is an abnormality, replace the limit switch.

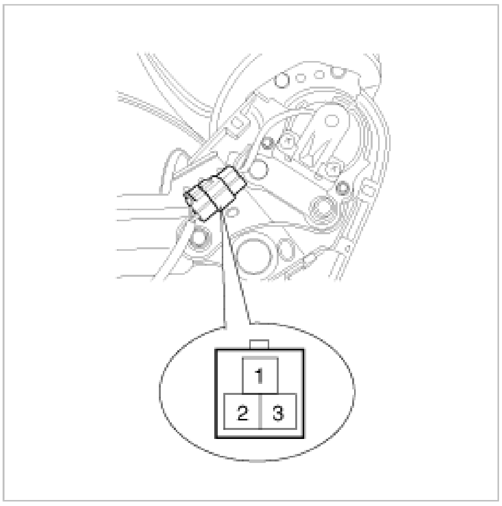


Position \ Terminal NO.	1	2	3
Frontward	O		O
Backward	O	O	

RECLINING MOTOR LIMIT SWITCH

1. Disconnect the limit switch and operate the limit switch.

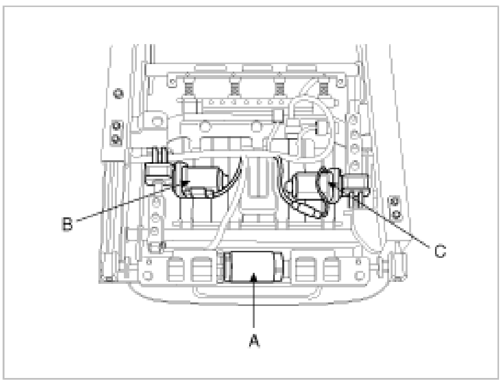
2. Check for continuity between the terminals.
3. Make sure that the seat operation is normal in the reverse after the maximum operation.
4. If there is an abnormality, replace the limit switch.



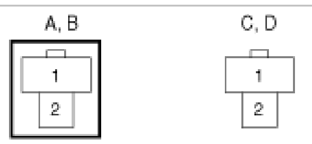
Position \ Terminal NO.	1	2	3
Frontward	○	―	○
Backward	○	○	

POWER SEAT MOTOR

1. Disconnect the connectors for each motor.



2. With the battery connected directly to the motor terminals, check if the motors run smoothly.
3. Reverse the connections and check that the motor turns in reverse.
4. If there is an abnormality, replace the motors.



Position \ Terminal NO.		1	2
Slide motor A	Front ward	⊖	⊕
	Back ward	⊕	⊖
Reclining motor D	For ward	⊕	⊖
	Rear ward	⊖	⊕

<Driver>

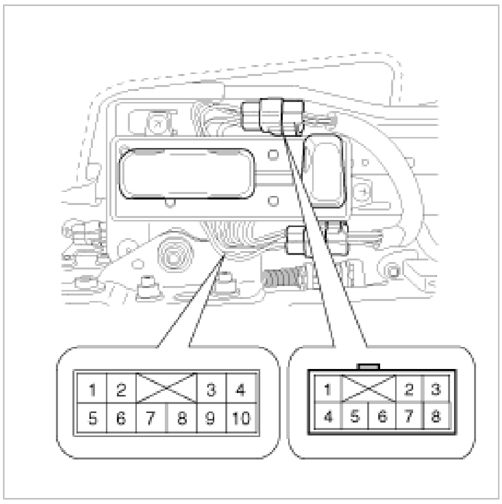
Position		Terminal NO. 1	Terminal NO. 2
Front height motor B	UP	⊖	⊕
	DOWN	⊕	⊖
Rear height motor C	UP	⊕	⊖
	DOWN	⊖	⊕

<Driver>

Body (Interior and Exterior) > Seat & Power Seat > powr seat control switch > Repair procedures

INSPECTION

With the power seat switch in each position, make sure that continuity exists between the terminals below. If continuity is not as specified, replace the power seat switch.

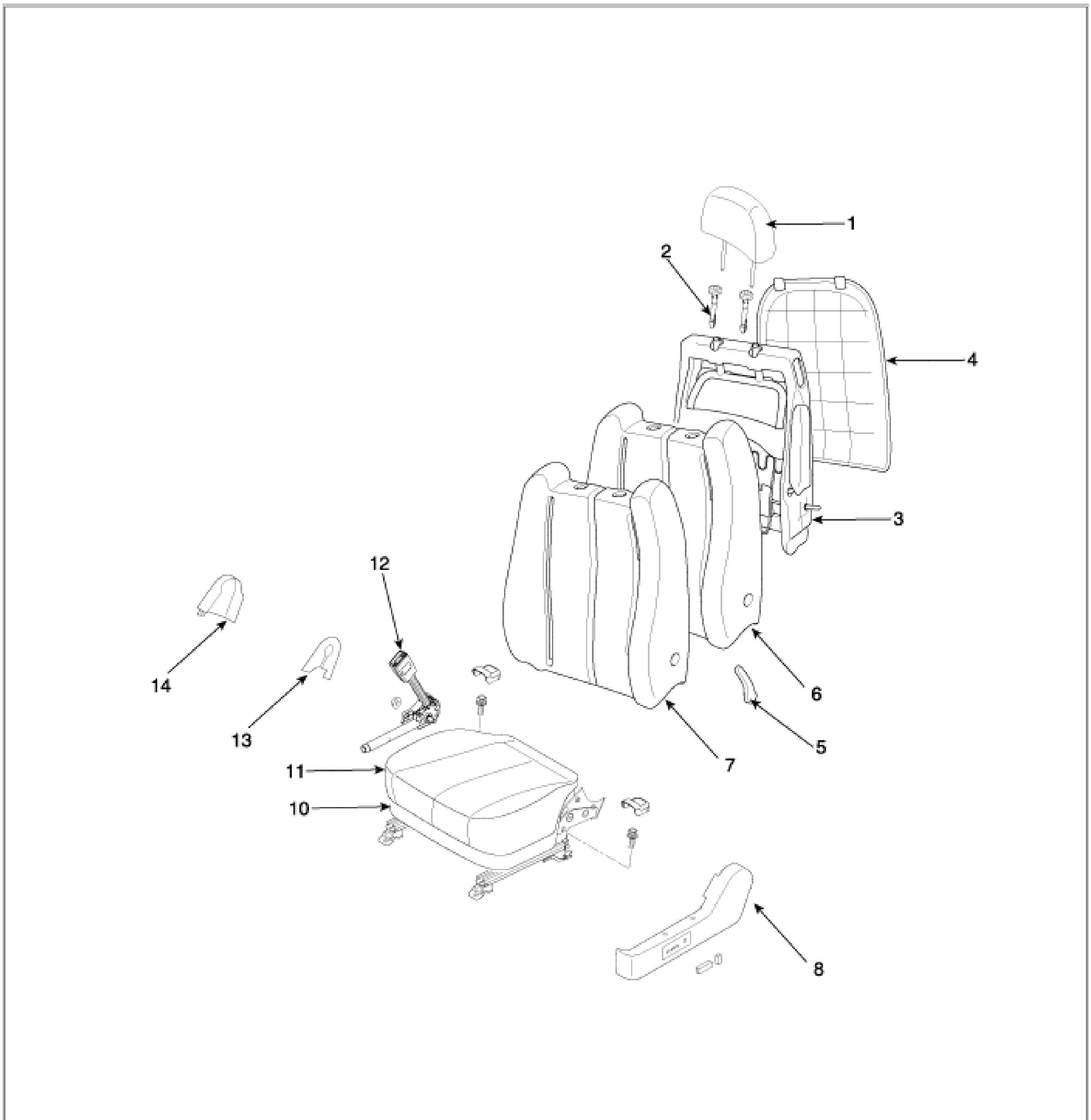


Position		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	B5	B6	B7	B8
Slide switch	Front ward	O														O			
												O			O				
	Back ward	O				O													
															O	O			
Front height switch	UP				O											O			
													O	O					
	DOWN		O		O														
													O			O			
Rear height switch	UP						O		O										
																O	O		
	DOWN						O									O			
								O									O		
Reclining switch	Front ward									O						O			
																		O	O
	Back ward									O	O								
																O			O

<Driver>

Body (Interior and Exterior) > Seat & Power Seat > front seat > Components and Components Location

COMPONENTS



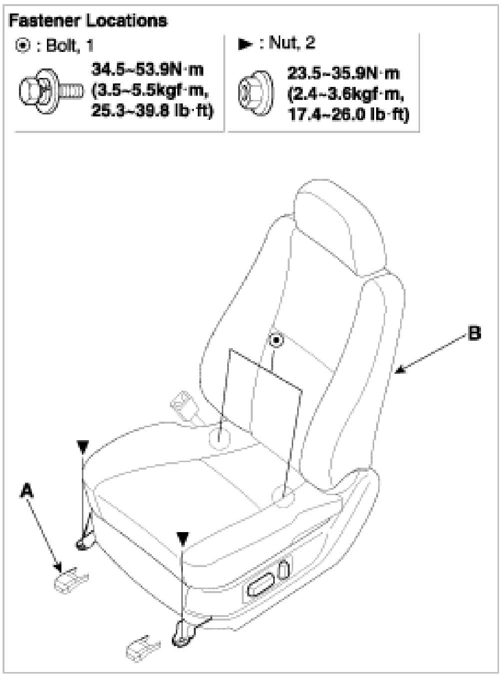
1. Headrest	5. Lumbar support lever	9. Cover
2. Headrest guide	6. Seat back	10. Seat cushion
3. Back frame	7. Seat back frame	11. Seat cushion cover
4. Back panel	8. Power sild cover	12. Seat back buckle

Body (Interior and Exterior) > Seat & Power Seat > front seat > Repair procedures

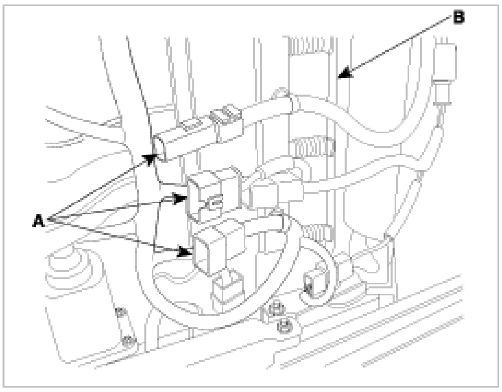
REPLACCEMENT

SEAT ASSEMBLY REPLACEMENT

1. Remove the seat assembly mounting cover (A).
2. After loosening the seat assembly mounting bolt and nut, remove the seat assembly (B).



3. Disconnect the connector (A), and remove the seat assembly.

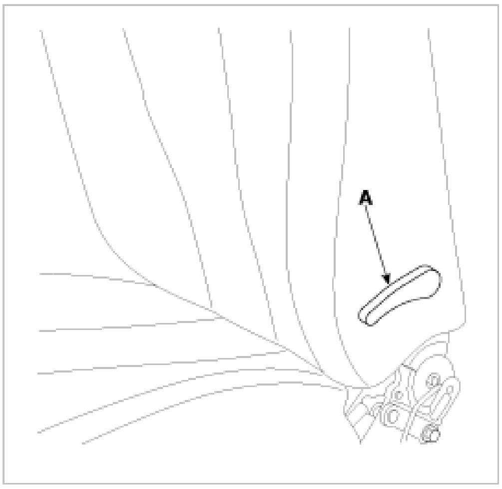


4. Installation is the reverse of removal.

> CAUTION
>
> SEAT MOUNTING BOLT INSTALLATION PROCEDURE
> - Set the into the most rearward position.
>   Check then each slide is locked, and then tighten the front mounting bolt temporarily.
> - Set the seat into most forward position.
>   Check that each slide is locked, and then Tighten the rear mounting bolt completely.
> - Set the seat into the most rearward position.
>   Check the front mounting bolt completely.
> - Check that the seat operates to and fro smoothy and the locking portion locks properly.

LUMBER SUPPORT LEVER REPLACEMENT

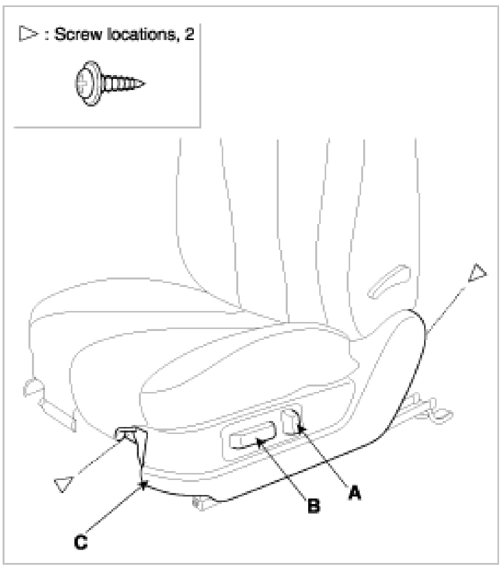
1. Remove the lumbar support lever (A).



2. Installation is the reverse of removal.

RECLINER LEVER AND HEIGHT KNOB REPLACEMENT

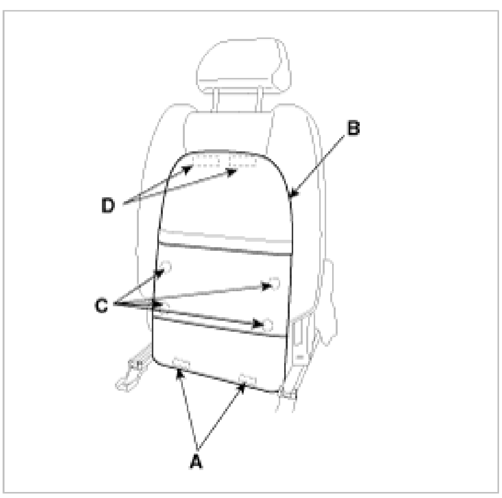
1. Remove the height adjuster knob (A) and recliner lever (B).
2. Loosen the recliner mounting screw and clip, then remove the recliner cover(C).



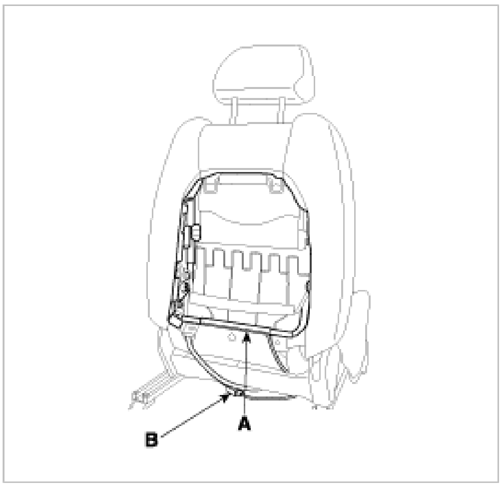
3. Installation is the reverse of removal.

SEAT BACK COVER REPLACEMENT

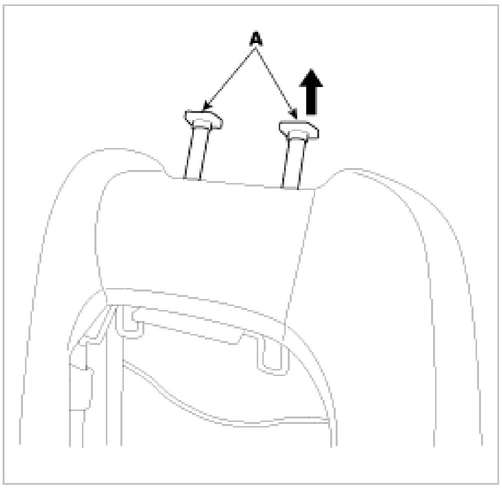
1. Remove the lumbar sport lever.
2. After disconnecting the scuff band (A), remove the seat back panel (B).



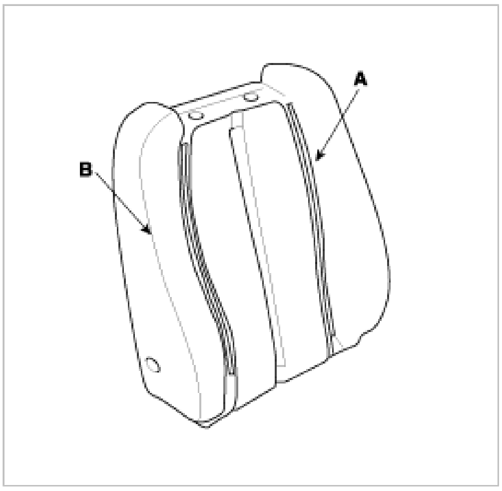
3. After disconnect the protector (A) from the back frame, then disconnect the connector (B).



4. Remove the headrest and headrest guide (A).



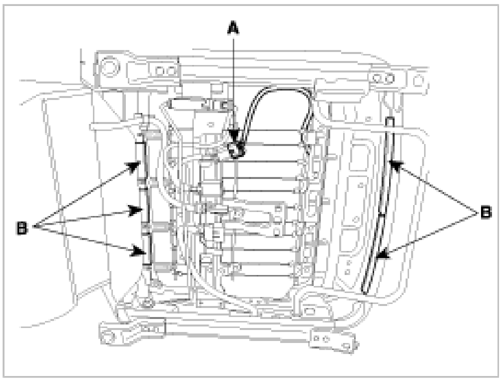
5. After removing the hogring clips (A) on the front of seat back remove the seat back cover (B).



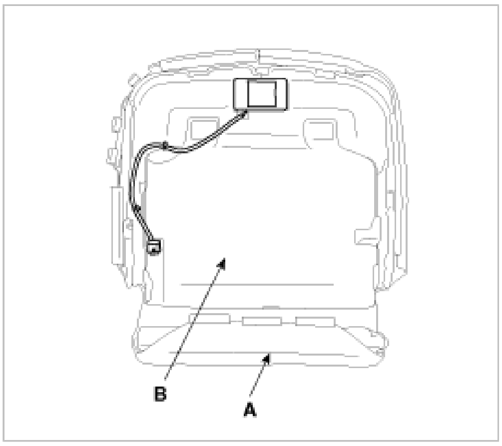
6. Installation is the reverse of removal.

SEAT CUSHION COVER REPLACEMENT

1. Remove front seat assembly.
2. Remove the scuff band.
3. After disconnect the protector (B)from the back frame, then disconnect the connector (A).

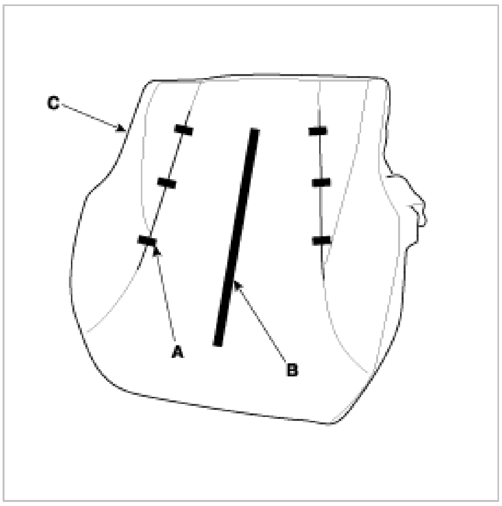


4. Remove the seat cushion(A).



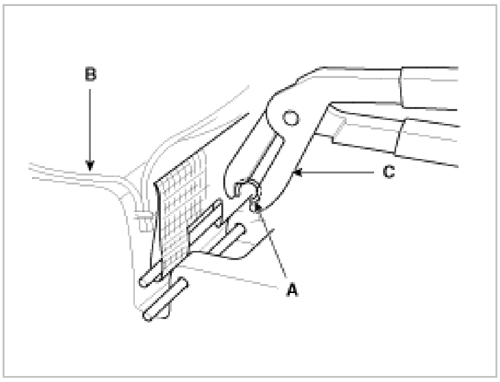
5. After removing the hogring clip (A) on the front of seat cushion and remove the seat cushion cover (C).

> **CAUTION**
>
> When removing the hogring clip, remove the hogring clip while pressing the wire so as not to separate the wire from the sponge.



6. Installation is the reverse of removal.

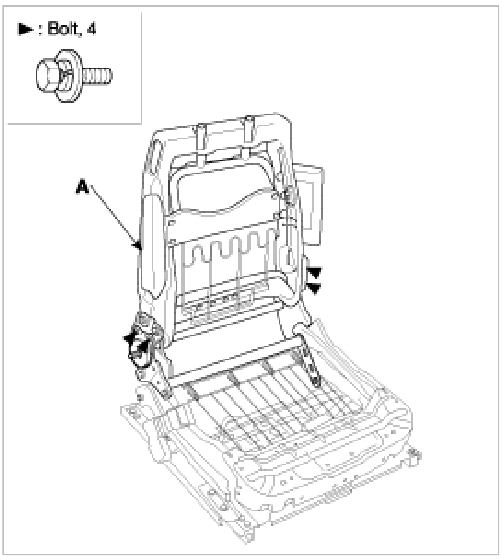
> **NOTE**
>
> - To prevent wrinkles, make sure the material is stretched evenly over the cover (B) before securing the hogring clips (A).
> - Replace the hogring clips with new ones using special tool (C).



SEAT BACK FRAME REPLACEMENT

1. Remove the lumbar support.
2. Remove the seat back panel.
3. Remove the headrest guide.
4. Remove the seat back cover and pad from frame.
5. Loosen the mounting bolts, then remove the seat back frame (A).

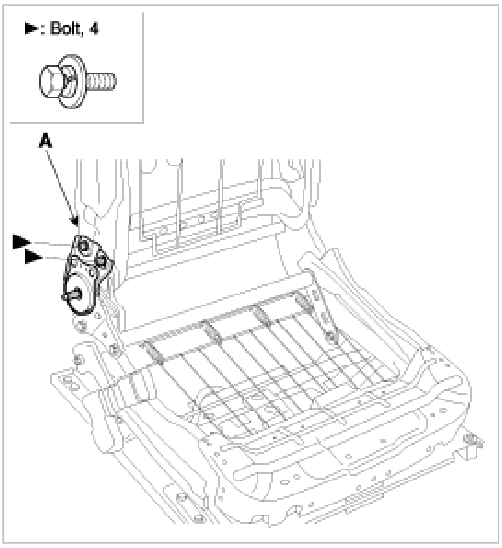
> NOTE
>
> - Remove the side air bag for replacing side air bag installation seat.
> - Be fore service, be fully aware of precautions and service procedure relevant to air bag (See page RT-Airbag).



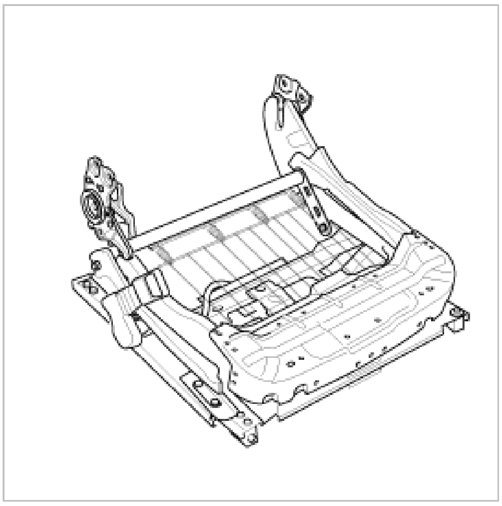
6. Installation is the reverse of removal.

SEAT TRACK REPLACEMENT

1. After removing the seat back panel, disconnect the protector.
2. Remove the recliner cover, knob and height knob.
3. Remove the seat assembly (A).



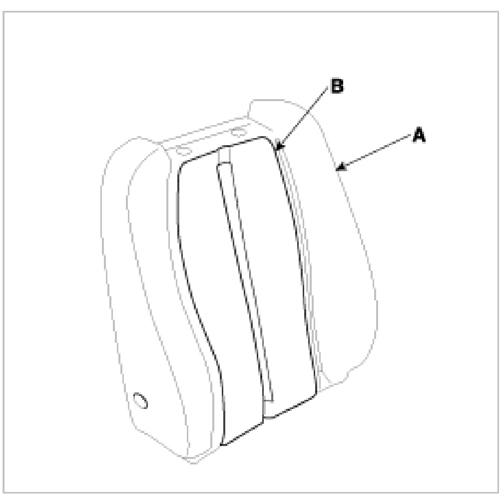
4. Remove the seat cushion.
5. Remove the seat track (A).



6. Installation is the reverse of removal.

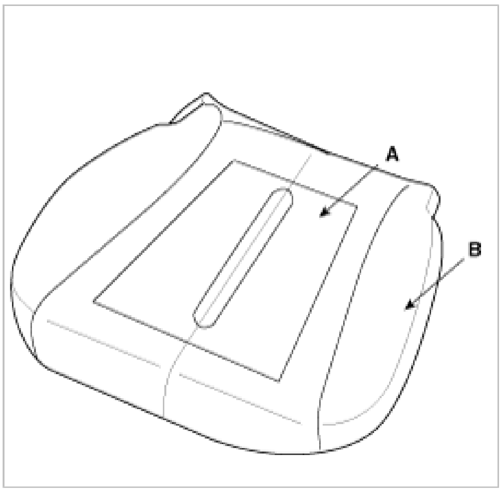
SEAT BACK HEATER REPLACEMENT

1. Remove the seat back cover.
2. Cut the heater (A)attached to the pad (B), as shown in the picture.
3. Take off the paper from the backside of the heater assembly.
4. Attach the heater to the main part of pad.
5. Install the seat back cover.



SEAT CUSHION HEATER REPLACEMENT

1. Remove the seat back cover.
2. Cut the heater (A)attached to the pad (B), as shown in the picture.
3. Take off the paper from the backside of the heater assembly.
4. Attach the heater to the main part of pad.
5. Install the seat back cover.

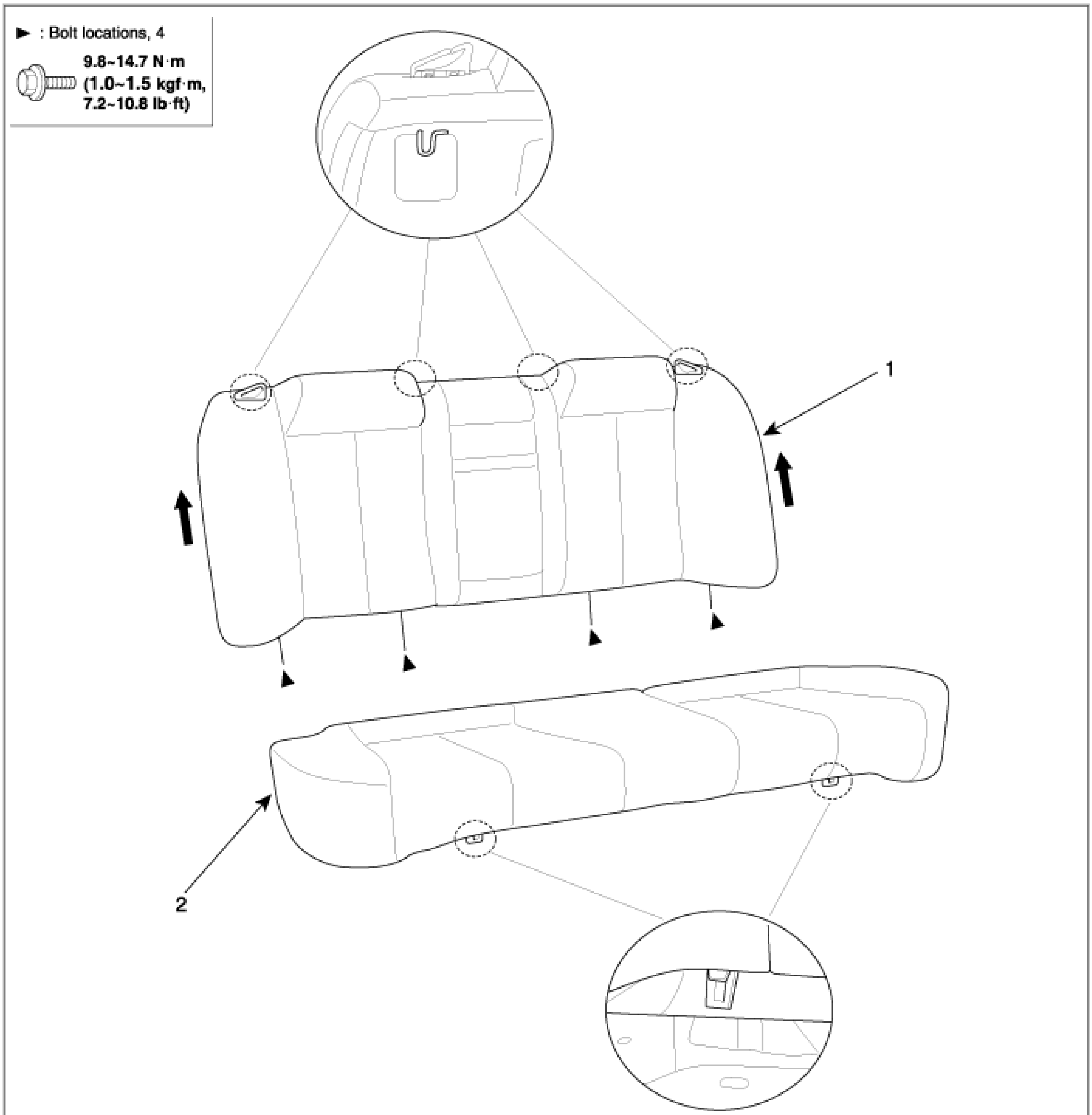


Body (Interior and Exterior) > Seat & Power Seat > rear seat > Repair procedures

REPLACEMENT

SEAT ASSEMBLY REPLACEMENT

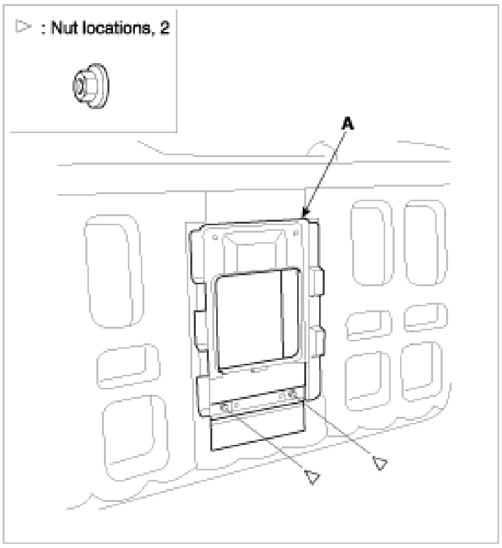
1. Remove the rear seat cushion.
2. Remove the rear seat back.
3. Installation is the reverse of removal.

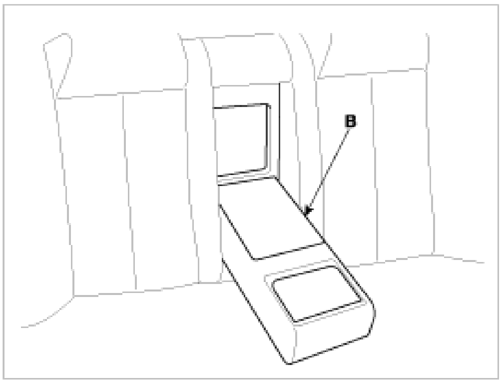


1. Seat back
2. Seat cushion

ARMREST REPLACEMENT

1. Loosening the armrest cover mounting screw.
2. After disconnecting the armrest cover (A), remove the armrest (B).

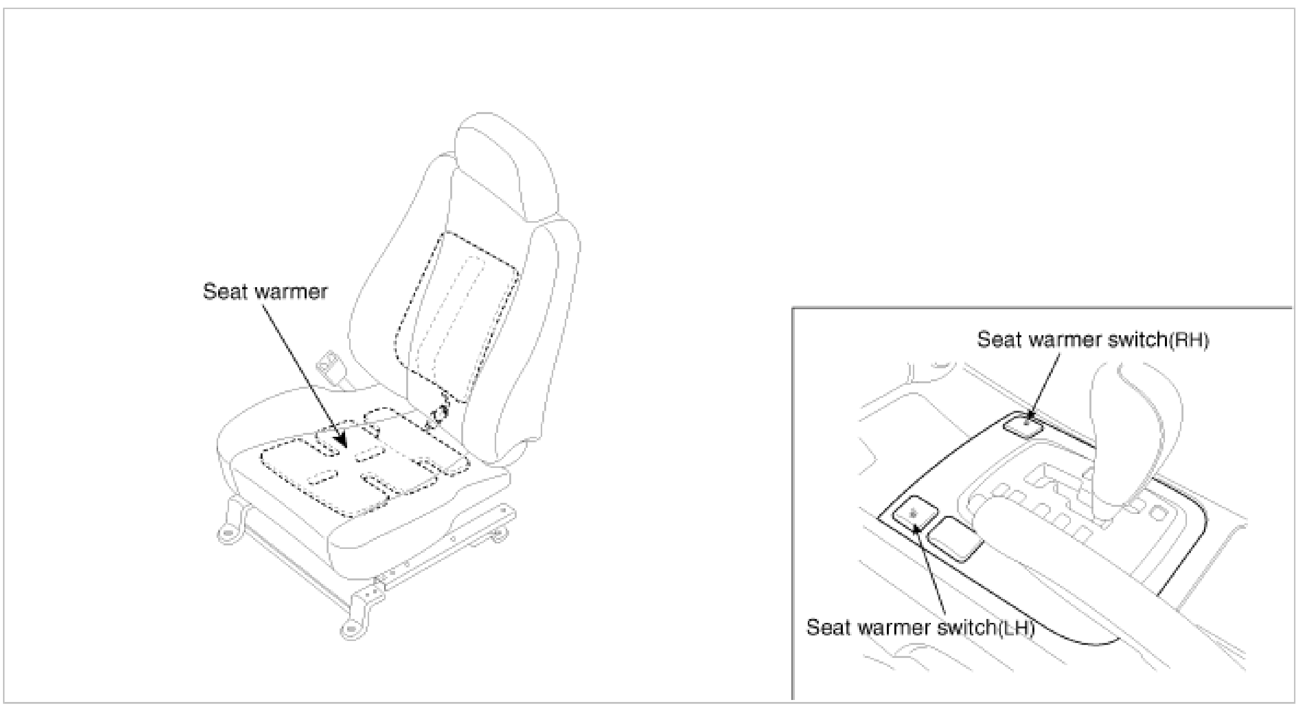




3. Installation is the reverse of removal.

Body (Interior and Exterior) > Seat Heater > Components and Components Location

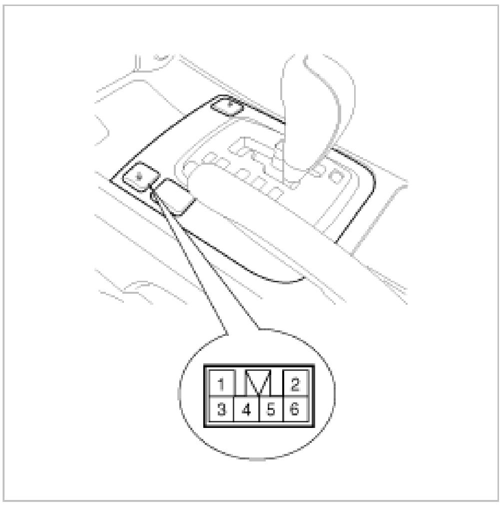
COMPONENT LOCATION



Body (Interior and Exterior) > Seat Heater > Seat Heater switch > Repair procedures

INSPECTION

1. Disconnect the negative (-) battery terminal.
2. Remove the seat warmer switch from the floor console upper cover with scraper.



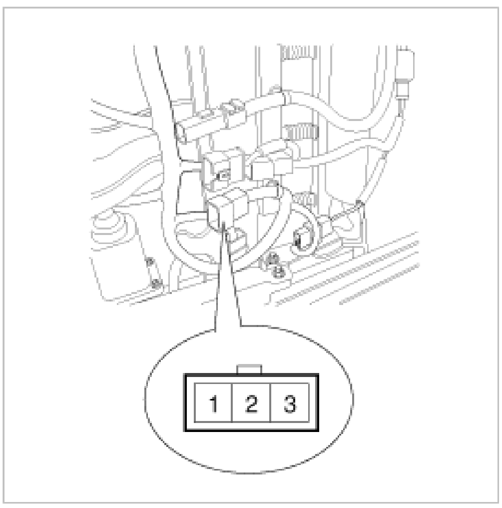
3. Check for continuity between the terminals in each switch position according to the table.

Position \ Terminal	2	6	3	4	1
ON	O	O	O	O IND.	O
OFF		Illumination			

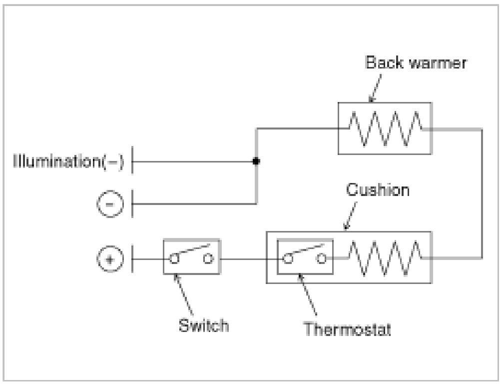
Body (Interior and Exterior) > Seat Heater > Seat heater > Repair procedures

INSPECTION

1. Check for continuity and measure the resistance between No.1 and NO.3 terminals.



Standard value: 2.45Ω ± 10%
(Cushion: 1.2Ω ± 10%, Back: 1.2Ω ± 10%)

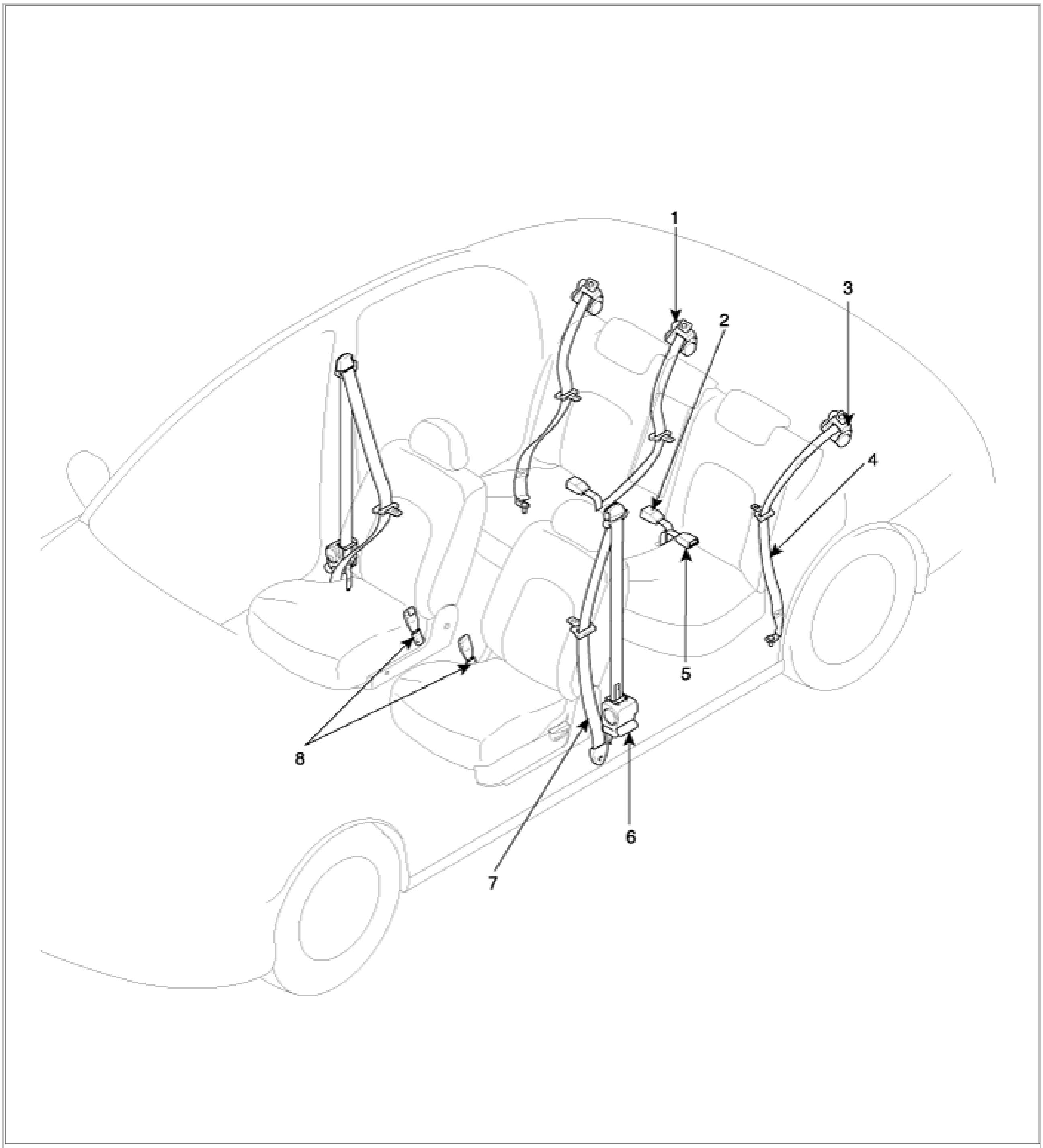


2. Operate the seat warmer after connecting the 3P connector, and then check the thermostat by measuring the temperature of seat surface.
3. Check for continuity between the terminals after disconnecting the 3P connector.

Standard value :
28 ± 3.5°C(Continuity), 37 ± 3.0°C(Short)

Body (Interior and Exterior) > Seat Belt > front seat belt > Components and Components Location

COMPONENTS



1. Rear center seat belt
2. Rear center seat buckle
3. Rear seat belt retractor
4. Rear seat belt
5. Rear seat buckle
6. Front seat belt retractor
7. Front seat belt
8. Front seat buckle

Body (Interior and Exterior) > Seat Belt > front seat belt > Repair procedures

REPLACEMENT

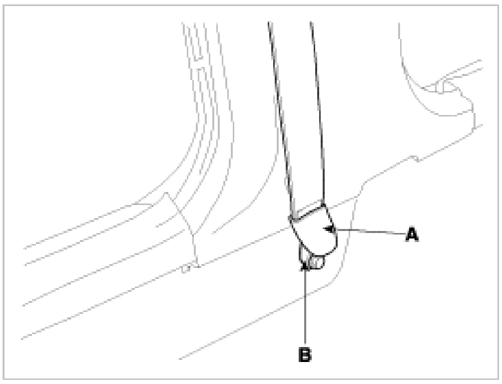
FRONT SEAT BELT REPLACEMENT

> CAUTION
>
> When installing the belt, make sure not to damage the pretensioner.

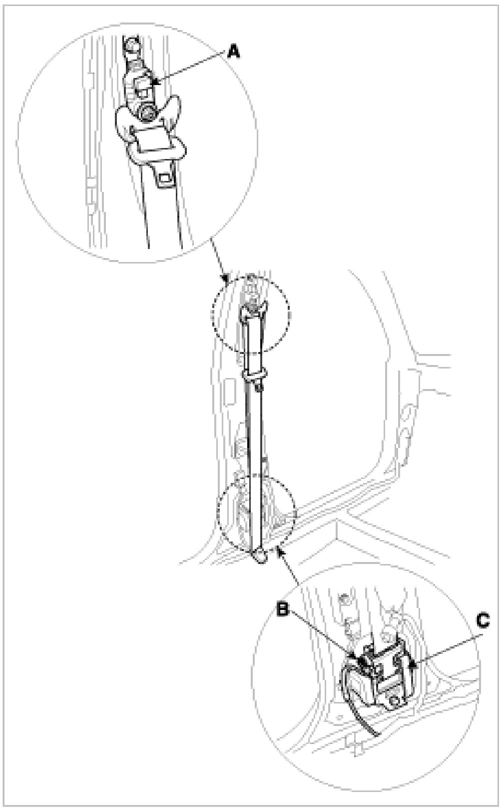
1. Remove the following items fist.

A. Front seat assembly.
B. Front and rear door scuff trim.

2. After raise the lower anchor cover (A), loosen the lower anchor mounting bolt (B).



3. Remove the center pillar lower trim.
4. Remove the center pillar upper trim.
5. Remove the upper anchor (A).



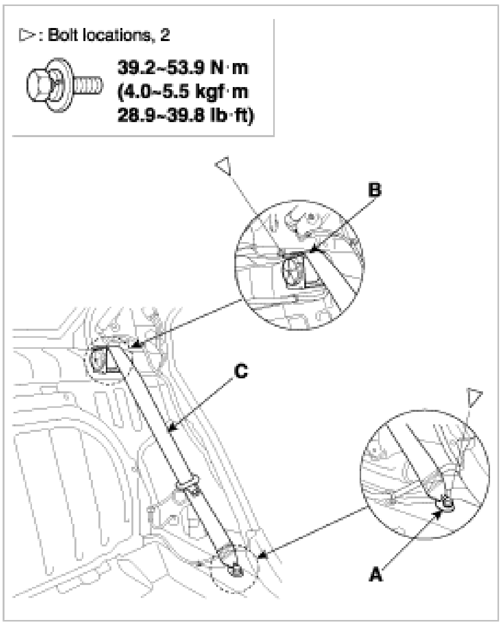
6. After disconnecting the pretensioner connector lock pin, remove the connector(B), Loosen the mounting bolt, then remove the pretensioner (C).

REAR SEAT BELT RELACEMENT

> CAUTION
>
> When installing the belt, make sure not to damage the pretensioner.

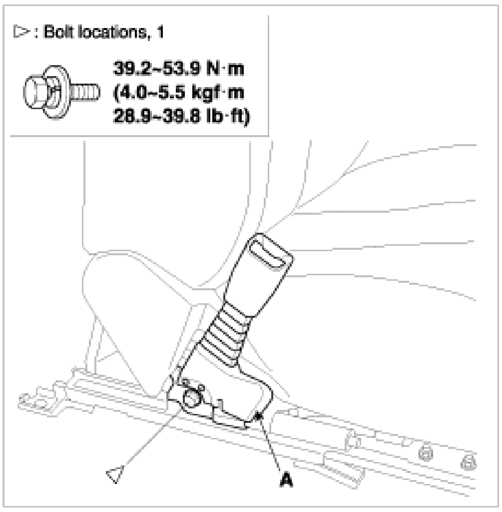
1. Remove the following items first.
   A. Rear seat assembly.
   B. Front and rear door scuff trim.
   C. Rear filler trim.
2. Remove the lower anchor (A).
3. Remove the package tray trim.

4. After loosening the retractor (B) mounting bolt, remove the rear seat belt (C).



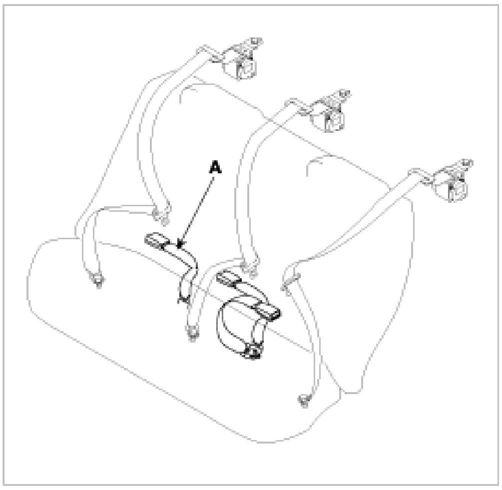
FRONT SEAT BELT BUCKLE REPLACEMENT

1. Remove the following items first.
   A. Front seat assembly.
2. Remove the wire harness of buckle from seat.
3. Remove the seat belt buckle (A).
4. Installation is the reverse of removal.



REAR SEAT BELT BUCKLE REPLACEMENT

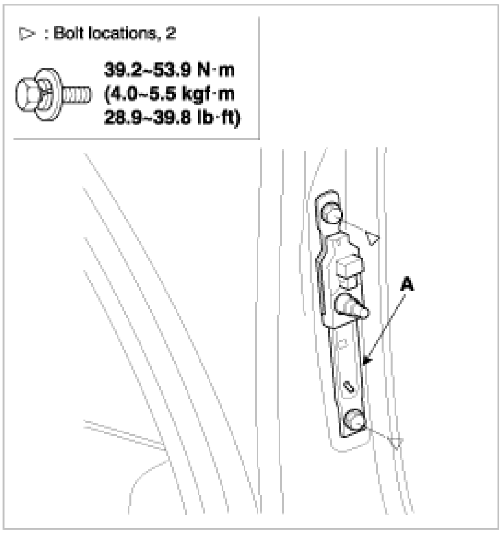
1. After cushion frame hinge mounting bolt, fold the cushion.
2. Remove the seat belt buckle (A).



3. Installation is the reverse of removal.

HIGHT ADJUSTER REPLACEMENT

1. Remove the following items first.
   A. Front seat assembly.
   B. Front and rear door scuff trim.
   C. Front seat belt upper and lower anchor.
   D. Center pillar lower and upper trim.
2. Loosen the mounting bolt, then remove the height adjuster (A).



3. Installation is the reverse of removal.

GENERAL TROUBLESHOOTING INFORMATION

BEFORE TROUBLESHOOTING

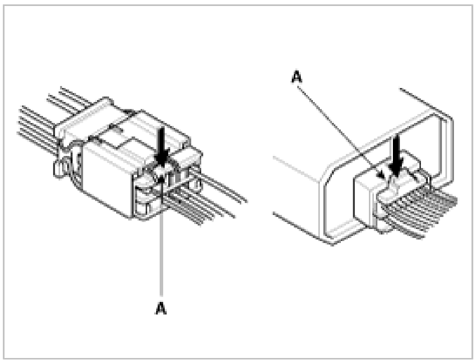
1. Check applicable fuses in the appropriate fuse/relay box.
2. Check the battery for damage, state of charge, and clean and tight connections.

> NOTE
>
> - Do not quick-charge a battery unless the battery ground cable has been disconnected, otherwise you will damage the alternator diodes.
> - Do not attempt to crank the engine with the battery ground cable loosely connected or you will severely damage the wiring.

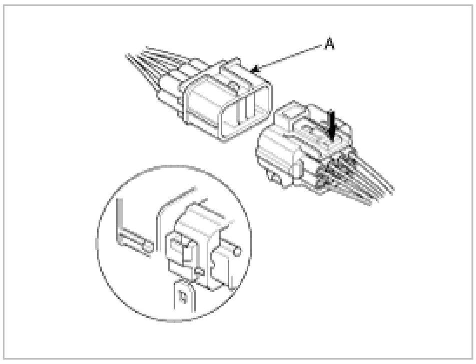
3. Check the alternator belt tension.

HANDLING CONNECTORS

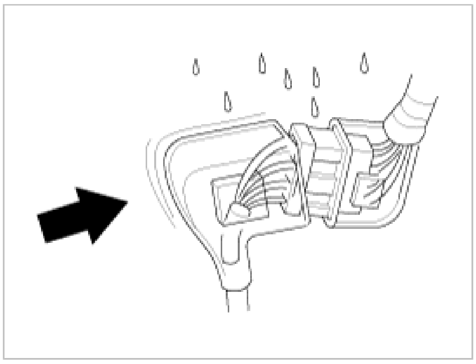
1. Make sure the connectors are clean and have no loose wire terminals.
2. Make sure multiple cavity connectors are packed with grease (except watertight connectors).
3. All connectors have push-down release type locks (A).



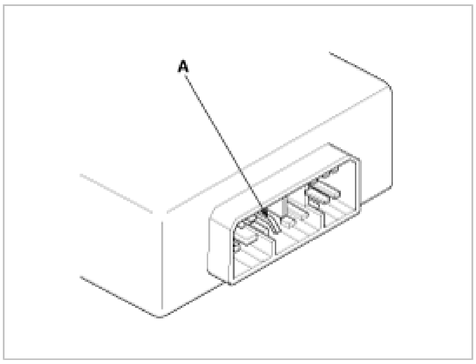
4. Some connectors have a clip on their side used to attach them to a mount bracket on the body or on another component. This clip has a pull type lock.
5. Some mounted connectors cannot be disconnected unless you first release the lock and remove the connector from its mount bracket (A).



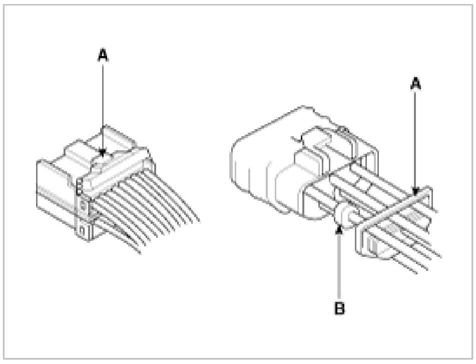
6. Never try to disconnect connectors by pulling on their wires; pull on the connector halves instead.
7. Always reinstall plastic covers.



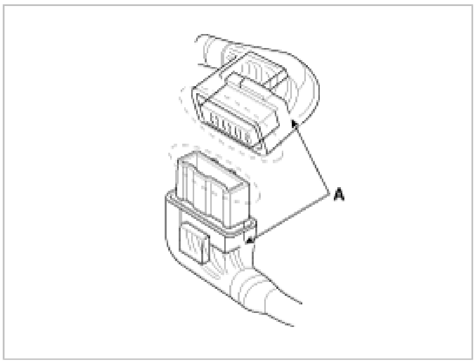
8. Before connecting connectors, make sure the terminals (A) are in place and not bent.



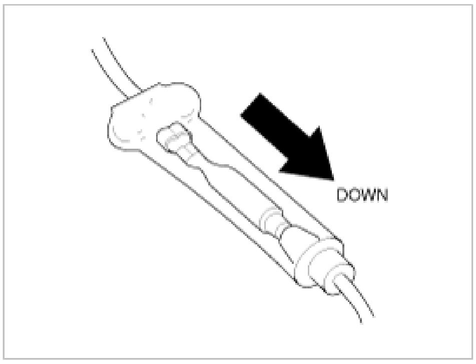
9. Check for loose retainer (A) and rubber seals (B).



10. The backs of some connectors are packed with grease. Add grease if necessary. If the grease (A) is contaminated, replace it.

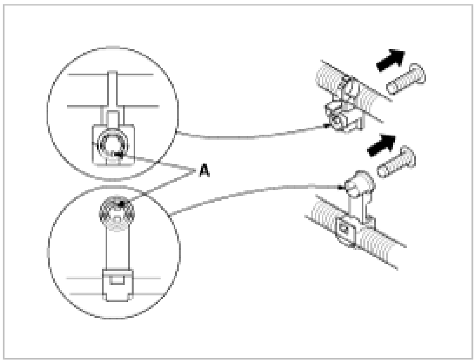


11. Insert the connector all the way and make sure it is securely locked.
12. Position wires so that the open end of the cover faces down.

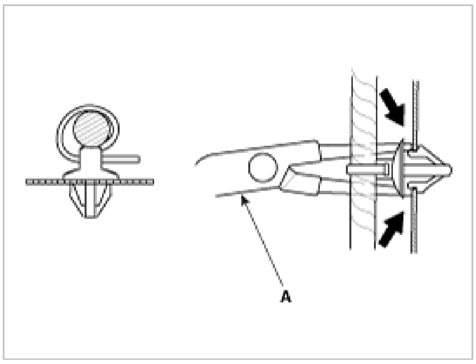


HANDLING WIRES AND HARNESSES

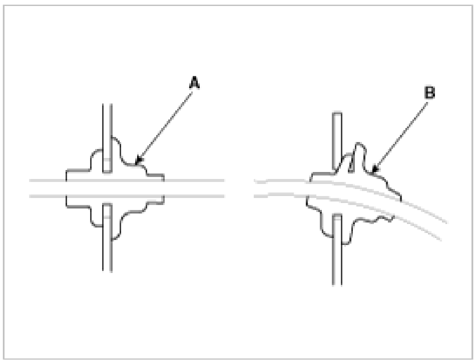
1. Secure wires and wire harnesses to the frame with their respective wire ties at the designated locations.
2. Remove clips carefully; don't damage their locks (A).



3. Slip pliers (A) under the clip base and through the hole at an angle, and then squeeze the expansion tabs to release the clip.



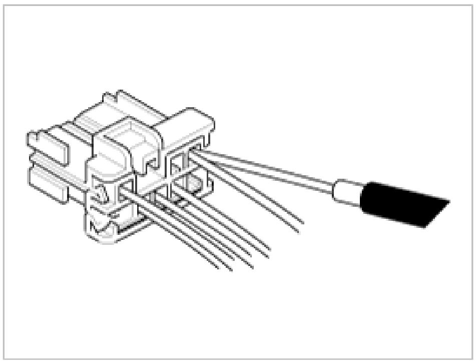
4. After installing harness clips, make sure the harness doesn't interfere with any moving parts.
5. Keep wire harnesses away from exhaust pipes and other hot parts, from sharp edges of brackets and holes, and from exposed screws and bolts.
6. Seat grommets in their grooves properly (A). Do not leave grommets distorted (B).



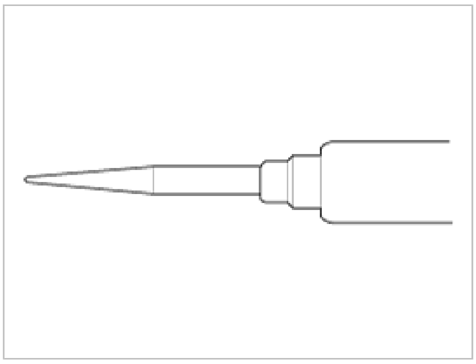
TESTING AND REPAIRS

1. Do not use wires or harnesses with broken insulation.
   Replace them or repair them by wrapping the break with electrical tape.
2. After installing parts, make sure that no wires are pinched under them.

3. When using electrical test equipment, follow the manufacturer's instructions and those described in this manual.
4. If possible, insert the probe of the tester from the wire side (except waterproof connector).



5. Use a probe with a tapered tip.

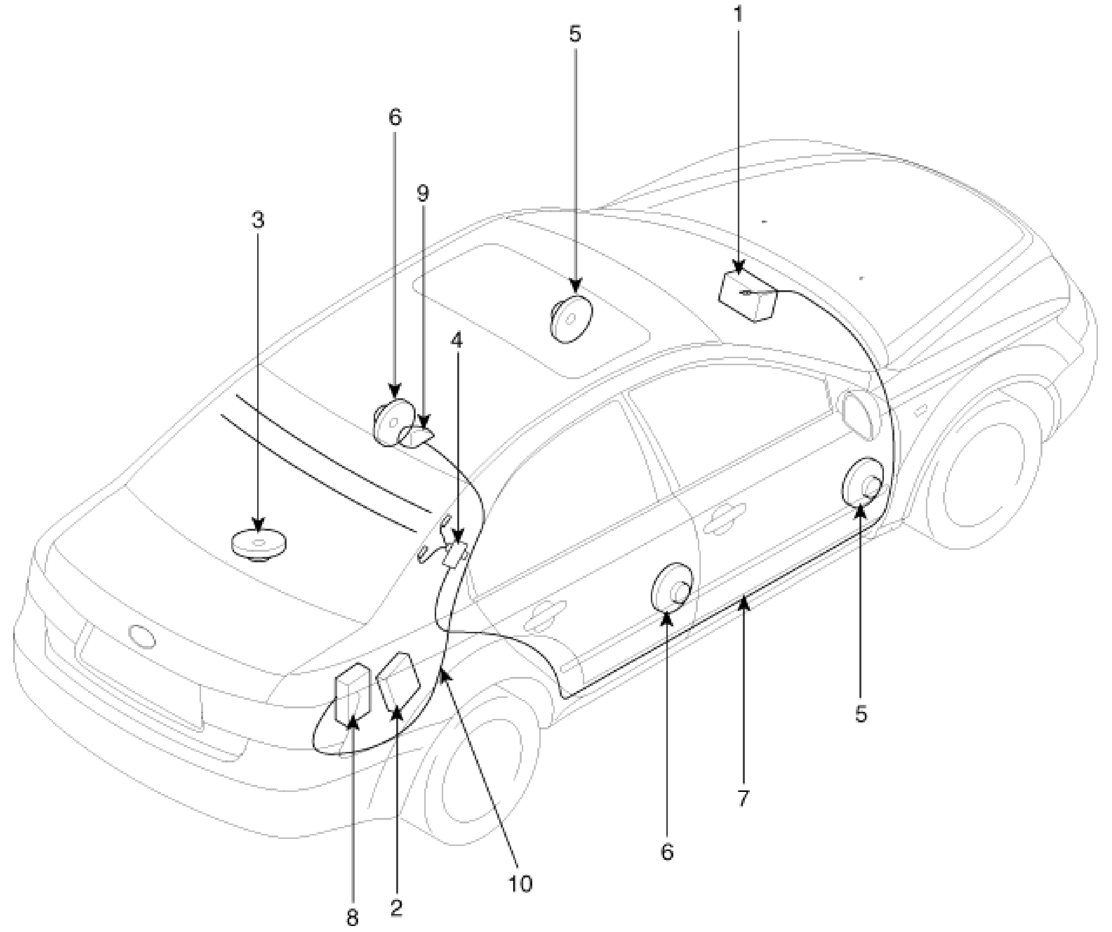


FIVE-STEP TROUBLESHOOTING

1. Verify the complaint
   Turn on all the components in the problem circuit to verify the customer complaint. Note the symptoms. Do not begin disassembly or testing until you have narrowed down the problem area.
2. Analyze the schematic
   Look up the schematic for the problem circuit.
   Determine how the circuit is supposed to work by tracing the current paths from the power feed through the circuit components to ground. If several circuits fail at the same time, the fuse or ground is a likely cause.
   Based on the symptoms and your understanding of the circuit operation, identify one or more possible causes of the problem.
3. Isolate the problem by testing the circuit.
   Make circuit tests to check the diagnosis you made in step 2. Keep in mind that a logical, simple procedure is the key to efficient troubleshooting.
   Test for the most likely cause of failure first. Try to make tests at points that are easily accessible.
4. Fix the problem
   Once the specific problem is identified, make the repair. Be sure to use proper tools and safe procedures.
5. Make sure the circuit works
   Turn on all components in the repaired circuit in all modes to make sure you've fixed the entire problem. If the problem was a blown fuse, be sure to test all of the circuits on the fuse. Make sure no new problems turn up and the original problem does not recur.

Body Electrical System > Audio > Components and Components Location

COMPONENT LOCATION



* SDARS : Satellite Digital Audio Radio Service

1. Audio unit	6. Rear door speaker
2. External amp	7. Antenna feeder cable
3. Woofer speaker	8. Set top box (SDARS)
4. Glass antenna	9. SDARS roof antenna
5. Front door speaker	10. SDARS roof antenna cable

Body Electrical System > Audio > Troubleshooting

TROUBLESHOOTING

There are six areas where a problem can occur: wiring harness, the radio, the cassette tape deck, the CD player, and speaker. Troubleshooting enables you to confine the problem to a particular area.

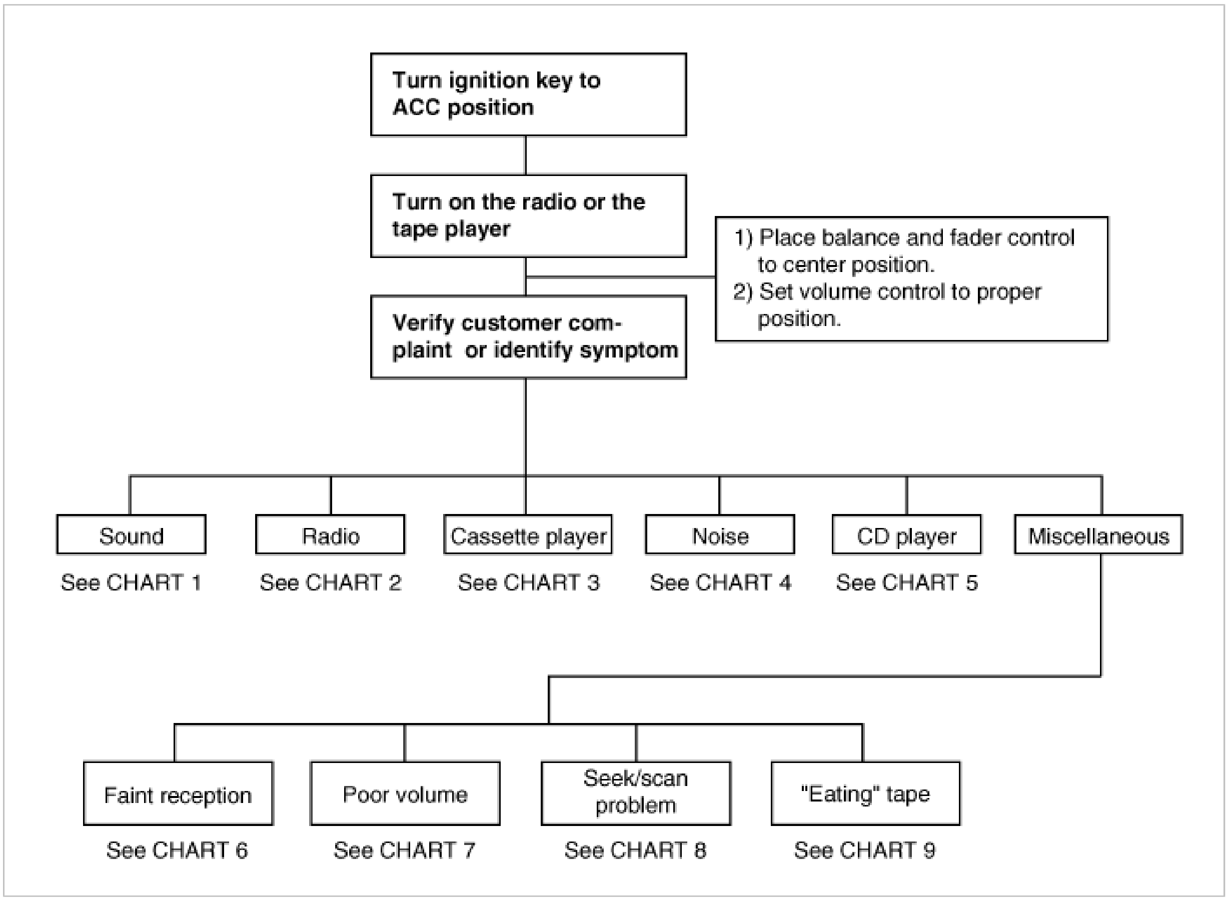
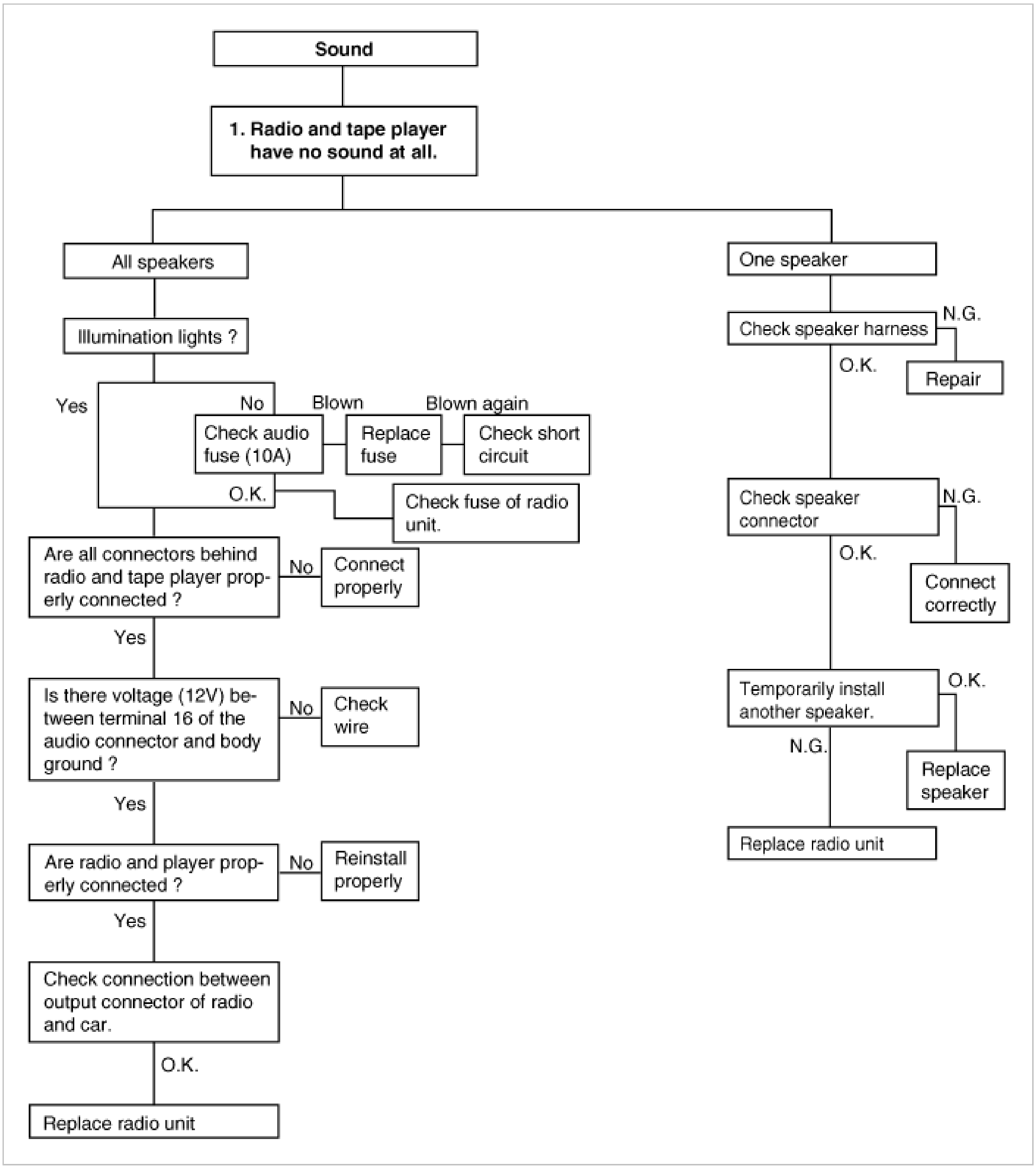
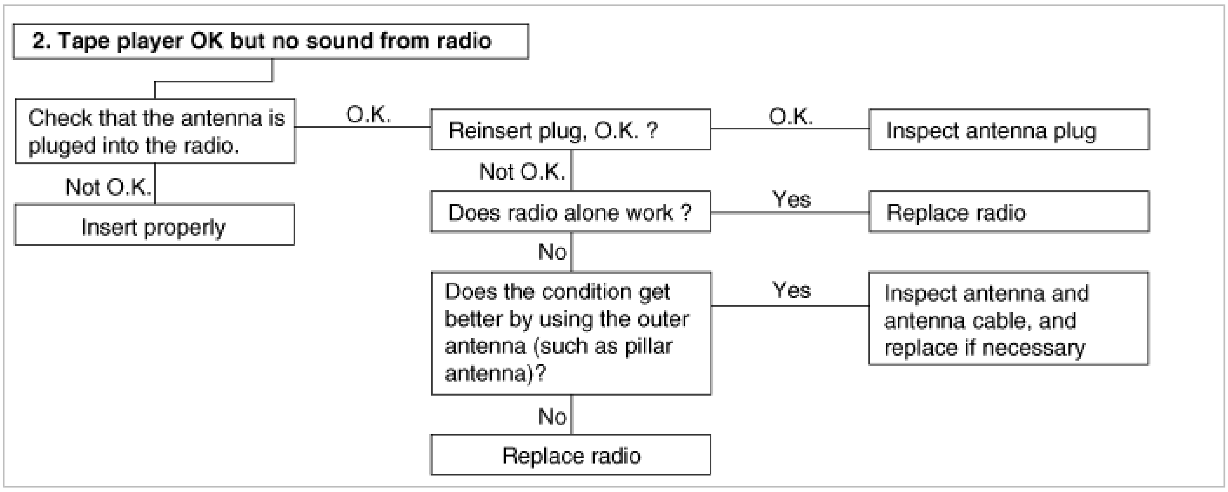

Turn ignition key to ACC position
Turn on the radio or the tape player
1) Place balance and fader control to center position.
2) Set volume control to proper position.
Verify customer complaint or identify symptom
Sound
See CHART 1
Radio
See CHART 2
Cassette player
See CHART 3
Noise
See CHART 4
CD player
See CHART 5
Miscellaneous
Faint reception
See CHART 6
Poor volume
See CHART 7
Seek/scan problem
See CHART 8
"Eating" tape
See CHART 9

CHART 1



Sound
1. Radio and tape player have no sound at all.
All speakers
Illumination lights ?
Yes
No
Check audio fuse (10A)
Blown
Replace fuse
Blown again
Check short circuit
O.K.
Check fuse of radio unit.
Are all connectors behind radio and tape player properly connected ?
No
Connect properly
Yes
Is there voltage (12V) between terminal 16 of the audio connector and body ground ?
No
Check wire
Yes
Are radio and player properly connected ?
No
Reinstall properly
Yes
Check connection between output connector of radio and car.
O.K.
Replace radio unit
One speaker
Check speaker harness
N.G.
Repair
O.K.
Check speaker connector
N.G.
Connect correctly
O.K.
Temporarily install another speaker.
O.K.
Replace speaker
N.G.
Replace radio unit



2. Tape player OK but no sound from radio
Check that the antenna is pluged into the radio.
O.K.
Reinsert plug, O.K. ?
O.K.
Inspect antenna plug
Not O.K.
Insert properly
Not O.K.
Does radio alone work ?
Yes
Replace radio
No
Does the condition get better by using the outer antenna (such as pillar antenna)?
Yes
Inspect antenna and antenna cable, and replace if necessary
No
Replace radio

CHART 2

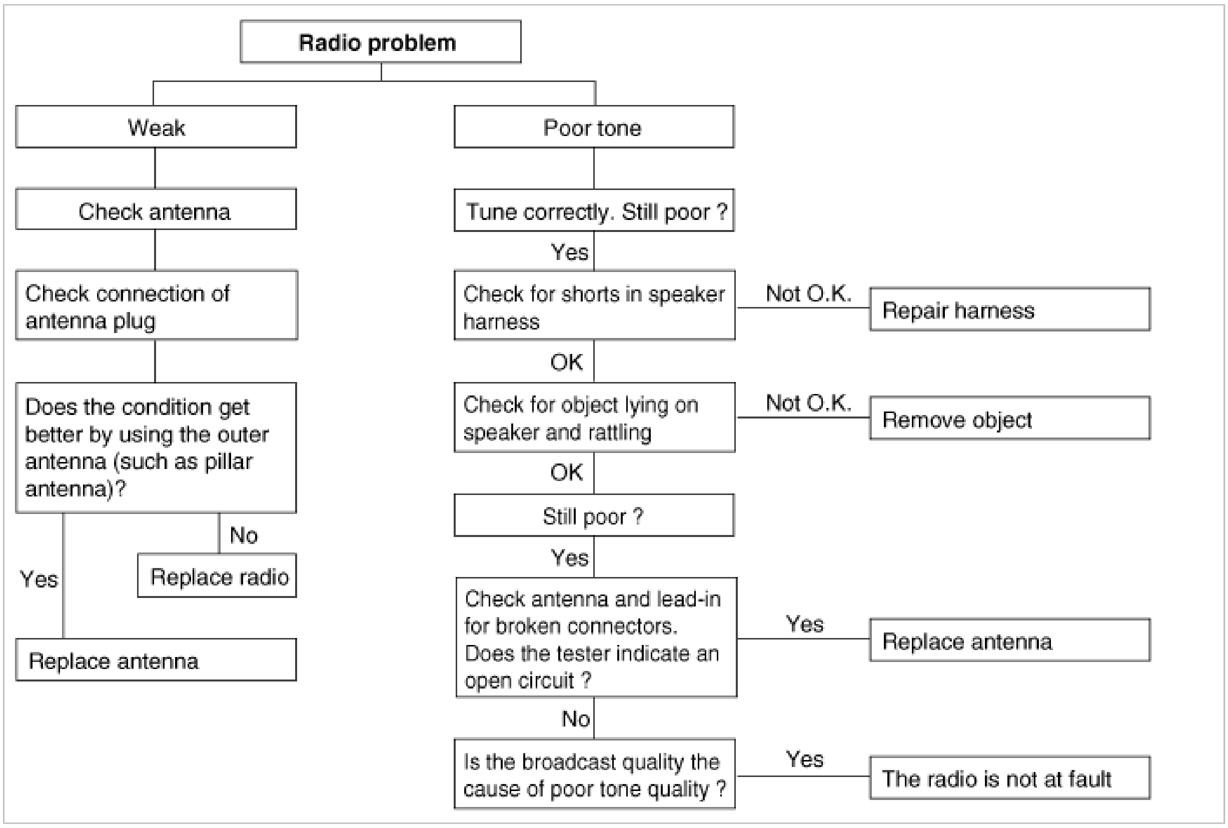

Radio problem
Weak
Check antenna
Check connection of antenna plug
Does the condition get better by using the outer antenna (such as pillar antenna)?
No
Replace radio
Yes
Replace antenna
Poor tone
Tune correctly. Still poor ?
Yes
Check for shorts in speaker harness
Not O.K.
Repair harness
OK
Check for object lying on speaker and rattling
Not O.K.
Remove object
OK
Still poor ?
Yes
Check antenna and lead-in for broken connectors. Does the tester indicate an open circuit ?
Yes
Replace antenna
No
Is the broadcast quality the cause of poor tone quality ?
Yes
The radio is not at fault

CHART 3

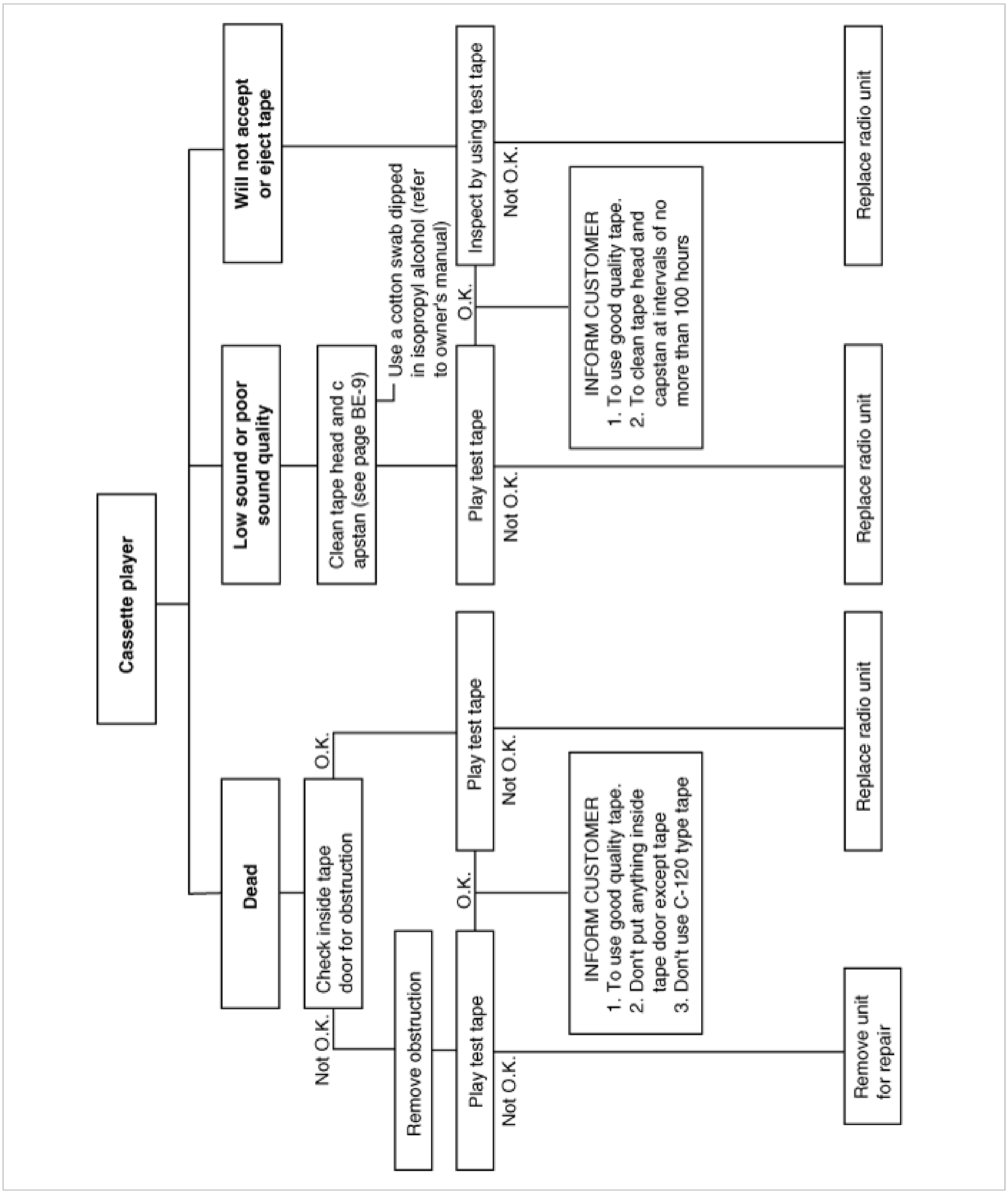
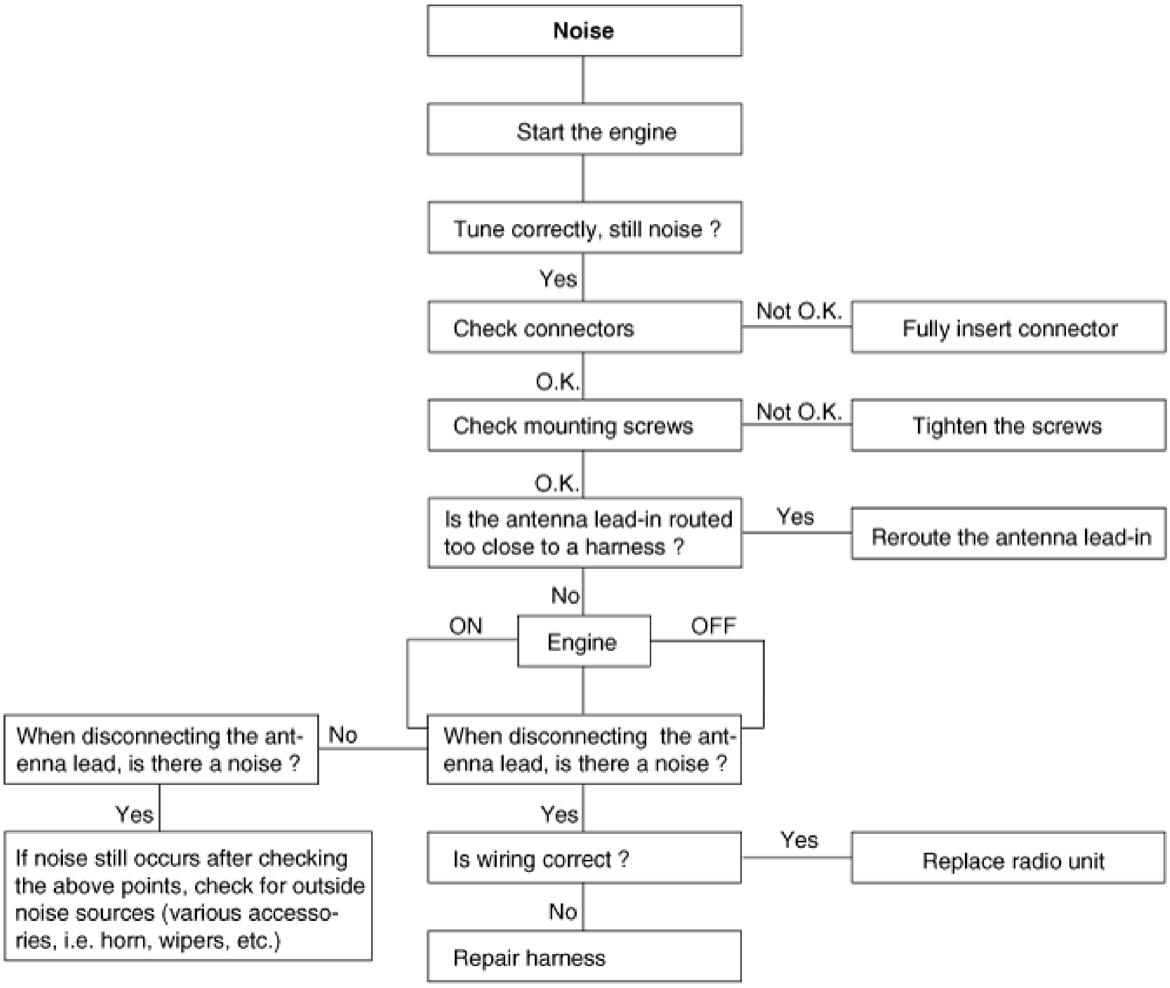

Cassette player
Dead
Low sound or poor sound quality
Will not accept or eject tape
Check inside tape door for obstruction
O.K.
Not O.K.
Remove obstruction
Play test tape
O.K.
Not O.K.
Play test tape
Not O.K.
INFORM CUSTOMER
1. To use good quality tape.
2. Don't put anything inside tape door except tape
3. Don't use C-120 type tape
Remove unit for repair
Replace radio unit
Clean tape head and c apstan (see page BE-9)
Use a cotton swab dipped in isopropyl alcohol (refer to owner's manual)
Play test tape
O.K.
Not O.K.
INFORM CUSTOMER
1. To use good quality tape.
2. To clean tape head and capstan at intervals of no more than 100 hours
Replace radio unit
Inspect by using test tape
Not O.K.
Replace radio unit

CHART 4

1. RADIO



2. TAPE

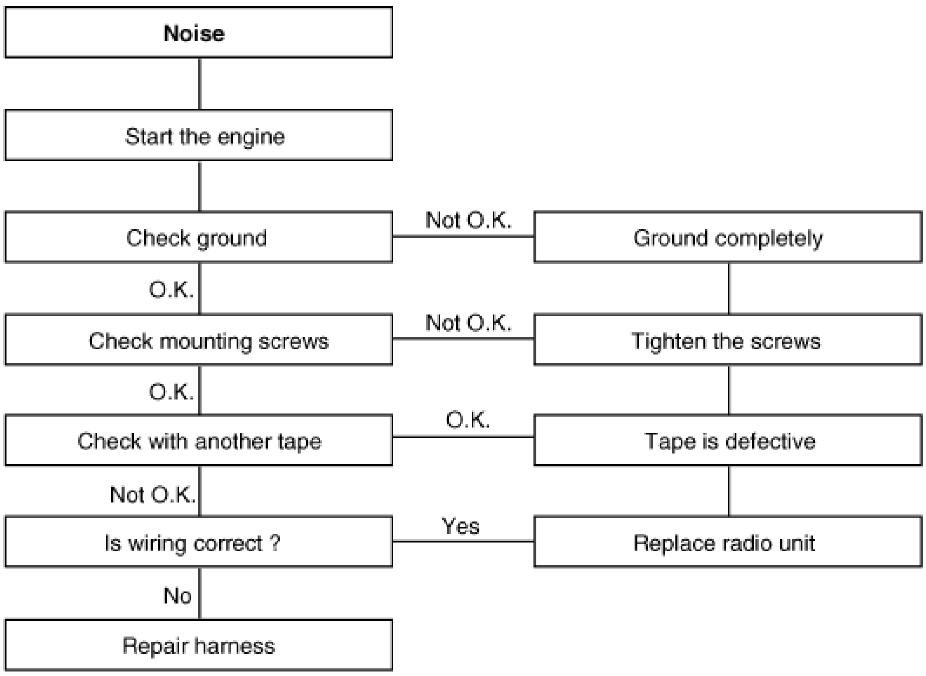
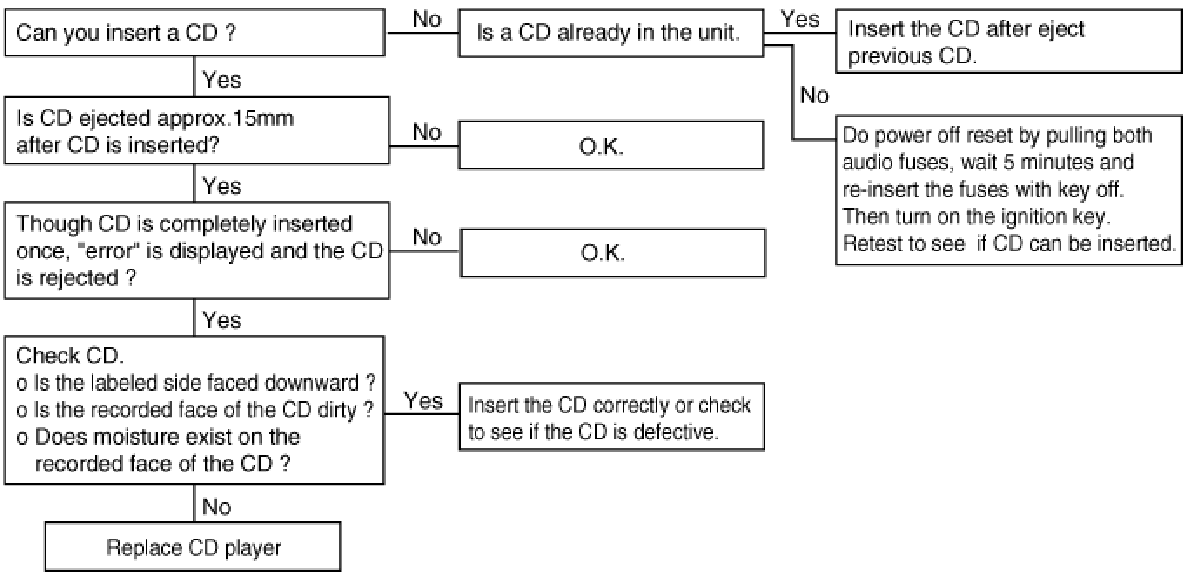
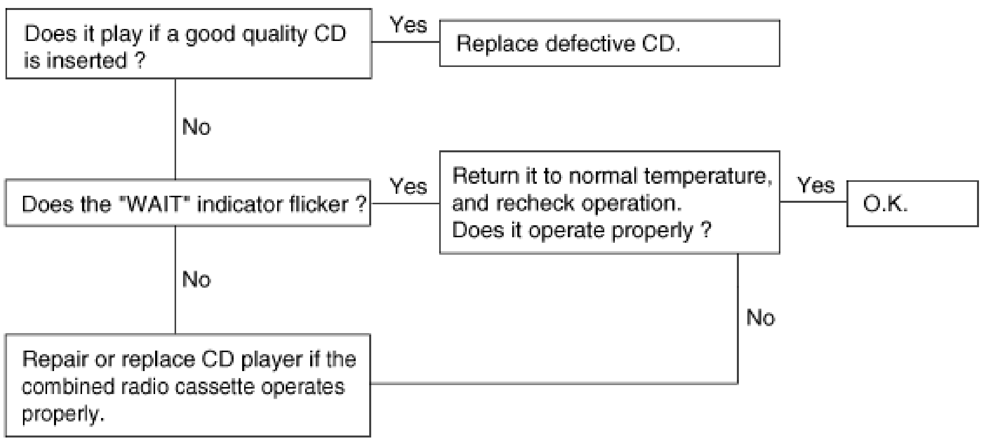


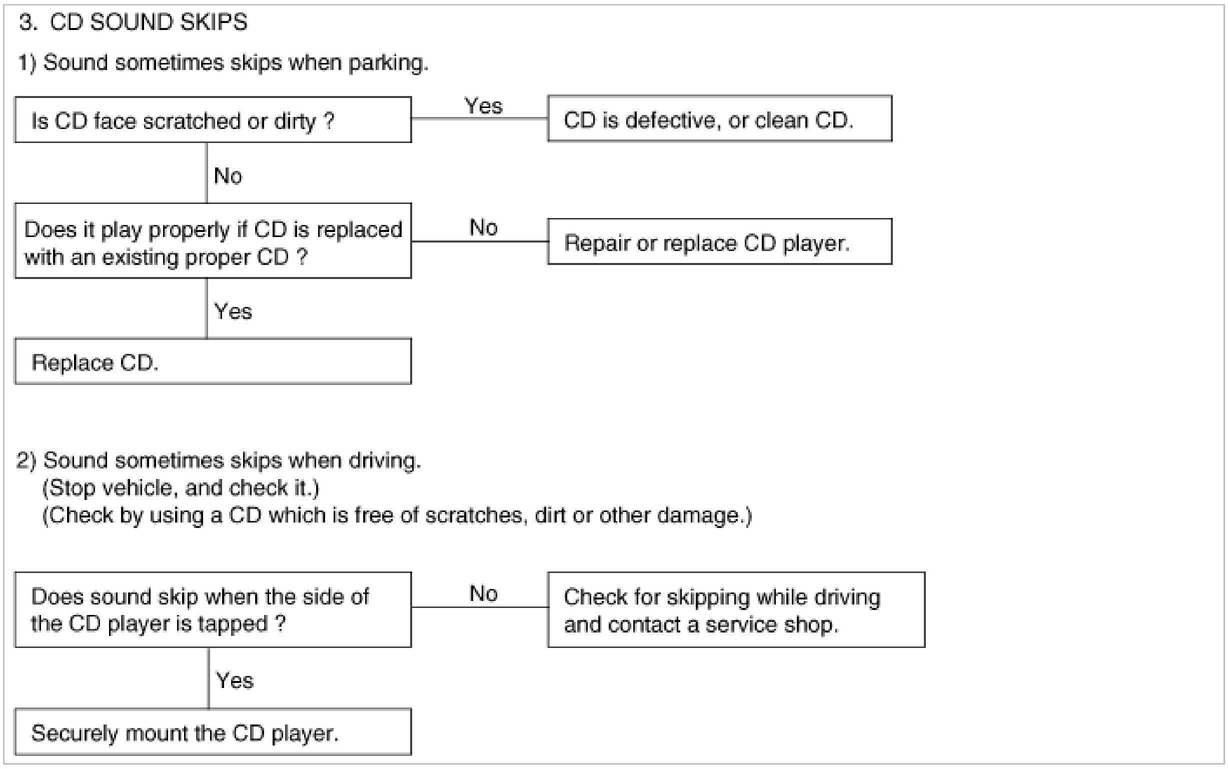
CHART 5

1. CD WILL NOT BE ACCEPTED



2. NO SOUND




3. CD SOUND SKIPS
1) Sound sometimes skips when parking.
Is CD face scratched or dirty ?
Yes
CD is defective, or clean CD.
No
Does it play properly if CD is replaced with an existing proper CD ?
No
Repair or replace CD player.
Yes
Replace CD.
2) Sound sometimes skips when driving.
(Stop vehicle, and check it.)
(Check by using a CD which is free of scratches, dirt or other damage.)
Does sound skip when the side of the CD player is tapped ?
No
Check for skipping while driving and contact a service shop.
Yes
Securely mount the CD player.

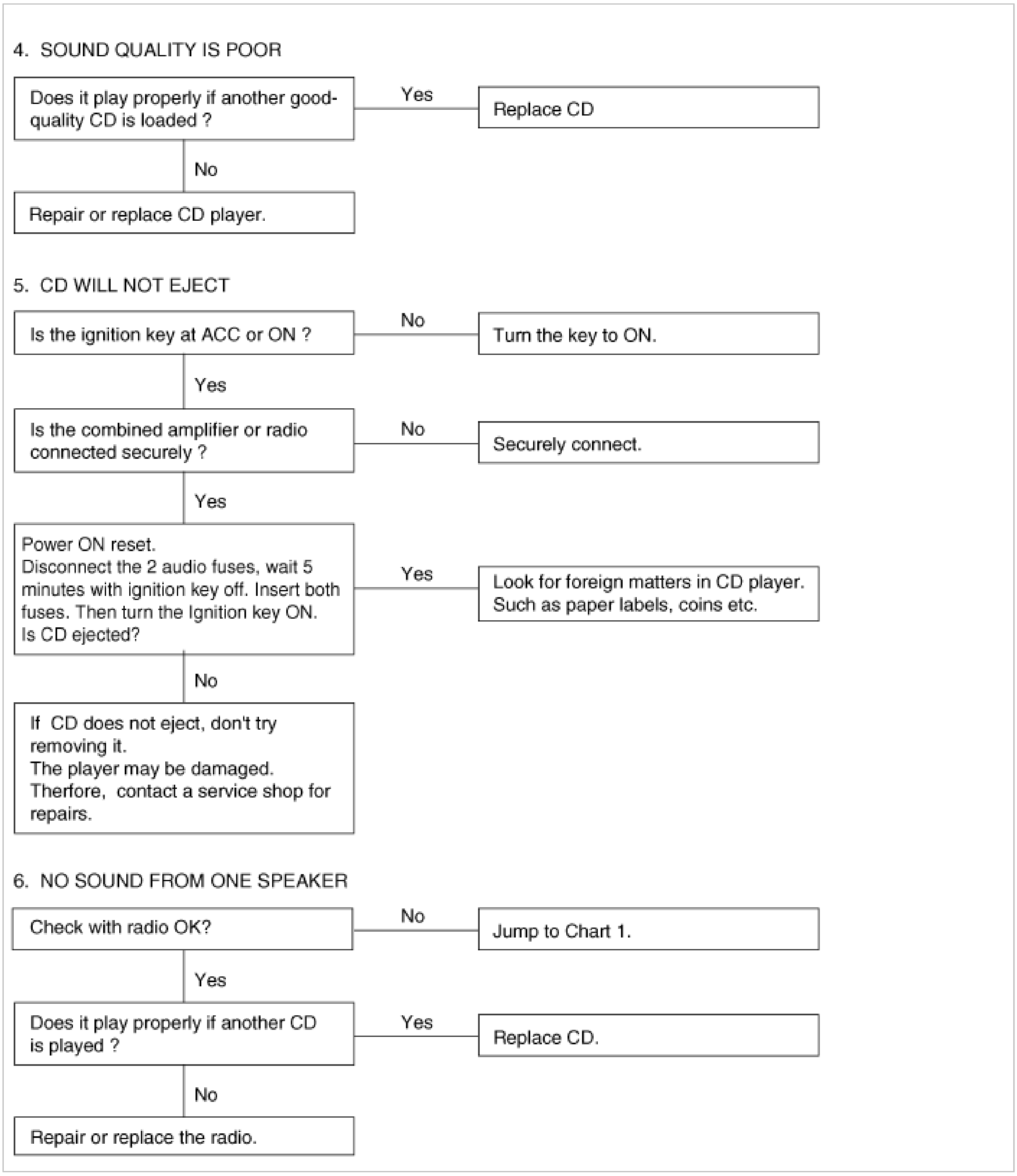

4. SOUND QUALITY IS POOR
Does it play properly if another good-quality CD is loaded ?
Yes
Replace CD
No
Repair or replace CD player.
5. CD WILL NOT EJECT
Is the ignition key at ACC or ON ?
No
Turn the key to ON.
Yes
Is the combined amplifier or radio connected securely ?
No
Securely connect.
Yes
Power ON reset.
Disconnect the 2 audio fuses, wait 5 minutes with ignition key off. Insert both fuses. Then turn the Ignition key ON.
Is CD ejected?
Yes
Look for foreign matters in CD player. Such as paper labels, coins etc.
No
If CD does not eject, don't try removing it.
The player may be damaged.
Therfore, contact a service shop for repairs.
6. NO SOUND FROM ONE SPEAKER
Check with radio OK?
No
Jump to Chart 1.
Yes
Does it play properly if another CD is played ?
Yes
Replace CD.
No
Repair or replace the radio.

CHART 6

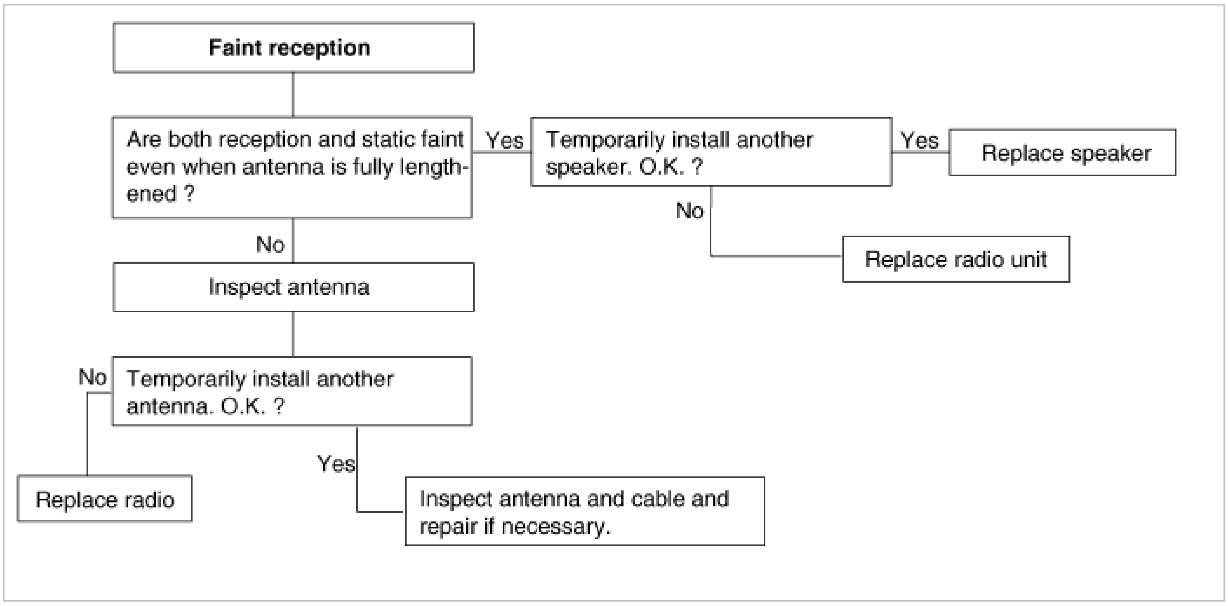


CHART 7

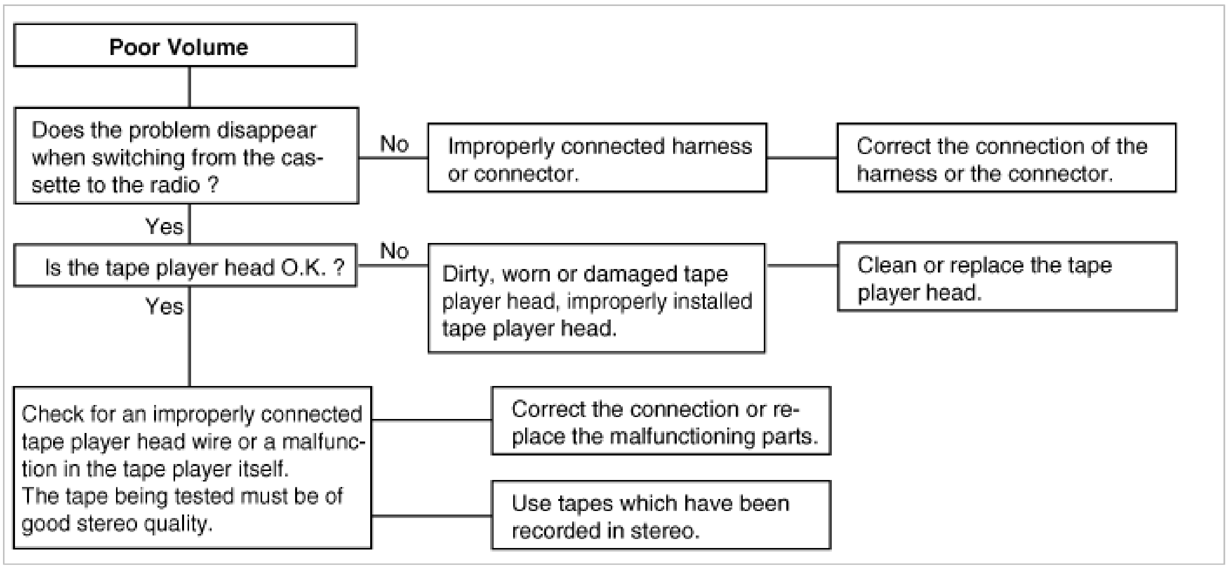


CHART 8

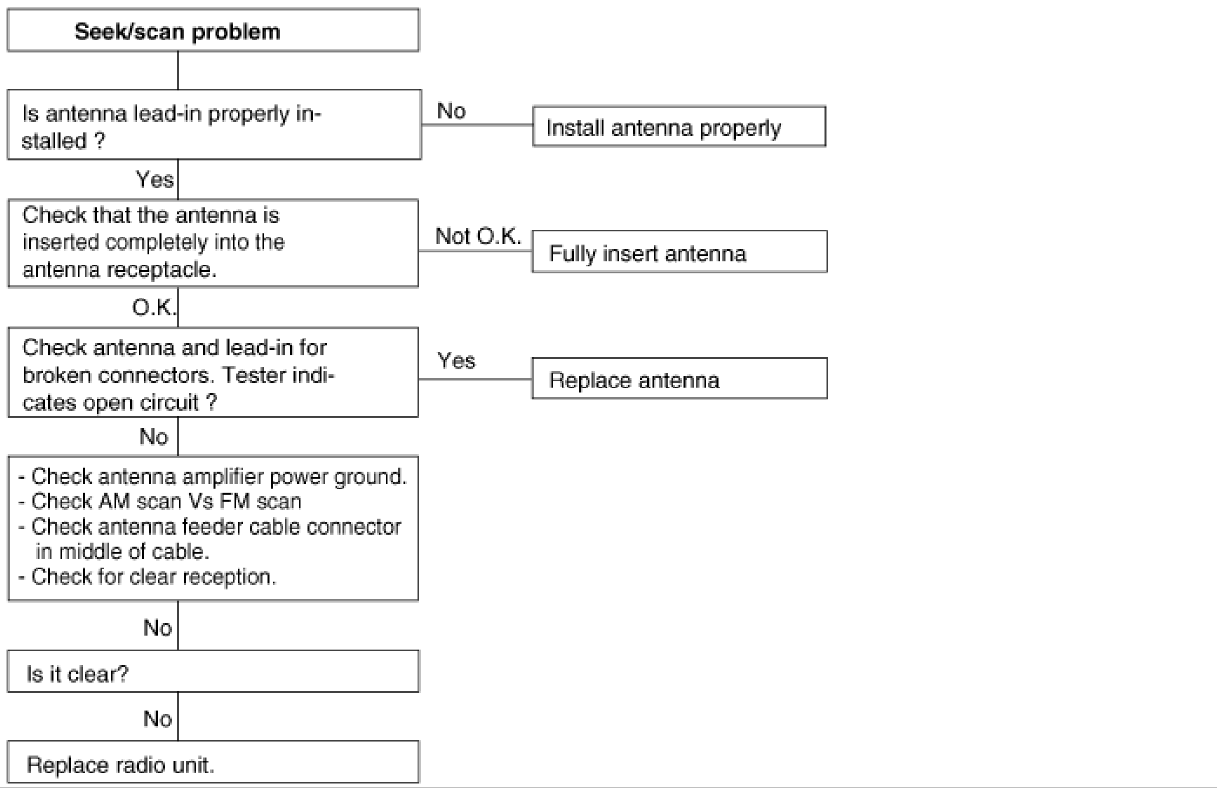
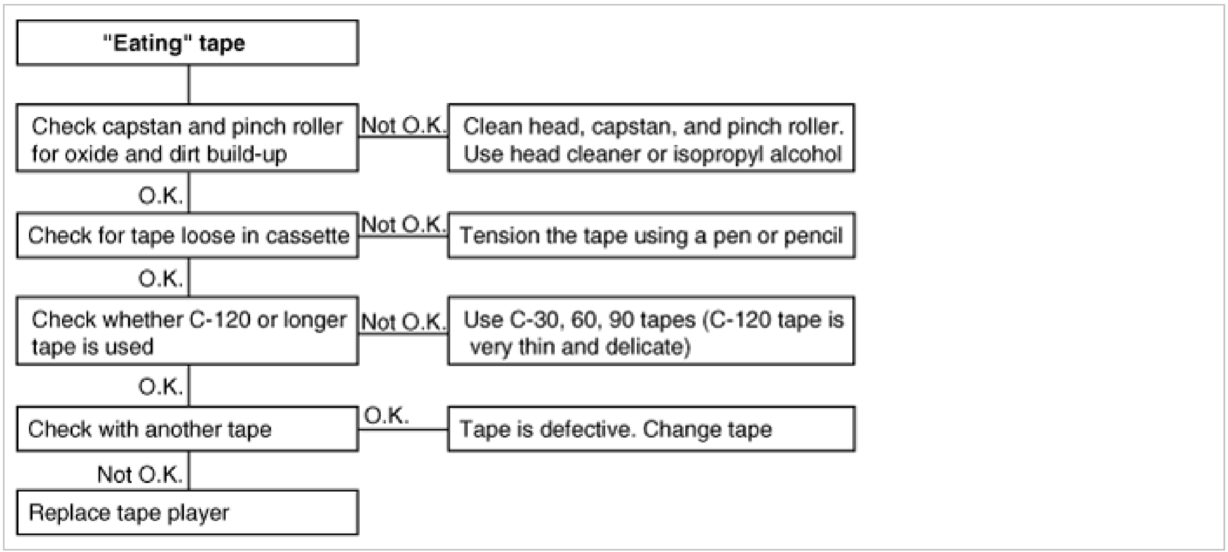


CHART 9



Body Electrical System > Audio > Specifications

SPECIFICATION

AUDIO

Item	Specification			
Model	AM / FM / CD / MP3 (V480)	AM / FM / MX / CD / MP3 (V480S)	AM / FM / MP3 / 6CDC (V490 / V490 PREMIUM)	AM / FM / XM / MP3 / 6CDC (V490S)
Power supply	DC 14.4V			
Rated output	Max 20W x 4		5.4Vrms	
Antenna	90PF 100Ω			
Tuning type	PLL synthesized type			
The others	-		External amp, woofer speaker	

Frequency range / Channel space	FM	87.9~107.9 MHz/ 220KHz
	AM	530~1710 KHz/ 10 KHz

* XM : Satellite Radio

SPEAKER

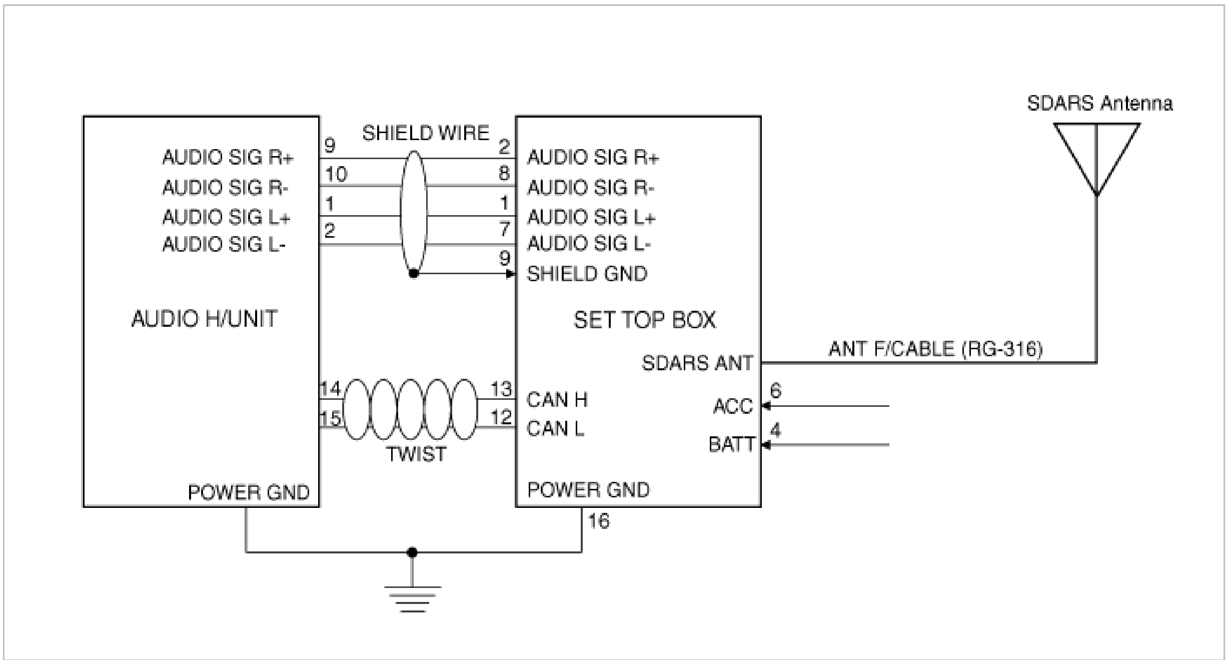
Item		V480	V490	V490/V490S PREMIUM
Input Power	Front	Max. 40W	Max. 40W	Max. 6.3 Vrms
	Rear	Max. 40W	Max. 40W	Max. 6.3 Vrms
	Tweeter	Max. 20W	Max. 20W	20 W
	Woofer	-	Max. 80W	64 W
Speaker Impedance (Ω)	Front	4	2	Min. 1.6 @ 400Hz
	Rear	4	2	Min. 1.6 @ 400Hz
	Tweeter	4	2	3.6 ± 0.4 @ 5KHz
	Woofer	-	2 + 2	1.35± 0.2 @200Hz
Speaker Number		6	7	7

EXTERNAL AMPLIFIER

Item	V480/V480S	V490/V490S	V490/V490S PREMIUM
Power supply	-	DC 14.4V	DC 14.4V
Output power	-	Max 240W (40W x 6CH)	Max 270W (45W x 6CH)
Speaker Impedance (Ω)	-	2	2

Body Electrical System > Audio > Audio Unit > Schematic Diagrams

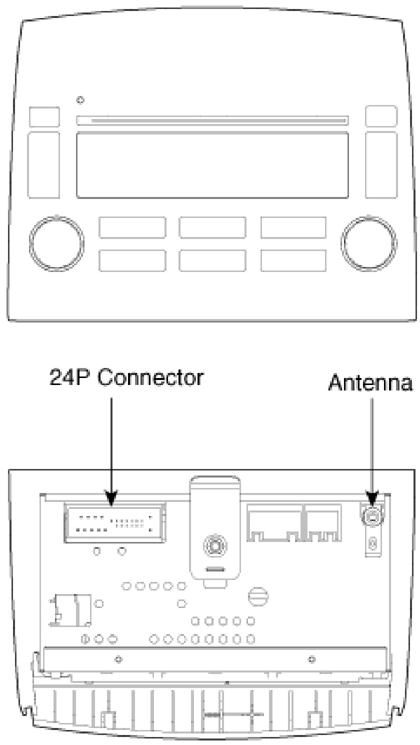
CIRCUIT DIAGRAM

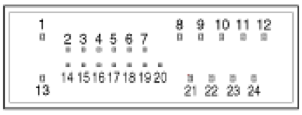


Body Electrical System > Audio > Audio Unit > Components and Components Location

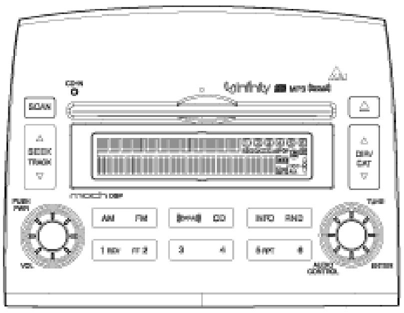
COMPONENT

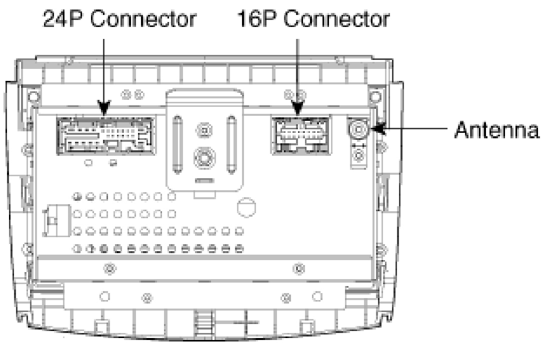
[AM/FM/CD/MP3 (V480)]
[AM/FM/MP3/6CDC (V490)]

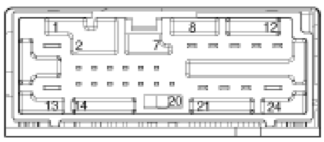


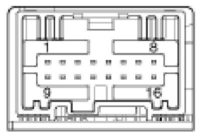
Audio connector	Terminal	Description	Terminal	Description
	1	Battery	13	Ground
	2	ACC	14	-
	3	Illumination (+)	15	-
	4	Illumination (-)	16	-
	5	External amp	17	-
	6	-	18	Steering remote control
	7	MUTE	19	Remote control ground
	8	Front left speaker (+)	20	-
	9	Rear left speaker (+)	21	Front left speaker (-)
	10	Rear right speaker (+)	22	Rear left speaker (-)
	11	Front right speaker (+)	23	Rear right speaker (-)
	12	Front right speaker (-)	24	Antenna B+

[AM/FM/XM/CD/MP3 (V480S)]



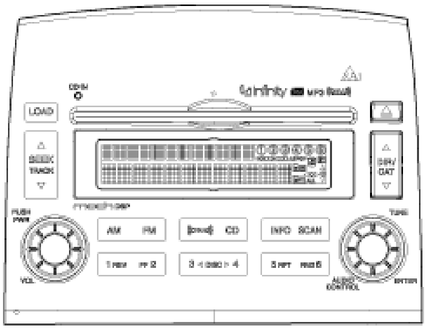


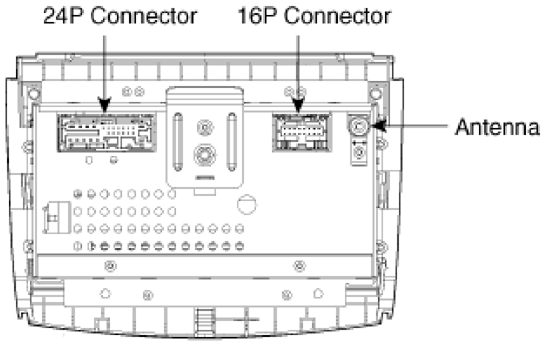

24P Connector

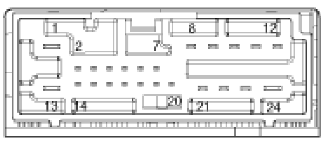

16P Connector

Pin	Description	Pin	Description	Pin	Description	Pin	Description
1	Battery	13	Power ground	1	XM SDARS L+	13	-
2	Run/Acc	14	LS CAN HI	2	XM SDARS L-	14	-
3	Illumination +	15	LS CAN LO	3	XM SDARS shield	15	-
4	Illumination -	16	-	4	-	16	-
5	-	17	-	5	-		
6	-	18	Remocon-SWC	6	-		
7	-	19	Remocon-GND	7	-		
8	Left front speaker +	20	-	8	-		
9	Left rear speaker +	21	Left front speaker -	9	XM SDARS R+		
10	Right rear speaker +	22	Left rear speaker -	10	XM SDARS R-		
11	Right front speaker +	23	Right rear speaker -	11	-		
12	Right front speaker -	24	Glass antenna amp enable	12	-		

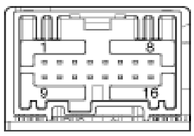
[AM/FM/XM/MP3/6CDC (V490S)]







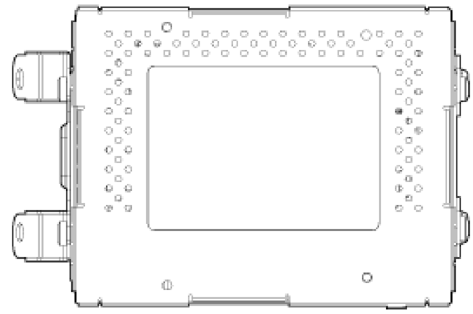
24P Connector

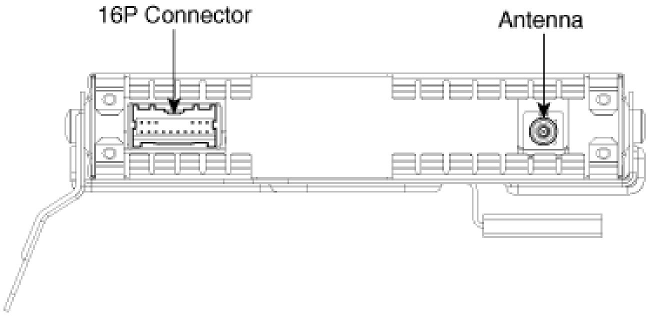


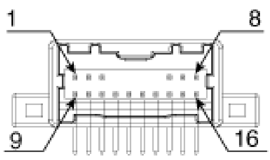
16P Connector

Pin	Description	Pin	Description	Pin	Description	Pin	Description
1	Battery	13	Power ground	1	XM SDARS L+	13	-
2	Run/Acc	14	LS CAN HI	2	XM SDARS L-	14	-
3	Illumination +	15	LS CAN LO	3	XM SDARS shield	15	-
4	Illumination -	16	-	4	-	16	-
5	Remote audio amplifier enable	17	-	5	-		
6	-	18	Remocon-SWC	6	-		
7	-	19	Remocon-GND	7	-		
8	Left front speaker +	20	-	8	-		
9	Left rear speaker +	21	Left front speaker -	9	XM SDARS R+		
10	Right rear speaker +	22	Left rear speaker -	10	XM SDARS R-		
11	Right front speaker +	23	Right rear speaker -	11	-		
12	Right front speaker -	24	Glass antenna amp enable	12	-		

[SET TOP BOX]



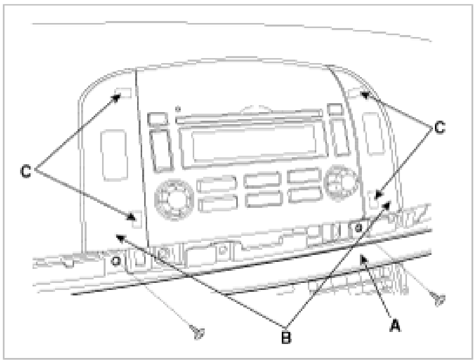


16P Connector	Pin	Description	Pin	Description
	1	SAT LCH (+)	9	EARTH (SIG)
	2	SAT RCH (+)	10	N.C
	3	DATA EARTH	11	N.C
	4	VBATT	12	CAN-L
	5	N.C	13	CAN-H
	6	ACC	14	N.C
	7	SAT LCH (-)	15	N.C
	8	SAT RCH (-)	16	EARTH (CASE)

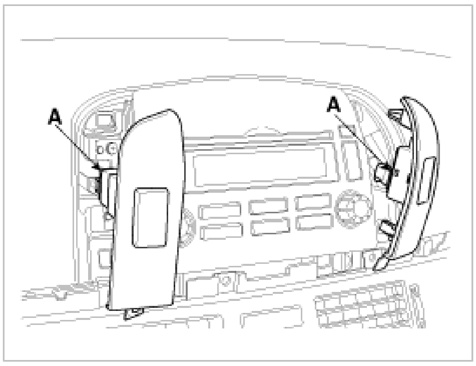
Body Electrical System > Audio > Audio Unit > Repair procedures

REPLACEMENT

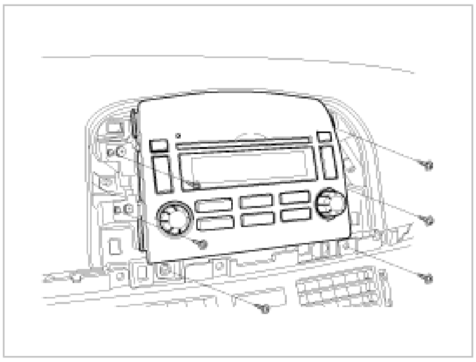
1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad garnish (A) after pulling it by using regular screw driver (-). Take care of fixing clips(C).
3. Remove the center facia panel (B) after loosening the screws.



4. Remove the connectors(A).



5. Remove the mounting screws then remove the audio unit (A).

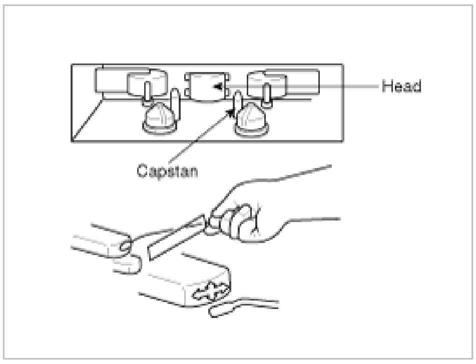


6. Installation is the reverse of removal.

INSPECTION

TAPE HEAD AND CAPSTAN CLEANING

1. To obtain optimum performance clean the head, and capstan as often as necessary, depending on frequency of use and tape cleanness.
2. To clean the tape head and capstan, use a cotton swab dipped in ordinary rubbing an alcohol. Wipe the head and capstan.

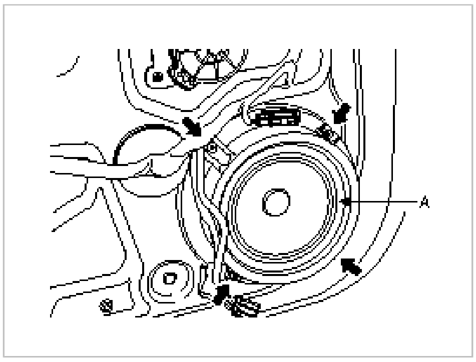


Body Electrical System > Audio > Speakers > Repair procedures

REPLACEMENT

FRONT SPEAKER

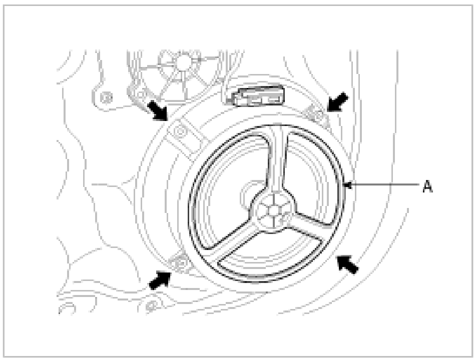
1. Remove the front door trim panel (Refer to the Body group - front door).
2. Remove the front speaker (A) after removing 4 rivets.



3. Installation is the reverse of removal.

REAR SPEAKER

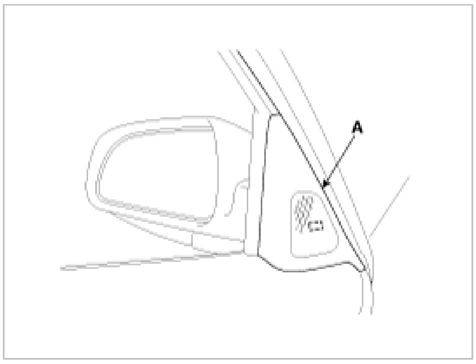
1. Remove the rear door trim panel (Refer to the Body group - rear door).
2. Remove the rear speaker (A) after removing 4 rivets.



3. Installation is the reverse of removal.

TWEETER SPEAKER

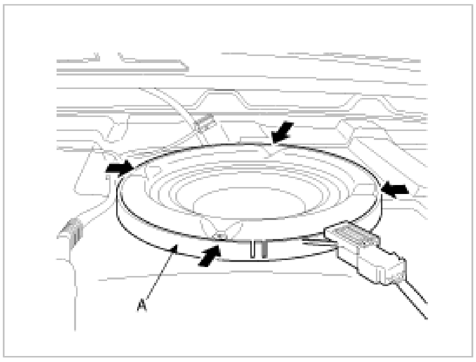
1. Remove the front door quadrant inner cover (A) (Refer to the Body group - front door).
2. Remove the tweeter speaker after disconnecting the connector.



3. Installation is the reverse of removal.

WOOFER SPEAKER

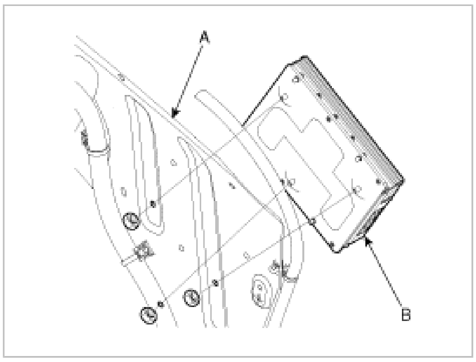
1. Remove the rear seat. (Refer to the Body group - rear seats)
2. Remove the rear package tray. (Refer to the Body group - package tray)
3. Remove the woofer speaker (A) after removing 4 bolts.



4. Installation is the reverse of removal.

EXTERNAL AMP

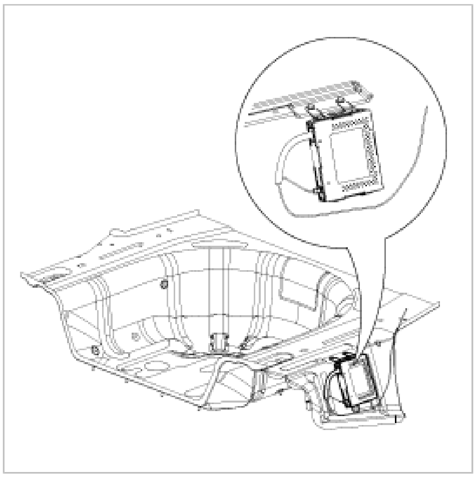
1. Remove the luggage side trim.
2. Remove the external amp (B) from the quarter inner panel (A) after removing 3 nuts.



3. Installation is the reverse of removal.

SET TOP BOX (FOR SDARS)

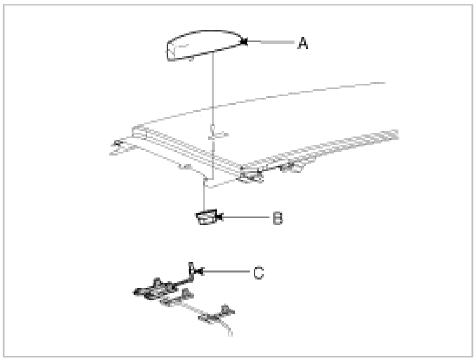
1. Remove the right lugguage side trim.
   (Refer to the Body Group - Trunk trim)
2. Remove the set top box(A) after loosening 2 bolts and disconnecting the cable and connector.



3. Installation is the reverse of removal.
4. Installation is the reverse of removal.

SDARS ROOF ANTENNA

1. Remove the rear headlining.
2. Remove the SDARS roof antenna(A) from the roof inner panel after loosening the mounting nut(B) and disconnecting the cable (C).

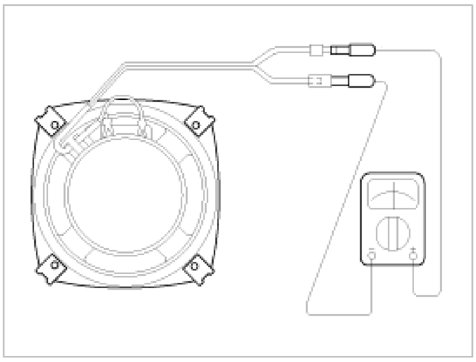


3. Installation is the reverse of removal.

INSPECTION

1. Check the speaker with an ohmmeter. If an ohmmeter indicates the correct impedance of the speaker when checking between the speaker (+) and speaker (-) of the same channel, the speaker is OK.

Specified impedance : 2 ~ 4Ω

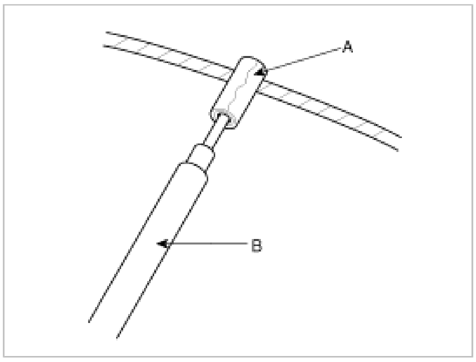


Body Electrical System > Audio > Antenna > Repair procedures

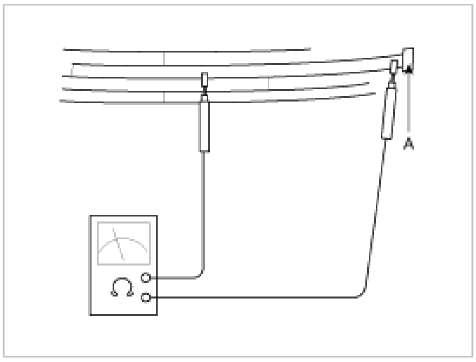
INSPECTION

GLASS ANTENNA TEST

1. Wrap aluminum foil (A) around the tip of the tester probe (B) as shown.



2. Touch one tester probe to the glass antenna terminal (A) hear, and move the other tester probe along the antenna wires to check that continuity exists.

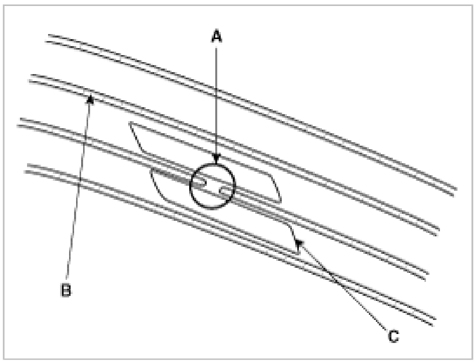


GLASS ANTENNA REPAIR

NOTE

To make an effective repair, the broken section must be no longer than one inch.

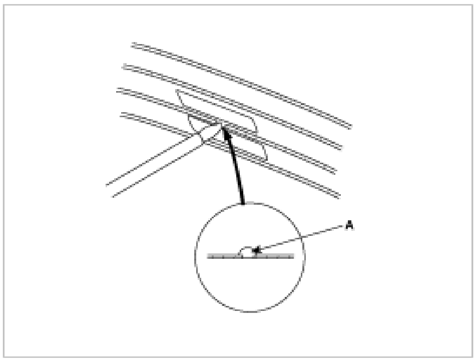
1. Lightly rub the area around the broken section (A) with fine steel wool, and then clean it with alcohol.



2. Carefully mask above and below the broken portion of the glass antenna wire (B) with cellophane tape (C).
3. Using a small brush, apply a heavy coat of silver conductive paint (A) extending about 1/8″on both sides of the break. Allow 30 minutes to dry.

NOTE

Thoroughly mix the paint before use.

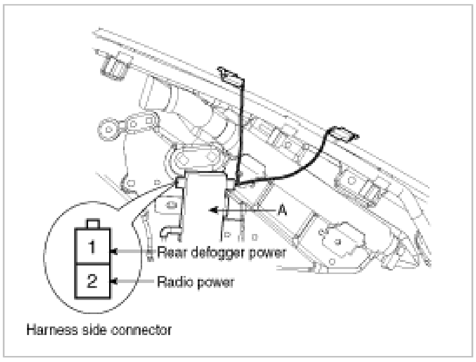


4. Check for continuity in the repaired wire.
5. Apply a second coat of paint in the same way. Let it dry three hours before removing the tape.

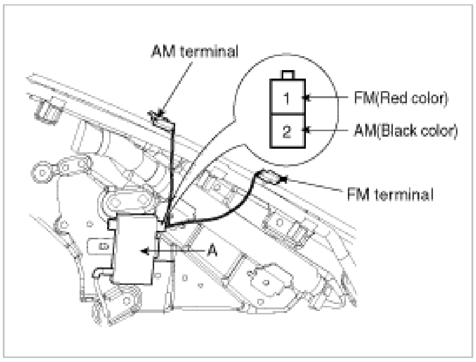
GLASS ANTENNA CIRCUIT INSPECTION

1. Remove the right side rear pillar trim. Then disconnect the 2P power connector from the glass antenna amp (A).
2. Turn the radio ON.
   Measure the voltage between terminal 2 of the harness side power connector (A) and body ground.

OK : approximately 12V (ACC+)



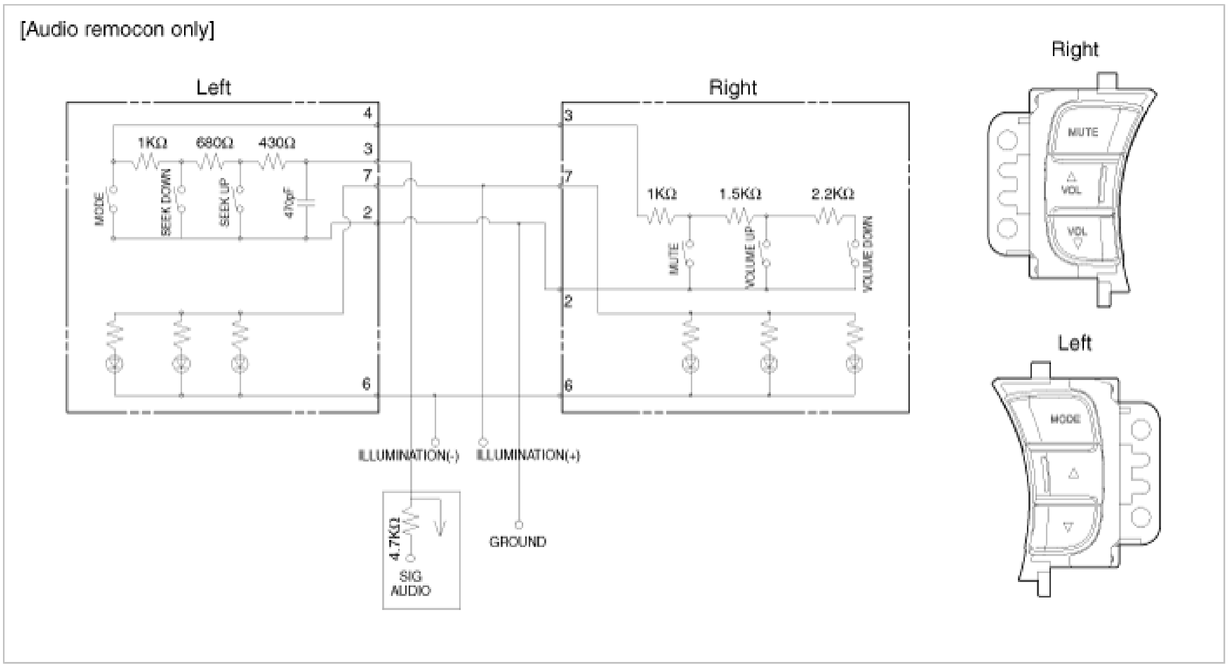
3. Disconnect the 2P connector of radio wiring from the glass antenna amp (A).
4. Check for continuity between terminals of harness side connector and antenna grid terminals (AM, FM).

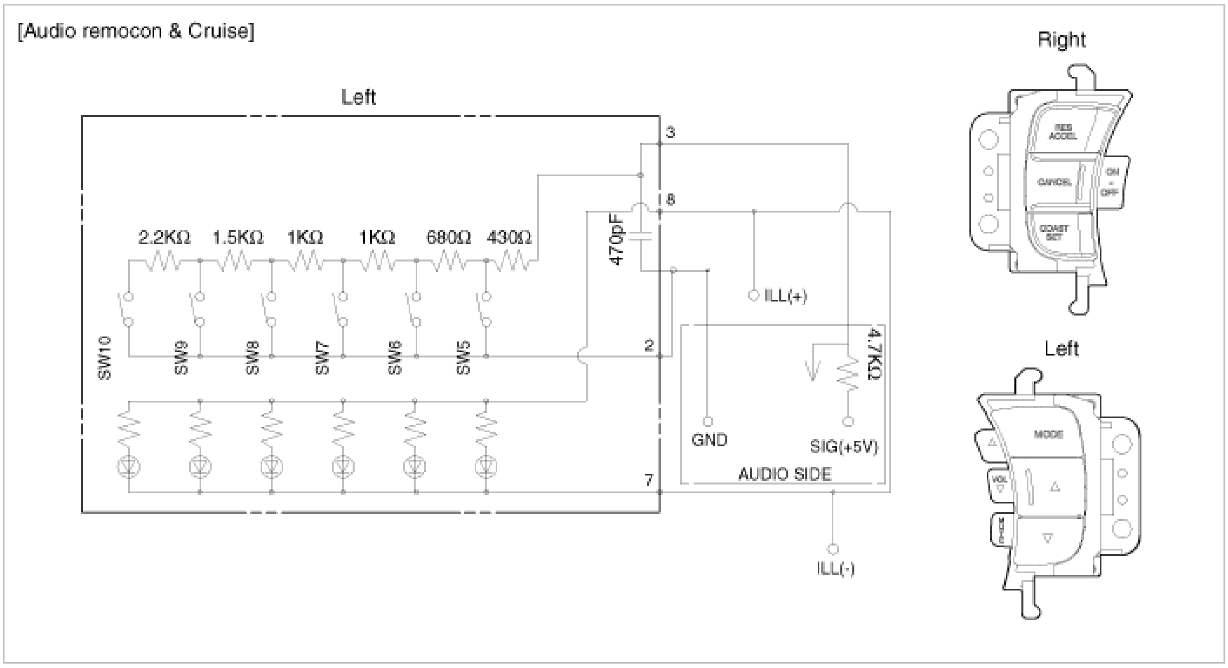


5. Check the grid lines that continuity exists.
6. When a poor radio reception is not repaired through the above inspection methods, replace the amp.
   If the radio reception is still poor, check the radio cable for short and radio head unit for failure.

Body Electrical System > Audio > Audio Remote control > Schematic Diagrams

CIRCUIT DIAGRAM

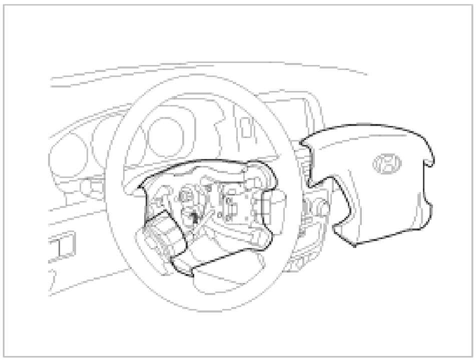




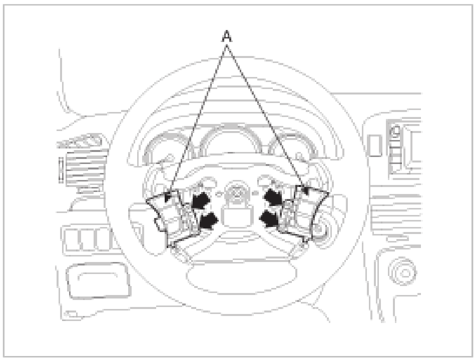
Body Electrical System > Audio > Audio Remote control > Repair procedures

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the driver airbag module(A). (Refer to the airbag group)



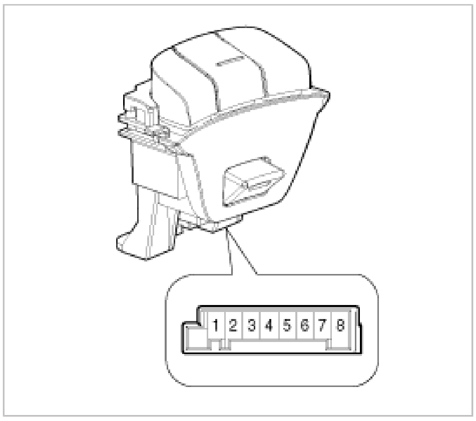
3. Remove the audio remote control switch (A) after remove the steering wheel remote control switch connector and 2 screws.



4. Installation is the reverse of removal.

INSPECTION

1. Check for resistance between No.2 and No.3 terminals in each switch position.



[Audio Remocon Only]

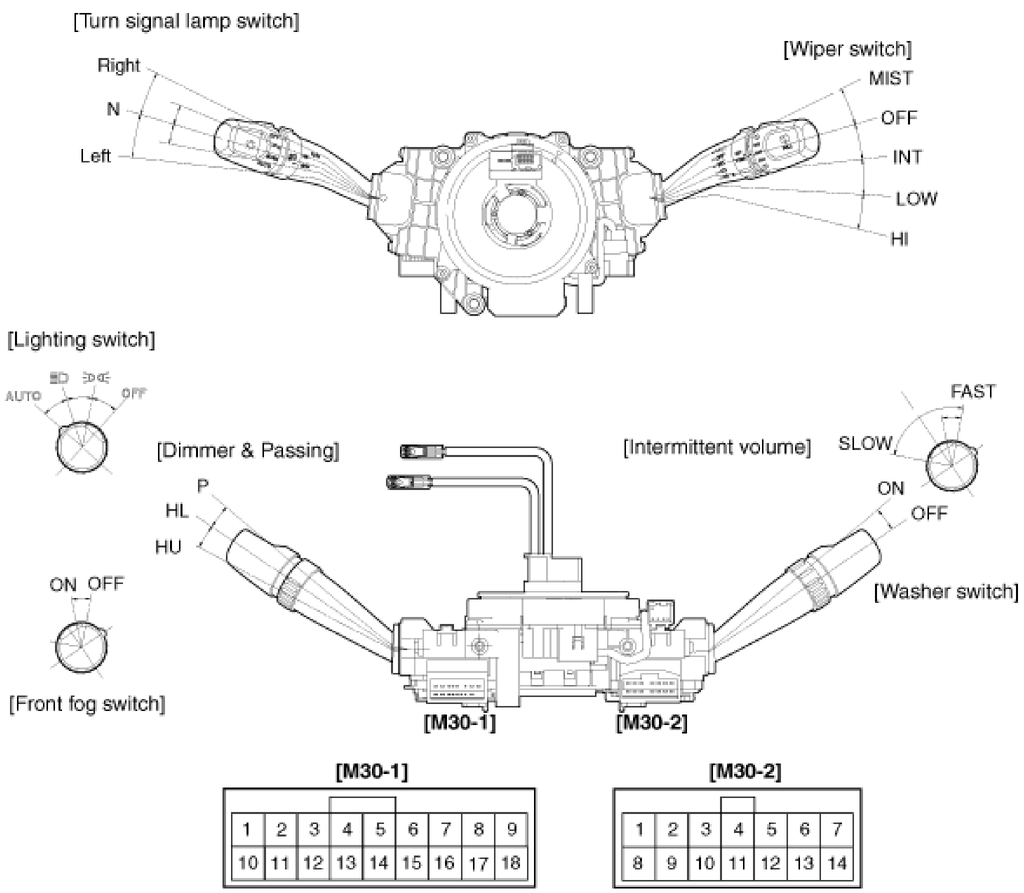
Switch	Connector terminal	Resistance (±5%)
VOLUME DOWN	2 - 3 (Right)	6.81 kΩ
VOLUME UP	2 - 3 (Right)	4.61 kΩ
SEEK UP	2 - 3 (Left)	430 Ω
SEEK DOWN	2 - 3 (Left)	1.11 kΩ
MODE	2 - 3 (Left)	2.11 kΩ
MUTE	2 - 3 (Right)	3..11 kΩ

[Audio Remocon & Cruise]

Switch	Connector terminal	Resistance (±5%)
VOLUME DOWN (SW 10)	2 - 3 (Left)	6.81 kΩ
VOLUME UP (SW 9)	2 - 3 (Left)	4.61 kΩ
MUTE (SW 8)	2 - 3 (Left)	3.11 kΩ
MODE (SW 7)	2 - 3 (Left)	2.11 kΩ
SEEK DOWN (SW 6)	2 - 3 (Left)	1.11 kΩ
SEEK UP (SW 5)	2 - 3 (Left)	430 Ω

Body Electrical System > Multifunction switch > Components and Components Location

COMPONENTS



Circuit connection

Connector No.	Terminal No.	Description	Connector No.	Terminal No.	Description
M30-1	1	Head lamp passing	M30-2	1	Wiper high speed
	2	Head lamp high beam power		2	Wiper low speed
	7	Turn signal lamp (RH)		3	Wiper parking
	8	Flasher unit power		4	Mist switch
	9	Turn signal lamp (LH)		5	IG2
	10	Head lamp low beam power		6	Intermittent wiper
	11	Dimmer & passing ground		7	Front washer switch
	12	Front fog switch		8	-
	13	Front fog switch ground		9	-
	14	Tail lamp switch		10	-
	15	Head lamp switch		11	-
	16	Auto light switch		12	-
	17	Lighting switch ground		13	Intermittent wiper volume
	18	-		14	Intermittent wiper ground

Body Electrical System > Multifunction switch > Specifications

SPECIFICATIONS

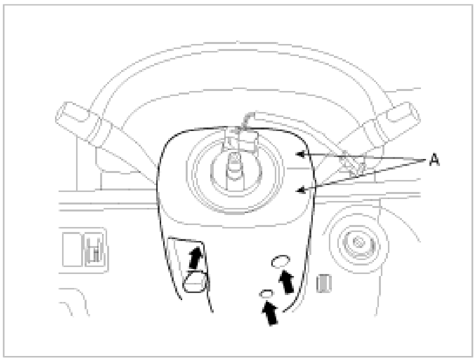
Items	Specifications
Rated voltage	DC 12 V
Operating temperature range	-30°C ~ +80°C (-22 ~ +176°F)
Rated load Dimmer & passing switch Lighting switch Turn signal & lane change switch Front fog lamp switch	 High : 1A (Relay load) Low : 1A (Relay load) Passing : 1A (Relay load) Lighting : 1A (Relay load) 6.6±0.5A (Lamp load) 1A (Relay load)

Wiper & mist switch	Low, High : 4.5A (Motor load) Intermittent : 0.22±0.05A (Relay load) Lock : Max. 28A (Motor load) Mist: 4A (Motor load)
Washer switch	4A (Motor load)
Variable intermittent volume switch	Max. 25mA

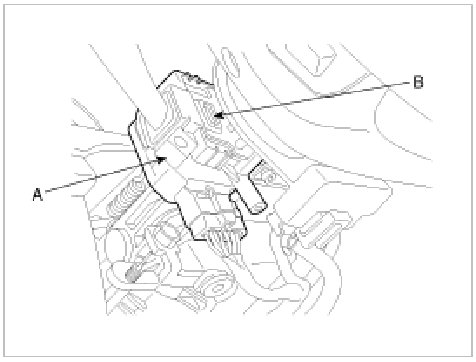
Body Electrical System > Multifunctoin switch > Multi Function Switch > Repair procedures

REPLACEMENT

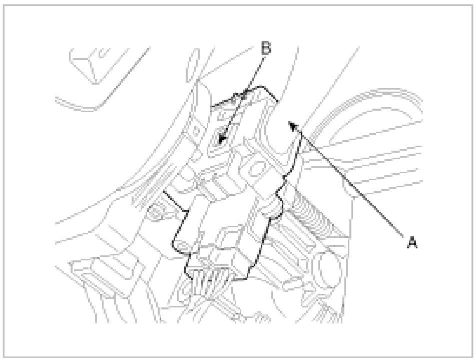
1. Disconnect the negative (-) battery terminal.
2. Remove the steering column upper and lower shrouds (A) after removing 3 screws.



3. Remove the light switch (A) by pushing the lock pin (B) after disconnecting the connector.



4. Remove the wiper switch (A) by pushing the lock pin (B) after disconnecting the connector.

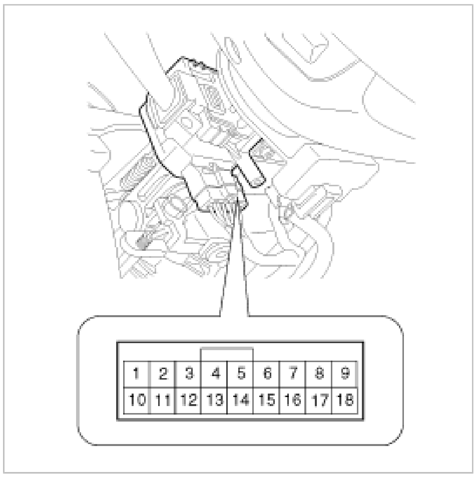


5. Installation is the reverse of removal.

INSPECTION

LIGHTING SWITCH INSPECTION

With the multi function switch in each position, make sure that continuity exists between the terminals below. If continuity is not as specified, replace the multi-function switch.



LIGHTING SWITCH (AUTO LIGHT)

Position \ Terminal	14	15	16	17
OFF				
I	○	—	—	○
II	○	○	—	○
AUTO			○	○

LIGHTING SWITCH

Position \ Terminal	14	15	16	17
OFF				
I	○	—	—	○
II	○	○	○	○

DIMMER AND PASSING SWITCH

Position \ Terminal	1	2	10	11
HU		○	—	○
HL			○	○
P	○	○	—	○

HU : Head lamp high beam
HL : Head lamp low beam
P : Head lamp passing switch

TURN SIGNAL SWITCH

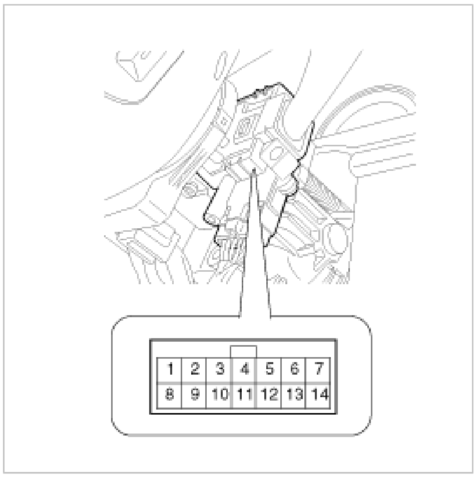
Hazard switch	Trun signal switch \ Terminal	7	8	9
OFF	L		○	○
	N			
	R	○	○	

FRONT FOG LAMP SWITCH

Position \ Terminal	12	13
OFF		
ON	○	○

WIPER AND WASHER SWITCH INSPECTION

With the multi function switch in each position, make sure that continuity exists between the terminals below. If continuity is not as specified, replace the multi-function switch.



WIPER SWITCH

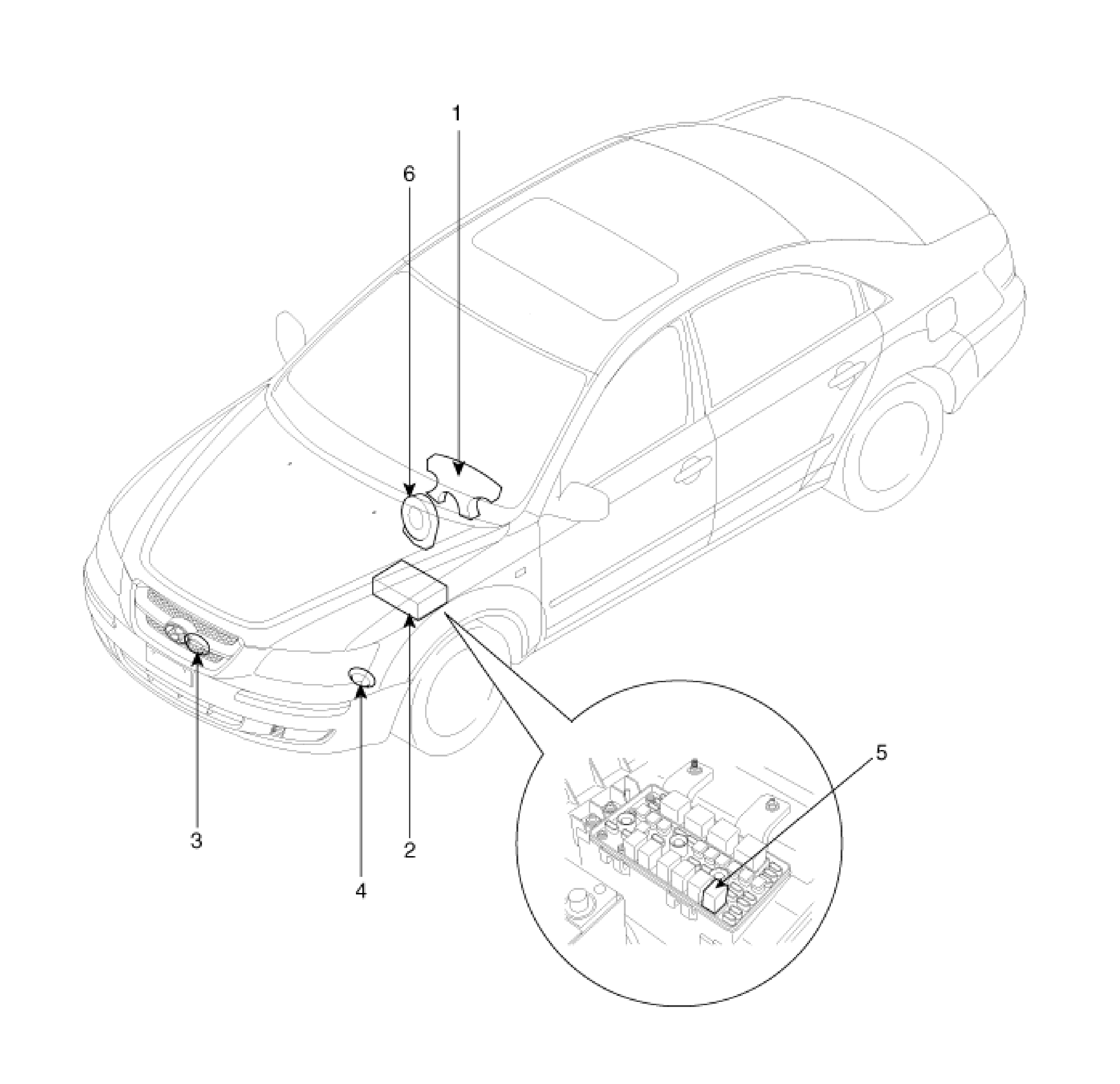
Position \ Terminal	1	2	3	4	5	6	13	14
MIST				○	○			
OFF		○	○					
INT		○	○		○	○	○	○
LOW		○			○			
HI	○				○			

WASHER SWITCH

Position \ Terminal	5	7
OFF		
ON	○	○

Body Electrical System > Horn > Components and Components Location

COMPONENT LOCATION

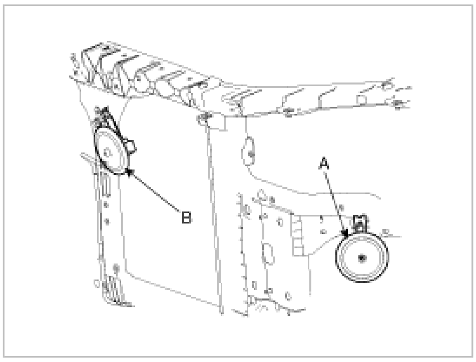


1. Horn switch
2. Relay box (Engine room compartment)
3. Horn (Low pitch)
4. Horn (High pitch)
5. Horn relay
6. Clock spring

Body Electrical System > Horn > Repair procedures

REPLACEMENT

1. Remove the front bumper. (Refer to the Body group - front bumper).
2. Remove the bolt and disconnect the horn connector, then remove the high pitch horn (A) and low pitch horn (B).



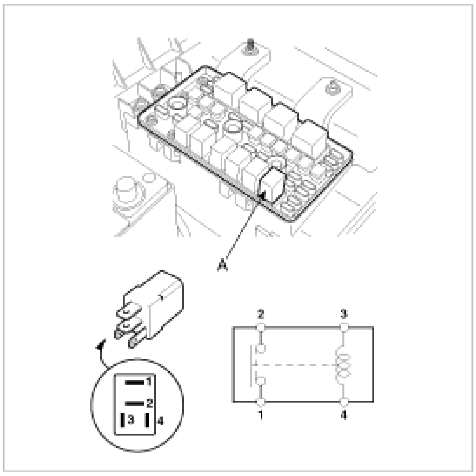
3. Installation is the reverse of removal.

INSPECTION

Test the horn by connecting battery voltage to the 1 terminal and ground the 2 terminal.
The horn should make a sound. If the horn fails to make a sound, replace it.

HORN RELAY INSPECTION

1. Remove the horn relay (A) from the engine room relay box.
2. There should be continuity between the No.1 and No.2 terminals when power and ground are connected to the No.3 and No.4 terminals.
3. There should be no continuity between the No.1 and No.2 terminals when power is disconnected.

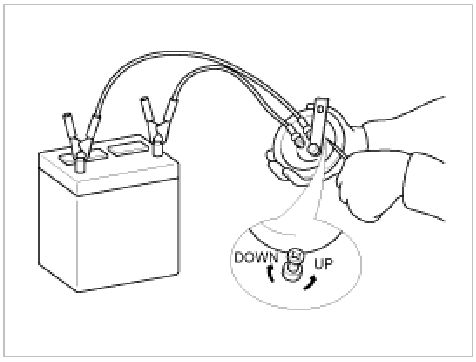


Terminal / Power (No.3-No.4)	1	2	3	4
Disconnected			○	○
Connected	○	○	⊖	⊕

ADJUSTMENT

Operate the horn, and adjust the tone to a suitable level by turning the adjusting screw.

> **NOTE**
> After adjustment, apply a small amount of paint around the screw head to keep it from loosening.



Body Electrical System > Keyless Entry And > Description and Operation

DESCRIPTION

BURGLAR ALARM SYSTEM

The burglar alarm system is armed automatically after the doors, hood, and trunk lid are closed and locked.
The system is set off when any of these things occur:

- A door is forced open.
- A door is unlocked without using the transmitter & key.
- The trunk lid is opened without using the key.
- The hood is opened.
- The engine starter circuit and battery circuit are bypassed by breaking the ignition switch.

When the system is set off, the alarm (horn) sounds and the hazard lamp flash for about two minutes or until the system is disarmed by unlocking the transmitter.
For the system to arm, the ignition switch must be off and the key removed. Then, the body control module must receive signals that the doors, hood, and trunk lid are closed and locked. When everything is closed and locked, none of the control unit inputs are grounded.
The door switches, hood switch and trunk lid switch are all close and lock the doors with the remote transmitter and then the system arms immediately.
If anything is opened or improperly unlocked after the system is armed, the body control module gets a ground signal from that switch, and the system is set off.
If one of the switches is misadjusted or there is a short in the system, the system will not arm. As long as the body control module continues to get a ground signal, it thinks the vehicle is not closed and locked and will not arm.
The receiver is integrated in the body control module.

KEYLESS ENTRY SYSTEM

The burglar alarm system is integrated with the keyless entry system. The keyless entry system allows you to lock and unlock the vehicle with the remote transmitter. When you push the LOCK button, all doors lock. When you push the UNLOCK button, driver door unlock. If the unlock button is pressed a second time right away, the remain doors unlock.
The room lamp, if its switch is in the center position, will come on when you press the UNLOCK button. If you do not open a door, the light will go off in about 30 seconds, the doors will automatically relock, and the burglar alarm system will rearm. If you relock the doors with the remote transmitter within 30 seconds, the light will go off immediately.
You cannot lock or unlock the doors with the remote transmitter if the key is in the ignition switch.
The system will signal you when the doors lock and unlock by flashing the hazard lamp once when they lock, and twice when they unlock.

PANIC MODE

The panic mode causes the BCM to sound the alarm with the remote transmitter in order to attract attention. When the PANIC button is pressed and held for 2 seconds, the alarm will sound and exterior lights will flash for about 30 seconds.
The panic mode can be canceled at any time by pressing any button on the remote transmitter or by turning the ignition switch ON. The panic mode will not function if the key in.
The panic mode can be canceled by lock or unlock with the key.

FUNCTIONS

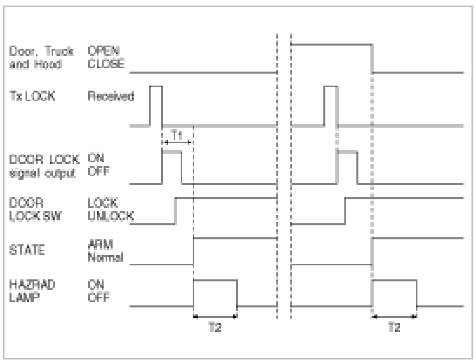
ANTI-THEFT FUNCTION

1. ARM Function
   (1) When using LOCK on the RKE (Remote Keyless Entry) or DOOR KEY the doors will lock, the hazard lamp will blink once within 0.6 seconds and the Anti-Theft System will ARM, if the following conditions have been met.
   A. The ignition key is removed from the ignition switch.
   B. All entry points are closed (doors, trunk, and hood)
   ※ Hazard lamp will not blink when driver door key lock switch transits to ARM mode by OFF→ON.

   (2) If either the door or trunk or hood is open when activating LOCK using the RKE, the doors will lock, however the hazard lamp will not flash and the Anti-Theft System will not arm.

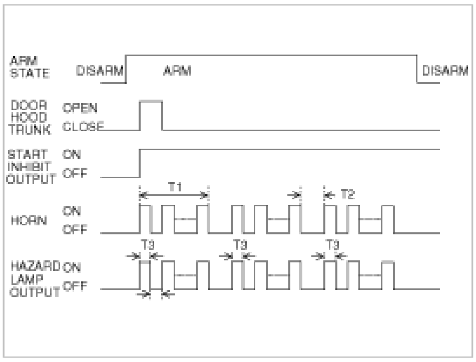
   (3) In Step 2) if the opened entry points are subsequently closed… the door will lock, the hazard lamp will blink once and the Anti-Theft System will ARM.

   (4) If the UNLOCK signal is sent by the RKE or DOOR KEY, and either the ignition key is not inserted or entry (door, trunk, hood) to the vehicle is not made within 30 seconds, the LOCK mode will be automatically reset, the hazard lamps will blink, and the Anti-Theft System will rearm. (Key IN = Key Insertion)
   (Provided that there is no automatic lock function at a period of 30 seconds, when the UNLOCK is done by the RKE with an entry being open).



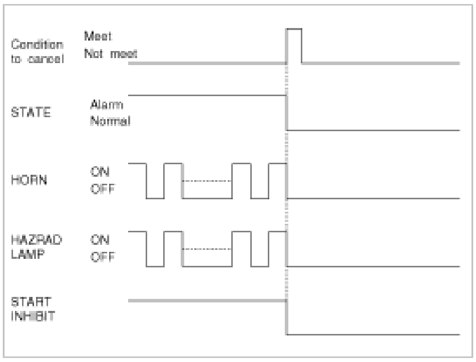
T1 : 0.6 sec,
T2 : 1.0 ±0.2 sec

2. ALARM Function
   (1) When a point of entry is opened without RKE or DOOR KEY unlock signal without RKE or DOOR KEY unlock signal while the Anti-Theft System is in the ARM mode, the hazard lamp and horn alarm will activate (ON/OFF 3 times each) for a period of 27 seconds.
   (2) Output intervals for the horn alarm and hazard lamps are identical.
   (3) The alarm sequence, when activated will continue for the duration of the alarm period even when the entry point is closed. (The alarm will reactivate if entry port is reopened after the initial alarm sequence completes.)



T1 : 27 ± 2 sec,
T2 : 10 ± 1 sec,
T3 : 0.45 ± 0.1 sec.

3. ALARM CLEARANCE
   (1) UNLOCK signal is output for 0.5s, alarm and start inhibit signal output become OFF when RKE UNLOCK signal is received or DOOR KEY UNLOCK signal is received.
   (2) LOCK signal is output for 0.5s, and alarm and start inhibit signal output become OFF when RKE LOCK signal is received or DOOR KEY LOCK signal is received.
   (3) Alarm and start inhibit signal output become OFF and the state becomes DISARM if "KEY IN SW=ON & IGN1 SW=ON & IGN2 SW=ON" is continued for 30s.
   In ARM mode, the state becomes DISARM in case of "KEY IN SW=ON & IGN1 SW=ON & IGN2 SW=ON".
   (4) In ARM mode, the state becomes DISARM at FRONT DOOR KEY UNLOCK ON and the state becomes Alarm Hold state at TRUNK KEY UNLOCK ON.
   (5) Under ALARM, FRONT DOOR or TRUNK KEY UNLOCK is turned ON, start inhibit signal output becomes OFF, then the state becomes DISARM.
   (6) If trunk is not opened after TRUNK UNLOCK signal is received with RKE or KEY, the mode enters into ARM mode 30s later after that.
   (7) If trunk is opened and closed again after TRUNK UNLOCK signal is received with RKE or KEY, the mode enters into ARM mode 30s later after that.



4. Battery Separation
   (1) When the battery is reconnected after having been disconnected/removed while in ARM mode. ARM mode continues.
   (2) When the battery is reconnected after having been disconnected/removed, and after the alarm completes, the alarm will restart.
   (3) When battery is reconnected after having been disconnected/ removed during an active alarm, the alarm sequence will restart from the beginning.

5. SECURITY INDICATOR
   (1) Security indicator: 0.3s ON, 2s OFF under key off.

(2) After entering to ARM, security indicator: 0.3s ON, 0.5s OFF in first 8s.

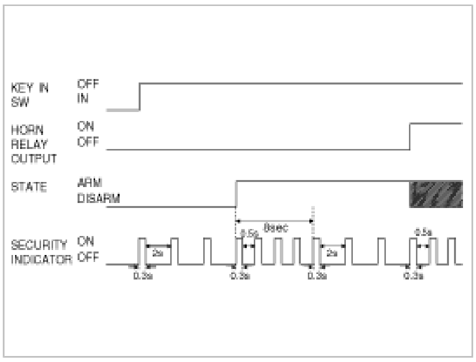
(3) After entering to ARM, the first 8s-TIMER is not reset when receiving RKE LOCK or KEY LOCK signal during the cycle: 0.3s ON, 0.5s OFF in the first 8s.

(4) 0.3s ON, 2s OFF if ARM is canceled during the cycle 0.3s ON, 0.5s OFF in the first 8s after entering to ARM.

(5) After entering to ARM, 0.3s ON, 2s OFF after the first 8s.

(6) Security indicator is OFF under key insert to key cylinder.

(7) 0.3s ON 0, 5s OFF during ALARM mode and PANIC mode.



6. DOOR UNLOCK BY P/WINDOW AND TRUNK OPEN INHIBITION FUNCTIONS

(1) Unlock signal output with door unlock switch by P/window and trunk switch is prohibited in case of RKE LOCK under ignition key off.

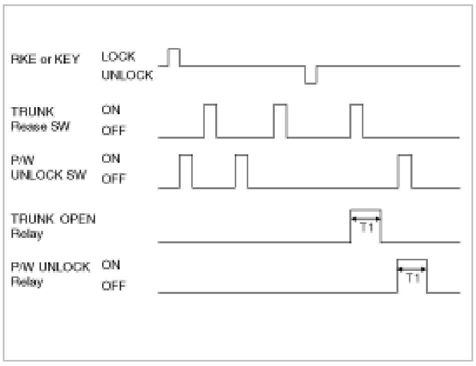
(2) Unlock signal output with door unlock switch and trunk switch by P/window is inhibited in case of door lock with door key under ignition key off.

(3) Unlock inhibition function is cancelled in case of RKE UNLOCK while door unlock inhibition function activates.

(4) Unlock inhibition function by P/window is cancelled in case of door unlock with door key while door unlock inhibition function activates.

(5) Unlock inhibition function by P/window is cancelled at ignition key in & on.

(6) In ARM mode, unlock signal by by P/window input is not output.



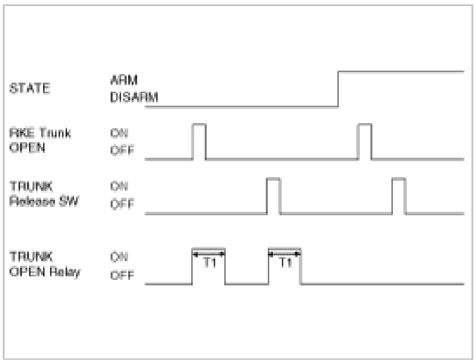
T1 : 0.5 ± 0.1 sec.

7. TRUNK OPEN WITH RKE

(1) Trunk release relay is turned ON for 0.5s if trunk signal of RKE is received. (Hold mode under ARM)

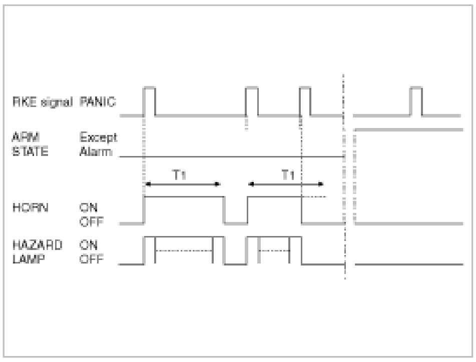
(2) Trunk release relay is turned ON for 0.5s in case of Trunk release switch OFF→ON.

(3) In ARM mode, signal by Trunk release switch input is not output.



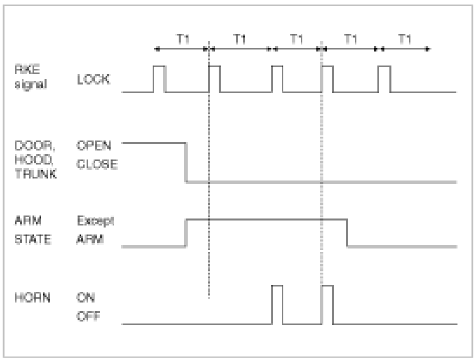
T1 : 0.5 ± 0.1 sec.

8. PANIC ALARM
   (1) PANIC alarm is turned ON for T1 by using horn and hazard if RKE PANIC signal is received.
   (2) PANIC alarm is turned OFF if (RKE LOCK/UNLOCK/PANIC/TRUNK UNLOCK /KEY IN /DOOR KEY LOCK/DOOR KEY UNLOCK / TRUNK KEY UNLOCK) signals are received during PANIC alarm.
   (3) PANIC signal output is immediately turned OFF and the state becomes ARM state if the condition for ARM is met during PANIC alarm.
   (4) The below is about antitheft alarm.
      A. Antitheft alarm does not stop even when PANIC signal of RKE is received during the alarm. (PANIC signal reception is ignored)
      B. Antitheft alarm signal is output when the condition for antitheft is met during PANIC alarm. (PANIC signal output : OFF)
      C. PANIC alarm is turned ON with continuing antitheft function when PANIC signal is received in ARM stand-by / ARM / Alarm end / RELOCK stand-by mode.



T1 : 30 ± 3 sec

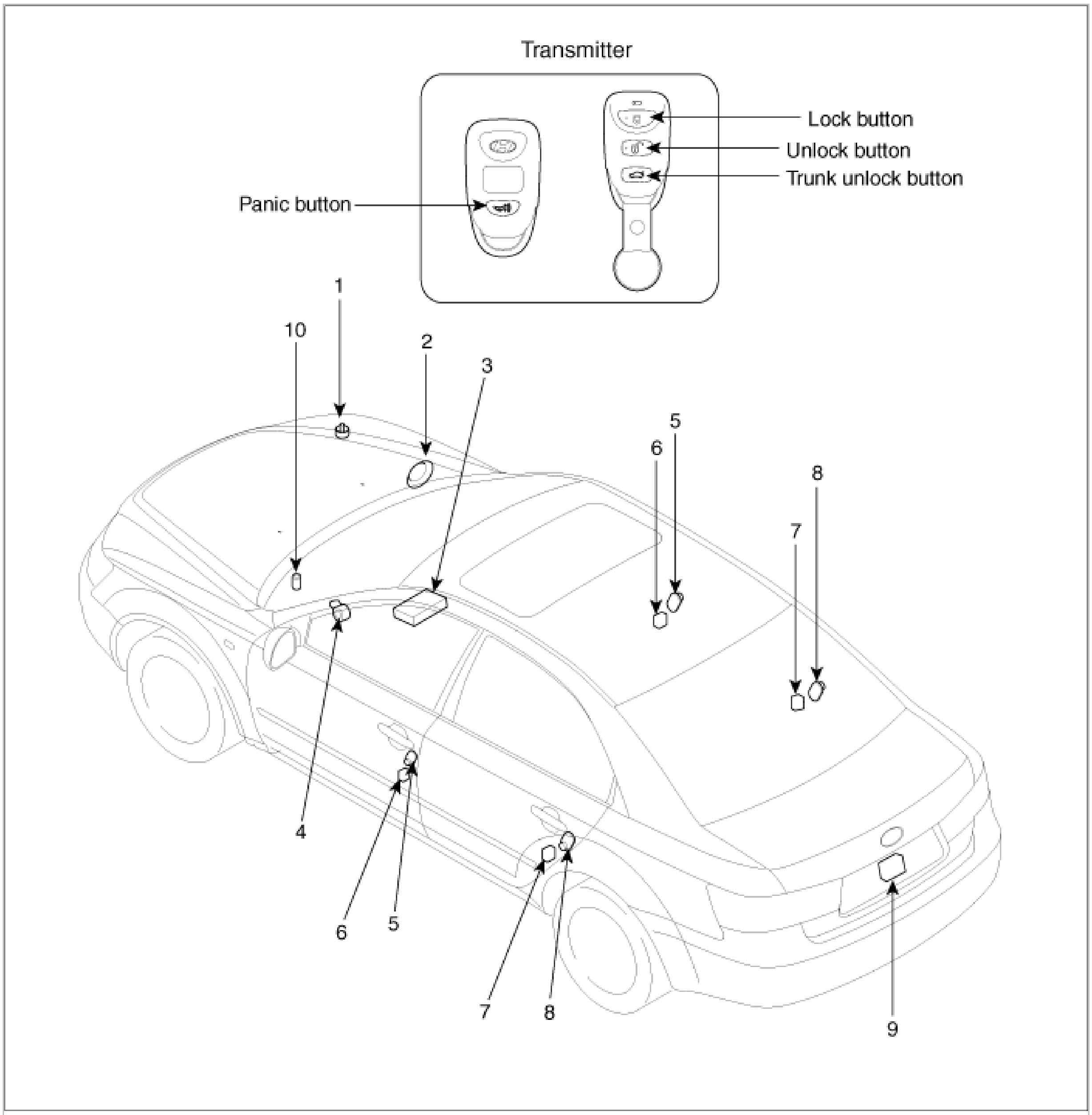
9. HORN ANSWER BACK
   (1) Under DOOR, TRUNK or HOOD: closed, horn and hazard(1s-output) signals are output if RKE LOCK signal is received again within T1 from the moment when the mode transits to ARM mode by RKE LOCK operation and ARM mode is kept.
   (2) Horn and hazard signals are not output if ARM mode is cancelled for T1.
   (3) Horn and hazard signal are output even when other LOCK signals of RKE, registered during T1, are received.



T1 : within 4sec

Body Electrical System > Keyless Entry And > Components and Components Location

COMPONENT LOCATION

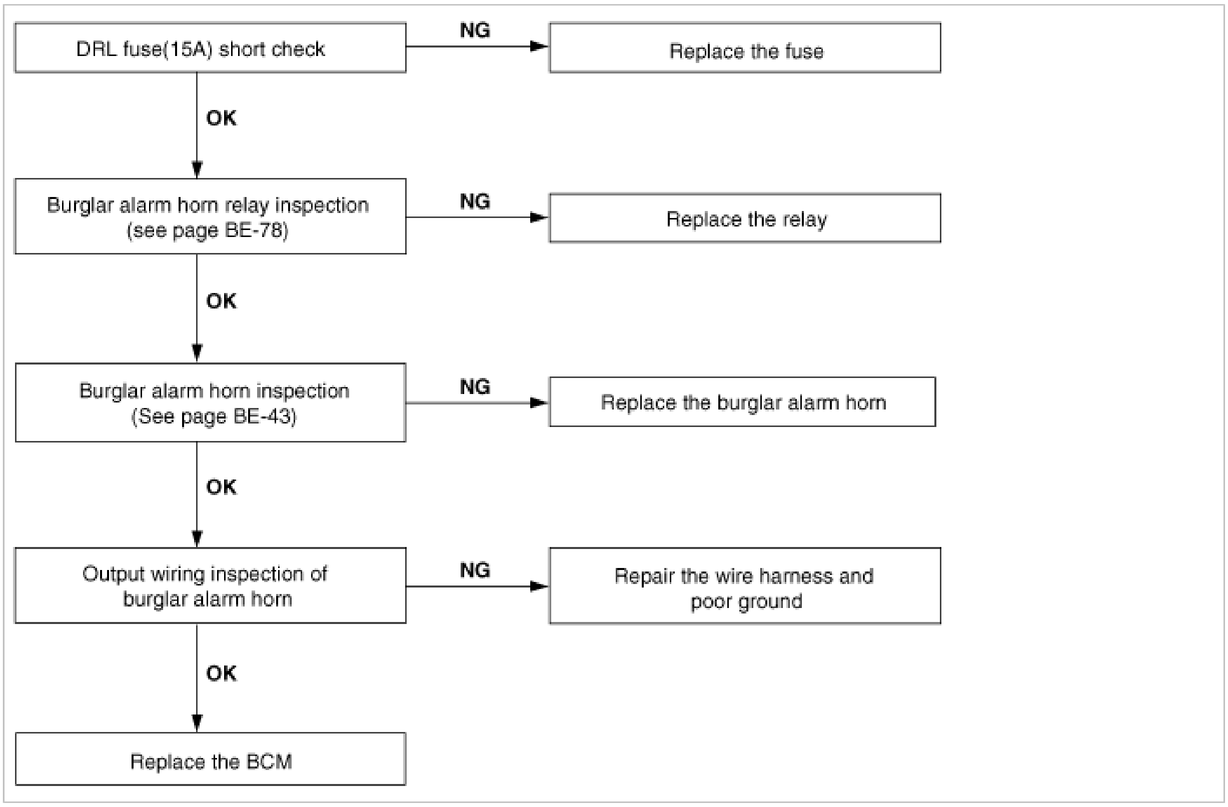


1. Hood switch
2. Burglar horn
3. Body control module
4. Key warning switch
5. Front door switch
6. Front door lock actuator & switch
7. Rear door lock actuator & switch
8. Rear door switch
9. Trunk lid lock actuator
10. Security indicator

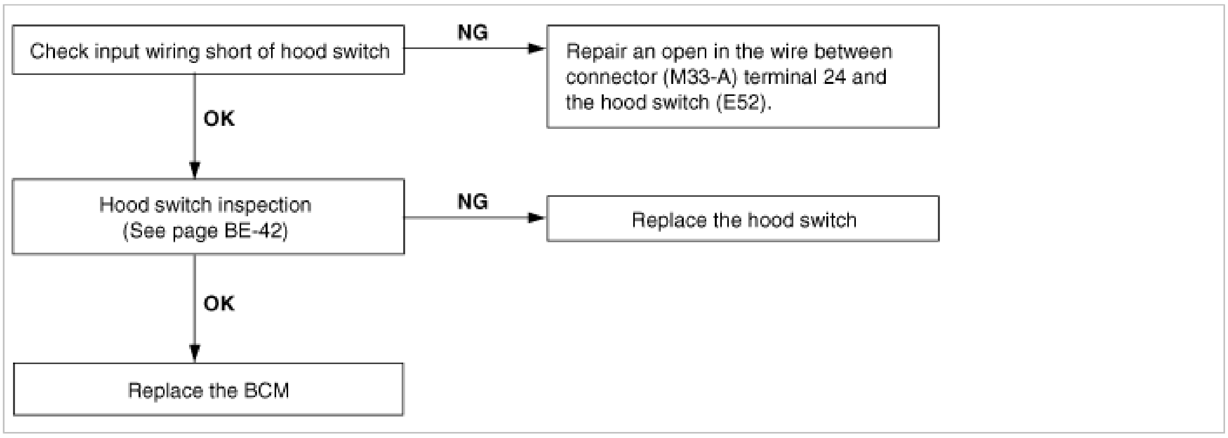
Body Electrical System > Keyless Entry And > Troubleshooting

TROUBLESHOOTING

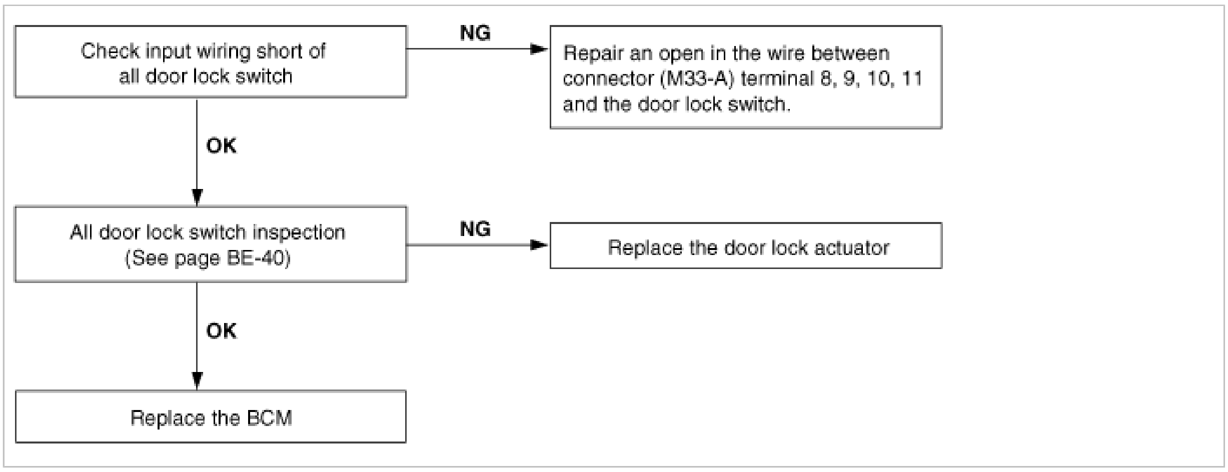
1. Alarm does not work. (Hazard lamps work)



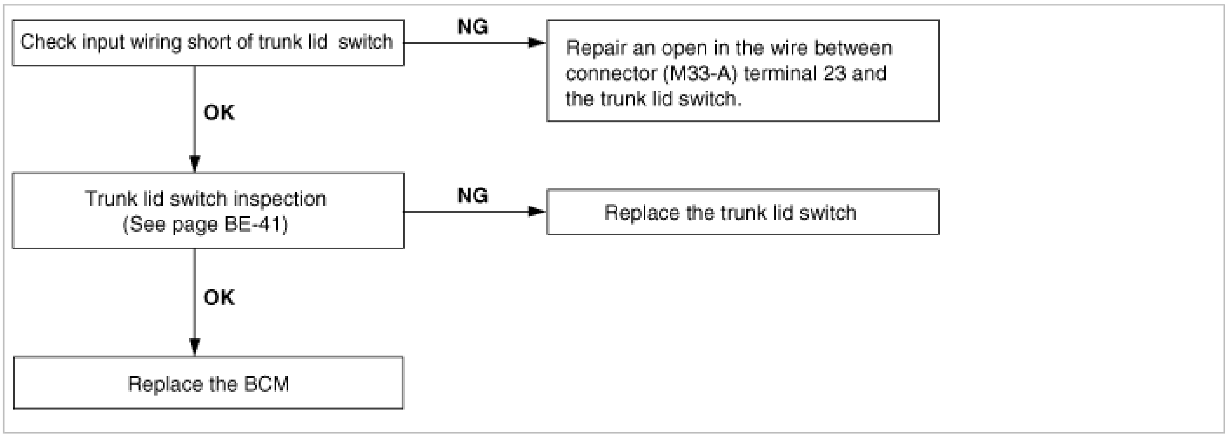
2. When hood is opened inside the car, burglar horn does not work.



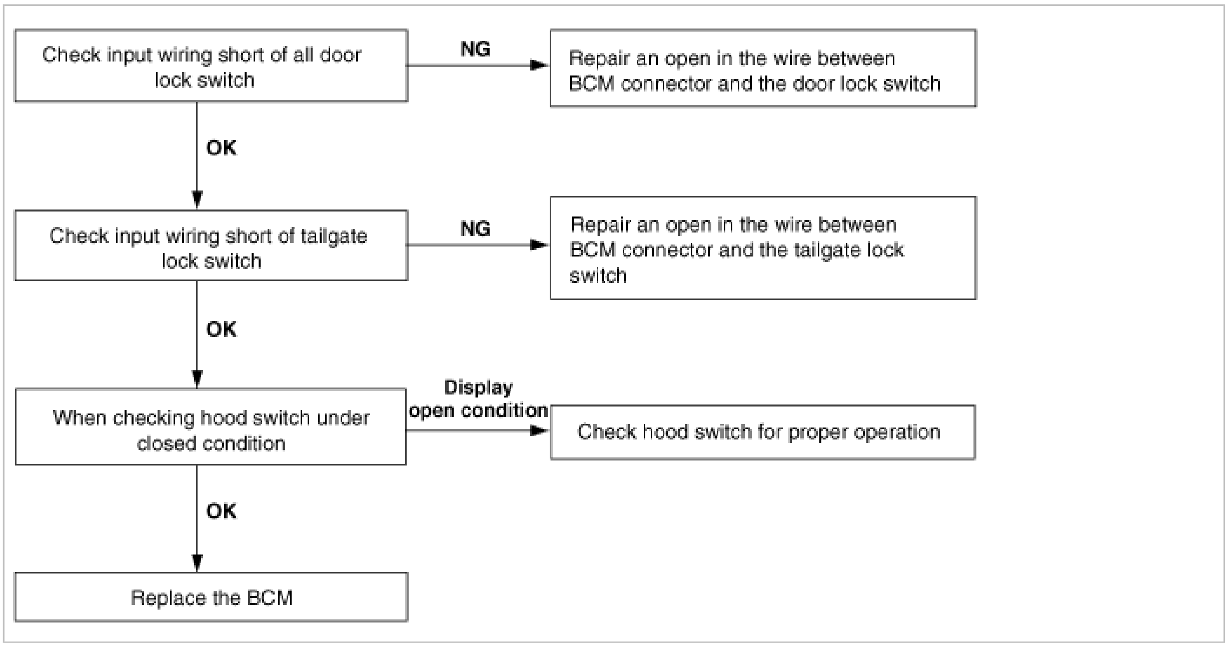
3. When door is opened inside the car, burglar horn does not work (If tailgate and hood is opened, alarm works)



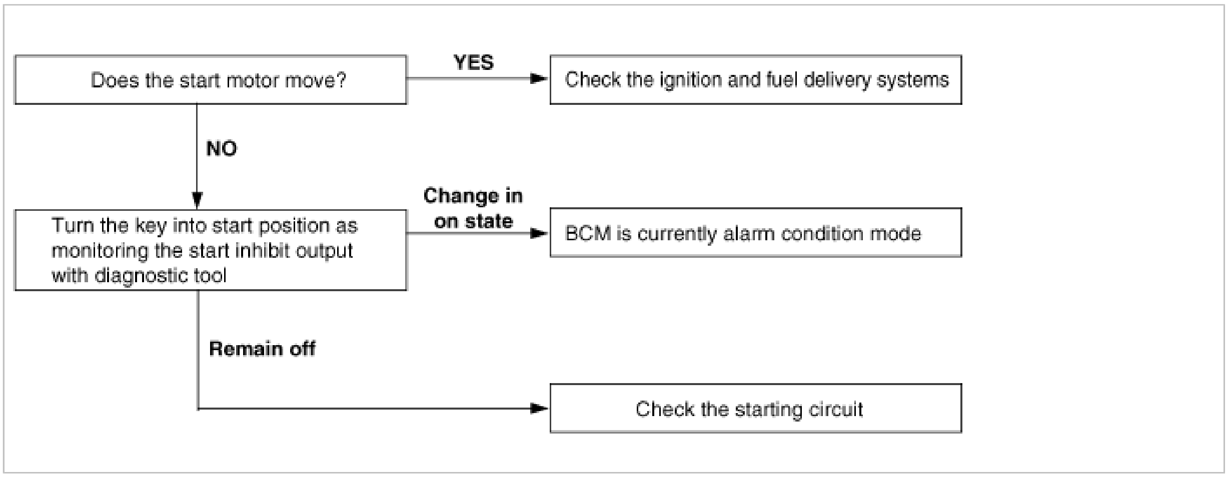
4. When trunk lid is opened inside the car, siren does not work.



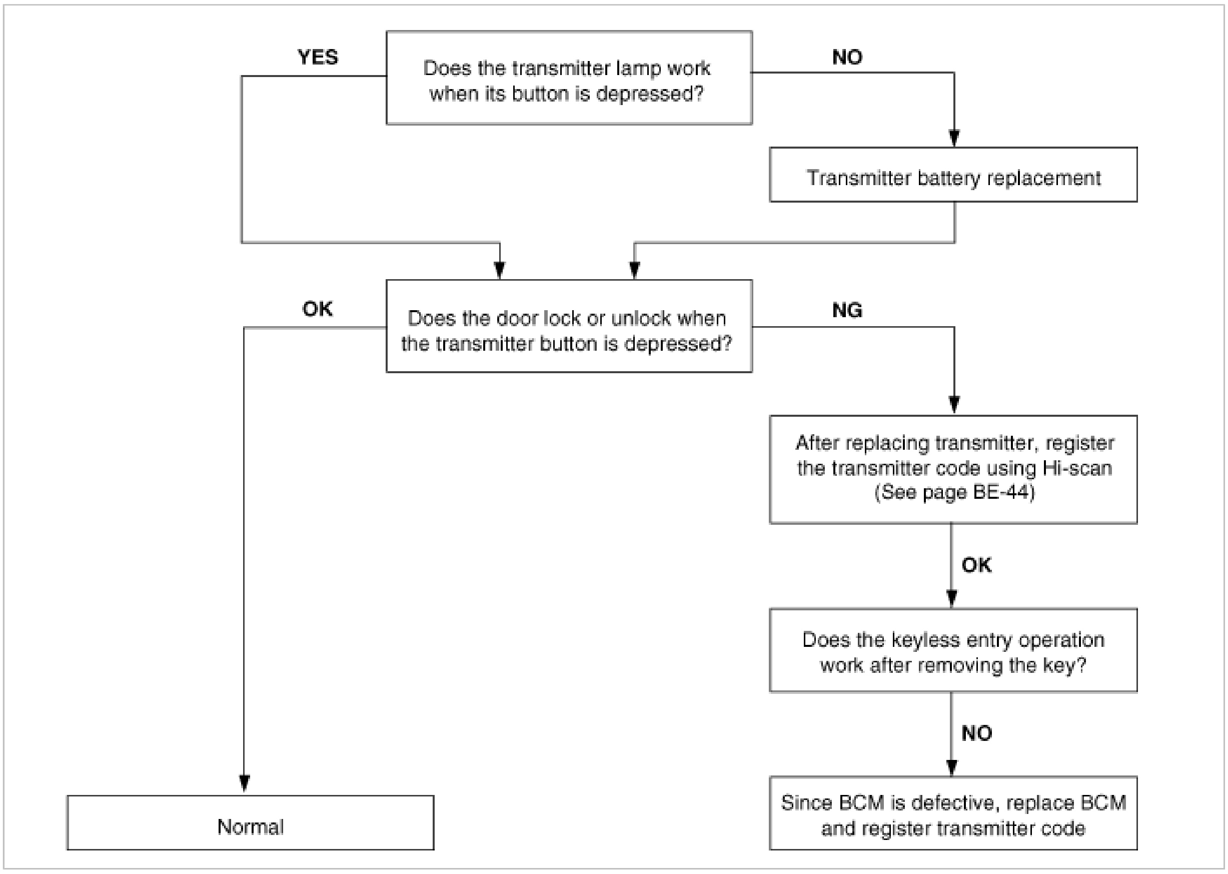
5. When the vehicle is locked by the transmitter, central door lock function works but hazard lamp doesn't blink.



6. Engine does not start, even when the alarm is disarmed.



7. Central door lock function works, but keyless entry system does not work.

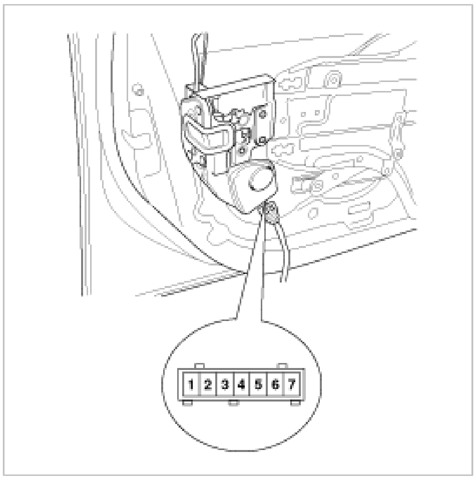


Body Electrical System > Keyless Entry And > Repair procedures

INSPECTION

FRONT DOOR LOCK ACTUATOR INSPECTION

1. Remove the front door trim panel. (Refer to the Body group - front door)
2. Disconnect the 7P connector from the actuator.

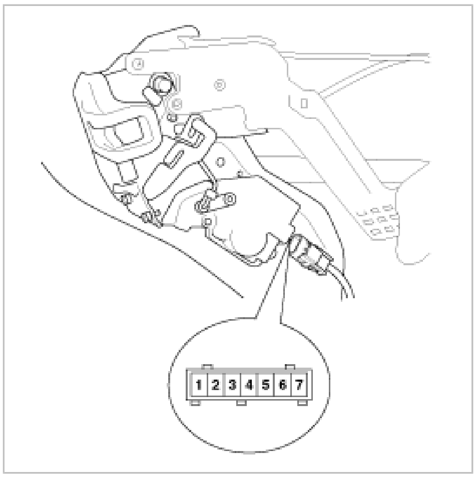


3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal		5	3	6	2
Front left	Lock	$\oplus$		$\ominus$	
	Unlock	$\ominus$		$\oplus$	
Front right	Lock		$\oplus$		$\ominus$
	Unlock		$\ominus$		$\oplus$

REAR DOOR LOCK ACTUATOR INSPECTION

1. Remove the rear door trim panel. (Refer to the Body group - rear door)
2. Disconnect the 7P connector from the actuator.

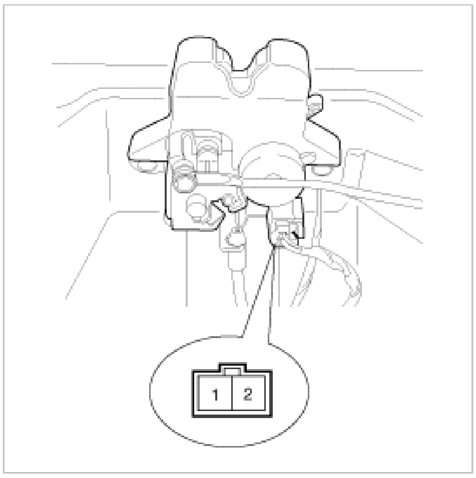


3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal		5	3	6	2
Rear left	Lock	⊕		⊖	
	Unlock	⊖		⊕	
Rear right	Lock		⊕		⊖
	Unlock		⊖		⊕

TRUNK LID RELEASE ACTUATOR INSPECTION

1. Remove the trunk lid trim panel. (Refer to the Body group-trunk lid)
2. Disconnect the 2P connector from the actuator.

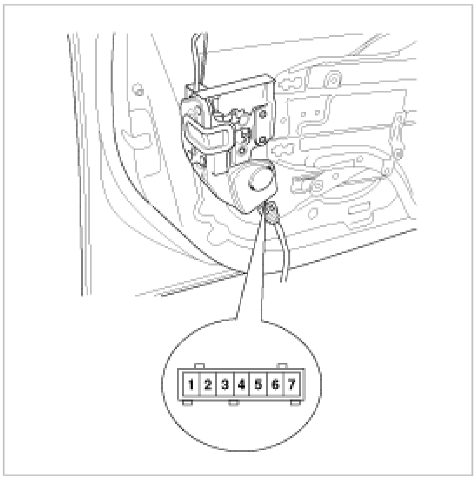


3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal	2	Chassis ground
Open	⊕	⊖

FRONT DOOR LOCK SWITCH INSPECTION

1. Remove the front door trim panel. (Refer to the Body group - front door)
2. Disconnect the 7P connector from the actuator.

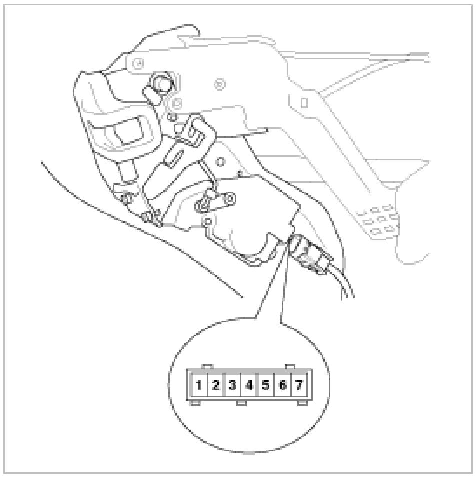


3. Check for continuity between the terminals in each switch position according to the table.

Position \ Terminal		1	5	3	7
Front left	Lock				
	Unlock	○		○	
Front right	Lock				
	Unlock		○		○

REAR DOOR LOCK SWITCH INSPECTION

1. Remove the rear door trim panel. (Refer to the Body group - rear door)
2. Disconnect the 7P connector from the actuator.

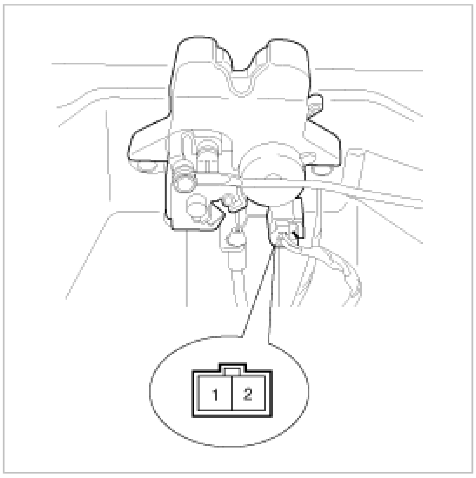


3. Check for continuity between the terminals in each switch position according to the table.

Position \ Terminal		1	5	3	7
Rear left	Lock				
	Unlock	○		○	
Rear right	Lock				
	Unlock		○		○

TRUNK LID OPEN SWITCH INSPECTION

1. Remove the trunk lid trim panel. (Refer to the Body group-trunk lid)
2. Disconnect the 2P connector from the actuator.

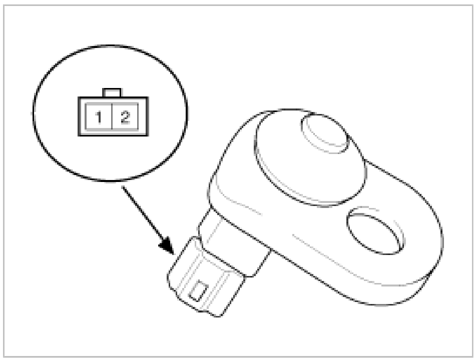


3. Check for continuity between the terminals in each switch position according to the table.

Terminal / Position	1	Chassis ground
Open	⊕	⊖

DOOR SWITCH INSPECTION

Remove the door switch and check for continuity between the terminals.



[FRONT DOOR SWITCH]

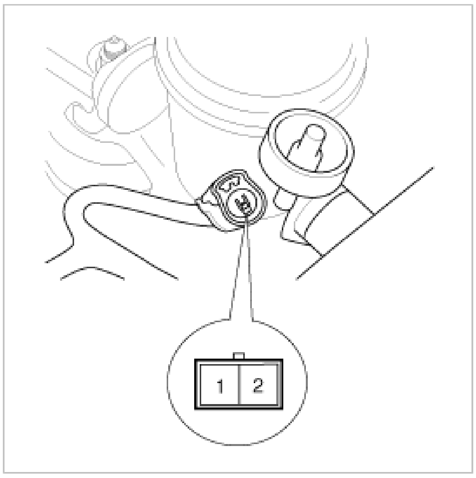
Terminal / Position	1	2	Body (Ground)
Free(Door open)	○	○	○
Push(Door close)			

[REAR DOOR SWITCH]

Terminal / Position	1	Ground
Free(Door open)	○	○
Push(Door close)		

HOOD SWITCH INSPECTION

1. Disconnect the 2P connector from the hood switch.

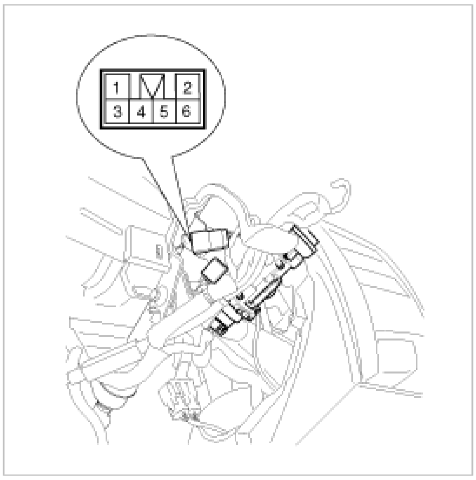


2. Check for continuity between the terminals and ground according to the table.

Terminal / Position	1	2
Hood open (Free)	○	○
Hood close (Push)		

KEY WARNING SWITCH INSPECTION

1. Remove the driver's crash pad lower panel. (see Body group-crash pad)
2. Disconnect the 6P connector from the door warning switch.

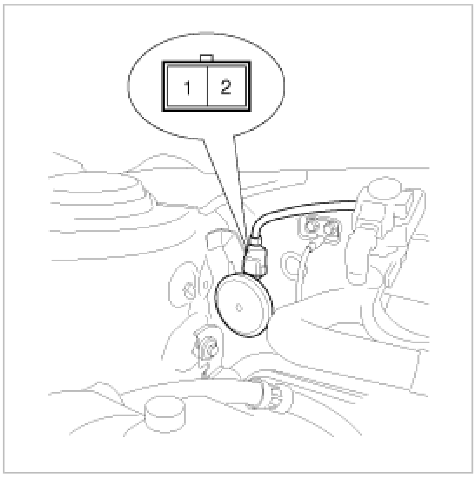


3. Check for continuity between the terminals in each position according to the table.

Terminal / Key position	5	6
Insert	○	○
Removal		

BURGLAR HORN INSPECTION

1. Remove the burglar horn after removing 2 bolts and disconnect the 2P connector from the burglar horn.
2. Test the burglar horn by connecting battery power to the terminal 1 and ground the terminal 2.



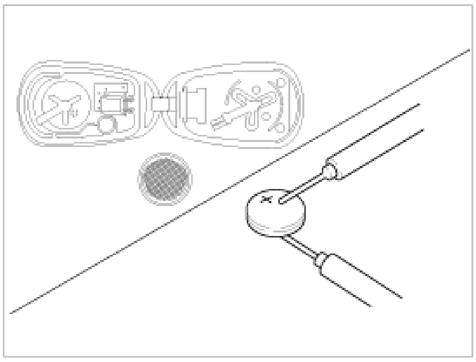
3. The burglar horn should make a sound. If the burglar horn fails to make a sound replace it.

Body Electrical System > Keyless Entry And > Transmitter > Repair procedures

INSPECTION

1. Check that the red light flickers when the door lock or unlock button is pressed on the transmitter.
2. Remove the battery and check voltage if the red light doesn't flicker.

Standard voltage : 3V



3. Replace the transmitter battery with a new one, if voltage is below 3V then try to lock and unlock the doors with the transmitter by pressing the lock or unlock button five or six times.
4. If the doors lock and unlock, the transmitter is O.K, but if the doors don't lock and unlock, register the transmitter code, then try to lock and unlock the doors.
5. If the doors lock and unlock, the transmitter is O.K, but if the doors don't lock and unlock, replace the transmitter.

TRANSMITTER CODE REGISTRATION

1. Connect the DLC cable of hi-scan to the data link connector (16 pins) in driver side crash pad lower panel, turn the power on hi-scan.

2. Select the vehicle model and then do "CODE SAVING"

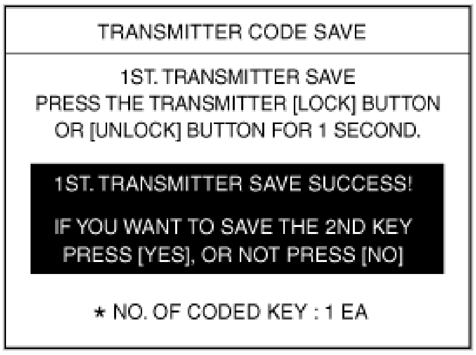
```
1. HYUNDAI VEHICLE DIAGNOSIS

MODEL   :                          ALL

  02. ENGINE
  03. AUTOMATIC TRANSAXLE
  04. ANTI-LOCK BRAKE SYSTEM
              :
              :
              :
  07. CODE SAVING
```

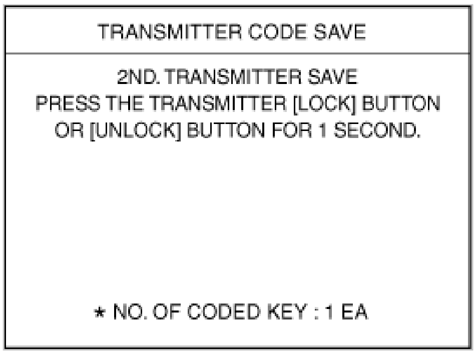
3. After selecting "CODE SAVING" menu, push "ENTER" key, then the screen will be shown as below.

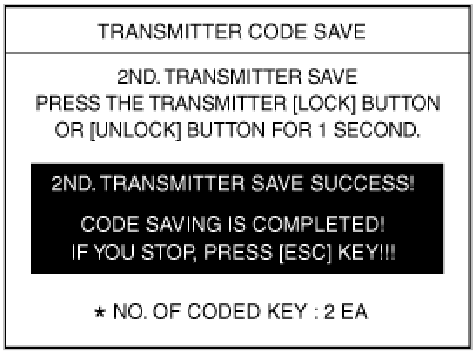
```
TRANSMITTER CODE SAVE

REMOVE THE IG. KEY FROM THE KEY
CYLINDER. CONNECT THE DLC CABLE
AND 16 PIN CONNECTOR OF THE VEHICLE.

PRESS [ENTER], IF YOU ARE READY!
```

4. After removing the ignition key from key cylinder, push "ENTER" key to proceed to the next mode for code saving. Follow steps 1 to 4 and then code saving is completed.

```
TRANSMITTER CODE SAVE

1ST. TRANSMITTER SAVE
PRESS THE TRANSMITTER [LOCK] BUTTON
OR [UNLOCK] BUTTON FOR 1 SECOND.

* NO. OF CODED KEY : 0 EA
```







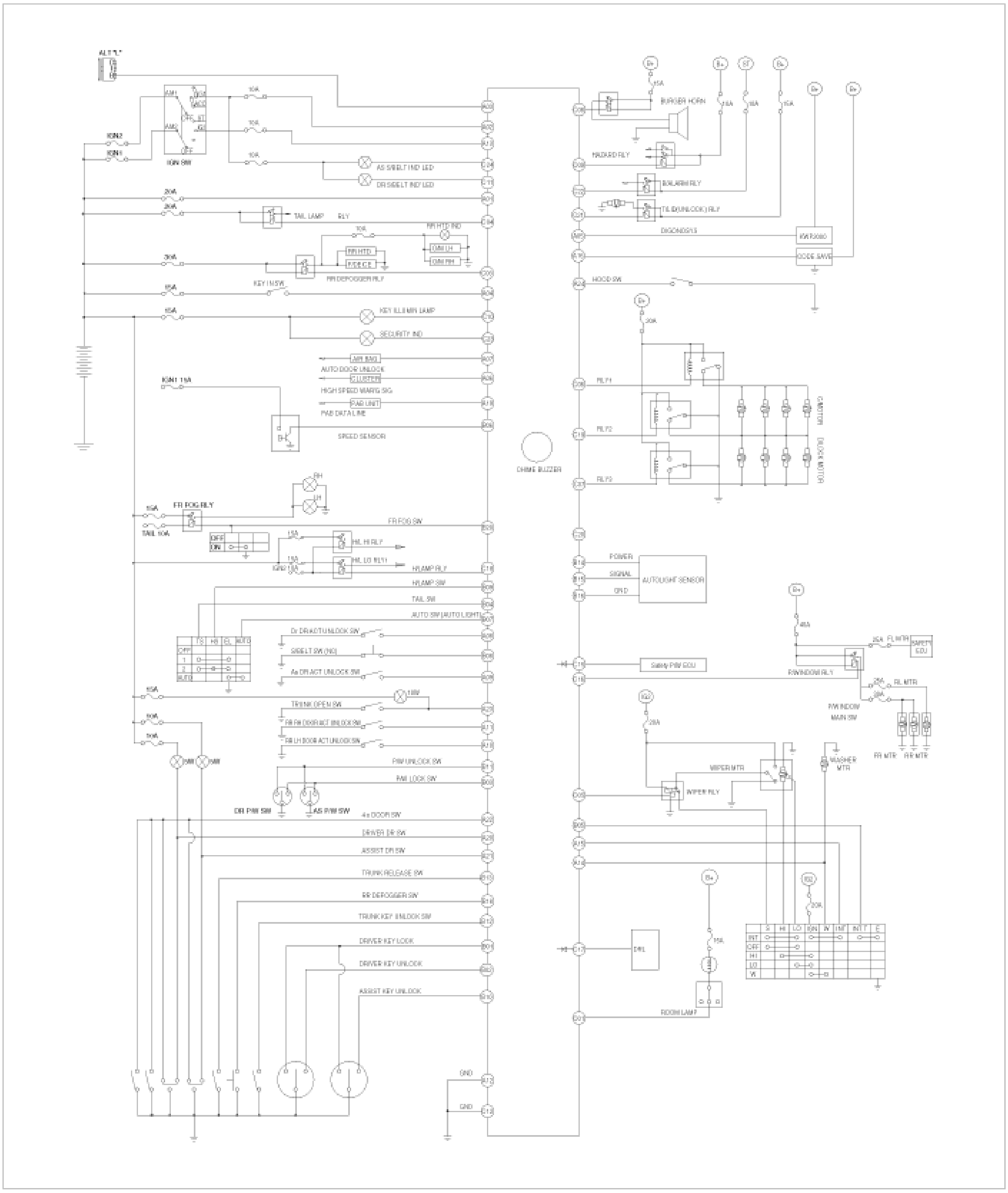
Body Electrical System > Keyless Entry And > Transmitter > Specifications

SPECIFICATIONS

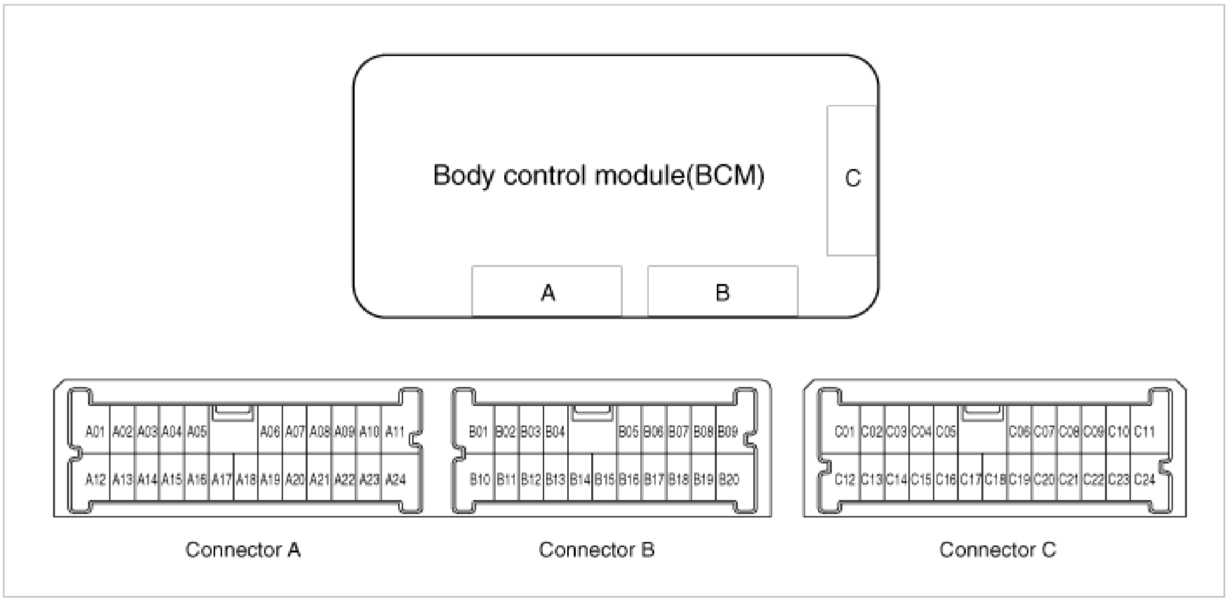
Items	Specifications
Keyless entry transmitter Power source	Lithium 3V battery (1EA)
Transmissible distance	10m or more
Life of battery	2 years or more (at 20 times per day)
Button	Door lock, Door unlock, Trunk lid open, Panic
Transmission frequency	313.85 MHz

Body Electrical System > ETACS (Electronic Time > Body Control Module > Schematic Diagrams

CIRCUIT DIAGRAM



BCM CONNECTOR TERMINALS



Terminal No.	Connector A	Connector B	Connector C
1	B+ [For BCM]	Driver door key lock switch	Room lamp
2	IGN 1	Driver door key unlock switch	-
3	Alternator (L)	Central door key lock switch	Rear defogger relay
4	Key warning switch	Tail lamp switch	Tail lamp relay
5	Diagnosis	Intermittent wiper volume	Wiper relay
6	Over speed (Cluster)	Speed sensor	Door lock relay 1
7	Crash unlock (Air bag)	Auto light switch	Door lock relay 3
8	Driver door unlock switch	Driver seat belt switch	Horn relay
9	Assist door unlock switch	Head lamp switch	Hazard lamp relay
10	Rear left unlock switch	Assist door key unlock switch	Key hole illumination
11	Rear right unlock switch	Central door unlock switch	Driver seat belt indicator
12	Ground	Trunk key unlock switch	Ground
13	IGN 2	Trunk open switch	-
14	Washer switch	Auto light (Power)	-
15	Intermittent wiper switch	Auto light (signal)	Safety power window ECU
16	Code saving	Auto light (Ground)	Power window relay
17	-	-	-
18	-	Rear defogger switch	Head lamp relay
19	Seat belt reminder signal	-	Door lock relay 2
20	Driver door switch	Front fog lamp switch	-
21	Assist door switch		Trunk lid open relay
22	4 door open switch		Start inhibit relay
23	Trunk open switch		Security indicator
24	Hood switch		Assist seat belt indicator

BCM MODULE INPUT SIGNAL TEST

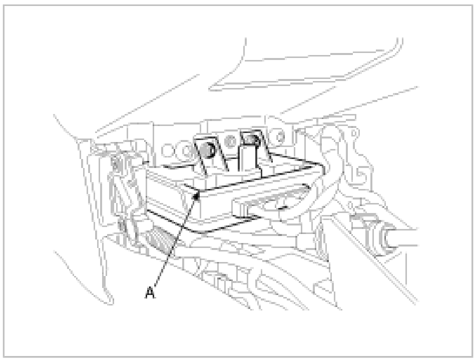
Pin No.	Input signal name	Test condition	Measured value	Ordinary
A1	B+ [For BCM]	Constant	Battery voltage	10V or more
A2	IGN1	Ignition switch ON	Battery voltage	1V or less
A3	Alternator (L)	Engine start condition	Battery voltage	1V or less

A4	Key warning switch	Key is inserted into the ignition switch	10V or more	1V or less
A7	Crash unlock (Air bag)	Crash sensor signal input	1V or less	10V or more
A8	Driver door unlock switch	Driver door unlock	1V or less	4V or more (Lock)
A9	Assist door unlock switch	Assist door unlock	1V or less	4V or more (Lock)
A10	Rear left unlock switch	Rear left unlock	1V or less	4V or more (Lock)
A11	Rear right unlock switch	Rear right unlock	1V or less	4V or more (Lock)
A13	IGN2	Ignition switch ON	Battery voltage	1V or less
A14	Washer switch	Washer switch ON	10V or more	1V or less
A15	Intermittent wiper switch	Intermittent wiper switch ON	10V or more	1V or less
A16	Code saving	Code saving	1V or less	4V or more
A20	Driver door switch	Driver door open	1V or less	4V or more
A21	Assist door switch	Driver door open	1V or less	4V or more
A22	4 door open switch	4 door close	4V or more	1V or less
A23	Trunk open switch	Trunk open	1V or less	4V or more
A24	Hood switch	Hood open	1V or less	4V or more
B1	Driver door key lock switch	Driver door key lock switch ON	1V or less	4V or more
B2	Driver door key unlock switch	Driver door key unlock switch ON	1V or less	4V or more
B3	Central door key lock switch	Central door key lock switch ON	1V or less	4V or more
B4	Tail lamp switch	Tail lamp switch ON	1V or less	4V or more
B5	Intermittent wiper volume	-	0 ~ 2.5V	-
B6	Speed sensor	Ignition switch ON	0~5V (Pulse)	-
B8	Driver seat belt switch	Fasten (Open), Unfasten (Ground)	4V or more (Fasten)	1V or less
B9	Head lamp switch	Head lamp switch ON	1V or less	4V or more
B10	Assist door key unlock switch	Assist door key unlock switch ON	1V or less	4V or more
B11	Central door key unlock switch	Central door key unlock switch ON	1V or less	4V or more
B12	Trunk key unlock switch	Trunk key unlock switch ON	1V or less	4V or more
B13	Trunk open switch	Trunk open switch ON	1V or less	4V or more
B18	Rear defogger switch	Rear defogger switch ON	1V or less	4V or more
B19	-	-	-	-
B20	Front fog lamp switch	Front fog lamp switch ON	1V or less	4V or more

Body Electrical System > ETACS (Electronic Time > Body Control Module > Description and Operation

DESCRIPTION

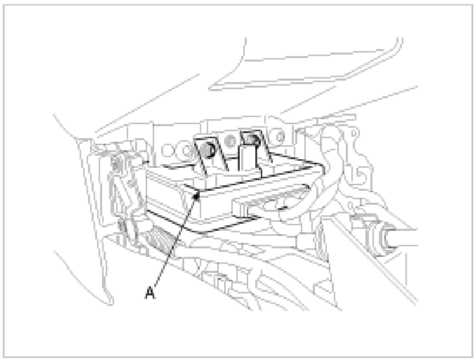
Body control module (A) receives various input switch signals controlling time and alarm functions for the intermittent wiper timer, washer timer, rear defogger timer, seat belt reminder, delayed out room lamp, central door lock, ignition key reminder, power window timer, door warning, tail lamp auto cut, crash door unlock, auto door lock, 2-Turn unlock, ignition key hole illumination control and keyless entry & burglar alarm.



Body Electrical System > ETACS (Electronic Time > Body Control Module > Repair procedures

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the floor console (Refer to the Body group-console).
3. Remove the keyless antenna cable and body control module (A) after loosening 2 nuts.

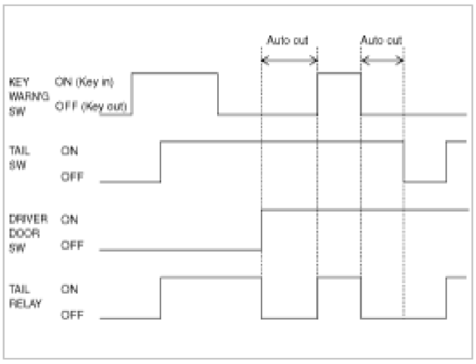


4. Installation is the reverse of removal.

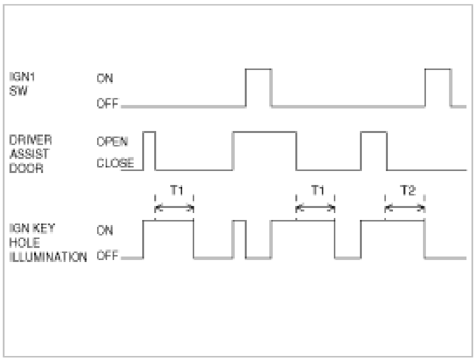
INSPECTION

Verify each components operation using related timing charts.

1. TAIL LAMP AUTO CUT
   (1) With the tail lamp switched ON, if the ignition
   Is switched OFF and the driver's door opened, the tail lamp should be automatically turned OFF.
   (2) With the ignition switch ON, if the driver's door is opened and the ignition is switched to OFF, the tail lamp should be automatically turned OFF.
   (3) When the tail lamp is cut automatically and the tail lamp switch is turned OFF and ON, the tail lamp illuminates and auto cut function is cancelled.
   (4) When the tail lamp is cut automatically and the ignition key is inserted, the tail lamp illuminates and auto cut function is canceled.

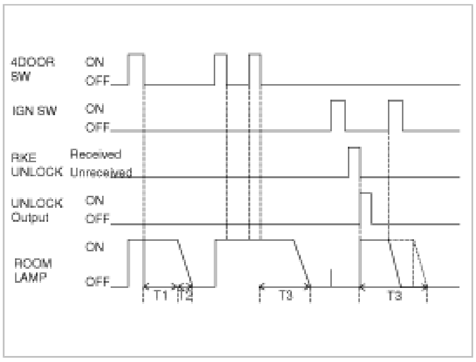


2. IGNITION KEYHOLE ILLUMINATION
   (1) Ignition keyhole illumination is turned ON when the driver or passenger door is opened.
   (2) The "ON" state for ignition keyhole illumination is delayed 10 seconds when the door is closed as in Step 1).
   (3) Ignition keyhole illumination is turned off if the ignition switch is turned ON as in Step 1) & 2).
   (4) Ignition keyhole illumination is turned off if ARM state is entered. See Steps 1) & 2).



T1 : 10 ± 1 sec.
T2 : 0 ~ 10 sec.

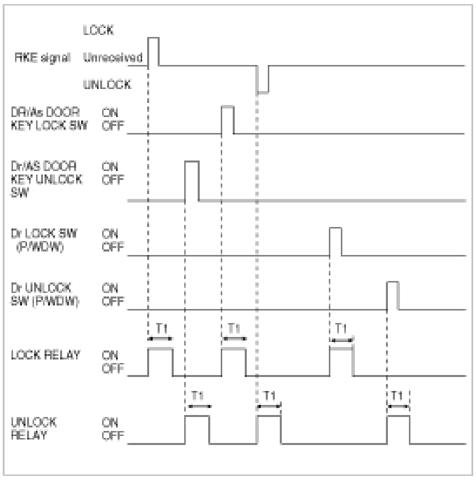
3. DELAYED ROOM LAMP
   (1) When the first door (driver, or assist or 4doors) is opened, room lamp is turned on.
   (2) When the door is closed, the room lamp is faded out for 2 seconds after there is on for 30 seconds.
   (3) Regardless of ignition ON/OFF in door open state, room lamp output is ON.
   (4) When remote control unlock is received, room lamp is turned on for 30 seconds.
   (5) While room lamp is on due to Remote control unlock, if another remote control unlock is received, then room lamp is again on for 30 sec.



T1 : 30 ± 3 sec.,
T2 : 2 ± 0.2 sec.,
T3 : 32 ± 3.2sec.

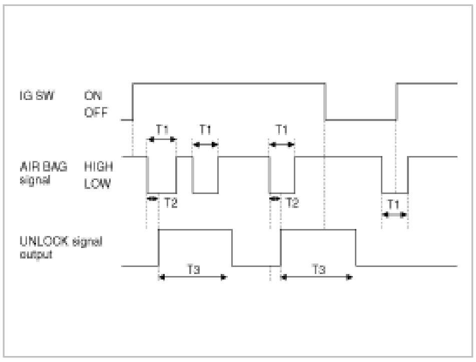
4. CENTRAL DOOR LOCK/UNLOCK
   (1) Central door lock/unlock

Function \ Option		Centeral door Lock	Transmitter (RKE)
Door key UNLOCK	Driver	2-Turn unlock	2-Turn unlock
	Assist	2-Turn unlock	2-Turn unlock
Door key LOCK	Driver	All lock	All lock
	Assist	All lock	All lock
Transmitter (RKE)	Lock	–	All lock
	Unlock	–	2-Turn unlock
Driver's knob	Lock	Driver lock	Driver lock
	Unlock	Driver unlock	Driver unlock
Assist knob	Lock	Assist lock	Assist lock
	Unlock	Assist unlock	Assist unlock
Door Lock switch	Lock	All lock	All lock
	Unlock	All unlock	All unlock



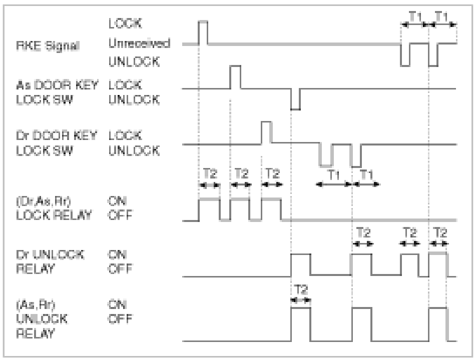
T1 : 0.5 ±0.1 sec.

5. CRASH DOOR UNLOCK
   (1) UNLOCK signal is always output when AIR BAG signal is input under IG SW = ON.
   (2) UNLOCK signal is output for the remaining time even when IG SW ON is turned to OFF during UNLOCK output.
   (3) UNLOCK signal is not output when IG SW OFF is turned to ON after AIR BAG signal is input in advance.
   (4) UNLOCK signal is output for T3 when driver, Assist or rear DOOR LOCK SW is locked from UNLOCK after UNLOCK signal is output.
   (5) AUTO DOOR LOCK function is not performed when CRASH UNLOCK condition is met.
   (6) CENTRAL DOOR LOCK function is not performed during or after CRASH UNLOCK signal output.
   But, CENTRAL DOOR LOCK function is performed normally if CRASH UNLOCK function is reset after IG OFF.



T1 : 0.2 ± 0.02 sec.,
T2 : 0.04 sec.,
T3 : 5 ± 0.5 sec.

6. 2-TURN UNLOCK
   (1) All door unlock signals are output for T2 if driver door key unlock switch is turned ON within T1 after changing driver door key unlock switch from OFF to ON(mechanically, driver door key unlock switch is unlocked and BCM signal is not output). (All door unlock signals are output even within T1 after RKE UNLOCK signal is received.)
   (2) Driver door unlock signal is output for T2 when RKE UNLOCK signal is received. But, all door unlock signals are output for T2 if RKE UNLOCK signal is received within T1.



T1 : within 4 ± 1sec,
T2 : 0.5 ± 0.1sec.

7. AUTO DOOR LOCK (USER OPTION)

(1) This does not activate when vehicle speed is less than 5km/h.

(2) Lock signal is output if vehicle speed is 5km/h or more for at least 1s under ALT"L" ON, IGN SW = ON. But, lock signal is not output if all doors are locked or all doors are fail in advance.

(3) Lock signal is output 3 times as Max ((2) is ignored) if either one door is unlocked after lock signal output in (2).(1s cycle) But, door, which is locked from unlock state during 3-time output, is ignored.

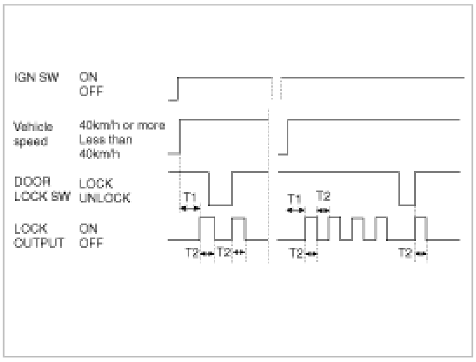
(4) Relevant door is fail if the state is unlock after 3-time output.

(5) Lock signal is output once if the fail door is unlocked again after the door is locked.

(6) Lock signal is output once if locked doors, which are lock state after lock signal output in (2),are unlocked again. But, lock signal is output once for the relevant door even when unlock state continues after lock signal output.

(7) Fail door is cleared at IGN SW = OFF.

(8) Auto door lock function is not performed when crash unlock condition is met.



T1 : 1 ± 0.1sec,
T2 : 0.5 ± 0.1sec.

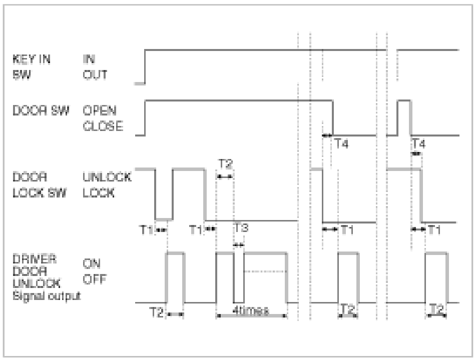
8. IGNITION KEY REMINDER

(1) This function is not performed when vehicle speed is 3km/h or more.

(2) DRIVER UNLOCK signal is output for 1s after 0.5s from when the state becomes KEY IN SW = IN & DRIVER DOOR = OPEN & DRIVER DOOR LOCK SW = LOCK.

(3) ALL DOOR UNLOCK signals are output for 1s after 0.5s from when the state becomes KEY IN SW = IN & ASSIST DOOR = OPEN & ASSIST DOOR LOCK SW = LOCK.

(4) UNLOCK signal is output 3times as Max (1s-output is excluded) in case LOCK state is held even when UNLOCK signal is output for 1s in (2),(3). (1s cycle: 0.5s ON/OFF)

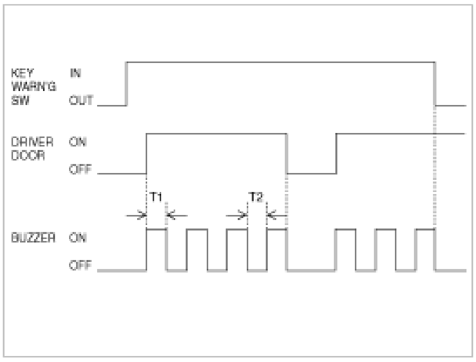


T1 : 0.5 ± 0.1 sec.
T2 : 1.0 ± 0.1 sec.
T3 : 0.5 ± 0.1 sec.
T4 : 0.5 sec.

9. KEY OPERATED WARNING

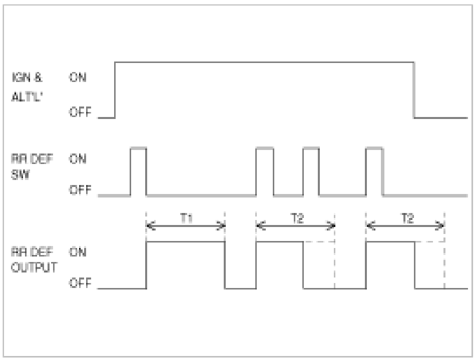
(1) If the key is in the key cylinder and the driver door is opened, the buzzer is sounded (period: 0.7 sec., duty rate: 50%).

(2) If the ignition key is removed, or the door is closed, the buzzer is switched OFF immediately.



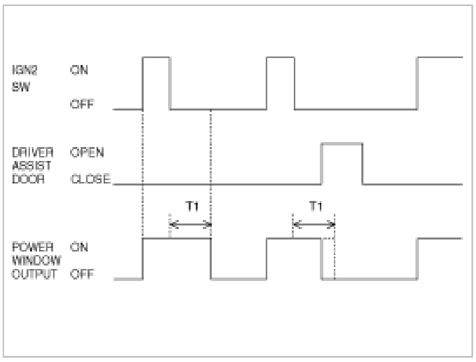
T1, T2 : 0.35 ± 0.1sec.

10. WINDSHIELD DEICER & DEFOGGER TIMER
    (1) Once ALT "L" is ON, if the defogger is switched ON, the defogger will stay ON for 20 minutes duration.
    (2) If defogger switch is pressed again (see Step 1), or if ignition is switched OFF, the defogger will shut OFF.



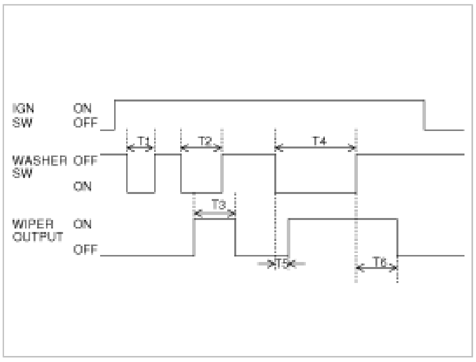
T1 : 20 ± 1 min.
T2 : MAX 20 ± 1 min.

11. POWER WINDOW TIMER
    (1) When the ignition is switched OFF, power window output remains ON for 30 seconds and then turns OFF.
    (2) Related to Step 1), if the driver's door or assist door is opened, window power output is turned OFF immediately.
    (3) When the driver's door or assist door is opened, the power window relay output is turned OFF immediately.



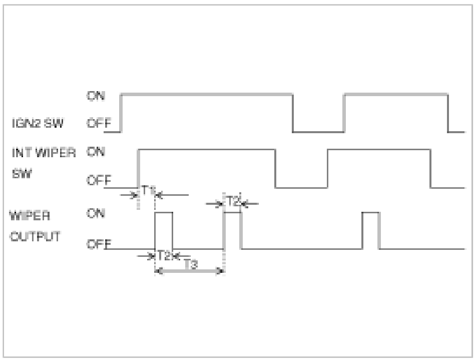
T1 : 30 ± 3 sec.

12. WIPER RELATED TO WASHER
    (1) When the ignition switch is turned ON :
        A. If washer switch is turned on, wiper output is ON after 0.3 sec. (T5)
        B. If washer switch is turned OFF, wiper output is OFF after 3.8 sec. (T6)
    (2) If the washer switch is turned OFF within 0.6 sec. (T2), the wiper will remain ON for up to 0.7 sec. (T3) from the moment that washer switch is turned OFF.



T1 : Less than 0.2 sec.
T2 : 0.2 ~0.6 sec. (MIST Function)
T3 : 0.7 ± 0.1sec.
T4 : More than 0.6 sec.
T5 : 0.3 sec.
T6 : 2.5 ~3.8 sec.

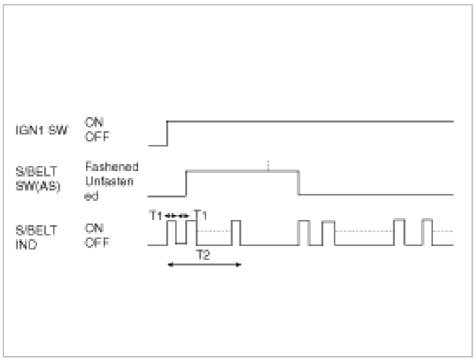
13. VARIABLE INTERMITTENT WIPER (WINDSHIELD WIPER)
    (1) With the ignition switch ON, if the intermittent wiper switch is turned on, wiper output is ON according to the setting.
    (2) When the intermittent wiper switch is ON, if the ignition switch is turned ON, wiper output is ON.



T1 : MAX 0.5 sec.
T2 : 0.7 ± 0.1sec.
T3 : 2.6 ± 0.7 sec. (FAST),
T3 : 18.0 ± 1.0sec. (SLOW) vehicle speed 0 km/h

14. SEAT BELT REMINDER FUNCTION (DRIVER)
    (1) Warning lamp lights every 0.6sec and buzzer sounds every 1sec for 6sec when IGN is ON under unfastened seat belt. (Warning lamp continues to light for 6sec if seat belt is fastened within 6sec) 30sec- time count starts at ALT"L" ON under this state. (30sec- time count starts after 6sec. if ALT"L" is ON within initial 6sec)
    (2) Buzzer stops and the warning lamp is turned OFF when IGN is turned OFF within 6sec-output.
    (3) Buzzer stops and the warning lamp is turned OFF and 30sec- time count also stops when seat belt is fastened after IGN ON.
    (4) If unfastened seat belt state continues after 60sec- time count from ALT"L"ON, the warning lamp flashes and buzzer sounds 11 times in 30sec-cycle (6sec ON/ 24sec OFF) after 30sec from ALT"L" ON.
    (5) Warning lamp & buzzer are turned OFF when IGN is OFF or seat belt is fastened during (4).
    (6) Operation in (1) is performed when seat belt is unfastened again under ALT"L" ON and fastened seat belt.
    (7) Operation in (4) is performed when ALT "L" is turned ON again after turning OFF under unfastened seat belt.

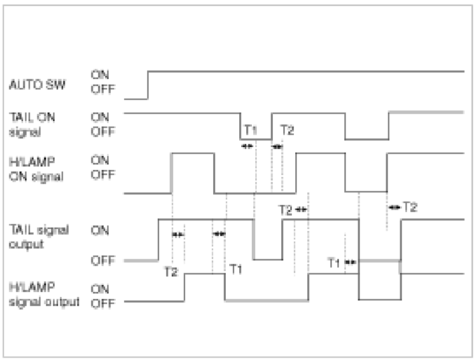
15. SEAT BELT REMINDER FUNCTION(ASSIST)
    (1) Warning lamp lights continuously every 0.6sec when IGN is turned ON under unfastened seat belt.
    (2) Warning lamp is turned OFF when IGN is turned OFF within 0.6sec.
    (3) When IGN is ON under unfastened seat belt, the warning lamp lights. The lamp continues to light for remaining time of 6sec when seat belt is fastened within 6sec. The lamp is OFF if seat belt is fastened after 6sec.
    (4) After 6 sec from IGN ON, warning lamp contintues to flash when S/BELT is unfastened and stop immediately when S/BELT is fastended.



T1 : 0.3 ± 0.1sec,
T2 : 6 ± 1sec.

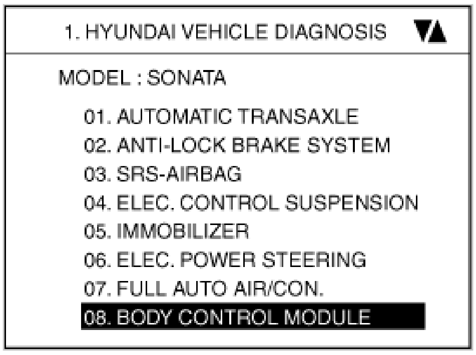
16. AUTO LIGHT CONTROL
   (1) Auto light sensor value is always read at IGN ON.
   (2) Light is turned ON after 2sec±0.2sec when auto light sensor value is same as light ON input value.
   (3) Light is turned OFF after 2sec±0.2sec when sensor value is same as light OFF input value.
   (4) Tail lamp and head lamp are turned ON when sensor value is same as tail lamp ON input value.
   (5) Light ON value of sensor is based on the below table.
   (6) Head lamp signal is output when head lamp switch is ON.
   (7) After head lamp is turned OFF, head lamp signal output is kept if head lamp ON luminance condition is met at auto light switch ON.
   (8) After head lamp is turned OFF, head lamp signal output is immediately stopped if head lamp OFF luminance condition is met at auto light switch ON.
   (9) After head lamp is turned OFF, head lamp signal output is immediately stopped at tail switch signal input.
   (10) After head lamp is turned OFF, head lamp signal output is stopped after 0.7s if there is no input of auto light switch or tail switch. (Shall be no flashing of head lamp)
   (11) Head lamp signal output is stopped when switch position is changed from AUTO to head lamp switch during head lamp ON with auto light. (Shall be no flashing of head lamp)
   (12) The condition of head lamp ON/OFF is same as the one of tail lamp ON/OFF at auto light switch ON. Light ON value of the input sensor is based on the table.

	TAIL LAMP	HEAD LAMP
ON	0.81V+/-0.08V	Same as tail sensor value
OFF	1.41V+/-0.10V	Same as tail sensor value

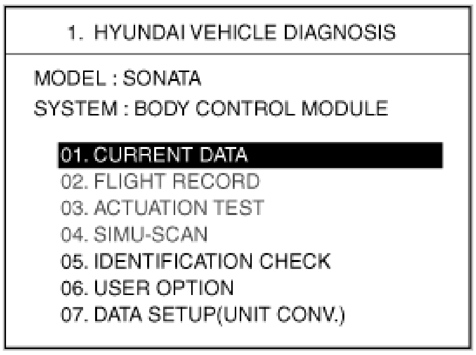


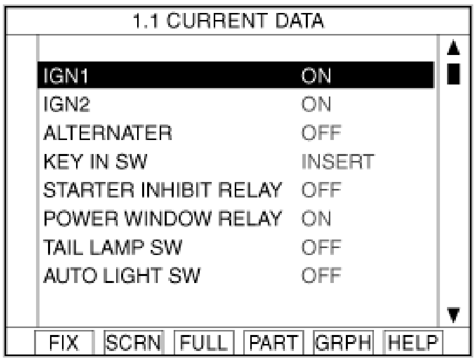
TROUBLE DIAGNOSTICS WHEN USING DIAGNOSIS TOOL

1. The body control module can diagnose by using the diagnosis tool more quickly.
   The BCM communicates with the diagnosis tool and then reads the input/output value and drives the actuator.
2. To diagnose the BCM function, select the menu of model and body control module.

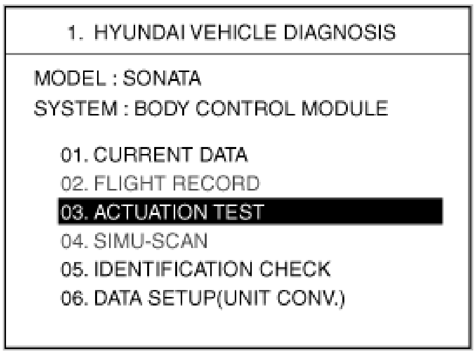


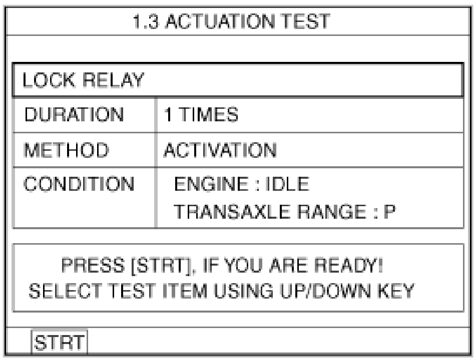
3. To consult the present input/out value of BCM, "02. INPUT/OUTPUT MONITORING". It provides information of BCM input/output conditions of power supply, turn signal/brake lamp, headlamp, door, locks, outside mirror, wiper, auto-light and transmitters etc.





4. To perform compulsory operation on BCM input factors, select "03. ACTUATION TEST"



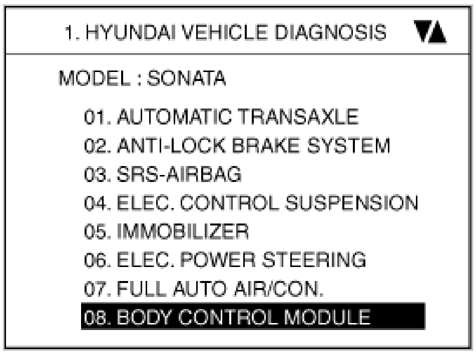


USER OPTION MODE

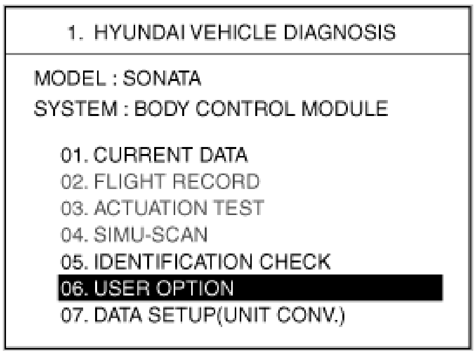
The BCM offers 3 items user option mode for a user convenience (Auto door lock, door key burglar alarm, door lock state inform horn)

- It is able to set up the enable or disable of AUTO DOOR LOCK function or AUTO DOOR LOCK operation vehicle speed when using it.
- It is able to set up the enable or disable of enter the burglar alarm mode when using door lock by the key.
- It is able to set up the enable or disable of horn inform function when using door lock by the key or RKE.

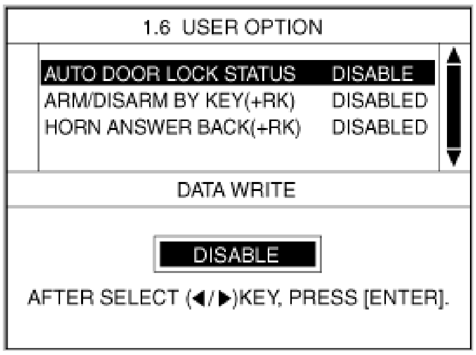
1. Select option "SONATA(NF)" and press ENTER.
2. Select option "BODY CONTROL MODULE" and press ENTER.



3. Select option "USER OPTION" and press ENTER.



4. Select option "AUTO DOOR LOCK STATUS by using the direction button(▲ / ▼).
5. Select the parameter by using the direction button(◂ / ▸) and press ENTER to save it.
   (Disable / 5km/h / 10km/h / 15km/h / 20km/h / 25km/h /30km/h / 35km/h / 40km/h)



6. Select option "ARM/DISARM BY KEY(+RKE)" by using the direction button(▲ / ▼).
7. Select the parameter by using the direction button(◂ / ▸) and press ENTER to save it.
   (Disable / Enable)
8. Select option "HORN ANSWER BACK (+RK)" by using the direction button(▲ / ▼).
9. Select the parameter by using the direction button(◂ / ▸) and press ENTER to save it.
   (Disable / Enable)

Body Electrical System > ETACS (Electronic Time > Body Control Module > Specifications

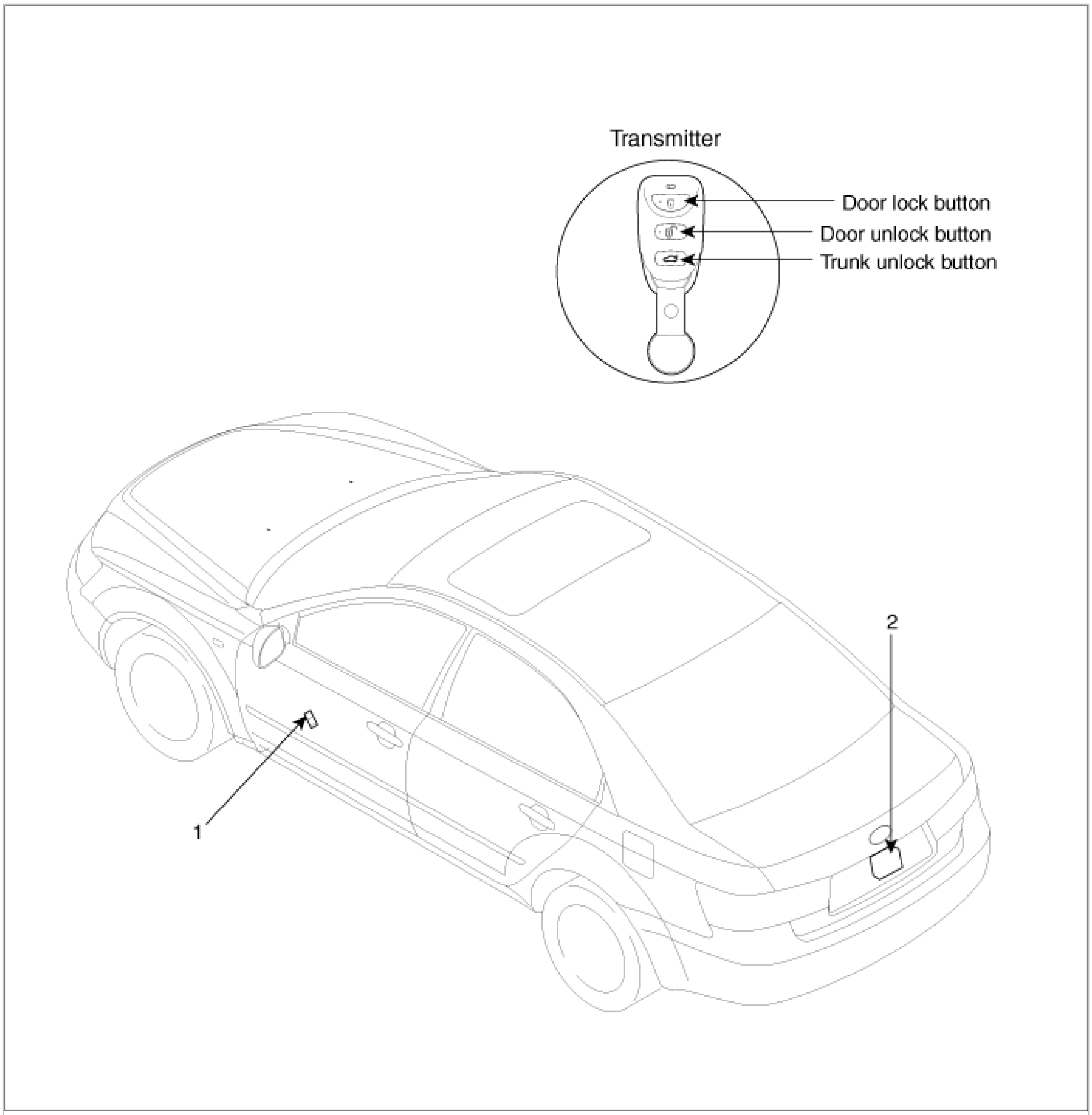
SPECIFICATIONS

Items	Specifications

Rated voltage	DC 12V
Operating voltage	DC 9 ~ 16V
Operating temperature	-22°F~167°F(-30°C~ 75°C)
Insulation resistance	100MΩ or more
Dark current	Less than 5.5mA (12.8 V) - BCM & Receiver Less than 4mA (12.8V) - BCM
Rated load Burglar relay Horn relay Tail lamp relay Security indicator Head lamp relay Rear defogger relay Power window timer relay Seat belt warning indicator (Driver/Assist) Key hole illumination lamp Room lamp Intermittent wiper relay DRL relay (For CANADA) Door lock relay Door unlock relay Hazard lamp relay Driver door unlock relay Trunk lid lock actuator	 DC 12V, 200mA (Inductance load) DC 12V, 200mA (Inductance load) DC 12V, 200mA (Inductance load) DC 12V, 1W (LED load) DC 12V, 200mA (Inductance load) DC 12V, 200mA (Inductance load) DC 12V, 200mA (Inductance load) DC 12V, 1.2W (LED load) DC 12V, 2W (Lamp load) DC 12V, 21W (Lamp load) DC 12V, 200mA (Inductance load) DC 12V, 200mA (Inductance load) DC 12V, 200mA (Inductance load) DC 12V, 200mA (Inductance load) DC 12V, 200mA (Inductance load) DC 12V, 200mA (Inductance load) DC 12V, 200mA (Inductance load)

Body Electrical System > Trunk lid > Components and Components Location

COMPONENT LOCATION

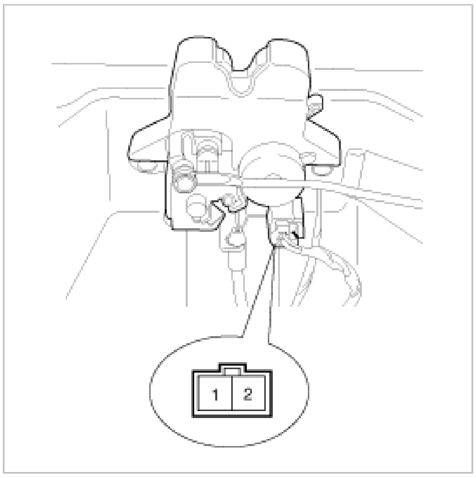


1. Trunk lid open switch
2. Trunk lid release actuator

Body Electrical System > Trunk lid > Trunk Lid Release Actuator > Repair procedures

INSPECTION

1. Remove the trunk lid trim panel. (Refer to the Body group-trunk lid)
2. Disconnect the 2P connector from the actuator.



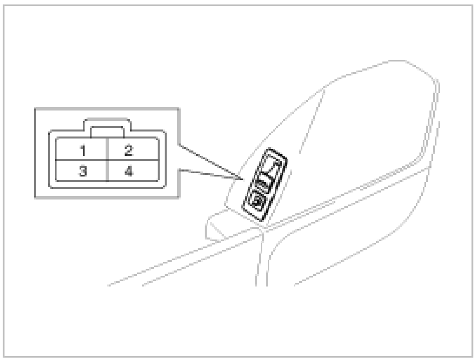
3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal	2	Chassis ground
Open	⊕	⊖

Body Electrical System > Trunk lid > Trunk Lid Open Switch > Repair procedures

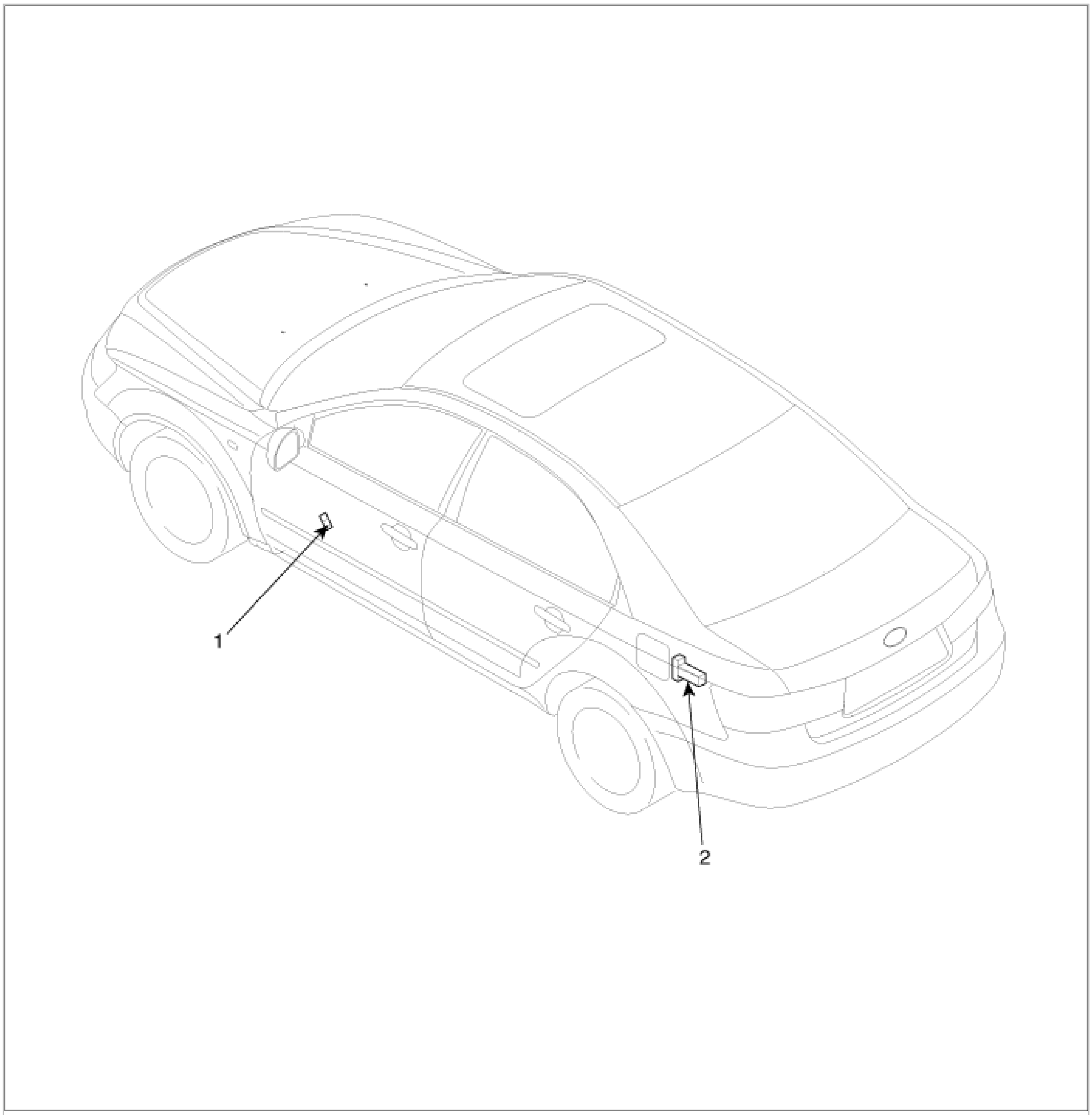
INSPECTION

1. Remove the front door trim panel. (Refer to the Body group-front door)
2. Check the switch for continuity between the No. 3 and No. 4 terminals.
3. If the continuity is not as specified, replace the switch.



Body Electrical System > Fuel Filler Door > Components and Components Location

COMPONENT LOCATION

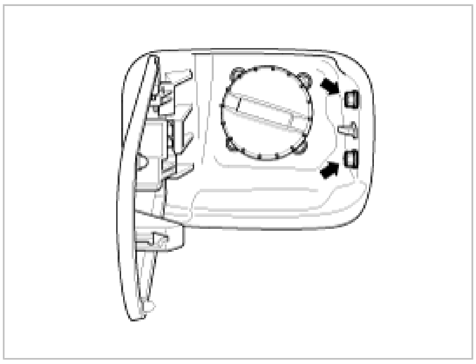


1. Fuel filler door open switch
2. Fuel filler door release actuator

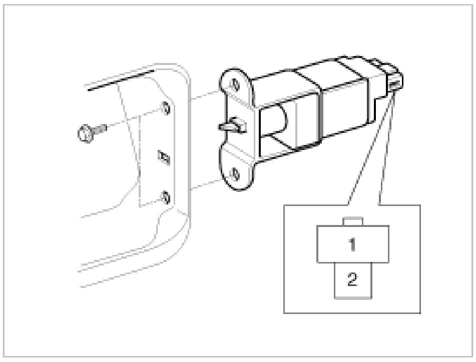
Body Electrical System > Fuel Filler Door > Fuel Filler Door Release Actuator > Repair procedures

INSPECTION

1. Remove the trunk room left trim.
2. Open the fuel filler door and remove the fuel filler door release actuator.



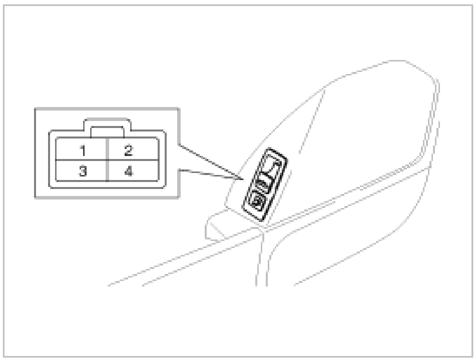
3. Check for continuity between terminal No. 1 and No. 2. If there is no continuity replace the fuel filler door opener.



Body Electrical System > Fuel Filler Door > Fuel Filler Door Open Switch > Repair procedures

INSPECTION

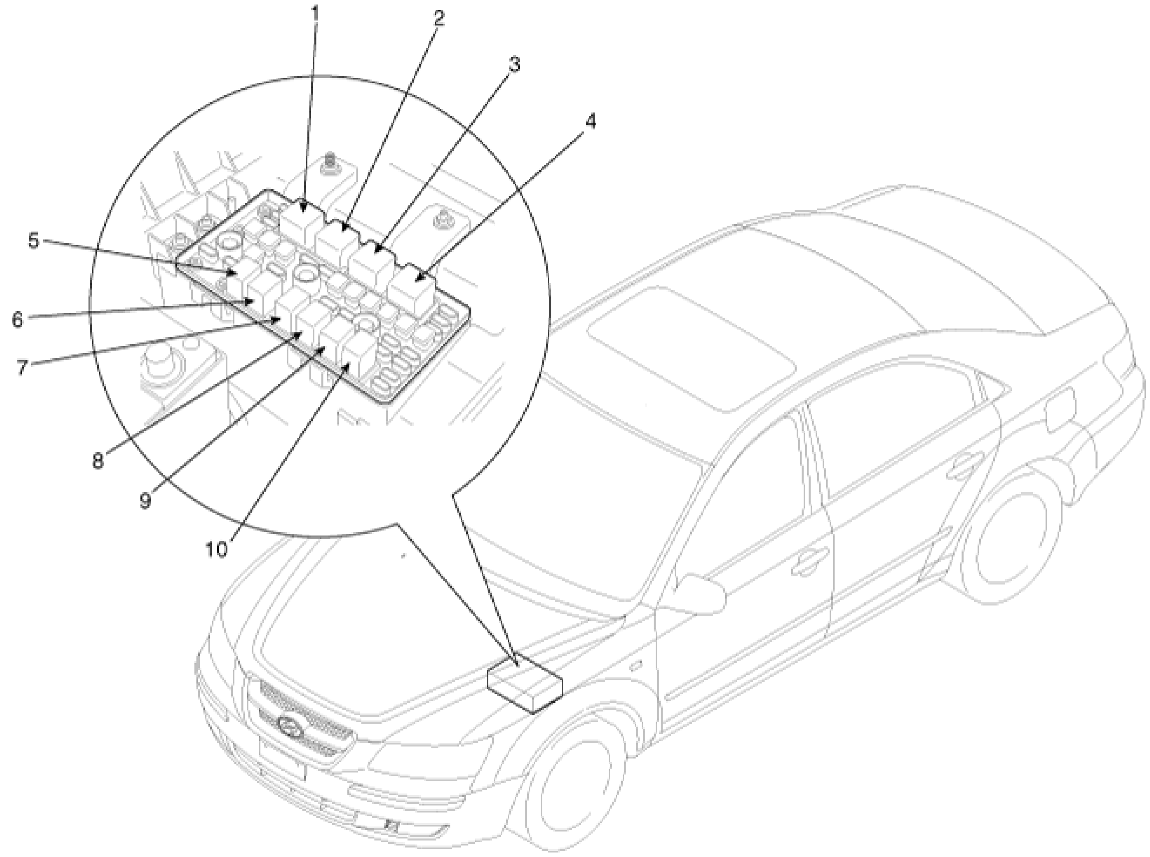
1. Remove the front door trim panel. (Refer to the Body group-front door)
2. Check the switch for continuity between the No. 1 and No. 2 terminals.
3. If the continuity is not as specified, replace the switch.



Body Electrical System > Fuses And Relays > Components and Components Location

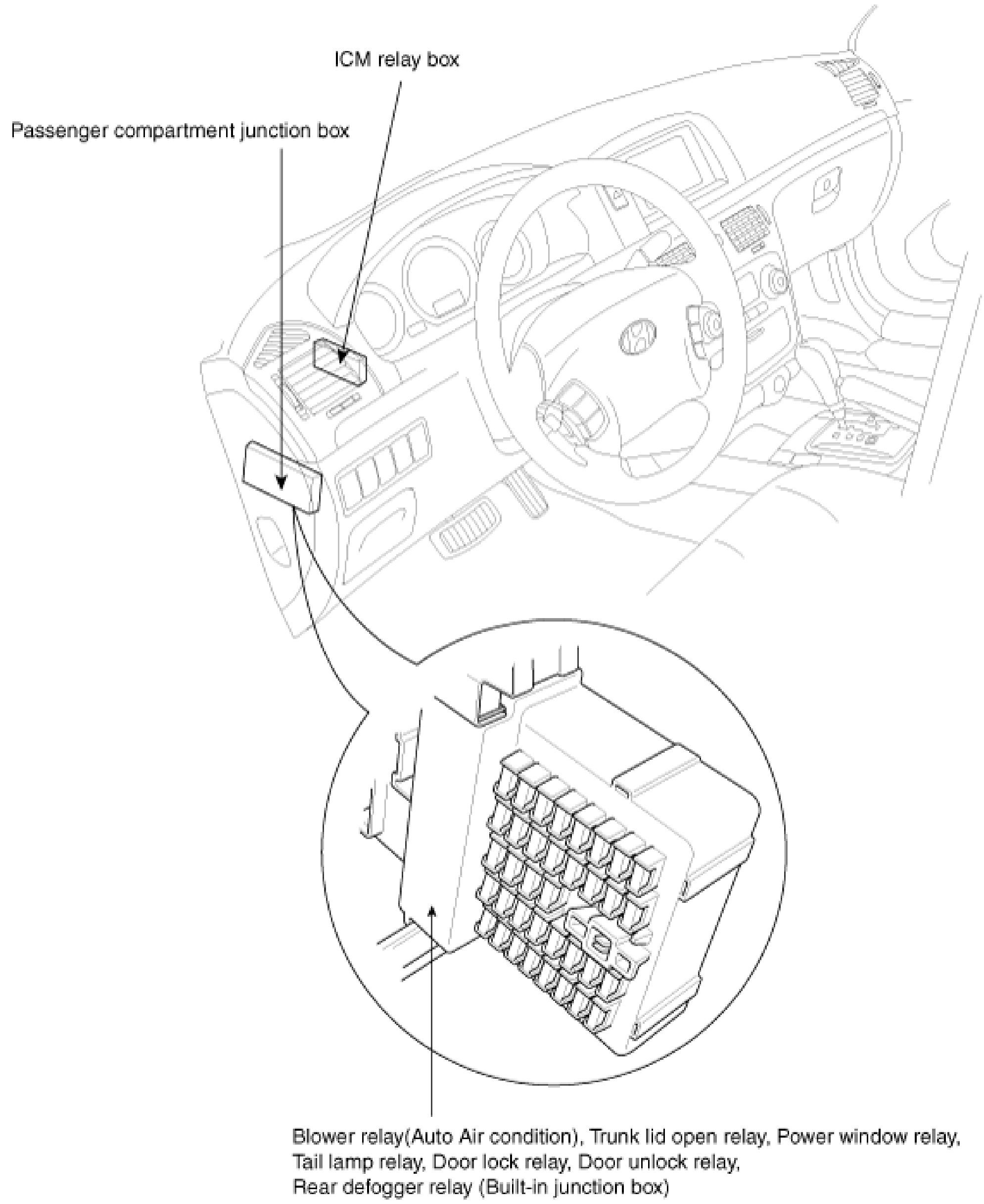
COMPONENT LOCATION

[Engine room relay box]



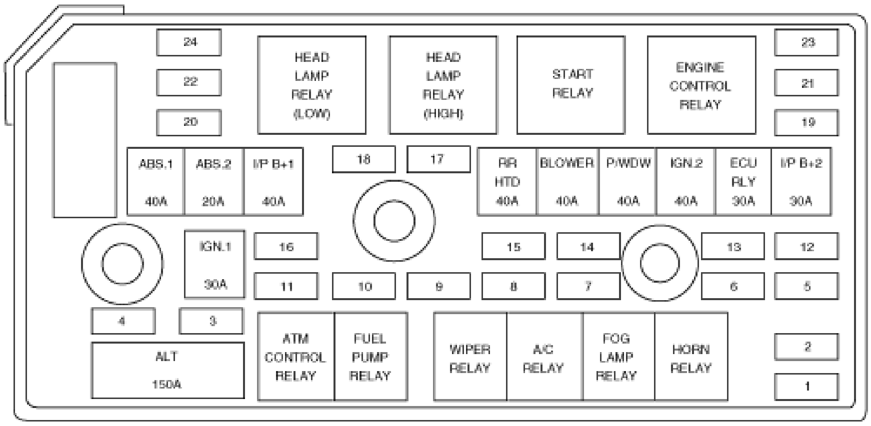
1. Head lamp relay (Low)
2. Head lamp relay (High)
3. Start relay
4. E/G control relay
5. A/T relay
6. Fuel pump relay
7. Wiper relay
8. Air conditioning relay
9. Front fog relay
10. Horn relay

[Passenger compartment relay box]



Body Electrical System > Fuses And Relays > Relay Box (Engine Compartment) > Components and Components Location

COMPONENTS



Description			(A)	Circuit Protected
FUSIBLE LINK	ABS.1		40A	ABS/ESP control module, Multipurpose check connector
	ABS.2		20A	ABS/ESP control module, Multipurpose check connector
	I/P B+1		40A	Fuse 23, 24, 30, 31, 32, 33, 34, 35
	RR HTD		40A	Defogger relay
	BLOWER		40A	Blower relay
	P/WDW		40A	Power window relay, Fuse 16
	IGN.2		40A	Start relay, Ignition switch (IG2, START)
	ECU RLY		30A	Engine control relay
	I/P B+2		30A	Power connector. 1/2, Fuse 21, 22
	IGN.1		30A	Ignition switch (ACC, IG1)
	ALT		150A	FUSIBLE LINK (ABS.1, ABS.2, RR HTD, BLOWER)
FUSE	1	HORN	15A	Horn relay
	2	TAIL LAMP	20A	Tail lamp relay
	3	ECU	10A	PCM
	4	IGN.1	10A	(SPARE)
	5	DRL	15A	DRL control module
	6	FR FOG	15A	Front fog lamp relay
	7	A/CON	10A	A/C relay
	8	F/PUMP	20A	Fuel pump relay
	9	DIODE	-	(SPARE)
	10	ATM	20A	ATM control relay
	11	STOP	15A	Stop lamp switch
	12	H/LP LO RH	15A	(SPARE)
	13	SUN ROOF	15A	Sunroof control module
	14	H/LP WASHER	20A	(SPARE)
	15	H/LP HI	20A	Head lamp relay (High)
	16	ECU	10A	PCM (3.3L)
	17	SNSR.3	10A	A/C relay, Cooling fan relay, Injectors
	18	SNSR.1	15A	Mass air flow sensor, Oil control valve, SMATRA, Canister close valve
	19	SNSR.2	15A	Oxygen sensor, Fuel pump relay
	20	B/UP	10A	Back-up lamp switch, Pulse generator, Vehicle speed sensor
	21	IGN COIL	20A	Ignition coils, condenser
	22	ECU	10A	PCM
	23	H/LP LO	20A	Head lamp relay (Low)
	24	ABS	10A	ABS/ESP control module, Multipurpose check connector

※ USE THE DESIGNATED FUSE ONLY

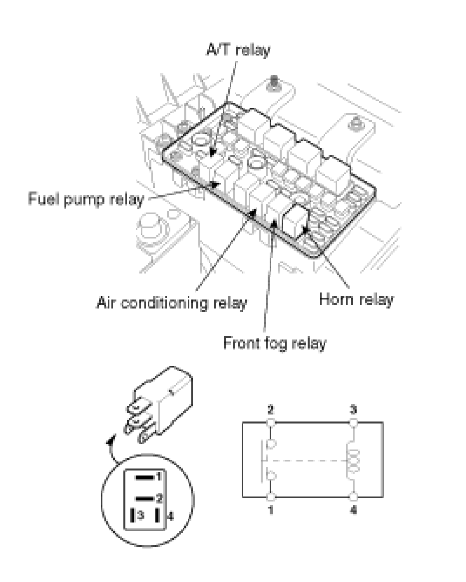
Body Electrical System > Fuses And Relays > Relay Box (Engine Compartment) > Repair procedures

INSPECTION

POWER RELAY TEST (TYPE A)

Check for continuity between the terminals.

1. There should be continuity between the No.1 and No.2 terminals when power and ground are connected to the No.3 and No.4 terminals.
2. There should be no continuity between the No.1 and No.2 terminals when power is disconnected.

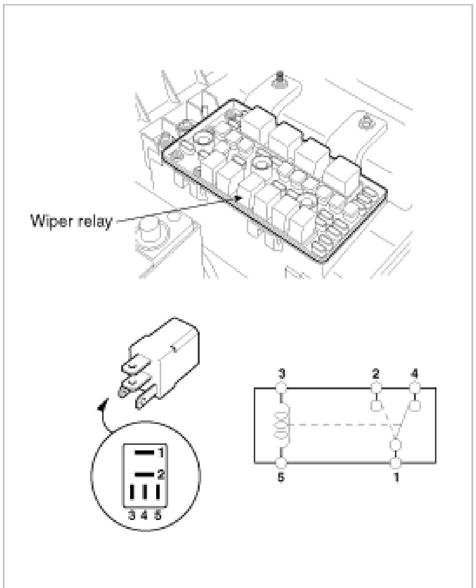


Terminal / Power (No.3-No.4)	1	2	3	4
Disconnected			○	○
Connected	○	○	⊖	⊕

POWER RELAY TEST (TYPE B)

Check for continuity between the terminals.

1. There should be continuity between the No.1 and No.2 terminals when power and ground are connected to the No.3 and No.5 terminals.
2. There should be continuity between the No.1 and No.4 terminals when power is disconnected.

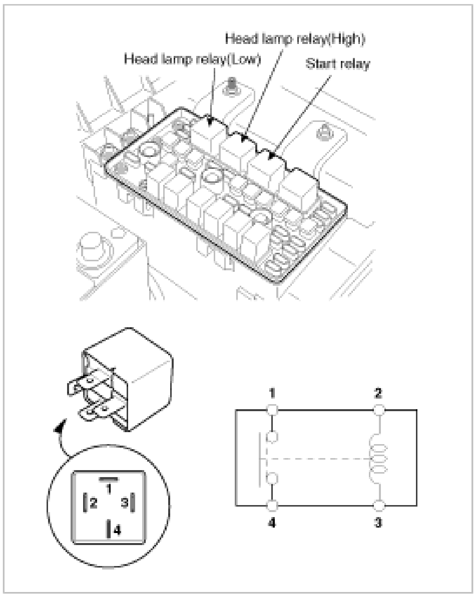


Terminal / Power (No.3-No.5)	3	5	1	2	4
Disconnected			○		○
Connected	⊖	⊕	○	○	

POWER RELAY TEST (TYPE C)

Check for continuity between the terminals.

1. There should be continuity between the No.1 and No.4 terminals when power and ground are connected to the No.2 and No.3 terminals.
2. There should be no continuity between the No.1 and No.4 terminals when power is disconnected.

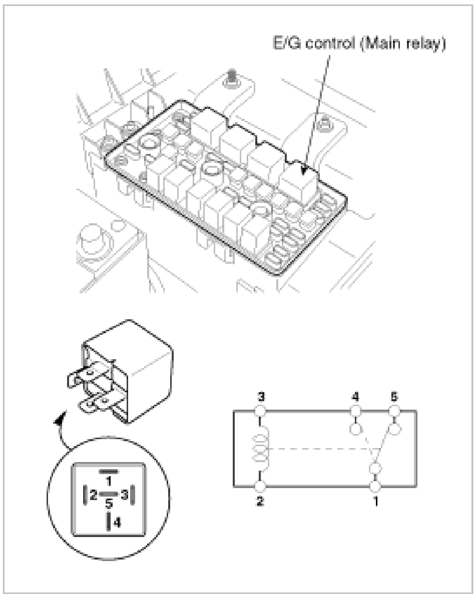


Terminal / Power (No.2-No.3)	2	3	1	4
Disconnected	○	○		
Connected	⊖	⊕	○	○

POWER RELAY TEST (TYPE D)

Check for continuity between the terminals.

1. There should be continuity between the No.1 and No.4 terminals when power and ground are connected to the No.2 and No.3 terminals.
2. There should be continuity between the No.1 and No.5 terminals when power is disconnected.



Terminal / Power (No.2-No.3)	2	3	1	4	5
Disconnected			○		○
Connected	⊖	⊕	○	○	

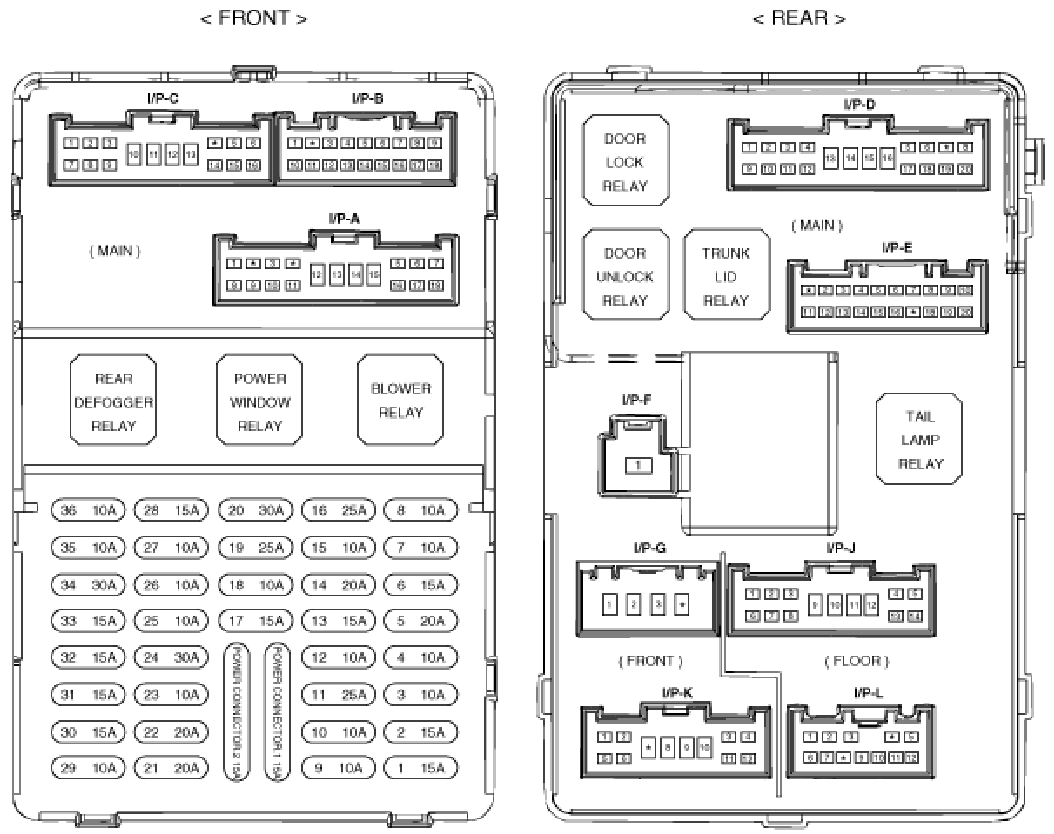
FUSE INSPECTION

1. Be sure there is no play in the fuse holders, and that the fuses are held securely.
2. Are the fuse capacities for each circuit correct?
3. Are there any blown fuses?
   If a fuse is to be replaced, be sure to use a new fuse of the same capacity. Always determine why the fuse blew first and

completely eliminate the problem before installing a new fuse.

Body Electrical System > Fuses And Relays > Relay Box (Passenger Compartment) > Components and Components Location

COMPONENTS



※ USE THE DESIGNATED FUSE ONLY

CIRCUIT

FUSE	(A)	Circuit Protected
1	15A	(SPARE)
2	15A	Seat warmer switch
3	10A	BCM, Sunroof control module, Home link connector
4	10A	Active incar & humidity sensor, Instrument cluster
5	20A	Cigarette lighter
6	15A	(SPARE)
7	10A	Illumination lamps, Right : License lamp, Rear combination lamp, Head lamp, Glove box lamp
8	10A	Front fog lamp relay, Left : License lamp, Rear combination lamp, Head lamp
9	10A	(SPARE)
10	10A	DRL control module, Head lamp relay, AQS & ambient sensor
11	25A	Wiper & washer
12	10A	A/C control module
13	15A	SRS control module, Telltale lamp, Passenger seat track position sensor
14	20A	Front accessory socket, Rear power outlet
15	10A	Digital clock, Audio, ATM key lock control module, Power outside mirror switch
16	25A	Safety window module
17	15A	(SPARE)
18	10A	ATM key lock control module, Tire pressure monitoring module
19	25A	Power window main switch, Left rear power window switch
20	30A	Power window main switch, Right power window switch
21	20A	Audio amp, JBL amp
22	20A	Door lock/unlock relay
23	10A	Hazard switch, Hazard relay
24	30A	(SPARE)
25	10A	Instrument cluster
26	10A	Hazard switch
27	10A	BCM, Instrument cluster, Yaw rate sensor, ESP switch
28	15A	(SPARE)
29	10A	Burglar alarm relay
30	15A	Adjustable pedal relay
31	15A	(SPARE)
32	15A	Trunk lid relay, Fuel filler door & trunk lid switch
33	15A	(SPARE)
34	30A	Power seat manual switch (LH)
35	10A	Sport mode switch, Key solenoid
36	10A	A/C control module, Outside mirror motor
POWER CONNECTOR.1	15A	Audio
POWER CONNECTOR.2	15A	BCM, Digital clock, Instrument cluster, A/C control module, Courtesy lamps

※ USE THE DESIGNATED FUSE ONLY

Body Electrical System > Fuses And Relays > Relay Box (Passenger Compartment) > Repair procedures

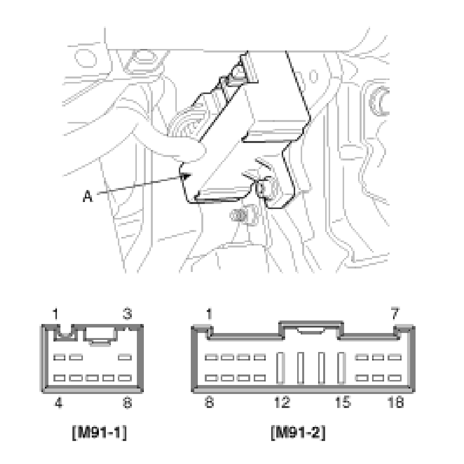
FUSE INSPECTION

1. Be sure there is no play in the fuse holders, and that the fuses are held securely.
2. Are the fuse capacities for each circuit correct?
3. Are there any blown fuses?
   If a fuse is to be replaced, be sure to use a new fuse of the same capacity. Always determine why the fuse blew first and completely eliminate the problem before installing a new fuse.

Body Electrical System > Fuses And Relays > ICM (Integrated Circuit Module) Relay Box > Description and Operation

DESCRIPTION

The ICM is united with many kinds of relays and installed below the relay box (passenger compartment).



Body Electrical System > Fuses And Relays > ICM (Integrated Circuit Module) Relay Box > Repair procedures

INSPECTION

HAZARD LAMP

Check for continuity between the terminals.

1. There should be continuity between the No.12 and No.13 terminals when power and ground are connected to the No.13 and No.3 in the M91-2 terminals.
2. There should be no continuity between the No12 and No.13 terminals when power is disconnected.

BURGLAR ALARM HORN

Check for continuity between the terminals.

1. There should be continuity between the No.8 and No.9 terminals when power and ground are connected to the No.1 and No.8 in the M91-2 terminals.
2. There should be no continuity between the No.8 and No.9 terminals when power is disconnected.

BURGLAR ALARM

Check for continuity between the terminals.

1. There should be no continuity between the No.11 and No.10 terminals when power and ground are connected to the No.11 and No.4 in the M91-2 terminals.
2. There should be continuity between the No.11 and No.10 terminals when power is disconnected.

ADJUST PEDAL

Check for continuity between the terminals.

1. There should be continuity between the No.15 and No.5 terminals when power and ground are connected to the No.15 and No.2 in the M91-2 terminals.
2. There should be no continuity between the No.15 and No.5 terminals when power is disconnected.

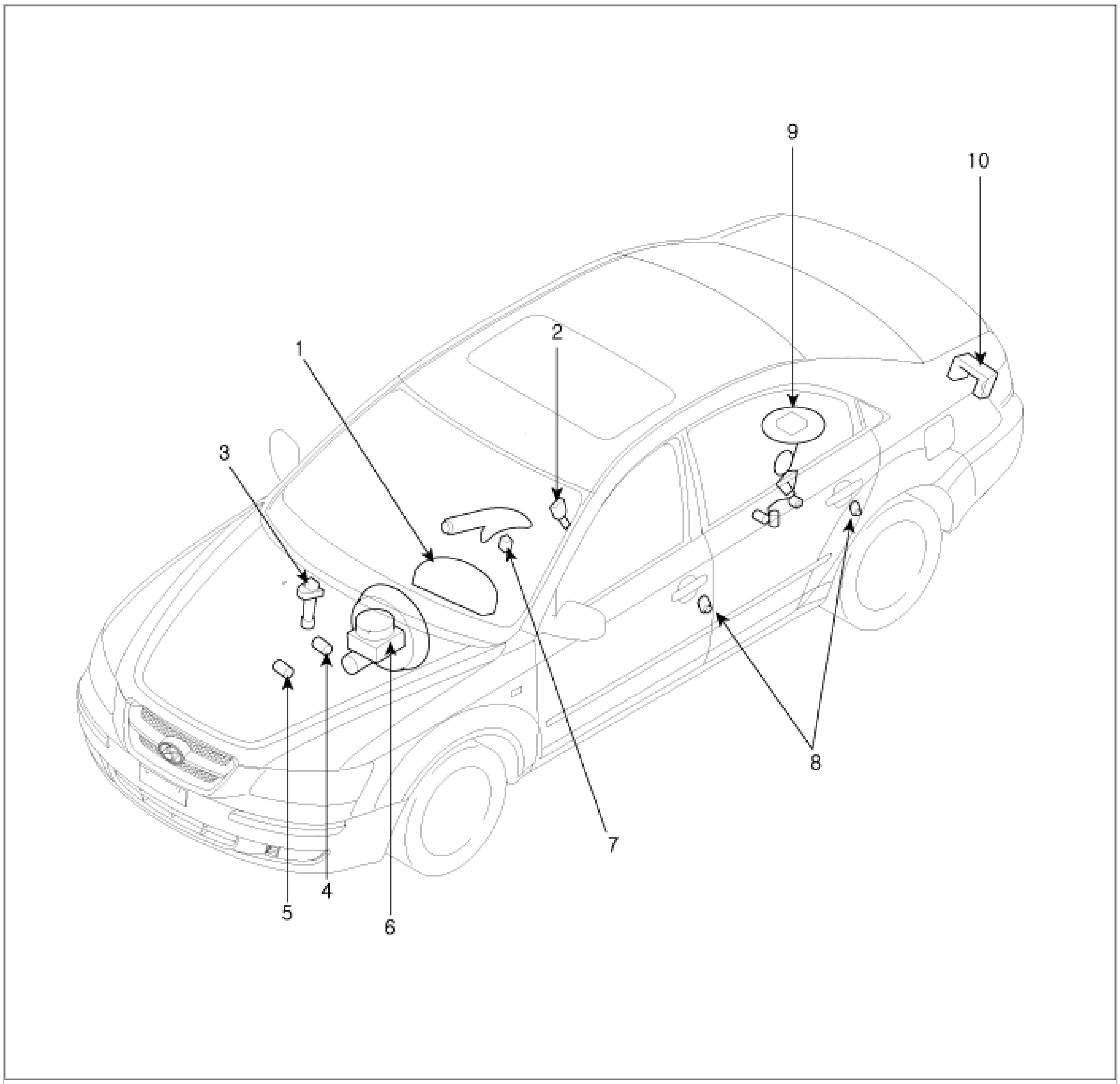
DRIVER DOOR TWO TURN UNLOCK

Check for continuity between the terminals.

1. There should be continuity between the No.7 and No.4 terminals when power and ground are connected to the No.6 and No.4 in the M91-1 terminals.
2. There should be continuity between the No.7 and No.5 terminals when power and ground are disconnected.

Body Electrical System > Indicators And Gauges > Components and Components Location

COMPONENT LOCATION



1. Cluster assembly
2. Seat belt switch
3. Vehicle speed sensor
4. Engine coolant temperature sender
5. Oil pressure switch
6. Brake fluid level warning switch
7. Parking brake switch
8. Door switch
9. Fuel gauge sender
10. Trunk lid open actuator

Body Electrical System > Indicators And Gauges > Troubleshooting

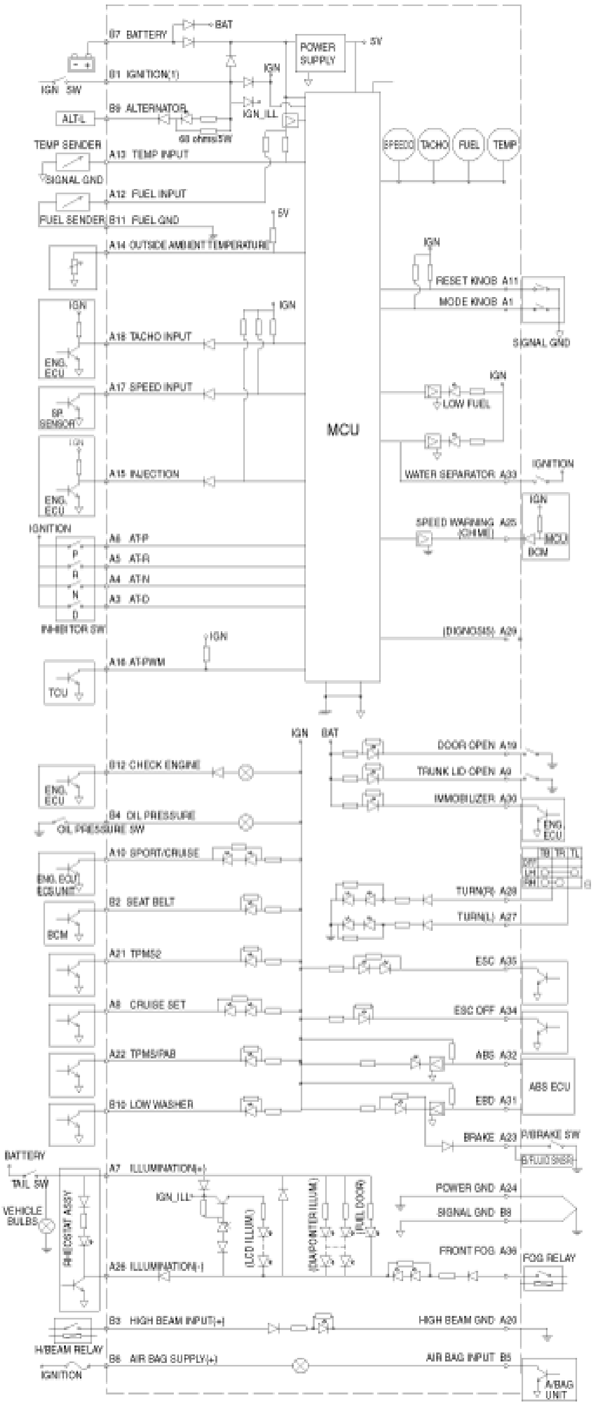
TROUBLESHOOTING

Symptom Poss	ible cause	Remedy
Speedometer does not operate	Cluster fuse (10A) blown	Check for short and replace fuse
	Speedometer faulty	Check speedometer
	Vehicle speed sensor faulty	Check vehicle speed sensor
	Wiring or ground faulty	Repair if necessary
Tachometer does not operate	Cluster fuse (10A) blown	Check for short and replace fuse
	Tachometer faulty	Check tachometer
	Wiring or ground faulty	Repair if necessary
Fuel gauge does not operate	Cluster fuse (10A) blown	Check for short and replace fuse
	Fuel gauge faulty	Check gauge
	Fuel sender faulty	Check fuel sender

	Wiring or ground faulty	Repair if necessary
Low fuel warning lamp does not light up	Cluster fuse (10A) blown	Check for short and replace fuse
	Bulb burned out	Replace bulb
	Fuel sender faulty	Check fuel sender
	Wiring or ground faulty	Repair if necessary
Water temperature gauge does not operate	Cluster fuse (10A) blown	Check for short and replace fuse
	Water temperature gauge faulty	Check gauge
	Water temperature sender faulty	Check sender
	Wiring or ground faulty	Repair if necessary
Oil pressure warning lamp does not light up	Cluster fuse (10A) blown	Check for short and replace fuse
	Bulb burned out	Replace bulb
	Oil pressure switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Parking brake warning lamp does not light up	Cluster fuse (10A) blown	Check for short and replace fuse
	Bulb burned out	Replace bulb
	Brake fluid level warning switch faulty	Check switch
	Parking brake switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Open door warning lamp and trunk lid warning lamp do not light up	Memory fuse (15A) blown	Check for short and replace fuse
	Bulb burned out	Replace bulb
	Door switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Seat belt warning lamp does not light up	Cluster fuse (10A) blown	Check for short and replace fuse
	Bulb burned out	Replace bulb
	Seat belt switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary

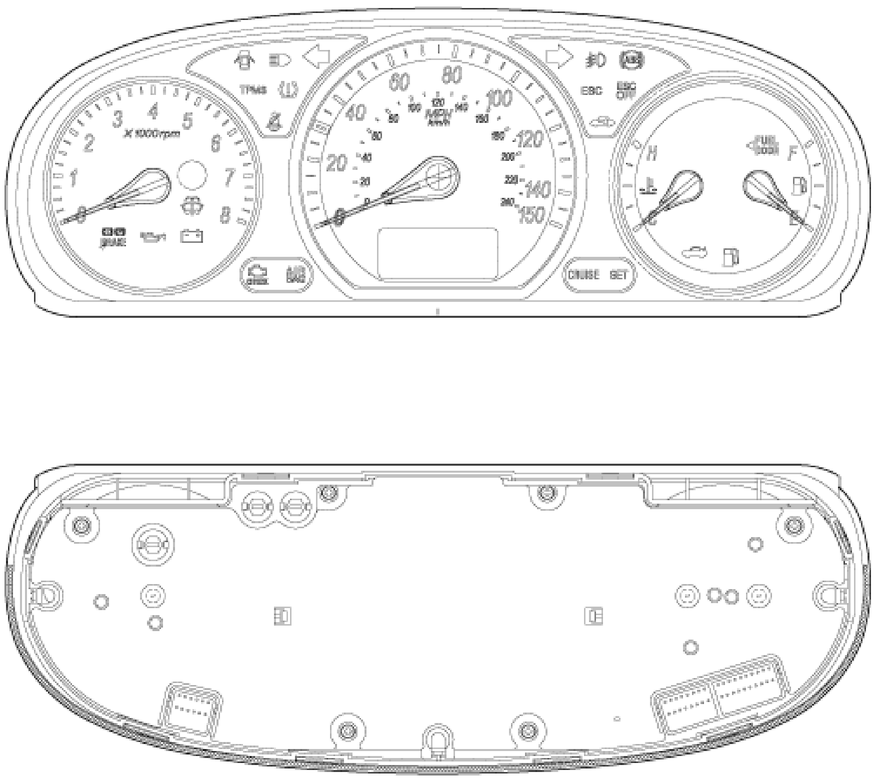
Body Electrical System > Indicators And Gauges > Instrument Cluster > Schematic Diagrams

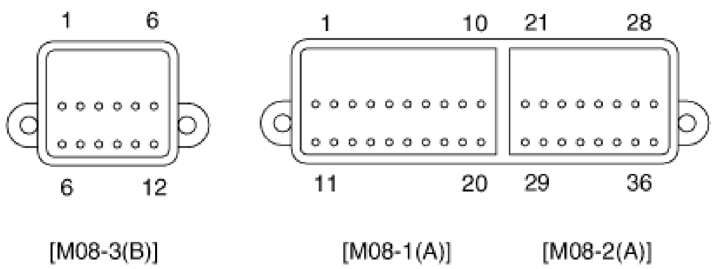
CIRCUIT DIAGRAM



Body Electrical System > Indicators And Gauges > Instrument Cluster > Components and Components Location

COMPONENTS

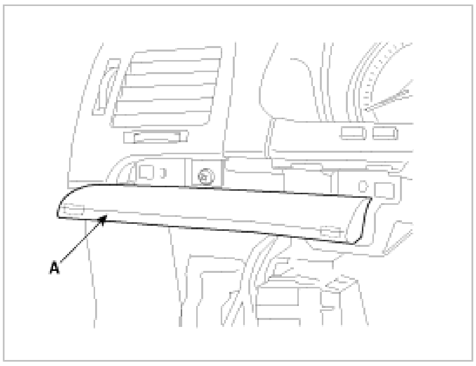




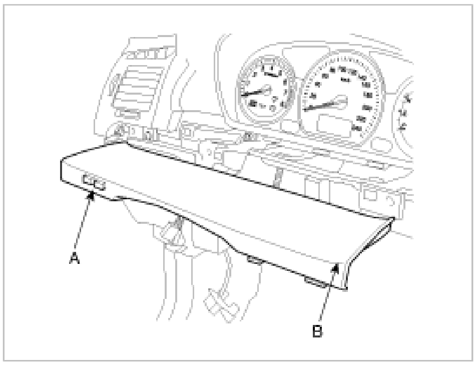
Body Electrical System > Indicators And Gauges > Instrument Cluster > Repair procedures

REPLACEMENT

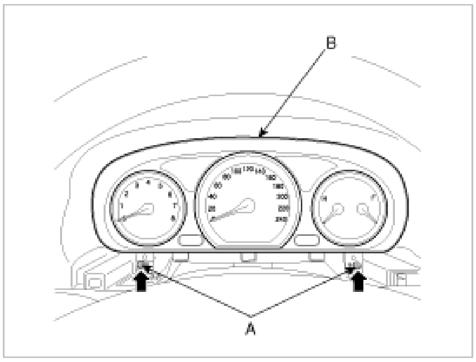
1. Disconnect the negative (-) battery terminal.
2. Remove the center garnish (A) (Refer to Body group-crash pad)



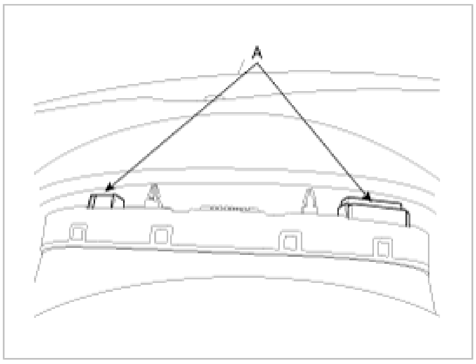
3. Remove the cluster facia panel (B) after disconnecting the connector of trip switch (A).



4. Remove the cluster from the housing (B) after removing 2 screws (A).



5. Disconnect the cluster connecter (A) and then remove the cluster.



6. Installation is the reverse of removal.

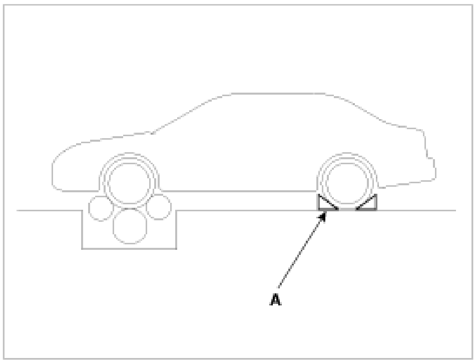
INSPECTION

SPEEDOMETER

1. Adjust the pressure of the tires to the specified level.
2. Drive the vehicle onto a speedometer tester. Use wheel chocks as appropriate.
3. Check if the speedometer indicator range is within the standard values.

> **CAUTION**
>
> Do not operate the clutch suddenly or increase/ decrease speed rapidly while testing.

> **NOTE**
>
> Tire wear and tire over or under inflation will increase the indication error.



[CANADA - km/h]

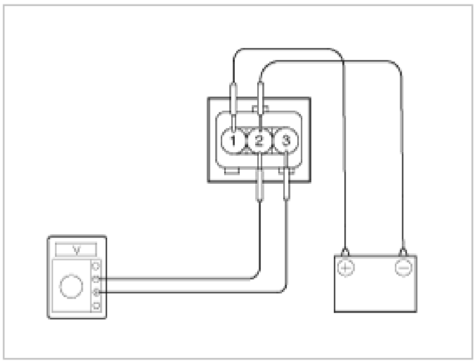
Velocity (km/h)	20	40	60	80	100	120
Tolerance (km/h)	+5.0 +0.2	+5.0 +0.2	+5.8 +0.2	+6.5 +0.5	+7.0 +1.5	+8.5 +1.5
Velocity (km/h)	140	160	180	200	220	240
Tolerance (km/h)	+10 +1.5	+11 +2.0	+12 +2.5	+13 +2.5	+14 +2.5	+15 +2.5

[USA MPH]

Velocity (MPH)	10	20	40	60	80
Tolerance (MPH)	+2.5 -1.0	+2.5 -1.0	+3.5 -1.0	+4.0 -1.0	+4.5 -1.0
Velocity (MPH)	100	120	140	150	-
Tolerance (MPH)	+5.0 -1.0	+6.0 -1.0	+6.5 -1.0	+7.0 -1.0	-

VEHICLE SPEED SENSOR

1. Connect the positive (+) lead from battery to terminal 1 and negative (-) lead to terminal 2.
2. Connect the positive (+) lead from tester to terminal 3 and the negative (-) lead to terminal 2.
3. Rotate the shaft.
4. Check that there is voltage change from approx. 0V to 11V or more between terminals 3 and 2.
5. The voltage change should be 4 times for every revolution of the speed sensor shaft.
   If operation is not as specified, replace the sensor.



TACHOMETER

1. Connect the scan tool to the diagnostic link connector or install a tachometer.
2. With the engine started, compare the readings of the tester with that of the tachometer. Replace the tachometer if the tolerance is exceeded.

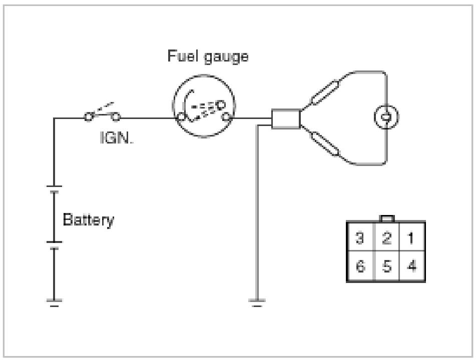
CAUTION

1. Reversing the connections of the tachometer will damage the transistor and diodes inside.
2. When removing or installing the tachometer, be careful not to drop it or subject it to severe shock.

Revolution(rpm)	1,000	2,000	3,000
Tolerance(rpm)	±120	±140	±170
Revolution(rpm)	4,000	5,000	6,000
Tolerance(rpm)	±170	±200	±200

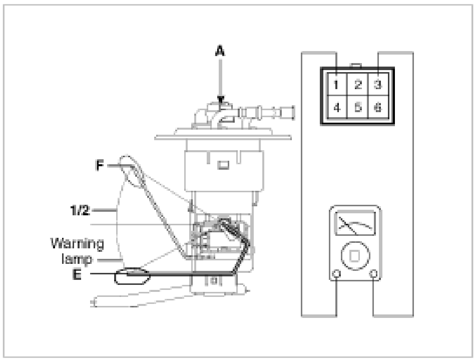
FUEL GAUGE

1. Disconnect the fuel sender connector from the fuel sender.
2. Connect a 3.4 watt, 12V test bulb to terminals 1 and 3 on the wire harness side connector.
3. Turn the ignition switch to the ON, and then check that the bulb lights up and the fuel gauge needle moves to full.



MAIN FUEL GAUGE SENDER

1. Using an ohmmeter, measure the resistance between terminals 1 and 3 of sender connector (A) at each float level.



2. Also check that the resistance changes smoothly when the float is moved from "E" to "F"

Position	Resistance(Ω)
Sender (E)	184 ± 2
Warning lamp	170 ± 2
1/2	66 ± 2
Sender (F)	15 ± 2

3. If the height resistance is unsatisfactory, replace the fuel sender as an assembly.

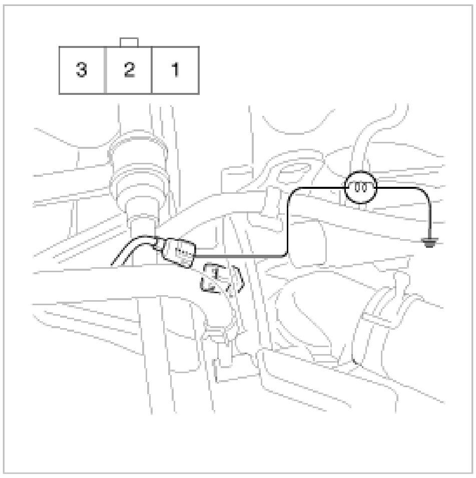
CAUTION

After completing this test, wipe the sender dry and reinstall it in the fuel tank.

ENGINE COOLANT TEMPERATURE GAUGE

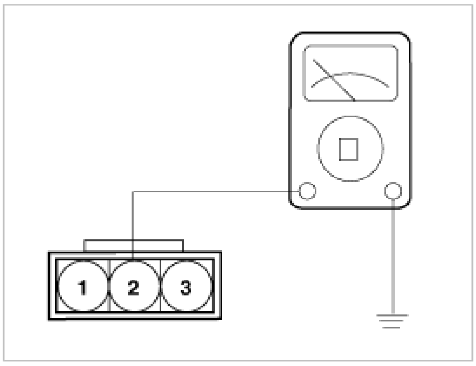
1. Disconnect the wiring connector (A) from the engine coolant temperature sender in the engine compartment.
2. Turn the ignition switch ON. Check that the gauge needle indicates cool. Turn the ignition switch OFF.

3. Connect a 12V, 3.4 wattages test bulb between the harness side connector and ground.
4. Turn the ignition switch ON.
5. Verify that the test bulb flashes and that the indicator moves to HOT.
   If operation is not as specified, replace the engine coolant temperature gauge. Then recheck the system.



ENGINE COOLANT TEMPERATURE SENDER

1. Using an ohmmeter, measure the resistance between the terminal 2 and ground.

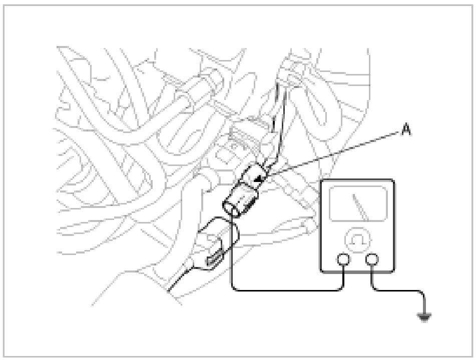


2. If the resistance value is not as shown in the table, replace the temperature sender.

Temperature [°F(°C)]	140(60)	185(85)	230(110)	257(125)
Gauge angle (°)	0	33	33	75
Resistance (Ω)	142±1	58±1	26±1	17.5±1

OIL PRESSURE SWITCH

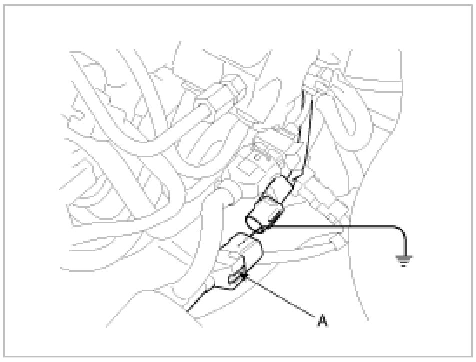
1. Check that there is continuity between the oil press switch terminal (A) and ground with the engine off.
2. Check that there is no continuity between the terminal and ground with the engine running.
3. If operation is not as specified, replace the switch.



OIL PRESSURE WARNING LAMP

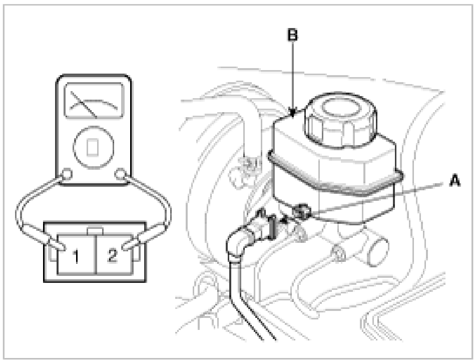
1. Disconnect the connector (A) from the warning switch and ground the terminal on the wire harness side connector.

2. Turn the ignition switch ON. Check that the warning lamp lights up. If the warning lamp doesn't light, test the bulb or inspect the wire harness.



BRAKE FLUID LEVEL WARNING SWITCH

1. Remove the connector(A) from the switch located at the brake fluid reservoir(B).
2. Verify that continuity exists between switch terminals 1 and 2 while pressing the switch (float) down with a rod.



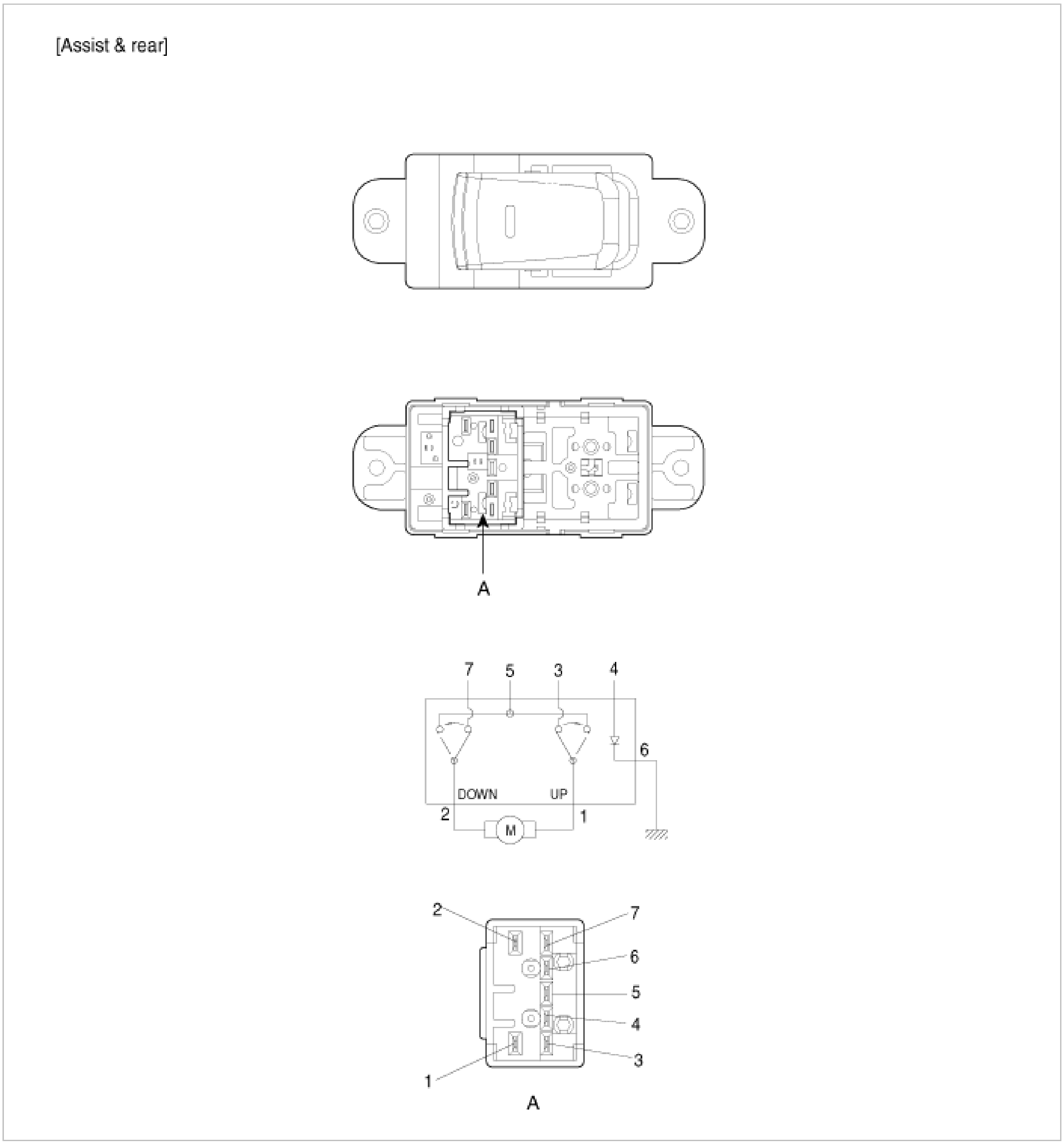
BRAKE FLUID LEVEL WARNING LAMP

1. Ignition "ON"
2. Release the parking brake.
3. Remove the connector from the brake fluid level warning switch.
4. Ground the connector at the harness side.
5. Verify that the warning lamp lights.

PARKING BRAKE SWITCH

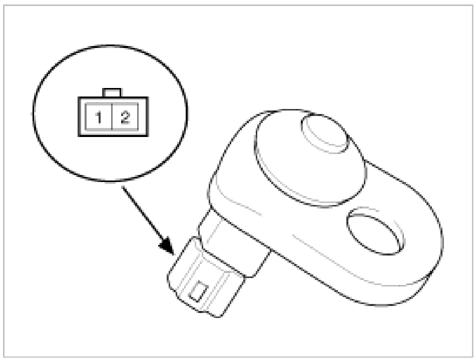
The parking brake switch (A) is a pulling type. It is located under the parking brake lever. To adjust, move the switch mount up and down with the parking brake lever released all the way.

1. Check that there is continuity between the terminal and switch body with the switch ON (Lever is pulled).
2. Check that there is no continuity between the terminal and switch body with the switch OFF (Lever is released).
   If continuity is not as specified, replace the switch or inspect its ground connection.



DOOR SWITCH

Remove the door switch and check for continuity between the terminals.



[FRONT DOOR SWITCH]

Terminal / Position	1	2	Body (Ground)
Free(Door open)	○	○	○
Push(Door close)			

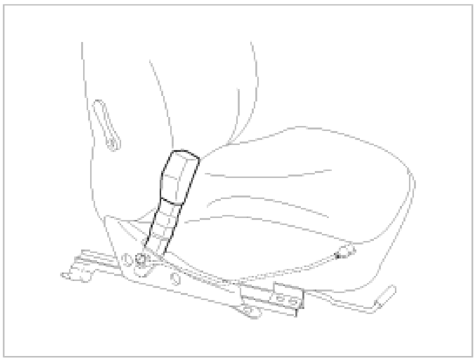
[REAR DOOR SWITCH]

Terminal / Position	1	Ground
Free(Door open)	○	○
Push(Door close)		

SEAT BELT SWITCH

1. Remove the connector from the switch.
2. Check for continuity between terminals.

Seat belt condition	Continuity
Fastened	Non-conductive (∞Ω)
Not fastened	Conductive (Ω)



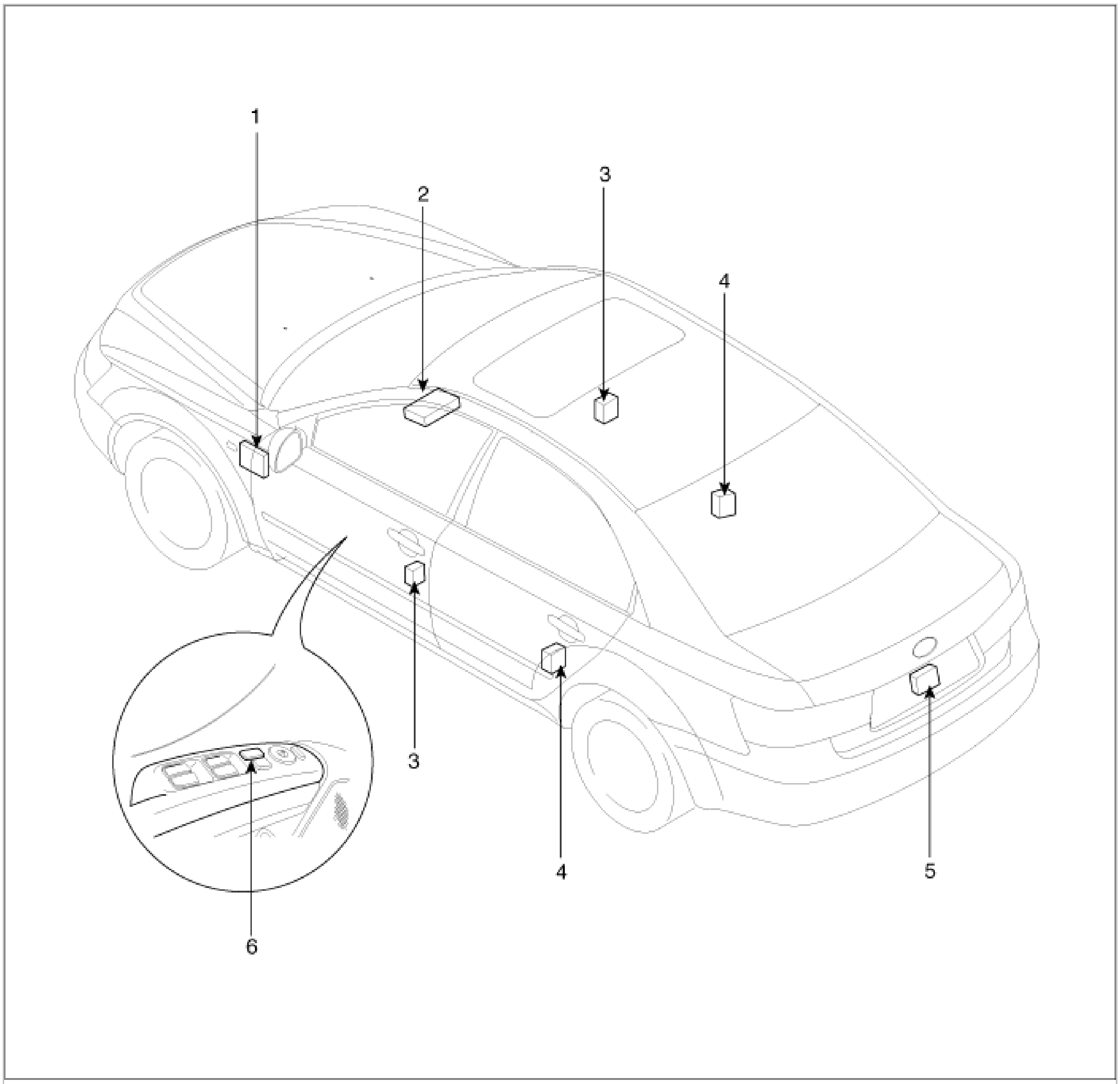
SEAT BELT WARNING LAMP

With the ignition switch turned ON, verify that the lamp glows.

Seat belt condition	Warning lamp
Fastened	OFF
Not fastened	ON

Body Electrical System > Power Door Locks > Components and Components Location

COMPONENT LOCATION

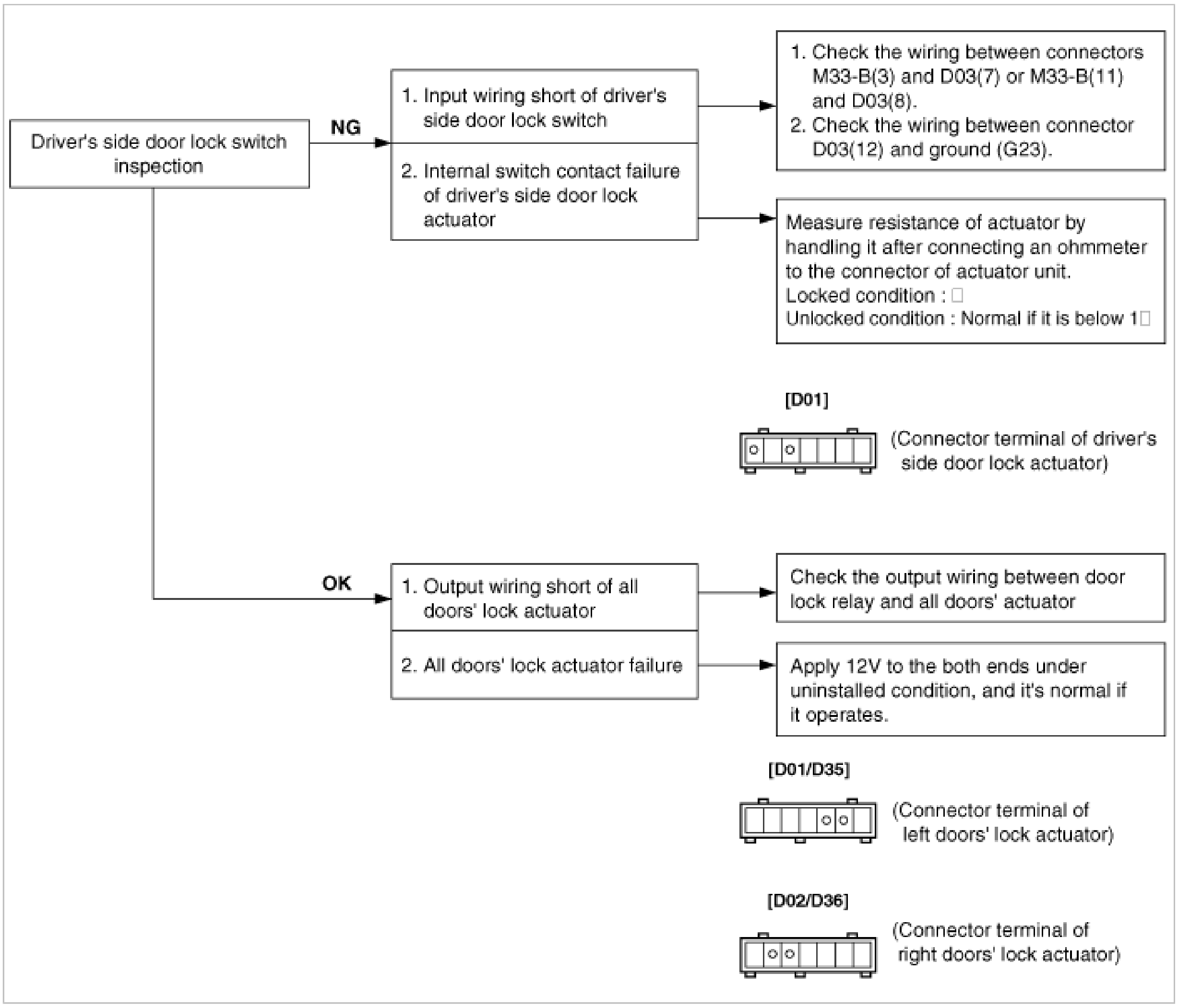


1. Junction box (Door lock/unlock relay)
2. Body control box
3. Front door lock actuator & switch
4. Rear door lock actuator & switch
5. Trunk lid release actuator
6. Door lock switch

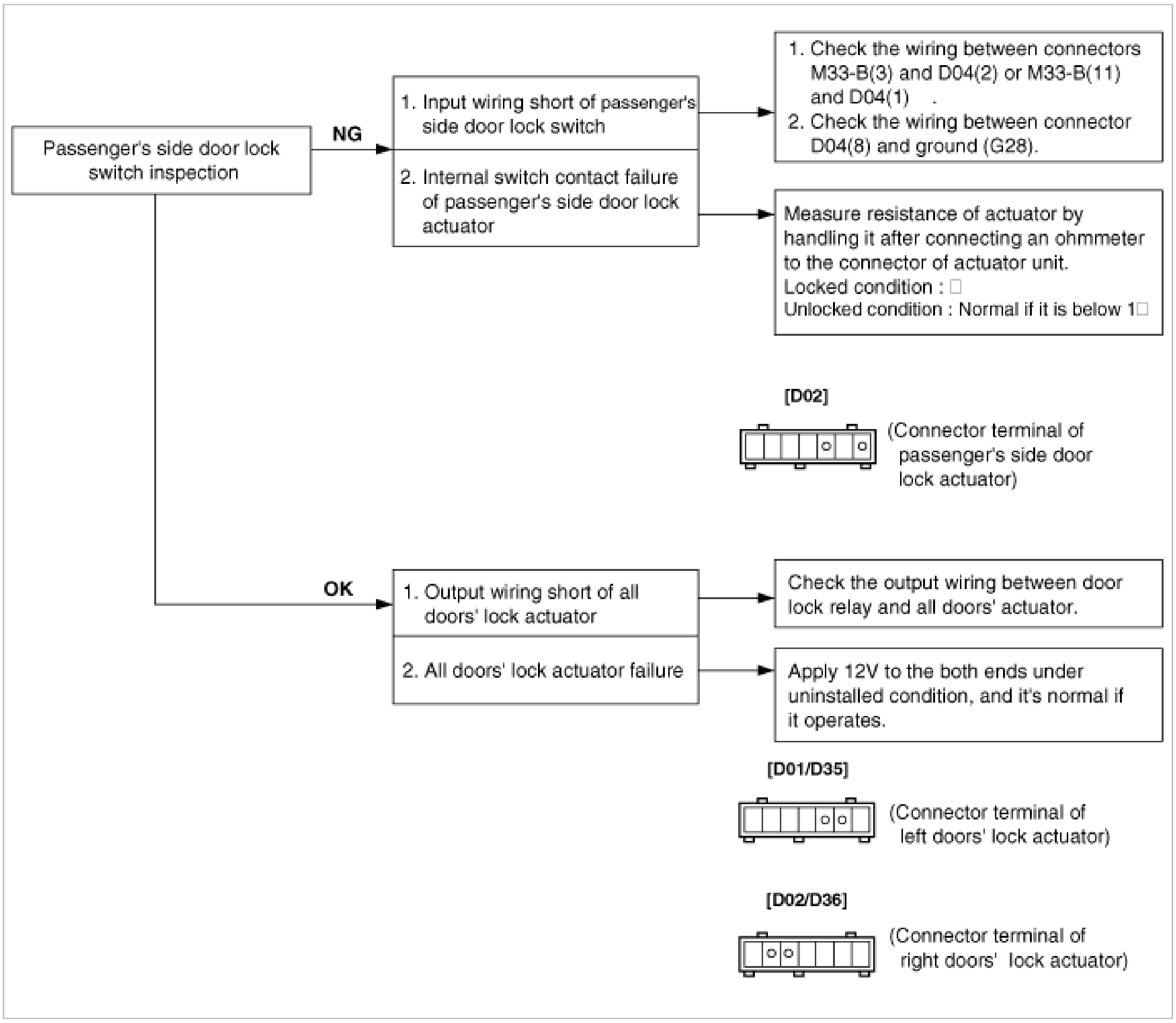
Body Electrical System > Power Door Locks > Troubleshooting

TROUBLESHOOTING

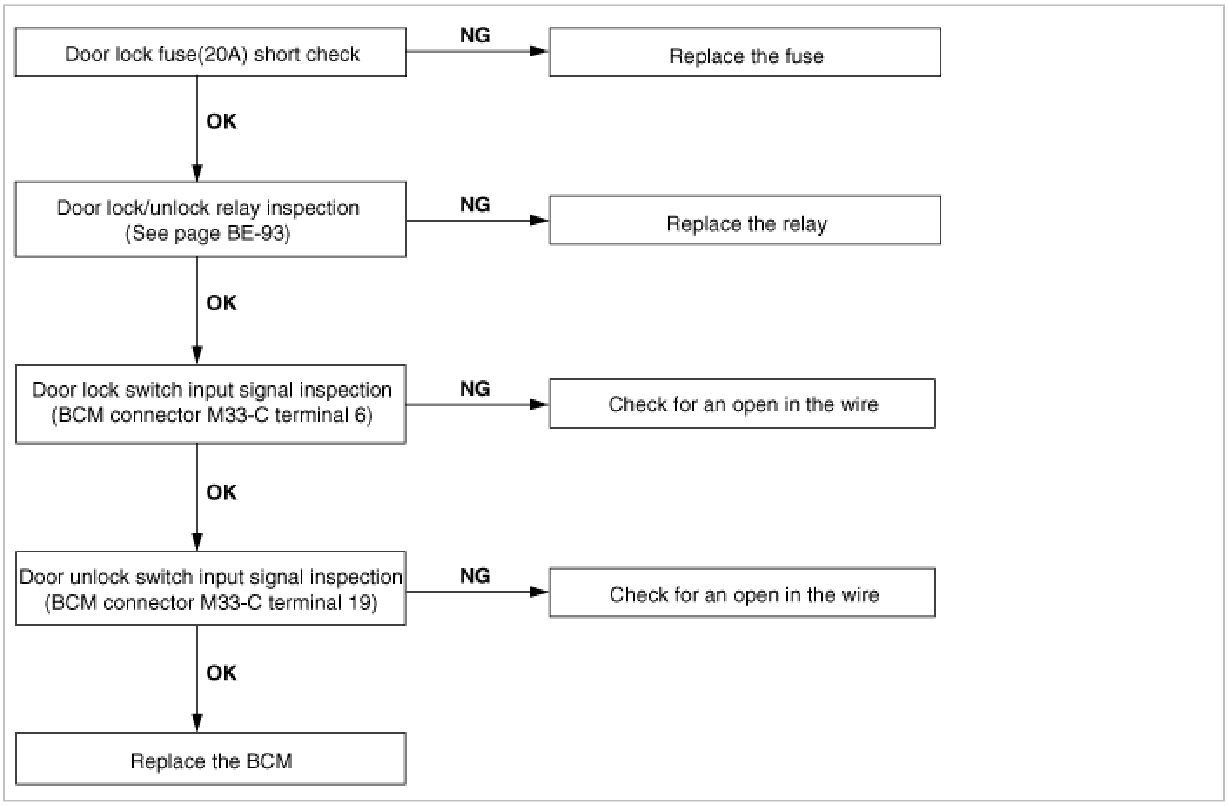
1. Lock function works but unlock function does not work. → Since door unlock relay is malfunction, replace the door unlock relay.
2. Unlock function works but lock function does not work. → Since door lock relay is malfunction, replace the door lock relay.
3. When passenger side knob is controlled, all doors locks, but when driver side knob is controlled, all doors do not lock.



4. When driver side knob is controlled. All doors lock. But when the passenger side knob is controlled, all doors do not lock.



5. Both sides do not lock either.

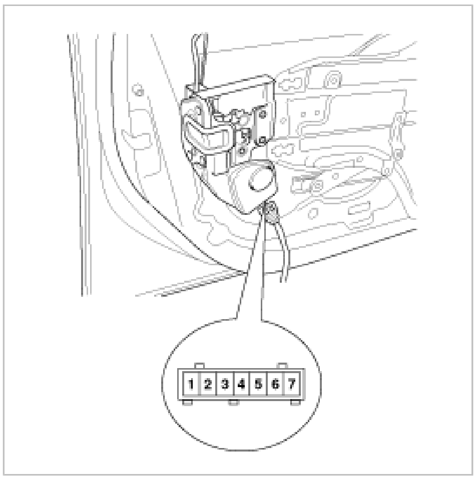


Body Electrical System > Power Door Locks > Power Door Lock Actuators > Repair procedures

INSPECTION

FRONT DOOR LOCK ACTUATOR INSPECTION

1. Remove the front door trim panel. (Refer to the Body group - front door)
2. Disconnect the 7P connector from the actuator.

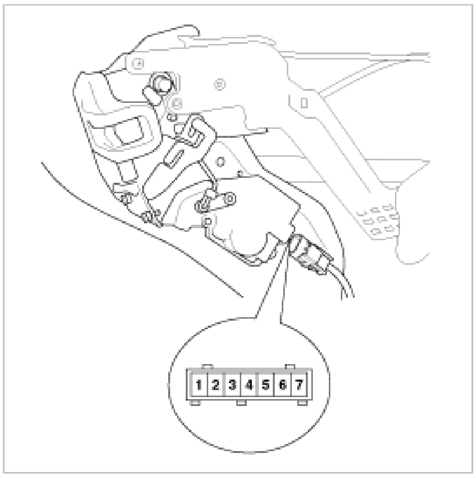


3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal		5	3	6	2
Front left	Lock	⊕		⊖	
	Unlock	⊖		⊕	
Front right	Lock		⊕		⊖
	Unlock		⊖		⊕

REAR DOOR LOCK ACTUATOR INSPECTION

1. Remove the rear door trim panel. (Refer to the Body group - rear door)
2. Disconnect the 7P connector from the actuator.

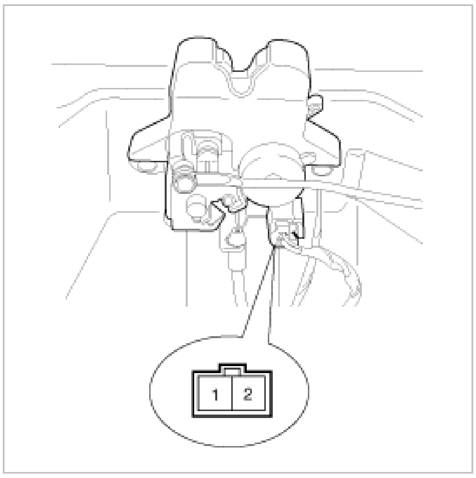


3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal		5	3	6	2
Rear left	Lock	⊕		⊖	
	Unlock	⊖		⊕	
Rear right	Lock		⊕		⊖
	Unlock		⊖		⊕

TRUNK LID RELEASE ACTUATOR INSPECTION

1. Remove the trunk lid trim panel. (Refer to the Body group - trunk lid)
2. Disconnect the 2P connector from the actuator.

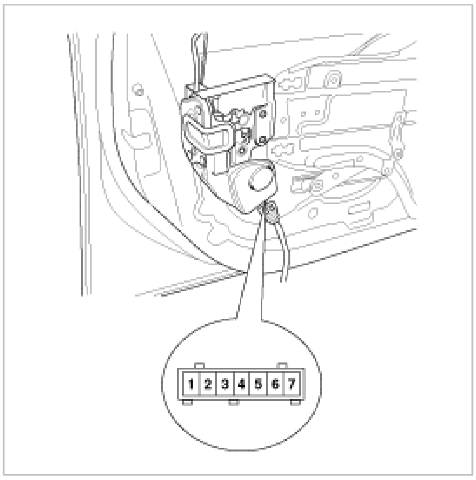


3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal	2	Chassis ground
Open	⊕	⊖

FRONT DOOR LOCK SWITCH INSPECTION

1. Remove the front door trim panel. (Refer to the Body group - front door)
2. Disconnect the 7P connector from the actuator.

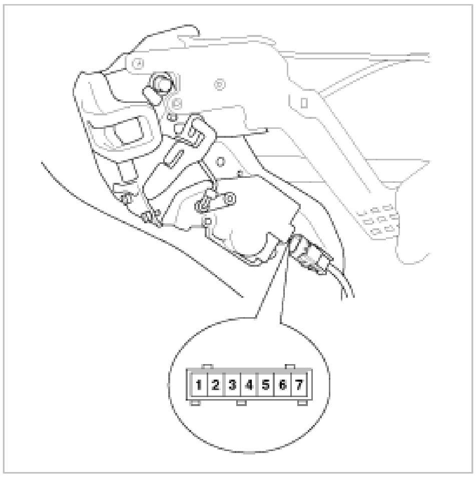


3. Check for continuity between the terminals in each switch position according to the table.

Position \ Terminal		1	5	3	7
Front left	Lock				
	Unlock	○	―	○	
Front right	Lock				
	Unlock		○	―	○

REAR DOOR LOCK SWITCH INSPECTION

1. Remove the rear door trim panel. (Refer to the Body group - rear door)
2. Disconnect the 7P connector from the actuator.

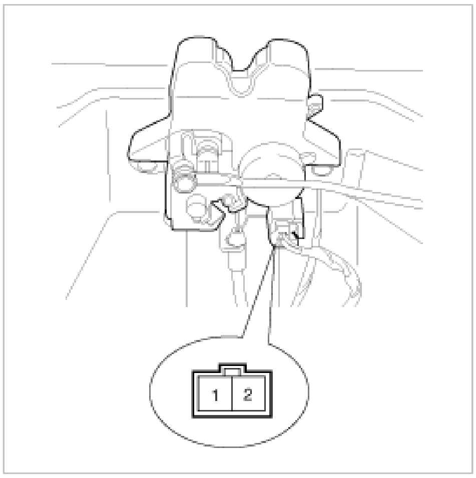


3. Check for continuity between the terminals in each switch position according to the table.

Position \ Terminal		1	5	3	7
Rear left	Lock				
	Unlock	○		○	
Rear right	Lock				
	Unlock		○		○

TRANK LID OPEN SWITCH INSPECTION

1. Remove the trunk lid trim panel. (Refer to the Body group - trunk lid)
2. Disconnect the 2P connector from the actuator.



3. Check for continuity between the terminals in each switch position according to the table.

Position \ Terminal	1	Chassis ground
Open	⊕	⊖

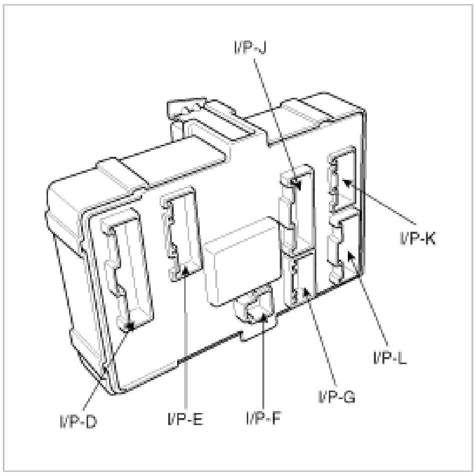
Body Electrical System > Power Door Locks > Power Door Lock Relay > Repair procedures

INSPECTION

1. Disconnect the negative (-) battery terminal.
2. Remove the junction box.
3. Check for continuity between the terminals.

DOOR LOCK

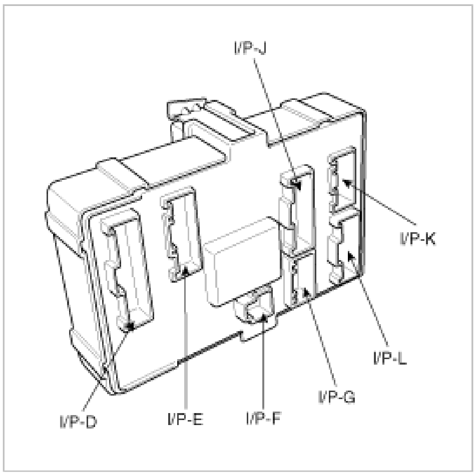
1. There should be continuity between the No.12 and No.9 terminals in the I/P-D when power and ground are connected to the No.12 terminal in the I/P-E and No.9 terminal in the I/P-D.
2. There should be no continuity between the No.12 terminal in the I/P-E and No.9 terminal in the I/P-D when power is disconnected.



Position \ Terminal	I/P-K (9)	I/P-A (15)	I/P-D (16)	I/P-B (13)
Disconnected			○	○
Connected	○	○	⊖	⊕

DOOR UNLOCK

1. There should be continuity between the No.3 terminal in the I/P-E and No.9 terminal in the I/P-D when power and ground are connected to the No.11 terminal in the I/P-E and No.9 terminal in the I/P-D.
2. There should be no continuity between the No.11 terminal in the I/P-E and No.9 terminal in the I/P-D when power is disconnected.



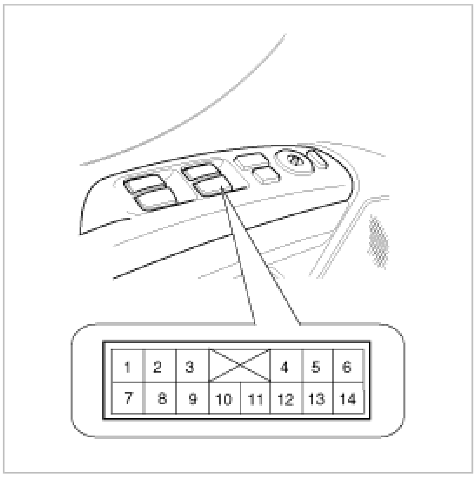
Power \ Terminal	I/P-D (9)	I/P-E (11)	I/P-E (3)	I/P-D (9)
Disconnected			○	○
Connected	○	○	⊖	⊕

Body Electrical System > Power Door Locks > Power Door Lock Switch > Repair procedures

INSPECTION

DRIVER DOOR LOCK SWITCH INSPECTION

1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim panel. (Refer to the Body group - front door)
3. Disconnect the 14P connector from the switch.

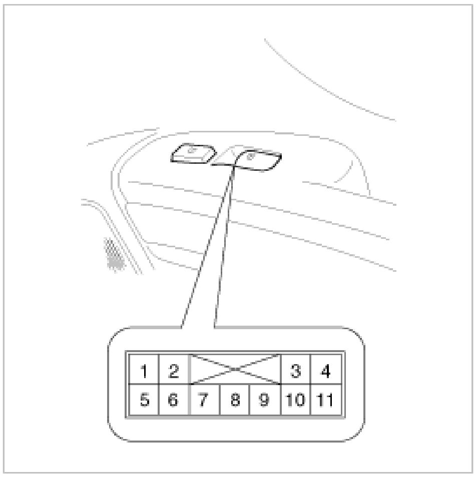


4. Check for continuity between the terminals in each switch position according to the table.

Terminal / Position	8	12	7
Lock		O	O
Unlock	O	O	

ASSIST DOOR LOCK SWITCH INSPECTION

1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim panel. (Refer to the Body group - front door)
3. Disconnect the 11P connector from the switch.

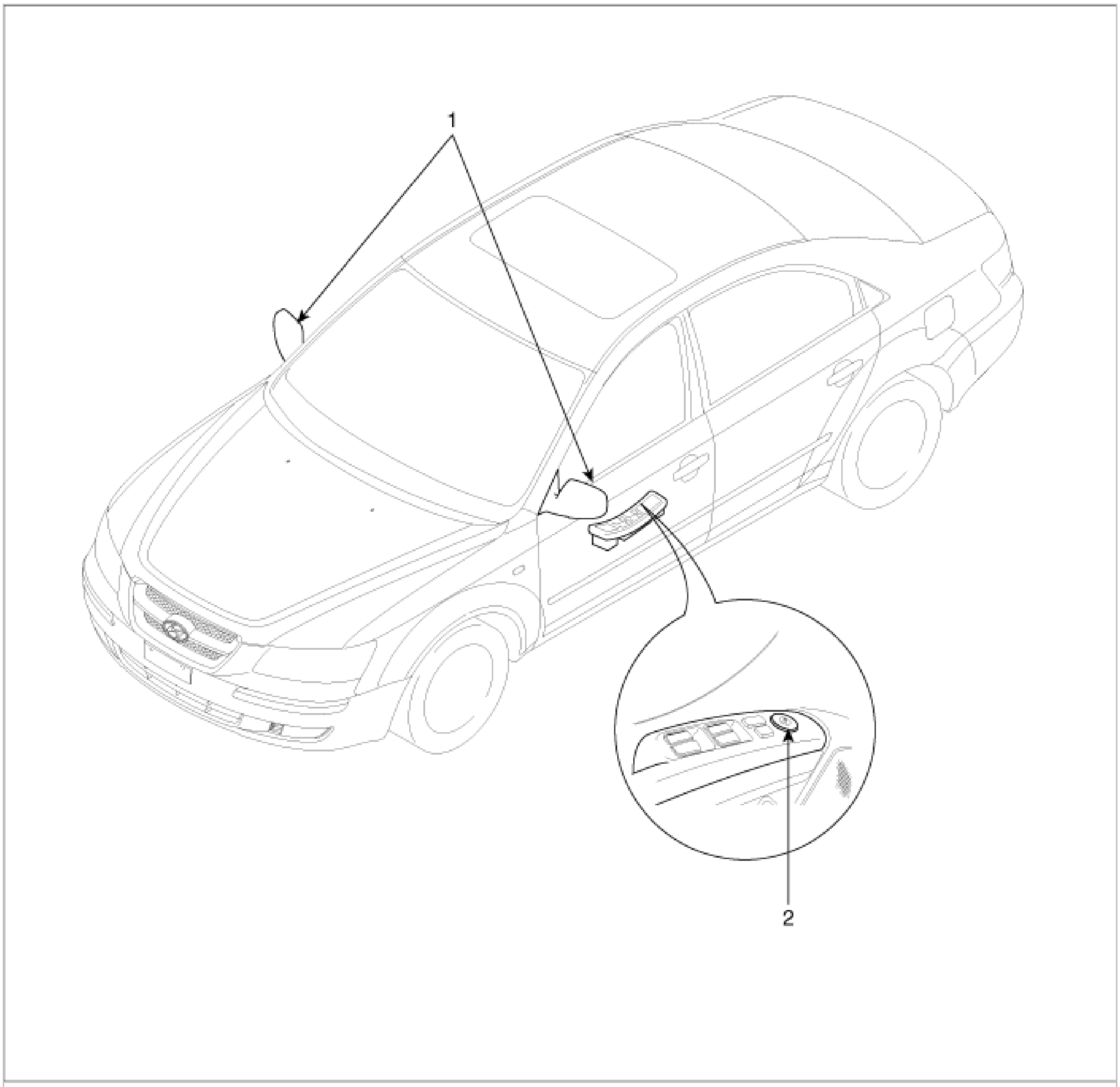


4. Check for continuity between the terminals in each switch position according to the table.

Terminal / Position	1	2	8
Lock		O	O
Unlock	O		O

Body Electrical System > Power Door Mirrors > Components and Components Location

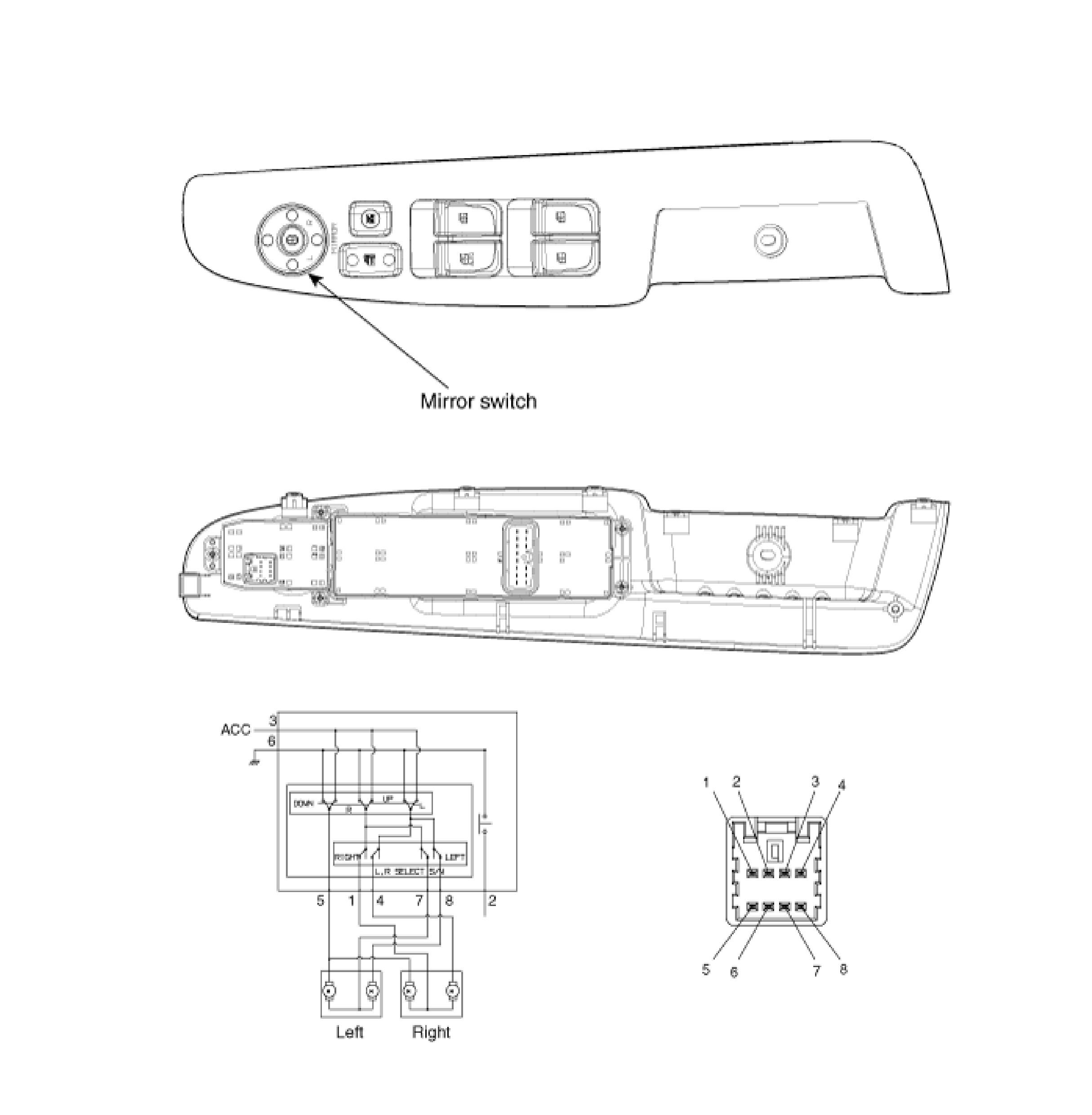
COMPONENT LOCATION



1. Power door mirror 2. Power door mirror switch

Body Electrical System > Power Door Mirrors > Power out side mirror switch > Components and Components Location

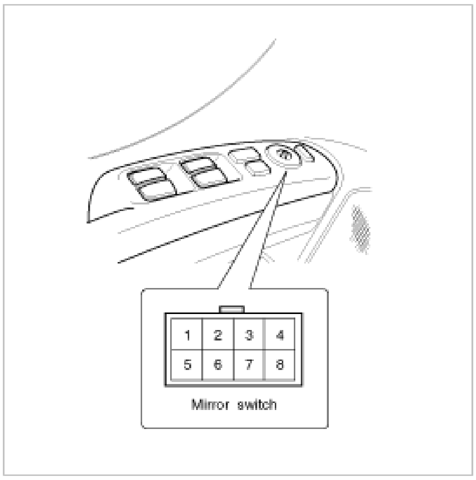
CIRCUIT DIAGRAM



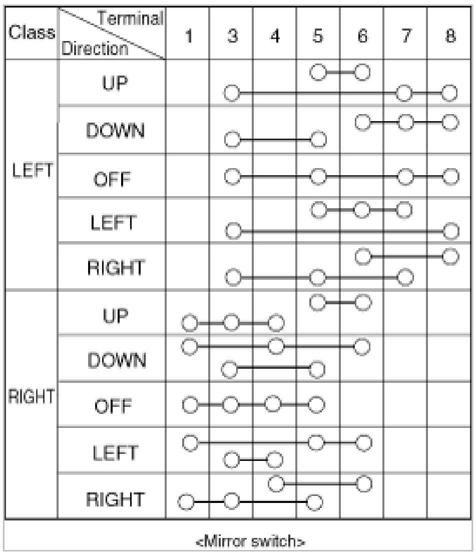
Body Electrical System > Power Door Mirrors > Power out side mirror switch > Repair procedures

INSPECTION

1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim panel. (Refer to the Body group-front door)
3. Disconnect the 8P connector from the switch.



4. Check for continuity between the terminals in each switch position according to the table.



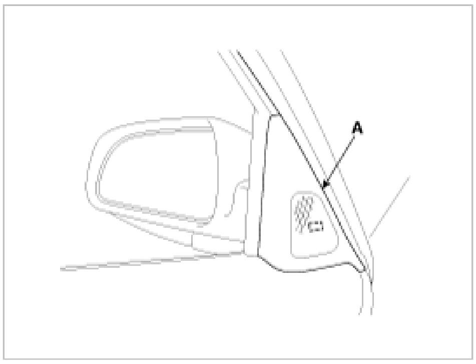
Class	Terminal / Direction	1	3	4	5	6	7	8
LEFT	UP		○		○	○	○	○
	DOWN		○		○	○	○	○
	OFF		○		○		○	○
	LEFT		○		○	○	○	○
	RIGHT		○		○	○	○	○
RIGHT	UP	○	○	○	○	○		
	DOWN	○	○	○	○	○		
	OFF	○	○	○	○			
	LEFT	○	○	○	○	○		
	RIGHT	○	○	○	○	○		

<Mirror switch>

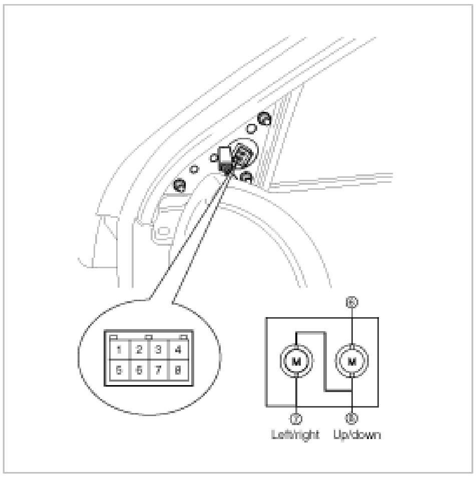
Body Electrical System > Power Door Mirrors > Power Door Mirror Actuator > Repair procedures

INSPECTION

1. Remove the front door quadrant inner cover (A) (Refer to the Body group - front door)



2. Disconnect the power door mirror connector from the harness.
3. Apply battery voltage to each terminal as shown in the table and verify that the mirror operates properly.



Terminal / Position	6	7	8
UP	⊖	⊕	⊕
DOWN	⊕	⊖	⊖
OFF	⊕	⊕	⊕
LEFT	⊖	⊕	⊖
RIGHT	⊕	⊖	⊕

MIRROR HEATER INSPECTION

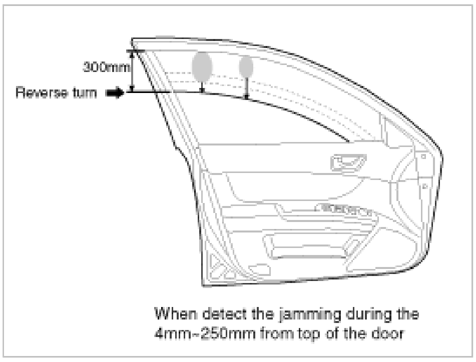
Terminal / Position	1	2
Heater	○—	—○

Body Electrical System > Power Windows > Description and Operation

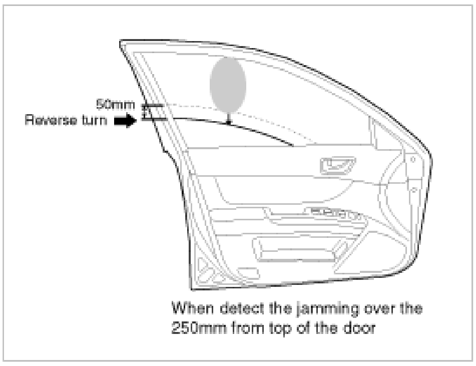
FUNCTION OF SAFETY POWER WINDOW

When driver door power window auto-up switch is operated, safety function is activated.

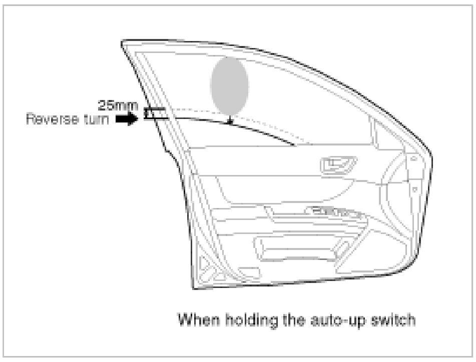
1. Safety function condition
   When detect the force of 100N during the window rising, window is reversed.
2. Length of window reversing (except holding the auto-up switch)
   A. When detect the jamming during the 4mm ~ 250mm from top of the door.
      → Window is reversed until 300mm from top of the door.



   B. When detect the jamming over the 250mm from top of the door.
      → Window is reversed until 50mm from jamming position.



3. Length of window reversing (holding the auto-up switch)
   A. When detect the jamming during holding the auto-up switch.
      → Window is reversed until 25mm from jamming position.
   B. Auto-up function is not available during the 5 seconds from above condition.
      → When holding the auto-up switch, window is operated as a manual-up function. (Safety function is not activated.)
   C. When holding the auto-up switch after 5 seconds from above condition.
      → Window is reverse until 25mm from jamming position.



4. Safety function is not available area
   Safety function is not available during the 4mm from top of the door.

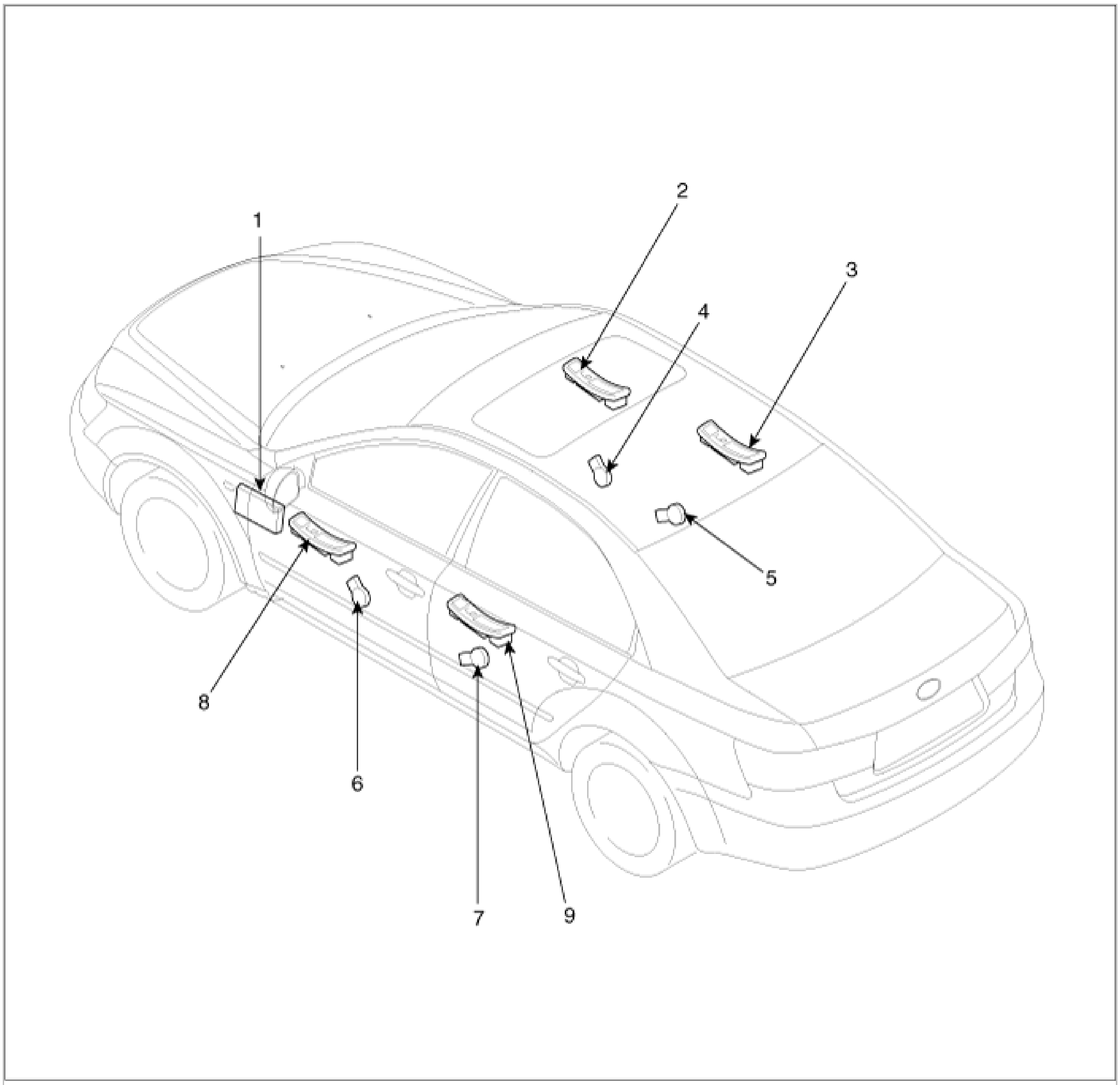
INITIALIZING METHOD OF THE SAFETY POWER WINDOW

1. Initializing of Battery Connection
   When the battery is not connected the vehicle over the 5 minutes, safety power window switch need the initializing.
   (1) Power window operation before initializing
      A. Manual-Up/Down function is available
      B. Auto-Up function is not available
         (When holding the auto-up/down switch, window is operated as a manual-up/down.)
   (2) Initializing method
      Close the window in window open position, and holding the switch in window full close position over the 0.2 second.
      (If start the closing the window in window full close position, initializing could be failed.)
   (3) If initialize the safety power window in jamming status, could occur below conditions.
      A. Safety function is not available

2. Initializing of fail safe mode
   (1) If the window moved by compulsion and motor have a problem, power window switch could be entering the fail safe mode for user's safety.
   (2) Power window operation in fail mode
      A. Auto/Manual-Down function is available
      B. Auto/Manual-Up function is not available
         (When auto/manual-up is operated, window is rising 20mm and is stopped the moving.)

Body Electrical System > Power Windows > Components and Components Location

COMPONENT LOCATION

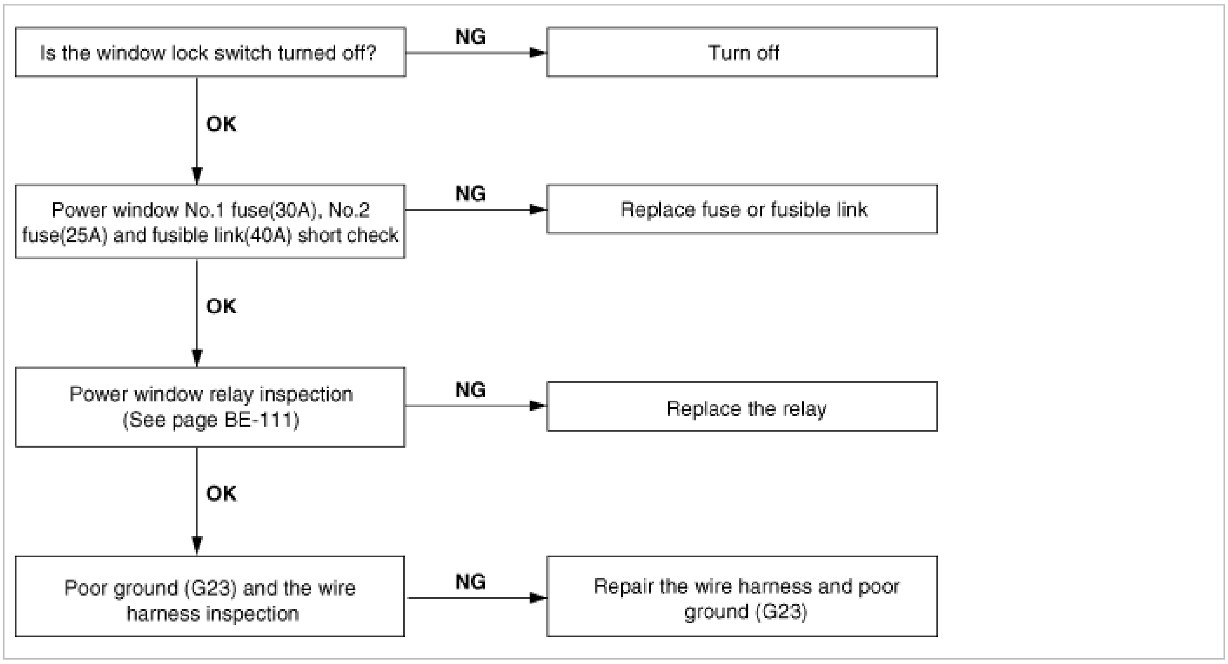


1. Passenger compartment junction box (Power window relay)	5. Rear window motor
2. Assist window switch	6. Front window motor (Safety window)
3. Rear window switch	7. Rear window motor
4. Front window motor	8. Driver window main switch
	9. Rear window switch

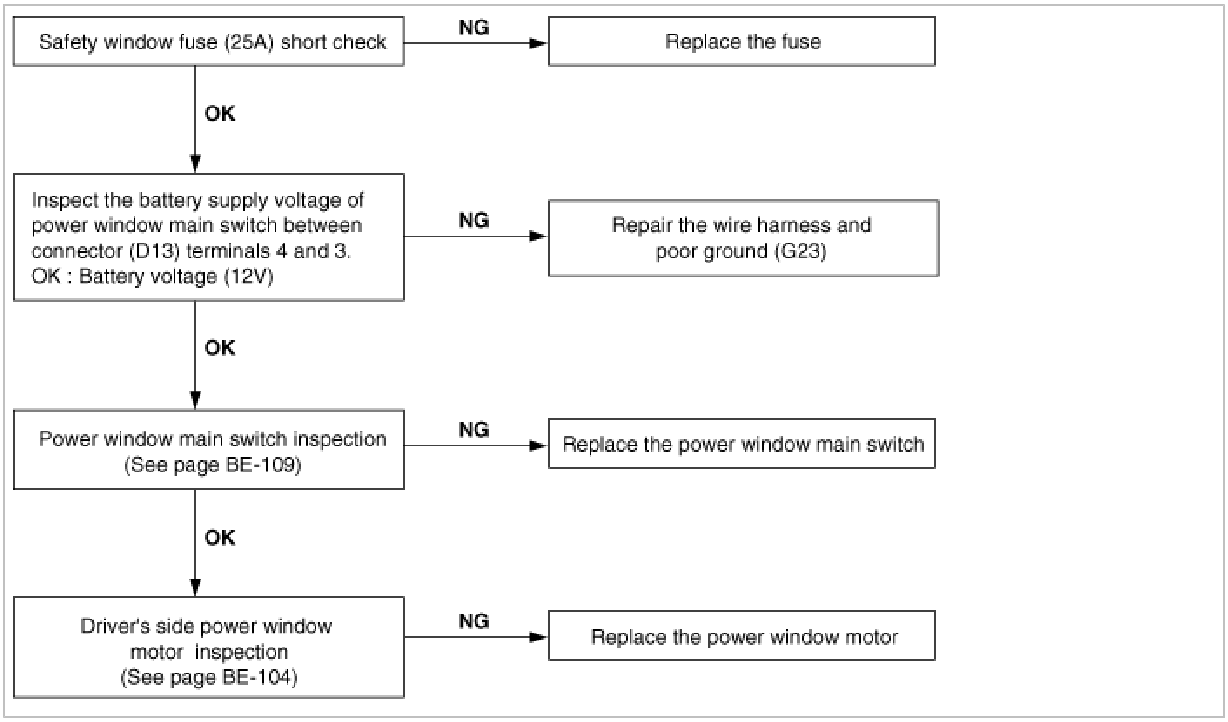
Body Electrical System > Power Windows > Troubleshooting

TROUBLESHOOTING

1. No windows operate from the main switch on the driver's door.



2. Driver's side window does not operate.



3. Passenger's side window does not operate.

Inspect the battery supply voltage of passenger's side power window switch between connector (D04) terminal 4 and 10/6.
OK : Battery voltage (12V)
→ NG → Repair the wire harness and poor ground (G23)

↓ OK

Passenger's side power window switch inspection (See page BE-109)
→ NG → Replace the power window switch

↓ OK

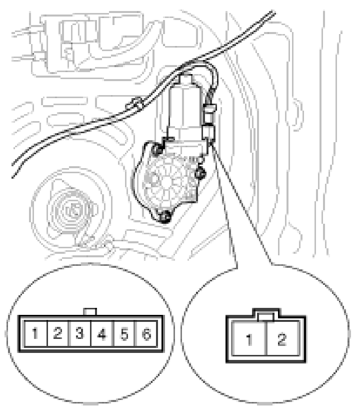
Passenger's side power window motor inspection (See page BE-104)
→ NG → Replace the power window motor

Body Electrical System > Power Windows > Power Window Motor > Repair procedures

INSPECTION

FRONT POWER WINDOW MOTOR INSPECTION

1. Remove the front door trim panel. (Refer to the Body group-front door)
2. Disconnect the connector from the motor.



[Safety power window]

3. Connect the motor terminals directly to battery voltage (12V) and check that the motor operates smoothly. Next, reverse the polarity and check that the motor operates smoothly in the reverse direction. If the operation is abnormal, replace the motor.

Position \ Terminal			1	2
LH	UP	Clockwise	⊖	⊕
	DOWN	Counter-clockwise	⊕	⊖
RH	DOWN	Clockwise	⊕	⊖
	UP	Counter-clockwise	⊖	⊕

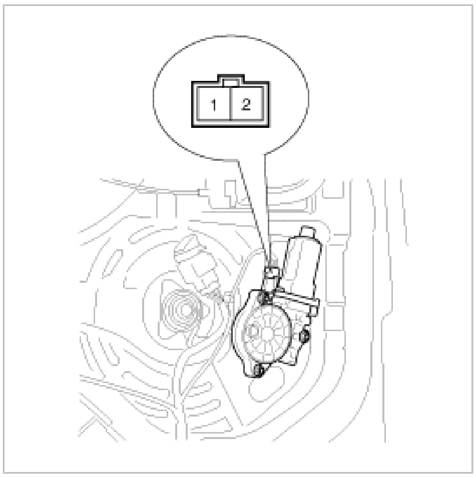
[With driver's side safety window]

Position \ Terminal			1	2	3	4	6
Driver's side	UP	Clockwise		⊕	⊖	⊕	⊖
	DOWN	Counter-clockwise	⊕		⊖	⊕	⊖

REAR POWER WINDOW MOTOR INSPECTION

1. Remove the rear door trim panel. (Refer to the Body group-rear door)

2. Disconnect the 2P connector from the motor.

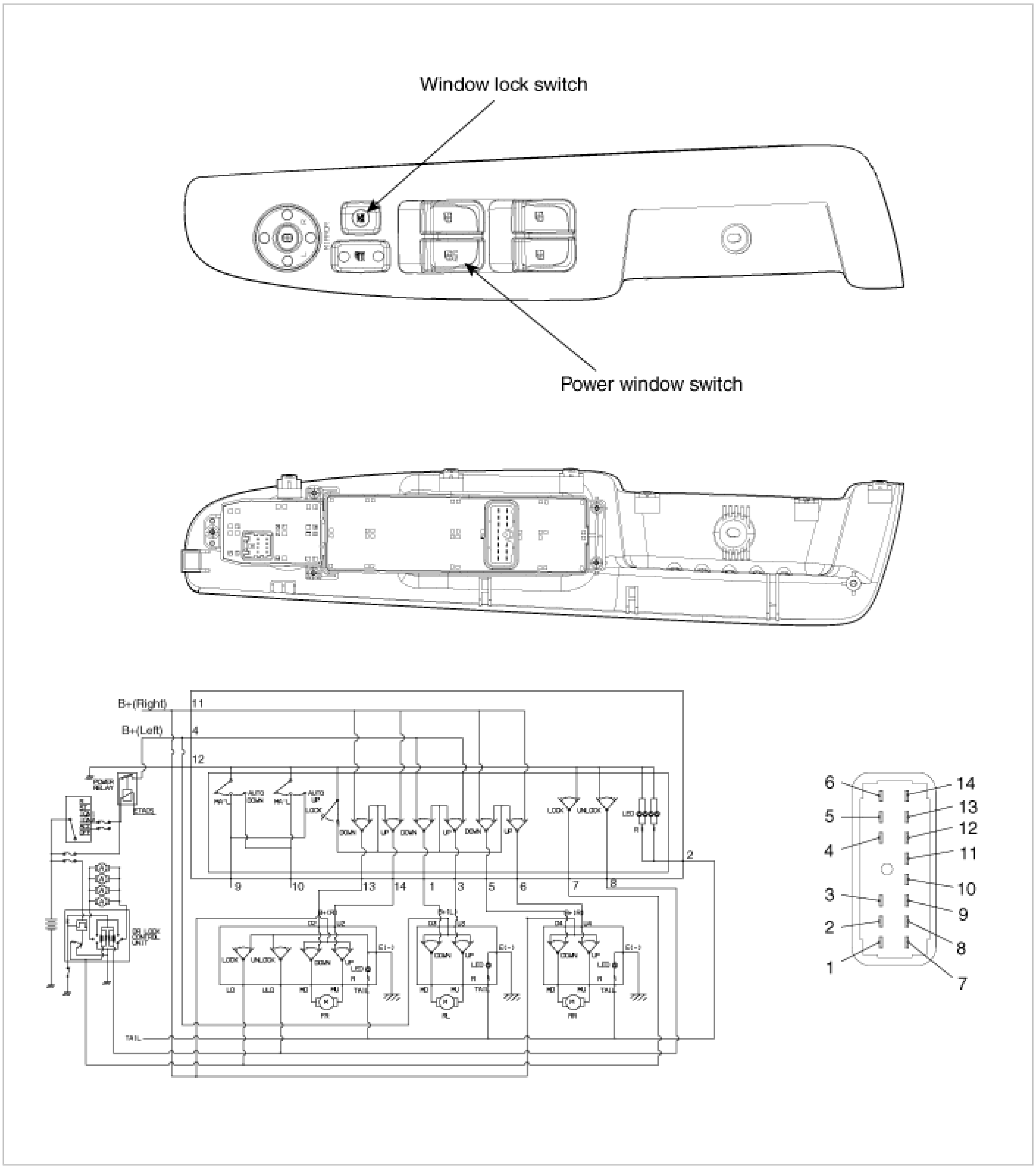


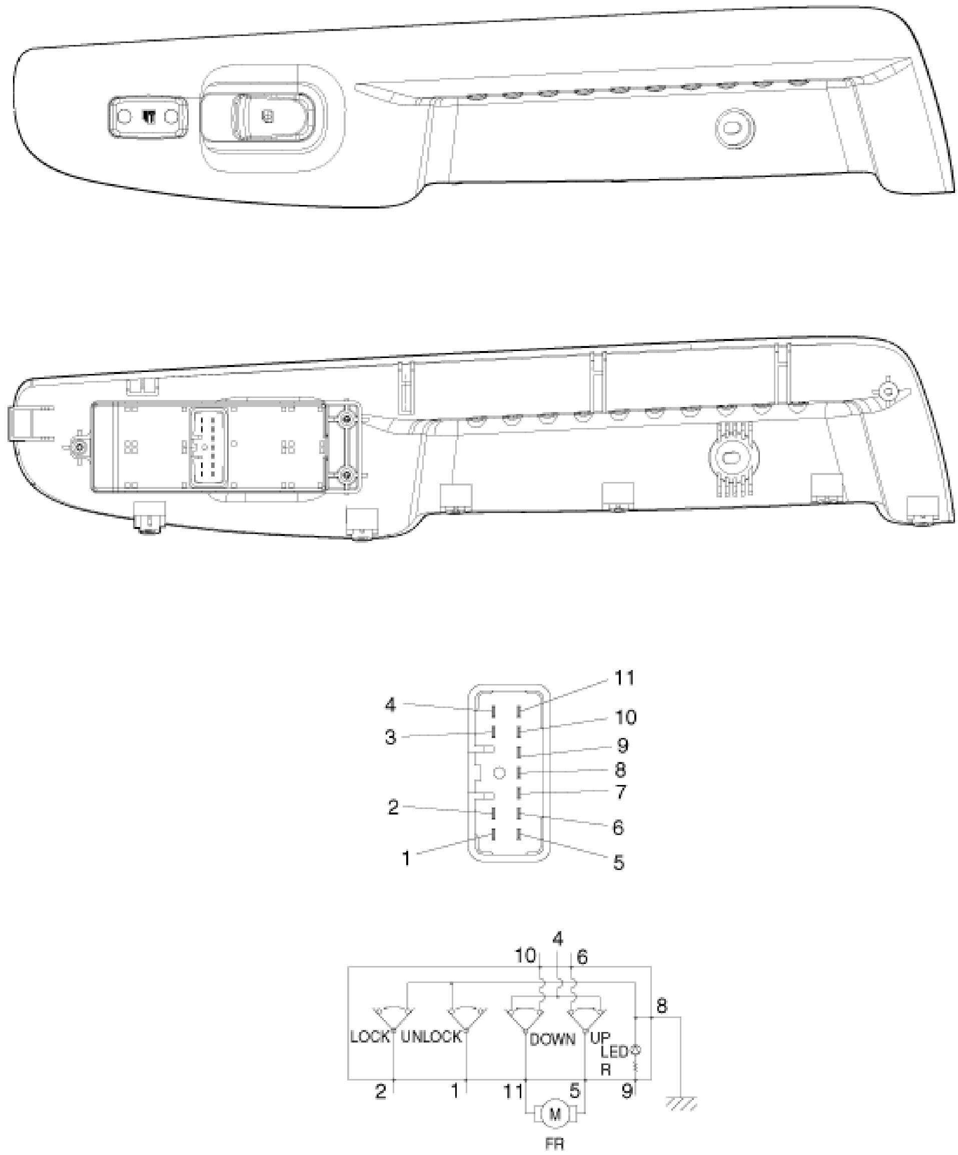
3. Connect the motor terminals directly to battery voltage (12V) and check that the motor operates smoothly. Next, reverse the polarity and check that the motor operates smoothly in the reverse direction. If the operation is abnormal, replace the motor.

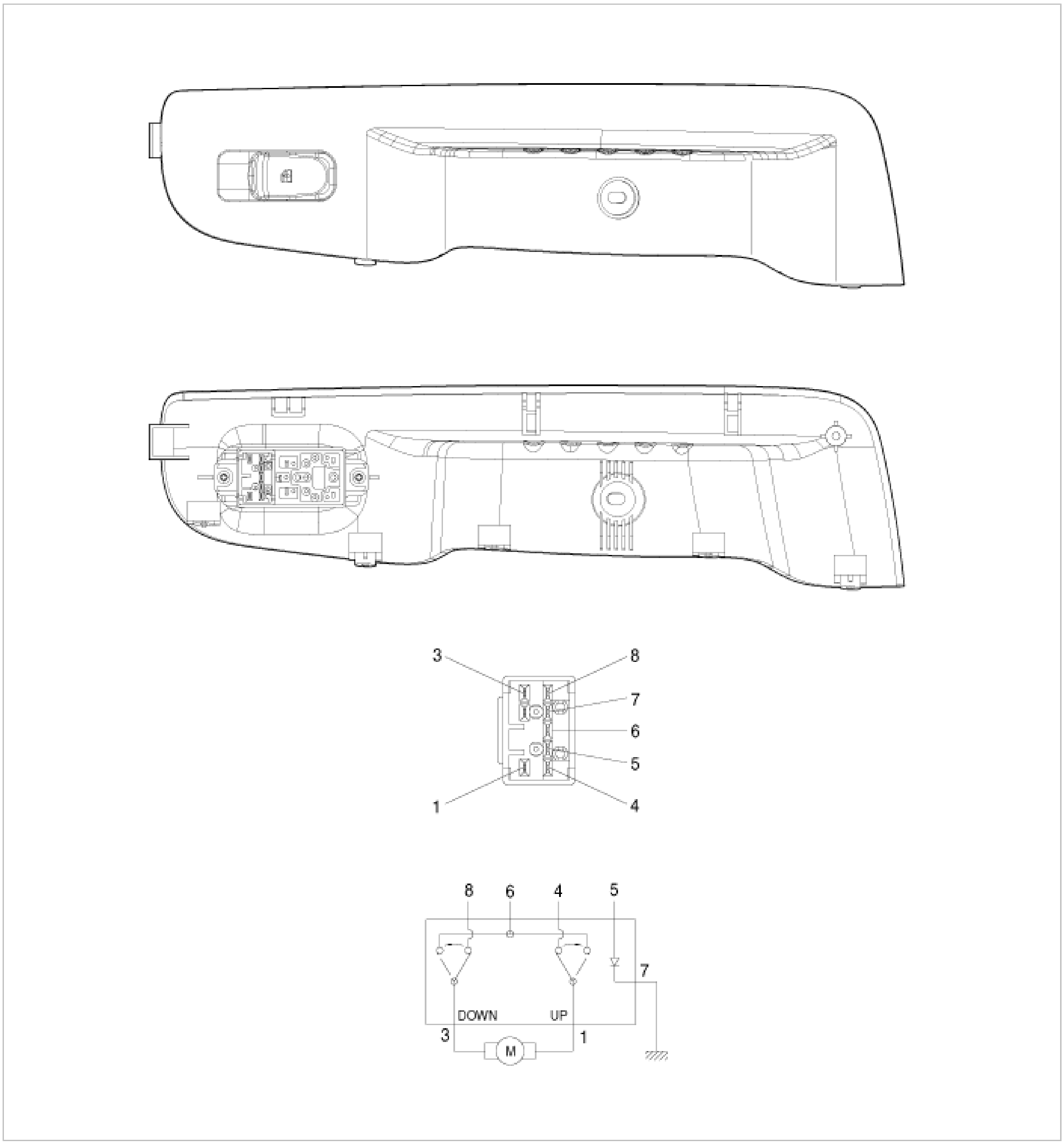
Position \ Terminal			1	2
LH	UP	Clockwise	⊖	⊕
	DOWN	Counter-clockwise	⊕	⊖
RH	DOWN	Clockwise	⊕	⊖
	UP	Counter-clockwise	⊖	⊕

Body Electrical System > Power Windows > Power Window Switch > Schematic Diagrams

CIRCUIT DIAGRAM


Window lock switch
Power window switch
B+(Right)
B+(Left)
11
4
12
9
10
13
14
1
3
5
6
7
8
2
6
5
4
3
2
1
14
13
12
11
10
9
8
7


4
3
2
1
11
10
9
8
7
6
5
10
4
6
8
LOCK
UNLOCK
DOWN
UP
LED
R
2
1
11
5
9
M
FR

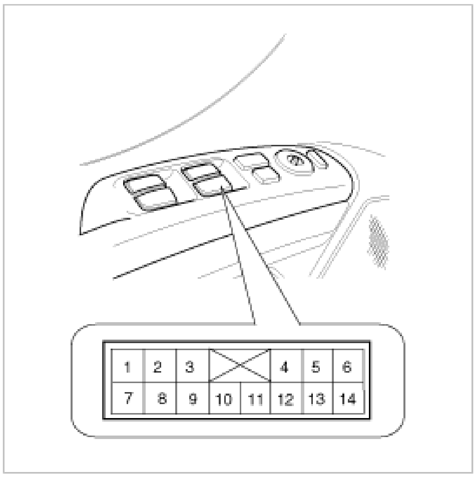


Body Electrical System > Power Windows > Power Window Switch > Repair procedures

INSPECTION

POWER WINDOW MAIN SWITCH INSPECTION

1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim panel. (Refer to the Body group - front door)
3. Disconnect the 14P connector from the switch.



4. Check for continuity between the terminals in each switch position according to the table. If the continuity condition is not normal, replace the switch.

Position \ Terminal	Front left 4	Front left 9	Front left 10	Front left 12	Front right 11	Front right 12	Front right 13	Front right 14
UP			O	O	O	O	O	O
OFF		O		O		O	O	O
DOWN	O	O	O	O	O	O	O	O

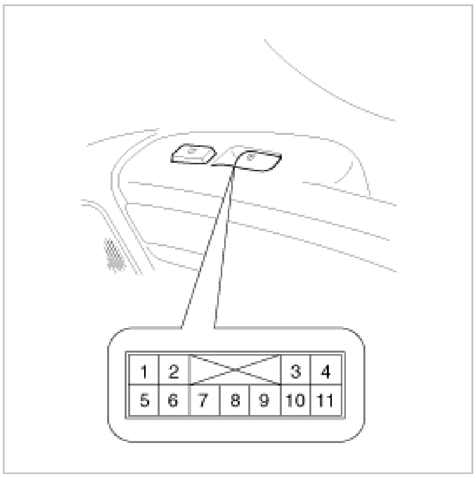
Position \ Terminal	Rear left 1	Rear left 3	Rear left 4	Rear left 12	Rear right 5	Rear right 6	Rear right 11	Rear right 12
UP	O	O	O	O	O	O	O	O
OFF	O	O		O	O	O		O
DOWN	O	O	O	O	O	O	O	O

POWER WINDOW LOCK SWITCH

Position \ Terminal	1	12
NORMAL	O	O
LOCK		

ASSIST POWER WINDOW SWITCH INSPECTION

1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim panel. (Refer to the Body group - front door)
3. Disconnect the 11P connector from the switch.

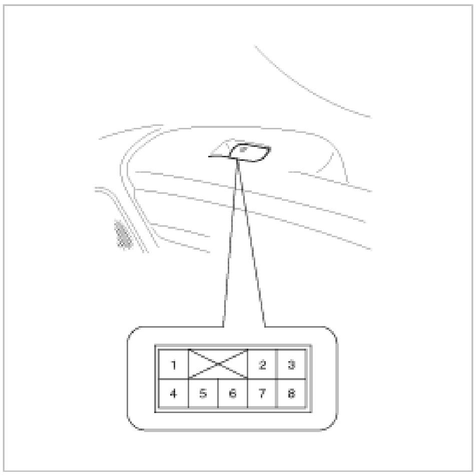


4. Check for continuity between the terminals in each switch position according to the table. If the continuity condition is not normal, replace the switch.

Position \ Terminal	4	5	6	10	11
UP	○	○		○	○
OFF		○	○	○	○
DOWN	○	○	○		○

REAR POWER WINDOW SWITCH INSPECTION

1. Disconnect the negative (-) battery terminal.
2. Remove the rear door trim panel. (Refer to the Body group - rear door)
3. Disconnect the 8P connector from the switch.



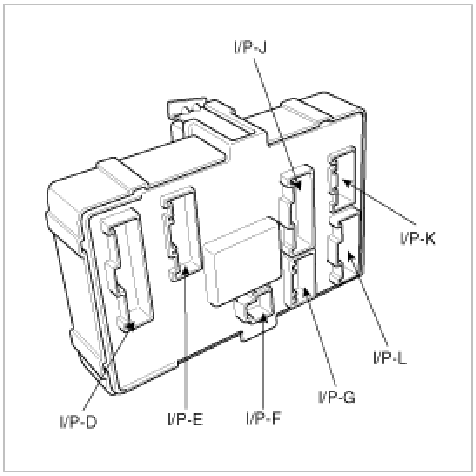
4. Check for continuity between the terminals in each switch position according to the table. If the continuity condition is not normal, replace the switch.

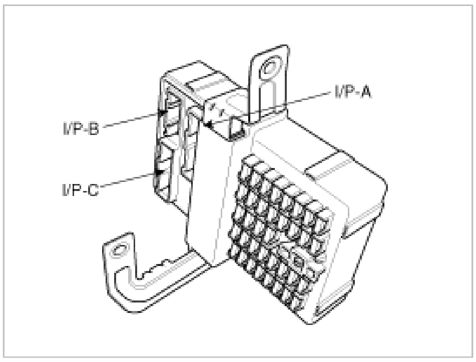
Position \ Terminal	1	3	4	6	8
UP	○	○		○	○
OFF	○	○	○		○
DOWN	○	○	○	○	

Body Electrical System > Power Windows > Power Window Relay > Repair procedures

INSPECTION

1. Disconnect the negative (-) battery terminal.
2. Remove the junction box.
3. Check for continuity between the terminals.
4. There should be continuity between the No.1 in the I/P-G and No.12 terminal in the I/P-A when power and ground are connected to the No.1 terminal in the I/P-G and No.2 terminal in the I/P-A.
5. There should be no continuity between the No.1 terminal in the I/P-G and No.12 terminal in the I/P-A when power is disconnected.





Terminal / Power	I/P-A (12)	I/P-G (1)	I/P-A (2)	I/P-G (1)
Disconnected			○	○
Connected	○	○	⊖	⊕

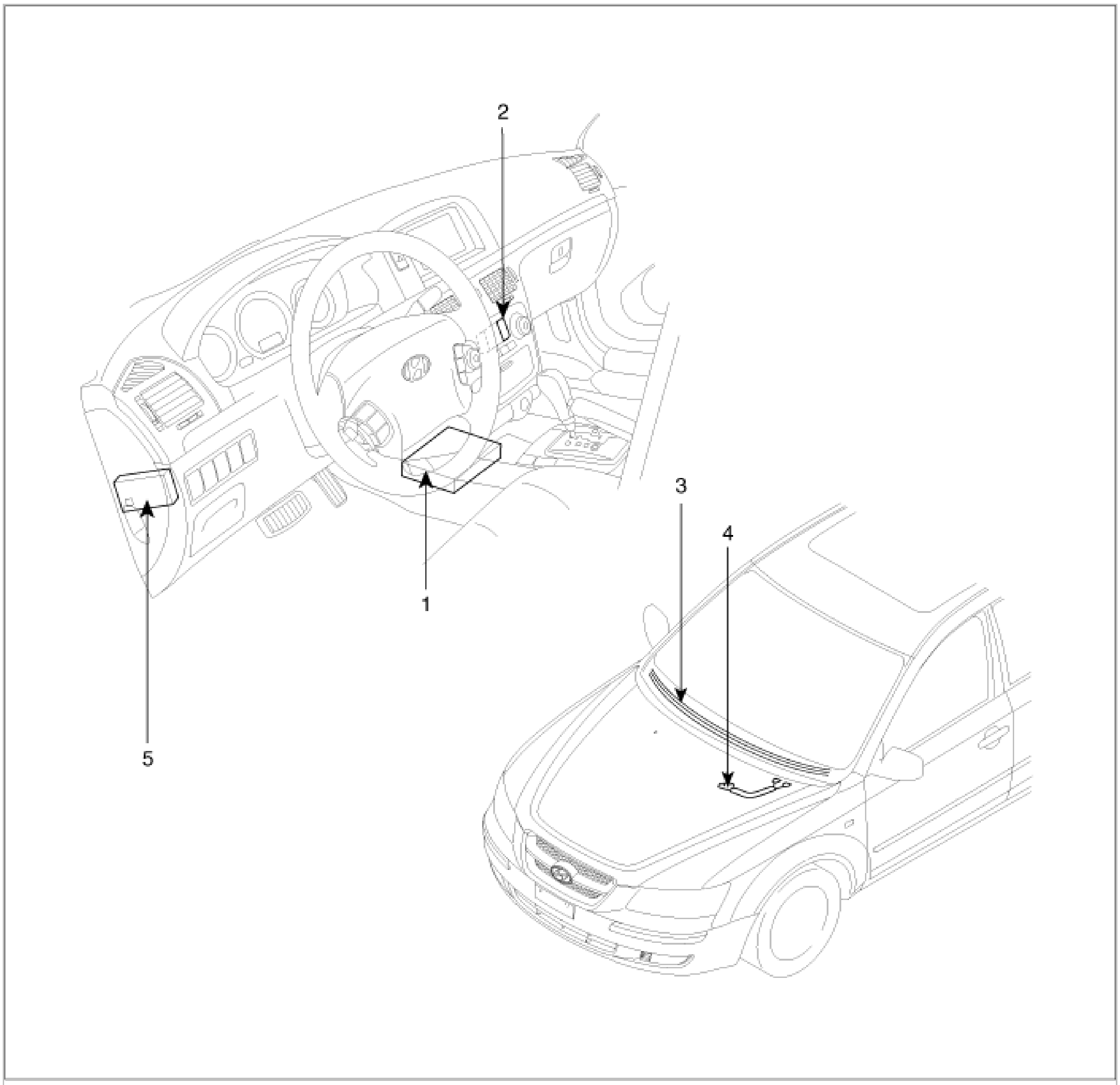
Body Electrical System > Windshield Deicer > Description and Operation

DESCRIPTION

Windshield deicer system prevent windshield wiper from freezing in the winter season. It consists of deicer in the lower part of windshield, switch and relay. Body control module receives an input signal from the deicer switch, then controls relay. Operating condition is the same that of rear window defogger system.
Since the generator "L" is switched ON, if the deicer switch is ON, then deicer output is ON for 20 minutes.

Body Electrical System > Windshield Deicer > Components and Components Location

COMPONENT LOCATION

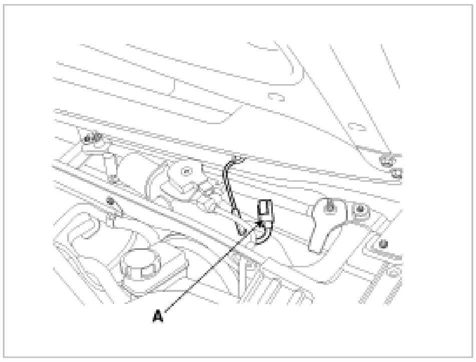


1. Body control module
2. Windshield deicer switch
3. Windshield deicer
4. Deicer connector
5. Windshield deicer relay (Built-in junction box)

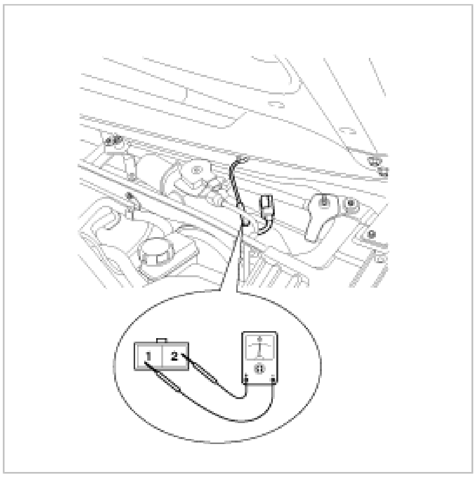
Body Electrical System > Windshield Deicer > Windshield Deicer > Repair procedures

INSPECTION

1. Remove the cowl top cover.(Refer to the wiper)
2. Disconnect the windshield deicer connector (A) from the wiper motor linkage.

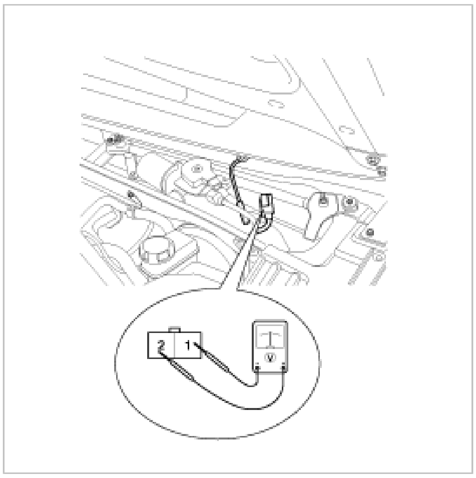


3. Check for continuity between the terminals of deicer lines.



4. Turn the ignition switch ON and the windshield deicer switch ON, then measure the voltage between the terminals of harness side deicer connector.

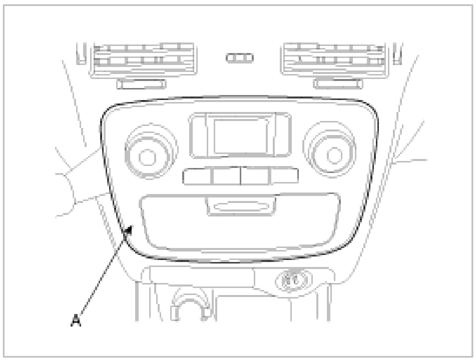
OK: approx. Battery voltage



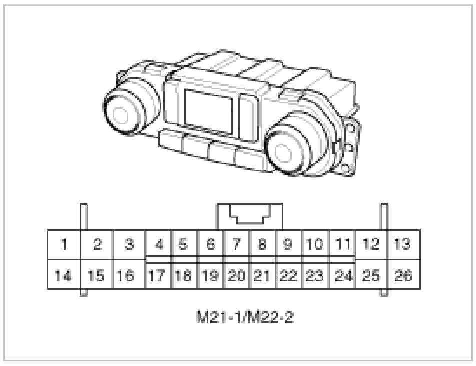
Body Electrical System > Windshield Deicer > Windshield Deicer Switch > Repair procedures

INSPECTION

1. Disconnect the negative (-) battery terminal.
2. Remove the center facia panel(A) by using a scraper (B). Take care of fixing clip.



3. Disconnect the connectors.
4. Using an ohmmeter, inspection the continuity between the terminals after removing to the switch connector.



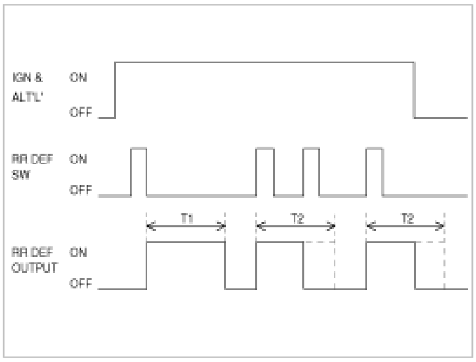
Position \ Terminal	M22-2 (23)	M22-2 (26)	M21-1 (26)	M21-1 (10)
ON (Manual)	O	O		
ON (Auto)			O	O
OFF				

Body Electrical System > Windshield Deicer > Windshield Deicer Timer > Repair procedures

INSPECTION

While operating the components, check whether the operations are normal as shown in the timing chart.

1. Once ALT "L" is ON, if the defogger is switched ON, the defogger will stay ON for 20 minutes duration.
2. If defogger switch is pressed again (see Step 1), or if ignition is switched OFF, the defogger will shut OFF.

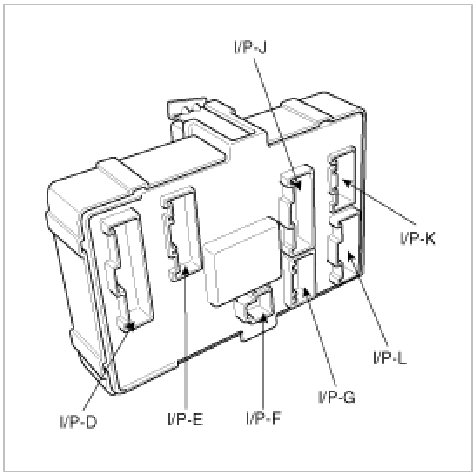


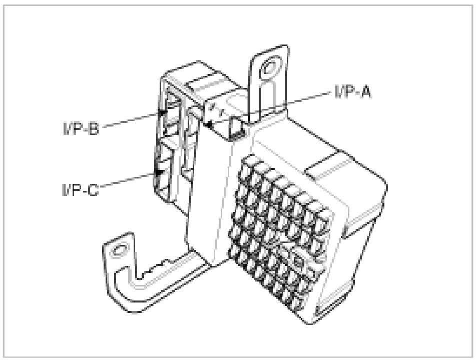
T1 : 20 ± 1 min.
T2 : MAX 20 ± 1 min.

Body Electrical System > Windshield Deicer > Windshield Deicer Relay > Repair procedures

INSPECTION

1. Disconnect the negative (-) battery terminal.
2. Remove the junction box.
3. Check for continuity between the terminals.
4. There should be continuity between the No.2 in the I/P-G and No.8 terminal in the I/P-K when power and ground are connected to the No.2 terminal in the I/P-G and No.8 terminal in the I/P-C.
5. There should be no continuity between the No.2 terminal in the I/P-G and No.8 terminal in the I/P-K when power is disconnected.

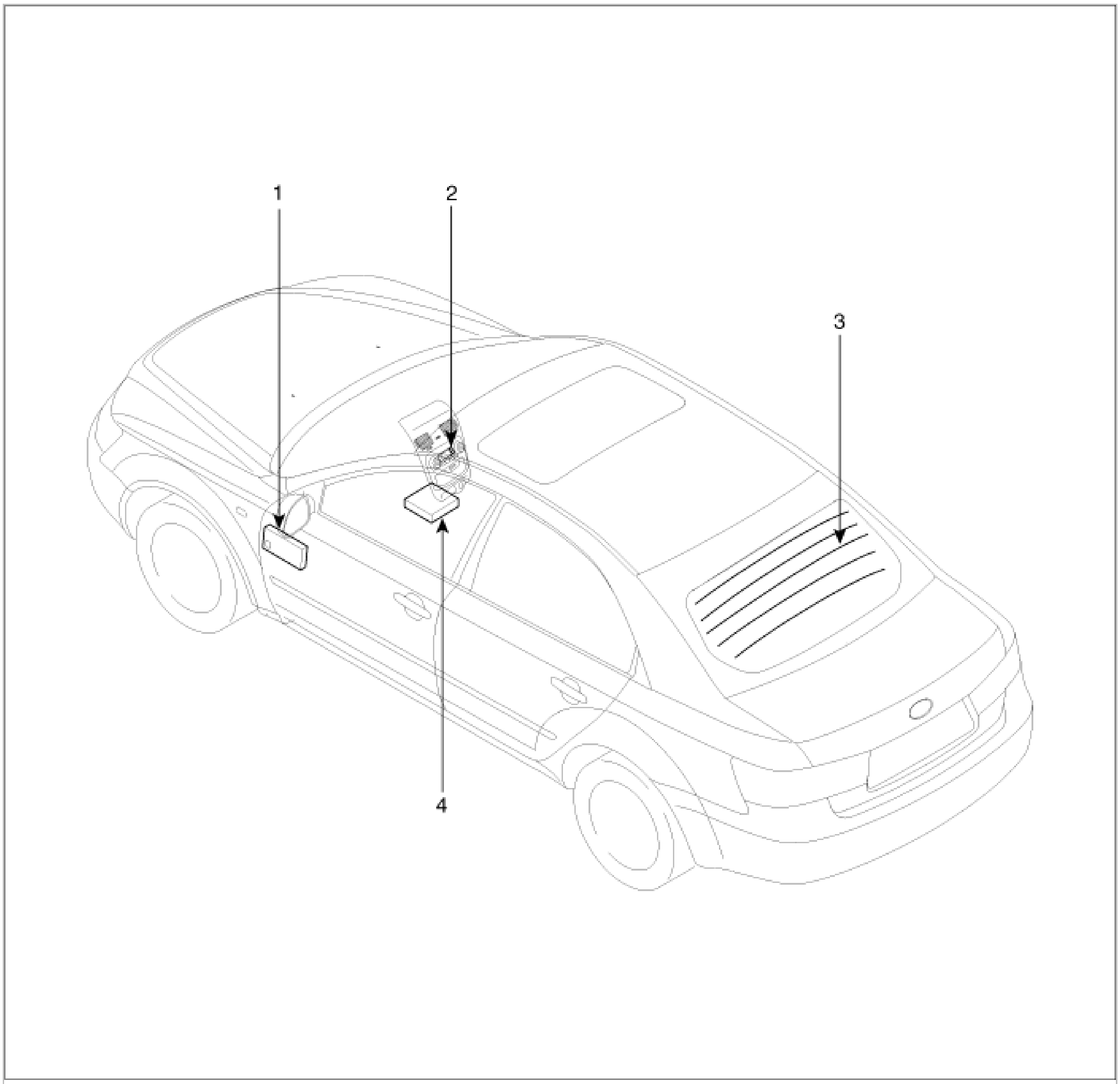




Power \ Terminal	I/P-K (8)	I/P-G (2)	I/P-C (8)	I/P-G (2)
Disconnected			○	○
Connected	○	○	⊖	⊕

Body Electrical System > Rear Window Defogger > Components and Components Location

COMPONENT LOCATION



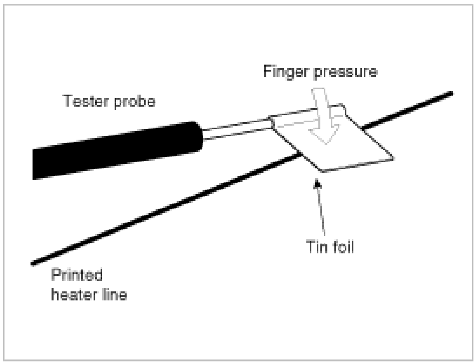
1. Junction box (Rear window defogger)	3. Rear window defogger
2. Rear window defogger switch (A/C controller)	4. Body control module

Body Electrical System > Rear Window Defogger > Rear Window Defogger Printed Heater > Repair procedures

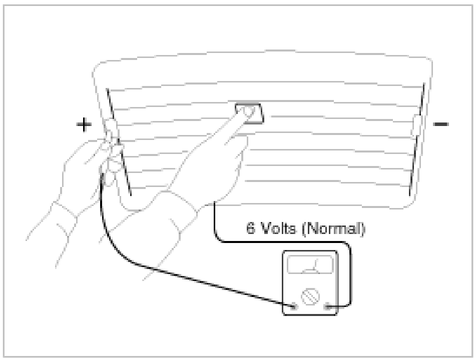
INSPECTION

CAUTION

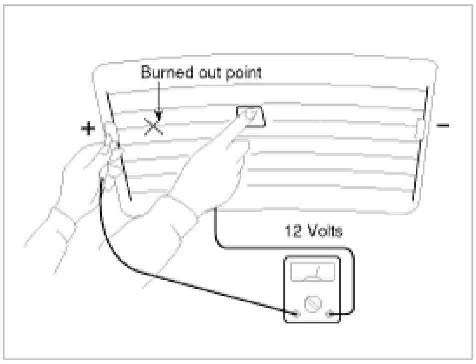
Wrap tin foil around the end of the voltmeter test lead to prevent damaging the heater line. Apply finger pressure on the tin foil, moving the tin foil along the grid line to check for open circuits.



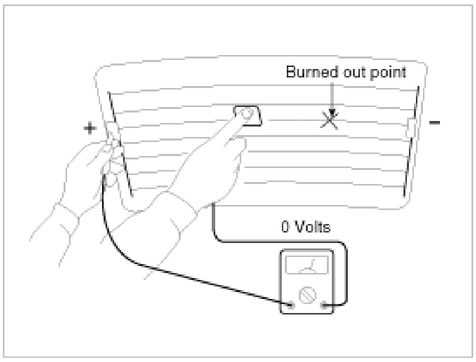
1. Turn on the defogger switch and use a voltmeter to measure the voltage of each heater line at the glass center point. If a voltage of approximately 6V is indicated by the voltmeter, the heater line of the rear window is considered satisfactory.



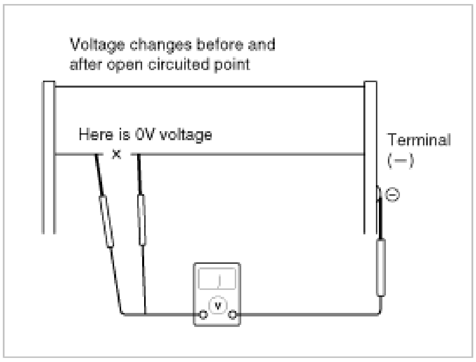
2. If a heater line is burned out between the center point and (+) terminal, the voltmeter will indicate 12V.



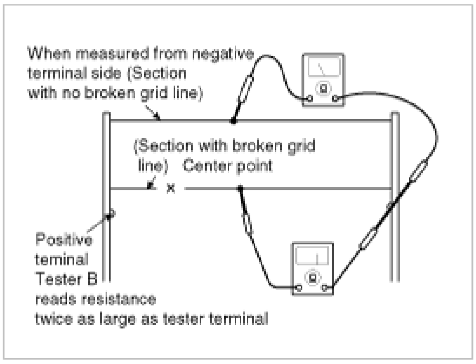
3. If a heater line is burned out between the center point and (-) terminal, the voltmeter will indicate 0V.



4. To check for open circuits, slowly move the test lead in the direction that the open circuit seems to exist. Try to find a point where a voltage is generated or changes to 0V. The point where the voltage has changed is the open-circuit point.



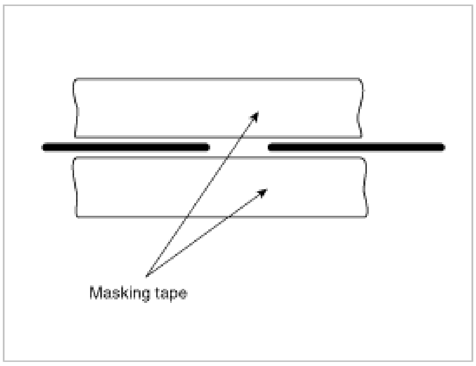
5. Use an ohmmeter to measure the resistance of each heater line between a terminal and the center of a grid line, and between the same terminal and the center of one adjacent heater line. The section with a broken heater line will have a resistance twice as that in other sections. In the affected section, move the test lead to a position where the resistance sharply changes.



REPAIR OF BROKEN HEATER LINE

Prepare the following items:

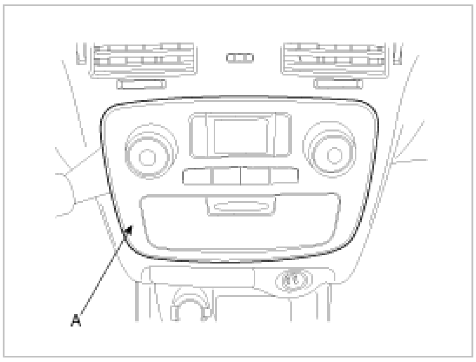
1. Conductive paint.
2. Paint thinner.
3. Masking tape.
4. Silicone remover.
5. Using a thin brush:
   Wipe the glass adjacent to the broken heater line, clean with silicone remover and attach the masking tape as shown. Shake the conductive paint container well, and apply three coats with a brush at intervals of about 15 minutes apart. Remove the tape and allow sufficient time for drying before applying power. For a better finish, scrape away excess deposits with a knife after the paint has completely dried. (Allow 24 hours).



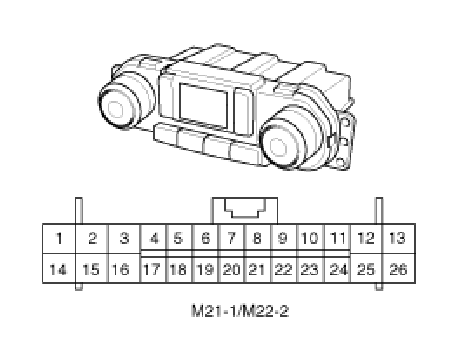
Body Electrical System > Rear Window Defogger > Rear Window Defogger Switch > Repair procedures

INSPECTION

1. Disconnect the negative (-) battery terminal.
2. Remove the center facia panel(A) by using a scraper (B). Take care of fixing clip.



3. Disconnect the connectors.
4. Using an ohmmeter, inspection the continuity between the terminals after removing to the switch connector.

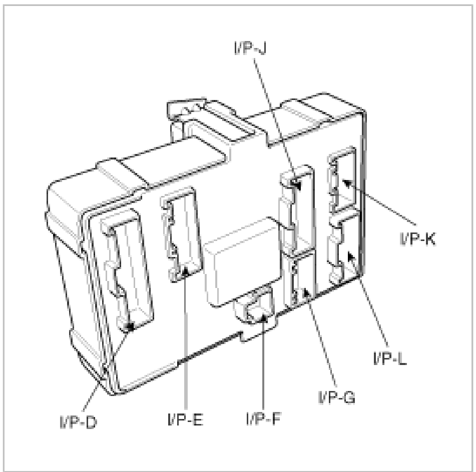


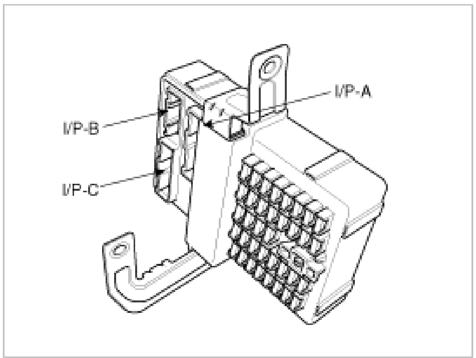
Terminal / Position	M22-2 (23)	M22-2 (26)	M21-1 (26)	M21-1 (10)
ON (Manual)	O	O		
ON (Auto)			O	O
OFF				

Body Electrical System > Rear Window Defogger > Rear Window Defogger Relay > Repair procedures

INSPECTION

1. Disconnect the negative (-) battery terminal.
2. Remove the junction box.
3. Check for continuity between the terminals.
4. There should be continuity between the No.2 in the I/P-G and No.7 terminal in the I/P-C when power and ground are connected to the No.2 terminal in the I/P-G and No.8 terminal in the I/P-C.
5. There should be no continuity between the No.2 terminal in the I/P-G and No.7 terminal in the I/P-C when power is disconnected.





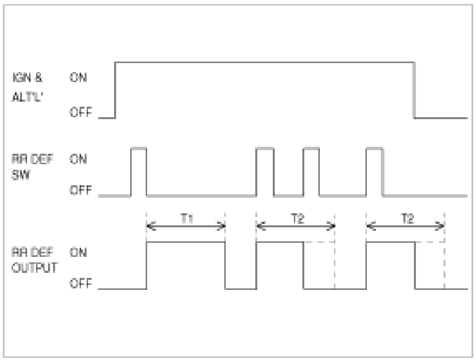
Terminal / Power	I/P-C (7)	I/P-G (2)	I/P-C (8)	I/P-G (2)
Disconnected			○	○
Connected	○	○	⊖	⊕

Body Electrical System > Rear Window Defogger > Rear Window Defogger Timer > Repair procedures

INSPECTION

While operating the components, check whether the operations are normal as shown in the timing chart.

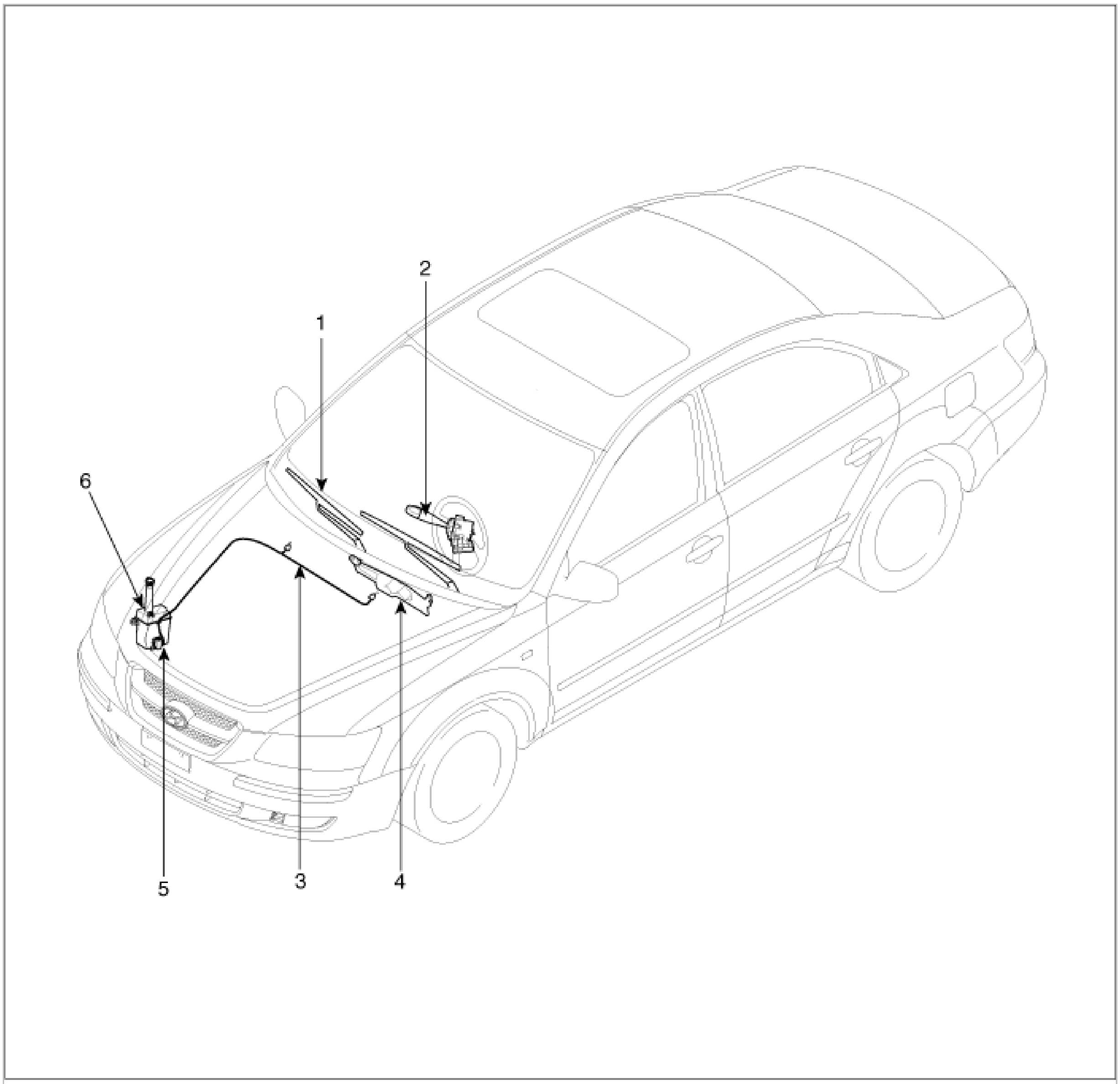
1. Once ALT "L" is ON, if the defogger is switched ON, the defogger will stay ON for 20 minutes duration.
2. If defogger switch is pressed again (see Step 1), or if ignition is switched OFF, the defogger will shut OFF.



T1 : 20 ± 1 min.
T2 : MAX 20 ± 1 min.

Body Electrical System > Windshield Wiper/Washer > Components and Components Location

COMPONENT LOCATION

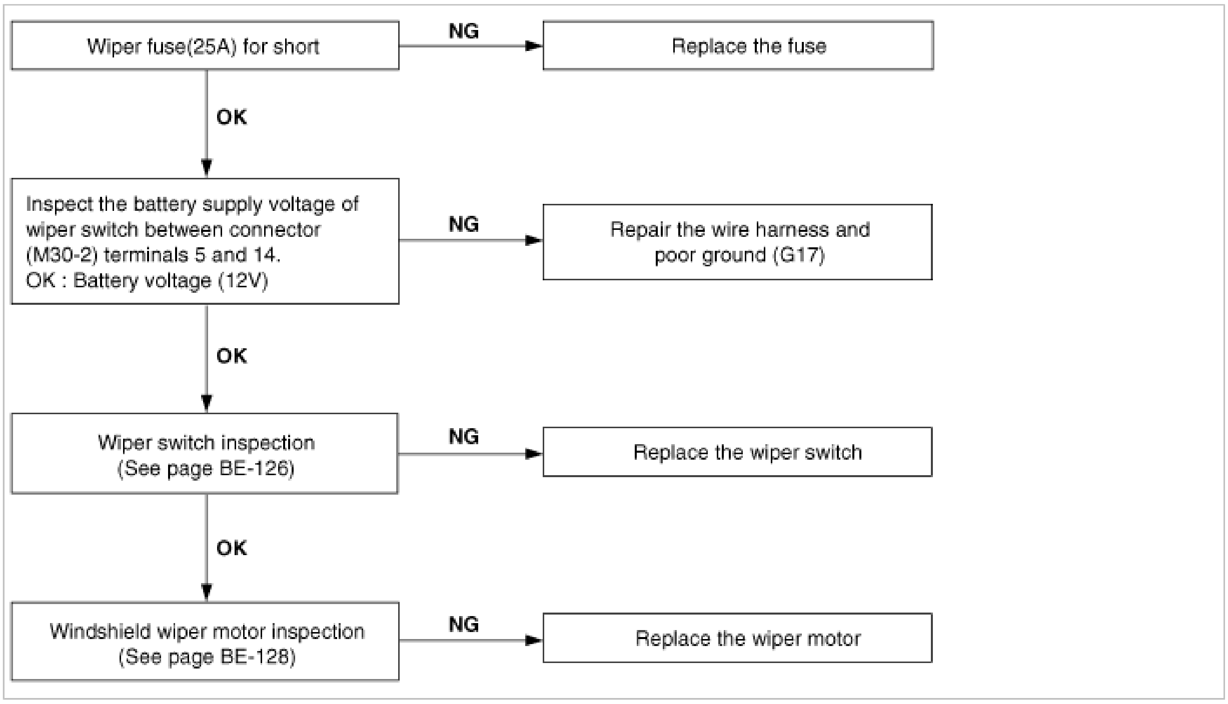


1. Windshield wiper arm & blade	4. Windshield wiper motor & linkage
2. Wiper & washer switch	5. Washer motor
3. Windshield washer hose	6. Washer reservoir

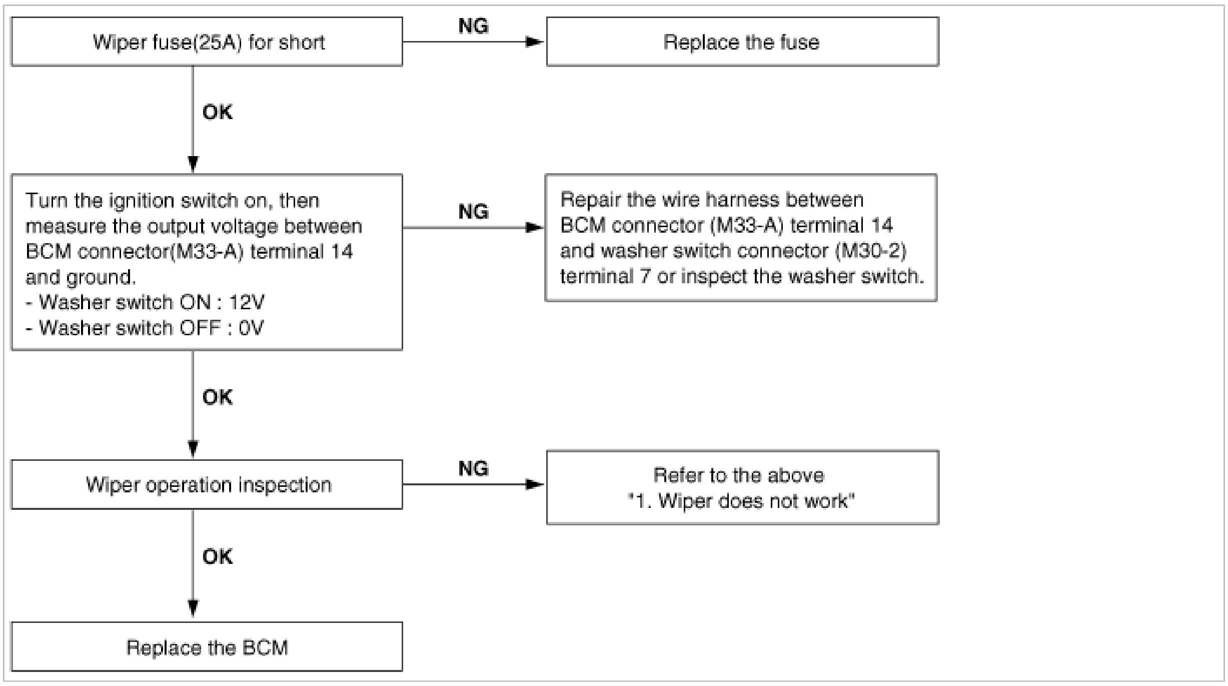
Body Electrical System > Windshield Wiper/Washer > Troubleshooting

TROUBLESHOOTING

1. Wiper low and wiper high do not work.



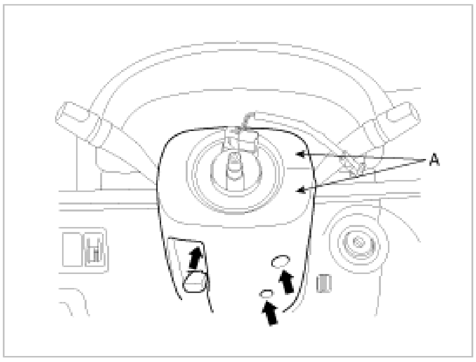
2. When washer switch is on, wiper does not work.



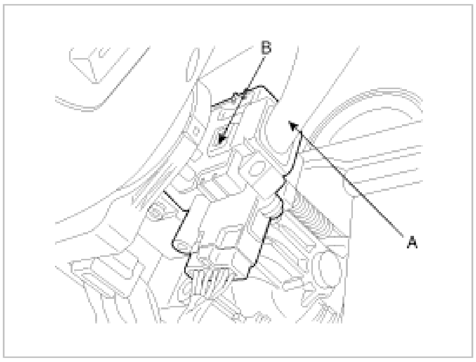
Body Electrical System > Windshield Wiper/Washer > Windshield Wiper/Washer Switch > Repair procedures

REPLACEMENT

1. Remove the steering column upper and lower shrouds (A) after removing 3 screws.



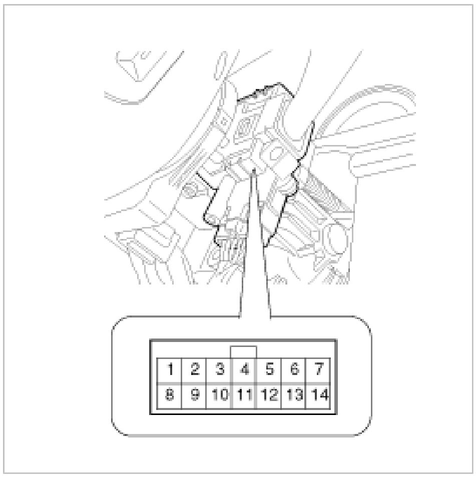
2. Remove the wiper switch (A) by pushing the lock pin (B) after disconnecting the connector.



3. Installation is the reverse of removal.

INSPECTION

Check for continuity between the terminals while operating the wiper and washer switch. If it is not normal condition, replace wiper and wiper switch.



WIPER SWITCH

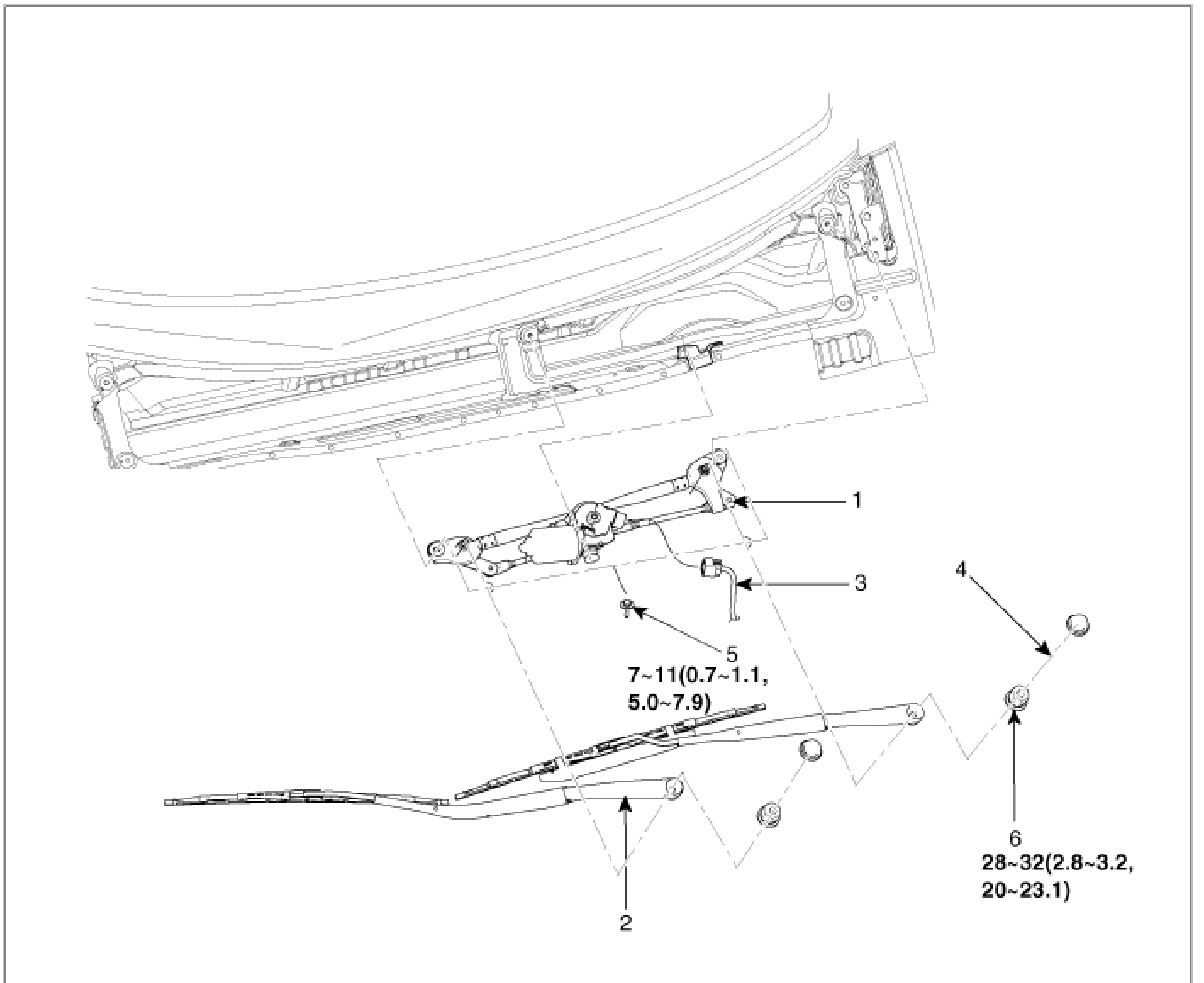
Terminal / Position	1	2	3	4	5	6	13	14
MIST				○	○			
OFF		○	○					
INT		○	○		○	○	○	○
LOW		○	—	—	○			
HI	○	—	—	—	○			

WASHER SWITCH

Terminal / Position	5	7
OFF		
ON	○	○

Body Electrical System > Windshield Wiper/Washer > Front Wiper Motor > Components and Components Location

COMPONENT LOCATION



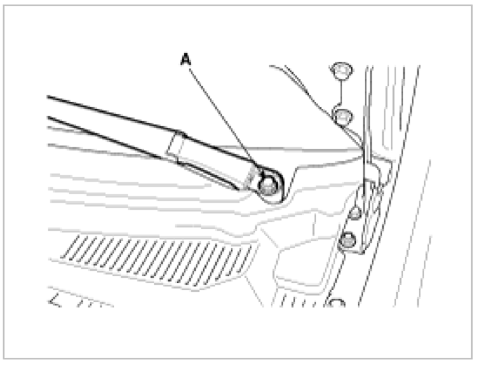
1. Wiper motor & linkage assembly	4. Cap
2. Wiper arm & blade	5. Bolt
3. Wiper motor connector	6. Nut

Body Electrical System > Windshield Wiper/Washer > Front Wiper Motor > Repair procedures

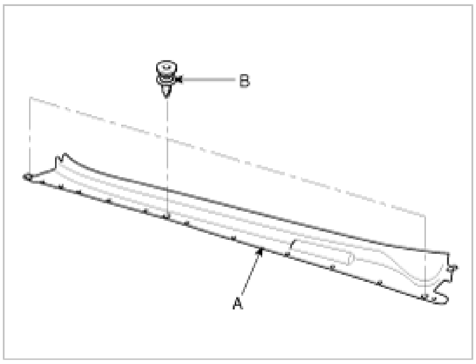
REMOVAL

1. Remove the windshield wiper arm and blade after removing a nut (A).

TORQUE: 28~32 Nm (2.8~3.2 kgf.m, 20~23.1 lbf.ft)

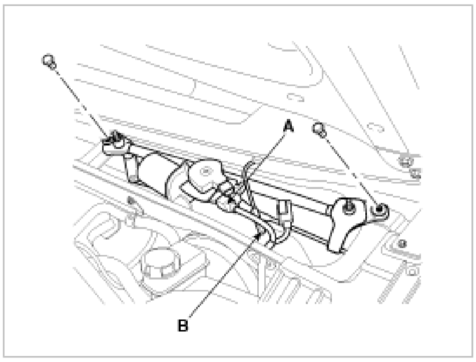


2. Remove the weather strip then remove the cowl top cover (A) after removing 3 clips (B).



3. Remove the windshield wiper motor and linkage assembly after removing 2 bolts. Disconnect the wiper motor connector (A) and windshield deicer connector (B) from the wiper motor & linkage assembly.

TORQUE: 7-11Nm (0.7-1.1, kgf.m, 5.0-7.9 lbf.ft)

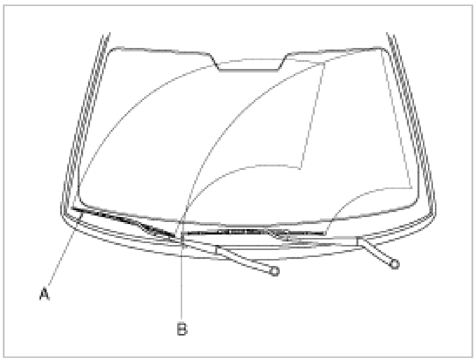


4. Installation is the reverse of removal.

INSTALLATION

1. Install the wiper arm and blade to the specified position.

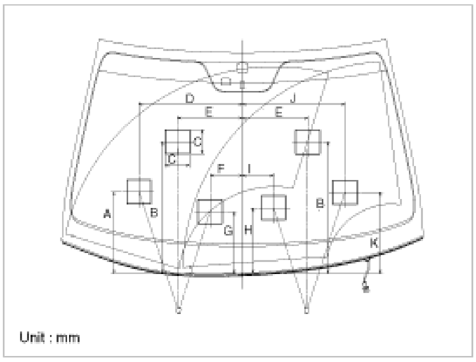
Specified position	A	B
Distance [in (mm)]	1.26+0.2/0 (32+5/0)	0.98+0.2/0 (25+5/0)



2. Set the washer nozzle on the specified spray position.

Specified position	Distance [in (mm)]
A	13.3 (337.5)
B	21.5 (545)
C	3.9 (100)
D	16.9 (429.5)
E	10.6 (270)
F	5.3 (134)

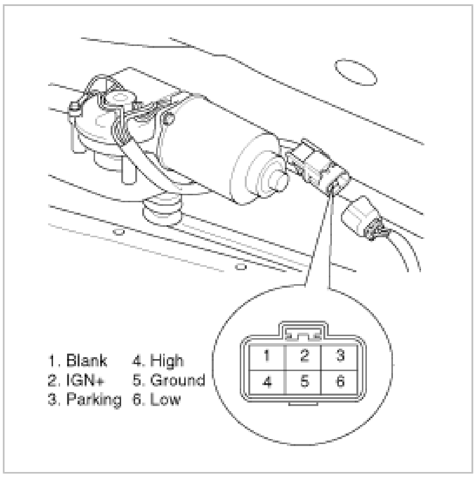
G	10.1(255.5)
H	10.7(271.5)
I	5.0(128)
J	16.7(424)
K	13.2(335.5)



INSPECTION

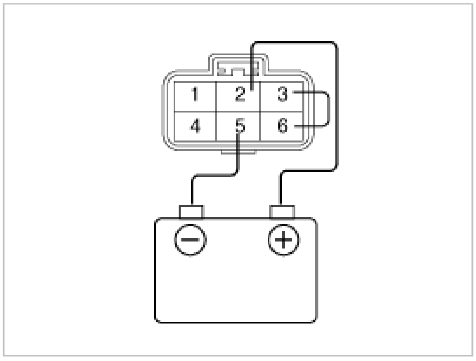
SPEED OPERATION CHECK

1. Remove the connector from the wiper motor.
2. Attach the positive (+) lead from the battery to terminal 6 and the negative (-) lead to terminal 5.
3. Check that the motor operates at low speed.
4. Connect the positive (+) lead from the battery to terminal 4 and the negative (-) lead to terminal 5.
5. Check that the motor operates at high speed.



AUTOMATIC STOP OPERATION CHECK

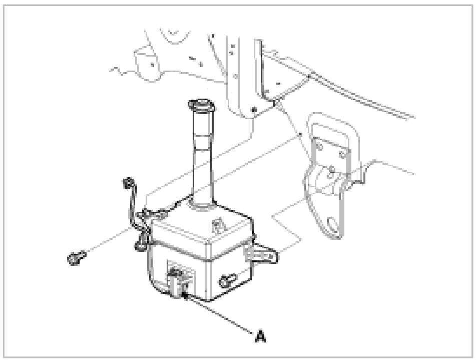
1. Operate the motor at low speed using the stalk control.
2. Stop the motor operation anywhere except at the off position by disconnecting terminal 6.
3. Connect terminals 3 and 6.
4. Connect the positive (+) lead from the battery to terminal 2 and the negative (-) lead to terminal 5.
5. Check that the motor stops running at the off position.



Body Electrical System > Windshield Wiper/Washer > Front Washer Motor > Repair procedures

REPLACEMENT

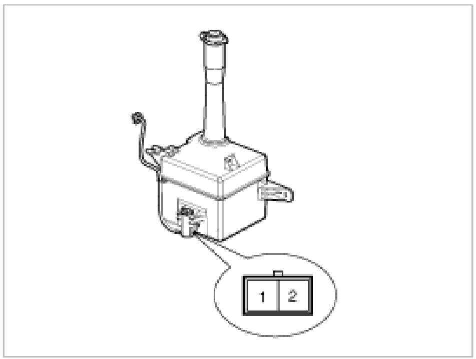
1. Disconnect the negative (-) battery terminal.
2. Remove the front bumper cover. (Refer to Body group-Front bumper)
3. Remove the washer hose and the washer motor connector (A).
4. Remove the washer reservoir after removing 3 bolts.

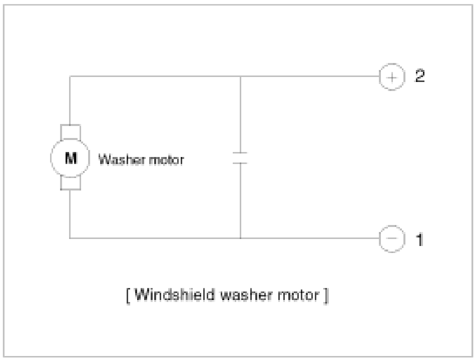


5. Installation is the reverse of removal.

INSPECTION

1. With the washer motor connected to the reservoir tank, fill the reservoir tank with water.
2. Connect positive (+) battery cables to terminal 2 and negative (-) battery cables to terminal 1 respectively.
3. Check that the motor operates normally and the washer motor runs and water sprays from the front nozzles.
4. If they are abnormal, replace the washer motor.

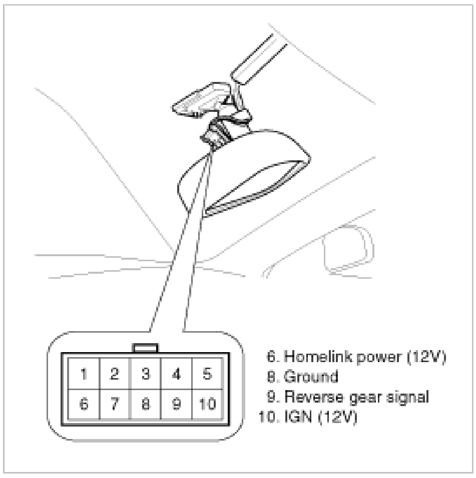




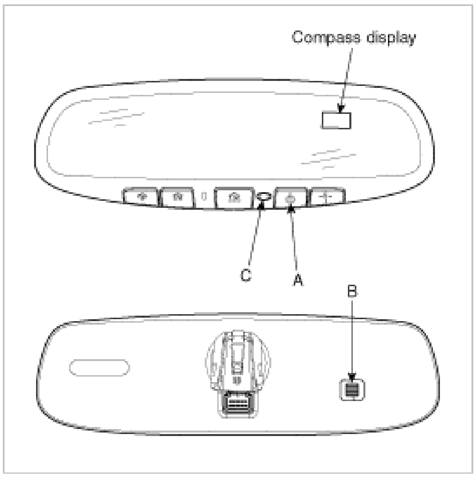
Body Electrical System > Electro chromic Inside > Electro chromic Inside Rear View Mirror > Description and Operation

DESCRIPTION

The ECM (Electro Chromic inside rear view Mirror) is for dimming the reflecting light from a vehicle behind at night, in order the user not to be dazzled by the light. The front looking sensor detects brightness of the surroundings, while the rearward looking sensor the strength of the reflecting light so that adjusts the reflexibility of the mirror in the range of 10~70%. But, when the reverse gear is engaged, it stops functioning.



1. The front looking sensor sees if the brightness of the surroundings is low enough for the mirror to operate its function.
2. The rearward looking sensor detects glaring of the reflecting light from a vehicle behind.
3. The ECM is darkened to the level as determined by the rearward looking sensor. When the glaring is no longer detected, the mirror stops functioning.



Body Electrical System > Electro chromic Inside > Electro chromic Inside Rear View Mirror > Repair procedures

INSPECTION

Check it by the procedure below to see if the function of the ECM is normal.

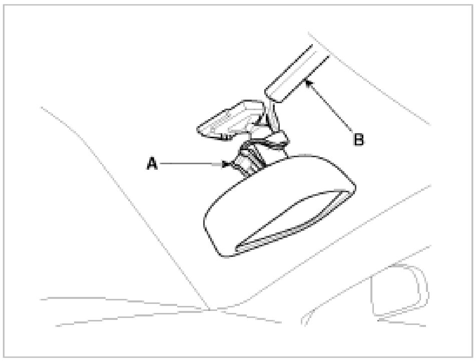
1. Turn the ignition key to the "ON" position.
2. Press the A button to turn the automatic dimming function ON/OFF.
3. Cover the front looking sensor (B) to stop functioning.
4. Head a light to the rearward looking sensor(C).
5. The ECM should be darkened as soon as the rearward looking sensor detects the light.

> NOTE
>
> If this test is performed in daytime, the ECM may be darkened as soon as the front looking sensor is covered.

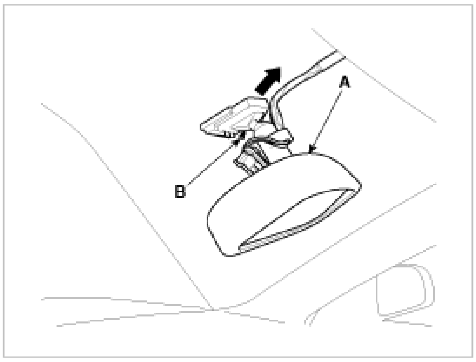
6. When the reverse gear is engaged, the ECM should not be darkened.
7. When heading lights to both the front looking and rearward looking sensors, the ECM should not be darkened.

REPLACEMENT

1. Remove the connector(A) and honelink cover (B).



2. Push the ECM base up to remove the ECM assembly (A) after loosening the mounting screw (B).



3. Installation is the reverse of removal.

Body Electrical System > Electro chromic Inside > Compass Mirror > Description and Operation

FUNCTION

1. Push the A button lower of the rear view mirror to turn on the function of the compass mirror so that displays a sign of a direction on the small board in the upper-right side of the mirror.
2. Push the A button again to turn off its function.

Body Electrical System > Electro chromic Inside > Compass Mirror > Repair procedures

CALIBRATION PROCEDURE

If the compass has been calibrated or set to variance zone number incorrectly, or you are driving in specific places (tunnel, parking lot in building, underground parking lot, near transformer substation, etc.), some phenomenon is occur as follows:

- The display read "C".
- The compass headings become inaccurate.
- The compass heading is not changed.
- Some compass headings are not displayed.

- The compass headings are inaccurate in long distance driving.

This compass automatically calibrates itself while the vehicle is driven as your route takes you in complete circles.
If the vehicle's compass headings become inaccurate continuously, the compass should be manually calibrated as follows:

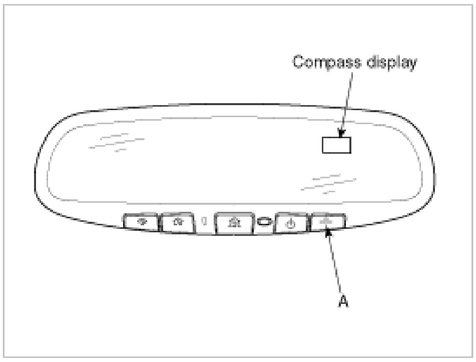
1. Move the vehicle from the large steel structure or electric power supply cable.
2. Turn on the compass by pressing the A button.
3. Check the zone number by pressing the A button for more than 4 seconds until the current zone number appears in the display.
   To re-calibrate, hold the A button for 3 seconds until C is displayed. If the zone number is different for your country, set the correct zone number referring to "Setting the compass zone" and do the "calibration procedure" again.
4. Drive your vehicle in at least 2 circles at less than 5 miles per hour (8 km/h) until the compass heading appears. Driving in a circle in right-handed direction and opposite direction is possible and if possible, stops the wiper operation.
5. If the vehicle's compass headings become inaccurate as before, do the following procedure again.

> NOTE
>
> If new vehicle is first driven or if the battery has been disconnected, do the calibration procedure as above.

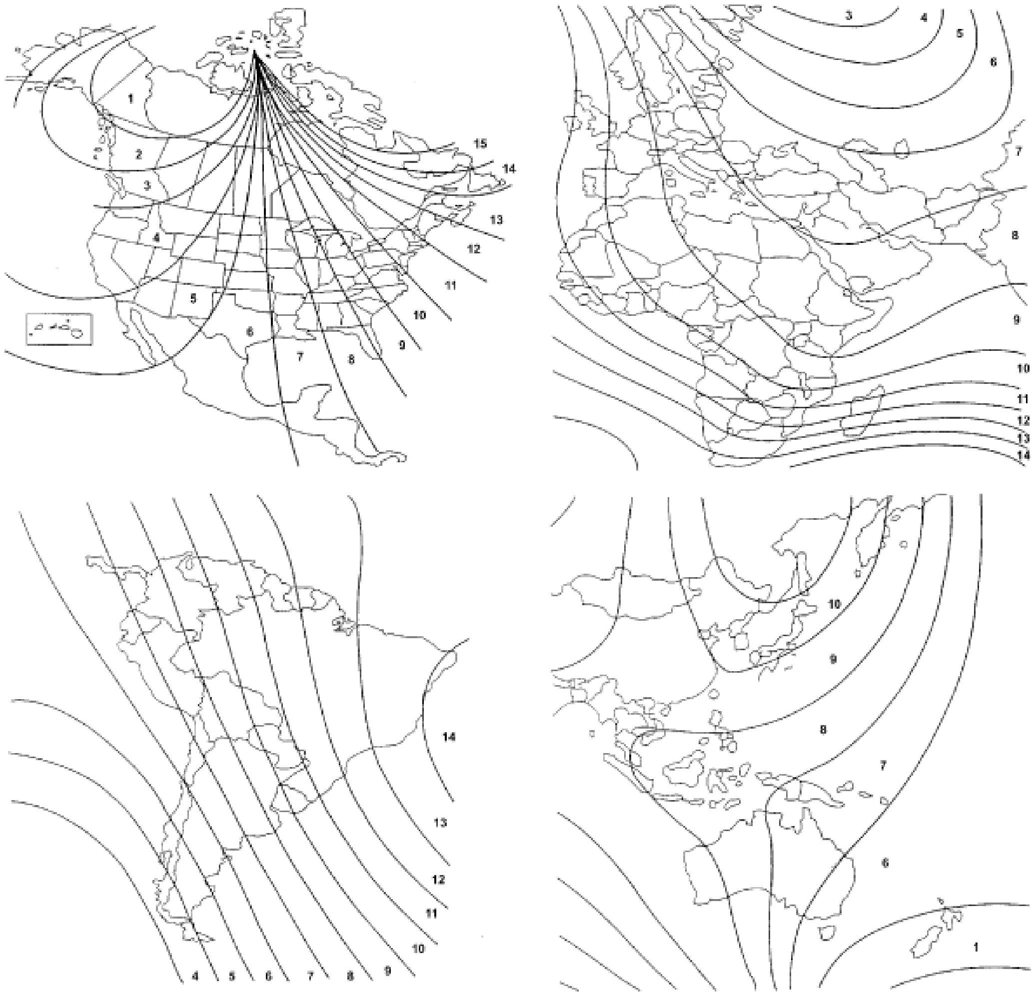
SETTING THE COMPASS ZONE

This compass must be set to compensate for the variation between true north and magnetic north. To set variation:

1. Find your current location and variance zone number on the zone map.
2. Press the A button for more than 4 seconds. The current zone number will appear in the display.
3. Release and press the A button until the new zone number appears in the display. After you stop pressing the button in, the display will show a compass direction within a few seconds.



ZONE MAP

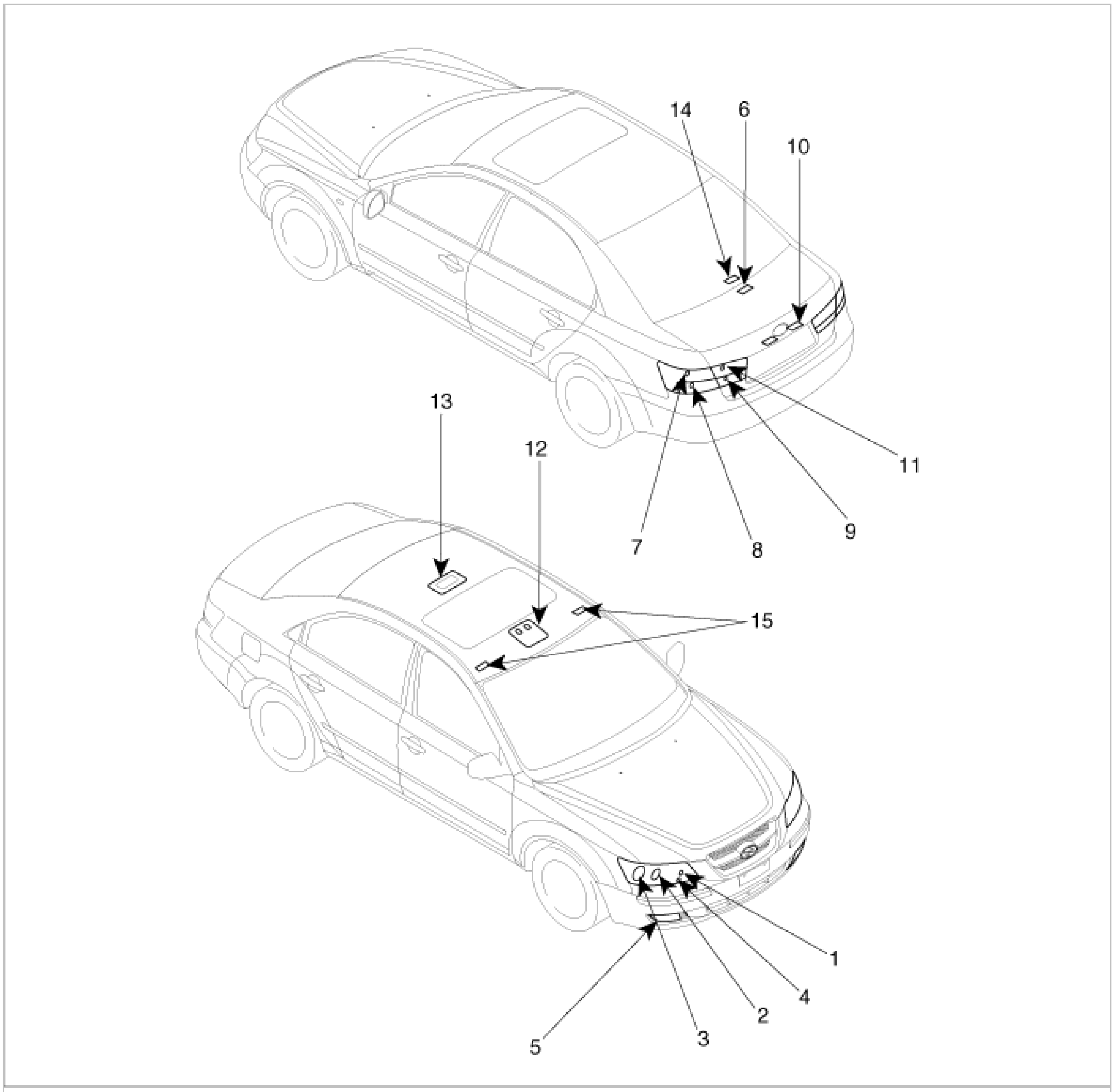


WARNING

1. Do not install the ski rack, antenna, etc. which are attached to the vehicle by means of a magnet. They affect the operation of the compass.
2. If the compass deviates from the correct indication soon after repeated adjustment, have the compass checked at an authorized dealer.
3. The compass may not indicate the correct compass point in tunnels or while driving up or down a steep hill. (The compass returns to the correct compass point when the vehicle moves to an area where the geomagnetism is stabilized.)

Body Electrical System > Lighting System > Components and Components Location

COMPONENT LOCATION



1. Head lamp (High)
2. Head lamp (Low)
3. Front turn signal lamp/Side marker
4. Position lamp
5. Front fog lamp
6. Luggage lamp
7. Tail/stop lamp
8. Rear turn signal lamp
9. Back up lamp
10. License plate lamp
11. Tail lamp
12. Overhead console lamp (Map lamp)
13. Room lamp
14. High mounted stop lamp
15. Vanity lamp

Body Electrical System > Lighting System > Troubleshooting

TROUBLESHOOTING

Symptom Poss	ible cause	Remedy
One lamp does not light (all exterior)	Bulb burned out	Replace bulb
	Socket, wiring or ground faulty	Repair if necessary
Head lamps do not light	Bulb burned out	Replace bulb
	Ignition fuse (LOW:20A, HIGH:20A) blown	Check for short and replace fuse
	Head lamp fuse (10A) blown	Check for short and replace fuse
	Head lamp relay faulty	Check relay
	Lighting switch faulty	Check switch

	Wiring or ground faulty	Repair if necessary
Tail lamps and license plate lamps do not light	Bulb burned out	Replace bulb
	Tail lamp fuse (20A) blown	Check for short and replace fuse
	Tail lamp relay faulty	Check relay
	Lighting switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Stop lamps do not light	Bulb burned out	Replace bulb
	Stop lamp fuse (15A) blown	Check for short and replace fuse
	Stop lamp switch faulty	Adjust or replace switch
	Wiring or ground faulty	Repair if necessary
Stop lamps do not turn off	Stop lamp switch faulty	Repair or replace switch
Instrument lamps do not light (Tail lamps light)	Rheostat faulty	Check rheostat
	Wiring or ground faulty	Repair if necessary
Turn signal lamp does not flash on one side	Bulb burned out	Replace bulb
	Turn signal switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Turn signal lamps do not light	Bulb burned out	Replace bulb
	Turn signal lamp fuse (10A) blown	Check for short and replace fuse
	Flasher unit faulty	Check flasher unit
	Turn signal switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Hazard warning lamps do not light	Bulb burned out	Replace bulb
	Hazard warning lamp fuse (10A) blown	Check for short and replace fuse
	Flasher unit faulty	Check flasher unit
	Hazard switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Flasher rate too slow or too fast	Lamps' wattages are smaller or larger than specified	Replace lamps
	Flasher unit faulty	Check flasher unit
Back up lamps do not light	Bulb burned out	Replace bulb
	Back up lamp fuse (10A) blown	Check for short and replace fuse
	Back up lamp switch (M/T) faulty	Check switch
	Transaxle range switch (A/T) faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Room lamp does not light	Bulb burned out	Replace bulb
	Room lamp fuse (15A) blown	Check for short and replace fuse
	Room lamp switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Front fog lamps do not light	Bulb burned out	Replace bulb
	Front fog lamp fuse (15A) blown	Check for short and replace fuse
	Front fog lamp relay faulty	Check relay
	Front fog lamp switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Map lamp does not light	Bulb burned out	Replace bulb
	Room lamp fuse (10A) blown	Check for short and replace fuse
	Map lamp switch faulty	Check switch

	Wiring or ground faulty	Repair if necessary
Trunk room lamp does not light	Bulb burned out	Replace bulb
	Room lamp fuse (10A) blown	Check for short and replace fuse
	Trunk room lamp switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary

Body Electrical System > Lighting System > Specifications

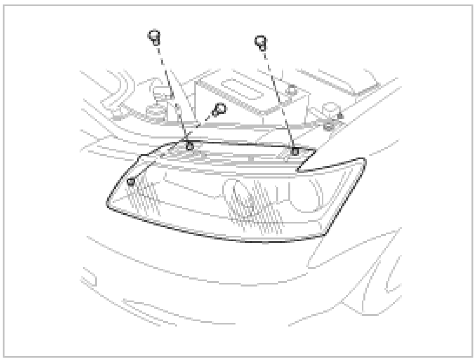
SPECIFICATION

Items	Bulb Wattage (W)
Head lamp (High/Low)	55/55
Front turn signal lamp/Side marker	28/8
Front position lamp	8
Front fog lamp	27
Rear tail/stop lamp (Outside)	28/8
Rear tail lamp (Inner)	8
Back up lamp	16
Rear turn signal lamp	27
License plate lamp	5
Room lamp	10
Overhead console lamp	10 x 2
High mounted stop lamp	16
Glove box lamp	5
Luggage lamp	5
Door courtesy lamp	5
Vanity lamp	5
Rear side marker	5

Body Electrical System > Lighting System > Head Lamps > Repair procedures

REPLACEMENT

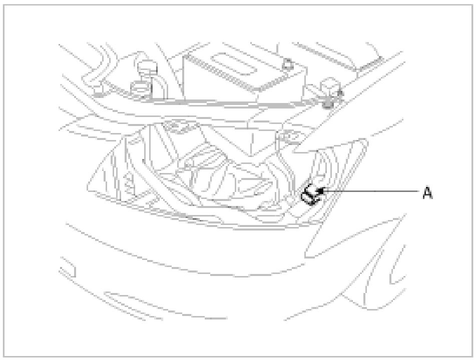
1. Disconnect the negative (-) battery terminal.
2. Loose the mounting bolts (3EA) of head lamp.



3. Remove the head lamp assembly after disconnecting the lamp connectors.

NOTE

Take care that holding clip (A) is not to be damaged.



4. Installation is the reverse of removal.

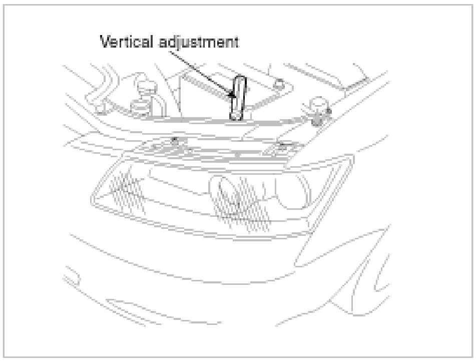
HEAD LAMP AIMING INSTRUCTIONS

The head lamps should be aimed with the proper beam-setting equipment, and in accordance with the equipment manufacturer's instructions.

> NOTE
>
> If there are any regulations pertinent to the aiming of head lamps in the area where the vehicle is to be used, adjust so as to meet those requirements.

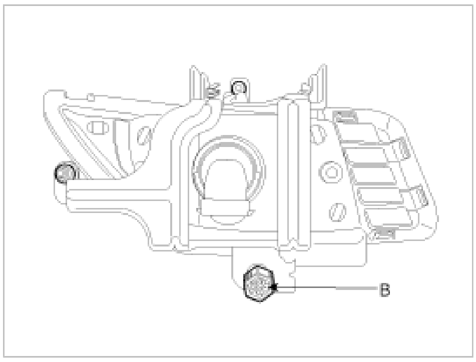
Alternately turn the adjusting gear to adjust the head lamp aiming. If beam-setting equipment is not available, proceed as follows:

1. Inflate the tires to the specified pressure and remove any loads from the vehicle except the driver, spare tire, and tools.
2. The vehicle should be placed on a flat floor.
3. Draw vertical lines (Vertical lines passing through respective head lamp centers) and a horizontal line (Horizontal line passing through center of head lamps) on the screen.
4. With the head lamp and battery in normal condition, aim the head lamps so the brightest portion falls on the horizontal and vertical lines.
   Make vertical adjustment to the lower beam using the adjusting wheel.

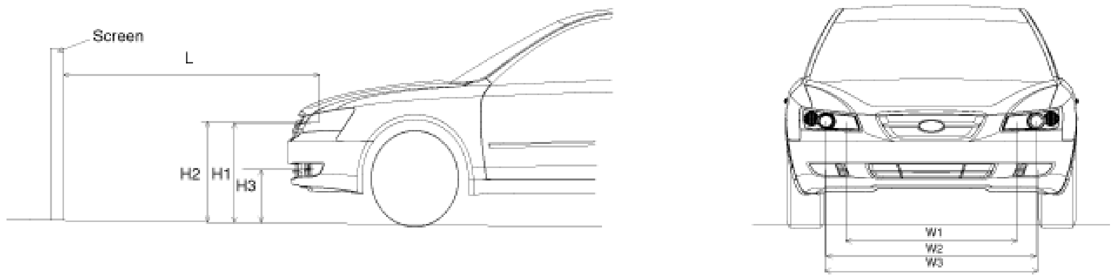


FRONT FOG LAMP AIMING

The front fog lamps should be aimed as the same manner of the head lamps aiming.
With the front fog lamps and battery normal condition, aim the front fog lamps by turning the adjusting gear.



HEAD LAMP AND FOG LAMP AIMING POINT

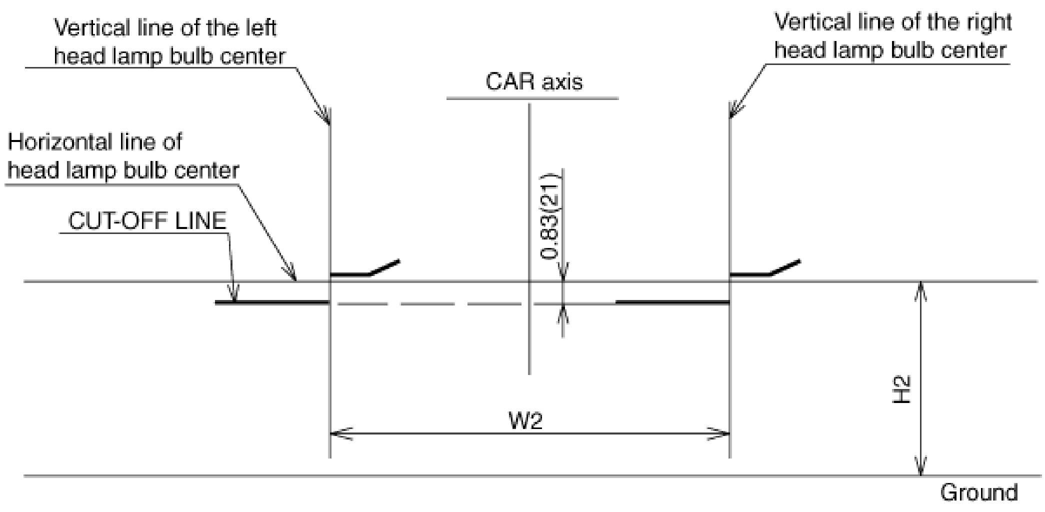


H1 : Height between the head lamp bulb center and ground (High beam)
H2 : Height between the head lamp bulb center and ground (Low beam)
H3 : Height between the fog lamp bulb center and ground
W1 : Distance between the two head lamp bulbs centers (High beam)
W2 : Distance between the two head lamp bulbs centers (Low beam)
W3 : Distance between the two fog lamp bulbs centers
L : Distance between the head lamp bulb center and screen

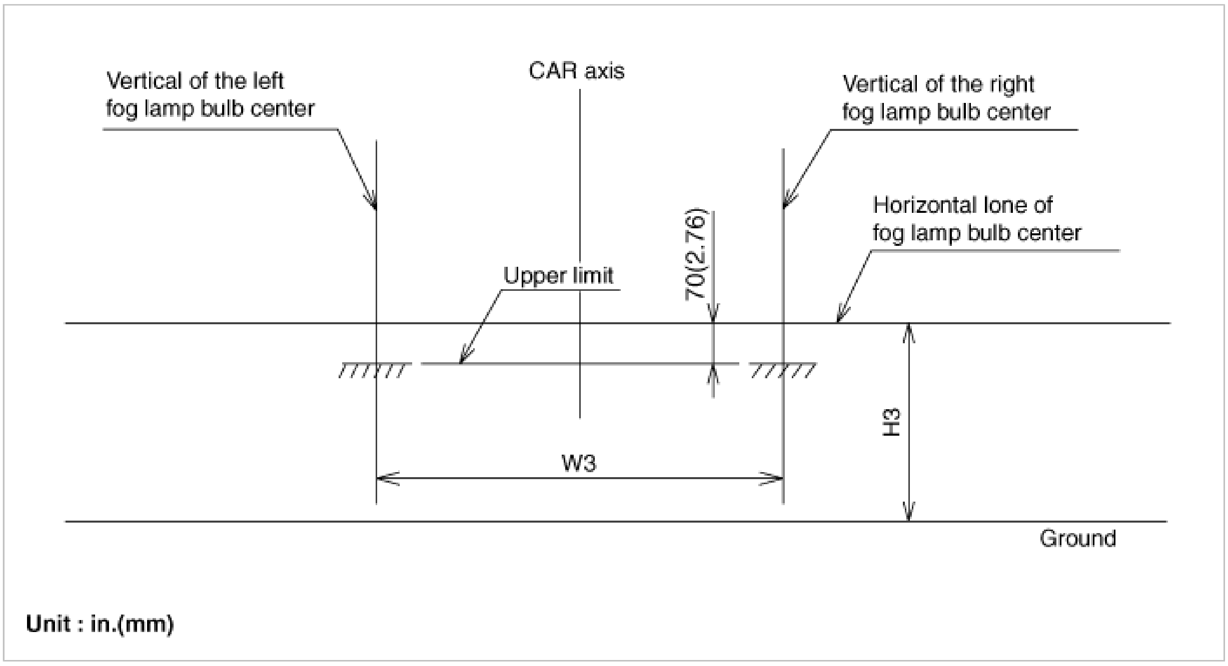
Unit : in(mm)

Vehicle condition	H1	H2	H2	W1	W2	W3	L
Without driver	26.7(679)	27.0(686)	14.3(362)	42.0(1,066)	51.4(1,306)	52.1(1,324)	118.1(3,000)
With driver	26.5(672)	26.7(679)	14.0(355)				

1. Turn the low beam on without driver aboard.
   The cut-off line should be projected in the allowable range (shaded region).

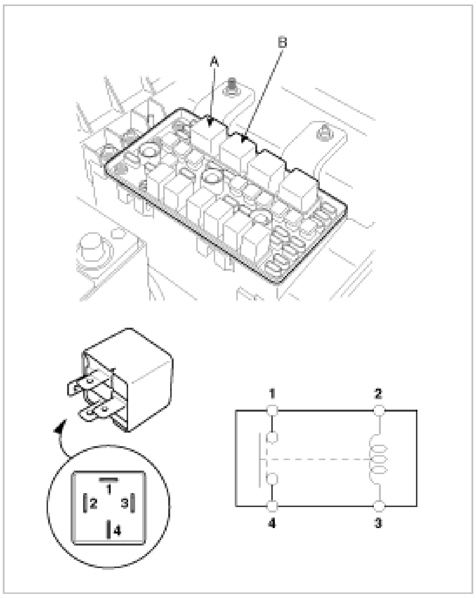


2. Turn the front fog lamp on without the driver aboard.
   The cut-off line should be projected in the allowable range (shaded region)



HEAD LAMP RELAY INSPECTION

1. Pull out the head lamp relay (Low) (A) and head lamp relay (High) (B) from the engine compartment relay box.



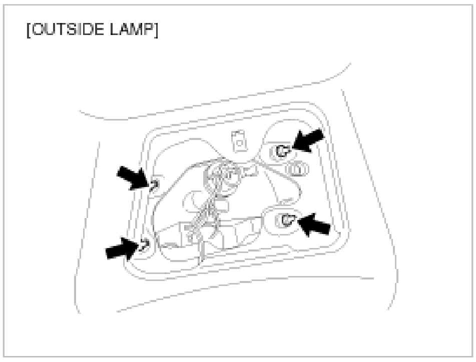
2. Check for continuity between terminals. There should be continuity between the No.1 and No.4 terminals when power and ground are connected to the No.2 and No.3 terminals.
3. There should be no continuity between the No.1 and No.4 terminals when power is disconnected.

Terminal / Power (No.2-No.3)	2	3	1	4
Disconnected	O	O		
Connected	⊖	⊕	O	O

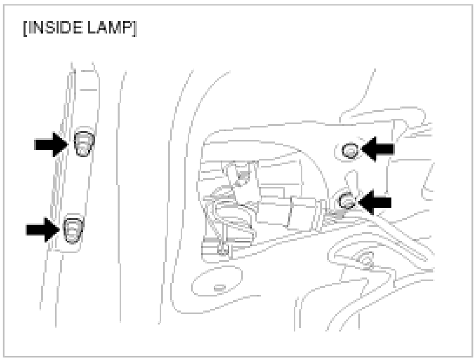
Body Electrical System > Lighting System > Turn Signal Lamp > Repair procedures

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Loose the nuts holding the rear combination lamp then disconnect the 4P connector then remove the outside rear combination lamp.



3. Loose the nuts holding the rear combination lamp then disconnect the 4P connector then remove the inner rear combination lamp.

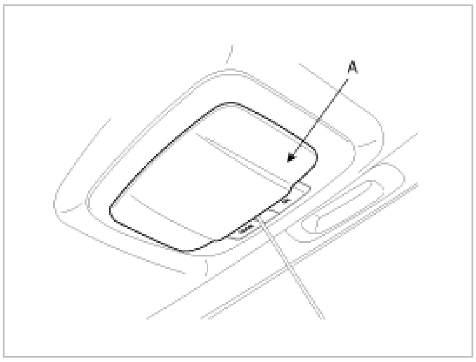


4. Installation is the reverse of removal.

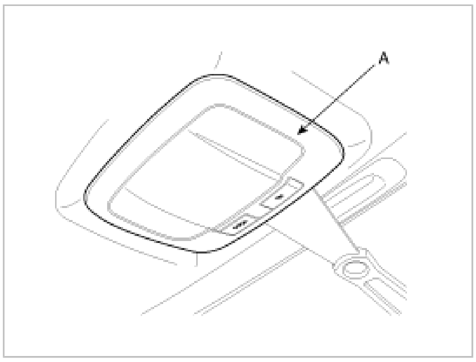
Body Electrical System > Lighting System > Room Lamp > Repair procedures

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Detach the lamp lens (A) from the room lamp with a flat-tip screwdriver then replace the bulb (B).



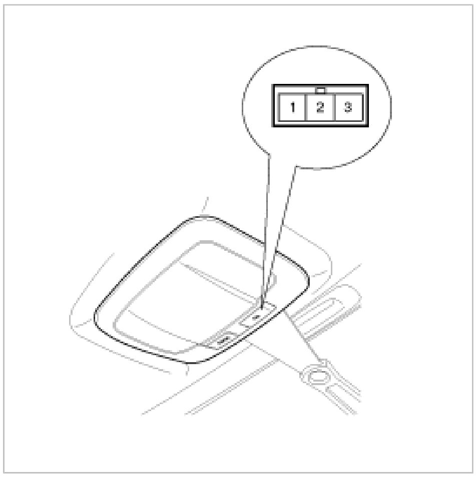
3. Remove the room lamp assembly after removing 2 screws and disconnecting the 3P connector (Standard type).
   Remove the room lamp assembly by using the scraper and then disconnect the 3P connector (Sunroof type).



4. Installation is the reverse of removal.

INSPECTION

Remove the room lamp assembly then check for continuity between terminals.

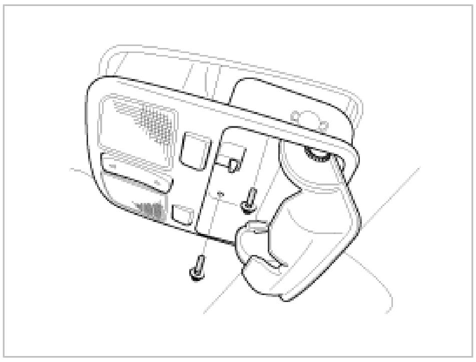


Position \ Terminal	1	2	3
ON		O	O
DOOR	O	O	
OFF			

Body Electrical System > Lighting System > Overhead Console Lamp > Repair procedures

REPLACEMENT

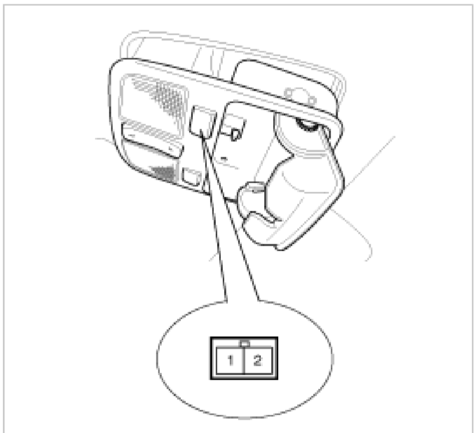
1. Disconnect the negative (-) battery terminal.
2. Open the sunglass case cover then remove the 2 screws holding the overhead console.



3. Disconnect the connector (4P) of sunroof switch and the connector (2P) of map lamp then remove the overhead console lamp assembly from the headliner.
4. Installation is the reverse of removal.

INSPECTION

Remove the overhead console lamp assembly then check for continuity between terminals. If the continuity is not as specified, replace the map lamp switch.



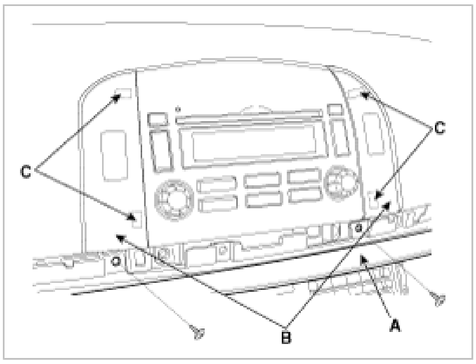
[Switch side connector]

Body Electrical System > Lighting System > Hazard Lamp Switch > Repair procedures

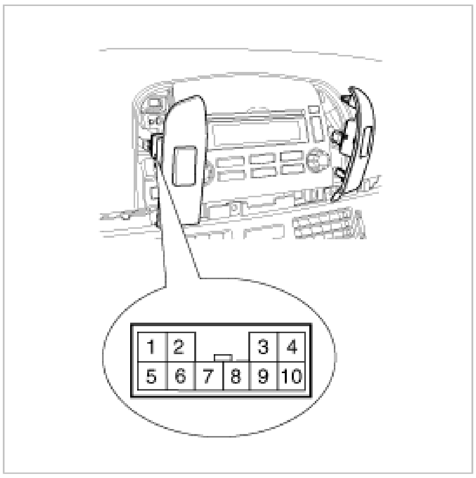
INSPECTION

HAZARD LAMP SWITCH

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad garnish (A) after pulling it by using regular screw driver (-). Take care of fixing clips(C).
3. Remove the center facia panel (B) after loosening the screws.



4. Disconnect the connectors(A).
5. Remove the hazard lamp switch from the center facia panel.



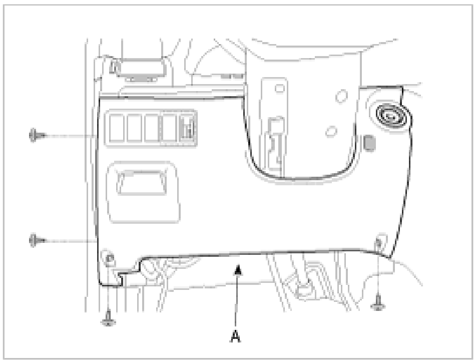
6. Operate the switch and check for continuity between terminals with an ohmmeter.

Terminal / Position	2	3	6	9	10	5	7	8
OFF	O	O				O	—	O
ON	Illumination	Illumination	O	O	O		O	O

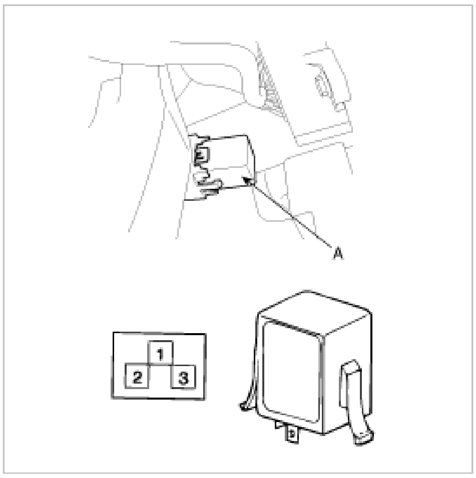
Body Electrical System > Lighting System > Flasher Unit > Repair procedures

INSPECTION

1. Disconnect the negative (-) battery terminal.
2. Disconnect the hood release cable from the hood release handle.
3. Remove the crash pad side cover (A).



4. Remove the flasher unit (A) after loosening the nut and disconnecting the connector.



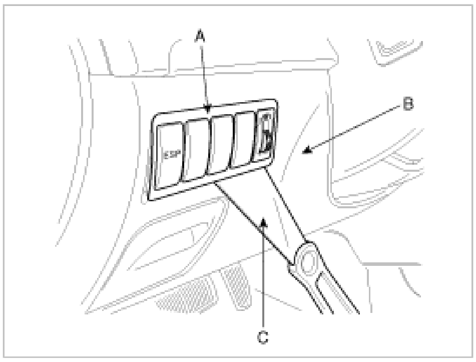
5. Connect the positive (+) lead from the battery to terminal 2 and the negative (-) lead to terminal 3.
6. Connect the two turn signal lamps in parallel to terminals 1 and 3. Check that the bulbs turn on and off.

> **NOTE**
>
> The turn signal lamps should flash 60 to 120 times per minute. If one of the front or rear turn signal lamps has an open circuit, the number of flashes will be more than 120 per minute. If operation is not as specified, replace the flasher unit.

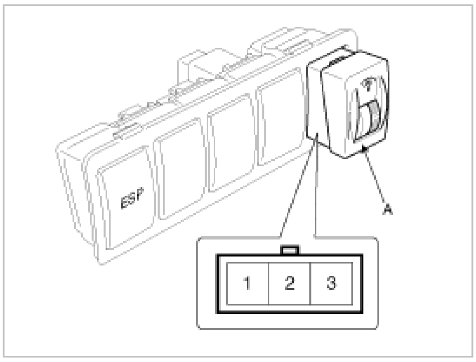
Body Electrical System > Lighting System > Rheostat > Repair procedures

INSPECTION

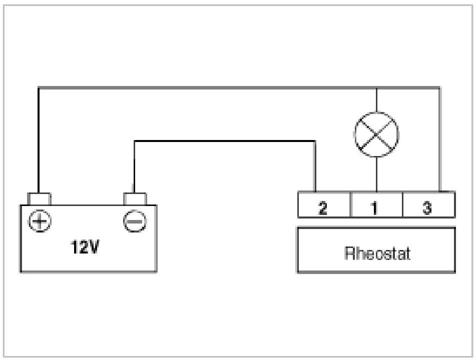
1. Disconnect the negative (-) battery terminal.
2. Remove the lower crash pad switch (A) from the side crash pad cover (B) by using the scraper (C) and then disconnect the connectors.



3. Remove the rheostat (A) from lower crash pad switch.



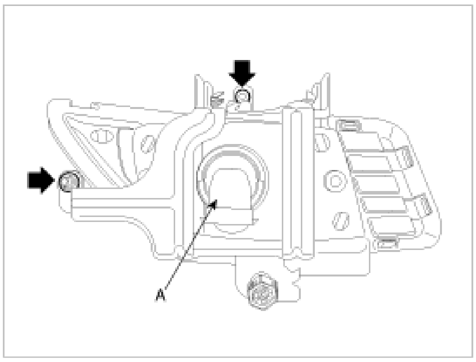
4. Check for intensity. If the light intensity of the lamps changes smoothly without any flickering when the rheostat is turned, it can be assumed that the rheostat is normal.



Body Electrical System > Lighting System > Front Fog Lamps > Repair procedures

REPLACEMENT

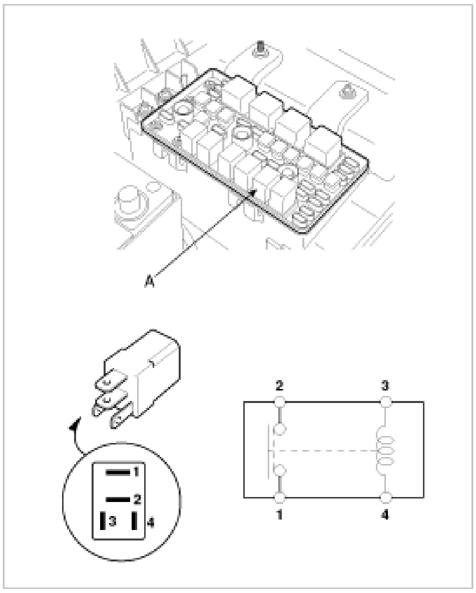
1. Disconnect the negative (-) battery terminal.
2. Remove the front bumper. (Refer to the BD group - front bumper).
3. Remove the front fog lamp (A) after loosening the screws and disconnecting the fog lamp connector.



4. Installation is the reverse of removal.

FRONT FOG LAMP RELAY INSPECTION

1. Pull out the front fog lamp (A) relay from the engine compartment relay box.
2. Check for continuity between terminals. There should be continuity between the No.1 and No.2 terminals when power and ground are connected to the No.3 and No.4 terminals.
3. There should be no continuity between the No.1 and No.2 terminals when power is disconnected.

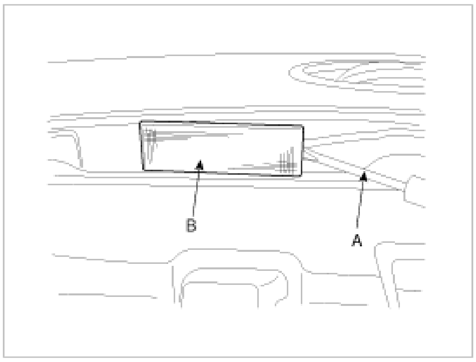


Terminal / Power (No.3-No.4)	1	2	3	4
Disconnected			○	○
Connected	○	○	⊖	⊕

Body Electrical System > Lighting System > License Lamps > Repair procedures

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Detach the lamp lens (A) from the room lamp with a flat-tip screwdriver (B).



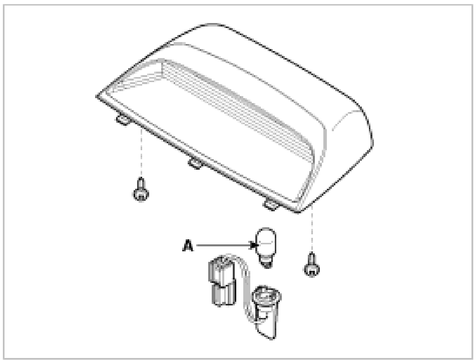
3. Replace the bulb.
4. Installation is the reverse of removal.

Body Electrical System > Lighting System > High Mounted stop lamp > Repair procedures

REPLACEMENT

HIGH MOUNTED STOP LAMP

1. Disconnect the negative(-) battery terminal.
2. Open the trunk lid and then disconnect the connector of high mounted stop lamp.
3. Remove the package tray (Refer to the Body group-package tray).
4. Replace the bulb(A) from the package tray.

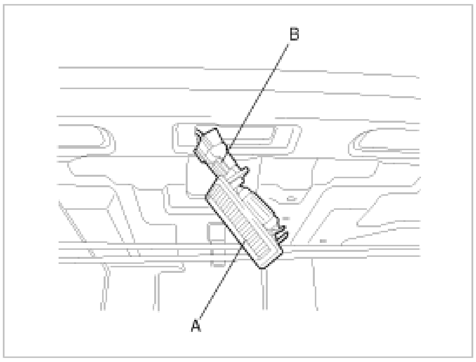


5. Installation is the reverse of removal.

Body Electrical System > Lighting System > Trunk Lamps > Repair procedures

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Open the trunk lid, then remove the trunk room lamp (A) with a flat-tip screwdriver and disconnect the 2P connector (B).



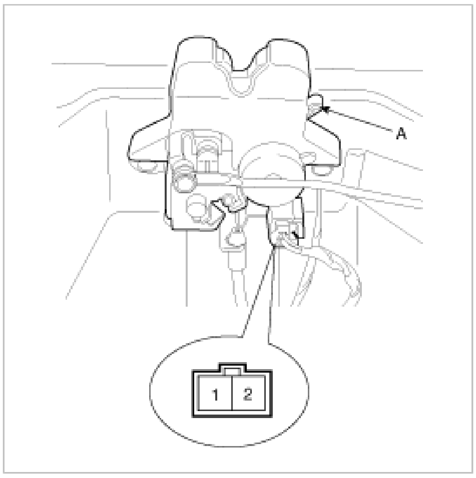
3. Replace the bulb.
4. Installation is the reverse of removal.

INSPECTION

TRUNK ROOM LAMP SWITCH

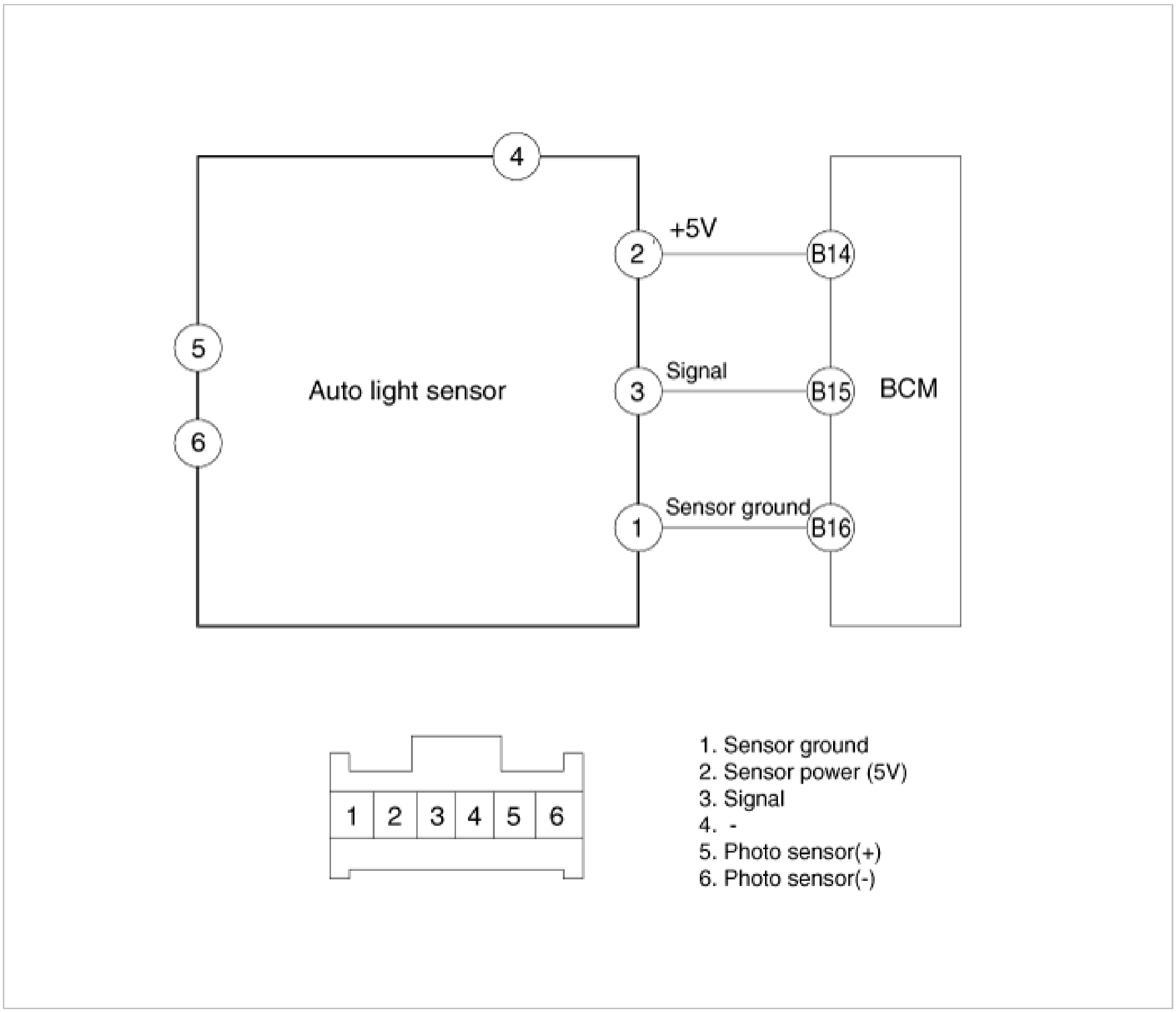
1. Disconnect the negative (-) battery terminal.
2. Remove the trunk lid trim panel. (Refer to the Body group - trunk lid)
3. Disconnect the 2P connector from the actuator.
4. Check for continuity between the terminal No. 1 and body while pushing the rod (A).

Switch rod condition	Continuity
Pushed (OFF)	Non-conductive (∞Ω)
Released (ON)	Conductive (0Ω)



Body Electrical System > Auto Lighting Control System > Schematic Diagrams

CIRCUIT DIAGRAM



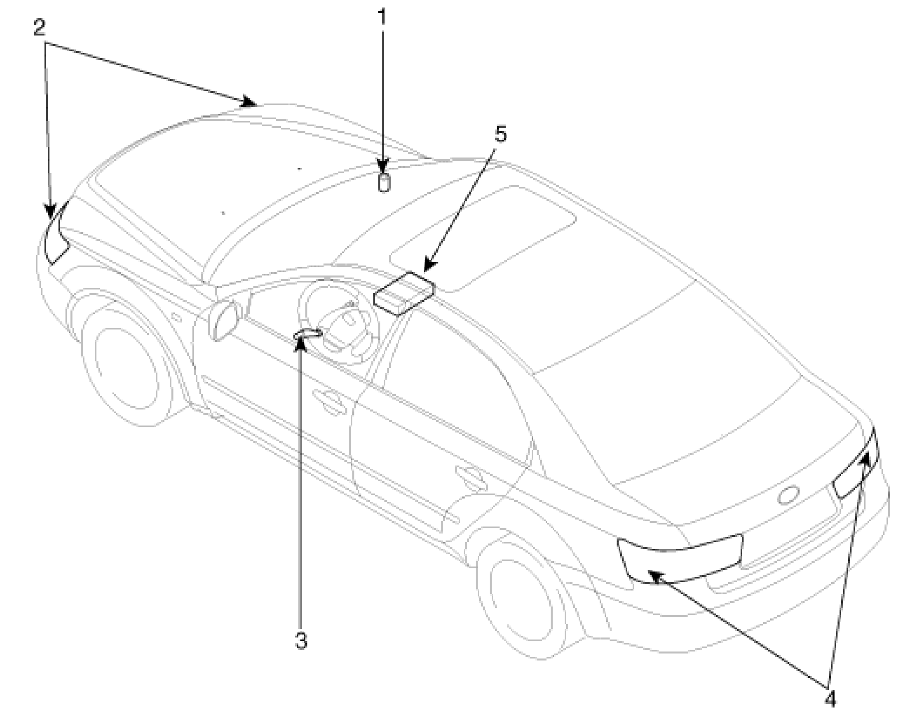
Body Electrical System > Auto Lighting Control System > Description and Operation

DESCRIPTION

The auto light control system operates by using the auto light switch.
If you set the multi-function switch to "AUTO" position, the tail lamp and head lamp will be turned automatically on or off according to external illumination.

Body Electrical System > Auto Lighting Control System > Components and Components Location

COMPONENT LOCATION



1. Auto light sensor	4. Tail lamps
2. Head lamps	5. Body control module
3. Lighting switch (Auto)	

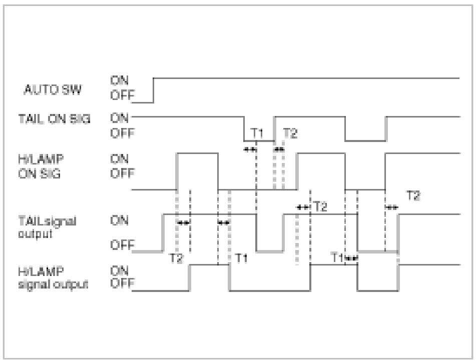
Body Electrical System > Auto Lighting Control System > Repair procedures

INSPECTION

1. While operating the auto light switch, check if the operations are normal as shown in the timing chart.
2. If operations are abnormal, check the body control module.
   (1) Auto light sensor value is always read at IGN ON.
   (2) Light is turned ON after 2sec±0.2sec when auto light sensor value is same as light ON input value.
   (3) Light is turned OFF after 2sec±0.2sec when sensor value is same as light OFF input value.
   (4) Tail lamp and head lamp are turned ON when sensor value is same as tail lamp ON input value.
   (5) Light ON value of sensor is based on the below table.
   (6) Head lamp signal is output when head lamp switch is ON.
   (7) After head lamp is turned OFF, head lamp signal output is kept if head lamp ON luminance condition is met at auto light switch ON.
   (8) After head lamp is turned OFF, head lamp signal output is immediately stopped if head lamp OFF luminance condition is met at auto light switch ON.
   (9) After head lamp is turned OFF, head lamp signal output is immediately stopped at tail switch signal input.
   (10) After head lamp is turned OFF, head lamp signal output is stopped after 0.7s if there is no input of auto light switch or tail switch. (Shall be no flashing of head lamp)
   (11) Head lamp signal output is stopped when switch position is changed from AUTO to head lamp switch during head lamp ON with auto light. (Shall be no flashing of head lamp)

(12) The condition of head lamp ON/OFF is same as the one of tail lamp ON/OFF at auto light switch ON. Light ON value of the input sensor is based on the table.

	TAIL LAMP	HEAD LAMP
ON	0.81V±0.08V	Same as tail sensor value
OFF	1.41V±0.10V	Same as tail sensor value



T1/T2 : 2.0 ± 0.2sec.

Body Electrical System > Auto Lighting Control System > Specifications

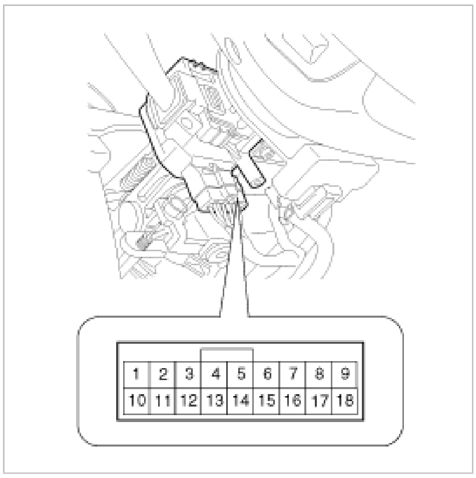
SPECIFICATIONS

Items	Specifications
Rated voltage	12V
Load	Max. 1mA
Detection illuminations Tail lamp / Head lamp	ON : 24 ± 5.2 (Lux), 0.81 ±0.08 (V) OFF : 48 ± 10.5 (Lux), 1.41 ±0.10 (V)

Body Electrical System > Auto Lighting Control System > Auto Light Switch > Repair procedures

INSPECTION

Operate the auto light switch, then check for continuity between terminals of 18P multi-function switch connector.

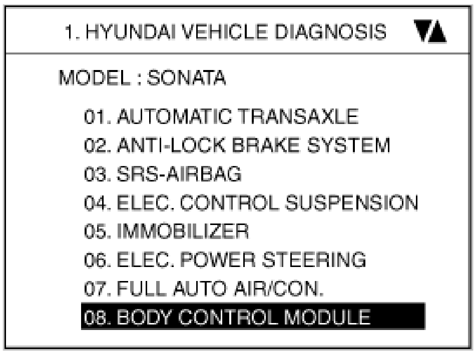


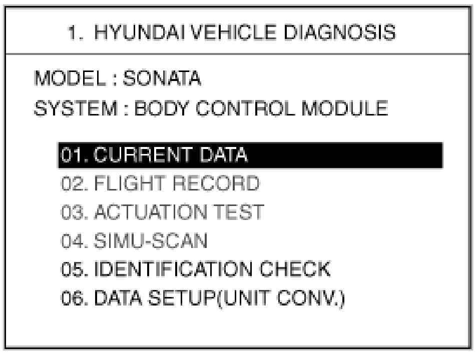
Terminal / Position	14	15	16	17
OFF				
I	O			O
II	O	O		O
AUTO			O	O

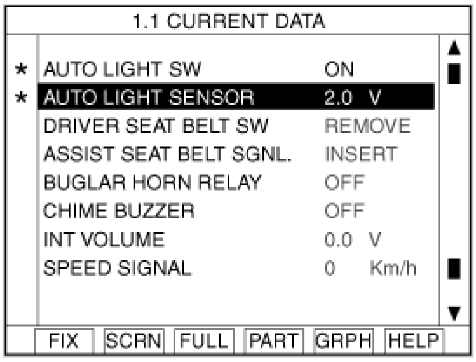
Body Electrical System > Auto Lighting Control System > Auto Light Sensor > Repair procedures

INSPECTION

1. Ignition "ON"
2. Using the scan tool.
3. Emit intensive light toward auto light sensor using sunshine, and check the output voltage change.
4. The voltage will rise with higher intensive light and reduce with lower intensive light.

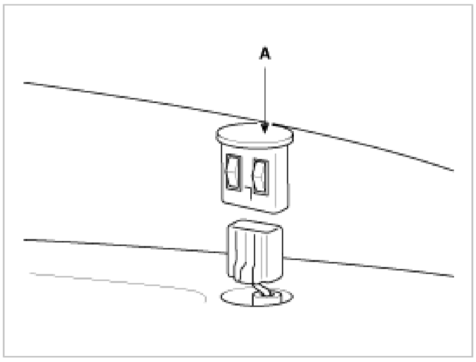






> **NOTE**
>
> When checking auto light sensor, select a place where sun shines directly on it.

5. If the measured resistance is not specification, substitute with a known-good auto light sensor and check for proper operation.
6. If the problem is corrected, replace the auto light sensor.
7. Remove the photo & auto light sensor (A) from the upper crash pad.



8. Disconnect the 6P connector from the auto light sensor then inspect the connector on the wire harness side, as shown in the chart.

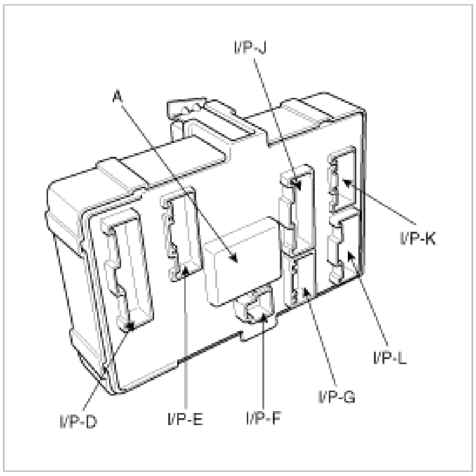
Tester connection	Condition	Specified condition
1-Ground	Auto light switch ON	Continuity
2-Ground	Sensor power	5V

9. If the circuit is not as specified, inspect the circuits connected to other parts.

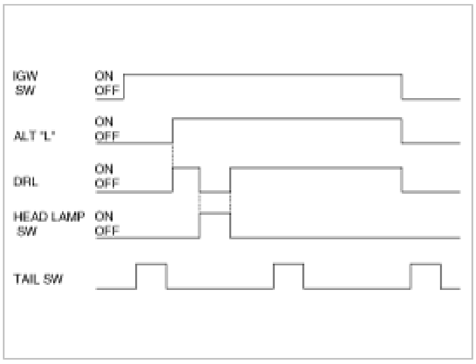
Body Electrical System > Daytime Running Lights > DRL Control Module > Repair procedures

INSPECTION

1. The daytime running light unit (A) is integrated in the junction box.



2. Check that the light operate according to the following timing chart.

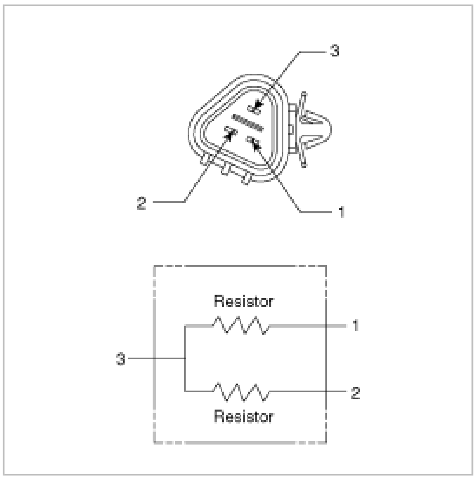


3. If the daytime running light is not operated well, inspect the connector and terminals to be sure they are all making good contact.
If the terminals are bent, loose or corroded, repair them as necessary, and recheck the system.
If the terminals look OK, go to step 4.
4. Make these input tests at the connector
If any test indicates a problem, find and by using ETM correct the cause, then recheck the system.
If all the input tests prove OK, the junction box must be faulty; replace it.

INSPECTION

1. Check for continuity and measure the resistance between No.1 and NO.3 terminals.

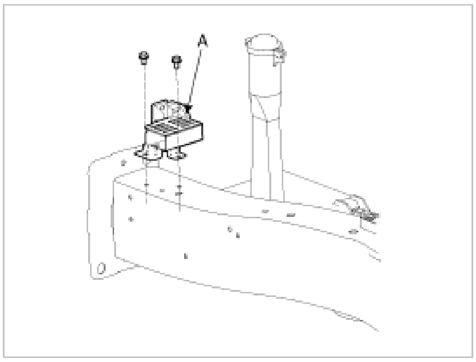
Standard value : 2.5Ω ± 5%



2. If resistance is not as specified, replace the DRL resistor.

REPLACEMENT

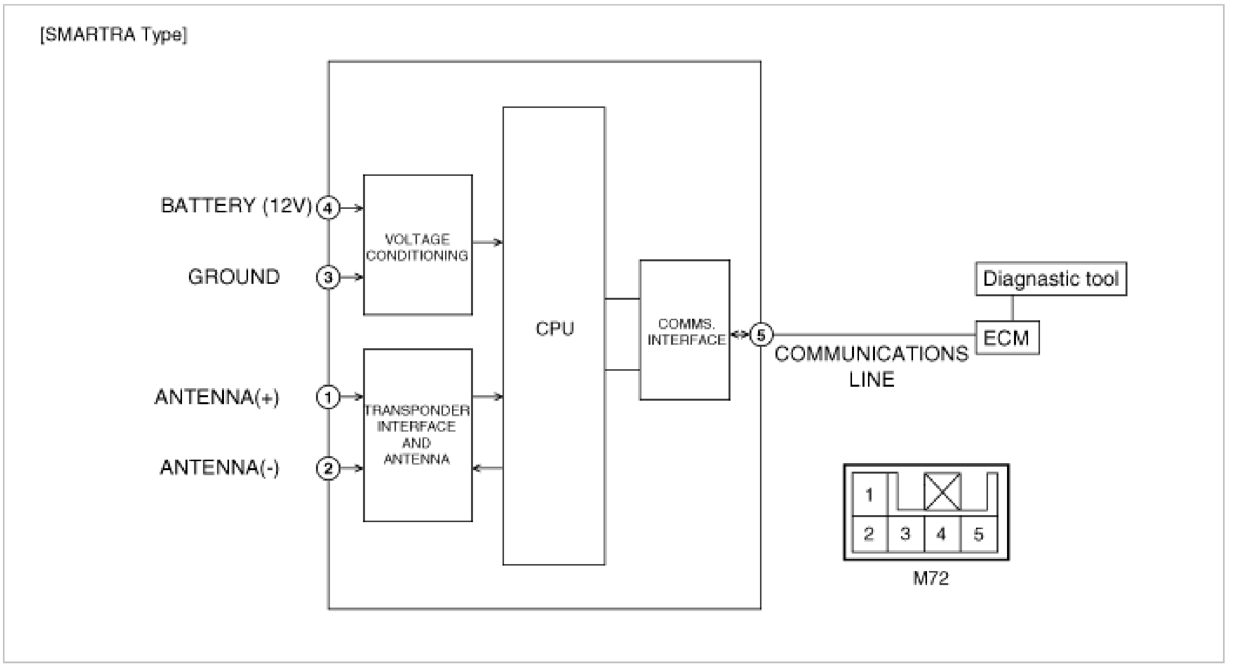
1. Disconnect the negative (-) battery terminal.
2. Remove the right head lamp assembly (Refer to the head lamp).
3. Disconnect the connector and then remove the DRL resistor (A) under the right head lamp after loosening the bolts (2EA).



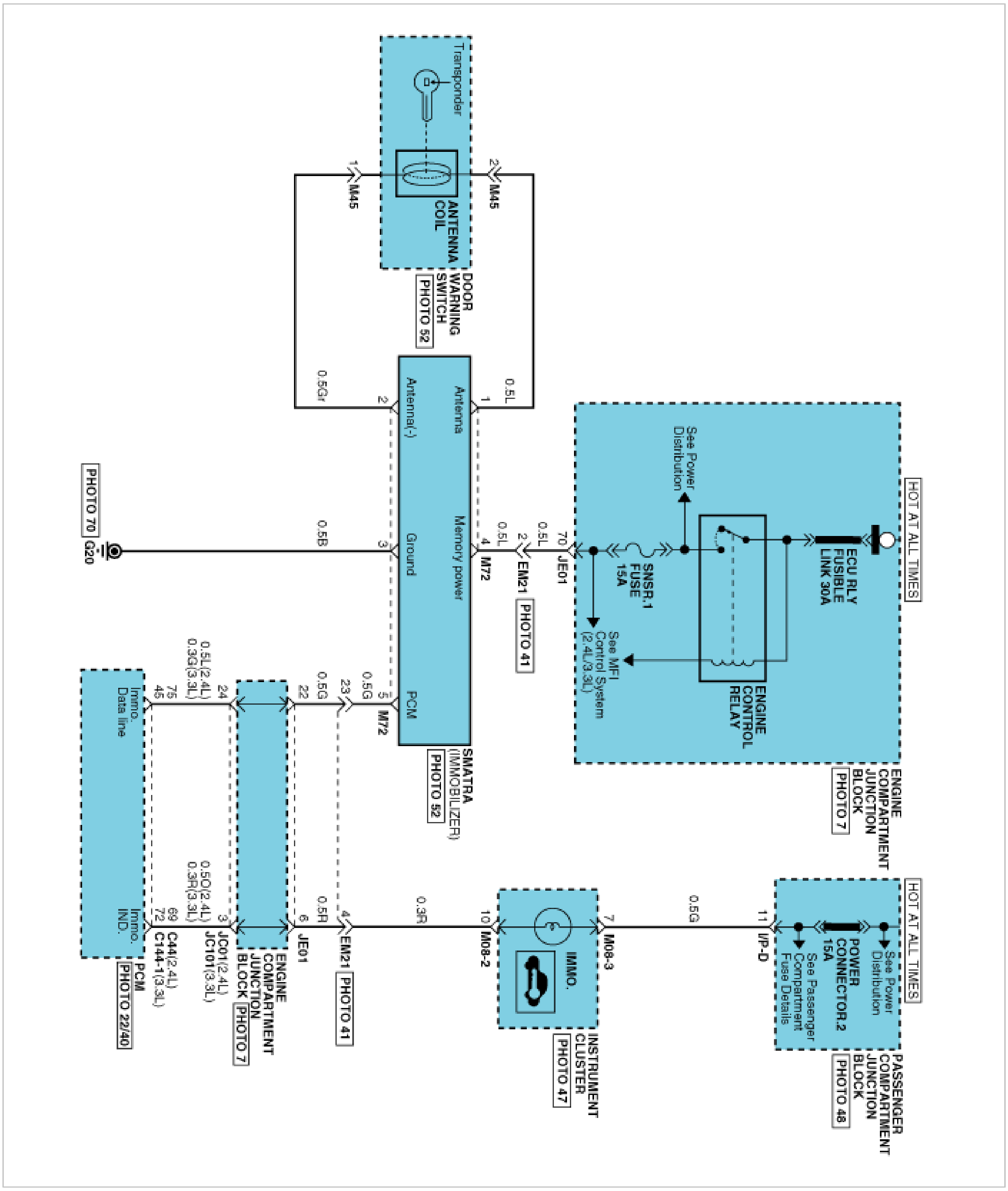
4. Installation is the reverse of removal procedure.

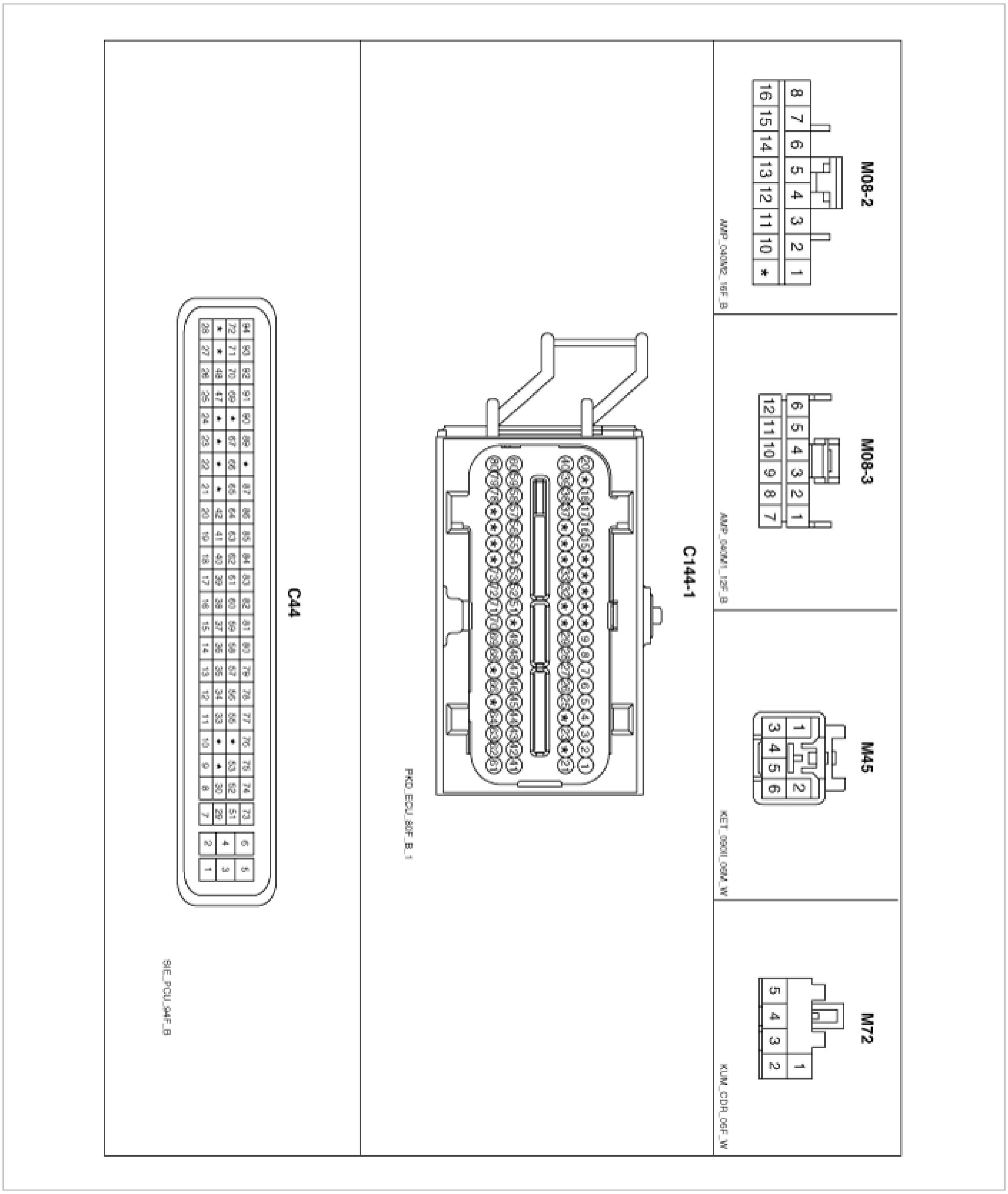
Body Electrical System > Immobilizer System > Schematic Diagrams

SYSTEM BLOCK DIAGRAM



CIRCUIT DIAGRAM


Transponder
ANTENNA COIL
M45
DOOR WARNING SWITCH
PHOTO 52
HOT AT ALL TIMES
ECU RLY FUSIBLE LINK 30A
ENGINE CONTROL RELAY
See Power Distribution
SNSR.1 FUSE 15A
See MFI Control System (2.4L/3.3L)
ENGINE COMPARTMENT JUNCTION BLOCK
PHOTO 7
JE01
EM21
PHOTO 41
M72
Antenna
Antenna(-)
Memory power
Ground
PCM
SMATRA (IMMOBILIZER)
PHOTO 70
G20
0.5L
0.5Gr
0.5B
0.5G
0.5L(2.4L)
0.3G(3.3L)
Immo. Data line
PASSENGER COMPARTMENT JUNCTION BLOCK
PHOTO 48
POWER CONNECTOR.2 15A
See Passenger Compartment Fuse Details
I/P-D
M08-3
IMMO.
INSTRUMENT CLUSTER
PHOTO 47
M08-2
0.3R
0.5R
0.5O(2.4L)
0.3R(3.3L)
JC01(2.4L)
JC101(3.3L)
Immo. IND.
C44(2.4L)
C144-1(3.3L)
PCM
PHOTO 22/40



Body Electrical System > Immobilizer System > Description and Operation

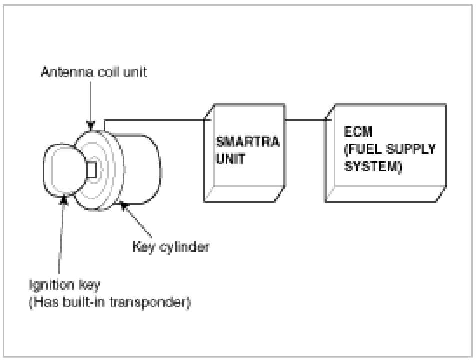
DESCRIPTION

The immobilizer system will disable the vehicle unless the proper ignition key is used, in addition to the currently available anti-theft systems such as car alarms, the immobilizer system aims to drastically reduce the rate of auto theft.

1. SMARTRA type immobilizer
   A. The SMARTRA system consists of a transponder located in the ignition key, an antenna coil, a SMARTRA unit, an indicator light and the ECM.
   B. The SMARTRA communicates to the ECM (Engine Control Module) via a dedicated communications line. Since the vehicle engine management system is able to control engine mobilization, it is the most suitable unit to control the SMARTRA.
   C. When the key is inserted in the ignition and turned to the ON position, the antenna coil sends power to the transponder in the ignition key. The transponder then sends a coded signal back through the SMARTRA unit to the ECM.
   D. If the proper key has been used, the ECM will energize the fuel supply system. The immobilizer indicator light in the cluster will simultaneously come on for more than five seconds, indicating that the SMARTRA unit has recognized the code sent by

the transponder.

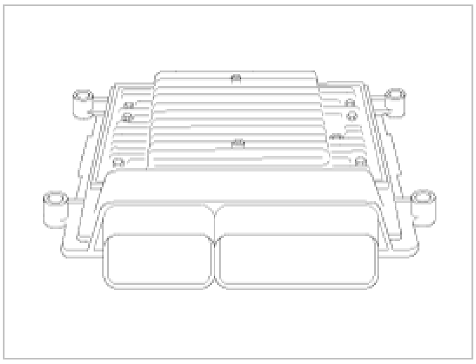
E. If the wrong key has been used and the code was not received or recognized by the ECM the indicator light will continue blinking for about five seconds until the ignition switch is turned OFF.
F. If it is necessary to rewrite the ECM to learn a new key, the dealer needs the customer's vehicle, all its keys and the Hi-scan (pro) equipped with an immobilizer program card. Any key that is not learned during rewriting will no longer start the engine.
G. The immobilizer system can store up to four key codes.
H. If the customer has lost his key, and cannot start the engine, contact HMC motor service station.



COMPONENTS OPERATIONS

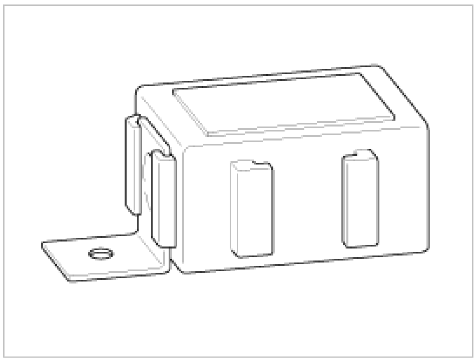
ECM (Engine Control Module)

1. The ECM carries out a check of the ignition key using a special encryption algorithm, which is programmed into the transponder as well as the ECM simultaneously. Only if the results are equal, the engine can be started. The data of all transponders, which are valid for the vehicle, are stored in the ECM.



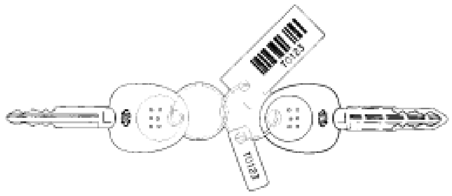
SMARTRA unit

The SMARTRA carries out communication with the built-in transponder in the ignition key. This wireless communication runs on RF (Radio frequency of 125 kHz). The SMARTRA is mounted behind of the crush pad under panel close to the antenna coil for RF transmission and receiving.
The RF signal from the transponder, received by the antenna coil, is converted into messages for serial communication by the SMARTRA device. And, the received messages from the ECM are converted into an RF signal, which is transmitted to the transponder by the antenna.
The SMARTRA does not carry out the validity check of the transponder or the calculation of encryption algorithm. This device is only an advanced interface, which converts the RF data flow of the transponder into serial communication to the ECM and vice versa.



TRANSPONDER (Built-in keys)

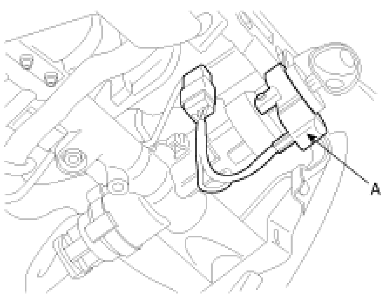
The transponder has an advanced encryption algorithm. During the key teaching procedure, the transponder will be programmed with vehicle specific data. The vehicle specific data are written into the transponder memory. The write procedure is once only; therefore, the contents of the transponder can never be modified or changed.



Antenna coil

The antenna coil (A) has the following functions.

- The antenna coil supplies energy to the transponder.
- The antenna coil receives signal from the transponder.
- The antenna coil sends transponder signal to the SMARTRA.
  It is located directly in front of the steering handle lock.



Body Electrical System > Immobilizer System > Troubleshooting

DIAGNOSIS OF IMMOBILIZER FAULTS

- Communication between the ECM and the SMARTRA.
- Function of the SMARTRA and the transponder.
- Data (stored in the ECM related to the immobilizer function.

The following table shows the assignment of immobilizer related faults to each type:

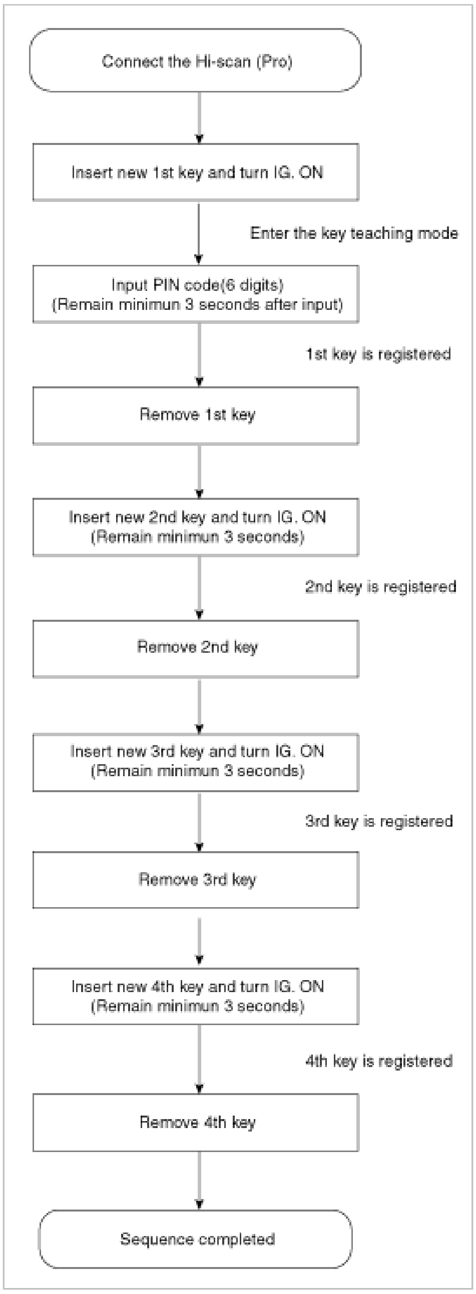
Immobilizer Related Faults	Fault types	Diagnostic codes
Transponder key fault	1. Transponder not in password mode. 2. Transponder transport data has been changed.	P1674 (Transponder status error)
Transponder key fault	1. Transponder programining error	P1675 (Transponder programming error)
SMARTRA fault	1. Invalid message from SMARTRA to ECM.	P1676 (SMARTRA message error)
SMARTRA fault	1. No response from SMARTRA (Communication Line Error - Open or Short etc.)	P1690 (SMARTRA no response)
Antenna coil fault	1. Antenna coil open/short circuit	P1691 (Antenna coil error)
Transponder key fault	1. Corrupted data from transponder 2. More than one transponder in the magnetic field (Antenna coil) 3. No transponder (Key without transponder) in the magnetic field (Antenna coil)	P1693 (Transponder no response error/invalid response)

ECM fault	1. Request from ECM is invalid (Protocol layer violation- Invalid request, check sum error etc.)	P1694 (ECM message error)
ECM internal permanent memory (EEPROM) fault	1. ECM internal permanent memory (EEPROM) fault 2. Invalid write operation to permanent memory (EEPROM)	P1695 (ECM memory error)
Invalid key fault	1. Virgin transponder at ECM status "Learnt" 2. Learnt (Invalid) Transponder at ECM status "Learnt"(Authentication fail)	P1696 (Authentication fail)
Locked by timer	1. Exceeding the maximum limit of Twice IGN ON (⊇ 32 times)	P1699 (Twice IG ON over trial)

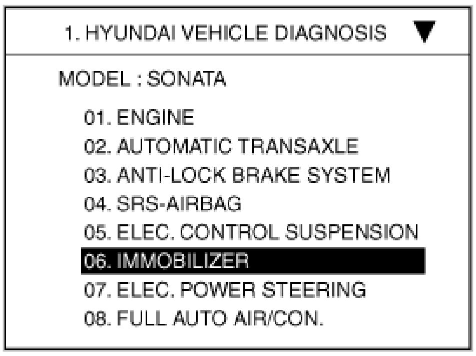
Body Electrical System > Immobilizer System > Repair procedures

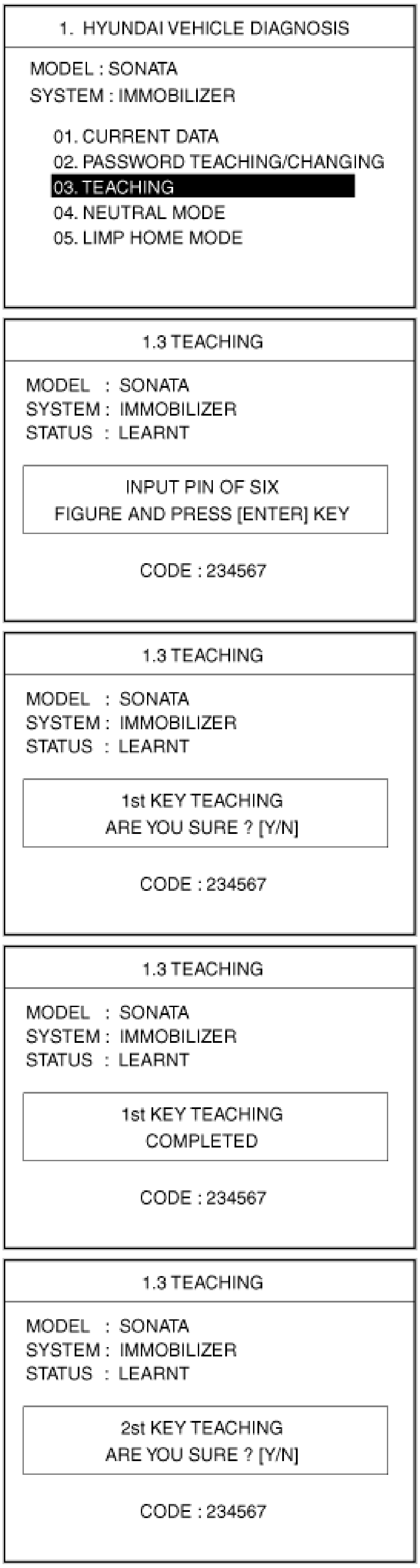
TEACHING PROCEDURES

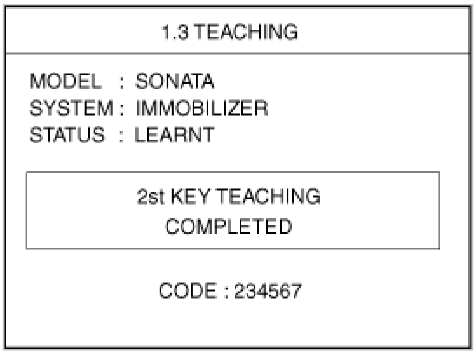
1. Key Teaching Procedure
   Key teaching must be done after replacing a defective ECM or when providing additional keys to the vehicle owner.
   The procedure starts with an ECM request for vehicle specific data (PIN code: 6digits) from the tester. The "virgin" ECM stores the vehicle specific data and the key teaching can be started. The "learnt" ECM compares the vehicle specific data from the tester with the stored data. If the data are correct, the teaching can proceed.
   If incorrect vehicle specific data have been sent to the ECM three times, the ECM will reject the request of key teaching for one hour. This time cannot be reduced by disconnecting the battery or any other manipulation. After reconnecting the battery, the timer starts again for one hour.
   The key teaching is done by ignition on with the key and additional tester commands. The ECM stores the relevant data in the EEPROM and in the transponder. Then the ECM runs the authentication required for confirmation of the teaching process. The successful programming is then confirmed by a message to the tester.
   If the key is already known to the ECM from a previous teaching, the authentication will be accepted and the EEPROM data are updated. There is no changed transponder content (this is impossible for a learnt transponder).
   The attempt to repeatedly teach a key, which has been taught already during the same teaching cycle, is recognized by the ECM. This rejects the key and a message is sent to the tester.
   The ECM rejects invalid keys, which are presented for teaching. A message is sent to the tester. The key can be invalid due to faults in the transponder or other reasons, which result from unsuccessful programming of data. If the ECM detects different authenticators of a transponder and an ECM, the key is considered to be invalid.
   The maximum number of taught keys is 4
   If an error occurs during the Immobilizer Service Menu, the ECM status remains unchanged and a specific fault code is stored.
   If the ECM status and the key status do not match for teaching of keys, the tester procedure will be stopped and a specific fault code will be stored at ECM.



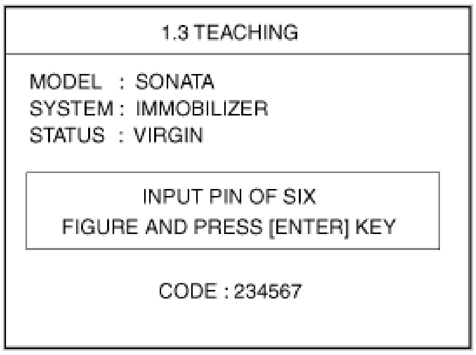
(1) ECM learnt status.

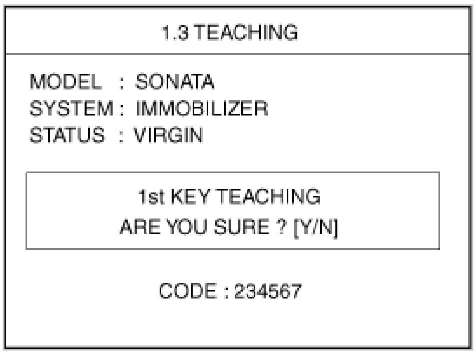


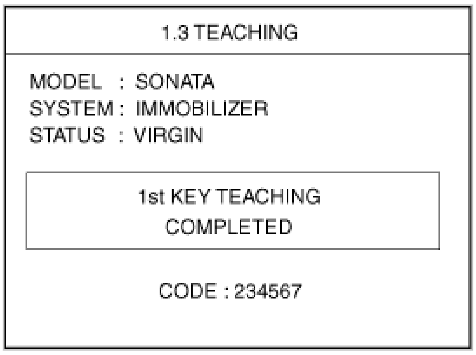

1. HYUNDAI VEHICLE DIAGNOSIS
MODEL : SONATA
SYSTEM : IMMOBILIZER
01. CURRENT DATA
02. PASSWORD TEACHING/CHANGING
03. TEACHING
04. NEUTRAL MODE
05. LIMP HOME MODE
1.3 TEACHING
MODEL : SONATA
SYSTEM : IMMOBILIZER
STATUS : LEARNT
INPUT PIN OF SIX
FIGURE AND PRESS [ENTER] KEY
CODE : 234567
1.3 TEACHING
MODEL : SONATA
SYSTEM : IMMOBILIZER
STATUS : LEARNT
1st KEY TEACHING
ARE YOU SURE ? [Y/N]
CODE : 234567
1.3 TEACHING
MODEL : SONATA
SYSTEM : IMMOBILIZER
STATUS : LEARNT
1st KEY TEACHING
COMPLETED
CODE : 234567
1.3 TEACHING
MODEL : SONATA
SYSTEM : IMMOBILIZER
STATUS : LEARNT
2st KEY TEACHING
ARE YOU SURE ? [Y/N]
CODE : 234567

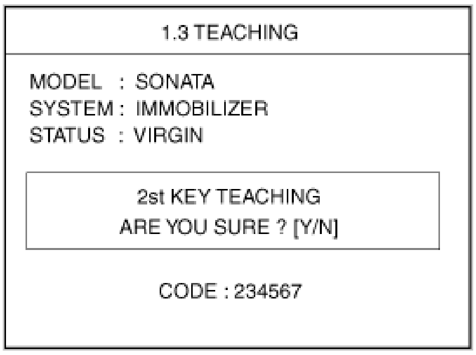


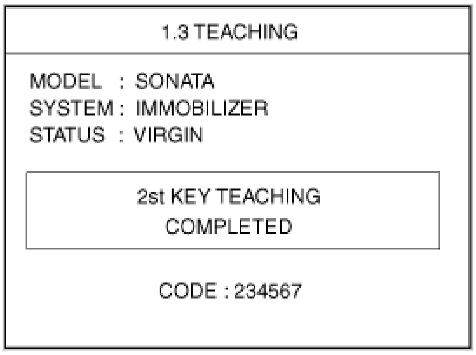
(2) ECM virgin status.
After replacing new "ECM" scantool displays that ECM is virgin status in Key Teaching mode.
"VIRGIN" status means that ECM has not matched any PIN code before.



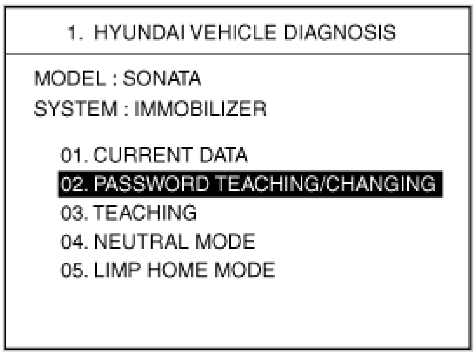


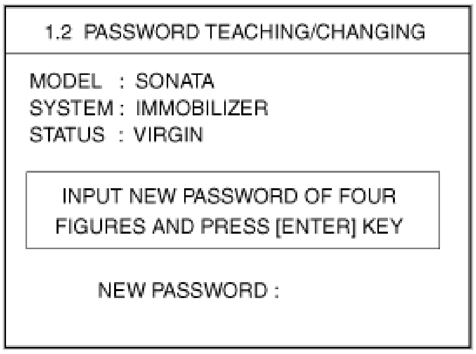


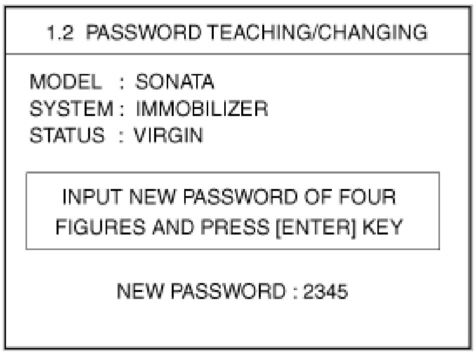




2. User Password Teaching Procedure
   The user password for limp home is taught at the service station. The owner of the vehicle can select a number with four digits. User password teaching is only accepted by a "learnt" ECM. Before first teaching of user password to an ECM, the status of the password is "virgin" No limp home function is possible.
   The teaching is started by ignition on, with a valid key and sending the user password by tester. After successful teaching, the status of the user password changes from "virgin" to "learnt"
   The learnt user password can also be changed. This can be done if the user password status is "learnt" and the tester sends authorization of access, either the old user password or the vehicle specific data. After correct authorization, the ECM requests the new user password. The status remains "learnt" and the new user password will be valid for the next limp home mode.
   If incorrect user passwords or wrong vehicle specific data have been sent to the ECM three times, the ECM will reject the request to change the password for one hour. This time cannot be reduced by disconnecting the battery or any other actions. After reconnecting the battery, the timer starts again for one hour.
   (1) User password teaching







```
1.2  PASSWORD TEACHING/CHANGING

MODEL   :  SONATA
SYSTEM :  IMMOBILIZER
STATUS  :  VIRGIN

ARE YOU SURE ? [Y/N]

NEW PASSWORD :  2345
```

```
1.2  PASSWORD TEACHING/CHANGING

MODEL   :  SONATA
SYSTEM :  IMMOBILIZER
STATUS  :  VIRGIN

COMPLETED
PRESS [ESC] TO EXIT

NEW PASSWORD : 2345
```

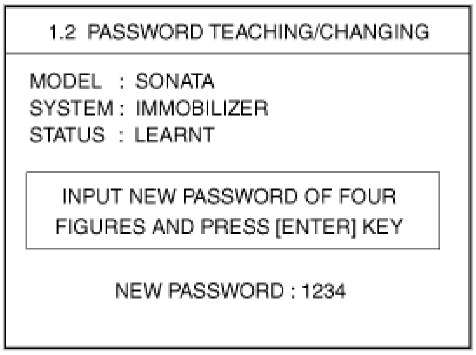
※ In case of putting wrong password, retry from first step after 10 seconds.

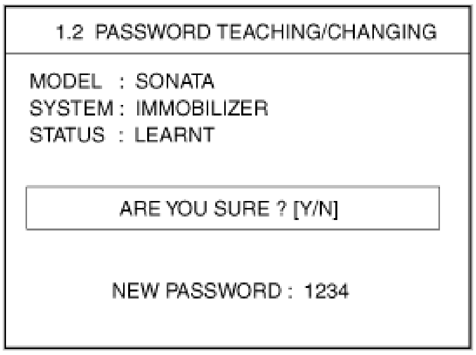
(2) User password changing

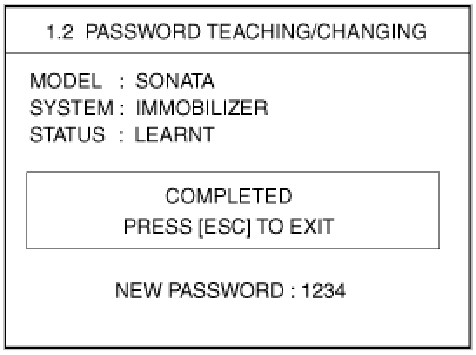
```
1.  HYUNDAI VEHICLE DIAGNOSIS

MODEL : SONATA
SYSTEM : IMMOBILIZER

01. CURRENT DATA
02. PASSWORD TEACHING/CHANGING
03. TEACHING
04. NEUTRAL MODE
05. LIMP HOME MODE
```

```
1.2  PASSWORD TEACHING/CHANGING

MODEL   :  SONATA
SYSTEM :  IMMOBILIZER
STATUS  :  LEARNT

INPUT OLD PASSWORD OF FOUR
FIGURES AND PRESS [ENTER] KEY

OLD PASSWORD :
```

```
1.2  PASSWORD TEACHING/CHANGING

MODEL   :  SONATA
SYSTEM :  IMMOBILIZER
STATUS  :  LEARNT

INPUT OLD PASSWORD OF FOUR
FIGURES AND PRESS [ENTER] KEY

OLD PASSWORD : 2345
```

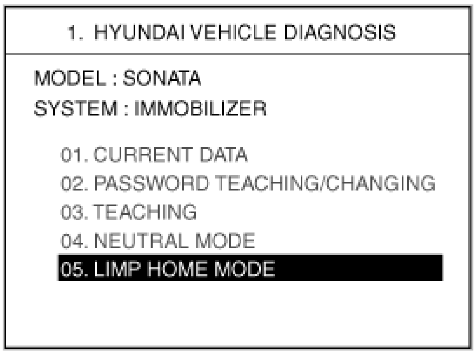


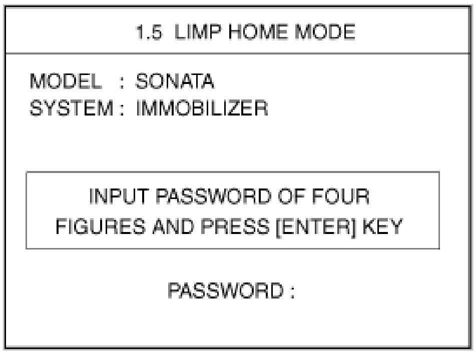


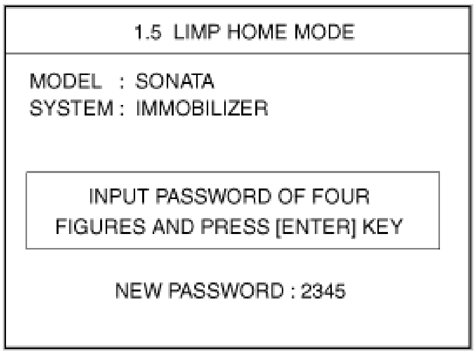


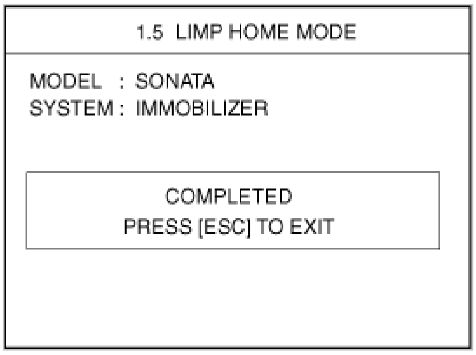
LIMP HOME FUNCTION

1. LIMP HOME BY TESTER
   If the ECM detects the fault of the SMARTRA or transponder, the ECM will allow limp home function of the immobilizer. Limp home is only possible if the user password (4 digits) has been given to the ECM before. This password can be selected by the vehicle owner and is programmed at the service station.
   The user password can be sent to the ECM via the special tester menu.
   Only if the ECM is in status "learnt" and the user password status is "learnt" and the user password is correct, the ECM will be unlocked for a period of time (30 sec.). The engine can only be started during this time. After the time has elapsed, engine start is not possible.
   If the wrong user password is sent, the ECM will reject the request of limp home for one hour. Disconnecting the battery or any other action cannot reduce this time. After connecting the battery to the ECM, the timer starts again for one hour.

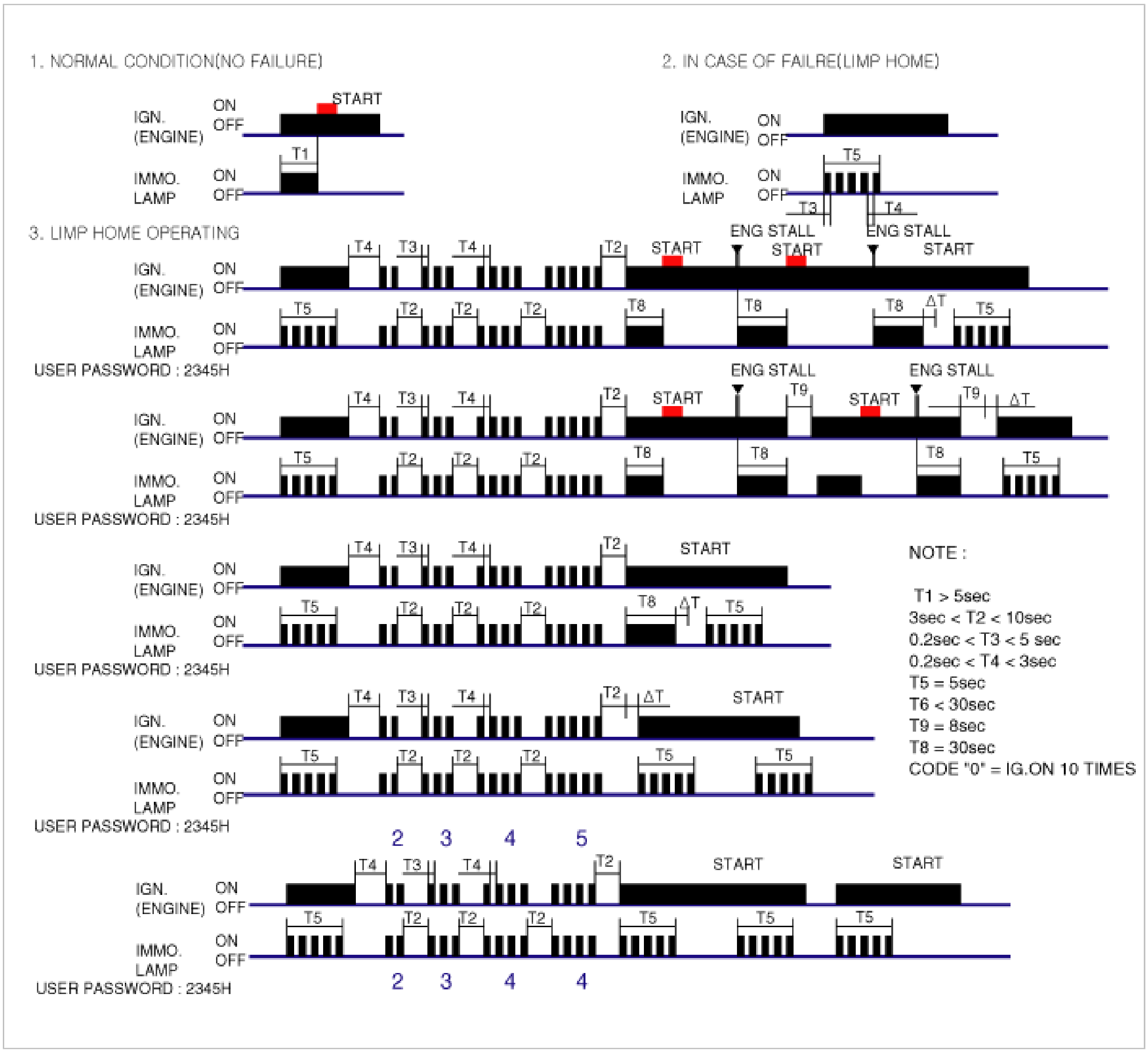








2. LIMP HOME BY IGNITION KEY
   The limp home can be activated also by the ignition key. The user password can be input to the ECM by a special sequence of ignition on/off.
   Only if the ECM is in status "learnt" and the user password status is "learnt" and the user password is correct, the ECM will be unlocked for a period of time (30 sec.). The engine can be started during this time. After the time has elapsed, engine start is not possible. After a new password has been input, the timer (30 sec.) will start again.
   After ignition off, the ECM is locked if the timer has elapsed 8 seconds. For the next start, the input of the user password is requested again.



PROBLEMS AND REPLACEMENT PARTS:

Problem	Part set	Scan tool required?
All keys have been lost	Blank key (4)	YES
Antenna coil unit does not work	Antenna coil unit	NO
ECM does not work	ECM	YES
Ignition switch does not work	Ignition switch with Antenna coil unit	YES
Unidentified vehicle specific data occurs	Key, ECM	YES
SMARTRA unit does not work	SMARTRA unit	NO

REPLACEMENT OF ECM AND SMARTRA

In case of a defective ECM, the unit has to be replaced with a "virgin" or "neutral" ECM. All keys have to be taught to the new ECM. Keys, which are not taught to the ECM, are invalid for the new ECM (Refer to key teaching procedure). The vehicle specific data have to be left unchanged due to the unique programming of transponder.

In case of a defective SMARTRA, there is no special procedure required. A new SMARTRA device simply replaces the old one. There are no transponder-related data stored in this device.

1. Things to remember before a replacement (ECM)

When installing ECM of car "A" on car "B"
※ All non-virgin ECM's need to be neutralized before installing on the other vehicles.

↓

Neutralize the ECM of car "A"

↓

Installing the ECM of car "A" on car "B"

↓

Register the keys with the PIN code of car "B"

↓

Register additional keys (Maximum of keys)
※ All phases of key registration should be completed in under 10 seconds

↓

Registration completed

2. Things to remember before a replacement (Keys & Additional registration)

Replace keys & additional registration
※ You must know the PIN code before executing this procedure

↓

Turn the key to the IG ON position

↓

Initialize the ECM (Under the Neutral Mode)

↓

Insert the key you want to register and turn it to the IG ON position

↓

Register the key (Under the Teaching Mode)

↓

Register additional keys (Maximum of 4 keys)
※ All phases of key registration should be completed in under 10 seconds

↓

Registration completed

NOTE

1. When there is only one key registered and you wish to register another key, you need to re-register the key which was already registered.
2. When the key #1 is registered and key #2 is not registered, Put the key #1 in the IG/ON or the start position and remove it. The engine can be started with the unregistered key #2.
   (Note that key #2 must be used within 10 seconds of removing key #1)
3. When the key #1 is registered and key #2 is not registered, put the unregistered master key #2 in the IG/ON or the start position.
   The engine cannot be started even with the registered key #1.
   (Note that key #1 must be used within 10 seconds of removing key #2)
4. When you inspect the immobilizer system, refer to the above paragraphs 1, 2 and 3.
   Always remember the 10 seconds zone.
5. If the pin code & password are entered incorrectly on three consecutive inputs, the system will be locked for one hour.
6. Be cautious not to overlap the transponder areas.
7. Problems can occur at key registration or vehicle starting if the transponders should overlap.

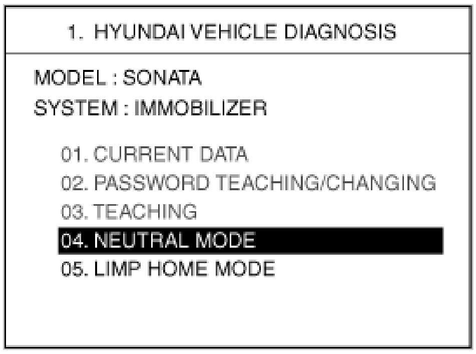
NEUTRALISING OF ECM

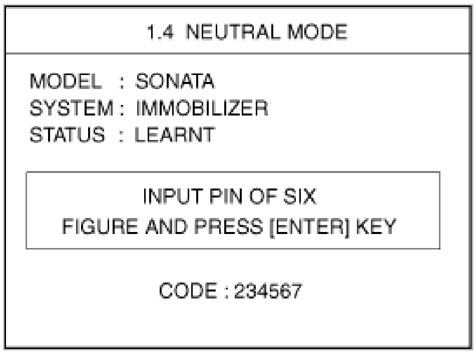
The ECM can be set to the "neutral" status by a tester.
A valid ignition key is inserted and after ignition on is recorded, the ECM requests the vehicle specific data from the tester. The communication messages are described at "Neutral Mode" After successfully receiving the data, the ECM is neutralized.
The ECM remains locked. Neither the limp home mode nor the "twice ignition on" function, is accepted by the ECM.
The teaching of keys follows the procedure described for the virgin ECM. The vehicle specific data have to be unchanged due to the unique programming of the transponder. If data should be changed, new keys with a virgin transponder are requested.
This function is for neutralizing the ECM. Ex) when lost key, Neutralize the ECM then teach keys.
(Refer to the Things to do when Key & PIN Code the ECM can be set to the "neutral" status by a scanner. A valid ignition key is inserted and after ignition on is recorded, the ECM requests the vehicle specific data from the scanner. The communication messages are described at" Neutral Mode". After successfully receiving the data, the ECM is neutralized.

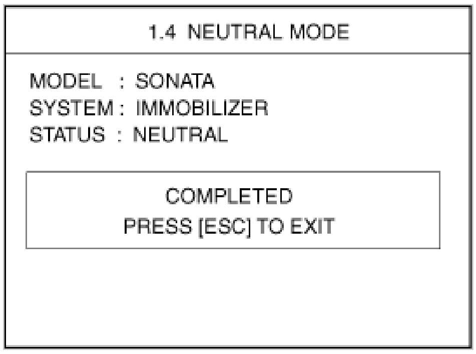
The ECM remains locked. Neither the limp home mode nor the "twice ignition on" function is accepted by ECM.
The teaching of keys follows the procedure described for virgin ECM. The vehicle specific data have to be unchanged due to the unique programming of transponder. If data should be changed, new keys with virgin transponder are requested.

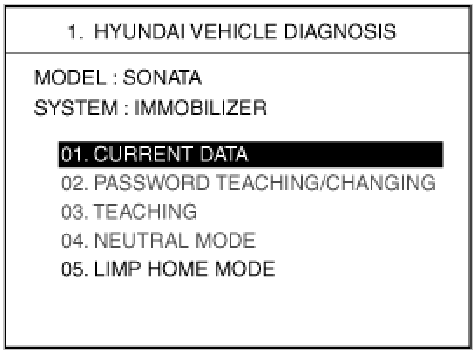
NOTE

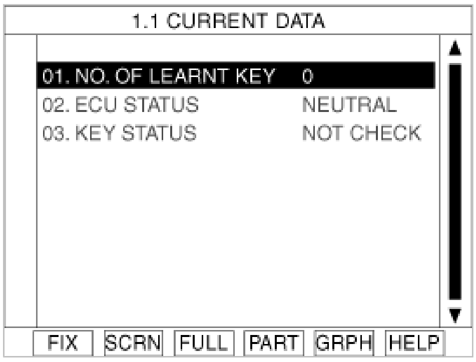
- Neutralizing setting condition
  - In case of ECM status "Learnt" regardless of user password "Virgin or Learnt"
  - Input correct PIN code by scanner.
  - Neutralizing meaning .
    : PIN code (6) & user password (4) deletion.
    : Locking of ECM (except key teaching permission)











Body Electrical System > Immobilizer System > P1674

GENERAL DESCRIPTION

During the key teaching procedure the transponder will be programmed with vehicle specific data. The vehicle specific data are written into the transponder memory. The write procedure is unique; therefore the content of transponder can never be modified or changed. The data are a string of 9 bytes defined by vehicle manufacturer.
The transponder memory is split into two strings called authenticator and key password after this programming the transponder memory is locked and the data (PIN code) cannot be read or changed respectively. The transponder status changes from "virgin" to "learnt" Additionally every transponder includes a unique IDE (Identifier number) of 32 bit. Unique means that the IDE of all transponder is different from each other. The IDE is programmed by the transponder manufacturer and is a read-only value. The authenticator and the key password are not transferred from ECM to transponder or vice versa. Only the results from the encryption algorithm are transferred. It is almost impossible to calculate the vehicle specific data from the encryption result.
For teaching of keys and special purposes the ECM is connected to the tester device.
When IG is ON, the coil supplies energy to the transponder which in turn accumulates energy in the condenser.
Once the energy supply from the coil has stopped, using the stored energy in the condenser, the transponder transmits the ID CODE (stored within the ASIC).

DTC DESCRIPTION

This DTC is defined as TP not in password mode, or Transponder transport data has been changed.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
Enable Condition	• IG ON	• Transponder Key
Detecting Factors	• Password mode invalid	
Detecting Window	• During Transponder Write or Read EEPROM Page	
Detecting Criteria	• TP not in password mode, or Transponder transport data has been changed	

MONITOR SCANTOOL DATA

1. Ignition "ON" & Engine "OFF".
2. Connect Scan tool and clear the DTCs.
3. If the DTCs are retrieved again, monitor "CURRENT DATA" to check No. of Learnt key, ECM and KEY status.

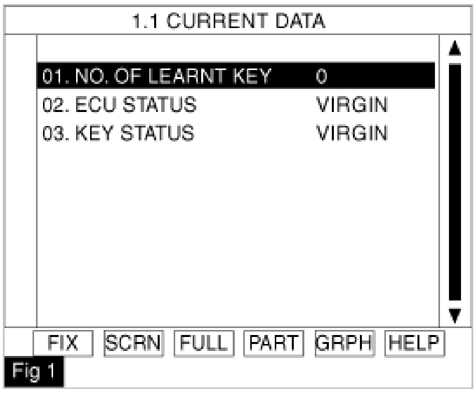


Fig 1

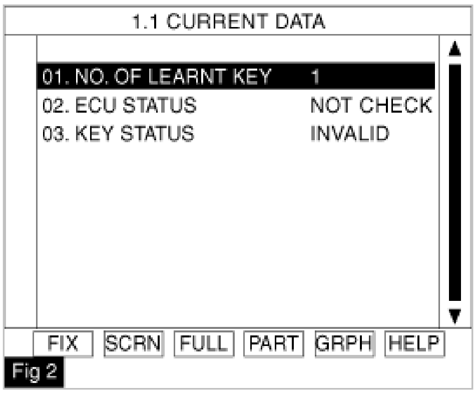


Fig 2

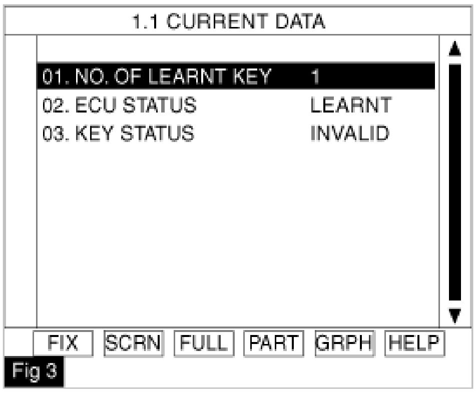


Fig 3

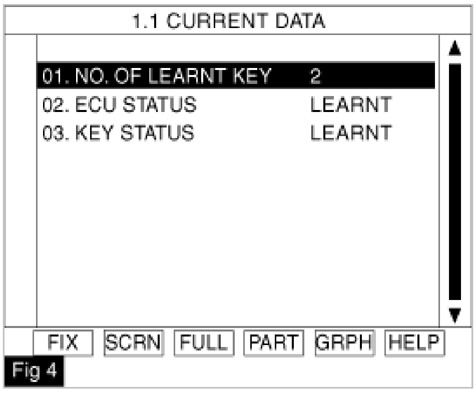


Fig 4

Fig 1 : ECM has not matched with any Key yet.
Fig 2 : ECM Internal Failure.
Fig 3 : IG On with unmatched key.
Fig 4 : 2(two) Keys have been matched with ECM.

4. Are both Key and ECM status learnt?

YES

Fault is intermittent caused by poor contact in the SMARTRA's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Go to "Component Inspection" procedure.

COMPONENT INSPECTION

1. Check Transponder
   (1) Ignition "ON" & Engine "OFF".
   (2) Perform neutral mode, key teaching and password teaching/changing.
   (Refer to "Reference Data in General Information")

   NOTE

   Be sure that PIN code is prepared before performing neutral mode.

   (3) Is the neutral, teaching and password teaching/changing mode possible?

   YES

   Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
   Repair or replace as necessary and then go to " Verification of Vehicle Repair" procedure.

   NO

   Substitute with a known-good virgin Transponder and monitor CURRENT DATA.
   If the key status is displayed as "Virgin", replace Transponder.
   Perform key teaching mode in " Reference Data"
   Go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and monitor CURRENT DATA to check No. of Learnt key, ECM and KEY status.
2. Select Diagnostic Trouble Codes(DTCs)" mode and Clear the DTCs.
3. Are any DTCs present?

   YES

   Go to the applicable troubleshooting procedure.

   NO

   System is performing to specification at this time.

Body Electrical System > Immobilizer System > P1675

GENERAL DESCRIPTION

During the key teaching procedure the transponder will be programmed with vehicle specific data. The vehicle specific data are written into the transponder memory. The write procedure is unique; therefore the content of transponder can never be modified or changed. The data are a string of 9 bytes defined by vehicle manufacturer.
The transponder memory is split into two strings called authenticator and key password after this programming the transponder memory is locked and the data(PIN code) cannot be read or changed respectively. The transponder status changes from "virgin" to "learnt" Additionally every transponder includes a unique IDE (Identifier number) of 32 bit. Unique means that the IDE of all transponder is different from each other. The IDE is programmed by the transponder manufacturer and is a read-only value. The authenticator and the key password are not transferred from ECM to transponder or vice versa. Only the results from the encryption algorithm are transferred. It is almost impossible to calculate the vehicle specific data from the encryption result.
For teaching of keys and special purposes the ECM is connected to the tester device.
When IG is ON, the coil supplies energy to the transponder which in turn accumulates energy in the condenser.
Once the energy supply from the coil has stopped, using the stored energy in the condenser, the transponder transmits the ID CODE (stored within the ASIC).

DTC DESCRIPTION

This DTC is defined as Invalid Transponder Data.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
Enable Condition	• IG ON	• Transponder Key
Detecting Factors	• TP programming error	

Detecting Window	• During Transponder Write EEPROM Page request while Transponder is in authorized state.	
Detecting Criteria	• Corrupted data form Transponder (Tp), or more than one TP in the field, or no TP in the magnetic field.	

MONITOR SCANTOOL DATA

1. Ignition "ON" & Engine "OFF".
2. Connect Scan tool and clear the DTCs.
3. If the DTCs are retrieved again, monitor "CURRENT DATA" to check No. of Learnt key, ECM and KEY status.

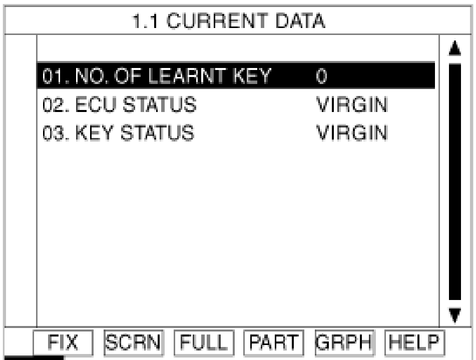


Fig 1

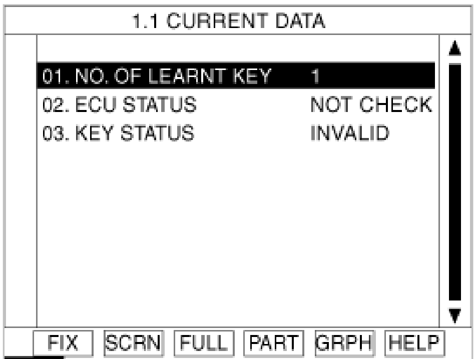


Fig 2

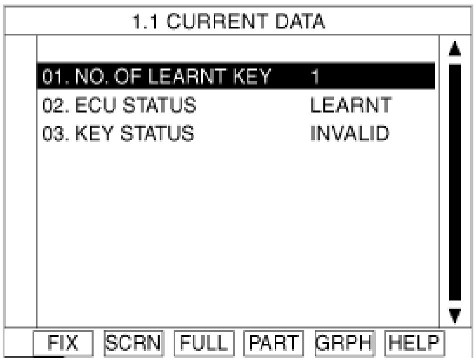


Fig 3

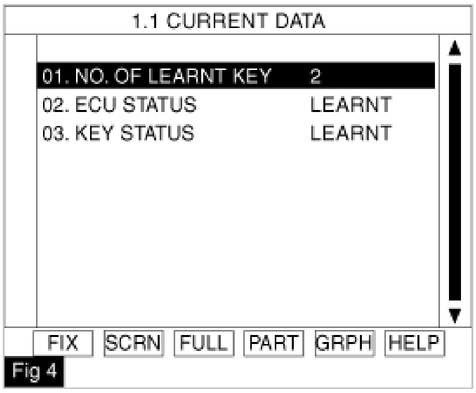


Fig 1 : ECM has not matched with any Key yet.
Fig 2 : ECM Internal Failure.
Fig 3 : IG On with unmatched key.
Fig 4 : 2(two) Keys have been matched with ECM.

4. Are both Key and ECM status learnt?

YES

Fault is intermittent caused by poor contact in the SMARTRA's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Go to "Component Inspection" procedure.

COMPONENT INSPECTION

1. Check Transponder
   (1) Ignition "ON" & Engine "OFF".
   (2) Perform neutral mode, key teaching and password teaching/changing.
   (Refer to "Reference Data in General Information")

   > NOTE
   >
   > Be sure that PIN code is prepared before performing neutral mode.

   (3) Is the neutral, teaching and password teaching/changing mode possible?

   YES

   Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
   Repair or replace as necessary and then go to " Verification of Vehicle Repair" procedure.

   NO

   Substitute with a known-good virgin Transponder and monitor CURRENT DATA.
   If the key status is displayed as "Virgin", replace Transponder.
   Perform key teaching mode in " Reference Data"
   Go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and monitor CURRENT DATA to check No. of Learnt key, ECM and KEY status.
2. Select Diagnostic Trouble Codes(DTCs)" mode and Clear the DTCs.
3. Are any DTCs present?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

Body Electrical System > Immobilizer System > P1676

GENERAL DESCRIPTION

The SMARTRA carries out communication with the built-in transponder of the ignition key. This wireless communication runs on RF (Radio frequency of 125 kHz). The SMARTRA is mounted at the ignition lock close to the antenna coil for RF transmission and receiving.
The RF signal from the transponder received by the antenna coil is converted into messages for serial communication by the SMARTRA device. And the received messages from the ECM are converted into an RF signal, which is transmitted, to the transponder by the antenna. The SMARTRA does not carry out the validity check of transponder or the calculation of encryption algorithm. This device is only an advanced interface, which converts the RF data flow of the transponder into serial communication to ECM and vice versa.
SMARTRA : SMARt TRansponder Antenna

DTC DESCRIPTION

This DTC defines Invalid message from SMARTRA to ECM.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
Enable Condition	• IG ON	• Open or Short in SMARTRA Circuit • Faulty SMARTRA
Detecting Criteria	• No response from SMARTRA Invalid message from SMARTRA to ECM	

MONITOR SCANTOOL DATA

1. Ignition "ON" & Engine "OFF".
2. Connect Scan tool and clear the DTCs.
3. If the DTCs are retrieved again, monitor "CURRENT DATA" to check No. of Learnt key, ECM and KEY status.

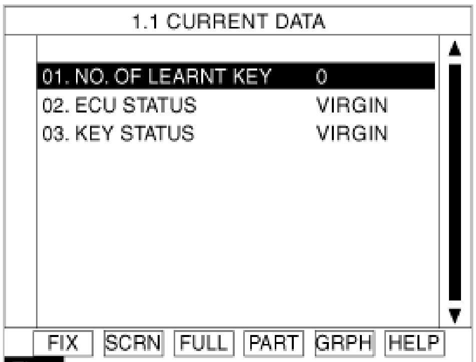


Fig 1

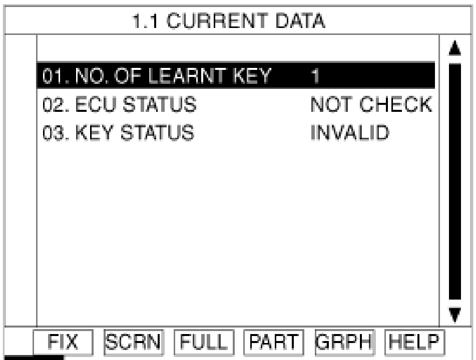


Fig 2

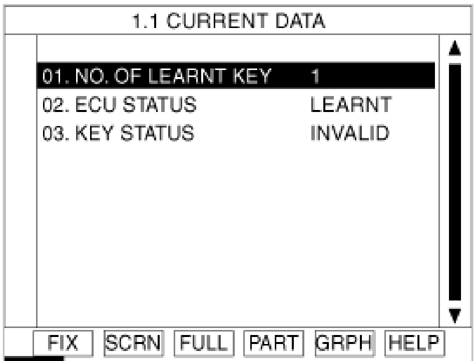


Fig 3

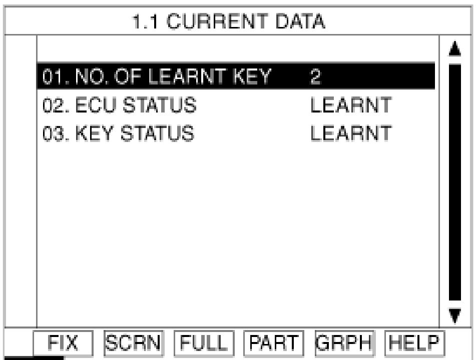


Fig 4

Fig 1 : ECM has not matched with any Key yet.
Fig 2 : ECM Internal Failure.
Fig 3 : IG On with unmatched key.
Fig 4 : 2(two) Keys have been matched with ECM.

4. Are both Key and ECM status learnt?

YES

Fault is intermittent caused by poor contact in the SMARTRA's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Go to "Component Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

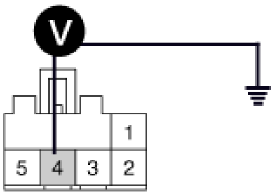
NO

Go to " Power Circuit Inspection " procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect SMARTRA connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 4 of the SMARTRA harness connector and chassis ground.

Specification : B+



5. Is the measured voltage within specifications?

YES

Go to "Signal Circuit Inspection" procedure.

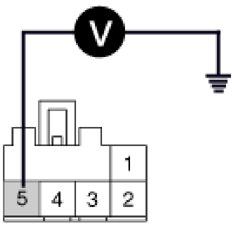
NO

Check open or short in power harness.
Check that 15A SENSOR fuse located between Main relay and SMARTRA is open or blown off.
Repair as necessary and go to "Verification of Vehicle repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check for short in harness.
   (1) Ignition "OFF".
   (2) Disconnect SMARTRA connector.
   (3) Ignition "ON" & Engine "OFF".
   (4) Measure voltage between terminal 5 of the SMARTRA harness connector and chassis ground.

Specification : Approx. 10.2V



   (5) Is the measured voltage within specifications?

YES

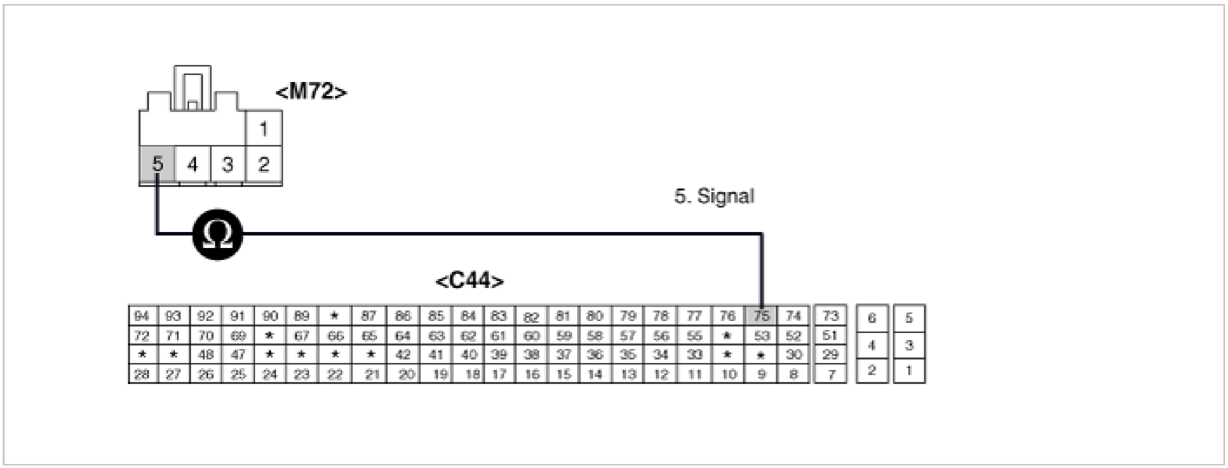
Go to "Check for open in harness" as below.

NO

Check short in signal harness.
Repair as necessary and go to "Verification of Vehicle repair" procedure.

2. Check for open in harness
   (1) Ignition "OFF".
   (2) Disconnect SMARTRA connector.
   (3) Measure resistance between terminal 5 of the SMARTRA harness connector and terminal 75 of ECM harness connector.

Specification : Approx. below 1Ω



(4) Is the measured resistance within specifications?

YES

Go to "Ground Circuit Inspection" procedure.

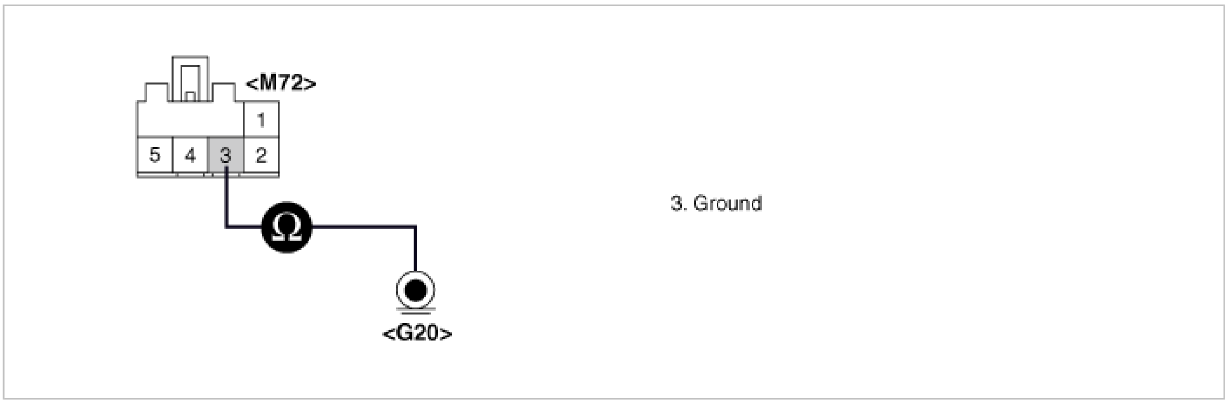
NO

Check for open in signal harness.
Repair as necessary and go to "Verification of Vehicle repair" procedure.

GROUND CIRCUIT INSPECTION

1. Check for open in harness between SMARTRA and Chassis ground.
   (1) Ignition "OFF".
   (2) Disconnect SMARTRA connector.
   (3) Measure resistance between terminal 3 of the SMARTRA harness connector and Chassis ground.

Specification : Approx. below 1Ω



(4) Is the measured resistance within specifications?

YES

Go to "Component Inspection" procedure.

NO

Check for open in ground harness.
Make sure that Chassis ground G20 is firmly tightened properly.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check SMARTRA
   (1) Ignition " ON" & Engine "OFF".
   (2) Perform the Neutral, Teaching, and Password teaching/ changing mode according to 2. ECM neutralization, 3.Key Teaching Procedure, 4. Password teaching/Changing in "Reference Data" described in General Information.

NOTE

Be sure that PIN code is prepared before performing neutral mode.

(3) Is Key teaching completed?

YES

Fault is intermittent caused by poor contact in the SMARTRA and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Substitute with a known-good SMARTRA and check for proper operation. If the problem is corrected, replace SMARTRA and go to "Go to "Verification of Vehicle Repair" procedure.

NOTE

In case of faulty SMARTRA, there are no special procedures required. A new SMARTRA device simply replaces the old one. (There are no transponder-related data stored in this device.)

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and monitor CURRENT DATA to check No. of Learnt key, ECM and KEY status.
2. Select Diagnostic Trouble Codes(DTCs)" mode and Clear the DTCs.
3. Are any DTCs present?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

Body Electrical System > Immobilizer System > P1690

GENERAL DESCRIPTION

The SMARTRA carries out communication with the built-in transponder of the ignition key. This wireless communication runs on RF (Radio frequency of 125 kHz). The SMARTRA is mounted at the ignition lock close to the antenna coil for RF transmission and receiving.
The RF signal from the transponder received by the antenna coil is converted into messages for serial communication by the SMARTRA device. And the received messages from the ECM are converted into an RF signal, which is transmitted, to the transponder by the antenna. The SMARTRA does not carry out the validity check of transponder or the calculation of encryption algorithm. This device is only an advanced interface, which converts the RF data flow of the transponder into serial communication to ECM and vice versa.
SMARTRA : SMARt TRansponder Antenna

DTC DESCRIPTION

This DTC is defined as No answer from SMARTRA because of communication line error(Open or short etc.)

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
Enable Condition	• IG ON	• Open or Short in SMARTRA Circuit • Faulty SMARTRA
Detecting Criteria	• No response from SMARTRA (Communication Line Error - Open or Short etc.)	

SIGNAL WAVEFORM

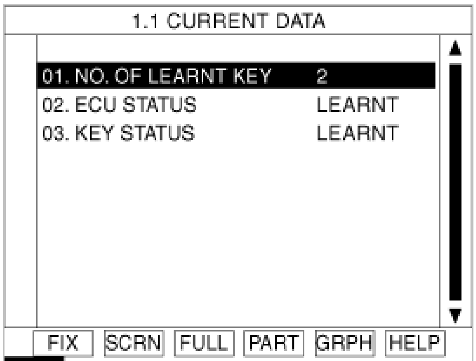


Fig 1

EMS Status	Engine start with valid key	Engine start by limp home	Teaching of key	Teaching or changing of user password	Twice ignition of function
Not yet checked	No	No	No	No	No
Virgin	No	No	Yes	No	Yes, with virgin key
Learnt	Yes	Yes, with learnt user password	Yes	Yes	No
Neutral	No	No	Yes	No	No
Locked by timer	No	No	No	No	No

Fig 2

1. ECM :
   (1) Virgin(This is status at the end of ECM production line before delivery to customer)

   (2) Neutral (This is a status that is erased all data regarding immobilizer by special command from scanner)

   (3) Not Check (The status is stored in permanent memory (EEPROM or Flash etc.)
   In case of not plausible data from this circuit the ECM cannot check the status.

   (4) Locked by timer (After a certain number of incorrect user Password(4) or PIN Code(6) the ECM is locked for one hour and no inputs are accepted during this time)

2. KEY :
   (1) Virgin (It means the key in the key cylinder has not matched with ECM yet)

   (2) Invalid (It means that data is mismatched between ECM and transponder)

   (3) Not Checked (It means that ECM cannot check the transponder data in the key cylinder)
      A. ECM cannot check the transponder data because of SMARTRA error or antenna coil error.
      B. ECM cannot check the transponder data because of communication circuit problem between ECM and SMARTRA.
      C. Key with NO Transponder
      D. More than 1(One) Transponder in the magnetic field
      E. No Transponder in the magnetic field
      F. TP data blocked
      G. TP data does not exist
      H. TP data changed
      I. TP Teaching error
      J. Multiple TP data input

Current Data from Immobilizer will show the numbers of Key learnt, ECM status, and Key status as
Fig 1. The current data provides an indication of the probable cause.
Fig 2. shows possibility of Engine start, Teaching or changing of user password according to ECM status.

MONITOR SCANTOOL DATA

1. Ignition "ON" & Engine "OFF".
2. Connect Scan tool and clear the DTCs.
3. If the DTCs are retrieved again, monitor "CURRENT DATA" to check No. of Learnt key, ECM and KEY status.

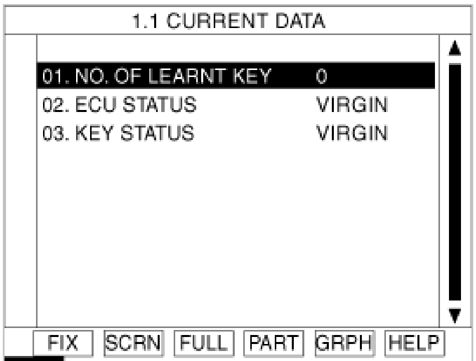


Fig 1

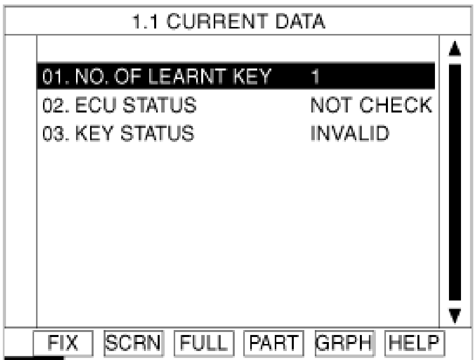


Fig 2

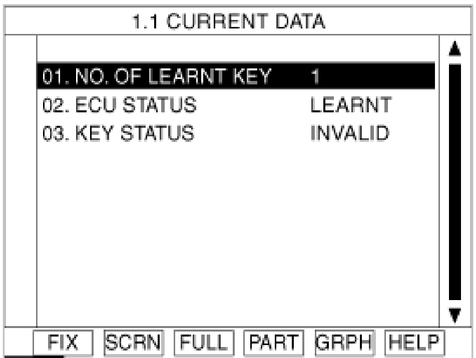


Fig 3

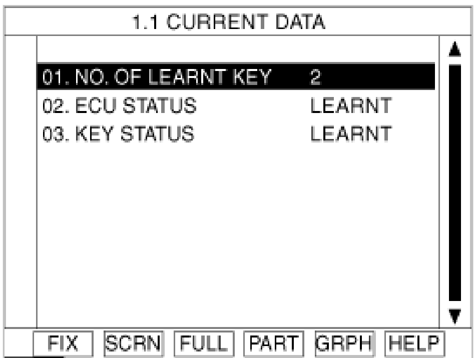


Fig 4

Fig 1 : ECM has not matched with any Key yet.
Fig 2 : ECM Internal Failure.
Fig 3 : IG On with unmatched key.
Fig 4 : 2(two) Keys have been matched with ECM.

4. Are both Key and ECM status learnt?

YES

Fault is intermittent caused by poor contact in the SMARTRA's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Go to "Component Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to " Power Circuit Inspection " procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect SMARTRA connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 4 of the SMARTRA harness connector and chassis ground.

Specification : B+

5. Is the measured voltage within specifications?

YES

Go to "Signal Circuit Inspection" procedure.

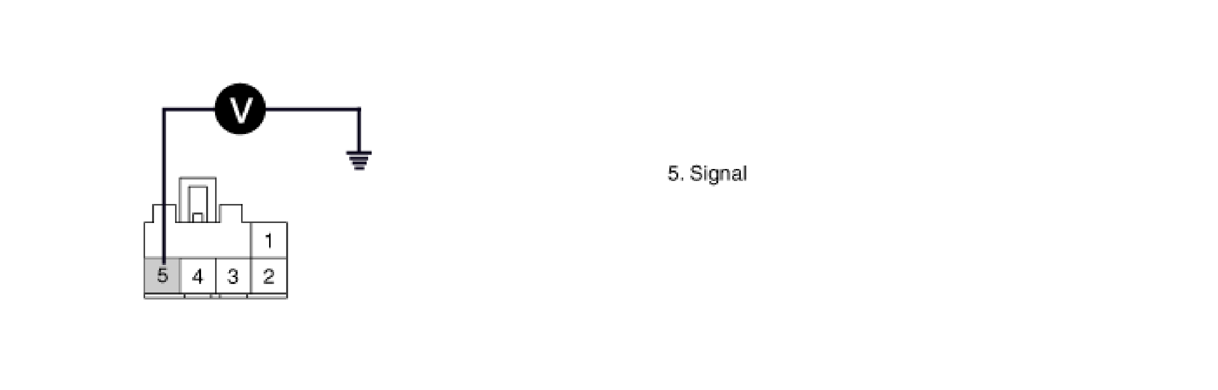
NO

Check open or short in power harness.
Check that 15A SENSOR fuse located between Main relay and Smartra is open or blown off.
Repair as necessary and go to "Verification of Vehicle repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check for short in harness.
   (1) Ignition "OFF".
   (2) Disconnect SMARTRA connector.
   (3) Ignition "ON" & Engine "OFF".
   (4) Measure voltage between terminal 5 of the SMARTRA harness connector and chassis ground.

   Specification : Approx. 10.2V



(5) Is the measured voltage within specifications?

YES

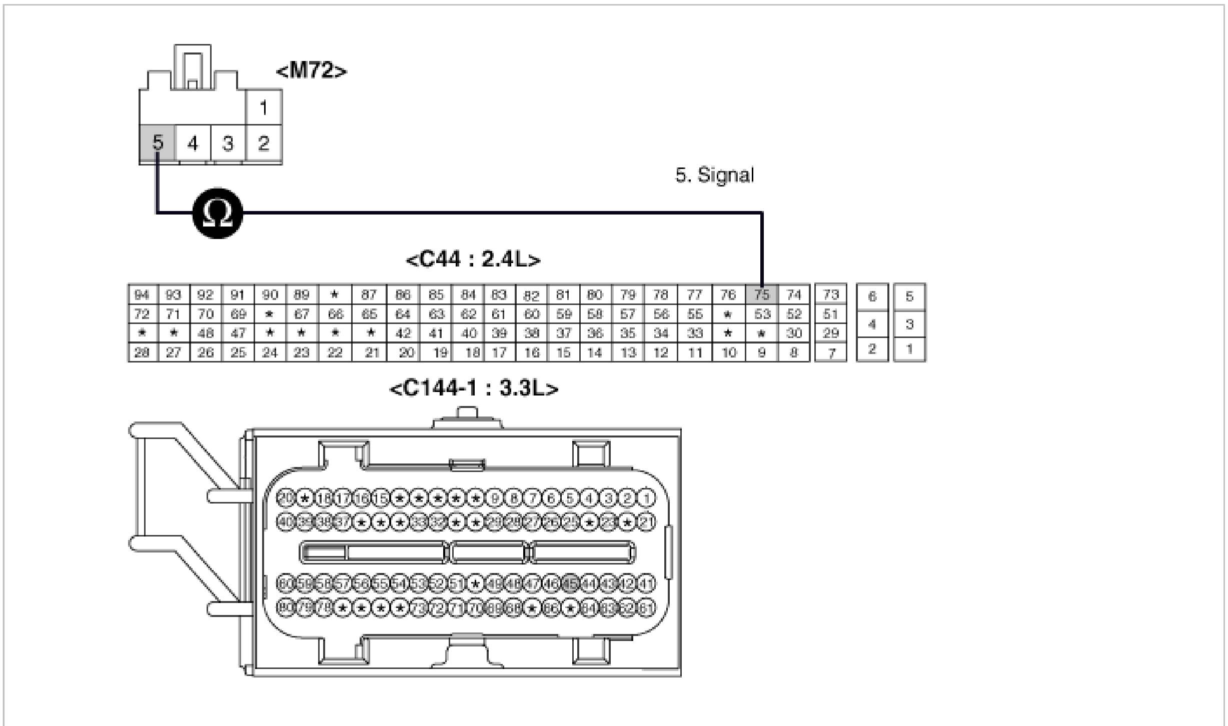
Go to "Check for open in harness" as below.

NO

Check short in signal harness.
Repair as necessary and go to "Verification of Vehicle repair" procedure.

2. Check for open in harness
   (1) Ignition "OFF".
   (2) Disconnect SMARTRA connector.
   (3) Measure resistance between terminal 5 of the SMARTRA harness connector and terminal 75(2.4L), 45(3.3L) of ECM harness connector.

Specification : Approx. below 1Ω



(4) Is the measured resistance within specifications?

YES

Go to "Ground Circuit Inspection" procedure.

NO

Check for open in signal harness.
Repair as necessary and go to "Verification of Vehicle repair" procedure.

GROUND CIRCUIT INSPECTION

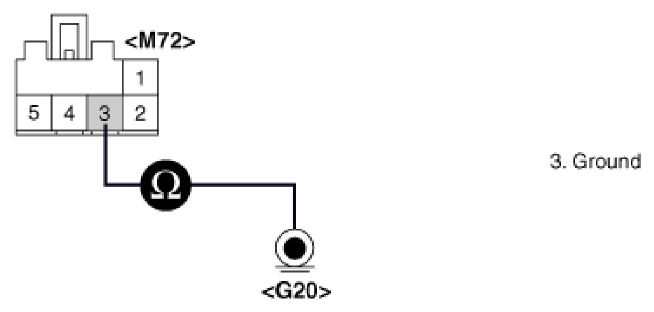
1. Check for open in harness between SMARTRA and Chassis ground.

(1) Ignition "OFF".

(2) Disconnect SMARTRA connector.

(3) Measure resistance between terminal 3 of the SMARTRA harness connector and Chassis ground.

Specification : Approx. below 1Ω



(4) Is the measured resistance within specifications?

YES

Go to "Component Inspection" procedure.

NO

Check for open in ground harness.
Make sure that Chassis ground G20 is firmly tightened properly.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check SMARTRA
   (1) Ignition " ON" & Engine "OFF".

   (2) Perform the Neutral, Teaching, and Password teaching/ changing mode according to 2. ECM neutralization, 3.Key Teaching Procedure, 4. Password teaching/Changing in "Reference Data" described in General Information.

   NOTE

   Be sure that PIN code is prepared before performing neutral mode.

   (3) Is Key teaching completed?

   YES

   Fault is intermittent caused by poor contact in the SMARTRA and/or EMC's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

   NO

   Substitute with a known-good SMARTRA and check for proper operation. If the problem is corrected, replace SMARTRA and go to "Go to "Verification of Vehicle Repair" procedure.

   NOTE

   In case of faulty SMARTRA, there are no special procedures required. A new SMARTRA device simply replaces the old one. (There are no transponder-related data stored in this device.)

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and monitor CURRENT DATA to check No. of Learnt key, ECM and KEY status.
2. Select Diagnostic Trouble Codes(DTCs)" mode and Clear the DTCs.
3. Are any DTCs present?

   YES

   Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

Body Electrical System > Immobilizer System > P1691

GENERAL DESCRIPTION

This wireless communication runs on RF . The SMARTRA is mounted at the ignition lock close to the antenna coil for RF transmission and receiving. The RF signal from the transponder received by the antenna coil is converted into messages for serial communication by the SMARTRA device. And the received messages from the EMS are converted into an RF signal, which is transmitted, to the transponder by the antenna.

DTC DESCRIPTION

This DTC is defined as Antenna coil open or short circuit.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
Enable Condition	• IG ON	• Open or short in coil circuit • Faulty Antenna Coil • Faulty SMARTRA
Detecting factors	• Antenna signal error	
Detecting Window	• Before transponder communications	
Detecting Criteria	• Antenna open/short circuit	

MONITOR SCANTOOL DATA

1. Ignition "ON" & Engine "OFF".
2. Connect Scan tool and clear the DTCs.
3. If the DTCs are retrieved again, monitor "CURRENT DATA" to check No. of Learnt key, ECM and KEY status.

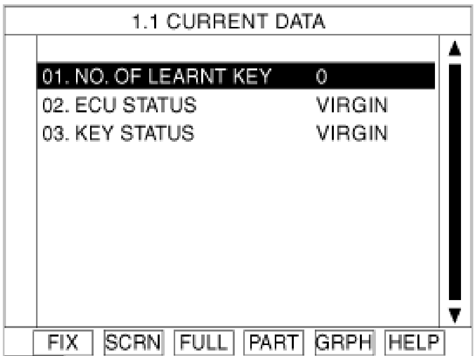


Fig 1

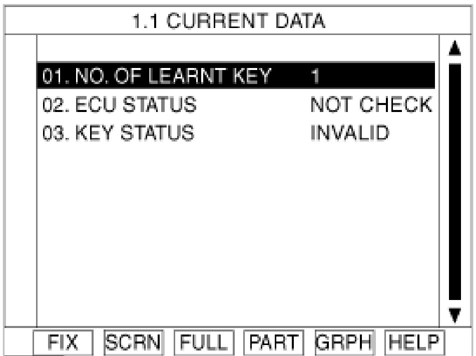


Fig 2

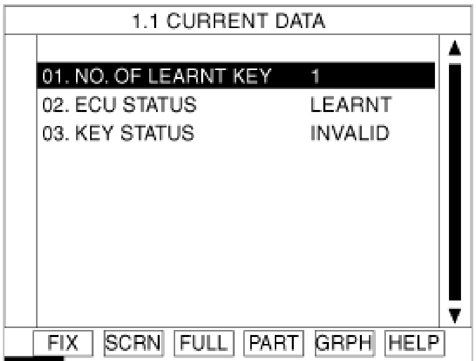


Fig 3

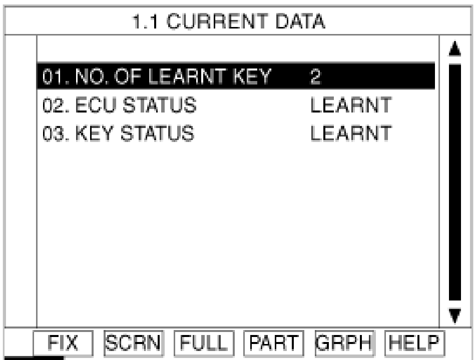


Fig 4

Fig 1 : ECM has not matched with any Key yet.
Fig 2 : ECM Internal Failure.
Fig 3 : IG On with unmatched key.
Fig 4 : 2(two) Keys have been matched with ECM.

4. Are both Key and ECM status learnt?

YES

Fault is intermittent caused by poor contact in the SMARTRA's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Go to "Component Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

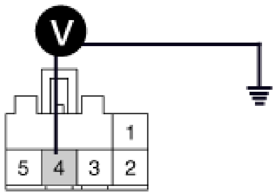
NO

Go to " Power Circuit Inspection " procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect SMARTRA connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 4 of the SMARTRA harness connector and chassis ground.

Specification : B+



5. Is the measured voltage within specifications?

YES

Go to "Signal Circuit Inspection" procedure.

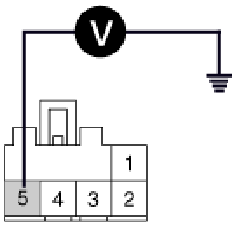
NO

Check open or short in power harness.
Check that 15A SENSOR fuse located between Main relay and Smartra is open or blown off.
Repair as necessary and go to "Verification of Vehicle repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check for short in harness.
   (1) Ignition "OFF".
   (2) Disconnect SMARTRA connector.
   (3) Ignition "ON" & Engine "OFF".
   (4) Measure voltage between terminal 5 of the SMARTRA harness connector and chassis ground.

   Specification : Approx. 10.2V



   (5) Is the measured voltage within specifications?

   YES

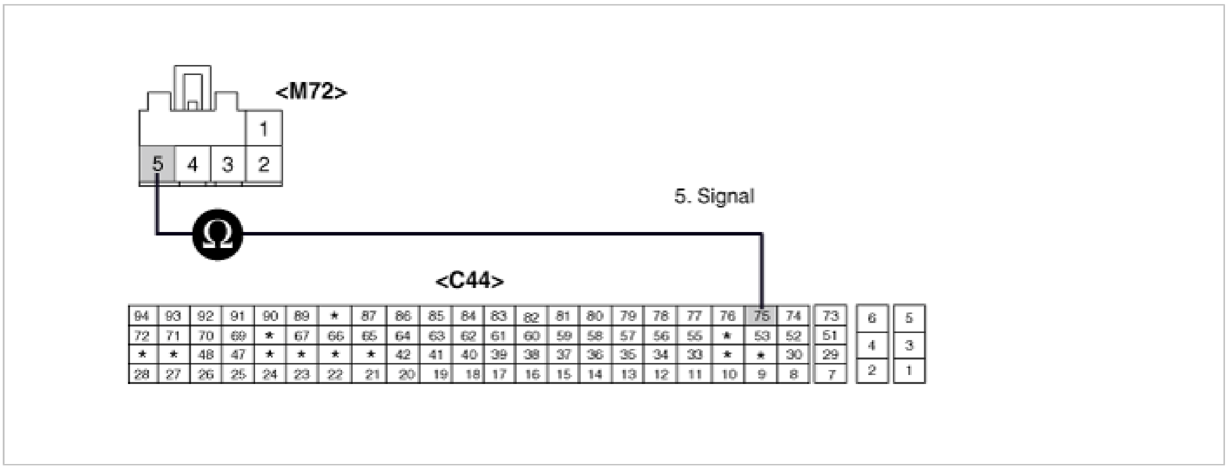
   Go to "Check for open in harness" as below.

   NO

   Check short in signal harness.
   Repair as necessary and go to "Verification of Vehicle repair" procedure.

2. Check for open in harness
   (1) Ignition "OFF".
   (2) Disconnect SMARTRA connector.
   (3) Measure resistance between terminal 5 of the SMARTRA harness connector and terminal 75 of ECM harness connector.

   Specification : Approx. below 1Ω



(4) Is the measured resistance within specifications?

YES

Go to "Ground Circuit Inspection" procedure.

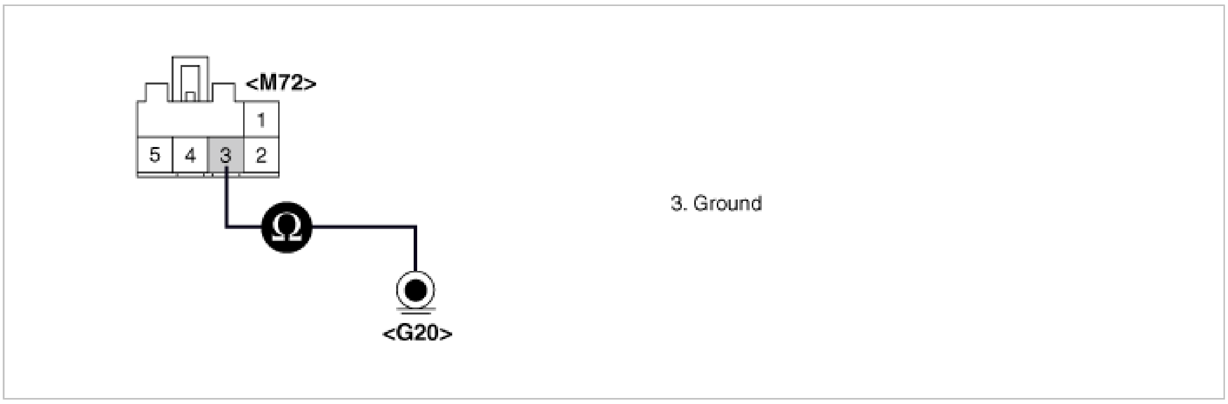
NO

Check for open in signal harness.
Repair as necessary and go to "Verification of Vehicle repair" procedure.

GROUND CIRCUIT INSPECTION

1. Check for open in harness between SMARTRA and Chassis ground.
   (1) Ignition "OFF".
   (2) Disconnect SMARTRA connector.
   (3) Measure resistance between terminal 3 of the SMARTRA harness connector and Chassis ground(G20).

Specification : Approx. below 1Ω



(4) Is the measured resistance within specifications?

YES

Go to "Component Inspection" procedure.

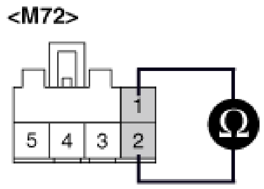
NO

Check for open in ground harness.
Make sure that Chassis ground G20 is firmly tightened properly.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check Antenna Coil
   (1) Ignition " OFF".
   (2) Disconnect SMARTRA connector.
   (3) Measure resistance between terminal 1 and 2 of the SMARTRA connector (Component side)

Specification : Approx. 9Ω



(4) Is the measured resistance within specifications?

YES

Go to " Check SMARTRA" as below.

NO

Check for open in harness between SMARTRA and Antenna coil, repair or replace as necessary.
Substitute with a known-good Antenna Coil and check for proper operation. If the problem is corrected, replace Antenna Coil. And then, go to "Verification of Vehicle Repair" procedure.

2. Check SMARTRA
   (1) Ignition " ON" & Engine "OFF".
   (2) Perform neutral mode, key teaching/changing and password teaching according to description in "System inspection" procedure.

> NOTE
>
> Be sure that PIN code is prepared before performing neutral mode.

   (3) Is Key teaching completed?

YES

Fault is intermittent caused by poor contact in the SMARTRA and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Substitute with a known-good SMARTRA and check for proper operation. If the problem is corrected, replace SMARTRA and Go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> In case of faulty SMARTRA, there are no special procedures required. A new SMARTRA device simply replaces the old one. (There are no transponder-related data stored in this device.)

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and monitor CURRENT DATA to check No. of Learnt key, ECM and KEY status.
2. Select Diagnostic Trouble Codes(DTCs)" mode and Clear the DTCs.
3. Are any DTCs present?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

Body Electrical System > Immobilizer System > P1693

GENERAL DESCRIPTION

During the key teaching procedure the transponder will be programmed with vehicle specific data. The vehicle specific data are written into the transponder memory. The write procedure is unique; therefore the content of transponder can never be modified or

changed. The data are a string of 9 bytes defined by vehicle manufacturer.
The transponder memory is split into two strings called authenticator and key password after this programming the transponder memory is locked and the data(PIN code) cannot be read or changed respectively. The transponder status changes from "virgin" to "learnt". Additionally every transponder includes a unique IDE (Identifier number) of 32 bit. Unique means that the IDE of all transponder is different from each other. The IDE is programmed by the transponder manufacturer and is a read-only value. The authenticator and the key password are not transferred from ECM to transponder or vice versa. Only the results from the encryption algorithm are transferred. It is almost impossible to calculate the vehicle specific data from the encryption result.
For teaching of keys and special purposes the ECM is connected to the tester device.
When IG is ON, the coil supplies energy to the transponder which in turn accumulates energy in the condenser.
Once the energy supply from the coil has stopped, using the stored energy in the condenser, the transponder transmits the ID CODE (stored within the ASIC).

DTC DESCRIPTION

This DTC is defined as Invalid Transponder Data.

DTC DESCRIPTION

Item	Detecting Condition	Possible cause
Enable Condition	• IG ON	• Transponder Key
Detecting factors	• Invalid Transponder Data	
Detecting Window	• During Transponder IDE • During Transponder Authentication requests • During Transponder Write EEPROM page requests • During Transponder Read EEPROM page requests	
Detecting Criteria	• Corrupted data form Transponder (Tp), or more than one TP in the field, or no TP in the magnetic field.	

MONITOR SCANTOOL DATA

1. Ignition "ON" & Engine "OFF".
2. Connect Scan tool and clear the DTCs.
3. If the DTCs are retrieved again, monitor "CURRENT DATA" to check No. of Learnt key, ECM and KEY status.

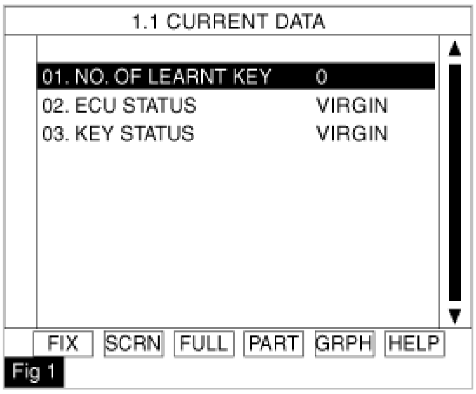


Fig 1

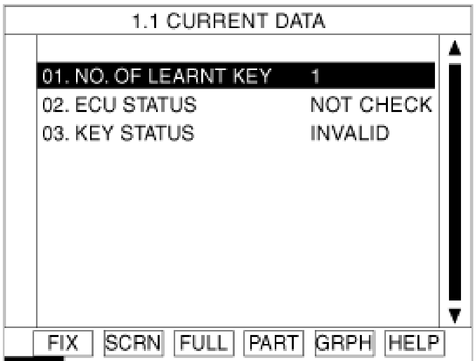


Fig 2

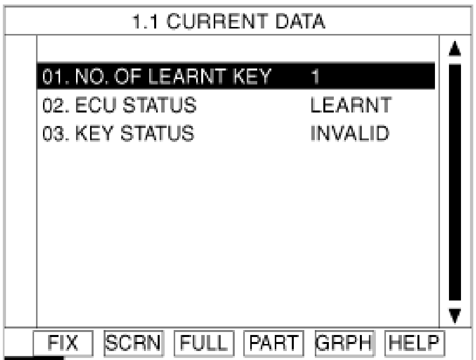


Fig 3

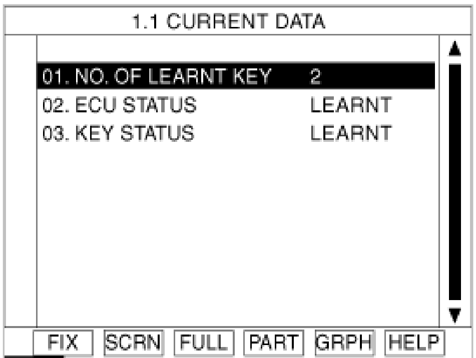


Fig 4

Fig 1 : ECM has not matched with any Key yet.
Fig 2 : ECM Internal Failure.
Fig 3 : IG On with unmatched key.
Fig 4 : 2(two) Keys have been matched with ECM.

4. Are both Key and ECM status learnt?

YES

Fault is intermittent caused by poor contact in the SMARTRA's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Go to "Component Inspection" procedure.

COMPONENT INSPECTION

1. Check Transponder
   (1) Ignition "ON" & Engine "OFF".
   (2) Perform neutral mode, key teaching and password teaching/changing according to "3. ECM Neutralization, 2. Key Teaching Procedure,4. Password Teaching in Reference Data" described in General Information.

> **NOTE**
>
> Be sure that PIN code is prepared before performing neutral mode.

(3) Is the neutral, teaching and password teaching/changing mode completed?

YES

Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to " Verification of Vehicle Repair" procedure.

NO

Substitute with a known-good virgin Transponder and monitor CURRENT DATA.
If the key status is displayed as "Virgin", replace Transponder.
Perform key teaching mode according to "2.Key Teaching Procedure belongs to Reference Data" described in General Information.
Go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and monitor CURRENT DATA to check No. of Learnt key, ECM and KEY status.
2. Select Diagnostic Trouble Codes(DTCs)" mode and Clear the DTCs.
3. Are any DTCs present?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

Body Electrical System > Immobilizer System > P1694

GENERAL DESCRIPTION

The ECM and the SMARTRA communicate by dedicated line. During this communication of ECM and SMARTRA the K line of ECM cannot be used for communication. The ECM controls the communication either to SMARTRA or to other devices(e.g. scanner) on K line by switching of a multiplexer and specific communication procedures. The multiplexer is a part of ECM hard ware.

DTC DESCRIPTION

This DTC is defined as invalid request from ECM or corrupted data.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
Enable Condition	• IG ON	• Faulty ECM
Detecting factors	• Request from Control unit is invalid	
Detecting Window	• End of ECM request message	
Detecting Criteria	• Protocol layer violation - Invalid request, Invalid check sum.)	

MONITOR SCANTOOL DATA

1. Ignition "ON" & Engine "OFF".
2. Connect Scan tool and clear the DTCs.
3. If the DTCs are retrieved again, monitor "CURRENT DATA" to check No. of Learnt key, ECM and KEY status.

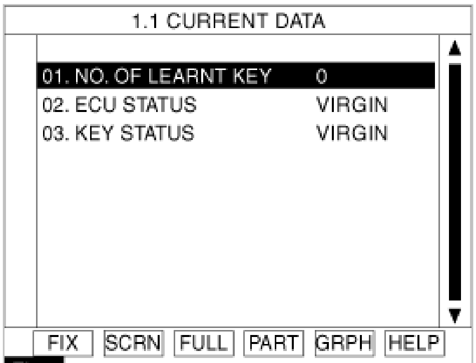


Fig 1

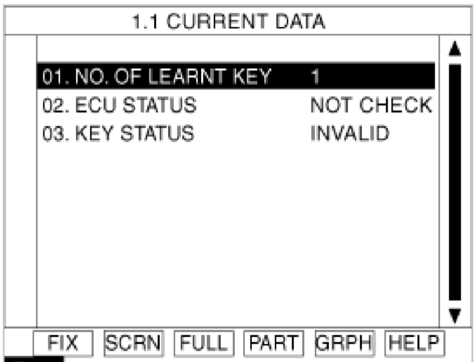


Fig 2

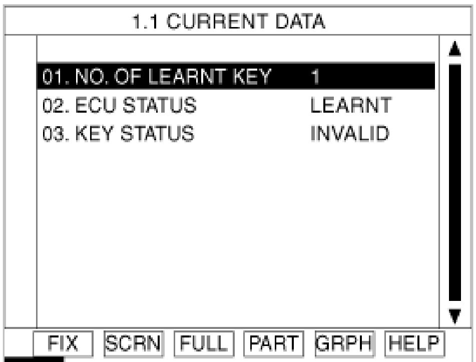


Fig 3

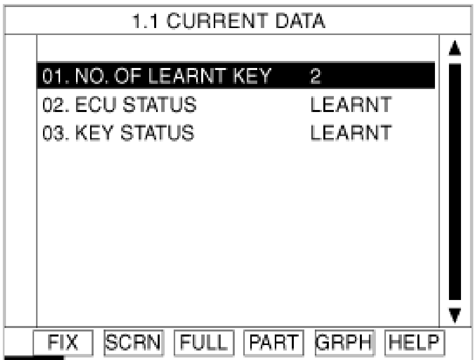


Fig 4

Fig 1 : ECM has not matched with any Key yet.
Fig 2 : ECM Internal Failure.
Fig 3 : IG On with unmatched key.
Fig 4 : 2(two) Keys have been matched with ECM.

4. Are both Key and ECM status learnt?

YES

Fault is intermittent caused by poor contact in the SMARTRA's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Go to "Component Inspection" procedure.

COMPONENT INSPECTION

1. Check ECM
   (1) Ignition " ON" & Engine "OFF".
   (2) Perform Key Teaching Procedure in "Reference Data" described in General Information.
   (3) Is the Key teaching completed?

   YES
   Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to " Verification of Vehicle Repair" procedure.

   NO
   Substitute with a known-good ECM and check for proper operation. If the problem is corrected, replace ECM and then go to " Verification of Vehicle repair" procedure.

> **NOTE**
>
> 1. Don't forget to prepare for the PIN of the vehicle before removing ECM from the vehicle.
> 2. Remember that substituting with a known-good ECM should be followed "The things to remember before repair(1)" in "Reference Data in General Information".
>   (In case of faulty ECM, it has to be replaced with "VIRGIN" or " NEUTRAL" ECM.)
> 3. Ensure that the correct PIN is entered when replacing a new ECM.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and monitor CURRENT DATA to check No. of Learnt key, ECM and KEY status.
2. Select Diagnostic Trouble Codes(DTCs)" mode and Clear the DTCs.
3. Are any DTCs present?

YES
Go to the applicable troubleshooting procedure.

NO
System is performing to specification at this time.

Body Electrical System > Immobilizer System > P1695

GENERAL DESCRIPTION

The relevant data for the immobilizer function are stored at permanent memory (EEPROM or Flash etc.).
The immobilizer data are stored by three independent entries.
The data from EEPROM are evaluated by "2 of 3 decision". That means all three entries are read and the content is compared before authentication process.
If the contents of all entries are equal, the authentication will run without additional measures.
If only the contents of two entries are equal, the authentication will run and fault code "EEPROM defective“ is stored at ECM.
If the contents of all three entries are different from each other, no authentication will be possible and the fault code "EEPROM defective“ will be stored. The limp home function cannot be activated. The ECM shall be replaced if the EEPROM related fault occurs again after new teaching of all keys.

DTC DESCRIPTION

This DTC is defined as not only ECM have inconsistent data of EEPROM for number of keys taught, user password state and invalid write operation to EEPROM but ECM can not recognize the unique PIN code during Key Authentication.

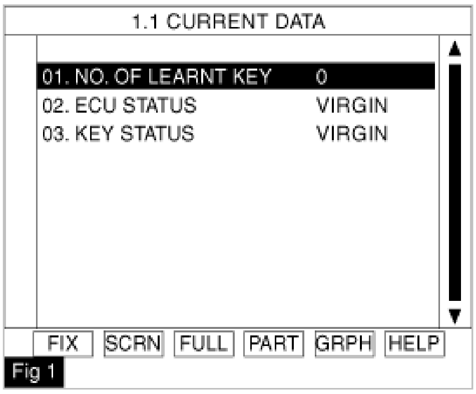
DTC DETECTING CONDITION

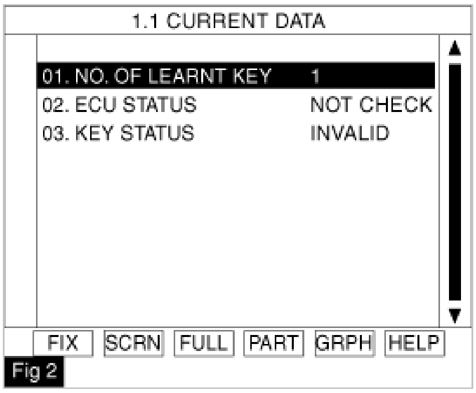
Item	Detecting Condition	Possible cause
Enable Condition	• IG ON	• Faulty ECM
Detecting Criteria	• ECM internal permanent memory (EEPROM or Flash etc.) fault. • Invalid write operation to permanent	

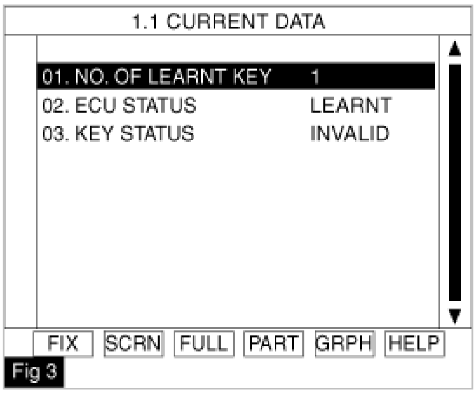
	memory(EEPROM or Flash etc.) fault.	

MONITOR SCANTOOL DATA

1. Ignition "ON" & Engine "OFF".
2. Connect Scan tool and clear the DTCs.
3. If the DTCs are retrieved again, monitor "CURRENT DATA" to check No. of Learnt key, ECM and KEY status.







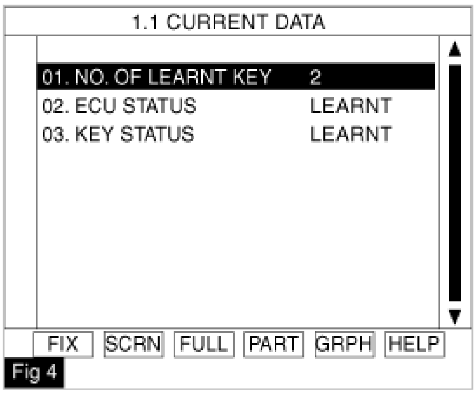


Fig 1 : ECM has not matched with any Key yet.
Fig 2 : ECM Internal Failure.
Fig 3 : IG On with unmatched key.

Fig 4 : 2(two) Keys have been matched with ECM.

4. Are both Key and ECM status learnt?

YES

Fault is intermittent caused by poor contact in the SMARTRA's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Go to "Component Inspection" procedure.

COMPONENT INSPECTION

1. Check ECM
   (1) Ignition " ON" & Engine "OFF".
   (2) Perform the Neutral, Teaching, and Password teaching/ changing mode according to 2. ECM neutralization, 3.Key Teaching Procedure, 4. Password teaching/Changing in "Reference Data" described in General Information.
   (3) Are both neutral and teaching mode completed?

   YES

   Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

   NO

   Substitute with a known-good ECM and check for proper operation. If the problem is corrected, replace ECM and then go to " Verification of Vehicle repair" procedure.

> NOTE
>
> 1. Don't forget to prepare for the PIN of the vehicle before removing ECM from the vehicle.
> 2. Remember that substituting with a known-good ECM should be followed "The things to remember before repair(1) in "Reference Data in General Information" (In case of faulty ECM, it has to be replaced with "VIRGIN" or " NEUTRAL" ECM.)
> 3. Ensure that the correct PIN is entered when replacing a new ECM.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and monitor CURRENT DATA to check No. of Learnt key, ECM and KEY status.
2. Select Diagnostic Trouble Codes(DTCs)" mode and Clear the DTCs.
3. Are any DTCs present?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

Body Electrical System > Immobilizer System > P1696

GENERAL DESCRIPTION

The relevant data for the immobilizer function are stored at permanent memory (EEPROM or Flash etc.).
The immobilizer data are stored by three independent entries.
The data from EEPROM are evaluated by "2 of 3 decision". That means all three entries are read and the content is compared before authentication process.
If the contents of all entries are equal, the authentication will run without additional measures.
If only the contents of two entries are equal, the authentication will run and fault code "EEPROM defective“ is stored at ECM.
If the contents of all three entries are different from each other, no authentication will be possible and the fault code "EEPROM defective“ will be stored. The limp home function cannot be activated. The ECM shall be replaced if the EEPROM related fault occurs again after new teaching of all keys.

DTC DESCRIPTION

This DTC is defined as Virgin TP or Invalid TP with “Learnt” ECM status (Authentication fail).

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
Enable Condition	• IG ON	• Faulty TP(Virgin or Invalid)
Detecting Criteria	• Virgin TP at EMS STATUS "Learnt" • Learnt(Invalid) TP at EMS status "Learnt"(Authentication fail)	

MONITOR SCANTOOL DATA

1. Ignition "ON" & Engine "OFF".
2. Connect Scan tool and clear the DTCs.
3. If the DTCs are retrieved again, monitor "CURRENT DATA" to check No. of Learnt key, ECM and KEY status.

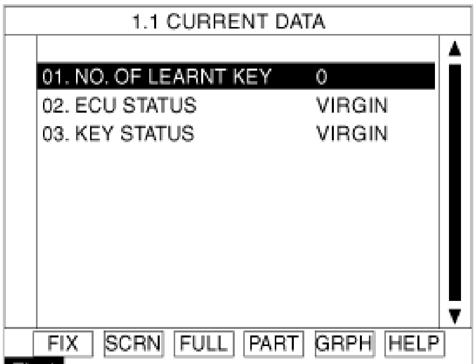


Fig 1

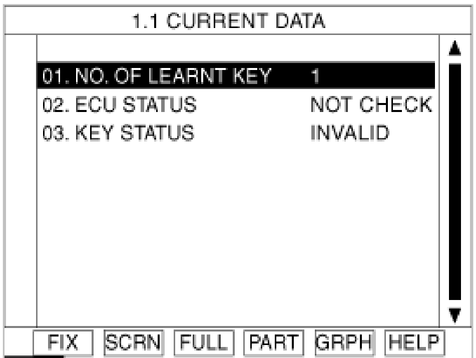


Fig 2

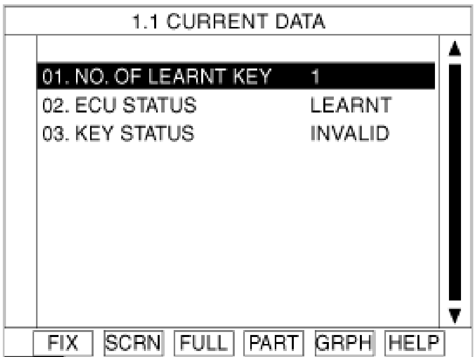


Fig 3

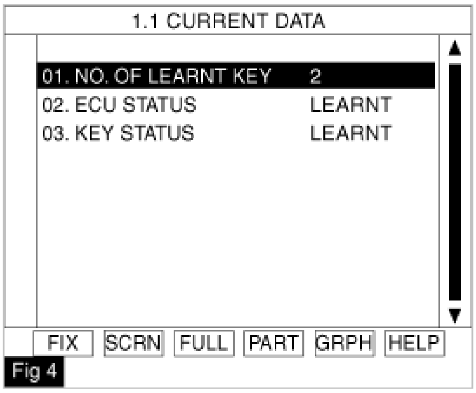


Fig 1 : ECM has not matched with any Key yet.
Fig 2 : ECM Internal Failure.
Fig 3 : IG On with unmatched key.
Fig 4 : 2(two) Keys have been matched with ECM.

4. Are both Key and ECM status learnt?

YES

Fault is intermittent caused by poor contact in the SMARTRA's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Go to "Component Inspection" procedure.

COMPONENT INSPECTION

1. Check Transponder
   (1) Ignition "ON" & Engine "OFF".
   (2) Perform neutral mode, key teaching and password teaching/changing.
   (Refer to "Reference Data in General Information")

   > **NOTE**
   >
   > Be sure that PIN code is prepared before performing neutral mode.

   (3) Is the neutral, teaching and password teaching/changing mode possible?

   YES

   In case that key status is "Invalid", Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary, and then go to " Verification of Vehicle Repair" procedure.
   In case that key status is "Learnt", go to "Verification of Vehicle Repair" procedure.

   NO

   Substitute with a known-good virgin Transponder and monitor CURRENT DATA.
   If the key status is displayed as "Virgin", replace Transponder.
   Perform key teaching mode in " Reference Data"
   Go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and monitor CURRENT DATA to check No. of Learnt key, ECM and KEY status.
2. Select Diagnostic Trouble Codes(DTCs)" mode and Clear the DTCs.
3. Are any DTCs present?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

Body Electrical System > Immobilizer System > P1699

GENERAL DESCRIPTION

This is a special function for engine start by vehicle manufacturer. The engine can be started for moving from the production line to an area where the key teaching is proceeded.

DTC DESCRIPTION

This DTC is defined as exceeding the maximum limit of twice ignition On.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
Enable Condition	• IG ON	• Locked by timer
Detecting Criteria	• Exceeding the maximum limit of Twice IGN ON ($\supseteq$ 32 times)	

MONITOR SCANTOOL DATA

1. Ignition "ON" & Engine "OFF".
2. Connect Scan tool and clear the DTCs.
3. Monitor Current Data for Immobilizer System.
4. Retry to communication from the vehicle selection menu although once communication is failed.

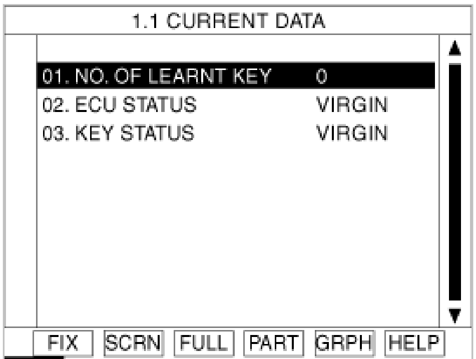


Fig 1

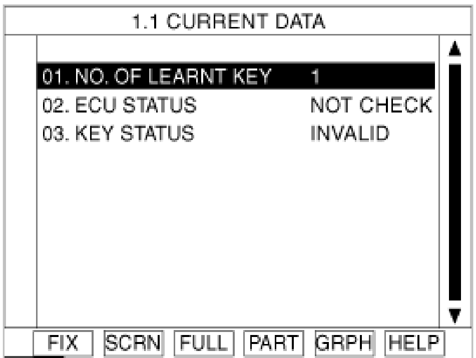
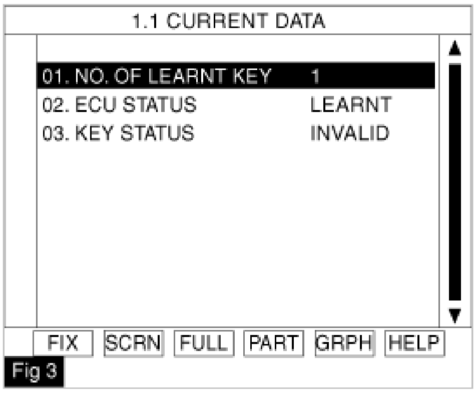


Fig 2



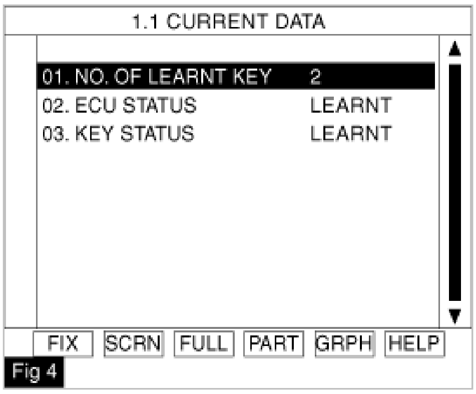


Fig 1 : ECM has not matched with any Key yet.
Fig 2 : ECM Internal Failure.
Fig 3 : IG On with unmatched key.
Fig 4 : 2(two) Keys have been matched with ECM.

5. Is the communication possible between scan tool and Immobilizer system?

YES

Wait for one hour with IG Key On. Be sure that the battery is fully enough to stay for an hour with IG ON.
Disconnecting battery or others manipulation can not reduce this time. After connecting the battery the timer starts again for one hour.
And then, reperform key teaching procedure(Refer to "Reference Data" in General Information")
Go to " Verification of Vehicle Repair" procedure

NO

Fault is intermittent caused by poor contact in the SMARTRA and/or ECM connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination. deterioration, or damage.
Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and monitor CURRENT DATA to check No. of Learnt key, ECM and KEY status.
2. Select Diagnostic Trouble Codes(DTCs)" mode and Clear the DTCs.
3. Are any DTCs present?

YES

Go to the applicable troubleshooting procedure.

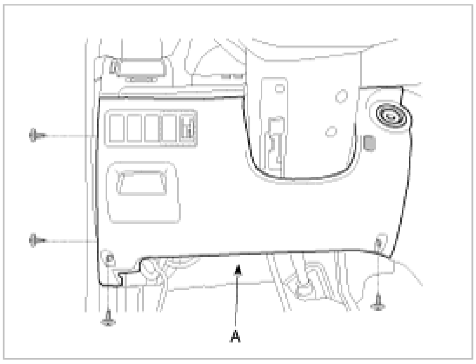
NO

System is performing to specification at this time.

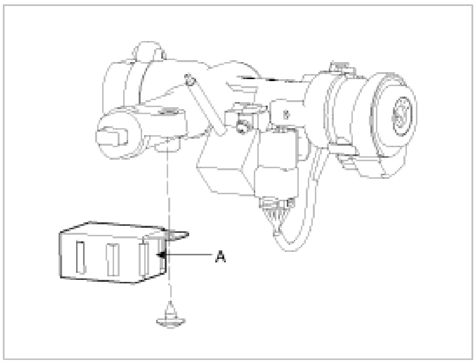
Body Electrical System > Immobilizer System > Immobilizer Control Unit > Repair procedures

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad side cover (A).



3. Remove the steering column shaft (Refer to the ST group).
4. Disconnect the 5P connector of the SMARTRA unit and then remove the SMARTRA unit (A) after loosening the screw.

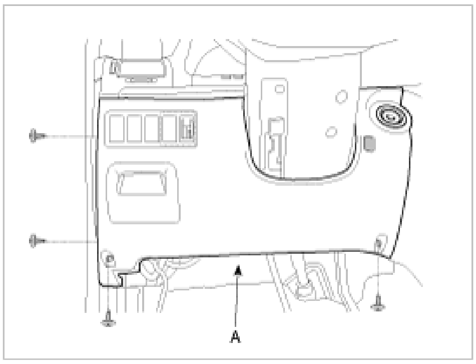


5. Installation is the reverse of removal procedure.

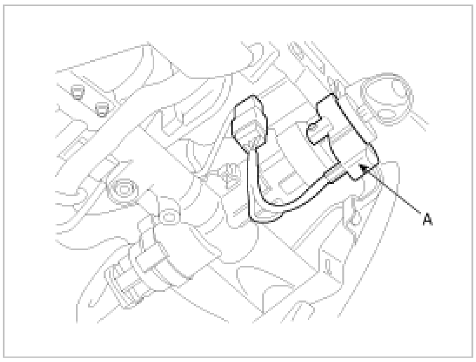
Body Electrical System > Immobilizer System > Coil Antenna > Repair procedures

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad side cover (A).



3. Remove the steering column shaft (Refer to the ST group).
4. Disconnect the 6P connector of the coil antenna and then remove the coil antenna (A) after loosening the screw.

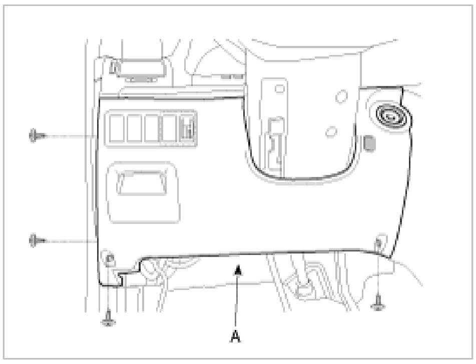


5. Installation is the reverse of removal procedure.

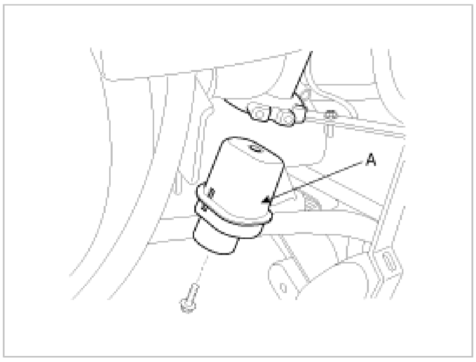
Body Electrical System > Ignition System > Ignition Switch > Repair procedures

REPLACEMENT

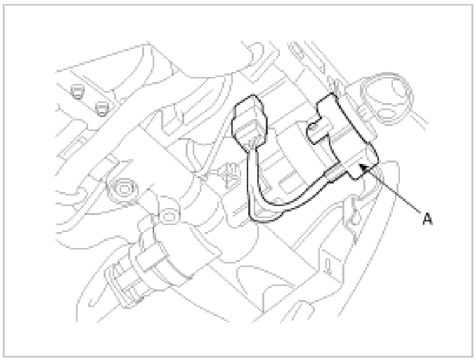
1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad side cover (A).



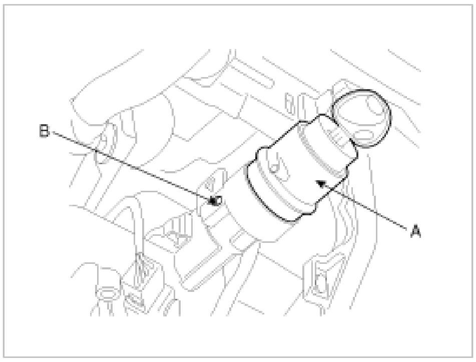
3. Remove the ignition switch (A) after loosening the screw and disconnecting the 6P connector.



4. Remove the steering column shaft (Refer to the ST group).
5. Remove the key warning switch and key illumination lamp (A) after loosening the screws and disconnecting the 6P connector.

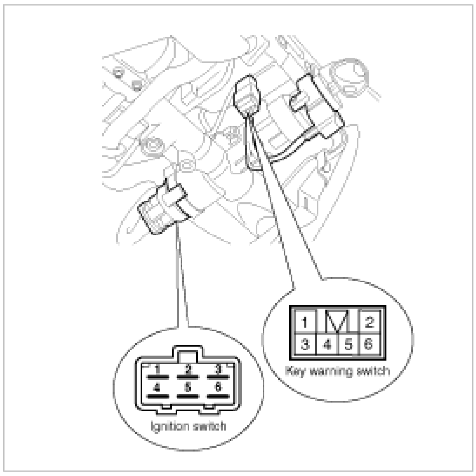


6. If it is necessary to remove the key lock cylinder (A), Remove the key lock cylinder (A) after pushing lock pin (B) with key ON.



7. Installation is the reverse of removal procedure.

INSPECTION

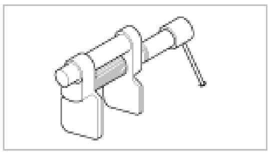


1. Disconnect the ignition switch connector and key warning switch connector from under the steering column.
2. Check for continuity between the terminals.
3. If continuity is not specified, replace the switch.

POSITION \ KEY \ TERMINAL		IGNITION SWITCH						STEERING		KEY WARNING SWITCH		KEY HOLE ILLUMINATION	
		2	4	6	5	3	1	TRAVEL	TRAVEL	5	6	3	4
LOCK	REMOVAL							LOCK				O	O
	INSERT							LOCK	UNLOCK	O	O		
ACC	INSERT	O	O					UNLOCK					
ON	INSERT	O	O	O	O	O							
START	INSERT	O		O	O	O	O						

Brake System > General Information > Special Service Tools

SPECIAL TOOL

Tool(Number and Name)	Illustration	Use
09581-11000 Piston expander		Spreading the front disc brake piston

Brake System > General Information > Troubleshooting

TROUBLESHOOTING

PROBLEM SYMPTOMS TABLE

Symptom	Suspect Area	Reference
Lower pedal or spongy pedal	1. Brake system (Fluid leaks) 2. Brake system (Air in) 3. Piston seals (Worn or damaged) 4. Rear brake shoe clearance(Out of adjustment) 5. Master cylinder (Faulty)	repair air·bleed replace adjust replace
Brake drag	1. Brake pedal freeplay (Minimum) 2. Parking brake lever travel (Out of adjustment) 3. Parking brake wire (Sticking) 4. Rear brake shoe clearance(Out of adjustment) 5. Pad or lining (Cracked or distorted) 6. Piston (Stuck) 7. Piston (Frozen) 8. Anchor or Return spring (Faulty) 9. Booster system (Vacuum leaks) 10. Master cylinder (Faulty)	adjust adjust repair adjust replace replace replace replace repair replace
Brake pull	1. Piston (Sticking) 2. Pad or lining (Oily) 3. Piston (Frozen) 4. Disc (Scored) 5. Pad or lining (Cracked or distorted)	replace replace replace replace replace
Hard pedal but brake inefficient	1. Brake system (Fluid leaks) 2. Brake system (Air in) 3. Pad or lining (Worn) 4. Pad or lining (Cracked or distorted) 5. Rear brake shoe clearance(Out of adjustment) 6. Pad or lining (Oily) 7. Pad or lining (Glazed) 8. Disc (Scored) 9. Booster system (Vacuum leaks)	repair air·bleed replace replace adjust adjust replace replace repair
Noise from brake	1. Pad or lining (Cracked or distorted) 2. Installation bolt (Loosen) 3. Disc (Scored) 4. Sliding pin (Worn) 5. Pad or lining (Dirty) 6. Pad or lining (Glazed) 7. Anchor or Return spring (Faulty) 8. Brake pad shim (Damage)	replace adjust replace replace clean replace replace replace

	9. Shoe hold-down spring (Damage)	replace
Brake fades	1. master cylinder	replace
Brake vibration, pulsation	1. brake booster 2. pedal free play 3. master cylinder 4. caliper 5. master cylinder cap seal 6. damaged brake lines	replace adjust replace replace replace replace
Brake Chatter	Brake chatter is usually caused by loose or worn components, or glazed or burnt linings. Rotors with hard spots can also contribute to brake chatter. Additional causes of chatter are out-of-tolerance rotors, brake lining not securely attached to the shoes, loose wheel bearings and contaminated brake lining.	

Brake System > General Information > Specifications

SPECIFICATIONS

Item	Specification	
Master cylinder · Type · I.D. mm(in) · Piston stroke mm(in) · Output port(ABS/ESC) · Fluid level warning sensor	Tandem type 25.4(1.0) 31(1.22) 2port Provided	
Brake booster · Type · Effective dia. mm(in.) · Boosting ratio	Vacuum 8+9 in 9:1	
Front brake(Disc)	2.4 L	3.3 L
· Type · Disc O.D. · Disc I.D. · Disc thickness · Pad thickness · Cylinder type · Cylinder I.D.	Floating type with ventilated disc 280 mm (11.02 in) 172 mm (6.77 in) 26 mm (1.02 in) 11 mm (0.43 in) single piston 57.2 mm (2.25 in.)	Floating type with ventilated disc 300 mm (11.8 in) 186 mm (7.32 in.) 28 mm (1.10 in) 11 mm (0.43 in) single piston 60 mm (2.36 in.)
Rear brake(Disc)	2.4 L	3.3 L
· Type · Disc O.D. · Parking Brake Drum I.D · Disc thickness · Pad thickness · Cylinder type · Cylinder I.D	Floating type with solid disc 262 mm (10.31 in) 168 mm (6.61 in) 10 mm (0.39 in) 10 mm (0.39 in) single piston 34 mm (1.34 in)	Floating type with solid disc 284 mm (11.18 in) 168 mm (6.61 in) 10 mm (0.39 in) 15 mm (0.59 in) single piston 34 mm (1.34 in)
Parking brake · Actuation · Cable arrangement	Mechanical brake acting on rear wheels Lever	

O.D=Outer Diameter
I.D=Inner Diameter

NOTE

ABS : Anti-lock Brake System

ESC : Electronic Stability Control

SPECIFICATION (ABS)

Part	Item	Standard value	Remark
HECU(Hydraulic and Electronic Control Unit)	System	4 channel 4 sensor (Solenoid)	·ABS system:ABS & EBD control
	Type	Motor, valve relay intergrated type	
	Operating voltage	10 V ~ 16 V(DC)	
	Operating temperature	-40 ~ 120 °C(-40 ~ 248 °F)	
Warning lamp	Operating voltage	12 V	·ABS W/L:ABS failure ·Brake W/L:Parking, brake oil, EBD failure
	Current consumption	80 mA	
Acitve wheel speed sensor (ABS)	Supply voltage	DC 4.5 ~ 2.0 V	
	Output current low	5.9 ~ 8.4 mA	Typ.7 mA
	Output current High	11.8 ~ 16.8 mA	Typ.14 mA
	Frequency range	1 ~ 2500 Hz	
	Air gap	0.4 ~ 1.0 mm (0.0157 ~ 0.04 in.)	
	Tone wheel	47 teeth	
	Output duty	30~70 %	

SPECIFICATION(ESC)

Part	Item	Standard Value	Remark
HECU(Hydraulic and Electronic Control Unit)	System	4 channel 4 sensor(Solenoid)	·Total control(ABS, EBD, TCS, ESC)
	Type	Motor, valve relay intergrated type	
	Operating voltage	10V ~ 16V(DC)	
	Operating temperature	-40 ~ 120 °C(-40 ~ 248 °F)	
Warning lamp	Operating voltage	12 V	·ESC Operating Lamp ·ESC Warning Lamp
	Current consumption	80 mA	
Active wheel speed sensor	Supply voltage	DC4.5 ~ 20V	
	Output current low	5.9~8.4 mA	
	Output current high	11.8 ~ 16.8 mA	
	Tone wheel	47 teeth	
	Frequency range	1~2500 HZ	
	Airgap	0.4 ~ 1.0 mm (0.02~0.04 in)	
Steering Wheel Angle Sensor	Operating Voltage	8V ~ 16 V	
	Current Consumption	Max 150 mA	
	Operating Angular velocity	Max ±2000 °/sec	
Yaw-rate & Lateral G sensor	Operating Voltage	8 V ~ 16 V	
	Current Consumption	Max. 120 mA	
	Output Voltage	0.35V ~ 4.65 V	
	Yaw Sensor Operating Range	±100 ° /s	
	G Sensor Operating Range	±1.8 G	
	Reference voltage output	2.464 ~ 2.536 V	Typ. 2.5 V

SERVICE STANDARD

	Standard value	Service limit
Brake pedal height	184.5 mm(7.264 in)	
Brake pedal full stroke	128 mm (5.04 in)	
Adjust Brake pedal full stroke	128 mm(5.04 in)	
Brake pedal free play	3~8 mm(0.11~0.31 in)	
Stop lamp switch outer case to pedal stopper clearance	1~2 mm (0.04 ~ 0.08 in)	
Booster push rod to master cylinder piston clearance	0 (at 500 mmHg vacuum)	
Parking brake lever stroke when lever assembly is pulled with 196N (20Kgf, 44lb force)	8 clicks	
Front disc brake pad thickness	11 mm (0.43 in)	3 ~ 4 mm (0.12 ~ 0.16 in)
Front disc thickness	26 mm (1.024 in) : 2.4 L 28 mm (1.1 in) : 3.3 L	24.4 mm (0.961 in) : 2.4 L 26.4 mm (1.04 in) : 3.3 L
Front disc runout		Max.0.04 mm (0.002 in)
Front disc thickness variation		Max.0.005 mm (0.0002 in)
Rear disc brake pad thickness	10 mm (0.394 in) : 2.4 L 15 mm (0.59 in) : 3.3 L	3 mm (0.12 in)
Rear disc brake disc thickness	10 mm (0.394 in)	8.4 mm (0.33 in)
Rear disc runout		Max.0.05mm (0.002 in)
Rear disc thickness variation		Max.0.01 mm (0.0004 in)

TIGHTENING TORQUE

	Nm	Kgf·m	lb-ft
Master cylinder to booster mounting nut	7.84~11.76	0.8~1.2	5.9~8.9
Brake booster mounting nut	12.74~15.68	1.3~1.6	9.6~11.8
Bleeder screw	6.86~12.74	0.7~1.3	5.2~9.6
Brake tube nut, brake hose	1372~16.66 (M10) 18.62~22.54 (M12)	1.4~1.7 (M10) 1.9~2.3 (M12)	10.326~12.54 (M10) 14.01~16.964 (M12)
Caliper assembly to knuckle	78.4~9.8	8~10	59.0~73.8
Brake hose to front caliper	24.5~29.4	2.5~3	18.4~22.1
Brake hub flange nut	196~254.8	20~26	147.5~191.8
Push rod locking nut	15.68~21.56	1.6~2.2	11.8~16.2
Caliper guide rod bolt	21.56~31.36	2.2~3.2	16.2~23.6
Stop lamp switch mounting nut	7.84~9.8	0.8~1	5.9~7.38

TIGHTENING TORQUE (ABS)

Item	Nm	kgf·m	lb-ft
Active wheel speed sensor mounting bolt on the brake plate	7.84~8.82	0.8~0.9	5.9~6.54
Hydraulic & electronic control unit mounting bolt	13.72~17.64	1.4~1.8	10.326~13.276
Hydraulic & electronic control unit mounting bracket bolt	16.66~25.48	1.7~2.6	12.54~19.177
Brake tubes nut	13.72~16.66	1.4~1.7	10.326~12.54
Air bleeder screw	6.86~12.74	0.7~1.3	5~9.6

TIGHTENING TORQUE (ESC)

Item	Nm	kgf·m	lb-ft

Yaw rate & lateral acceleration sensor Nut	4.9~7.84	0.5~0.8	3.69~5.9
Brake tube nut	13.72~16.66 (M10) 18.62~22.54(M12)	1.4~1.7 (M10) 1.9~2.3(M12)	10.326~12.54 (M10) 14.01~16.964 (M12)

Brake System > Brake System > Description and Operation

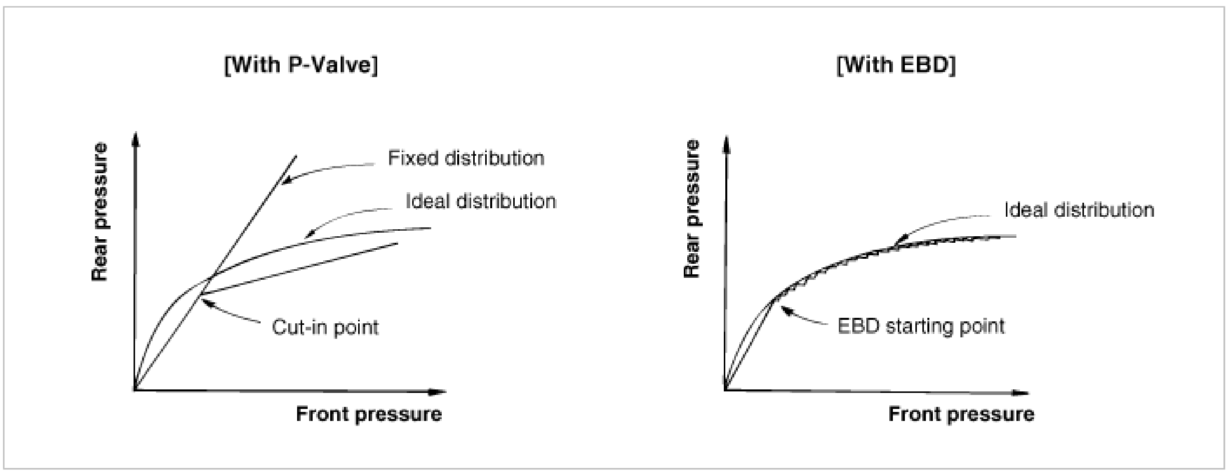
DESCRIPTION

The EBD system (Electronic Brake force Distribution) as a sub-system of the ABS system is to control the effective adhesion utilization by the rear wheels.
It further utilizes the efficiency of highly developed ABS equipment by controlling the slip of the rear wheels in the partial braking range.
The brake force is moved even closer to the optimum and controlled electronically, thus dispensing with the need for the proportioning valve.
The proportioning valve, because of a mechanical device, has limitations to achieve an ideal brake force distribution tothe rear wheels as well as to carry out the flexible brake force distribution proportioning to the vehicle load or weight increasing. And in the event of malfunctioning, driver cannot notice whether it fails or not.
EBD controlled by the ABS Control Module, calculates the slip ratio of each wheel at all times and controls the brake pressure of the rear wheels not to exceed that of the front wheels.
If the EBD fails, the EBD warning lamp (Parking brake lamp) lights up.

ADVANTAGES

- Function improvement of the base-brake system.
- Compensation for the different friction coefficients.
- Elimination of the proportioning valve.
- Failure recognition by the warning lamp.

Comparison between Proportioning valve and EBD



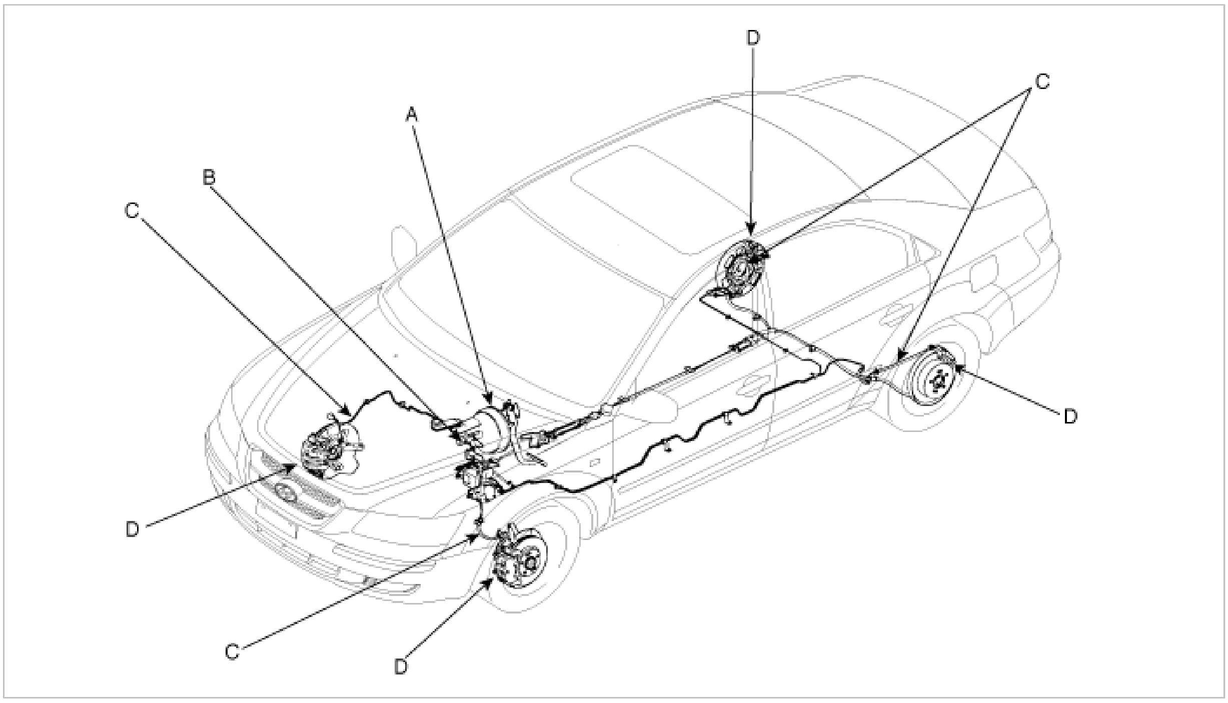
Brake System > Brake System > Repair procedures

Operation and Leakage Check

Check all of the following items:

Component	Procedure
Brake Booster (A)	Check brake operation by applying the brakes during a test drive. If the brakes do not work properly, check the brake booster. Replace the brake booster as an assembly if it does not work properly or if there are signs of leakage.
Piston cup and pressure cup inspection (B)	• Check brake operation by applying the brakes. Look for damage or signs of fluid leakage. Replace the master cylinder as an assembly if the pedal does not work properly or if there is damage or signs of fluid leakage. • Check for a difference in brake pedal stroke between quick and slow brake applications. Replace the master cylinder if there is a difference in pedal stroke.
Brake hoses (C)	Look for damage or signs of fluid leakage. Replace the brake hose with a new one if it is damaged or leaking.

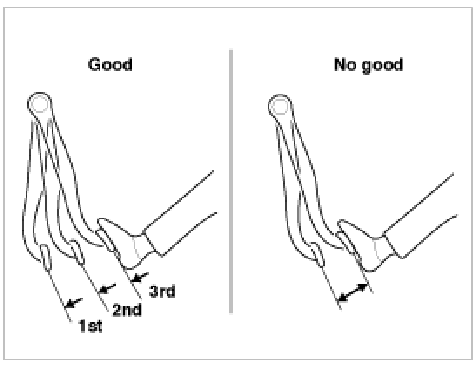
Caliper piston seal and piston boots (D)	Check brake operation by applying the brakes. Look for damage or signs of fluid leakage. If the pedal does not work properly, the brakes drag, or there is damage or signs of fluid leakage, disassemble and inspect the brake caliper. Replace the boots and seals with new ones whenever thebrake caliper is disassembled.



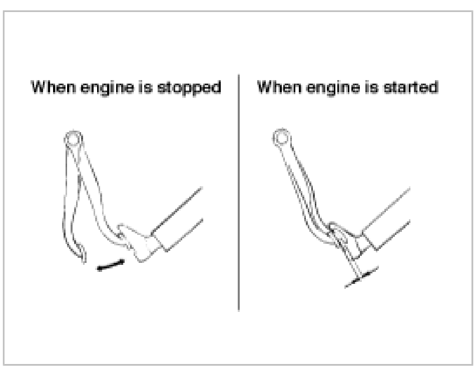
BRAKE BOOSTER OPERATING TEST

For simple checking of the brake booster operation, carry out the following tests

1. Run the engine for one or two minutes, and then stop it. If the pedal depresses fully the first time but gradually becomes higher when depressed succeeding times, the booster is operating properly, if the pedal height remains unchanged, thebooster is defective.

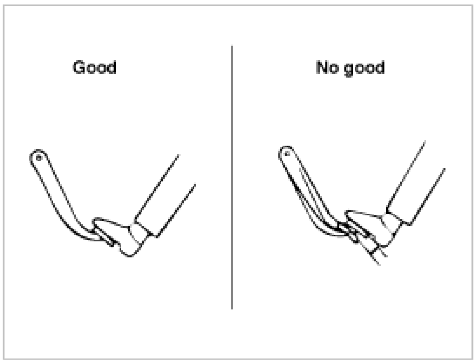


2. With the engine stopped, step on the brake pedal several times.
   Then step on the brake pedal and start the engine. If the pedal moves downward slightly, the booster is in good condition. If there is no change, the booster is defective.



3. With the engine running, step on the brake pedal and then stop the engine.
   Hold the pedal depressed for 30 seconds. If the pedal height does not change, the booster is in good condition, if the pedal

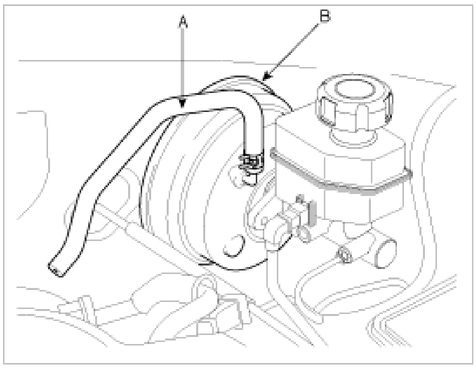
rises, the booster is defective.
If the above three tests are okay, the booster performance can be determined as good.
Even if one of the above three tests is not okay, check the check valve, vacuum hose and booster for defect.



VACUUM HOSE (CHECK VALVE)

INSPECTION

1. Disconnect the brake booster vacuum hose (check valve built in) (A) at the booster (B).
2. Start the engine and let it idle. There should be vacuum available. If no vacuum is available, the check valve is not working properly. Replace the brake booster vacuum hose and check valve and retest.

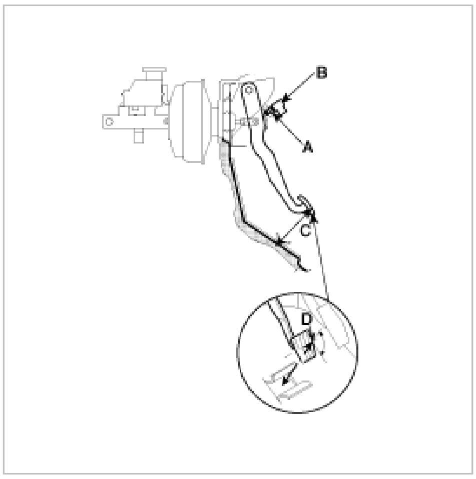


BRAKE PEDAL BRAKE SWITCH ADJUSTMENT

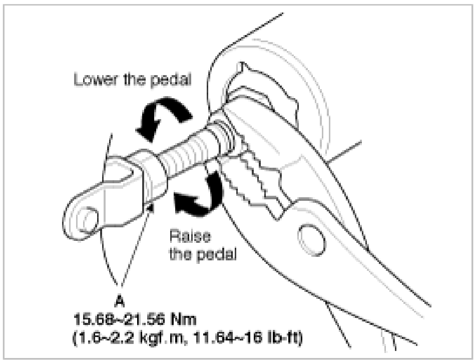
PEDAL HEIGHET

1. Disconnect the brake switch connector, loosen the brake switch locknut (A), and brake off the brake switch (B) until it is no longer touching the brake pedal.
2. Lift up the carpet. At the insulator cutout, measure the pedal height (C) from the middle of the left-side center of the pedal pad (D).

Standard pedal height(with carpet removed): 184.5mm(7.26 in.)

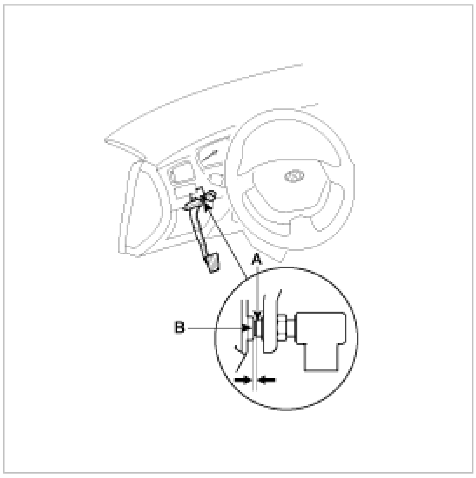


3. Loosen the pushrod locknut (A), and screw the pushrod in or out with pliers until the standard pedal height from the floor is reached. After adjustment, tighten the locknut firmly. Do not adjust the pedal height with the pushrod depressed.



BRAKE SWITCH CLEARANCE

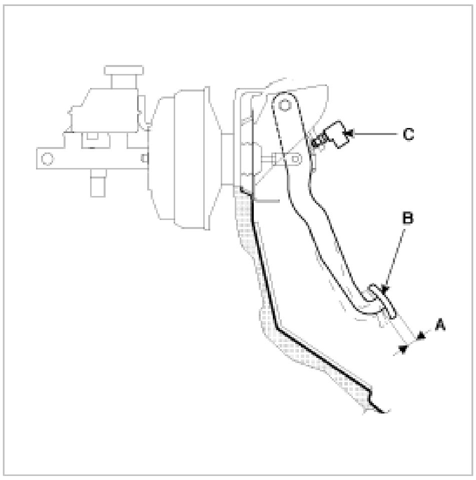
Screw in the brake switch until its plunger is fully depressed (threded end (A) touching the pad (B) on the pedal arm) then brake off the switch 3/4 turn to make 1 ~ 2 mm (0.04 ~ 0.08 in.) of clearance between the brake switch connector. Make sure that the brake lights go off when the pedal is released.



PEDAL FREE PLAY

1. With the engine off, inspect the pedal free play (A) on the pedal pad (B) by pushing the pedal by hand.

   Free play: 3 ~ 8 mm (0.12 ~ 0.31 in.)

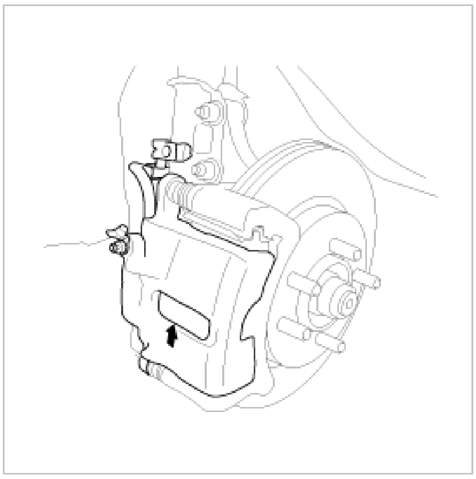


2. If the pedal free play is out of specification, adjust the brake switch (C). If the pedal free play is insufficient, it may result in brake drag.

INSPECTION OF FRONT DISC BRAKE PAD

1. Check the brake pad thickness through the caliper body inspection hole.

   Pad thickness
   Standard value : 11.0 mm (0.43 in.)
   Service limit : 3 ~ 4 mm (0.12 ~ 0.16 in.)



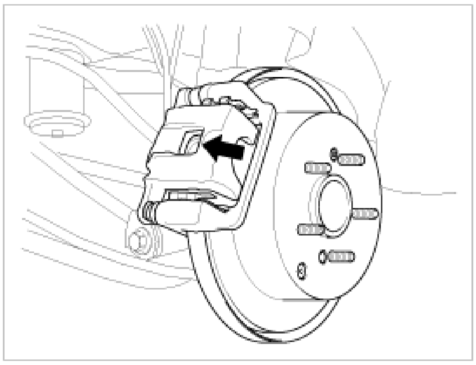
CAUTION

- If the pad lining thickness is out of specilfication, left and right pads must be replaced as a complete set.
- When the thickness difference between the left pad and right pad is large, check the sliding condition of the piston and the guide rod.

INSPECTION OF REAR DISC BRAKE PAD

1. Check the rear disk brake pad thickness through the caliper body inspection hole.

Pad thickness
Standard value : 10.0 mm (0.39 in.)
Service limit : 3.0 mm (0.12 in.)

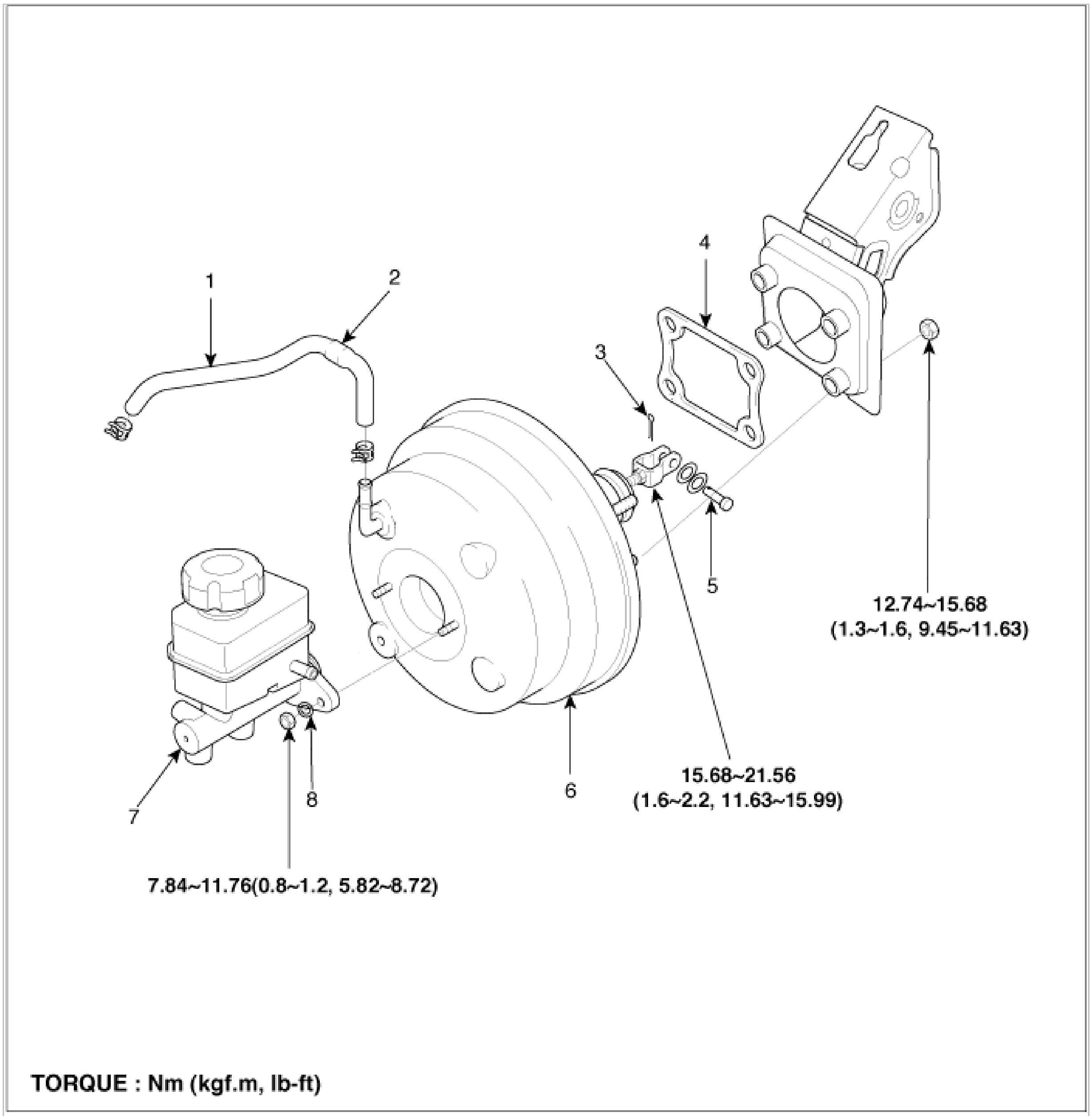


CAUTION

- If the pad thickness is out of specification, left and right pads must be replaced as a complete set.
- When the thickness difference between the left pad and right pad is large, check the sliding condition of the piston and the guide rod.

Brake System > Brake System > Brake Booster > Components and Components Location

COMPONENTS

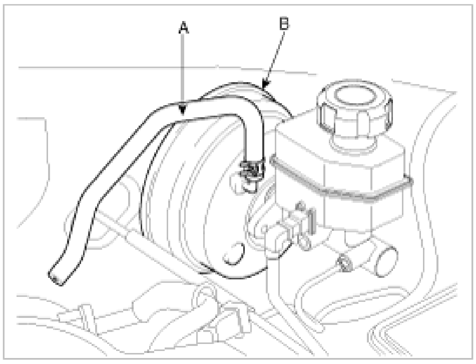


1. Vacuum hose
2. Check valve
3. Snap pin
4. Seal
5. Clevis pin
6. Brake booster
7. Master cylinder
8. Washer

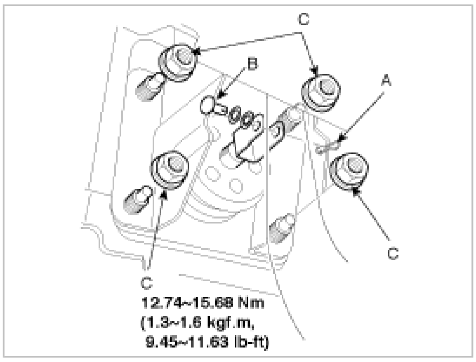
Brake System > Brake System > Brake Booster > Repair procedures

Removal

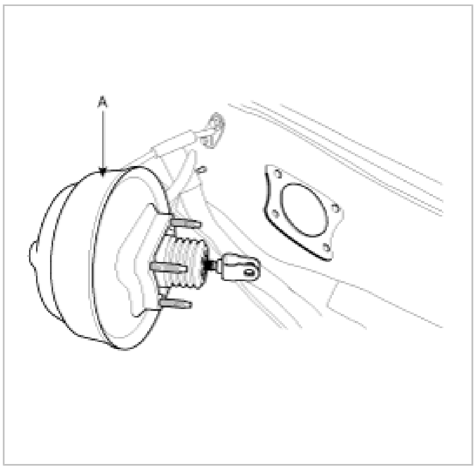
1. Remove the master cylinder.
2. Disconnect the vacuum hose (A) from the brake booster (B).



3. Remove the snap pin (A) and clevis pin (B).



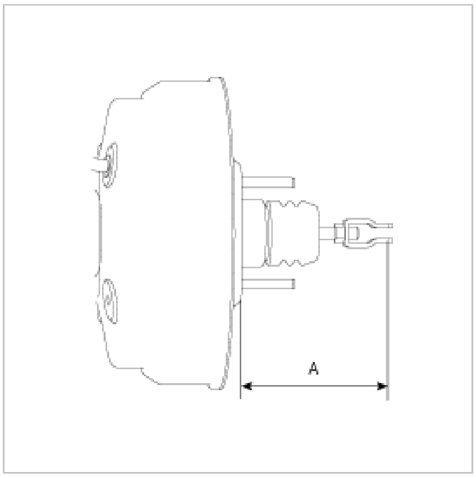
4. Remove the four booster mounting nuts (C).
5. Remove the brake booster (A).



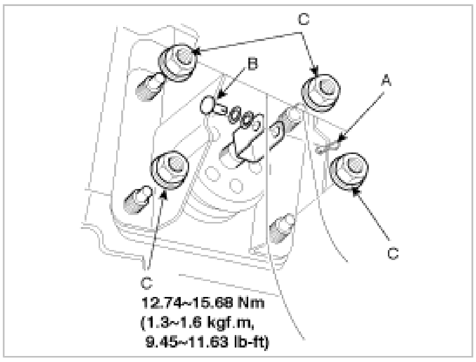
INSTALLATION

1. Adjust push rod length of the booster, and then install the seal on the booster assembly.

Standard length (A): 108± 0.5 mm (4.25 ± 0.019 in.)



2. Insert the booster and tighten the nuts (C).



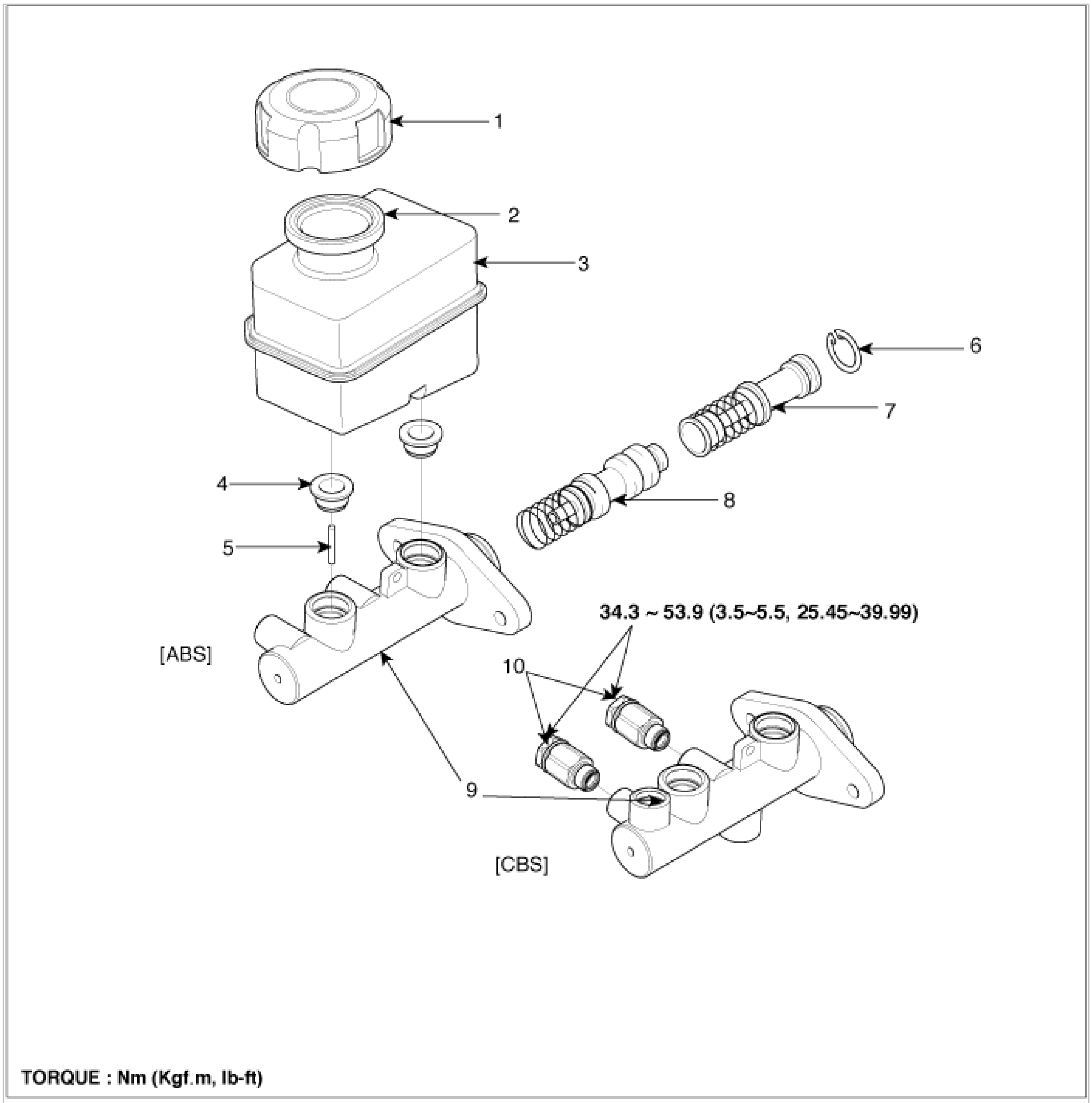
3. Connect the booster push rod and brake pedal with a pin (B) and install a snap clevis pin (A) to the clevis pin (B).

> CAUTION
>
> Grease the pin before installing the snap pin.
> Always use a new snap pin.

4. Install the master cylinder.
5. Connect the vacuum hose to the brake booster.
6. After filling the brake reservoir with brake fluid, bleed the system.
7. Check for fluid leakage.
8. Check and adjust the brake pedal for proper operation.

Brake System > Brake System > Master Cylinder > Components and Components Location

COMPONENTS



1. Reservoir cap
2. Brake fluid filter
3. Reservoir
4. Grommet
5. Cylinder pin
6. Retainer
7. Primary piston assembly
8. Secondary piston assembly
9. Master cylinder body
10. Proportioning valve

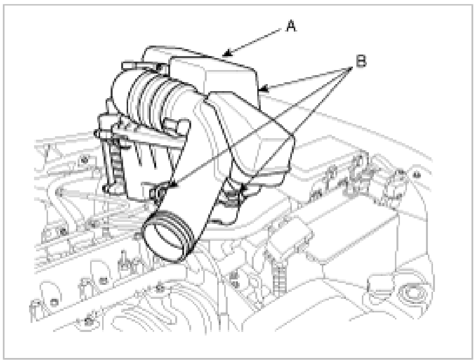
Brake System > Brake System > Master Cylinder > Repair procedures

REMOVAL

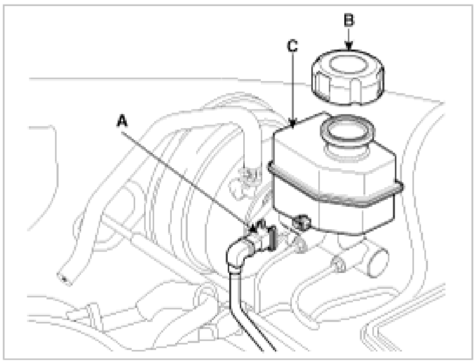
NOTE

Do not spill brake fluid on the vehicle; it may damage the paint; if brake fluid does contact the paint, wash it off immediately with water.

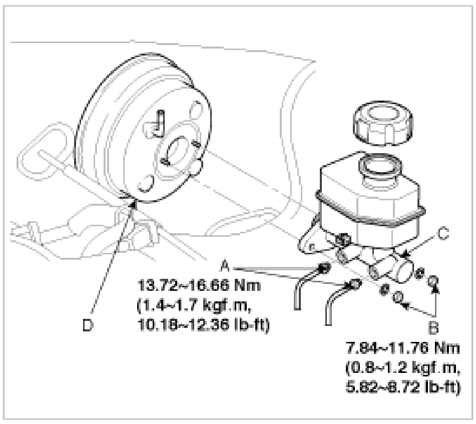
1. Remove air cleaner mounting bolts (B) from the air cleaner mounting bracket and air cleaner body (A).



2. Disconnect the brake fluid level switch connector (A), and remove the reservoir cap (B).



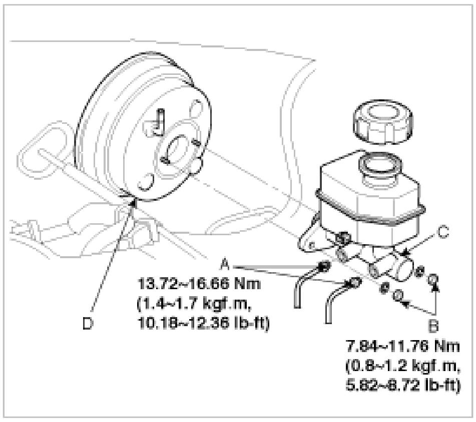
3. Remove the brake fluid from the master cylinder reservoir (C) with a syringe.
4. Disconnect the brake lines (A) from the master cylinder. To prevent spills, cover the hose joints with rags or shop towels.



5. Remove the master cylinder mounting nuts (B) and washers.
6. Remove the master cylinder(C) from the brake booster (D). Be careful not to bend or damage the brake lines when removing the master cylinder.

INSTALLATION

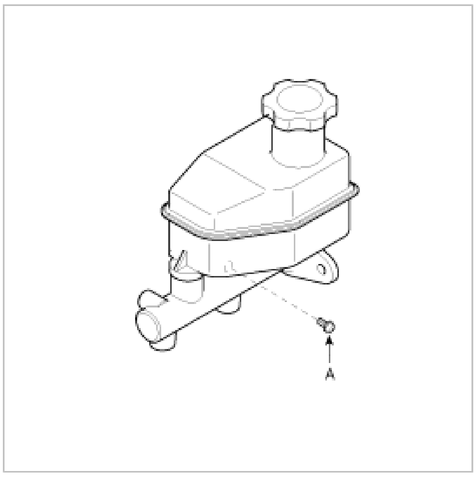
1. Install the master cylinder on the brake booster with 2 nuts.
2. Connect 2 brake tubes and the brake fluid level sensor connector.



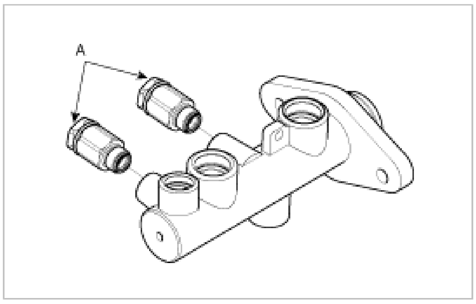
3. Fill the brake reservoir with the brake fluid and bleed the brake system.

DISASSEMBLY

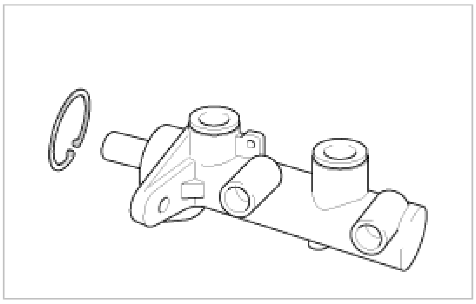
1. Remove the reservoir cap and drain the brake fluid into a suitable container.
2. Remove the fluid level sensor.
3. Remove the reservoir from the master cylinder, after remove mounting screw (A).



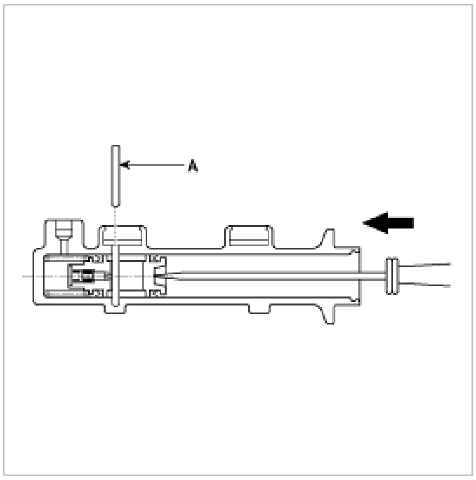
4. Remove the proportioning valves (A) - CBS only.



5. Remove the retainer ring by using the snap ring pliers then remove the primary piston assembly.



6. Remove the pin with the secondary piston pushed completely using a screwdriver. Remove the secondary piston assembly.



NOTE

Do not disassemble the primary and secondary piston assembly.

INSPECTION

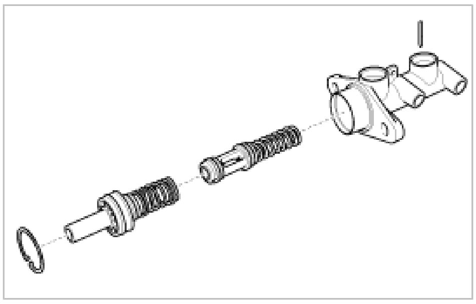
1. Check the master cylinder bore for rust or scratching.
2. Check the master cylinder for wear or damage. If necessary, clean or replace the cylinder.

CAUTION

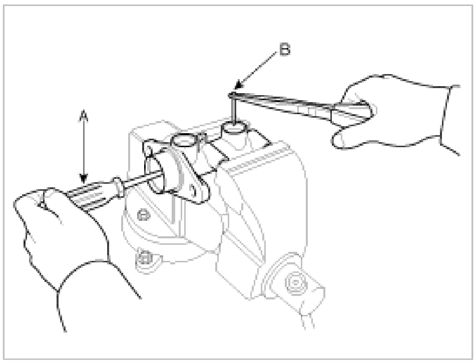
- If the cylinder bore is damaged, replace the master cylinder assembly.
- Wash the contaminated parts in alcohol.

REASSEMBLY

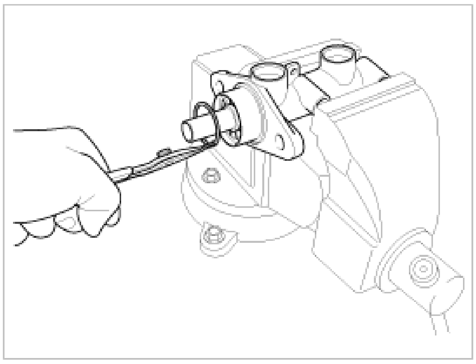
1. Apply genuine brake fluid to the rubber parts of the cylinder kit and grommets.
2. Carefully insert the springs and pistons in the proper direction.



3. Press the piston with a screwdriver(A) and install the cylinder pin(B).



4. Press the piston with a screwdriver and install the retainer ring.



5. Mount two grommets.
6. Install the reservoir on the cylinder.

Brake System > Brake System > Proportioning Valve > Description and Operation

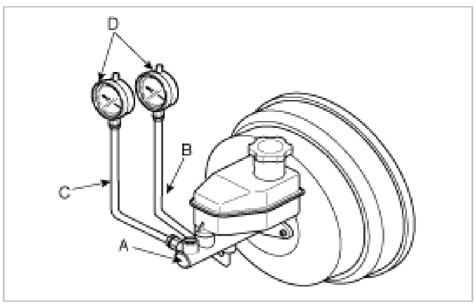
DESCRIPTION

Do not disassemble the proportioning valve. The proportioning valve makes the ideal distribution of fluid pressure to the front and rear brakes to prevent the brakes from skidding in the event of rear wheel lock up and to obtain a higher brake efficiency within the range of service brake application.

Brake System > Brake System > Proportioning Valve > Repair procedures

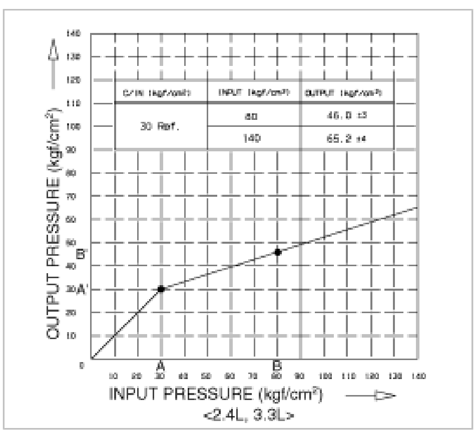
INSPECTION

1. Remove the front brake tube (B) and rear brake tube (C) from the master cylinder (A).
2. Connect two pressure gauges (D); one to the output valve of the front (B) and rear (C) brake.



> **NOTE**
>
> Be sure to bleed the system after connecting the pressure gauges.

3. With the brake applied, measure the front pressure and the rear pressure.
   If the measured pressures are within the specified range as illustrated, the proportioning valve is good.



4. Reconnect the brake lines in their original positions and bleed the system.

> **NOTE**

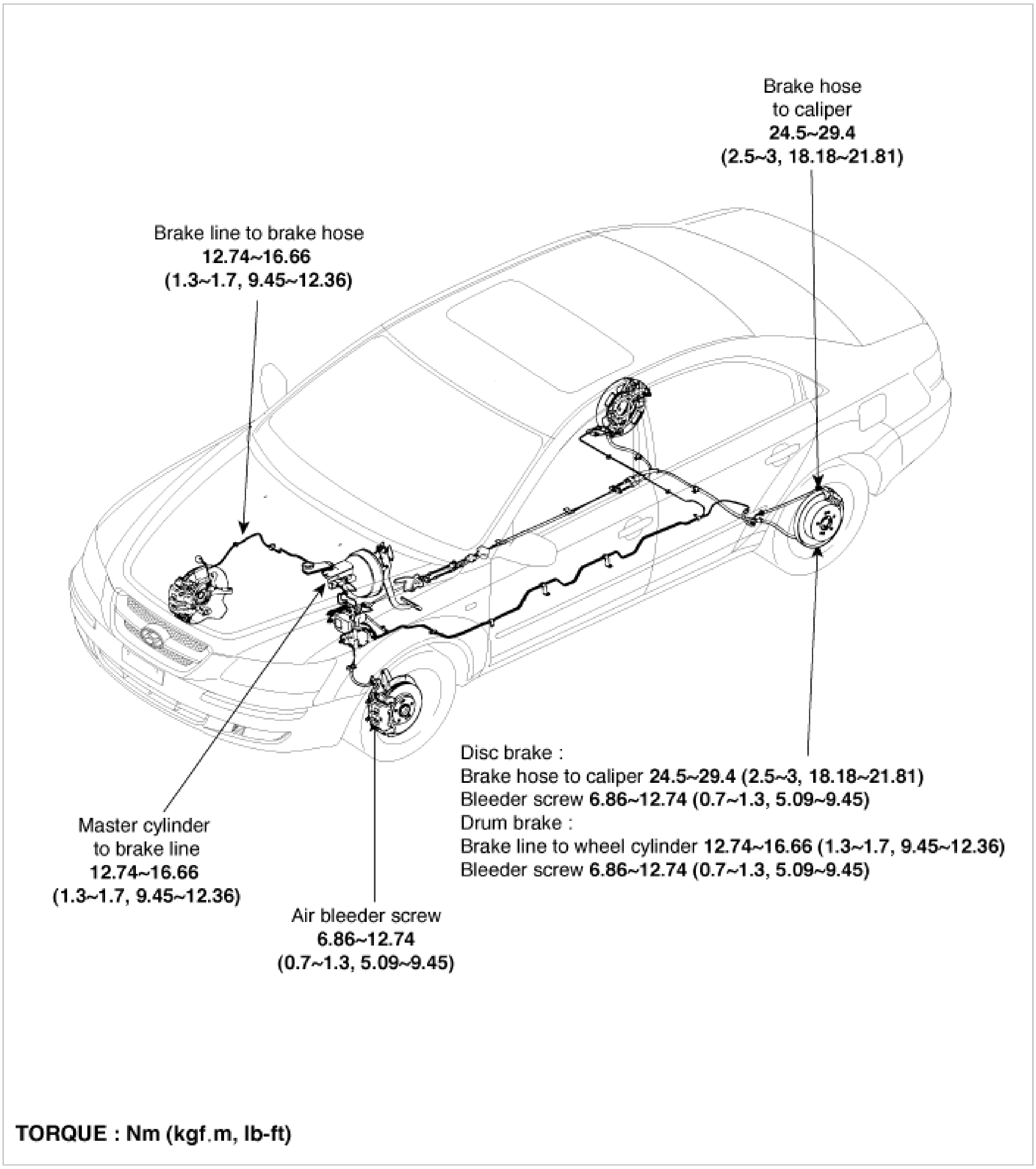
This table shows characteristics of the proportioning valve as the pressure increases.

<2.4L, 3.3L>

Input Pressure	Output Pressure
A : 30 kg/cm²	A' : 30 kg/cm²
B : 80 kg/cm²	B' : 46 kg/cm²

Brake System > Brake System > Brake Line > Components and Components Location

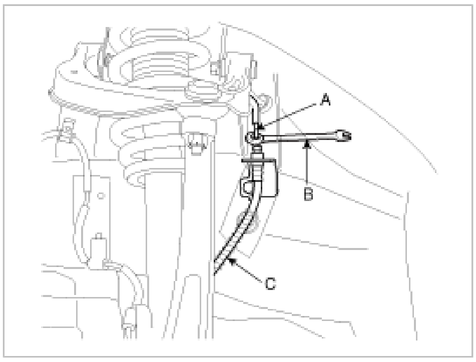
COMPONENT



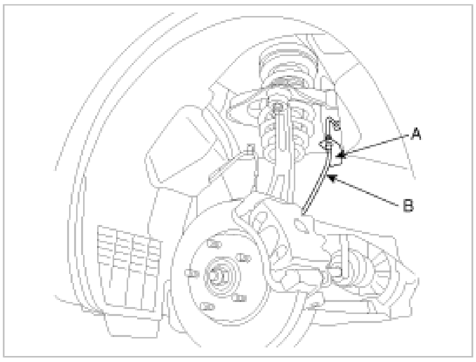
Brake System > Brake System > Brake Line > Repair procedures

REMOVAL

1. Disconnect the brake hose(C) from the brake line(A) using a flare-nut wrench(B).



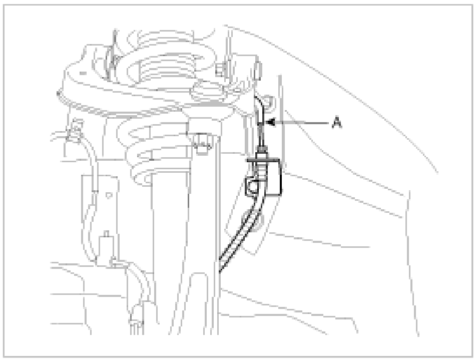
2. Remove the bracket mounting bolt(A), and then remove the brake hose(B).



3. Remove the connector bolt from the caliper, and disconnect the brake hose from the caliper.

INSTALLATION

1. Install a brake hose on the caliper with tightening brake hose bolt.
2. Install the bracket and the brake hose mounting bolt.



3. Connect the brake hose(A) to the brake line.
4. After installing the brake hose, bleed the brake system.

INSPECTION

• Check the brake tubes for cracks, crimps and corrosion.
• Check the brake hoses for cracks, damaged and oil leakage.
• Check the brake tube flare nuts for damage and oil leakage.

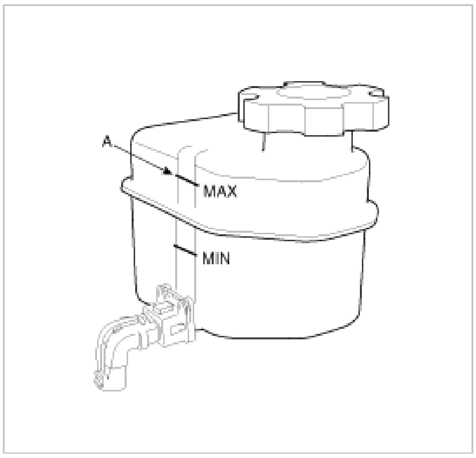
BRAKE SYSTEM BLEEDING

NOTE

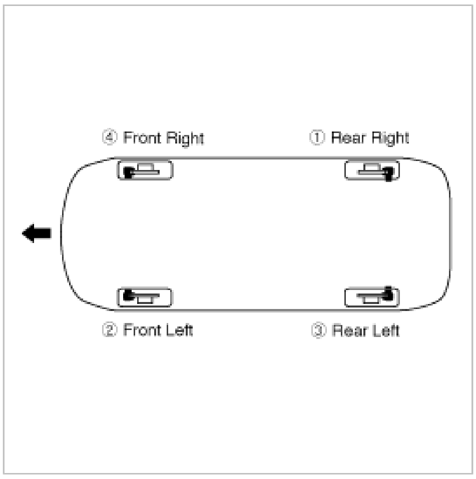
• Do not reuse the drained fluid.
• Always use Genuine DOT3 or DOT 4 Brake Fluid. Using a non-Genuine DOT or 4 brake fluid can cause corrosion and decrease the life of the system.
• Make sure no dirt of other foreign matter is allowed to contaminate the brake fluid.
• Do not spill brake fluid on the vehicle, it may damage the paint; if brake fluid does contact the paint, wash it off

immediately with water.
- The reservoir on the master cylinder must be at the MAX (upper) level mark at the start of bleeding procedure and checked after bleeding each brake caliper. Add fluid as required.

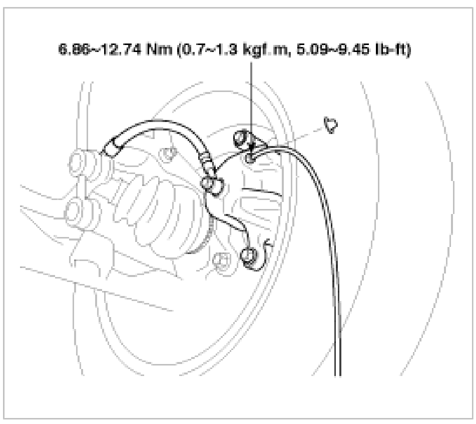
1. Make sure the brake fluid in the reservoir is at the MAX (upper) level line (A).



2. Have someone slowly pump the brake pedal several times, then apply pressure.
3. Lossen the right-rear brake bleed screw to allow air to escape from the system. Then tighten the bleed screw securely.
4. Repeat the procedure for wheel in the sequence shown below unit air bubbles no longer appear in the fluid.
5. Refill the master cylinder reservoir to MAX(upper) level line.

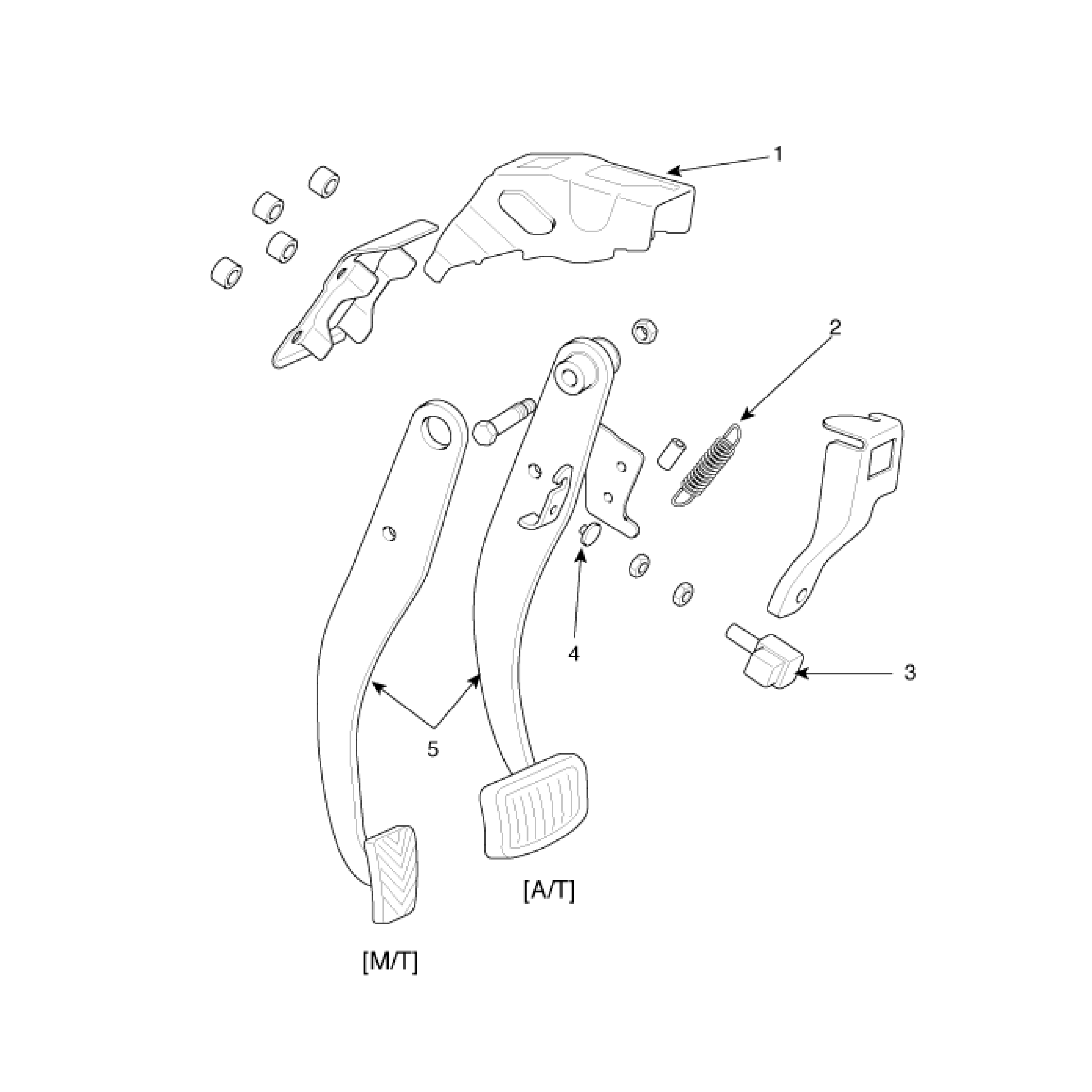


FRONT DISC BRAKE



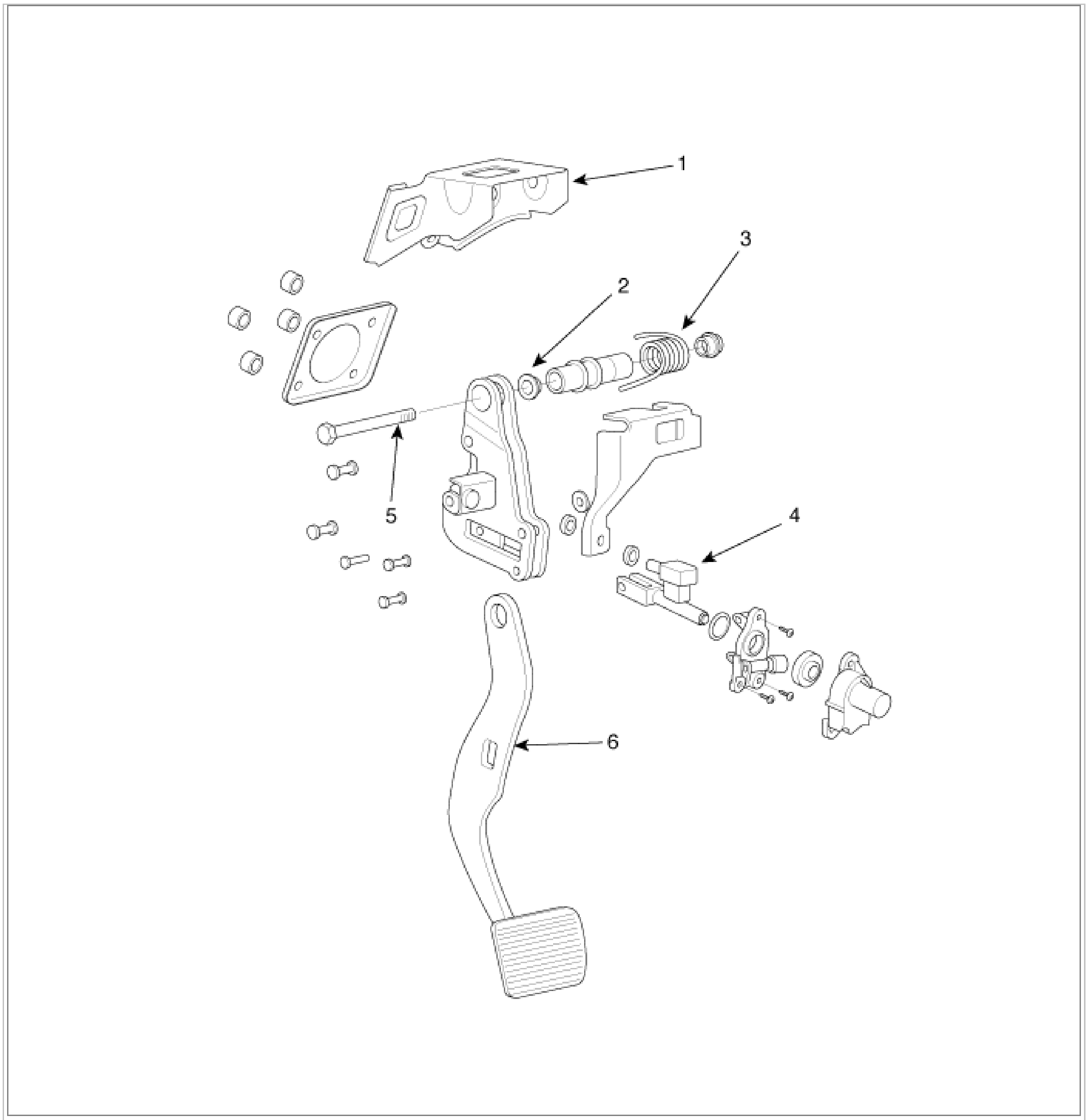
Brake System > Brake System > Brake Pedal > Components and Components Location

COMPONENTS



1. Member assembly bracket 2. Return spring 3. Stop lamp switch	4. Bushing 5. Brake pedal

COMPONENTS (ADJUSTABLE PEDAL)



1. Member assembly bracket
2. Bushing
3. Return spring
4. Stop lamp switch
5. Shaft bolt
6. Brake pedal

Brake System > Brake System > Brake Pedal > Repair procedures

REMOVAL

1. Remove the lower crash pad.(Refer to BD-"crash pad")
2. Pull down steering column shaft after removing 4 bolts.
3. Remove the stop lamp switch connector (A).
4. Remove the shift lock cable (A/T).

5. Remove the pin and snap pin.
6. Loosen the brake pedal member assembly mounting nuts and then remove the brake pedal assembly.

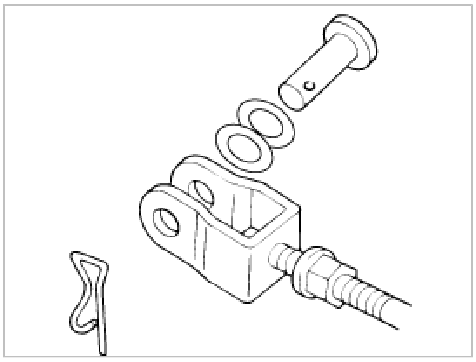
INSTALLATION

1. Installation is the reverse of removal.

> CAUTION
>
> Coat the inner surface of the bushings with the specified grease.

Specified grease : SAE J310

2. Before inserting the pin, apply the specified grease to the joint pin.



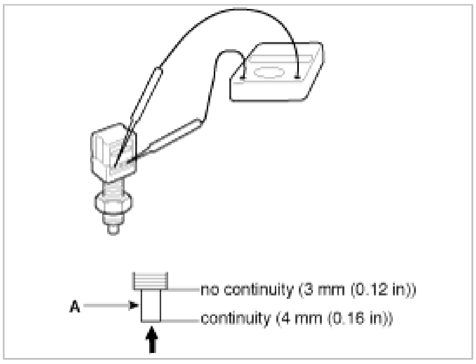
3. Install the snap pin.
4. Install the nuts with specified torque, when installing the brake pedal.

TORQUE : Nm(kgf·m,lb-ft); 12.74~15.68(1.3~1.6, 9.45~11.63)

5. Adjust the brake pedal height and free play.
6. Install the stop lamp switch.

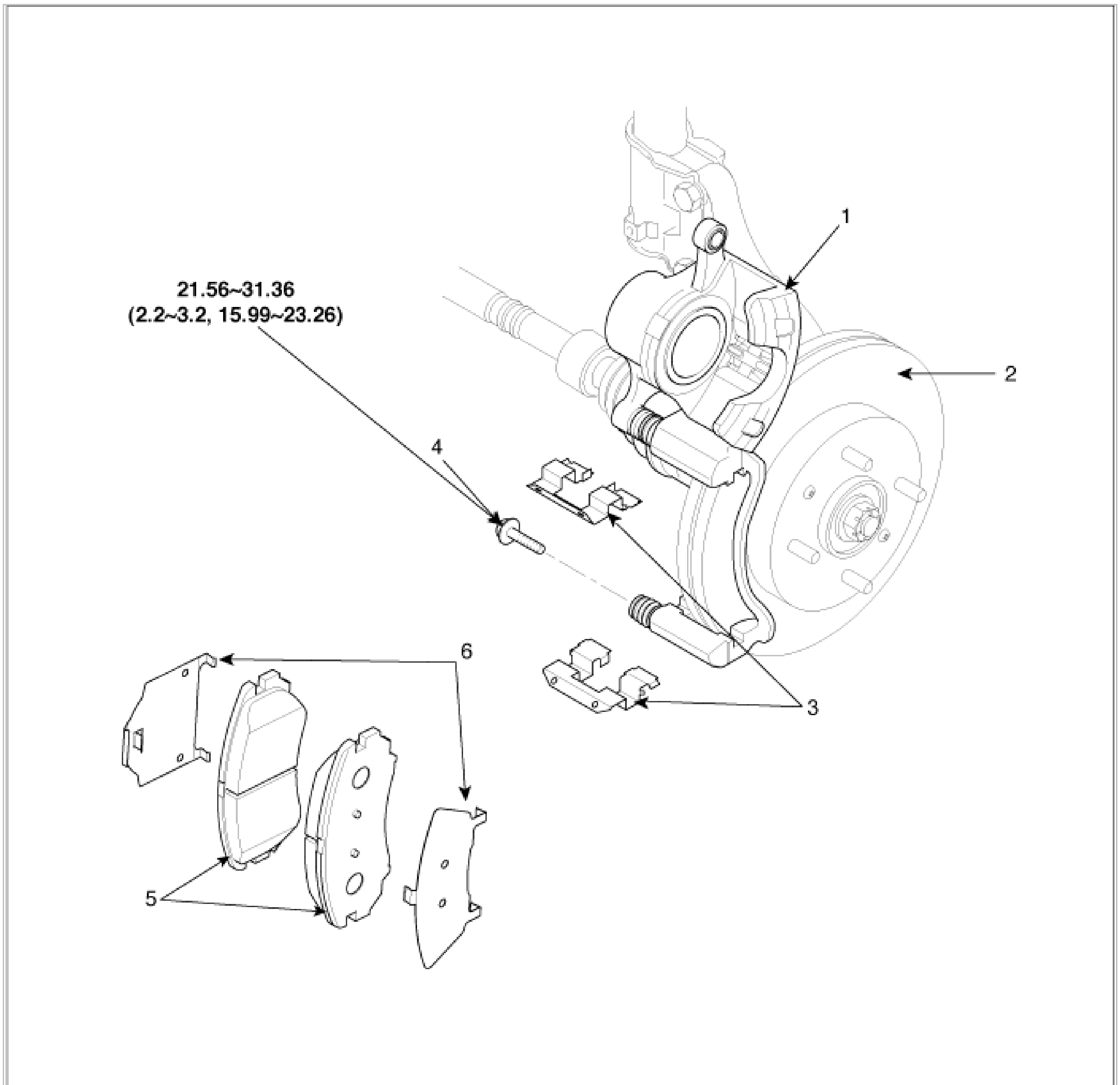
INSPECTION

1. Check the bushing for wear.
2. Check the brake pedal for bending or twisting.
3. Check the brake pedal return spring for damage.
4. Check the stop lamp switch.
   (1) Connect a circuit tester to the connector of stop lamp switch, and check whether or not there is continuity when the plunger of the stop lamp switch is pushed in and when it is released.
   (2) The stop lamp switch is in good condition if there is no continuity when plunger(A) is pushed.



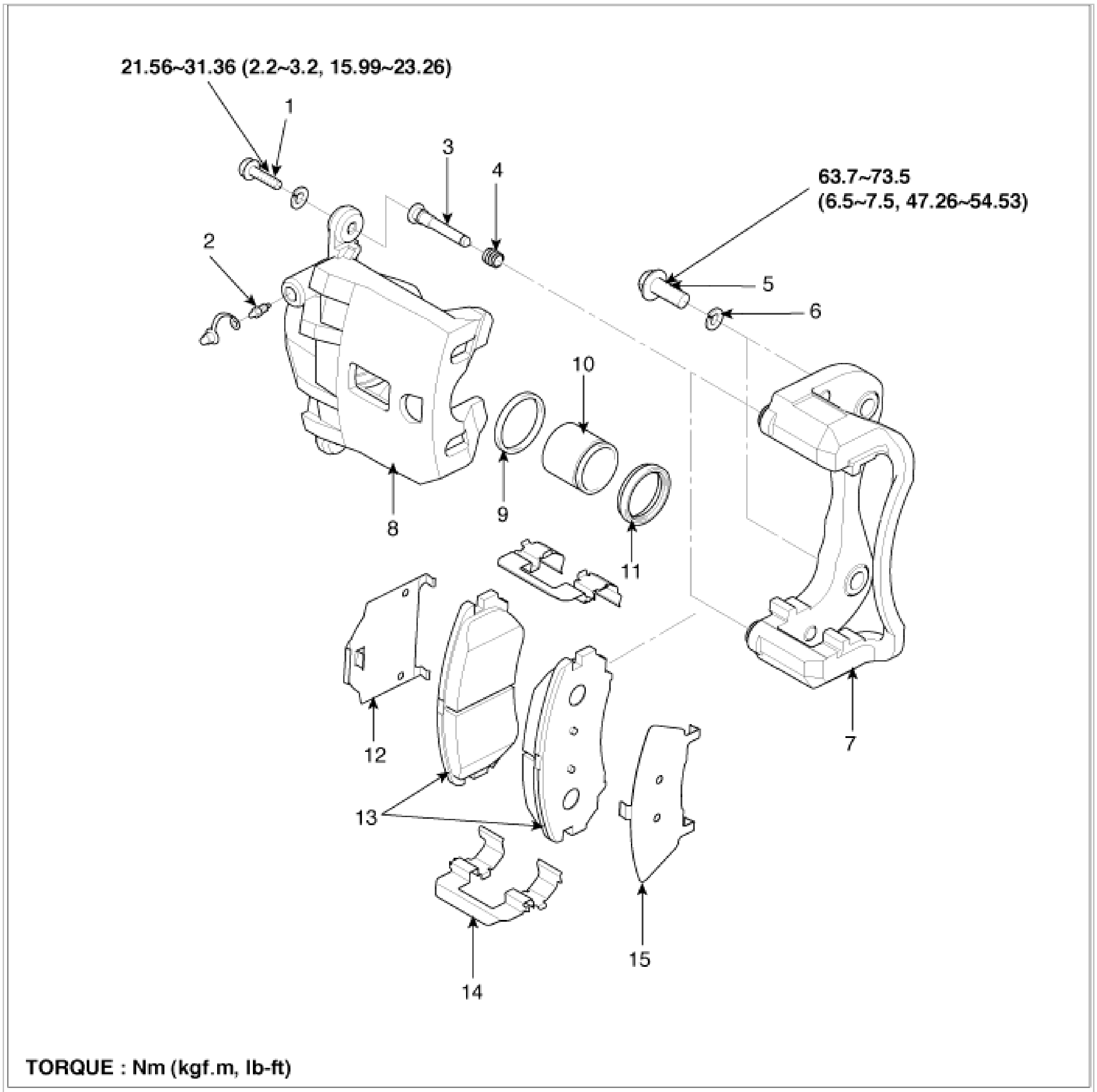
Brake System > Brake System > Front Disc Brake > Components and Components Location

COMPONENTS



TORQUE: Nm (kgf.m, lb-ft)

1. Brake caliper
2. Brake disc
3. Pad retainers
4. Guide rod bolt
5. Brake pads
6. Brake pad shims



1. Guide rod bolt
2. Bleeder screw
3. Guide rod
4. Boot
5. Caliper mounting bolt
6. Washer
7. Caliper bracket
8. Caliper body
9. Piston seal
10. Piston
11. Piston boot
12. Inner shim
13. Brake pad
14. Pad retainer
15. Outer shim

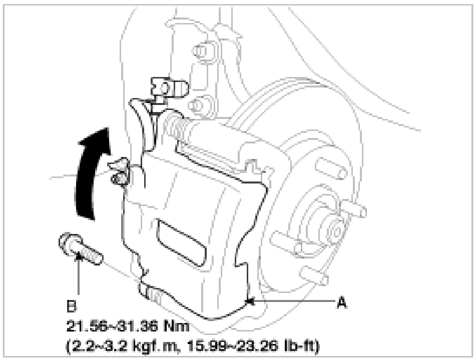
Brake System > Brake System > Front Disc Brake > Repair procedures

REMOVAL

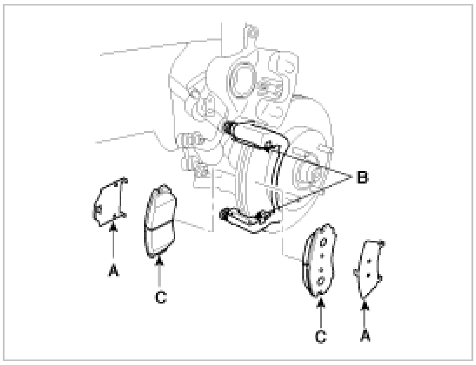
CAUTION

Frequent inhalation of brake pad dust, regardless of material composition, could be hazardous to your health.
- Avoid breathing dust particles.
- Never use on air hose or brush to clean brake assemblies.

1. Lossen the front wheel nuts slightly. Raise the front of the vehicle, and make sure it is securely supported. Remove the front wheels.
2. Remove the guide rod bolt(B), After raise the caliper assembly(A), support it with a wire.

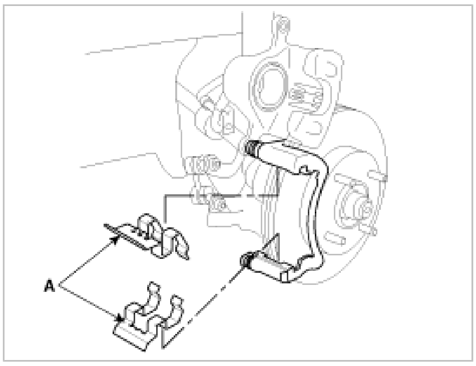


3. Remove pad shim(A), pad retainer(B) and pad assembly(C) in the caliper bracket.

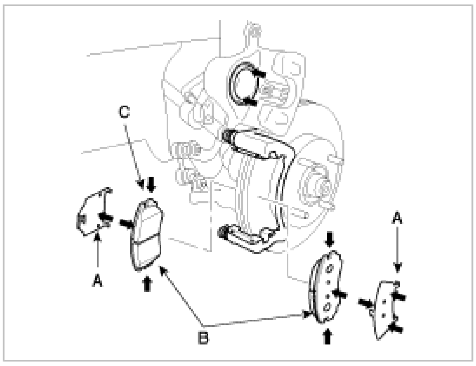


INSTALLATION

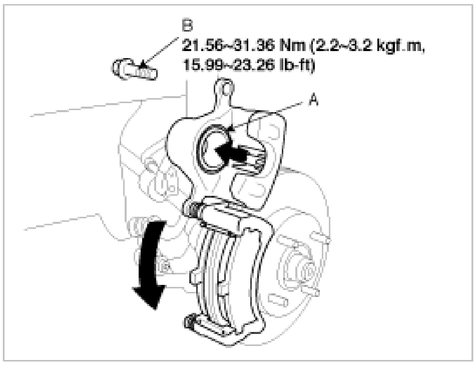
1. Install the pad retainers (A) on the caliper bracket.



2. Check the foreign material at the pad shims (A) and the back of the pads (B).
   Contaminated brake discs or pads reduce stopping ability. Keep grease off the discs and pads.

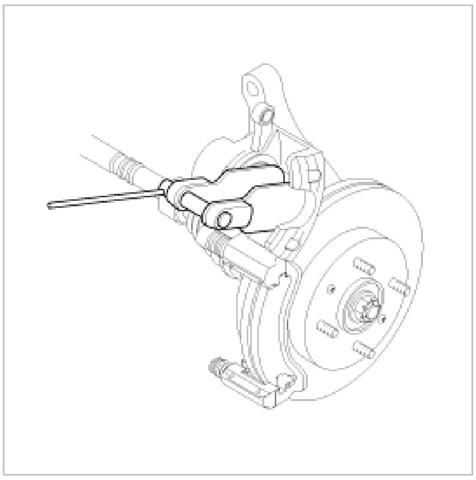


3. Install the brake pads (B) and pad shims (A) correctly. Install the pad with the wear indicator (C) on the inside.
   If you are reusing the pads, always reinstall the brake pads in their original positions to prevent a momentary loss of braking efficiency.
4. Push in the piston (A) so that the caliper will fit over the pads. Make sure that the piston boot is in position to prevent damaging it when pivoting the caliper down.
5. Pivot the caliper down into position. Being careful not to damage the pin boot, install the guide rod bolt (B) and torque it to proper specification.



NOTE

Insert the piston in the cylinder using the special tool (09581-11000).



6. Depress the brake pedal several times to make sure the brakes work, then test-drive.

NOTE

Engagement of the brake may require a greater pedal stroke immediately after the brake pads have been replaced as a set.Several applications of the brake will restore the normal pedal stroke.
Be sure to do this before driving the vehicle.

7. After installation, check for leaks at hose and line joints or connections, and retighten if necessary.

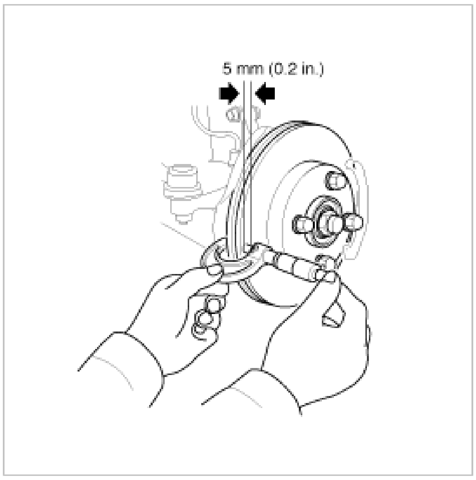
INSPECTION

FRONT BRAKE DISC THICKNESS CHECK

1. Remove all rust and contramination from the surface, and measure the disc thickness at 12 points, at least, of same distance (5mm) front the brake disc outer circle.

Front brake disc thickness
Standard value :
26.0 mm(1.024 in) - 2.4 L
28.0 mm(1.10 in) - 3.3 L
Limit :
24.4 mm(0.961 in) - 2.4 L
26.4 mm(1.04 in) - 3.3 L

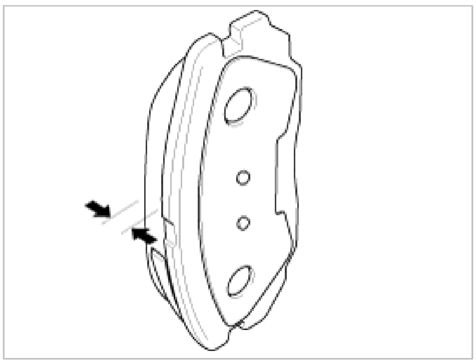
2. Thickness variation should not exceed 0.005mm (0.0002 in) (circumference) and 0.01 mm (0.0004 in)(radius) at any directions.
3. If wear exceeds the limit, replace the discs and pad assembly left and right of the vehicle.



FRONT BRAKE PAD CHECK

1. Check the pad wear. Measure the pad thickness and replace it, if it is less than the specified value.

Pad thickness
Standard value : 11 mm (0.43 in.)
Service limit : 3 ~ 4 mm (0.12 ~ 0.16 in.)



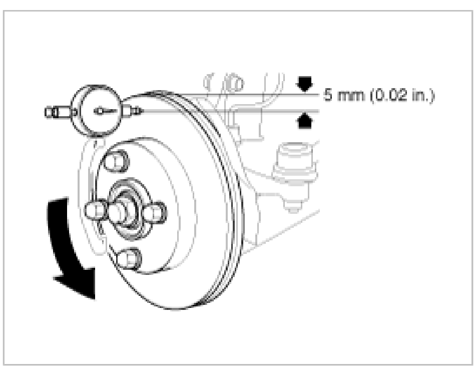
2. Check that grease is applied, to sliding contact points and the pad and backing metal for damage.

FRONT BRAKE DISC RUN OUT CHECK

1. Place a dial gauge about 5mm (0.2 in.) from the outer circumference of the brake disc, and measure the run out of the disc.

Brake disc run out
Limit : 0.04 mm (0.0016 in.) or less (new one)

2. If the run out of the brake disc exceeds the limit specification, replace the disc, and then measure the run out again.
3. If the run out does not exceed the limit specification, install the brake disc after turning it 180° and then check the run out of the brake disc again.
4. If the run out cannot be corrected by changing the position of the brake disc, replace the brake disc.



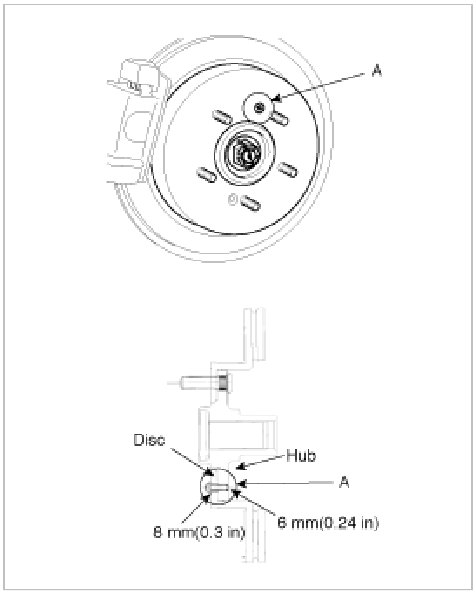
Seizing of Front brake disc

1. Remove the brake disc from hub using an M8 screw(A) if the brake disc has been seized with the hub due to corrosion or

overheating.

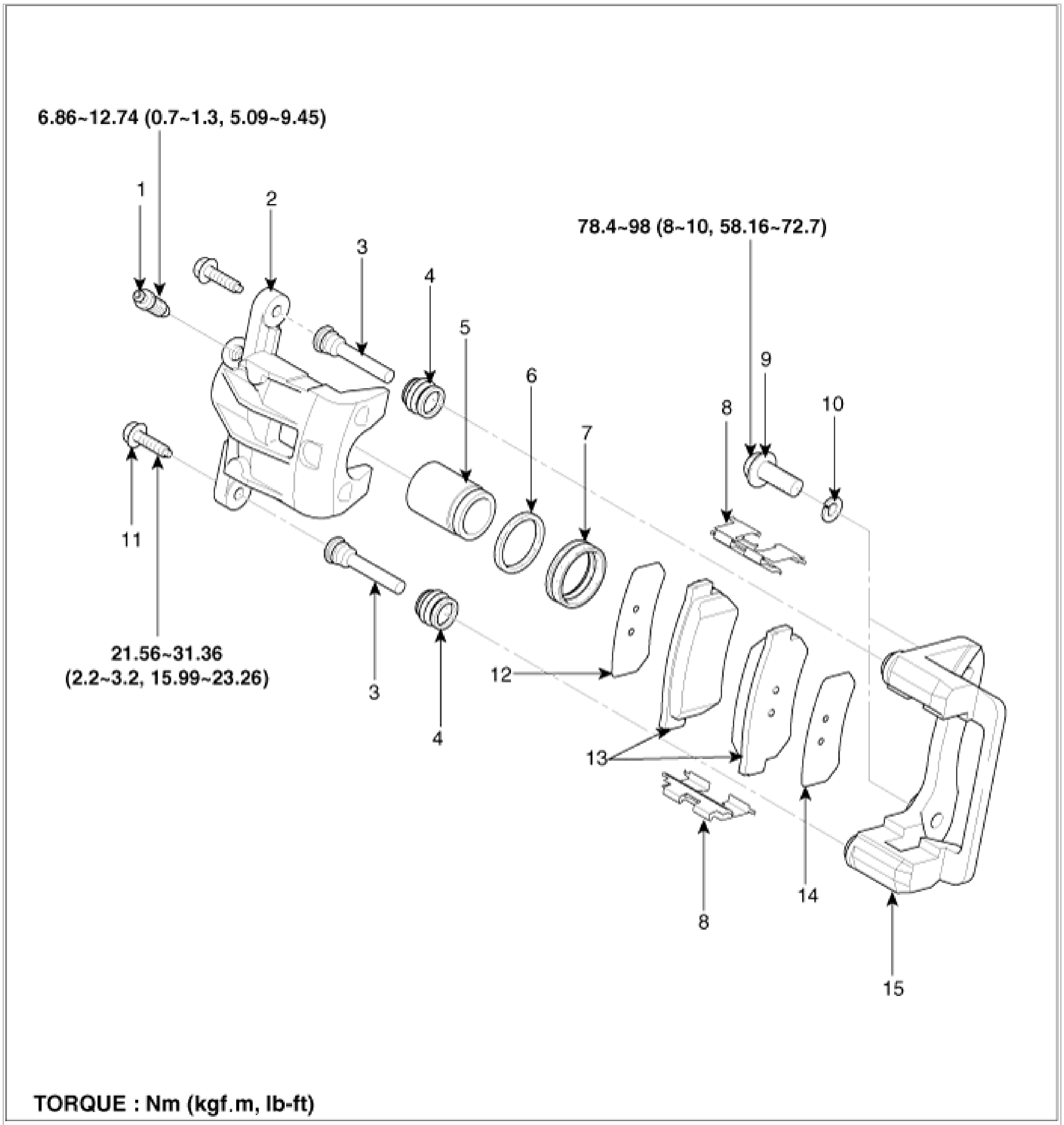
NOTE

Be careful not to use a hammer. The disc can be damaged if you remove the disc from the hub by hammering.



Brake System > Brake System > Rear Disc Brake > Components and Components Location

COMPONENTS

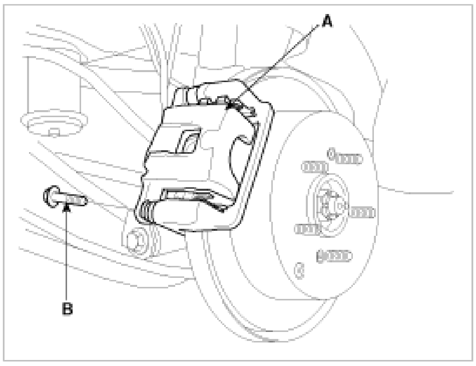


1. Bleeder screw	6. Piston seal	11. Guide rod bolt
2. Caliper body	7. Piston boot	12. Inner shim
3. Guide rod	8. Pad retainer	13. Brake Pad
4. Boot	9. Caliper mounting bolt	14. Outer shim
5. Piston	10. Washer	15. Caliper bracket

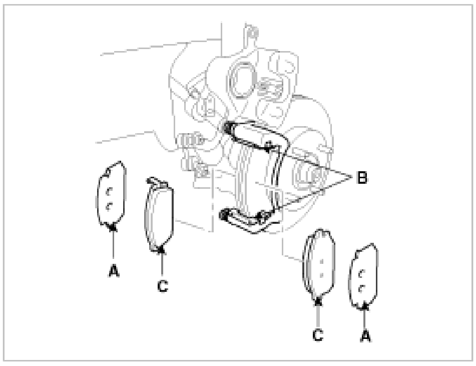
Brake System > Brake System > Rear Disc Brake > Repair procedures

REMOVAL

1. Raise the rear of the vehicle and make sure it is securely supported. Remove the rear wheel.
2. Remove the guide rod bolt(B), After raising the caliper assembly(A), support it with a wire.

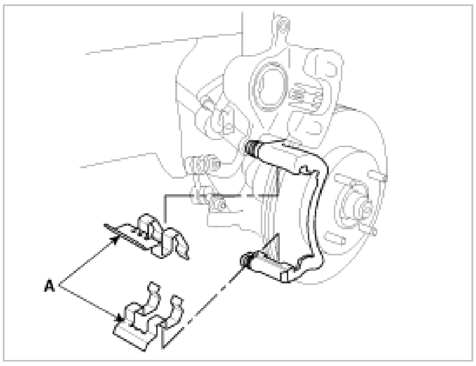


3. Remove pad shim(A), pad retainer(B) and pad assembly(C) in the caliper bracket.

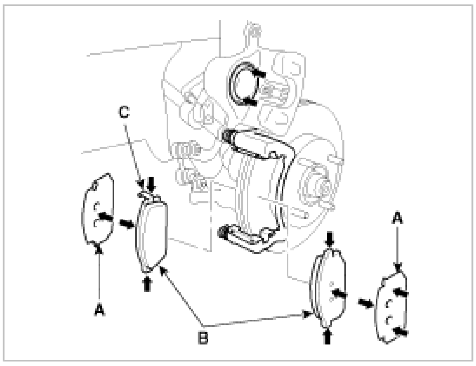


INSTALLATION

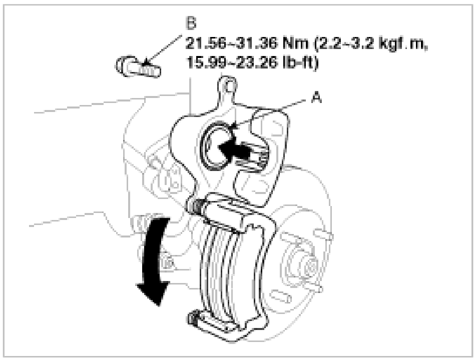
1. Install the pad retainers(A) on the caliper bracket.



2. Check for foreign material between the pad shim (A) and the back of the pads (B).

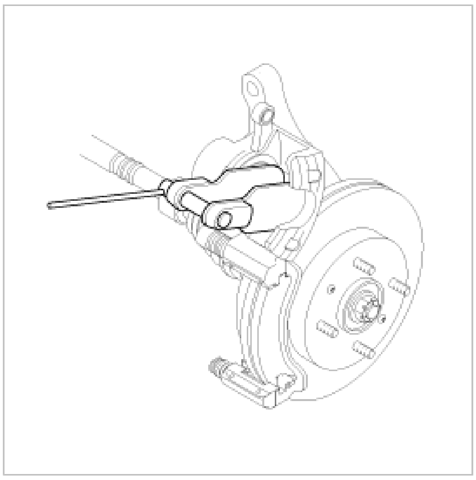


3. Contaminated brake discs or pads reduce stopping ability. Keep grease off the discs and pads.
4. Install the brake pads (B) and pad shims (A) correctly. Install the pad with the wear indicator (C) on the inside.
   If you are reusing the pads, always reinstall the brake pads in their original position to prevent a momentary loss of braking efficiency.
5. Push in the piston (A) so that the caliper will fit over the pads. Make sure that the piston boot is in position to prevent damaging it when pivoting the caliper down.
6. Pivot caliper down into position. Being careful not to damage the pin boot, install the guide rod bolt (B) and torque it to proper specification



NOTE

Insert the piston in the cylinder using the special tool(09581-11000).



7. Depress the brake pedal several time to make sure the brakes work, then test-drive.

NOTE

Engagement of the brake may require a greater pedal stroke immediately after the brake pads have been replaced as a set. Several applications of the brake will restore the normal pedal stroke.

8. After installaion, check for leaks at hose and line joints or connections, and retighten if necessary.

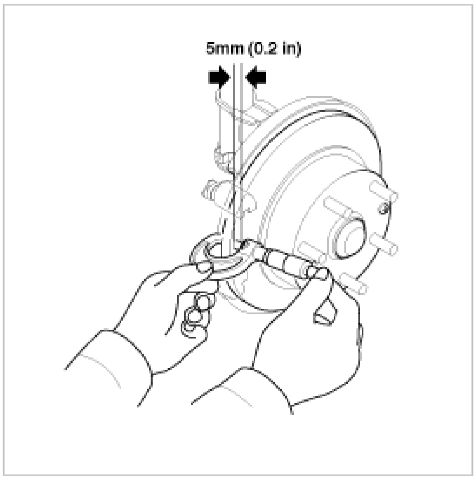
INSPECTION

REAR BRAKE DISC THICKNESS CHECK

1. Remove all rust and contamination from the disc surface, and then measure the disc thickness at 8 points, al least, of the same distance (5 mm(0.12 in)) from the brake disk outer circle.

Rear brake disc thickness
Standard value : 10.0 mm (0.39 in)
Limit : 8.4 mm (0.33 in)

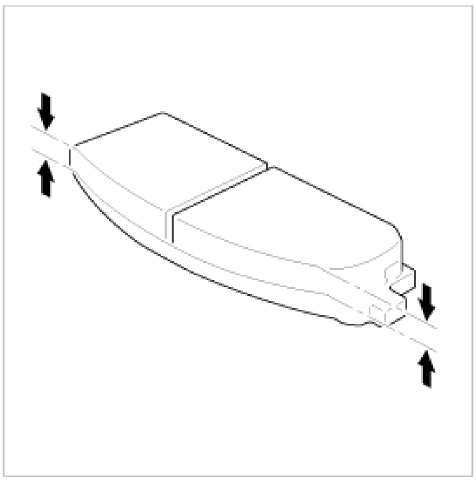
2. Thickness variation should not exceed 0.01 mm(0.0004 in) (circumference) and 0.01 mm(0.0004 in) (radius) at any directions.
3. If wear exceeds the limit, replace the discs and pad assembly for left and right of the vehicle.



REAR BRAKE PAD CHECK

1. Check the pad wear. Measure the pad thickness and replace it, if it is less than the specified value.

Pad thickness
Standard value :
10.0 mm (0.39 in) - 2.4 L
15.0 mm (0.59 in) - 3.3 L
Service limit : 3.0 mm (0.12 in)

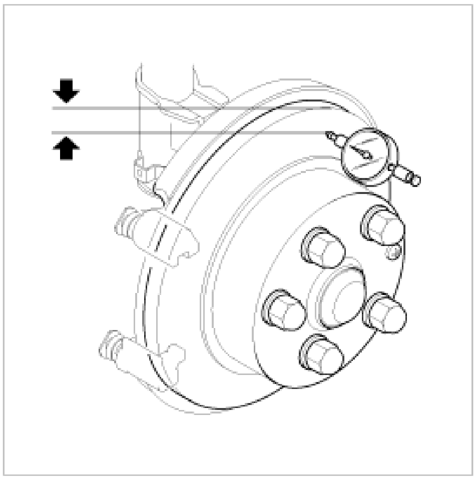


2. Check that grease is applied, and the pad and backing metal for damage.

REAR BRAKE DISC RUN OUT CHECK

1. Place a dial gauge about 5 mm (0.2 in) from the outer circumference of the brake disc, and measure the run out of the disc.

Brake disc run out
Limit : 0.05 mm (0.002 in) or less (new one)

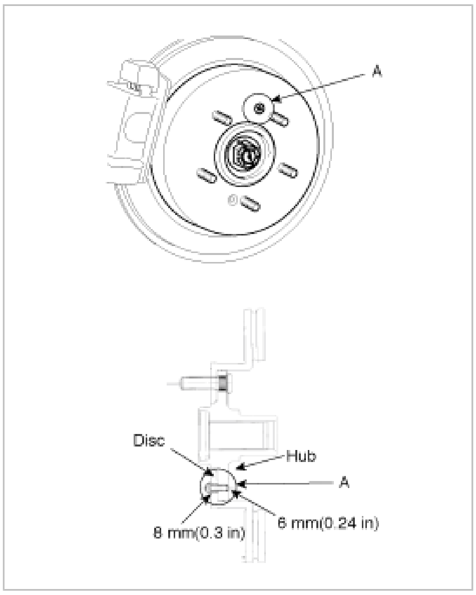


2. If the run out of the brake disc exceeds the limit specification, replace the disc, and then measure the run out again.
3. If the run out does not exceed the limit specification, install the brake disc after turning it 180° and then check the run out of the brake disc again.
4. If the run out cannot be corrected by changing the position of the brake disc, replace the brake disc.

Seizing of Rear brake disc

1. Remove the brake disc from hub using an M8 screw(A) if the brake disc has been seized with the hub due to corrosion or overheating.

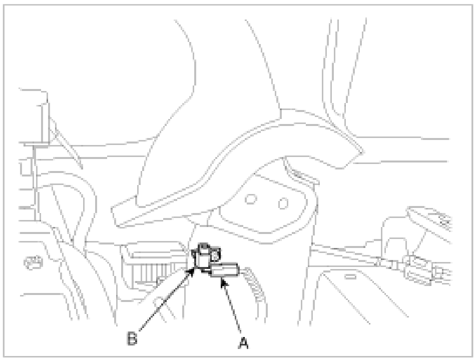
> **NOTE**
>
> Be careful not to use a hammer. The disc can be damaged if you remove the disc from the hub by hammering.



Brake System > Parking Brake System > Parking Brake Switch > Repair procedures

INSPECTION

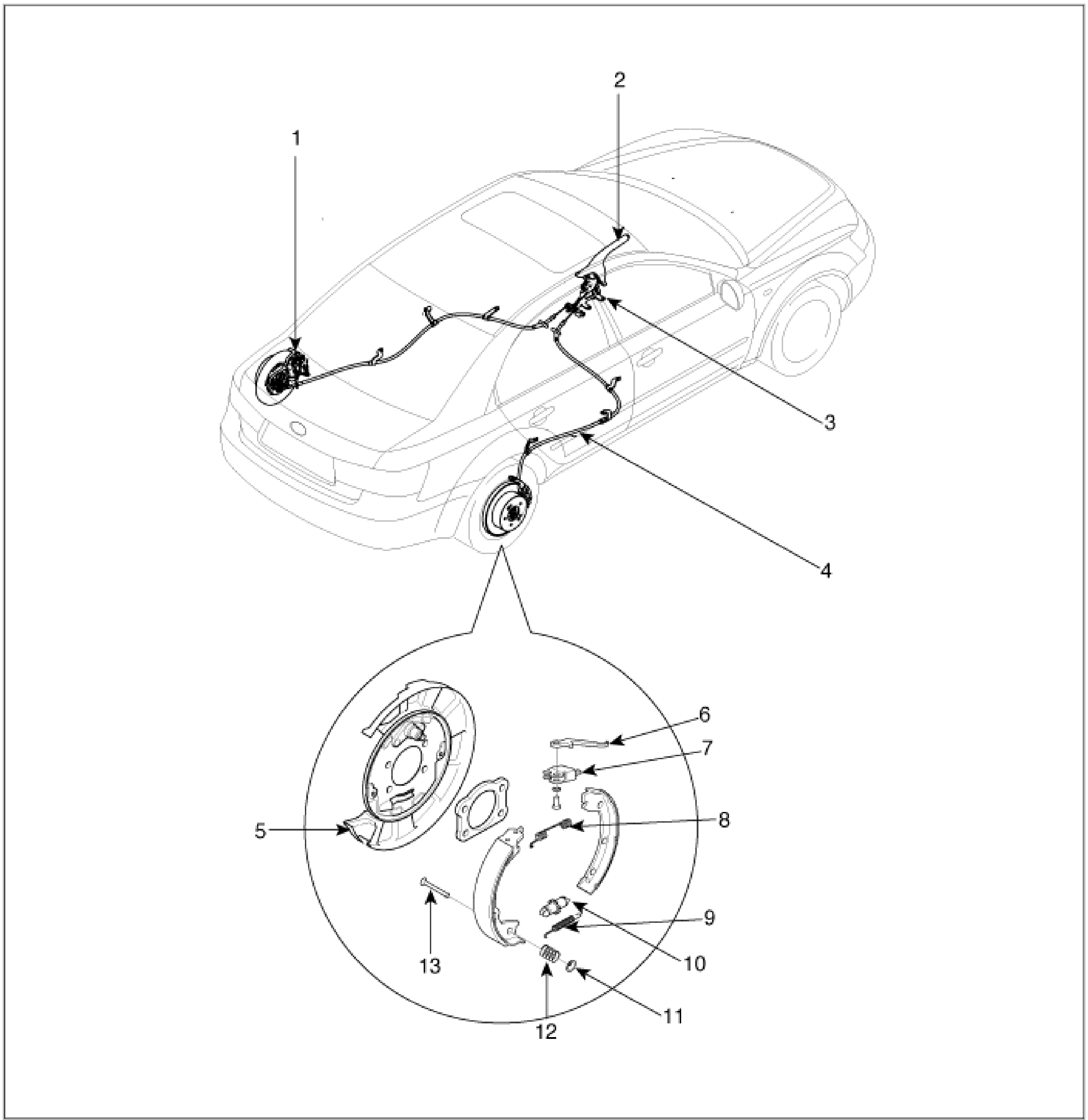
1. Remove the floor console and the connector(B) from the switch(A).



2. Inspect the continuity between (-) terminal and the ground.
   A. When the brake lever is pulled, there should be the continuity between them.
   B. When the brake lever is released, there should be no continuity between them.

Brake System > Parking Brake System > Parking Brake Assembly > Components and Components Location

COMPONENTS



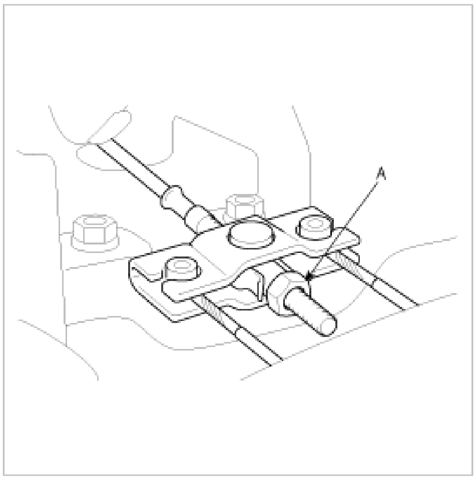
1. Rear brake caliper	6. Operating lever	11. Cup washer
2. Parking brake lever	7. Strut	12. Shoe hold down spring
3. Parking brake switch	8. Upper spring	13. Shoe hold down pin
4. Parking brake cable	9. Lower spring	
5. Backing plate	10. Adjuster	

Brake System > Parking Brake System > Parking Brake Assembly > Repair procedures

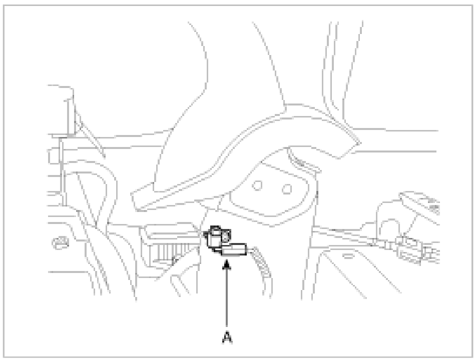
REMOVAL

> NOTE
>
> The parking brake cables must not be bent or distorted.
> This will lead to stiff operation and premature failure.

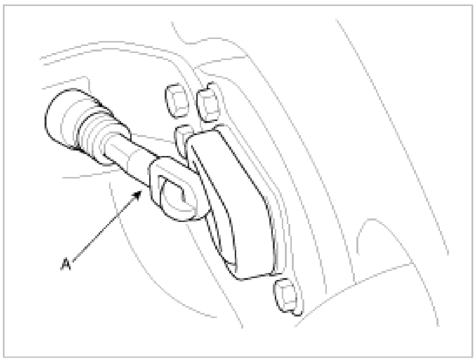
1. Remove the floor console.
2. Loosen the adjusting nut (A) and remove the parking brake cables.



3. Disconnect the connector(A) of the parking brake switch connector.



4. Remove the bolts and parking brake lever assembly(A).
5. Remove the wheel and tire.
6. Remove the brake disc and the brake shoe (Refer to the rear disc brake).
7. Remove the parking brake hook(A).



8. Remove the parking brake cable assembly.

INSTALLATION

1. Install the removed parts in the reverse order of removal.
2. Apply the specified grease to each sliding parts of the ratchet plate or the ratchet pawl.

Specified grease :
Multi purpose grease SAE J310, NLGI No.2

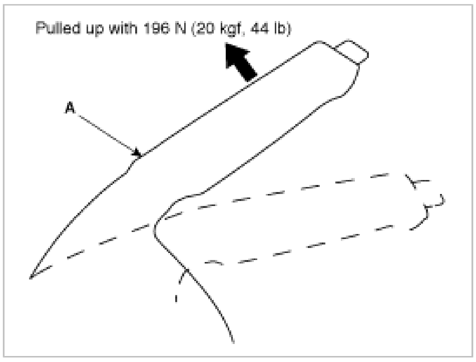
3. After installing the parking brake cable adjuster, adjust the parking brake lever stroke (Refer to the parking brake check and adjustment).

Parking brake check and adjustment

INSPECTION

1. Pull the parking brake lever (A) with 196 N (20 kgf, 44 lbf) force to fully apply the parking brake. The parking brake lever should be locked within the specified number of clicks.

   Lever locked clicks : 8

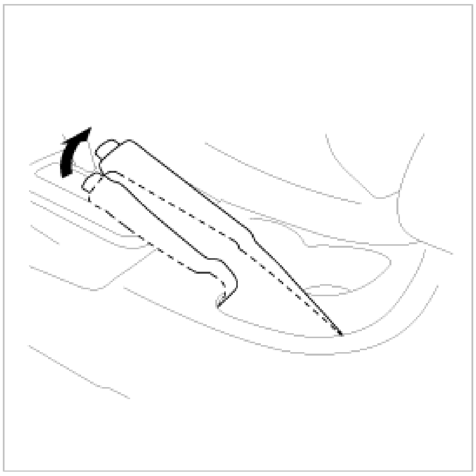
   

2. Adjust the parking brake if the lever clicks are out of specification.

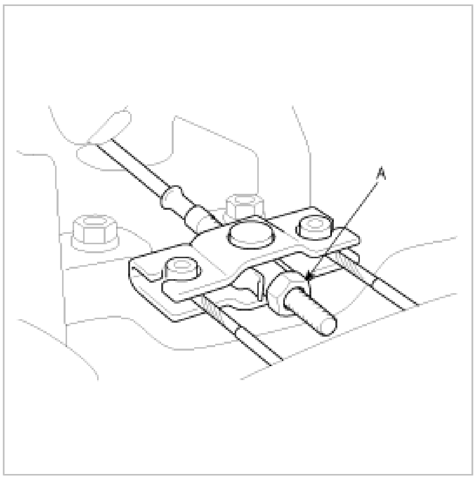
ADJUSTMENT

> **NOTE**
>
> After rear brake caliper servicing, loosen the parking brake adjusting nut, start the engine and depress the brake pedal several times to set the self-adjusting brake before adjusting the parking brake.

1. Block the front wheels, then raise the rear of the vehicle and make sure it is securely supported.
2. Pull the parking brake lever up one click.

3. Remove the floor console.
4. Tighten the adjusting nut (A) until the parking brakes are dragged slightly when the rear wheels are turned.

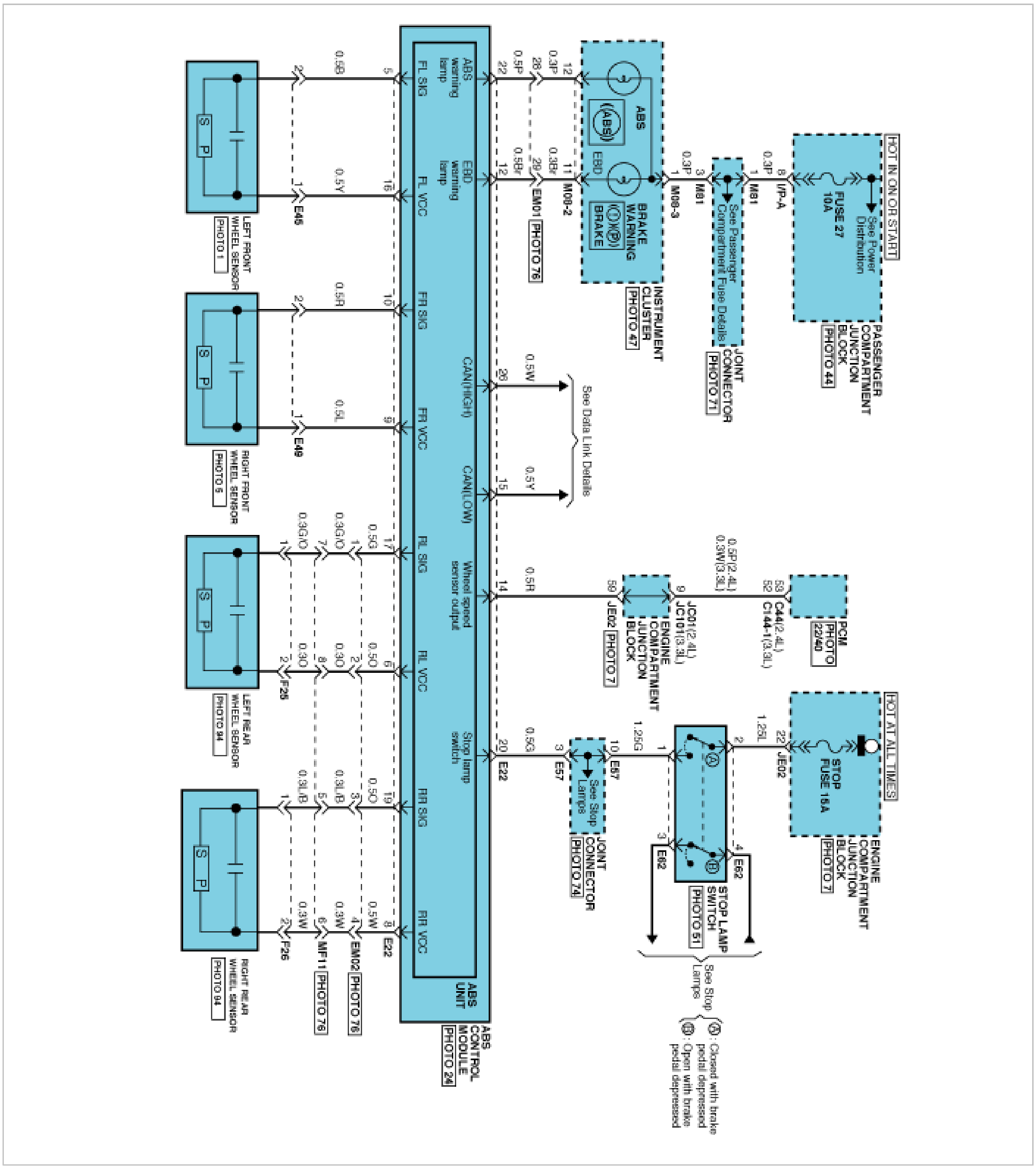
5. Release the parking brake lever completely, and check if parking brakes are not dragged when the rear wheels are turned.

Readjust if necessary.

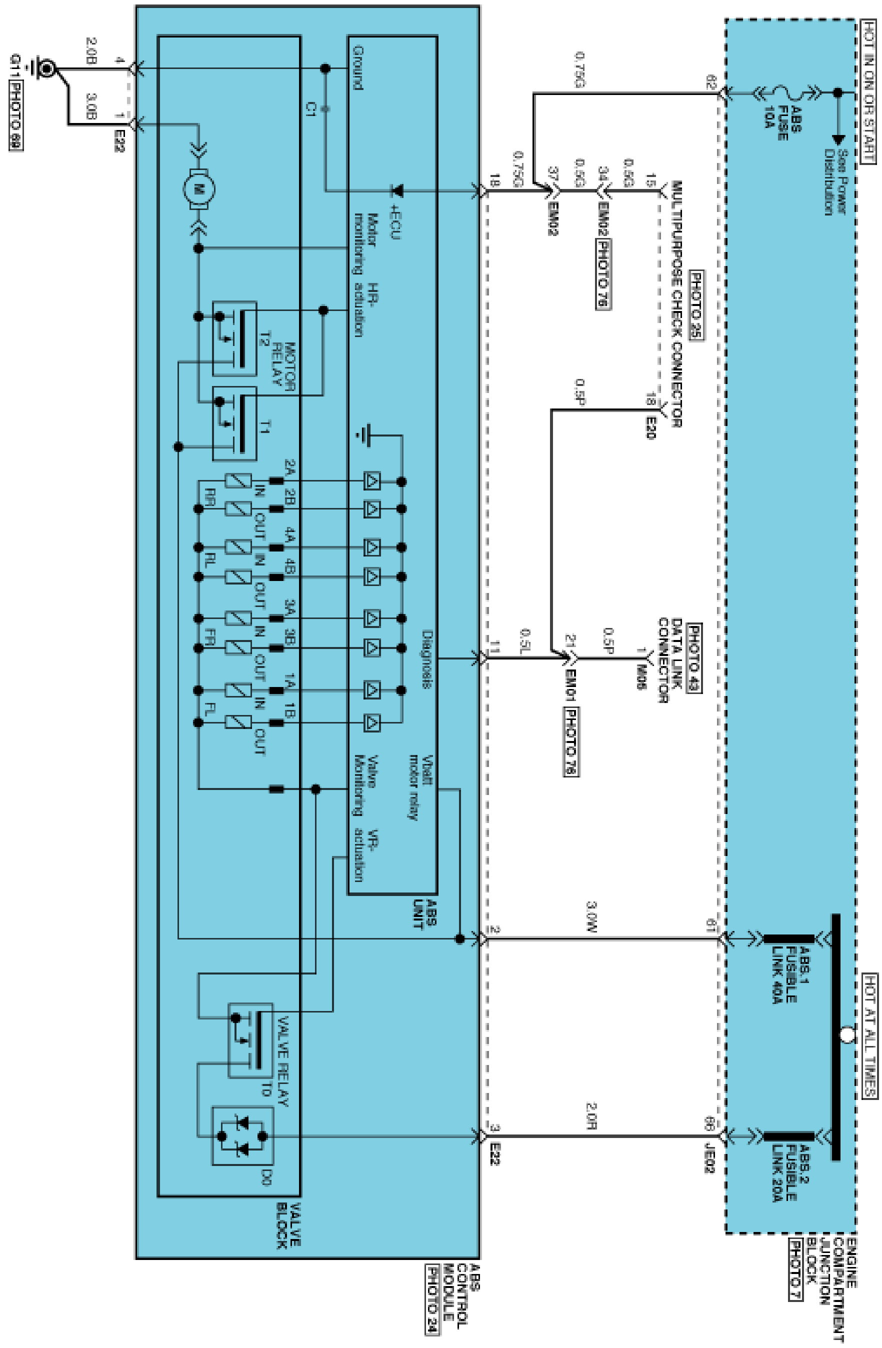
6. Make sure that the parking brakes are fully applied when the parking brake lever is pulled up completly.
7. Reinstall the floor console.

Brake System > ABS(Anti-Lock Brake System) > Schematic Diagrams

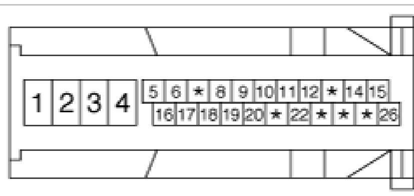
ABS CIRCUIT DIAGRAM(1)



ABS CIRCUIT DIAGRAM(2)



ECU CONNECTOR INPUT/OUTPUT(ABS)



Wire No.	Designation	Current		max.permissible wire resistance R_L (mΩ)	min.leakage resistance R_P (kΩ)
		max	min		
1	Ground for recirculation pump	20~39 A	10 A	10	
4	Ground for solenoid valves and ECU	5~15 A	2.5 A	10	
2	Voltage supply for pump motor	20~39 A	10 A	10	200

3	Voltage supply for solenoid valves	5~15 A	2 A	10	200
18	Voltage for hybrid ECU	1 A	500 mA	60	200
5,10,17,19	signal wheel speed sensor FL, FR, RL,RR	6 mA	16 mA	250	200 to ground 1.5M to bat
16,9,6,8	Voltage supply for the active wheel speed sensor FL,FR, RL, RR	6 mA	16 mA	250	200 to ground 1.5M to bat
14,24	wheel speed sensor output (FR, RL)	20 mA	10 mA	250	200
11	Diagnostic wire K	6 mA	3 mA	250	200
22	ABS-warning lamp actuation	30 mA	5 mA	250	200
12	EBD-warning lamp actuation	30 mA	5 mA	250	200
20	brake light switch	10 mA	5 mA	250	200
15	CAN Low	30 mA	20 mA	250	200
26	CAN High	30 mA	20 mA	250	200

ABS HECU CONNECTOR

Connector terminal		Specification	Condition
Number	Description		
1	Ground for recirculation pump	Current range: Min.10A Max.20~39A	Always
4	Ground for solenoid valves and ECU	Current range: Min.2.5A Max.5~15A	Always
2	Voltage supply for pump motor	Battery voltage	Always
3	Voltage supply for solenoid valves		
16	Voltage supply for the active wheel speed sensor FL,FR, RL, RR	Battery voltage	IG ON
9			
6			
8			
5	signal wheel speed sensor FL, FR, RL,RR	Voltage(High) : 0.89~1.26 V Voltage (Low) : 0.44~0.63 V	On driving
10			
17			
19			
11	Diagnostic wire K	Voltage (High) ≥ 0.8 * IG ON Voltage (Low) ≤ 0.2 * IG ON	On HI-SCAN communication
18	Voltage for hybrid ECU	Battery voltage	KEY ON/OFF
20	Brake light switch	Voltage (High) ≥ 0.8 * IG ON Voltage (Low) ≤ 0.3 * IG ON	BRAKE ON/OFF

SENSOR OUTPUT ON Hi-SCAN(ABS)

	Description	Abbreviation	Unit	Remarks
1	Vehicle speed sensor	VEH. SPD	Km/h	
2	Battery voltage	BATT. VOL	V	
3	FL Wheel speed sensor	FL WHEEL	Km/h	
4	FR Wheel speed sensor	FR WHEEL	Km/h	
5	RL Wheel speed sensor	RL WHEEL	Km/h	
6	RR Wheel speed sensor	RR WHEEL	Km/h	
7	ABS Warning lamp	ABS LAMP	-	
8	EBD Warning lamp	EBD LAMP	-	

9	Brake Lamp	B/LAMP	-	
10	Pump relay state	PUMP RLY	-	
11	Valve relay state	VALVE RLY	-	
12	Motor	MOTOR	-	
13	Front Left valve(IN)	FL INLET	-	
14	Front Right valve (IN)	FR INLET	-	
15	Rear Left valve (IN)	RL INLET	-	
16	Rear Right valve (IN)	RR INLET	-	
17	Front Left valve (OUT)	FL OUTLET	-	
18	Front Right valve (OUT)	FR OUTLET	-	
19	Rear Left valve(OUT)	RL OUTLET	-	
20	Rear Right valve (OUT)	RR OUTLET	-	

Brake System > ABS(Anti-Lock Brake System) > Description and Operation

DESCRIPTION

This specification applies to HCU(Hydraulic Control Unit) and ECU(Electronic Control Unit) of the HECU.(Hydraulic and Electronic Control Unit)
This specification is for the wiring design and installation of ABS/TCS/ESC ECU.
This unit has the functions as follows.

- Input of signal from Pressure sensor, Steering angle sensor, Yaw & Lateral G sensor, the wheel speed sensors attached to each wheel.
- Control of braking force / traction force/ yaw moment.
- Failsafe function.
- Self diagnosis function.
- Interface with the external diagnosis tester.

Installation position : engine compartment

- Brake tube length from Master cylinder port to HECU inlet port should be max. 1m
- The position should not be close to the engine block and not lower than the wheel.

OPERATION

The ECU shall be put into operation by switching on the operating voltage (IGN).
On completion of the initialization phase, the ECU shall be ready for operation.
In the operating condition, the ECU shall be ready, within the specified limits (voltage and temperature), to process the signals offered by the various sensors and switches in accordance with the control algorithm defined by the software and to control the hydraulic and electrical actuators.

Wheel Sensor signal processing

The ECU shall receive wheel speed signal from the four active wheel sensors.
The wheel signals are converted to voltage signal by the signal conditioning circuit after receiving current signal from active wheel sensors and given as input to the MCU.

Solenoid Valve Control

When one side of the valve coil is connected to the positive voltage that is provided through the valve relay and the other side is connected to the ground by the semiconductor circuit, the solenoid valve goes into operation.
The electrical function of the coils are always monitored by the valve test pulse under normal operation conditions.

Voltage limits

- Overvoltage
  When overvoltage is detected(above 16V), the ECU switches off the valve relay and shuts down the system.
  When voltage is returned to operating range, the system goes back to the normal condition after the initialization phase.
- Undervoltage
  In the event of undervoltage(below 10V), ABS control shall be inhibited and the warning lamp shall be turned on.
  When voltage is returned to operating range, the warning lamp is switched off and ECU returns to normal operating mode.

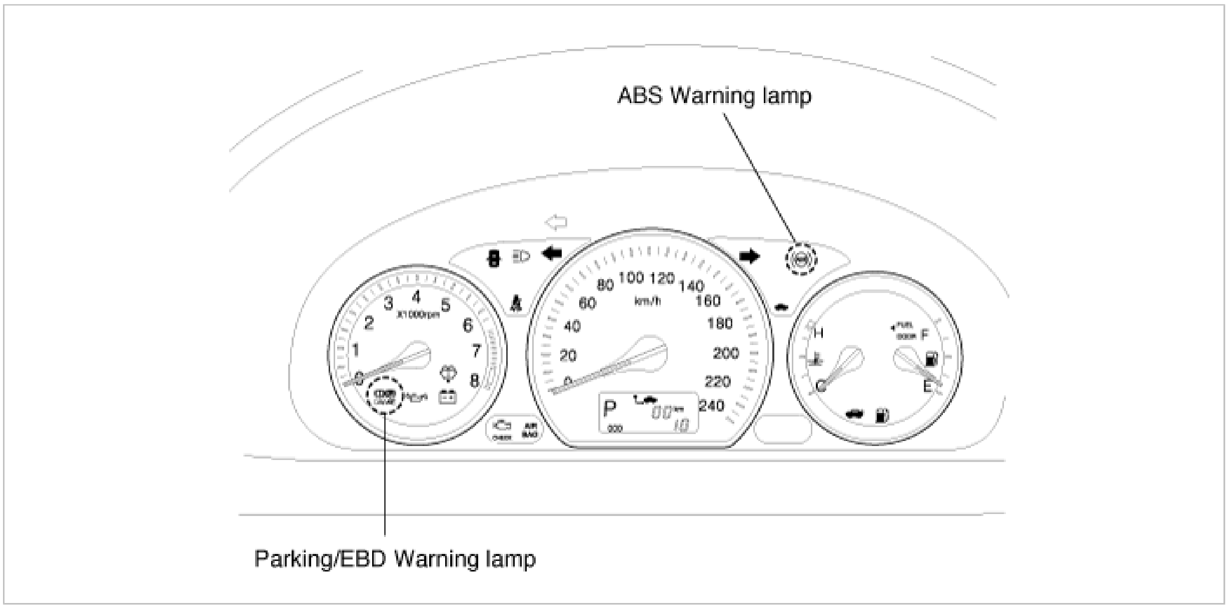
Pump Motor Checking

The ECU performs a pump motor test at a speed of 15km/h once after IGN is switched on.

Diagnostic Interface

Failures detected by the ECU are encoded on the ECU, stored in a EEPROM and read out by diagnostic equipment when the ignition switch is turned on.
The diagnosis interface can also be used for testing the ECU during production of the ECU and for actuating the HCU in the test line of manufactories (Air-bleeding line or Roll and Brake Test line).

Warning Lamp module

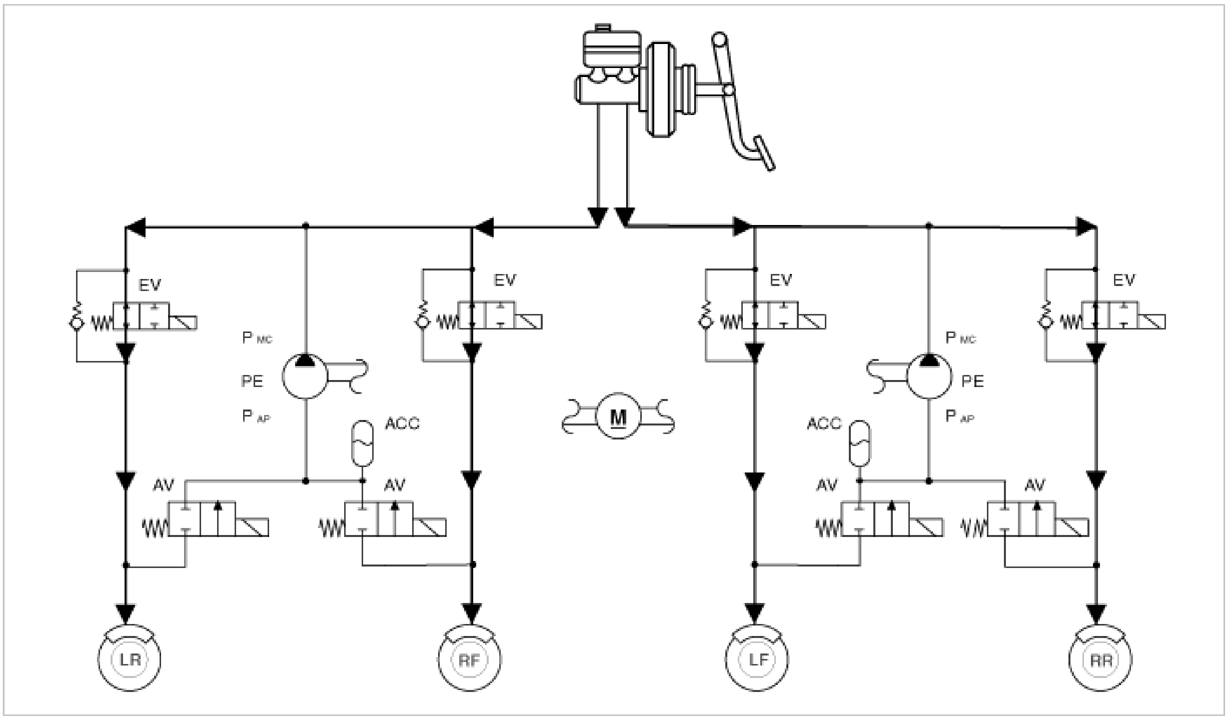


1. ABS WARNING LAMP MODULE
   The active ABS warning lamp module indicates the selftest and failure status of the ABS.The ABS warning lamp shall be on:
   A. During the initialization phase after IGN ON. (continuously 3 seconds).
   B. In the event of inhibition of ABS functions by failure.
   C. During diagnostic mode.
   D. When the ECU Connector is seperated from ECU.
2. PARKING/EBD WARNING LAMP MODULE
   The active EBD warning lamp module indicates the selftest and failure status of the EBD.However, in case the Parking Brake Switch is turned on, the EBD warning lamp is always turned on regardless of EBD functions.The EBD warning lamp shall be on:
   A. During the initialization phase after IGN ON. (continuously 3 seconds).
   B. When the Parking Brake Switch is ON or brake fluid level is low.
   C. When the EBD function is out of order.
   D. During diagnostic mode.
   E. When the ECU Connector is seperated from ECU.

ABS CONTROL

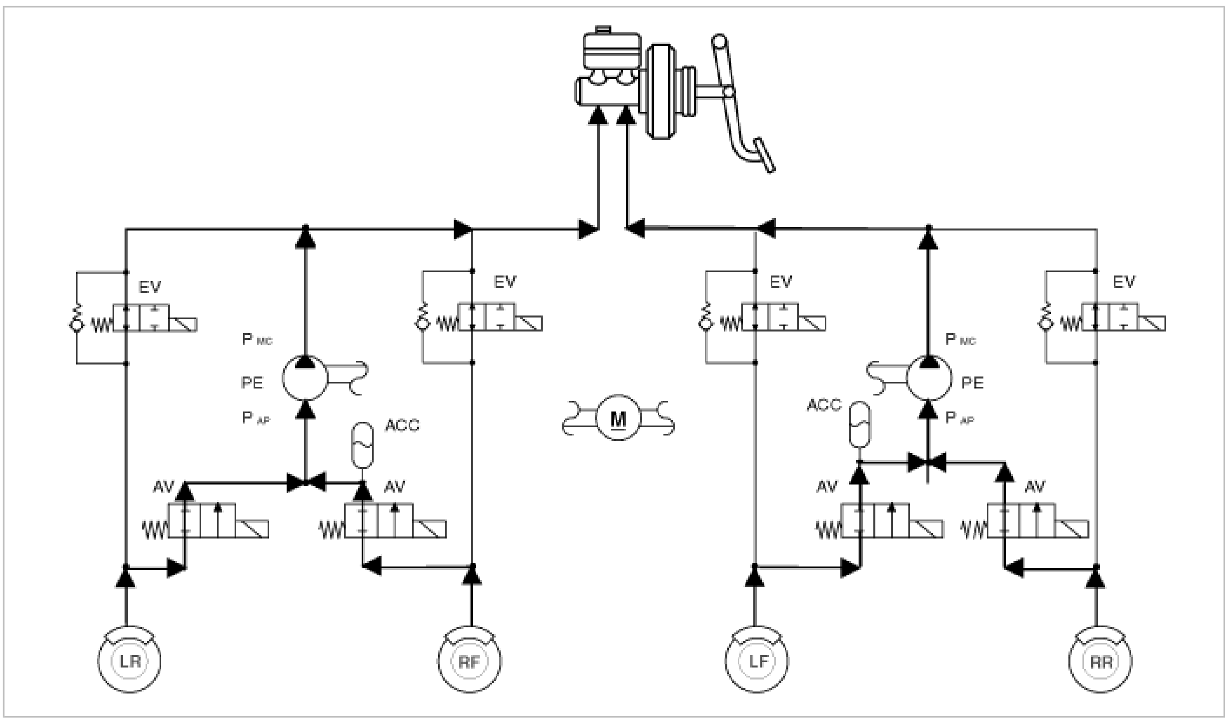
1. NORMAL BRAKING without ABS

	Inlet valve(EV)	Outlet valve(AV)	Pump motor
Operation	Open	Close	OFF



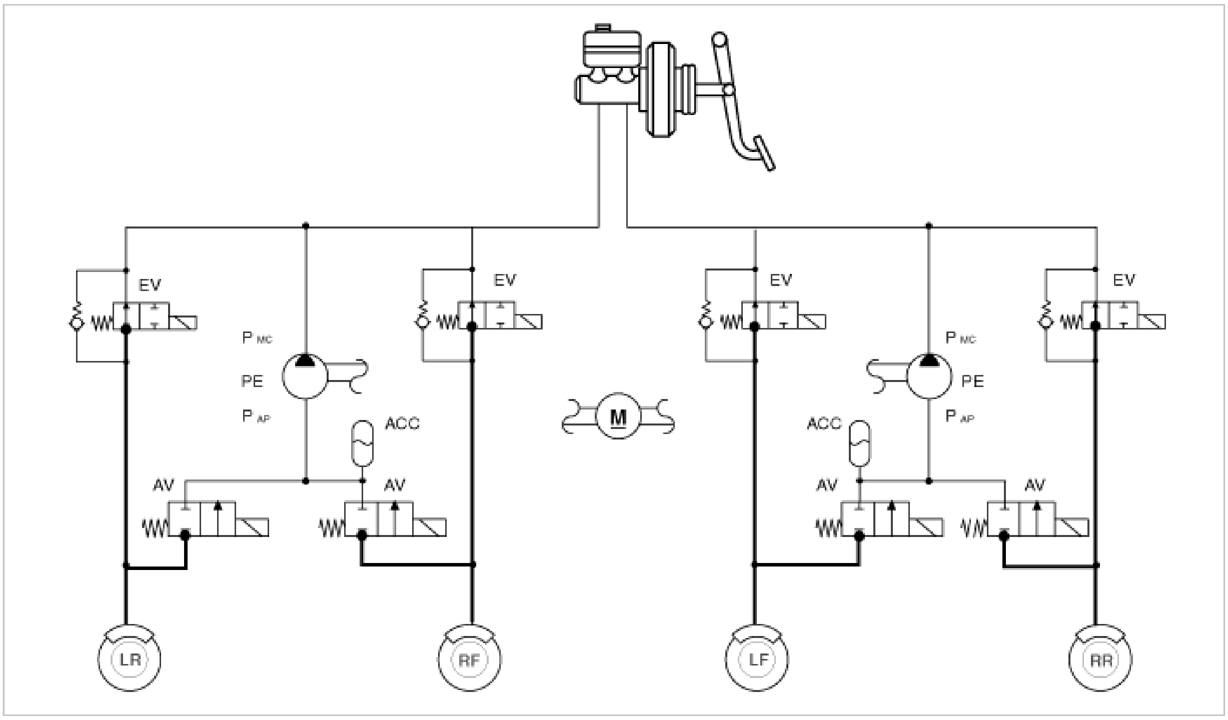
2. DECREASE MODE

	Inlet valve(EV)	Outlet valve(AV)	Pump motor
Operation	Close	Open	ON(Motor speed control)



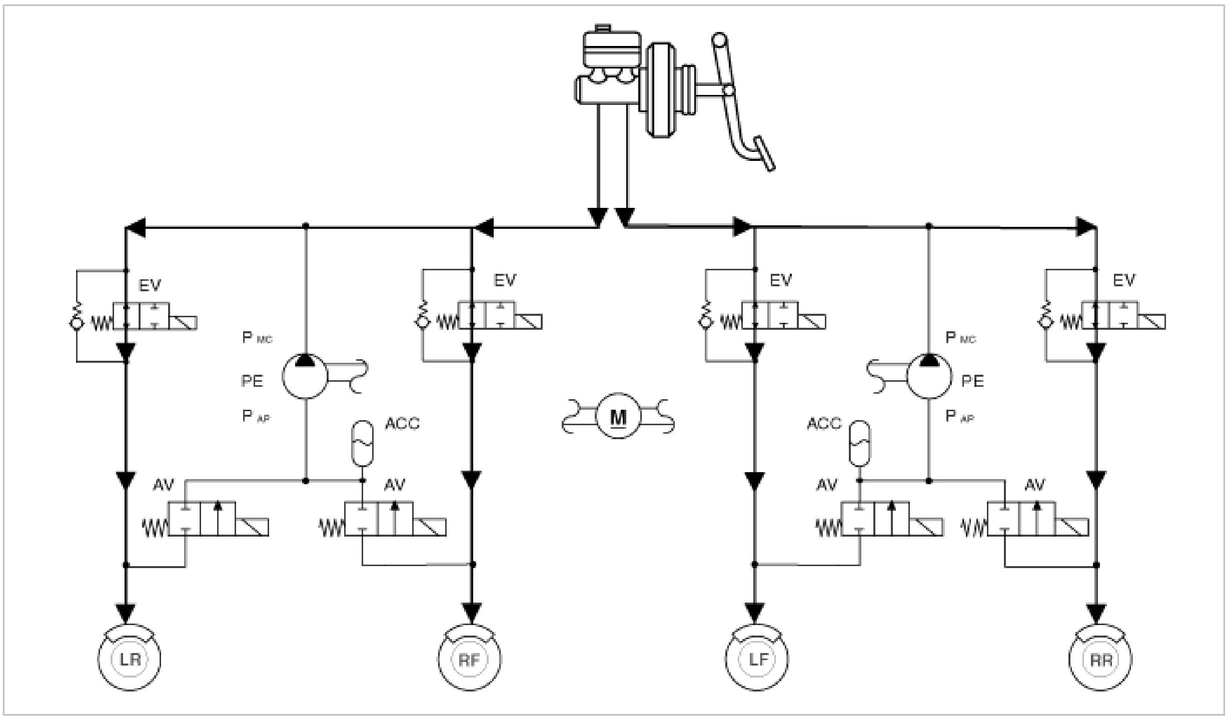
3. HOLD MODE

	Inlet valve(EV)	Outlet valve(AV)	Pump motor
Operation	Close	Close	OFF



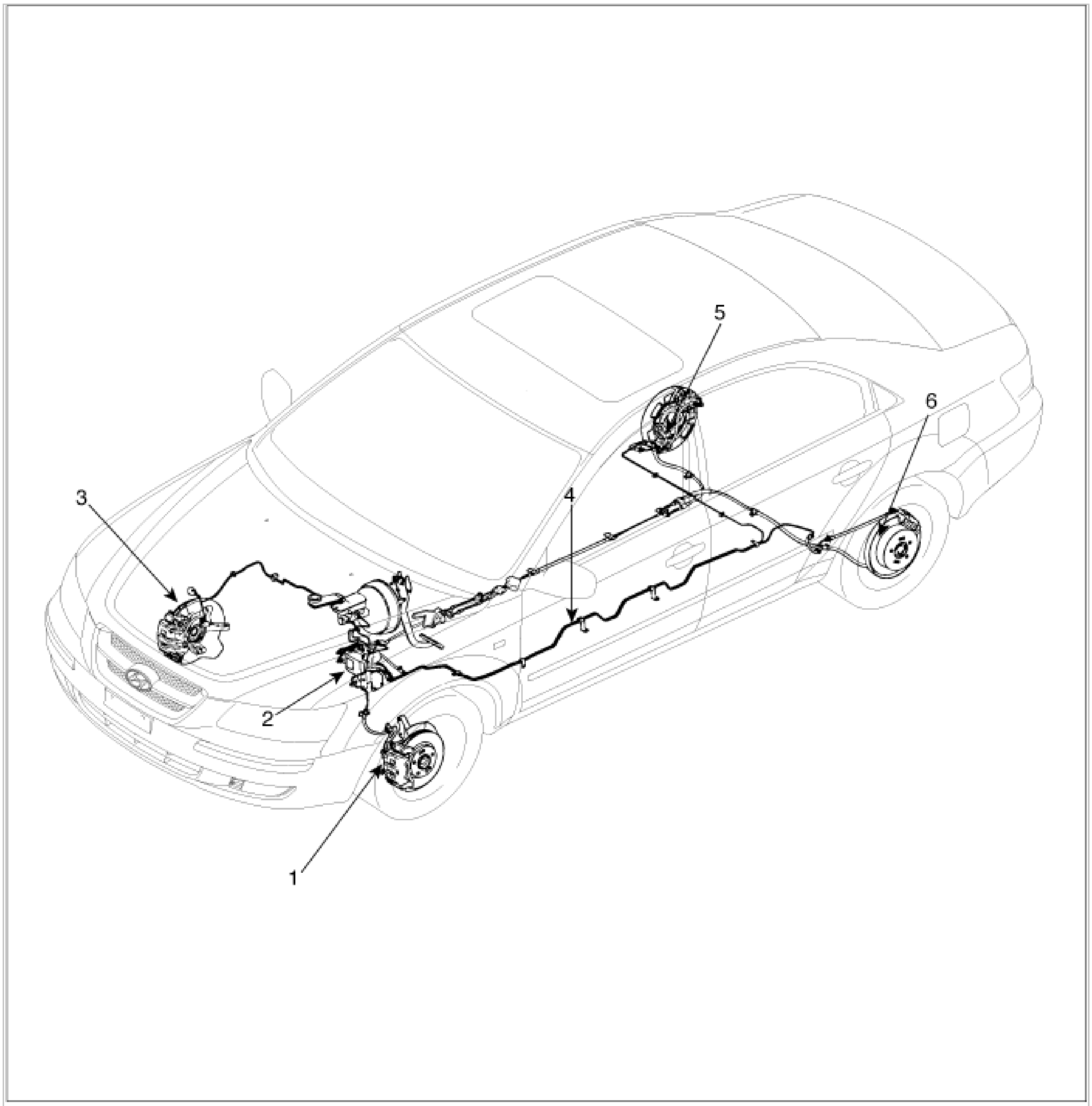
4. INCREASE MODE

	Inlet valve(EV)	Outlet valve(AV)	Pump motor
Operation	Open	Close	OFF



Brake System > ABS(Anti-Lock Brake System) > Components and Components Location

COMPONENTS

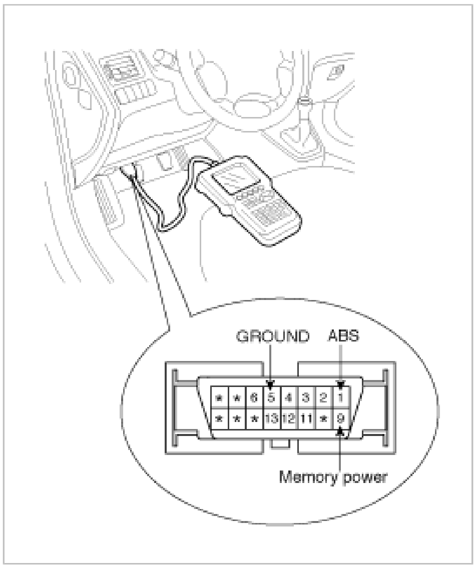


1. Front left wheel speed sensor
2. ABS control module(HECU)
3. Front right wheel speed sensor
4. Hydrauric line
5. Rear right wheel speed sensor
6. Rear left wheel speed sensor

Brake System > ABS(Anti-Lock Brake System) > Troubleshooting

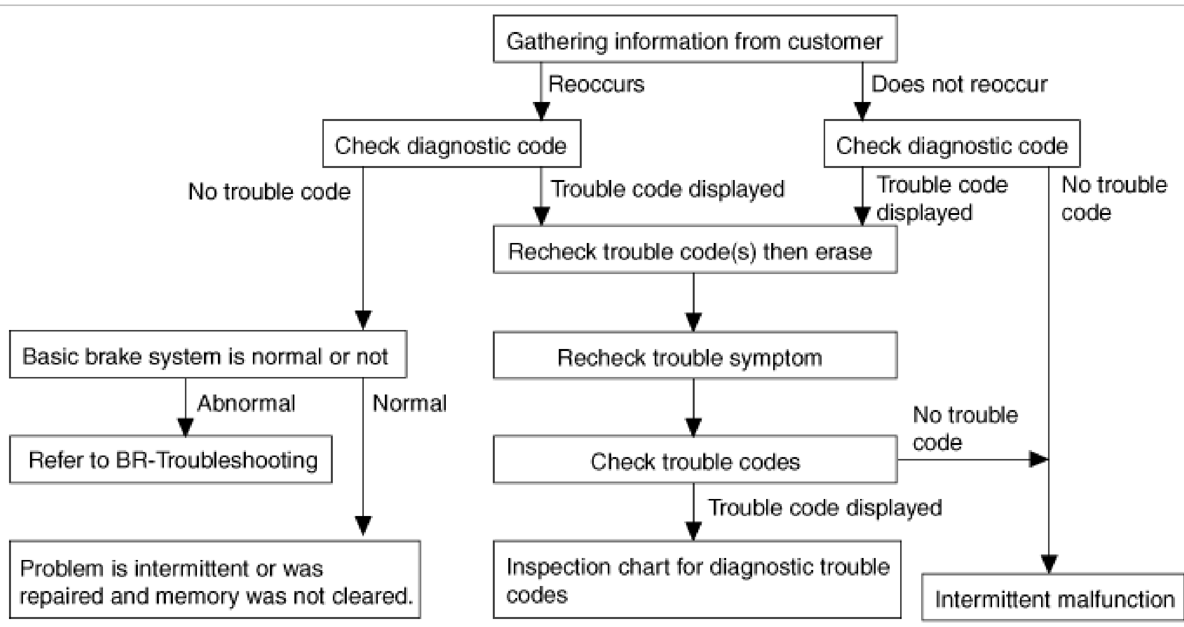
HI-SCAN (PRO) CHECK

1. Turn the ignition switch OFF.
2. Connector the Hi-scan(pro) to the 16P data link connector located the driver's side kick panel.



3. Turn the ignition switch ON.
4. Check for diagnostic trouble using the Hi-scan(pro)
5. After completion trouble of the repair or correction of the problem, erase the stored fault codes the clear key on the Hi-scan (pro).
6. Disconnect the Hi-scan(pro) from the 16P data link connector.

STANDARD FLOW OF DIAGNOSTIC TROUBLESHOOTING



*** Using the customer problem analysis check sheet for reference, ask the customer as much detail as possible about the problem.**

NOTES WITH REGARD TO DIAGNOSIS

The phenomena listed in the following table are not abnormal.

Phenomenon	Explanation
System check sound	When starting the engine, a thudding sound can sometimes be heard coming from inside the engine compartment. This is because the system operation check is being performed.
ABS operation sound	1. Sound of the motor inside the ABS hydraulic unit operation (whine). 2. Sound is generated along with vibration of the brake pedal (scraping). 3. When ABS operates, sound is generated from the vehicle chassis due to repeated brake application and release (Thump : suspension; squeak: tires)

ABS operation (Long braking distance)	For road surfaces such as snow-covered and gravel roads, the braking distance for vehicles with ABS can sometimes be longer than that for other vehicles. Accordingly, advise the customer to drive safely on such roads by lowering the vehicle speed.
Diagnosis detection conditions can vary depending on the diagnosis code. When checking the trouble symptom after the diagnosis code has been erased, ensure that the requirements listed in "Comment" are met.	

ABS CHECK SHEET

ABS Check Sheet

Inspector's Name

Customer's Name		Registration No.	
		Registration Year	/ /
		VIN.	
Date Vehicle Brought In	/ /	Odometer	Km Miles

Date the Problem First Occurred	/ /
Frequency of Occurence of Problem	☐ Continuous ☐ Intermittent (times a day)

Symptoms	☐ ABS does not operate.	
	☐ ABS does not operate efficiently.	☐ Intermittent (times a day)
	ABS Warning Light Abnormal	☐ Remains ON ☐ Does not light up

Diagnostic Trouble Code Check	1st Time	☐ Normal Code	☐ Malfunction Code (Code)
	2nd Time	☐ Normal Code	☐ Malfunction Code (Code)

PROBLEM SYMPTOMS TABLE

Symptom	Suspect Area	See page
ABS does not operate.	Only when 1. -4. are all normal and the problem is still occurring, replace the HECU. 1. Check the DTC reconfirming that the normal code is output. 2. Power source circuit. 3. Speed sensor circuit. 4. Check the hydraulic circuit for leakage.	BR - 75
ABS does not operate intermittently.	Only when 1. -4. are all normal and the problem is still occurring, replace the ABS actuator assembly. 1. Check the DTC reconfirming that the normal code is output. 2. Wheel speed sensor circuit. 3. Stop lamp switch circuit.	BR - 77

	4. Check the hydraulic circuit for leakage.	
Communication with Hi-scan (pro) is not possible. (Communication with any system is not possible)	1. Power source circuit 2. Diagnosis line	BR - 79
Communication with Hi-scan (pro) is not possible. (Communication with ABS only is not possible)	1. Power source circuit 2. Diagnosis line 3. HECU	BR - 80
When ignition key is turned ON (engine OFF), the ABS warning lamp does not light up.	1. ABS warning lamp circuit 2. HECU	BR - 81
Even after the engine is started, the ABS warning lamp remains ON.	1. ABS warning lamp circuit 2. HECU	BR - 82

CAUTION

During ABS operation, the brake pedal may vibrate or may not be able to be depressed. Such phenomena are due to intermittent changes in hydraulic pressure inside the brake line to prevent the wheels from locking and is not an abnormality.

ABS Does Not Operate

DETECTING CONDITION

Trouble Symptoms	Possible Cause
Brake operation varies depending on driving conditions and road surface conditions, so diagnosis can be difficult.However if a normal DTC is displayed, check the following probable cause. When the problem is still occurring, replace the ABS control module.	- Faulty power source circuit - Faulty wheel speed sensor circuit - Faulty hydraulic circuit for leakage - Faulty HECU

INSPECTION PROCEDURES

DTC INSPECTION

1. Connect the Hi-Scan (pro) with the data link connector and turn the ignition switch ON.
2. Verify that the normal code is output.
   Is the normal code output?

   NO

   ▸ Check the power source circuit.

   YES

   ▸ Erase the DTC and recheck using Hi-Scan (pro).

CHECK THE POWER SOURCE CIRCUIT.

1. Disconnect the connector from the ABS control module.
2. Turn the ignition switch ON, measure the voltage between terminal 18 of the ABS control module harness side connector and body ground.

   Specification: approximately B+

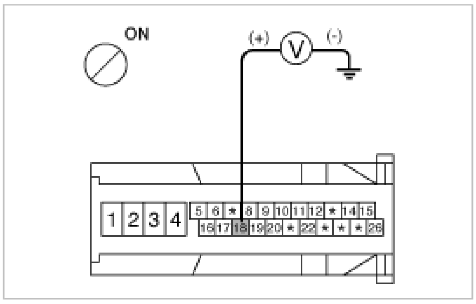
   Is the voltage within specification?

   YES

   ▸ Check the ground circuit.

   NO

   ▸ Check the harness or connector between the fuse (10A) in the engine compartment junction block and the ABS control module. Repair if necessary.



CHECK THE GROUND CIRCUIT.

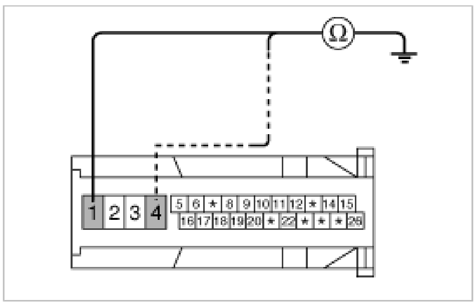
1. Disconnect the connector from the ABS control module.
2. Check for continuity between terminals 1,4 of the ABS control module harness side connector and ground point.
   Is there continuity?

YES

▸ Check the wheel speed sensor circuit.

NO

▸ Repair an open in the wire and ground point.



CHECK THE WHEEL SPEED SENSOR CIRCUIT.

Refer to the DTC troubleshooting procedures.
Is it normal?

YES

▸ Check the hydraulic circuit for leakage.

NO

▸ Repair or replace the wheel speed sensor.

CHECK THE HYDRAULIC CIRCUIT FOR LEAKAGE.

Refer to the hydraulic lines.
Inspect leakage of the hydraulic lines.
Is it normal?

YES

▸ The problem is still occurring, replace the ABS control module.

NO

▸ Repair the hydraulic lines for leakage.

ABS Does Not Operate Intermittently.

DETECTING CONDITION

Trouble Symptoms	Possible Cause
Brake operation varies depending on driving conditions and road surface conditions, so diagnosis can be difficult.However if a normal DTC is displayed, check the following probable cause. When the problem is still occurring, replace the ABS control module.	- Faulty power source circuit - Faulty wheel speed sensor circuit - Faulty hydraulic circuit for leakage - Faulty HECU

INSPECTION PROCEDURES

DTC INSPECTION

1. Connect the Hi-Scan (pro) with the data link connector and turn the ignition switch ON.
2. Verify that the normal code is output.

Is the normal code output?

NO

▸ Check the wheel speed sensor circuit.

YES

▸ Erase the DTC and recheck using Hi-Scan (pro).

CHECK THE WHEEL SPEED SENSOR CIRCUIT.

Refer to the DTC troubleshooting procedures.
Is it normal?

YES

▸ Check the stop lamp switch circuit.

NO

▸ Repair or replace the wheel speed sensor.

CHECK THE STOP LAMP SWITCH CIRCUIT.

1. Check that stop lamp lights up when brake pedal is depressed and turns off when brake pedal is released.
2. Measure the voltage between terminal 20 of the ABS control module harness side connector and body ground when brake pedal is depressed.

Specification: approximately B+

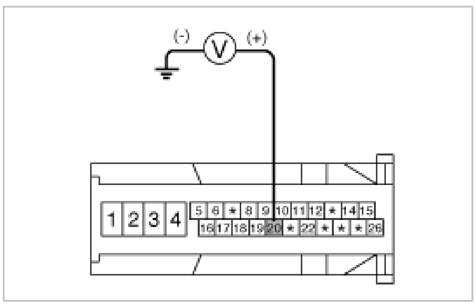
Is the voltage within specification?

YES

▸ Check the hydraulic circuit for leakage.

NO

▸ Repair the stop lamp switch. Repair an open in the wire between the ABS control module and the stop lamp switch.



CHECK THE HYDRAULIC CIRCUIT FOR LEAKAGE.

Refer to the hydraulic lines.
Inspect leakage of the hydraulic lines.
Is it normal?

YES

▸ The problem is still occurring, replace the ABS control module.

NO

▸ Repair the hydraulic lines for leakage.

Communication With Hi-Scan (pro) Is Not Possible. (Communication With Any System Is Not Possible)

DETECTING CONDITION

Trouble Symptoms	Possible Cause
Possible defect in the power supply system (including ground) for the diagnosis line.	- An open in the wire - Poor ground - Faulty power source circuit

INSPECTION PROCEDURES

CHECK THE POWER SUPPLY CIRCUIT FOR THE DIAGNOSIS

Measure the voltage between terminal 9 of the data link connector and body ground.

Specification: approximately B+

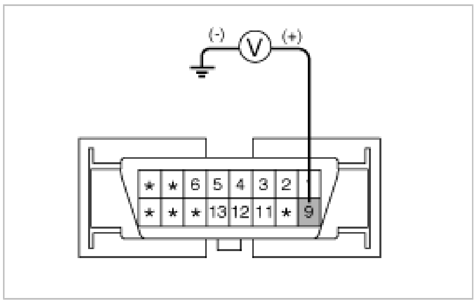
Is voltage within specification?

YES

▸ Check the ground circuit for the diagnosis.

NO

▸ Repair an open in the wire. Check and replace fuse (15A) from the engine compartment junction block.

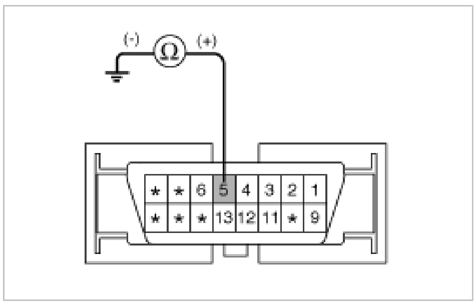


CHECK THE GROUND CIRCUIT FOR THE DIAGNOSIS

Check for continuity between terminal 5 of the data link connector and body ground.
Is there continuity?

NO

▸ Repair an open in the wire between terminal 5 of the data link connector and ground point.



Communication With Hi-Scan (pro) Is Not Possible. (Communication With ABS Only Is Not Possible)

DETECTING CONDITION

Trouble Symptoms	Possible Cause
When communication with Hi-Scan (pro) is not possible, the cause may be probably an open in the HECU power circuit or an open in the diagnosis output circuit.	- An open in the wire - Faulty HECU - Faulty power source circuit

INSPECTION PROCEDURES

CHECK FOR CONTINUITY IN THE DIAGNOSIS LINE

1. Disconnect the connector from the ABS control module.
2. Check for continuity between terminals 11 of the ABS control module connector and 1 of the data link connector.
   Is there continuity?

   YES

   ▸ Check the power source of ABS control module.

   NO

   ▸ Repair an open in the wire.

CHECK THE POWER SOURCE OF ABS CONTROL MODULE

1. Disconnect the connector from the ABS control module.
2. Turn the ignition switch ON, measure the voltage between terminal 18 of the ABS control module harness side connector and body ground.

   Specification: approximately B+

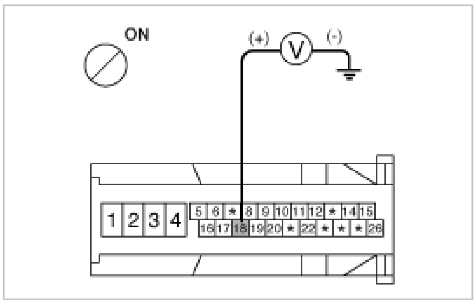
   Is voltage within specification?

YES

▸ Check for poor ground.

NO

▸ Check the harness or connector between the fuse (10A) in the engine compartment junction block and the ABS control module.Repair if necessary.



CHECK FOR POOR GROUND

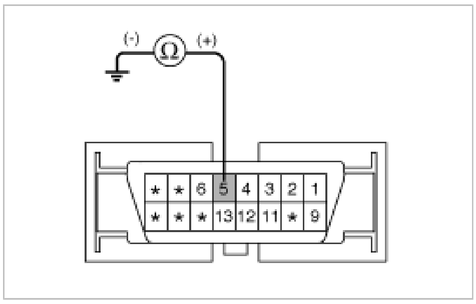
Check for continuity between terminal 5 of the data link connector and ground point.

YES

▸ Replace the ABS control module and recheck.

NO

▸ Repair an open in the wire or poor ground.



When Ignition Key Is Turned ON (Engine OFF), The ABS Warning Lamp Does Not Light Up.

DETECTING CONDITION

Trouble Symptoms	Possible Cause
When current flows in the HECU the ABS warning lamp turns from ON to OFF as the initial check.Therefore if the lamp does not light up, the cause may be an open in the lamp power supply circuit, a blown bulb, an open in the both circuits between the ABS warning lamp and the HECU, and the faulty HECU.	- Faulty ABS warning lamp bulb - Blown No.2 fuse (10A) in the engine compartment junction block - Faulty ABS warning lamp module - Faulty HECU

INSPECTION PROCEDURES

PROBLEM VERIFICATION

Disconnect the connector from the ABS control module and turn the ignition switch ON.
Does the ABS warning lamp light up?

YES

▸ It is normal. Recheck the ABS control module.

NO

▸ Check the power source for the ABS warning lamp.

CHECK THE POWER SOURCE FOR THE ABS WARNING LAMP

1. Disconnect the instrument cluster connector and turn the ignition switch ON.
2. Measure the voltage between terminal 5 of the cluster harness side connector and body ground.

Specification: approximately B+

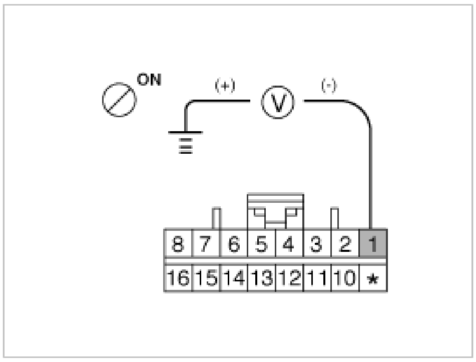
Is voltage within specification?

YES

▸ Repair bulb or instrument cluster assembly.

NO

▸ Check for blown fuse.



CHECK FOR BLOWN FUSE

Check continuity of fuse (10A) from the engine compartment junction block.
Is there continuity?

YES

▸ Repair an open in the wire between ABS fuse and 1 of cluster connector.

NO

▸ Replace the blown fuse.

Even After The Engine Is Started, The ABS Warning Lamp Remains ON.

DETECTING CONDITION

Trouble Symptoms	Possible Cause
If the HECU detects trouble, it lights the ABS warning lamp while at the same time prohibiting ABS control. At this time, the HECU records a DTC in memory.Even though the normal code is output, the ABS warning lamp remains ON, then the cause may be probably an open or short in the ABS warning lamp circuit.	- An open in the wire - Faulty instrument cluster assembly - Faulty ABS warning lamp module - Faulty HECU

INSPECTION PROCEDURES

CHECK DTC OUTPUT.

1. Connect the Hi-Scan (pro) to the 16P data link connector located behind the driver's side kick panel.
2. Check the DTC output using Hi-Scan (pro).
   Is DTC output?

   YES

   ▸ Repair circuit indicated by code output.

   NO

   ▸ Check instrument cluster.

CHECK INSTRUMENT CLUSTER

Disconnect the cluster connector and turn the ignition switch ON.
Does the ABS warning lamp remains ON?

YES

▸ Replace the instrument cluster.

NO

▸ Check for open the wire.

CHECK FOR OPEN IN THE WIRE

Check for continuity in the wire between cluster and ABS control module.
Is there continuity?

YES

▸ Replace the ABS control module and recheck.

NO

▸ Repair an open in the wire between cluster and ABS control module.

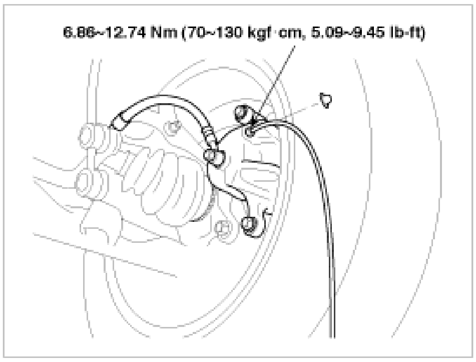
BLEEDING OF BRAKE SYSTEM

1. Remove the reservoir cap and fill the brake reservoir with brake fluid.

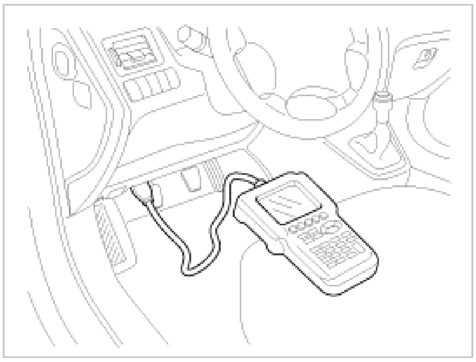
> **CAUTION**
>
> If there is any brake fluid on any painted surface, wash it off immediately.

> **NOTE**
>
> When pressure bleeding, do not depress the brake pedal.
> Recommended fluid........ DOT3 or DOT4

2. Connect a clear plastic tube to the wheel cylinder bleeder plug and insert the other end of the tube into a half filled clear plastic bottle.



3. Connect the hi-scan (pro) to the data link connector located underneath the dash panel.



4. Select and operate according to the instructions on the hi-scan (Pro) screen.

> **CAUTION**
>
> You must obey the maximum operating time of the ABS motor with the hi-scan (Pro) to prevent the motor pump from burning.

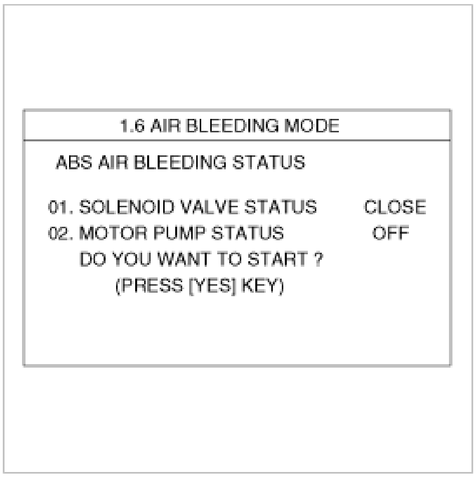
(1) Select hyundai vehicle diagnosis.

(2) Select vehicle name.

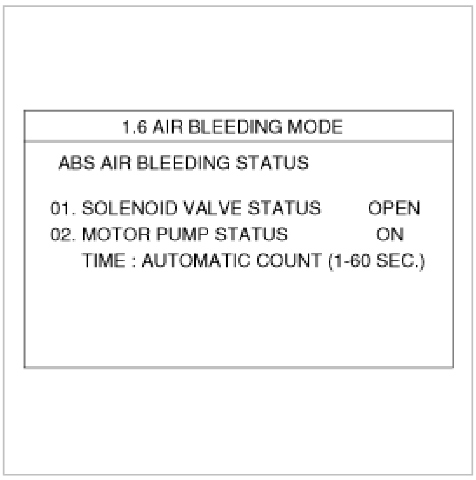
(3) Select Anti-Lock Brake system.

(4) Select air bleeding mode.

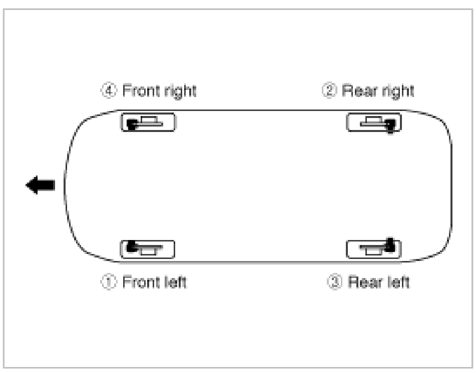
(5) Press "YES" to operate motor pump and solenoid valve.



(6) Wait 60 sec. before operating the air bleeding. (If not, you may damage the motor.)



5. Pump the brake pedal several times, and then loosen the bleeder screw until fluid starts to run out without bubbles. Then close the bleeder screw.
6. Repeat step 5 until there are no more bubbles in the fluid for each wheel.



7. Tighten the bleeder screw.

Bleed screw tightening torque:
6.86~12.74 Nm (70 ~130 kgf·cm, 5.09 ~ 9.45 lb-ft)

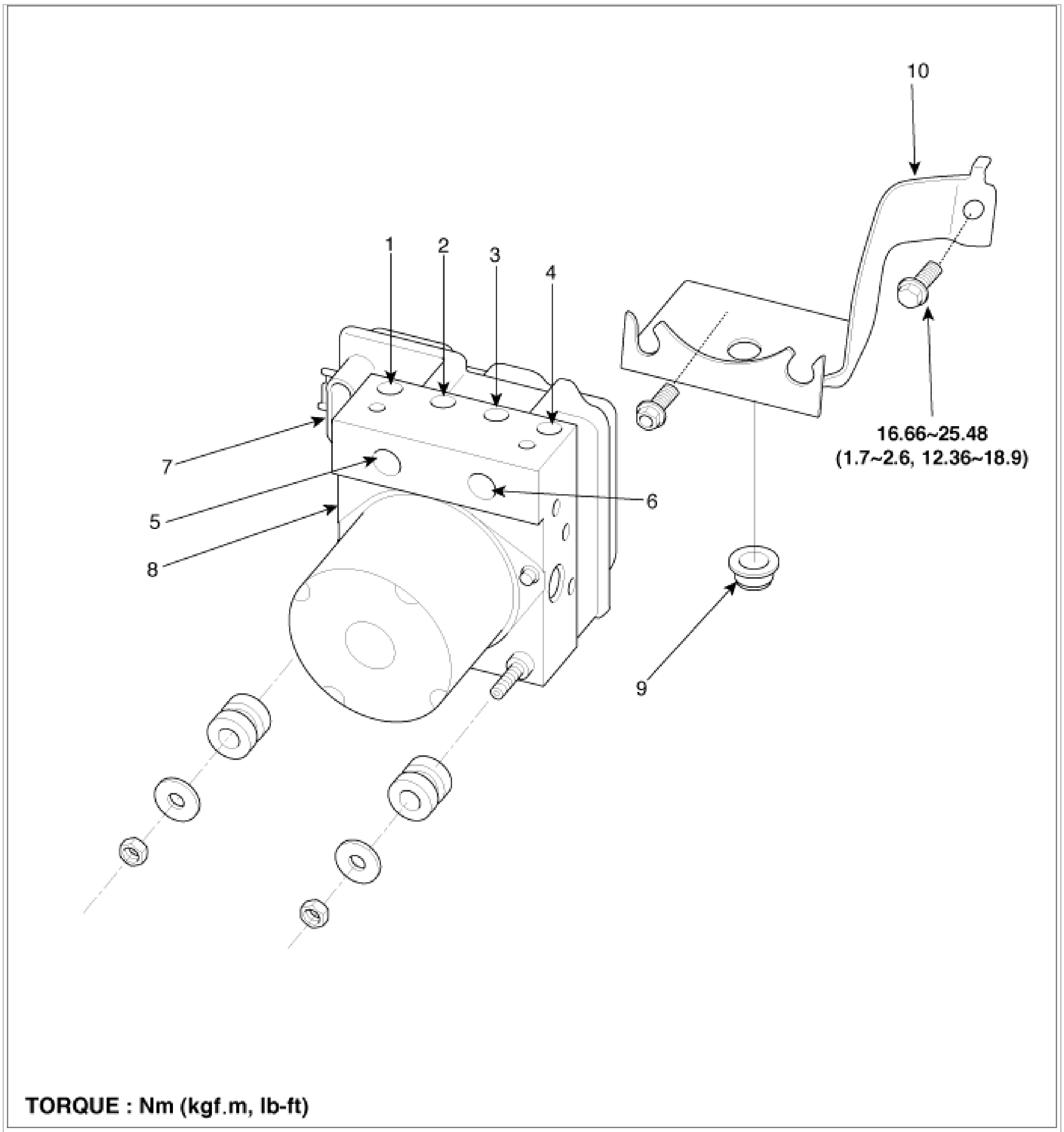
DIAGNOSTIC TROUBLE CODE CHART(DTC)

DTC	DESCRIPTION	WARNING LAMP			REMARK	SEE PAGE
		ABS	EBD	ESC		
C1101	BATTERY VOLTAGE HIGH	O	O	O		
C1102	BATTERY VOLTAGE LOW	O		O		
C1200	FL WHEEL SPEED SENSOR- OPEN/SHORT	O		O		

C1201	FL WHEEL SENSOR- RANGE/ PERFORMANCE	O		O		
C1202	FL WHEEL WHEEL SPEED SENSOR-NO SIGNAL	O		O		
C1203	FR WHEEL SENSOR- OPEN/SHORT	O		O		
C1204	FR WHEEL SENSOR- RANGE/ PERFORMANCE	O		O		
C1205	FR WHEEL SPEED SENSOR-NO SIGNAL	O		O		
C1206	RL WHEEL SENSOR- OPEN/SHORT	O		O		
C1207	RL WHEEL SENSOR- RANGE/ PERFORMANCE	O		O		
C1208	RL WHEEL SPEED SENSOR-NO SIGNAL	O		O		
C1209	RR WHEEL SENSOR- OPEN/SHORT	O		O		
C1210	RR WHEEL SENSOR- RANGE/ PERFORMANCE	O		O		
C1211	RR WHEEL SPEED SENSOR-NO SIGNAL	O		O		
C1213	WHEEL SPEED FREQUENCY ERROR	O		O		
C1235	PRESSURE SENSOR-ELECTRICAL			O	ESC	
C1237	PRESSURE SENSOR-SIGNAL FAULT			O	ESC	
C1260	STEERING ANGLE SENSOR-SIGNAL			O	ESC	
C1261	STEERING ANGLE SENSOR IS NOT CALIBRATED			O	ESC	
C1282	YAW RATE & LATERAL G SENSOR-ELECTRICAL			O	ESC	
C1283	YAW RATE & LATERAL G SENSOR-SIGNAL			O	ESC	
C1503	ESC SWIRCH ERROR			O	ESC	
C1513	BRAKE LIGHT SWITCH MAL.			O		
C1604	ECU HARDWARE ERROR	O	O	O		
C1605	CAN CONTROL HARDWARE ERROR			O	ESC	
C1611	CAN TIME OUT-ECM			O	ESC	
C1612	CAN TIME OUT-TCU			O	ESC	
C1616	CAN BUS OFF			O	ESC	
C1623	CAN TIMEOUT STEERING ANGLE SENSOR			O	ESC	
C1625	CAN TIME OUT-ESC			O	ESC	
C1626	IMPLAUSIBLE CONTROL	O		O	ESC	
C1702	VARIANT CODING	O	O	O	ESC	
C2112	VALVE RELAY MAL.	O	O	O		
C2308	FL INLET VALVE MAL.	O	O	O		
C2312	FL OUTLET VALVE MAL.	O	O	O		
C2316	FR INLET VALVE MAL.	O	O	O		
C2320	FR OUTLET VALVE MAL.	O	O	O		
C2324	RL INLET VALVE MAL.	O	O	O		
C2328	RL OUTLET VALVE MAL.	O	O	O		
C2332	RR INLET VALVE MAL.	O	O	O		
C2336	RR OUTLET VALVE MAL.	O	O	O		
C2366	TC VALVE PRIMARY(USV1) ERROR	O	O	O	ESC	
C2370	TC VALVE SECONDARY (USV2) ERROR	O	O	O	ESC	
C2372	ESC VALVE 1(HSV1) ERROR	O	O	O	ESC	
C2374	ESC VALVE 2 (HSV2) ERROR	O	O	O	ESC	
C2402	MOTOR-ELECTRICAL	O	O	O		

Brake System > ABS(Anti-Lock Brake System) > ABS Control Module > Components and Components Location

COMPONENTS

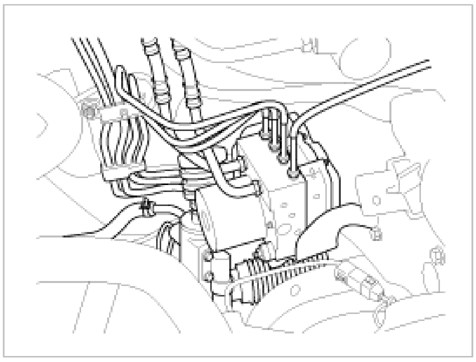


1. Front-right tube	6. MC1
2. Rear-left tube	7. ABS control module connector(26P)
3. Rear-right tube	8. ABS control module(HECU)
4. Front-left tube	9. Damper
5. MC2	10. Bracket

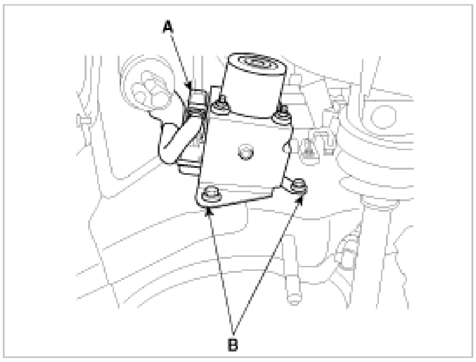
Brake System > ABS(Anti-Lock Brake System) > ABS Control Module > Repair procedures

REMOVAL

1. Disconnect the brake tube from the HECU by unlocking the nuts counterclockwise with a spanner.



2. Lift up the vehicle.
3. Disconnect the connector(A) from the HECU.



4. Remove the two HECU brake mounting bolts(B) , and then disassemble the HECU with the bracket.

> CAUTION
>
> 1. Never attempt to disassemble the HECU.
> 2. The HECU must be transported and stored in
> 3. Never shock to the HECU.

5. Remove the two HECU mounting nuts and washer, and then remove the bracket.

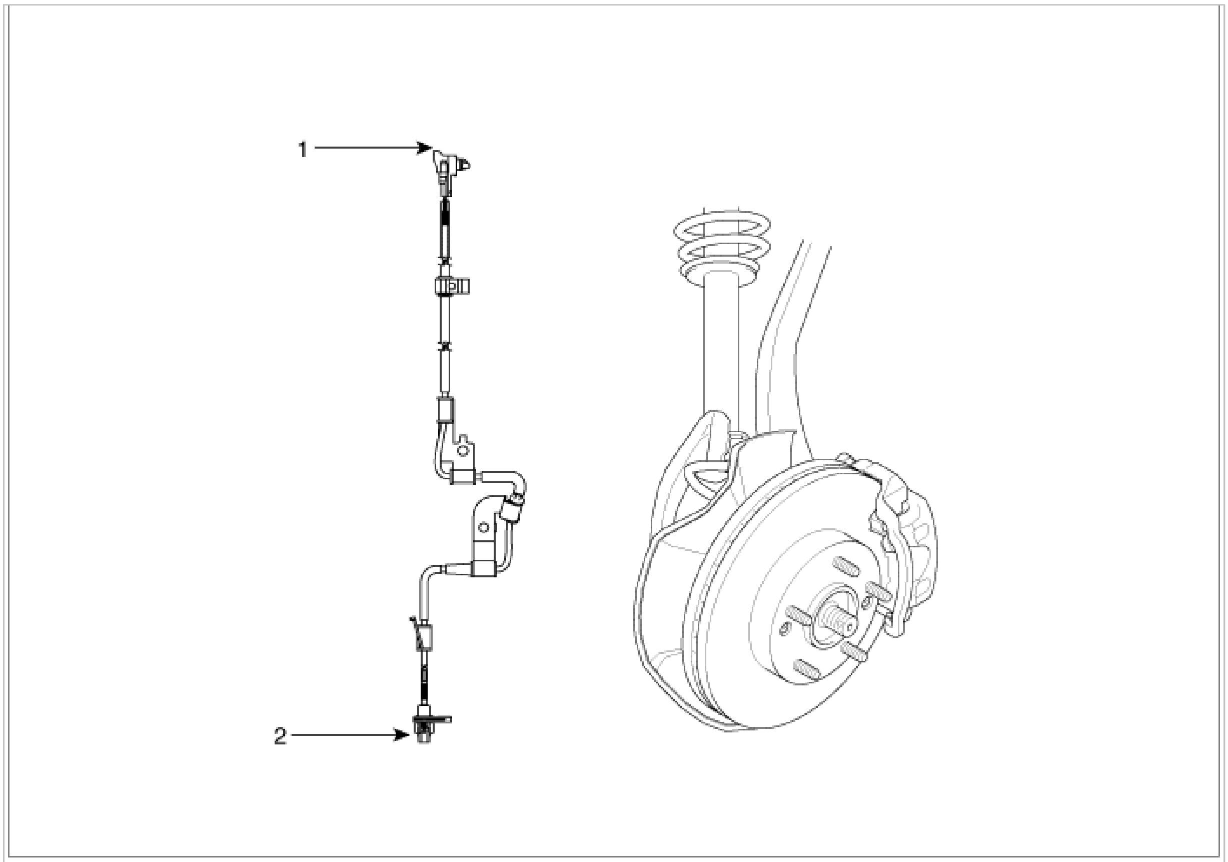
INSTALLATION

1. Installation is the reverse of removal.
2. Tighten the HECU mounting bolts and brake tube nuts to the specified torque.

Tighterning torque
HECU mounting nut :
5.88~9.8 Nm (0.6~1 kgf·m, 4.36~7.27 lb-ft)
HECU bracket mounting bolt:
16.66~25.48 Nm (1.7~2.6 kgf·m, 12.36~18.9 lb-ft)

Brake System > ABS(Anti-Lock Brake System) > Front Wheel Speed Sensor > Components and Components Location

COMPONENTS

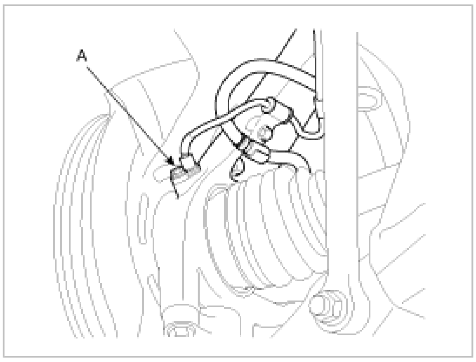


1. Front wheel speed sensor connector
2. Front wheel speed sensor

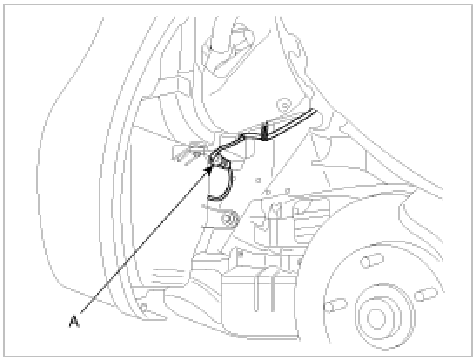
Brake System > ABS(Anti-Lock Brake System) > Front Wheel Speed Sensor > Repair procedures

REMOVAL

1. Remove the front wheel speed sensor mounting bolt(A).



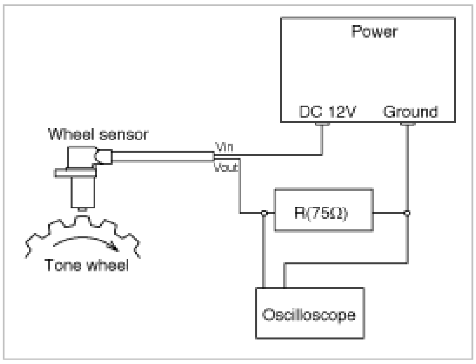
2. Remove the front wheel guard.
3. Remove the front wheel speed sensor after disconnecting the wheel speed sensor connector(A).



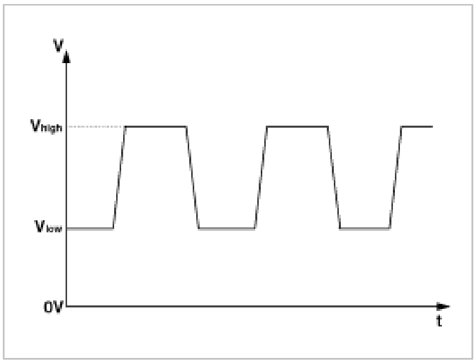
INSPECTION

1. Measure the output voltage between the terminal of the wheel speed sensor and the body ground.

> **CAUTION**
>
> In order to protect the wheel speed sensor, when measuring output voltage, a 75Ω resistor must be used as shown.



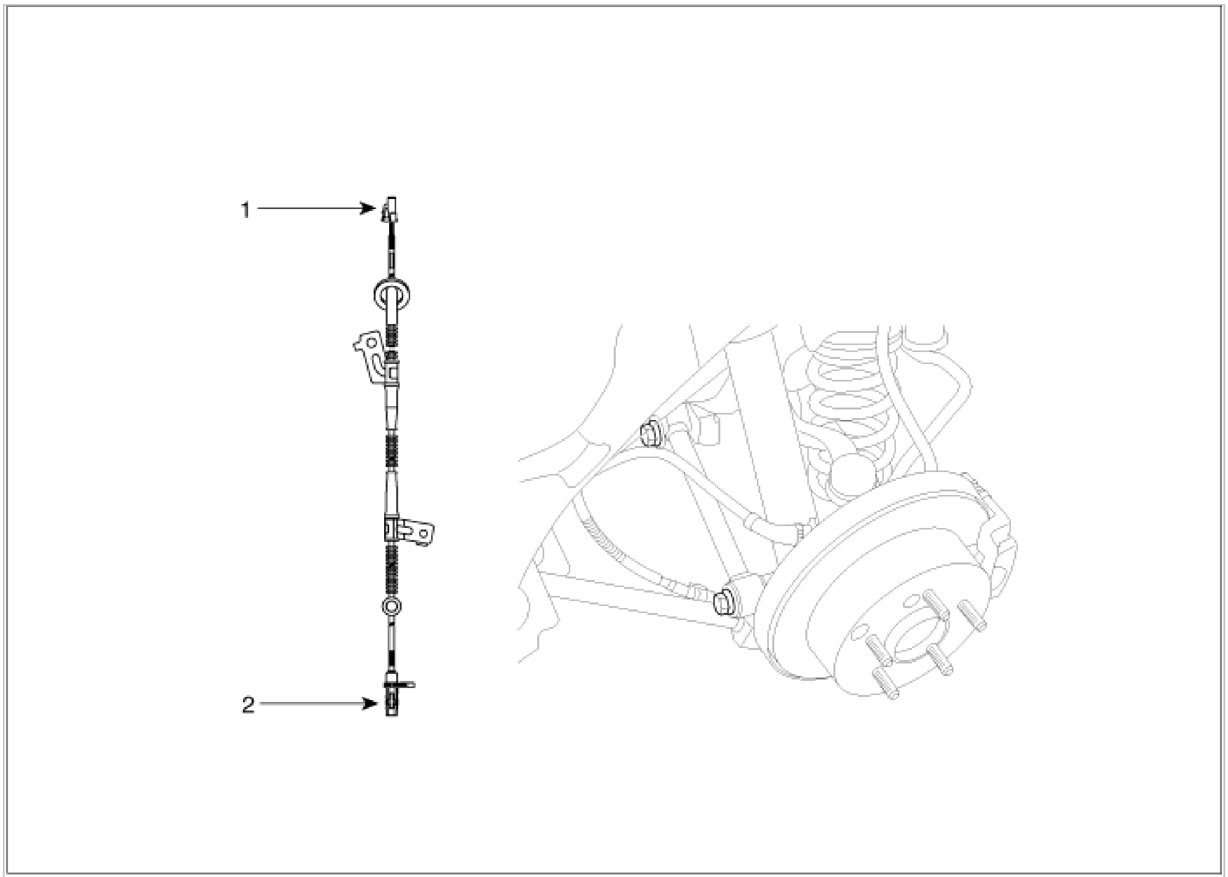
2. Compare the change of the output voltage of the wheel speed sensor to the normal change of the output voltage as shown below.



A. V_low : 0.44 V ~ 0.63 V
B. V_high : 0.885 V ~ 1.26 V
C. Frequency range : 1~2,500 Hz

Brake System > ABS(Anti-Lock Brake System) > Rear Wheel Speed Sensor > Components and Components Location

COMPONENTS

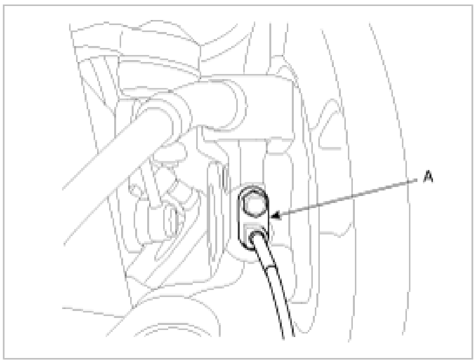


1. Rear wheel speed sensor connector
2. Rear wheel speed sensor

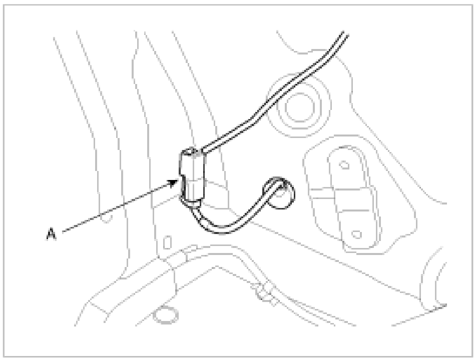
Brake System > ABS(Anti-Lock Brake System) > Rear Wheel Speed Sensor > Repair procedures

REMOVAL

1. Remove the rear wheel speed sensor mounting bolt(A).



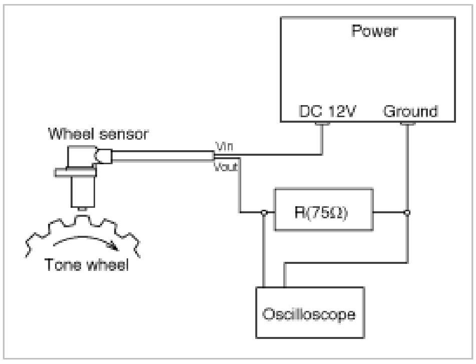
2. Remove the rear seat side pad then disconnect the rear wheel speed sensor connector(A).



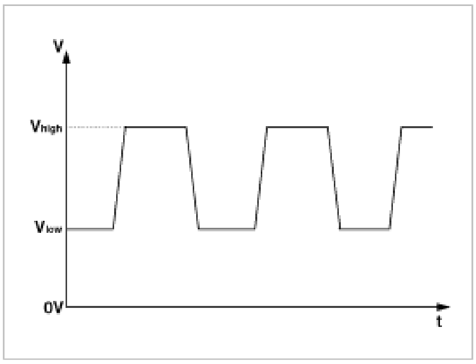
INSPECTION

1. Measure the output voltage between the terminal of the wheel speed sensor and the body ground.

> CAUTION
>
> In order to protect the wheel speed sensor, when measuring output voltage, a 75Ω resistor must be used as shown.



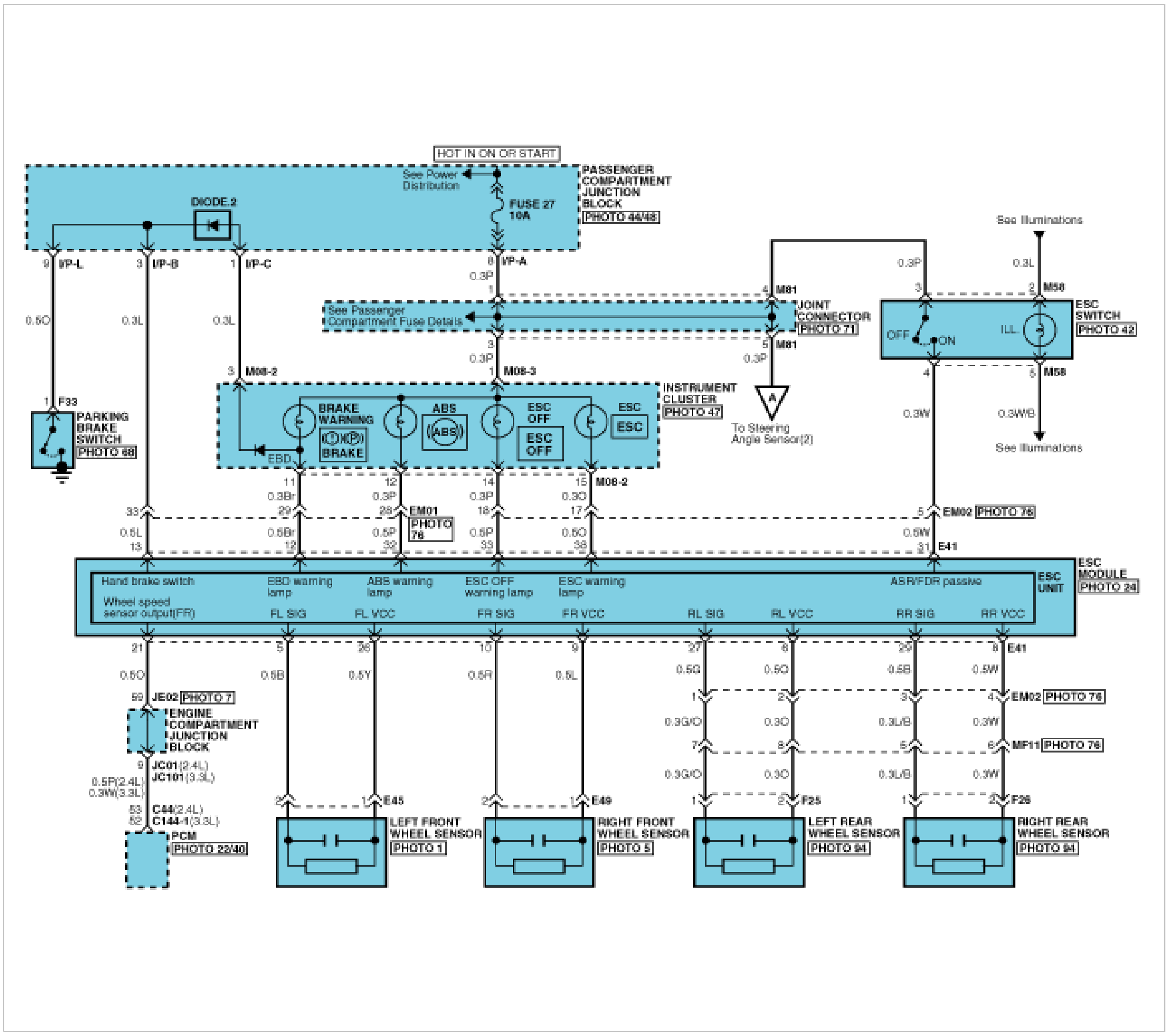
2. Compare the change of the output voltage of the wheel speed sensor to the normal change of the output voltage as shown below.



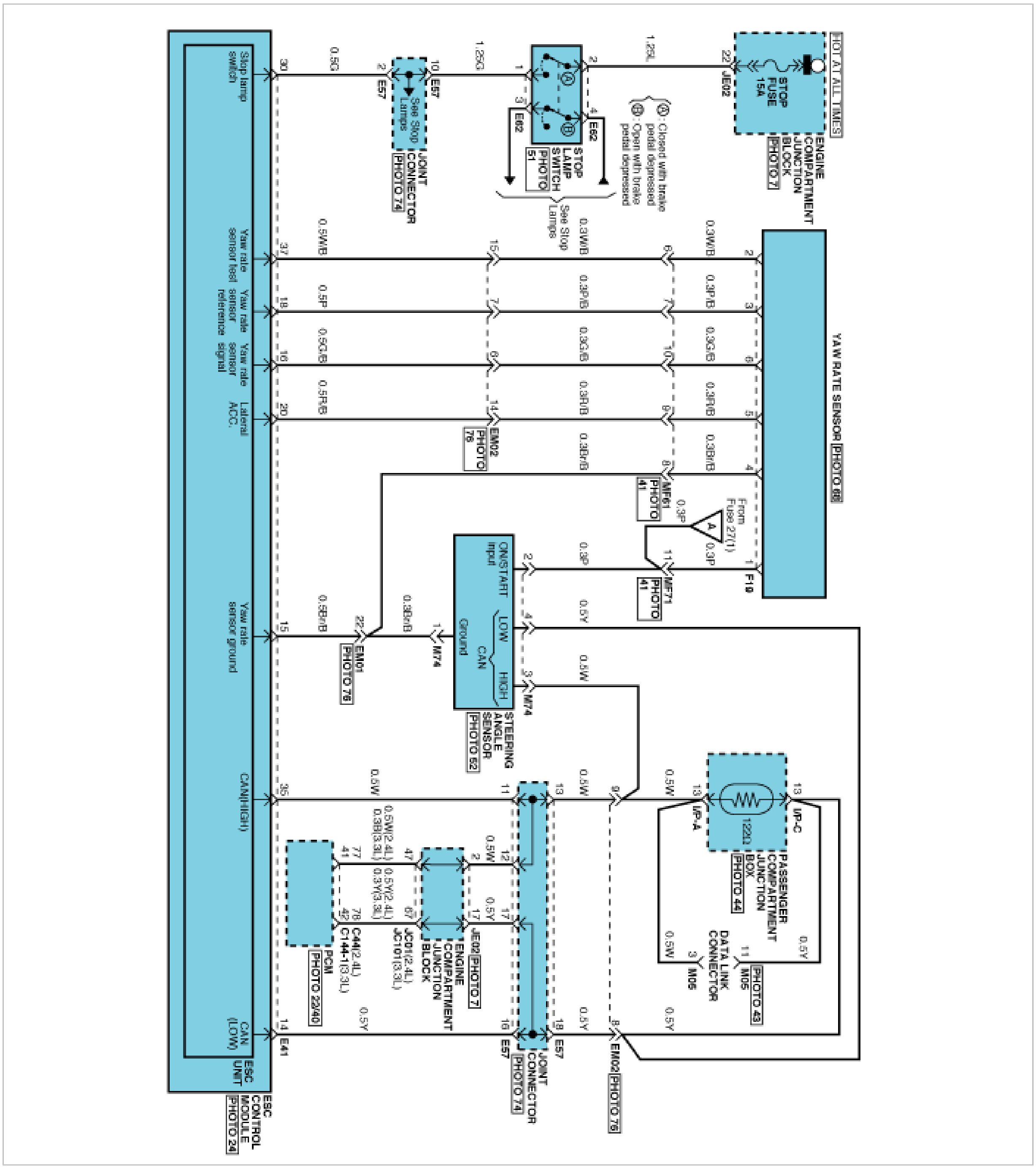
A. V_low : 0.44 V ~ 0.63 V
B. V_high : 0.885 V ~ 1.26 V
C. Frequency range : 1~2,500 Hz

Brake System > ESP(Electronic Stability Program) System > Schematic Diagrams

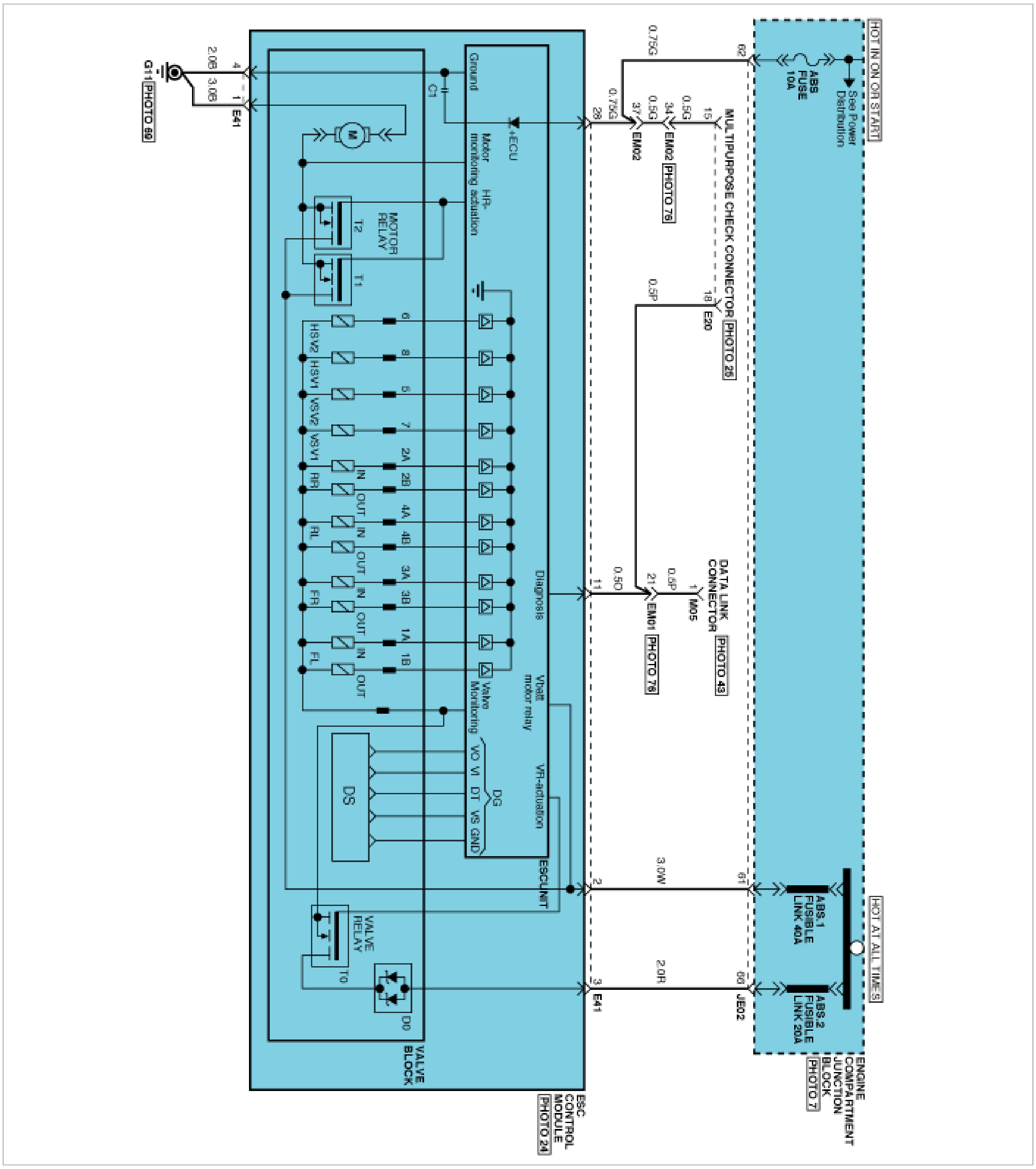
ESP circuit DIAGRAM(1)



ESP circuit DIAGRAM(2)

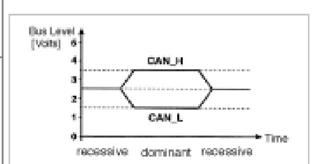


ESP circuit DIAGRAM(3)



ESP HECU CONNECTOR INPUT / OUTPUT

Connector Terminal		Signal name	Specifications	Conditions
No	Description			
1	Ground(Pump)	GND	Current range : Min-10 A Max-20 ~ 39 A	Always
4	Ground(Valve,ECU)	GND	Current range : Min-2.5 A Max-5 ~ 15 A	Always
2	Supply voltage(Pump)	Vb MOTOR	Battery voltage	Always
3	Supply voltage(Valve)	Vb VALVE		
26	Wheel sensor voltage (FL)	WP FL	Battery voltage	IG ON
9	Wheel sensor voltage (FR)	WP FR		

6	Wheel sensor voltage (RL)	WP RL		
8	Wheel sensor voltage (RR)	WP RR		
5	Wheel sensor signal(FL)	WS FL	Voltage(High) : 0.89~1.26 V Voltage(Low) : 0.44~0.63 V	RUNNING
10	Wheel sensor signal (FR)	WS FR		
27	Wheel sensor signal(RL)	WS RL		
29	Wheel sensor signal (RR)	WS RR		
11	Diagnosis Input/oupput	DIAG'K'	Voltage(High) : 0.8 * IG ON more Voltage(Low) : 0.2 * IG ON lower	HI-SCAN Communication
28	Ignition	IG.KEY	Battery voltage	KEY ON/OFF
31	ESC Passive switch	ESC Passive switch	Voltage(High) : 0.6 * IG ON more Voltage(Low) : 0.4 * IG ON lower	Switch ON/OFF
13	Hand brake switch	Hand brake switch	Voltage(High) : 0.7 * IG ON more Voltage(Low) : 0.3 * IG ON lower	Switch ON/OFF
37	Yaw Rate Sensor Test	Yaw Rate Sensor Test	Voltage(High) : 4.1 V more Voltage(Low) : 1 V lower	IG ON
18	Yaw Rate Sensor Reference	Yaw Rate Sensor Reference	2.464 V ~ 2.536 V	IG ON
16	Yaw Rate Sensor Signal	Yaw Rate Sensor Signal	Offset voltage :2.5 V range : 0.35 V ~ 4.65 V (-100 ~ 100 °/s)	IG ON
20	Acceleration Sensor Signal	Acceleration Sensor Signal	Offset voltage :2.5 V range : 0.35 V ~ 4.65 V (-1.8 g ~ 1.8 g)	IG ON
15	Yaw Rate Sensor Ground	Yaw Rate Sensor Ground	GND LEVEL	Always
35	CAN High	CAN High	not communication:2.5 ± 0.5 V communication : 	IG ON
14	CAN Low	CAN Low		
30	BRAKE LIGHT SWITCH	BRAKE LIGHT SWITCH	voltage(High) : 4.5V more voltage(Low) : 2V lower	BRAKE ON/OFF

NF ABS/ESC SENSOR OUTPUT LIST

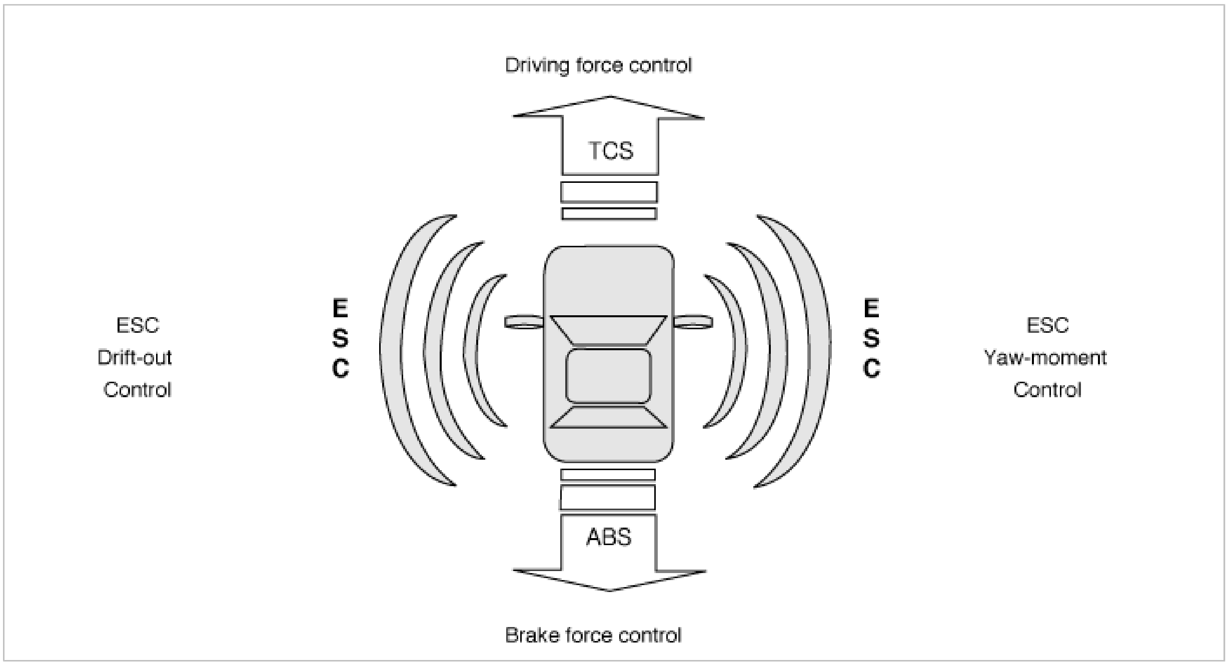
	DISPLAY(Hi-DS Scanner)	Abbreviation	Unit	Remarks
1	ENGINE SPEED	ENG. SPD	RPM	ESC ONLY
2	VEHICLE SPEED	VEH. SPD	Km/h	
3	THROTTLE P. SNESOR	TP. SNSR	%	ESC ONLY
4	SHIFT LEVER POSITION	SHIFT POSI.	-	ESC ONLY
5	BATTERY VOLTAGE	BATT. VOL	V	
6	WHEEL SPEED SNSR-FL	FL WHEEL	Km/h	
7	WHEEL SPEED SNSR-FR	FR WHEEL	Km/h	
8	WHEEL SPEED SNSR-RL	RL WHEEL	Km/h	
9	WHEEL SPEED SNSR-RR	RR WHEEL	Km/h	
10	ABS WARNING LAMP	ABS LAMP	-	
11	EBD WARNING LAMP	EBD LAMP	-	

12	ESC FUNCTION LAMP	ESC LAMP	-	ESC ONLY
13	ESC OFF LAMP	ESC OFF	-	ESC ONLY
14	ESC OFF SWITCH	ESC SW	-	ESC ONLY
15	BRAKE LAMP SWITCH	B/LAMP	-	
16	PUMP RELAY STATE	PUMP RLY	-	
17	VALVE RELAY STATE	VALVE RLY	-	
18	MOTOR	MOTOR	-	
19	FL VALVE (IN)	FL INLET	-	
20	FR VALVE (IN)	FR INLET	-	
21	RL VALVE (IN)	RL INLET	-	
22	RR VALVE (IN)	RR INLET	-	
23	FL VALVE (OUT)	FL OUTLET	-	
24	FR VALVE (OUT)	FR OUTLET	-	
25	RL VALVE (OUT)	RL OUTLET	-	
26	RR VALVE (OUT)	RR OUTLET	-	
27	TCS VALVE(USV)1	USV1	-	ESC ONLY
28	TCS VALVE(USV)1	USV2	-	ESC ONLY
29	ESC VALVE(HSV1)	HSV1	-	ESC ONLY
30	ESC VALVE(HSV2)	HSV2	-	ESC ONLY
31	STEERING ANGLE SNSR	SAS	deg	-780 ~ 779.9 °(ESC ONLY)
32	YAW RATE SNSR-LATERAL	LATERAL	g	-1.8 ~ 1.8 G(ESC ONLY)
33	YAW RATE SNSR-YAW	YAW	deg/S	-100 ~ 100 deg/s(ESC ONLY)
34	PRESSURE SENSOR	PRES. SNSR	bar	-42.5 ~ 425 bar(ESC ONLY)
35	PARKING BRAKE SIGNAL	P/BRAKE	-	ESC ONLY
37	SAS CALIBRATED	SAS CALI.	-	ESC ONLY
38	YAW RATE SENSOR TEST PASSED	YAW TEST	-	ESC ONLY

Brake System > ESP(Electronic Stability Program) System > Description and Operation

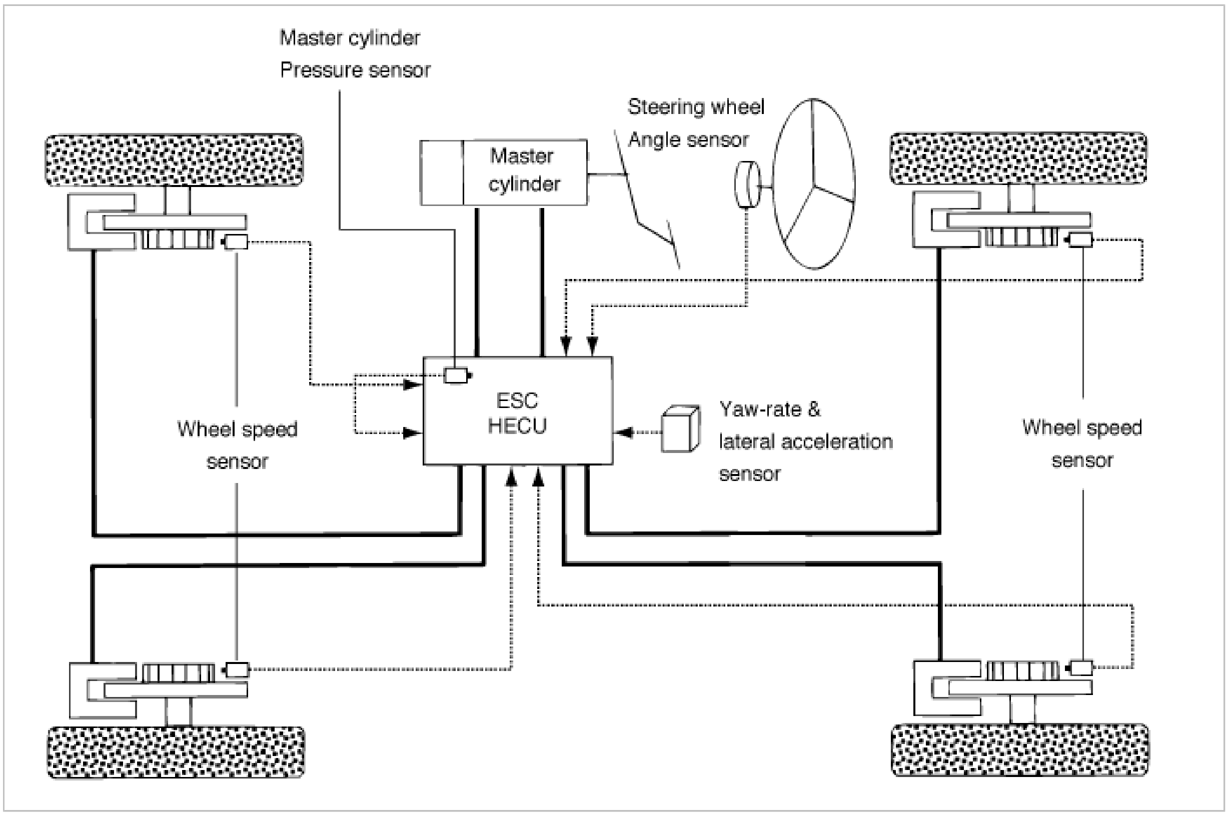
description of ESC

Optimum driving safety now has a name : ESC, the Electronic Stability Control.
ESC recognizes critical driving conditions, such as panic reactions in dangerous situations, and stabilizes the vehicle by wheel-individual braking and engine control intervention with no needfor actuating the brake or the gas pedal.
ESC adds a further function known as Active Yaw Control (AYC) to the ABS, TCS, EBD and ESC functions. Whereas the ABS/TCS function controls wheel slip during braking and acceleration and, thus, mainly intervenes in the longitudinal dynamics of the vehicle, active yaw control stabilizes the vehicle about its vertical axis.
This is achieved by wheel individual brake intervention and adaptation of the momentary engine torque with no need for any action to be taken by the driver.
ESC essentially consists of three assemblies : the sensors, the electronic control unit and the actuators.
Of course, the stability control feature works under all driving and operating conditions. Under certain driving conditions, the ABS/TCS function can be activated simultaneously with the ESC function in response to a command by the driver.
In the event of a failure of the stability control function, the basic safety function, ABS, is still maintained.



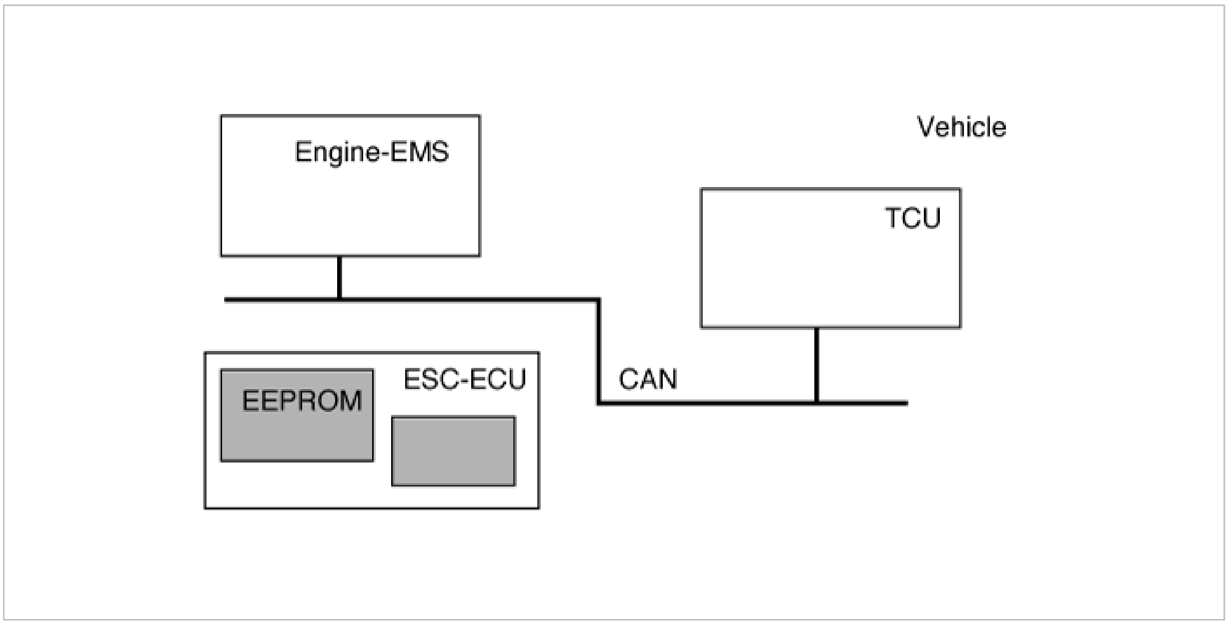
DESCRIPTION OF ESP CONTROL

ESP system includes ABS/EBD, TCS and AYC function.
ABS/EBD function The ECU changes the active sensor signal (current shift) coming from the four wheel sensors to the square wave.By using the input of above signals, the ECU calculates the vehicle speed and the acceleration & deceleration of the four wheels.And, the ECU judges whether the ABS/EBD should be actuated or not.
TCS function prevents the wheel slip of drive direction by adding the brake pressure and engine torque reduction via CAN communication.TCS function uses the wheel speed sensor signal to determine the wheel slip as far as ABS function.
AYC function prevents unstable maneuver of the vehicle. To determine the vehicle maneuver, AYC function uses the maneuver sensor signals(Yaw Rate Sensor, Lateral Acceleration Sensor, Steering Wheel Angle Sensor).If vehicle maneuver is unstable (Over Steer or Under Steer), AYC function applies the brake pressure on certain wheel, and send engine torque reduction signal by CAN.
After the key-on, the ECU continually diagnoses the system failure. (self-diagnosis)If the system failure is detected, the ECU informs driver of the system failure through the BRAKE/ABS/ESC warning lamp. (fail-safe warning)



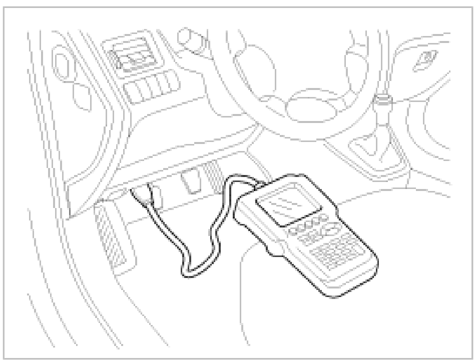
VARIANT CODING

A hardware difference of ECU does not exist according to the specification of the vehicle, but a software changes according to deference of vehicle parameter. The ESC stores variant code (data of engine, displacement volume , T/M) at the ECU memory. Since then an ESC uses the stored data.

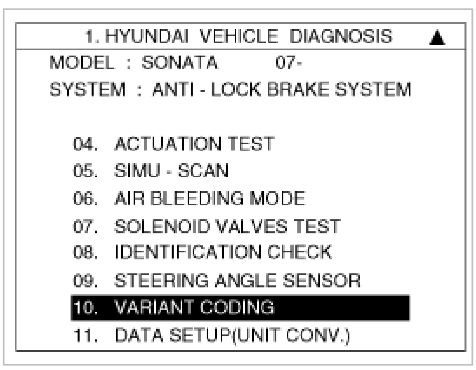


***PROCEDURE**

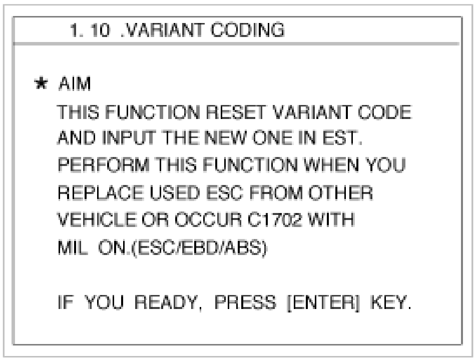
1. Install a EMS/TCU/ESC normally.
2. Connect the hi-scan (pro) to the data link connector located underneath the dash panel.



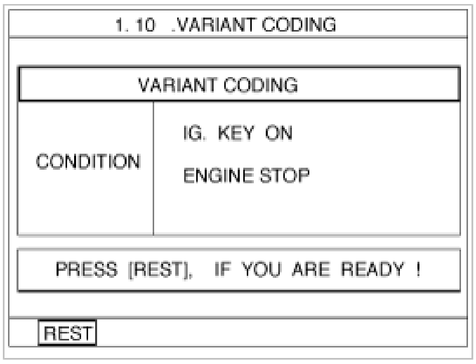
3. Select vehicle name.
4. Select ANTI-LOCK BRAKE SYSTEM.
5. Select the variant coding.



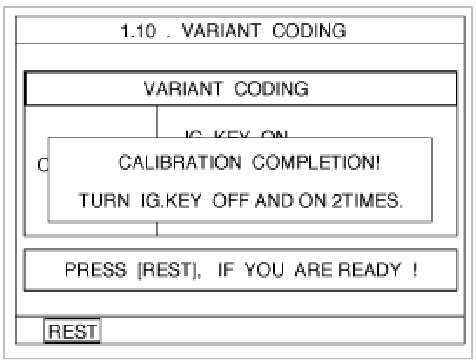
6. Follow the next procedure according to the comment .



7. Confirm the condition , and then push the "REST".



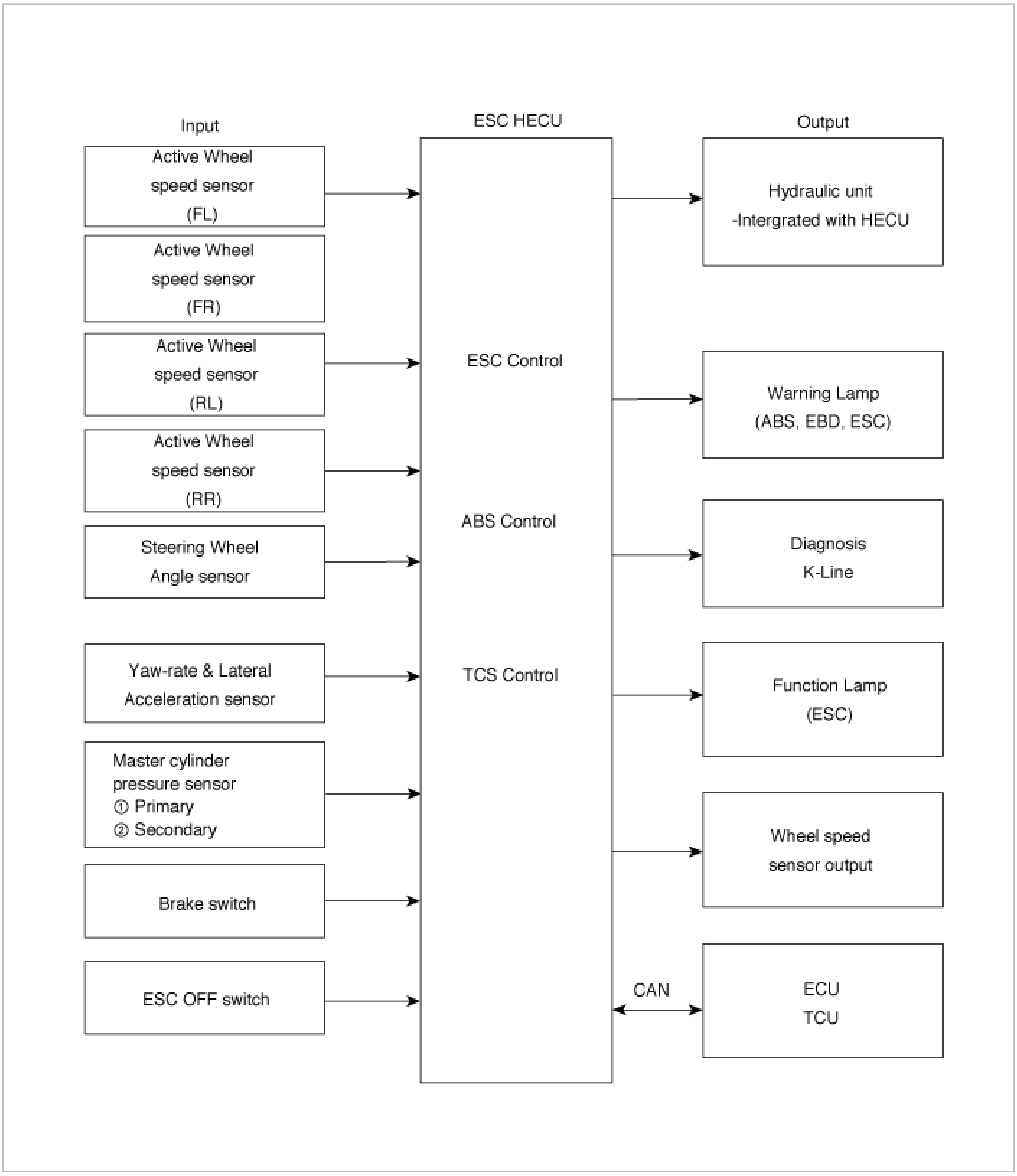
8. If the procedure is finished , the below screen is displayed .



9. IGN off.
10. IGN on.
11. The variant coding is completed.

> CAUTION
>
> If the warning lamp(ESC, EBD, ABS) is lighted up, follow the "Variant coding" again.

INPUT AND OUTPUT DIAGRAM



ESC OPERATION MODE

1. STEP 1
   The ESC analyzes the intention of the driver.

Position of steering wheel + Vehicle speed + Acceleration pedal →	ECU decides the intention of the driver.

2. STEP 2
   It analyzes the movement of the ESC vehicle.

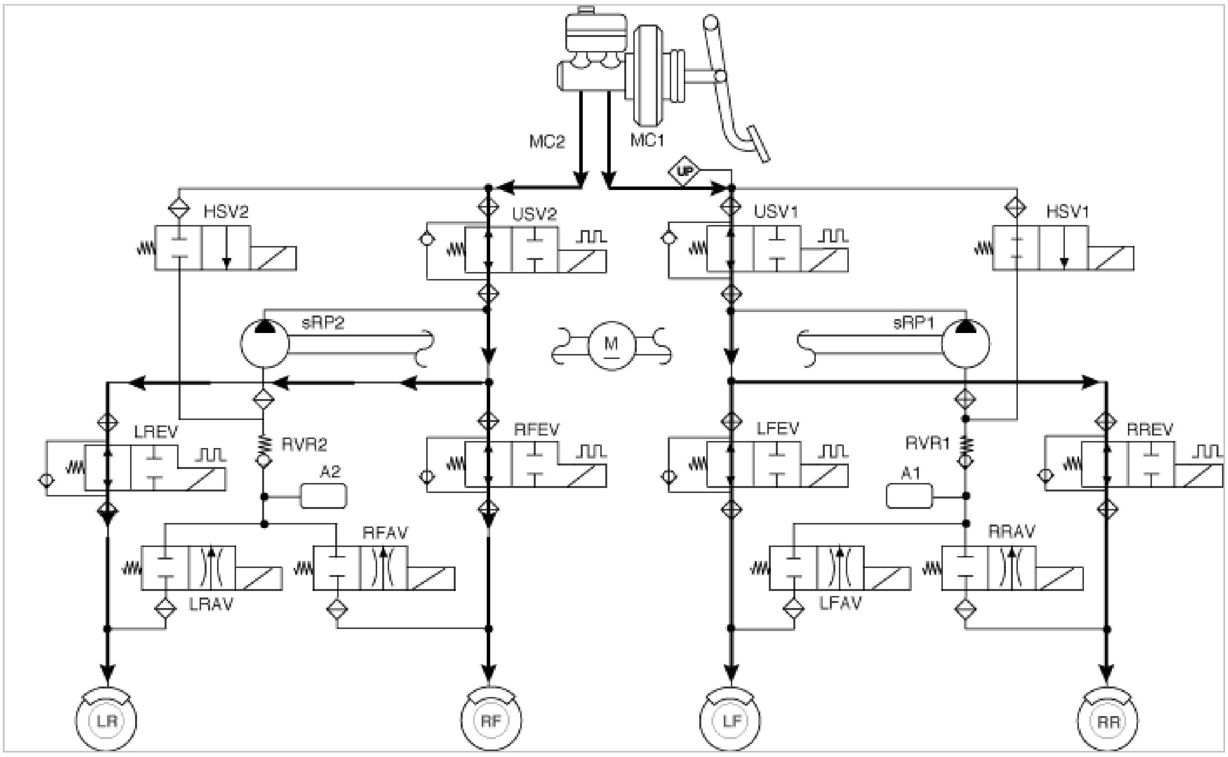
Vehicle rotation speed + Operated power to the side →	ECU decides movement of the ESC vehicle.

3. STEP 3
   It controls a vehicle posture control through the ESC braking power.
   A. The ECU calculates the needed countermeasure.
   B. The hydraulic unit controls Independently the braking power of each wheel.
   C. The ESC adjusts engine output through an engine and communication line to be connected.

ESC OPERATION MODE

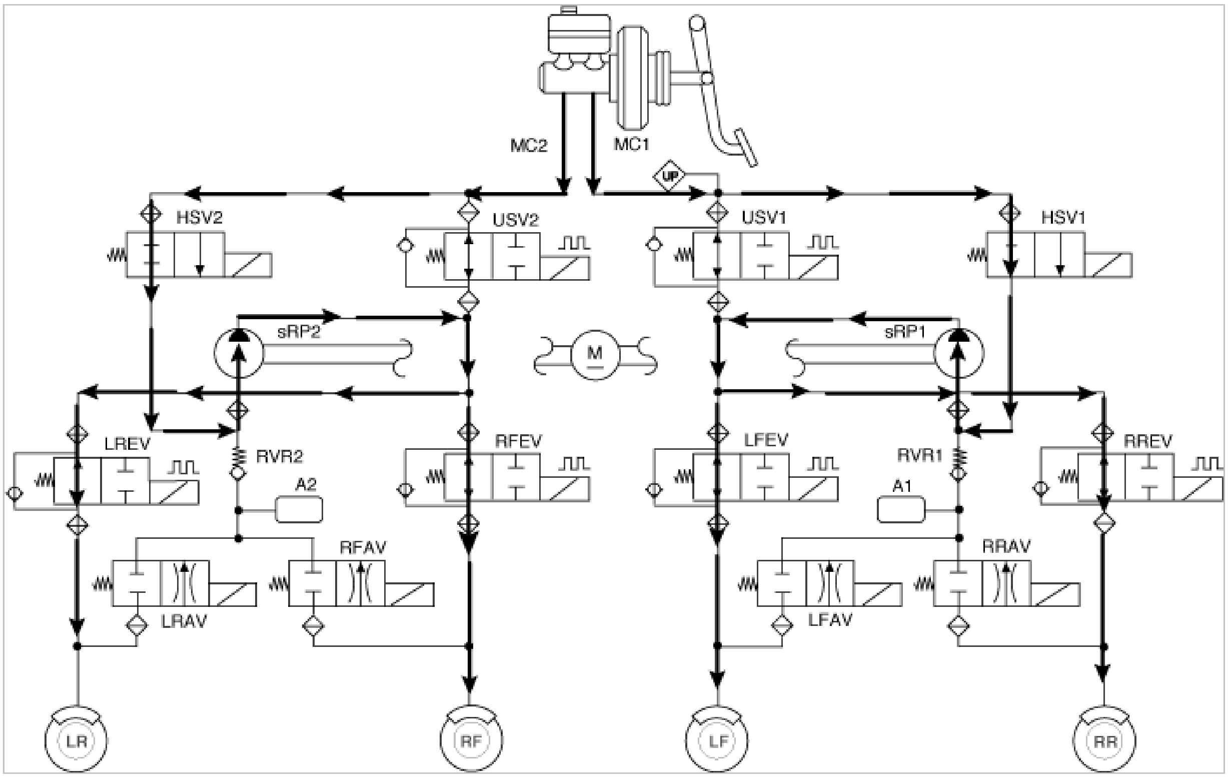
1. ESC Non-operation-Normal braking.

	Inlet valve(EV)	Outlet valve(AV)	Pilot valve(USV)	High pressure switch valve(HSV)	Pump motor
Normal braking	Open	Close	Open	Close	OFF



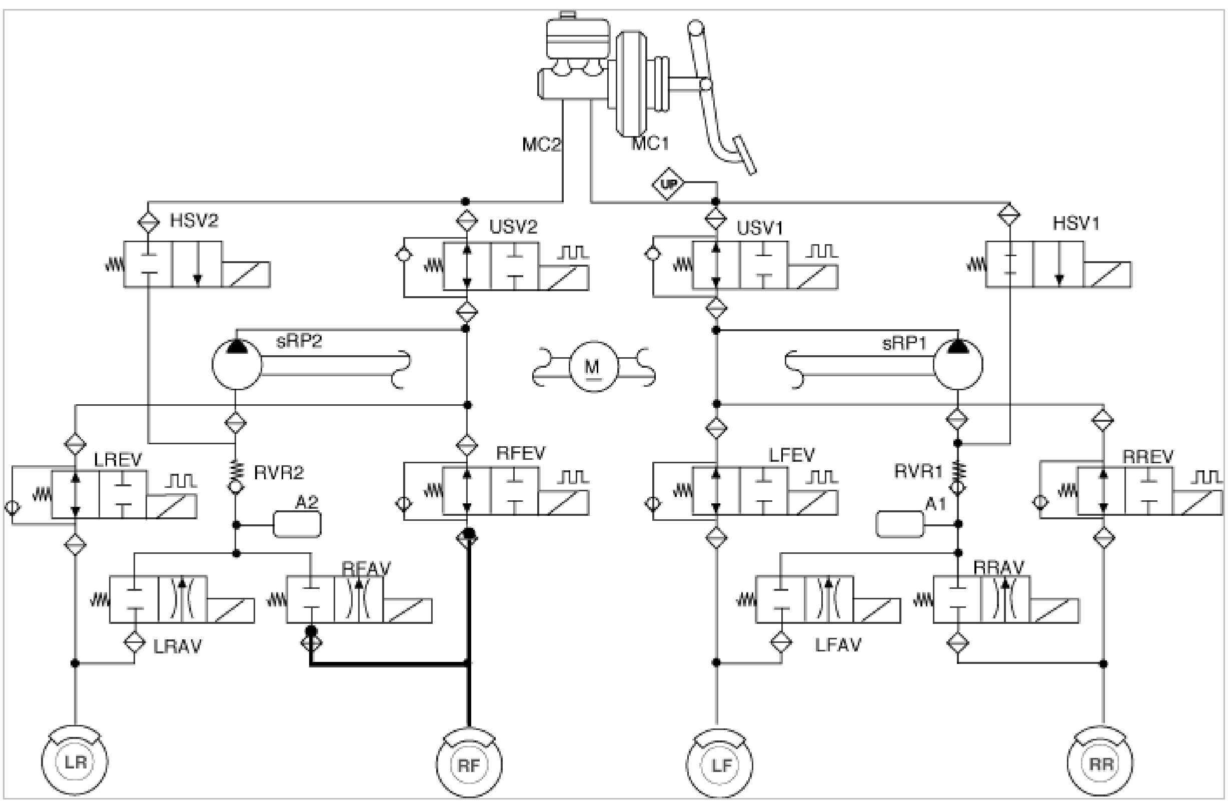
2. ESC INCREASE MODE

	Inlet valve(EV)	Outlet valve(AV)	Pilot valve(USV)	High pressure switch valve(HSV)	Pump motor
Normal braking	Open	Close	Close(Partial)	Open	ON(Motor speed control)



3. ESC HOLD MODE (FR is only controlled.)

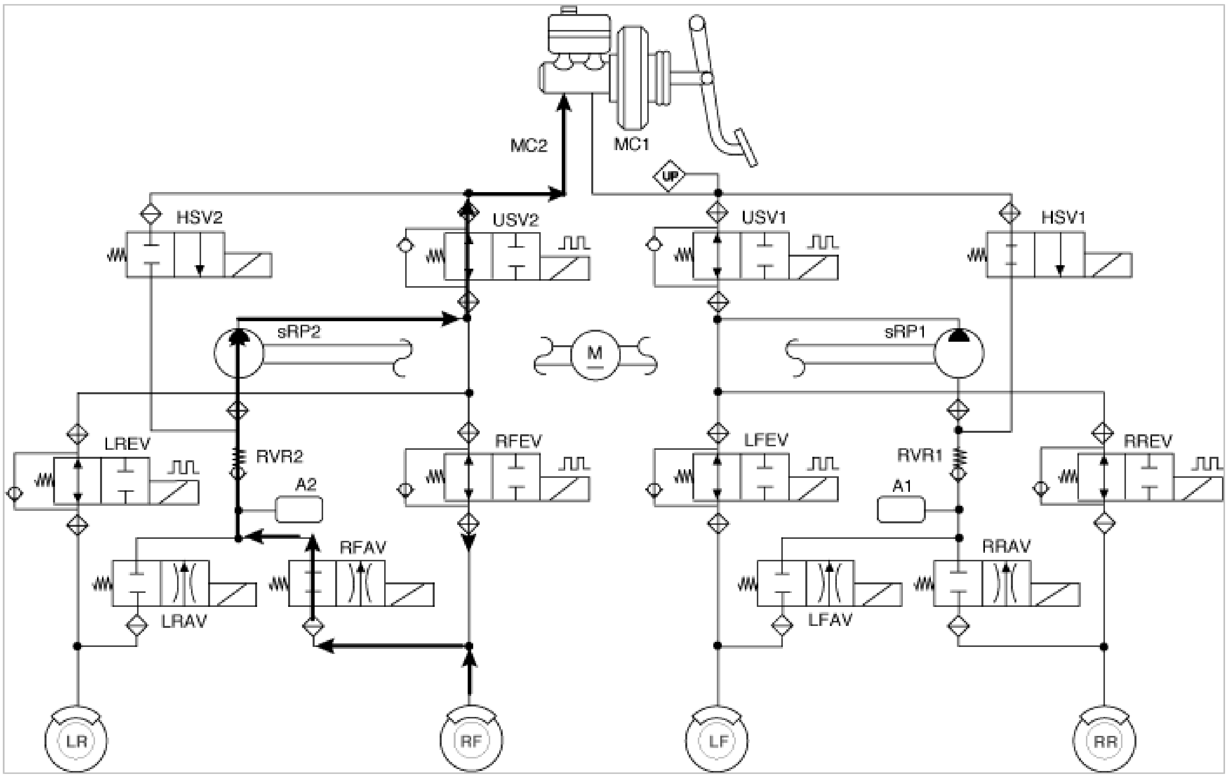
	Inlet valve(EV)	Outlet valve(AV)	Pilot valve(USV)	High pressure switch valve(HSV)	Pump motor
Normal braking	Close	Close	Close(Partial)	Open	ON(Motor speed low control)



4. ESC DECREASE MODE (FR is only controlled)

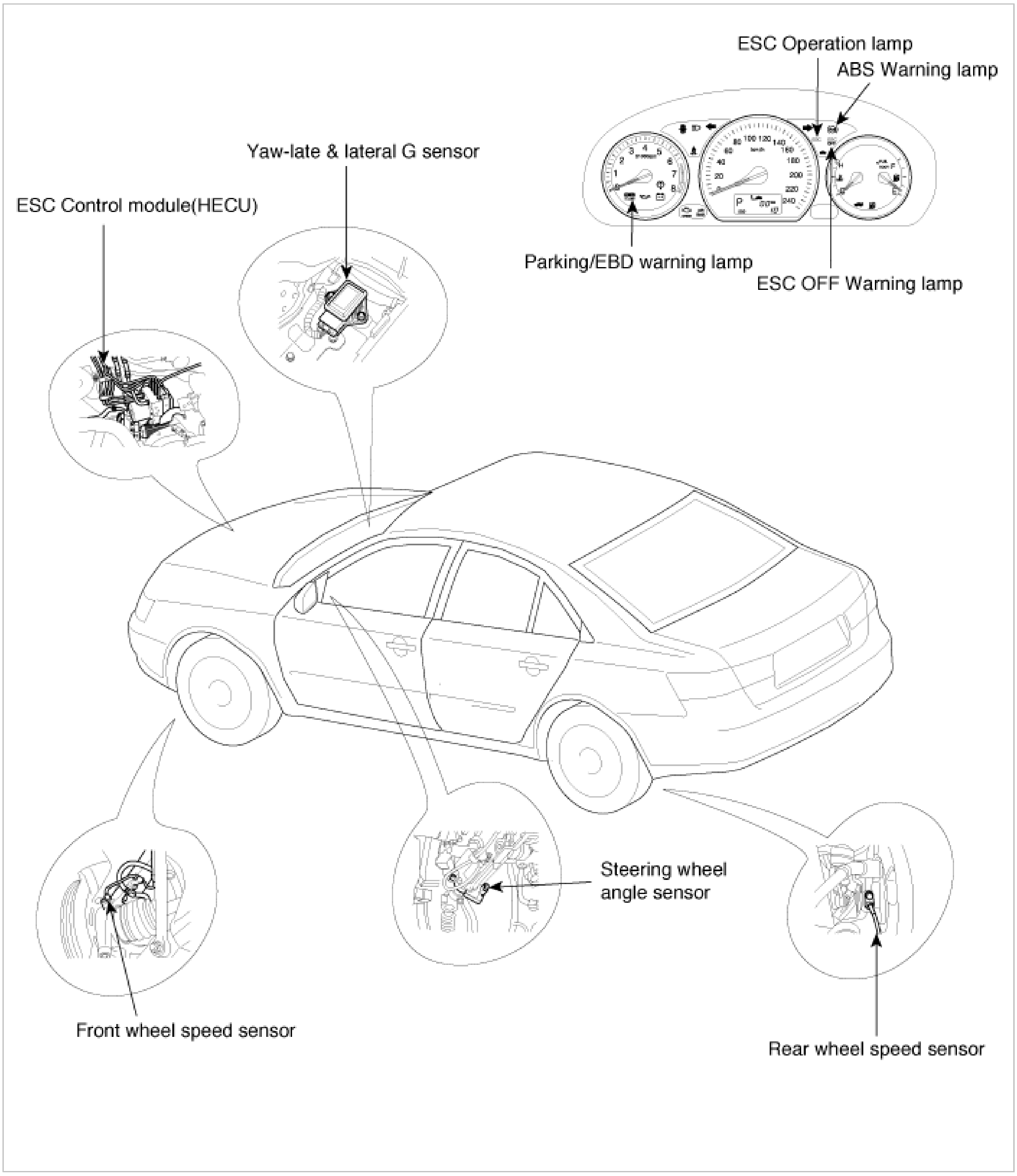
	Inlet valve(EV)	Outlet valve(AV)	Pilot valve(USV)	High pressure switch valve(HSV)	Pump motor

Normal braking	Close	Open	Close(Partial)	Open	ON(Motor speed low control)



Brake System > ESP(Electronic Stability Program) System > Components and Components Location

COMPONENTS



Brake System > ESP(Electronic Stability Program) System > Troubleshooting

FAILURE DIAGNOSIS

1. In principle, ESC and TCS controls are prohibited in case of ABS failure.
2. When ESC or TCS fails, only the failed system control is prohibited.
3. However, when the solenoid valve relay should be turned off in case of ESC failure, refer to the ABS fail-safe.
4. Information on ABS fail-safe is identical to the fail-safe in systems where ESC is not installed.

MEMORY OF FAIL CODE

1. It keeps the code as far as the backup lamp power is connected. (O)
2. It keeps the code as far as the HCU power is on. (X)

FAILURE CHECKUP

1. Initial checkup is performed immediately after the HECU power on.

2. Valve relay checkup is performed immediately after the IG2 ON.
3. It executes the checkup all the time while the IG2 power is on.
4. Initial checkup is made in the following cases.
   (1) When the failure is not detected now
   (2) When ABS and ESC are not in control.
   (3) Initial checkup is not made after ECU power on.
   (4) If the vehicle speed is over 5 mph(8 km/h) when the brake lamp switch is off.
   (5) When the vehicle speed is over 24.8 mph(40 km/h).
5. Though, it keeps on checkup even if the brake lamp switch is on.
6. When performing ABS or ESC control before the initial checkup, stop the initial checkup and wait for the HECU power input again.
7. Judge failure in the following cases.
   (1) When the power is normal.
   (2) From the point in which the vehicle speed reaches 4.9 mph(8 km/h) after HECU power on.

COUNTERMEASURES IN FAIL

1. Turn the system down and perform the following actions and wait for HECU power OFF.
2. Turn the valve relay off.
3. Stop the control during the operation and do not execute any until the normal condition recovers.

WARNING LAMP ON

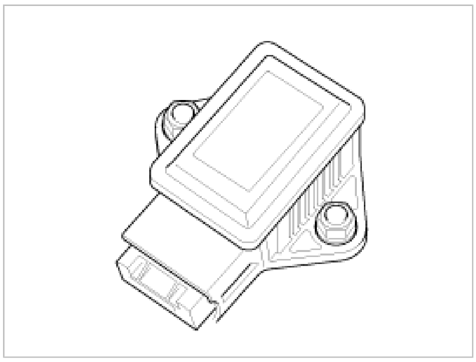
1. ABS warning lamp turns on when ABS is fail.
2. ESC operation lamp turns on when ESC is fail.

When power voltage and valve relay voltage are abnormal, input/output related failure judgment is not made.

Brake System > ESP(Electronic Stability Program) System > Yaw-rate Sensor > Description and Operation

DESCRIPTION

1. The yaw-rate & lateral G sensor is applied for the ESC system.
2. The yaw-rate is the angular velocity, when a vehicle turns a corner, and the lateral G is the acceleration to move a vehicle out of the way when cornering.
3. The sensor is located in the crash pad lower floor on vehicle.

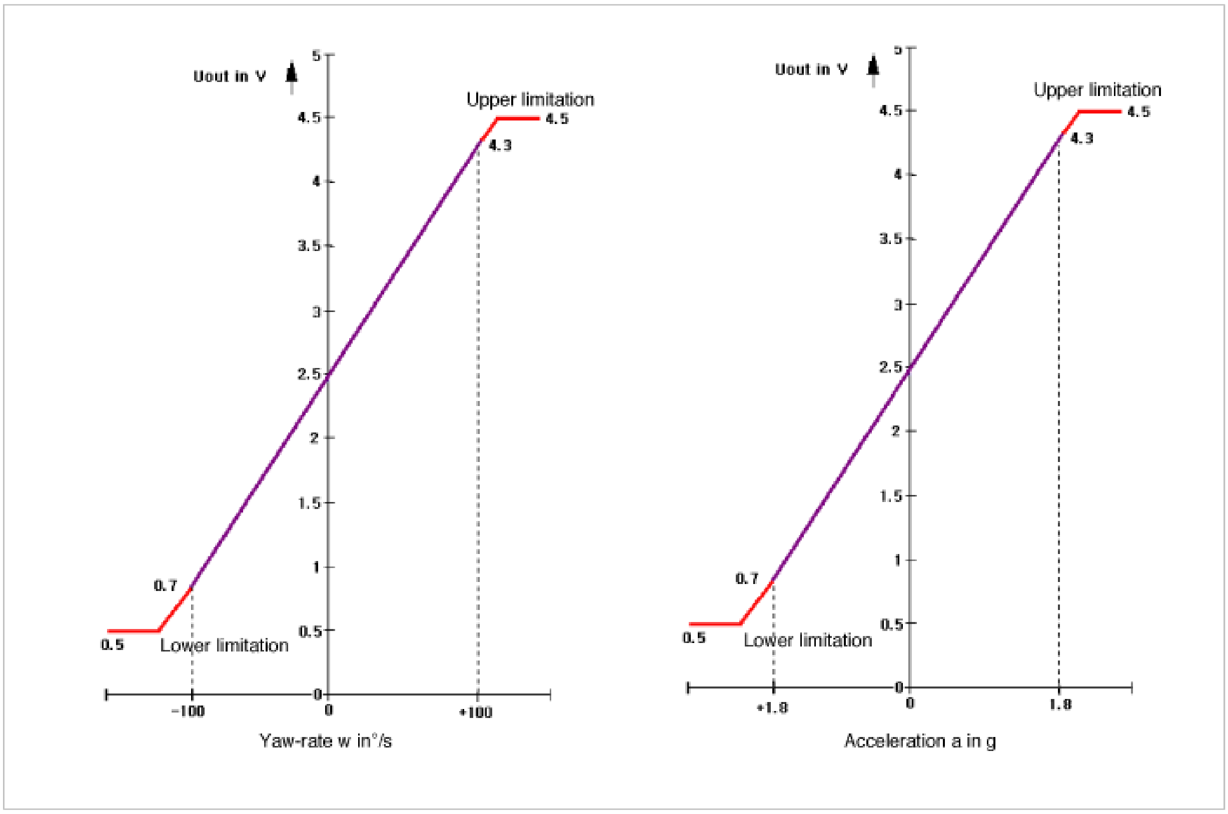


SPECIFICATION

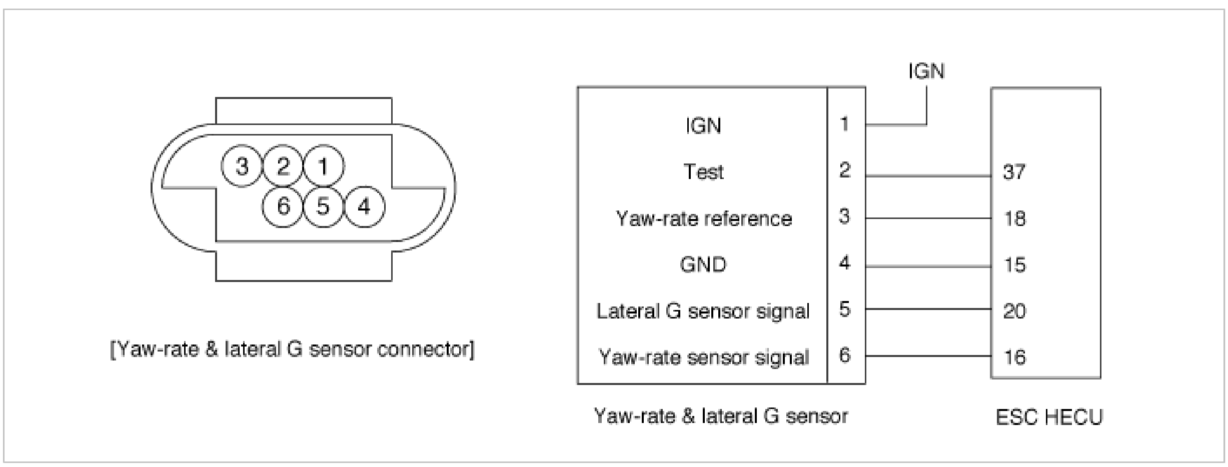
DESCRIPTION			SPECIFICATION	REMARK
Nominal supply voltage			11.5 ~ 12.5 V	
Supply voltage range			8 ~ 16 V	
Supply current			Max. 120 mA	Typ. 75 mA
Reference Voltage Output			2.464 ~ 2.536 V	Typ. 2.5 V
Operating temperature range			-40 ~ 85°C	
Yaw-late sensor	Measurement	+w direction, left turn	Min.100 °/s	Typ. 111 °/S

	range	-w direction, right turn	Min.100 °/s	Typ. 111 °/S
	Non-linearity		-1 ~ 1 %	
	Offset (within life,within operating temperature)		3.75 °/S	
	Upper cut-off frequency		Min. 45 Hz	Typ. 60 Hz
Lateral G sensor	Measurement range	+y direction, left turn	Min.1.8 g	Typ. 2 g
		-y direction, right turn	Min. -1.8 g	Typ. 2 g
	Non-linearity		-4 ~ 4 %	
	Offset (within life,within operating temperature)		-0.09 ~ 0.09 g	
	Upper cut-off frequency		Min. 20 Hz	Typ. 40 Hz

OUTPUT CHARACTERISTIC



CIRCUIT DIAGRAM (YAW-RATE & LATERAL G SENSOR)



Brake System > ESP(Electronic Stability Program) System > ESP OFF Switch > Description and

Operation

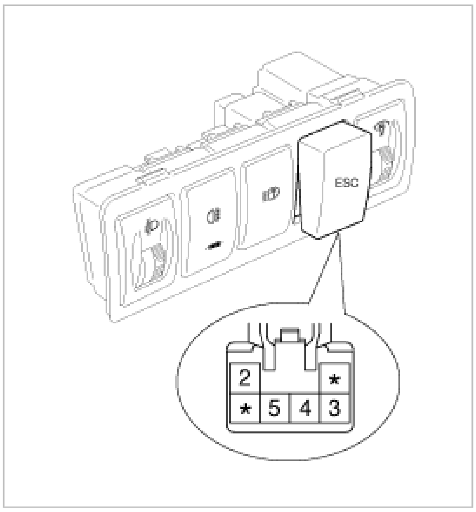
DESCRIPTION

1. The ESC OFF switch is for the user to turn off the ESC system.
2. The ESC OFF lamp is on when ESC OFF switch is engaged.

Brake System > ESP(Electronic Stability Program) System > ESP OFF Switch > Repair procedures

INSPECTION

1. Remove the ESC OFF switch from the switch panel on the crashpad of the driver's side.



2. Check the continuity between the switch terminals as the ESC OFF switch is engaged.

Position \ Terminal	2	5	3	4
ON	○	○	○	○
OFF				

Brake System > ESP(Electronic Stability Program) System > Steering Angle Position Sensor > Description and Operation

DESCRIPTION

GENERAL DATA

The steering angle speed sensor detects the angle of the steering wheel in order to which direction a user chooses.The sensor is detached on the MFS(Mutil-Function Switch) under the steering wheel.

MEASUREING PRINCIPLE

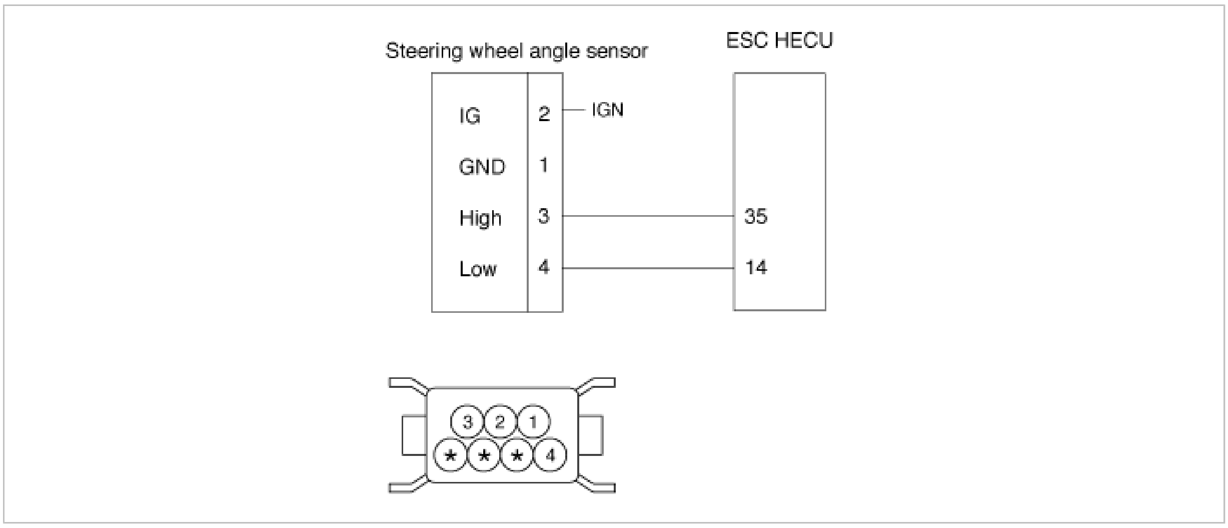
A non contact, analog angle sensor carrying out absolute measuring by the use of the Anisotropic-Magneto-Resistive effect (AMR).Measuring of the absolute angle by means of a toothed measuring gear with magnetic properties in combination with different ratios. Corresponding AMR elements that change their electrical resistance according to the magnetic field direction detect the angle position of the measuring gears.A micro-controller decodes the measured voltage signals after A/D converting with the help of a mathematical function. Output of the digital angle value and velocity via CAN-interface.

SPECIFICATION

DESCRIPTION	SPECIFICATION
Operating voltage	8~16 V
Operating temperature	-40 ~ 85 °C
Current consumption	Max.150 mA
Steering angle velocity	Max. ±2000 °/sec

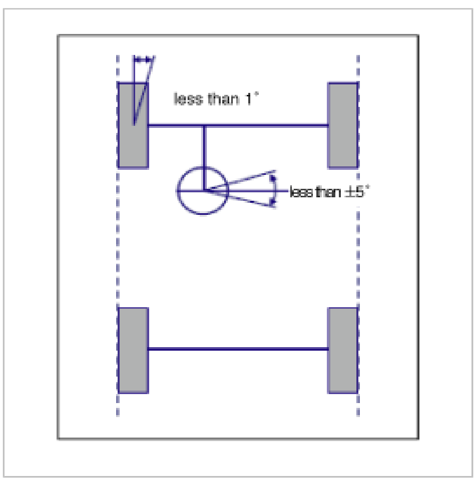
Connection delay time		t < 200 ms
Reverse voltage		-13.5 V
Measuring range	Angle	-780 ° ~ 779 °
	Angular velocity	0~ 1016 °/s
Nonlinearity angle		-2.5 ° ~ +2.5 °
Hysteresis angle		0 ° ~ 5 °
Rotational friction torque measuring		10 °/s

CIRCUIT DIAGRAM(STEERING WHEEL SPEED ANGLE SENSOR)



STEERING ANGLE SENSOR (SAS) calibration

1. PURPOSE OF calibration
    A. On vehicle control, an ESC analyzes the intention of the driver.
    B. An ESC recognizes a steering angle which a driver rotates through the steering angle sensor.
    C. A steering angle sensor used in ESC8 adjusts 0° setting of steering wheel through K-line or CAN communication.
2. STEERING ANGLE SENSOR (SAS) CALIBRATION METHOD

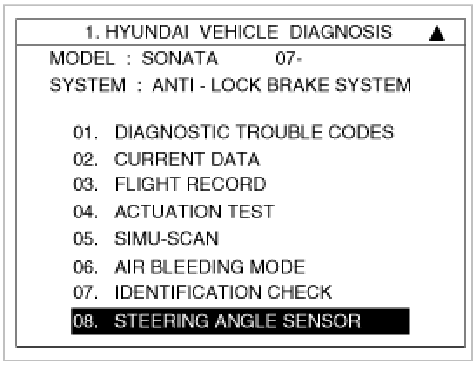


(1) Align the wheel to the straight line. (steering wheel < ± 5°)
ex) Perform the wheel alignment first.
Align the wheel to the straight line.
A driver moves the vehicle to the front and back about 5 meters twice or three times.

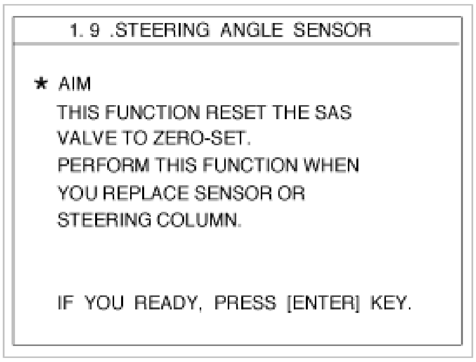
(2) Connect Hi-scan to the vehicle.

(3) Select Brake system.

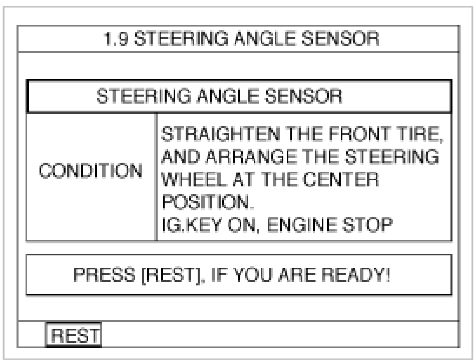
(4) Select Steering angle sensor(SAS) calibration.



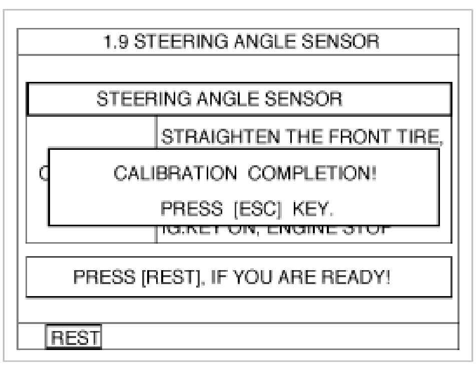
(5) Perform the Steering angle sensor(SAS) calibration.



(6) Perform the procedure continuously.



(7) The procedure is finished. Push the "ESC" key.



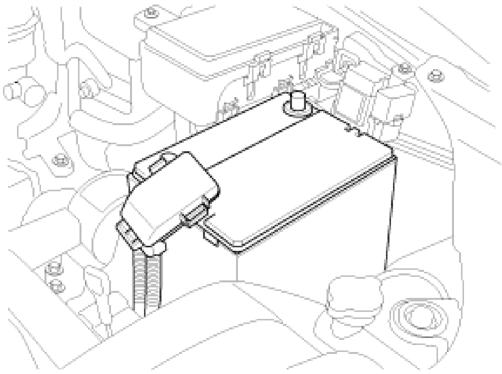
(8) Scanner OFF.

(9) Remove the scanner from the vehicle.

(10) Confirm the Steering angle sensor(SAS) calibration as driving the vehicle.(turn left once, turn right once)

Brake System > Troubleshooting > C1101

COMPONENT LOCATION



GENERAL DESCRIPTION

The ABS ECU(Electronic Control Unit) checks the battery voltage to determine, as a safety issue, whether the ABS system can operate normally or not. The normal battery voltage range is essential for controlling the ABS system as intended.

DTC DESCRIPTION

The ABS ECU monitors battery voltage by reading the value of voltage.

1. When the voltage is higher than the expected normal value, this code is set, and the ABS/EBD/TCS/ESC functions are prohibited. If the voltage recovers, to within normal operating ranges, then the controller returns to normal operation as well.
2. When the voltage is lower than the expected normal value, this code is set. The ABS/TCS/ESC functions are prohibited and the EBD function is allowed on LOW VOLTAGE CONDITION 1, the ABS/EBD/TCS/ESC functions are prohibited on UNDER VOLTAGE CONDITION.
3. If the voltage recovers, to within normal operating ranges, then the controller returns to normal operations as well.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible cause
DTC Strategy	Battery Voltage Monitoring		• Poor connection in power supply circuit (IGN+) • Faulty Alternator • Faulty HECU
Enable Conditions	C1101	High voltage problem will be monitored if filtered Ignition Voltage is > 16.8 V. It will be reset if filtered Ignition Voltage < 16.7 V.	
	C1102	1. Ignition Voltage is monitored for a level of filtered Ignition Voltage < 9.3 V outside control, or a level of filtered Ignition Voltage < 9.2 V during control. 2. Hard under voltage due to low voltage glitches is detected if unfiltered Ignition Voltage < = 8.2 V for t >= 20 ms. 3. A hard under voltage problem will be detected if the filtered UZ < 7.7 V. The system remains in this condition until filtered UZ > 7.8 V. NOTE All under voltage failures will only be saved in EEPROM if vehicle speed is > 6 km/h(3 MPH). This prevents false failure entries due to a bad battery at ignition on.	
Monitoring period	Continuous. Under voltage faults are only entered in the EEPROM if the vehicle speed is v > 6 km/h (3 MPH). Over voltage faults will be always stored.		
Effect	The proper function of valves and return pump is not guaranteed.		
Fail Safe	• System down. The ABS/EBD/TCS/ESC functions are inhibited. - The valve relay and all solenoids are prevented from being switched on. • The ABS/EBD/ESC warning lamps are activated.		

SPECIFICATION

Voltage : 9.3 ≤ V ≤ 16.8 V

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Go to the next step.

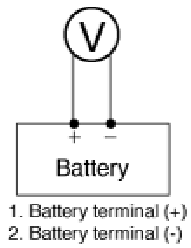
POWER SUPPLY CIRCUIT INSPECTION

1. ALTERNATOR OUTPUT VOLTAGE INSPECTION

(1) Engine "ON".

(2) Measure voltage between the battery terminal(+) and the battery terminal(-).

Specification : Approx. 14.4 ± 0.3 V (20 °C)



Voltage regulator ambient temperature(°C)	Regulating voltage
-30	14.1 ~ 15.2
20	14.1 ~ 14.7
120	13.3 ~ 14.7

Is the measured voltage within specifications?

YES

▸ Go to "Power Circuit Inspection" procedure.

NO

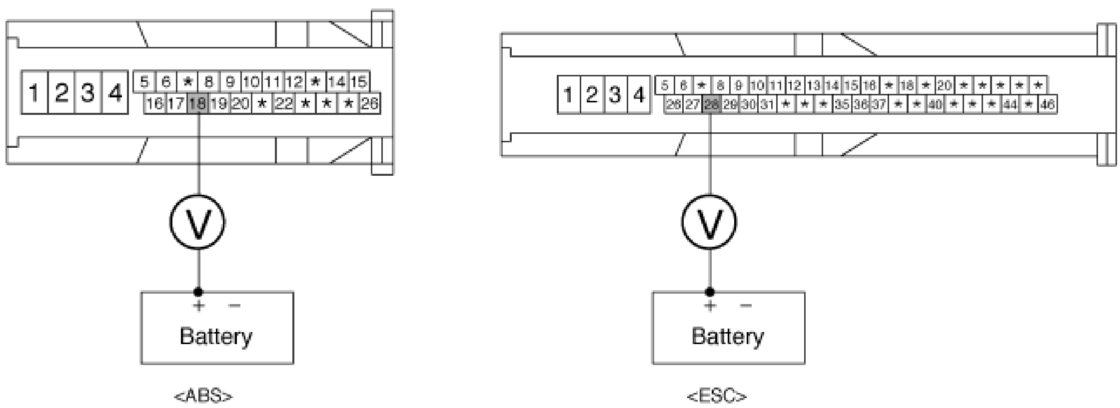
▸ Check for damaged harness and poor connection between alternator and battery. If OK , repair or replace alternator and then go to "Verification of vehicle Repair" procedure.

2. POWER CIRCUIT INSPECTION

(1) Engine "ON".

(2) Measure voltage between the battery terminal(+) and terminal "18(28:ESC)" of the HECU harness connector.

Specification : Approx. below 0.2 V



Is the measured voltage within specifications?

YES

▸Go to "Ground Circuit Inspection" procedure.

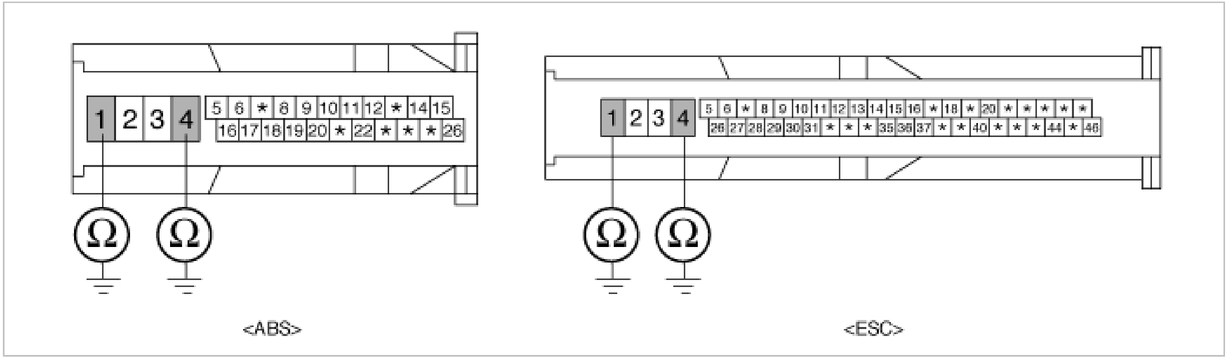
NO

▸ Check for damaged harness and poor connection between the battery terminal(+) and terminal "18(28:ESC)" of the HECU harness connector. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect HECU connector.
3. Measure resistance between terminal "1,4" of the HECU harness connector and chassis ground.

Specification : Approx. below 1 Ω



Is the measured resistance within specifications?

NO

▸ Check for damaged harness and poor connection between terminal "1,4" of the HECU harness connector and chassis ground. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

YES

▸ Go to "Component Inspection" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
   Does warning lamp remain On?

YES

▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Fault is intermittent caused by poor connection in power harness (IGN+), faulty Alternator and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.
   Are any DTCs present?

YES

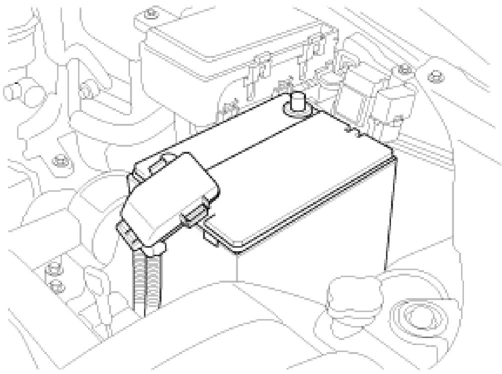
▸ Go to the applicable troubleshooting procedure.

NO

▸ A system performs normally at this time.

Brake System > Troubleshooting > C1102

COMPONENT LOCATION



GENERAL DESCRIPTION

The ABS ECU(Electronic Control Unit) checks the battery voltage to determine, as a safety issue, whether the ABS system can operate normally or not. The normal battery voltage range is essential for controlling the ABS system as intended.

DTC DESCRIPTION

The ABS ECU monitors battery voltage by reading the value of voltage.

1. When the voltage is higher than the expected normal value, this code is set, and the ABS/EBD/TCS/ESP functions are prohibited. If the voltage recovers, to within normal operating ranges, then the controller returns to normal operation as well.
2. When the voltage is lower than the expected normal value, this code is set. The ABS/TCS/ESP functions are prohibited and the EBD function is allowed on LOW VOLTAGE CONDITION 1, the ABS/EBD/TCS/ESP functions are prohibited on UNDER VOLTAGE CONDITION.
3. If the voltage recovers, to within normal operating ranges, then the controller returns to normal operations as well.

DTC DETECTING CONDITION

<table>
<tr><th>Item</th><th colspan="2">Detecting Condition</th><th>Possible cause</th></tr>
<tr><td>DTC Strategy</td><td colspan="2">Battery Voltage Monitoring</td><td rowspan="7">• Poor connection in power supply circuit (IGN+)
• Faulty Alternator
• Faulty HECU</td></tr>
<tr><td rowspan="2">Enable Conditions</td><td>C1101</td><td>High voltage problem will be monitored if filtered Ignition Voltage is > 16.8 V.
It will be reset if filtered Ignition Voltage < 16.7 V.</td></tr>
<tr><td>C1102</td><td>1. Ignition Voltage is monitored for a level of filtered Ignition Voltage < 9.3V outside control, or a level of filtered Ignition Voltage < 9.2 V during control.
2. Hard under voltage due to low voltage glitches is detected if unfiltered Ignition Voltage < = 8.2 V for t >= 20 ms.
3. A hard under voltage problem will be detected if the filtered UZ < 7.7 V. The system remains in this condition until filtered UZ > 7.8 V.

NOTE
All under voltage failures will only be saved in EEPROM if vehicle speed is > 6km/h(3 MPH). This prevents false failure entries due to a bad battery at ignition on.</td></tr>
<tr><td>Monitoring period</td><td colspan="2">Continuous.
Under voltage faults are only entered in the EEPROM if the vehicle speed is v > 6 km/h (3 MPH).
Over voltage faults will be always stored.</td></tr>
<tr><td>Effect</td><td colspan="2">The proper function of valves and return pump is not guaranteed.</td></tr>
<tr><td>Fail Safe</td><td colspan="2">• System down. The ABS/EBD/TCS/ESP functions are inhibited.
- The valve relay and all solenoids are prevented from being switched on.
• The ABS/EBD/ESP warning lamps are activated.</td></tr>
</table>

SPECIFICATION

Voltage : 9.3 ≤ V ≤ 16.8 V

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

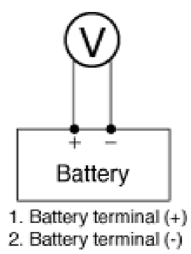
NO

▸ Go to the next step.

POWER SUPPLY CIRCUIT INSPECTION

1. ALTERNATOR OUTPUT VOLTAGE INSPECTION
   (1) Engine "ON".
   (2) Measure voltage between the battery terminal(+) and the battery terminal(-).

Specification : Approx. 14.4 ± 0.3 V (20 °C)



Voltage regulator ambient temperature(°C)	Regulating voltage
-30	14.1 ~ 15.2
20	14.1 ~ 14.7
120	13.3 ~ 14.7

Is the measured voltage within specifications?

YES

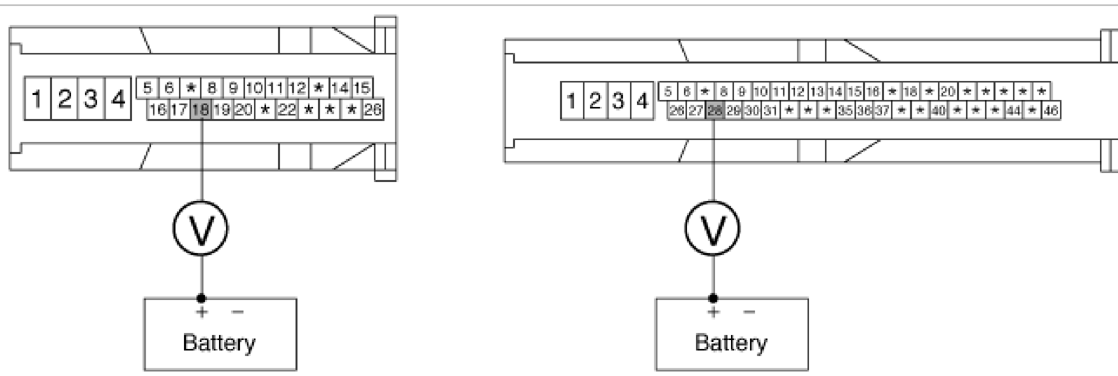
▸ Go to "Power Circuit Inspection" procedure.

NO

▸ Check for damaged harness and poor connection between alternator and battery. If OK , repair or replace alternator and then go to "Verification of vehicle Repair" procedure.

2. POWER CIRCUIT INSPECTION
   (1) Engine "ON".
   (2) Measure voltage between the battery terminal(+) and terminal "18(28:ESP)" of the HECU harness connector.

Specification : Approx. below 0.2 V



<ABS> <ESC>

Is the measured voltage within specifications?

YES

▸Go to "Ground Circuit Inspection" procedure.

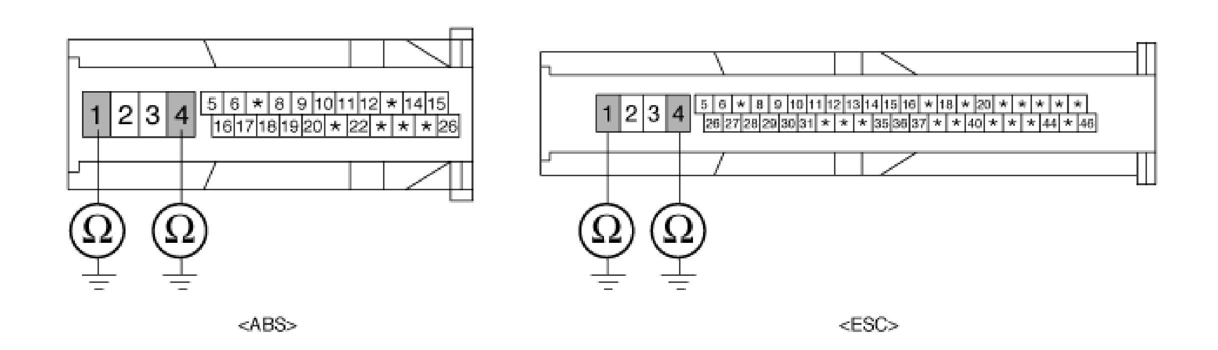
NO

▸ Check for damaged harness and poor connection between the battery terminal(+) and terminal "18(28:ESP)" of the HECU harness connector. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect HECU connector.
3. Measure resistance between terminal "1,4" of the HECU harness connector and chassis ground.

Specification : Approx. below 1 Ω



Is the measured resistance within specifications?

NO

▸ Check for damaged harness and poor connection between terminal "1,4" of the HECU harness connector and chassis ground. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

YES

▸ Go to "Component Inspection" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
   Does warning lamp remain On?

YES

▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Fault is intermittent caused by poor connection in power harness (IGN+), faulty Alternator and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.
   Are any DTCs present?

YES

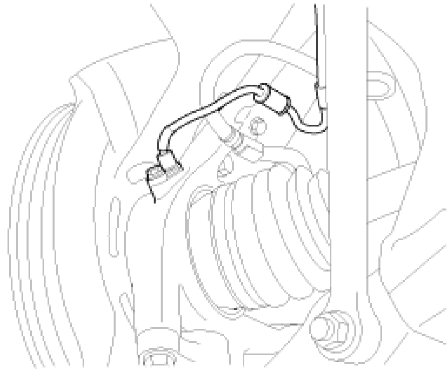
▸ Go to the applicable troubleshooting procedure.

NO

▸ A system performs normally at this time.

Brake System > Troubleshooting > C1200

COMPONENT LOCATION



GENERAL DESCRIPTION

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is an active hall-sensor type and good at temperature and noise charicteristic. Digital wave is produced as tone wheel rotate according as hall sensor principle. Frequency of duty wave is changed in proportion to rotation of tone wheel and HECU calculate vehicle speed by this frequency.

DTC DESCRIPTION

The ABS ECU monitors the wheel speed sensor circuit continuously. If the sensor signal current is continuously out of the specified range for 200msec, then the HECU determines that the circuit is open/short, and sets this code. Warning lamp is turned OFF if the detected fault is not more than when the IG KEY is turned to ON again, and wheel speeds are more than 10 Km/h(6 MPH).

DTC DETECTING CONDITION

Item	Detecting Condition		Possible cause
DTC Strategy	Current Monitoring		• Open or short of Wheel speed sensor circuit • Faulty Wheel speed sensor • Faulty HECU
CASE 1	Monitoring period	Once after power up.	
	Enable Conditions	Wheel speed sensor test starts immediate after power. Especially shorts between WSS(Wheel speed sensor) lines and shorts to UZ(ECU voltage supply) can be detected by switching single WSS channels in sequence. After end of test only the channels with no fault are switched on.	
CASE 2	Monitoring period	Continuous	
	Enable Conditions	The sensor circuitry has two current levels I = 7 mA and I= 14mA. If the sensor line is broken, shorted to ground or shorted to supply voltage a faulty current level will be detected.WSS line faults are detected, if the fault condition exists uninterrupted for t >= 200 ms.	
Effect	No correct WSS Signal can be generated. Control of the corresponding wheel is no longer possible. If a sensor fault occurs on a front wheel, pressure is increased; on a rear wheel, pressure is decreased (until switch off).		

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

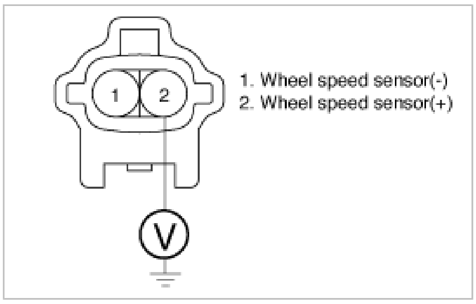
NO

▸ Go to the next step.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal "2" of the wheel speed sensor harness connector and chassis ground.

Specification : approx. B+



Is the measured voltage within specifications?

YES

▸ Go to "Signal Circuit Inspection" procedure.

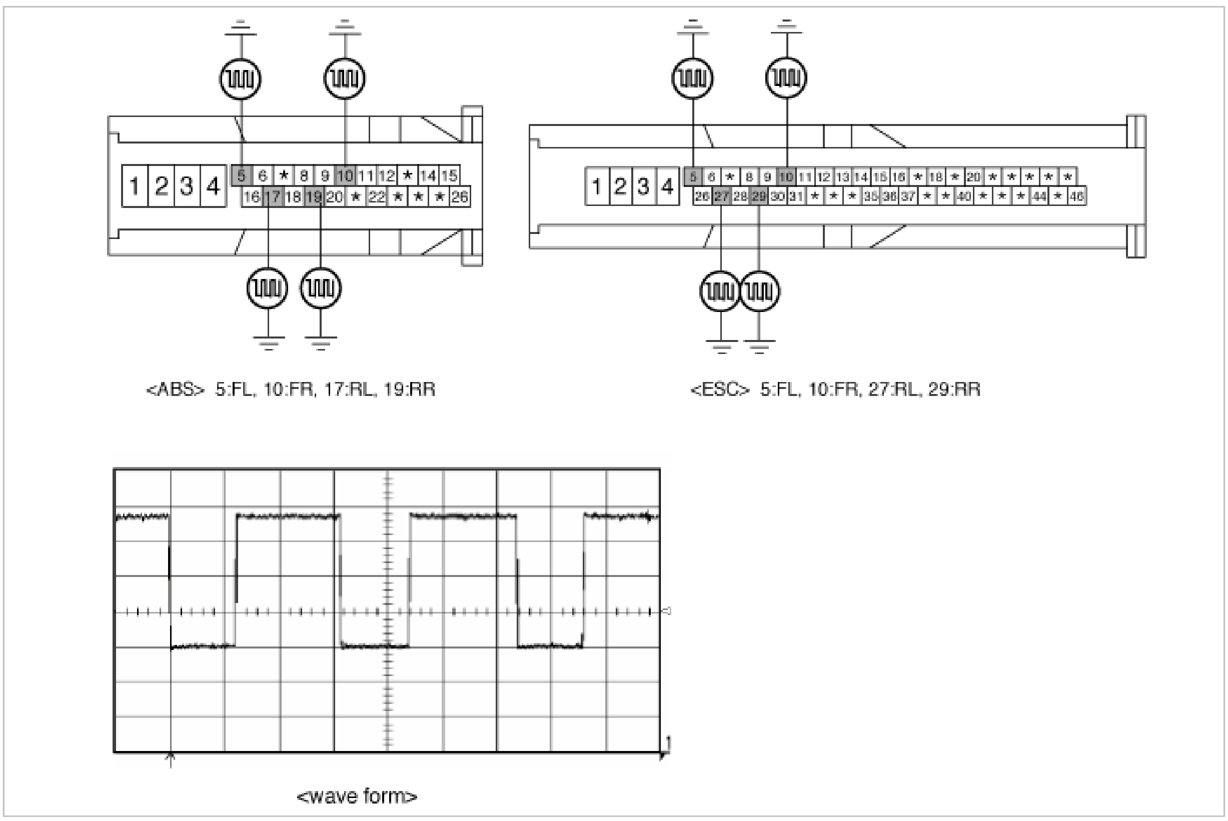
NO

▸ Check for open or short to GND in wheel speed sensor harness between terminal "16(ESC:26),9,6,8" of the HECU harness connector and terminal "2" of the Wheel speed sensor harness connector. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. By turning the wheel with hand.
3. Measure voltage between terminal "5,10,17(ESC:27),19(ESC:29)" of the HECU harness connector and chassis ground.

Specification : High : 0.89 ~ 1.26 V , Low : 0.44 ~ 0.63 V



Is the measured voltage within specifications?

YES

▸Go to "Component Inspection" procedure.

NO

▸ Check for open or short to GND in wheel speed sensor harness between terminal "1" of the wheel speed sensor harness connector and terminal "5,10,17(ESC:27),19(ESC:29)" of the HECU harness connector. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 10km/h or more(6mph or more).
   Does warning lamp remain On?

YES

▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected,replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Fault is intermittent caused by open or short of wheel speed sensor harness, faulty wheel speed sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.(Start and drive vehicle in gear and maintain vehicle speed is approx. 10 km/h or more(6 mph or more))
   Are any DTCs present?

YES

▸ Go to the applicable troubleshooting procedure.

NO

▸ A system performs normally at this time.

Brake System > Troubleshooting > C1201

COMPONENT LOCATION

GENERAL DESCRIPTION

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is an active hall-sensor type and good at temperature and noise charicteristic. Digital wave is produced as tone wheel rotate according as hall sensor principle. Frequency of duty wave is changed in proportion to rotation of tone wheel and HECU calculate vehicle speed by this frequency.

DTC DESCRIPTION

The ABS ECU monitors the wheel speed sensor signal continuously. This code is set if an abnormal speed change ratio is detected while the vehicle speed is 10~80 Km/h(6~50 MPH). Warning lamp is turned OFF if the detected fault is not more than when the IG KEY is turned to ON again, and wheel speeds are more than 12 Km/h(7MPH).

DTC DETECTING CONDITION

<table>
<tr><th>Item</th><th colspan="2">Detecting Condition</th><th>Possible cause</th></tr>
<tr><td>DTC Strategy</td><td colspan="2">Current Monitoring</td><td rowspan="6">• mproper installation of wheel speed sensor
• Abnormal Rotor and wheel bearing
• Faulty Wheel speed sensor
• Faulty HECU</td></tr>
<tr><td rowspan="2">CASE 1</td><td>Monitoring period</td><td>The monitoring is active from 10 km/h to 80km/h(6~50 MPH) and if no ABS-control is active at a front wheel and a rear wheel.</td></tr>
<tr><td>Enable Conditions</td><td>Every time, if a gap in the wheel speed sensor signal occurs cyclically with one wheel rotation, a fault counter is increased by one.
If the fault counter exceeds its limit of 10, a wheel specific fault is stored in the EEPROM.</td></tr>
<tr><td rowspan="2">CASE 2</td><td>Monitoring period</td><td>Continuous if V_Vehicle > 12 m/s</td></tr>
<tr><td>EnableConditions</td><td>No wheel speed signals within 10 ms to 20 ms at a vehicle speed> 12 m/s (43.2 km/h, 27MPH). If the dynamic sensor monitor responses, the failures will be stored into failure memory immediately after a waiting period of 60ms.</td></tr>
<tr><td>Effect</td><td colspan="2">Due to faulty wheel speed information the control of the corresponding wheel is no longer possible.
reaction of the controller: If a sensor fault occurs on a front wheel, pressure is increased; on a rear wheel, pressure is decreased.</td></tr>
</table>

MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC)
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 40 km/h or more(24 mph or more) Monitor the "Wheel speed sensor" parameter on the Scantool.

   Specification : Approx. 12 km/h or more(7 mph or more)

   Is it normal?

   YES

   ▸ Fault is intermittent caused by faulty wheel speed sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Repair or replace as necessary and then go to "Component Inspection" procedure.

   NO

   (1) Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure.

   (2) Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure.

   (3) Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 12 km/h or more(7 mph or more).
   Does warning lamp remain On?

   YES

   ▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Fault is intermittent caused by open or short of wheel speed sensor harness, faulty wheel speed sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.(Start and drive vehicle in gear and maintain vehicle speed is approx. 12 km/h or more(7 mph or more))
   Are any DTCs present ?

YES

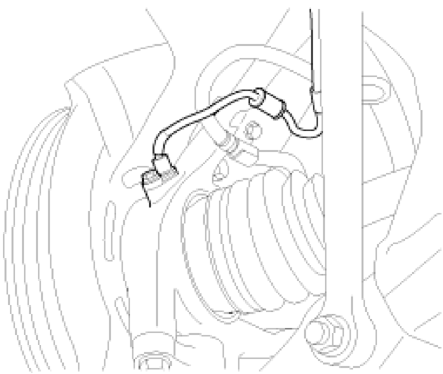
▸ Go to the applicable troubleshooting procedure.

NO

▸ A system performs normally at this time.

Brake System > Troubleshooting > C1202

COMPONENT LOCATION



GENERAL DESCRIPTION

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is an active hall-sensor type and good at temperature and noise charicteristic. Digital wave is produced as tone wheel rotate according as hall sensor principle. Frequency of duty wave is changed in proportion to rotation of tone wheel and HECU calculate vehicle speed by this frequency.

DTC DESCRIPTION

The ABS ECU monitors the wheel speed sensor signal continuously. This code is set when the sensor air gap is out of specified range or when No wheel speed signals within 10 ms to 20 ms at a vehicle speed > 43.2 km/h(26 MPH) . Warning lamp is turned OFF if the detected fault is not more than when the IG KEY is turned to ON again, and wheel speeds are more than 12 Km/h (7MPH)

DTC DETECTING CONDITION

Item	Detecting Condition		Possible cause
DTC Strategy	Signal monitoring		
CASE 1	Monitoring period	Continuous except no under voltage is detected.	
	Enable Conditions	The test detects a failure if one (or two) wheel are at Vmin(2.75 km/h ;1.7 MPH) and the other wheels are above 12 km/h for longer than 1s.A fault could also be set during driving, if the vehicle accelerates 18 km/h after a particular wheel speed gets to vmin(2.75 km/h ;1.7 MPH) and stays there. This monitoring	

<table>
<tr><td></td><td></td><td>could only detect singular faults.</td><td rowspan="6">• Improper installation of wheel speed sensor
• Abnormal Rotor and wheel bearing
• Faulty Wheel speed sensor
• Faulty HECU</td></tr>
<tr><td rowspan="2">CASE 2</td><td>Monitoring period</td><td>Continuous except no under voltage is detected.</td></tr>
<tr><td>Enable Conditions</td><td>No wheel speed signals within 10 ms to 20 ms at a vehicle speed > 12 m/s (43,2 km/h). If the dynamic sensor monitor responses, the failures will be stored into failure memory immediately after a waiting period of 60 ms.</td></tr>
<tr><td rowspan="2">CASE 3</td><td>Monitoring period</td><td>• The main monitor (λ5) needs additional information of the ESC-sensors and is active for a velocity > 20 km/h(12 MPH) and no under voltage(9.2 V) is detected.
• The backup monitor (λ6) manages with the wheel speeds alone.</td></tr>
<tr><td>Enable Conditions</td><td>• The main monitor (λ5): If the maximum difference of wheel speeds related to maximum wheel speed exceeds 5% a wheel specific wheel speed sensor fault is set.
- the above conditions apply for 20s for 1 defective WSS.
- the above conditions apply for 40s for 2 defective WSS.
• The backup monitor (λ6):If the velocity is higher than 50 km/h(31 MPH), the deviation between the fastest and the slowest wheel must exceeds 6% related to the fastest wheel. If the velocity is below 50 km/h(31 MPH), the deviation must exceed an absolute value of 3 km/h(1.8 MPH) .
- detection filter time : normally 20s</td></tr>
<tr><td>Effect</td><td colspan="2">Due to faulty wheel speed information the control of the corresponding wheel is no longer possible.
reaction of the controller: If a sensor fault occurs on a front wheel, pressure is increased; on a rear wheel, pressure is decreased</td></tr>
</table>

MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 50km/h or more(31mph or more) Monitor the "Wheel speed sensor" parameter on the Scantool.

Specification : Approx. 50 km/h or more(31 mph or more)

Is it normal?

YES

▶ Fault is intermittent caused by faulty wheel speed sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Repair or replace as necessary and then go to "Component Inspection" procedure.

NO

(1) Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure.

(2) Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure.

(3) Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 50 km/h or more(31 mph or more).
   Does warning lamp remain On?

YES

▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Fault is intermittent caused by open or short of wheel speed sensor harness, faulty wheel speed sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.(Start and drive vehicle in gear and maintain vehicle speed is approx. 50km/h or more(31mph or more)).
   Are any DTCs present ?

YES

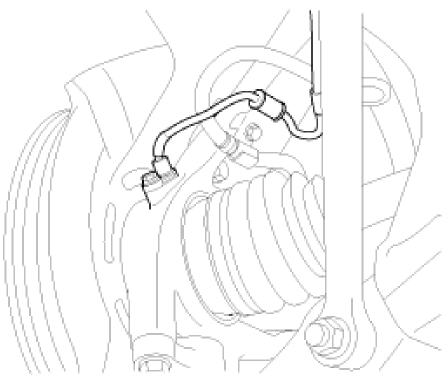
▸ Go to the applicable troubleshooting procedure.

NO

▸ A system performs normally at this time.

Brake System > Troubleshooting > C1203

COMPONENT LOCATION



GENERAL DESCRIPTION

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is an active hall-sensor type and good at temperature and noise charicteristic. Digital wave is produced as tone wheel rotate according as hall sensor principle. Frequency of duty wave is changed in proportion to rotation of tone wheel and HECU calculate vehicle speed by this frequency.

DTC DESCRIPTION

The ABS ECU monitors the wheel speed sensor circuit continuously. If the sensor signal current is continuously out of the specified range for 200 msec, then the HECU determines that the circuit is open/short, and sets this code. Warning lamp is turned OFF if the detected fault is not more than when the IG KEY is turned to ON again, and wheel speeds are more than 10 Km/h(6 MPH).

DTC DETECTING CONDITION

Item	Detecting Condition		Possible cause
DTC Strategy	Current Monitoring		
CASE 1	Monitoring period	Once after power up.	
		Wheel speed sensor test starts immediate after power. Especially shorts between WSS(Wheel speed sensor) lines and	

	Enable Conditions	shorts to UZ(ECU voltage supply) can be detected by switching single WSS channels in sequence. After end of test only the channels with no fault are switched on.	
CASE 2	Monitoring period	Continuous	• Open or short of Wheel speed sensor circuit • Faulty Wheel speed sensor • Faulty HECU
	Enable Conditions	The sensor circuitry has two current levels I = 7 mA and I= 14 mA. If the sensor line is broken, shorted to ground or shorted to supply voltage a faulty current level will be detected.WSS line faults are detected, if the fault condition exists uninterrupted for t >= 200 ms.	
Effect	No correct WSS Signal can be generated. Control of the corresponding wheel is no longer possible. If a sensor fault occurs on a front wheel, pressure is increased; on a rear wheel, pressure is decreased (until switch off).		

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

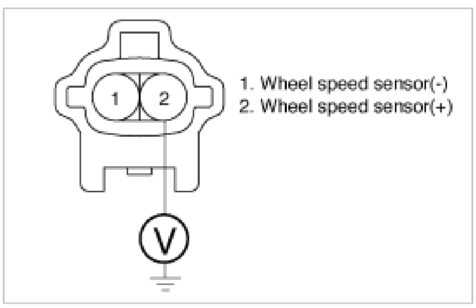
NO

▶ Go to the next step.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal "2" of the wheel speed sensor harness connector and chassis ground.

Specification : approx. B+



Is the measured voltage within specifications?

YES

▶ Go to "Signal Circuit Inspection" procedure.

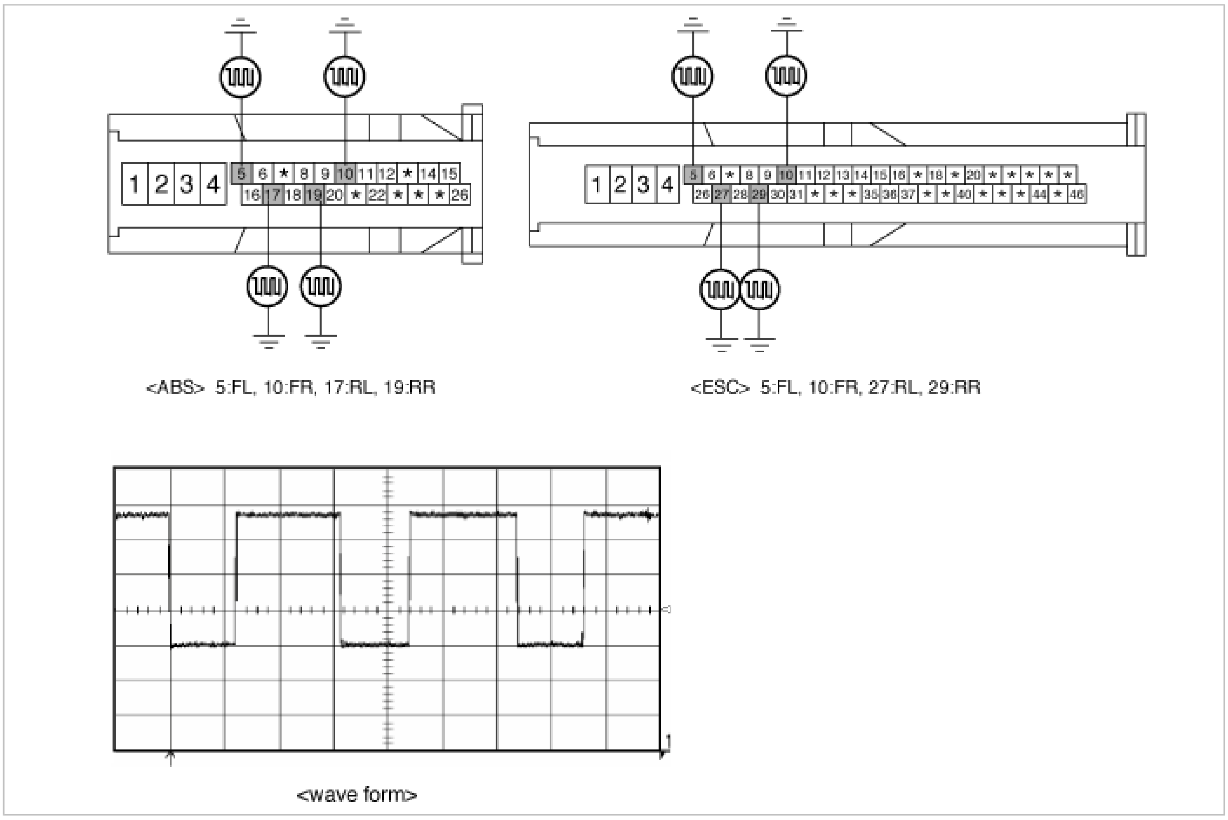
NO

▶ Check for open or short to GND in wheel speed sensor harness between terminal "16(ESP:26),9,6,8" of the HECU harness connector and terminal "2" of the Wheel speed sensor harness connector. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. By turning the wheel with hand.
3. Measure voltage between terminal "5,10,17(ESP:27),19(ESP:29)" of the HECU harness connector and chassis ground.

Specification : High : 0.89 ~ 1.26 V , Low : 0.44 ~ 0.63 V



Is the measured voltage within specifications?

YES

▸Go to "Component Inspection" procedure.

NO

▸ Check for open or short to GND in wheel speed sensor harness between terminal "1" of the wheel speed sensor harness connector and terminal "5,10,17(ESP:27),19(ESP:29)" of the HECU harness connector. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 10km/h or more(6mph or more).
   Does warning lamp remain On?

YES

▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected,replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Fault is intermittent caused by open or short of wheel speed sensor harness, faulty wheel speed sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.(Start and drive vehicle in gear and maintain vehicle speed is approx. 10 km/h or more(6 mph or more))
   Are any DTCs present?

YES

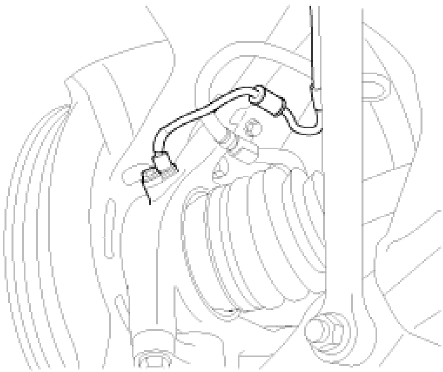
▸ Go to the applicable troubleshooting procedure.

NO

▸ A system performs normally at this time.

Brake System > Troubleshooting > C1204

COMPONENT LOCATION



GENERAL DESCRIPTION

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is an active hall-sensor type and good at temperature and noise charicteristic. Digital wave is produced as tone wheel rotate according as hall sensor principle. Frequency of duty wave is changed in proportion to rotation of tone wheel and HECU calculate vehicle speed by this frequency.

DTC DESCRIPTION

The ABS ECU monitors the wheel speed sensor signal continuously. This code is set if an abnormal speed change ratio is detected while the vehicle speed is 10~80 Km/h(6~50 MPH). Warning lamp is turned OFF if the detected fault is not more than when the IG KEY is turned to ON again, and wheel speeds are more than 12 Km/h(7MPH).

DTC DETECTING CONDITION

<table>
<tr><th>Item</th><th colspan="2">Detecting Condition</th><th>Possible cause</th></tr>
<tr><td>DTC Strategy</td><td colspan="2">Current Monitoring</td><td rowspan="6">• mproper installation of wheel speed sensor
• Abnormal Rotor and wheel bearing
• Faulty Wheel speed sensor
• Faulty HECU</td></tr>
<tr><td rowspan="2">CASE 1</td><td>Monitoring period</td><td>The monitoring is active from 10 km/h to 80km/h(6~50 MPH) and if no ABS-control is active at a front wheel and a rear wheel.</td></tr>
<tr><td>Enable Conditions</td><td>Every time, if a gap in the wheel speed sensor signal occurs cyclically with one wheel rotation, a fault counter is increased by one.
If the fault counter exceeds its limit of 10, a wheel specific fault is stored in the EEPROM.</td></tr>
<tr><td rowspan="2">CASE 2</td><td>Monitoring period</td><td>Continuous if V_Vehicle > 12 m/s</td></tr>
<tr><td>EnableConditions</td><td>No wheel speed signals within 10 ms to 20 ms at a vehicle speed> 12 m/s (43.2 km/h, 27MPH). If the dynamic sensor monitor responses, the failures will be stored into failure memory immediately after a waiting period of 60ms.</td></tr>
<tr><td>Effect</td><td colspan="2">Due to faulty wheel speed information the control of the corresponding wheel is no longer possible.
reaction of the controller: If a sensor fault occurs on a front wheel, pressure is increased; on a rear wheel, pressure is decreased.</td></tr>
</table>

MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC)
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 40 km/h or more(24 mph or more) Monitor the "Wheel

speed sensor" parameter on the Scantool.

Specification : Approx. 12 km/h or more(7 mph or more)

Is it normal?

YES

▸ Fault is intermittent caused by faulty wheel speed sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Repair or replace as necessary and then go to "Component Inspection" procedure.

NO

(1) Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure.

(2) Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure.

(3) Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 12 km/h or more(7 mph or more).
   Does warning lamp remain On?

YES

▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Fault is intermittent caused by open or short of wheel speed sensor harness, faulty wheel speed sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.(Start and drive vehicle in gear and maintain vehicle speed is approx. 12 km/h or more(7 mph or more))
   Are any DTCs present ?

YES

▸ Go to the applicable troubleshooting procedure.

NO

▸ A system performs normally at this time.

Brake System > Troubleshooting > C1205

COMPONENT LOCATION

GENERAL DESCRIPTION

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is an active hall-sensor type and good at temperature and noise charicteristic. Digital wave is produced as tone wheel rotate according as hall sensor principle. Frequency of duty wave is changed in proportion to rotation of tone wheel and HECU calculate vehicle speed by this frequency.

DTC DESCRIPTION

The ABS ECU monitors the wheel speed sensor signal continuously. This code is set when the sensor air gap is out of specified range or when No wheel speed signals within 10 ms to 20 ms at a vehicle speed > 43.2 km/h(26 MPH) . Warning lamp is turned OFF if the detected fault is not more than when the IG KEY is turned to ON again, and wheel speeds are more than 12 Km/h (7MPH)

DTC DETECTING CONDITION

<table>
<tr><th>Item</th><th colspan="2">Detecting Condition</th><th>Possible cause</th></tr>
<tr><td>DTC Strategy</td><td colspan="2">Signal monitoring</td><td rowspan="9">• Improper installation of wheel speed sensor
• Abnormal Rotor and wheel bearing
• Faulty Wheel speed sensor
• Faulty HECU</td></tr>
<tr><td rowspan="2">CASE 1</td><td>Monitoring period</td><td>Continuous except no under voltage is detected.</td></tr>
<tr><td>Enable Conditions</td><td>The test detects a failure if one (or two) wheel are at Vmin(2.75 km/h ;1.7 MPH) and the other wheels are above 12 km/h for longer than 1s.A fault could also be set during driving, if the vehicle accelerates 18 km/h after a particular wheel speed gets to vmin(2.75 km/h ;1.7 MPH) and stays there. This monitoring could only detect singular faults.</td></tr>
<tr><td rowspan="2">CASE 2</td><td>Monitoring period</td><td>Continuous except no under voltage is detected.</td></tr>
<tr><td>Enable Conditions</td><td>No wheel speed signals within 10 ms to 20 ms at a vehicle speed > 12 m/s (43,2 km/h). If the dynamic sensor monitor responses, the failures will be stored into failure memory immediately after a waiting period of 60 ms.</td></tr>
<tr><td rowspan="2">CASE 3</td><td>Monitoring period</td><td>• The main monitor (λ5) needs additional information of the ESP-sensors and is active for a velocity > 20 km/h(12 MPH) and no under voltage(9.2 V) is detected.
• The backup monitor (λ6) manages with the wheel speeds alone.</td></tr>
<tr><td>Enable Conditions</td><td>• The main monitor (λ5): If the maximum difference of wheel speeds related to maximum wheel speed exceeds 5% a wheel specific wheel speed sensor fault is set.
- the above conditions apply for 20s for 1 defective WSS.
- the above conditions apply for 40s for 2 defective WSS.
• The backup monitor (λ6):If the velocity is higher than 50 km/h(31 MPH), the deviation between the fastest and the slowest wheel must exceeds 6% related to the fastest wheel. If the velocity is below 50 km/h(31 MPH), the deviation must exceed an absolute value of 3 km/h(1.8 MPH) .
- detection filter time : normally 20s</td></tr>
<tr><td>Effect</td><td colspan="2">Due to faulty wheel speed information the control of the corresponding wheel is no longer possible.
reaction of the controller: If a sensor fault occurs on a front wheel, pressure is increased; on a rear wheel, pressure is decreased</td></tr>
</table>

MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).

2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 50km/h or more(31mph or more) Monitor the "Wheel speed sensor" parameter on the Scantool.

   Specification : Approx. 50 km/h or more(31 mph or more)

   Is it normal?

   YES

   ▸ Fault is intermittent caused by faulty wheel speed sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Repair or replace as necessary and then go to "Component Inspection" procedure.

   NO

   (1) Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure.

   (2) Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure.

   (3) Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 50 km/h or more(31 mph or more).
   Does warning lamp remain On?

   YES

   ▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Fault is intermittent caused by open or short of wheel speed sensor harness, faulty wheel speed sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.(Start and drive vehicle in gear and maintain vehicle speed is approx. 50km/h or more(31mph or more)).
   Are any DTCs present ?

   YES

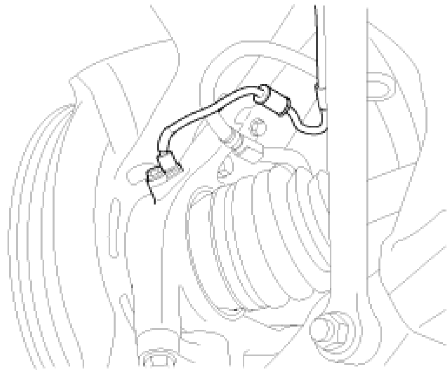
   ▸ Go to the applicable troubleshooting procedure.

   NO

   ▸ A system performs normally at this time.

Brake System > Troubleshooting > C1206

COMPONENT LOCATION



GENERAL DESCRIPTION

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is an active hall-sensor type and good at temperature and noise charicteristic. Digital wave is produced as tone wheel rotate according as hall sensor principle. Frequency of duty wave is changed in proportion to rotation of tone wheel and HECU calculate vehicle speed by this frequency.

DTC DESCRIPTION

The ABS ECU monitors the wheel speed sensor circuit continuously. If the sensor signal current is continuously out of the specified range for 200msec, then the HECU determines that the circuit is open/short, and sets this code. Warning lamp is turned OFF if the detected fault is not more than when the IG KEY is turned to ON again, and wheel speeds are more than 10 Km/h(6 MPH).

DTC DETECTING CONDITION

Item	Detecting Condition		Possible cause
DTC Strategy	Current Monitoring		• Open or short of Wheel speed sensor circuit • Faulty Wheel speed sensor • Faulty HECU
CASE 1	Monitoring period	Once after power up.	
	Enable Conditions	Wheel speed sensor test starts immediate after power. Especially shorts between WSS(Wheel speed sensor) lines and shorts to UZ(ECU voltage supply) can be detected by switching single WSS channels in sequence. After end of test only the channels with no fault are switched on.	
CASE 2	Monitoring period	Continuous	
	Enable Conditions	The sensor circuitry has two current levels I = 7 mA and I= 14mA. If the sensor line is broken, shorted to ground or shorted to supply voltage a faulty current level will be detected.WSS line faults are detected, if the fault condition exists uninterrupted for t >= 200 ms.	
Effect	No correct WSS Signal can be generated. Control of the corresponding wheel is no longer possible. If a sensor fault occurs on a front wheel, pressure is increased; on a rear wheel, pressure is decreased (until switch off).		

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

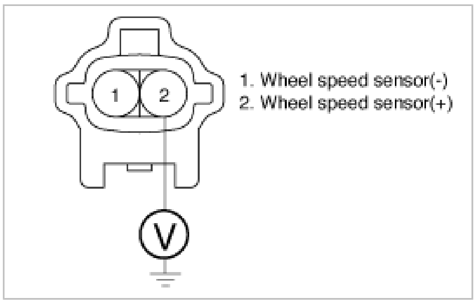
NO

▸ Go to the next step.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal "2" of the wheel speed sensor harness connector and chassis ground.

Specification : approx. B+



Is the measured voltage within specifications?

YES

▸ Go to "Signal Circuit Inspection" procedure.

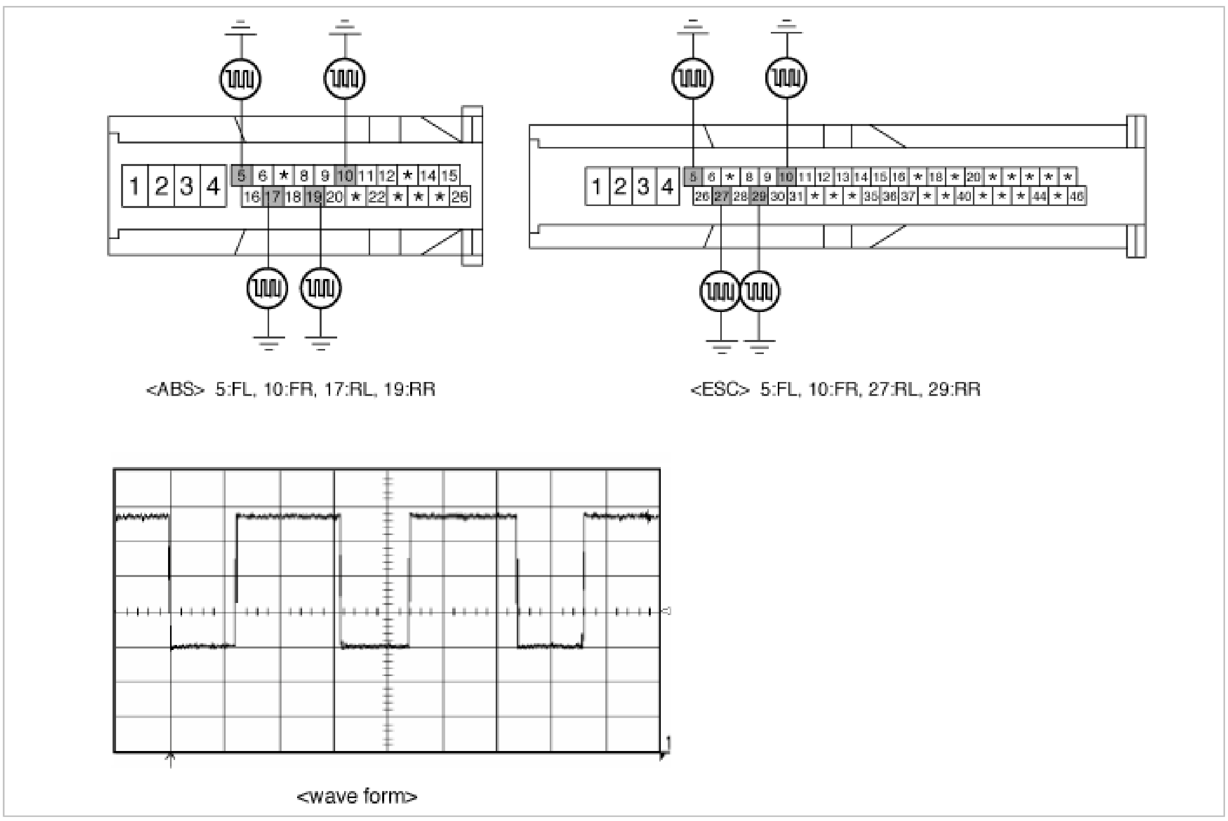
NO

▸ Check for open or short to GND in wheel speed sensor harness between terminal "16(ESP:26),9,6,8" of the HECU harness connector and terminal "2" of the Wheel speed sensor harness connector. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. By turning the wheel with hand.
3. Measure voltage between terminal "5,10,17(ESP:27),19(ESP:29)" of the HECU harness connector and chassis ground.

Specification : High : 0.89 ~ 1.26 V , Low : 0.44 ~ 0.63 V



Is the measured voltage within specifications?

YES

▸Go to "Component Inspection" procedure.

NO

▸ Check for open or short to GND in wheel speed sensor harness between terminal "1" of the wheel speed sensor harness connector and terminal "5,10,17(ESP:27),19(ESP:29)" of the HECU harness connector. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 10km/h or more(6mph or more).
   Does warning lamp remain On?

YES

▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected,replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Fault is intermittent caused by open or short of wheel speed sensor harness, faulty wheel speed sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.(Start and drive vehicle in gear and maintain vehicle speed is approx. 10 km/h or more(6 mph or more))
   Are any DTCs present?

YES

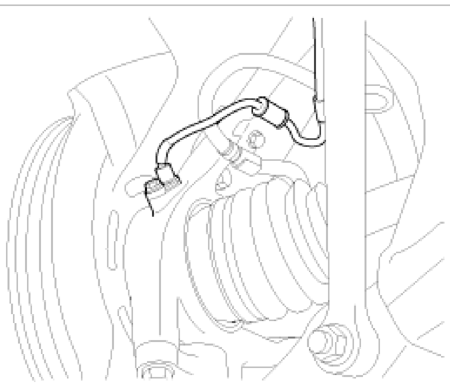
▸ Go to the applicable troubleshooting procedure.

NO

▸ A system performs normally at this time.

Brake System > Troubleshooting > C1207

COMPONENT LOCATION



GENERAL DESCRIPTION

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is an active hall-sensor type and good at temperature and noise charicteristic. Digital wave is produced as tone wheel rotate according as hall sensor principle. Frequency of duty wave is changed in proportion to rotation of tone wheel and HECU calculate vehicle speed by this frequency.

DTC DESCRIPTION

The ABS ECU monitors the wheel speed sensor signal continuously. This code is set if an abnormal speed change ratio is detected while the vehicle speed is 10~80 Km/h(6~50 MPH). Warning lamp is turned OFF if the detected fault is not more than when the IG KEY is turned to ON again, and wheel speeds are more than 12 Km/h(7MPH).

DTC DETECTING CONDITION

<table>
<tr><th>Item</th><th colspan="2">Detecting Condition</th><th>Possible cause</th></tr>
<tr><td>DTC Strategy</td><td colspan="2">Current Monitoring</td><td rowspan="6">• mproper installation of wheel speed sensor
• Abnormal Rotor and wheel bearing
• Faulty Wheel speed sensor
• Faulty HECU</td></tr>
<tr><td rowspan="2">CASE 1</td><td>Monitoring period</td><td>The monitoring is active from 10 km/h to 80km/h(6~50 MPH) and if no ABS-control is active at a front wheel and a rear wheel.</td></tr>
<tr><td>Enable Conditions</td><td>Every time, if a gap in the wheel speed sensor signal occurs cyclically with one wheel rotation, a fault counter is increased by one.
If the fault counter exceeds its limit of 10, a wheel specific fault is stored in the EEPROM.</td></tr>
<tr><td rowspan="2">CASE 2</td><td>Monitoring period</td><td>Continuous if V_Vehicle > 12 m/s</td></tr>
<tr><td>EnableConditions</td><td>No wheel speed signals within 10 ms to 20 ms at a vehicle speed> 12 m/s (43.2 km/h, 27MPH). If the dynamic sensor monitor responses, the failures will be stored into failure memory immediately after a waiting period of 60ms.</td></tr>
<tr><td>Effect</td><td colspan="2">Due to faulty wheel speed information the control of the corresponding wheel is no longer possible.
reaction of the controller: If a sensor fault occurs on a front wheel, pressure is increased; on a rear wheel, pressure is decreased.</td></tr>
</table>

MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC)
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 40 km/h or more(24 mph or more) Monitor the "Wheel speed sensor" parameter on the Scantool.

   Specification : Approx. 12 km/h or more(7 mph or more)

   Is it normal?

   YES

   ▸ Fault is intermittent caused by faulty wheel speed sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Repair or replace as necessary and then go to "Component Inspection" procedure.

   NO

   (1) Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure.

   (2) Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure.

   (3) Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 12 km/h or more(7 mph or more).
   Does warning lamp remain On?

   YES

   ▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Fault is intermittent caused by open or short of wheel speed sensor harness, faulty wheel speed sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.(Start and drive vehicle in gear and maintain vehicle speed is approx. 12 km/h or more(7 mph or more))
   Are any DTCs present ?

YES

▸ Go to the applicable troubleshooting procedure.

NO

▸ A system performs normally at this time.

Brake System > Troubleshooting > C1208

COMPONENT LOCATION

GENERAL DESCRIPTION

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is an active hall-sensor type and good at temperature and noise charicteristic. Digital wave is produced as tone wheel rotate according as hall sensor principle. Frequency of duty wave is changed in proportion to rotation of tone wheel and HECU calculate vehicle speed by this frequency.

DTC DESCRIPTION

The ABS ECU monitors the wheel speed sensor signal continuously. This code is set when the sensor air gap is out of specified range or when No wheel speed signals within 10 ms to 20 ms at a vehicle speed > 43.2 km/h(26 MPH) . Warning lamp is turned OFF if the detected fault is not more than when the IG KEY is turned to ON again, and wheel speeds are more than 12 Km/h (7MPH)

DTC DETECTING CONDITION

Item	Detecting Condition		Possible cause
DTC Strategy	Signal monitoring		
CASE 1	Monitoring period	Continuous except no under voltage is detected.	
	Enable Conditions	The test detects a failure if one (or two) wheel are at Vmin(2.75 km/h ;1.7 MPH) and the other wheels are above 12 km/h for longer than 1s.A fault could also be set during driving, if the vehicle accelerates 18 km/h after a particular wheel speed gets to vmin(2.75 km/h ;1.7 MPH) and stays there. This monitoring	

		could only detect singular faults.	
CASE 2	Monitoring period	Continuous except no under voltage is detected.	
	Enable Conditions	No wheel speed signals within 10 ms to 20 ms at a vehicle speed > 12 m/s (43,2 km/h). If the dynamic sensor monitor responses, the failures will be stored into failure memory immediately after a waiting period of 60 ms.	
CASE 3	Monitoring period	• The main monitor (λ5) needs additional information of the ESP-sensors and is active for a velocity > 20 km/h(12 MPH) and no under voltage(9.2 V) is detected. • The backup monitor (λ6) manages with the wheel speeds alone.	• Improper installation of wheel speed sensor • Abnormal Rotor and wheel bearing • Faulty Wheel speed sensor • Faulty HECU
	Enable Conditions	• The main monitor (λ5): If the maximum difference of wheel speeds related to maximum wheel speed exceeds 5% a wheel specific wheel speed sensor fault is set. - the above conditions apply for 20s for 1 defective WSS. - the above conditions apply for 40s for 2 defective WSS. • The backup monitor (λ6):If the velocity is higher than 50 km/h(31 MPH), the deviation between the fastest and the slowest wheel must exceeds 6% related to the fastest wheel. If the velocity is below 50 km/h(31 MPH), the deviation must exceed an absolute value of 3 km/h(1.8 MPH) . - detection filter time : normally 20s	
Effect	Due to faulty wheel speed information the control of the corresponding wheel is no longer possible. reaction of the controller: If a sensor fault occurs on a front wheel, pressure is increased; on a rear wheel, pressure is decreased		

MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 50km/h or more(31mph or more) Monitor the "Wheel speed sensor" parameter on the Scantool.

Specification : Approx. 50 km/h or more(31 mph or more)

Is it normal?

YES

▸ Fault is intermittent caused by faulty wheel speed sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Repair or replace as necessary and then go to "Component Inspection" procedure.

NO

(1) Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure.

(2) Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure.

(3) Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 50 km/h or more(31 mph or more).
   Does warning lamp remain On?

YES

▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Fault is intermittent caused by open or short of wheel speed sensor harness, faulty wheel speed sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.(Start and drive vehicle in gear and maintain vehicle speed is approx. 50km/h or more(31mph or more)).
   Are any DTCs present ?

YES

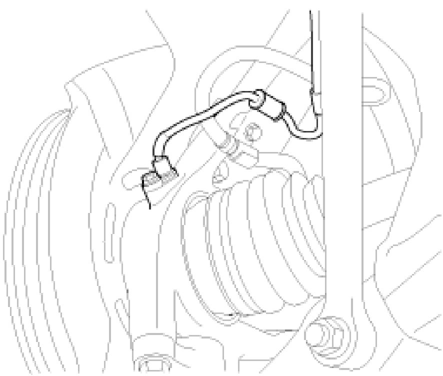
▸ Go to the applicable troubleshooting procedure.

NO

▸ A system performs normally at this time.

Brake System > Troubleshooting > C1209

COMPONENT LOCATION



GENERAL DESCRIPTION

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is an active hall-sensor type and good at temperature and noise charicteristic. Digital wave is produced as tone wheel rotate according as hall sensor principle. Frequency of duty wave is changed in proportion to rotation of tone wheel and HECU calculate vehicle speed by this frequency.

DTC DESCRIPTION

The ABS ECU monitors the wheel speed sensor circuit continuously. If the sensor signal current is continuously out of the specified range for 200msec, then the HECU determines that the circuit is open/short, and sets this code. Warning lamp is turned OFF if the detected fault is not more than when the IG KEY is turned to ON again, and wheel speeds are more than 10 Km/h(6 MPH).

DTC DETECTING CONDITION

Item	Detecting Condition		Possible cause
DTC Strategy	Current Monitoring		
CASE 1	Monitoring period	Once after power up.	
		Wheel speed sensor test starts immediate after power. Especially shorts between WSS(Wheel speed sensor) lines and	

	Enable Conditions	shorts to UZ(ECU voltage supply) can be detected by switching single WSS channels in sequence. After end of test only the channels with no fault are switched on.	
CASE 2	Monitoring period	Continuous	• Open or short of Wheel speed sensor circuit • Faulty Wheel speed sensor • Faulty HECU
	Enable Conditions	The sensor circuitry has two current levels I = 7 mA and I= 14mA. If the sensor line is broken, shorted to ground or shorted to supply voltage a faulty current level will be detected.WSS line faults are detected, if the fault condition exists uninterrupted for t >= 200 ms.	
Effect	No correct WSS Signal can be generated. Control of the corresponding wheel is no longer possible. If a sensor fault occurs on a front wheel, pressure is increased; on a rear wheel, pressure is decreased (until switch off).		

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

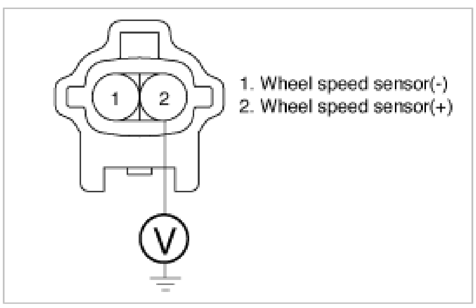
NO

▸ Go to the next step.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal "2" of the wheel speed sensor harness connector and chassis ground.

Specification : approx. B+



Is the measured voltage within specifications?

YES

▸ Go to "Signal Circuit Inspection" procedure.

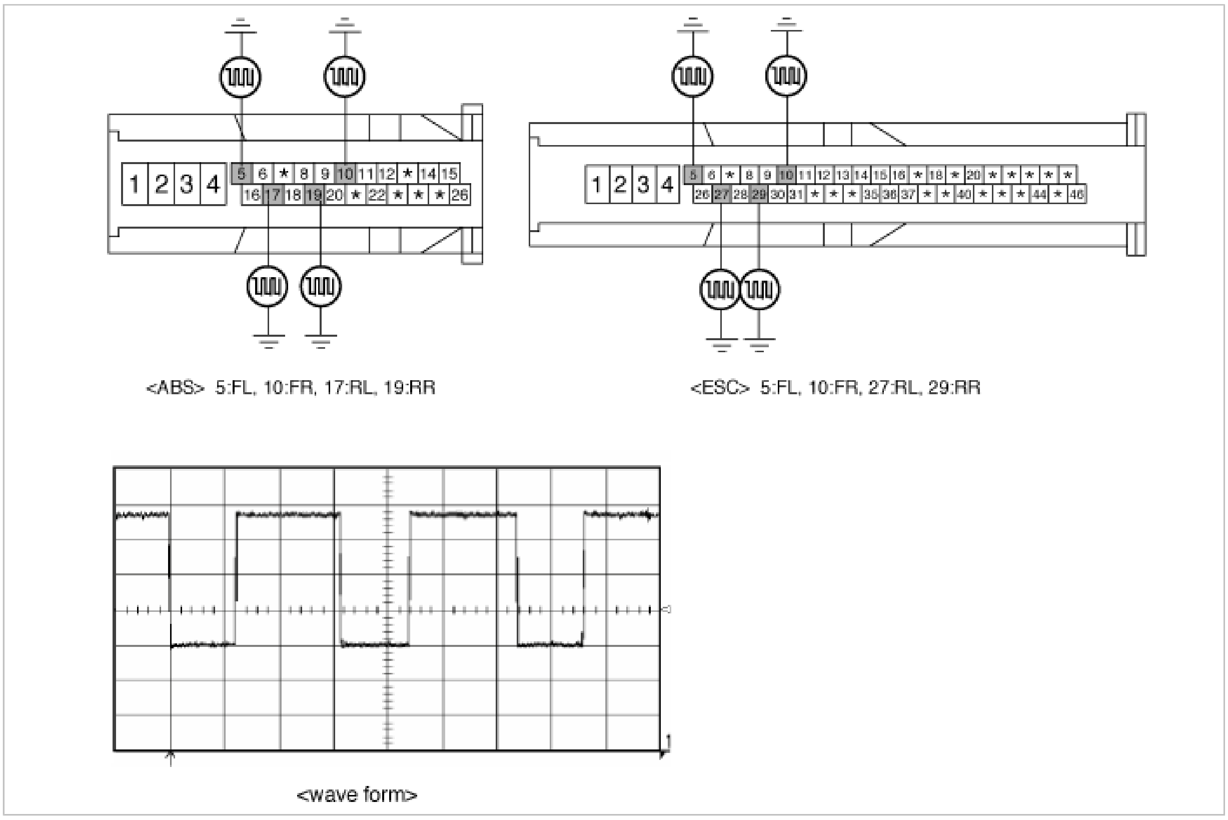
NO

▸ Check for open or short to GND in wheel speed sensor harness between terminal "16(ESP:26),9,6,8" of the HECU harness connector and terminal "2" of the Wheel speed sensor harness connector. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. By turning the wheel with hand.
3. Measure voltage between terminal "5,10,17(ESP:27),19(ESP:29)" of the HECU harness connector and chassis ground.

Specification : High : 0.89 ~ 1.26 V , Low : 0.44 ~ 0.63 V



Is the measured voltage within specifications?

YES

▸Go to "Component Inspection" procedure.

NO

▸ Check for open or short to GND in wheel speed sensor harness between terminal "1" of the wheel speed sensor harness connector and terminal "5,10,17(ESP:27),19(ESP:29)" of the HECU harness connector. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 10km/h or more(6mph or more).
   Does warning lamp remain On?

YES

▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected,replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Fault is intermittent caused by open or short of wheel speed sensor harness, faulty wheel speed sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.(Start and drive vehicle in gear and maintain vehicle speed is approx. 10 km/h or more(6 mph or more))
   Are any DTCs present?

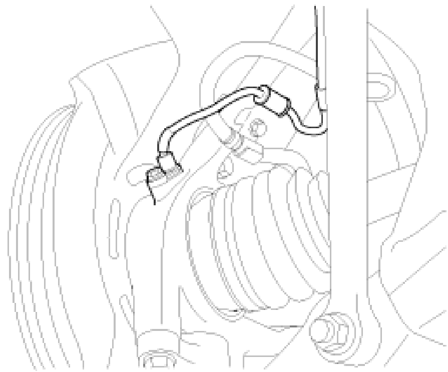
YES

▸ Go to the applicable troubleshooting procedure.

NO

▸ A system performs normally at this time.

COMPONENT LOCATION



GENERAL DESCRIPTION

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is an active hall-sensor type and good at temperature and noise charicteristic. Digital wave is produced as tone wheel rotate according as hall sensor principle. Frequency of duty wave is changed in proportion to rotation of tone wheel and HECU calculate vehicle speed by this frequency.

DTC DESCRIPTION

The ABS ECU monitors the wheel speed sensor signal continuously. This code is set if an abnormal speed change ratio is detected while the vehicle speed is 10~80 Km/h(6~50 MPH). Warning lamp is turned OFF if the detected fault is not more than when the IG KEY is turned to ON again, and wheel speeds are more than 12 Km/h(7MPH).

DTC DETECTING CONDITION

Item	Detecting Condition		Possible cause
DTC Strategy	Current Monitoring		• mproper installation of wheel speed sensor • Abnormal Rotor and wheel bearing • Faulty Wheel speed sensor • Faulty HECU
CASE 1	Monitoring period	The monitoring is active from 10 km/h to 80km/h(6~50 MPH) and if no ABS-control is active at a front wheel and a rear wheel.	
	Enable Conditions	Every time, if a gap in the wheel speed sensor signal occurs cyclically with one wheel rotation, a fault counter is increased by one. If the fault counter exceeds its limit of 10, a wheel specific fault is stored in the EEPROM.	
CASE 2	Monitoring period	Continuous if V_Vehicle > 12 m/s	
	EnableConditions	No wheel speed signals within 10 ms to 20 ms at a vehicle speed> 12 m/s (43.2 km/h, 27MPH). If the dynamic sensor monitor responses, the failures will be stored into failure memory immediately after a waiting period of 60ms.	
Effect	Due to faulty wheel speed information the control of the corresponding wheel is no longer possible. reaction of the controller: If a sensor fault occurs on a front wheel, pressure is increased; on a rear wheel, pressure is decreased.		

MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC)
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 40 km/h or more(24 mph or more) Monitor the "Wheel

speed sensor" parameter on the Scantool.

Specification : Approx. 12 km/h or more(7 mph or more)

Is it normal?

YES

▸ Fault is intermittent caused by faulty wheel speed sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Repair or replace as necessary and then go to "Component Inspection" procedure.

NO

(1) Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure.

(2) Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure.

(3) Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 12 km/h or more(7 mph or more).
   Does warning lamp remain On?

YES

▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Fault is intermittent caused by open or short of wheel speed sensor harness, faulty wheel speed sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.(Start and drive vehicle in gear and maintain vehicle speed is approx. 12 km/h or more(7 mph or more))
   Are any DTCs present ?

YES

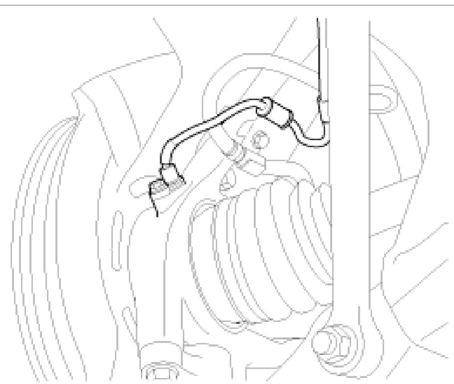
▸ Go to the applicable troubleshooting procedure.

NO

▸ A system performs normally at this time.

Brake System > Troubleshooting > C1211

COMPONENT LOCATION



GENERAL DESCRIPTION

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is an active hall-sensor type and good at temperature and noise charicteristic. Digital wave is produced as tone wheel rotate according as hall sensor principle. Frequency of duty wave is changed in proportion to rotation of tone wheel and HECU calculate vehicle speed by this frequency.

DTC DESCRIPTION

The ABS ECU monitors the wheel speed sensor signal continuously. This code is set when the sensor air gap is out of specified range or when No wheel speed signals within 10 ms to 20 ms at a vehicle speed > 43.2 km/h(26 MPH) . Warning lamp is turned OFF if the detected fault is not more than when the IG KEY is turned to ON again, and wheel speeds are more than 12 Km/h (7MPH)

DTC DETECTING CONDITION

<table>
<tr><th>Item</th><th colspan="2">Detecting Condition</th><th>Possible cause</th></tr>
<tr><td>DTC Strategy</td><td colspan="2">Signal monitoring</td><td rowspan="10">• Improper installation of wheel speed sensor
• Abnormal Rotor and wheel bearing
• Faulty Wheel speed sensor
• Faulty HECU</td></tr>
<tr><td rowspan="2">CASE 1</td><td>Monitoring period</td><td>Continuous except no under voltage is detected.</td></tr>
<tr><td>Enable Conditions</td><td>The test detects a failure if one (or two) wheel are at Vmin(2.75 km/h ;1.7 MPH) and the other wheels are above 12 km/h for longer than 1s.A fault could also be set during driving, if the vehicle accelerates 18 km/h after a particular wheel speed gets to vmin(2.75 km/h ;1.7 MPH) and stays there. This monitoring could only detect singular faults.</td></tr>
<tr><td rowspan="2">CASE 2</td><td>Monitoring period</td><td>Continuous except no under voltage is detected.</td></tr>
<tr><td>Enable Conditions</td><td>No wheel speed signals within 10 ms to 20 ms at a vehicle speed > 12 m/s (43,2 km/h). If the dynamic sensor monitor responses, the failures will be stored into failure memory immediately after a waiting period of 60 ms.</td></tr>
<tr><td rowspan="2">CASE 3</td><td>Monitoring period</td><td>• The main monitor (λ5) needs additional information of the ESP-sensors and is active for a velocity > 20 km/h(12 MPH) and no under voltage(9.2 V) is detected.
• The backup monitor (λ6) manages with the wheel speeds alone.</td></tr>
<tr><td>Enable Conditions</td><td>• The main monitor (λ5): If the maximum difference of wheel speeds related to maximum wheel speed exceeds 5% a wheel specific wheel speed sensor fault is set.
- the above conditions apply for 20s for 1 defective WSS.
- the above conditions apply for 40s for 2 defective WSS.
• The backup monitor (λ6):If the velocity is higher than 50 km/h(31 MPH), the deviation between the fastest and the slowest wheel must exceeds 6% related to the fastest wheel. If the velocity is below 50 km/h(31 MPH), the deviation must exceed an absolute value of 3 km/h(1.8 MPH) .
- detection filter time : normally 20s</td></tr>
<tr><td>Effect</td><td colspan="2">Due to faulty wheel speed information the control of the corresponding wheel is no longer possible.
reaction of the controller: If a sensor fault occurs on a front wheel, pressure is increased; on a rear wheel, pressure is decreased</td></tr>
</table>

MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).

2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 50km/h or more(31mph or more) Monitor the "Wheel speed sensor" parameter on the Scantool.

Specification : Approx. 50 km/h or more(31 mph or more)

Is it normal?

YES

▸ Fault is intermittent caused by faulty wheel speed sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Repair or replace as necessary and then go to "Component Inspection" procedure.

NO

(1) Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure.

(2) Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure.

(3) Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 50 km/h or more(31 mph or more).
   Does warning lamp remain On?

YES

▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Fault is intermittent caused by open or short of wheel speed sensor harness, faulty wheel speed sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.(Start and drive vehicle in gear and maintain vehicle speed is approx. 50km/h or more(31mph or more)).
   Are any DTCs present ?

YES

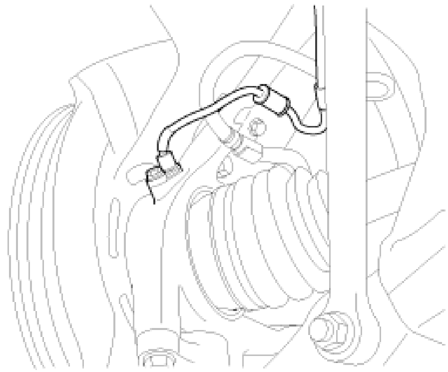
▸ Go to the applicable troubleshooting procedure.

NO

▸ A system performs normally at this time.

Brake System > Troubleshooting > C1213

COMPONENT LOCATION



GENERAL DESCRIPTION

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is an active hall-sensor type and good at temperature and noise charicteristic. Digital wave is produced as tone wheel rotate according as hall sensor principle. Frequency of duty wave is changed in proportion to rotation of tone wheel and HECU calculate vehicle speed by this frequency.

DTC DESCRIPTION

The ABS ECU monitors the wheel speed sensor signal continuously. The monitoring reports a failure if the ABS target slip breaks out.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	Signal monitoring	• Improper installation of wheel speed sensor • Abnormal Rotor and wheel bearing • Faulty Wheel speed sensor • Faulty HECU
Enable Conditions	The monitoring reports a failure if the ABS target slip is exceeded for a time period >= 10 s at one or more wheels. If the driver brakes or the velocity is lower than 50 km/h(31 MPH) the detection time is enlarged to 60s.	
Monitoring period	Continuous	
Effect	Reduced function of the ESC system.	

MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 10 km/h or more(6 mph or more). Monitor the "Wheel speed sensor" parameter on the Scantool.

   Specification : Approx.10 km/h or more(6 mph or more)

   Is it normal?

   YES

   ▸ Fault is intermittent caused by faulty wheel speed sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Repair or replace as necessary and then go to "Component Inspection" procedure.

   NO

   (1) Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure.

   (2) Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure.

   (3) Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 10 km/h or more(6 mph or more).
   Does warning lamp remain On?

   YES

   ▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Fault is intermittent caused by open or short of wheel speed sensor harness, faulty wheel speed sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.(Start and drive vehicle in gear and maintain vehicle speed is approx. 10 km/h or more(6 mph or more))
   Are any DTCs present?

   YES

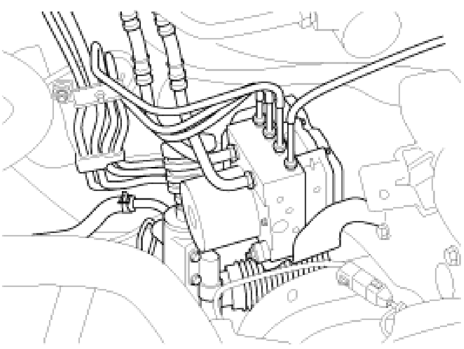
   ▸ Go to the applicable troubleshooting procedure.

   NO

   ▸ System performing to specification at this time.

Brake System > Troubleshooting > C1235

COMPONENT LOCATION



GENERAL DESCRIPTION

The pressure sensor senses the brake oil pressure to judge driver's brake intention when ESC is operating.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible cause
DTC Strategy		Signal monitoring	
		1. Sensor supply voltage is continuous monitored (except power on). A sensor supply failure is detected if Sensor Supply Voltage > 5.3 V OR Sensor Supply Voltage < 4.7 V for t ≥ 60 ms. 2. Pressure signal 1 (DSO: original pressure value) is continuous monitored (except power on). Line faults like open, short to GND or short to UZ are detected. A Fault is	

<table>
<tr><td rowspan="2">C1235</td><td>Enable Conditions</td><td>set if the DSO signal is U DSO > 4.7 V OR U DSO < 0.3 V for a time t >= 100 ms.
3. Pressure signal 2 (DSI: inverted pressure value) is continuous monitored (except power on). Line faults like open, short to GND or short to UZ are detected. A Fault is set if the DSI signal isU DSI > 4.7 V OR U DSI < 0.3 V for a time t >= 100 ms.
4. Plausibility of DSO and DSI pressure lines are continuous monitored.Internal DS5 faults (amplification-, bridge-, analog-digital converter malfunction, etc.) are detected if DSO+DSI < 4.5 V OR DSO+DSI > 5.5 V is present longer than t >= 100 ms .
5. POS(Power On Selftest) detects internal sensor malfunctions. sensor element, amplification, etc.) The test phase is divided in two 60 ms parts. DSO signal must be <0.5 V for 30 ms. In phase 2 DSO signal must be between 1.9 V and 3.1V for also 30 ms then the POS Test is passed. The test phase is divided in two 60 ms parts. DSO and DSI signal must be < 0.5 V for 30 ms. In phase 2 DSO and DSI signal must be between 1.9 V and 3.1 V for also 30 ms then the POS Test is passed.</td><td rowspan="5">• Faulty HECU</td></tr>
<tr><td>Monitoring period</td><td>1~4 : Continuous
5 : Once during Power Up</td></tr>
<tr><td rowspan="2">C1237</td><td>Enable Conditions</td><td>1. The DS(Pressure sensor)-offset value must be in the range of 15 bar. A failure is detected if this range is exceeded.
2. There are three monitoring which have different thresholds concerning the allowed pressure and the detection time.
1) Plausibility 1 :
For redundancy reasons an additional hardware-BLS-signal is created by the pressure sensor signal.
If the pressure sensor is compensated, the threshold for generating the hardware-BLS or signal is 10 bar.
If the pressure sensor is not compensated, the threshold is increased by 15 bar.
If this signal is set without any hardware-BLS-signals being set, and if no pump is operated during that time, a fault is set after the braking.
2) Plausibility 2 :
If the pressure signal is higher than 30 bar and not both of the hardware-BLS are set, a fault is stored after 2s.
3) Plausibility 3:
If the pressure signal is higher than 80 bar and not both of the hardware-BLS are set, a fault is stored after 1s.</td></tr>
<tr><td>Monitoring period</td><td>1. After DS-initialization, no under voltage, no pumps are running and no BLS-signal is set.
2. Continuous in the normal operating voltage range.</td></tr>
<tr><td colspan="2">Effect</td><td>No Pressure Signal available.</td></tr>
</table>

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
   Does warning lamp remain On?

YES

▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.
   Are any DTCs present?

   YES

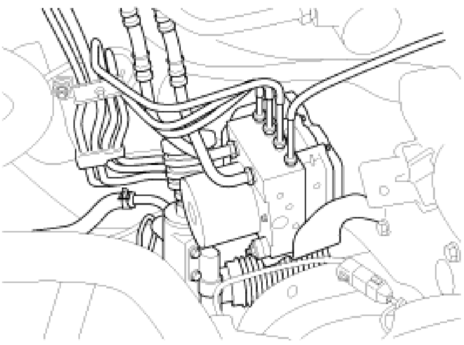
   ▸ Go to the applicable troubleshooting procedure.

   NO

   ▸ System performing to specification at this time.

Brake System > Troubleshooting > C1237

COMPONENT LOCATION



GENERAL DESCRIPTION

The pressure sensor senses the brake oil pressure to judge driver's brake intention when ESP is operating.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible cause
DTC Strategy		Signal monitoring	
C1235	Enable Conditions	1. Sensor supply voltage is continuous monitored (except power on). A sensor supply failure is detected if Sensor Supply Voltage > 5.3 V OR Sensor Supply Voltage < 4.7 V for t ≥ 60 ms. 2. Pressure signal 1 (DSO: original pressure value) is continuous monitored (except power on). Line faults like open, short to GND or short to UZ are detected. A Fault is set if the DSO signal is U DSO > 4.7 V OR U DSO < 0.3 V for a time t >= 100 ms. 3. Pressure signal 2 (DSI: inverted pressure value) is continuous monitored (except power on). Line faults like open, short to GND or short to UZ are detected. A Fault is set if the DSI signal isU DSI > 4.7 V OR U DSI < 0.3 V for a time t >= 100 ms. 4. Plausibility of DSO and DSI pressure lines are continuous monitored.Internal DS5 faults (amplification-, bridge-, analog-digital converter malfunction, etc.) are detected if DSO+DSI < 4.5 V OR DSO+DSI > 5.5 V is present longer than t >= 100 ms . 5. POS(Power On Selftest) detects internal sensor	

		malfunctions. sensor element, amplification, etc.) The test phase is divided in two 60 ms parts. DSO signal must be <0.5 V for 30 ms. In phase 2 DSO signal must be between 1.9 V and 3.1V for also 30 ms then the POS Test is passed. The test phase is divided in two 60 ms parts. DSO and DSI signal must be < 0.5 V for 30 ms. In phase 2 DSO and DSI signal must be between 1.9 V and 3.1 V for also 30 ms then the POS Test is passed.	
	Monitoring period	1~4 : Continuous 5 : Once during Power Up	
C1237	Enable Conditions	1. The DS(Pressure sensor)-offset value must be in the range of 15 bar. A failure is detected if this range is exceeded. 2. There are three monitoring which have different thresholds concerning the allowed pressure and the detection time. 1) Plausibility 1 : For redundancy reasons an additional hardware-BLS-signal is created by the pressure sensor signal. If the pressure sensor is compensated, the threshold for generating the hardware-BLS or signal is 10 bar. If the pressure sensor is not compensated, the threshold is increased by 15 bar. If this signal is set without any hardware-BLS-signals being set, and if no pump is operated during that time, a fault is set after the braking. 2) Plausibility 2 : If the pressure signal is higher than 30 bar and not both of the hardware-BLS are set, a fault is stored after 2s. 3) Plausibility 3: If the pressure signal is higher than 80 bar and not both of the hardware-BLS are set, a fault is stored after 1s.	• Faulty HECU
	Monitoring period	1. After DS-initialization, no under voltage, no pumps are running and no BLS-signal is set. 2. Continuous in the normal operating voltage range.	
Effect		No Pressure Signal available.	

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
   Does warning lamp remain On?

   YES

   ▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.
   Are any DTCs present?

   YES

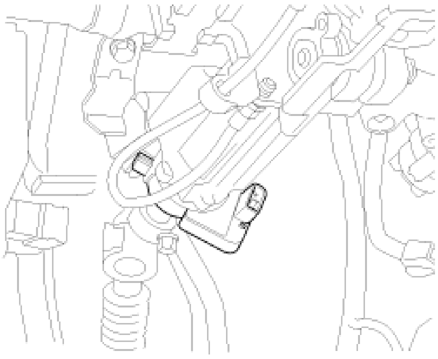
   ▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Brake System > Troubleshooting > C1260

COMPONENT LOCATION



DTC DESCRIPTION

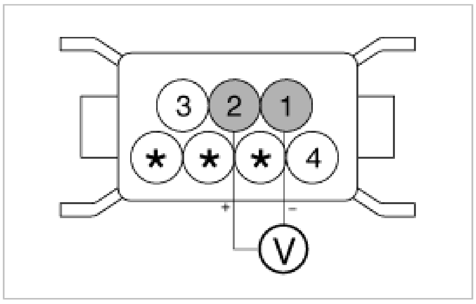
The Steering wheel angle sensor determines the direction of the rotation.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	Signal monitoring	• Faulty steering wheel sensor
Enable Conditions	1. LWS(steering angle sensor) offset monitoring : If the offset value exceeds a threshold of approximately 15 deg a LWS-fault is determined. 2. LWS Gradient monitoring : - signal gradient (steering angle velocity) from one 20 ms-cycle to another is higher than 40° or - change of this gradient (steering angle acceleration) is higher than 15° 3. LWS range monitoring : If value is higher than possible range for more than 300 ms a fault is determined. 4. LWS Plausibility monitoring : Dependent on the driving conditions failures in size of [10 + 60 m/s / FZREF(reference speed] deg at steering angle are recognized within 400 .. 4800 ms . 5. LWS Constant Signal Monitoring : If there is no change in the signal, but a right AND left cornering has been recognized, a fault is determined. (lateral acceleration > 2 m/s^2 in combination with a yaw rate > 6 °/s in both directions). 6. LWS Wrong Sign Monitoring : If the signals don't fit and forwards driving is detected, a fault is determined. 7. LWS Message counter monitoring : If the message counter shows an increase higher than 3 or lower than 1 in one 20 ms-cyle, a fault is stored after 160 ms.	
Monitoring period	1. Continuous during driving. 2. no under voltage and at least one LWS-message was sent in the current 20 ms-cycle. 3. After initialization and no under voltage detected. 4. Continuous during driving. 5. Initialization once in every ignition cycle. 6,7. Continuous during driving.	
Effect	Reduced controller function caused by faulty LWS signal.	

POWER SUPPLY CIRCUIT INSPECTION

1. Measure the voltage between terminal 1 and 2 of the steering angle sensor connector.



Is the voltage within 8~16V?

YES

▸ Clear the DTC, and then drive a vehicle over 40 Km/h(24 MPH) .If ESC warning lamp is turned on, replace the steering wheel sensor. Then go to "Verification of Vehicle Repair" procedure.

NO

▸ Check harness and connector between the HECU and the steering angle sensor. If NG ,replace the steering wheel sensor.

COMPONENT INSPECTION

1. CHECK INSTALLATION OF STEERING ANGLE SENSOR
   Check if the steering angle sensor is properly installed.
   Is the installation proper?

YES

▸ Check power of steering angle sensor.

NO

▸ Reinstall the steering angle sensor properly.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and practice the steering angle sensor calibration.(See page BR-161).
2. Select "Diagnostic Trouble Codes(DTCs)" mode.
3. Using a scantool, Clear DTC.
4. Operate the vehicle within DTC Detecting Condition in General Information.
   Are any DTCs present?

YES

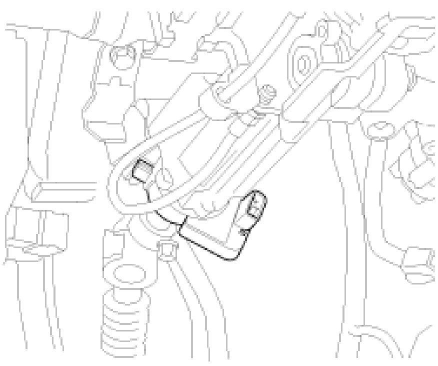
▸ Go to the applicable troubleshooting procedure.

NO

▸ A system performs normally at this time.

Brake System > Troubleshooting > C1261

COMPONENT LOCATION



DTC DESCRIPTION

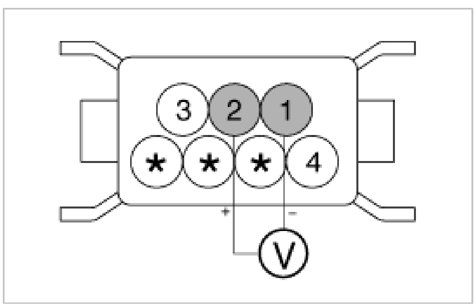
The Steering wheel angle sensor determines the direction of the rotation.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	Signal monitoring	• Faulty steering wheel sensor
Enable Conditions	1. LWS(steering angle sensor) offset monitoring : If the offset value exceeds a threshold of approximately 15 deg a LWS-fault is determined. 2. LWS Gradient monitoring : - signal gradient (steering angle velocity) from one 20 ms-cycle to another is higher than 40° or - change of this gradient (steering angle acceleration) is higher than 15° 3. LWS range monitoring : If value is higher than possible range for more than 300 ms a fault is determined. 4. LWS Plausibility monitoring : Dependent on the driving conditions failures in size of [10 + 60 m/s / FZREF(reference speed] deg at steering angle are recognized within 400 .. 4800 ms . 5. LWS Constant Signal Monitoring : If there is no change in the signal, but a right AND left cornering has been recognized, a fault is determined. (lateral acceleration > 2 m/s^2 in combination with a yaw rate > 6 °/s in both directions). 6. LWS Wrong Sign Monitoring : If the signals don't fit and forwards driving is detected, a fault is determined. 7. LWS Message counter monitoring : If the message counter shows an increase higher than 3 or lower than 1 in one 20 ms-cyle, a fault is stored after 160 ms.	
Monitoring period	1. Continuous during driving. 2. no under voltage and at least one LWS-message was sent in the current 20 ms-cycle. 3. After initialization and no under voltage detected. 4. Continuous during driving. 5. Initialization once in every ignition cycle. 6,7. Continuous during driving.	
Effect	Reduced controller function caused by faulty LWS signal.	

POWER SUPPLY CIRCUIT INSPECTION

1. Measure the voltage between terminal 1 and 2 of the steering angle sensor connector.



Is the voltage within 8~16 V?

YES

▸ Clear the DTC, and then drive a vehicle over 40 Km/h(24 MPH) .If ESP warning lamp is turned on, replace the steering wheel sensor. Then go to "Verification of Vehicle Repair" procedure.

NO

▸ Check harness and connector between the HECU and the steering angle sensor. If NG ,replace the steering wheel sensor.

COMPONENT INSPECTION

1. CHECK INSTALLATION OF STEERING ANGLE SENSOR
   Check if the steering angle sensor is properly installed.
   Is the installation proper?

YES

▸ Check power of steering angle sensor.

NO

▸ Reinstall the steering angle sensor properly.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and practice the steering angle sensor calibration.(See page BR-161).
2. Select "Diagnostic Trouble Codes(DTCs)" mode.
3. Using a scantool, Clear DTC.
4. Operate the vehicle within DTC Detecting Condition in General Information.
   Are any DTCs present?

YES

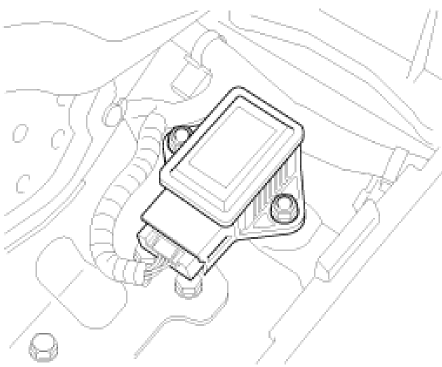
▸ Go to the applicable troubleshooting procedure.

NO

▸ A system performs normally at this time.

Brake System > Troubleshooting > C1282

COMPONENT LOCATION



GENERAL DESCRIPTION

The yaw-rate & Lateral G sensor are used for the stability of a vehicle. The yaw-rate is used to measure angular velocity while the Lateral G is to measure the force that moves the vehicle away from the center, when a vehicle is cornering.

DTC DESCRIPTION

This code sets when there is an open or short in the circuit of the yaw-rate & lateral G sensor.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	Signal monitoring	• Open or short of Yaw Rate & Lateral G sensor circuit • Faulty Yaw Rate & Lateral G sensor • Faulty HECU
Enable Conditions	1. The AY(Acceleration Sensor) sensor voltage is monitored for a is out of range value. A line fault is detected if AY < 0.3 V OR AY > 4.7 V for a time t >= 100 ms.. 2. Open line, short to GND and short to UZ are detected. The DRS sensor voltage is monitored for a is out of range value. A line fault is detected, if - DRSS < 0.225 V OR DRSS > 4.774 V for a time t >= 100 ms. - DRSR < 2.1 V OR DRSR > 2.9 V for a time t > 200 ms. ※DRSS (Yaw sensor reference), DRS(yaw sensor), DRSR(Yaw sensor signal)	
Monitoring period	Continuous	
Effect	Reduced controller function caused by faulty DRS and AY signal.	

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

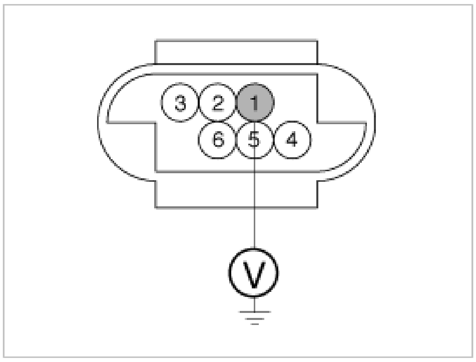
NO

▸ Go to the next step.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal "1" of the Yaw Rate & Lateral G sensor harness connector and chassis ground.

Specification : approx. B+



Is the measured voltage within specifications?

YES

▸ Go to "Ground Circuit Inspection" procedure.

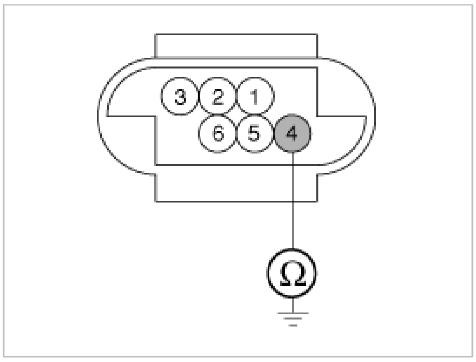
NO

▸ Check for open or short to GND in the Yaw Rate & Lateral G sensor harness between terminal "3" of the Yaw Rate & Lateral G sensor harness connector and terminal "16,20" of the HECU harness connector. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect Yaw Rate & Lateral G sensor connector
3. Measure resistance between terminal "4" of the Yaw Rate & Lateral G sensor harness connector and chassis ground.

Specification : Approx. below 1 Ω



Is the measured resistance within specifications?

YES

▸ Go to "Signal Circuit Inspection" procedure.

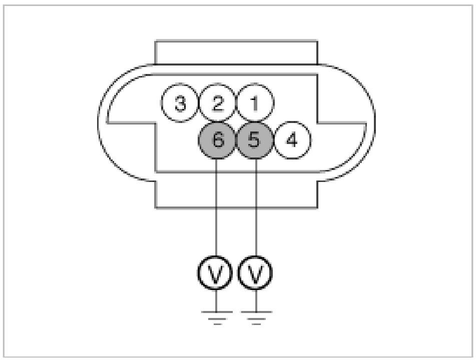
NO

▸ Check for open or short in the Yaw Rate & Lateral G sensor harness between terminal "4" of the Yaw Rate & Lateral G sensor harness connector and terminal "15" of the HECU harness connector. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Ignition "ON".
2. Measure voltage between terminal "5, 6" of the Yaw Rate & Lateral G sensor harness connector and chassis ground.

Specification : Approx. 2.5 V



Is the measured voltage within specifications?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Check for open or short in the Yaw Rate & Lateral G sensor harness between terminal "5, 6" of the Yaw Rate & Lateral G sensor harness connector and terminal "16, 20" of the HECU harness connector. Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
   Does warning lamp remain On?

YES

▸ Substitute with a known-good Yaw Rate & Lateral G sensor and check for proper operation. If problem is corrected, replace Yaw Rate & Lateral G sensor and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Fault is intermittent caused by open or short of Yaw Rate & Lateral G sensor harness and/or faulty Yaw Rate & Lateral G sensor or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.
   Are any DTCs present?

YES

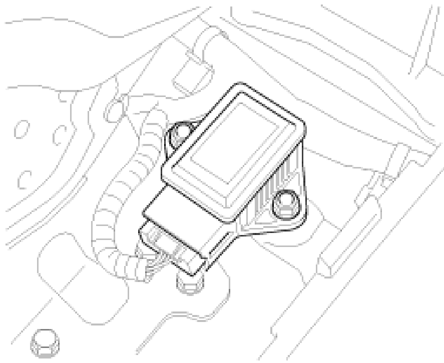
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Brake System > Troubleshooting > C1283

COMPONENT LOCATION



GENERAL DESCRIPTION

The yaw-rate & Lateral G sensor are used for the stability of a vehicle. The yaw-rate is used to measure angular velocity while the Lateral G is to measure the force that moves the vehicle away from the center, when a vehicle is cornering.

DTC DESCRIPTION

This code sets when there is an open or short in the circuit of the yaw-rate & lateral G sensor.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	Signal monitoring	• Faulty Lateral Acceleration Sensor • Faulty Yaw Rate Sensor • Faulty HECU
EnableConditions	This test detects internal AY(Acceleration sensor) sensor malfunctions. 1. During the POS measure window (t = 100 ms) the AY signal must be for at least t = 60 ms between 0.2 V < AY < 0.8 V 2. If during stable vehicle behavior an AY-Failure larger than approximately 2.5 m/s occurs, the ESP controller will disregard the AY sensor information so that a false ESP intervention is prevented. A fault is recognized after 1.6 s during model validity. 3. If the offset value exceeds a threshold of approximately 2.25 m/s² an AY fault is determined. 4. During standstill the plausible range of |AY| is below 7 m/s². If the filtered value of |AY| is larger than 7 m/s² for more than 400 m/s a fault is set. 5. If the lateral acceleration is higher than 15 m/s² for more than 800 ms a suspected failure bit is set. After 1,6 s a fault is detected. 6. Standstill compensation: Failure threshold 5.25 °/s.Fast compensation (during driving if no standstill compensation could be completed): Failure threshold is 7,5 °/s.Long-term ("normal") compensation (during driving after succeeded standstill or fast offset compensation): Failure threshold is 7,5 °/s. 7. The fault criteria is approx. 25 % sensitivity failure. 8. If the measured yaw rate deviates more than 2.5 °/s plus a dynamicthreshold from the reference yaw rate during model validity, a failure isrecognized after 1.6 s. The dynamic threshold is between 2.5 °/s and more than 5 °/s. A typical value is 3 °/s. 9. The measured yaw rate and the model yaw rates, calculated from theWSS and LWS are compared. If the signals doesn.t fit and forward driving is recognized, a fault is determined. 10. In case of a YRS-failure, the YRS will send an abnormal yaw rate signal.	
Monitoring period	1. Once after power up and no low voltage. 2,3,8. Continuous during stable driving. 4. Continuous during standstill. 5. Continuous, if no under voltage is detected. 6. Continuous, dependent on driving situation. 7. During stable cornering after completed offset compensation. 9. After every standstill 10. Continuous	

Effect	Reduced controller function caused by faulty DRS(yaw sensor) signal.	

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

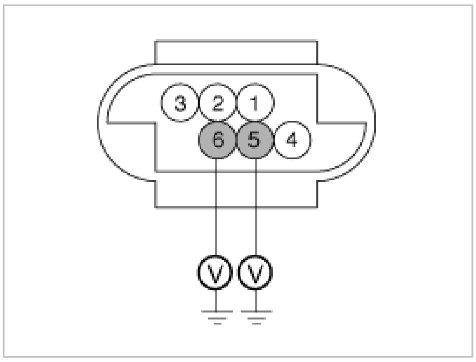
NO

▸ Go to the next step.

SIGNAL CIRCUIT INSPECTION

1. Ignition "ON".
2. Measure voltage between terminal "5, 6" of the Yaw Rate & Lateral G sensor harness connector and chassis ground.

Specification : Approx. 2.5 V



Is the measured voltage within specifications?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Check for open or short in the Yaw Rate & Lateral G sensor harness between terminal "5, 6" of the Yaw Rate & Lateral G sensor harness connector and terminal "16, 20" of the HECU harness connector. Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 20 km/h or more(12 mph or more)
   Does warning lamp remain On?

YES

▸ Substitute with a known-good Yaw Rate & Lateral G sensor and check for proper operation. If problem is corrected, replace Yaw Rate & Lateral G sensor and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Fault is intermittent caused by open or short of Yaw Rate & Lateral G sensor harness and/or faulty Yaw Rate & Lateral G sensor or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.(Start and drive vehicle in gear and maintain vehicle speed is approx. 20 km/h or more(12 mph or more))

Are any DTCs present?

YES

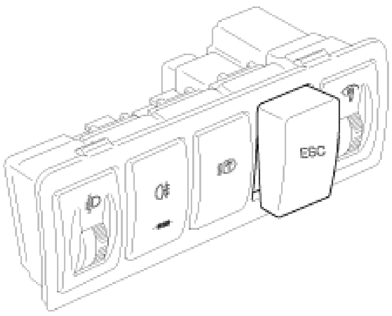
▸ Go to the applicable troubleshooting procedure.

NO

▸ A system performs normally at this time.

Brake System > Troubleshooting > C1503

COMPONENT LOCATION



GENERAL DESCRIPTION

Driver can inhibit the ESC control by ESC switch. When switch signal send into HECU, ESC warning lamp go ON and ESC control is stopped and if next switch signal is inputted again, ESC control is ready. This function is used for sporty driving or vehicle inspection.

DTC DESCRIPTION

Trouble code is set when the condition that the level of ESC switch is high is continued for 60sec.When the ESC switch failure is set there is no signal in the warning lamp and HECU inhibit the ESC control and allow the ABS/EBD control.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	Short circuit monitoring	• Open or short ESC switch
Enable Conditions	Trouble code is set when the condition that the level of ESC switch is high is continued for 60 sec.	
Monitoring period	Continuous	

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

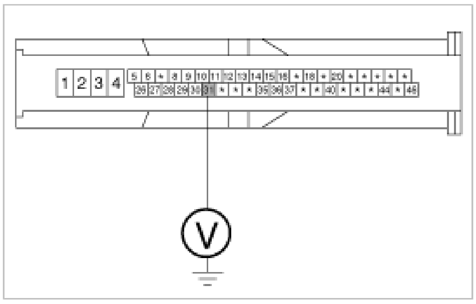
NO

▸ Go to the next step.

SIGNAL CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF" & ESC Switch"ON".
2. Measure voltage between terminal "31" of the HECU harness connector and chassis ground.

Specification : Approx B+



Is the measured voltage within specifications?

YES

▸ Fault is intermittent caused by open or short in ESC switch line, faulty ESC switch or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

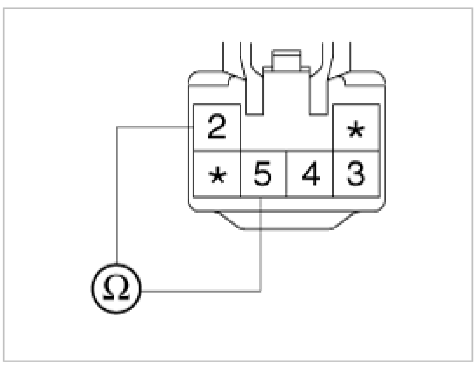
NO

▸ Check for damaged harness and poor connection in the power harness between the battery terminal(+) and the terminal "31" of the HECU harness connector . Check for open or blown 10A fuse referring to "Circuit Diagram" . Repair as necessary and then go to "Verification of vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Disconnect ESC switch connector.
3. Press the ESC switch.
4. Measure resistance between terminal "2" of the ESC switch harness connector and terminal "5" of the ESC switch harness connector.

Specification : Approx below 1 Ω



Is the measured resistance within specifications?

YES

▸ Fault is intermittent caused by faulty ESC switch or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

NO

▸ Substitute with a known-good ESC switch and check for proper operation. If problem is corrected, replace ESC switch and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.
   Are any DTCs present?

YES

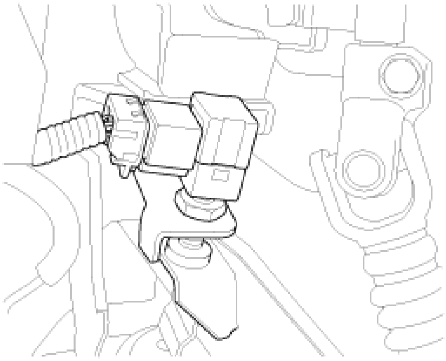
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Brake System > Troubleshooting > C1513

COMPONENT LOCATION



GENERAL DESCRIPTION

The brake light switch indicates brake pedal status to the ABS control unit. The switch is turned on when brake is depressed. The brake light switch is a normally-open contact which runs to battery voltage when active (brake depressed). When passive (brake not depressed), the cable is grounded via the break light bulbs.

DTC DESCRIPTION

The brake light signal is a reference to judge driver's will for braking. ABS ECU monitor open circuit of brake light switch for normal ABS control.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	Open circuit monitoring	• Open circuit in brake switch line • Faulty brake light switch • Faulty input stage in HECU
Enable Conditions	If the BLS-signals is high for 60 s, while the gas pedal is stepped, with vehicle speed > 3 m/s, offset compensated pVor < 5 bar and no control is active, a fault is set.	
Monitoring period	Continuous, if no under voltage is detected.	
Effect	Reduced function caused by a faulty brake light switch.	

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

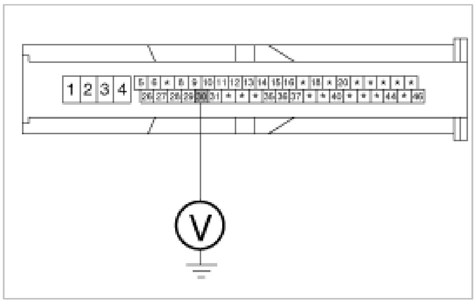
NO

▸ Go to the next step.

SIGNAL CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Press the brake pedal.
3. Measure voltage between the terminal "30" of the HECU harness connector and chassis ground.

Specification : Brake Light Switch - Approx. B+



Is the measured voltage within specifications?

YES

▸ Fault is intermittent caused by open harness in brake lamp switch and brake switch line, faulty brake lamp switch was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

NO

▸ Check for damaged harness and poor connection in the power harness between the battery terminal(+) and the terminal "30" of the HECU harness connector . Check for open or blown 15A STOP fuse. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

COMPONENT INSPECTION

1. Connect a ohmmeter to the connector of brake light switch, and check whether or not there is continuity when the plunger of the brake light switch is pushed in and when it is released.
   The switch is in good condition if there is no continuity when the plunger is pushed.
2. Is there no continuity when the plunger is pushed?

YES

▸ Fault is intermittent caused by open harness in brake light switch line, faulty brake lamp switch or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

NO

▸ Substitute with a known-good brake lamp switch and check for proper operation. If problem is corrected, replace brake lamp switch and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.
   Are any DTCs present?

YES

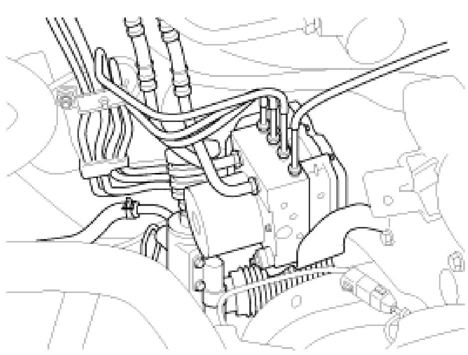
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Brake System > Troubleshooting > C1604

COMPONENT LOCATION



GENERAL DESCRIPTION

The HECU is composed of a ECU (Electronic Control Unit) and a HCU(Hydraulic Control Unit) , so the HECU hardware includes all solenoid valves inside the unit as well as the ECU.

DTC DESCRIPTION

The HECU monitors the operation of the IC components such as memory, register, A/D converter and so on. The HECU sets this code when the EEPROM data read by the master processor is different than prior data writed, or when the master/slave processor detects abnormal operation in RAM, Status Register, Interrupt, Timer, A/D converter or cycle time.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	Internal monitoring	• Faulty HECU
EnableConditions	1. Internal control unit failures of the Micro controller and peripheral integrated circuits will be continuous monitored for proper function. 2. After EEPROM-values have been read from EEPROM, the values are monitored for corrupt data. Failure is set if: 1) Checksum not correct or 2) PSW-EEPROM-Handler reported unknown failure during EEPROM-value reading. 3. Evaluate EEPROM reading sequence. If EEPROM reading sequence take longer then 3 s, a failure is set.	
Monitoring period	1.Continuos 2,3.directly after ignition on, during reading of EEPROM-values.	
Effect	No control is available.	

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
   Does warning lamp remain On?

   YES

   ▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.
   Are any DTCs present?

   YES

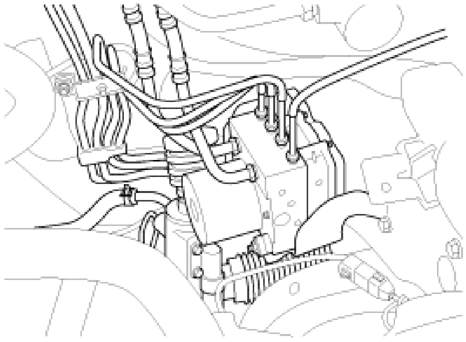
   ▸ Go to the applicable troubleshooting procedure.

   NO

   ▸ System performing to specification at this time.

Brake System > Troubleshooting > C1605

COMPONENT LOCATION



GENERAL DESCRIPTION

The CAN is for sending and receiving the information for TCS(ESC) control, between the HECU and EMS/TCU.

DTC DESCRIPTION

This code shows in case that there is an error on the CAN hardware. In this case, replace the HECU and check.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	CAN RAM monitoring	• Faulty HECU
Enable Conditions	1. Monitoring whether the initialization software has write access to the configuration registers of the CAN-controller module.Faults are detected immediately. 2. Monitoring includes line short to ground, line short to supply voltage and mutual line short. Line interruptions are detected by CAN message monitor.After detecting a BUSOFF failure the transmission is reinitialized. A BUSOFF fault is established if re-initialization is tried for 15 times in sequence without success.	
Monitoring period	1. immediate during start up. 2. Continuous	
Effect	1. CAN-Controller is not initialized correctly. Possibly no reception or transmission of messages. 2. CAN messages can not be processed. BLS is not controlled.	

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
   Does warning lamp remain On?

   YES

   ▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Fault is intermittent caused by short harness in CAN line and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.

3. Operate the vehicle within DTC Detecting Condition in General Information.
   Are any DTCs present?

   YES

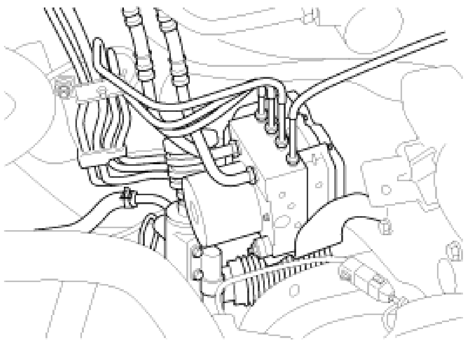
   ▸ Go to the applicable troubleshooting procedure.

   NO

   ▸ System performing to specification at this time.

Brake System > Troubleshooting > C1611

COMPONENT LOCATION



GENERAL DESCRIPTION

The CAN is for sending and receiving the information for TCS(ESC) control, between the HECU and EMS/TCU.

DTC DESCRIPTION

This code shows in case that there is an error on the CAN hardware. In this case, replace the HECU and check.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	CAN RAM monitoring	• Faulty HECU • Faulty ECM • Faulty TCU • Faulty Steering angle sensor
Enable Conditions	1. Purpose is to monitor if received message was not received by CAN controller of ABS8/ESC8 ECU.Faults are detected after filtering. Filtering has to be customized. 2. Purpose is to monitor if transmitted message has the expected data length.Actually the monitoring is reduced the check for too short messages.A message with oversized data length causes no fault. Faults are detected immediate.	
Monitoring period	Continuous	
Effect	1. CAN messages are not correct erceived. 2. CAN messages are not according to what was expected at compile time of the software.	

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
   Does warning lamp remain On?

   YES

   ▸ Substitute with a known-good ECM(C1611)[TCU(C1612)/Steering angle sensor(C1623)] and check for proper operation. If problem is corrected, replace ECM(C1611)[TCU(C1612)/Steering angle sensor(C1623)] and then go to "Verification of Vehicle Repair" procedure. If NG, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Fault is intermittent caused by faulty ECM(C1611)[TCU(C1612)/Steering angle sensor(C1623)] and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.
   Are any DTCs present?

YES

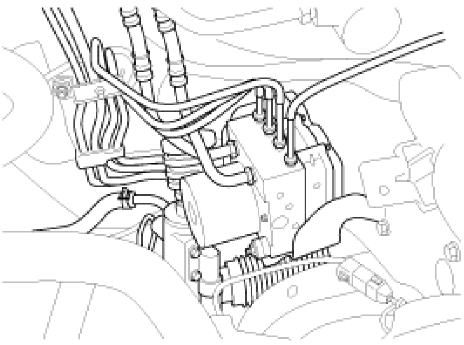
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Brake System > Troubleshooting > C1612

COMPONENT LOCATION



GENERAL DESCRIPTION

The CAN is for sending and receiving the information for TCS(ESP) control, between the HECU and EMS/TCU.

DTC DESCRIPTION

This code shows in case that there is an error on the CAN hardware. In this case, replace the HECU and check.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	CAN RAM monitoring	• Faulty HECU • Faulty ECM • Faulty TCU • Faulty Steering angle sensor
Enable Conditions	1. Purpose is to monitor if received message was not received by CAN controller of ABS8/ESC8 ECU.Faults are detected after filtering. Filtering has to be customized. 2. Purpose is to monitor if transmitted message has the expected data length.Actually the monitoring is reduced the check for too short messages.A message with oversized data length causes no fault. Faults are detected immediate.	
Monitoring period	Continuous	
Effect	1. CAN messages are not correct erceived. 2. CAN messages are not according to what was expected at compile time of the software.	

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
   Does warning lamp remain On?

YES

▸ Substitute with a known-good ECM(C1611)[TCU(C1612)/Steering angle sensor(C1623)] and check for proper operation. If problem is corrected, replace ECM(C1611)[TCU(C1612)/Steering angle sensor(C1623)] and then go to "Verification of Vehicle Repair" procedure. If NG, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Fault is intermittent caused by faulty ECM(C1611)[TCU(C1612)/Steering angle sensor(C1623)] and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.
   Are any DTCs present?

YES

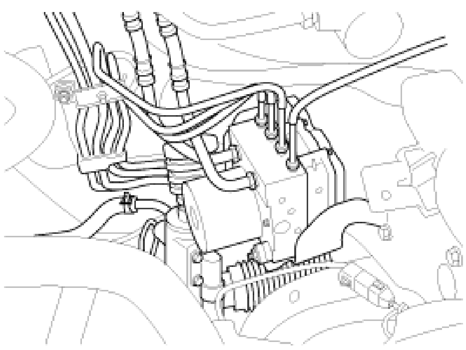
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Brake System > Troubleshooting > C1616

COMPONENT LOCATION



GENERAL DESCRIPTION

The CAN is for sending and receiving the information for TCS(ESC) control, between the HECU and EMS/TCU.

DTC DESCRIPTION

The HECU checks the CAN communication lines for normal TCS control, and sets this code if CAN BUS OFF status is detected for more than 100 ms.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	Open or short circuit monitoring	• Open or short circuit in CAN line
Enable Conditions	Monitoring includes line short to ground, line short to supply voltage and mutual line short. Line interruptions are detected by CAN message monitor. After detecting a BUSOFF failure the transmission is reinitialized. A BUSOFF fault is established if re-initialization is tried for 15 times in sequence without success.	

Monitoring period	Continuous	
Effect	CAN messages can not be processed. BLS(Brake light switch) is not controlled.	

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

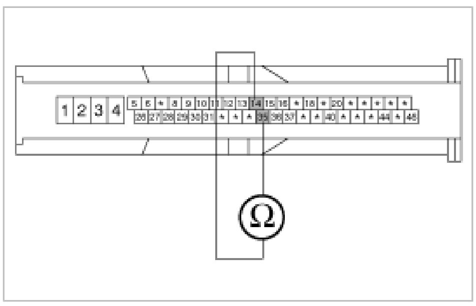
NO

▸ Go to the next step.

SIGNAL CIRCUIT INSPECTION

1. Ignition "OFF".
2. Measure resistance between terminal "35" of the HECU harness connector and terminal "14" of the HECU harness connector.

Specification : Approx. 60 Ω



Is the measured resistance within specifications?

YES

▸ Fault is intermittent caused by open or short in CAN signal harnessor was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

NO

▸ Check for open or short in CAN signal harness between terminal "35" of the HECU harness connector and terminal "14" of the HECU harness connector. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.
   Are any DTCs present?

YES

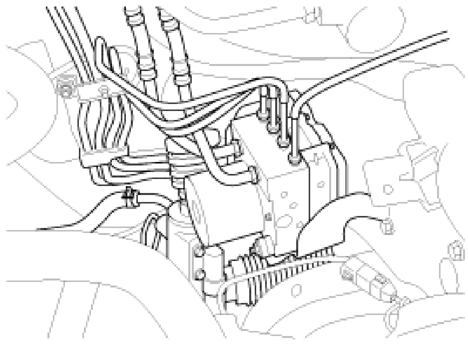
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Brake System > Troubleshooting > C1623

COMPONENT LOCATION



GENERAL DESCRIPTION

The CAN is for sending and receiving the information for TCS(ESP) control, between the HECU and EMS/TCU.

DTC DESCRIPTION

This code shows in case that there is an error on the CAN hardware. In this case, replace the HECU and check.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	CAN RAM monitoring	• Faulty HECU • Faulty ECM • Faulty TCU • Faulty Steering angle sensor
Enable Conditions	1. Purpose is to monitor if received message was not received by CAN controller of ABS8/ESP8 ECU.Faults are detected after filtering. Filtering has to be customized. 2. Purpose is to monitor if received message has the expected data length.Actually the monitoring is reduced the check for too short messages.A message with oversized data length causes no fault. Faults are detected immediate.	
Monitoring period	Continuous	
Effect	1. CAN messages are not correct received. 2. CAN messages are not according to what was expected at compile time of the software.	

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
   Does warning lamp remain On?

   YES

   ▸ Substitute with a known-good ECM(C1611)[TCU(C1612)/Steering angle sensor(C1623)] and check for proper operation. If problem is corrected, replace ECM(C1611)[TCU(C1612)/Steering angle sensor(C1623)] and then go to "Verification of Vehicle Repair" procedure. If NG, replace HECU and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Fault is intermittent caused by faulty ECM(C1611)[TCU(C1612)/Steering angle sensor(C1623)] and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.
   Are any DTCs present?

YES

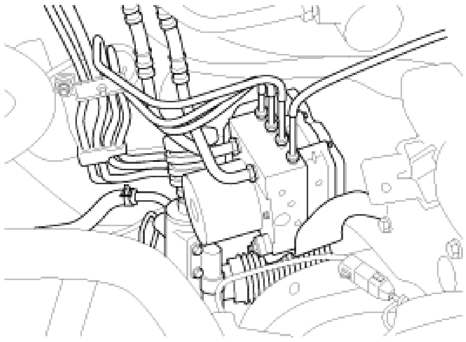
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Brake System > Troubleshooting > C1625

COMPONENT LOCATION



GENERAL DESCRIPTION

The CAN is for sending and receiving the information for TCS(ESC) control, between the HECU and EMS/TCU.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	Open or short circuit monitoring	• Open or short circuit in CAN line • Faulty HECU
Enable Conditions	Purpose is to monitor if transmitted message was not transmitted on time by the CAN controller of ABS8/ESC8 ECU. Faults are detected after filtering.	
Monitoring period	Continuous	
Effect	CAN messages are not transmitted on time.	

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Go to the next step.

SIGNAL CIRCUIT INSPECTION

1. Check for open or short in CAN signal harness between terminal "35" of the HECU harness connector and PCM harness connector.
2. Check for open or short in CAN signal harness between terminal "14" of the HECU harness connector and PCM harness connector.
   Is it normal?

YES

▸ Replace the HECU. Then go to "Verification of vehicle Repair" procedure.

NO

▸ Repair or replace harness and connector.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.
   Are any DTCs present?

   YES

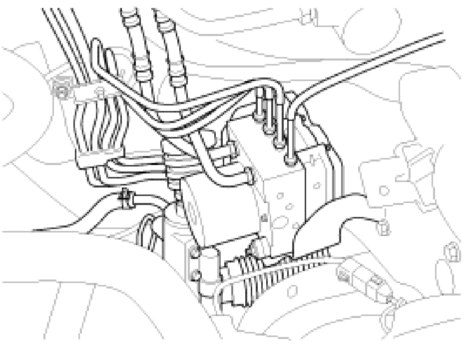
   ▸ Go to the applicable troubleshooting procedure.

   NO

   ▸ System performing to specification at this time.

Brake System > Troubleshooting > C1626

COMPONENT LOCATION



DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	Internal error	• Faulty HECU
Enable Conditions	1. Under normal conditions, the inlet valves of all four wheels are not closed during control for longer than 1.28 s. If the controller requests pressure-hold or pressure-decrease for longer than 1.28 s, a fault is stored. 2. The monitoring reports a failure if continuous ESC control occurs for a time period >= 10 s. A continuous ESC control for longer than 10 s is not possible under normal conditions.	
Monitoring period	1. Continuous 2. detected under voltage and a fault is not already detected.	
Effect	1. Reduced function as all wheel valves will remain in pressure build-up position. 2. Reduced function of the ESC system, no more ESC, no more ABS.	

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
   Does warning lamp remain On?

   YES

   ▸ Replace the HECU. Then go to "Verification of vehicle Repair" procedure.

   NO

▸ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.
   Are any DTCs present?

YES

▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Brake System > Troubleshooting > C1702

GENERAL DESCRIPTION

A hardware difference of ECU does not exist according to the specification of the vehicle, but a software changes according to deference of vehicle parameter. The ESC stores variant code (data of engine, displacement volume , T/M) at the ECU memory. Since then a ESC uses the stored data.

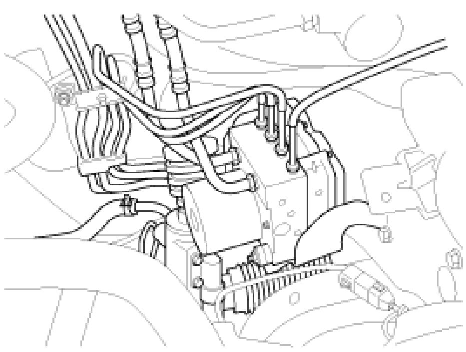
COMPONENT INSPECTION

*Variant Coding (See page BR - 142)

1. Install a EMS/TCU/ESC normally.
2. Connect a scanner to the vehicle.
3. IGN On
4. Scanner On
5. Select a brake mode.
6. Push the Variant Coding button.
7. Scanner Off
8. IGN Off
9. Remove the scanner.
10. IGN On
11. Finish the Variant Coding.

Brake System > Troubleshooting > C2112

COMPONENT LOCATION



GENERAL DESCRIPTION

The ABS ECU supplies battery power to all solenoid valves by way of a valve relay which is controlled by the Electronic Control UNIT(ECU). The valve relay and all solenoid valves are installed inside the HECU (Hydraulic and Electronic Control Unit).

DTC DESCRIPTION

ABS ECU monitors voltage of the valve relay to check if ABS ECU can perform ABS control normally. When the valve relay is switched to ON, the HECU will set this code if the solenoid drive voltage is below permissible voltage ranges for a period of time. When the valve relay is switched to OFF, the HECU sets this code if the solenoid drive voltage is over the permissible voltage range for a period of time.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	Battery Voltage Monitoring	• Open or short of power supply circuit • Faulty HECU • Faulty of the valve relay fuse(20 A)
Enable Conditions	1. Watchdog and VR(valve relay) function is tested during startup.FSA test(Fail Save Circuit test) detects if the VR/Enable remains in off position when it is turned on and vice versa. Reason could be short to GND or UZ(ECU voltage supply), interrupted lines or a defective output stage etc. 2. A Fault is detected if UVR(valve relay voltage) < 0.8 * UZ for a time t > 500 ms. 3. This test evaluates the function of the VR (valve relay) periodically. The VR is switched off and back on. VR malfunction and UVR short to UZ or UBVR (supply solenoid valves) and medium or high ohmic short of UVR (or a valve) to UZ, UBVR(supply solenoid valves) or GND are detected.	
Monitoring period	1.Once during startup. 2,3.Continuous	
Effect	No valve actuation possible.	

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

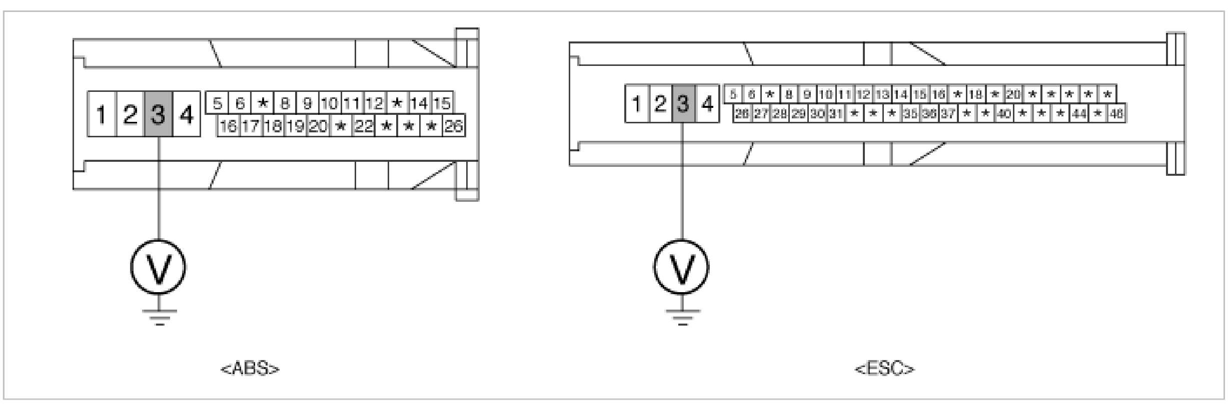
NO

▸ Go to the next step.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "OFF"
2. Disconnect HECU connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal "3" of the HECU harness connector and chassis ground.

Specification :Approx. B+



Is the measured voltage within specifications?

YES

▸ Go to "Ground Circuit Inspection" procedure.

NO

▸ Check for open or short in power harness between battery terminal(+) and terminal "3" of the HECU harness connector. Check for open or blown 20A fuse . Repair as necessary and then go to "Verification of vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect HECU connector.
3. Measure resistance between terminal "4" of the HECU harness connector and chassis ground.

Specification :Approx.below 1 Ω

Is the measured resistance within specifications?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Check for damaged harness and poor connection between terminal "4" of the HECU harness connector and chassis ground. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
Does warning lamp remain On?

YES

▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Fault is intermittent caused by open or short of power harness and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.
Are any DTCs present?

YES

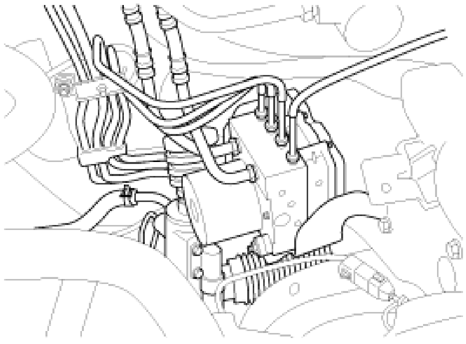
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Brake System > Troubleshooting > C2308

COMPONENT LOCATION



GENERAL DESCRIPTION

The ABS HECU is composed of an ECU (Electronic Control Unit) and a HCU(Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydraulic pressure supplied to a wheel cylinder.

DTC DESCRIPTION

The HECU monitors the operation of the valves by checking the drive circuit of the solenoid valves, and then sets this code when the unexpcted drive voltage is detected. For example, the HECU sets the DTC if an unexpected high drive voltage is detected when the valve relay is switched to OFF.

DTC DETECTING CONDITION

<table>
<tr><th>Item</th><th>Detecting Condition</th><th>Possible cause</th></tr>
<tr><td>DTC Strategy</td><td>Battery Voltage Monitoring</td><td rowspan="4">• Faulty HECU</td></tr>
<tr><td>Enable Conditions</td><td>1. The electrical feedback signal does not match the actuation signal for the corresponding valve:
Actuation Signal != Feedback Signal
Fault filter time is t = 30 ms
(for current controlled valves and under voltage conditions: t =80 ms)
2. Cyclic Valve and Relay Test (CVRT):
• A Fault is found if UVR(Valve relay voltage) is not within 0.1 * UZ(Ignition voltage) < UVR < 0.8 * UZ
• A Fault is found if UVR is not UVR < 0.2 * UZ and the Valve Feedback is not act. Valve = = FALSE, not act. Valve = = TRUE
At least VR is switched on again.
3. The valve and pump motor test detects electrical actuation malfunction of ABS valves. The test actuates all valves in series (to detect short cuts or shunts between the valve lines). Faults are detected by monitoring the valve response signals.</td></tr>
<tr><td>Monitoring period</td><td>1. Continuous
2. CVRT is executed immediately after power on and then periodic every t =20 s. The Test is canceled if any control/valve actuation takes place or if the Vehicle is in motion and the BLS is on.
3. The Valve and Pump motor Test is performed once after ignition on if vehicle speed is >= 15 km/h(9 MPH).</td></tr>
<tr><td>Effect</td><td>Valve cannot be actuated or valve is incorrectly actuated.
This may result in locked wheels or wheels without pressure.</td></tr>
</table>

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more)
   Does warning lamp remain On?

   YES

   ▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.

2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more))
   Are any DTCs present?

   YES

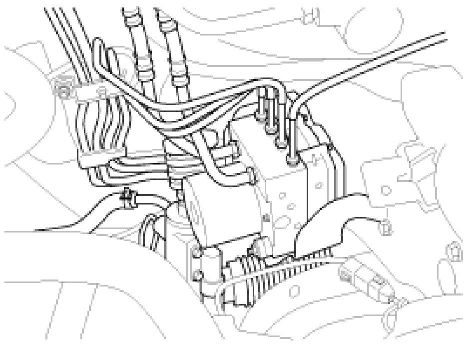
   ▸ Go to the applicable troubleshooting procedure.

   NO

   ▸ System performing to specification at this time.

Brake System > Troubleshooting > C2312

COMPONENT LOCATION



GENERAL DESCRIPTION

The ABS HECU is composed of an ECU (Electronic Control Unit) and a HCU(Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydraulic pressure supplied to a wheel cylinder.

DTC DESCRIPTION

The HECU monitors the operation of the valves by checking the drive circuit of the solenoid valves, and then sets this code when the unexpcted drive voltage is detected. For example, the HECU sets the DTC if an unexpected high drive voltage is detected when the valve relay is switched to OFF.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	Battery Voltage Monitoring	• Faulty HECU
Enable Conditions	1. The electrical feedback signal does not match the actuation signal for the corresponding valve: Actuation Signal != Feedback Signal Fault filter time is t = 30 ms (for current controlled valves and under voltage conditions: t =80 ms) 2. Cyclic Valve and Relay Test (CVRT): • A Fault is found if UVR(Valve relay voltage) is not within 0.1 * UZ(Ignition voltage) < UVR < 0.8 * UZ • A Fault is found if UVR is not UVR < 0.2 * UZ and the Valve Feedback is not act. Valve = = FALSE, not act. Valve = = TRUE At least VR is switched on again. 3. The valve and pump motor test detects electrical actuation malfunction of ABS valves. The test actuates all valves in series (to detect short cuts or shunts between the valve lines). Faults are detected by monitoring the valve response signals.	
	1. Continuous 2. CVRT is executed immediately after power on and then periodic every t =20 s.	

Monitoring period	The Test is canceled if any control/valve actuation takes place or if the Vehicle is in motion and the BLS is on. 3. The Valve and Pump motor Test is performed once after ignition on if vehicle speed is >= 15 km/h(9 MPH).	
Effect	Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.	

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more)
   Does warning lamp remain On?

   YES

   ▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more))
   Are any DTCs present?

   YES

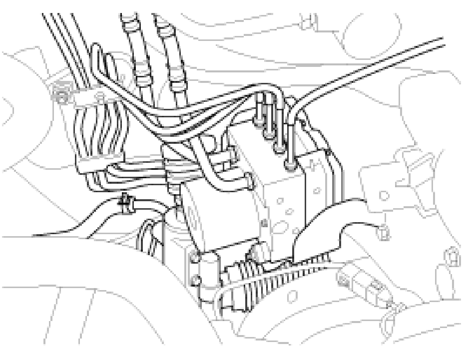
   ▸ Go to the applicable troubleshooting procedure.

   NO

   ▸ System performing to specification at this time.

Brake System > Troubleshooting > C2316

COMPONENT LOCATION



GENERAL DESCRIPTION

The ABS HECU is composed of an ECU (Electronic Control Unit) and a HCU(Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydraulic pressure supplied to a wheel cylinder.

DTC DESCRIPTION

The HECU monitors the operation of the valves by checking the drive circuit of the solenoid valves, and then sets this code when the unexpcted drive voltage is detected. For example, the HECU sets the DTC if an unexpected high drive voltage is detected when the valve relay is switched to OFF.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	Battery Voltage Monitoring	• Faulty HECU
Enable Conditions	1. The electrical feedback signal does not match the actuation signal for the corresponding valve: Actuation Signal != Feedback Signal Fault filter time is t = 30 ms (for current controlled valves and under voltage conditions: t =80 ms) 2. Cyclic Valve and Relay Test (CVRT): • A Fault is found if UVR(Valve relay voltage) is not within 0.1 * UZ(Ignition voltage) < UVR < 0.8 * UZ • A Fault is found if UVR is not UVR < 0.2 * UZ and the Valve Feedback is not act. Valve = = FALSE, not act. Valve = = TRUE At least VR is switched on again. 3. The valve and pump motor test detects electrical actuation malfunction of ABS valves. The test actuates all valves in series (to detect short cuts or shunts between the valve lines). Faults are detected by monitoring the valve response signals.	
Monitoring period	1. Continuous 2. CVRT is executed immediately after power on and then periodic every t =20 s. The Test is canceled if any control/valve actuation takes place or if the Vehicle is in motion and the BLS is on. 3. The Valve and Pump motor Test is performed once after ignition on if vehicle speed is >= 15 km/h(9 MPH).	
Effect	Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.	

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more)
   Does warning lamp remain On?

   YES

   ▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more))
   Are any DTCs present?

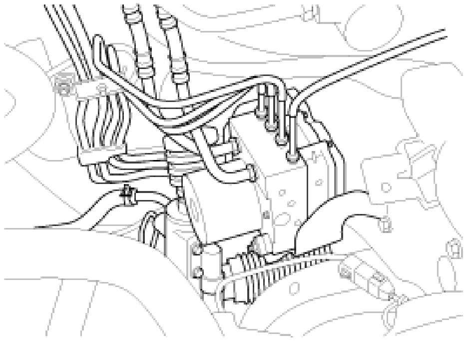
   YES

   ▸ Go to the applicable troubleshooting procedure.

   NO

   ▸ System performing to specification at this time.

COMPONENT LOCATION



GENERAL DESCRIPTION

The ABS HECU is composed of an ECU (Electronic Control Unit) and a HCU(Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydraulic pressure supplied to a wheel cylinder.

DTC DESCRIPTION

The HECU monitors the operation of the valves by checking the drive circuit of the solenoid valves, and then sets this code when the unexpcted drive voltage is detected. For example, the HECU sets the DTC if an unexpected high drive voltage is detected when the valve relay is switched to OFF.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	Battery Voltage Monitoring	• Faulty HECU
Enable Conditions	1. The electrical feedback signal does not match the actuation signal for the corresponding valve: Actuation Signal != Feedback Signal Fault filter time is t = 30 ms (for current controlled valves and under voltage conditions: t =80 ms) 2. Cyclic Valve and Relay Test (CVRT): • A Fault is found if UVR(Valve relay voltage) is not within 0.1 * UZ(Ignition voltage) < UVR < 0.8 * UZ • A Fault is found if UVR is not UVR < 0.2 * UZ and the Valve Feedback is not act. Valve = = FALSE, not act. Valve = = TRUE At least VR is switched on again. 3. The valve and pump motor test detects electrical actuation malfunction of ABS valves. The test actuates all valves in series (to detect short cuts or shunts between the valve lines). Faults are detected by monitoring the valve response signals.	
Monitoring period	1. Continuous 2. CVRT is executed immediately after power on and then periodic every t =20 s. The Test is canceled if any control/valve actuation takes place or if the Vehicle is in motion and the BLS is on. 3. The Valve and Pump motor Test is performed once after ignition on if vehicle speed is >= 15 km/h(9 MPH).	
Effect	Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.	

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more)
   Does warning lamp remain On?

YES

▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more))
   Are any DTCs present?

YES

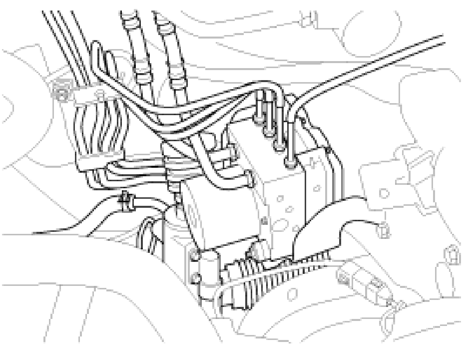
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Brake System > Troubleshooting > C2324

COMPONENT LOCATION



GENERAL DESCRIPTION

The ABS HECU is composed of an ECU (Electronic Control Unit) and a HCU(Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydraulic pressure supplied to a wheel cylinder.

DTC DESCRIPTION

The HECU monitors the operation of the valves by checking the drive circuit of the solenoid valves, and then sets this code when the unexpcted drive voltage is detected. For example, the HECU sets the DTC if an unexpected high drive voltage is detected when the valve relay is switched to OFF.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	Battery Voltage Monitoring	

Enable Conditions	1. The electrical feedback signal does not match the actuation signal for the corresponding valve: Actuation Signal != Feedback Signal Fault filter time is t = 30 ms (for current controlled valves and under voltage conditions: t =80 ms) 2. Cyclic Valve and Relay Test (CVRT): • A Fault is found if UVR(Valve relay voltage) is not within 0.1 * UZ(Ignition voltage) < UVR < 0.8 * UZ • A Fault is found if UVR is not UVR < 0.2 * UZ and the Valve Feedback is not act. Valve = = FALSE, not act. Valve = = TRUE At least VR is switched on again. 3. The valve and pump motor test detects electrical actuation malfunction of ABS valves. The test actuates all valves in series (to detect short cuts or shunts between the valve lines). Faults are detected by monitoring the valve response signals.	• Faulty HECU
Monitoring period	1. Continuous 2. CVRT is executed immediately after power on and then periodic every t =20 s. The Test is canceled if any control/valve actuation takes place or if the Vehicle is in motion and the BLS is on. 3. The Valve and Pump motor Test is performed once after ignition on if vehicle speed is >= 15 km/h(9 MPH).	
Effect	Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.	

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more)
   Does warning lamp remain On?

   YES

   ▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more))
   Are any DTCs present?

   YES

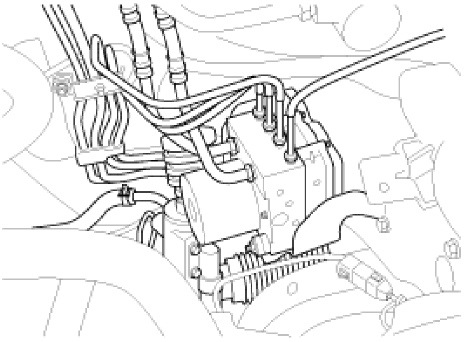
   ▸ Go to the applicable troubleshooting procedure.

   NO

   ▸ System performing to specification at this time.

Brake System > Troubleshooting > C2328

COMPONENT LOCATION



GENERAL DESCRIPTION

The ABS HECU is composed of an ECU (Electronic Control Unit) and a HCU(Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydraulic pressure supplied to a wheel cylinder.

DTC DESCRIPTION

The HECU monitors the operation of the valves by checking the drive circuit of the solenoid valves, and then sets this code when the unexpcted drive voltage is detected. For example, the HECU sets the DTC if an unexpected high drive voltage is detected when the valve relay is switched to OFF.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	Battery Voltage Monitoring	• Faulty HECU
Enable Conditions	1. The electrical feedback signal does not match the actuation signal for the corresponding valve: Actuation Signal != Feedback Signal Fault filter time is t = 30 ms (for current controlled valves and under voltage conditions: t =80 ms) 2. Cyclic Valve and Relay Test (CVRT): • A Fault is found if UVR(Valve relay voltage) is not within 0.1 * UZ(Ignition voltage) < UVR < 0.8 * UZ • A Fault is found if UVR is not UVR < 0.2 * UZ and the Valve Feedback is not act. Valve = = FALSE, not act. Valve = = TRUE At least VR is switched on again. 3. The valve and pump motor test detects electrical actuation malfunction of ABS valves. The test actuates all valves in series (to detect short cuts or shunts between the valve lines). Faults are detected by monitoring the valve response signals.	
Monitoring period	1. Continuous 2. CVRT is executed immediately after power on and then periodic every t =20 s. The Test is canceled if any control/valve actuation takes place or if the Vehicle is in motion and the BLS is on. 3. The Valve and Pump motor Test is performed once after ignition on if vehicle speed is >= 15 km/h(9 MPH).	
Effect	Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.	

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more)

Does warning lamp remain On?

YES

▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more))
   Are any DTCs present?

YES

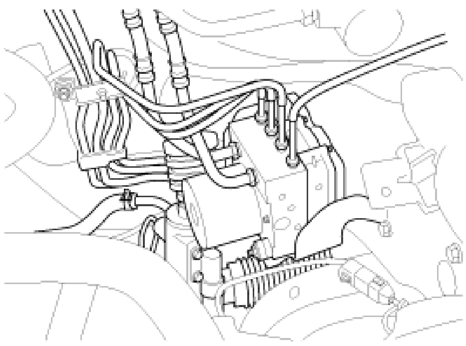
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Brake System > Troubleshooting > C2332

COMPONENT LOCATION



GENERAL DESCRIPTION

The ABS HECU is composed of an ECU (Electronic Control Unit) and a HCU(Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydraulic pressure supplied to a wheel cylinder.

DTC DESCRIPTION

The HECU monitors the operation of the valves by checking the drive circuit of the solenoid valves, and then sets this code when the unexpcted drive voltage is detected. For example, the HECU sets the DTC if an unexpected high drive voltage is detected when the valve relay is switched to OFF.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	Battery Voltage Monitoring	
	1. The electrical feedback signal does not match the actuation signal for the corresponding valve: Actuation Signal != Feedback Signal Fault filter time is t = 30 ms (for current controlled valves and under voltage conditions: t =80 ms) 2. Cyclic Valve and Relay Test (CVRT):	

Enable Conditions	• A Fault is found if UVR(Valve relay voltage) is not within 0.1 * UZ(Ignition voltage) < UVR < 0.8 * UZ • A Fault is found if UVR is not UVR < 0.2 * UZ and the Valve Feedback is not act. Valve = = FALSE, not act. Valve = = TRUE At least VR is switched on again. 3. The valve and pump motor test detects electrical actuation malfunction of ABS valves. The test actuates all valves in series (to detect short cuts or shunts between the valve lines). Faults are detected by monitoring the valve response signals.	• Faulty HECU
Monitoring period	1. Continuous 2. CVRT is executed immediately after power on and then periodic every t =20 s. The Test is canceled if any control/valve actuation takes place or if the Vehicle is in motion and the BLS is on. 3. The Valve and Pump motor Test is performed once after ignition on if vehicle speed is >= 15 km/h(9 MPH).	
Effect	Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.	

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more)
   Does warning lamp remain On?

   YES

   ▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more))
   Are any DTCs present?

   YES

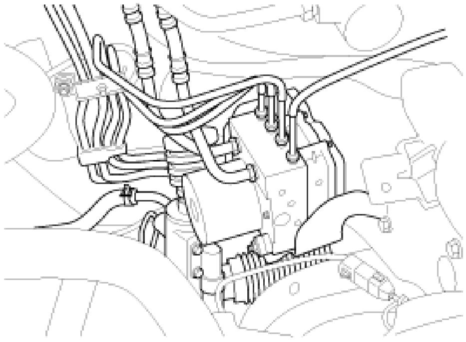
   ▸ Go to the applicable troubleshooting procedure.

   NO

   ▸ System performing to specification at this time.

Brake System > Troubleshooting > C2336

COMPONENT LOCATION



GENERAL DESCRIPTION

The ABS HECU is composed of an ECU (Electronic Control Unit) and a HCU(Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydraulic pressure supplied to a wheel cylinder.

DTC DESCRIPTION

The HECU monitors the operation of the valves by checking the drive circuit of the solenoid valves, and then sets this code when the unexpcted drive voltage is detected. For example, the HECU sets the DTC if an unexpected high drive voltage is detected when the valve relay is switched to OFF.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	Battery Voltage Monitoring	• Faulty HECU
Enable Conditions	1. The electrical feedback signal does not match the actuation signal for the corresponding valve: Actuation Signal != Feedback Signal Fault filter time is t = 30 ms (for current controlled valves and under voltage conditions: t =80 ms) 2. Cyclic Valve and Relay Test (CVRT): • A Fault is found if UVR(Valve relay voltage) is not within 0.1 * UZ(Ignition voltage) < UVR < 0.8 * UZ • A Fault is found if UVR is not UVR < 0.2 * UZ and the Valve Feedback is not act. Valve = = FALSE, not act. Valve = = TRUE At least VR is switched on again. 3. The valve and pump motor test detects electrical actuation malfunction of ABS valves. The test actuates all valves in series (to detect short cuts or shunts between the valve lines). Faults are detected by monitoring the valve response signals.	
Monitoring period	1. Continuous 2. CVRT is executed immediately after power on and then periodic every t =20 s. The Test is canceled if any control/valve actuation takes place or if the Vehicle is in motion and the BLS is on. 3. The Valve and Pump motor Test is performed once after ignition on if vehicle speed is >= 15 km/h(9 MPH).	
Effect	Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.	

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more)

Does warning lamp remain On?

YES

▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more))
   Are any DTCs present?

YES

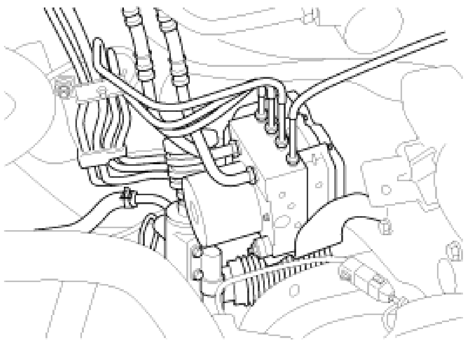
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Brake System > Troubleshooting > C2366

COMPONENT LOCATION



GENERAL DESCRIPTION

The ESC HECU is composed of an ECU (Electronic Control Unit) and a HCU(Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS/ESC is activated. Solenoid valves function is to increase, decrease or maintain the hydraulic pressure supplied to a wheel cylinder.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	Battery Voltage Monitoring	• Faulty HECU
Enable Conditions	The valve and pump motor test detects electrical actuation malfunction of USV and HSV valves. The test actuates all valves in series (to detect shorts or shunts between the valve lines). Faults are detected by monitoring the valve response signals.	
Monitoring period	The USV Test is performed once after ignition on at standstill if the BLS is off and at vehicle speed is v >= 15 km/h(9MPH) if the BLS is on.	
Effect	Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.	

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more)
   Does warning lamp remain On?

   YES

   ▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more))
   Are any DTCs present?

   YES

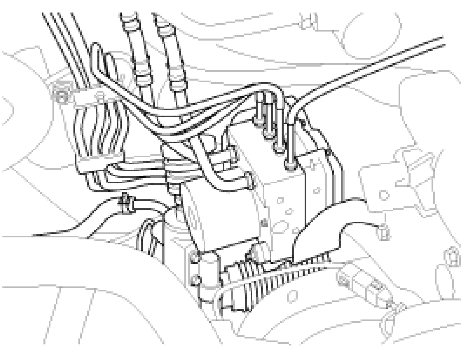
   ▸ Go to the applicable troubleshooting procedure.

   NO

   ▸ System performing to specification at this time.

Brake System > Troubleshooting > C2370

COMPONENT LOCATION



GENERAL DESCRIPTION

The ESP HECU is composed of an ECU (Electronic Control Unit) and a HCU(Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS/ESP is activated. Solenoid valves function is to increase, decrease or maintain the hydraulic pressure supplied to a wheel cylinder.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	Battery Voltage Monitoring	• Faulty HECU
Enable Conditions	The valve and pump motor test detects electrical actuation malfunction of USV and HSV valves. The test actuates all valves in series (to detect shorts or shunts between the valve lines). Faults are detected by monitoring the valve response signals.	
	The USV Test is performed once after ignition on at standstill if the BLS is off and	

Monitoring period	at vehicle speed is v > 15 km/h(9 MPH) if the BLS is on.	
Effect	Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.	

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more)
   Does warning lamp remain On?

   YES

   ▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more))
   Are any DTCs present?

   YES

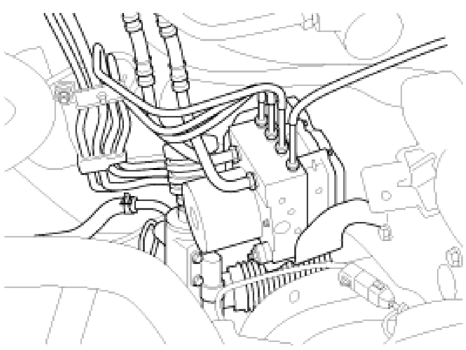
   ▸ Go to the applicable troubleshooting procedure.

   NO

   ▸ System performing to specification at this time.

Brake System > Troubleshooting > C2372

COMPONENT LOCATION



GENERAL DESCRIPTION

The ESP HECU is composed of an ECU (Electronic Control Unit) and a HCU(Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS/ESP is activated. Solenoid valves function is to increase, decrease or maintain the hydraulic pressure supplied to a wheel cylinder.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	Battery Voltage Monitoring	

Enable Conditions	The valve and pump motor test detects electrical actuation malfunction of USV and HSV valves. The test actuates all valves in series (to detect shorts or shunts between the valve lines). Faults are detected by monitoring the valve response signals.	• Faulty HECU
Monitoring period	The USV Test is performed once after ignition on at standstill if the BLS is off and at vehicle speed is v > 15 km/h(9 MPH) if the BLS is on.	
Effect	Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.	

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more)
   Does warning lamp remain On?

   YES

   ▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more))
   Are any DTCs present?

   YES

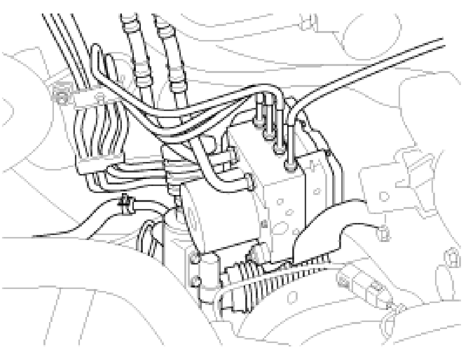
   ▸ Go to the applicable troubleshooting procedure.

   NO

   ▸ System performing to specification at this time.

Brake System > Troubleshooting > C2374

COMPONENT LOCATION



GENERAL DESCRIPTION

The ESP HECU is composed of an ECU (Electronic Control Unit) and a HCU(Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS/ESP is activated. Solenoid valves function is to increase, decrease or maintain the hydraulic pressure supplied to a wheel cylinder.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	Battery Voltage Monitoring	• Faulty HECU
Enable Conditions	The valve and pump motor test detects electrical actuation malfunction of USV and HSV valves. The test actuates all valves in series (to detect shorts or shunts between the valve lines). Faults are detected by monitoring the valve response signals.	
Monitoring period	The USV Test is performed once after ignition on at standstill if the BLS is off and at vehicle speed is v > = 15 km/h(9 MPH) if the BLS is on.	
Effect	Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.	

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more)
   Does warning lamp remain On?

   YES

   ▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more))
   Are any DTCs present?

   YES

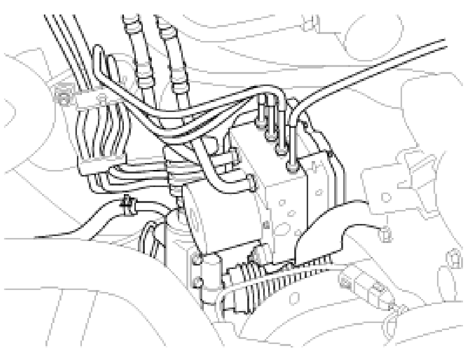
   ▸ Go to the applicable troubleshooting procedure.

   NO

   ▸ System performing to specification at this time.

Brake System > Troubleshooting > C2402

COMPONENT LOCATION



GENERAL DESCRIPTION

The ABS ECU supplies battery power to the electric motor by way of a motor relay which is controlled by the Electronic Control Unit(ECU). The electric motor pump supplies hydraulic pressure to all wheel brake calipers by operating the piston inside the pump.

DTC DESCRIPTION

The ABS/ESC ECU monitors the pump motor relay or fuse open, open or short in motor or motor lock and then sets this code if a malfunction is detected.

DTC DETECTING CONDITION

<table>
<tr><th>Item</th><th>Detecting Condition</th><th>Possible cause</th></tr>
<tr><td>DTC Strategy</td><td>Battery Voltage Monitoring</td><td rowspan="4">• Open or short of power supply circuit
• Faulty HECU
• Faulty of the pump motor fuse(40A)</td></tr>
<tr><td>Enable Conditions</td><td>1. A failure is detected if the voltage UM (Pump motor voltage) > 2.0 V for a time t >= 1 s.
2. A failure is detected if the voltage UM (Pump motor voltage) < (UZ(battery voltage) - 4.0 V) for a time t >= 100 ms.
3. After the end of the actuation of the motor relay has, the pump motor is still in motion and is generating a Voltage during it.s slowdown. The generated UM is monitored for a certain time on high level. The time depends on the supply voltage and is in the range of t = 30 ms to t = 125 ms.If the slow down condition isn.t met, the pump is activated again (see actuation times below) and the slowdown time is measured again. This is repeated for maximum n = 3 times. If, after the last pump activation, the pump motor slowdown time is still to short, a failure is detected.Actuation times:
1st actuation: 200 ms
2nd actuation: 1000 ms
3rd actuation: 3000 ms</td></tr>
<tr><td>Monitoring period</td><td>1. Stop monitor is active if the pump is off i.e. not actuation and no Slowdown.
2. The monitor is active if the pump is switched on .
3. Monitor is always active in the transition "pump on -> pump off".</td></tr>
<tr><td>Effect</td><td>1. The return pump does not work correct.
2. Pressure decrease (outlet valve) is no longer possible (wheels block).
3. Pressure decrease (outlet valve) is no longer possible (wheels lock).</td></tr>
</table>

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

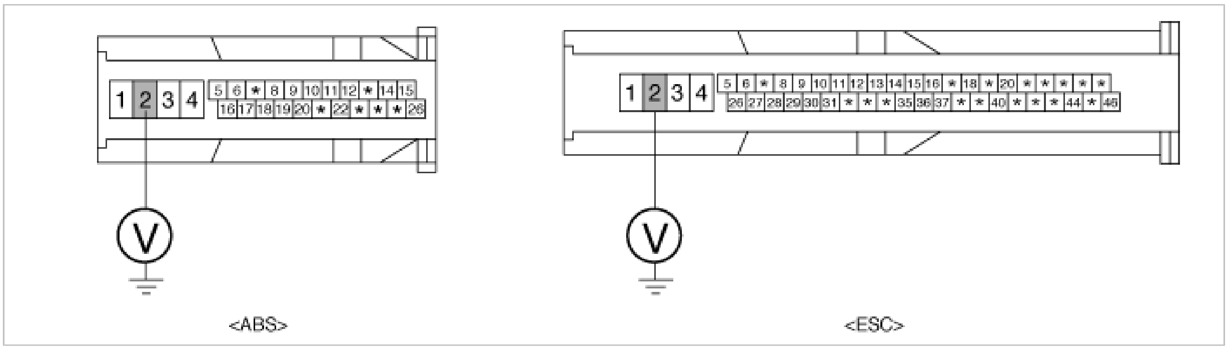
NO

▸ Go to the next step.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "OFF"
2. Disconnect HECU connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal "2" of the HECU harness connector and chassis ground.

Specification :Approx. B+



Is the measured voltage within specifications?

YES

▸ Go to "Ground Circuit Inspection" procedure.

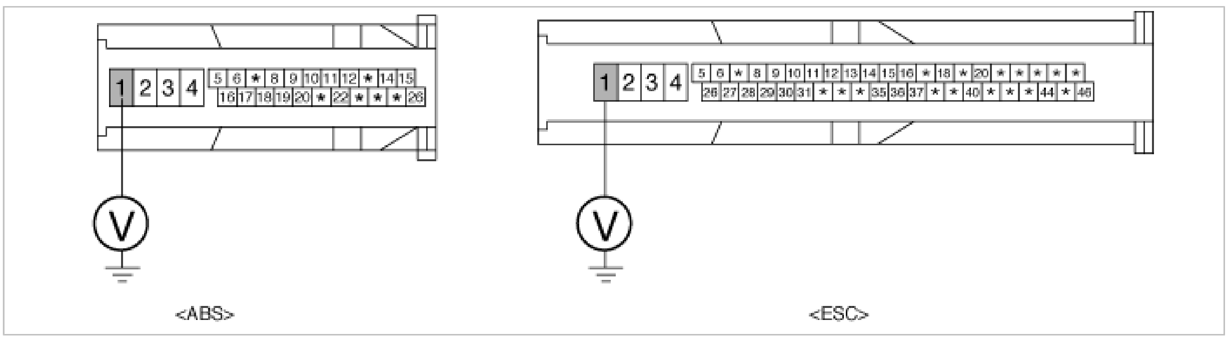
NO

▸ Check for open or short in power harness between battery terminal(+) and terminal "2" of the HECU harness connector. Check for open or blown 40A fuse . Repair as necessary and then go to "Verification of vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect HECU connector.
3. Measure resistance between terminal "1" of the HECU harness connector and chassis ground.

Specification :Approx.below 1 Ω



Is the measured resistance within specifications?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Check for damaged harness and poor connection between terminal "1" of the HECU harness connector and chassis ground. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more)
   Does warning lamp remain On?

YES

▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected..

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.

2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more))
   Are any DTCs present?

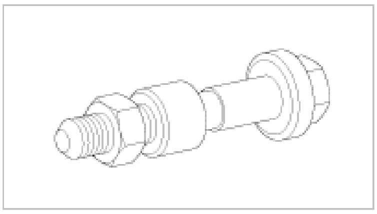
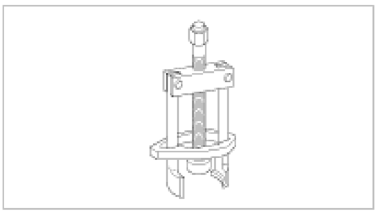
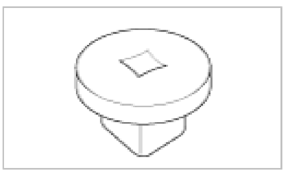
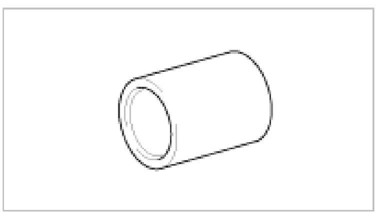
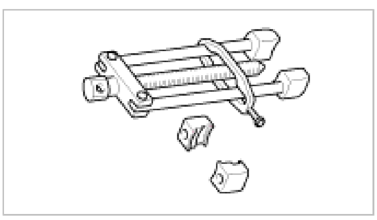
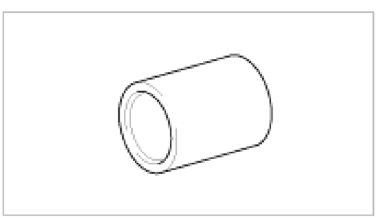
   YES

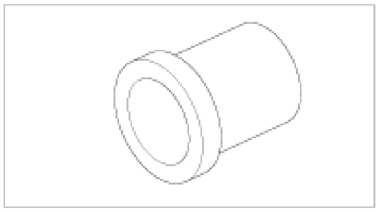
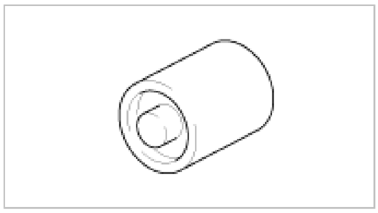
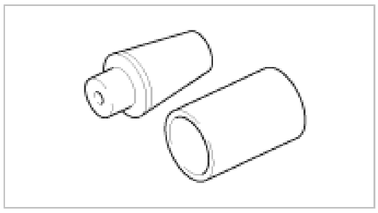
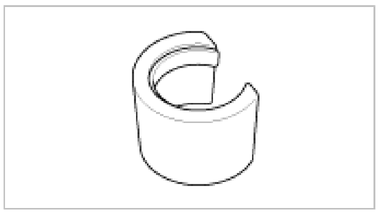
   ▸ Go to the applicable troubleshooting procedure.

   NO

   ▸ System performing to specification at this time.

SPECIAL TOOLS

Tool (Number and Name)	Illustration	Use
09568-4A000 Ball joint remover		Removal of the front lower arm and tie rod end ball joint
09517-21500 Front hub remover and installer		Measurement of wheel bearing preload
09432-11000 Bearing and gear puller		Removal of the bearing inner race from the front hub
09532-11600 Preload socket		Measurement of the wheel bearing preload (use with torque wrench)
09216-21100 Mount bushing remover and installer		• Removal of the center bearing • Press-fitting of the front wheel bearing outer race (Use with 09495-33100, 09216-21600)
09495-33000 Mainshaft bearing puller		Removal of the tone wheel
09216-21600 Mount bushing remover and installer		Removal of the wheel bearing outer race
09545-21100 Ball joint dust cover installer		Press-fitting of the front hub to the knuckle

		
09545-34100 Lower arm bushing remover and installer		Removal of the bearing inner race from the front hub
09453-33000B Snap ring installer		Removal and installation of the rear axle carrier bushing (Use with 09552-38200)
09216-22100 Mount bushing removerand installation base		Removal of the wheel bearing outer race (Use with 09216-21600)

Driveshaft and axle > General Information > Troubleshooting

TROUBLESHOOTING

Symptom Pos	sible cause	Remedy
Vehicle pulls to one side	Scoring of driveshaft ball joint Wear, rattle or scoring of wheel bearing Defective front suspension and steering	Replace Replace Adjust or replace
Vibration	Wear, damage or bending of driveshaft Driveshaft rattle and worn hub splines Wear, rattle or scratching of wheel bearing	Replace Replace Replace
Shimmy I	mproper wheel balance Bent wheel Defective front suspension and steering	Adjust or replace Replace Adjust or replace
Excessive noise	Wear, damage or bending of driveshaft Driveshaft rattle and worn hub splines Driveshaft rattle and worn side gear splines Wear, rattle or galling of wheel bearing Loose hub nut Defective front suspension and steering	Replace Replace Replace Replace Adjust or replace Adjust or replace
Bent cage	Cage damaged by improper handling or tool usage	Replace bearing
Galling	Metal smears on roller end due to overheating, incorrect lubricant or overloading	Replace bearing Check seals, check for proper lubrication
Cracked inner race	Race cracked due to improper fit, cocking or poor bearing seats	Replace bearing
Etching	Bearing surfaces appear gray or grayish black	Replace bearing

	in color accompanied by material etched away usually at roller spacing	Check seals, check for proper lubrication
Brinelling Surface	indentations on race surface caused by rollers being under impact loading or vibration while the bearing is not rotating	Replace bearing
Heat discoloration	Heat discoloration is dark blue resulting from overload or no lubricant (Yellow or brown color is normal)	Replace bearing Check seals and other parts
Fatigue spalling	Flaking of surface metal resulting from fatigue	Replace bearing Clean all related parts

Driveshaft and axle > General Information > Specifications

SPECIFICATIONS

Items			Joint type		Max. permissible angle	
			Inner side	Outer side	Inner side	Outer side
Drive shaft	ASAN (KOREA)	2.4 M/T	TJ	BJ	23°	45°
		2.4 A/T	TJ	BJ	23°	45°
		3.3A/T SF	J	BJ	23°	45°
	ALLABAMA (USA)	2.4 M/T	[LH]TG [RH]TP	RJ	[LH]23° [RH]23.16°	45°
		2.4 A/T	[LH]TG [RH]TP	RJ	[LH]23° [RH]23.16°	45°
		3.3A/T TG		RJ	23°	45°
Center bearing	[3.3L] ASAN (KOREA)	Type	Radial ball bearing			
		Dimension (O.D X I.D.) mm (in)	Ø 62 X Ø 30 (Ø 2.44 X Ø 1.18)			
	[3.3L] ALLABAMA (USA)	Type	Radial ball bearing			
		Dimension (O.D X I.D.) mm (in)	Ø 62 X Ø 30 (Ø 2.44 X Ø 1.18)			
Wheel bearing		Type	Double row angular contact ball bearing			
		Dimension (O.D X I.D.) mm (in)	Ø 84 X Ø 45 (Ø 3.3 X Ø 1.77)			
		Starting torque	28N (0.18 kgf·m, 16 lbf·in) or less			
Hub end play			0.008 mm (0.0003 in) or less			

-BJ : Birfield Joint (ASAN)
-TJ : Tripod Joint (ASAN)
-RJ : Rzeppa Joint (ALABAMA)
-SFJ : Shudderless Free ring Joint (ASAN)
-TP : Tripod Joint (ALABAMA)
-TG : Tri Glide Joint (ALABAMA)

TIGHTNING TORQUE

Item	N·m	kgf·m	lb-ft

Inner shaft cover	8.8~13.7	0.9~1.4	6.5~10
Inner shaft bearing bracket	39~49	4~5	28.9~36
Drive shaft castle nut	200~280	20~28	148~207
Brake caliper to knuckle	50~60	5~6	36~44
Lower arm and ball joint	100~120	10~12	74~88
Wheel nut	90~110	9~11	66~81
Shock absorber lower mounting bolt	140~160	14~16	101~118
Stabilizer link mounting nut 100~	120	10~12	74~88
Tie rod end self locking nut	24~34	2.4~3.4	18~25
Rear upper arm to carrier self locking nut	80~90	8~9	59~66
Lower arm ball joint self locking nut	75~90	7.5~9	54.2~66
Rear axle mounting bolt	60~70	6~7	44~52
Front Upper arm to knuckle self locking nut	35~45	3.5~4.5	26~33

CAUTION

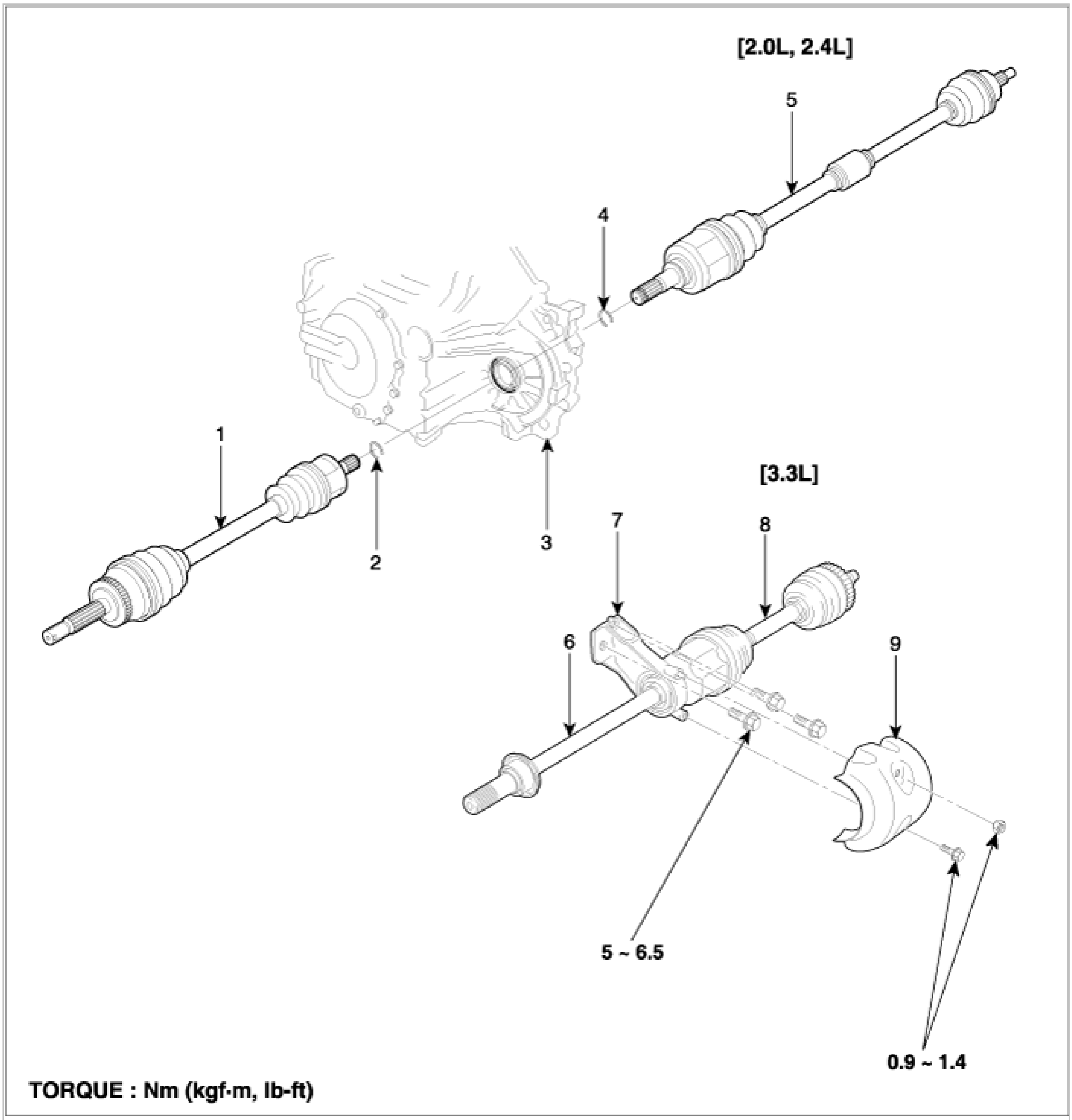
Replace self-locking nuts with new ones after removal.

LUBRICANTS

Items			Specified lubricants	Quantity
ASAN (KOREA)	[2.4L]	BJ	CENTOPLEX 278M/136K	JOINT : 85 ± 5g, BOOT : 70 ± 5g
		TJ	MX-13KT	JOINT : 60 ± 5g, BOOT : 60 ± 5g
	[3.3L]	BJ	CENTOPLEX 278M/136K	JOINT : 140 ± 5g, BOOT : 60 ± 5g
		SFJ	MX-13KT	JOINT : 100 ± 5g, BOOT : 45 ± 5g
ALLABAMA (USA)	[2.4L]	RJ	DELPHI 5389	JOINT : 80 ± 5g, BOOT : 70 ± 5g
		TG	DELPHI 5476	JOINT :100 ± 5g, BOOT : 120 ± 5g
		TP	DELPHI 5389	JOINT : 110 ± 5, gBOOT : 130 ± 5g
	[3.3L]	RJ	DELPHI 5389	JOINT : 80 ± 5g, BOOT : 70 ± 5g
		TG	DELPHI 5476	JOINT :100 ± 5g, BOOT : 120 ± 5g

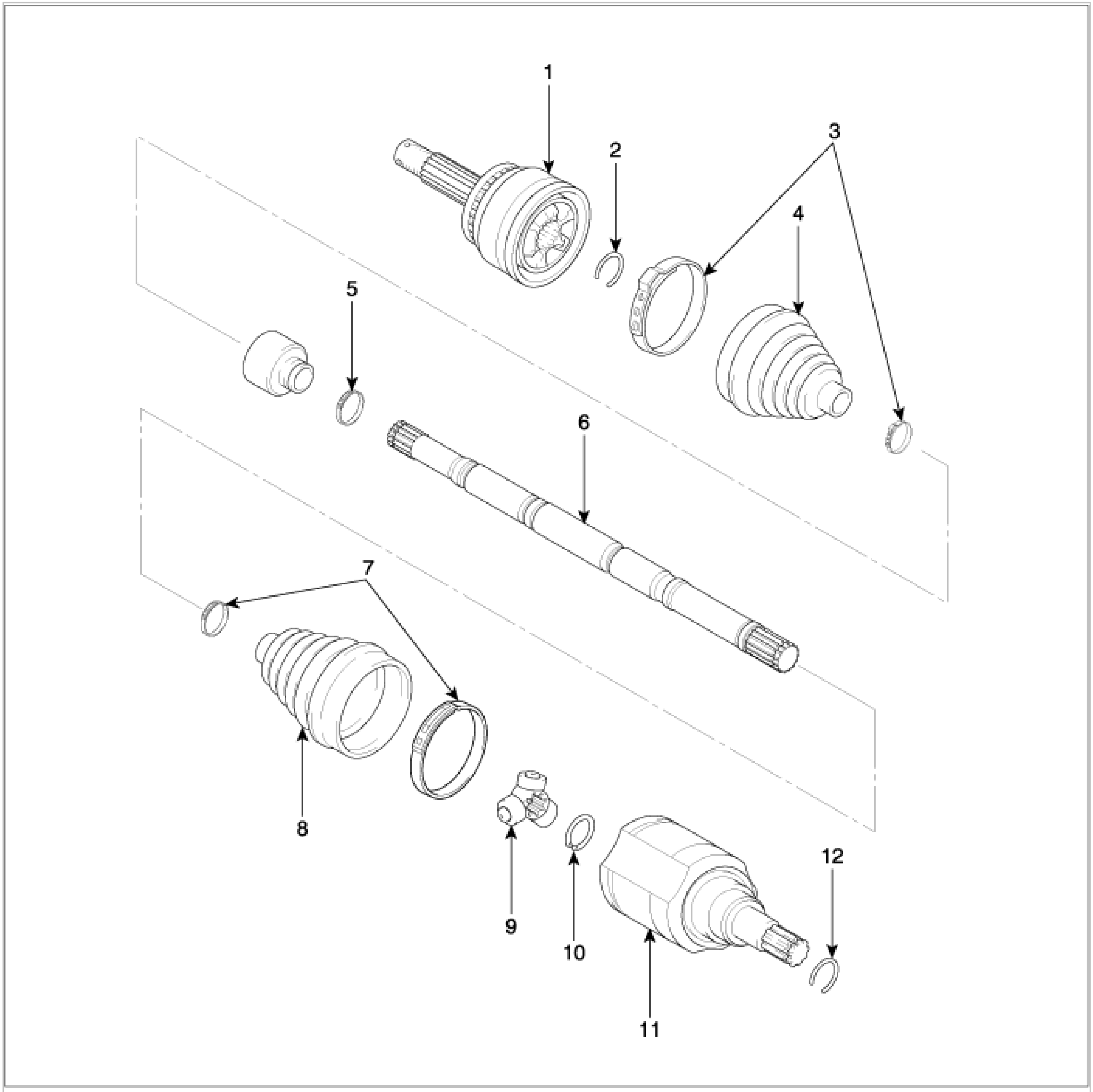
Driveshaft and axle > Driveshaft Assembly > Front Driveshaft > Components and Components Location

COMPONENTS



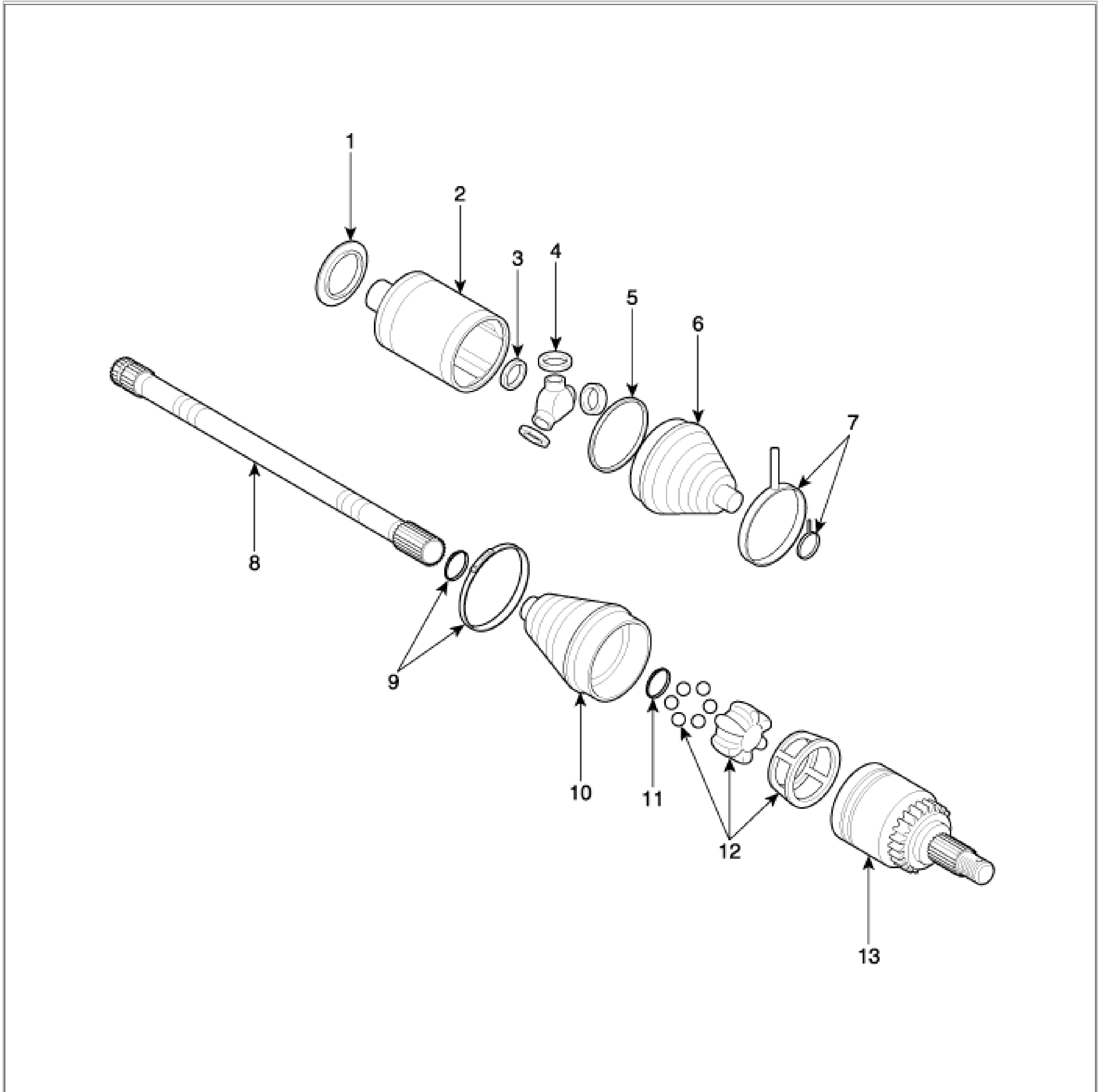
1. Driveshaft (LH)
2. Circlip
3. Transaxle
4. Circlip
5. Driveshaft (RH) [2.0L, 2.4L]
6. Inner shaft
7. Inner shaft bracket mounting
8. Driveshaft (RH) [3.3L]
9. Inner shaft cover

COMPONENTS



1. BJ assembly	7. TJ boot bands
2. Clip	8. TJ boot
3. BJ boot bands	9. Spider assembly
4. BJ boot	10. Clip
5. Dynamic damper bands	11. TJ case
6. Shaft	12. Clip

COMPONENTS

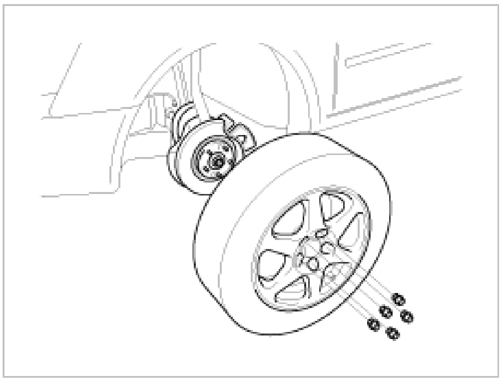


1. Dust cover
2. SFJ assembly
3. Snap ring
4. Spider assembly
5. Circle pin
6. SFJ boot
7. SFJ boot band
8. Driveshaft (RH)
9. BJ boot band
10. BJ boot
11. Snap ring
12. BJ inner race and ball
13. BJ assembly

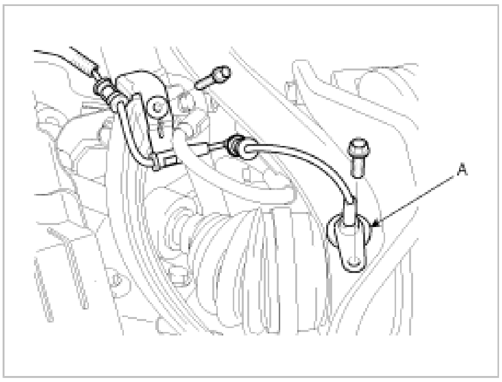
Driveshaft and axle > Driveshaft Assembly > Front Driveshaft > Repair procedures

REMOVAL

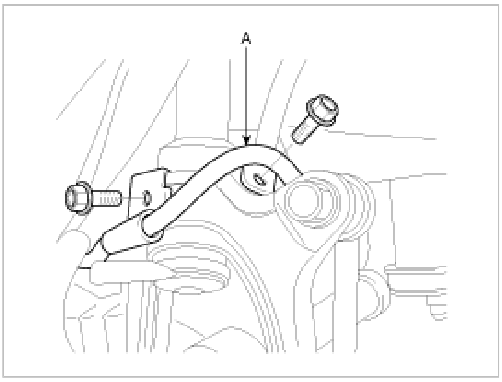
1. Remove the wheel and tire.



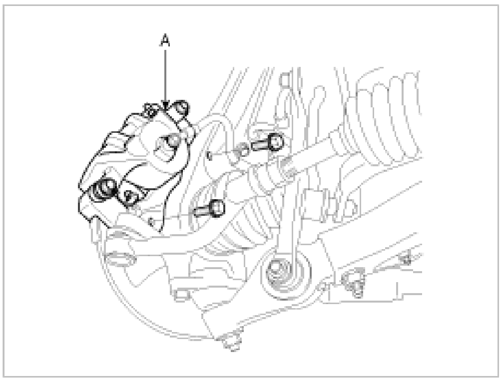
2. Disconnect the wheel speed sensor(A) from the knuckle.

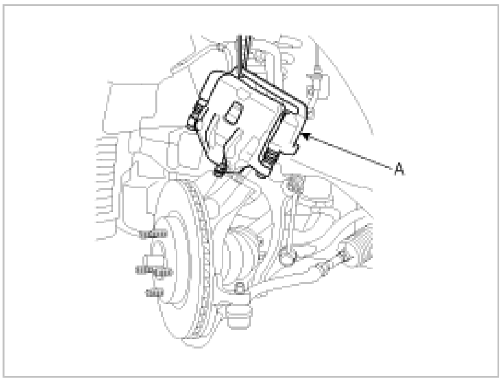


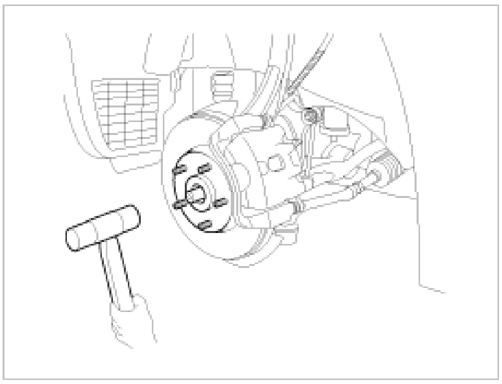
3. Disconnect the brake hose(A) from the knuckle.



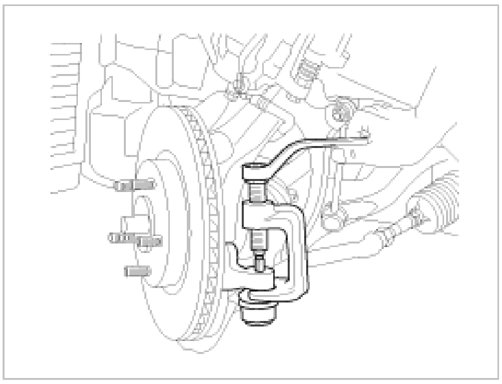
4. Remove the caliper assembly(A) and suspend it with wire.



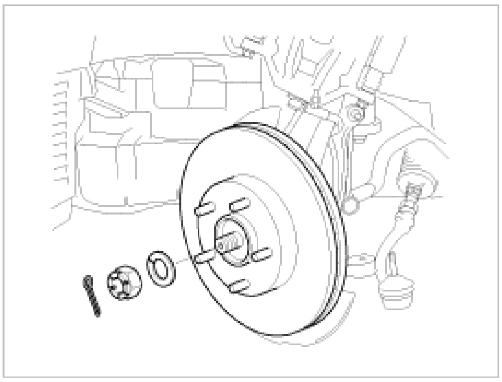




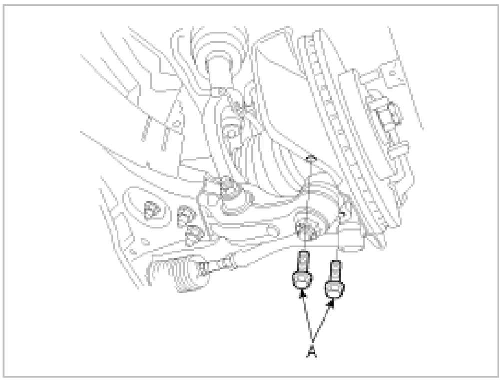
5. Using the special tool (09568-4A000), disconnect the tie rod end from the knuckle.



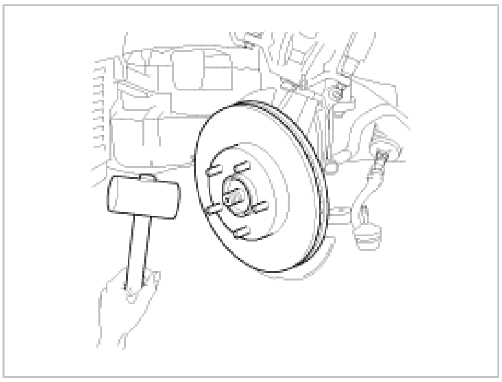
6. Remove the spilt pin and driveshaft castle nut and washer from the front hub.



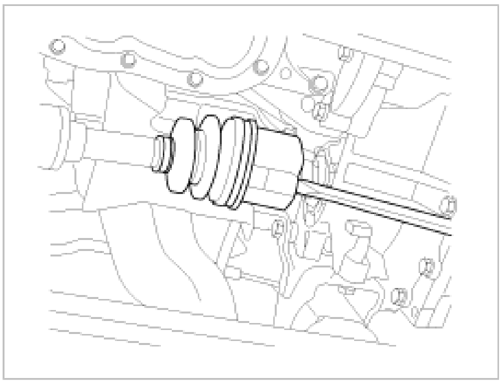
7. Remove the 2 bolts(A) and disconnect the ball joint from the knuckle.



8. Using a plastic hammer, disconnect the driveshaft from the axle hub.

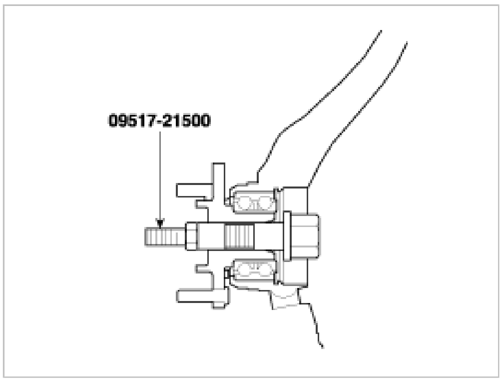


9. Removing the driveshaft from the transaxle by using a pry bar as shown below.



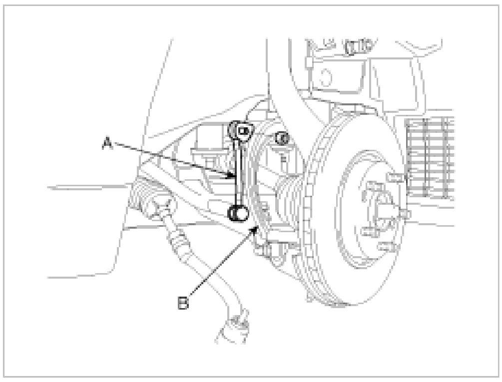
CAUTION

- Use a pry bar so you do not damage the joint.
- If you pull the driveshaft by excessive force, components inside the joint can be displaced causing the boot to be torn and the bearing to be damaged.
- Plug the transaxle case opening with an oil seal cap in order to avoid contamination.
- Support the driveshaft properly.
- Replace the retainer ring each time the driveshaft is removed from the transaxle case.
- While loosening the driveshaft nut, do not allow vehicle weight to be concentrated on the wheel bearing. If the vehicle moves, hold the wheel bearing using the special tool.

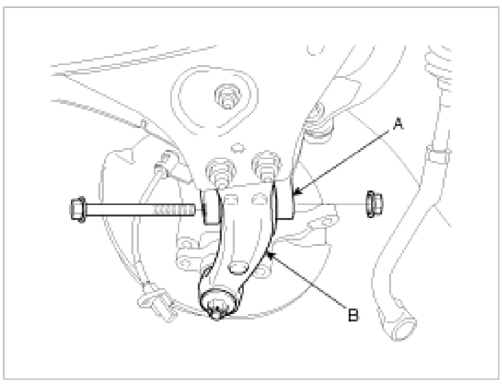


[RH3.3]

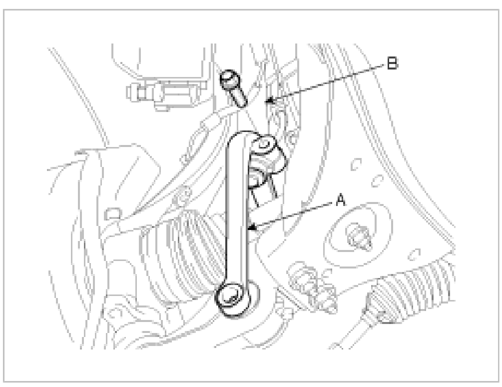
A. Remove the stabilzer link(A) from the fork(B).



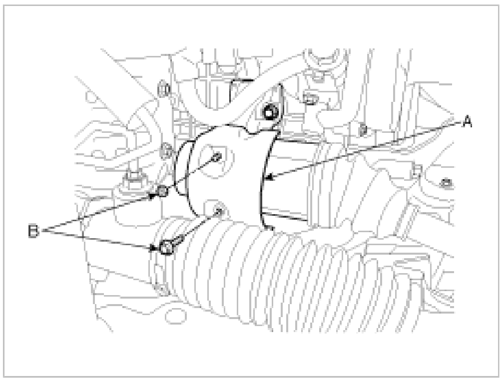
B. Remove the fork(A) from the front lower arm(B).



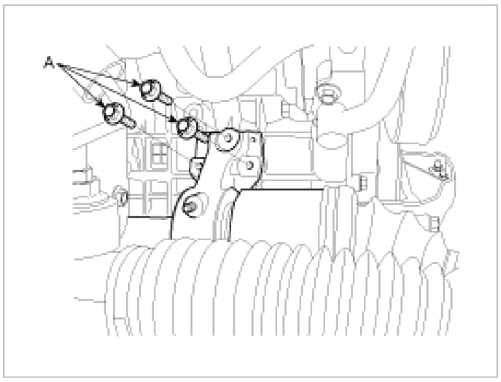
C. Remove the fork(A) from the front strut assembly(B).



D. Remove the inner shaft cover(A) from the inner shaft bracket(B).

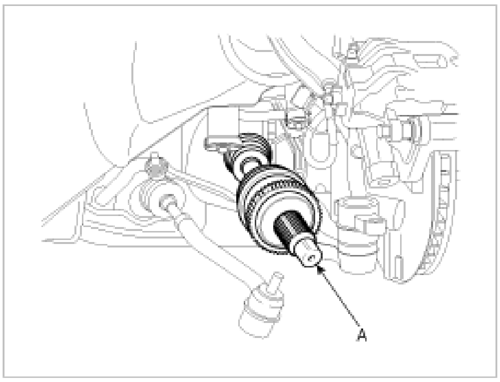


E. Remove the inner shaft bracket mounting bolt(A).

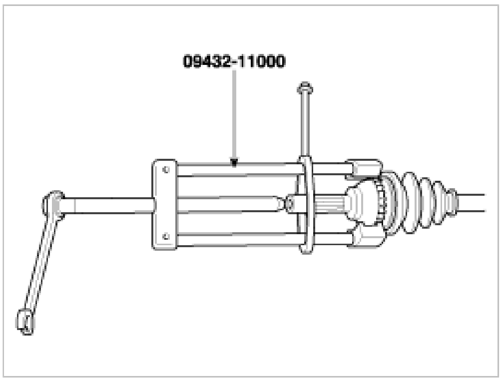


F. Remove the front driveshaft assembly(A) with the inner shaft from the transaxle.

> **CAUTION**
>
> Do not try to disconnect the inner shaft from the driveshaft. Because they can not be disconnected once assembled.
> Do not reuse the driveshaft which is disassembled from the innershaft.



10. Using the special tool (09432-11000), remove the tone wheel.

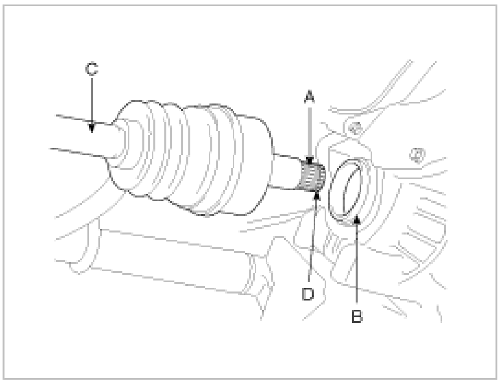


INSTALLATION

CAUTION

Replace the circlip with new ones after removal.

1. Apply gear oil on the drive shaft spliness(A) and the contacting surface of differential case oil seal(B).
2. Before installing the drive shaft(C), set the opening side of the clip(D) facing downward.



3. After installation, check if the drive shaft cannot be removed.
4. Install the drive shaft into the knuckle.

CAUTION

Be careful not to damage the boot.

5. Install the knuckle in the lower arm assembly.

Tightening Torque Nm(kgf·m, lb-ft) :
100~120 (10~12, 74~88)

6. Install the tie rod end in the knuckle.

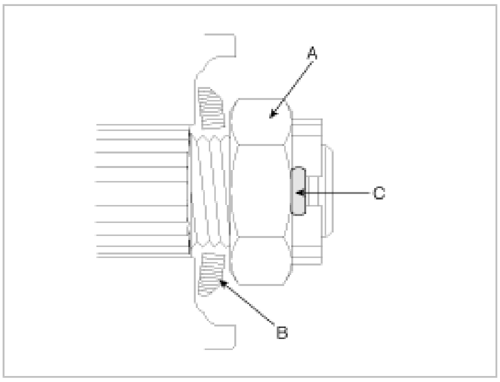
Tightening Torque Nm(kgf·m, lb-ft) :
24~34 (2.4~3.4, 18~25)

7. Install the wheel speed sensor in the knuckle.

Tightening Torque Nm(kgf·m, lb-ft) :
8~10 (0.8~1, 5.8~7.2)

8. After installing the washer(B) with convex surface outward, install the lock nut(A) and the spilt pin(C)

Tightening Torque Nm(kgf·m, lb-ft) :
200~280 (20~28, 148~207)

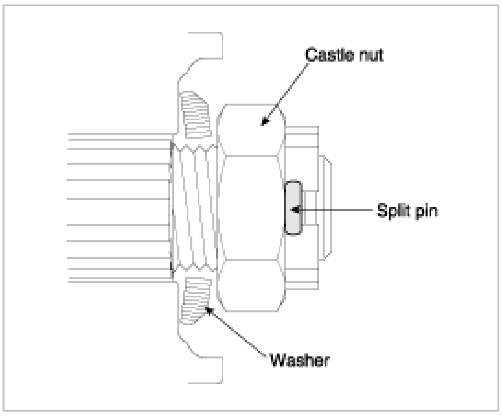


9. Install the wheel and tire.

INSTALLATION

1. Tighten the components with the tightening torque.

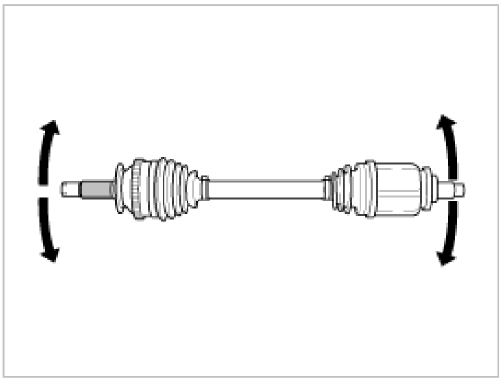
Item T	orque (kg·m)
Driveshaft nut	20 ~ 28
Lower arm and ball joint	10 ~ 12
Shock absorber lower mounting bolts	14 ~ 16
Tie rod end and knuckle	2.4 ~ 3.4



2. Replace the retainer ring every time the driveshaft is removed from the transaxle case.
3. Install the washer on driveshaft and tighten the nut as illustrated.
4. Install the split pin.

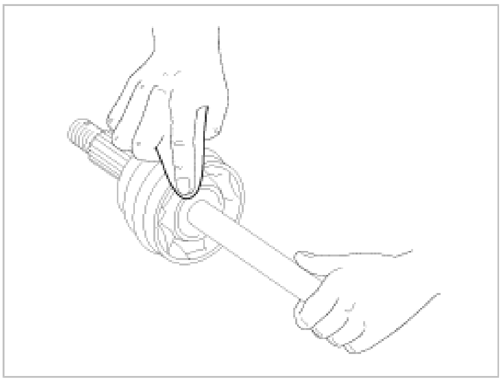
INSPECTION

1. Check the driveshaft boots for damage and deterioration.
2. Check the splines for wear and damage.
3. Check the ball joints for wear and operating condition.



INSPECTION

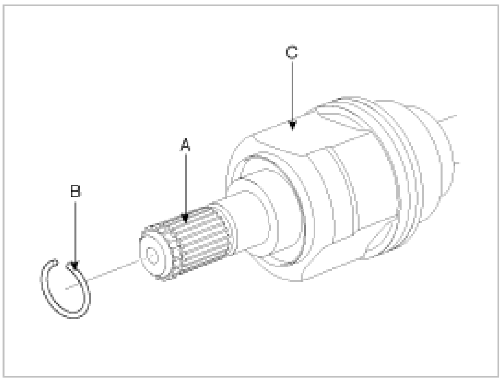
1. Check the driveshaft spline part for wear.
2. Check for entry of water and foreign material into boot.
3. Check the spider ring for revolution and wear.
4. Check the SFJ case inside wear and rust.



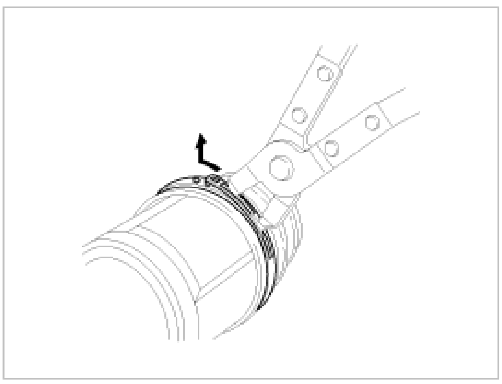
DISASSEMBLY

> **NOTE**
>
> - Do not disassemble the BJ assembly.
> - Special grease must be applied to the drive shaft joint. Do not substitute with another type of grease.
> - The boot band should be replaced with a new one.

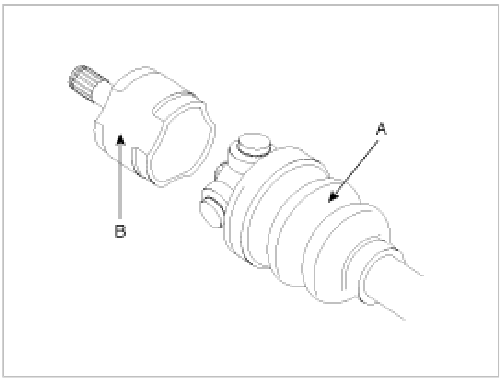
1. Remove the clip(B) from drive shaft splines(A) of the transaxle side TJ case(C).



2. Remove both boot bands from the transaxle side TJ case.

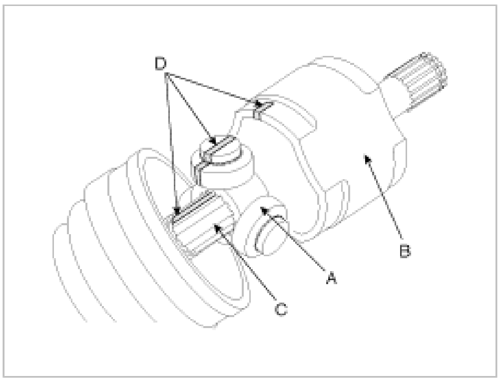


3. Pull out the boot from the transaxle side joint(TJ).
4. When separating the joint and boot(A), remove the grease from the TJ case(B).

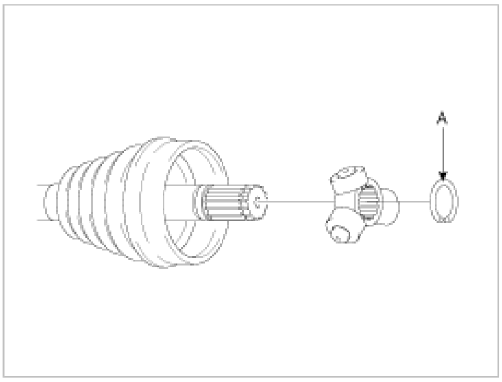


CAUTION

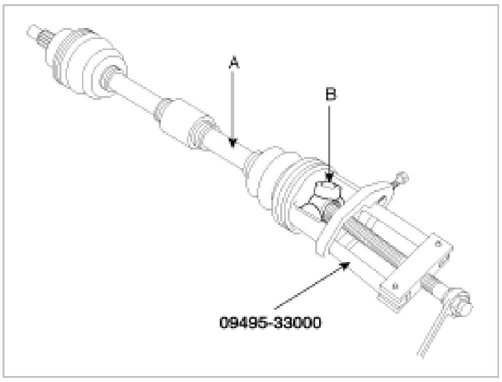
- Be careful not to damage the boot.
- Make alignment marks on spider roller assembly(A), TJ case(B), and shaft splines(C) to aid reassembly.



5. Using a plier or flat-tipped (-) screwdriver, remove the snap ring(A).



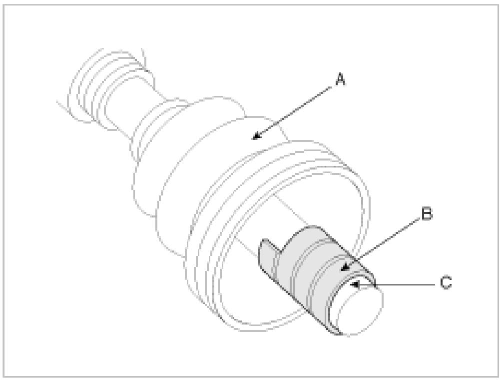
6. Remove the spider assembly(B) from drive shaft(A) by using the Special Tool(09495-33000).



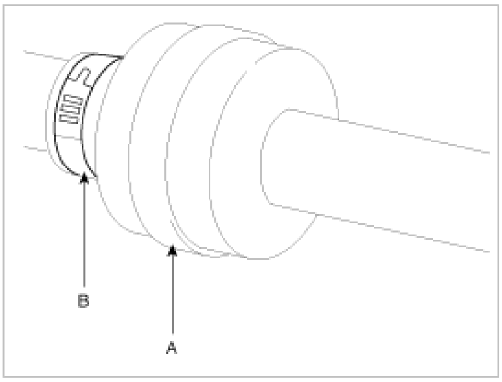
7. Clean the spider assembly.
8. Remove the boot(A), of the transaxle side joint(TJ).

CAUTION

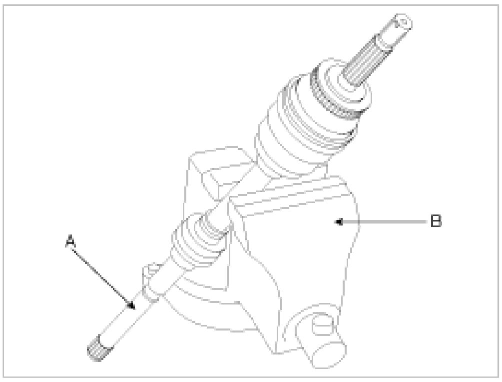
Wrap tape(B) around the driveshaft splines(C) to protect the boot(A).



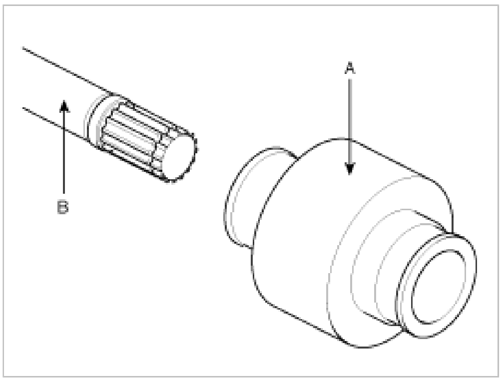
9. Remove both side of bands(B,C) of the dynamic damper(A).



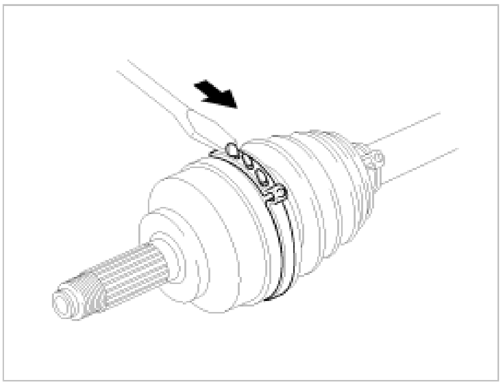
10. Fix the drive shaft(A) with a vice(B) as illustrated.



11. Apply soapy water to the shaft to prevent being damaged between the shaft spline and the dynamic damper when the dynamic damper is removed.
12. Separate dynamic damper(A) from the shaft(B) carefully.



13. Remove both bands on the side of wheel.



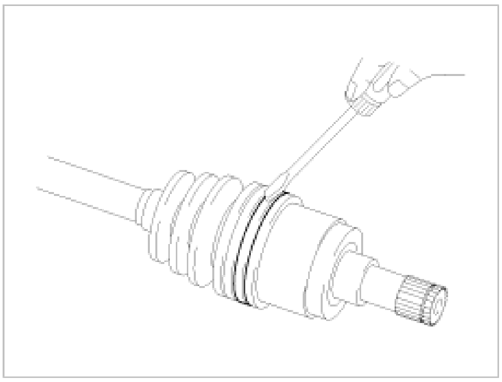
14. Pull out the joint(BJ) boot on the side of wheel into the transaxle direction.
 Be carefull not to damage the boot.

DISASSEMBLY

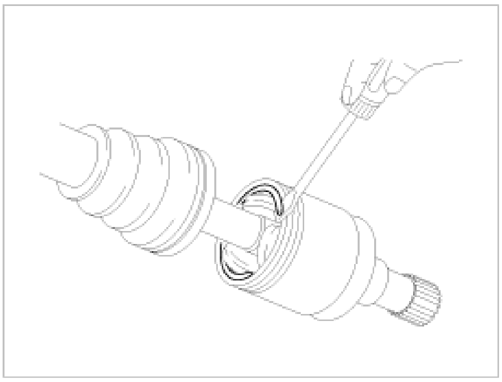
> **NOTE**
>
> - Do not disassemble the BJ assembly.
> - The Driveshaft joint uses special grease. Do not subtitute with another type of grease.
> - The Boot band should be replaced with a new one.

1. Remove the SFJ boot band and pull the boot from SFJ outer race.

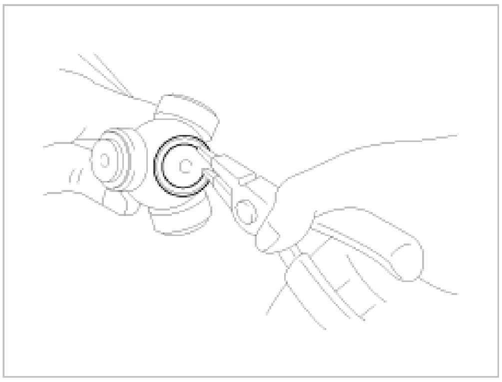
> **NOTE**
>
> Be careful not to damage it.



2. Remove the circlip using a screwdriver.
 (ASAN) KOREA



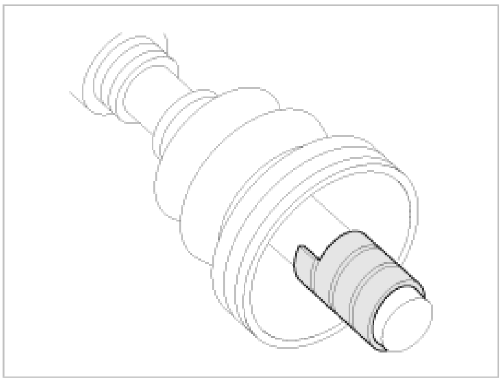
3. Remove the driveshaft from SFJ outer race.



4. Remove the snap ring and disassemble the spider assembly from the shaft.
5. Clean the spider assembly.
6. Remove the BJ boot band and removal of the SFJ boot and the BJ boot.

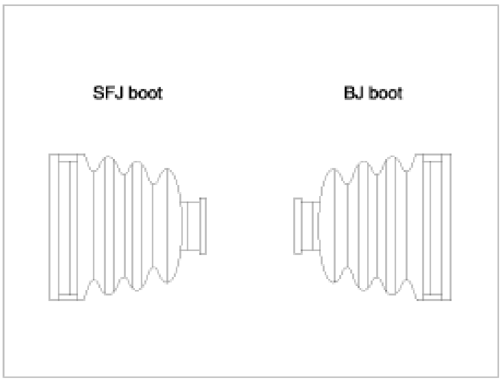
CAUTION

If the boot is reused, wrap a tape around the driveshaft splines to protect the boot.



REASSEMBLY

1. Wrap a tape around the driveshaft spline(SFJ side) to avoid boot damage.



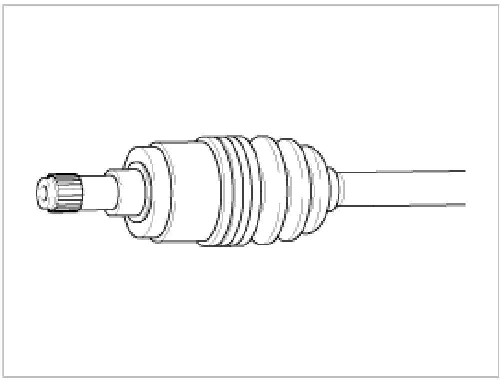
2. Apply specified grease at the driveshaft and install the boot.

Item 3.3		L
Grease filling quantity	BJ boot	Joint 140g ± 5g, Boot 60g ± 5g
	SFJ boot	Joint 100g ± 5g, Boot 45g ± 5g

3. Add the specified grease in the amount wiped away at the of inspection.
4. Tighten the boot band.

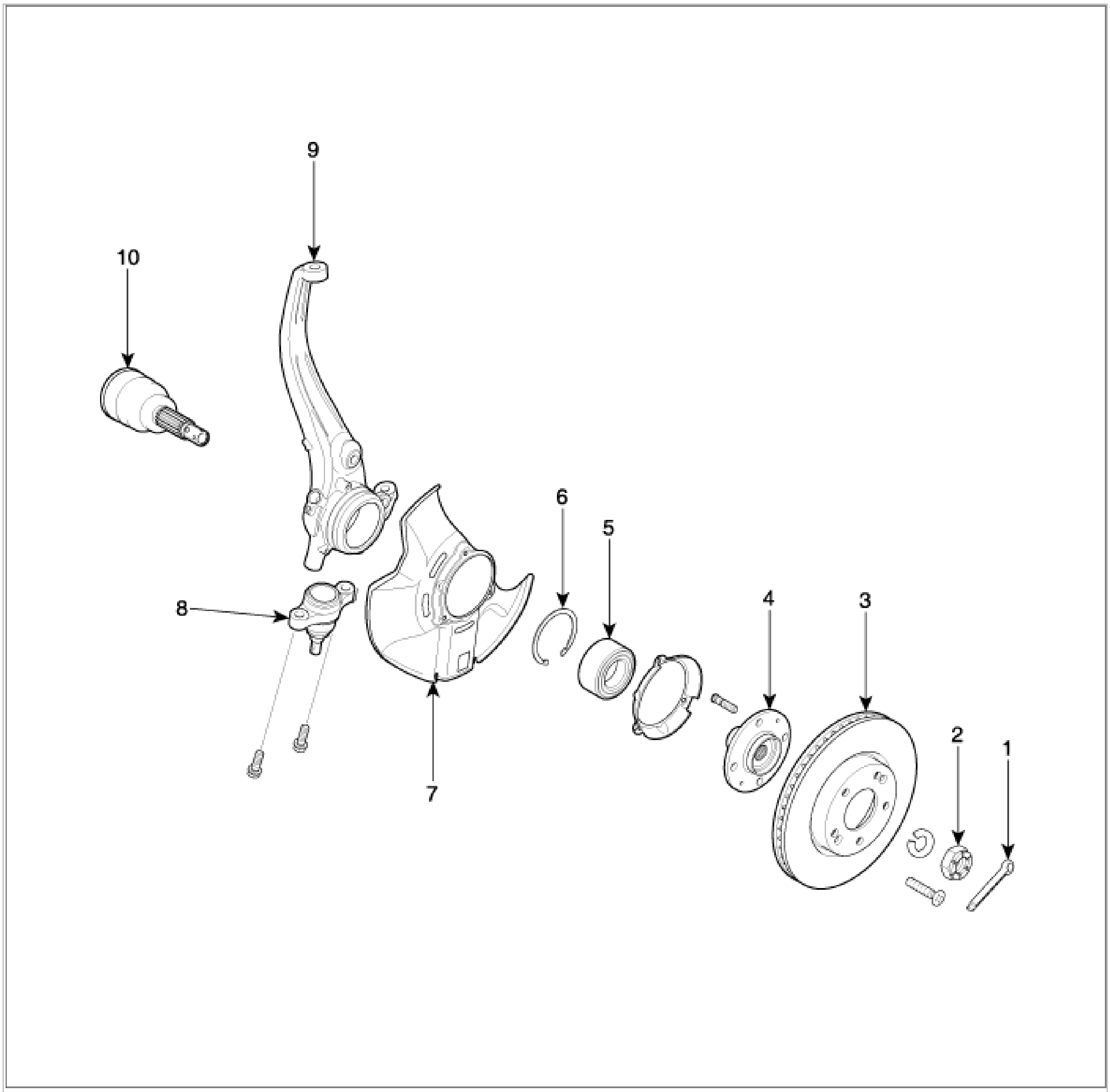
CAUTION

Adjust the distance between boot bands within the specification range when tightening the boot band to adjust air in the boot.



Driveshaft and axle > Front Axle Assembly > Front Hub / Axle > Components and Components Location

COMPONENTS

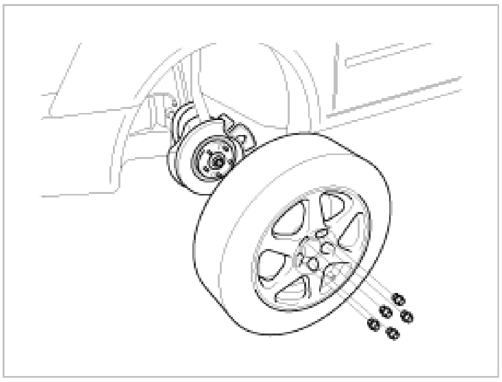


1. Split pin
2. Driveshaft nut
3. Brake disc
4. Hub
5. Wheel bearing
6. Snap ring
7. Dust cover
8. Lower arm ball joint
9. Knuckle
10. Driveshaft

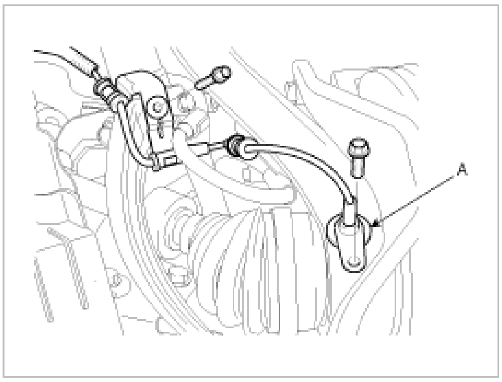
Driveshaft and axle > Front Axle Assembly > Front Hub / Axle > Repair procedures

REMOVAL

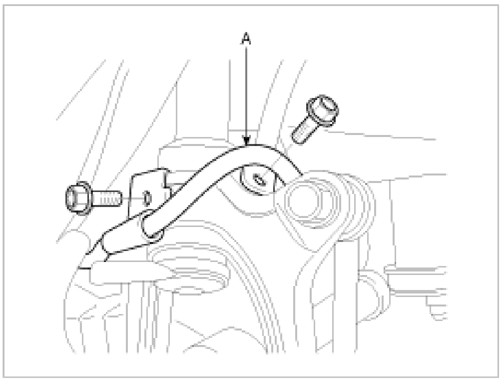
1. Remove the wheel and tire.



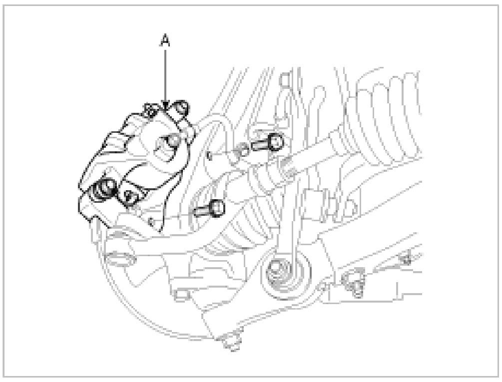
2. Disconnect the wheel speed sensor(A) from the knuckle.

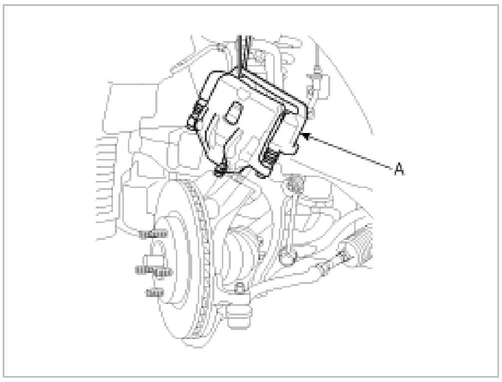


3. Disconnect the brake hose(A) from the knuckle.

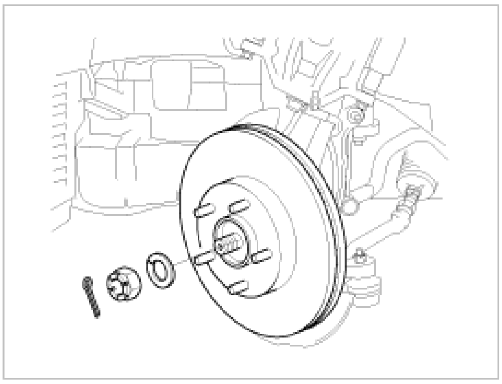


4. Remove the caliper assembly(A) and suspend it with wire.

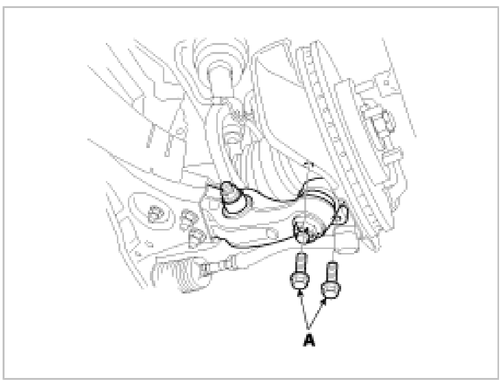




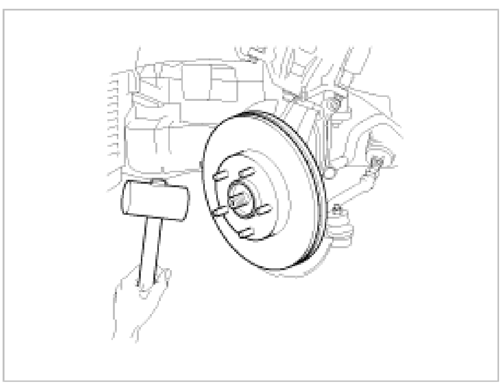
5. Remove the split pin and driveshaft castle nut from the front hub.



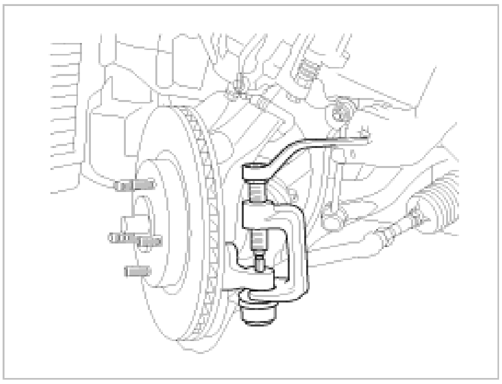
6. Remove the 2 bolts(A) and disconnect the ball joint from the knuckle.



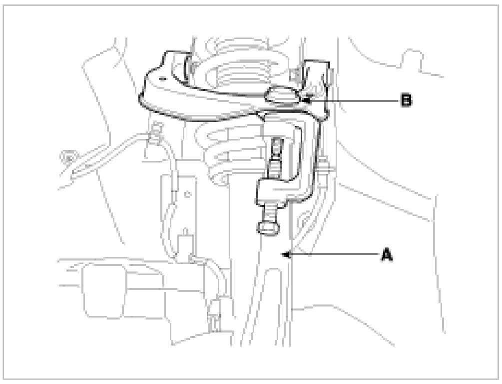
7. Using a plastic hammer, disconnect the driveshaft from the axle hub.



8. Using the special tool (09568-4A000), disconnect the tie rod end from the knuckle.



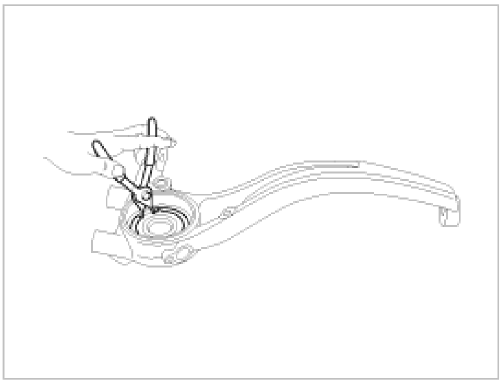
9. Loosen the upper armmounting nut but do not remove it.
10. Using the special tool (09568-4A000), disconnect the upper arm from the knuckle.



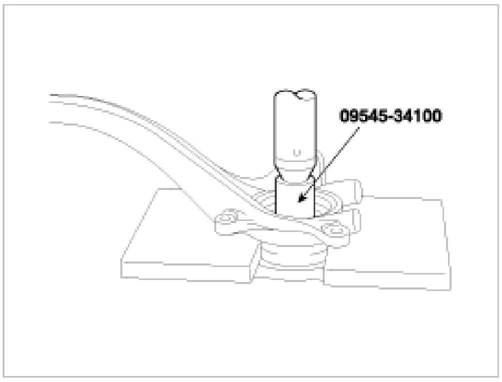
11. Remove the front axle and knuckle together.
12. Installation is the reverse of removal.

DISASSEMBLY

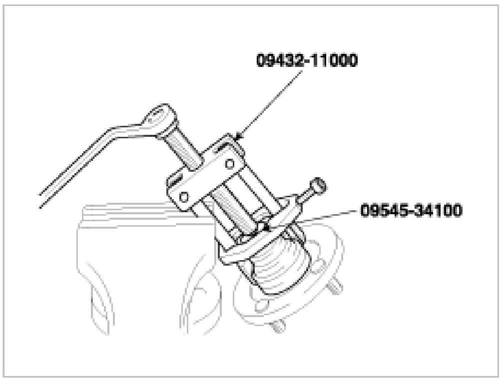
1. Remove the brake disc from the hub.
2. Remove the snap ring.



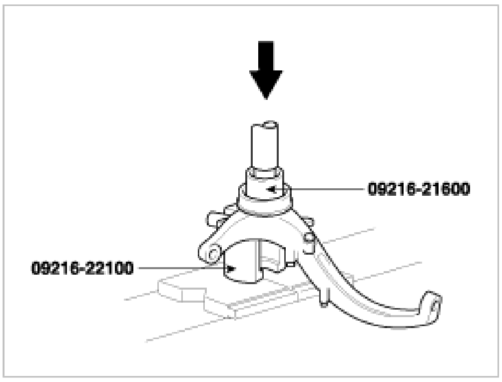
3. Using the special tool (09545-34100), disconnect the hub from the knuckle.



4. Using the special tools (09432-11000, 09545-34100), remove the wheel bearing inner race from the hub.



5. Using the special tools (09216-21600, 09216-22100), remove the wheel bearing outer race from the knuckle.



INSPECTION

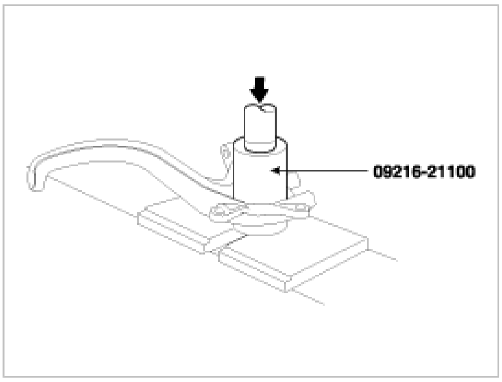
1. Check the hub for cracks and splines for wear.
2. Check the snap ring for cracks or damage.
3. Check the knuckle inner surface for scoring and cracks.

REASSEMBLY

1. Apply a thin coat of multi-purpose grease to the knuckle and bearing contact surface.
2. Using the special tool (09216-21100), press-in the bearing to the knuckle.

NOTE

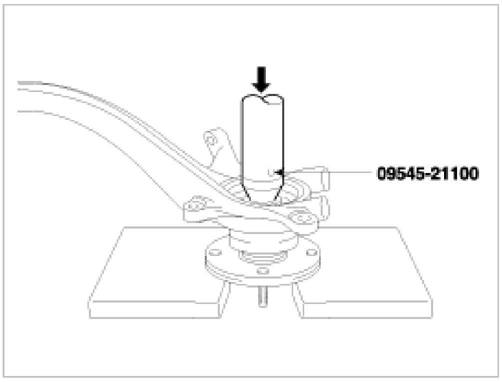
- Do not press against the inner race of the wheel bearing because that can cause damage to the bearing assembly.
- Always use a new bearing assembly.



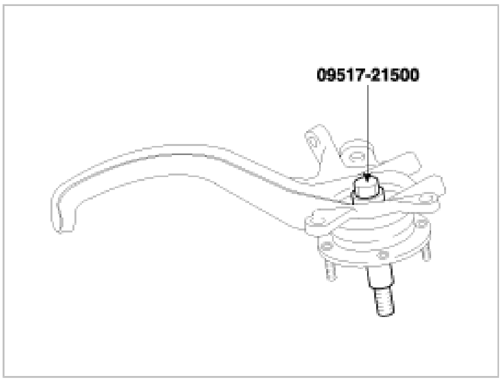
3. Install the snap ring into the groove of the knuckle.
4. Using the special tool (09545-21100), press the hub on to the knuckle.

NOTE

Do not press against the outer race of the wheel bearing because that can cause damage to the bearing assembly.

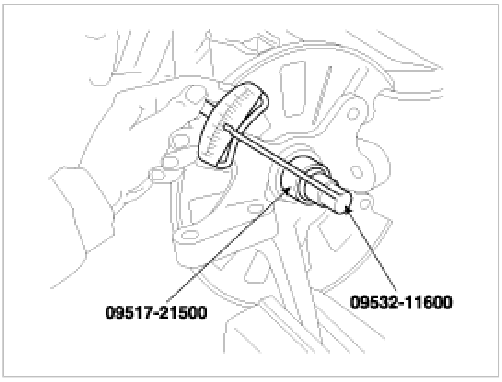


5. Tighten the hub to the knuckle to 200 Nm (20 kgf·m, 148 lb-ft) with the special tool (09517-21500).



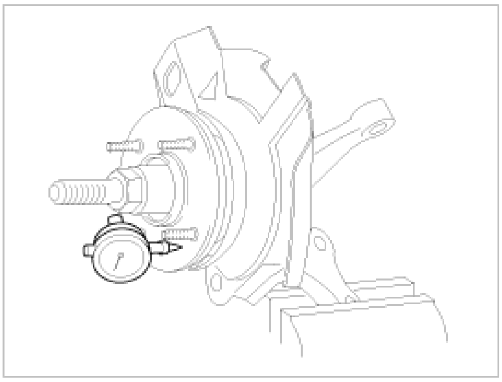
6. Rotate the hub to seat the bearing.
7. Measure the wheel bearing starting torque.

Standard value
Starting torque : 1.8 Nm (0.18 kgf·m, 16 lb-ft) or less



Fix a dial gauge and measure the hub end play. Check that it is within the standard value.

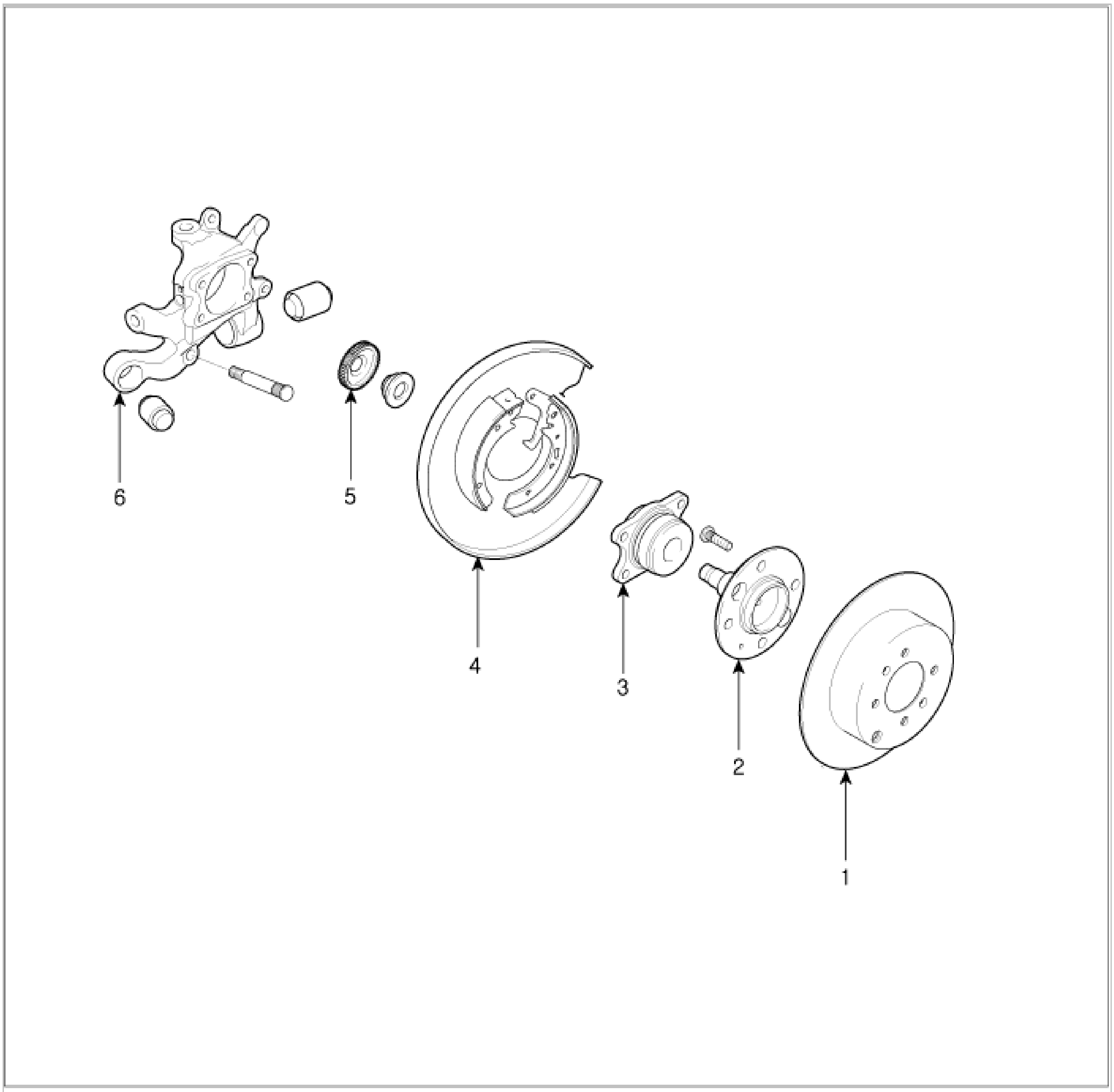
Standard value
Hub end play : 0.008 mm (0.0003 in) or less



8. Remove the special tool.
9. Install the disc to the hub.

Driveshaft and axle > Rear Axle Assembly > Rear Hub / Axle > Components and Components Location

COMPONENTS

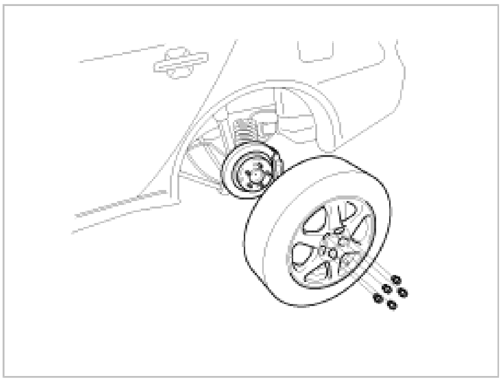


1. Brake disc	4. Brake assembly
2. Hub	5. Tone wheel (ABS System)
3. Hub bearing	6. Carrier assembly

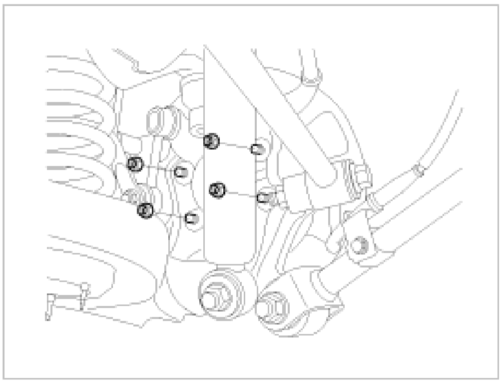
Driveshaft and axle > Rear Axle Assembly > Rear Hub / Axle > Repair procedures

REMOVAL

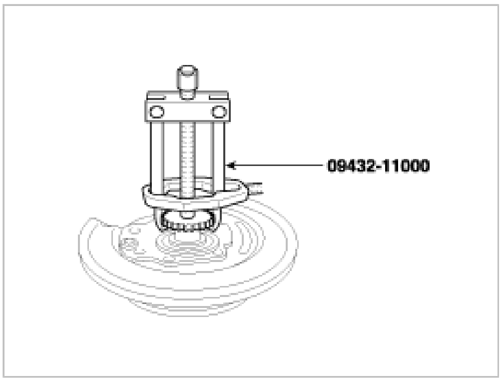
1. Release the parking brake.
2. Remove the wheel and tire.



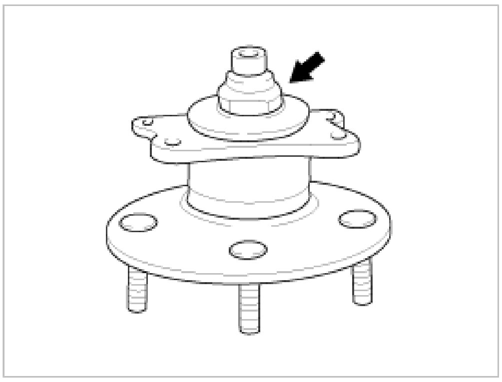
3. Remove the ABS sensor from the carrier.
4. Remove the caliper assembly from the carrier and suspend it with wire.
5. Remove the brake disc.
6. Remove the rear axle hub mounting bolts (4).



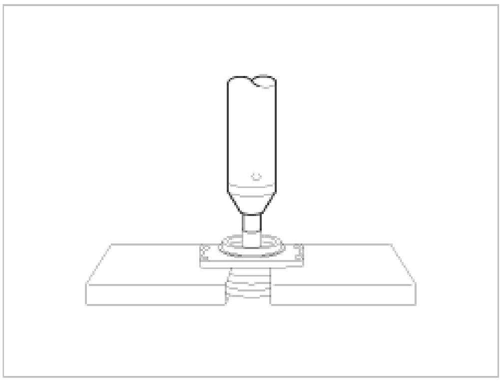
7. Using the special tool (09432-11000), remove the tone wheel.



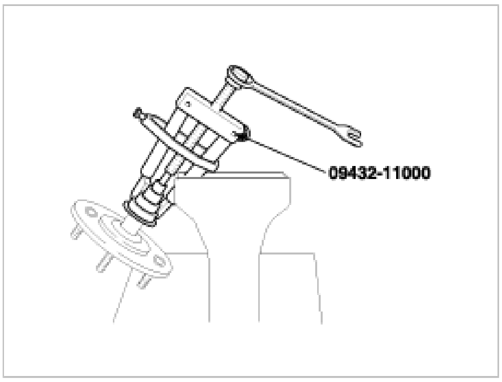
8. Remove the carrier assembly.
9. After unstaking the flange nut, remove the nut.



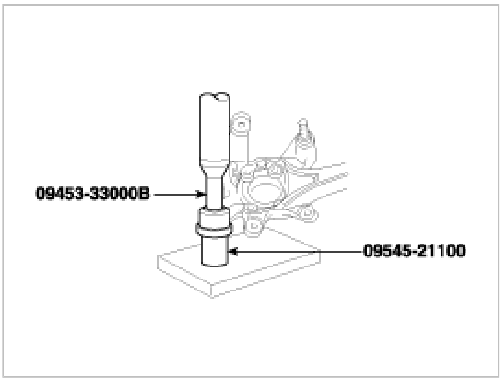
10. While supporting the flange area of the bearing outer race, press out the rear axle hub.



11. Using the special tool (09432-11000), remove the bearing inner race from the axle hub.

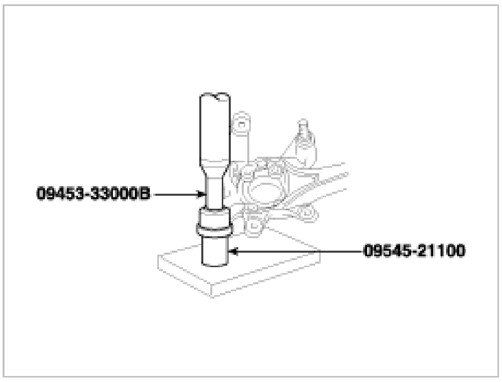


12. Using the special tools (09453-33000B, 09545-21100), remove the 2 bushings from the carrier.

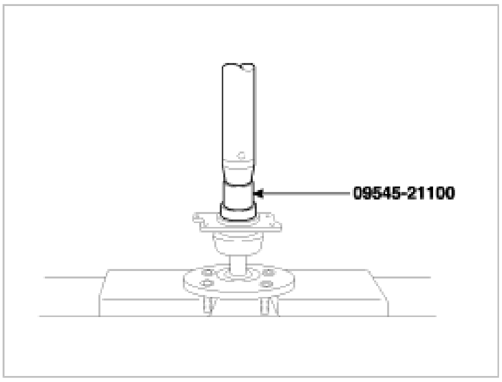


INSTALLATION

1. Using the special tools (09453-33000B, 09545-21100) press-in the 2 bushings to the carrier.



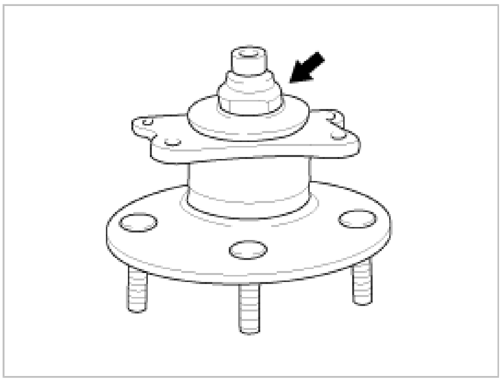
2. Apply a thin coat of multi-purpose grease to the hub and bearing contact surface.
3. Using the special tool (09545-21100), press-in the bearing to the hub.



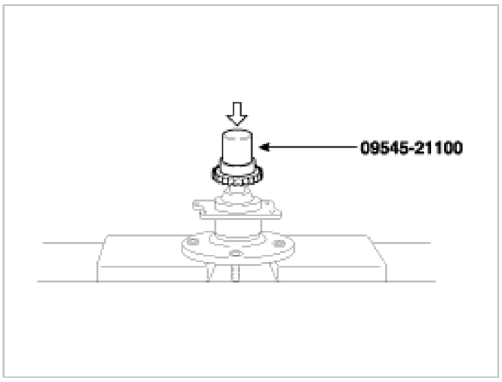
NOTE

- Do not press against the outer race of the bearing because that can cause the damage to the bearing assembly.
- Always use a new bearing assembly.

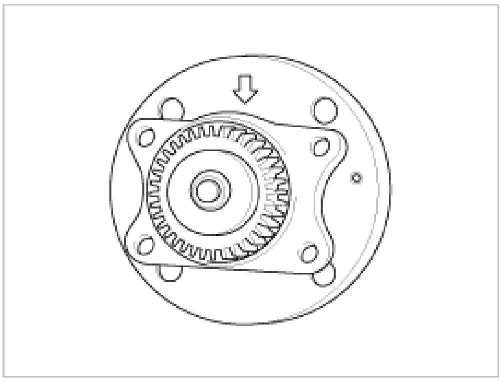
4. After tightening the flange nut, stake the nut to meet the concave portion of the spindle.



5. Using the special tool (09221-21000), press-in the tone wheel.

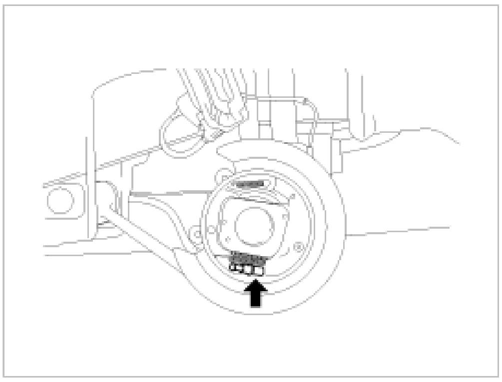


6. Fix the hub and bearing assembly to the brake backing plate so that the rounded area of the bearing outer race is placed facing upward.

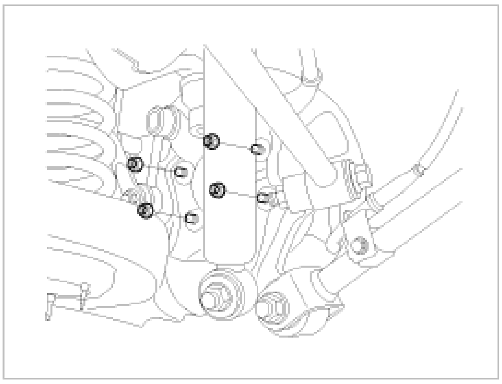


NOTE

If it is difficult to fix, adjust the parking brake adjusting nut in clockwise direction to enlarge the space between the shoe and lining assembly.

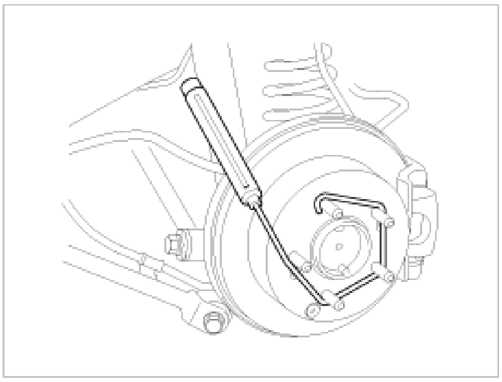


7. Tighten the 4 bolts to the specified torque.



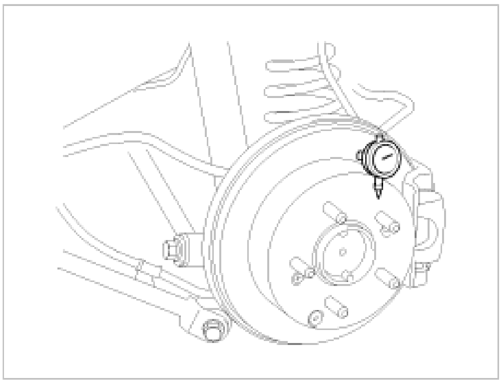
8. Rotate the hub to seat the bearing.
9. Using a spring balance, measure the wheel bearing starting torque.

Standard value
Starting torque : 1.76 Nm (0.18 kgf·m, 15.6 lb-in) or less



10. Fix a dial gauge andmeasure the hub end play. Check that it is within the standard value.

Standard value
Hub end play : 0.008 mm (0.0003 in) or less

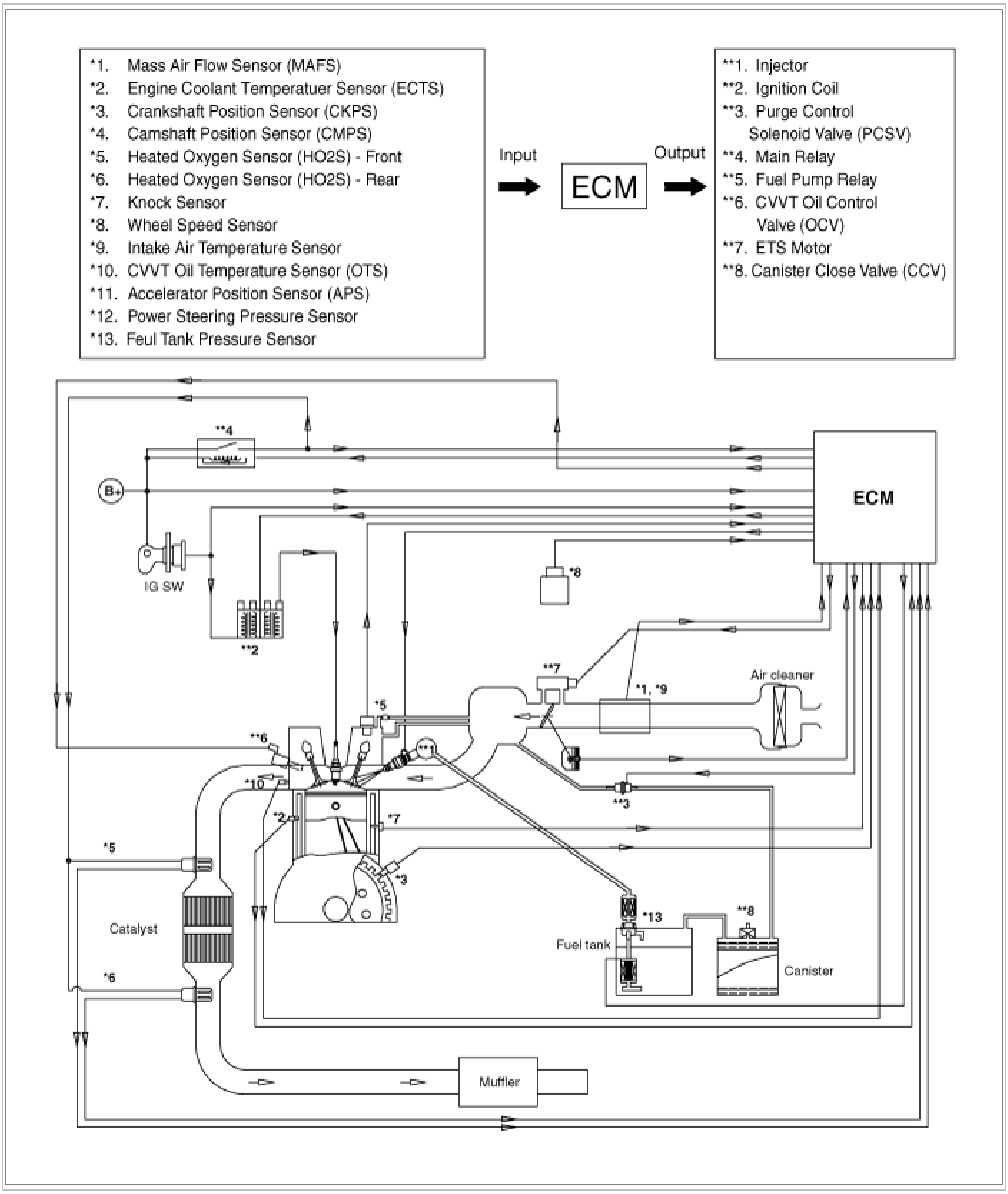


INSPECTION

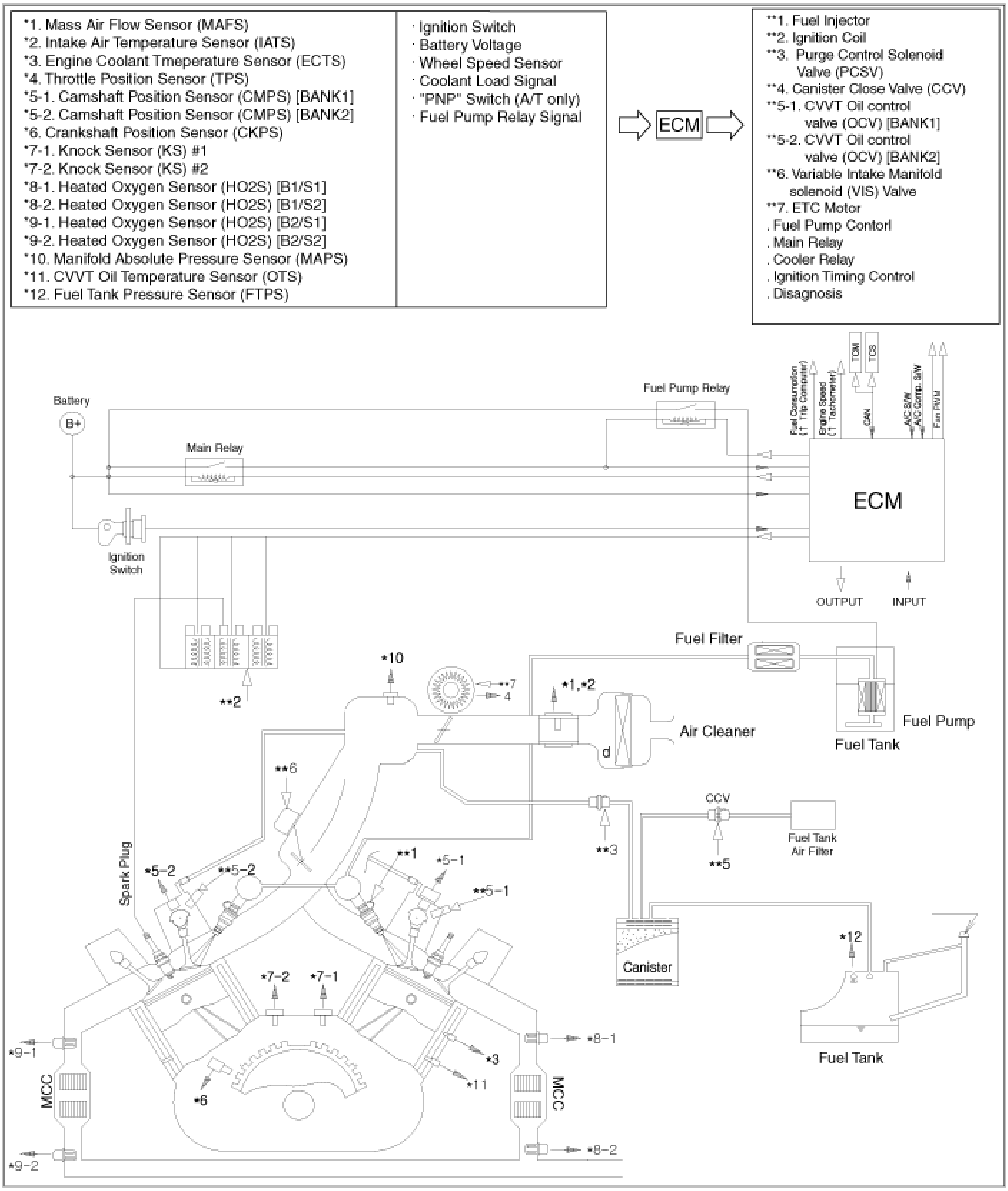
1. Check the rear hub bearing for wear or damage.
2. Check the rear tone wheel for chipped teeth.
3. Check the hub inner surface for scoring.
4. Check the carrier for crack.

SCHEMATIC DIAGRAM

[2.4 DOHC]



[3.3 V6]



Emission Control System > General Information > General Information

SPECIFICATIONS

Item Spec	ification	
Purge Control Solenoid Valve (PCSV)	Type	Duty Control type
	Resistance (Ω)	19 ~ 22 at 20 °C (68 °F)
Canister Close Valve (CCV)	TYPE	ON/OFF
	Resistance	19.8 ~ 21.8 at 20°C (68°F)

TIGHTENING TORQUE

Item N·m		kg·cm	lbf·ft
Positive Crankcase Ventilation Valve	8 ~ 12	80 ~ 120	6 ~ 8
Purge Control Solenoid Valve (PCSV)	9.7 ~ 11.77	100 ~ 120	7.23 ~ 8.68
Canister	16.7 ~ 25.5	170.3 ~ 260	12.3 ~ 18.8

TROUBLESHOOTING

Symptom Suspect	area	Remedy
Engine will not start or hard to start	Vacuum hose disconnected or damaged	Repair or replace
	Malfunction of the EVAP. Canister Purge Solenoid Valve	Repair or replace
Rough idle or engine stalls	Vacuum hose disconnected or damaged	Repair or replace
	Malfunction of the PCV valve	Replace
	Malfunction of the evaporative emission canister purge system	Check the system; if there is a problem, check related components parts
Excessive oil consumption	Positive crankcase ventilation line clogged	Check positive crankcase ventilation system

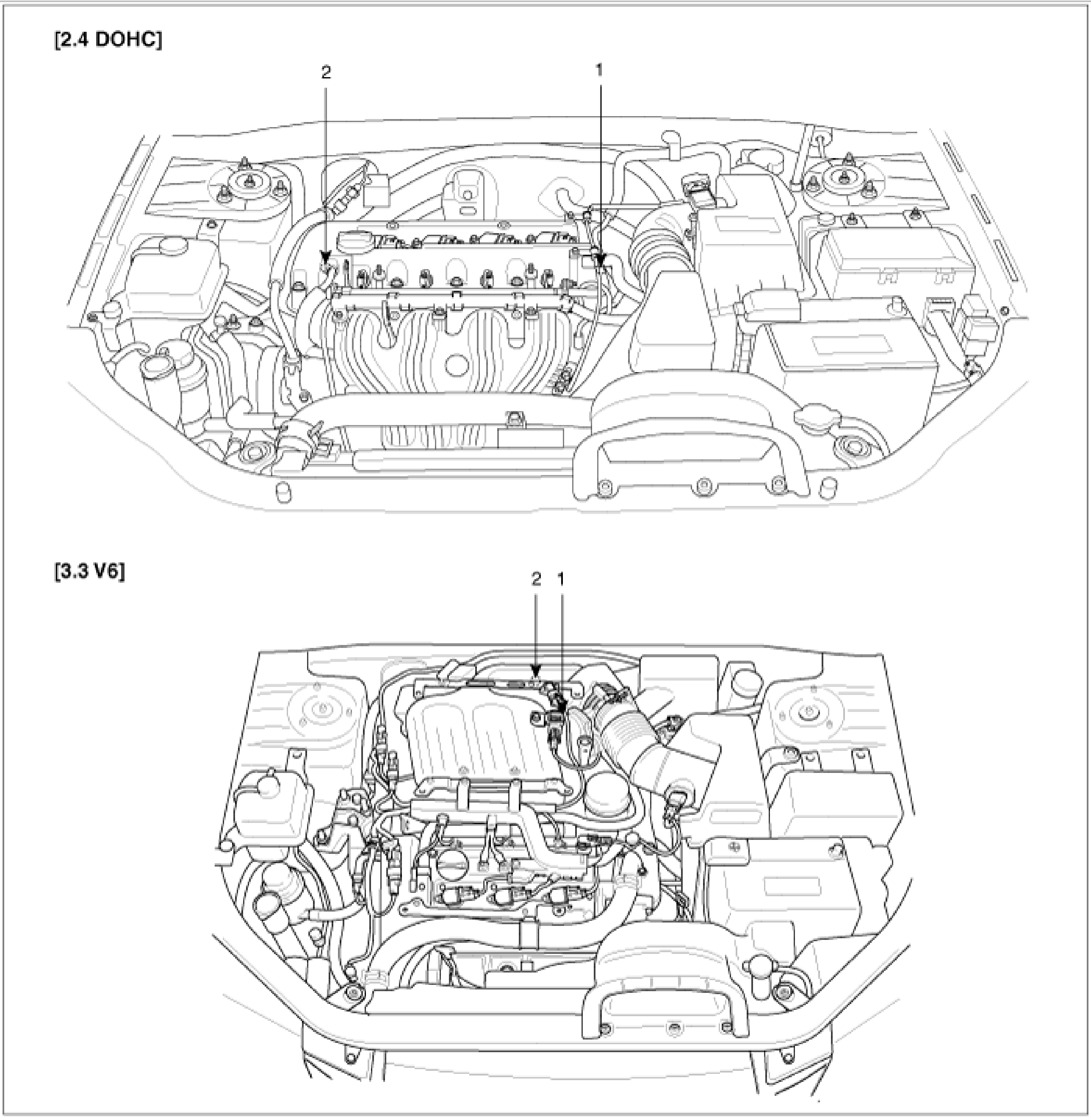
COMPONENTS

Components F	unction	Remarks
Crankcase Emission System - Positive Crankcase Ventilation (PCV) valve	HC reduction	Variable flow rate type
Evaporative Emission System - Evaporative emission canister - Purge Control Solenoid Valve (PCSV)	HC reduction HC reduction	Duty control solenoid valve
Exhaust Emission System - MFI system (air-fuel mixture control device) - Three-way catalytic converter	CO, HC, NOx reduction CO, HC, NOx reduction	Heated oxygen sensor feedback type Monolithic type

MFI : Multiport Fuel Injection
EVAP : Evaporative Emission

Emission Control System > General Information > Components and Components Location

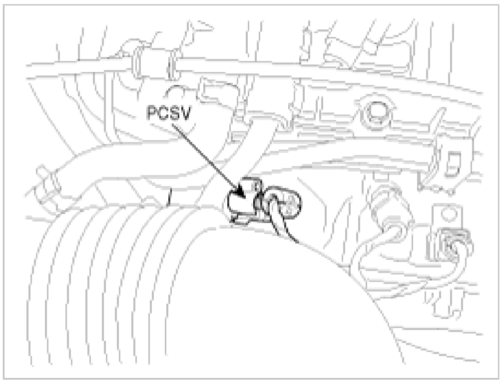
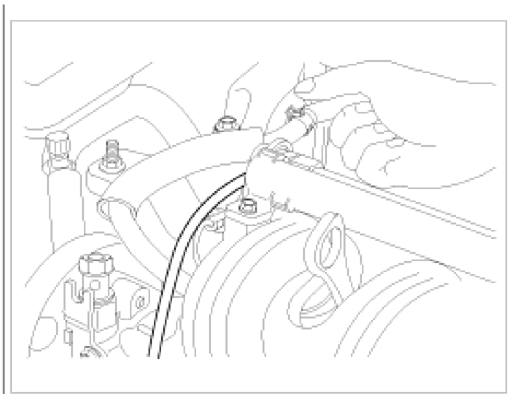
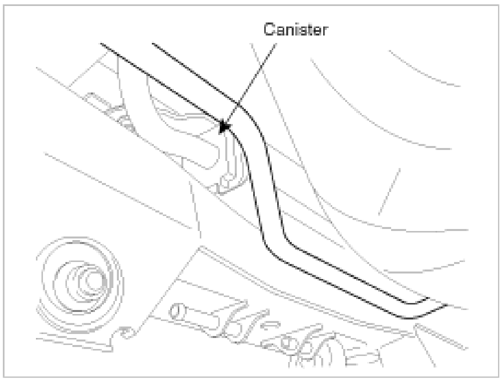
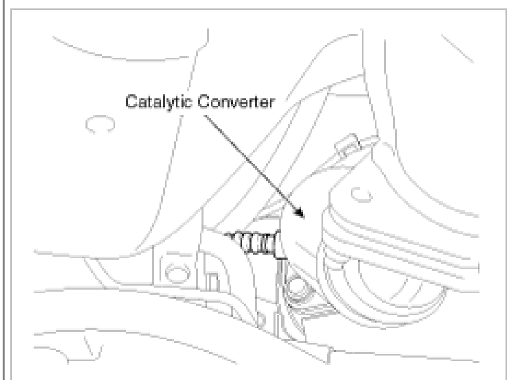
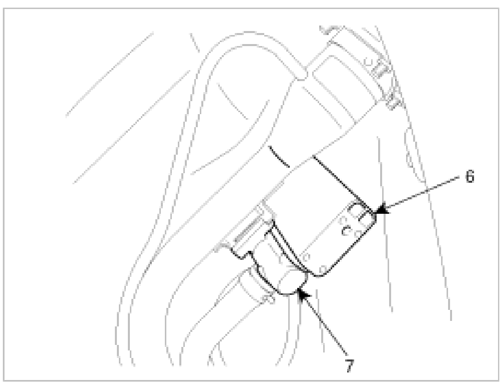
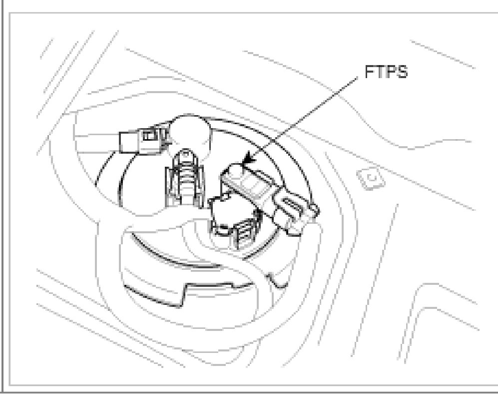
COMPONENTS LOCATION



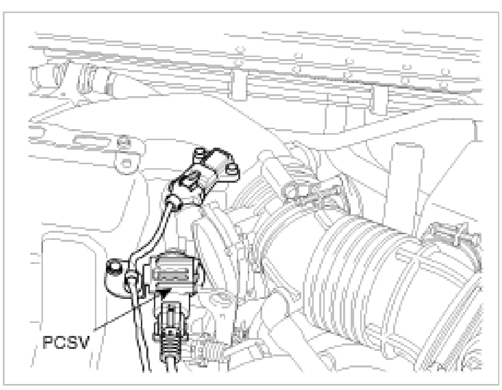
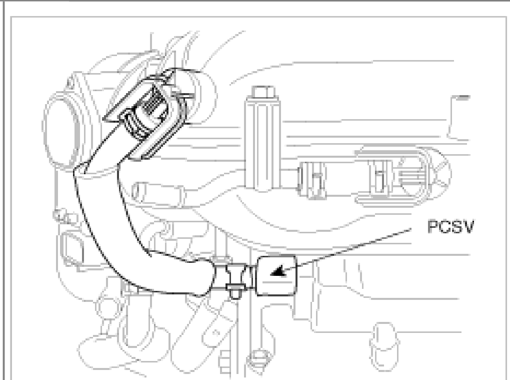
1. Purge Control Solenoid Valve (PCSV)
2. PCV Valve
3. Canister
4. Catalytic Converter (Bank 1)
5. Catalytic Converter (Bank 2)
6. Fuel Tank Air Filter
7. Canister Close Valve (CCV)
8. Fuel Tank Pressure Sensor (FTPS)

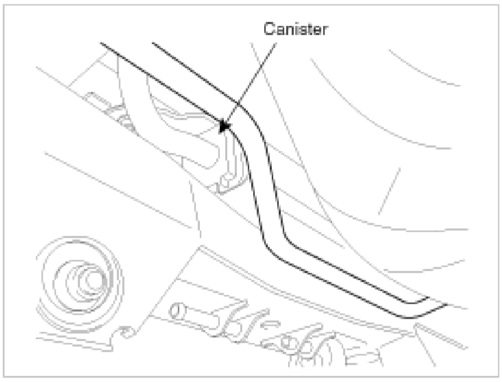
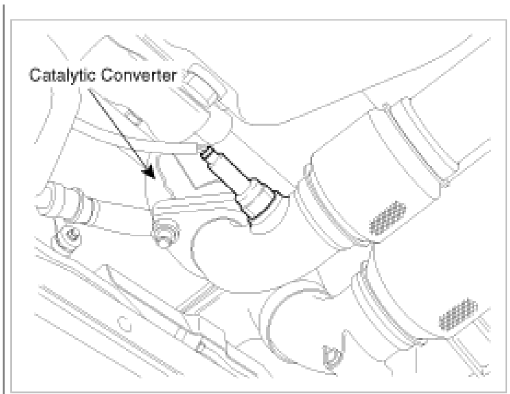
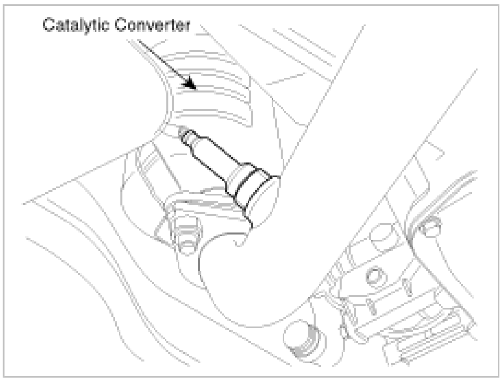
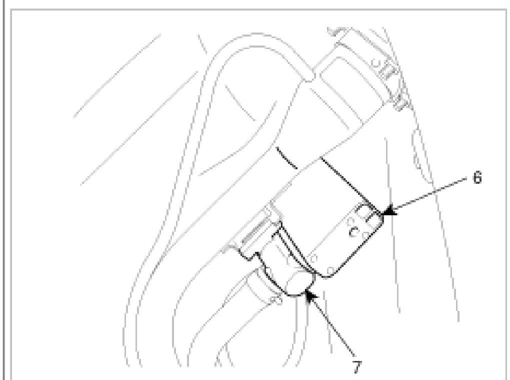
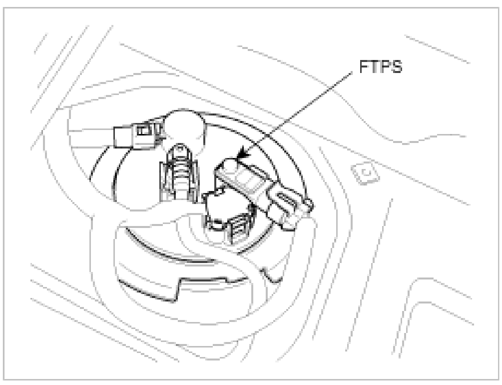
[2.4 DOHC]

1	Purge Control Solenoid Valve (PCSV)	2	Positive Crankcase Ventilation (PCV) Valve

			
3	Canister	4	Catalytic Converter
			
6	Canister Air Filter	8	Fuel Tank Pressure Sensor (FTPS)
7	Canister Close Valve (CCV)		
			

[3.3 V6]

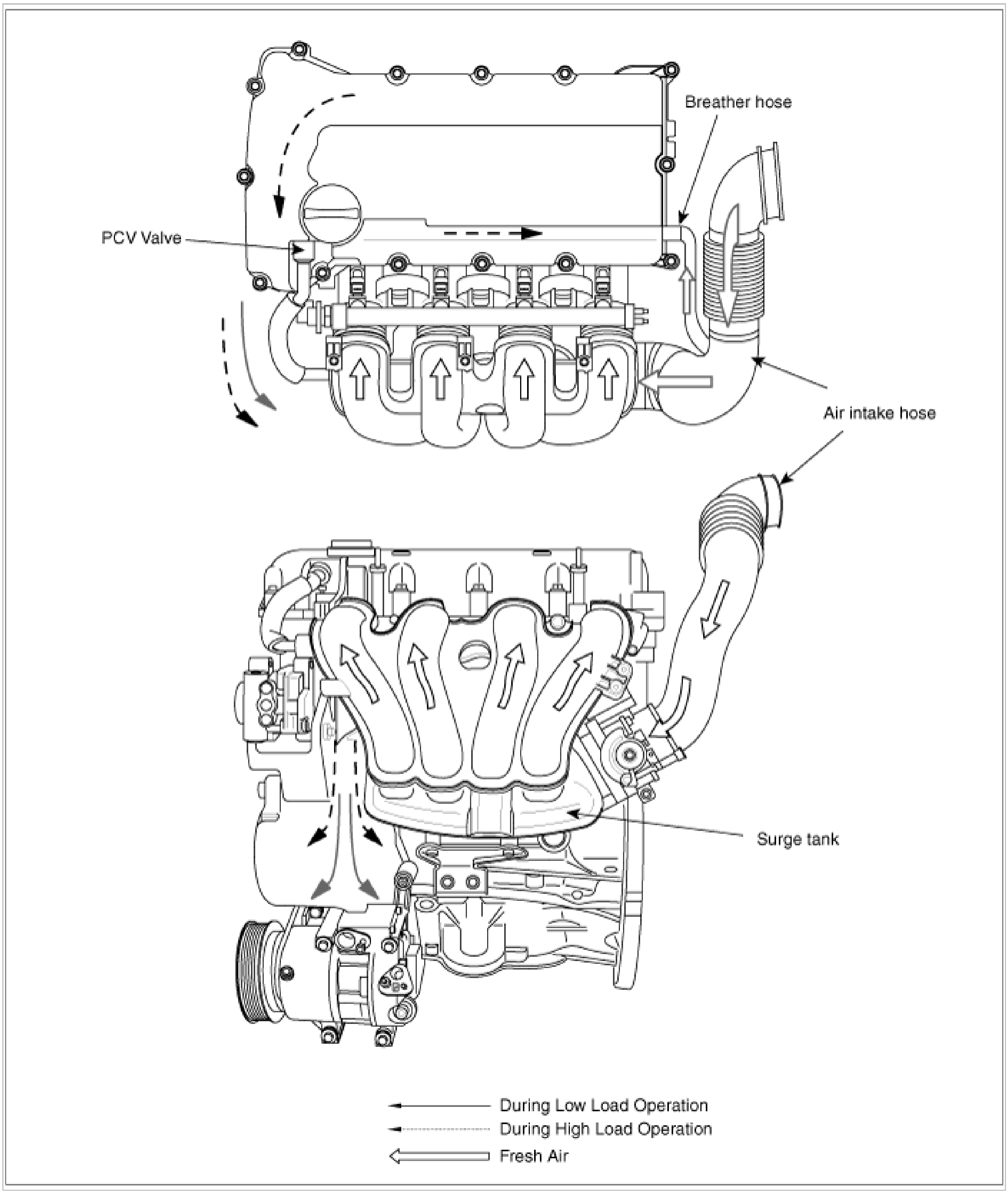
1	Purge Control Solenoid Valve (PCSV)	2	Positive Crankcase Ventilation (PCV) Valve
			
3	Canister	4	Catalytic Converter (Bank 1)

			
5	Catalytic Converter (Bank 2)	6	Canister Air Filter
		7	Canister Close Valve (CCV)
			
8	Fuel Tank Pressure Sensor (FTPS)		
			

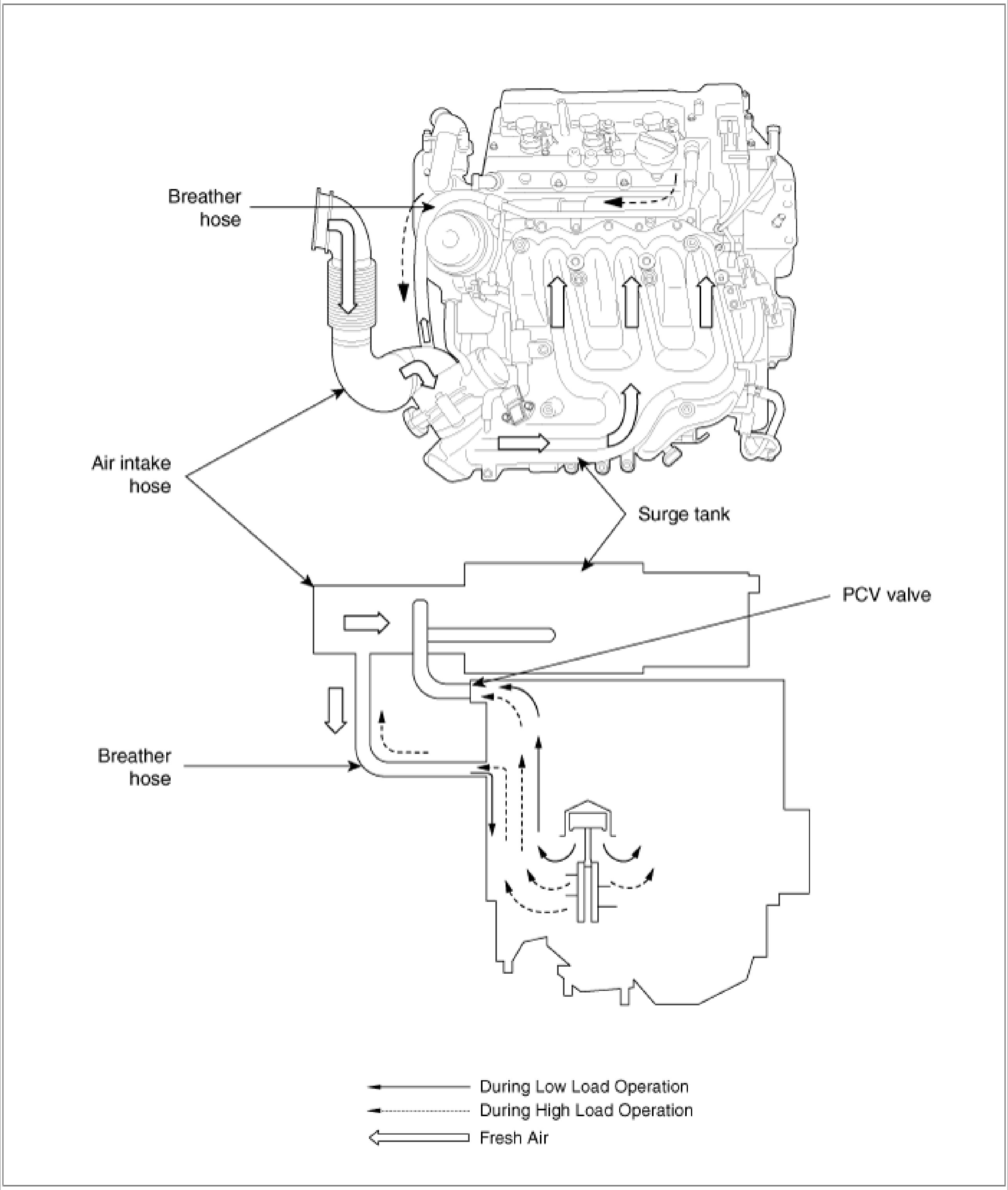
Emission Control System > Crankcase Emission Control System > Components and Components Location

COMPONENTS LOCATION

[2.4 DOHC]


Breather hose
PCV Valve
Air intake hose
Surge tank
During Low Load Operation
During High Load Operation
Fresh Air

[3.3 V6]



Emission Control System > Crankcase Emission Control System > Positive Crankcase Ventilation (PCV) Valve > Description and Operation

OPERATION

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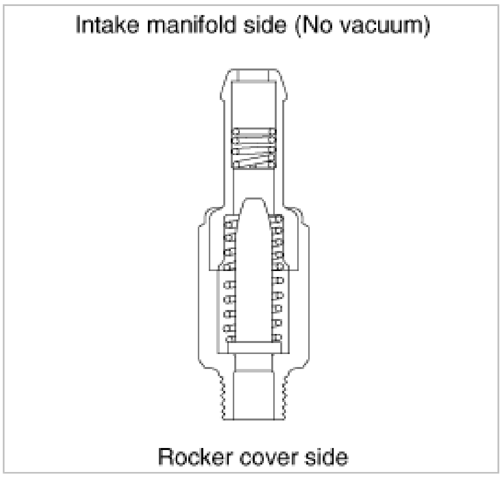
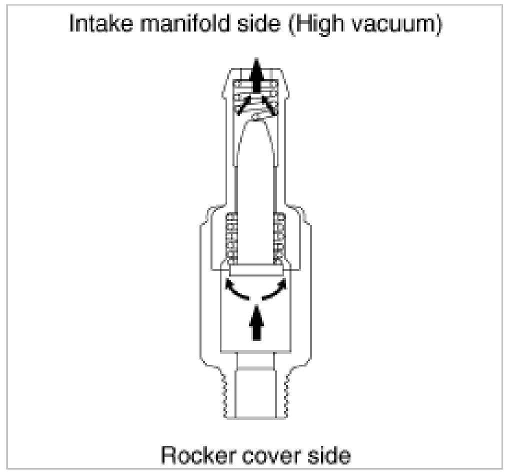
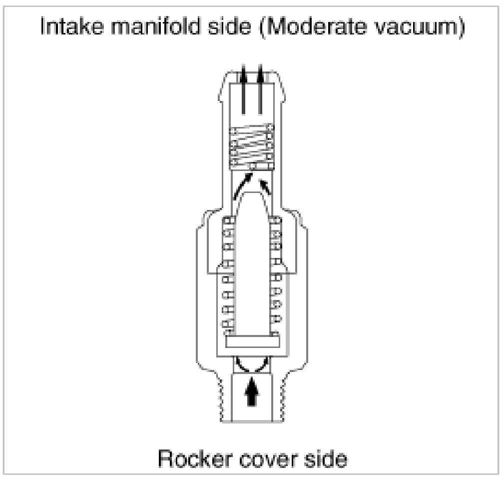
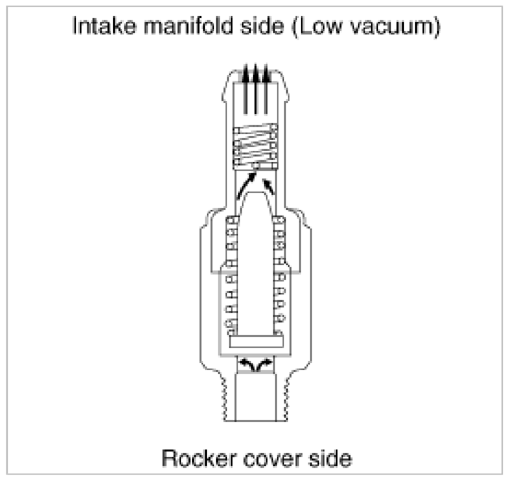
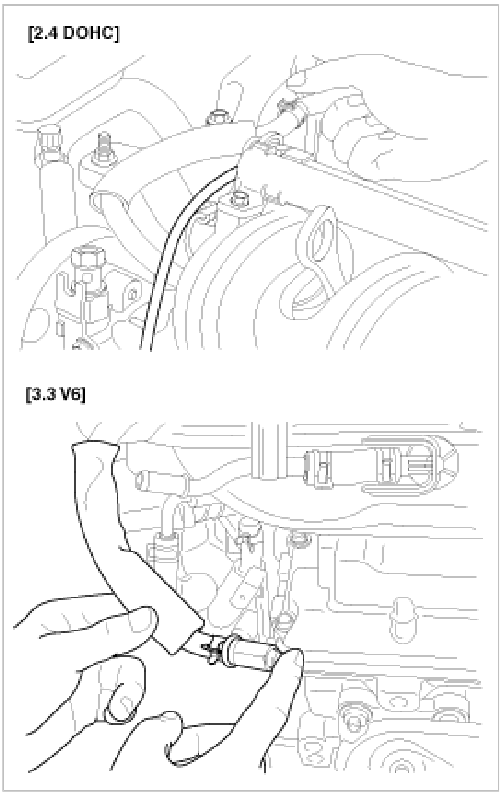
<tr><td colspan="2">
</td><td colspan="2">
</td></tr>
<tr><td>Engine condition</td><td>Not running</td><td>Engine condition</td><td>Idling or decelerating</td></tr>
<tr><td>PCV valve</td><td>Not operating</td><td>PCV valve</td><td>Fully operating</td></tr>
<tr><td>Vacuum passage</td><td>Restricted</td><td>Vacuum passage</td><td>Small</td></tr>
<tr><td colspan="2">
</td><td colspan="2">
</td></tr>
<tr><td>Engine condition</td><td>Normal operation</td><td>Engine condition</td><td>Accelerating and high load</td></tr>
<tr><td>PCV valve</td><td>Properly operating</td><td>PCV valve</td><td>Slightly operating</td></tr>
<tr><td>Vacuum passage</td><td>Large</td><td>Vacuum passage</td><td>Very large</td></tr>
</table>

Emission Control System > Crankcase Emission Control System > Positive Crankcase Ventilation (PCV) Valve > Repair procedures

REMOVAL

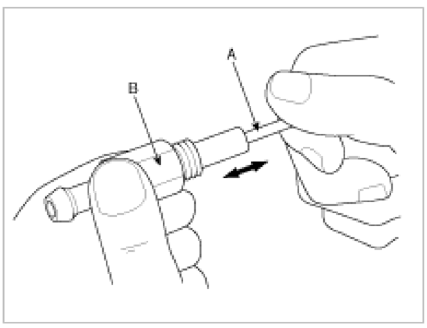
1. Disconnect the ventilation hose from the positive crankcase ventilation (PCV) valve. Remove the PCV valve from the rocker cover and reconnect it to the ventilation hose.
2. Run the engine at idle and put a finger on the open end of the PCV valve and make sure that intake manifold vacuum can be felt.

> NOTE
>
> The plunger inside the PCV valve will move back and forth.



INSPECTION

1. Remove the PCV valve.
2. Insert a thin stick(A) into the PCV valve(B) from the threaded side to check that the plunger moves.
3. If the plunger does not move, the PCV valve is clogged. Clean it or replace.



INSTALLATION

Install the PCV valve and tighten to the specified torque.

PCV valve : 0.8~1.2 kgf·m

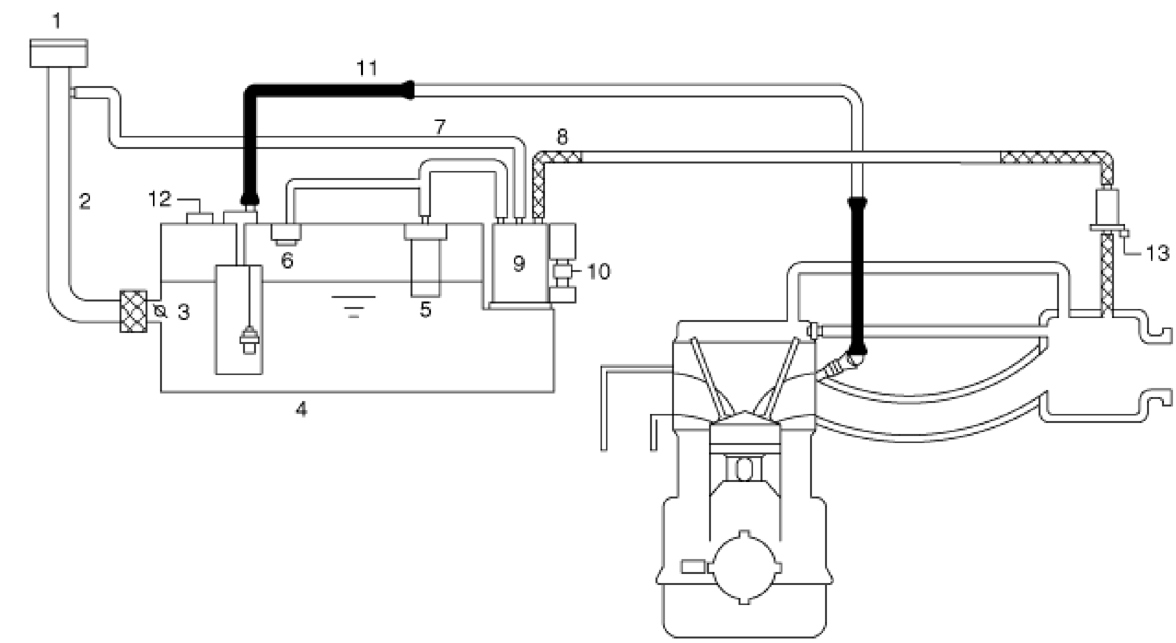
Emission Control System > Evaporative Emission Control System > Description and Operation

DESCRIPTION

This system consists of a fill vent valve, fuel shut-off valve, fuel cut valve (for roll over), two way valve (pressure/vacuum relief), fuel liquid/vapor separator which is installed beside the filler pipe, charcoal canister which is mounted under the rear floor LH side member and protector, tubes and miscellaneous connections.
While refueling, ambient air is drawn into the filler pipe so as not to emit fuel vapors in the air. The fuel vapor in the tank is then forced to flow into the canister via the fill vent valve. The fuel liquid/vapor separator isolates liquid fuel and passes the pure vapor to the charcoal canister.
While the engine is operating, the trapped vapor in the canister is drawn into the intake manifold and then into the engine

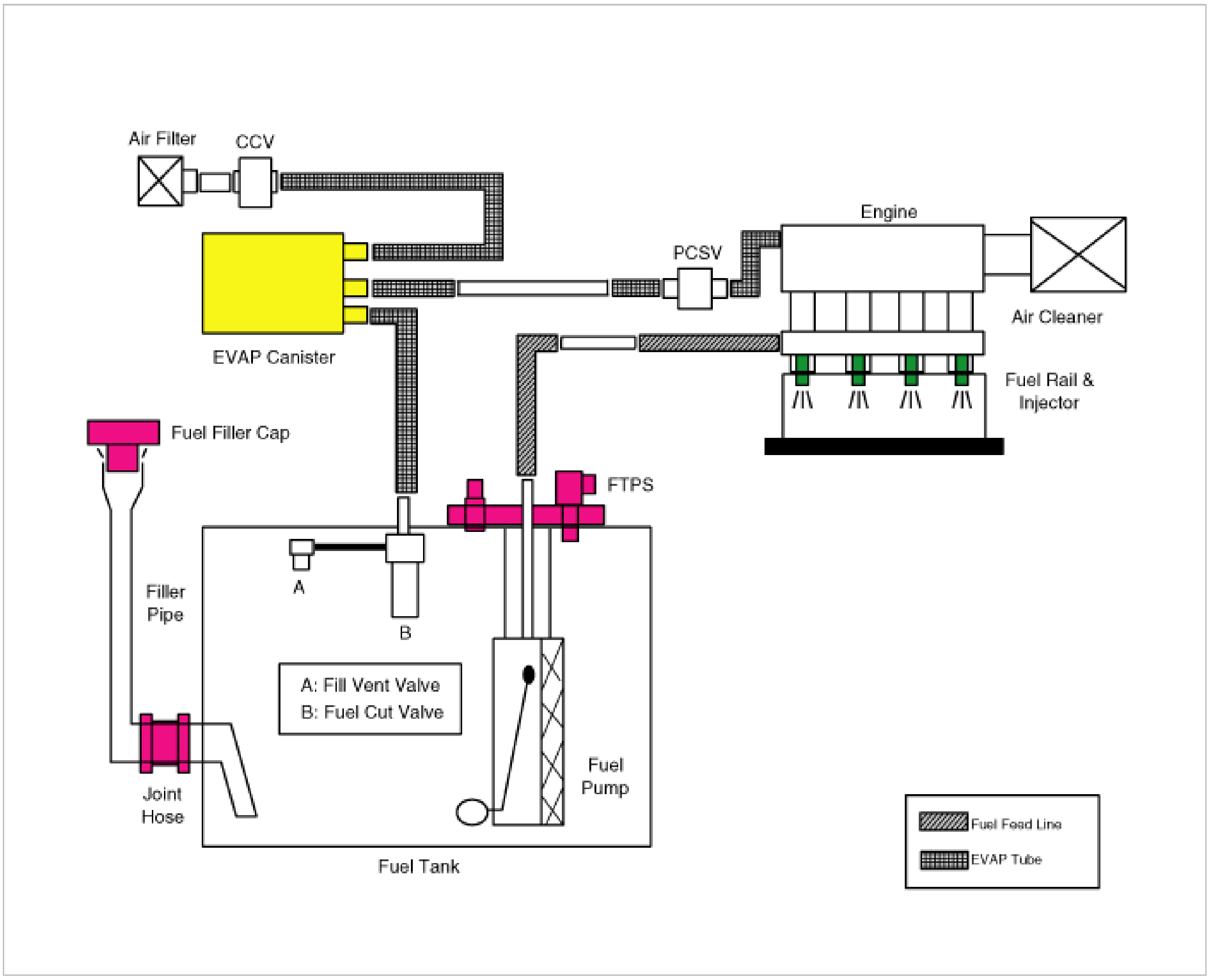
combustion chamber. According to this purge process, the charcoal canister is purged and recovers its absorbing capability.

COMPONENTS

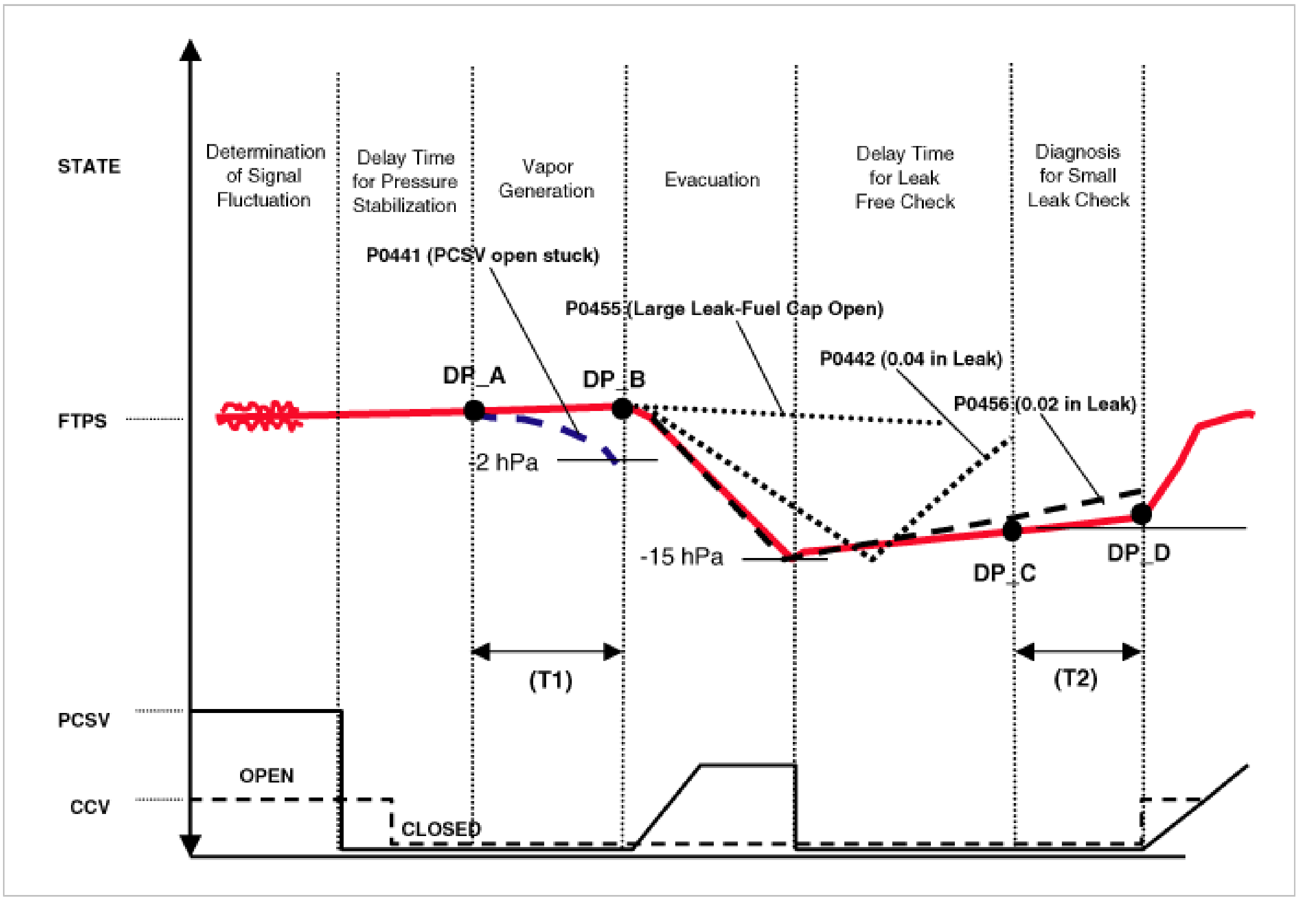


1. Filler cap
2. Fuel filler pipe
3. Check valve
4. Fuel tank
5. ORVR control valve
6. Vapor valve
7. EVAP. Hose
8. EVAP. Hose
9. Canister
10. Canister Close Valve (CCV)
11. Fuel feed line
12. Fuel Tank Pressure Sensor (FTPS)
13. Purge Control Solenoid Valve (PCSV)

DESCRIPTION



EVAP. SYSTEM MONITORING



Emission Control System > Evaporative Emission Control System > Repair procedures

INSPECTION

1. Disconnect the vacuum hose from the throttle body, and connect a vacuum pump to the vacuum hose.
2. Check the following points when the engine is cold [engine coolant temperature 60°C(140°F) or below] and when it is warm [engine coolant temperature 80°C(176°F) or higher].

WHEN ENGINE IS COLD

Engine operating condition	Applied vacuum	Result
Idling	50 kPa (7.3 psi)	Vacuum is held
3,000 rpm		

WHEN ENGINE IS WARM

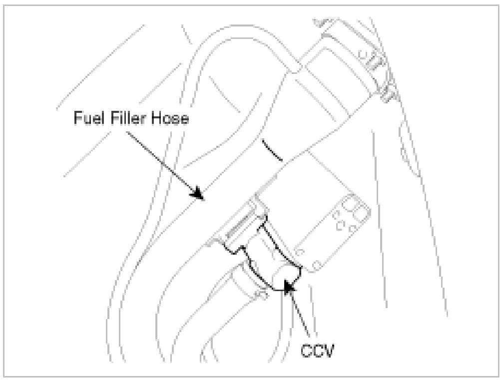
Engine operating condition	Applied vacuum	Result
Idling	50 kPa (7.3 psi)	Vacuum is held
Within 3 minutes after engine start at 3,000 rpm	Try to apply vacuum	Vacuum is released
After 3 minutes have passed after engine start at 3,000 rpm	50 kPa (7.3 psi)	Vacuum will be held momentarily, after which, it will be released

Emission Control System > Evaporative Emission Control System > Canister > Description and Operation

DESCRIPTION

The evaporative emission control system prevents hydrocarbon (HC) vapors from the fuel tank from escaping into the atmosphere where they could form photochemical smog. Gasoline vapors are collected in the charcoal canister. The

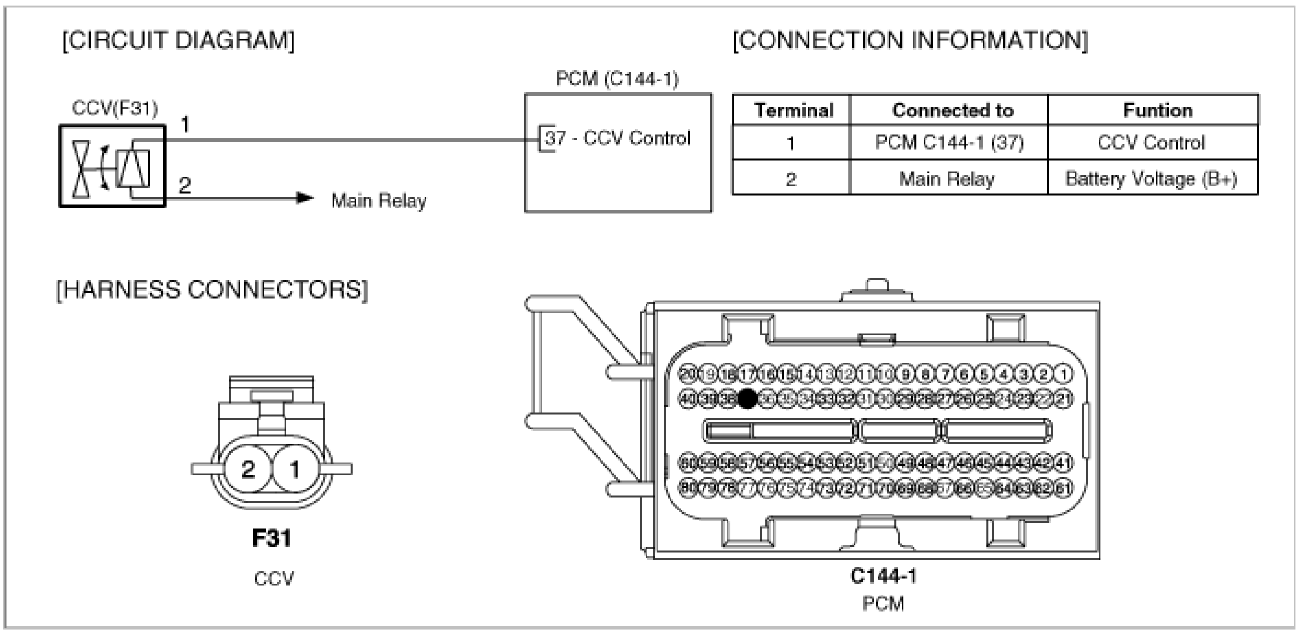
Canister Close Valve (CCV) closes off the air inlet into the canister for leak detection of the evaporative emission system. The CCV also prevents fuel vapors from escaping from the canister. When the engine purges the HC vapors from the canister, the clean air comes into the canister through the canister air-filter and the CCV.



SPECIFICATION

Item Spec	ification
Coil Resistance (Ω)	19.8 ~ 21.8Ω at 20°C (68°F)

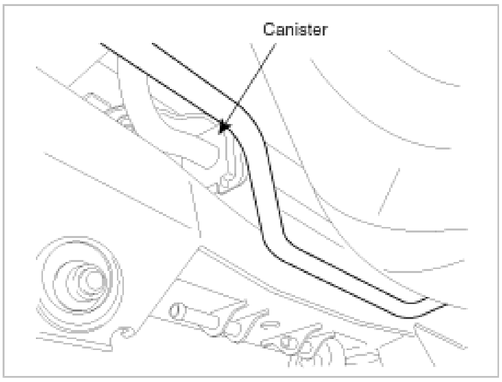
SCHEMATIC DIAGRAM



Emission Control System > Evaporative Emission Control System > Canister > Repair procedures

REMOVAL

1. Remove the fuel tank. (Refer to "Fuel System" group)
2. Disconnect hoses connecting to the canister.
3. Unfasten two mounting bolts and remove the canister.



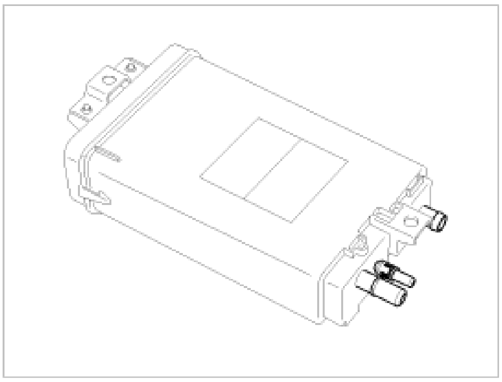
INSTALLATION

Installation is in reverse order of removal.

Torque : 1.7 ~ 2.6kgf·m (16.7 ~ 25.5N·m, 12.3 ~ 18.8lbf·ft)

INSPECTION

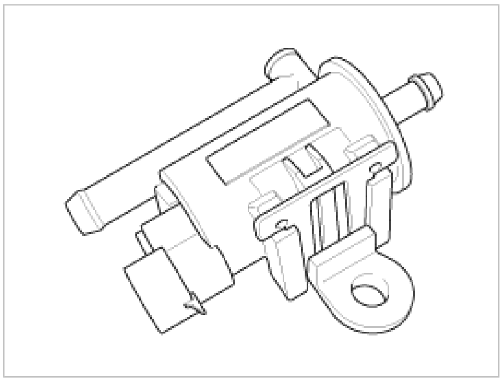
1. Lock for loose connections, sharp bends or damage to the fuel vapor lines.
2. Look for distortion, cracks or fuel damage.
3. After removing the canister, inspect for cracks or damage.



Emission Control System > Evaporative Emission Control System > Purge Control Solenoid Valve (PCSV) > Description and Operation

DESCRIPTION

Purge Control Solenoid Valve (PCSV) is installed on the surge tank and controls the passage between the canister and the intake manifold. It is a solenoid valve and is open when the PCM grounds the valve control line. When the passage is open (PCSV ON), fuel stored in the canister is transferred to the intake manifold.



SPECIFICATION

Item	Specification

Coil Resistance (Ω)	19.0 ~ 22.0Ω at 20°C (68°F)

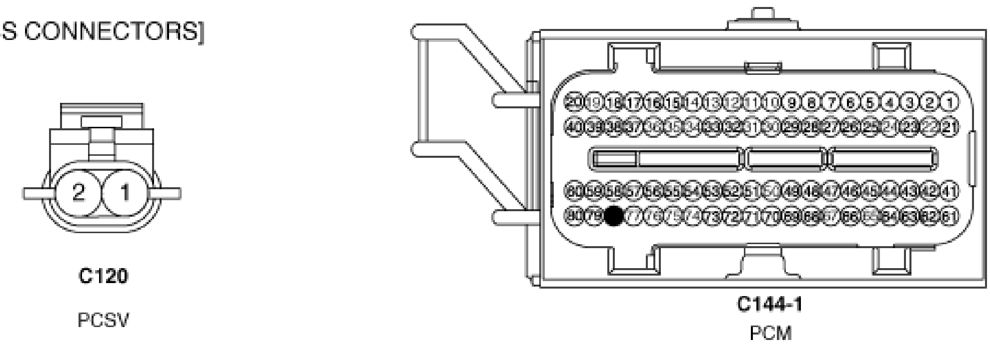
SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]

[CONNECTION INFORMATION]

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-1 (78)	PCSV Control

[HARNESS CONNECTORS]



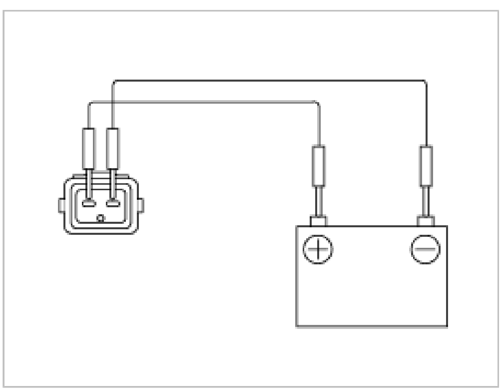
Emission Control System > Evaporative Emission Control System > Purge Control Solenoid Valve (PCSV) > Repair procedures

INSPECTION

> **NOTE**
>
> When disconnecting the vacuum hose, make an identification mark on it so that it can be reconnected to its original position.

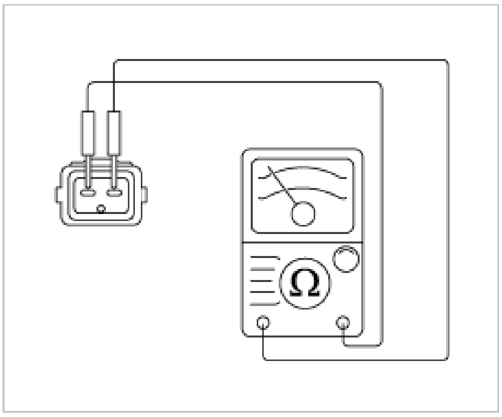
1. Disconnect the vacuum hose from the solenoid valve.
2. Detach the harness connector.
3. Connect a vacuum pump to the nipple to which the red-striped vacuum hose was connected.
4. Apply vacuum and check when voltage is applied to the PCSV and when the voltage is discontinued.

Battery voltage	Normal condition
When applied	Vacuum is released
When discontinued	Vacuum is maintained



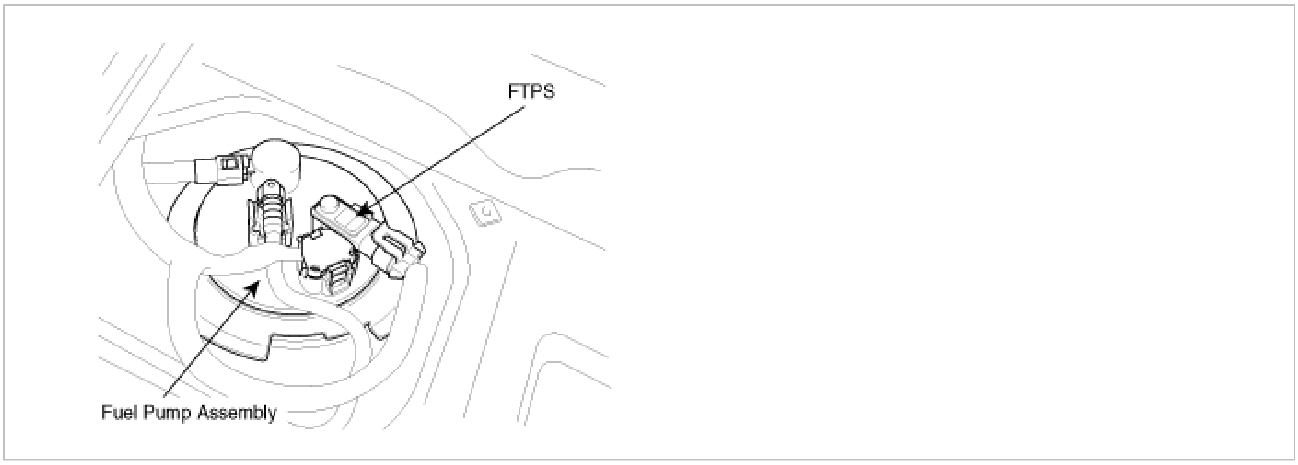
5. Measure the resistance between the terminals of the solenoid valve.

PCSV coil resistance(Ω) :
19 ~ 22Ω at 20°C (68°F)



Emission Control System > Evaporative Emission Control System > Fuel Tank Pressure Sensor (FTPS) > Description and Operation

DESCRIPTION



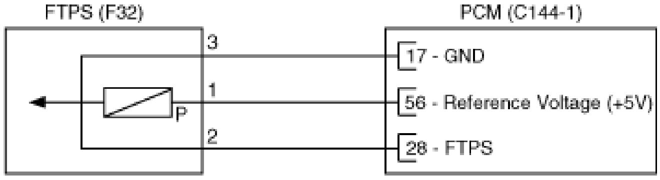
The evaporative emission control system prevents hydrocarbon vapors from escaping from the fuel tank into the atmosphere where they could form photochemical smog. Gasoline vapors are collected in the charcoal canister. The Fuel Tank Pressure Sensor (FTPS) is installed on fuel pump assembly and is an integral part of the evaporative monitoring system. The PCM monitors the FTPS signal to detect vacuum decay and excess vacuum. The FTPS measures the difference between the air pressure inside the fuel tank and outside air pressure to check the purge control solenoid valve operation and for leak detection in the evaporative emission control system by monitoring pressure and vacuum levels in the fuel tank during the purge control solenoid valve operating cycles.

SPECIFICATION

Pressure (kPa)	Output Voltage (V)
-3.75 kPa	4.5 V
0 kPa	1.5 V
1.25 kPa	0.5 V

SCHEMATIC DIAGRAM

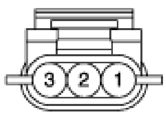
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

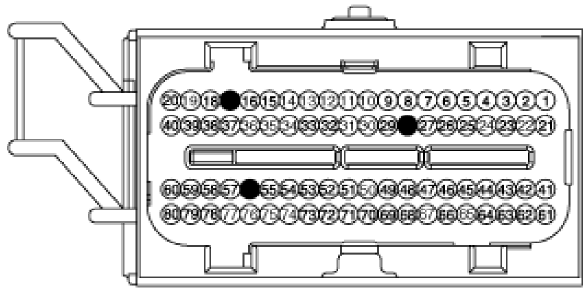
Terminal	Connected to	Funtion
1	PCM C144-1 (56)	Reference Voltage (+5V)
2	PCM C144-1 (28)	FTPS signal
3	PCM C144-1 (17)	Sensor ground

[HARNESS CONNECTORS]



F32

MAPS

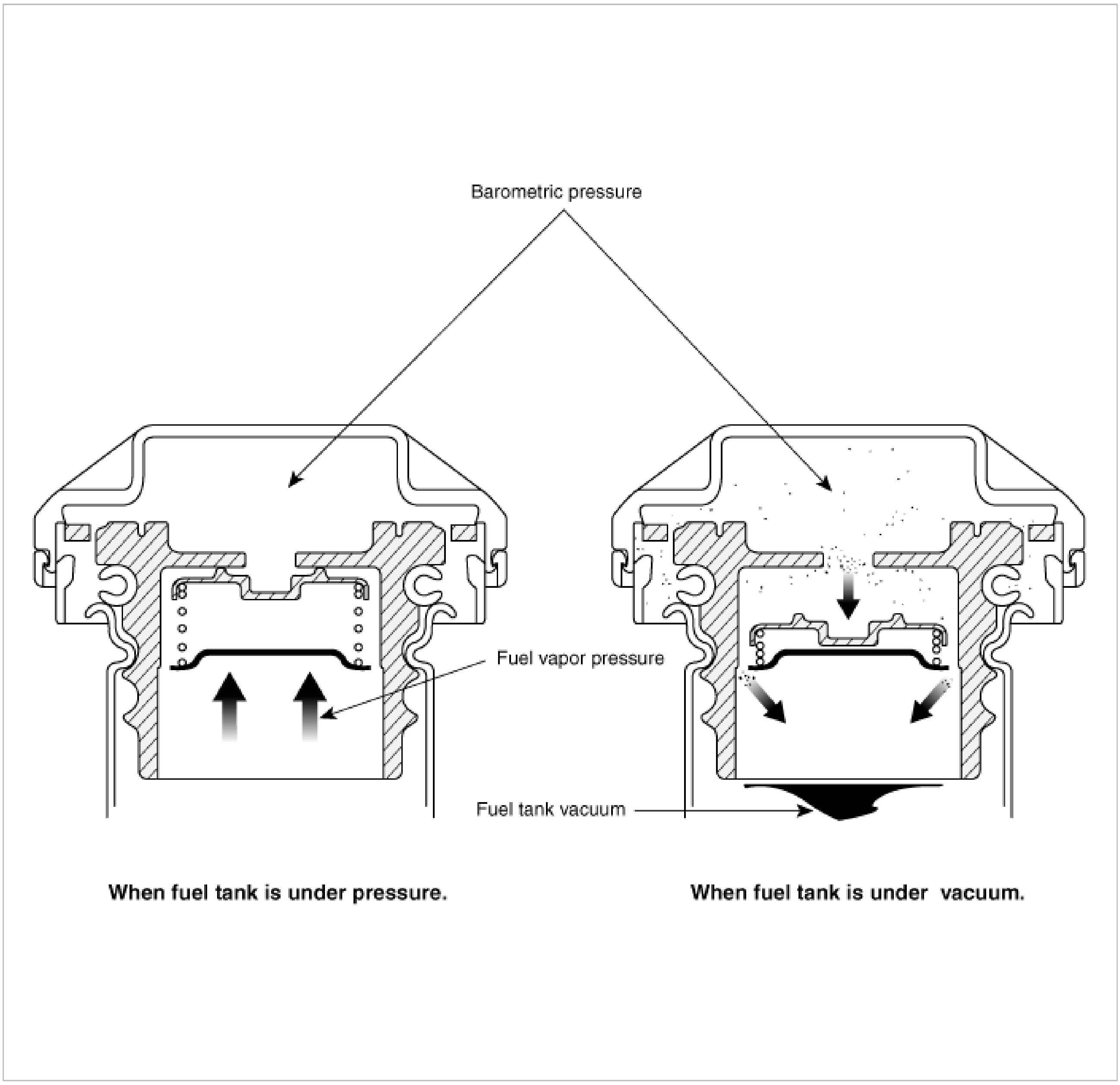


C144-1

PCM

Emission Control System > Evaporative Emission Control System > Fuel Filler Cap > Description and Operation

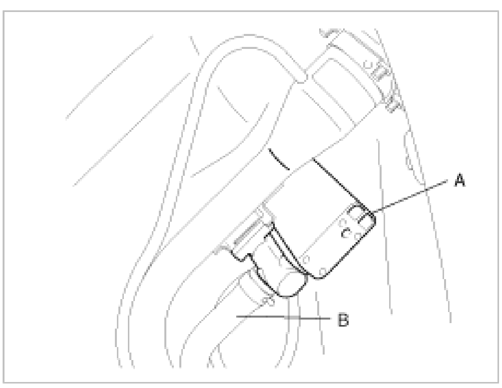
DESCRIPTION



Emission Control System > Evaporative Emission Control System > Fuel Tank Air Filter > Repair procedures

REPLACE

1. Remove the rear left wheel house.
   (Refer to "BD" group)
2. Disconnect the canister close valve wiring connector and the vapor hose to canister (B).



3. Remove the fuel tank air filter(A).
4. Install a new fuel tank air filter.

Emission Control System > Exhaust Emission Control System > Description and Operation

DESCRIPTION

Modifications to the combustion chamber, intake manifold, camshaft and ignition system form the basic control system. These items have been integrated into a highly effective system which controls exhaust emissions while maintaining good driveability and fuel economy.

AIR/FUEL MIXTURE CONTROL SYSTEM [MULTIPORT FUEL INJECTION (MFI) SYSTEM]

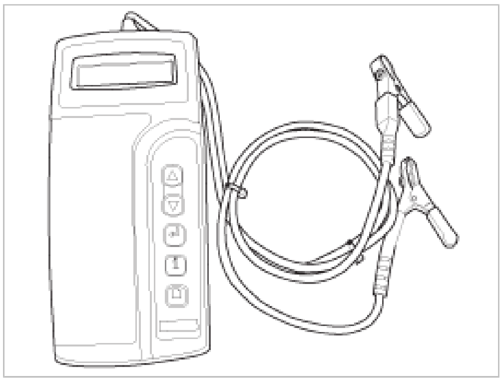
This in turn allows the engine to produce exhaust gases of the proper composition to permit the use of a three way catalyst. The three way catalyst is designed to convert the three pollutants (1) hydrocarbons (HC), (2) carbon monoxide (CO), and (3) oxides of nitrogen (NOx) into harmless substances. There are two operating modes in the MFI system.

1. Open Loop air/fuel ratio is controlled by information programmed into the ECM.
2. Closed Loop air/fuel ratio is adjusted by the ECM based on information supplied by the oxygen sensor.

THE MICRO 570 ANALYZER

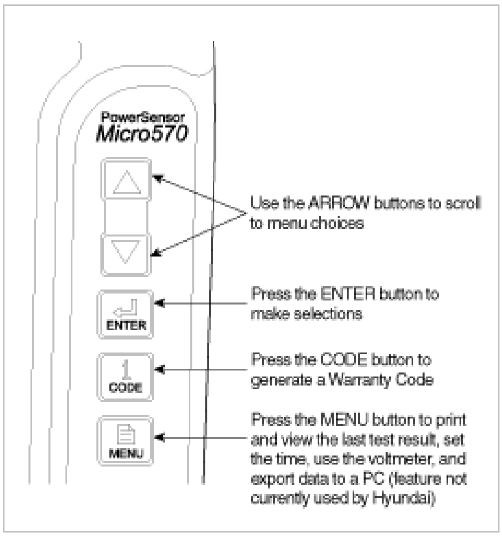
The MICRO 570 Analyzer provides the ability to test the charging and starting systems, including the battery, starter and alternator.

> **CAUTION**
>
> Because of the possibility of personal injury, always use extreme caution and appropriate eye protection when working with batteries.



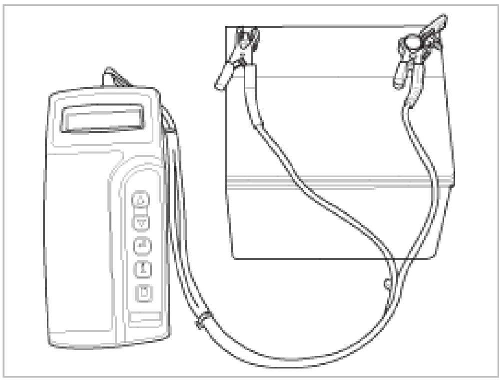
KEYPAD

The MICRO570 button on the key pad provides the following functions :



BATTERY TEST PROCEDURE

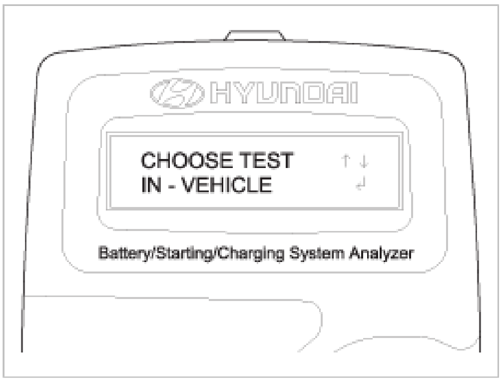
1. Connect the tester to the battery.
    A. Red clamp to battery positive (+) terminal.
    B. Black clamp to battery negative (-) terminal.



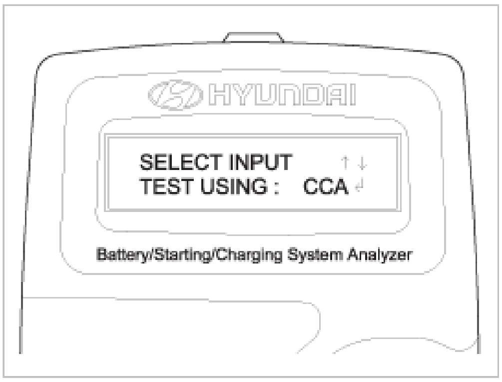
CAUTION

Connect clamps securely. If "CHECK CONNECTION" message is displayed on the screen, reconnect clamps securely.

2. The tester will ask if the battery is connected "IN A VEHICLE" or "OUT OF A VEHICLE". Make your selection by pressing the arrow buttons; then press ENTER.



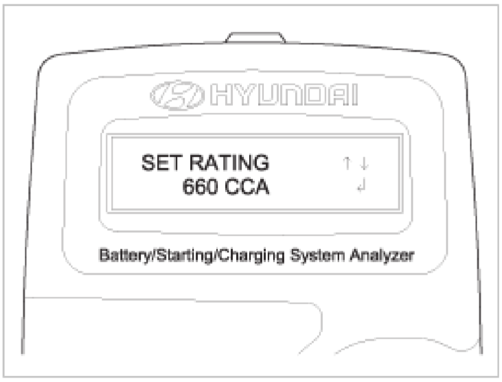
3. Choose either CCA or CCP and press the ENTER button.



NOTE

- CCA : Cold cranking amps, is an SAE specification for cranking batteries at -18°C (0°F).
- CCP : Cold cranking amps, is an SAE specification for korean manufacturer's for cranking batteries at -18°C (0° F).

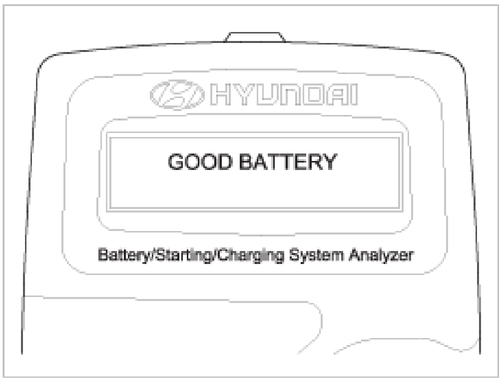
4. Set the CCA value displayed on the screen to the CCA value marked on the battery label by pressing up and down buttons and press ENTER.



NOTE

The battery ratings(CCA) displayed on the tester must be identical to the ratings marked on battery label.

5. The tester (Micro570) displays battery test results including voltage and battery ratings.
   A relevant action must be given according to the test results by referring to the battery test results as shown in the table below.



NOTE

The battery ratings (CCA) displayed on the tester must be identical to the ratings marked on battery label.

6. To conduct starter test, continuously, press ENTER.

BATTERY TEST RESULTS

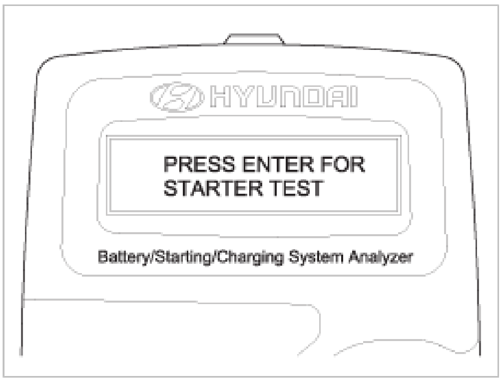
RESULT ON PRINTER	REMEDY
Good battery	No action is required
Good recharge	Battery is in a good state Recharge the battery and use
Charge & Retest	Battery is not charged properly => Charge and test the battery again (Failure to charge the battery fully may read incorrect measurement value)
Replace battery	=> Replace battery and recheck the charging system. (Improper connection between battery and vehicle cables may cause "REPLACE BATTERY", retest the battery after removing cables and connecting the tester to the battery terminal directly prior to replacing the battery)
Bad cell-replace	=> Charge and retest the battery. And then, test results may cause "REPLACE BATTERY", replace battery and recheck the charging system

WARNING

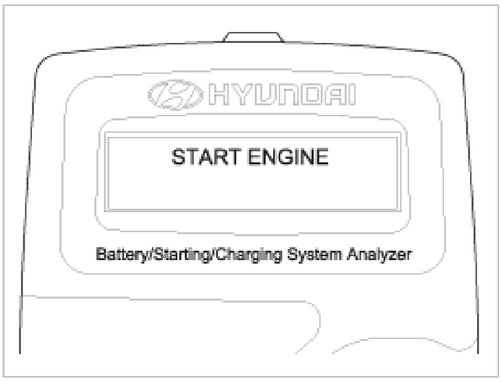
Whenever filing a claim for battery, the print out of the battery test results must be attached.

STARTER TEST PROCEDURE

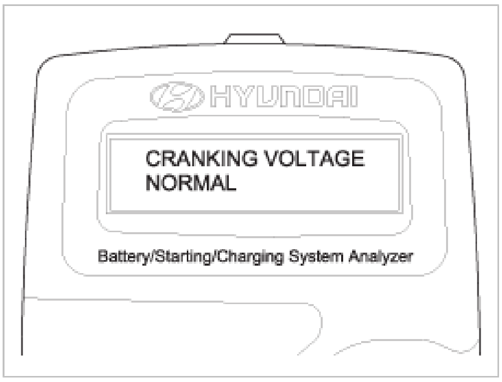
1. After the battery test, press ENTER immediately for the starter test.



2. After pressing ENTER key, start the engine.



3. Cranking voltage and starter test results will be displayed on the screen.
   Take a relevant action according to the test results by referring to the starter test results as given below.



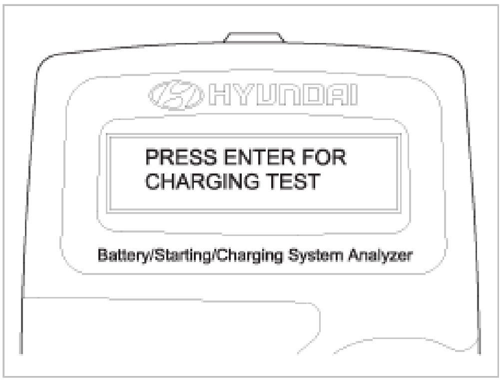
4. To continue charging system test, press ENTER.

STARTER TEST RESULTS

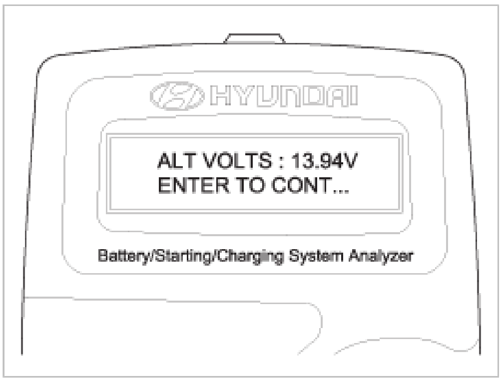
RESULT ON PRINTER	REMEDY
Cranking voltage normal	System shows a normal starter draw
Cranking voltage low	Cranking voltage is lower than normal level => Check starter
Charge battery	The state of battery charge is too low to test => Charge the battery and retest
Replace battery	=> Replace battery => If the vehicle is not started though the battery condition of "Good and fully charged" is displayed. => Check wiring for open circuit, battery cable connection, starter and repair or replace as necessary. => If the engine does crank, check fuel system.

CHARGING SYSTEM TEST PROCEDURE

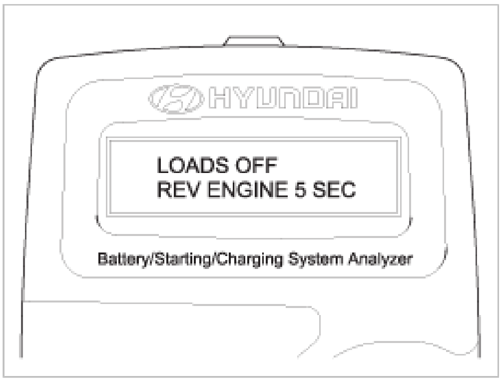
1. Press ENTER to begin charging system test.



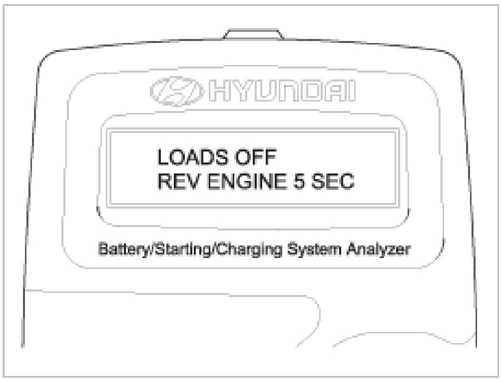
2. ENTER button is pressed, the tester displays the actual voltage of alternator.
   Press ENTER to test the charging system.



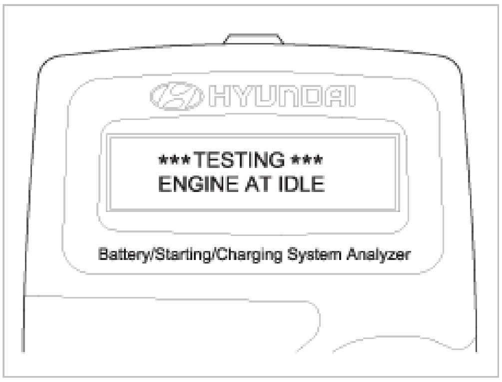
3. Turn off all electrical load and rev engine for 5 seconds by pressing the accelerator pedal.



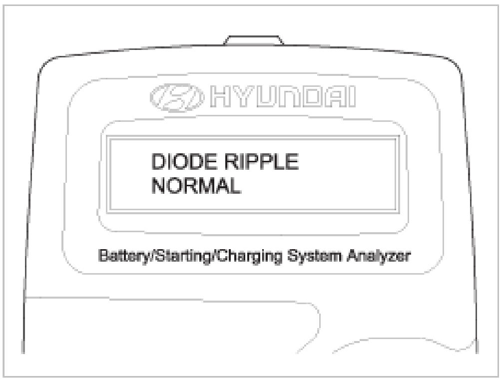
4. Press ENTER.



5. The MICRO 570 analyzer charging system output at idle for comparison to other readings.



6. Take a relevant action according to the test results by referring to the table below after shutting off the engine and disconnect the tester clamps from the battery.

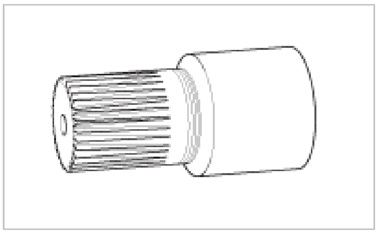


CHARGING SYSTEM TEST RESULTS

RESULT ON PRINTER	REMEDY
Charging system normal/Diode ripple normal	Charging system is normal
No charging voltage	Alternator does not supply charging current to battery => Check belts, connection between alternator and battery Replace belts or cable or alternator as necessary
Low charging voltage	Alternator does not supply charging current to battery and electrical load to system fully => Check belts and alternator and replace as necessary
High charging voltage	The voltage from alternator to battery is higher than normal limit during voltage regulating. => Check connection and ground and replace regulator as necessary => Check electrolyte level in the battery
Excess ripple detected	One or more diodes in the alternator is not functioning properly => Check alternator mounting and belts and replace as necessary

Engine Electrical System > General Information > Special Service Tools

SPECIAL SERVICE TOOL

Tool (Number and name)	Illustration	Use
Alternator pulley remover wrench		Removal and installation of alternator pulley

Engine Electrical System > General Information > Troubleshooting

TROUBLE SHOOTING

IGNITION SYSTEM

Symptom	Suspect area	Remedy
Engine will not start or is hard to start (Cranks OK)	Ignition lock switch Ignition coil Spark plugs Ignition wiring disconnected or broken	Inspect ignition lock switch, or replace as required Inspect ignition coil, or replace as required Inspect spark plugs, or replace as required Repair wiring, or replace as required
Rough idle or stalls	Ignition wiring Ignition coil	Repair wiring, or replace as required Inspect ignition coil, or replace as required
Engine hesitates/poor acceleration	Spark plugs and spark plug cables Ignition wiring	Inspect spark plugs / cable, or replace as required Repair wiring, or replace as required
Poor mileage	Spark plugs and spark plug cables	Inspect spark plugs / cable, or replace as required

CHARGING SYSTEM

Symptom	Suspect area	Remedy
Charging warning indicator does not light with ignition switch "ON" and engine off.	Fuse blown Light burned out Wiring connection loose Electronic voltage regulator	Check fuses Replace light Tighten loose connection Replace voltage regulator
Charging warning indicator does not go out with engine running. (Battery requires frequent recharging)	Drive belt loose or worn Battery cable loose, corroded or worn Electronic voltage regulator or alternator Wiring	Adjust belt tension or replace belt Inspect cable connection, repair or replace cable Replace voltage regulator or alternator Repair or replace wiring
Overcharge	Electronic voltage regulator Voltage sensing wire	Replace voltage regulator Repair or replace wiring
Discharge	Drive belt loose or worn Wiring connection loose or short circuit Electronic voltage regulator or alternator Poor grounding Worn battery	Adjust belt tension or replace belt Inspect wiring connection, repair or replace wiring Replace voltage regulator or alternator Inspect ground or repair Replace battery

STARTING SYSTEM

Symptom	Suspect area	Remedy
Engine will not crank	Battery charge low Battery cables loose, corroded or worn out Transaxle range switch (Vehicle with automatic transaxle only) Fuse blown Starter motor faulty Ignition switch faulty	Charge or replace battery Repair or replace cables Refer to TR group-automatic transaxle Replace fuse Replace Replace
Engine cranks slowly	Battery charge low Battery cables loose, corroded or worn out Starter motor faulty	Charge or replace battery Repair or replace cables Replace
Starter keeps running	Starter motor Ignition switch	Replace Replace
Starter spins but engine will not crank	Short in wiring Pinion gear teeth broken or starter motor Ring gear teeth broken	Repair wiring Replace Replace fly wheel or torque converter

SPECIFICATION

IGNITION SYSTEM

Items			Specification
Ignition coil	Primary resistance		0.62 ± 10 % (Ω)
	Secondary resistance		7.0 ± 15 % (kΩ)
Spark plugs	Unleaded	NGK	IFR5G-11 (3.3L)
		DENSO	SK16PR-A11 (2.4L)
		Gap	1.0 ~ 1.1 mm (0.0394 ~ 0.0433 in.)

STARTING SYSTEM

Items			Specification	
			2.4L	3.3L
Starter	Rated voltage		12 V, 1.2 kW	12 V, 1.4 kW
	No. of pinion teeth		8	8
	No-load characteristics	Voltage	11.5 V	11.5 V
		Ampere	90A, MAX	85A, MAX
		Speed	2,600 rpm, MIN	2,600 rpm, MIN

CHARGING SYSTEM

Items		Specification	
		2.4L	3.3L
Alternator	Type	Battery voltage sensing	←
	Rate voltage	13.5 V, 110A	13.5V, 130A
	Speed in use	1,000 ~ 18,000 rpm	←
	Voltage regulator	IC regulator built-in type	←
	Regulator setting voltage	14.55 ± 0.2 V	14.2 ~ 14.8V
	Temperature compensation	-3.5 ± 1 mV / °C	-4 ± 4 mV / °C
Battery	Type	MF 68AH	←
	Cold cranking amperage [at -18°C(-0.4°F)]	600 A	←
	Reserve capacity	110 min	←
	Specific gravity [at 20°C(68°F)]	1.280 ± 0.01	←

NOTE

- COLD CRANKING AMPERAGE is the amperage a battery can deliver for 30 seconds and maintain a terminal voltage of 7.2V or greater at a specified temperature.
- RESERVE CAPACITY RATING is amount of time a battery can deliver 25A and maintain a minimum terminal voltage of 10.5V at 26.7°C(80.1°F).

AUTO CRUISE CONTROL SYSTEM

Items	Specification
Setting error	Within ± 1.5Km/h on level road

Vehicle speed memory variation	No variation
Setting time	0.1sec max
Resuming time	0.1sec max.
Minimum operating speed	40 ± 2Km/h
Cancel speed range	15 ± 2Km/h
Maximum memorized speed	160 ± 2Km/h
Pulling force	127N(13Kgf)
Main switch serial resistance value	3.9kΩ ± 1%
Command switch serial resistance value	SET switch : 220Ω ± 1%
	RESUME switch : 910Ω ± 1%

Engine Electrical System > Ignition System > Description and Operation

DESCRITION

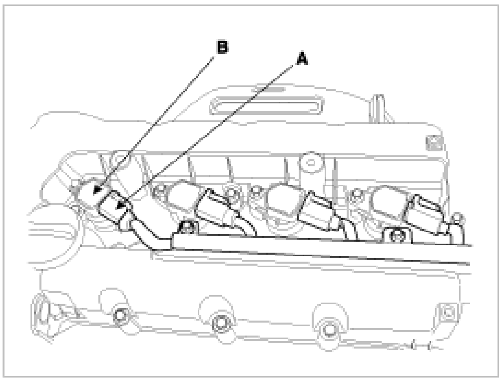
Ignition timing is controlled by the electronic control ignition timing system. The standard reference ignition timing data for the engine operating conditions are preprogrammed in the memory of the ECM (Engine Control Module).
The engine operating conditions (speed, load, warm-up condition, etc.) are detected by the various sensors. Based on these sensor signals and the ignition timing data, signals to interrupt the primary current are sent to the ECM. The ignition coil is activated, and timing is controlled.

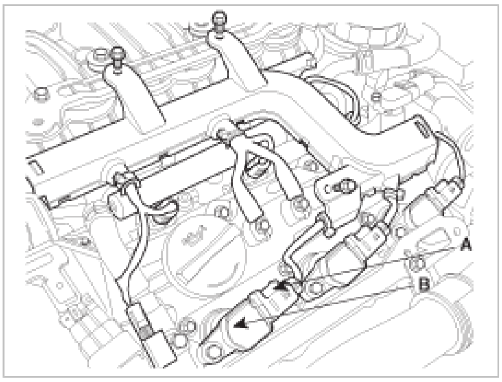
Engine Electrical System > Ignition System > Repair procedures

REMOVAL

IGNITION COIL

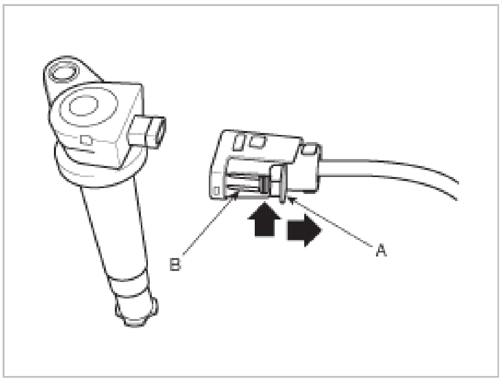
1. Remove the engine cover.
2. Disconnect the ignition coil connector(A).





NOTE

When removing the ignition coil connector, pull the lock pin(A) and push the clip(B).

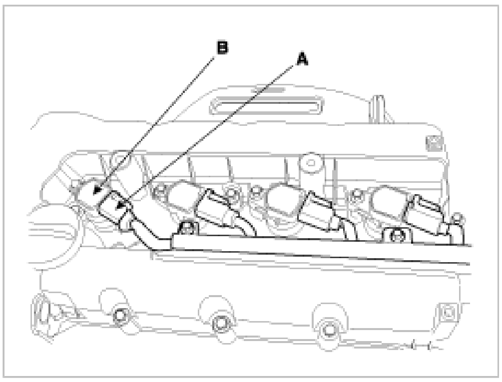


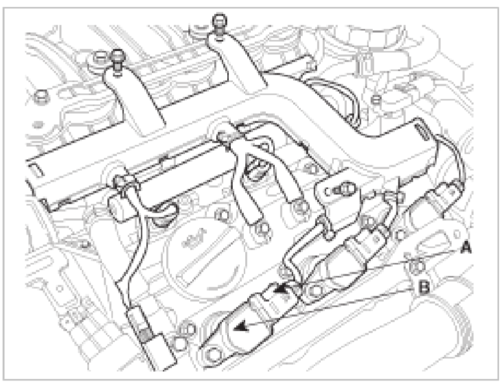
3. Remove the ignition coil (B).
4. Installation is the reverse of removal.

ON-VEHICLE INSPECTION

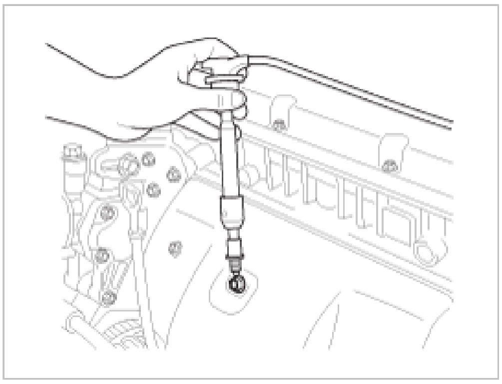
SPARK TEST

1. Remove the ignition coil connector(A).



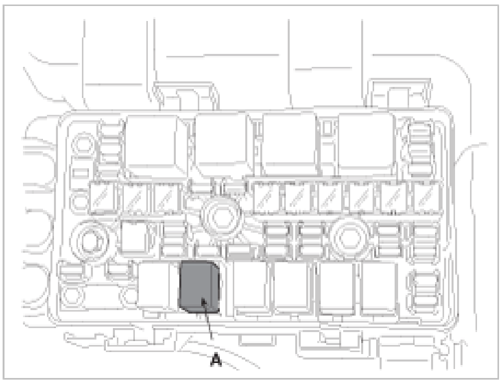


2. Remove the ignition coil(B).
3. Using a spark plug socket, remove the spark plug.
4. Install the spark plug to the ignition coil.
5. Ground the spark plug to the engine.

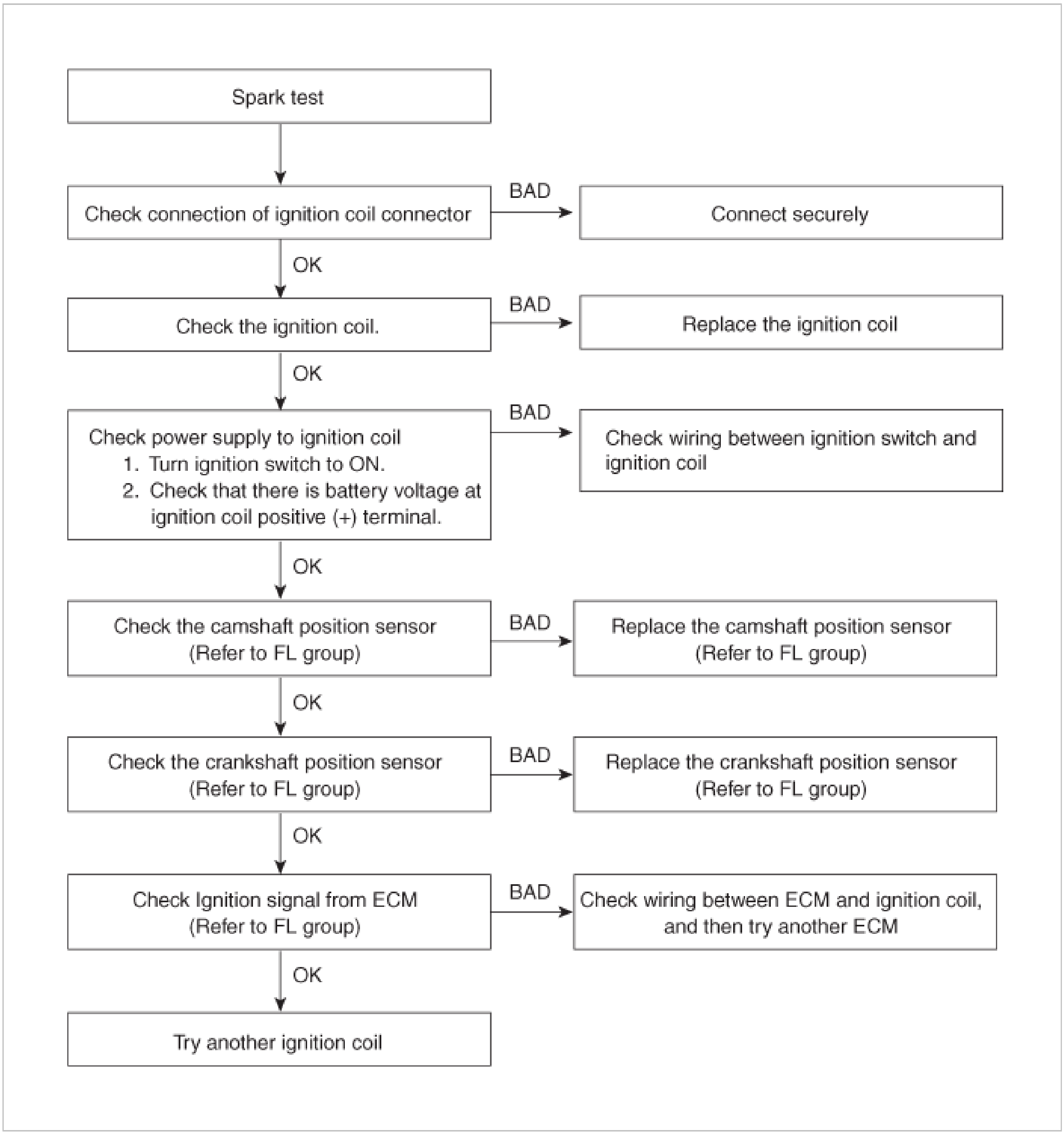


6. Check if spark occurs while engine is being cranked.

> NOTE
>
> To prevent fuel being injected from injectors while the engine is being cranked, remove the fuel pump(A) relay from the fuse box.
> Crank the engine for no more than 5 ~ 10 seconds.

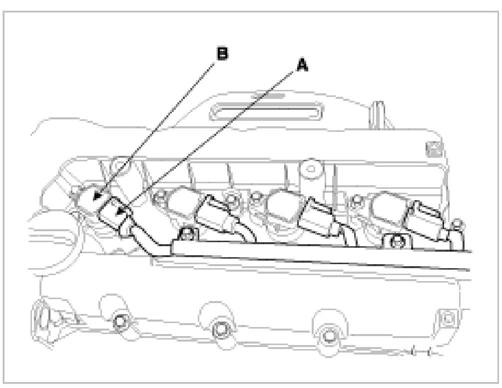


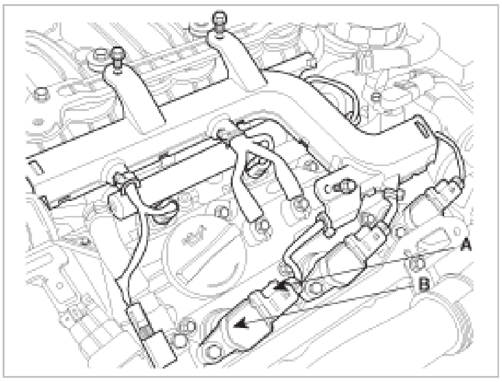
7. Inspect all the spark plugs.
8. Using a spark plug socket, install the spark plug.
9. Install the ignition coil.
10. Reconnect the ignition coil connector.



INSPECT SPARK PLUG

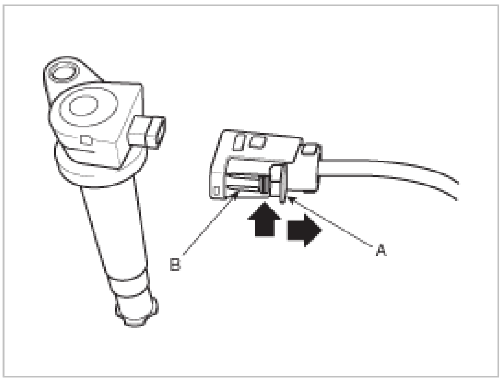
1. Remove the ignition coil connector(A).





NOTE

When removing the ignition coil connector, pull the lock pin(A) and push the clip(B).

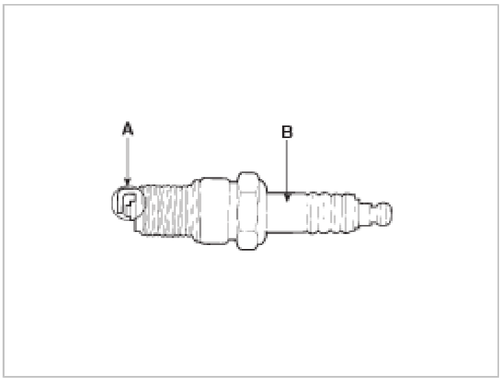


2. Remove the ignition coil(B).
3. Using a spark plug socket, remove the spark plug.

CAUTION

Be careful that no contaminates enter through the spark plug holes.

4. Inspect the electrodes (A) and ceramic insulator (B).

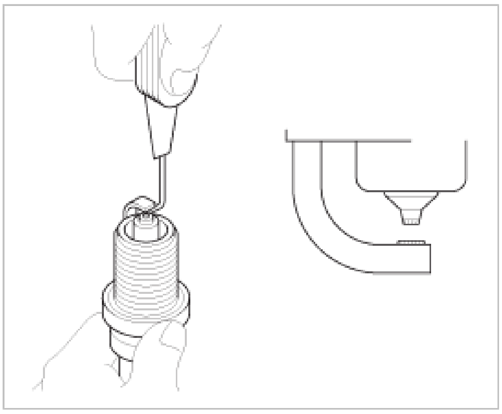


INSPECTION OF ELECTRODES

Condition	Dark deposits	White deposits
Description	- Fuel mixture too rich - Low air intake	- Fuel mixture too lean - Advanced ignition timing - Insufficient plug tightening torque

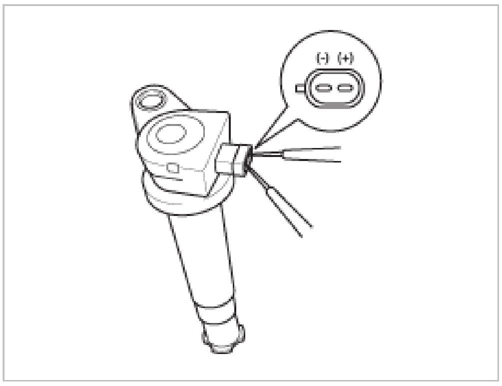
5. Check the electrode gap (A).

Standard :
Unleaded : 1.0 ~ 1.1 mm (0.0394 ~ 0.0433 in.)



INSPECT IGNITION COIL

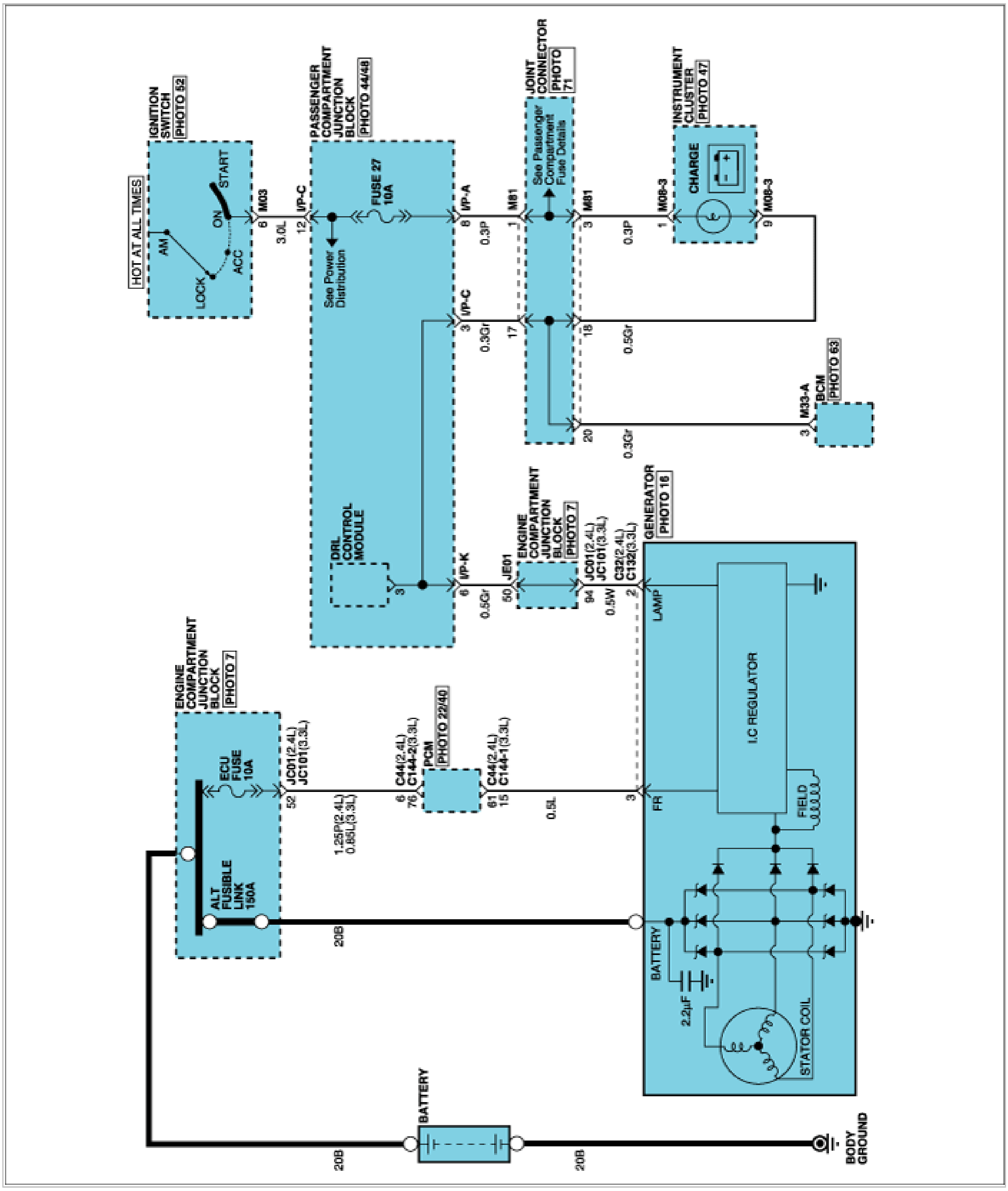
1. Measure the primary coil resistance between terminals (+) and (-).



Standard value: 0.62Ω ± 10%

Engine Electrical System > Charging System > Schematic Diagrams

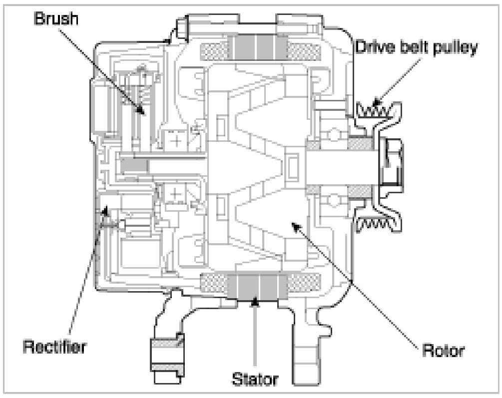
CIRCUIT DIAGRAM FOR CHARGING SYSTEM



Engine Electrical System > Charging System > Description and Operation

DESCRIPTION

The charging system includes a battery, an alternator with a built-in regulator, and the charging indicator light and wire.
The Alternator has built-in diodes, each rectifying AC current to DC current.
Therefore, DC current appears at alternator "B" terminal.
In addition, the charging voltage of this alternator is regulated by the battery voltage detection system.
The main components of the alternator are the rotor, stator, rectifier, capacitor brushes, bearings and V-ribbed belt pulley.
The brush holder contains a built-in electronic voltage regulator.



Engine Electrical System > Charging System > Repair procedures

ON-VEHICLE INSPECTION

CAUTION

- Check that the battery cables are connected to the correct terminals.
- Disconnect the battery cables when the battery is given a quick charge.
- Never disconnect the battery while the engine is running.

CHECK BATTERY VOLTAGE

1. If 20 minutes have not passed since the engine was stopped, turn the ignition switch ON and turn on the electrical system (headlamp, blower motor, rear defogger etc.) for 60 seconds to remove the surface charge.
2. Turn the ignition switch OFF and turn off the electrical systems.
3. Measure the battery voltage between the negative (-) and positive (+) terminals of the battery.

   Standard voltage : 12.5 ~ 12.9V at 20°C(68°F)

   If the voltage is less than specification, charge the battery.

CHECK THE BATTERY TERMINALS AND FUSES

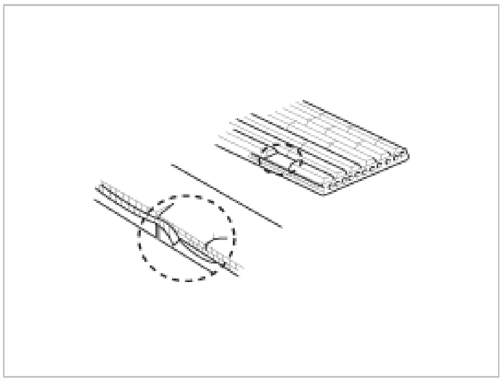
1. Check that the battery terminals are not loose or corroded.
2. Check the fuses for continuity.

INSPECT DRIVE BELT

Visually check the belt for excessive wear, frayed cords etc.
If any defect has been found, replace the drive belt.

NOTE

Cracks on the rib side of a belt are considered acceptable. If the belt has chunks missing from the ribs, it should be replaced.



VISUALLY CHECK ALTERNATOR WIRING AND LISTEN FOR ABNORMAL NOISES

1. Check that the wiring is in good condition.
2. Check that there is no abnormal noise from the alternator while the engine is running.

CHECK DISCHARGE WARNING LIGHT CIRCUIT

1. Warm up the engine and then turn it off.
2. Turn off all accessories.
3. Turn the ignition switch "ON". Check that the discharge warning light is lit.
4. Start the engine. Check that the light is lit.
   If the light does not go off as specified, troubleshoot the discharge light circuit.

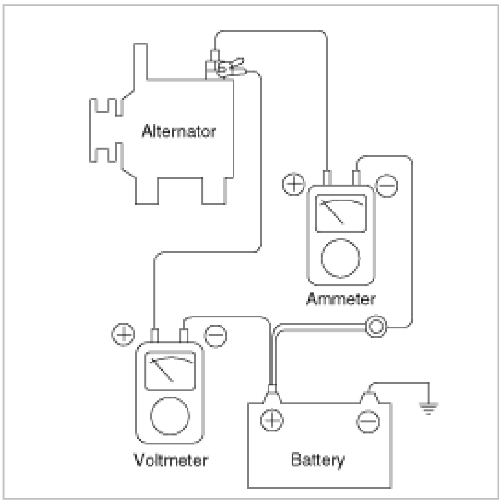
INSPECT CHARGING SYSTEM

VOLTAGE ;DROP ;TEST ;OF ;ALTERNATOR ;OUTPUT ;WIRE

This test determines whether or not the wiring between the alternator "B" terminal and the battery (+) terminal is good by the voltage drop method.

PREPARATION

1. Turn the ignition switch to "OFF".
2. Disconnect the output wire from the alternator "B" terminal. Connect the (+) lead wire of ammeter to the "B" terminal of alternator and the (-) lead wire of ammeter to the output wire. Connect the (+) lead wire of voltmeter to the "B" terminal of alternator and the (-) lead wire of voltmeter to the (+) terminal of battery.



TEST

1. Start the engine.
2. Turn on the headlamps and blower motor, and set the engine speed until the ammeter indicates 20A.
   And then, read the voltmeter at this time.

RESULT

1. The voltmeter may indicate the standard value.

   Standard value: 0.2V max

2. If the value of the voltmeter is higher than expected (above 0.2V max.), poor wiring is suspected. In this case check the wiring from the alternator "B" terminal to the battery (+) terminal. Check for loose connections, color change due to an over-heated harness, etc. Correct them before testing again.
3. Upon completion of the test, set the engine speed at idle.
   Turn off the headlamps, blower motor and the ignition switch.

OUTPUT CURRENT TEST

This test determines whether or not the alternator gives an output current that is equivalent to the normal output.

PREPARATION

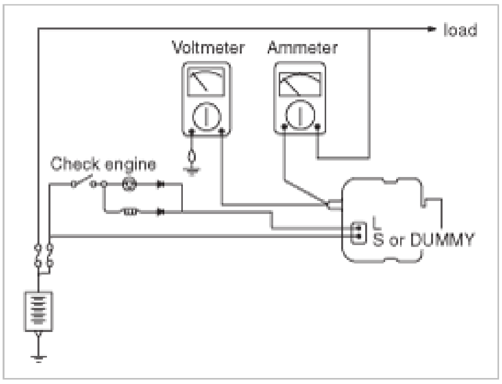
1. Prior to the test, check the following items and correct as necessary.

Check the battery installed in the vehicle to ensure that it is in good condition. The battery checking method is described in the section "Battery".
The battery that is used to test the output current should be one that has been partially discharged. With a fully charged battery, the test may not be conducted correctly due to an insufficient load.
Check the tension of the alternator drive belt. The belt tension check method is described in the section "Inspect drive belt".

2. Turn off the ignition switch.
3. Disconnect the battery ground cable.
4. Disconnect the alternator output wire from the alternator "B" terminal.
5. Connect a DC ammeter (0 to 150A) in series between the "B" terminal and the disconnected output wire. Be sure to connect the (-) lead wire of the ammeter to the disconnected output wire.

> NOTE
>
> Tighten each connection securely, as a heavy current will flow. Do not rely on clips.

6. Connect a voltmeter (0 to 20V) between the "B" terminal and ground. Connect the (+) lead wire to the alternator "B" terminal and (-) lead wire to a good ground.
7. Attach an engine tachometer and connect the battery ground cable.
8. Leave the engine hood open.



TEST

1. Check to see that the voltmeter reads as the same value as the battery voltage. If the voltmeter reads 0V, and the open circuit in the wire between alternator "B" terminal and battery (-) terminal or poor grounding is suspected.
2. Start the engine and turn on the headlamps.
3. Set the headlamps to high beam and the heater blower switch to HIGH, quickly increase the engine speed to 2,500 rpm and read the maximum output current value indicated by the ammeter.

> NOTE
>
> After the engine start up, the charging current quickly drops.
> Therefore, the above operation must be done quickly to read the maximum current value correctly.

RESULT

1. The ammeter reading must be higher than the limit value. If it is lower but the alternator output wire is in good condition, remove the alternator from the vehicle and test it.

Limit value : 77A min.(110A alternator)
91A min.(130A alternator)

> NOTE
>
> - The nominal output current value is shown on the nameplate affixed to the alternator body.
> - The output current value changes with the electrical load and the temperature of the alternator itself. Therefore, the nominal output current may not be obtained. If such is the case, keep the headlamps on the cause discharge of the battery, or use the lights of another vehicle to increase the electrical load.

The nominal output current may not be obtained if the temperature of the alternator itself or ambient temperature is too high.
In such a case, reduce the temperature before testing again.

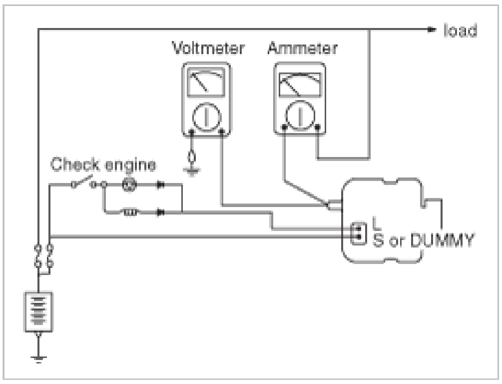
2. Upon completion of the output current test, lower the engine speed to idle and turn off the ignition switch.
3. Disconnect the battery ground cable.
4. Remove the ammeter and voltmeter and the engine tachometer.
5. Connect the alternator output wire to the alternator "B" terminal.
6. Connect the battery ground cable.

REGULATED VOLTAGE TEST

The purpose of this test is to check that the electronic voltage regulator controls voltage correctly.

PREPARATION

1. Prior to the test, check the following items and correct if necessary.
   Check that the battery installed on the vehicle is fully charged. The battery checking method is described in the section "Battery".
   Check the alternator drive belt tension. The belt tension check method is described in the section "Inspect drive belt".
2. Turn ignition switch to "OFF".
3. Disconnect the battery ground cable.
4. Connect a digital voltmeter between the "B" terminal of the alternator and ground. Connect the (+) lead of the voltmeter to the "B" terminal of the alternator. Connect the (-) lead to good ground or the battery (-) terminal.
5. Disconnect the alternator output wire from the alternator "B" terminal.
6. Connect a DC ammeter (0 to 150A) in series between the "B" terminal and the disconnected output wire.
   Connect the (-) lead wire of the ammeter to the disconnected output wire.
7. Attach the engine tachometer and connect the battery ground cable.



TEST

1. Turn on the ignition switch and check to see that the voltmeter indicates the following value.

   Voltage: Battery voltage

   If it reads 0V, there is an open circuit in the wire between the alternator "B" terminal and the battery and the battery (-) terminal.
2. Start the engine. Keep all lights and accessories off.
3. Run the engine at a speed of about 2,500 rpm and read the voltmeter when the alternator output current drops to 10A or less

RESULT

1. If the voltmeter reading agrees with the value listed in the regulating voltage table below, the voltage regulator is functioning correctly. If the reading is other than the standard value, the voltage regulator or the alternator is faulty.
   REGULATING VOLTAGE TABLE

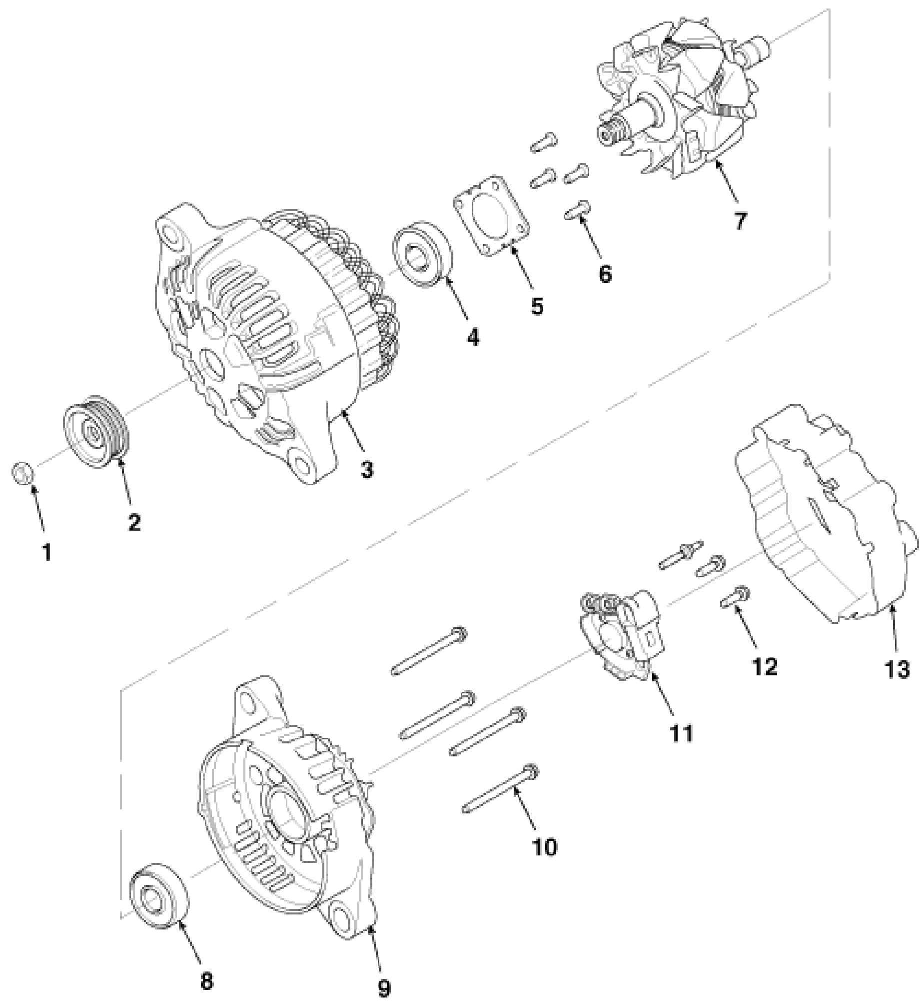
Voltage regulator ambient temperature °C (°F)	Regulating voltage (V)
-30 (-22)	14.2 ~ 15.3

25 (77) 135 (275)	14.2 ~ 14.8 13.3 ~ 14.8

2. Upon completion of the test, reduce the engine speed to idle, and turn off the ignition switch.
3. Disconnect the battery ground cable.
4. Remove the voltmeter and ammeter and the engine tachometer.
5. Connect the alternator output wire to the alternator "B" terminal.
6. Connect the battery ground cable.

Engine Electrical System > Charging System > Alternator > Components and Components Location

COMPONENT

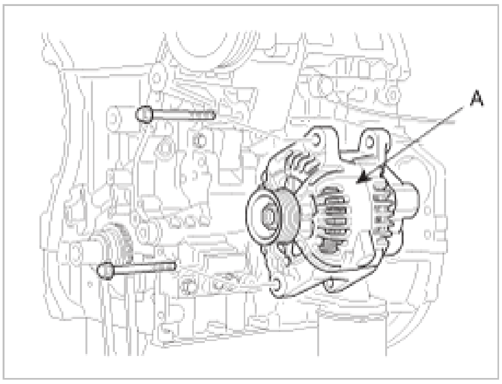


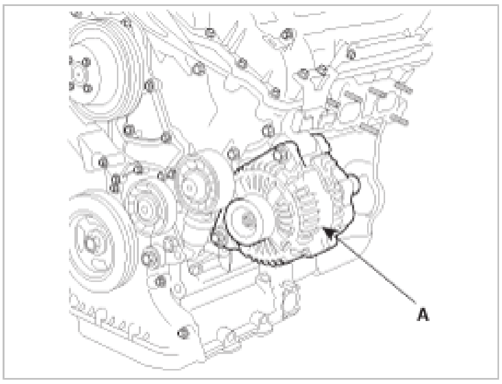
1. Nut
2. Pulley
3. Front bracket
4. Front bearing
5. Bearing cover
6. Bearing cover bolt
7. Rotor coil
8. Rear bearing
9. Rear bracket
10. Through bolt
11. Brush holder assembly
12. Brush holder bolt
13. Rear cover

Engine Electrical System > Charging System > Alternator > Repair procedures

REMOVAL

1. Disconnect the battery negative terminal first, then the positive terminal.
2. Disconnect the alternator connector, and remove the cable from alternator "B" terminal.
3. Remove the drive belt.
4. Pull out the through bolt and then remove the alternator(A).

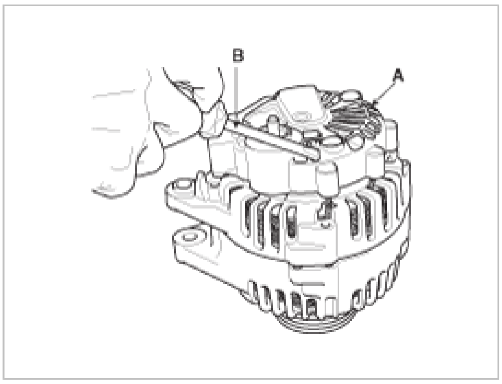




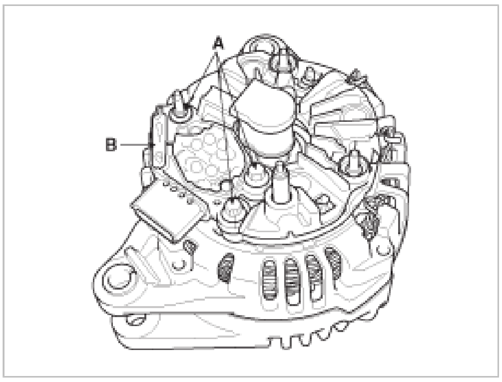
5. Installation is the reverse of removal.

DISASSEMBLY

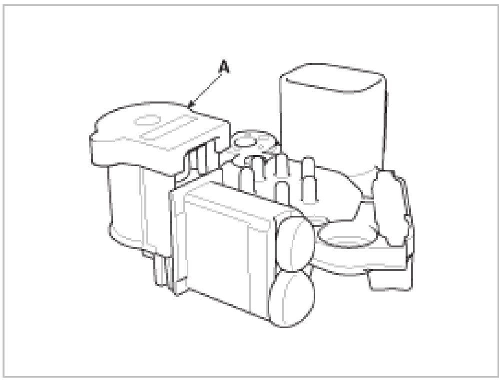
1. Remove the alternator cover(A) using a screw driver(B).



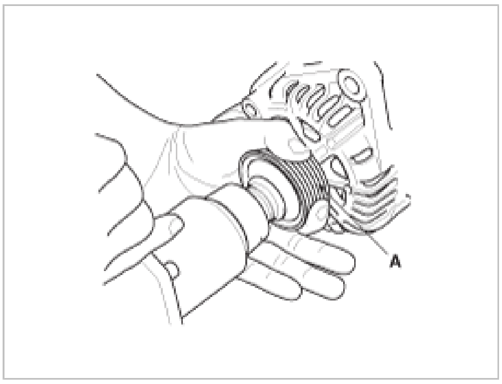
2. Loosen the mounting bolts(A) and disconnect the brush holder assembly(B).



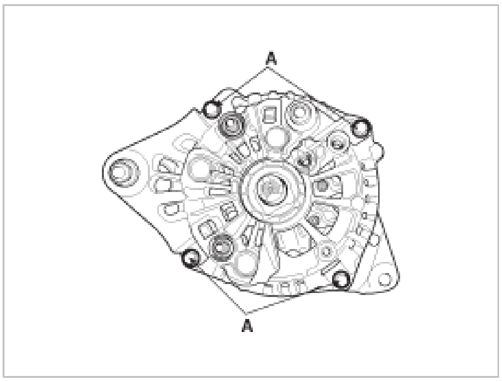
3. Remove the slip ring guide(A).



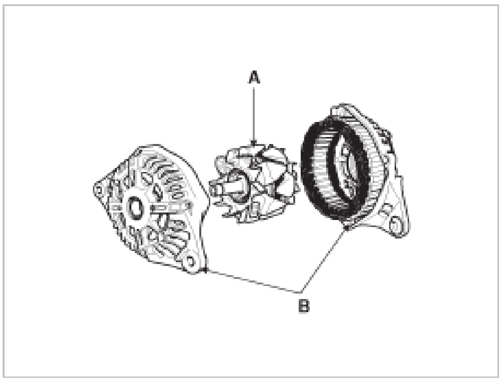
4. Remove the nut, pulley(A) and spacer.



5. Loosen the 4 through bolts(A).



6. Disconnect the rotor(A) and cover(B).

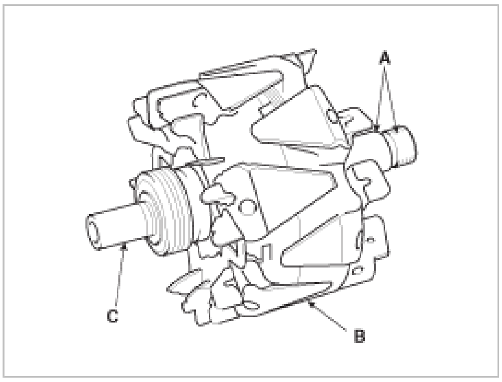


7. Reassembly is the reverse order of disassembly.

INSPECTION

INSPECT ROTOR

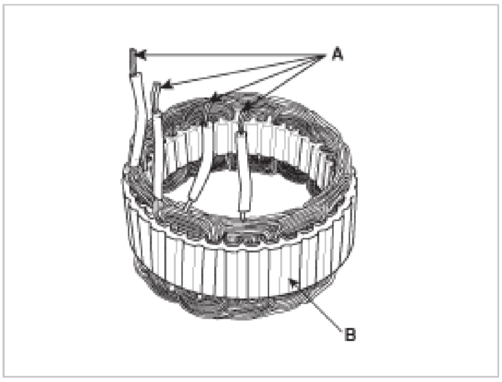
1. Check that there is continuity between the slip rings (A).



2. Check that there is no continuity between the slip rings and the rotor (B) or rotor shaft (C).
3. If the rotor fails either continuity check, replace the alternator.

INSPECT STATOR

1. Check that there is continuity between each pair of leads (A).

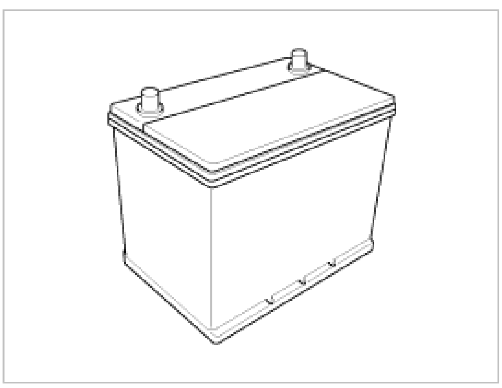


2. Check that there is no continuity between each lead and the coil core.
3. If the coil fails either continuity check, replace the alternator.

Engine Electrical System > Charging System > Battery > Description and Operation

DESCRIPTION

1. The maintenance-free battery is, as the name implies, totally maintenance free and has no removable battery cell caps.
2. Water never needs to be added to the maintenance-free battery.
3. The battery is completely sealed, except for small vent holes in the cover.

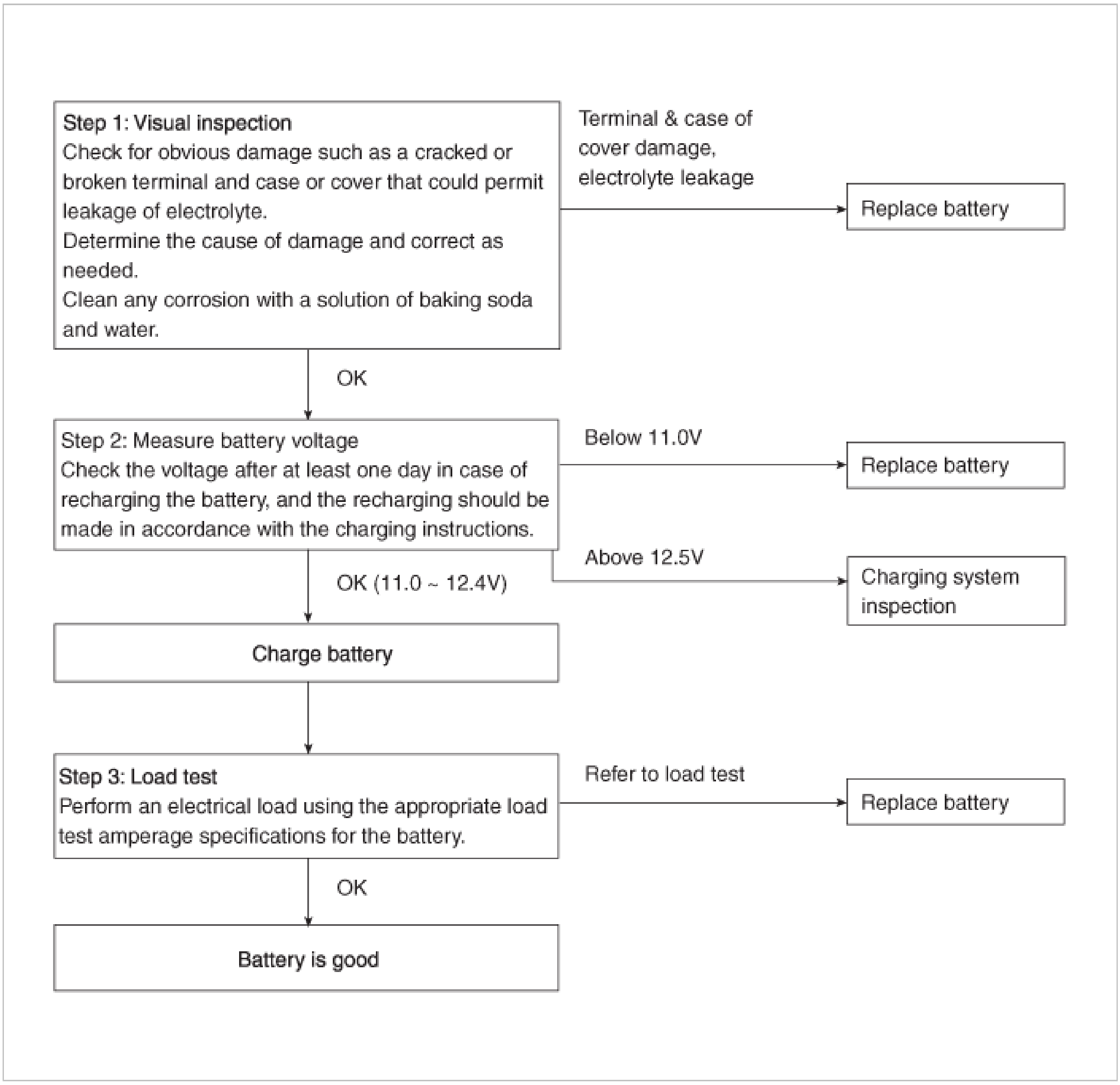


Engine Electrical System > Charging System > Battery > Repair procedures

INSPECTION

BATTERY DIAGNOSTIC TEST (1)

CHECKING FLOW



LOAD TEST

1. Perform the following steps to complete the load test procedure for maintenance free batteries.
2. Connect the load tester clamps to the terminals and proceed with the test as follow:
   (1) If the battery has been on charge, remove the surface charge by connecting a 300ampere load for 15 seconds.
   (2) Connect the voltmeter and apply the specified load.
   (3) Read the voltage after the load has been applied for 15 seconds.
   (4) Disconnect the load.
   (5) Compare the voltage reading with the minimum and replace the battery if battery test voltage is below that shown in the voltage table.

Voltage	Temperature
9.6V	20°C (68.0°F) and above
9.5V	16°C (60.8°F)
9.4V	10°C (50.0°F)
9.3V	4°C (39.2°F)
9.1V	-1°C (30.2°F)

8.9V	-7°C (19.4°F)
8.7V	-12°C (10.4°F)
8.5V	-18°C (-0.4°F)

NOTE

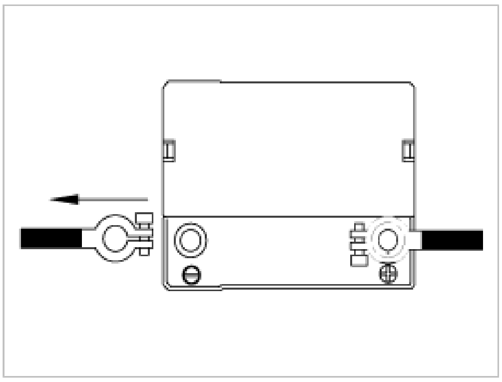
- If the voltage is greater than shown in the table, the battery is good.
- If the voltage is less than shown in the table, replace the battery.

BATTERY DIAGNOSTIC TEST (2)

1. Make sure the ignition switch and all accessories are in the OFF position.
2. Disconnect the battery cables (negative first).
3. Remove the battery from the vehicle.

CAUTION

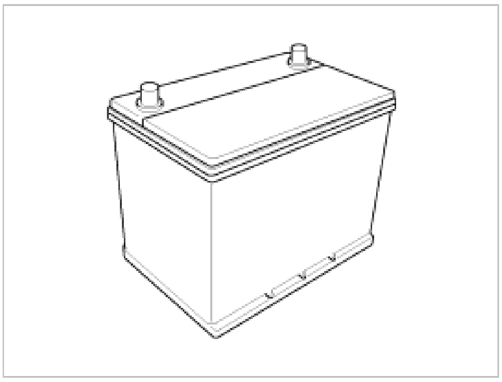
Care should be taken in the event the battery case is cracked or leaking, to protect your skin from the electrolyte. Heavy rubber gloves (not the household type) should be wore when removing the battery.



4. Inspect the battery tray for damage caused by the loss of electrolyte. If acid damage is present, it will be necessary to clean the area with a solution of clean warm water and baking soda. Scrub the area with a stiff brush and wipe off with a cloth moistened with baking soda and water.
5. Clean the top of the battery with the same solution as described above.
6. Inspect the battery case and cover for cracks. If cracks are present, the battery must be replaced.
7. Clean the battery posts with a suitable battery post tool.
8. Clean the inside surface of the terminal clamps with a suitable battery cleaning tool. Replace damaged or frayed cables and broken terminal clamps.
9. Install the battery in the vehicle.
10. Connect the cable terminals to the battery post, making sure tops of the terminals are flush with the tops of the posts.
11. Tighten the terminal nuts securely.
12. Coat all connections with light mineral grease after tightening.

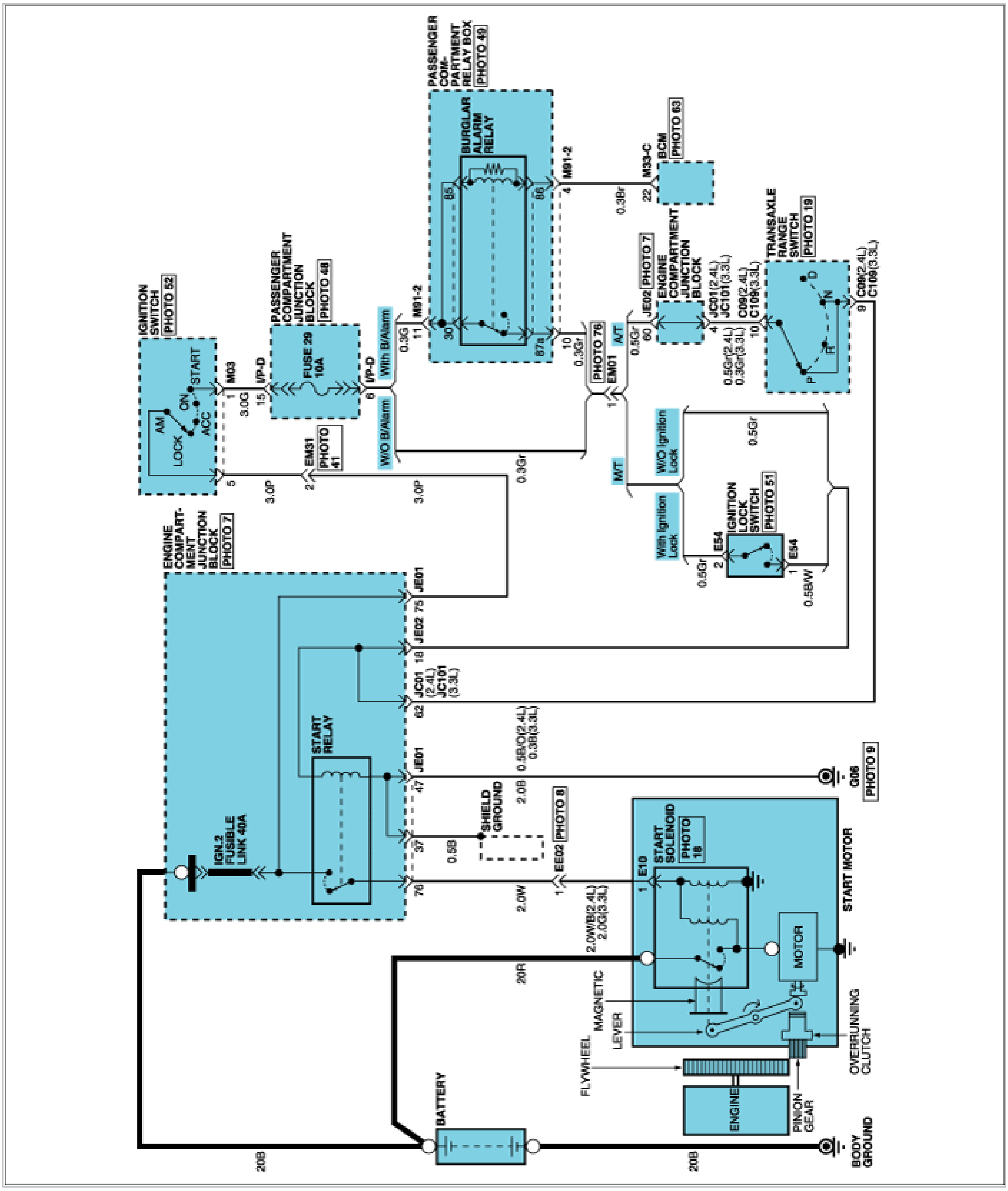
CAUTION

When batteries are being charged, an explosive gas forms beneath the cover of each cell. Do not smoke near batteries being charged or which have recently been charged. Do not break live circuit at the terminals of batteries being charged.
A spark will occur when the circuit is broken. Keep open flames away from battery.



Engine Electrical System > Starting System > Schematic Diagrams

CIRCUIT DIAGRAM OF STARTING SYSTEM



Engine Electrical System > Starting System > Description and Operation

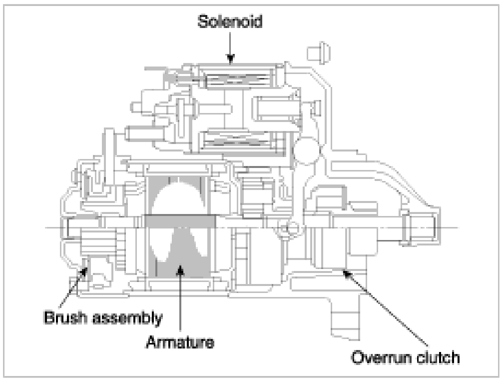
DESCRIPTION

The starting system includes the battery, starter, solenoid switch, ignition switch, inhibitor switch (A/T), ignition lock switch, connection wires and the battery cable.

When the ignition key is turned to the start position, current flows and energizes the starter motor's solenoid coil.

The solenoid plunger and clutch shift lever are activated, and the clutch pinion engages the ring gear.

The contacts close and the starter motor cranks. In order to prevent damage caused by excessive rotation of the starter armature when the engine starts, the clutch pinion gear overruns.



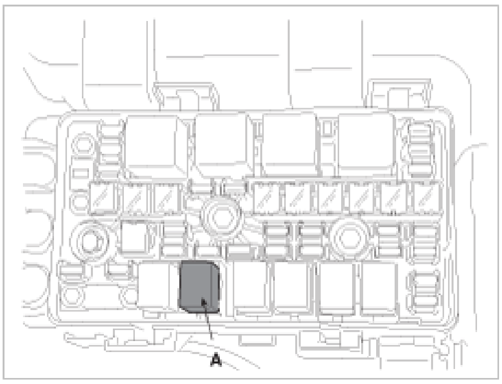
Engine Electrical System > Starting System > Repair procedures

STARTER CIRCUIT TROUBLESHOOTING

NOTE

The battery must be in good condition and fully charged.

1. Remove the fuel pump relay(A) from the fuse box.

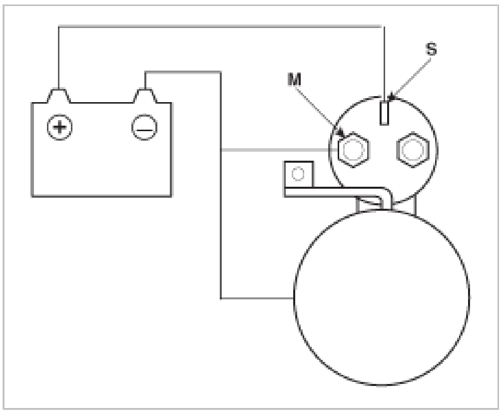


2. With the shift lever in N or P (A/T) or clutch pedal pressed (M/T), turn the ignition switch to "START"
   If the starter normally cranks the engine, starting system is OK. If the starter will not crank the engine at all, go to next step.
   If it won't disengage from the ring gear when you release key, check for the following until you find the cause.
   A. Solenoid plunger and switch malfunction.
   B. Dirty pinion gear or damaged overrunning clutch.
3. Check the battery condition. Check electrical connections at the battery, battery negative cable connected to the body, engine ground cables, and the starter for looseness and corrosion. Then try starting the engine again.
   If the starter cranks normally the engine, repairing the loose connection repaired the problem. The starting system is now OK.
   If the starter still does not crank the engine, go to next step.
4. Disconnect the connector from the S-terminal of solenoid. Connect a jumper wire from the B-terminal of solenoid to the S-terminal of solenoid.
   If the starter cranks the engine, go to next step.
   If the starter still does not crank the engine, remove the starter, and repair or replace as necessary.
5. Check the following items in the order listed until you find the open circuit.
   A. Check the wire and connectors between the driver's under-dash fuse/relay box and the ignition switch, and between the driver's under-dash fuse/relay box and the starter.
   B. Check the ignition switch (Refer to BE group - ignition system)
   C. Check the transaxle range switch connector or ignition lock switch connector.
   D. Inspect the starter relay.

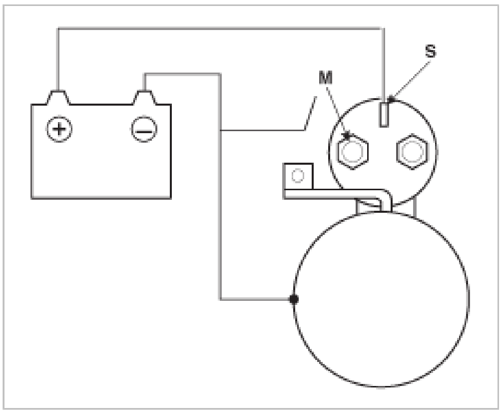
STARTER SOLENOID TEST

1. Disconnect the field coil wire from the M-terminal of solenoid switch.
2. Connect the battery as shown. If the starter pinion pops out, it is working properly. To avoid damaging the starter, do not

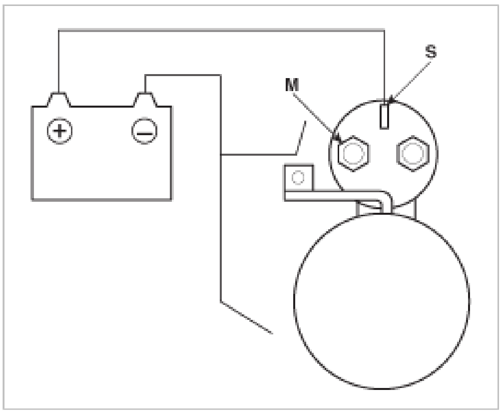
leave the battery connected for more than 10 seconds.



3. Disconnect the battery from the M terminal.
   If the pinion does not retract, the hold-in coil is working properly. To avoid damaging the starter, do not leave the battery connected for more than 10 seconds.

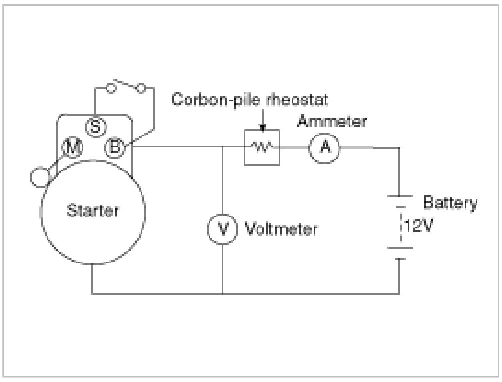


4. Disconnect the battery also from the body. If the pinion retracts immediately, it is working properly. To avoid damaging the starter, do not leave the battery connected for more than 10 seconds.



FREE RUNNING TEST

1. Place the starter motor in a vise equipped with soft jaws and connect a fully-charged 12-volt battery to starter motor as follows.
2. Connect a test ammeter (100-ampere scale) and carbon pile rheostats as shown in the illustration.
3. Connect a voltmeter (15-volt scale) across starter motor.

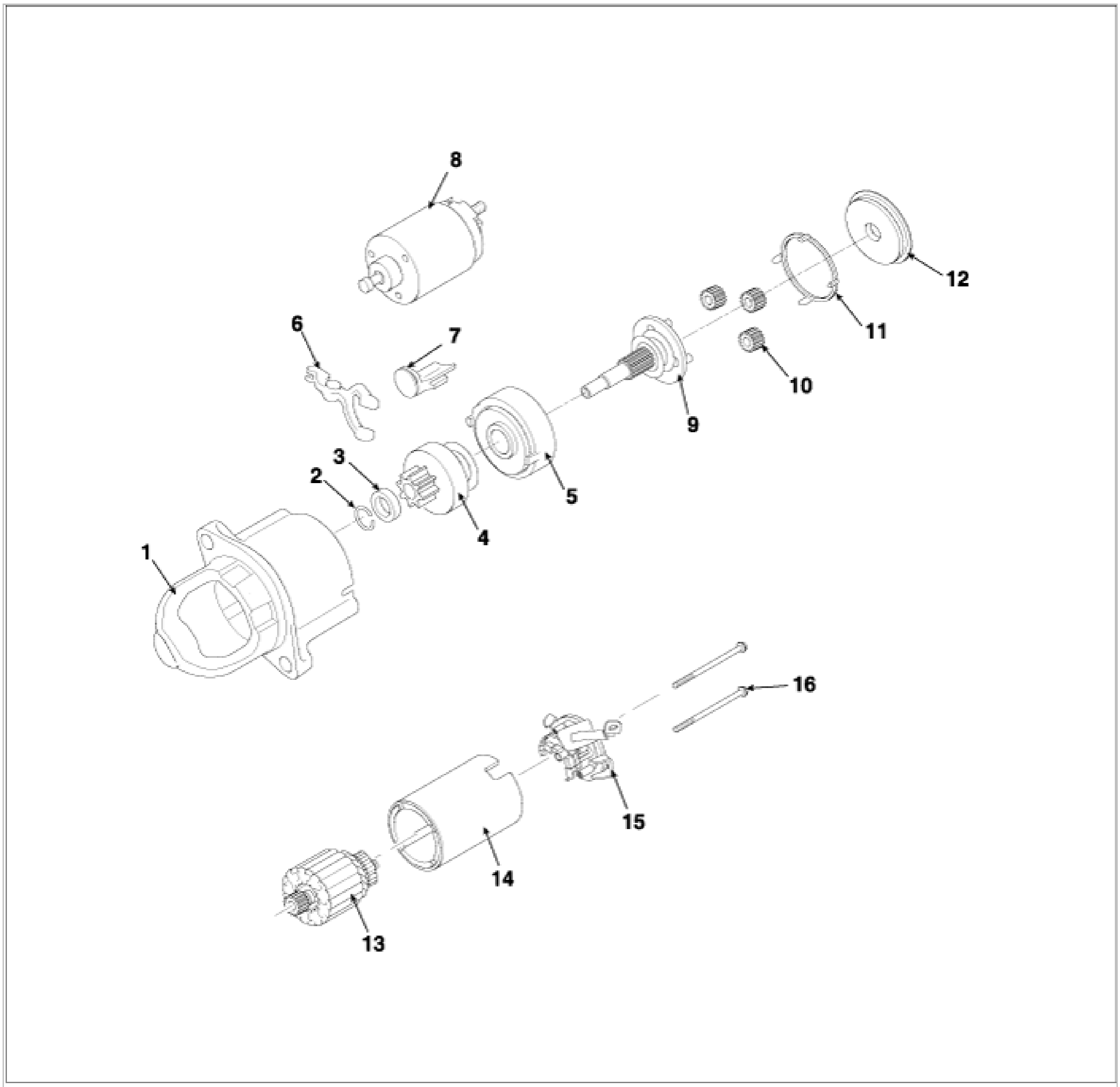


4. Rotate carbon pile to the off position.
5. Connect the battery cable from battery's negative post to the starter motor body.
6. Adjust until battery voltage shown on the voltmeter reads 11volts.
7. Confirm that the maximum amperage is within the specifications and that the starter motor turns smoothly and freely.

Current : 90A max (2.4L), 85A MAX (3.3L)
Speed : 2,600 rpm

Engine Electrical System > Starting System > Starter > Components and Components Location

COMPONENT



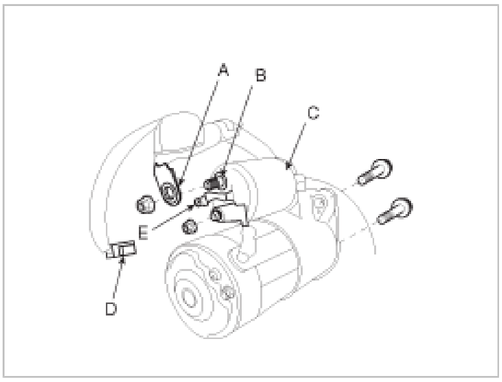
1. Front bracket
2. Stop ring
3. Stopper
4. Overrun clutch assembly
5. Internal gear assembly
6. Lever
7. Lever packing
8. Magnet switch assembly
9. Planet shaft assembly
10. Planetary gear assembly
11. Packing
12. Shield
13. Armature assembly
14. Yoke assembly
15. Brush holder assembly
16. Through bolt

Engine Electrical System > Starting System > Starter > Repair procedures

STARTER

REMOVAL

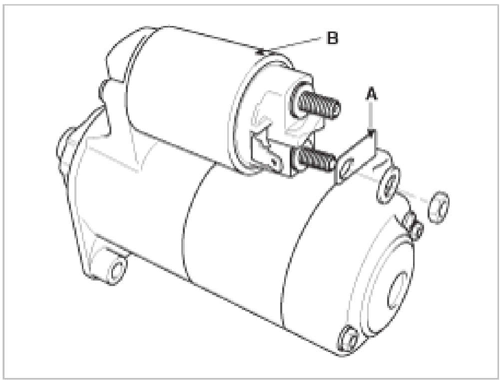
1. Disconnect the battery negative cable.
2. Disconnect the starter cable (A) from the B terminal (B) on the solenoid (C), then disconnect the connector (D) from the S terminal (E).



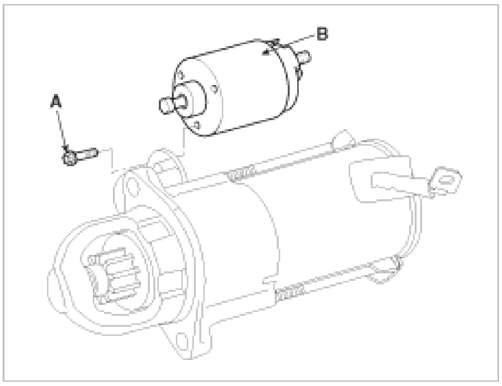
3. Remove the 2 bolts holding the starter, then remove the starter.
4. Installation is the reverse of removal.
5. Connect the battery negative cable to the battery.

DISASSEMBLY

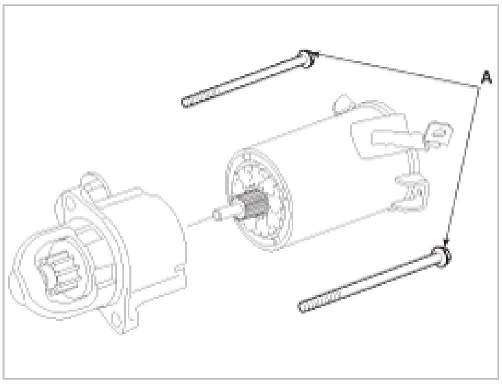
1. Disconnect the M-terminal (A) on the magnet switch assembly (B).



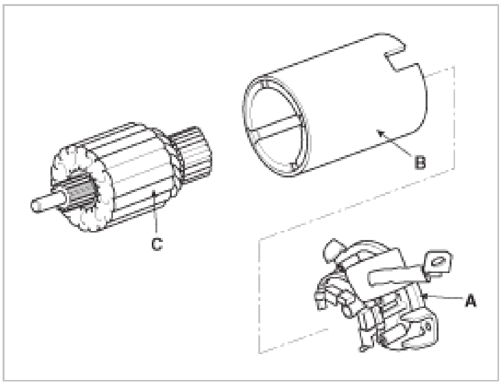
2. After loosening the 3 screws (A), detach the magnet switch assembly (B).



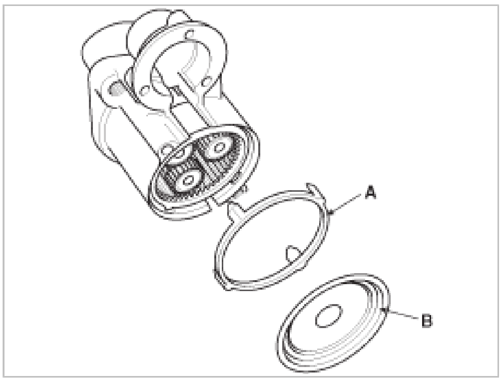
3. Loosen the through bolts (A).



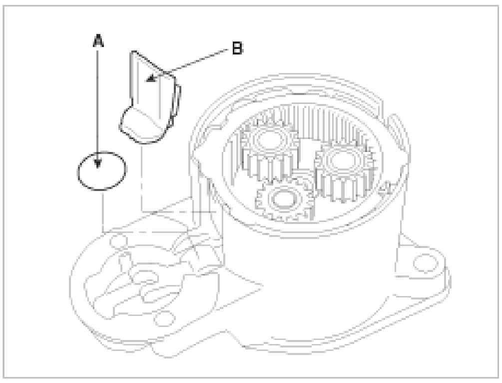
4. Remove the brush holder assembly (A), yoke (b) and armature (C).



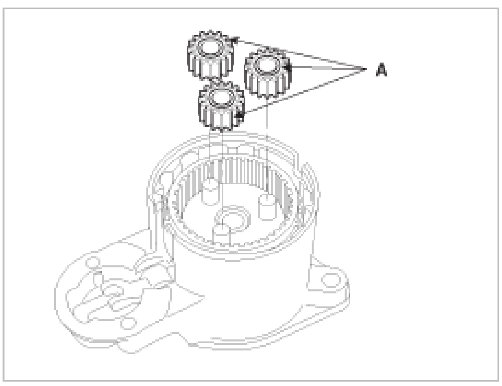
5. Remove the shield (A) and packing (B).



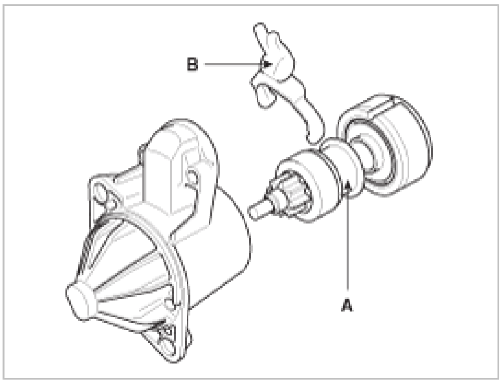
6. Remove the lever plate (A) and lever packing (B).



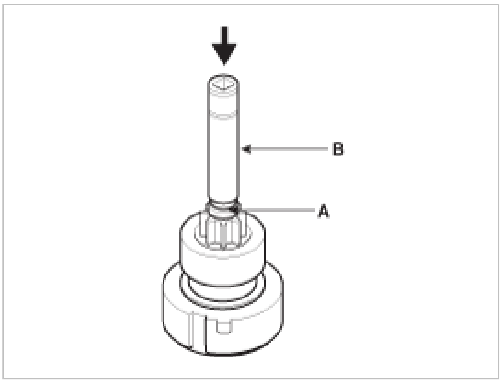
7. Disconnect the planet gear (A).



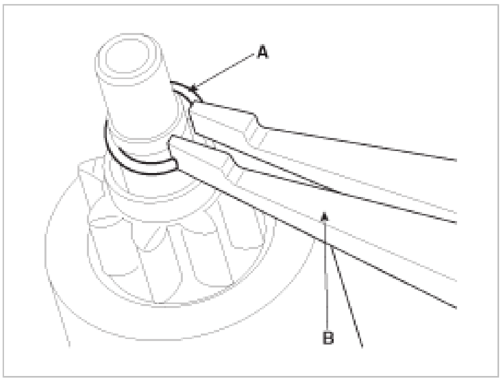
8. Disconnect the planet shaft assembly (A) and lever (B).



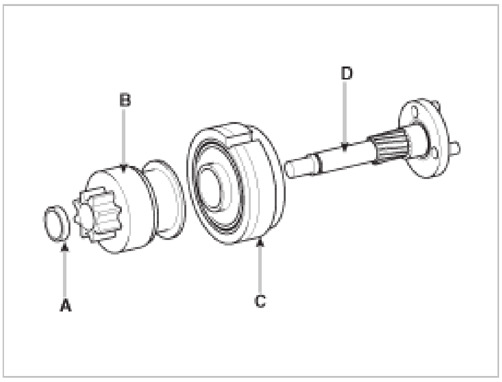
9. Press the stop ring (A) using a socket (B).



10. After removing the stopper (A) using stopper pliers (B).

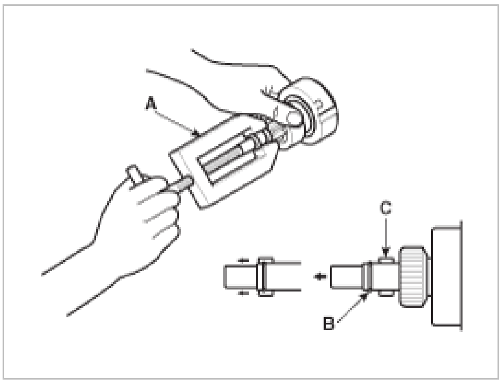


11. Disconnect the stop ring (A), overrunning clutch (B), internal gear (C) and planet shaft (D).



12. Reassembly is the reverse of disassembly.

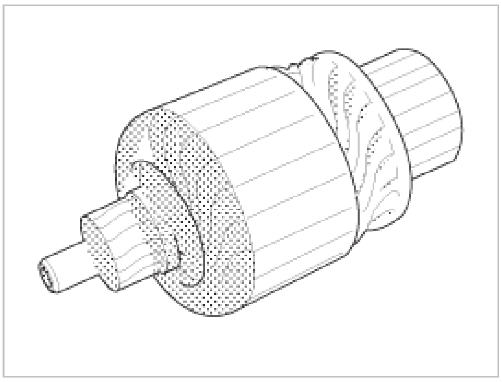
NOTE
Using a suitable pulling tool (A), pull the overrunning clutch stop ring (B) over the stopper (C).



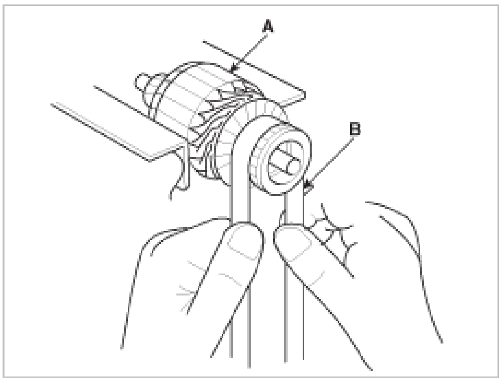
INSPECTION

ARMATURE INSPECTION AND TEST

1. Remove the starter.
2. Disassemble the starter as shown at the beginning of this procedure.
3. Inspect the armature for wear or damage from contact with the permanent magnet. If there is wear or damage, replace the armature.

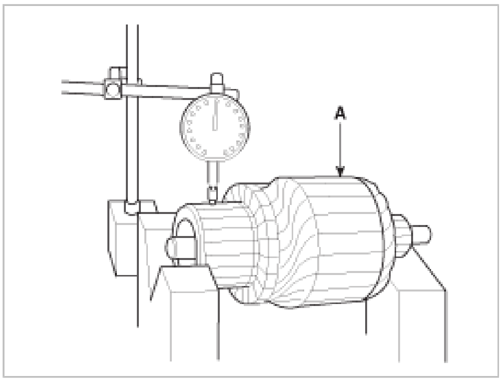


4. Check the commutator (A) surface. If the surface is dirty or burnt, resurface with emery cloth or a lathe within the following specifications, or recondition with #500 or #600 sandpaper (B).



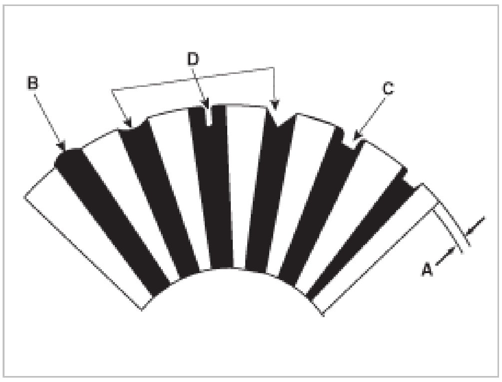
5. Measure the commutator (A) runout.
   A. If the commutator runout is within the service limit, check the commutator for carbon dust or brass chips between the segments.
   B. If the commutator run out is not within the service limit, replace the armature.

Commutator runout
Standard (New): 0.02mm (0.0008in.) max
Service limit: 0.05mm (0.0020in.)

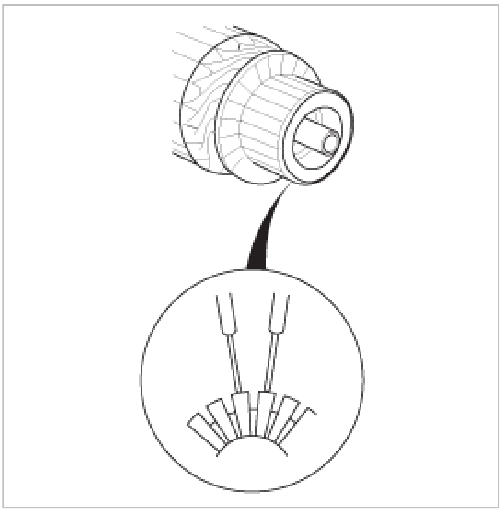


6. Check the mica depth (A). If the mica is too high (B), undercut the mica with a hacksaw blade to the proper depth. Cut away all the mica (C) between the commutator segments. The undercut should not be too shallow, too narrow, or v-shaped (D).

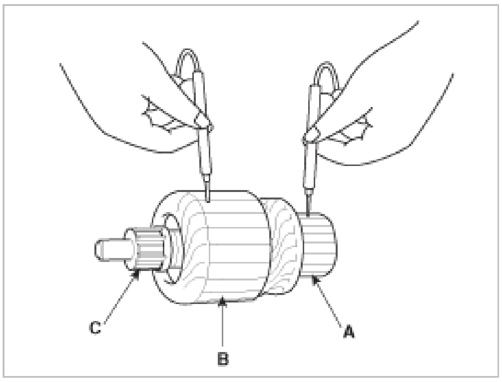
Commutator mica depth
Standard (New) : 0.5 mm (0.0197 in.)
Limit : 0.2mm (0.0079 in.)



7. Check for continuity between the segments of the commutator. If an open circuit exists between any segments, replace the armature.

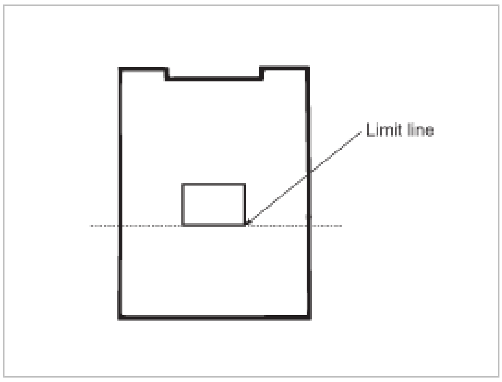


8. Check with an ohmmeter that no continuity exists between the commutator (A) and armature coil core (B), and between the commutator and armature shaft (C). If continuity exists, replace the armature.



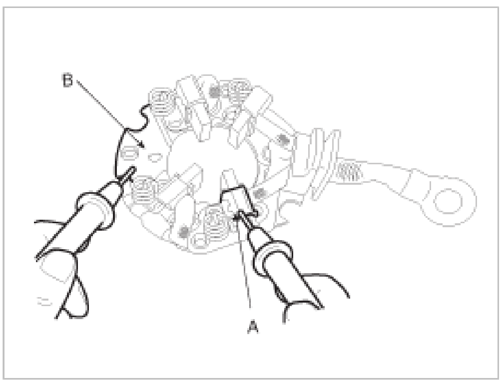
INSPECT STARTER BRUSH

Brushes that are worm out, or oil-soaked, should be replaced.

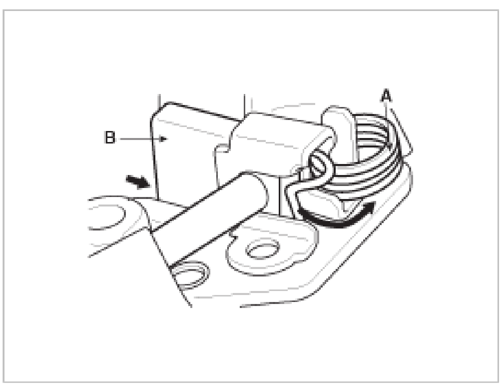


STARTER BRUSH HOLDER TEST

1. Check that there is no continuity between the (+) brush holder (A) and (-) brush holder (B). If there is no continuity, replace the brush holder assembly.



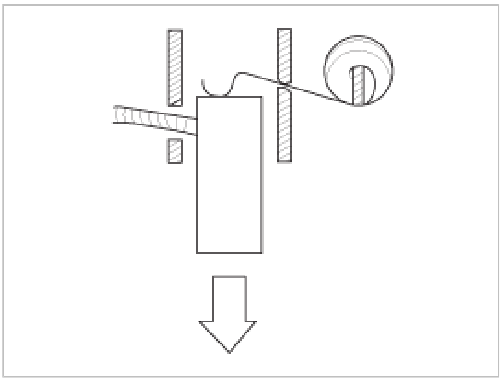
2. Pry back each brush spring (A) with a screwdriver, then position the brush (B) about halfway out of its holder, and release the spring to hold it there.



3. Install the armature in the housing, and install the brush holder. Next, pry back each brush spring again, and push the brush down until it seats against the commutator, then release the spring against the end of the brush.

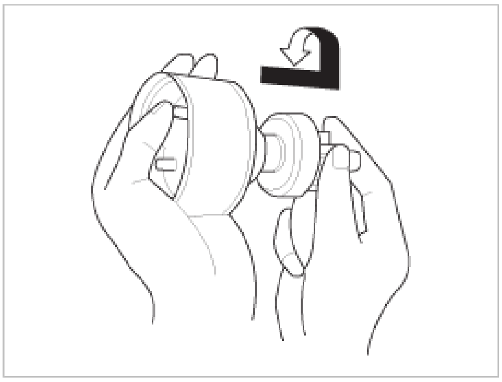
NOTE

To seat new brushes, slip a strip of #500 or #600 sandpaper, with the grit side up, between the commutator and each brush, and smoothly rotate the armature. The contact surface of the brushes will be sanded to the same contour as the commutator.



INSPECT OVERRUNNING CLUTCH

1. Slide the overrunning clutch along the shaft.
   Replace it if does not slide smoothly.
2. Rotate the overrunning clutch both ways.
   Does it lock in one direction and rotate smoothly in reverse? If it does not lock in either direction or it locks in both directions, replace it.



3. If the starter drive gear is worn or damaged, replace the overrunning clutch assembly. (the gear is not available separately).
   Check the condition of the flywheel or torque converter ring gear if the starter drive gear teeth are damaged.

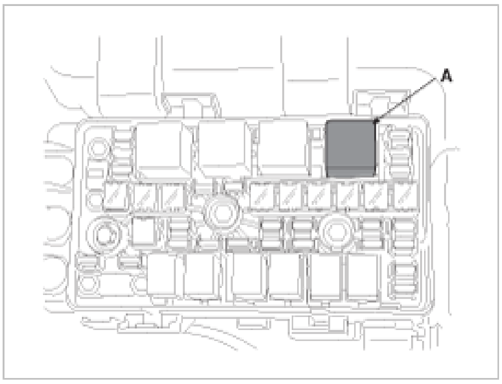
CLEANING

1. Do not immerse parts in cleaning solvent. Immersing the yoke assembly and/or armature will damage the insulation. Wipe these parts with a cloth only.
2. Do not immerse the drive unit in cleaning solvent. The overrun clutch is pre-lubricated at the factory and solvent will wash lubrication from the clutch.
3. The drive unit may be cleaned with a brush moistened with cleaning solvent and wiped dry with a cloth.

Engine Electrical System > Starting System > Starter Relay > Repair procedures

INSPECTION

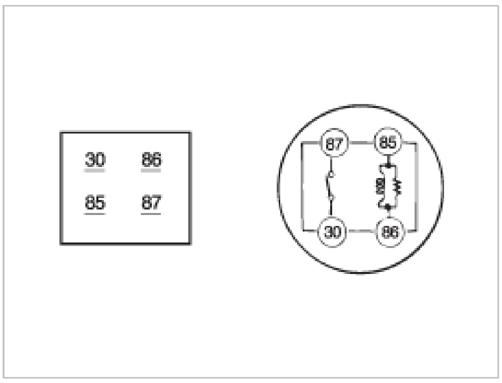
1. Remove the fuse box cover.
2. Remove the starter relay (A).



3. Using an ohmmeter, check that there is continuity between each terminal.

Terminal	Continuity
30 - 87	NO
85 - 86	YES

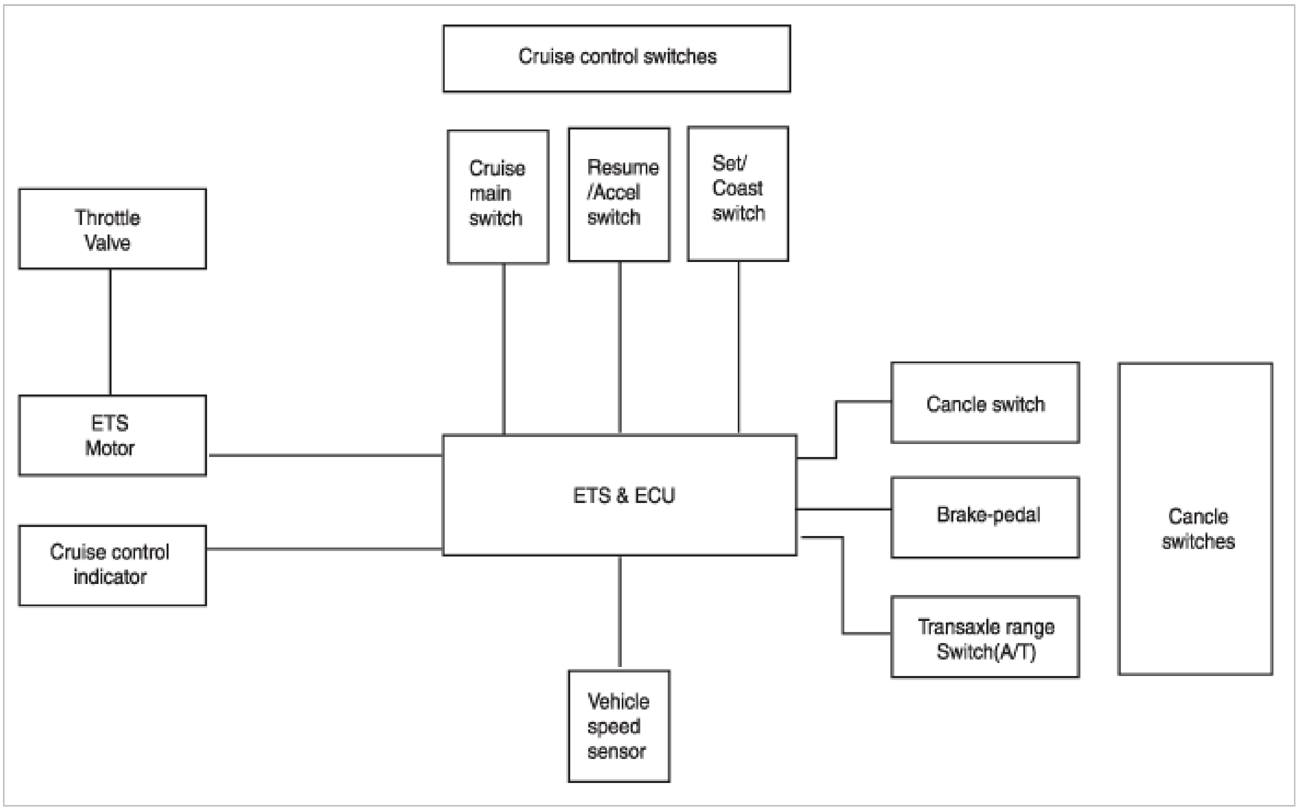
4. Apply 12V to terminal 85 and ground to terminal 86.
   Check for continuity between terminals 30 and 87.



5. If there is no continuity, replace the starter relay.
6. Install the starter relay.
7. Install the fuse box cover.

Engine Electrical System > Cruise Control System > Description and Operation

SYSTEM BLOCK DIAGRAM



COMPONENT PARTS AND FUNCTION OUTLINE

Component part		Function
Vehicle-speed sensor		Converts vehicle speed to pulse.
Engine control module (ECM)		Receives signals from sensor and control switches;
Cruise control indicator		Illuminate when CRUISE main switch is ON (Built into cluster)
Cruise Control switches	CRUISE main switch	Switch for automatic speed control power supply.
	Resume/Accel switch	Controls automatic speed control functions by Resume/Accel switch (Set/Coast switch)
	Set/Coast switch	
Cancel switch	Cancel switch	Sends cancel signals to ECM
	Brake-pedal switch	
	Transaxle range switch (A/T) Clutch switch (M/T)	
ETS motor		Regulates the throttle valve to the set opening by ECM.

* ETS : Electronic Throttle System

CRUISE CONTROL

Cruise control system is engaged by "ON. OFF" main switch located on right of steering wheel column. System has the capability to cruise, coast, resume speed, and accelerate, and raise "tap-up" or lower "tap-down" set speed.
It also has a safety interrupt, engaged upon depressing brake or shifting select lever.
ECM is a speed control system that maintains a required vehicle speed at normal driving conditions.
The main components of cruise control system are mode control switches, transaxle range switch, brake switch, vehicle speed sensor, ECM and ETS motor that connect throttle body.
ECM contains a low speed limit which will prevent system engagement below a minimum speed of 40km/h (25mph).
The operation of the controller is controlled by mode control switches located on steering wheel.
Transaxle range switch and brake switch are provided to disengage the cruise control system. The switches are on brake pedal bracket and transaxle. When the brake pedal is depressed or select lever shifted, the cruise control system is electrically disengaged and the throttle is returned to the idle position.

Cruise main switch

Cruise control system is engaged by pressing "ON. OFF" push button. Releasing "ON.OFF" push button release throttle, clears cruise memory speed, and puts vehicle in a non-cruise mode.

Coast/Set switch

COAST.SET switch located on right of steering wheel column has two positions - "Normal" and "Depressed". The set position - With COAST.SET switch depressed and then released the cruise speed will be set at the speed the vehicle was going when COAST.SET switch was released. The coast position - With COAST.SET switch fully depressed, driver can lower cruise speed. To decrease cruise speed, COAST.SET switch is held in, disengaging cruise control system. When vehicle has slowed to required cruise speed, releasing COAST.SET switch will re-engage speed at new selected speed. The tap down - To lower vehicle speed, cruise must be engaged and operating. Tap down is done by quickly pressing and releasing COAST.SET switch. Do not hold COAST.SET switch in depressed position.
Tap down is a function in which cruise speed car be decreased by 1mph (1.6km/h)

Resume/Accel switch

RES.ACCEL switch located on right of steering wheel column has two positions - "Normal" and "Depressed".
The resume position - With RES.ACCEL switch depressed and then release, this switch also returns cruise control operation to last speed (Which is temporarily disengaged by Cancel switch or Brake pedal), setting when momentarily operating RES.ACCEL switch by constant acceleration.
The accel position - With RES.ACCEL switch depressed and held in, disengaging cruise control system, when vehicle has accelerated to required cruise speed, releasing RES.ACCEL switch will re-engage speed at new selected speed.
The tap up - To increase vehicle speed, the cruise must be engaged and operating.
Tap up is done by quickly pressing and releasing RES.ACCEL switch less than 0.5 second. Do not hold RES.ACCEL switch in depressed position. Tap up is a function in which cruise speed can be increased by 1mph (1.6km/h).

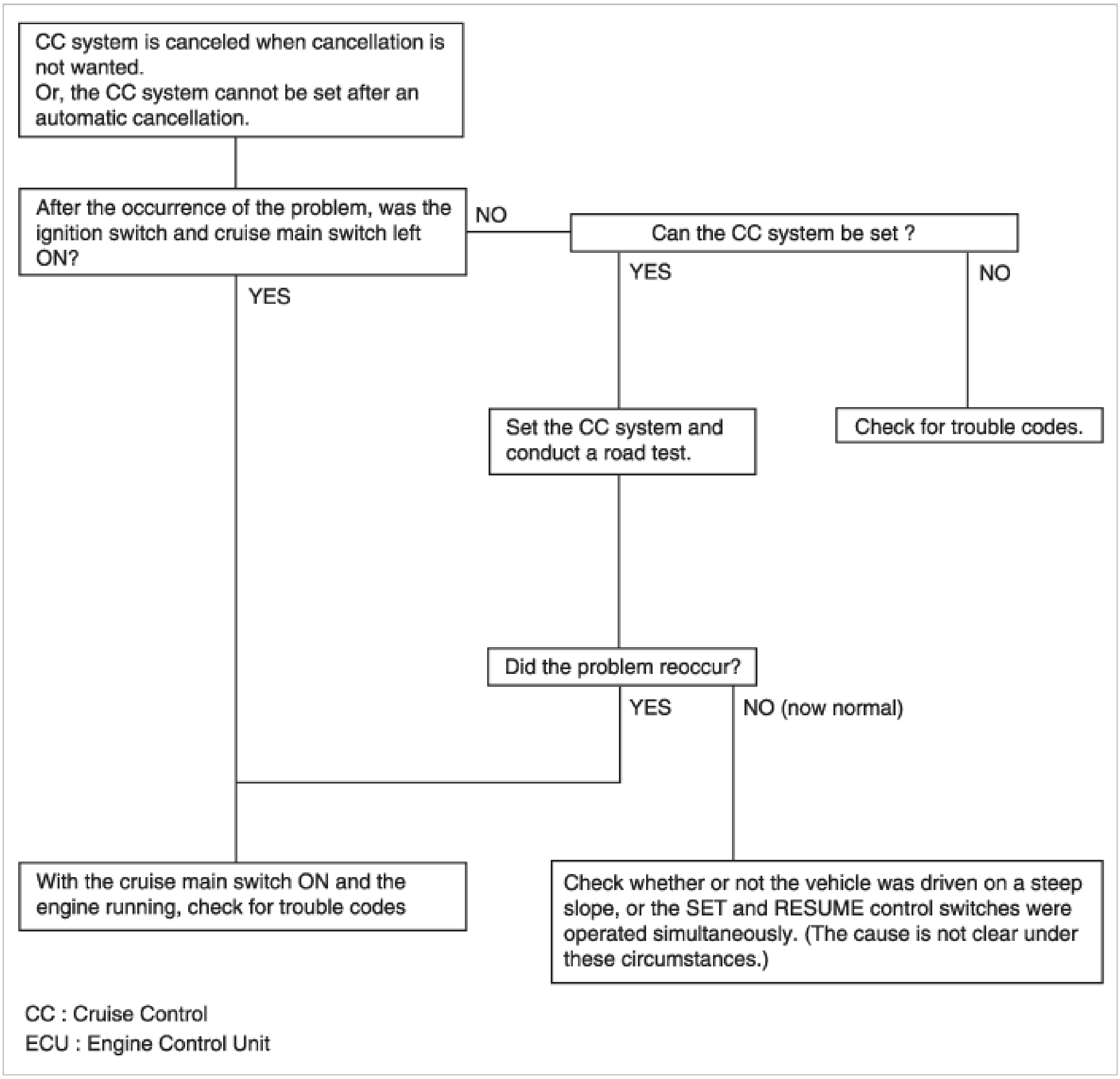
Cancel switch

Cruise control system is temporarily disengaged by pressing "CANCEL" switch.
Cruise speed canceled by this switch will be recovered by RES.ACCEL switch

Engine Electrical System > Cruise Control System > Troubleshooting

TROUBLE SYMPTOM CHARTS

TROUBLE SYMPTOM 1



TROUBLE SYMPTOM 2

Trouble symptom	Probable cause	Remedy
The set vehicle speed varies greatly upward or downward "Surging" (repeated alternating acceleration and deceleration) occurs after setting	Malfunction of the vehicle speed sensor circuit	Repair the vehicle speed sensor system, or replace the part
	Malfunction of ECM	Replace the ECM

TROUBLE SYMPTOM 3

Trouble symptom	Probable cause	Remedy
The CC system is not canceled when the brake pedal is depressed	Damaged or disconnected wiring of the brake pedal switch	Repair the harness or replace the brake pedal switch
	Malfunction of the ECM	Replace the ECM

TROUBLE SYMPTOM 4

Trouble symptom	Probable cause	Remedy
The CC system is not canceled when	Damaged or disconnected wiring of inhibitor switch input circuit	Repair the harness or repair or replace

the shift lever is moved to the "N" position (It is canceled, however, when the brake pedal is depressed	Improper adjustment of inhibitor switch	the inhibitor switch
	Malfunction of the ECM	Replace the ECM

TROUBLE SYMPTOM 5

Trouble symptom	Probable cause	Remedy
Cannot decelerate (coast) by using the SET switch	Temporary damaged or disconnected wiring of SET switch input circuit	Repair the harness or replace the SET switch
	Malfunction of the ECM	Replace the ECM

TROUBLE SYMPTOM 6

Trouble symptom	Probable cause	Remedy
Cannot accelerate or resume speed by using the RESUME switch	Damaged or disconnected wiring, or short circuit, or RESUME switch input circuit	Repair the harness or replace the RESUME switch
	Malfunction of the ECM	Replace the ECM

TROUBLE SYMPTOM 7

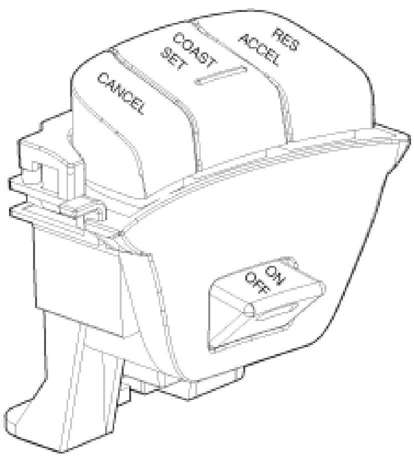
Trouble symptom	Probable cause	Remedy
CC system can be set while driving at a vehicle speed of less than 40km/h (25mph), or there is no automatic cancellation at that speed	Malfunction of the vehicle-speed sensor circuit	Repair the vehicle speed sensor system, or replace the part
	Malfunction of the ECM	Replace the ECM

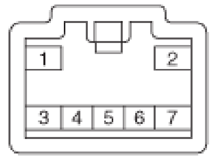
TROUBLE SYMPTOM 8

Trouble symptom	Probable cause	Remedy
The cruise main switch indicator lamp does not illuminate (But CC system is normal)	Damaged or disconnected bulb of cruise main switch indicator lamp	Repair the harness or replace the part.
	Harness damaged or disconnected	

Engine Electrical System > Cruise Control System > Cruise Control Switch > Schematic Diagrams

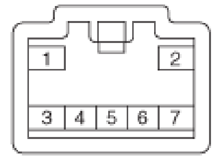
CIRCUIT DIAGRAM





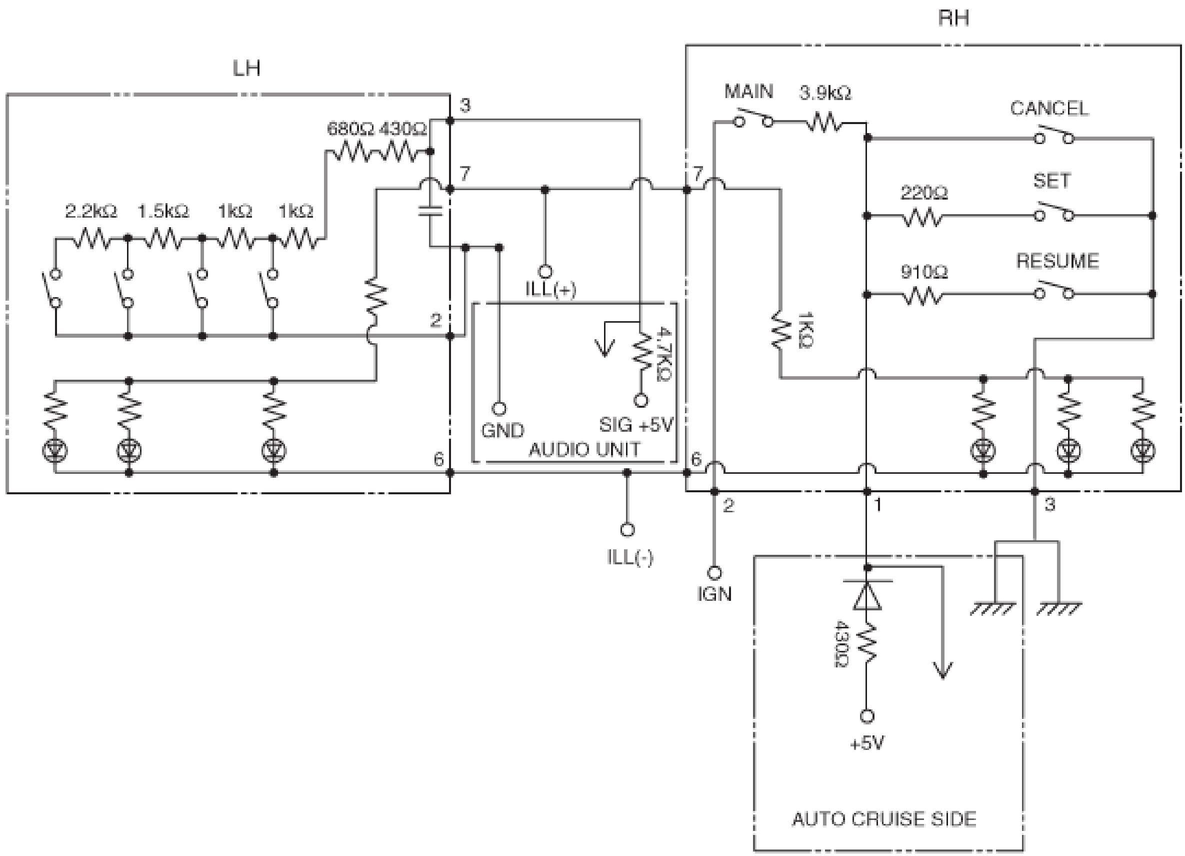
LH CONNECTOR

NO	CONNECTOR
1	–
2	AUDIO UNIT (GND)
3	AUDIO UNIT (SIG IN)
4	–
5	–
6	ILL(-)
7	ILL(+)



RH CONNECTOR

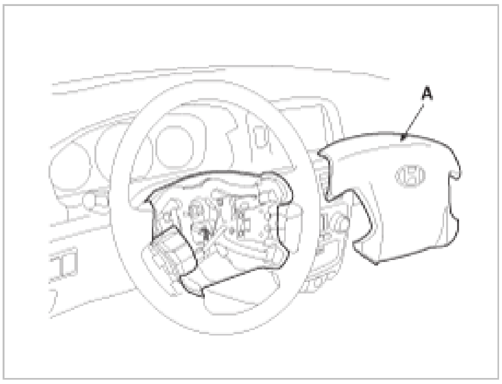
NO	CONNECTOR
1	CRUSIE SW(SIG IN)
2	CRUSIE MAIN SW(IGN)
3	CRUSIE SW(SIG OUT)
4	–
5	–
6	ILL(-)
7	ILL(+)



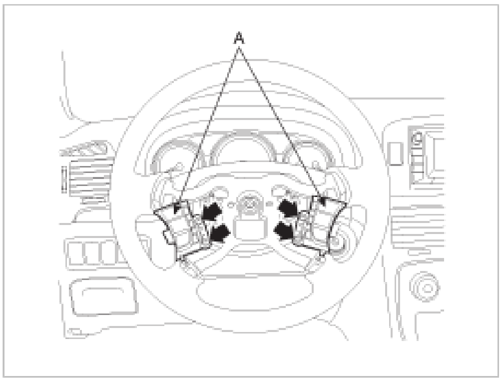
Engine Electrical System > Cruise Control System > Cruise Control Switch > Repair procedures

REMOVAL

1. Disconnect the battery (-) terminal.
2. Remove the driver side air bag module(A). (Refer to RT GR.)



3. Disconnect the cruise control switch connector and then remove the cruise control switch(A) with two screws.

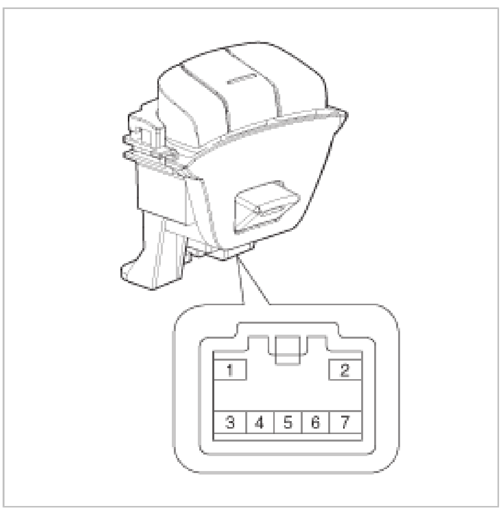


4. Installation is the reverse of removal.

INSPECTION

MEASURING RESISTANCE

1. Disconnect the cruise control switch connector from the control switch.



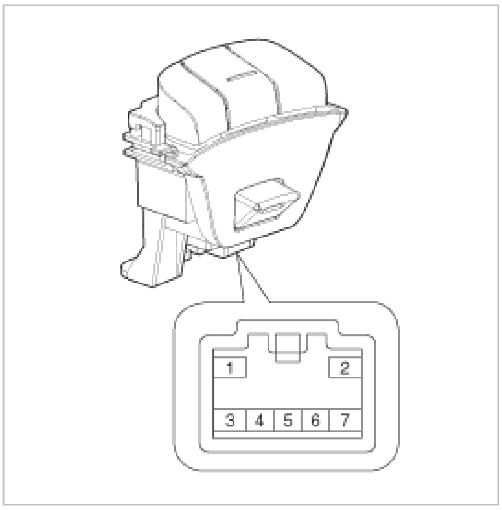
2. Measure resistance between terminals on the control switch when each function switch is ON (switch is depressed).

Function switch	Terminal	Resistance
Cruise Main	RH 1-2	3.9kΩ ± 1%
Cancel	RH 1-3	0Ω ± 1%
Set/Coast	RH 1-3	220Ω ± 1%
Resume/Accel	RH 1-3	910Ω ± 1%

3. If not within specification, replace switch.

MEASURING VOLTAGE

1. Connect the cruise control switch connector to the control switch.



2. Measure voltage between terminals on the harness side connector when each function switch is ON (switch is depressed).

Function switch	Terminal	Voltage
Cruise Main	RH 1-2	-
Cancel	RH 1-3	0.0V ± 0.22V
Set/Coast	RH 1-3	1.5V ± 0.22V
Resume/Accel	RH 1-3	3.0V ± 0.22V

3. If not within specification, replace switch.

Engine Mechanical System > General Information > General Information

SPECIFICATION

Description Spe			cifications	Limit
General				
Type			V-type, DOHC	
Number of cylinders			6	
Bore			92mm (3.6220in)	
Stroke			83.8mm (3.2992in)	
Total displacement			3,342cc (203.86cu.in.)	
Compression ratio			10.4	
Firing order			1-2-3-4-5-6	
Valve timing				
Intake	Opens(ATDC)		14°	
	Closes(ABDC)		62°	
Exhaust	Opens(BBDC)		42°	
	Closes(ATDC)		6°	
Cylinder head				
Flatness of gasket surface			Less than 0.05mm (0.0019in.) [Less than 0.02mm (0.0008in.) / 150x150]	
Flatness of manifold mounting	Intake		Less than 0.1mm(0.0039in.) [Less than 0.03mm(0.001in)/110x110]	
	Exhaust		Less than 0.1mm(0.0039in.) [Less than 0.03mm(0.001in)/110x110]	
Camshaft				
Cam height	LH Camshaft	Intake	46.3mm	
		Exhaust	45.8mm	
	RH Camshaft	Intake	46.3mm	
		Exhaust	45.8mm	
Journal outer diameter	LH ,RHcamshaft	Intake	No.1: 27.964 ~ 27.980mm (1.1009 ~ 1.1016in.) No.2,3,4: 23.954 ~ 23.970mm (0.9430 ~ 0.9437in.)	
		Exhaust	No.1: 27.964 ~ 27.980mm (1.1009 ~ 1.1016in.) No.2,3,4: 23.954 ~ 23.970mm (0.9430 ~ 0.9437in.)	
Bearing oil clearance	LH ,RHcamshaft	Intake	No.1: 0.020 ~ 0.057mm (0.0008 ~ 0.0022in.) No.2,3,4: 0.030 ~ 0.067mm (0.0012 ~ 0.0026in.)	
		Exhaust	No.1: 0.020 ~ 0.057mm (0.0008 ~ 0.0022in.) No.2,3,4: 0.030 ~ 0.067mm (0.0012 ~ 0.0026in.)	
End play			0.056 ~ 0.064mm (0.0022 ~ 0.0025in.)	
Valve				
Valve length	Intake		105.27mm(4.1445in.)	
	Exhaust		105.50mm (4.1535in.)	
Stem outer diameter	Intake		5.465 ~ 5.480mm (0.2151 ~ 0.2157in.)	
	Exhaust		5.458 ~ 5.470mm (0.2149 ~ 0.2153in.)	

Face angle		45.25° ~ 45.75°	
Thickness of valvehead (margin)	Intake	1.56 ~ 1.86mm(0.06142 ~ 0.07323in.)	
	Exhaust	1.73 ~ 2.03mm(0.06811 ~ 0.07992in.)	
Valve stem to valve guide clearance	Intake	0.020 ~ 0.047mm (0.00078 ~ 0.00185in.)	0.07mm (0.00275in.)
	Exhaust	0.030 ~ 0.054mm (0.00118 ~ 0.00212in.)	0.09mm (0.00354in.)
Valve guide			
Inner diameter	Intake	5.500 ~ 5.512mm (0.2165 ~ 0.2170in.)	
	Exhaust	5.500 ~ 5.512mm (0.2165 ~ 0.2170in.)	
Length	Intake	41.8 ~ 42.2mm (1.6457 ~ 1.6614in.)	
	Exhaust	41.8 ~ 42.2mm (1.6457 ~ 1.6614in.)	
Valve seat			
Width of seat contact	Intake	1.15 ~ 1.45mm(0.05118 ~ 0.05709in.)	
	Exhaust	1.35 ~ 1.65mm(0.05315 ~ 0.06496in.)	
Seat angle	Intake	44.75° ~ 45.20°	
	Exhaust	44.75° ~ 45.20°	
Valve spring			
Free length		43.86mm (1.7267in.)	
Load		19.3±0.8kg/34.0mm (42.7±1.8 lb/1.3386in)	
		42.3±1.3kg/24.2mm (93.3±2.9 lb/0.9527in)	
Out of squareness		Less than 1.5°	
MLA			
MLA outer diameter	Intake	34.964 ~ 34.980mm (1.3765 ~ 1.3772in.)	
	Exhaust	34.964 ~ 34.980mm (1.3765 ~ 1.3772in.)	
Cylinder head tappet bore inner diameter	Intake	35.000 ~ 35.025mm (1.3779 ~ 1.3789in.)	
	Exhaust	35.000 ~ 35.025mm (1.3779 ~ 1.3789in.)	
MLA to tappet bore clearance	Intake	0.020 ~ 0.061mm (0.0008 ~ 0.0024in.)	0.07mm (0.0027in.)
	Exhaust	0.020 ~ 0.061mm (0.0008 ~ 0.0024in.)	0.07mm (0.0027in.)
Valve clearance			
Intake		0.17 ~ 0.23mm (0.0067 ~ 0.0090in.)	0.10 ~ 0.30mm (0.0039 ~ 0.0118in.)
Exhaust		0.27 ~ 0.33mm (0.0106 ~ 0.0129in,)	0.20 ~ 0.40mm (0.0078 ~ 0.0157in.)
Cylinder block			
Cylinder bore		92.00 ~ 92.03mm (3.6220 ~ 3.6232in.)	
Flatness of gasket surface		Less than 0.05mm (0.0019in.) [Less than 0.02mm (0.0008in.) / 150x150]	
Piston			
Piston outer diameter		91.97 ~ 92.00mm(3.6209 ~ 3.6220in.)	
Piston to cylinder clearance		0.02 ~ 0.04mm(0.0008 ~ 0.0016in.)	

Ring groove width	No. 1 ring groove	1.23 ~ 1.25mm (0.0484 ~ 0.0492in.)	1.26mm (0.0496in.)
	No. 2 ring groove	1.22 ~ 1.24mm (0.0480 ~ 0.0488in.)	1.26mm (0.0496in.)
	Oil ring groove	2.01 ~ 2.03mm (0.0791 ~ 0.0799in.)	2.05mm (0.0807in.)
Piston ring			
Side clearance	No. 1 ring	0.04 ~ 0.078mm (0.0016 ~ 0.0031in.)	0.1mm (0.004in.)
	No. 2 ring	0.03 ~ 0.07mm (0.0012 ~ 0.0027in.)	0.1mm (0.004in.)
	Oil ring	0.06 ~ 0.15mm (0.0024 ~ 0.0059in.)	0.2mm (0.008in.)
End gap	No. 1 ring	0.17 ~ 0.32mm (0.0067 ~ 0.0126in.)	0.6mm (0.0236in.)
	No. 2 ring	0.32 ~ 0.47mm (0.0126 ~ 0.0185in.)	0.7mm (0.0275in.)
	Oil ring	0.20 ~ 0.70mm (0.0078 ~ 0.0275in.)	0.8mm (0.0315in.)
Piston pin			
Piston pin outer diameter		23.002 ~ 23.006mm (0.9056 ~ 0.9057in.)	
Piston pin hole inner diameter		23.015 ~ 23.019mm (0.9061 ~ 0.9063in.)	
Piston pin hole clearance		0.009 ~ 0.017mm (0.0004 ~ 0.0007in.)	
Connecting rod small end inner diameter		22.974 ~ 22.985mm (0.9045 ~ 0.9049in.)	
Connecting rod small end hole clearance		0.017 ~ 0.032mm (0.0007 ~ 0.0013in.)	
Connecting rod			
Connecting rod big end innerdiameter		58.000 ~ 58.018mm(2.2834 ~2.2842in.)	
Connecting rod bearing oil clearance		0.030 ~ 0.048mm (0.0012 ~ 0.0019in.)	
Side clearance		0.1 ~ 0.25mm (0.0039 ~ 0.0098in.)	
Crankshaft			
Main journal outer diameter		68.942 ~ 68.960mm (2.7142 ~ 2.7149in.)	
Pin journal outer diameter		54.954 ~ 54.972mm (2.1635 ~ 2.1642in.)	
Main bearing oil clearance		0.022 ~ 0.040mm (0.0008 ~ 0.0016in.)	
End play		0.10 ~ 0.28mm (0.0039 ~ 0.0110in.)	
Oil pump			
Relief valve opening pressure		450 ~ 550kPa (4.59 ~ 5.61kgf/cm²,65.28 ~ 79.79psi)	
Engine oil			
Oil quantity (Total)		6.4L(6.76U.S.qus,5.63Imp.qts)	
Oil quantity (Oil pan)		5.5L(5.81U.S.qus,4.84Imp.qts)	
Oil quantity (Oil filter)		0.4L(0.42U.S.qus,0.35Imp.qts)	
Oil quantity (Drain and refill)		5.2L(5.49U.S.qus,4.58Imp.qts)	
Oil quality		Above SJ or SL	
Oil pressure		130kPa(1.32kgf/cm²,18.77psi) [at 1000rpm,110°C(230°F)]	
Cooling system			
Cooling method		Forced circulation with electrical fan	

Coolant quantity		8.9L(9.40U.S.qus,7.83lmp.qts)	
Thermostat	Type	Wax pellet type	
	Opening temperature	82±2°C (179.6±35.6°F)	
	Fully openedtemperature	95°C (203°F)	
	Full lift	10mm (0.3937in.)	
Radiator cap	Main valve opening pressure	93.16 ~ 122.58kpa (0.95 ~ 1.25kg/cm², 13.51 ~ 17.78psi)	
	Vacuum valve opening pressure	0.98 ~ 4.90 kpa (0.01 ~ 0.05kg/cm², 0.14 ~ 0.71 psi)	
Water temperature sensor			
Type		Thermister type	
Resistance	20°C (68°F)	2.31 ~ 2.59KΩ	
	80°C(176°F)	0.3222 KΩ	

TIGHTENING TORQUE

Item Q	uantity	Nm	kgf.m	lbf.ft
Crankshaft pulley bolt	1	284.2 ~ 303.8	29.0 ~ 31.0	209.76 ~ 224.22
Timing chain cover bolt B	17	18.62 ~ 21.56	1.9 ~ 2.2	13.74 ~ 15.91
Timing chain cover bolt C	4	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Timing chain cover bolt D	1	58.80 ~ 68.80	6.0 ~ 7.0	43.40 ~ 50.63
Timing chain cover bolt E	1	58.80 ~ 68.80	6.0 ~ 7.0	43.40 ~ 50.63
Timing chain cover bolt F	2	24.50 ~ 26.46	2.5 ~ 2.7	18.08 ~ 19.53
Timing chain cover bolt G	4	21.56 ~ 23.52	2.2 ~ 2.4	15.91 ~ 17.36
Timing chain cover bolt H	1	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Timing chain cover bolt I	1	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Timing chain cover bolt J	1	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Cam to cam guide bolt	4	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Timing chain auto tensioner bolt	2	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Timing chain auto tensioner nut	2	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Timing chain guide bolt	4	19.60 ~ 24.50	2.0 ~ 2.5	14.17 ~ 18.08
Oil pump chain cover bolt	3	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Oil pump chain tensioner bolt	1	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Oil pump chain guide bolt	2	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Oil pump chain sprocket bolt	1	18.62 ~ 21.56	1.9 ~ 2.2	13.74 ~ 15.91
Lower oil pan bolt	13	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Drive belt auto tensioner bolt(M12)	1	96.04 ~ 99.96	9.8 ~ 10.2	70.88 ~ 73.78
Drive belt auto tensioner bolt(M8)	1	17.64 ~ 21.56	1.8 ~ 2.2	13.02 ~ 15.91
Drive belt idler bolt	1	53.90 ~ 57.82	5.5 ~ 5.9	39.78 ~ 42.67
OCV(oil control valve) bolt	2	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Cylinder head bolt	16	(37.3~41.2) + (118~122°) + (88~92°)	(3.8~4.2) + (118~122°) + (88~92°)	(27.5~30.4) + (118~122°) + (88~92°)
Cylinder head bolt	1	18.62 ~ 23.52	1.9 ~ 2.4	13.74 ~ 17.36
CVVT & exhaust cam sprocket bolt	4	64.68 ~ 76.44	6.6 ~ 7.8	47.74 ~ 56.42
Camshaft bearing cap bolt	32	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68

Cylinder head cover bolt	38	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Connecting rod bearing bolt	12	(17.7~21.6) + (88~92°)	(1.8~2.2) + (88~92°)	(13.0~15.9) + (88~92°)
Main bearing cap inner bolt(M11)	8	49.00 + 90°	5.0 + 90°	36.16 + 90°
Main bearing cap outer bolt(M8)	8	19.60 + 120°	2.0 + 120°	14.46 + 120°
Main bearing cap side bolt(M8)	6	29.40 ~ 31.36	3.0 ~ 3.2	21.70 ~ 23.14
Oil drain cover bolt	6	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Rear oil seal case bolt	6	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Baffle plate bolt	12	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Upper oil pan bolt	16	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Knock sensor bolt	2	15.68 ~ 23.52	1.6 ~ 2.4	11.57 ~ 17.36
Drive plate bolt	8	71.54 ~ 75.46	7.3 ~ 7.7	52.80 ~ 55.69
Oil filter cap	1	24.50	2.5	18.08
Oil drain bolt	1	34.30 ~ 44.10	3.5 ~ 4.5	25.31 ~ 32.55
Oil pump bolt	3	19.60 ~ 23.52	2.0 ~ 2.4	14.47 ~ 17.36
Oil filter body bolt	10	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Oil filter body cover bolt	11	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Water vent hose bolt	2	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Water pump bolt(Timing chain cover bolt L)	1	21.56 ~ 26.46	2.2 ~ 2.7	15.91 ~ 19.53
Water pump bolt(Timing chain cover bolt K)	4	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Water pump pulley bolt	4	7.84 ~ 9.80	0.8 ~ 1.0	5.78 ~ 7.23
Water temp. control nut	4	18.62 ~ 23.52	1.9 ~ 2.4	13.74 ~ 17.36
Water temp. control bolt	2	18.62 ~ 23.52	1.9 ~ 2.4	13.74 ~ 17.36
Water inlet pipe bolt	3	16.66 ~ 19.60	1.7 ~ 2.0	12.30 ~ 14.47
Air vent pipe bolt	2	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Intake manifold bolt	6	18.62 ~ 23.52	1.9 ~ 2.4	13.74 ~ 17.36
Intake manifold nut	2	18.62 ~ 23.52	1.9 ~ 2.4	13.74 ~ 17.36
Surge tank bolt	5	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Surge tank nut	2	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Breather pipe bolt	2	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Surge tank bracket bolt	2	27.44 ~ 31.36	2.8 ~ 3.2	20.25 ~ 23.14
ETC bracket bolt	2	15.68 ~ 25.48	1.6 ~ 2.6	11.57 ~ 18.80
Exhaust manifold nut	16	39.20 ~ 44.10	4.0 ~ 4.5	28.93 ~ 32.55
Heat protector bolt	8	16.66 ~ 21.56	1.7 ~ 2.2	12.30 ~ 15.91
Front muffler	2	39.20 ~ 58.80	4.0 ~ 6.0	28.93 ~ 43.40

COMPRESSION

NOTE

If the there is lack of power, excessive oil consumption or poor fuel economy, measure the compression pressure.

1. Warm up and stop engine.
   Allow the engine to warm up to normal operating temperature.
2. Remove ignition coils. (See EE group - ignition)
3. Remove spark plugs.
   Using a 16mm plug wrench, remove the 6 spark plugs.

4. Check cylinder compression pressure.
   A. Insert a compression gauge into the spark plug hole.
   B. Fully open the throttle.
   C. After 7times of cranking the engine, measure the compression pressure.

> NOTE
>
> Always use a fully charged battery to obtain engine speed of 200 rpm or more.

   D. Repeat steps (a) through (c) for each cylinder.

> NOTE
>
> This measurement must be done in as short a time as possible.

Compression pressure :
1,225kPa (12.5kgf/cm², 177psi) - 200 ~ 250rpm
Minimum pressure :
1,078kPa (11.0kgf/cm², 156psi)

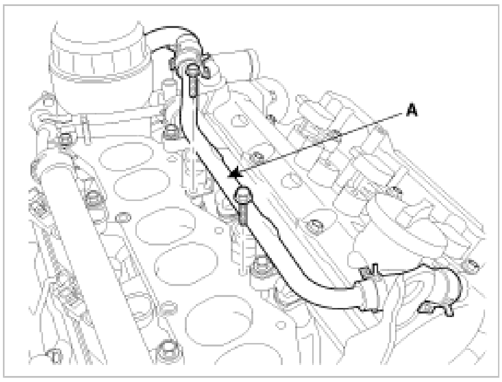
   E. If the cylinder compression in 1 or more cylinders is low, pour a small amount of engine oil into the cylinder through the spark plug hole and repeat steps (a) through (c) for cylinders with low compression.
      - If adding oil helps the compression, it is likely that the piston rings and/or cylinder bore are worn or damaged.
      - If pressure stays low, a valve may be sticking or seating is improper, or there may be leakage past the gasket.

5. Reinstall spark plugs.
6. Install ignition coils. (See EE group - ignition)

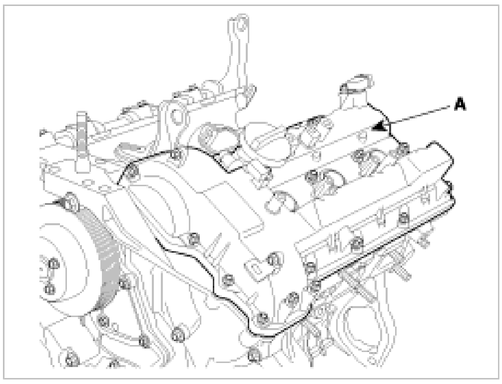
VALVE CLEARANCE INSPECTION AND ADJUSTMENT

> NOTE
>
> Inspect and adjust the valve clearance when the engine is cold (Engine coolant temperature : 20°C) and cylinder head is installed on the cylinder block.

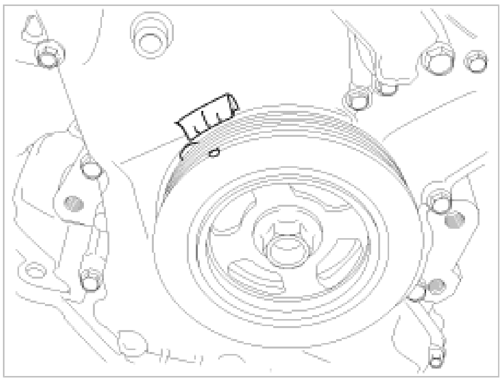
1. Remove the engine cover.
2. Remove air cleaner assembly.
3. Remove the surge tank.
4. Remove the cylinder head cover.
   A. Disconnect the ignition coil connector and remove the ignition coil.
   B. Disconnect the breather hose(A) from the cylinder head cover.



   C. Loosen the cylinder head cover bolts and then remove the cover(A) and gasket.



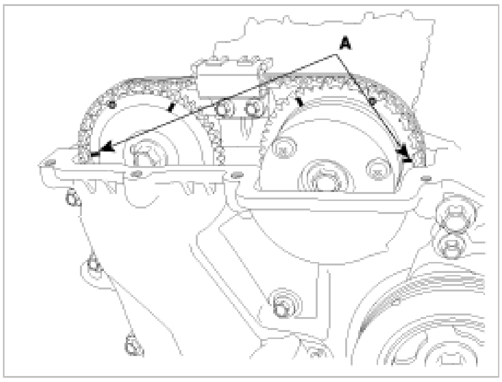
5. Set No.1 cylinder to TDC/compression.
   A. Turn the crankshaft pulley and align its groove with the timing mark "T" of the lower timing chain cover.



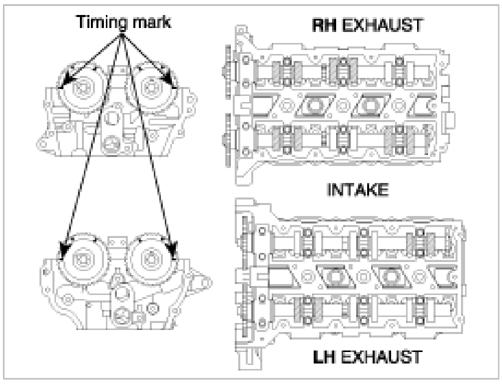
   B. Check that the mark(A) of the camshaft timing sprockets are in straight line on the cylinder head surface as shown in the illustration.
      If not, turn the crankshaft one revolution (360°)

NOTE

Do not rotate engine counterclockwise



6. Inspect the valve clearance.
   A. Check only the valve indicated as shown. [No. 1 cylinder : TDC/Compression] measure the valve clearance.



· Using a thickness gauge, measure the clearance between the tappet and the base circle of camshaft.

· Record the out-of-specification valve clearance measurements. They will be used later to determine the required replacement adjusting tappet.

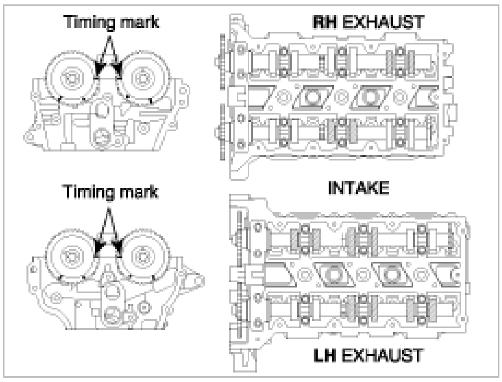
Valve clearance
Specification
Engine coolant temperature : 20°C [68°F]
Limit
Intake : 0.10 ~ 0.30mm (0.0039 ~ 0.0118in.)
Exhaust : 0.20 ~ 0.40mm (0.0079 ~ 0.0157in.)

B. Turn the crankshaft pulley one revolution (360°) and align the groove with timing mark "T" of the lower timing chain cover.

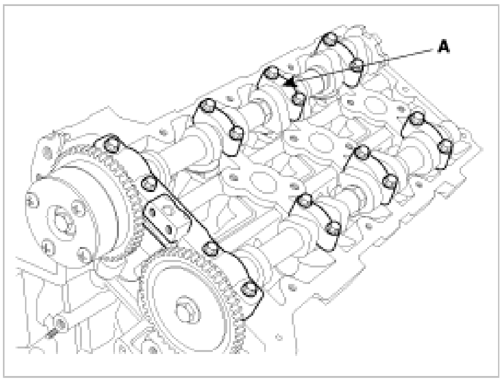
NOTE

Do not rotate engine counterclockwise

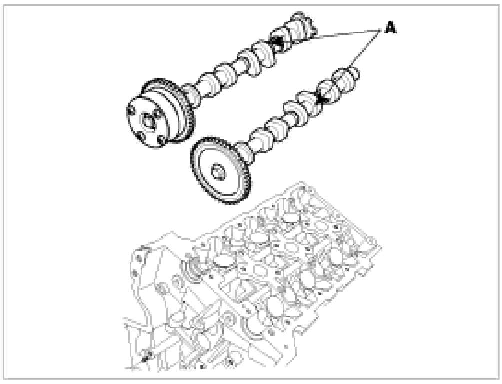
C. Check only valves indicated as shown. [NO. 4 cylinder : TDC/compression]. Measure the valve clearance.



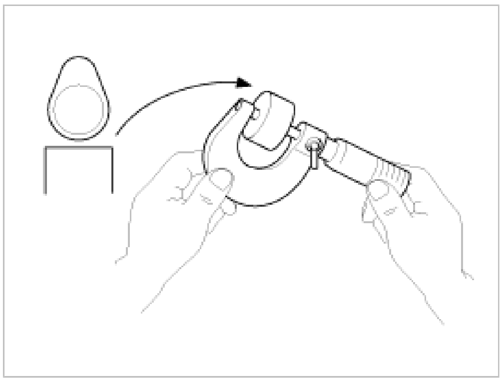
7. Adjust the intake and exhaust valve clearance.
   A. Set the No.1 cylinder to the TDC/compression.
   B. Remove the timing chain.
   C. Remove the camshaft bearing caps(A).



   D. Remove the camshaft assembly(A).



   E. Remove MLAs.
   F. Measure the thickness of the removed tappet using a micrometer.



G. Calculate the thickness of a new tappet so that the valve clearance comes within the specified value.

Valve clearance(Engine coolant temperature: 20°C[68°F])
T : Thickness of removed tappet
A : Measured valve clearance
N : Thickness of new tappet
Intake : N = T + [A - 0.20mm(0.0079in.)]
Exhaust : N = T + [A - 0.30mm (0.0118in.)]

H. Select a new tappet with a thickness as close as possible to the calculated value.

NOTE

Shims are available in 41size increments of 0.015mm (0.0006in.) from 3.00mm (0.118in.) to 3.600mm (0.1417in.)

I. Place a new tappet on the cylinder head.

NOTE

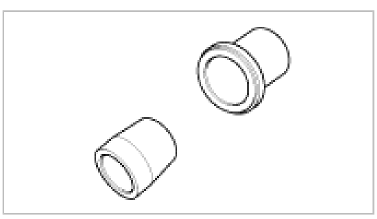
Appling engine oil at the selected tappet on the periphery and top surface.

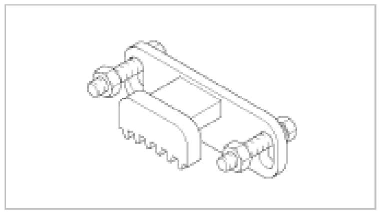
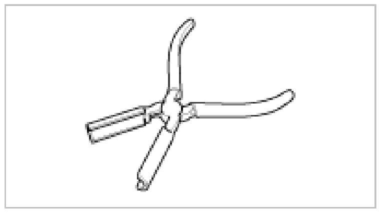
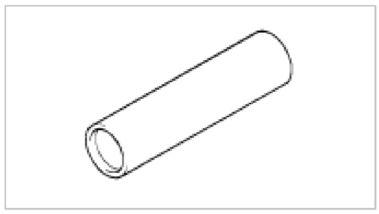
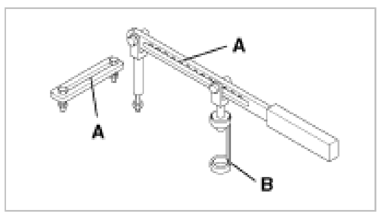
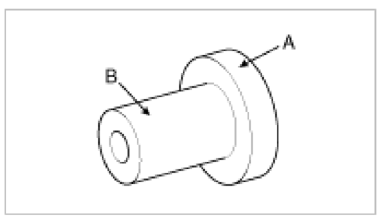
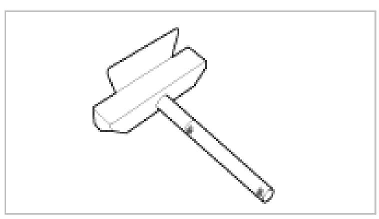
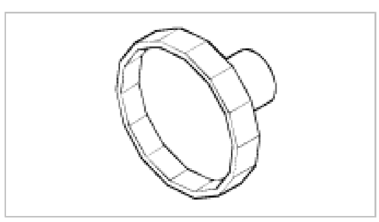
J. Install the intake and exhaust camshaft.
K. Install the bearing caps.
L. Install the timing chain.
M. Turn the crankshaft two turns in the operating direction(clockwise) and realign crankshaft sprocket and camshaft sprocket timing marks.
N. Recheck the valve clearance.

Valve clearance (Engine coolant temperature: 20°C[68°F])
[Specification]
Intake : 0.17 ~ 0.23mm (0.0067 ~ 0.0090in.)
Exhaust : 0.27 ~ 0.33mm (0.0106 ~ 0.0129in.)

Engine Mechanical System > General Information > Special Service Tools

SPECIAL TOOLS

Tool (Number and name)	Illustration	Use
Crankshaft front oil seal installer (09231-3C100)		Installation of the front oil seal
Flywheel stopper (09231-3C300)		Removal and installation of the flywheel and crankshaft pulley.

		
Torque angle adapter (09221-4A000)		Installation of bolts & nuts needing an angular method
Valve stem seal remover (09222-29000)		Remover of the valve stem seal
Valve stem seal remover (09222-3C100)		Installation of the valve stem seal
Valve spring compressor & holder (09222-3K000) (09222-3C300)		Removal and installation of the intake or exhaust valve A : 09222-3K000 B : 09222-3C300 (holder)
Crankshaft rear oil seal installer (09231-3C200) (09231-H1100)		Installation of the crankshaft rear oil seal A : 09231-3C200 B : 09231-H1100
Oil pan remover (09215-3C000)		Removal of oil pan
Oil filter wrench (09263-3C100)		Removal and installation of the oil filter

Engine Mechanical System > General Information > Troubleshooting

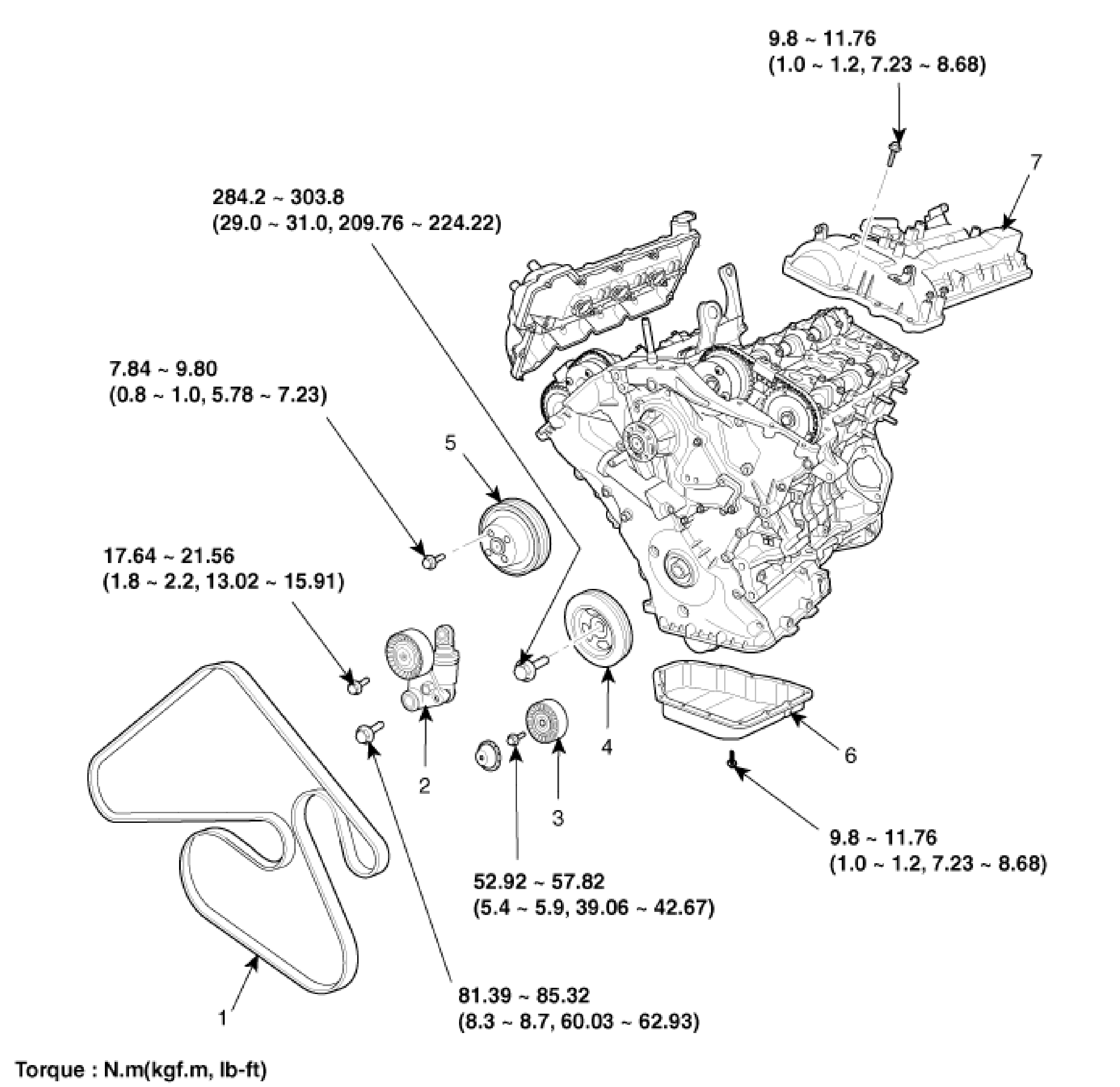
TROUBLESHOOTING

Symptom S	uspect area	Remedy
Engine misfire with abnormal internal lower engine noises.	Worn crankshaft bearings. Loose or improperly engine drive plate.	Replace the crankshaft and bearings as required. Repair or replace the drive plate as required.
	Worn piston rings. (Oil consumption may or may not cause the engine to misfire.)	Inspect the cylinder for a loss of compression. Repair or replace as required.
	Worn crankshaft thrust bearings	Replace the crankshaft and bearings as required.
Engine misfire with abnormal valve train noise.	Stuck valves. (Carbon buildup on the valve stem)	Repair or replace as required.
	Excessive worn or mis-aligned timing chain.	Replace the timing chain and sprocket as required.
	Worn camshaft lobes.	Replace the camshaft and valve lifters.
Engine misfire with coolant consumption.	• Faulty cylinder head gasket and/or cranking or other damage to the cylinder head and engine block cooling system. • Coolant consumption may or may not cause the engine to overheat.	• Inspect the cylinder head and engine block for damage to the coolant passages and/or a faulty head gasket. • Repair or replace as required.
Engine misfire with excessive oil consumption.	Worn valves, guides and/or valve stem oil seals.	Repair or replace as required.
	Worn piston rings. (Oil consumption may or may not cause the engine to misfire)	• Inspect the cylinder for a loss of compression. • Repair or replace as required.
Engine noise on start-up, but only lasting a few seconds.	Incorrect oil viscosity.	• Drain the oil. • Install the correct viscosity oil.
	Worn crankshaft thrust bearing.	• Inspect the thrust bearing and crankshaft. • Repair or replace as required.
Upper engine noise,regardless of engine speed.	Low oil pressure.	Repair or replace as required.
	Broken valve spring.	Replace the valve spring.
	Worn or dirty valve lifters.	Replace the valve lifters.
	Stretched or broken timing chain and/or damaged sprocket teeth.	Replace the timing chain and sprockets.
	Worn timing chain tensioner, if applicable.	Replace the timing chain tensioner as required.
	Worn camshaft lobes.	• Inspect the camshaft lobes. • Replace the timing camshaft and valve lifters as required.
	Worn valve guides or valve stems.	Inspect the valves and valve guides,then repair as required.
	Stuck valves. (Carbon on the valve stem or valve seat may cause the valve to stay open.	Inspect the valves and valve guides, then repair as required.
	Worn drive belt, idler, tensioner and bearing.	Replace as required.
Lower engine noise,regardless of engine speed.	Low oil pressure.	Repair or required.
	Loose or damaged drive plate.	Repair or replace the drive plate.
	Damaged oil pan, contacting the oil pump screen.	• Inspect the oil pan. • Inspect the oil pump screen. • Repair or replace as required.
	Oil pump screen loose, damaged or restricted.	• Inspect the oil pump screen.

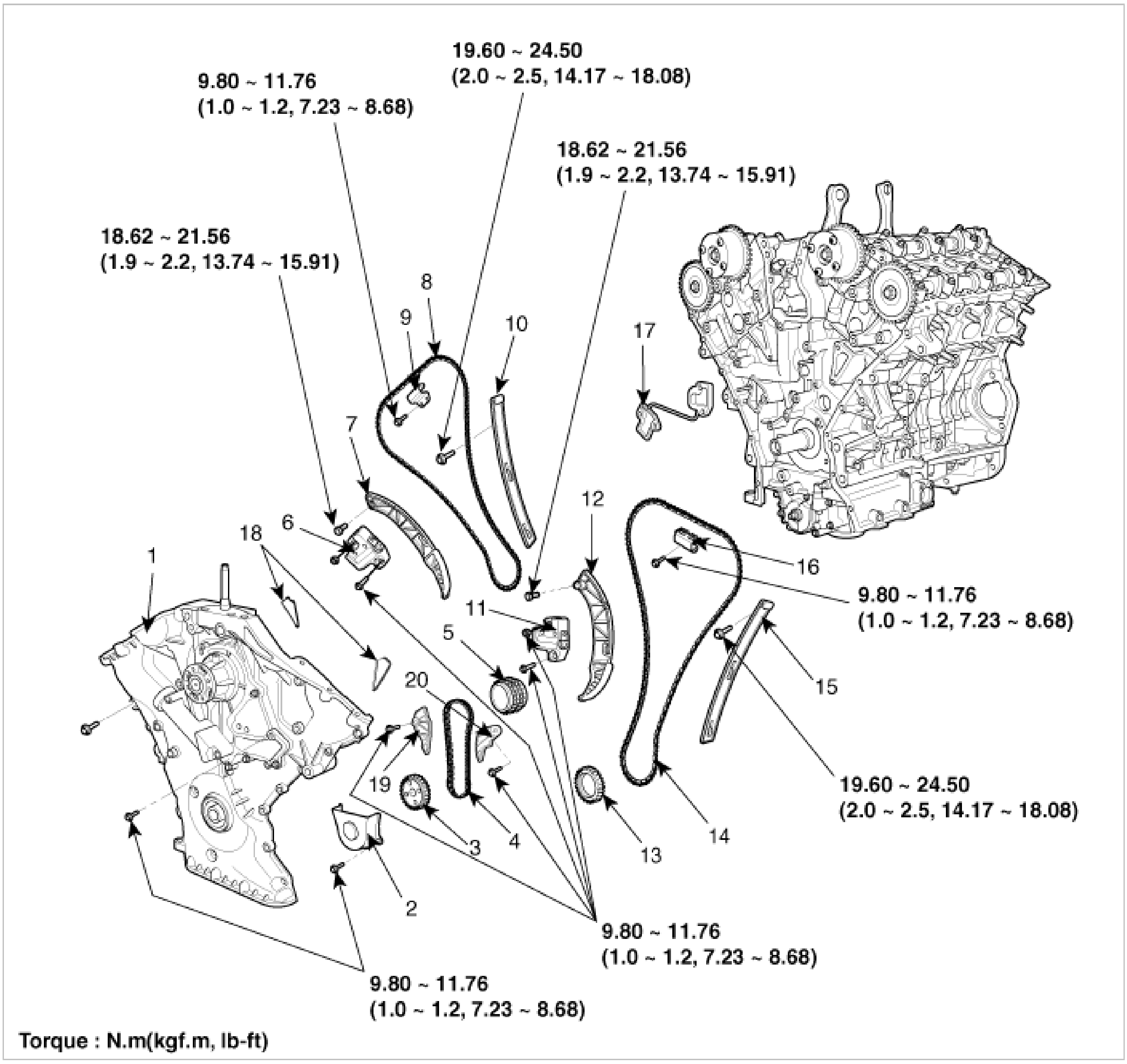
		• Repair or replace as required.
	Excessive piston-to-cylinder bore clearance.	• Inspect the piston, piston pin and cylinder bore. • Repair as required.
	Excessive piston pin-to-piston clearance.	• Inspect the piston, piston pin and the connecting rod. • Repair or replace as required.
	Excessive connecting rod bearing clearance	Inspect the following components and repair as required. • The connecting rod bearings. • The connecting rods. • The crankshaft pin journals.
	Excessive crankshaft bearing clearance.	Inspect the following components, and repair as required. • The crankshaft bearings. • The crankshaft main journals. • The cylinder block.
	Incorrect piston, piston pin and connecting rod installation	• Verify the piston pins and connecting rods are installed correctly. • Repair as required.
Engine noise under load.	Low oil pressure	Repair or replace as required.
	Excessive connecting rod bearing clearance .	Inspect the following components andrepair as required : • The connecting rod bearings. • The connecting rods. • The crankshaft.
	Excessive crankshaft bearing clearance.	Inspect the following components, andrepair as required. • The crankshaft bearings. • The crankshaft main journals. • The cylinder block.
Engine will not crank-crankshaft will not rotate.	Hydraulically locked cylinder. • Coolant/antifreeze in cylinder. • Oil in cylinder. • Fuel in cylinder.	1. Remove spark plugs and check for fluid. 2. Inspect for broken head gasket. 3. Inspect for cracked engine block or cylinder head. 4. Inspect for a sticking fuel injector and/or leaking fuel regulator.
	Broken timing chain and/or timing chain and/or timing chain gears.	1. Inspect timing chain and gears. 2. Repair as required.
	Material in cylinder. • Broken valve • Piston material • Foreign material	1. Inspect cylinder for damaged components and/or foreign materials. 2. Repair or replace as required.
	Seized crankshaft or connecting rod bearings.	1. Inspect crankshaft and connecting rod bearing. 2. Repair as required.
	Bent or broken connecting rod.	1. Inspect connecting rods. 2. Repair as required.
	Broken crankshaft.	1. Inspect crankshaft. 2. Repair as required.

Engine Mechanical System > Timing System > Timing Chain > Components and Components Location

Components



1. Drive belt 2. Drive belt tensioner 3. Idler 4. Damper pulley	5. Water pump pulley 6. Oil pan 7. Cylinder head cover



1. Timing chain cover 2. Oil pump chain cover 3. Oil pump sprocket 4. Oil pump chain 5. Crankshaft sprocket 6. Timing chain auto tensioner 7. Timing chain tensioner arm	8. Timing chain 9. Cam to cam guide 10. Timing chain guide 11. Timing chain auto tensioner 12. Timing chain tensioner arm 13. Crankshaft sprocket 14. Timing chain	15. Timing chain guide 16. Cam to cam guide 17. Tensioner adapter 18. Gasket 19. Oil pump chain guide 20. Oil pump temsioner assembly

Engine Mechanical System > Timing System > Timing Chain > Repair procedures

Removal

CAUTION

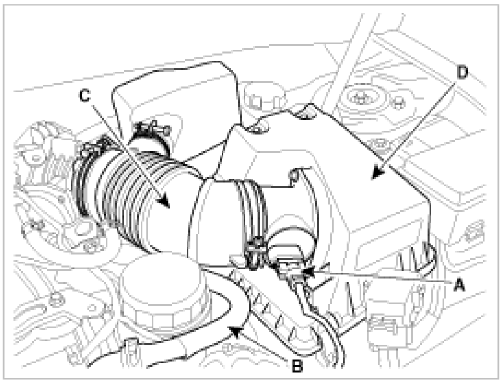
- Use fender covers to avoid damaging painted surfaces.
- To avoid damage, unplug the wiring connectors carefully while holding the connector portion.

NOTE

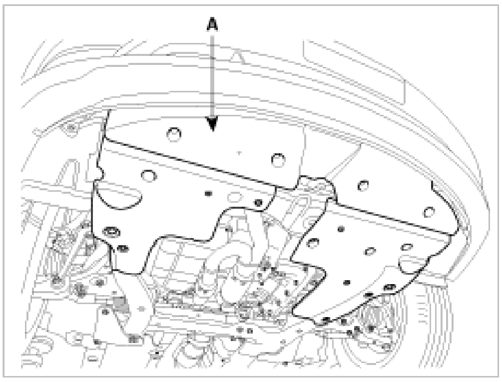
- Mark all wiring and hoses to avoid misconnection.

• Turn the crankshaft pulley so that the No.1 piston is at top dead center.

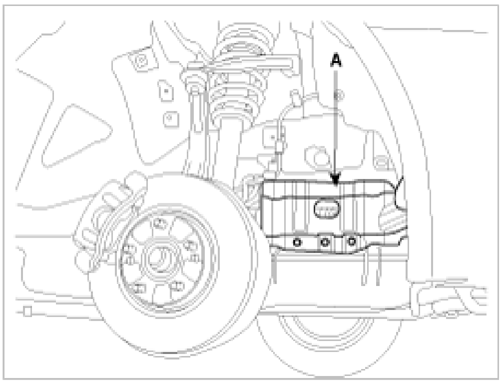
1. Disconnect the negative terminal from the battery.
2. Remove the engine cover.
3. Remove the air duct.
4. Remove the intake air hose and air cleaner assembly.
   (1) Disconnect the AFS connector(A).
   (2) Disconnect the breather hose(B) from air cleaner hose.
   (3) Disconnect the ECM connector. (Refer to FL group)
   (4) Remove the intake air hose(C) and air cleaner(D).



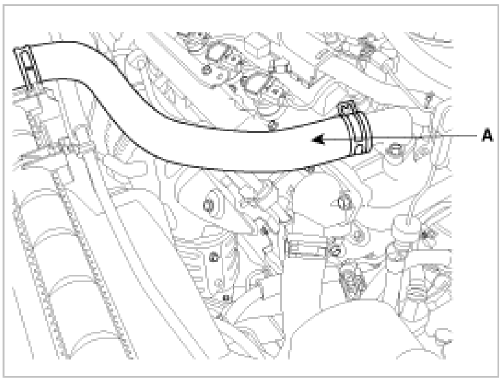
5. Remove the front wheels.
6. Remove the under cover(A).



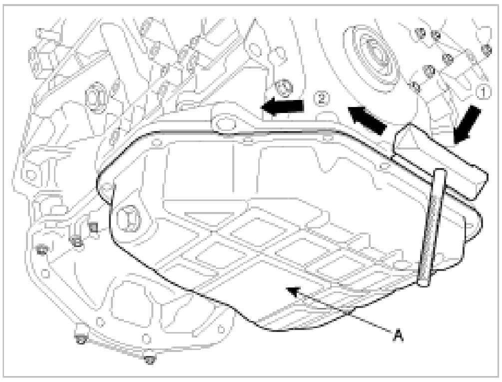
7. Remove the side cover(A).



8. Drain the engine coolant.
   Remove the radiator cap to speed draining.
9. Remove the upper radiator hose(A).



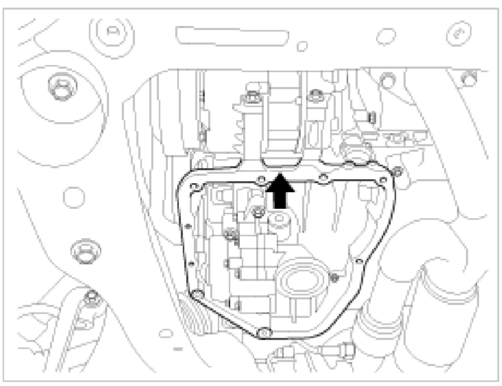
10. Drain the engine oil.
11. Remove the lower oil pan(A).
    Insert the blade of SST(09215-3C000) between the upper oil pan and lower oil pan, and cut off applied sealer and removed lower oil pan.



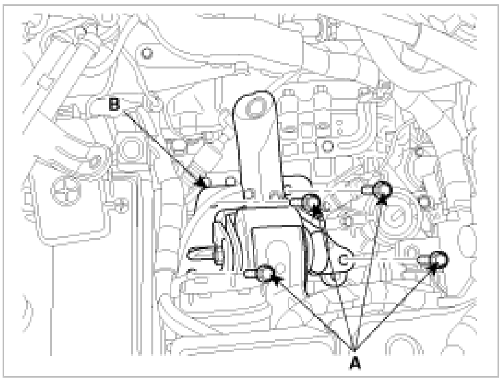
NOTE

- Insert the SST between the oil pan and the ladder frame by tapping it with a plastic hammer in the direction of arrow.
- After tapping the SST with a plastic hammer along the direction of arrow around more than 2/3 edge of the oil pan, remove it from the ladder frame.
- Do not turn over the SST abruptly without tapping. It be result in damage of the SST.
- Be careful not to damage the contact surfaces of Upper oil pan and lower oil pan.

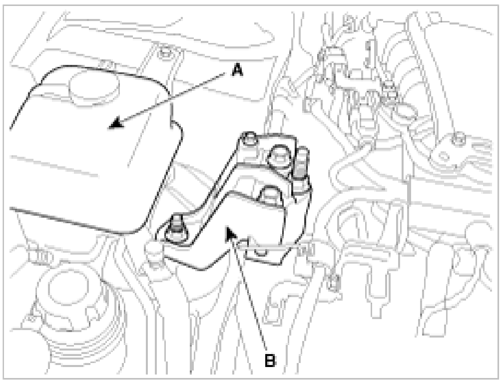
12. Install the jack to the upper oil pan.



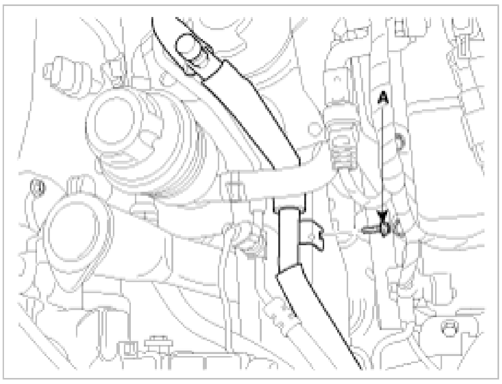
13. Just loosen the transaxle mounting bolts(A) without removing the transaxle mounting(B).



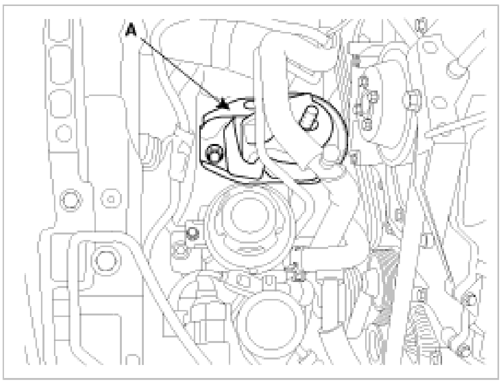
14. Remove the engine coolant reservoir tank (A).
15. Remove the engine mounting bracket (B).



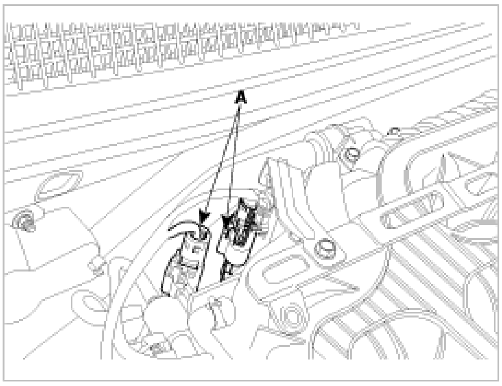
16. Loosen the A/C pipe bracket mounting bolt (A).



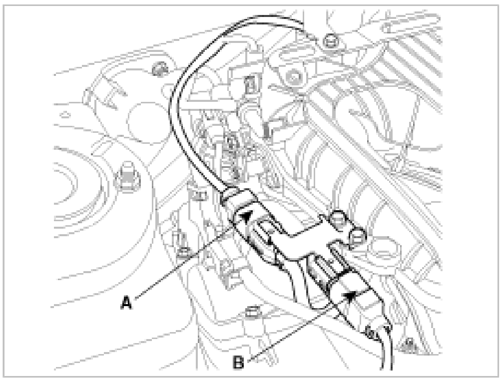
17. Remove the no.1 engine mounting (A) through the lower position of A/C pipe line.



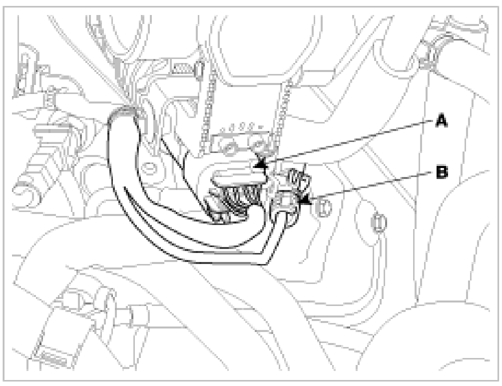
18. Remove the surge tank.
    (1) Disconnect the RH oxygen sensor connector(A).



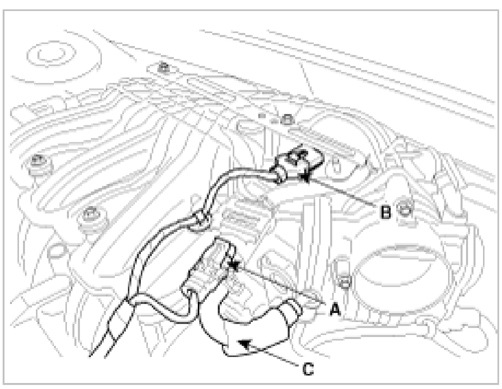
(2) Disconnect the RH injector connector(A) and the ignition coil connector(B).



(3) Disconnect the ETC connector(A) and the knock sensor connector(B).



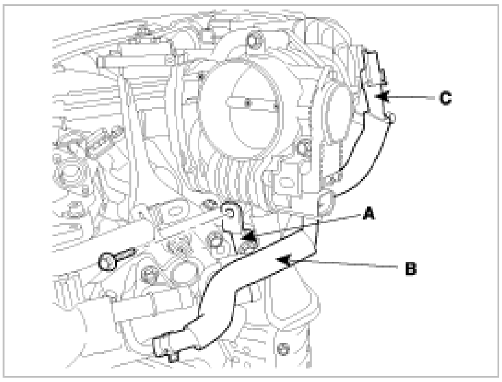
(4) Disconnect the PCSV connector(A), the MAP sensor connector(B) and the PCSV hose(C).



(5) Remove the ETC bracket(A).

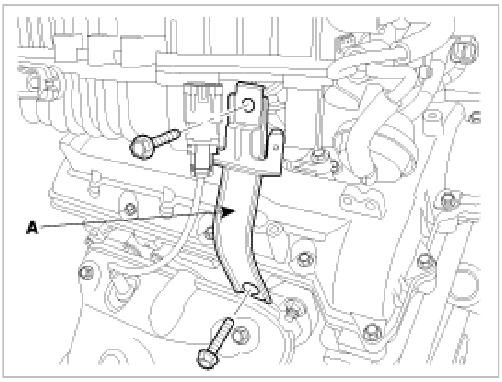
(6) Disconnect the water hoses(B) from the ETC.

(7) Disconnect the PCV(C) hose.

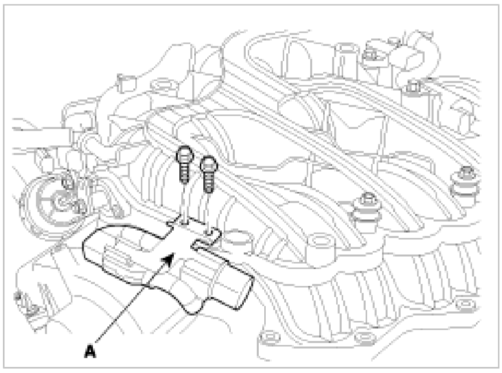


(8) Disconnect the brake vacuum hose.

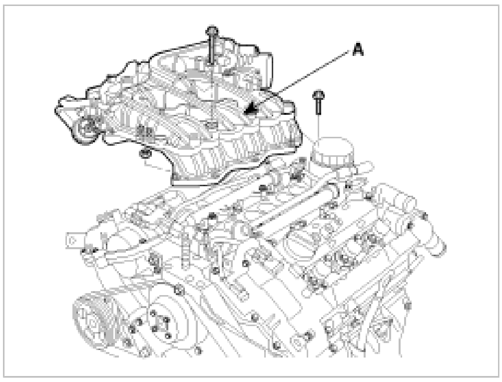
(9) Remove the surge tank stay(A).



(10) Remove the connector bracket(A) from the surge tank.



(11) Remove the surge tank(A).

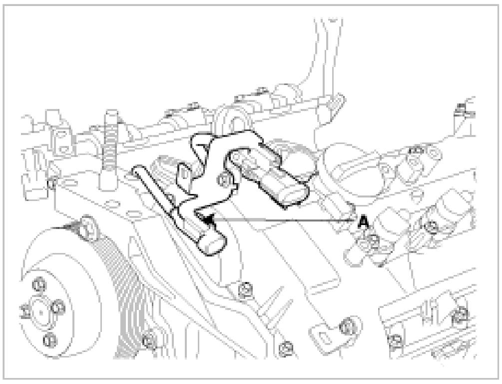


NOTE

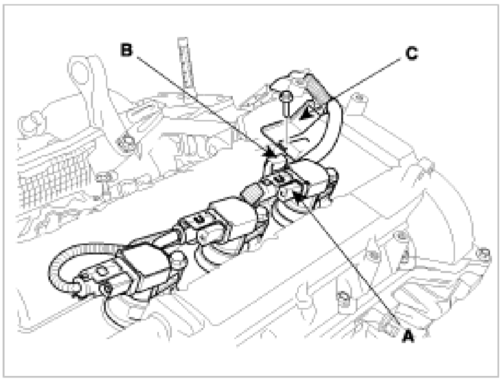
- Cover the inlet of intake manifold with a clean woven stuff or vinyl cover to prevent foreign materials from entering.

19. Remove the cylinder head cover.

(1) Remove the connector bracket (A) from the LH cylinder head cover.

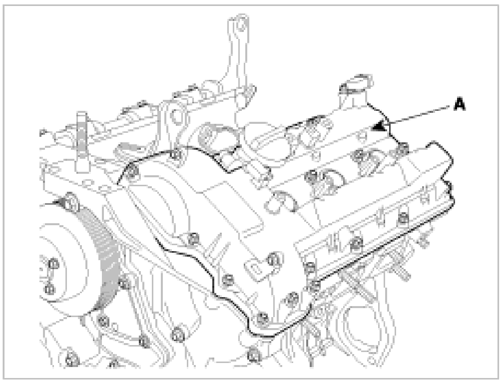


(2) Disconnect the RH ignition coil connector(A), the condenser connector (B) and remove the wiring bracket(C).



(3) Remove the LH,RH ignition coil.

(4) Remove the LH,RH cylinder head cover(A).



NOTE

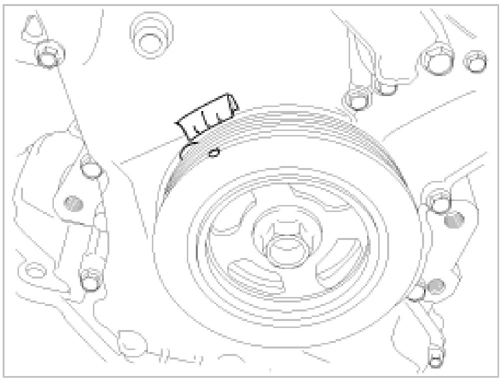
- Cover the upside of engine head with a clean woven stuff or vinyl cover to prevent foreign materials from entering.

20. Set No.1 cylinder to TDC/compression.

(1) Turn the crankshaft pulley and align its groove with the timing mark "T" of the lower timing chain cover.

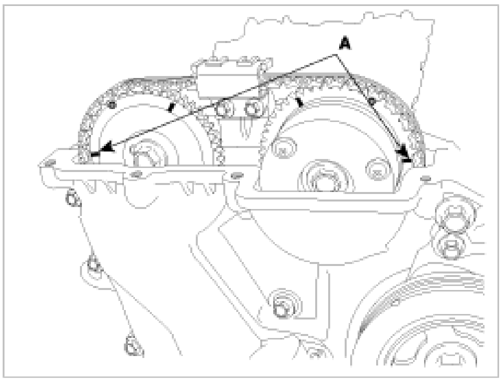
NOTE

Do not rotate engine counterclockwise.



(2) Check that the mark (A) of the camshaft timing sprockets are in straight line on the cylinder head surface as shown in the illustration.

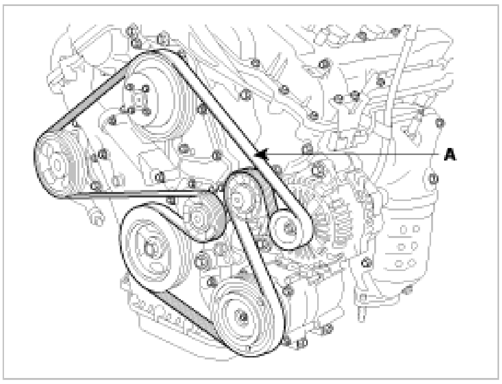
If not, turn the crankshaft one revolution (360°).



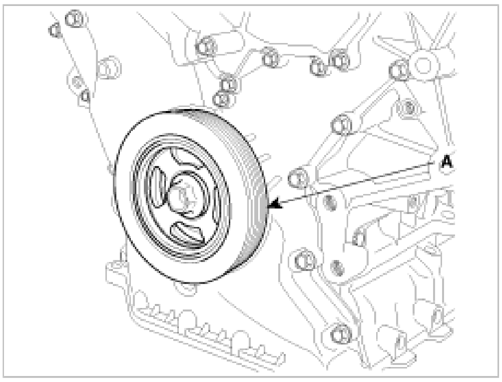
NOTE

Do not rotate engine counterclockwise.

21. Remove the drive belt(A).

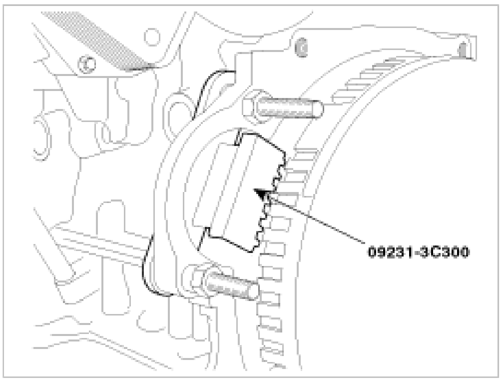


22. Remove the crankshaft damper pulley(A).

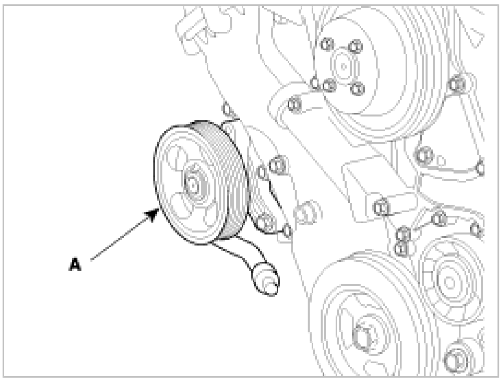


NOTE

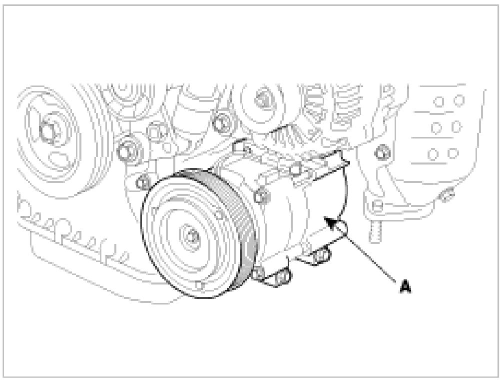
• Use the SST(flywheel stopper, 09231-3C300) to remove the crankshaft pulley bolt, after remove the starter.



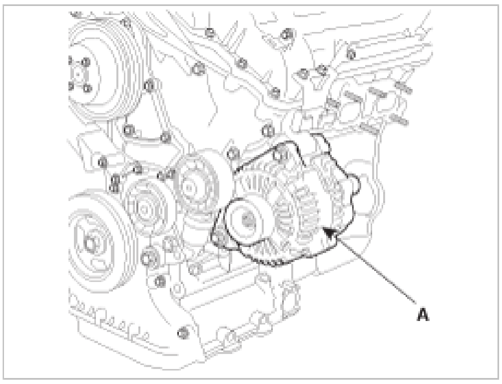
23. Lift up the engine assembly by using the jack.
24. Remove the power steering pump(A).



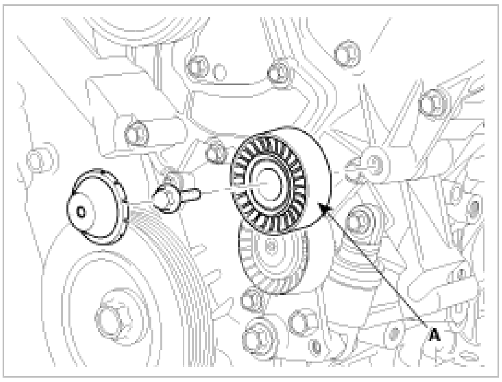
25. Remove the air conditioner compressor(A).



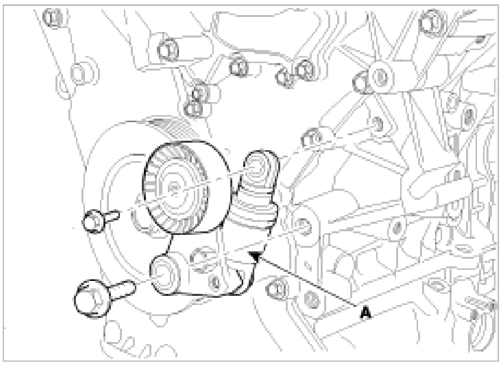
26. Remove the alternator(A).



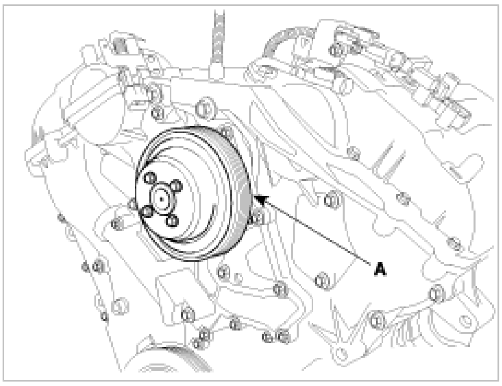
27. Remove the drive belt idler(A).



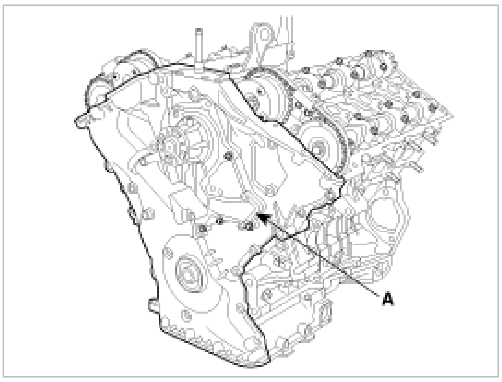
28. Remove the drive belt auto tensioner(A).



29. Remove water pump pulley(A).



30. Remove the timing chain cover(A).

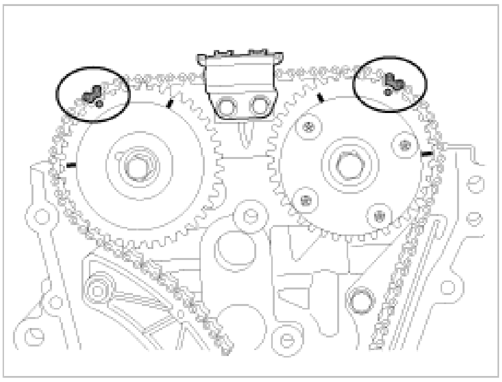


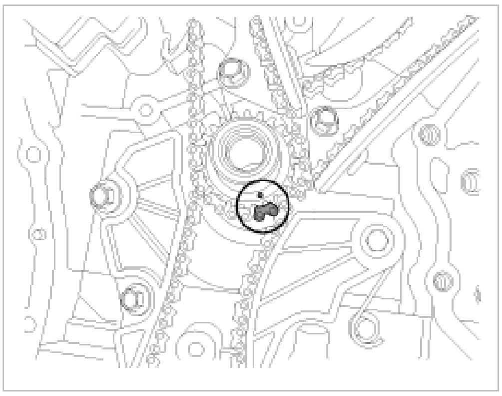
CAUTION

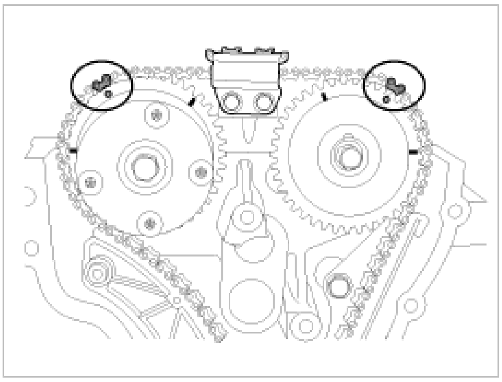
- Be careful not to damage the contact surfaces of cylinder block, cylinder head and timing chain cover.

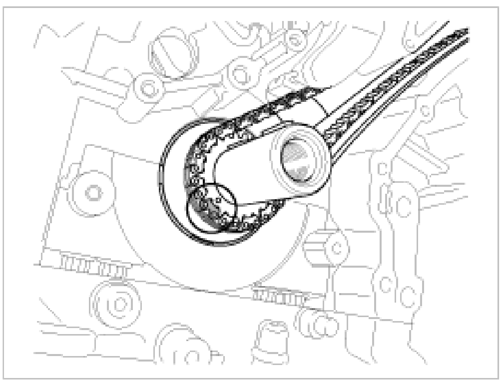
NOTE

- Before removing the timing chain, mark the RH/LH timing chain with an identification based on the location of the sprocket because the identification mark on the chain for TDC (Top Dead Center) can be erased.

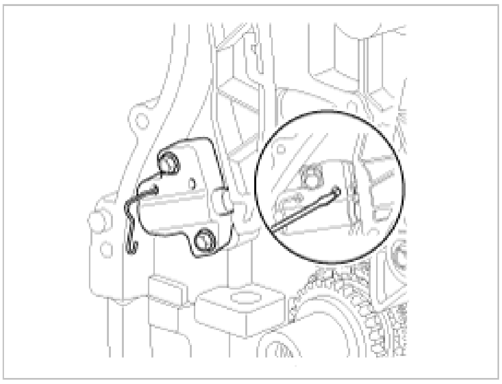




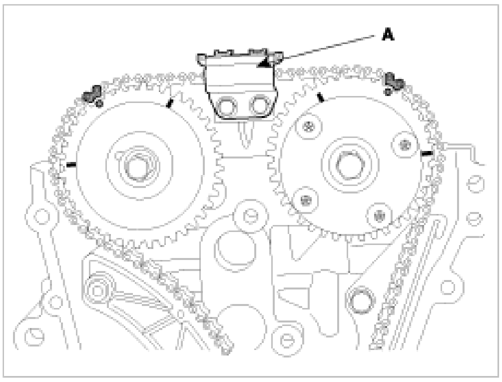




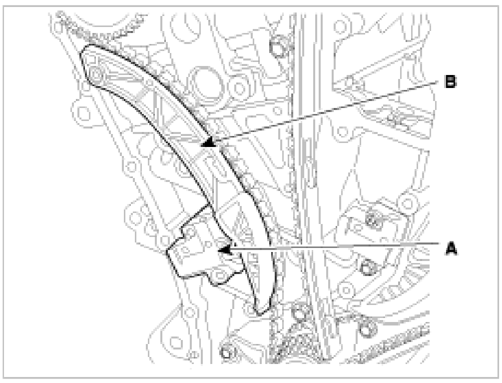
31. Install a set pin after compressing the RH timing chain tensioner.



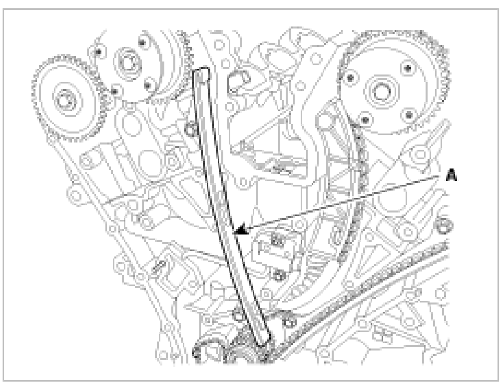
32. Remove the RH cam-to-cam guide(A).



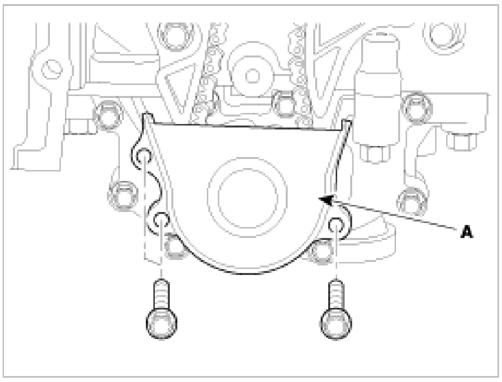
33. Remove the RH timing chain auto tensioner (A) and the RH timing chain tensioner arm(B).



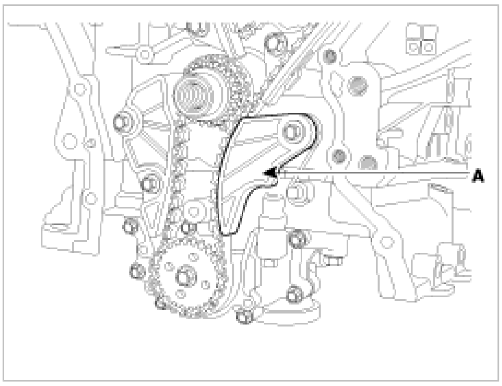
34. Remove the RH timing chain.
35. Remove the RH timing chain guide(A).



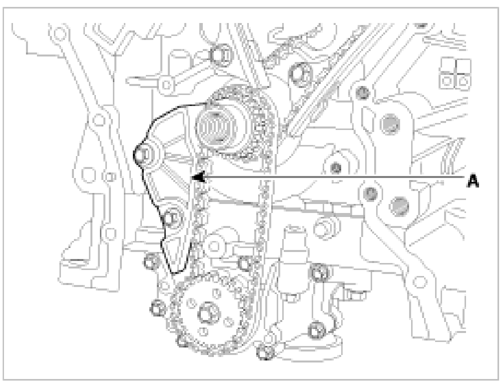
36. Remove the oil pump chain cover(A).



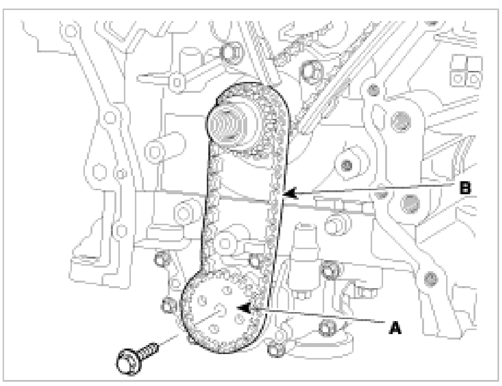
37. Remove the oil pump chain tensioner assembly(A).



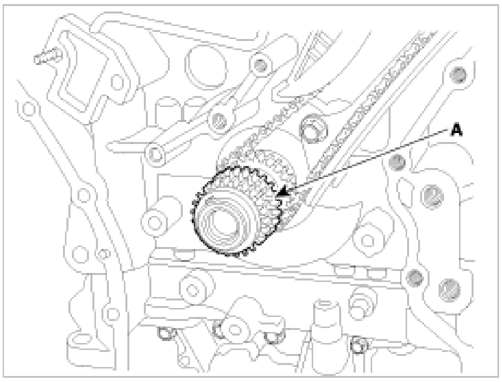
38. Remove the oil pump chain guide(A).



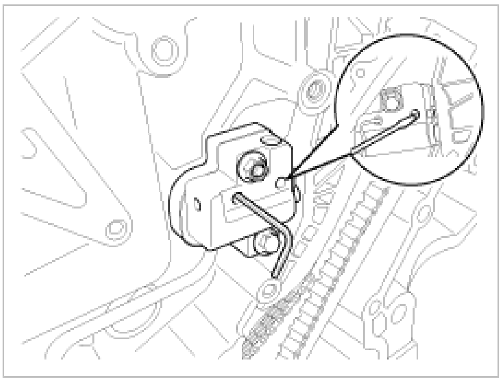
39. Remove the oil pump chain sprocket(A) and oil pump chain(B).



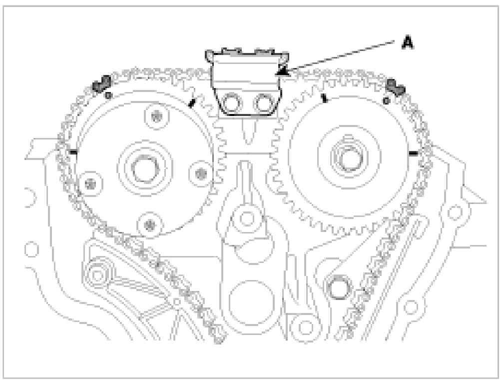
40. Remove the crankshaft sprocket(A) (O/P & RH camshaft drive).



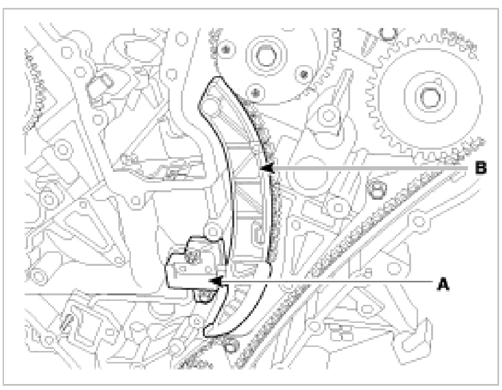
41. Install a set pin after compressing the LH timing chain tensioner.



42. Remove the LH cam-to-cam guide(A).

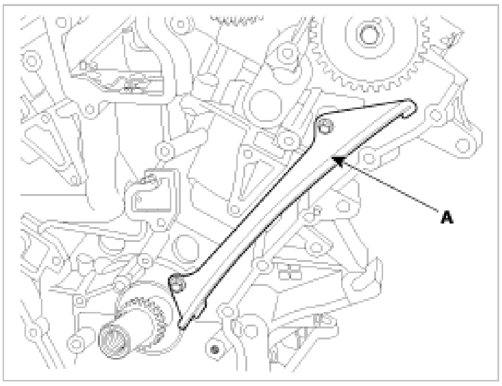


43. Remove the LH timing chain auto tensioner (A) and LH timing chain tensioner arm(B).

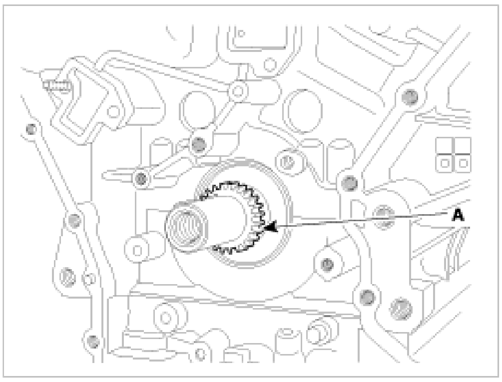


44. Remove the LH timing chain.

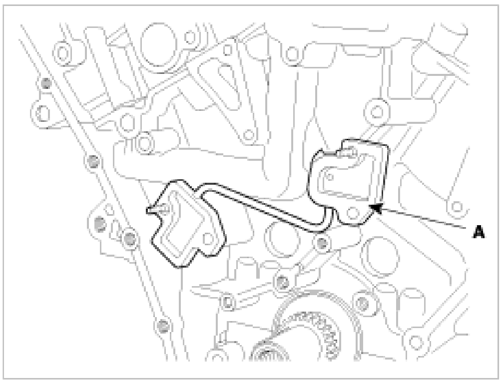
45. Remove the LH timing chain guide(A).



46. Remove the crankshaft sprocket(A) (LH camshaft drive).



47. Remove the tensioner adapter assembly(A).



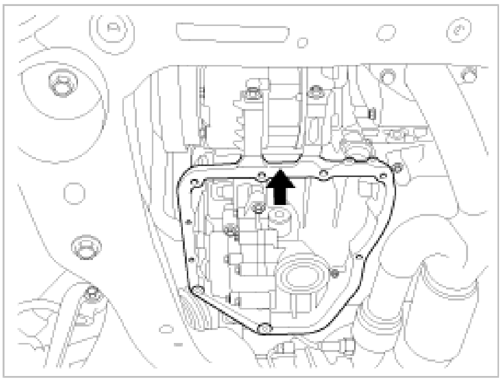
Inspection

Sprockets, Chain Tensioner, Chain Guide, Chain Tensioner Arm

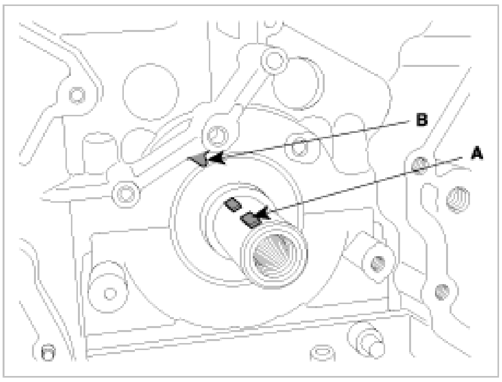
1. Check the camshaft sprocket and crankshaft sprocket for abnormal wear, cracks, or damage. Replace as necessary.
2. Inspect the tensioner arm and chain guide for abnormal wear, cracks, or damage. Replace as necessary.
3. Check that the tensioner piston moves smoothly when the ratchet pawl is released with thin rod.

Installation

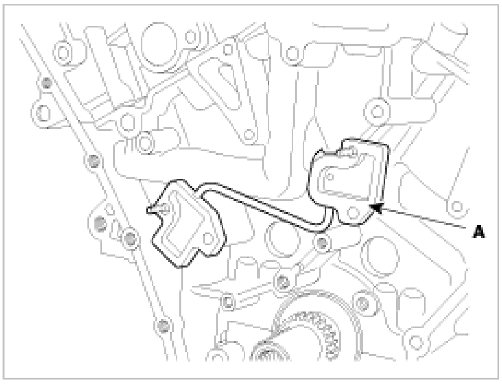
1. Install the jack to the upper oil pan.



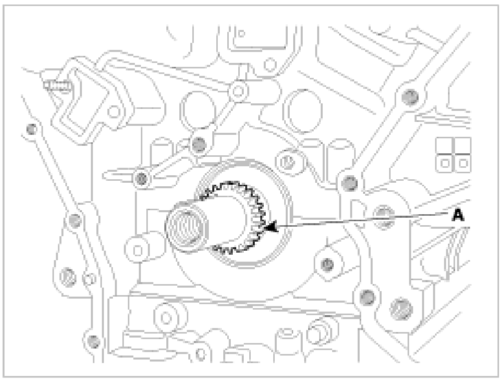
2. The key (A) of crankshaft should be aligned with the timing mark (B) of timing chain cover. As a result of this, the piston of No.1 cylinder is placed at the top dead center on compression stroke.



3. Install the tensioner adapter assembly(A).

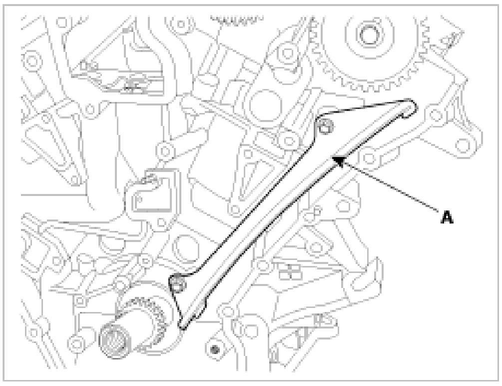


4. Install the crankshaft sprocket(A) (LH camshaft drive).

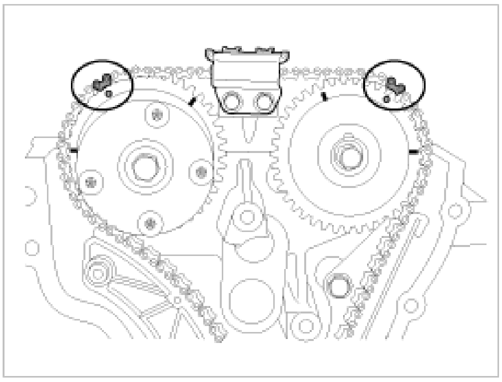


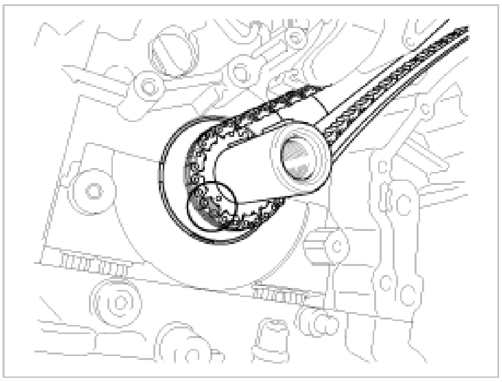
5. Install the LH timing chain guide(A).

Tightening torque
19.60 ~ 24.50N.m (2.0 ~ 2.5kgf.m, 14.17 ~ 18.08lb-ft)



6. Install the LH timing chain.
   To install the timing chain with no slack between each shaft (cam, crank), follow the below procedure.
   Crankshaft sprocket → Timing chain guide → Exhaust camshaft sprocket → Intake camshaft sprocket.
   The timing mark of each sprockets should be matched with timing mark (color link) of timing chain at installing timing chain.





7. Install the LH timing chain tensioner arm(B).

Tightening torque
18.62 ~ 21.56N.m (1.9 ~ 2.2kgf.m, 13.74 ~ 15.91lb-ft)

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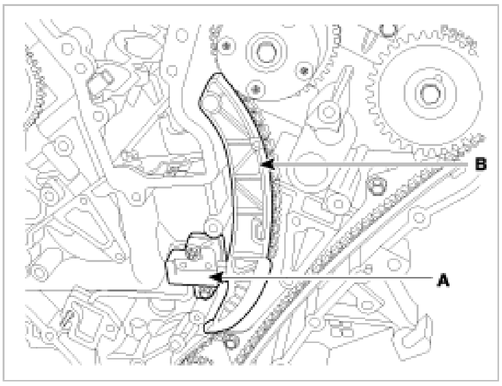
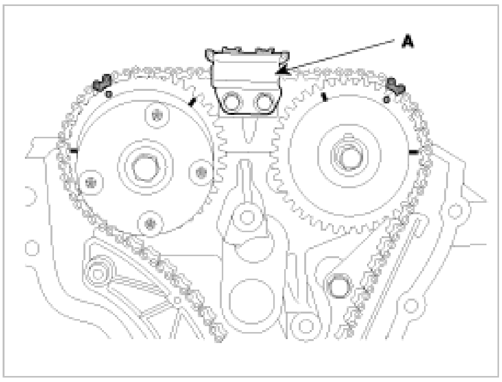
8. Install the chain tensioner(A).

Tightening torque
9.80 ~ 11.76N.m (1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lb-ft)

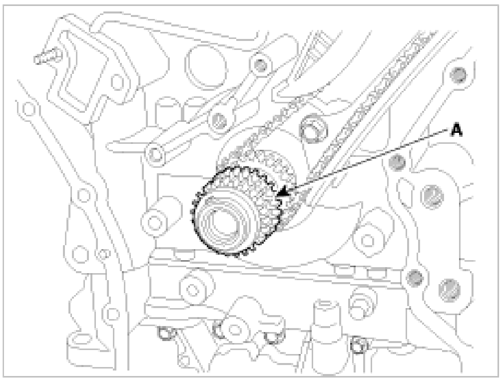


9. Install the LH cam-to-cam guide(A).

Tightening torque
9.80 ~ 11.76N.m (1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lb-ft)

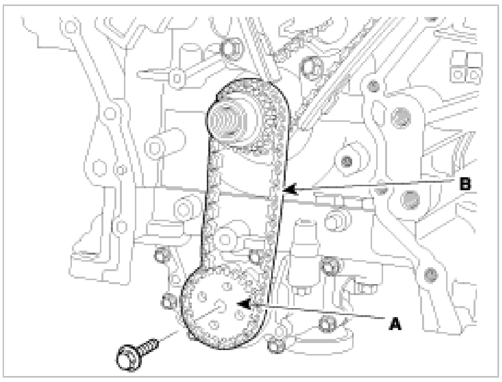


10. Install the crankshaft sprocket(A) (O/P & RH camshaft drive).



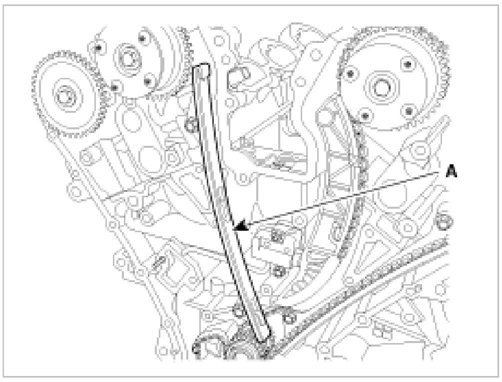
11. Install the oil pump chain(B) and the oil pump sprocket(A).

Tightening torque
18.62 ~ 21.56N.m (1.9 ~ 2.2kgf.m, 13.74 ~ 15.91lb-ft)

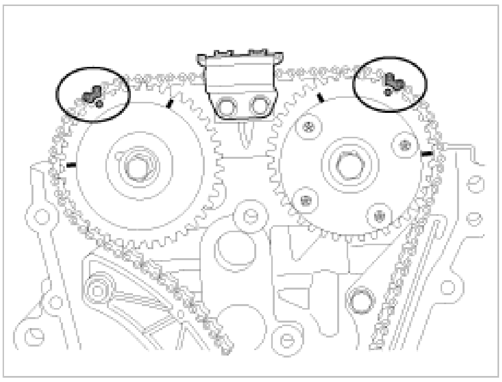


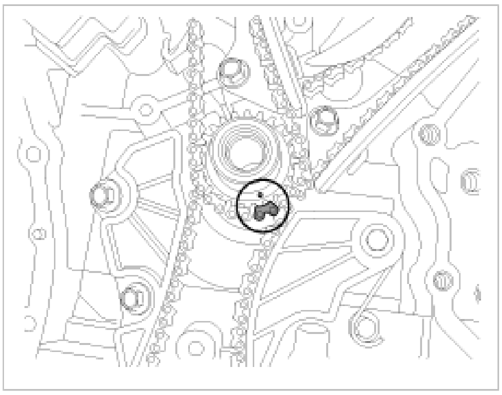
12. Install the RH timing chain guide(A).

Tightening torque
19.60 ~ 24.50N.m (2.0 ~ 2.5kgf.m, 14.17 ~ 18.08lb-ft)



13. Install the RH timing chain.
To install the timing chain with no slack between each shaft (cam, crank), follow the below procedure.
Crankshaft sprocket → Intake camshaft sprocket → Exhaust camshaft sprocket.
The timing mark of each sprockets should be matched with timing mark (color link) of timing chain at installing timing chain.



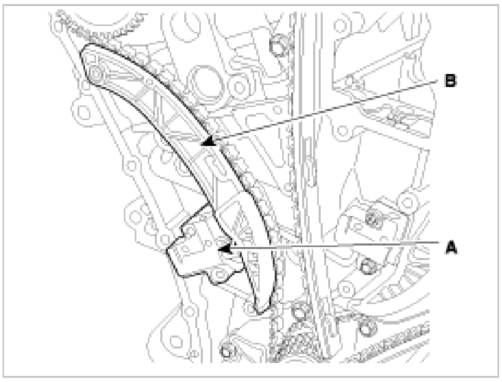


14. Install the RH timing chain tensioner arm(B).

Tightening torque
18.62 ~ 21.56N.m (1.9 ~ 2.2kgf.m, 13.74 ~ 15.91lb-ft)

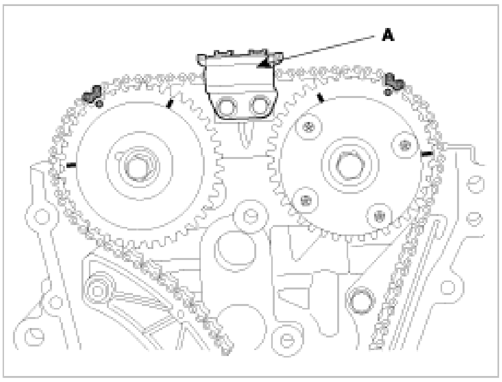
15. Install the RH timing chain auto tensioner(A).

Tightening torque
9.80 ~ 11.76N.m (1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lb-ft)



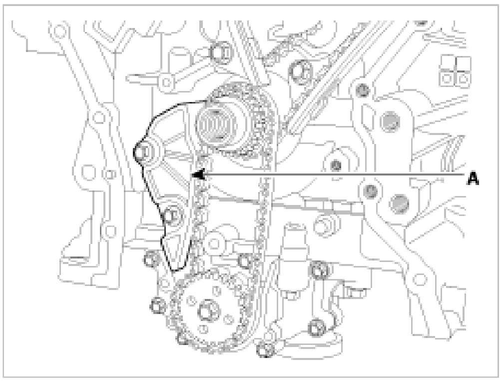
16. Install the RH cam-to-cam guide(A).

Tightening torque
9.80 ~ 11.76N.m (1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lb-ft)



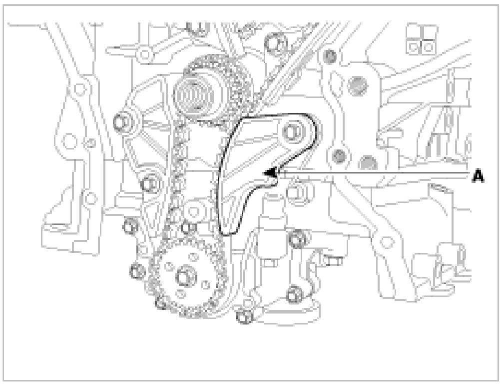
17. Install the oil pump chain guide(A).

Tightening torque
9.80 ~ 11.76N.m (1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lb-ft)

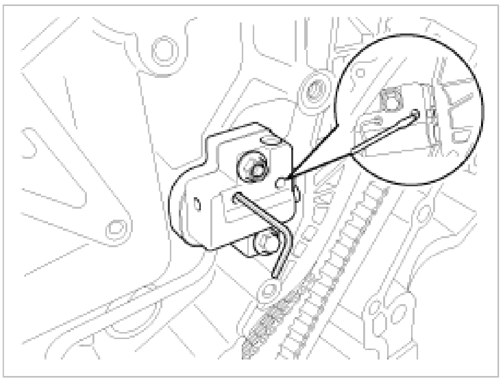


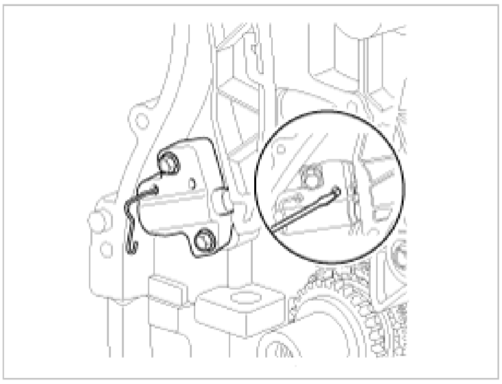
18. Install the oil pump chain tensioner assembly(A).

Tightening torque
9.80 ~ 11.76N.m (1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lb-ft)



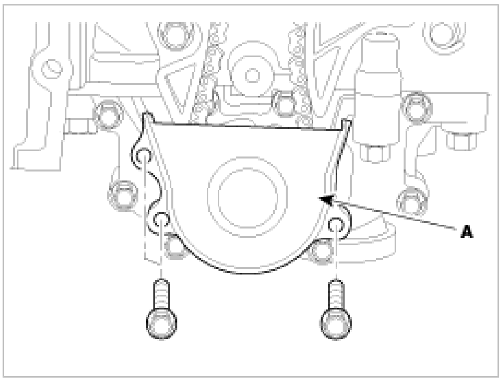
19. Pull out the pins of hydraulic tensioner (LH & RH).





20. Install the oil pump chain cover(A).

Tightening torque
9.80 ~ 11.76N.m (1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lb-ft)



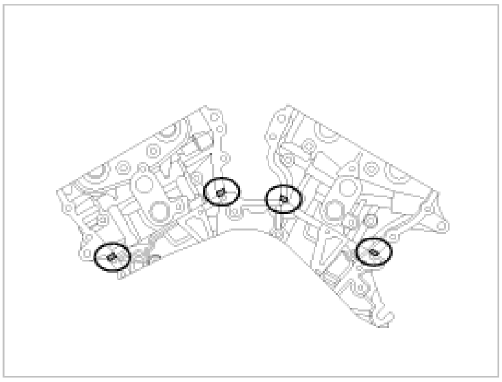
21. After rotating the crankshaft 2 revolutions in regular direction (clockwise viewed from front), confirm the timing mark.

NOTE

Always turn the crankshaft clockwise.

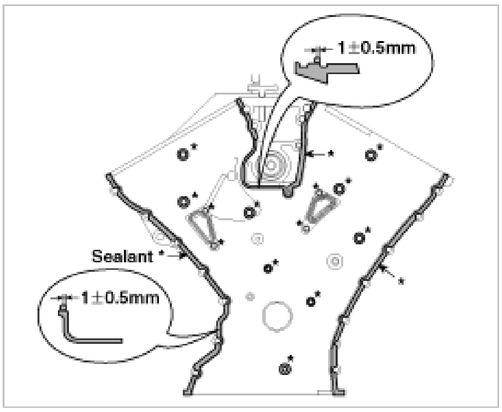
22. Install the timing chain cover.
   (1) The sealant locations on chain cover and on counter parts (cylinder head, cylinder block, and lower oil pan) must be free of engine oil and etc.
   (2) Before assembling the timing chain cover, the liquid sealant TB 1217H should be applied on the gap between cylinder head and cylinder block.
   The part must be assembled within 5 minutes after sealant was applied.

Bead width : 2.5mm(0.1in.)

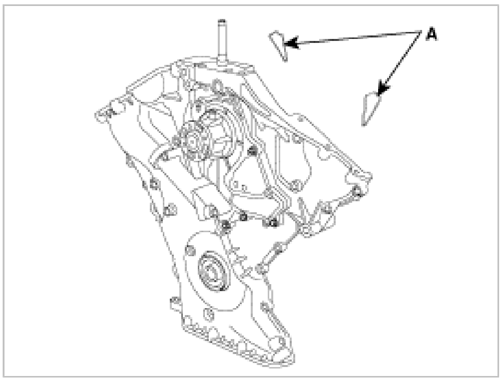


   (3) After applying liquid sealant TB1217H on timing chain cover.
   The part must be assembled within 5 minutes after sealant was applied.
   Selant should be applied without discontinuity.

Bead width : 2.5mm(0.1in.)



   (4) Install the new gasket(A) to the timing chain cover.

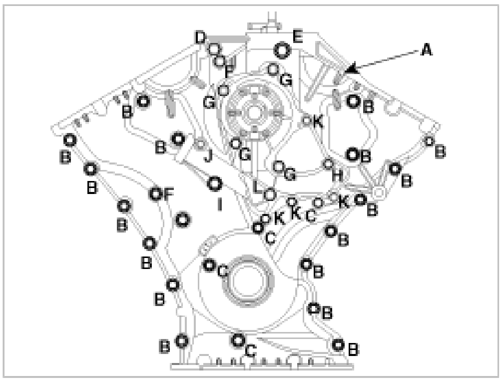


NOTE

During timing cover installation, care not to take off applied sealant on the timing cover by contact with other parts.

   (5) The dowel pins on the cylinder block and holes on the timing chain cover should be used as a reference in order to assemble the timing chain cover to be in exact position.

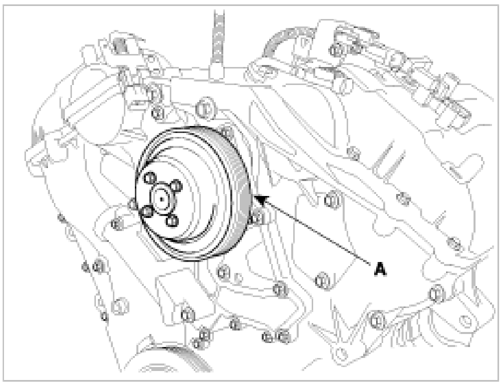
Tightening torque
B(17) :
18.62 ~ 21.56N.m (1.9 ~ 2.2kgf.m, 13.74 ~ 15.91lb-ft)
C(4) :
9.80 ~ 11.76N.m (1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lb-ft)
D(1) :
58.80 ~ 68.80N.m (6.0 ~ 7.0kgf.m, 43.40 ~ 50.63lb-ft)
E(1) :
58.80 ~ 68.80N.m (6.0 ~ 7.0kgf.m, 43.40 ~ 50.63lb-ft)
F(2) :
24.50 ~ 26.46N.m (2.5 ~ 2.7kgf.m, 18.08 ~ 19.53lb-ft)
G(4) :
21.56 ~ 23.52N.m (2.2 ~ 2.4kgf.m, 15.91 ~ 17.36lb-ft)
H(1) :
9.80 ~ 11.76N.m (1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lb-ft)
I(1) :
9.80 ~ 11.76N.m (1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lb-ft)
J(1) :
9.80 ~ 11.76N.m (1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lb-ft)
K(4) :
9.80 ~ 11.76N.m (1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lb-ft)
L(1):
21.56 ~ 26.46N.m (2.2 ~ 2.7kgf.m, 15.91 ~ 19.53lb-ft)
- New bolt



(6) The firing and/or blow out test should not be performed within 30 minutes after the timing chain cover was assembled.

23. Install the water pump pulley(A).

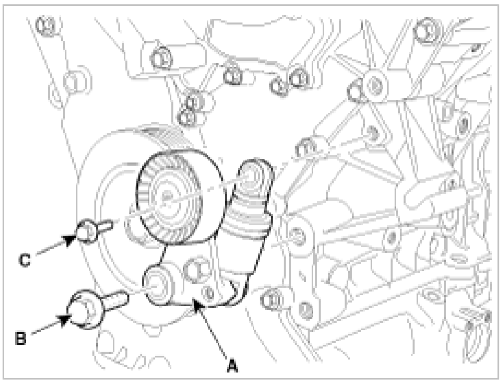
Tightening torque
7.84 ~ 9.80N.m (0.8 ~ 1.0kgf.m, 5.78 ~ 7.23lb-ft)



24. Install the drive belt auto tensioner(A).

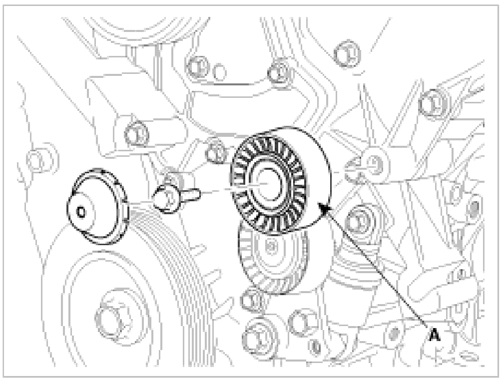
Tightening torque

Bolt(B) :
81.39 ~ 85.32N.m (8.3 ~ 8.7kgf.m, 60.03 ~ 62.93lb-ft)
Bolt(C) :
17.64 ~ 21.56N.m (1.8 ~ 2.2kgf.m, 13.02 ~ 15.91lb-ft)



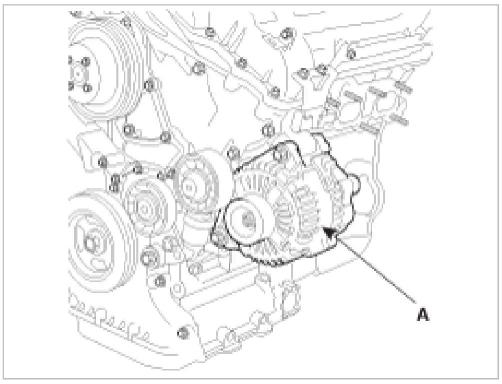
25. Install the drive belt idler(A).

Tightening torque
52.92 ~ 57.82N.m (5.4 ~ 5.9kgf.m, 39.06 ~ 42.67lb-ft)

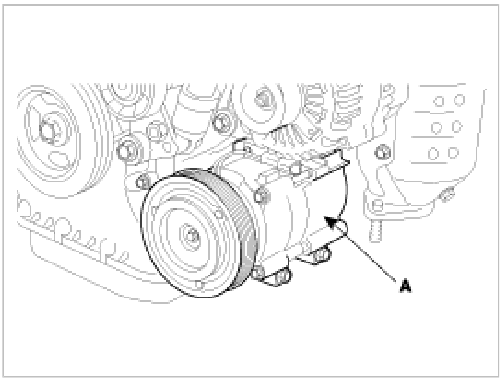


26. Install the alternator(A).

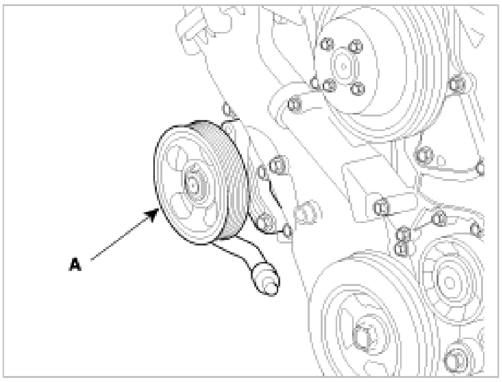
Tightening torque
26.48 ~ 33.34N.m (2.7 ~ 3.4kgf.m, 19.53 ~ 24.59lb-ft)



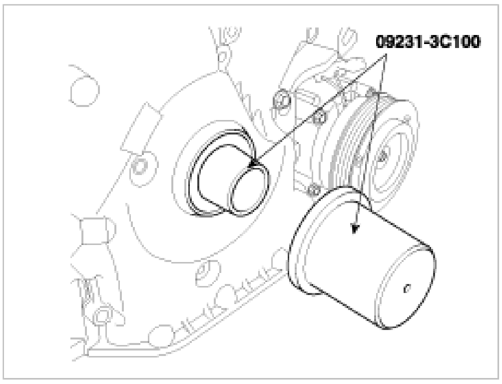
27. Install the air conditioner compressor(A). (Refer to HA group)



28. Install the power steering pump(A). (Refer to ST group)

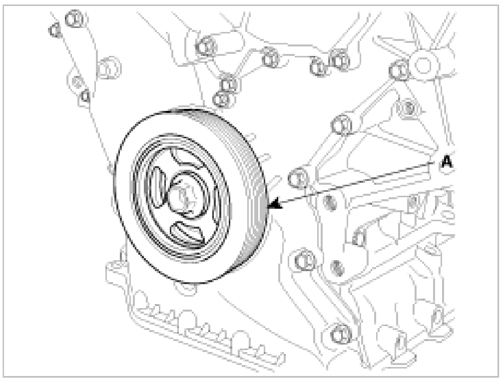


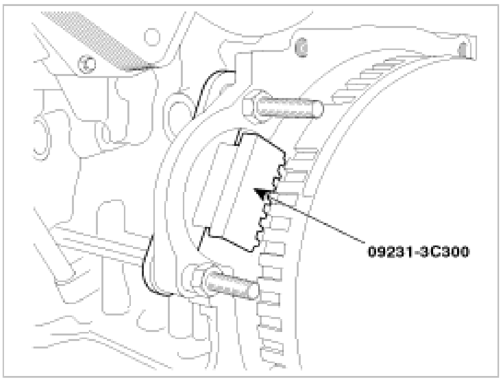
29. Lower the engine assembly by using the jack.
30. Using SST(09231-3C100), install timing chain cover oil seal.



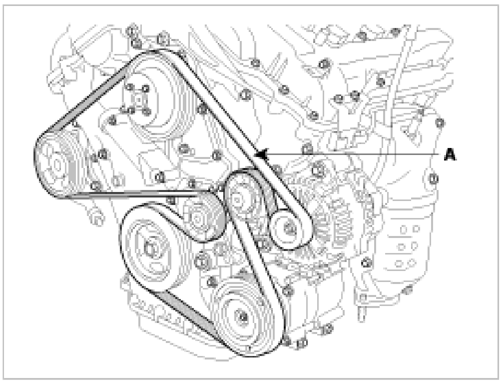
31. Using SST(09231-3C300) install the crankshaft damper pulley(A).

Tightening torque
284.2~303.8N.m (29.0~31.0kgf.m, 209.76~224.22lb-ft)



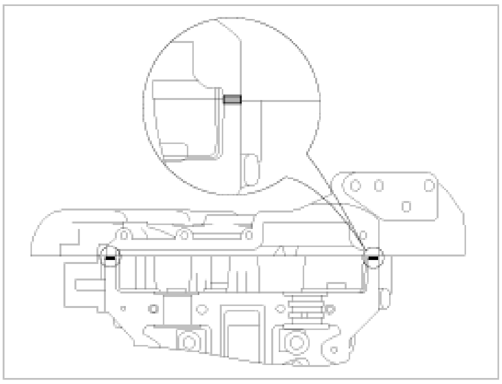


32. Install the drive belt(A).
    Crankshaft pulley → A/C pulley → idler pulley → alternator pulley → water pump pulley → P/S pump pulley→ tensioner pulley.
    Rotate auto tensioner arm in the counterclockwise moving auto tensioner pulley bolt with wrench.
    After putting belt on auto tensioner pulley, release the auto tensioner pulley slowly.



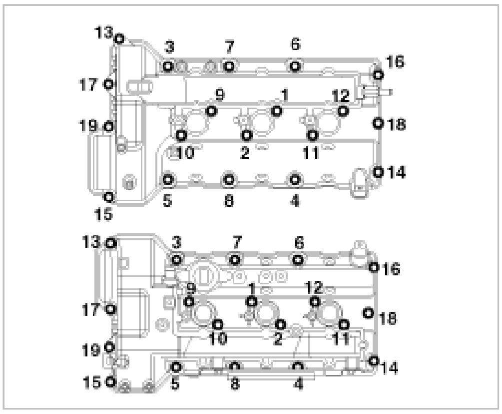
33. Install the cylinder head cover.
    (1) The hardening sealant located on the upper area between timing chain cover and cylinder head should be removed before assembling cylinder head cover.
    (2) After applying sealant(TB1217H), it should be assembled within 5 minutes.

Bead width : 2.5mm (0.1in.)



(3) The firing and/or blow out test should not be performed within 30 minutes after the cylinder head cover was assembled.
(4) Install the cylinder head cover bolts as following method.

Tightening torque
9.80 ~ 11.76N.m (1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lb-ft)

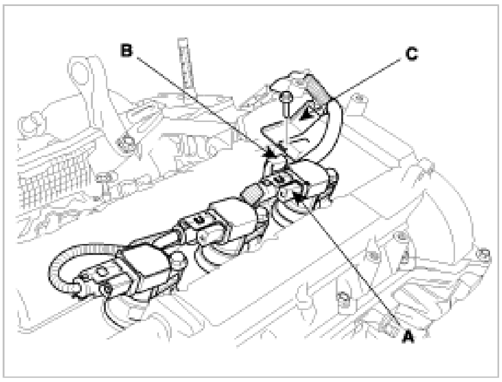


CAUTION

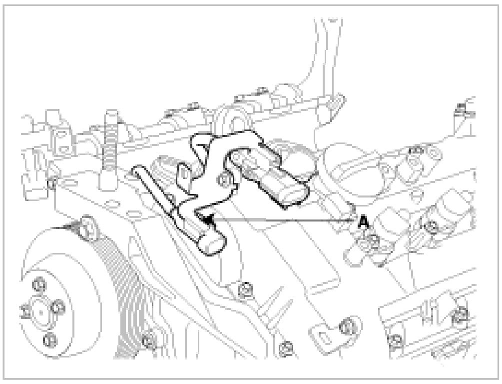
Do not reuse cylinder head cover gasket.

(5) Install the ignition coil.

(6) Connect the RH ignition coil connector(A), the condenser connector(B) and install the wiring bracket(C).



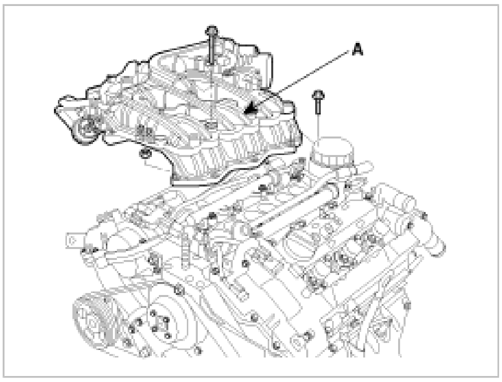
(7) Install the connector bracket(A) from the LH cylinder head cover.



34. Install the surge tank.

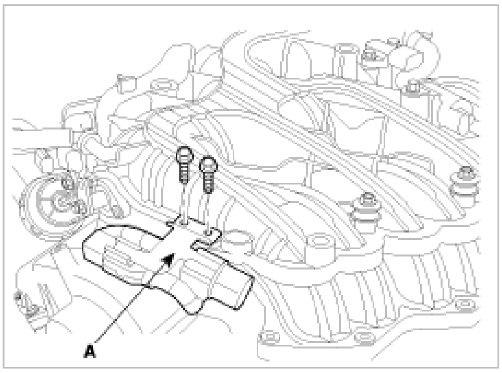
(1) Install the surge tank(A).

Tightening torque
9.80 ~ 11.76N.m (1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lb-ft)



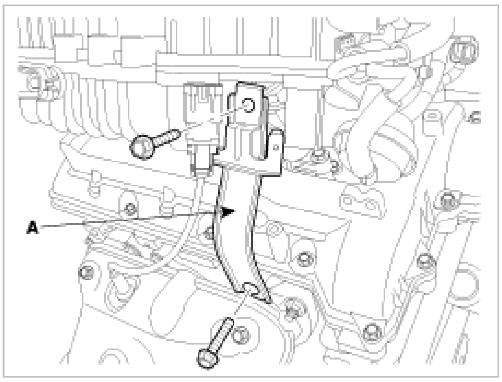
(2) Install the connector bracket(A) on the surge tank.

Tightening torque
6.86 ~ 10.78N.m (0.7 ~ 1.1kgf.m, 5.06 ~ 7.96lb-ft)



(3) Install the surge tank stay.

Tightening torque
27.44 ~ 31.36N.m (2.8 ~ 3.2kgf.m, 20.25 ~ 23.14lb-ft)



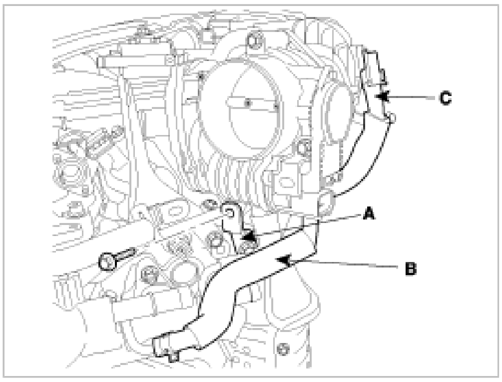
(4) Connect the brake vacuum hose.

(5) Connect the PCV hose(C).

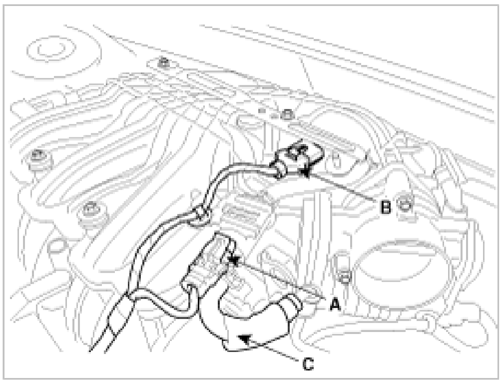
(6) Connect the water hoses(B) to the ETC.

(7) Install the ETC bracket(A).

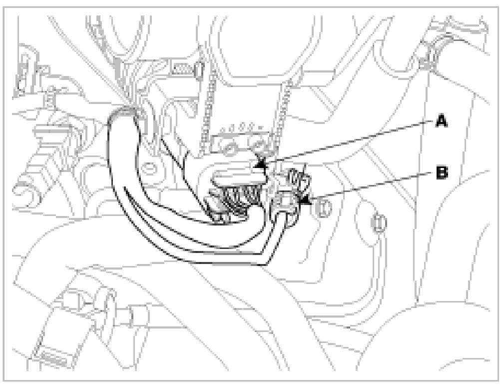
Tightening torque
15.68 ~ 25.48N.m (1.6 ~ 2.6kgf.m, 11.57 ~ 18.80lb-ft)



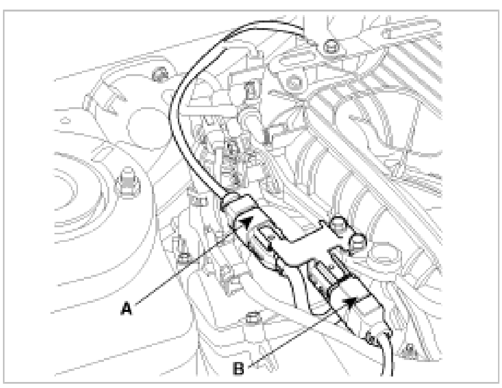
(8) Connect the PCSV connector(A), the MAP sensor connector(B) and the PCSV hose(C).



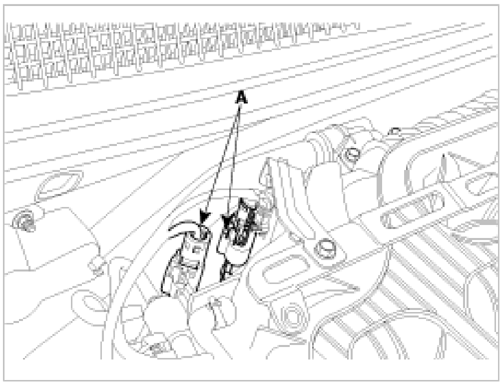
(9) Connect the ETC connector(A) and the knock sensor connector(B).



(10) Connect the RH injector connector (A) and the ignition coil connector(B).

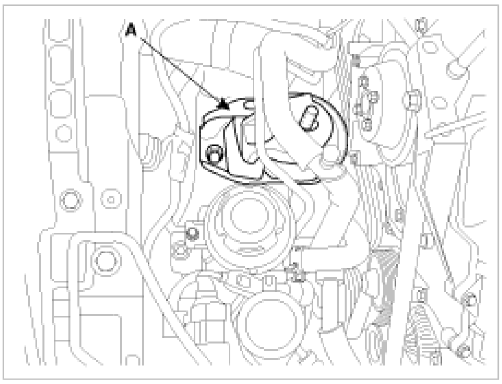


(11) Connect the RH oxygen sensor connector(A).

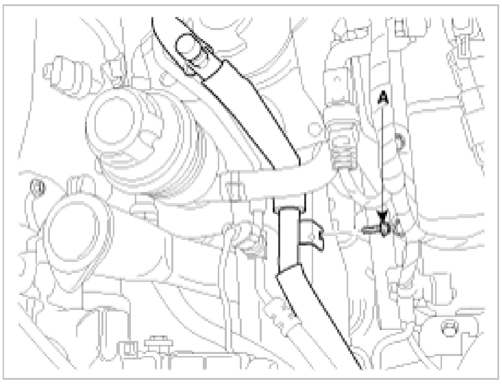


35. Install the no.1 engine mounting (A) through the lower position of A/C pipe line.

Tightening torque
49.03 ~ 63.74N.m (5.0 ~ 6.5kgf.m, 36.17 ~ 47.01lb-ft)

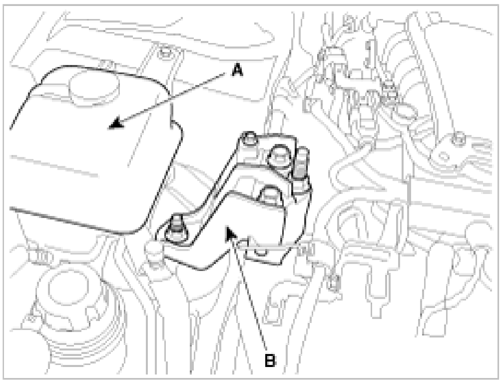


36. Install the A/C pipe bracket mounting bolt (A).



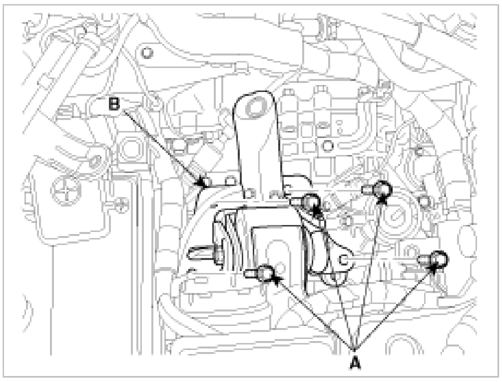
37. Install the engine coolant reservoir tank (A).
38. Install the engine mounting bracket (B).

Tightening torque
63.74 ~ 83.36N.m (6.5 ~ 8.5kgf.m, 47.01 ~ 61.48lb-ft)

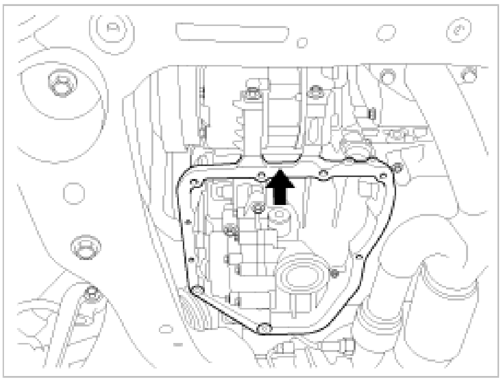


39. Install the transaxle mounting bolts(A).

Tightening torque
49.03 ~ 63.74N.m (5.0 ~ 6.5kgf.m, 36.17 ~ 47.01lb-ft)

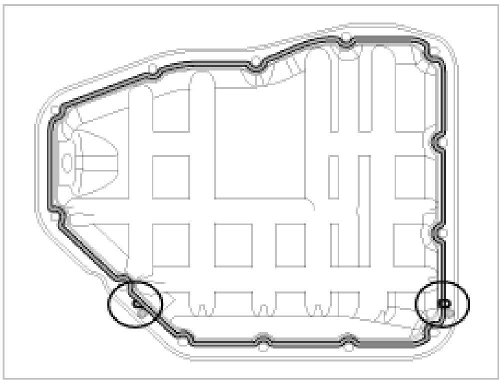


40. Remove the jack from the upper oil pan.



41. Install the lower oil pan.
    (1) Using a gasket scraper, remove all the old packing material from the gasket surfaces.
    (2) Before assembling the oil pan, the liquid sealant TB 1217H should be applied on oil pan.
    The part must be assembled within 5 minutes after the sealant was applied.

Bead width : 2.5mm(0.1in.).
But marked area(*) to be 5.0mm(0.2in.)

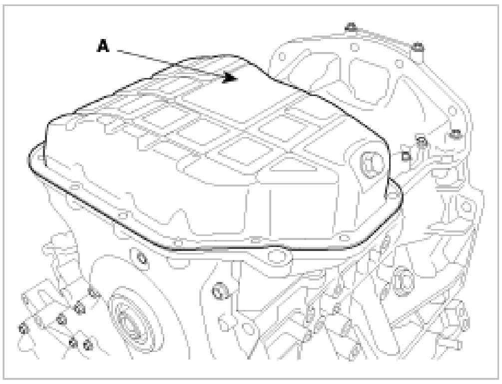


CAUTION

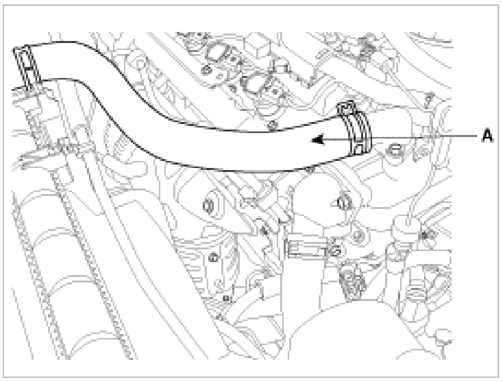
- Make clean the sealing face before assembling two parts.
- Remove harmful foreign matters on the sealing face before applying sealant.
- When applying sealant gasket, sealant must not be protruded into the inside of oil pan.
- To prevent leakage of oil, apply sealant gasket to the inner threads of the bolt holes.

(3) Install the oil pan(A).
Uniformly tighten the bolts in several passes.

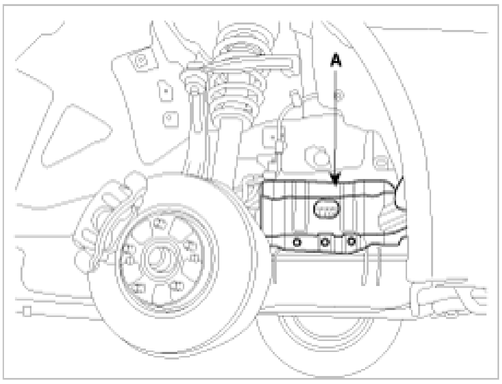
Tightening torque
9.80 ~ 11.76N.m (1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lb-ft)



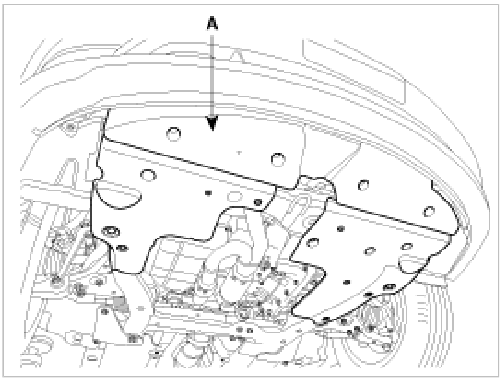
42. Install the upper radiator hose(A).



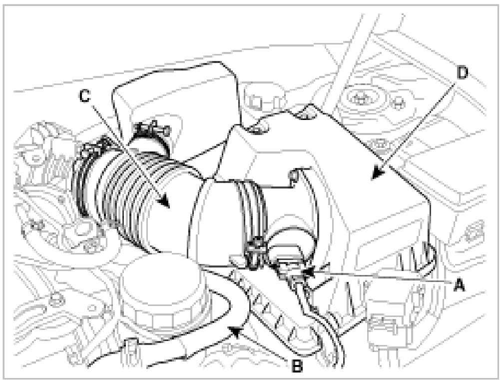
43. Install the side cover(A).



44. Install the under cover(A).



45. Install the front wheels.
46. Install the intake air hose and air cleaner assembly.
    (1) Install the intake air hose(C) and air cleaner(D).
    (2) Connect the ECM connector. (Refer to FL group)
    (3) Connect the breather hose(B) from air cleaner hose.
    (4) Connect the AFS connector(A).

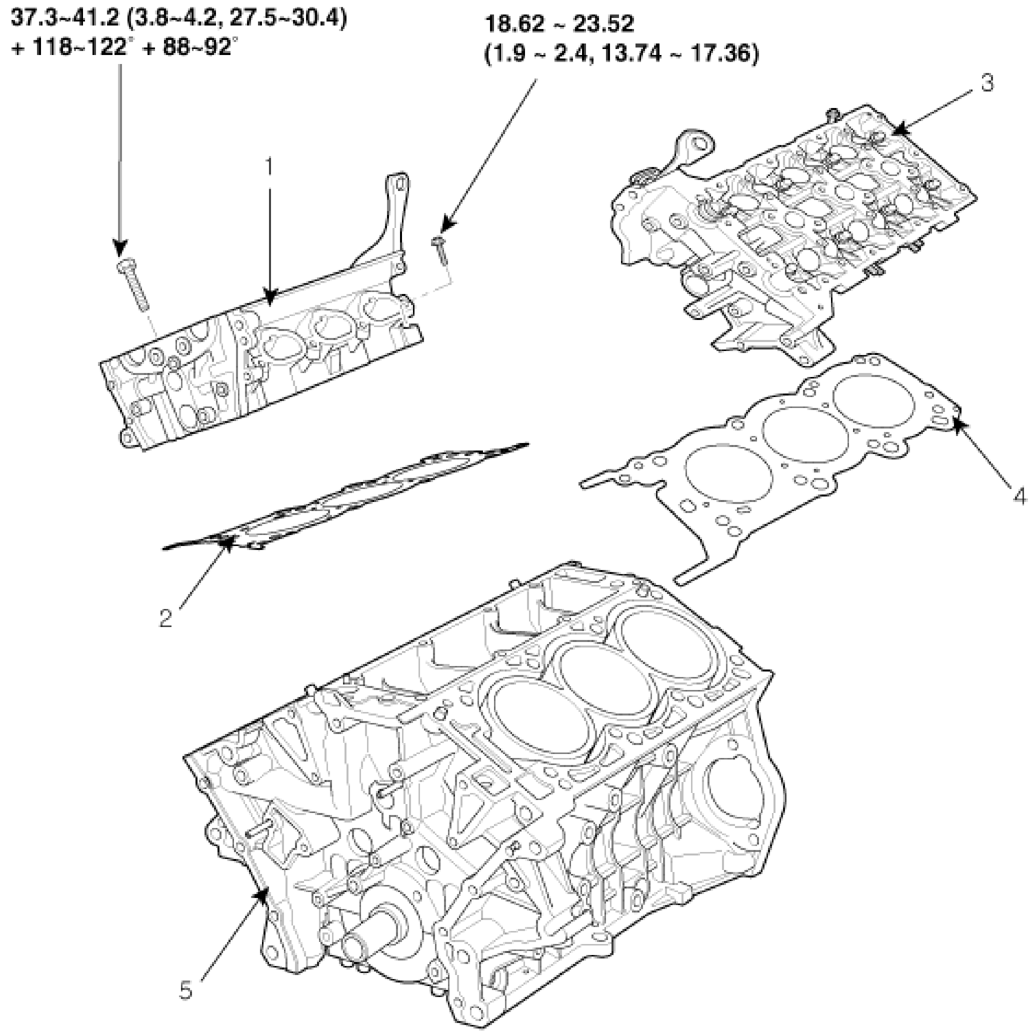


47. Install the air duct.
48. Install the engine cover.
49. Connect the negative terminal from the battery.

NOTE

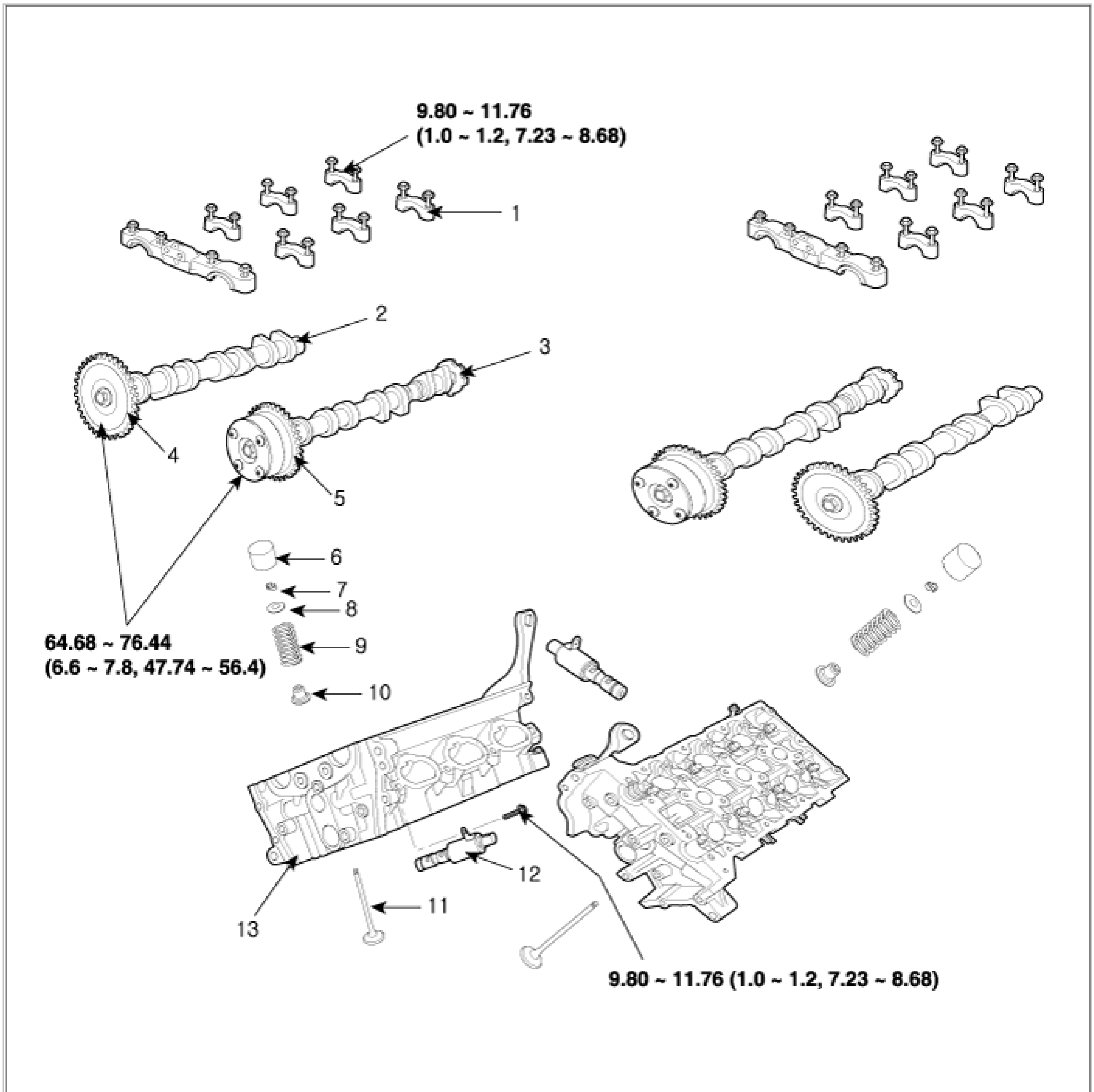
- Refill engine with engine oil.
- Refill radiator and reservoir tank with engine coolant.
- Bleed air from the cooling system.
- Start engine and let it run until it warms up. (until the radiator fan operates 3 or 4 times.)
- Turn Off the engine. Check the level in the radiator, add coolant if needed. This will allow trapped air to be removed from the cooling system.
- Put radiator cap on tightly, then run the engine again and check for leaks.

COMPONENTS



TORQUE : N.m (kgf.m, lbf.ft)

1. RH cylinder head
2. RH cylinder head gasket
3. LH cylinder head
4. LH cylinder head gasket
5. Cylinder block



1. Camshaft bearing cap
2. Exhaust camshaft
3. Intake camshaft
4. Exhaust camshaft sprocket
5. CVVT assembly
6. MLA
7. Retainer lock
8. Retainer
9. Valve spring
10. Valve stem seal
11. Valve
12. OCV
13. Cylinder head

Engine Mechanical System > Cylinder Head Assembly > Repair procedures

REMOVAL

CAUTION

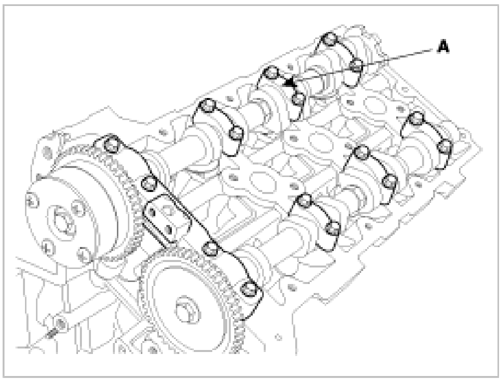
- Use fender covers to avoid damaging painted surfaces.
- To avoid damaging the cylinder head, wait until the engine coolant temperature drops below normal temperature before removing it.
- When handling a metal gasket, take care not to fold the gasket or damage the contact surface of the gasket.
- To avoid damage, unplug the wiring connectors carefully while holding the connector portion.

NOTE

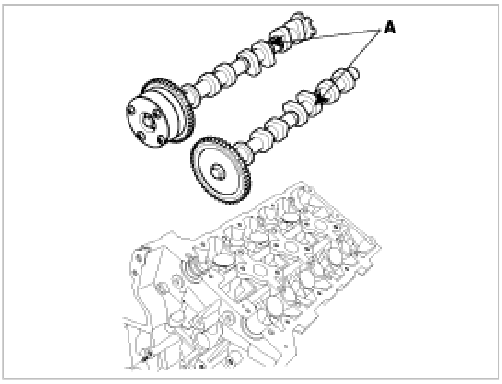
- Mark all wiring and hoses to avoid misconnection.
- Turn the crankshaft pulley so that the No. 1 piston is at top dead center.

Engine removal is required for this procedure.

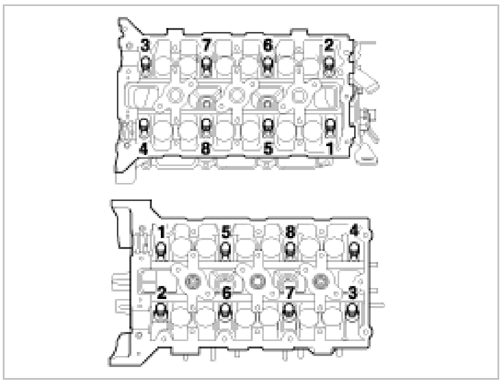
1. Remove exhaust manifold.
2. Remove intake manifold.
3. Remove timing chain.
4. Remove water temperature control assembly.
5. Remove camshaft bearing cap(A).



6. Remove camshaft assembly(A).



7. Remove cylinder head bolts, then remove cylinder head.
   (1) Uniformly loosen and remove the 16 cylinder head bolts, in several passes, in the sequence shown. Remove the 16 cylinder head bolts and plate washers.



CAUTION

Head warpage or cracking could result from removing bolts in an incorrect order.

   (2) Lift the cylinder head from the dowels on the cylinder block and place the cylinder head on wooden blocks on a bench.

CAUTION

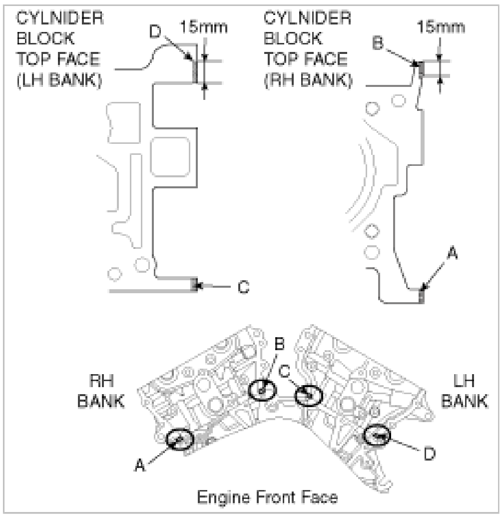
Be careful not to damage the contact surfaces of the cylinder head and cylinder block.

INSTALLATION

NOTE

- Thoroughly clean all parts to be assembled.
- Always use a new head and manifold gasket.
- The cylinder head gasket is a metal gasket. Take care not to bend it.
- Rotate the crankshaft, set theNo.1 piston at TDC.

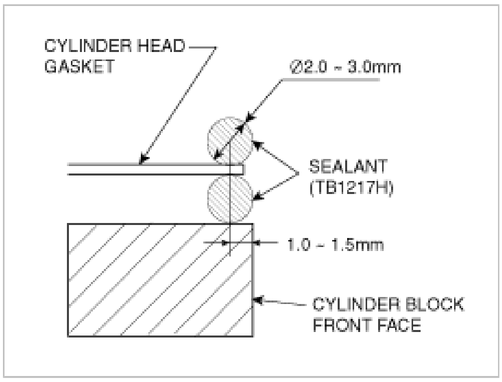
1. Install the cylinder head.
   A. The sealant locations on cylinder head and cylinder block must be free of engine oil and ETC.
   B. Apply sealant on cylinder block top face before assembling cylinder head gaskets.
   The part must be assembled within 5 minutes after sealant was applied.



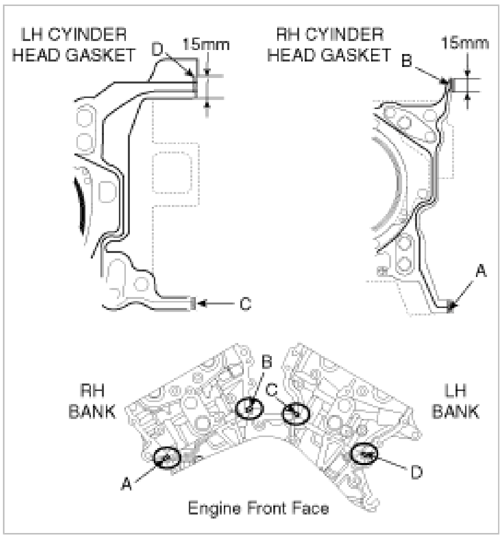
NOTE

Refer to below illustration to apply the sealant.

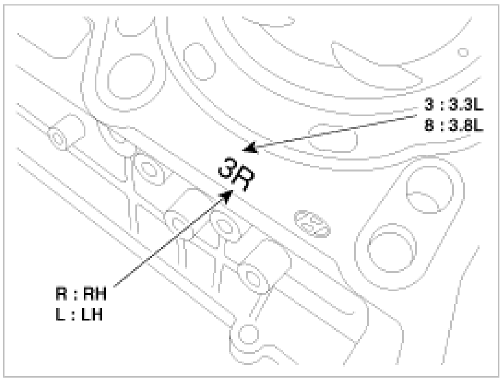
Bead width : 2.0~3.0 mm
Sealant locations : 1.0~1.5mm from block surface
Recommended sealant :Liquid sealant TB1217H



   C. Apply sealant on cylinder head gaskets after assembling cylinder head gaskets on cylinder block.
   The part must be assembled within 5 minutes after sealant was applied.

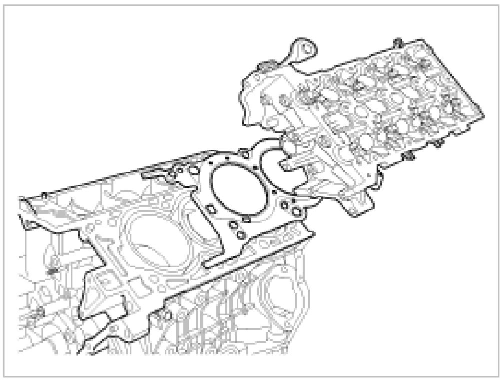


> **NOTE**
>
> Be careful of the installation direction.



D. Install the cylinder head.

> **NOTE**
>
> Remove the extruded sealant after assembling cylinder heads.

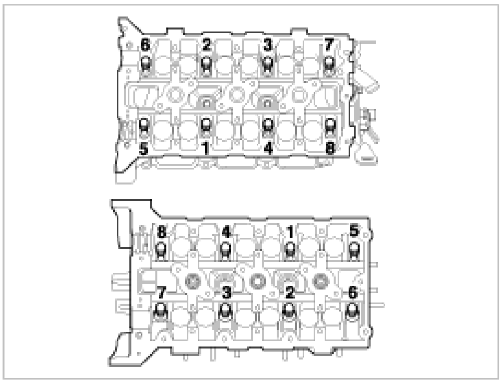


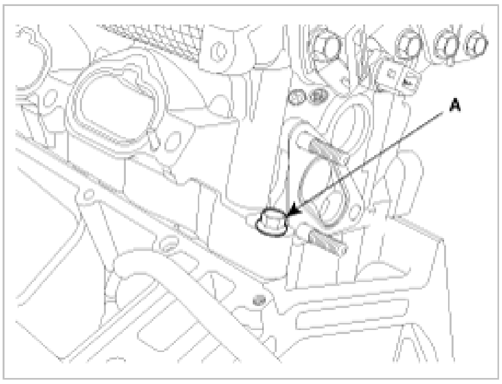
2. Place the cylinder head carefully in order not to damage the gasket with the bottom part of the end.
3. Install cylinder head bolts.
   (1) Do not apply engine oil on the threads and under the heads of the cylinder head bolts.
   (2) Using SST(09221-4A000), install and tighten the cylinder head bolts and plate washers, in several passes, in the sequence shown.

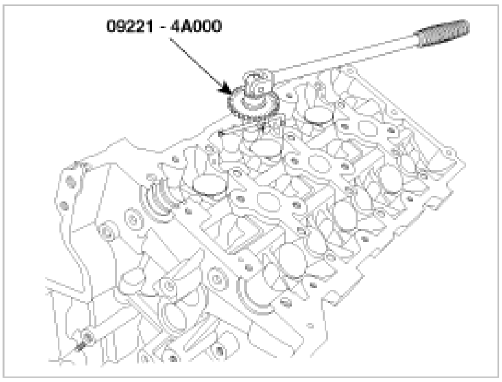
Tightening torque
Head bolt : 37.3~41.2Nm (3.8~4.2kgf.m, 27.5~30.4lb-ft) + 118~122° + 88~92°
Bolt (A) : 18.62 ~ 23.52Nm(1.9 ~ 2.4kgf.m, 13.74 ~ 17.36lbf.ft)

NOTE

Always use new cylinder head bolt.

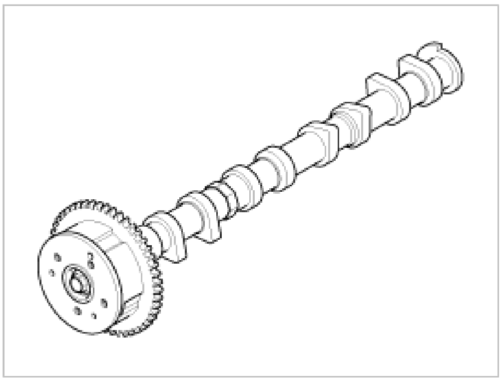






4. Install the CVVT and camshaft sprocket.

Tightening torque
64.68 ~ 76.44Nm(6.6 ~ 7.8 kgf.m, 47.74 ~ 56.4lbf.ft)



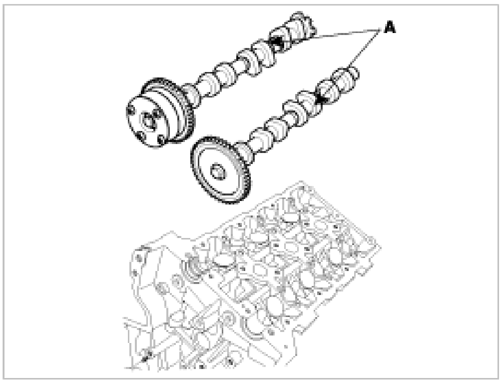
NOTE

- Install camshaft-inlet to dowel pin of CVVT assembly .
  At this time, attend not to be installed to oil hole of camshaft-inlet.
- Hold the hexagonal head wrench portion of the camshaft with a vise, and install the bolt and CVVT assembly.
- Do not rotate CVVT assembly when camshaft is installed to dowel pin of CVVT assembly.

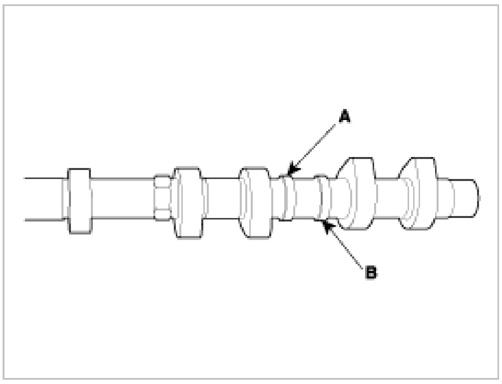
5. Install camshafts(A).

NOTE

- Apply a light coat of engine oil on camshaft journals.
- Assemble the key groove of camshaft rear side to the same level of head top surface.
- Be careful the right, left bank, intake, exhaust side before assembling.

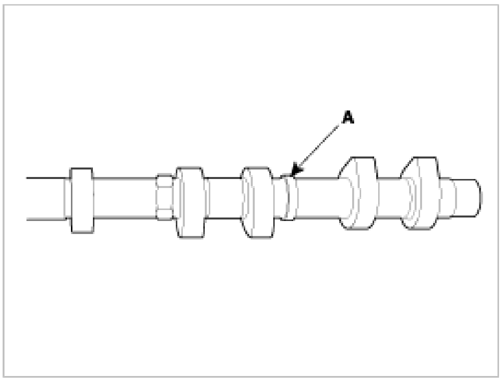


Intake camshaft



	LH	RH
3.3L	A: 27mm(1.0630in.) B: 27mm(1.0630in.)	A: 30mm(1.1811in.) B: 30mm(1.1811in.)

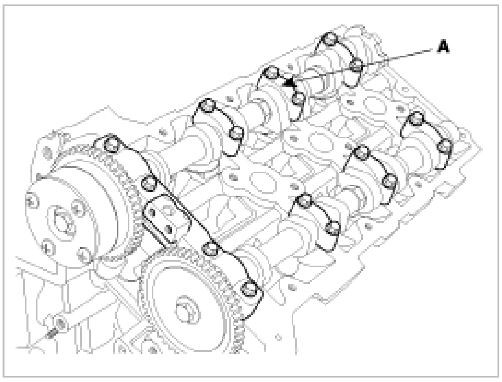
Exhaust camshaft



	LH	RH
3.3L	A: 27mm(1.0630in.)	A: 30mm(1.1811in.)

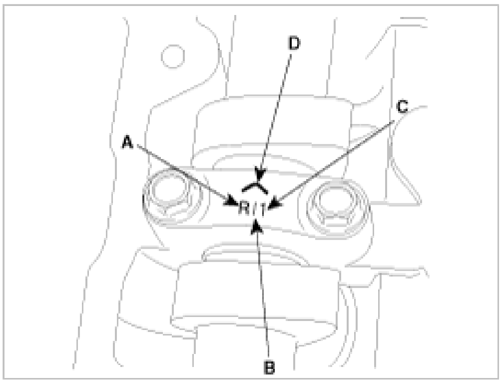
6. Install camshaft bearing caps.

Tightening torque
9.80 ~ 11.76Nm(1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lbf.ft)



NOTE

Be careful the right, left bank, intake, exhaust side before assembling.



A : L(LH),R(RH)
B : I(Intake),None(Exhaust)
C : Journal number
D : Front mark

CAUTION

Rotate the crankshaft not to contact the valves to the pistons by making the pistons below 10mm(0.3937in.) from the top of cylinder block.

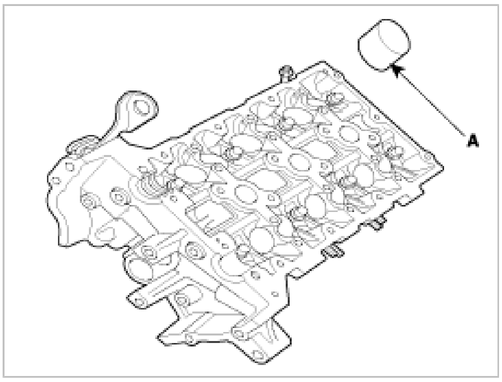
7. Install water temperature control assembly.
8. Install timing chain.
9. Check and adjust valve clearance.
10. Install the exhaust manifold.
11. Install the intake manifold.

DISASSEMBLY

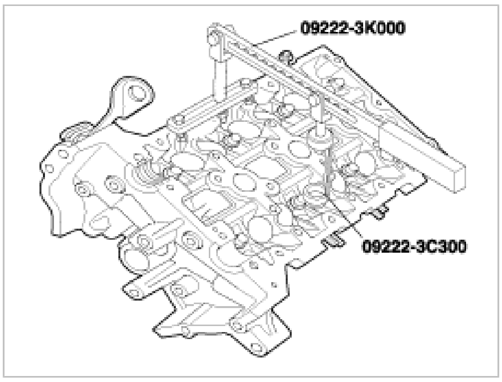
NOTE

Identify MLA, valves and valve springs as they are removed so that each item can be reinstalled in its original position.

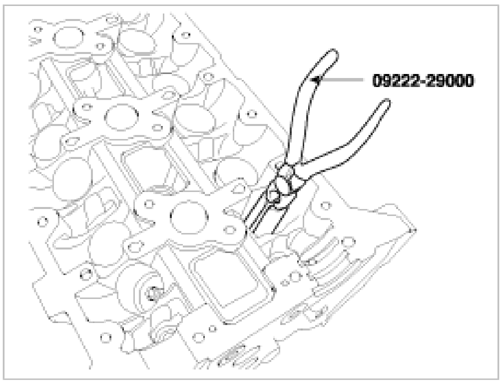
1. Remove MLAs(A).



2. Remove valves.
   (1) Using SST(09222-3K000, 09222-3C300), compress the valve spring and remove retainer lock.



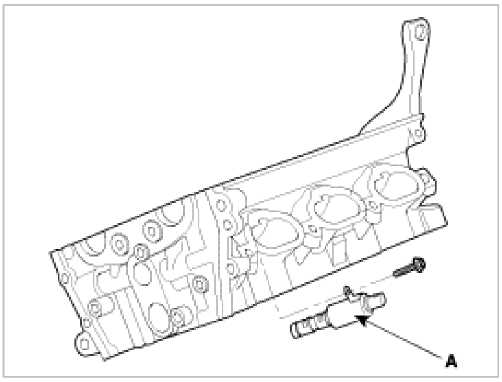
   (2) Remove the spring retainer.
   (3) Remove the valve spring.
   (4) Remove the valve.
   (5) Using SST(09222-29000), remove the valve stem seal.



NOTE

Do not reuse old valve stem seals.

3. Remove OCV(A).

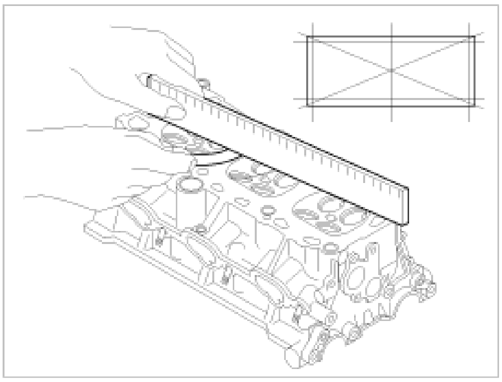


INSPECTION

CYLINDER HEAD

1. Inspect for flatness.
   Using a precision straight edge and feeler gauge, measure the surface the contacting the cylinder block and the manifolds for warpage.

Flatness of cylinder head gasket surface
Standard : Less than 0.05mm(0.002in.)[Less than 0.02mm(0.0008in.)/150x150]
Flatness of manifold gasket surface
Standard : Less than 0.03mm(0.001in)/110x110

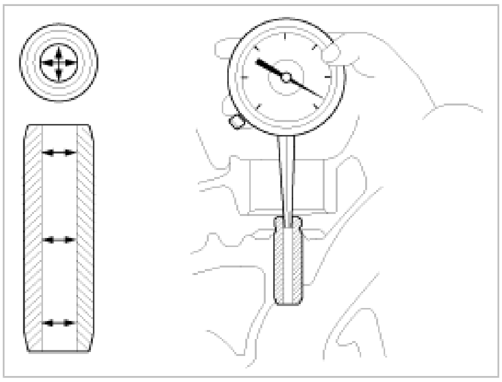


2. Inspect for cracks.
   Check the combustion chamber, intake ports, exhaust ports and cylinder block surface for cracks. If cracked, replace the cylinder head.

VALVE AND VALVE SPRING

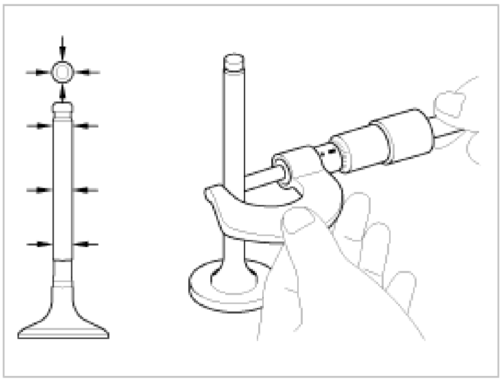
1. Inspect valve stems and valve guides.
   (1) Using a caliper gauge, measure the inside diameter of the valve guide.

Valve guide I.D.
Intake / Exhaust : 5.500 ~ 5.512mm (0.216 ~ 0.217in.)



(2) Using a micrometer, measure the diameter of the valve stem.

Valve stem O.D.
Intake : 5.465 ~ 5.480mm (0.2151 ~ 0.2157in.)
Exhaust : 5.458 ~ 5.470mm (0.2149 ~ 0.2153in.)

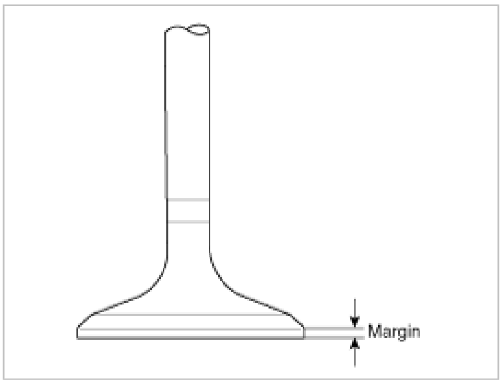


(3) Subtract the valve stem diameter measurement from the valve guide inside diameter measurement.

Valve stem-to-guide clearance
[Standard]
Intake : 0.020 ~ 0.047mm (0.0008 ~ 0.0018in.)
Exhaust : 0.030 ~ 0.054mm (0.0012 ~ 0.0021in.)
[Limit]
Intake : 0.07mm (0.0027in.)
Exhaust : 0.09mm (0.0035in.)

2. Inspect valves.
(1) Check the valve is ground to the correct valve face angle.
(2) Check that the surface of the valve for wear.
If the valve face is worn, replace the valve.
(3) Check the valve head margin thickness.
If the margin thickness is less than minimum, replace the valve.

Margin
[Standard]
Intake : 1.56 ~ 1.86mm(0.06142 ~ 0.07323in.)
Exhaust : 1.73 ~ 2.03mm(0.06811 ~ 0.07992in.)



(4) Check the valve length.

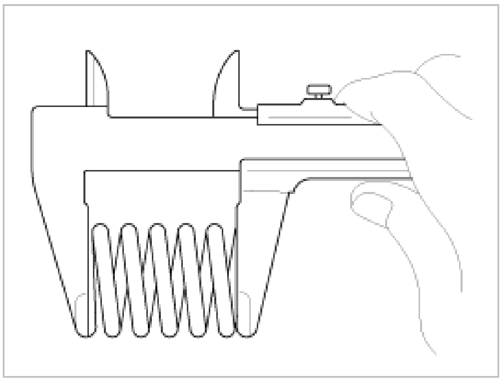
Length
Intake : 105.27mm (4.1445in)
Exhaust : 105.50mm (4.1535in)

(5) Check the surface of the valve stem tip for wear.

If the valve stem tip is worn, replace the valve.

3. Inspect valve seats
   Check the valve seat for evidence of overheating and improper contact with the valve face.
   If the valve seat is worn, replace cylinder head.
   Before reconditioning the seat, check the valve guide for wear. If the valve guide is worn, replace cylinder head.
   Recondition the valve seat with a valve seat grinder or cutter. The valve seat contact width should be within specifications and centered on the valve face.
4. Inspect valve springs.
   (1) Using a steel square, measure the out-of-square of the valve spring.
   (2) Using a vernier calipers, measure the free length of the valve spring.

Valve spring
[Standard]
Free height : 43.86mm (1.7267in.)
Out-of-square : 1.5°



MLA

1. Inspect MLA.
   Using a micrometer, measure the MLA outside diameter.

MLA O.D.
Intake/Exhaust : 34.964 ~ 34.980mm(1.3765 ~ 1.3771in.)

2. Using a caliper gauge, measure MLA tappet bore inner diameter of cylinder head.

Tappet bore I.D.
Intake/Exhaust : 35.000 ~ 35.025mm(1.3779 ~ 1.3789in.)

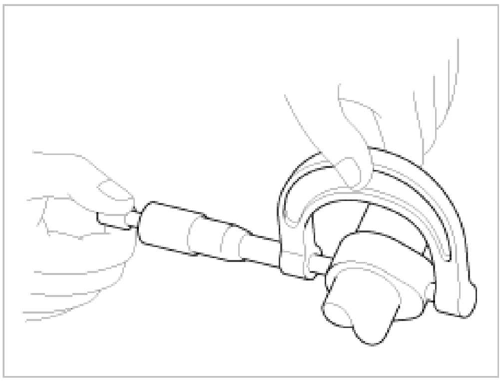
3. Subtract MLA outside diameter measurement from tappet bore inside diameter measurement.

MLA to tappet bore clearance
[Standard]
Intake/Exhaust : 0.020 ~ 0.061mm(0.0008 ~ 0.0024in.)
[Limit]
Intake/Exhaust : 0.07mm(0.0027in.)

CAMSHAFT

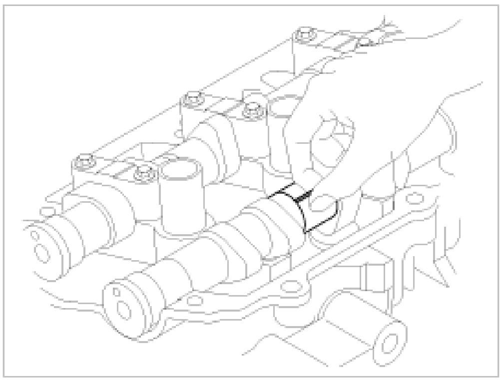
1. Inspect cam lobes.
   Using a micrometer, measure the cam lobe height.

Cam height
[Standard value]
Intake : 46.3mm (1.8228in.)
Exhaust : 45.8mm (1.8031in.)



If the cam lobe height is less than standard, replace the camshaft.

2. Inspect camshaft journal clearance.
   (1) Clean the bearing caps and camshaft journals.
   (2) Place the camshafts on the cylinder head.
   (3) Lay a strip of plastigage across each of the camshaft journal.



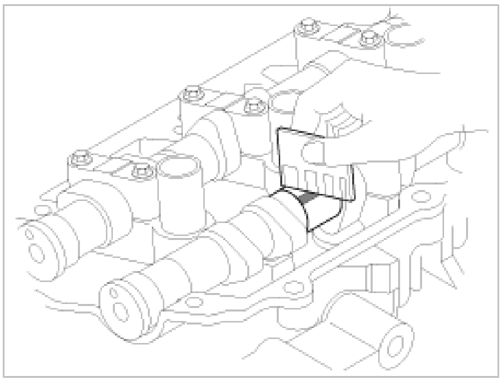
   (4) Install the bearing caps.

CAUTION

Do not turn the camshaft.

   (5) Remove the bearing caps.
   (6) Measure the plastigage at its widest point.

Bearing oil clearance
[Standard value]
Intake
No.1 journal : 0.020 ~ 0.057mm (0.0008 ~ 0.0022in.)
No.2,3,4,, journal : 0.030 ~ 0.067mm (0.0012 ~ 0.0026in.)
Exhaust
No.1 journal : 0.020 ~ 0.057mm (0.0008 ~ 0.0022in.)
No.2,3,4,, journal : 0.030 ~ 0.067mm (0.0012 ~ 0.0026in.)



If the oil clearance is greater than maximum, replace the camshaft. If necessary, replace cylinder head.

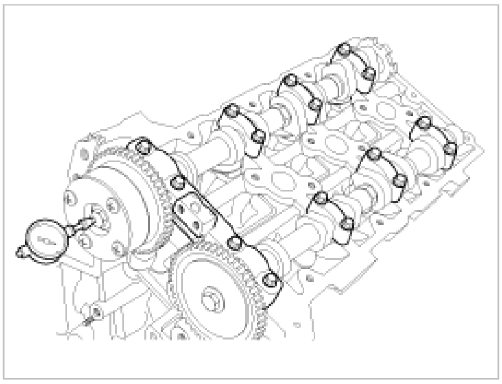
(7) Completely remove the plastigage.

(8) Remove the camshafts.

3. Inspect camshaft end play.
   (1) Install the camshafts.

   (2) Using a dial indicator, measure the end play while moving the camshaft back and forth.

Camshaft end play
[Standard value] : 0.056 ~ 0.064mm(0.0022 ~ 0.0025in.)



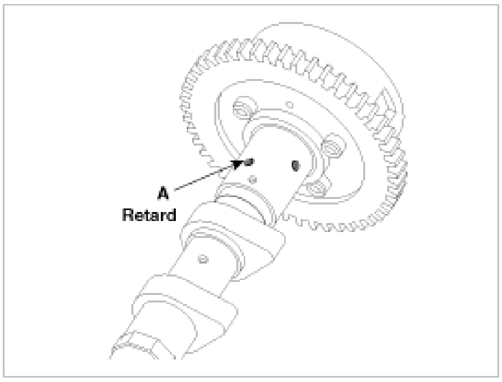
If the end play is greater than maximum, replace the camshaft. If necessary, replace cylinder head.

   (3) Remove the camshafts.

CVVT ASSEMBLY

1. Inspect CVVT assembly.
   (1) Check that the CVVT assembly will not turn.

   (2) Apply vinyl tape to the retard hole except the one indicated by the arrow in the illustration.

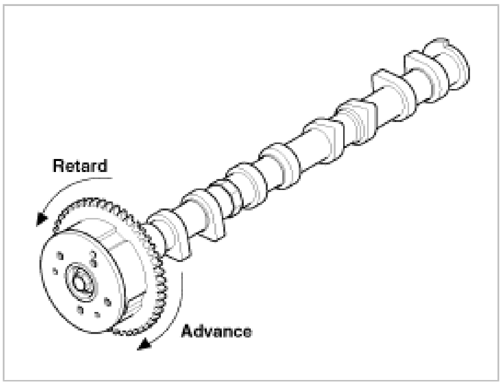


   (3) Wind tape around the tip of the air gun and apply air of approx. 150kpa(1.5kgf/cm², 21psi) to the port of the camshaft.
   (Perform this order to release the lock pin for the maximum delay angle locking.)

NOTE

When the oil splashes, wipe it off with a shop rag.

   (4) Under the condition of (3), turn the CVVT assembly to the advance angle side (the arrow marked direction in the illustration) with your hand.
   Depending on the air pressure, the CVVT assembly will turn to the advance side without applying force by hand. Also, under the condition that the pressure can be hardly applied because of the air leakage from the port, there may be the casethat the lock pin could be hardly released.



(5) Except the position where the lock pin meets at the maximum delay angle, let the CVVT assembly turn back and forth and check the movable range and that there is no disturbance.

Standard: Movable smoothly in the range about 22.5°

(6) Turn the CVVT assembly with your hand and lock it at the maximum delay angle position (counter clockwise).

REASSEMBLY

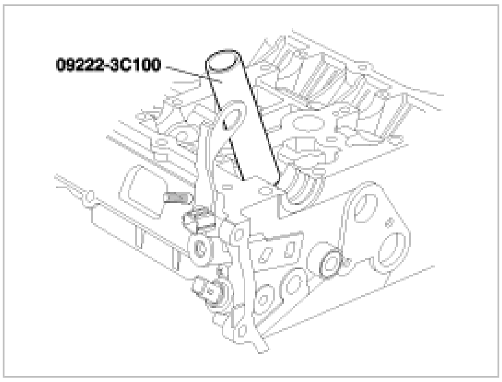
NOTE

Thoroughly clean all parts to be assembled.
Before installing the parts, apply fresh engine oil to all sliding and rotating surfaces.
Replace oil seals with new ones.

1. Install valves.
   (1) Using SST(09222-3C100), push in a new oil seal.

   NOTE

   Do not reuse old valve stem seals.
   Incorrect installation of the seal could result in oil leakage past the valve guides.

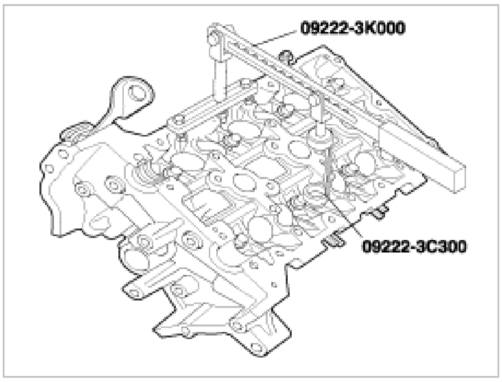


   (2) Install the valve, valve spring and spring retainer.

   NOTE

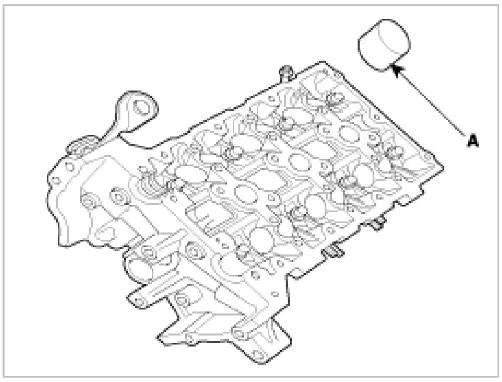
   Place valve springs so that the side coated with enamel faces toward the valve spring retainer and then installs the retainer.

   (3) Using the SST(09222 - 3K000, 09222-3C300), compress the spring and install the retainer locks. After installing the valves, ensure that the retainer locks are correctly in place before releasing the valve spring compressor.



(4) Lightly tap the end of each valve stem two or three times with the wooden handle of a hammer to ensure proper seating of the valve and retainer lock.

2. Install MLAs.
Check that the MLA rotates smoothly by hand.

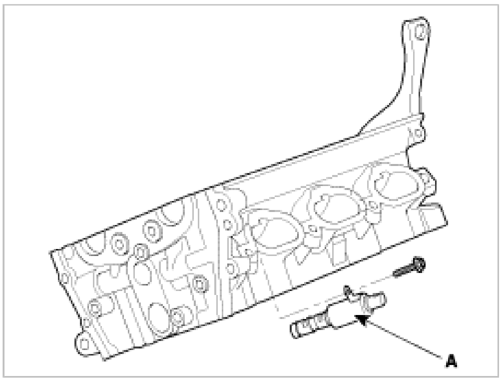


NOTE

MLA can be reinstalled in its original position.

3. Install OCV(A).

Tightening torque
9.80 ~ 11.76Nm(1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lbf.ft)



NOTE

- To install OCV with gray colored connector into RH bank.
- To install OCV with black colored connector into LH bank.

CAUTION

- Do not reuse the OCV when dropped.
- Keep clean the OCV.

• Do not hold the OCV sleeve during servicing.
• When the OCV is installed on the engine, do not move the engine with holding the OCV yoke.

Engine Mechanical System > Engine And Transaxle Assembly > Repair procedures

REMOVAL

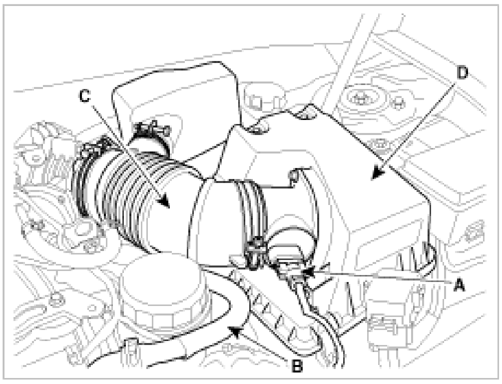
CAUTION

• Use fender covers to avoid damaging paintedsurfaces.
• To avoid damage, unplug the wiring connectors carefully while holding the connector portion.

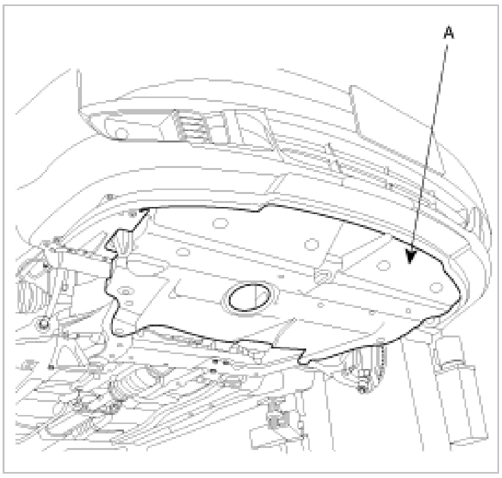
NOTE

• Mark all wiring and hoses to avoid misconnection.
• Turn the crankshaft pulley so that the No.1 piston is at top dead center.

1. Disconnect the neagative terminal from the battery.
2. Remove the engine cover.
3. Remove the air duct.
4. Remove the intake air hose and air cleaner assembly.
   (1) Disconnect the AFS connector(A).
   (2) Disconnect the breather hose(B) from air cleanerhose.
   (3) Disconnect the ECM connector. (See FL group)
   (4) Remove the intake air hose(C) and air cleaner(D).

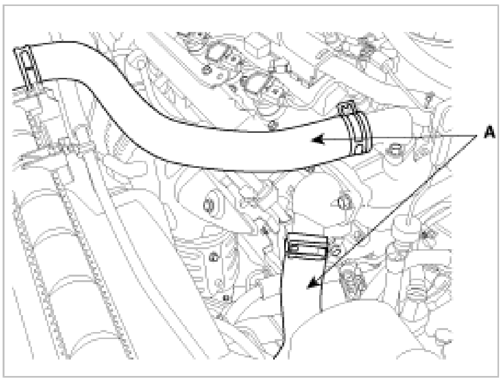


5. Remove front wheels.
6. Remove under cover(A).

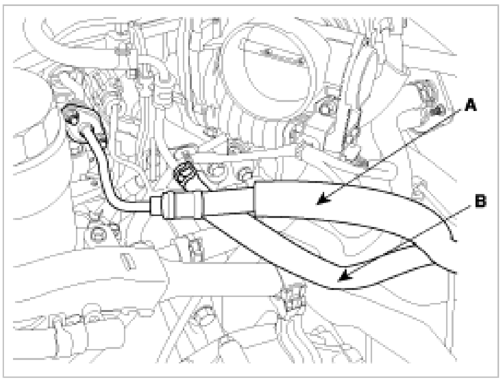


7. Drain the engine coolant.
   Remove the radiator cap to speed draining.

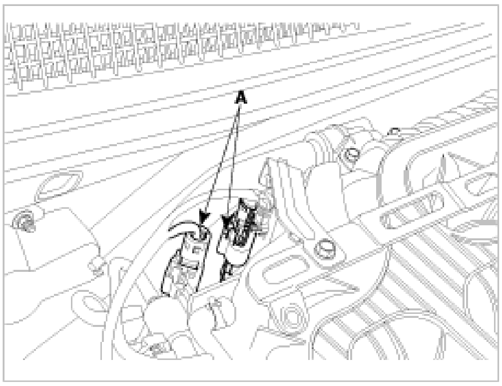
8. Remove the upper radiator hose and lower radiator hose(A).



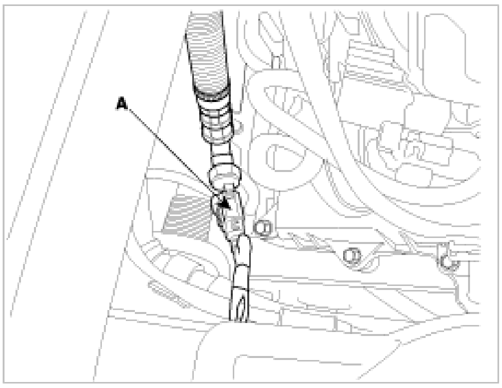
9. Remove transaxle oil cooler hose.
10. Remove fuel hose(A) and PCSV(B) hose.



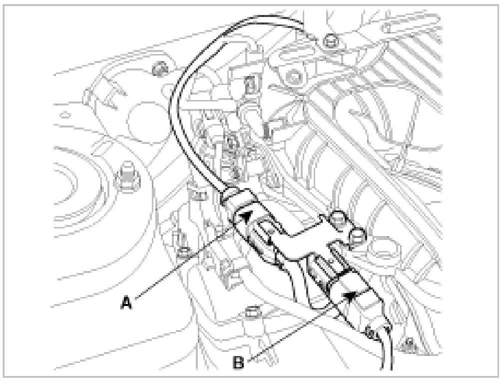
11. Remove engine wiring.
    (1) Disconnect RH oxygen sensor connector(A).



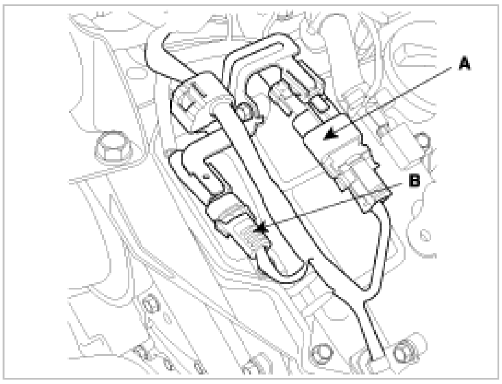
    (2) Disconnect power steering oil pressure sensor connector(A).



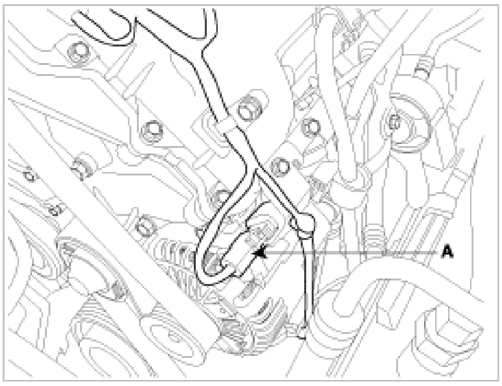
    (3) Disconnect RH injector connector(A) and ignition coil connector(B).



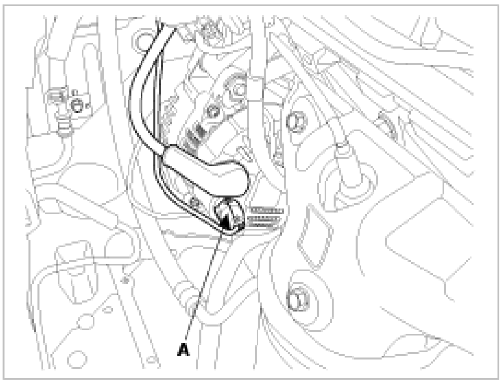
(4) Disconnect OCV connector(A) and knock sensor connector(B).



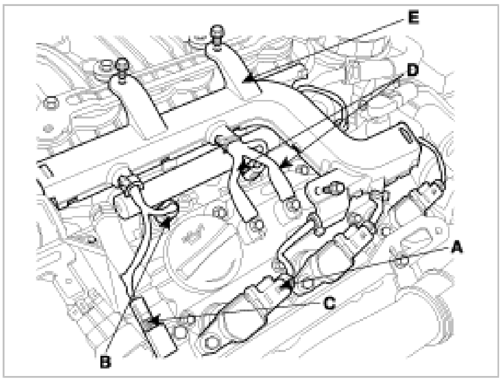
(5) Disconnect LH front oxygen sensor connector(A).



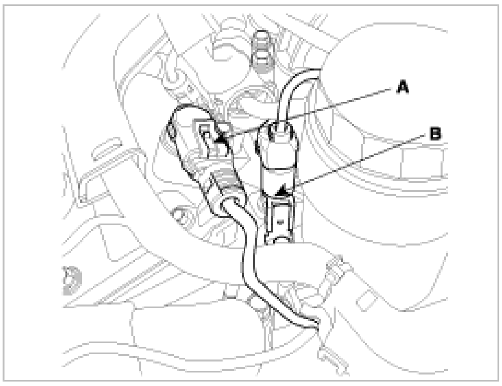
(6) Disconnect alternator connector(A).



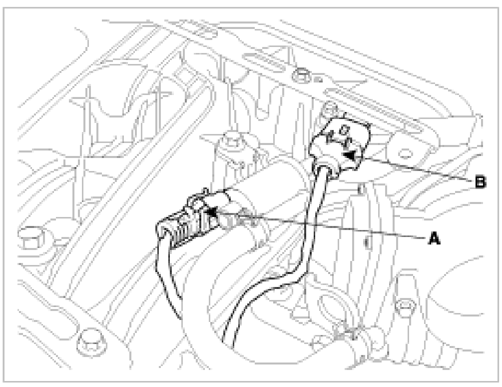
(7) Disconnect LH ignition coil connector(A), injector connector(B), condenser connector(C) and ground(D), and remove wiring harness protector(E).



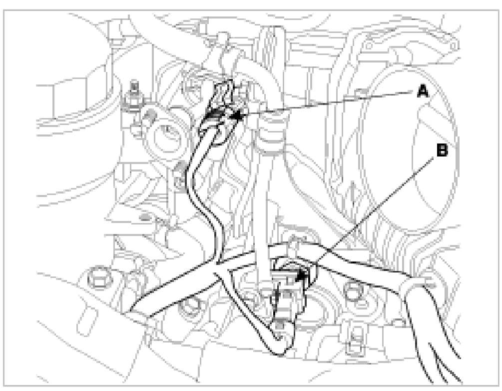
(8) Disconnect LH CMPS(A) and oil pressure switch connector(B).



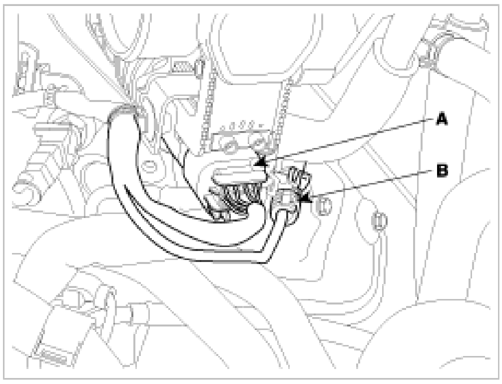
(9) Disconnect PCSV connector(A) and MAP sensor connector(B).



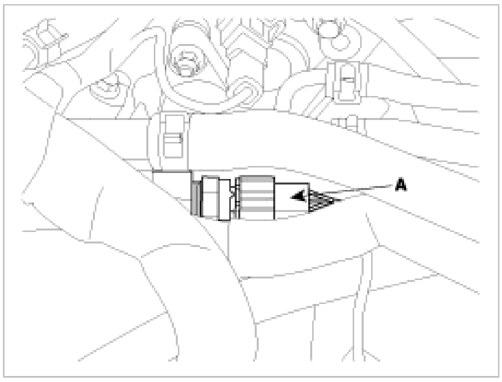
(10) Disconnect RH CMPS(A) and OTS connector(B).



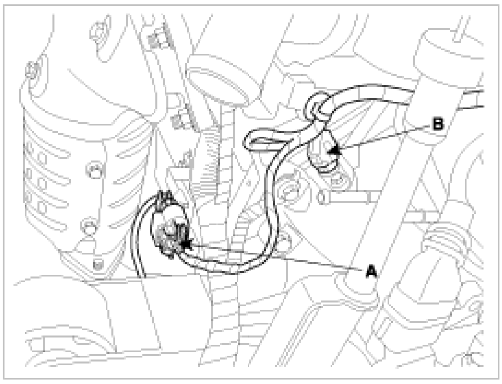
(11) Disconnect ETC connector(A) and knock sensor connector(B).



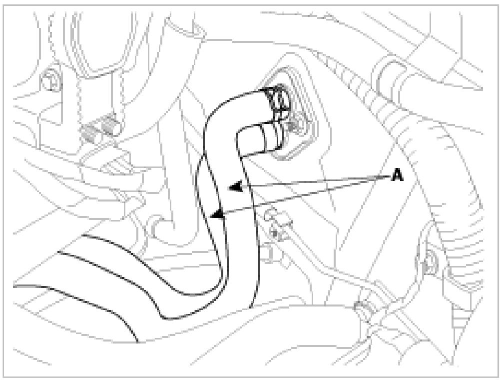
(12) Disconnect WTS connector(A).



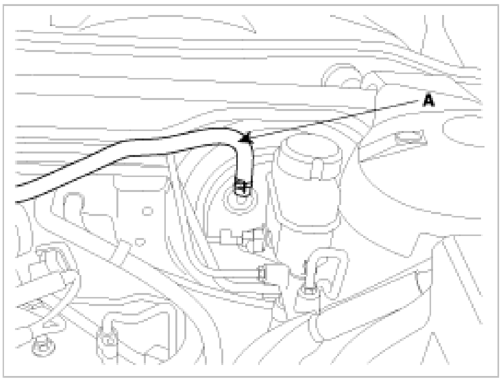
(13) Disconnect LH rear oxygen sensor connector(A) and CPS connector(B).



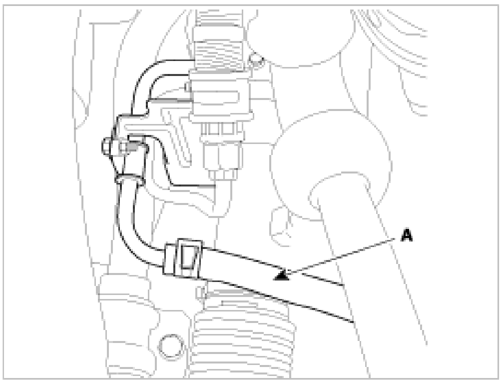
12. Disconnect the transaxle wire harness connector and remove the transaxle control cable.(See TR group)
13. Disconnect EPS connector.
14. Remove heater hose(A).



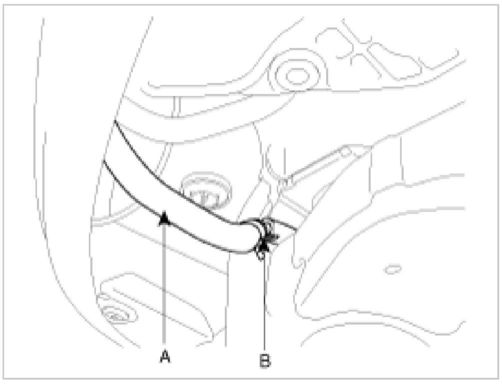
15. Remove brake vacuum hose(A).



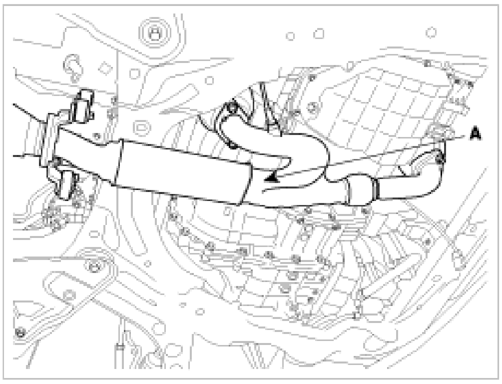
16. Remove power steering pump hose(A).



17. Remove A/C compressor hose.
18. Drain transaxle oil.
19. Remove lower arm ball joint. (SeeDS group)
20. Remove tile rod end ball joint. (See DS group)
21. Remove stabilizer link. (See SS group)
22. After removing a split pin and nut from the steering bar tie rod, disconnect it. (See ST group)
23. Remove power steering return hose(A) and drain power steering oil.

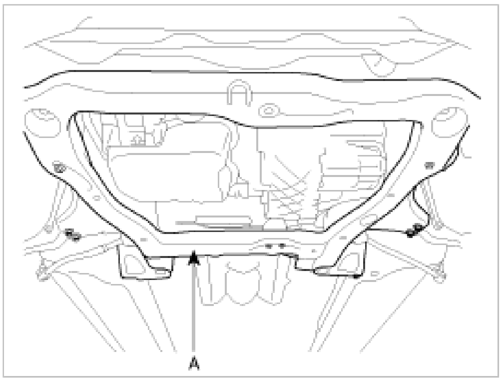


24. Remove front roll stopper mounting bolt.
25. Remove rear roll stopper mounting bolt.
26. Remove steering u-joint mounting (See ST group)
27. Remove front exhaust pipe(A).

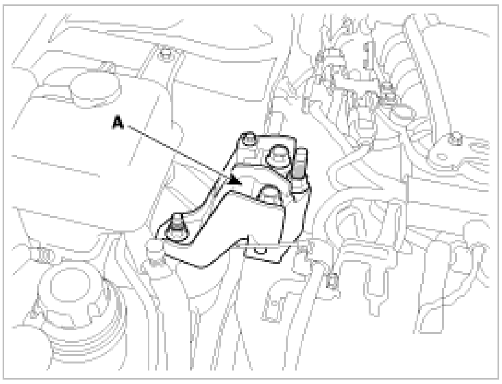


28. Supporting the cross member(A) with a jack, remove the stay with the mounting bolts.

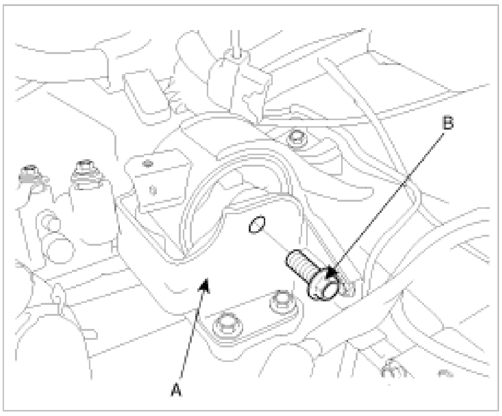
Tightening torque :
137.3~156.9Nm (14.0~16.0kgf.m, 101.3~115.7lb-ft)



29. Remove drive shaft from transaxle.(See DS group)
30. Install jack for supporting engine and transaxle assembly.
31. Remove the engine mounting bracket(A).



32. Remove the transaxle mounting bracket(A).



33. Jack up the vehicle.

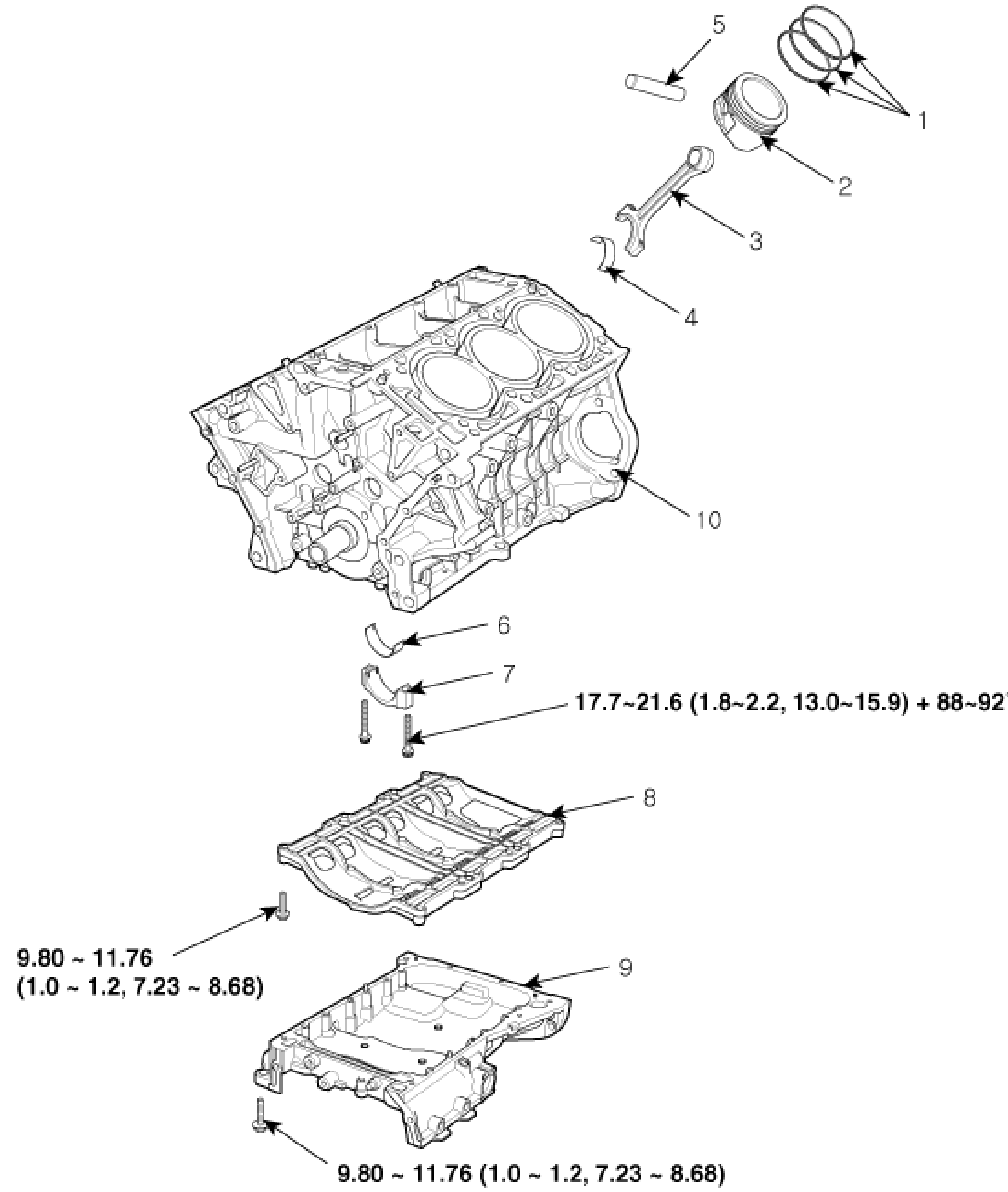
INSTALLATION

Installation is in the reverse order of removal.
Perform the following :

- Adjust the shift cable.
- Refill the engine with engine oil.
- Refill the transaxle with fluid.
- Refill the radiator with engine coolant.
- Bleed air from the cooling system with the heater valve open.
- Clean the battery posts and cable terminals with sandpaper assemble them, then apply grease to prevent corrosion.
- Inspect for fuel leakage.
  After assembling the fuel line, turn on the ignition switch (do not operate the starter) so that the fuel pump runs for approximately two seconds and fuel line pressurizes.
  Repeat this operation two or three times, then check for fuel leakage at any point in the fuel line.

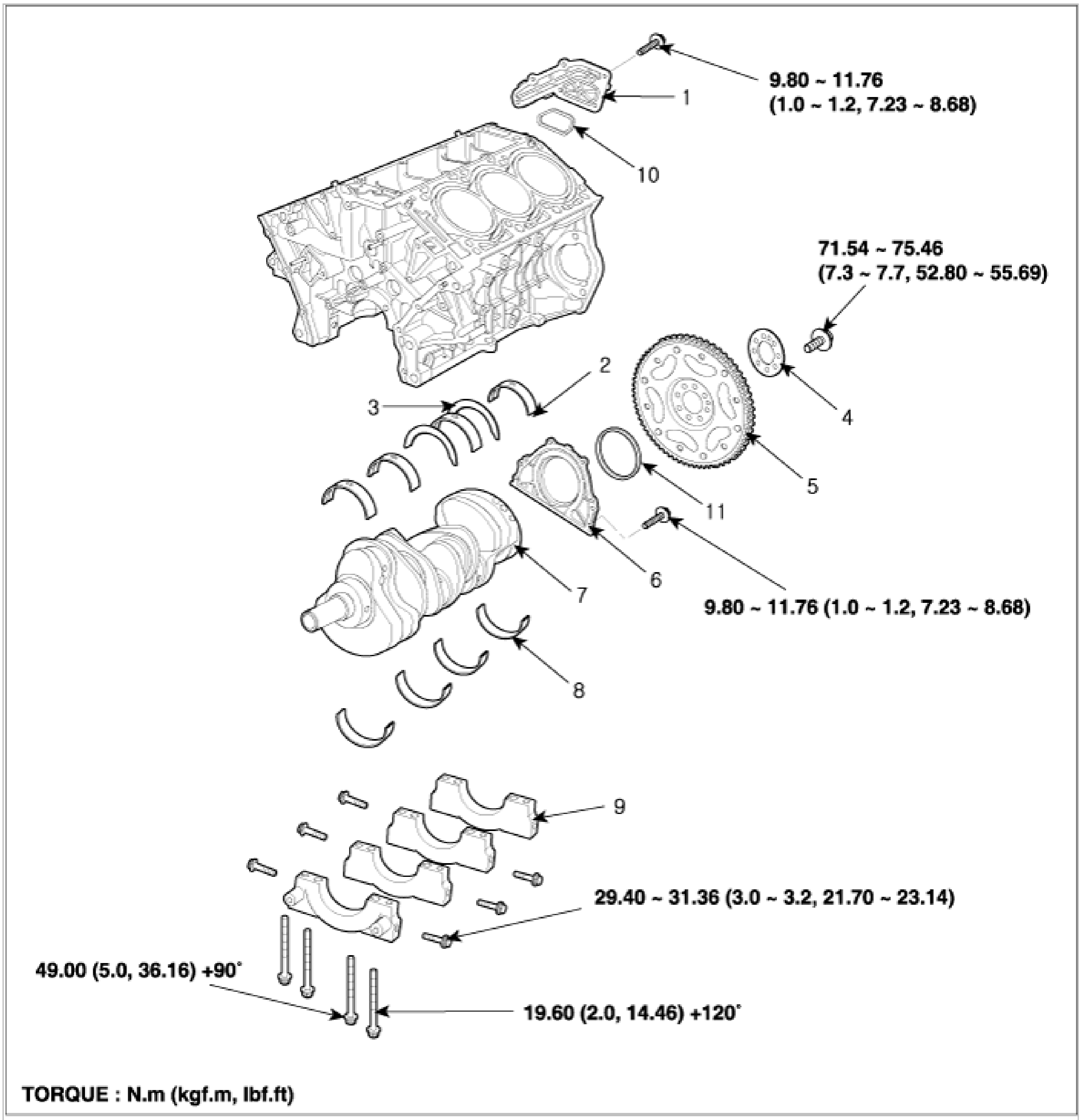
Engine Mechanical System > Cylinder Block > Components and Components Location

COMPONENTS



TORQUE : N.m (kgf.m, lbf.ft)

1. Piston ring
2. Piston
3. Connecting rod
4. Connecting rod upper bearing
5. Piston pin
6. Connecting rod lower bearing
7. Connecting rod bearing cap
8. Baffle plate
9. Upper oil pan
10. Cylinder block



1. Oil drain cover
2. Crankshaft upper bearing
3. Thrust bearing
4. Plate adapter
5. Drive plate
6. Rear oil seal case
7. Crankshaft
8. Crankshaft lower bearing
9. Main bearing cap
10. Oil drain cover gasket
11. Rear oil seal

Engine Mechanical System > Cylinder Block > Repair procedures

REMOVAL

CAUTION

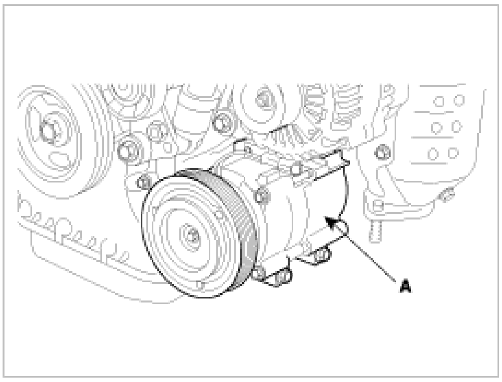
- Use fender covers to avoid damaging painted surfaces.
- To avoid damage, unplug the wiring connectors carefully while holding the connector portion.

NOTE

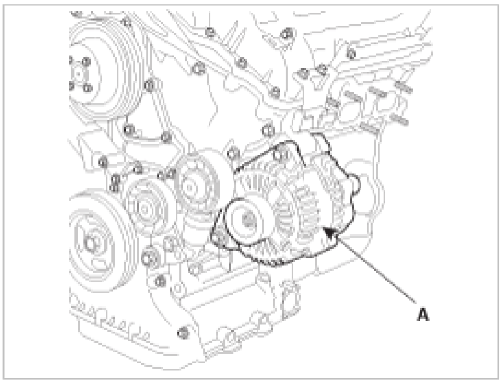
- Mark all wiring and hoses to avoid misconnection.

• Inspection the timing belt before removing the cylinder head.
• Turn the crankshaft pulley so that the No.1 piston is at top dead center.

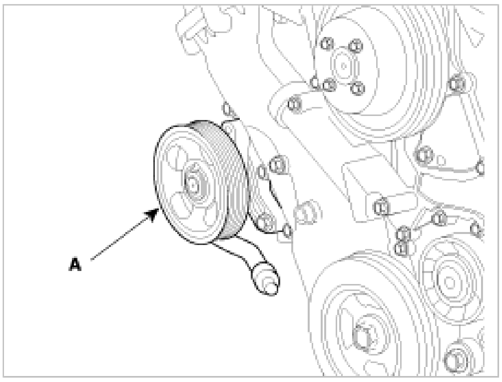
1. Remove exhaust manifold.
2. Remove intake manifold.
3. Remove timing chain.
4. Remove water temperature control assembly.
5. Remove cylinder head.
6. Remove oil pump.
7. Remove oil filter assembly.
8. Remove A/C compressor(A) from engine.



9. Remove alternator(A) from engine.



10. Remove power steering pump(A) from engine.



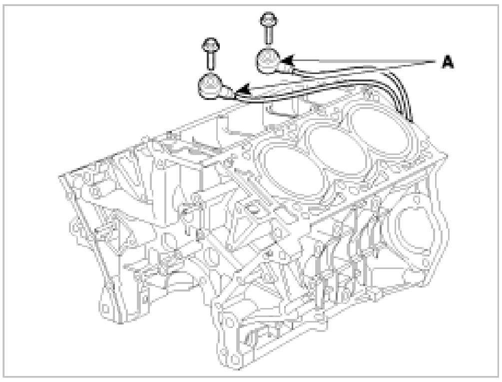
INSTALLATION

1. Install power steering pump.
2. Install alternator.
3. Install air compressor
4. Install oil filter assembly.

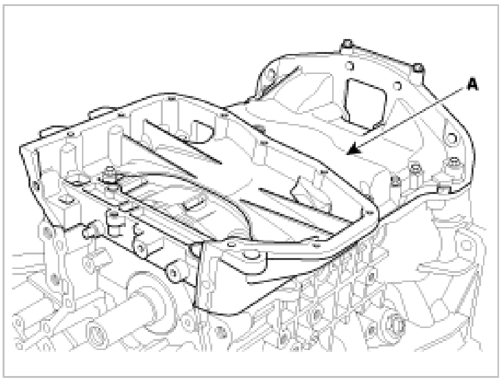
5. Install oil pump.
6. Install cylinder head.
7. Install water temperature control assembly.
8. Install timing chain.
9. Install intake manifold.
10. Install exhaust manifold.

DISASSEMBLY

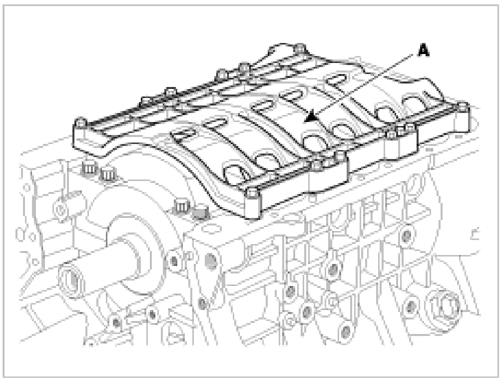
1. Remove drive plate.
2. Remove knock sensor(A).



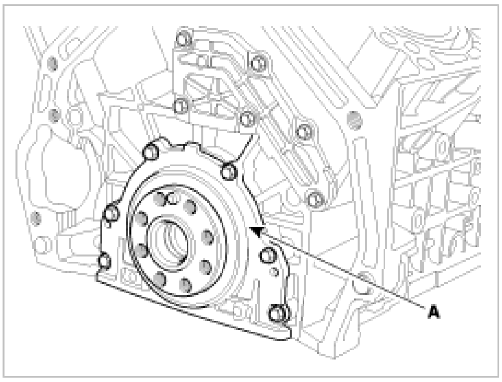
3. Remove upper oil pan(A).



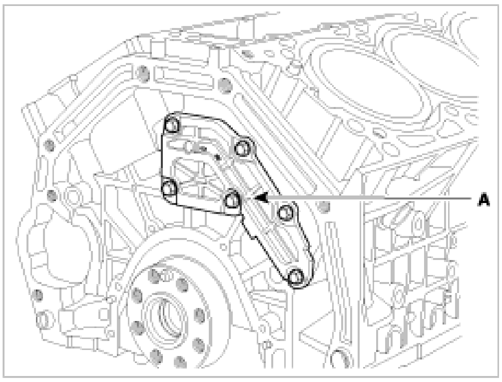
4. Remove baffle plate(A).



5. Remove rear oil seal case(A).



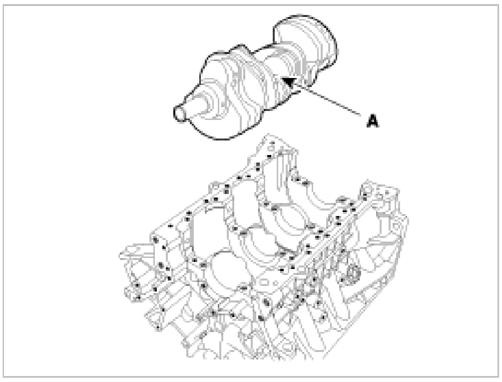
6. Remove oil drain cover(A).



7. Check the connecting rod end play.
8. Check the connecting rod oil clearance.
9. Remove piston and connecting rod assemblies.
   (1) Using a ridge reamer, remove all the carbon from the top of the cylinder.
   (2) Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.

> NOTE
>
> - Keep the bearings, connecting rod and cap together.
> - Arrange the piston and connecting rod assemblies in the correct order.

10. Remove crankshaft main bearing cap and check oil clearance.
11. Check the crankshaft end play.
12. Lift the crankshaft(A) out of engine, being careful not to damage journals.



> NOTE
>
> Arrange the main bearings and thrust bearings in the correct order.

13. Check fit between piston and piston pin.
    Try to move the piston back and forth on the piston pin. If any movement is felt, replace piston and piston pin as a set.
14. Remove piston rings.

(1) Using a piston ring expender, remove the 2 compression rings.

(2) Remove 2 side rails and the spacer by hand.

> NOTE
>
> Arrange the piston rings in the correct order only.

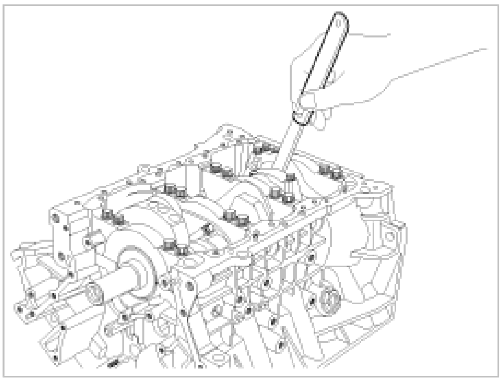
15. Disconnect connecting rod from piston.

INSPECTION

CONNECTING ROD AND CRANKSHAFT

1. Check the connecting rod end play.
   Using a feeler gauge, measure the end play while moving the connecting rod back and forth.

   Standard end play : 0.1~ 0.25mm(0.004 ~ 0.010in.)



   A. If out-of-tolerance, install a new connecting rod.
   B. If still out-of-tolerance, replace the crankshaft.

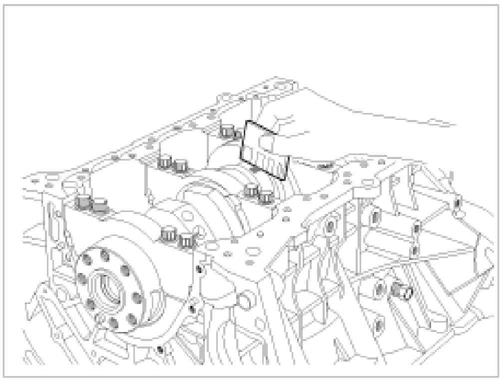
2. Check the connecting rod bearing oil clearance.
   (1) Check the matchmarks on the connecting rod and cap are aligned to ensure correct reassembly.
   (2) Remove 2 connecting rod cap bolts.
   (3) Remove the connecting rod cap and bearing half.
   (4) Clean the crank pin and bearing.
   (5) Place plastigage across the crank pin.
   (6) Reinstall the bearing half and cap, and torque the bolts.

   Tightening torque
   17.7~21.6Nm (1.8~2.2kgf.m, 13.0~15.9lb-ft) + 88~92°

   > NOTE
   >
   > Do not turn the crankshaft.

   (7) Remove 2 bolts, connecting rod cap and bearinghalf.
   (8) Measure the plastigage at its widest point.

   Standard oil clearance
   0.030 ~ 0.048mm(0.0012 ~ 0.0019in.)



(9) If the plastigage measures too wide or too narrow, remove the upper half of the bearing, install a new, complete bearing with the same color mark (select the color as shown in the next column), and recheck the clearance.

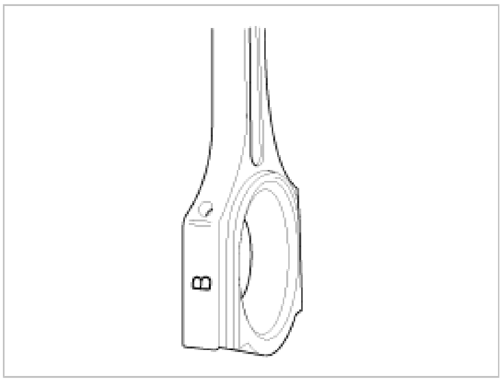
> CAUTION
>
> Do not file, shim, or scrape the bearings or the caps to adjust clearance.

(10) If the plastigage shows the clearance is still incorrect, try the next larger or smaller bearing (the color listed above or below that one), and check clearance again.

> NOTE
>
> If the proper clearance cannot be obtained by using the appropriate larger or smaller bearings, replace the crankshaft and start over.

> CAUTION
>
> If the marks are indecipherable because of an accumulation of dirt and dust, do not scrub them with a wire brush or scraper. Clean them only with solvent or detergent.

CONNECTING ROD MARK LOCATION

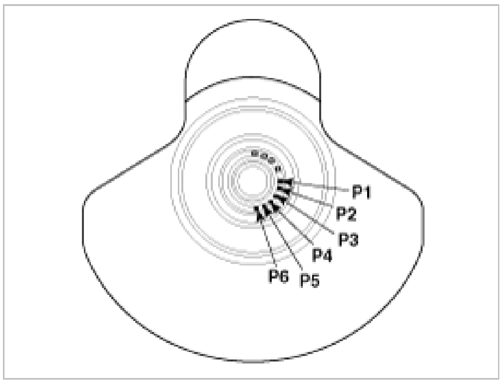


DISCRIMINATION OF CONNECTING ROD

CLASS	MARK	INSIDE DIAMETER
0	a	58.000 ~ 58.006mm (2.2834 ~ 2.2837in.)
1	b	58.006 ~ 58.012mm (2.2837 ~ 2.2839in.)
2	c	58.012 ~ 58.018mm (2.2839 ~ 2.2842in.)

CRANKSHAFT PIN MARK LOCATION

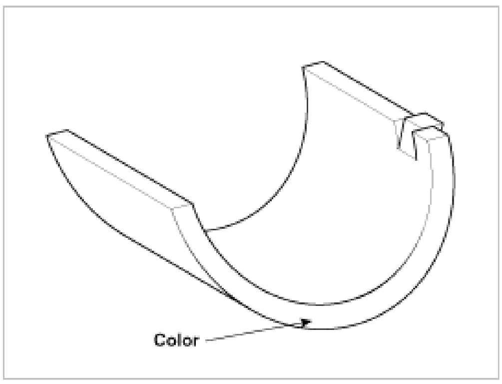
DISCRIMINATION OF CRANKSHAFT



DISCRIMINATION OF CRANKSHAFT

CLASS	MARK	OUTSIDE DIAMETER OF PIN
I	A	54.966 ~ 54.972mm (2.1640 ~ 2.1642in.)
II	B	54.960 ~ 54.966mm (2.1638 ~ 2.1640in.)
III	C	54.954 ~ 54.960mm (2.1635 ~ 2.1638in.)

PLACE OF IDENTIFICATION MARK (CONNECTING ROD BEARING)



DISCRIMINATION OF CONNECTING ROD BEARING

CLASS	MARK	THICKNESS OF BEARING
E	BLUE	1.514 ~ 1.517mm (0.0596 ~ 0.0597in.)
D	BLACK	1.511 ~ 1.514mm (0.0595 ~ 0.0596in.)
C	BROWN	1.508 ~ 1.511mm (0.0594 ~ 0.0595in.)
B	GREEN	1.505 ~ 1.508mm (0.0593 ~ 0.0594in.)
A	YELLOW	1.502 ~ 1.505mm (0.0591 ~ 0.0593in)

(11) Selection

		CONNECTING ROD IDENTIFICATION MARK		
		0(a)	1(b)	2(c)
CRANKSHAFT	I(A)	A (YELLOW)	B (GREEN)	C (BROWN)
	II(B)	B	C	D

INDENTIFICATION MARK		(GREEN)	(BROWN)	(BLACK)
	III(C)	C (BROWN)	D (BLACK)	E (BLUE)

3. Check the crankshaft bearing oil clearance.
   (1) To check main bearing-to-journal oil clearance, remove the main bearing caps and bearing halves.
   (2) Clean each main journal and bearing half with a clean shop tower.
   (3) Place one strip of plastigage across each main journal.
   (4) Reinstall the bearings and caps, then torque the bolts.

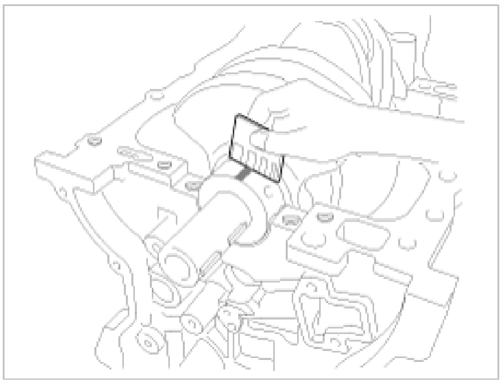
Tightening torque
49.00Nm(5.0 kgf.m, 36.16lbf.ft) + 90°
19.60 Nm(2.0 kgf.m, 14.46lbf.ft)+ 120°
29.40 ~ 31.36Nm(3.0 ~ 3.2 kgf.m, 21.70 ~ 23.14lbf.ft)

NOTE

Do not turn the crankshaft.

   (5) Remove the cap and bearing again, and measure the widest part of the plastigage.

Standard oil clearance
0.022 ~ 0.040mm (0.0009 ~ 0.0016in.)



   (6) If the plastigage measures too wide or too narrow, remove the upper half of the bearing, install a new, complete bearing with the same color mark (select the color as shown in the next column), and recheck the clearance.

CAUTION

Do not file, shim, or scrape the bearings or the caps to adjust clearance.

   (7) If the plastigage shows the clearance is still incorrect, try the next larger or smaller bearing (the color listed above or below that one), and check clearance again.

NOTE

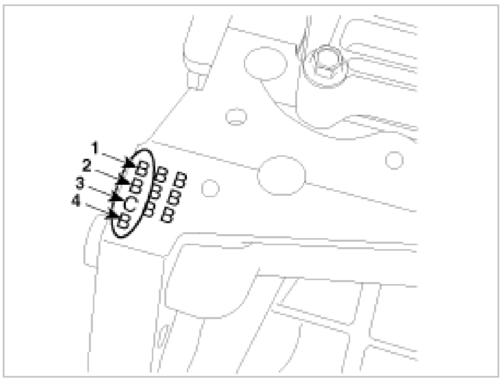
If the proper clearance cannot be obtained by using the appropriate larger or smaller bearings, replace the crankshaft and start over.

CAUTION

If the marks are indecipherable because of an accumulation of dirt and dust, do not scrub them with a wire brush or scraper. Clean them only with solvent or detergent.

Crankshaft bore mark location
Letters have been stamped on the block as a mark for the size of each of the 5 main journal bores.
Use them, and the numbers or bar stamped on the crank (marks for main journal size), to choose the correct

bearings.

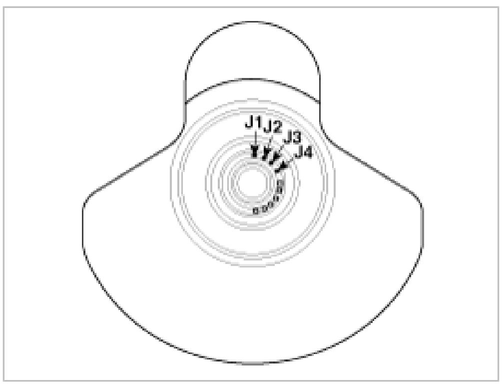


DISCRIMINATION OF CYLINDER BLOCK

CLASS	MARK	INSIDE DIAMETER
a	A	73.500 ~ 73.506mm (2.8937 ~ 2.8939in.)
b	B	73.506 ~ 73.512mm (2.8939 ~ 2.8942in.)
c	C	73.512 ~ 73.518mm (2.8942 ~ 2.8944in.)

CRANKSHAFT JOURNAL MARK LOCATION

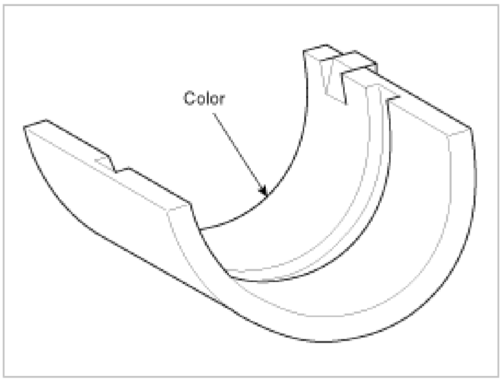
DISCRIMINATION OF CRANKSHAFT



DISCRIMINATION OF CRANKSHAFT

CLASS	MARK	OUTSIDE DIAMETER OF JOURNAL
I	A	68.954 ~ 68.960mm (2.7147 ~ 2.7150in.)
II	B	68.948 ~ 68.954mm (2.7145 ~ 2.7147in.)
III	C	68.942 ~ 68.948mm (2.7142 ~ 2.7145in.)

PLACE OF IDENTIFICATION MARK (CRANKSHAFT BEARING)



DISCRIMINATION OF CRANKSHAFT BEARING

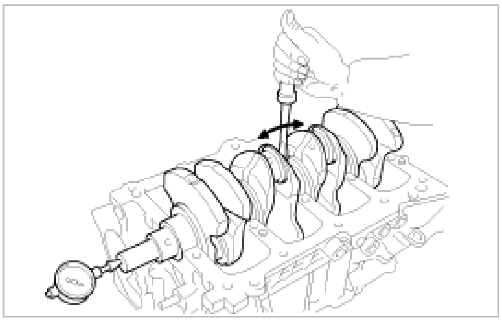
CLASS	MARK	THICKNESS OF BEARING
E	BLUE	2.277 ~ 2.280mm (0.0896 ~ 0.0897in.)
D	BLACK	2.274 ~ 2.277mm (0.0895 ~ 0.0896in.)
C	BROWN	2.271 ~ 2.274mm (0.0894 ~ 0.0895in.)
B	GREEN	2.268 ~ 2.271mm (0.0893 ~ 0.0894in.)
A	YELLOW	2.265 ~ 2.268mm (0.0892 ~ 0.0893in.)

SELECTION

		CRANKSHAFT BORE IDENTIFICATION MARK		
		a(A)	b(B)	c(C)
CRANKSHAFT IDENTIFICATION MARK	I(A)	A (YELLOW)	B (GREEN)	C (BROWN)
	II(B)	B (GREEN)	C (BROWN)	D (BLACK)
	III(C)	C (BROWN)	D (BLACK)	E (BLUE)

4. Check crankshaft end play.
   Using a dial indicator, measure the thrust clearance while prying the crankshaft back and forth with a screwdriver.

   Standard end play
   0.10 ~ 0.28mm (0.0039 ~ 0.0110in.)

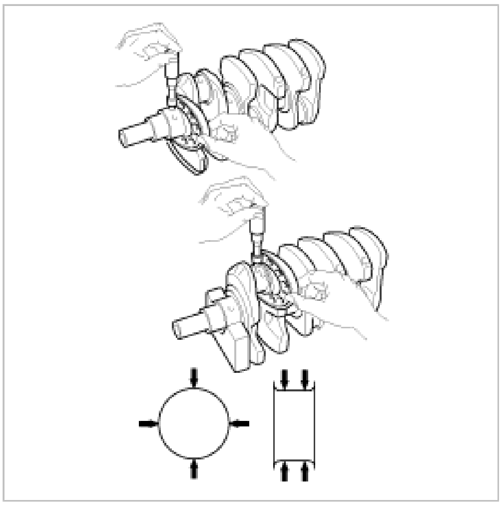
   

   If the end play is greater than maximum, replace the thrust bearings as a set.

   Thrust bearing thickness
   2.41 ~ 2.45mm(0.0949 ~ 0.0964in.)

5. Inspect main journals and crank pins
   Using a micrometer, measure the diameter of each main journal and crank pin.

   Main journal diameter : 68.942 ~ 68.960mm (2.7142 ~ 2.7149in.)
   Crank pin diameter : 54.954 ~ 54.972mm (2.1635 ~ 2.1642in.)



CONNECTING RODS

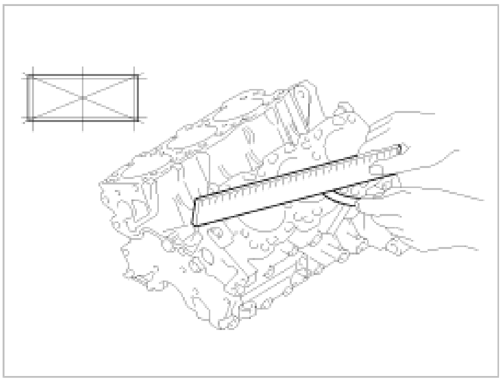
1. When reinstalling, make sure that cylinder numbers put on the connecting rod and cap at disassembly match. When a new connecting rod is installed, make sure that the notches for holding the bearing in place are on the same side.
2. Replace the connecting rod if it is damaged on the thrust faces at either end. Also if step wear or a severely rough surface of the inside diameter of the small end is apparent, the rod must be replaced as well.
3. Using a connecting rod aligning tool, check the rod for bend and twist. If the measured value is close to the repair limit, correct the rod by a press. Any connecting rod that has been severely bent or distorted should be replaced.

   Allowable bend of connecting rod :
   0.05mm / 100mm (0.0020 in./3.94 in.) or less
   Allowable twist of connecting rod :
   0.1mm / 100mm (0.0039 in./3.94 in.) or less

CYLINDER BLOCK

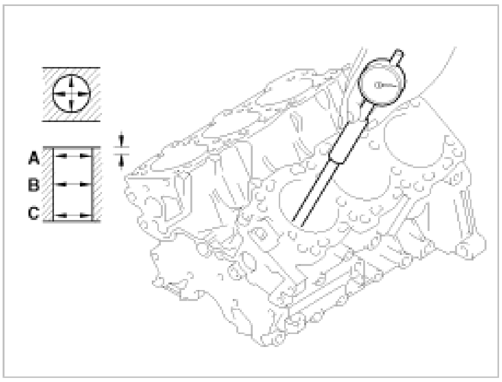
1. Remove gasket material.
   Using a gasket scraper, remove all the gasketmaterial from the top surface of the cylinder block.
2. Clean cylinder block
   Using a soft brush and solvent, thoroughly clean the cylinder block.
3. Inspect top surface of cylinder block for flatness.
   Using a precision straight edge and feeler gauge, measure the surface contacting the cylinder head gasket for warpage.

   Flatness of cylinder block gasket surface
   Standard : Less than 0.05mm(0.0020 in.),Less than 0.02mm(0.0008in.) / 150 x 150

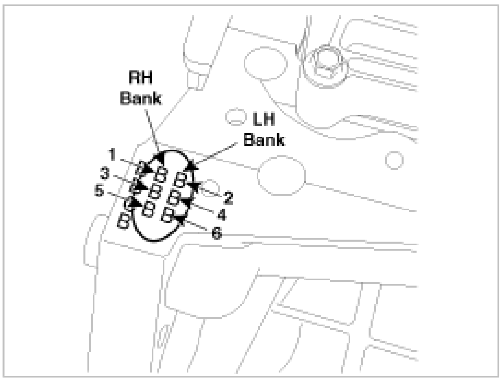


4. Inspect cylinder bore diameter
   Visually check the cylinder for vertical scratchs.
   If deep scratches are present, replace the cylinder block.
5. Inspect cylinder bore diameter
   Using a cylinder bore gauge, measure the cylinder bore diameter at position in the thrust and axial directions.

Standard diameter
92.00 ~ 92.03mm (3.6220 ~ 3.6232in.)

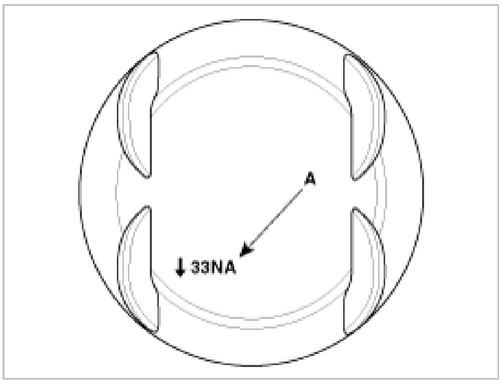


6. Check the cylinder bore size code on the cylinder block.



Class	Size code	Cylinder bore inner diameter
A	A	92.00~92.01mm (3.6220 ~ 3.6224in.)
B	B	92.01~92.02mm (3.6224 ~ 3.6228in.)
C	C	92.02~92.03mm (3.6228 ~ 3.6232in.)

7. Check the piston size code on the piston top face.



Class	Size code	Piston outer diameter
A	A	91.97~91.98mm (3.6209 ~ 3.6212in.)
B	B	91.98~91.99mm (3.6212 ~ 3.6216in.)
C	C	91.99~92.00mm (3.6216 ~ 3.6220in.)

8. Select the piston related to cylinder bore class.

Clearance : 0.02 ~ 0.04mm(0.0008 ~ 0.0016in.)

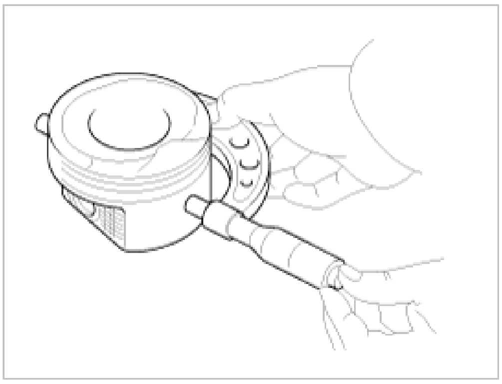
PISTON AND RINGS

1. Clean piston
   (1) Using a gasket scraper, remove the carbon from the piston top.
   (2) Using a groove cleaning tool or broken ring, clean the piston ring grooves.
   (3) Using solvent and a brush, thoroughly clean the piston.

   NOTE
   Do not use a wire brush.

2. The standard measurement of the piston outside diameter is taken 14 mm (0.5512 in.) from the bottom of the piston.

Standard diameter
91.97 ~ 92.00mm (3.6209~ 3.6220in.)



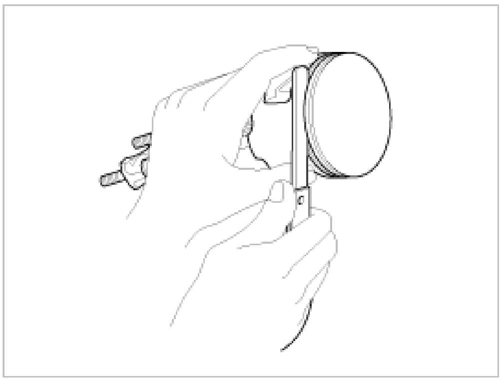
3. Calculate the difference between the cylinder bore diameter and the piston diameter.

Piston-to-cylinder clearance
0.02 ~ 0.04mm(0.0008 ~ 0.0016in.)

4. Inspect the piston ring side clearance.

Using a feeler gauge, measure the clearance between new piston ring and the wall of the ring groove.

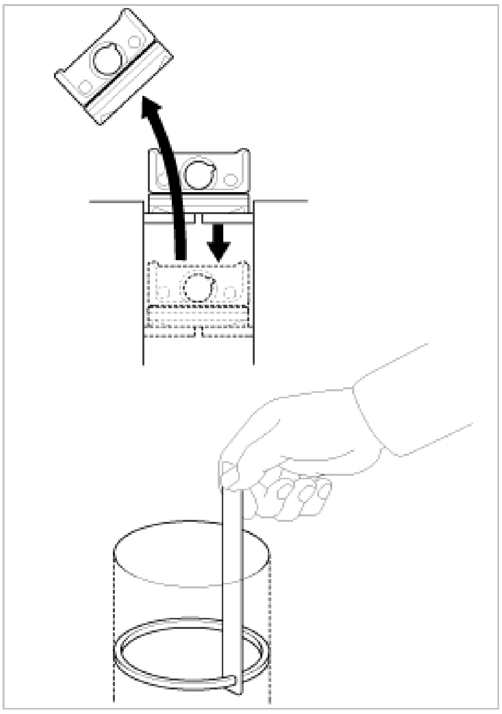
Piston ring side clearance
Standard
No.1 : 0.04 ~ 0.078mm (0.0016 ~ 0.0031in.)
No.2 : 0.03 ~ 0.07mm (0.0012 ~ 0.0027in.)
Oil ring : 0.06 ~ 0.15mm (0.0024 ~ 0.0059in.)
Limit
No.1 : 0.1mm (0.004in.)
No.2 : 0.1mm (0.004in.)
Oil ring : 0.2mm (0.008in.)



If the clearance is greater than maximum, replace the piston.

5. Inspect piston ring end gap.
To measure the piston ring end gap, insert a piston ring into the cylinder bore. Position the ring at right angles to the cylinder wall by gently pressing it down with a piston. Measure the gap with a feeler gauge. If the gap exceeds the service limit, replace the piston ring. If the gap is too large, recheck the cylinder bore diameter against the wear limits. If the bore is over the service limit, the cylinder block must be replaced.

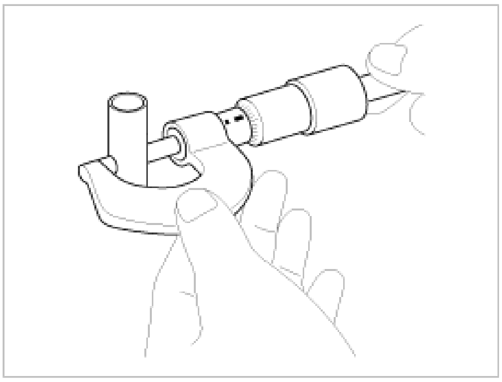
Piston ring end gap
Standard
No.1 : 0.17 ~ 0.32mm (0.0067 ~ 0.0126in.)
No.2 : 0.32 ~ 0.47m (0.0126 ~ 0.0185in.)
Oil ring : 0.20 ~ 0.70mm (0.0079 ~ 0.0275in.)
Limit
No.1 : 0.6mm (0.0236in.)
No.2 : 0.7mm (0.0275in.)
Oil ring : 0.8mm (0.0315in.)



PISTON PINS

1. Measure the diameter of the piston pin.

Piston pin diameter
23.002 ~ 23.006mm (0.9056 ~ 0.9057in.)



2. Measure the piston pin-to-piston clearance.

Piston pin-to-piston clearance
0.009 ~ 0.017mm (0.0004 ~ 0.0007in.)

3. Check the difference between the piston pin diameter and the connecting rod small end diameter.

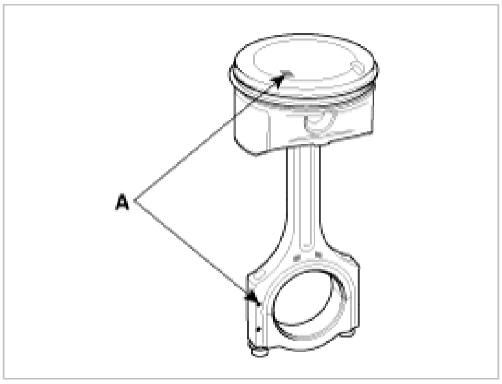
Piston pin-to-connecting rod interference
0.017 ~ 0.032mm (0.0007 ~ 0.0013in.)

REASSEMBLY

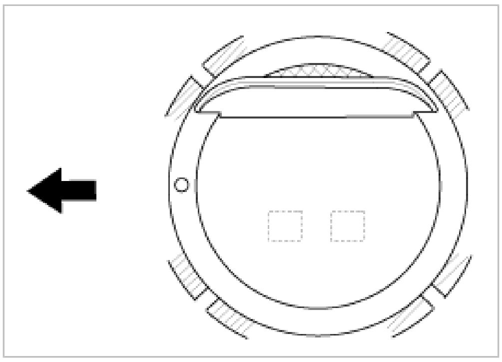
NOTE

- Thoroughly clean all parts to assembled.
- Before installing the parts, apply fresh engine oil to all sliding and rotating surfaces.
- Replace all gaskets, O-rings and oil seals with new parts.

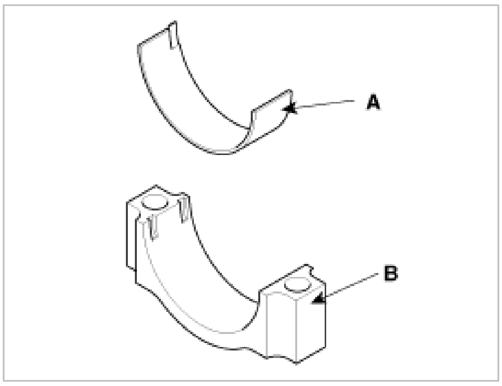
1. Assemble piston and connecting rod.
   (1) Use a hydraulic press for installation.
   (2) The piston front mark and the connecting rod front mark must face the timing belt side of the engine.



2. Install piston rings.
   (1) Install the oil ring spacer and 2 side rails by hand.
   (2) Using a piston ring expander, install the 2 compression rings with the code mark facing upward.
   (3) Position the piston rings so that the ring ends are as shown.



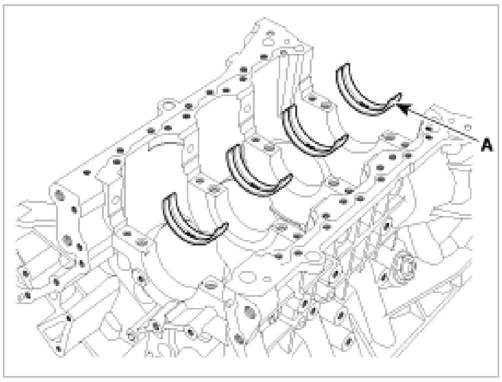
3. Install connecting rod bearings.
   (1) Align the bearing claw with the groove of the connecting rod or connecting rod cap.
   (2) Install the bearings(A) in the connecting rod and connecting rod cap(B).



4. Install main bearings.

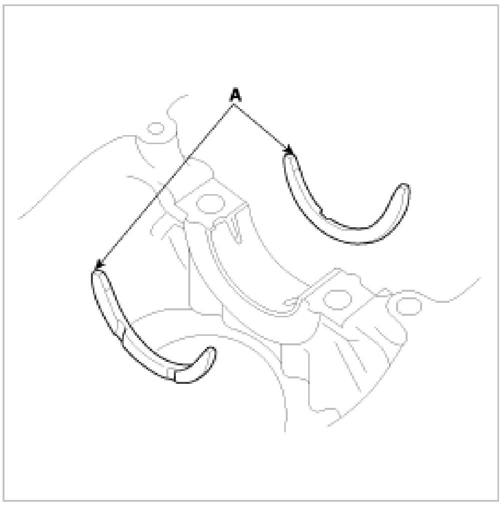
> **NOTE**
>
> Upper bearings have an oil groove of oil holes; Lower bearings do not.

   (1) Align the bearing claw with the claw groove of the cylinder block, push in the 4 upper bearings(A).

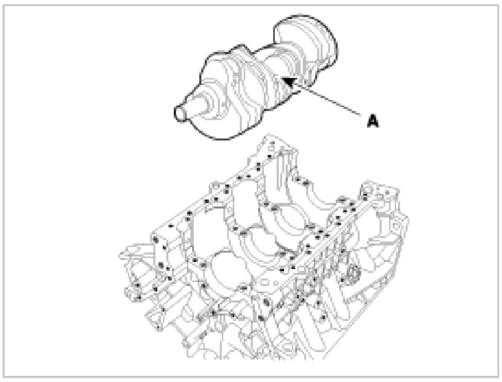


(2) Align the bearing claw with the claw groove of the main bearing cap, and push in the 4 lowerbearings.

5. Install thrust bearings.
   Install the 2 thrust bearings(A) under the No.3 journal position of the cylinder block with the oil grooves facing outward.



6. Place crankshaft on the cylinder block.

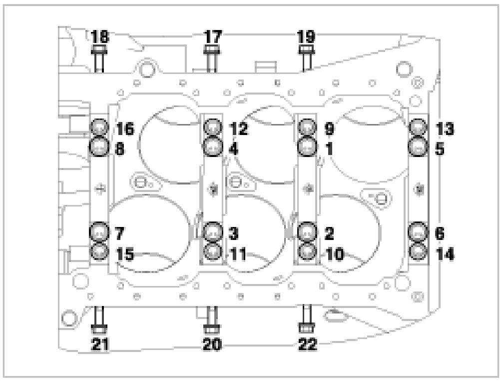


7. Place main bearing caps on cylinder block.
8. Install main bearing cap bolts.
   (1) Install and uniformly tighten the bearing cap bolts, in several passes, in the sequence shown.

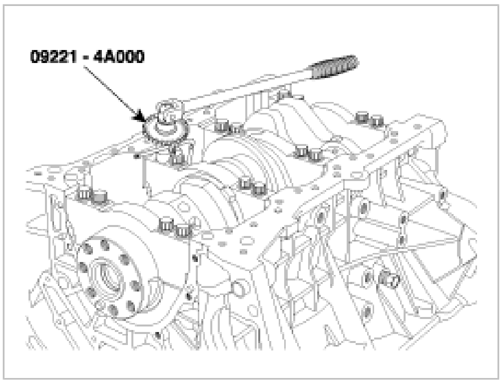
Tightening torque
Main bearing cap bolt
49.00Nm(5.0 kgf.m, 36.16lbf.ft) + 90° (1 ~ 8)
19.60 Nm(2.0 kgf.m, 14.46lbf.ft)+ 120° (9 ~ 16)
29.40 ~ 31.36Nm(3.0 ~ 3.2 kgf.m, 21.70 ~ 23.14lbf.ft) (17 ~ 22)

NOTE

- Always use new main bearing cap bolt.
- If any of the bearing cap bolts in broken or deformed, replace it.



Use SST(09221-4A000), install main bearing cap bolts.



(2) Check that the crankshaft turns smoothly.

9. Check crankshaft end play.
10. Install piston and connecting rod assemblies.

> **NOTE**
>
> Before installing the pistons, apply a coat of engine oil to the ring grooves and cylinder bores.

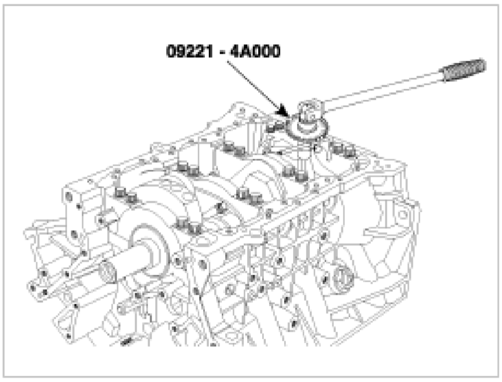
(1) Install the ring compressor, check that the bearing is securely in place, then position the piston in the cylinder, and tap it in using the wooden handle of a hammer.

(2) Stop after the ring compressor pops free, and check the connecting rod-to-check journal alignment before pushing the piston into place.

(3) Apply engine oil to the bolt threads. Install the rod caps with bearings, and torque the bolts.

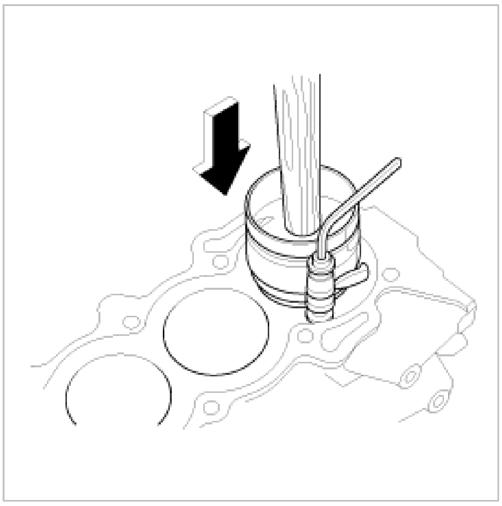
Tightening torque
17.7~21.6Nm (1.8~2.2kgf.m, 13.0~15.9lb-ft) + 88~92°

Use SST(09221-4A000), install connecting rod bearing cap bolts.



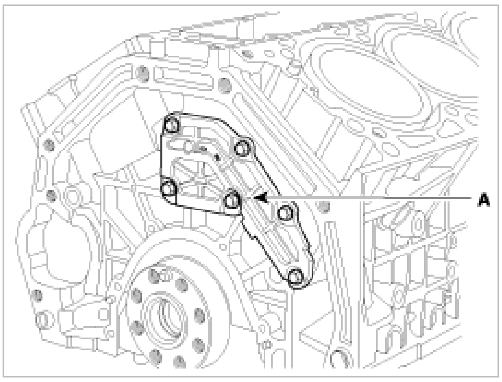
> **NOTE**
>
> • Always use new connecting rod bearing cap bolt.

• Maintain downward force on the ring compressor to prevent the rings from expanding before entering the cylinder bore.



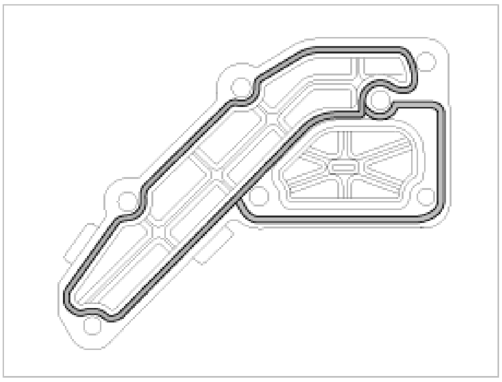
11. Check the connecting rod end play.
12. Install oil drain cover.

Tightening torque
9.80 ~ 11.76Nm (1.0 ~ 1.2kgf.m, 7.23 ~ 8.67lbf.ft)



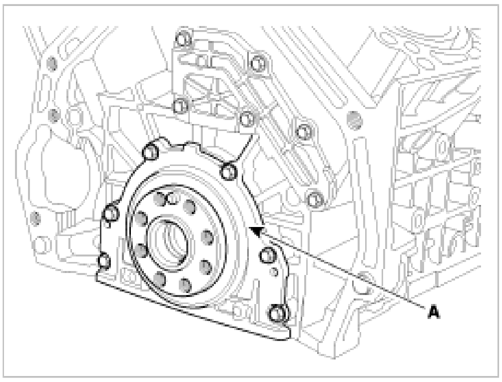
NOTE

• Make clean the sealing face before assembling two parts.
• Remove harmful foreign matters on the sealing face before applying sealant
• Be assembling oil drain cover, the liquid sealant TB1217H should be applied oil drain cover.
• The part must be assembled within 5 minutes after sealant was applied.
• Apply sealant to the inner threads of the bolt holes.



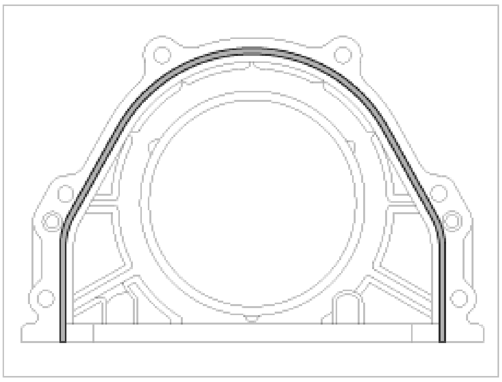
13. Install rear oil seal case.

Tightening torque
9.80 ~ 11.76Nm (1.0 ~ 1.2kgf.m, 7.23 ~ 8.67lbf.ft)

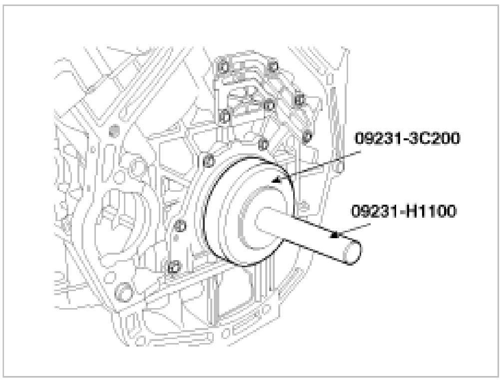


NOTE

- Make clean the sealing face before assembling two parts.
- Remove harmful foreign matters on the sealing face before applying sealant
- Be assembling rear oil seal case, the liquid sealant TB1217H should be applied rear oil seal case.
- The part must be assembled within 5 minutes after sealant was applied.
- Apply sealant to the inner threads of the bolt holes.

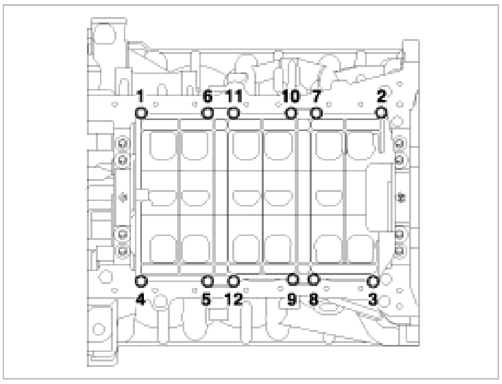


14. Using SST(09231-3C200, 09231-H1100), install rear oil seal.



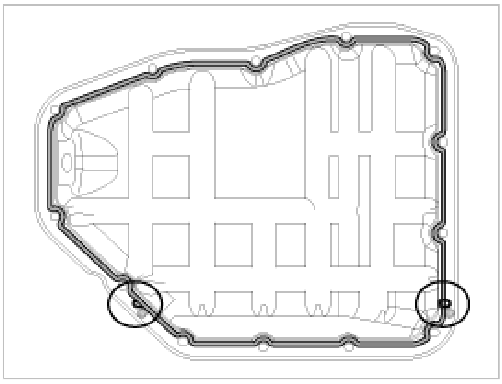
15. Install baffle plate.
    Install and uniformly tighten the baffle plate bolts, in several passes, in the sequence shown.

Tightening torque
9.80 ~ 11.76Nm (1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lbf.ft)



16. Install upper oil pan.
    A. Using a gasket scraper, remove all the old packing material from the gasket surfaces.
    B. Before assebling the oil pan, the liquid sealant TB1217H should be applied on upper oil pan. The part must be assembled within 5 minutes after the sealant was applied.

    Bead width : 2.5mm(0.1in.)

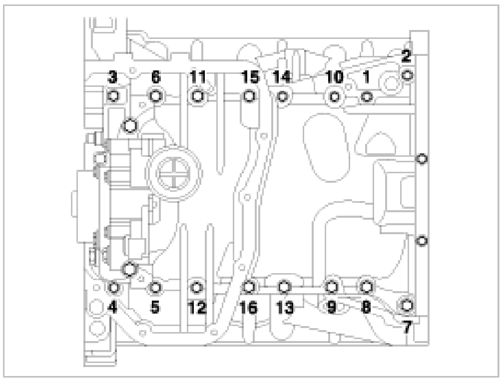


CAUTION

- Make clean the sealing face before assembling two parts.
- Remove harmful foreign matters on the sealing face before applying sealant
- When applying sealant gasket, sealant must not be protruded into the inside of oil pan.
- To prevent leakage of oil, apply sealant gasket ot the inner threads of the bolt holes.

    C. Install oil pan.
    Uniformly tighten the bolts in several passes.

    Tightening torque
    9.80 ~ 11.76Nm (1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lbf.ft)

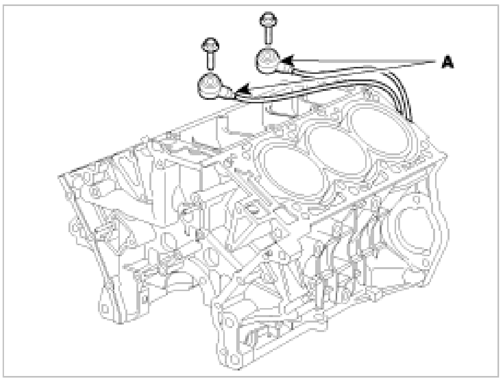


    D. After assembly, wait at least 30 minutes before filling the engine with oil.

17. Install knock sensor.

Tightening torque

15.68 ~ 23.52Nm (1.6 ~ 2.4kgf.m, 11.57 ~ 17.36lbf.ft)



18. Install drive plate.

Tightening torque
71.54 ~ 75.46Nm (7.3 ~ 7.7kgf.m, 52.80 ~ 55.69lbf.ft)

Engine Mechanical System > Cooling System > Description and Operation

ENGINE COOLANT REFILLING AND BLEEDING

WARNING

Never remove the radiator cap when the engine is hot. Serious scalding could be caused by hot fluid under high pressure escaping from the radiator.

CAUTION

When pouring engine coolant, be sure to shut the relay box lid and not to let coolant spill on the electrical parts or the paint. If any coolant spills, rinse it off immediately.

1. Make sure the engine and radiator are cool to the touch.
2. Remove radiator cap.
3. Loosen the drain plug, and drain the coolant.
4. Tighten the radiator drain plug securely.
5. Remove, drain and reinstall the reservoir. Fill the tank halfway to the MAX mark with water, then up to the MAX mark with antifreeze.
6. Fill fluid mixture with coolant and water(4 : 6) slowly through the radiator cap. Push the upper/lower hoses of the radiator so as bleed air easily.

NOTE

- Use only genuine antifreeze/coolant.
- For best corrosion protection, the coolant concentration must be maintained year-round at 50% minimum. Coolant concentrations less than 50% may not provide sufficient protection against corrosion or freezing.
- Coolant concentrations greater then 60% will impair cooling efficiency and are not recommended.

CAUTION

- Do not mix different brands of antifreeze/coolants.
- Do not use additional rust inhibitors or antirust products; they may not be compatible with the coolant.

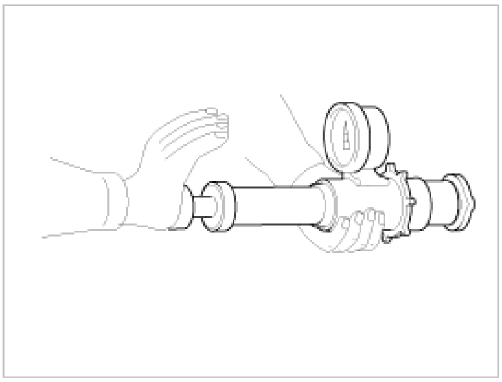
7. Start the engine and run coolant circulates.
When the cooling fan operates and coolant circulates, refill coolant through the radiator cap.
8. Repeat 7 until the cooling fan 3 ~ 5times and bleed air sufficiently out of the cooling system.
9. Install the radiator cap and fill the reservoir tank to the "MAX" line with coolant.

10. Run the vehicle under idle until the cooling fan operates 2 ~ 3 times.
11. Stop the engine and wait coolant gets cool.
12. Repeat 6 to 11 until the coolant level doesn't fall any more, bleed air out of the cooling system.

> **NOTE**
>
> As it is to bleed air out to the cooling system and refill coolant when coolant gets cool completely, recheck the coolant level in the reservoir tank for 2 ~ 3 days after replacing coolant.

CAP TESTING

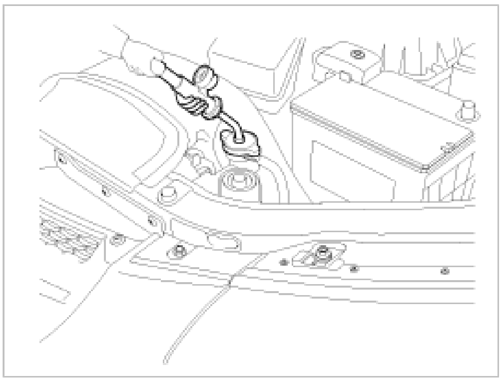
1. Remove the radiator cap, wet its seal with engine coolant, then install it no pressure tester.



2. Apply a pressure of 93 ~ 123kPa (0.95 ~ 1.25kgf/cm², 14 ~ 19psi)
3. Check for a drop in pressure.
4. If the pressure drops, replace the cap.

TESTING

1. Wait until engine is cool, then carefully remove the radiator cap and fill the radiator with engine coolant, then install it on the pressure tester.

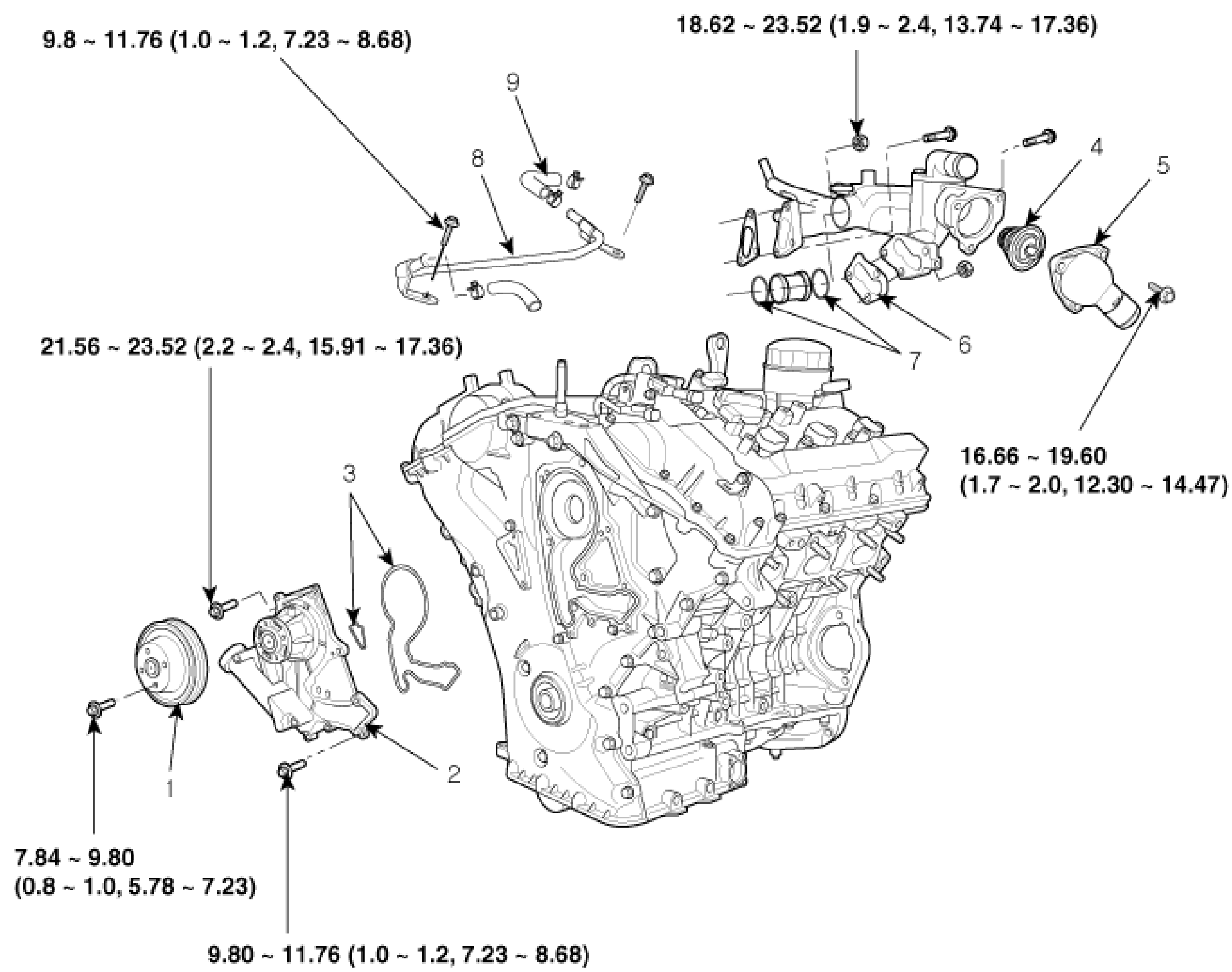


2. Apply a pressure tester to the radiator and apply a pressure of 93 ~ 123kPa (0.95 ~ 1.25kgf/cm² 14 ~18psi).
3. Inspect for engine coolant leaks and a drop in pressure.
4. Remove the tester and reinstall the radiator cap.

> **NOTE**
>
> Check for engine oil in the coolant and/or coolant in the engine oil.

Engine Mechanical System > Cooling System > Components and Components Location

COMPONENT



TORQUE : N.m (kgf.m, lb-ft)

1. Water pump pulley
2. Water pump
3. Water pump gasket
4. Thermostat
5. Water inlet pipe
6. Gasket
7. O - ring
8. Air vent pipe
9. Hose

Engine Mechanical System > Cooling System > Repair procedures

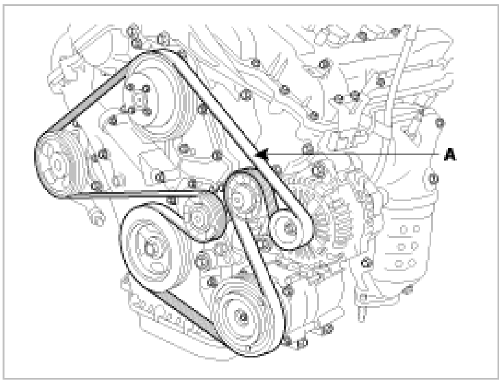
REMOVAL

WATER PUMP

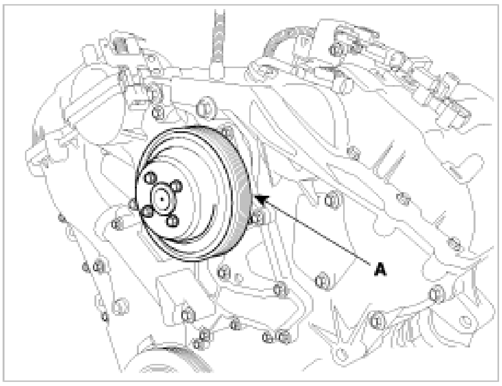
1. Drain the engine coolant.

> WARNING
>
> System is under high pressure when the engine is hot. To avoid danger of releasing scalding engine coolant, remove the cap only when the engine is cool.

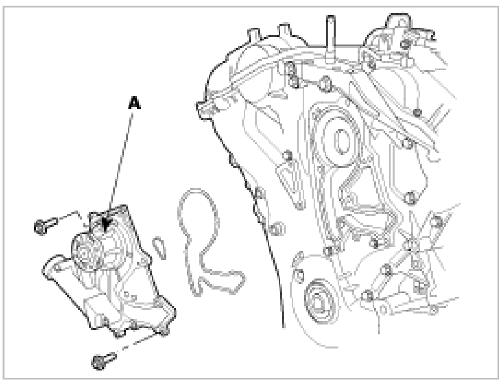
2. Remove drive belt(A).



3. Remove the 4 bolts and pump pulley(A).

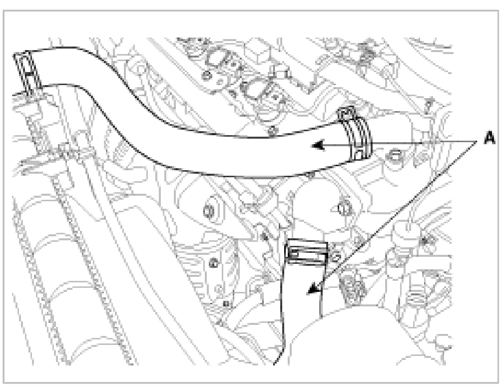


4. Remove the water pump(A) and gasket.



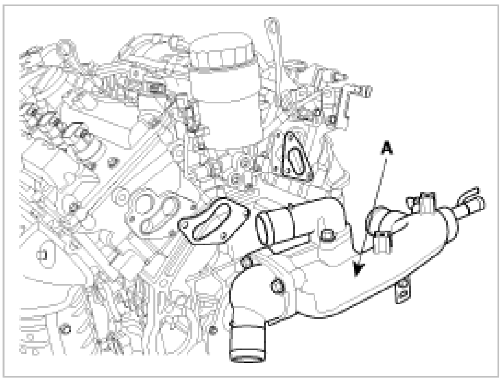
WATER TEMPERATURE CONTROL ASSEMBLY

1. Drain the engine coolant.
2. Remove air cleaner assembly.
3. Disconnect radiator upper and lower hose(A).



4. Disconnect WTS connector.
5. Disconnect heater hose, water vent hose and water hose from water temperature control assembly.
6. Remove wiring protector.

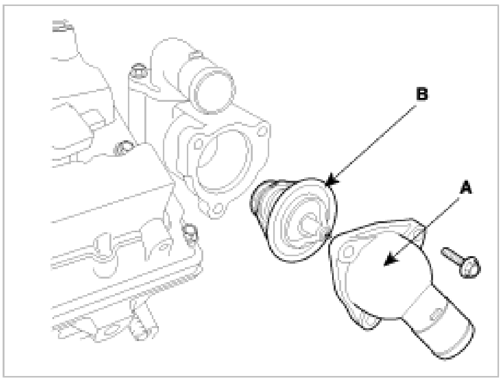
7. Remove water temperature control assembly(A).



THERMOSTAT

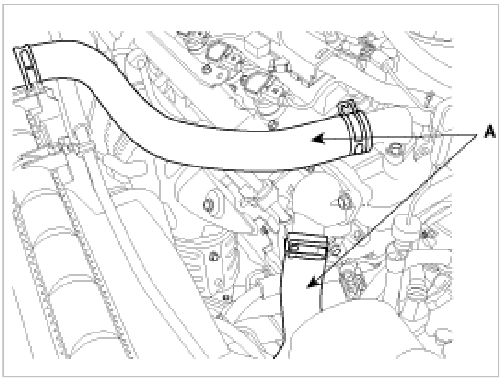
> **NOTE**
>
> Removal of the thermostat would have an adverse effect, causing a lowering of cooling efficiency. Do not remove the thermostat, even if the engine tends to overheat.

1. Drain engine coolant so its level is below thermostat.
2. Remove water inlet(A) and thermostat(B).



RADIATOR

1. Drain the engine coolant.
2. Disconnect radiator upper and lower hoses(A).



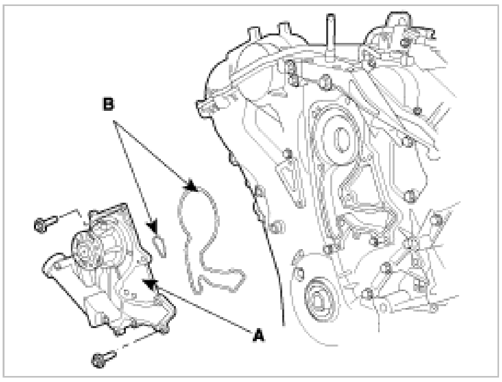
3. Disconnect transaxle oil cooler hoses.(See TR group)
4. Remove radiator bracket.
5. Remove radiator assembly.

INSTALLATION

WATER PUMP

1. Install the water pump(A) and a new gasket(B) with 12 bolts.

Tightening torque
21.56 ~ 23.52Nm (2.2 ~ 2.4kgf.m, 15.91 ~ 17.36lbf.ft)
9.80 ~ 11.76Nm (1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lbf.ft)

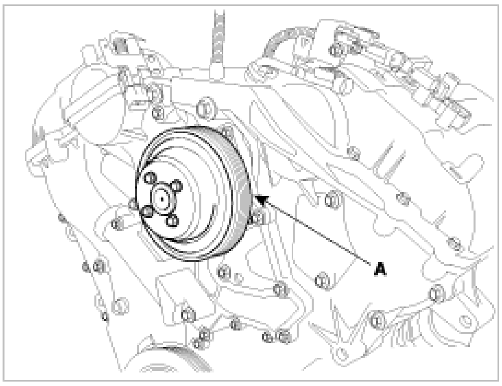


NOTE

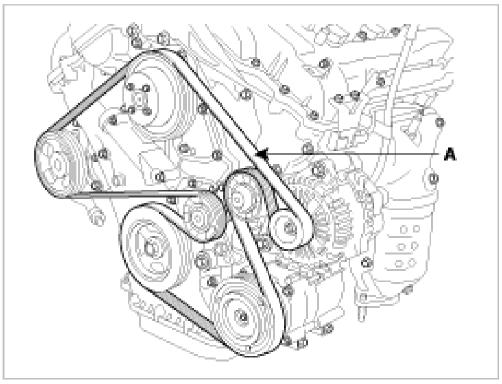
Make clean the contact face before assembly.

2. Install the 4 bolts and pump pulley(A).

Tightening torque
7.84 ~ 9.80Nm (0.8 ~ 1.0kgf.m, 5.78 ~ 7.23lbf.ft)



3. Install drive belt(A).



4. Fill with engine coolant.
5. Start engine and check for leaks.
6. Recheck engine coolant level.

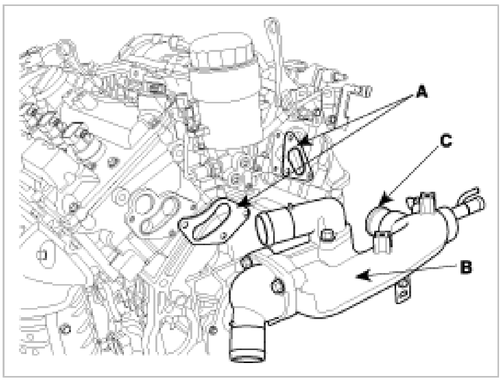
WATER TEMPERATURE CONTROL ASSEMBLY

NOTE

Make clean the contact face before assembly.

1. Install water temperature control assembly(B) and new gasket(A).

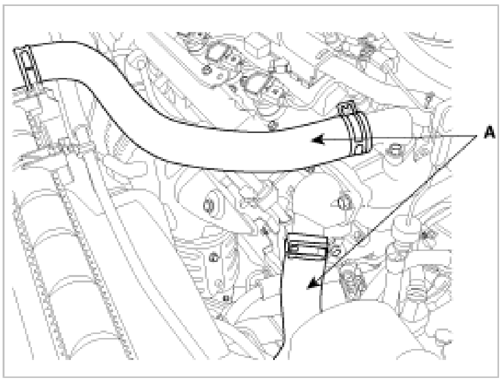
Tightening torque
18.62 ~ 23.52Nm (1.9 ~ 2.4kgf.m, 13.74 ~ 17.36lbf.ft)



NOTE

Use new O-rings(C) when reassembling.

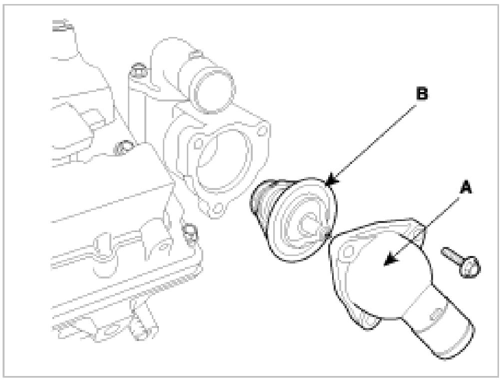
2. Connect water hoses to the water temperature control assembly.
3. Install wiring protector.
4. Connect WTS connector.
5. Connect radiator upper and lower hose(A).



6. Install air cleaner assembly.
7. Fill with engine coolant.
8. Start engine and check for leaks.
9. Recheck engine coolant level.

THERMOSTAT

1. Place thermostat in thermostat housing.
   (1) Install the thermostat with the jiggle valve upward.
   (2) Install a new thermostat(B).



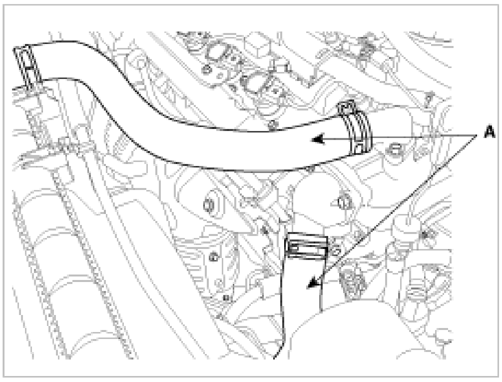
2. Install water inlet(A).

Tightening torque
16.66 ~ 19.60Nm (1.7 ~ 2.0kgf.m, 12.30 ~ 14.47lbf.ft)

3. Fill with engine coolant.
4. Start engine and check for leaks.

RADIATOR

1. Install radiator assembly.
2. Install radiator upper bracket.
3. Connect transaxle oil cooler hoses.(See TR group)
4. Connect radiator upper and lower hoses(A).



5. Fill with engine coolant.
6. Start engine and check for leaks.
7. Recheck engine coolant level.

INSPECTION

WATER PUMP

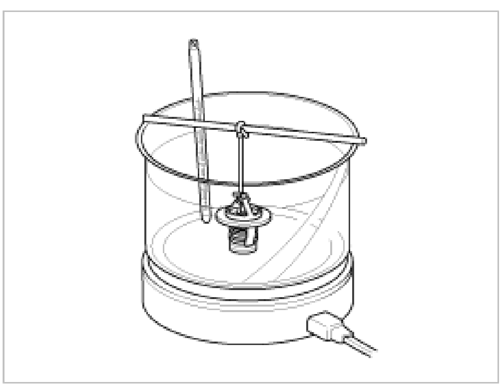
1. Check each part for cracks, damage or wear, and replace the coolant pump assembly if necessary.
2. Check the bearing for damage, abnormal noise and sluggish rotation, and replace the coolant pump assembly if necessary.
3. Check for coolant leakage. If coolant leaks from hole, the seal is defective. Replace the coolant pump assembly.

NOTE

A small amount of "weeping" from the bleed hole is normal.

THERMOSTAT

1. Immerse the thermostat in water and gradually heatthe water.



2. Check the valve opening temperature.
Valve opening temperature : 82°C (177°F)

Full opening temperature : 95°C (205°F)
If the valve opening temperature is not as specified, replace the thermostat.

3. Check the valve lift.
   Valve lift : Min. 10mm (0.4in.) at 95°C (205°F)
   If the valve lift is not as specified, replace the thermostat.

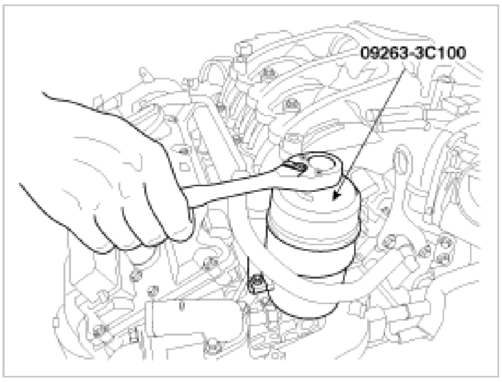
Engine Mechanical System > Lubrication System > Description and Operation

OIL AND FILTER

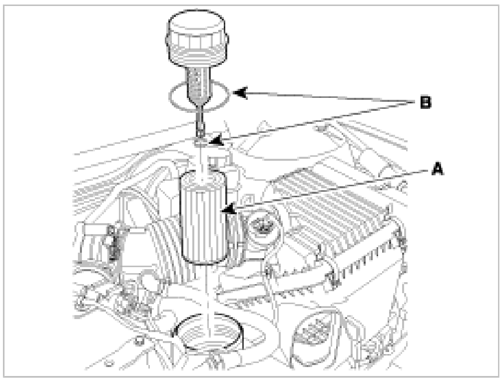
CAUTION

- Prolonged and repeated contact with mineral oil will result in the removal of natural fats from the skin, leading to dryness, irritation and dermatitis. In addition, used engine oil contains potentially harmful contaminants which may cause skin cancer.
- Exercise caution in order to minimize the length and frequency of contact of your skin to used oil. Wear protective clothing and gloves. Wash your skin thoroughly with soap and water, or use water-less hand cleaner, to remove any used engine oil. Do not use gasoline, thinners, or solvents.
- In order to preserve the environment, used oil and used oil filter must be disposed of only at designated disposal sites.

1. Park the car on level ground.
   Start the engine and let it warm up.
2. Turn the engine off and open the hood.
   Remove the engine cover.
3. Wait for 5minutes after loosening the oil filter cap by turning it counterclockwise with SST(09263-3C100) to drain well the oil in the oil filter.



4. Drain the engine oil.
   A. Remove the oil filler cap.
   B. After lifting the car, remove the oil drain plug and drain the oil into a container.
5. Replace oil filter.
   A. Disconnect the oil filter cap from oil filter body.
   B. Remove the oil filter element.
   C. Check and clean the oil filter installation surface.
   D. Check the part number of the new oil filter is as same as old one.
   E. Install new oil filter element(A) and two new O-rings(B).



F. Apply clean engine oil to the new O-rings.
   Lightly screw the oil filter cap into place, and tighten it until the O-ring contacts the seat.
G. Finally tighten it again by specified tightening torque.

Tightening torque
24.50Nm (2.5kgf.m, 18.08lbf.ft)

6. Refill with engine oil.
   A. Install the oil drain plug with a new gasket.

   Tightening torque
   34.3 ~ 44.1Nm (3.5 ~ 4.5kgf.m, 25.3 ~ 32.5lbf.ft)

   B. Fill with fresh engine oil, after remove the engine oil level gauge.

   Capacity
   Total : 6.4L(6.76U.S.qus,5.63lmp.qts)
   Oil pan : 5.5L(5.81U.S.qus,4.84lmp.qts)
   Oil filter : 0.4L(0.42U.S.qus,0.35lmp.qts)
   Drain and refill : 5.2L(5.49U.S.qus,4.58lmp.qts)

   C. Install the oil filler cap and oil level gauge.
7. Start the engine and check to be sure no oil is leaking from the drain plug or oil filter.
8. Recheck engine oil level.

INSPECTION

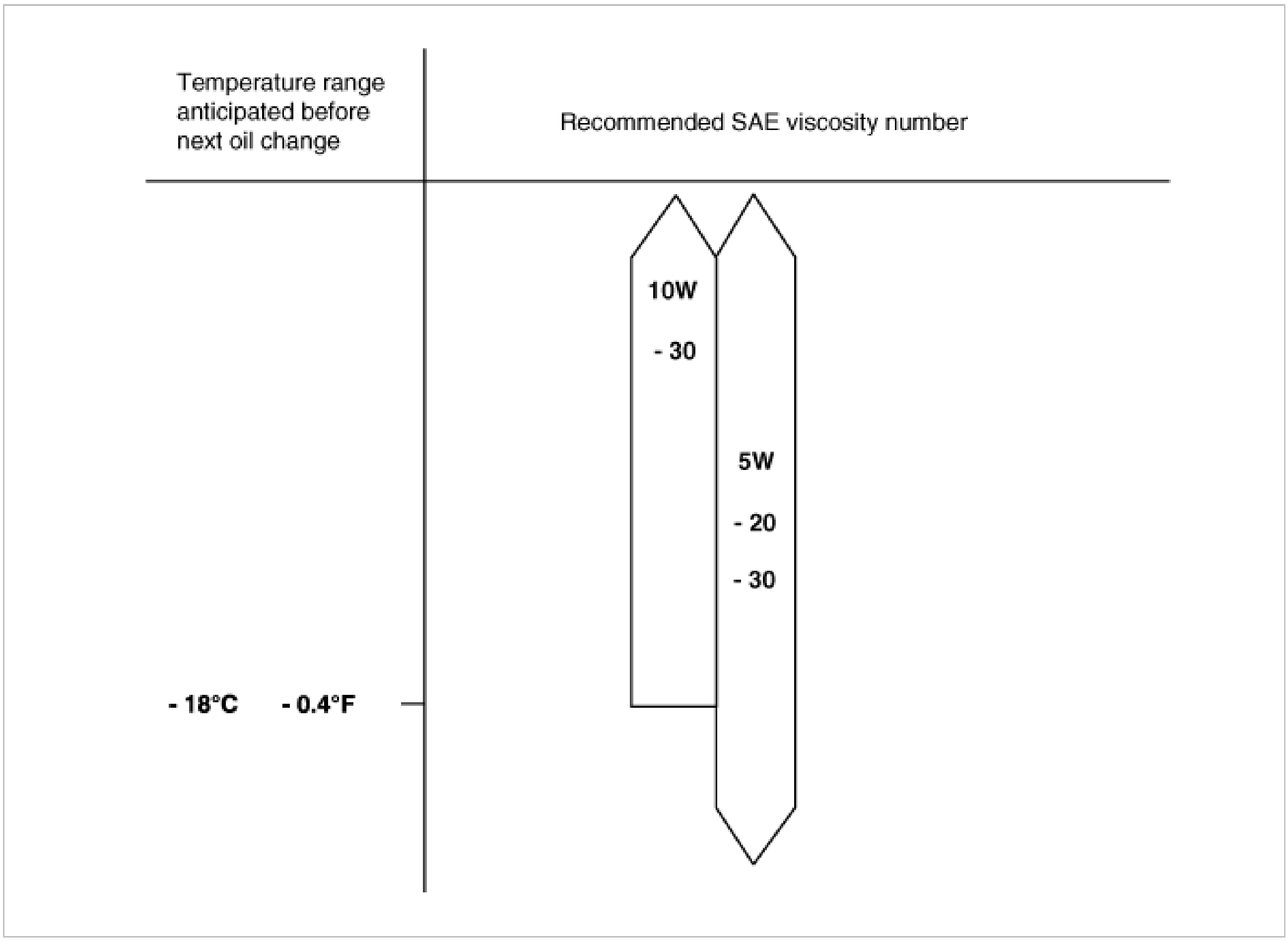
1. Check engine oil quality.
   Check the oil for deterioration, entry of water, discoloring or thinning.
   If the quality is visibly poor, replace the oil.
2. Check engine oil level.
   After warming up the engine and then 5 minutes after the engine stop, oil level should be between the "L" and "F" marks on the dipstick.
   If low, check for leakage and add oil up to the "F" mark.

NOTE

Do not fill with engine oil above the "F" mark.

SELECTION OF ENGINE OIL

Recommended API classification : Above SJ or SL
Recommended SAE viscosity grades : 5W-20
If 5W-20 engine oil is not available, 5W-30 or secondary recommanded engine oil for carrespanding temperature range can be used.



NOTE

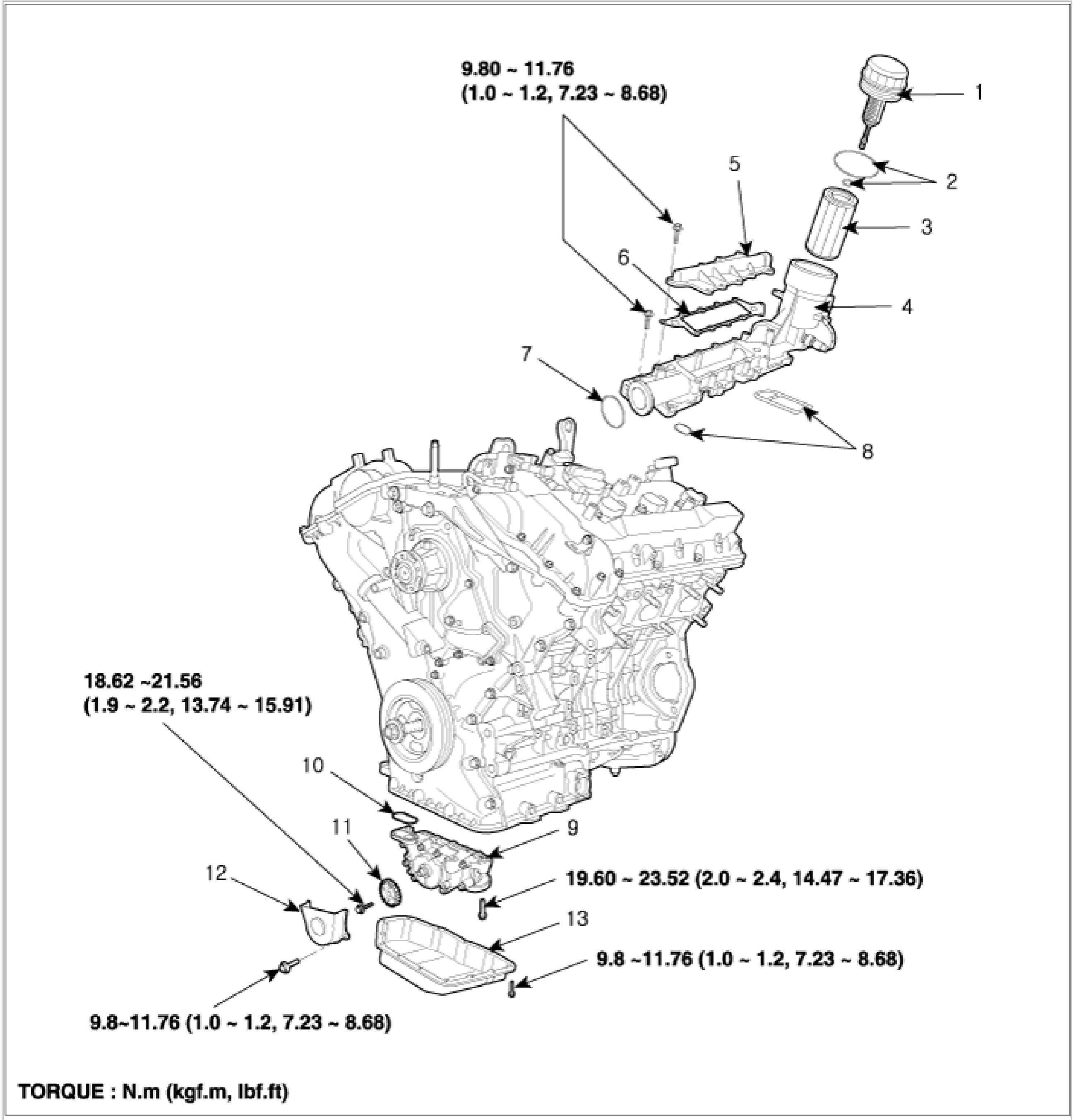
For best performance and maximum protection of all types of operation, select only those lubricants which :

- Satisfy the requirement of the API classification.
- Have proper SAE grade number for expected ambient temperature range.

Lubricants that do not have both an SAE grade number and API service classification on the container should not be used.

Engine Mechanical System > Lubrication System > Components and Components Location

COMPONENT



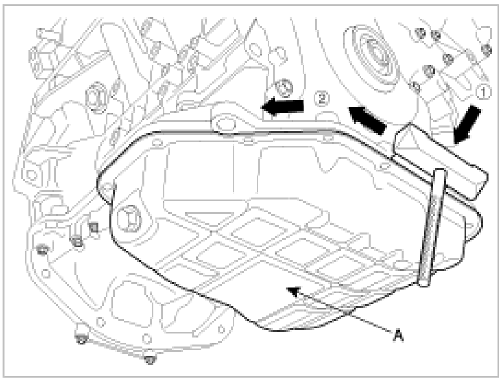
1. Oil filter cap
2. O - ring
3. Oil filter element
4. Oil filter body
5. Oil filter body cover
6. Gasket
7. O - ring
8. Gasket
9. Oil pump
10. Gasket
11. Oil pump sprocket
12. Oil pump chain cover
13. Lower oil paon

Engine Mechanical System > Lubrication System > Repair procedures

REMOVAL

Oil pump

1. Drain engine oil.
2. Using SST(09215-3C000) remove lower oil pan(A).

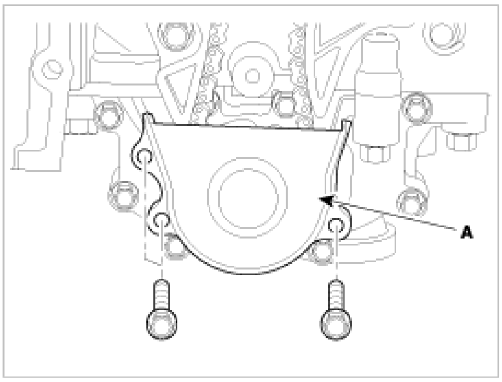


CAUTION

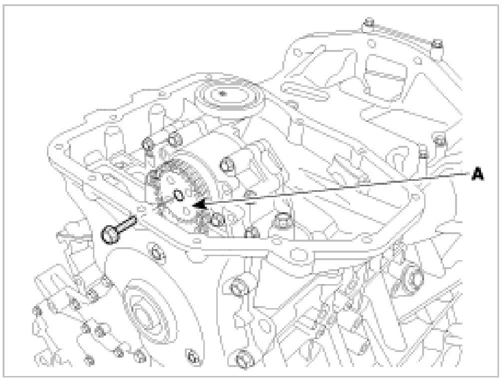
- Insert the SST between the oil pan and the ladder frame by tapping it with a plastic hammer in the direction of ① arrow.
- After tapping the SST with a plastic hammer along the direction of ② arrow around more than 2/3 edge of the oil pan, remove it from the ladder frame.
- Do not turn over the SST abruptly without tapping. It be result in damage of the SST.

Be careful not to damage the contact surfaces of upper oil pan and lower oil pan.

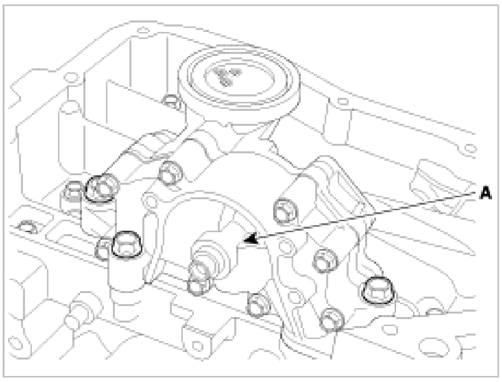
3. Remove oil pump chain cover(A).



4. Remove oil pump chain sprocket(A).

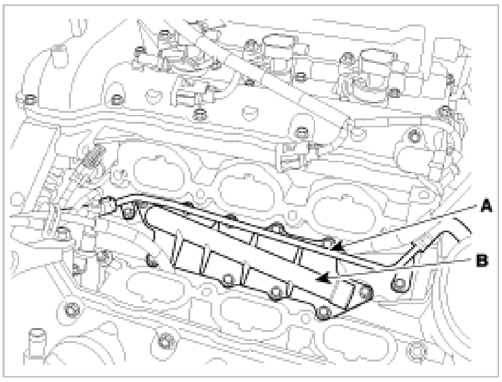


5. Remove oil pump(A).

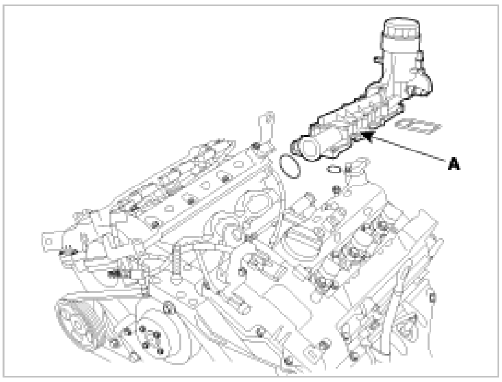


Oil filter assembly

1. Loosen the oil filter cap by turning it counterclockwise to drain well the oil in the oil filter.
2. Remove surge tank and intake manifold.
3. Disconnect oil pressure switch connector.
4. Drain the engine coolant.
5. Disconnect water hoses from ETC.
6. Remove water temperature control assembly.
7. Disconnect water vent hose(A).
8. Remove oil filter body cover(B).



9. Remove oil filter body.(A).



> NOTE
>
> Be careful of the knock sensor connector.

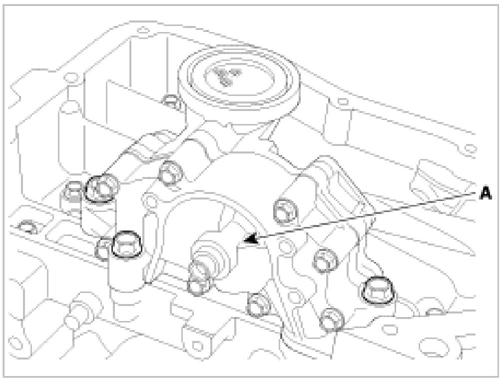
INSTALLATION

Oil pump

1. Install oil pump(A).

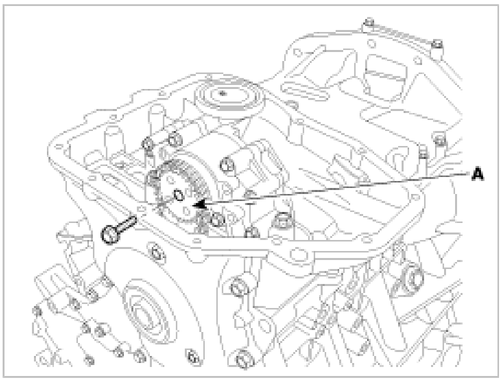
Tightening torque
19.60 ~ 23.52Nm (2.0 ~ 2.4kgf.m, 14.47 ~ 17.36lbf.ft)

> NOTE
>
> Always use a new O-ring.



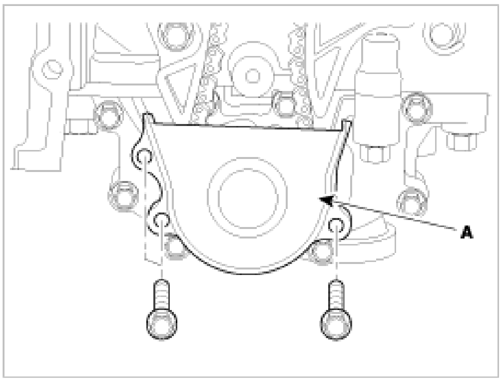
2. Install oil pump sprocket(A)and oil pump chain on the oil pump.

Tightening torque
18.62 ~ 21.56Nm (1.9 ~ 2.2kgf.m, 13.74 ~ 15.91lbf.ft)



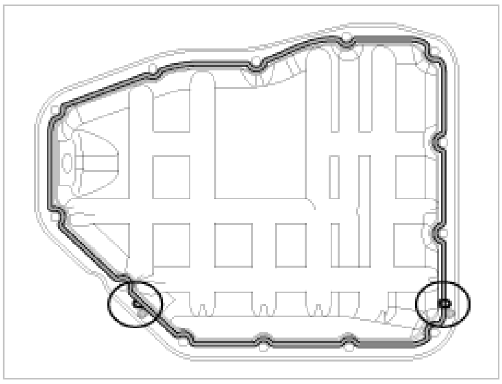
3. Install oil pump chain cover(A).

Tightening torque
9.80 ~ 11.76Nm (1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lbf.ft)



4. Install upper oil pan.
   A. Using a gasket scraper, remove all the old packing material from the gasket surfaces.
   B. Before assembling the oil pan, the liquid sealant TB1217H should be applied on upper oil pan. The part must be assembled within 5 minutes after the sealant was applied.

   Bead width : 2.5mm(0.1in.)

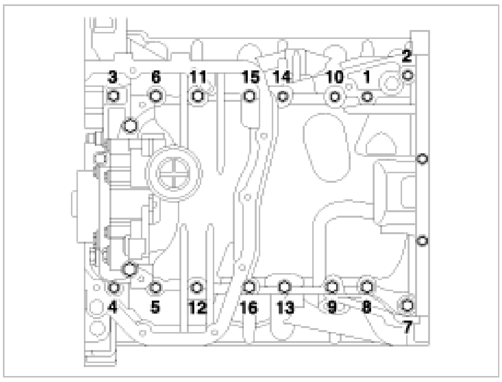


CAUTION

- Make clean the sealing face before assembling two parts.
- Remove harmful foreign matters on the sealing face before applying sealant
- When applying sealant gasket, sealant must not be protruded into the inside of oil pan.
- To prevent leakage of oil, apply sealant gasket ot the inner threads of the bolt holes.

C. Install upper oil pan.
   Uniformly tighten the bolts in several passes.

Tightening torque
9.80 ~ 11.76Nm (1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lbf.ft)

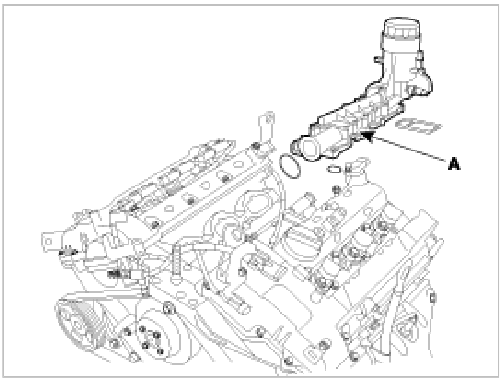


D. After assembly, wait at least 30 minutes before filling the engine with oil.

OIL FILTER ASSEMBLY

1. Install oil filter body(A) and new O-rings.

Tightening torque
9.80 ~ 11.76Nm (1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lbf.ft)

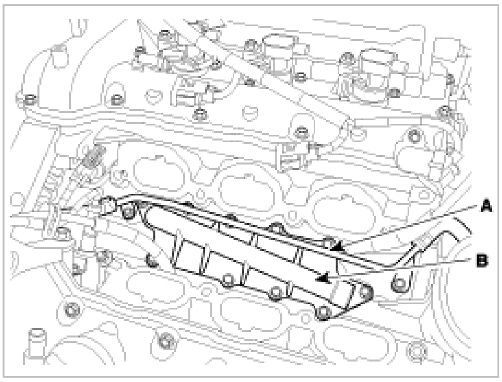


NOTE

• All rubber gasket must be no damaged by assembling parts.
• Be careful of the knock sensor connector.
• Always use a new O-ring

2. Install oil filter body cover(B) and new gasket on the oil filter body.

Tightening torque
9.80 ~ 11.76Nm (1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lbf.ft)



3. Connect water vent hose.

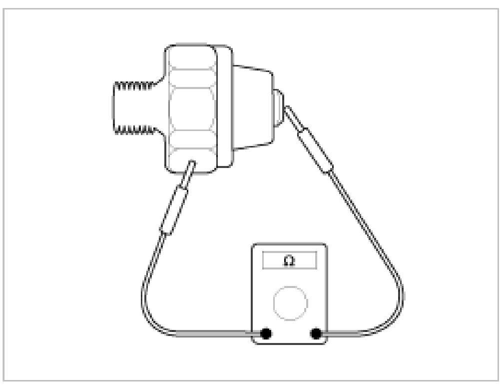
Tightening torque
9.80 ~ 11.76Nm (1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lbf.ft)

4. Install water temperature control assembly.
5. Connect water hoses on the ETC.
6. Connect oil pressure switch connector.
7. Install intake manifold and surge tank.
8. Fill with engine coolant.
9. Start engine and check for leaks.
10. Recheck engine coolant level.

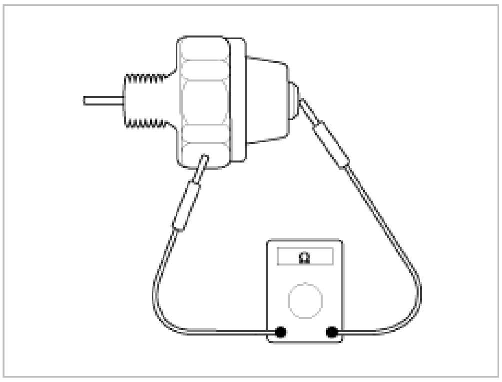
INSPECTION

OIL PRESSURE SWITCH

1. Check the continuity between the terminal and the body with an ohmmeter.
   If there is no continuity, replace the oil pressure switch.

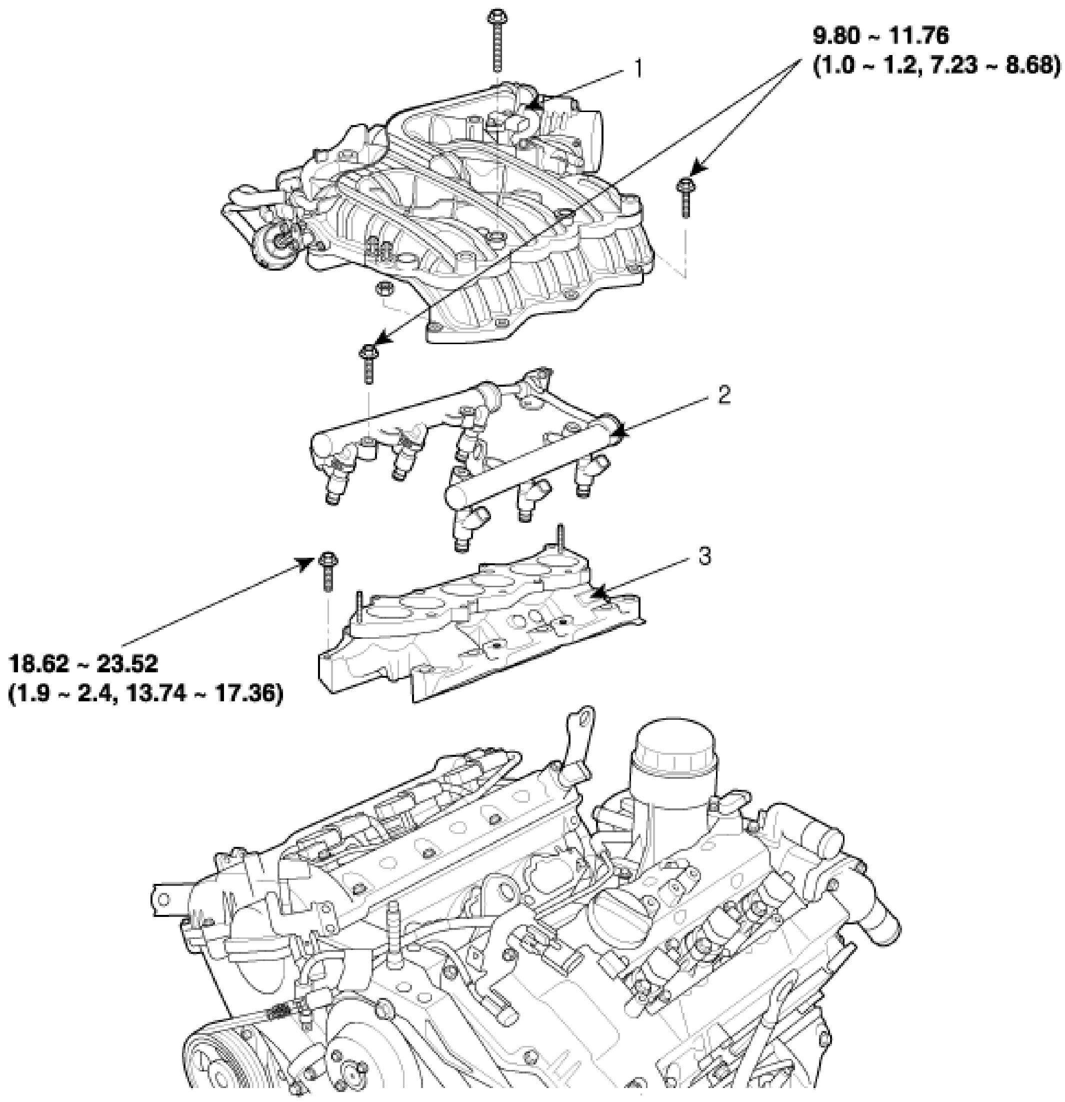


2. Check the continuity between the terminal and the body when the fine wire is pushed. If there is continuity even when the fine wire is pushed, replace the switch.
3. If there is no continuity when a 50kpa (7psi) is applied throgh the oil hole, the switch is operaing properly.
   Check for air leakage. If air leaks, the diaphragm is broken. Replace it.



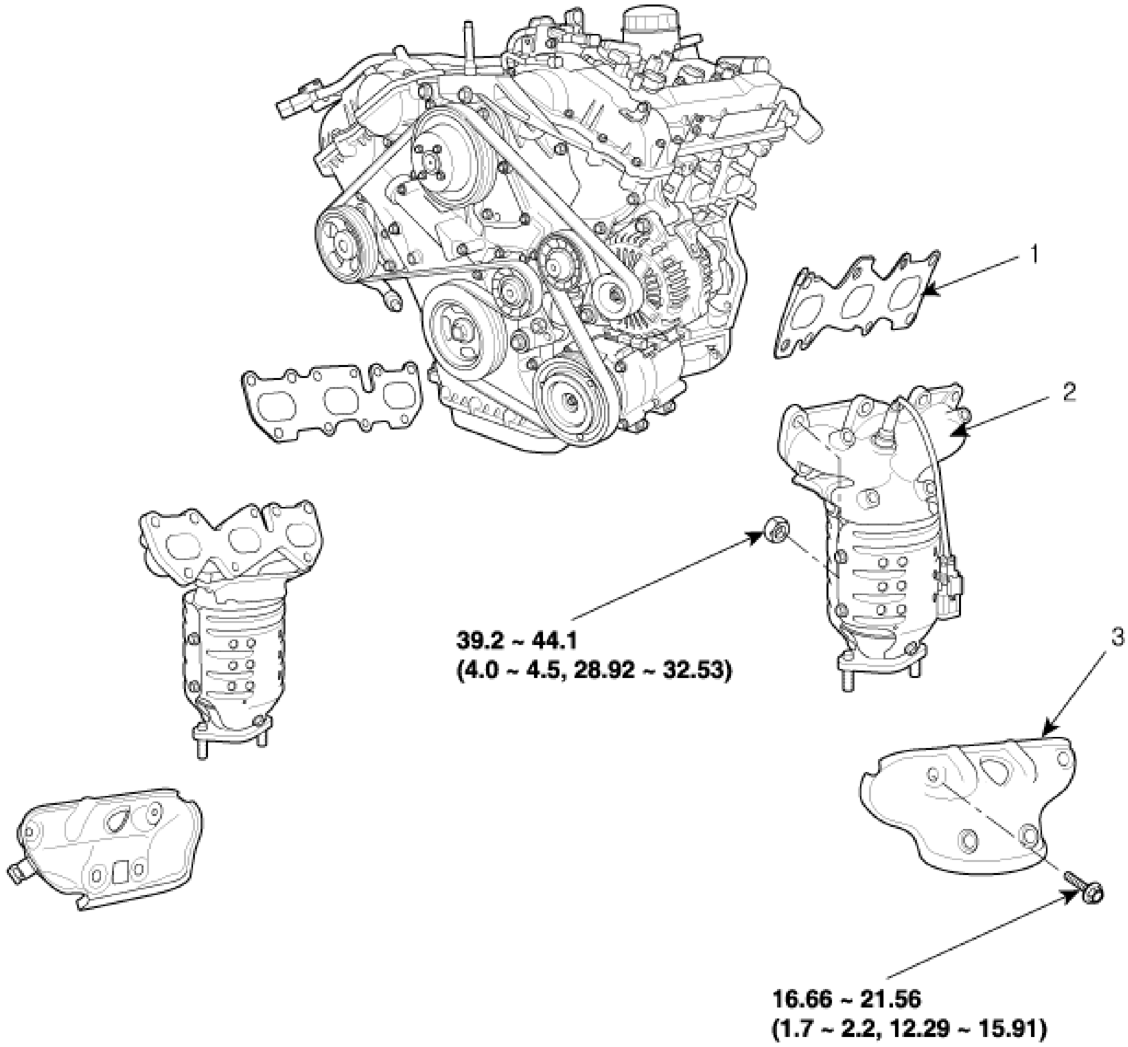
Engine Mechanical System > Intake And Exhaust System > Components and Components Location

COMPONENT



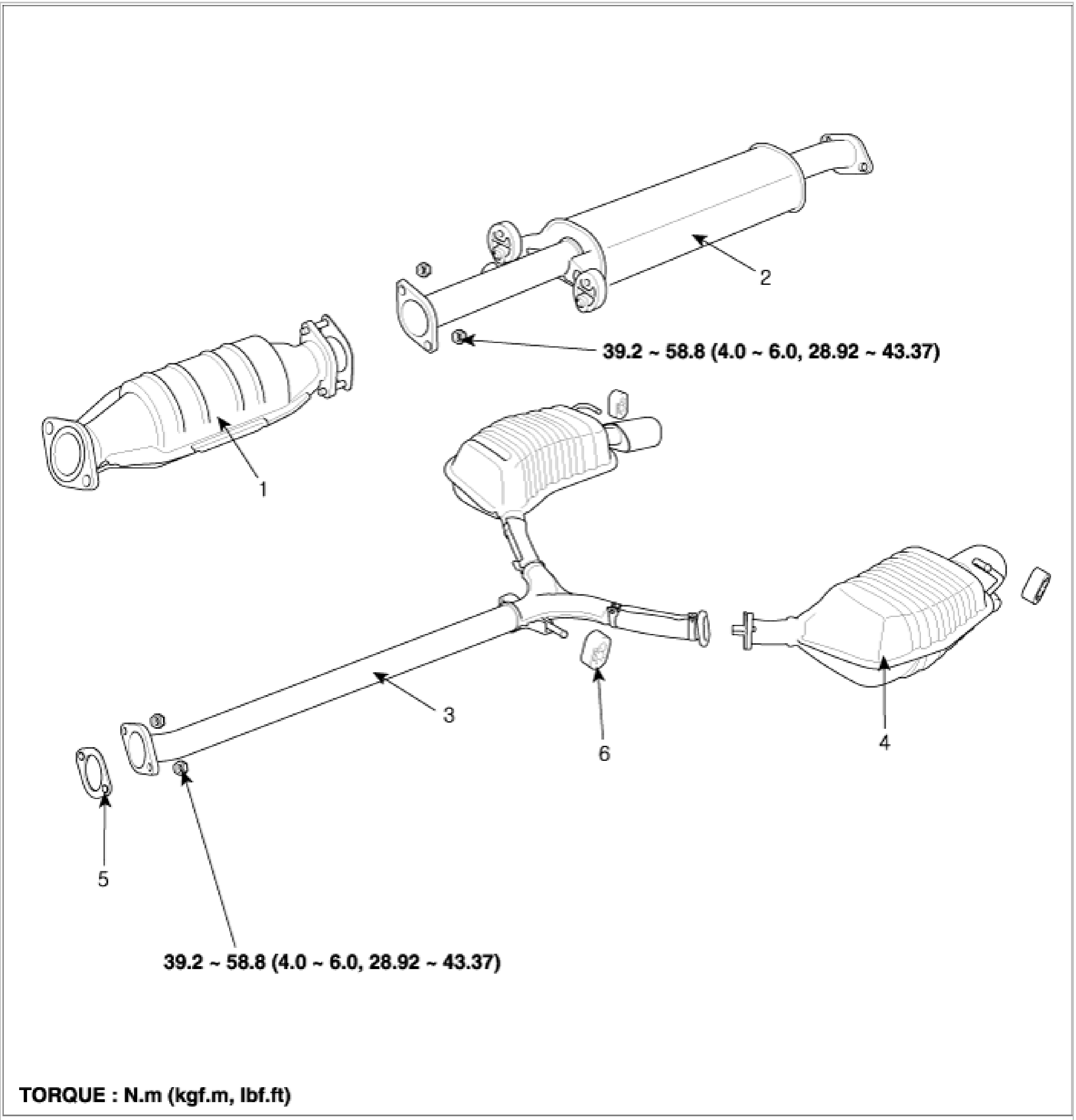
TORQUE : N.m (kgf.m, lbf.ft)

1. Surge tank
2. Delivery pipe
3. Intake manifold



TORQUE : N.m (kgf.m, lbf.ft)

1. Gasket
2. Exhaust manifold
3. Heat protector



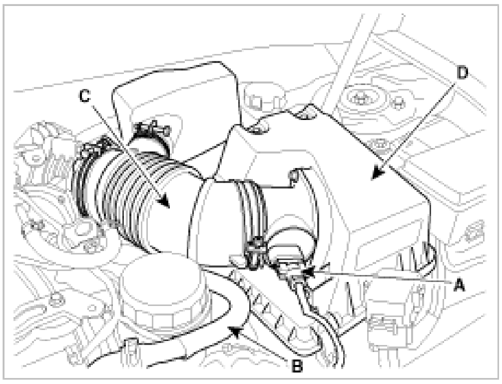
1. Catalytic converter
2. Center muffler
3. Main muffler
4. LH muffler
5. Gasket
6. Rubber hanger

Engine Mechanical System > Intake And Exhaust System > Repair procedures

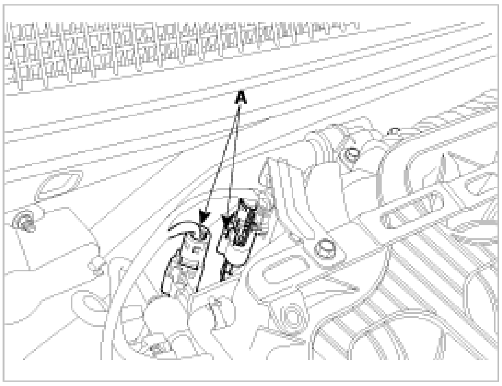
REMOVAL

INTAKE MANIFOLD

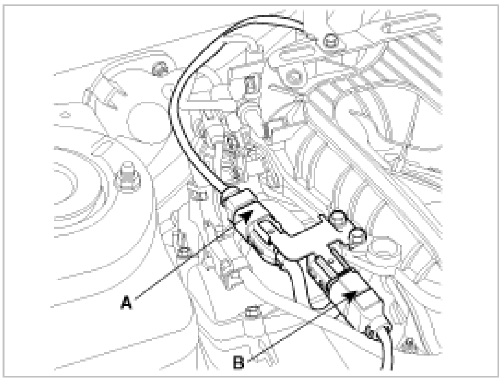
1. Disconnect AFS(A) and breather hose(B).
2. Remove air cleaner upper cover(D) and intake hose(C).



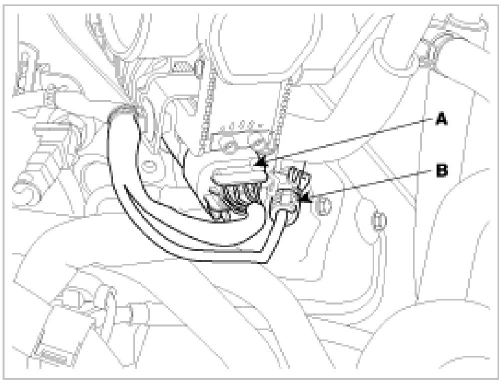
3. Disconnect RH oxygen sensor connector(A).



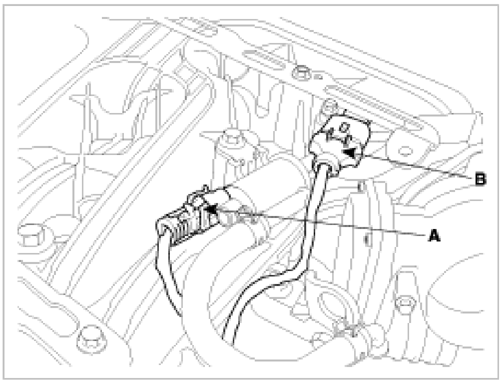
4. Disconnect RH injector connector(A) and ignition coil connector(B).



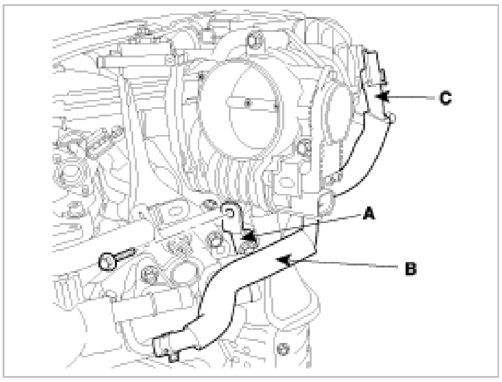
5. Disconnect ETC connector(A) and knock sensor connector(B).



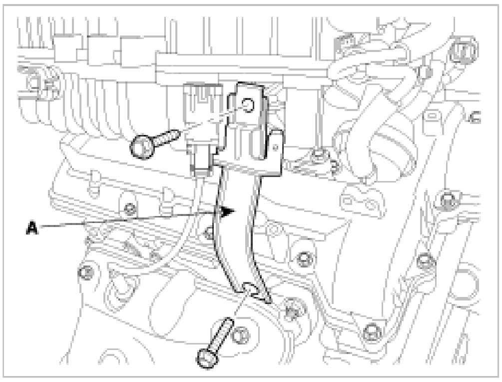
6. Disconnect PCSV connector(A), MAP sensor connector(B) and PCSV hose.



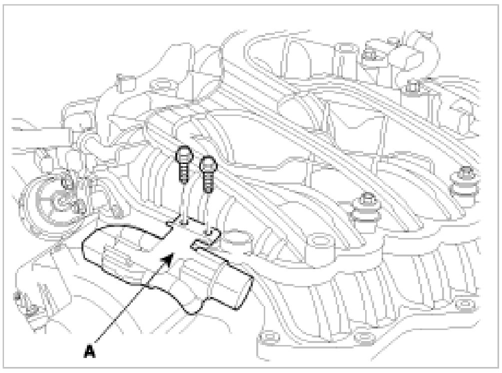
7. Remove ETC bracket(A).
8. Disconnect water hoses(B) from ETC.
9. Disconnect PCV(C) hose.



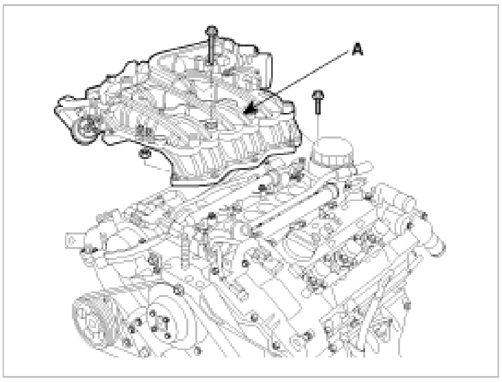
10. Disconnect brake vacuum hose.
11. Remove surge tank stay(A).



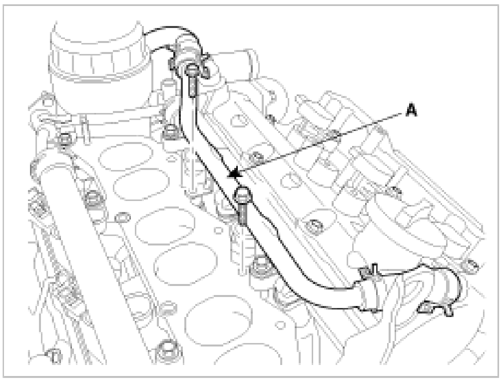
12. Remove connector bracket(A) from surge tank.



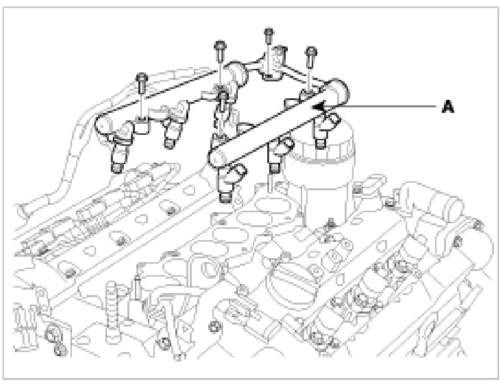
13. Remove surge tank(A).



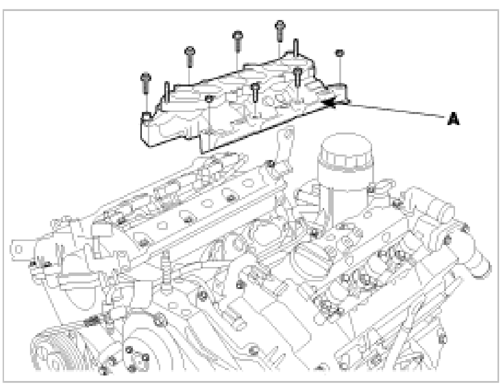
14. Disconnect breather hose(A).



15. Disconnect LH injector connector.
16. Remove delivery pipe(A).

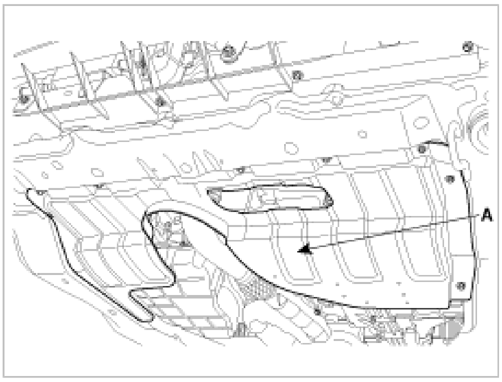


17. Remove intake manifold(A) and gasket.

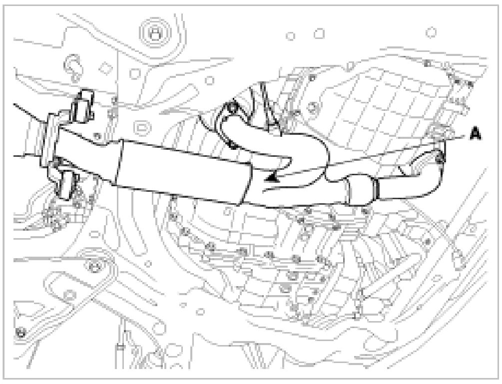


EXHAUST MANIFOLD

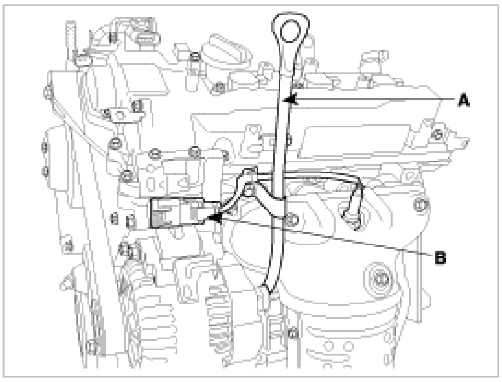
1. Remove under cover(A).



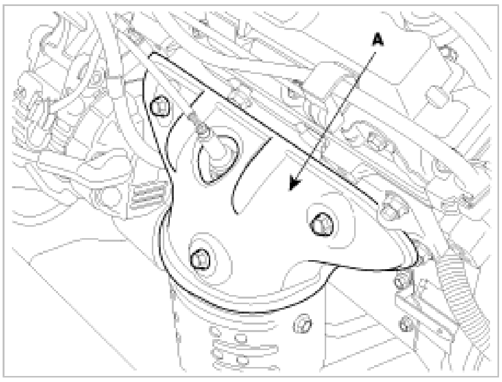
2. Disconnect LH,RH rear oxygen sensor connector from bracket.
3. Remove front muffler(A).



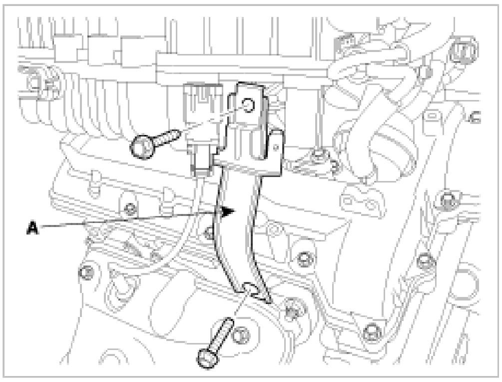
4. Remove oil level gauge(A).
5. Disconnect LH front oxygen sensor connector(B) from bracket.



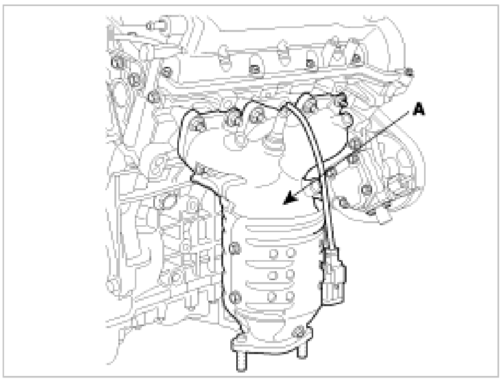
6. Remove LH heat protector.



7. Remove LH exhaust manifold.
8. Disconnect RH front oxygen sensor connector from bracket.



9. Remove RH heat protector.
10. Remove RH exhaust manifold.



INSTALLATION

INTAKE MANIFOLD

1. Install intake manifold and new gasket on the cylinder head.

Tightening torque
18.62 ~ 23.52Nm (1.9 ~ 2.4kgf.m, 13.74 ~ 17.36lbf.ft)

NOTE
Be careful of the installation direction.

2. Install delivery pipe.(See FL group)
3. Connect LH injector connector.
4. Connect breather hose.

Tightening torque
9.80 ~ 11.76Nm (1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lbf.ft)

5. Install surge tank.

Tightening torque
9.80 ~ 11.76Nm (1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lbf.ft)

6. Install connector bracket on the surge tank.

Tightening torque
6.86 ~ 10.78Nm (0.7 ~ 1.1kgf.m, 5.06 ~ 7.96lbf.ft)

7. Install surge tank stay.

Tightening torque
27.44 ~ 31.36Nm (2.8 ~ 3.2kgf.m, 20.25 ~ 23.14lbf.ft)

8. Connect brake vacuum hose.
9. Connect PCV hose.
10. Connect water hoses to ETC.
11. Install ETC bracket.

Tightening torque
15.68 ~ 25.48Nm (1.6 ~ 2.6kgf.m, 11.57 ~ 18.80lbf.ft)

12. Connect ETC connector and knoch sensor connector.
13. Connect PCSV connector, MAP sensor connector and PCSV hoe.
14. Connect RH injector connector and ignition coil connector.
15. Connect RH oxygen sensor connector.
16. Install air cleaner upper cover and in take hose.
17. Connect AFS(A) and breather hose.

EXHAUST MANIFOLD

1. Install new gasket and exhaust manifold.

Tightening torque
39.2 ~ 44.1Nm(4.0 ~ 4.5kgf.m, 28.92 ~ 32.53lbf.ft)

2. Install heat protector.

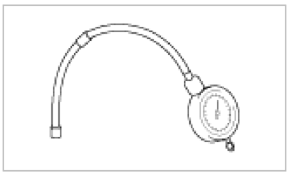
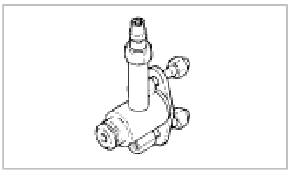
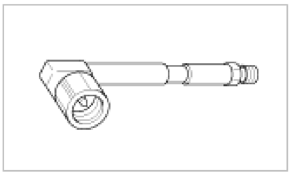
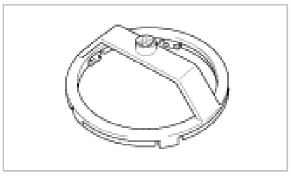
Tightening torque
16.66 ~ 21.56Nm(1.7 ~ 2.2kgf.m, 12.30 ~ 15.91lbf.ft)

3. Install front muffler.

Tightening torque
39.2 ~ 58.8N.m(4.0 ~ 6.0kgf.m, 28.92 ~ 43.37lbf.ft)

4. Connect oxygen sensor connector.
5. Install under cover.

SPECIAL SERVICE TOOLS

Tool (Number and name)	Illustration	Application
09353-24100 Fuel Pressure Gauge		Measuring the fuel line pressure
09353-38000 Fuel Pressure Gauge Adapter		Connection between the delivery pipe and fuel feed line
09353-24000 Fuel Pressure Gauge Connector		Connection between Fuel Pressure Gauge (09353-24100) and Fuel Pressure Gauge Adapter (09353-38000)
09310-3K000 Fuel Pump Locking Ring Wrench		Removing the fuel Pump assembly

BASIC TROUBLESHOOTING

BASIC TROUBLESHOOTING GUIDE

1	**Bring Vehicle to Workshop**

2	**Analyze Customer's Problem**
•	Ask the customer about the conditions and environment relative to the issue (Use CUSTOMER PROBLEM ANALYSIS SHEET).

3	**Verify Symptom, and then Check DTC and Freeze Frame Data**
•	Connect Hi-Scan (Pro) to Diagnostic Link Connector (DLC).
•	Record the DTC and freeze frame data.
	NOTE *To erase DTC and freeze frame data, refer to Step 5.*

4	**Confirm the Inspection Procedure for the System or Part**
•	Using the SYMPTOM TROUBLESHOOTING GUIDE CHART, choose the correct inspection procedure for the system or part to be checked.

5	**Erase the DTC and Freeze Frame Data**
	WARNING **NEVER erase DTC and freeze frame data before completing Step 2 MIL/DTC in "CUSTOMER PROBLEM ANALYSIS SHEET".**

6	**Inspect Vehicle Visually**
•	Go to Step 11, if you recognize the problem.

7	**Recreate (Simulate) Symptoms of the DTC**
•	Try to recreate or simulate the symptoms and conditions of the malfunction as described by customer.
•	If DTC(s) is/are displayed, simulate the condition according to troubleshooting procedure for the DTC.

8	**Confirm Symptoms of Problem**
•	If DTC(s) is/are not displayed, go to Step 9.
•	If DTC(s) is/are displayed, go to Step 11.

9	**Recreate (Simulate) Symptom**
•	Try to recreate or simulate the condition of the malfunction as described by the customer.

10	**Check the DTC**
•	If DTC(s) does(do) not occur, refer to INTERMITTENT PROBLEM PROCEDURE in BASIC INSPECTION PROCEDURE.
•	If DTC(s) occur(s), go to Step 11.

11	**Perform troubleshooting procedure for DTC**
12	**Adjust or repair the vehicle**
13	**Confirmation test**
14	**END**

CUSTOMER PROBLEM ANALYSIS SHEET

1. VEHICLE INFORMATION

(I) VIN:
(II) Production Date:
(III) Odometer Reading: (miles)

2. SYMPTOMS

□ Unable to start	□ Engine does not turn over □ Incomplete combustion □ Initial combustion does not occur
□ Difficult to start	□ Engine turns over slowly □ Other_________________
□ Poor idling	□ Rough idling □ Incorrect idling □ Unstable idling (High: ______ rpm, Low: ______rpm)

	□ Other ________________________________
□ Engine stall	□ Soon after starting □ After accelerator pedal depressed □ After accelerator pedal released □ During A/C ON □ Shifting from N to D-range □ Other ____
□ Others	□ Poor driving (Surge) □ Knocking □ Poor fuel economy □ Back fire □ After fire □ Other __________________________

3. ENVIRONMENT

Problem frequency	□ Constant □ Sometimes (________________) □ Once only □ Other ____
Weather	□ Fine □ Cloudy □ Rainy □ Snowy □ Other _________________
Outdoor temperature	Approx. _____ °C/°F
Place	□ Highway □ Suburbs □ Inner City □ Uphill □ Downhill □ Rough road □ Other _________________________________
Engine temperature	□ Cold □ Warming up □ After warming up □ Any temperature
Engine operation	□ Starting □ Just after starting (____ min) □ Idling □ Racing □ Driving □ Constant speed □ Acceleration □ Deceleration □ A/C switch ON/OFF □ Other ___________________________

4. MIL/DTC

MIL (Malfunction Indicator Lamp)		□ Remains ON □ Sometimes lights up □ Does not light
DTC	Normal check (Pre-check)	□ Normal □ DTC (____________________________________) □ Freeze Frame Data
	Check mode	□ Normal □ DTC (____________________________________) □ Freeze Frame Data

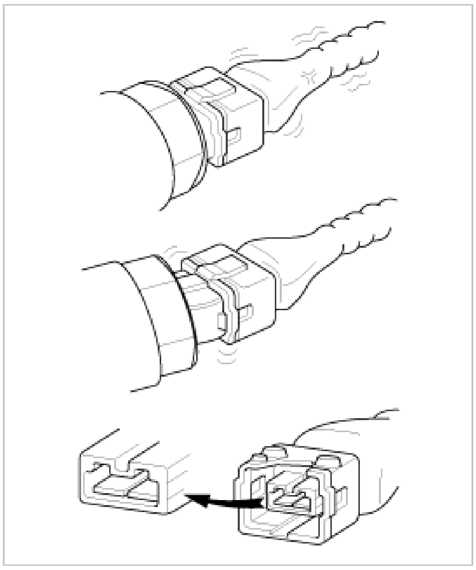
BASIC INSPECTION PROCEDURE

The measured resistance at high temperature after vehicle running may be high or low. So all resistance must be measured at ambient temperature (20°C, 68°F), unless there is any notice.

> NOTE
>
> The measured resistance in except for ambient temperature (20°C, 68°F) is reference value.

Sometimes the most difficult case in troubleshooting is when a problem symptom occurs but does not occur again during testing. An example would be if a problem appears only when the vehicle is cold but has not appeared when warm. In this case, the technician should thoroughly make out a "CUSTOMER PROBLEM ANALYSIS SHEET" and recreate (simulate) the environment and condition which occurred when the vehicle was having the issue.

1. Clear Diagnostic Trouble Code (DTC).
2. Inspect connector connection, and check terminal for poor connections, loose wires, bent, broken or corroded pins, and then verify that the connectors are always securely fastened.



3. Slightly shake the connector and wiring harness vertically and horizontally.
4. Repair or replace the component that has a problem.
5. Verify that the problem has disappeared with the road test.

● SIMULATING VIBRATION

1) Sensors and Actuators
: Slightly vibrate sensors, actuators or relays with finger.

> WARNING
>
> Strong vibration may break sensors, actuators or relays

2) Connectors and Harness
: Lightly shake the connector and wiring harness vertically and then horizontally.

● SIMULATING HEAT

1) Heat components suspected of causing the malfunction with a hair dryer or other heat sourre.

> WARNING
>
> • DO NOT heat components to the point where they may be damaged.
> • DO NOT heat the ECM directly.

● SIMULATING WATER SPRINKLING

1) Sprinkle water onto vehicle to simulate a rainy day or a high humidity condition.

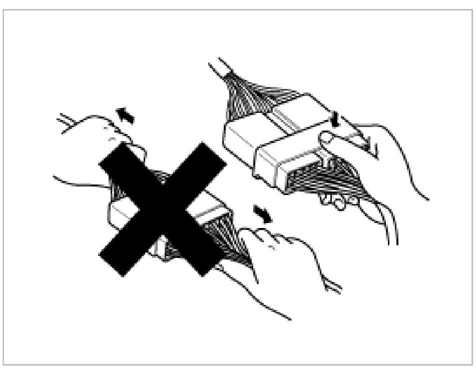
> WARNING
>
> DO NOT sprinkle water directly into the engine compartment or electronic components.

● SIMULATING ELECTRICAL LOAD

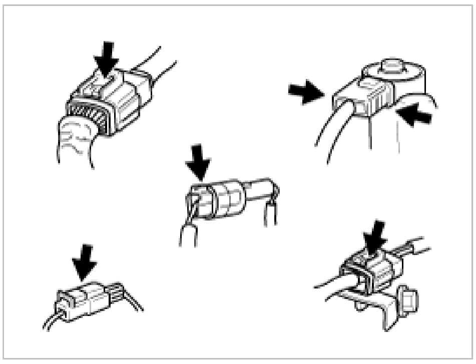
1) Turn on all electrical systems to simulate excessive electrical loads (Radios, fans, lights, etc.).

CONNECTOR INSPECTION PROCEDURE

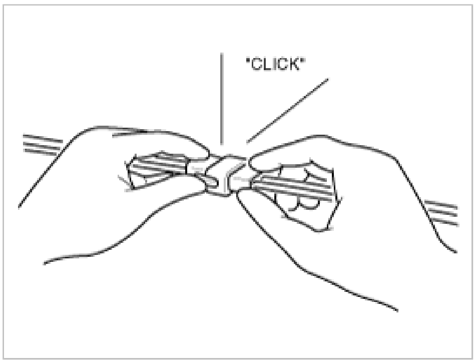
1. Handling of Connector
   A. Never pull on the wiring harness when disconnecting connectors.



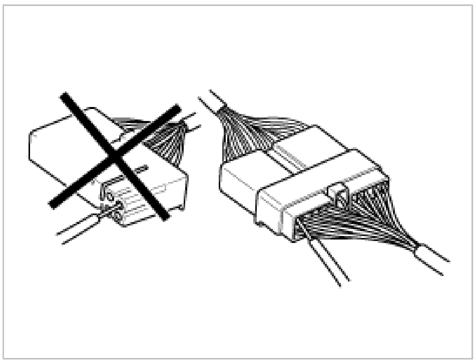
   B. When removing the connector with a lock, press or pull locking lever.



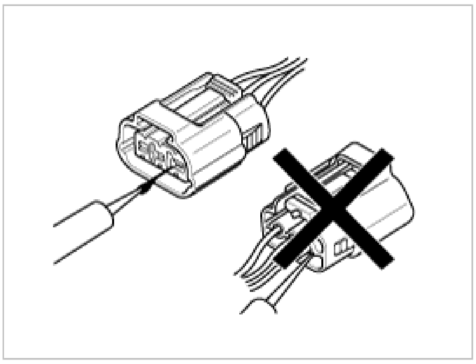
C. Listen for a click when locking connectors. This sound indicates that they are securely locked.



D. When a tester is used to check for continuity, or to measure voltage, always insert tester probe from wire harness side.



E. Check waterproof connector terminals from the connector side. Waterproof connectors cannot be accessed from harness side.



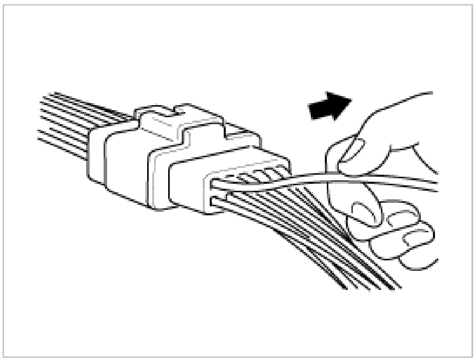
NOTE

- Use a fine wire to prevent damage to the terminal.
- Do not damage the terminal when inserting the tester lead.

2. Checking Point for Connector
   A. While the connector is connected:
      Hold the connector, check connecting condition and locking efficiency.
   B. When the connector is disconnected:
      Check missed terminal, crimped terminal or broken core wire by slightly pulling the wire harness.
      Visually check for rust, contamination, deformation and bend.

C. Check terminal tightening condition:
Insert a spare male terminal into a female terminal, and then check terminal tightening conditions.

D. Pull lightly on individual wires to ensure that each wire is secured in the terminal.



3. Repair Method of Connector Terminal
    A. Clean the contact points using air gun and/or shop rag.

    > **NOTE**
    > Never use sand paper when polishing the contact points, otherwise the contact point may be damaged.

    B. In case of abnormal contact pressure, replace the female terminal.

WIRE HARNESS INSPECTION PROCEDURE

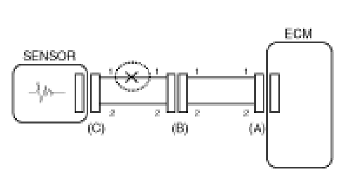
1. Before removing the wire harness, check the wire harness position and crimping in order to restore it correctly.
2. Check whether the wire harness is twisted, pulled or loosened.
3. Check whether the temperature of the wire harness is abnormally high.
4. Check whether the wire harness is rotating, moving or vibrating against the sharp edge of a part.
5. Check the connection between the wire harness and any installed part.
6. If the covering of wire harness is damaged; secure, repair or replace the harness.

ELECTRICAL CIRCUIT INSPECTION PROCEDURE

1. Procedures for Open Circuit
    A. Continuity Check
    B. Voltage Check

    If an open circuit occurs (as seen in [FIG. 1]), it can be found by performing Step 2 (Continuity Check Method) or Step 3 (Voltage Check Method) as shown below.

FIG 1



2. Continuity Check Method

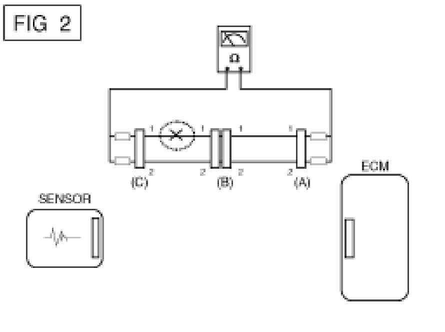
    > **NOTE**
    > When measuring for resistance, lightly shake the wire harness above and below or from side to side.

Specification (Resistance)
1Ω or less → Normal Circuit
1MΩ or Higher → Open Circuit

A. Disconnect connectors (A), (C) and measure resistance between connector (A) and (C) as shown in [FIG. 2].
In [FIG.2.] the measured resistance of line 1 and 2 is higher than 1MΩ and below 1 Ω respectively. Specifically the open

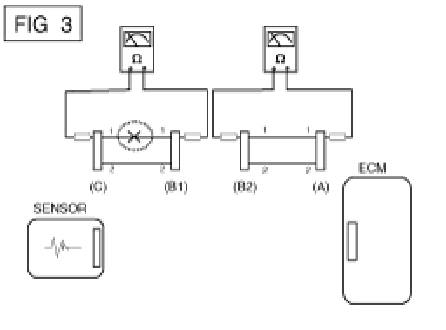
circuit is line 1 (Line 2 is normal). To find exact break point, check sub line of line 1 as described in next step.

FIG 2



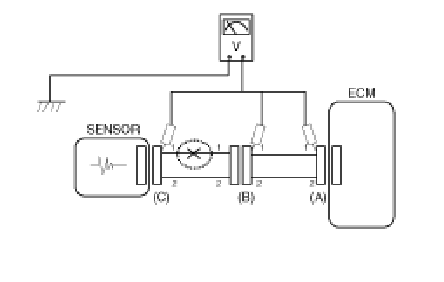
B. Disconnect connector (B), and measure for resistance between connector (C) and (B1) and between (B2) and (A) as shown in [FIG. 3].
In this case the measured resistance between connector (C) and (B1) is higher than 1MΩ and the open circuit is between terminal 1 of connector (C) and terminal 1 of connector (B1).

FIG 3



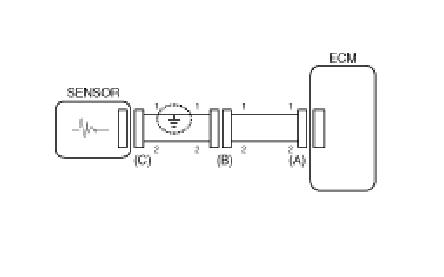
3. Voltage Check Method
A. With each connector still connected, measure the voltage between the chassis ground and terminal 1 of each connectors (A), (B) and (C) as shown in [FIG. 4].
The measured voltage of each connector is 5V, 5V and 0V respectively. So the open circuit is between connector (C) and (B).

FIG 4



4. Test Method for Short to Ground Circuit
A. Continuity Check with Chassis Ground
If short to ground circuit occurs as shown in [FIG. 5], the broken point can be found by performing below Step 2 (Continuity Check Method with Chassis Ground) as shown below.

FIG 5



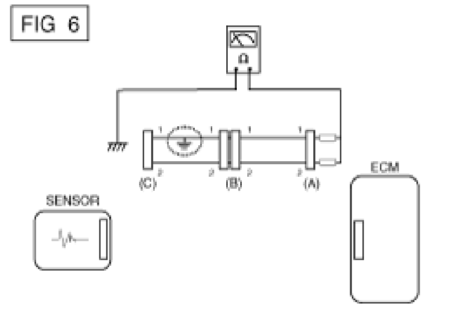
5. Continuity Check Method (with Chassis Ground)

> **NOTE**
>
> Lightly shake the wire harness above and below, or from side to side when measuring the resistance.

Specification (Resistance)
1Ω or less → Short to Ground Circuit
1MΩ or Higher → Normal Circuit

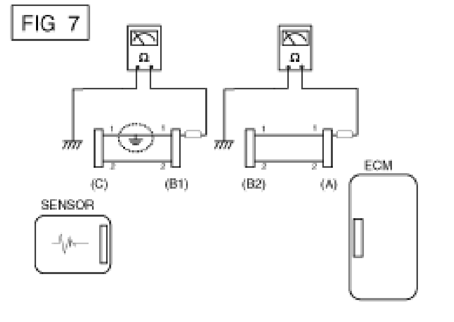
A. Disconnect connectors (A), (C) and measure for resistance between connector (A) and Chassis Ground as shown in [FIG. 6].
   The measured resistance of line 1 and 2 in this example is below 1 Ω and higher than 1MΩ respectively. Specifically the short to ground circuit is line 1 (Line 2 is normal). To find exact broken point, check the sub line of line 1 as described in the following step.

FIG 6



B. Disconnect connector (B), and measure the resistance between connector (A) and chassis ground, and between (B1) and chassis ground as shown in [FIG. 7].
   The measured resistance between connector (B1) and chassis ground is 1Ω or less. The short to ground circuit is between terminal 1 of connector (C) and terminal 1 of connector (B1).

FIG 7



SYMPTOM TROUBLESHOOTING GUIDE CHART

MAIN SYMPTOM	DIAGNOSTIC PROCEDURE	ALSO CHECK FOR
Unable to start (Engine does not turn over)	1. Test the battery 2. Test the starter 3. Inhibitor switch (A/T) or clutch start switch (M/T)	
Unable to start (Incomplete combustion)	1. Test the battery 2. Check the fuel pressure 3. Check the ignition circuit 4. Troubleshooting the immobilizer system (In case of immobilizer lamp ON)	• DTC • Low compression • Intake air leaks • Slipped or broken timing belt • Contaminated fuel
Difficult to start	1. Test the battery 2. Check the fuel pressure 3. Check the ECT sensor and circuit (Check DTC) 4. Check the ignition circuit	• DTC • Low compression • Intake air leaks • Contaminated fuel • Weak ignition spark
	1. Check the fuel pressure 2. Check the Injector	• DTC

Poor idling (Rough, unstable or incorrect Idle)	3. Check the long term fuel trim and short term fuel trim (Refer to CUSTOMER DATASTREAM) 4. Check the idle speed control circuit (Check DTC) 5. Inspect and test the Throttle Body 6. Check the ECT sensor and circuit (Check DTC)	• Low compression • Intake air leaks • Contaminated fuel • Weak ignition spark
Engine stall	1. Test the Battery 2. Check the fuel pressure 3. Check the idle speed control circuit (Check DTC) 4. Check the ignition circuit 5. Check the CKPS Circuit (Check DTC)	• DTC • Intake air leaks • Contaminated fuel • Weak ignition spark
Poor driving (Surge)	1. Check the fuel pressure 2. Inspect and test Throttle Body 3. Check the ignition circuit 4. Check the ECT Sensor and Circuit (Check DTC) 5. Test the exhaust system for a possible restriction 6. Check the long term fuel trim and short term fuel trim (Refer to CUSTOMER DATASTREAM)	• DTC • Low compression • Intake air leaks • Contaminated fuel • Weak ignition spark
Knocking	1. Check the fuel pressure 2. Inspect the engine coolant 3. Inspect the radiator and the electric cooling fan 4. Check the spark plugs	• DTC • Contaminated fuel
Poor fuel economy	1. Check customer's driving habits • Is A/C on full time or the defroster mode on? • Are tires at correct pressure? • Is excessively heavy load being carried? • Is acceleration too much, too often? 2. Check the fuel pressure 3. Check the injector 4. Test the exhaust system for a possible restriction 5. Check the ECT sensor and circuit	• DTC • Low compression • Intake air leaks • Contaminated fuel • Weak ignition spark
Hard to refuel (Overflow during refueling)	1. Test the canister close valve 2. Inspect the fuel filler hose/pipe • Pinched, kinked or blocked? • Filler hose is torn 3. Inspect the fuel tank vapor vent hose between the EVAP. canister and air filter 4. Check the EVAP. canister	• Malfunctioning gas station filling nozzle (If this problem occurs at a specific gas station during refueling)

Fuel System > General Information > Specifications

SPECIFICATION

FUEL DELIVERY SYSTEM

Items	Specification	
Fuel Tank	Capacity	67ℓit. (17.7 U.S.gaℓ., 14.7 Imp. gaℓ.)
Fuel Filter (built in Fuel Pump assembly)	Type	High pressure type
Fuel Pressure Regulator (built in Fuel Pump assembly)	Regulated Fuel Pressure	375 ~ 385 kPa(3.82 ~ 3.92 kgf/cm², 54.3 ~ 55.8 psi)
Fuel Pump	Type	Electrical, in-tank type
	Driven by	Electric motor

SENSOR

MASS AIR FLOW SENSOR (MAFS)

▷ Type: Hot-film type

▷ Specification

Air Flow (kg/h)	Frequency (Hz)
12.6 kg/h	2,617Hz
18.0 kg/h	2,958Hz
23.4 kg/h	3,241Hz
32.4 kg/h	3,653Hz
43.2 kg/h	4,024Hz
57.6 kg/h	4,399Hz
72.0 kg/h	4,704Hz
108.0 kg/h	5,329Hz
144.0 kg/h	5,897Hz
198.0 kg/h	6,553Hz
270.0 kg/h	7,240Hz
360.0 kg/h	7,957Hz
486.0 kg/h	8,738Hz
666.0 kg/h	9,644Hz
900.0 kg/h	10,590Hz

INTAKE AIR TEMPERATURE SENSOR (IATS)
▷ Type: Thermistor type
▷ Specification

Temperature		Resistance (kΩ)
°C	°F	
-40	-40	100.87kΩ
-20	-4	28.58kΩ
0	32	9.40kΩ
10	50	5.66kΩ
20	68	3.51kΩ
40	104	1.47kΩ
60	140	0.67kΩ
80	176	0.33kΩ

MANIFOLD ABSOLUTE PRESSURE SENSOR (MAPS)
▷ Type: Piezo-resistive pressure type
▷ Specification

Pressure (kPa)	Output Voltage (V)
20.0kPa	0.79V
46.66kPa	1.84V
101.32kPa	4.00V

ENGINE COOLANT TEMPERATURE SENSOR (ECTS)
▷ Type: Thermistor type
▷ Specification

Temperature		Resistance (kΩ)
°C	°F	
-40	-40	48.14kΩ
-20	-4	14.13 ~ 16.83kΩ
0	32	5.79kΩ
20	68	2.31 ~ 2.59kΩ

40	104	1.15kΩ
60	140	0.59kΩ
80	176	0.32kΩ

THROTTLE POSITION SENSOR (TPS)
▷ Type: Variable resistor type
▷ Specification (When reference voltage = 5.0V)

Throttle Angle (°)	Output Voltage(V)	
	TPS1	TPS2
0°	0V	5.0V
10°	0.5V	4.5V
20°	0.9V	4.1V
30°	1.4V	3.6V
40°	1.8V	3.2V
50°	2.3V	2.7V
60°	2.7V	2.3V
70°	3.2V	1.8V
80°	3.6V	1.4V
90°	4.1V	0.9V
100°	4.5V	0.5V
110°	5.0V	0V

Item	Sensor Resistance (kΩ)
TPS1	4.0 ~ 6.0kΩ at 20°C (68°F)
TPS2	2.72 ~ 4.08kΩ at 20°C (68°F)

ACCELERATOR POSITION SENSOR (APS)
▷ Type: Variable resistor type
▷ Specification (When reference voltage = 5.0V)

Accelerator Position	Output Voltage (V)	
	APS1	APS2
C.T	0.7 ~ 0.8V	0.29 ~ 0.46V
W.O.T	3.85 ~ 4.35V	1.93 ~ 2.18V

Item	Sensor Resistance (kΩ)
APS1	0.7 ~ 1.3kΩ at 20°C (68°F)
APS2	1.4 ~ 2.6kΩ at 20°C (68°F)

HEATED OXYGEN SENSOR (HO2S)
▷ Type: Zirconia (ZrO_2) type
▷ Specification

A/F Ratio	Output Voltage (V)
RICH	0.75 ~ 1.00V
LEAN	0 ~ 0.12V

Item	Resistance (Ω)
Sensor Heater	8.1 ~ 11.1Ω at 21°C (69.8°F)

CAMSHAFT POSITION SENSOR (CMPS)
▷ Type: Hall effect type

▷ Specification

Item	Specification
Output Voltage (V)	High: 5.0V
	Low: 0.7V
Air Gap (mm)	0.5 ~ 1.5mm

CRANKSHAFT POSITION SENSOR (CKPS)
▷ Type: Magnetic field sensitive type
▷ Specification

Item	Specification
Coil Resistance (Ω)	630 ~ 770Ω at 20°C (68°F)
Air Gap (mm)	0.5 ~ 1.5mm

KNOCK SENSOR (KS)
▷ Type: Piezo-electricity type
▷ Specification

Item	Specification
Capacitance (pF)	1,480 ~ 2,220pF

CVVT OIL TEMPERATURE SENSOR (OTS)
▷ Type: Thermistor type
▷ Specification

Temperature		Resistance (kΩ)
°C	°F	
-20	-4	16.52kΩ
20	68	2.45kΩ
80	176	0.29kΩ

FUEL TANK PRESSURE SENSOR (FTPS)
▷ Type: Piezo-Resistivity type
▷ Specification

Pressure (kPa)	Output Voltage (V)
-3.75 kPa	4.5 V
0 kPa	1.5 V
1.25 kPa	0.5 V

ACTUATORS

INJECTOR
▷ Number: 6
▷ Specification

Item	Specification
Coil Resistance (Ω)	11.4 ~ 12.6Ω at 20°C (68°F)

PURGE CONTROL SOLENOID VALVE (PCSV)
▷ Type: Duty control type
▷ Specification

Item	Specification
Coil Resistance (Ω)	19.0 ~ 22.0Ω at 20°C (68°F)

VARIABLE INTAKE SOLENOID (VIS) VALVE
▷ Specification

Item	Specification

Coil Resistance (Ω)	30.0 ~ 35.0Ω [22°C (71.6°F)]

CVVT OIL CONTROL VALVE (OCV)

▷ Specification

Item	Specification
Coil Resistance (Ω)	6.7 ~ 7.7Ω at 20°C (68°F)

ETC MOTOR

▷ Specification

Item	Specification
Coil Resistance (Ω)	1.275 ~ 1.725Ω at 20°C (68°F)

IGNITION COIL

▷ Type: Stick type

▷ Specification

Item	Specification
1st Coil Resistance (Ω)	0.62Ω±10% at 20°C (68°F)
2nd Coil Resistance (kΩ)	7.0kΩ±15% at 20°C (68°F)

CANISTER CLOSE VALVE (CCV)

▷ Type: ON/OFF control type

▷ Specification

Item	Specification
Coil Resistance (Ω)	19.8 ~ 21.8 at 20°C (68°F)

SERVICE STANDARD

Ignition Timing	BTDC 10° ± 5°		
Idle Speed	A/CON OFF	Neutral,N,P-range	620 ± 100 rpm
		D-range	
	A/CON ON	Neutral,N,P-range	
		D-range	

TIGHTENING TORQUES

ENGINE CONTROL SYSTEM

Item	Kgf·m	N·m	lbf·ft
PCM installation bolts	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
Heated oxygen sensor (Bank 1 / Sensor 1) installation	5.0 ~ 6.0	49.1 ~ 58.9	36.2 ~ 43.4
Heated oxygen sensor (Bank 1 / Sensor 2) installation	5.0 ~ 6.0	49.1 ~ 58.9	36.2 ~ 43.4
Heated oxygen sensor (Bank 2 / Sensor 1) installation	5.0 ~ 6.0	49.1 ~ 58.9	36.2 ~ 43.4
Heated oxygen sensor (Bank 2 / Sensor 2) installation	5.0 ~ 6.0	49.1 ~ 58.9	36.2 ~ 43.4
Engine coolant temperature sensor installation	2.0 ~ 4.0	19.6 ~ 39.2	14.5 ~ 28.9
Manifold absolute pressure sensor installation bolt	0.9 ~ 1.2	8.8 ~ 11.8	6.5 ~ 8.7
Camshaft position sensor [Bank 1] installation bolt	0.7 ~ 1.0	6.9 ~ 9.8	5.1 ~ 7.2
Camshaft position sensor [Bank 2] installation bolt	0.7 ~ 1.0	6.9 ~ 9.8	5.1 ~ 7.2
Crankshaft position sensor installation	0.8 ~ 1.2	7.8 ~ 11.8	5.8 ~ 8.7
Knock sensor #1,2 installation	1.6 ~ 2.4	15.7 ~ 23.5	11.6 ~ 17.4
ETC module installation bolt (on throttle body)	0.7 ~ 1.1	6.9 ~ 10.8	5.1 ~ 8.0

ETC module installation bolt (on ETC stay)	1.6 ~ 2.6	15.7 ~ 25.5	11.6 ~ 18.8
CVVT Oil temperature sensor installation	2.0 ~ 4.0	19.6 ~ 39.2	14.5 ~ 28.9
CVVT Oil control valve [Bank 1] installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
CVVT Oil control valve [Bank 2] installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
Vacuum valve (Variable intake actuator) installation bolts	0.9 ~ 1.2	8.8 ~ 11.8	6.5 ~ 8.7
Ignition coil condenser installation bolt	0.7 ~ 1.1	6.9 ~ 10.8	5.1 ~ 8.0
Ignition coil installation bolt	0.4 ~ 0.6	3.9 ~ 5.9	2.9 ~ 4.3

FUEL DELIVERY SYSTEM

Item	Kgf·m	N·m	lbf·ft
Fuel Tank band mounting nuts	3.5 ~ 5.5	34.3 ~ 53.9	25.3 ~ 39.8
Accelerator pedal bolt	1.3 ~ 1.6	12.8 ~ 15.7	9.4 ~ 11.6
Delivery pipe installation bolts	0.9 ~ 1.2	8.8 ~ 11.8	6.5 ~ 8.7

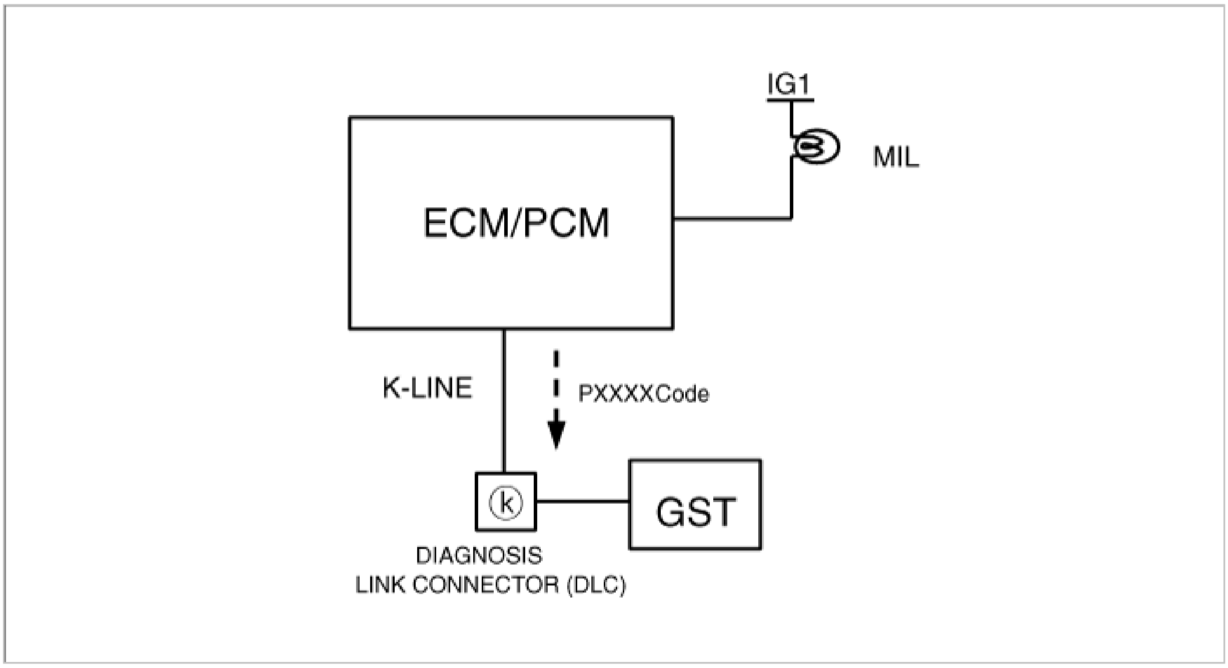
Fuel System > Engine Control System > Description and Operation

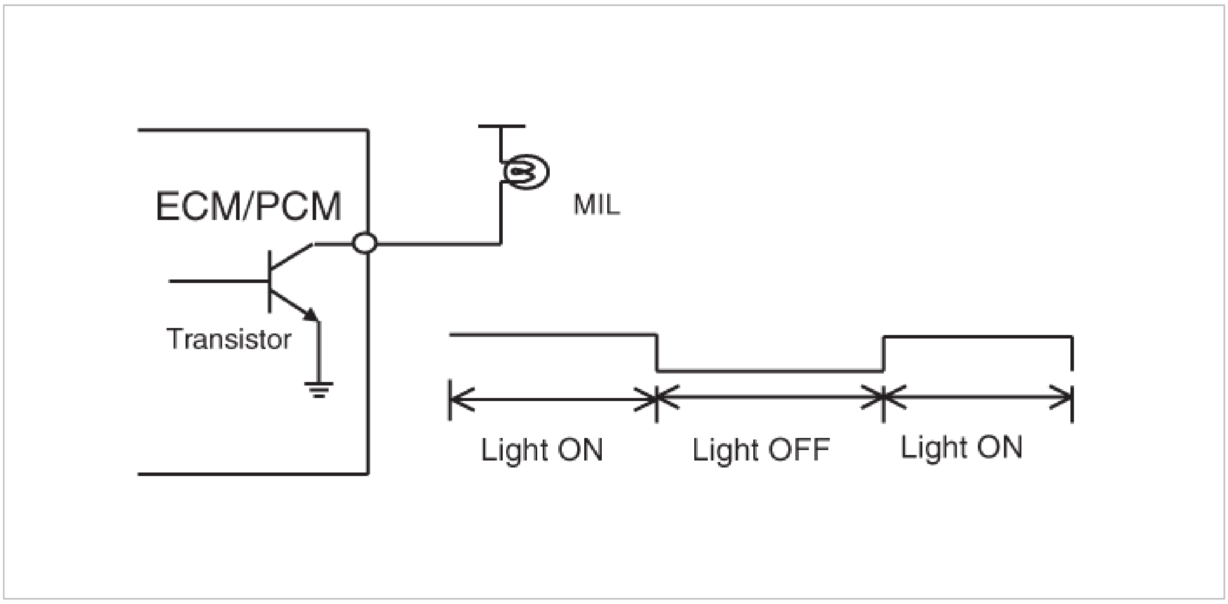
OBD-II REVIEW

1. OVERVIEW

The California Air Resources Board (CARB) began regulation of On Board Diagnostics (OBD) for vehicles sold in california beginning with the 1988 model year. The first phase, OBD-I, required monitoring of the fuel metering system, Exhust Gas Recirculation (EGR) system and additional emission related components. The Malfunction Indicator Lamp (MIL) was required to light and alert the driver of the fault and the need for repair of the emission control system. Associated with the MIL was a fault code or Diagnostic Trouble Code (DTC) idenfying the specific area of the fault.
The OBD system was proposed by CARB to improve air quality by identifying vehicle exceeding emission standards. Passage of the Federal Clean Air Act Amendments in 1990 has also prompted the Environmental Protection Agency (EPA) to develop On Board Diagnostic requirements. CARB OBD-II regulations were followed until 1999 when the federal regulations were used.
The OBD-II system meets government regulations by monitoring the emission control system. When a system or component exceeds emission threshold or a component operates outside tolerance, a DTC will be stored and the MIL illuminated.
The diagnostic executive is a computer program in the Engine Control Module (ECM) or PowertrainControl Module (PCM) that coordinates the OBD-II self-monitoring system. This program controls all the monitors and interactions, DTC and MIL operation, freeze frame data and scan tool interface.
Freeze frame data describes stored engine conditions, such as state of the engine, state of fuel control, spark, RPM, load and warm status at the point the first fault is detected. Previously stored conditions will be replaced only if a fuel or misfire fault is detected. This data is accessible with the scan tool to assist in repairing the vehicle.
The center of the OBD-II system is a microprocessor called the Engine Control Module (ECM) or Powertrain Control Module (PCM).
The ECM or PCM receives input from sensors and other electronic components (switches, relays, and others) based on information received and programmed into its memory (keep alive random access memory, and others), the ECM or PCM generates output signals to control various relays, solenoids and actuators.

2. CONFIGURATION OF HARDWARE AND RELATED TERMS





The Malfunction Indicator Lamp (MIL) is connected between ECM or PCM-terminal Malfunction Indicator Lamp and battery supply (open collector amplifier).
In most cars, the MIL will be installed in the instrument panel. The lamp amplifier can not be damaged by a short circuit.
Lamps with a power dissipation much greater than total dissipation of the MIL and lamp in the tester may cause a fault indication.
▹ At ignition ON and engine revolution (RPM)< MIN. RPM, the MIL is switched ON for an optical check by the driver.
When the ECM or PCM detects a malfunction related emission during the first driving cycle, the DTC and engine data are stored in the freeze frame memory. The MIL is illuminated only when the ECM or PCM detects the same malfunction related the DTC in two consecutive driving cycles.
● Misfire and Fuel System Malfunctions:
For misfire or fuel system malfunctions, the MIL may be eliminated if the same fault does not reoccur during monitoring in three subsequent sequential driving cycles in which conditions are similar to those under which the malfunction was first detected.
● All Other Malfunctions:
For all other faults, the MIL may be extinguished after three subsequent sequential driving cycles during which the monitoring system responsible for illuminating the MIL functions without detecting the malfunction and if no other malfunction has been identified that would independently illuminate the MIL according to the requirements outlined above.
The diagnostic system may erase a fault code if the same fault is not re-registered in at least 40 engine warm-up cycles, and the MIL is not illuminated for that fault code.

- Bidirectional line
- K-Line is defined as the line which provides information in a serial digital form from ECM or PCM to the diagnostic tester. K-Line is used bidirectionally, in which case it may carry commands or data from the diagnostic tester to the ECM or PCM. K-Line is also used to initialize the serial communication.

A driving cycle consists of engine start up, and engine shut off.

A warm-up cycle means sufficient vehicle operation such that the engine coolant temperature has risen by at least 40 degrees Fahrenheit from engine starting and reaches a minimum has risen by at least 40 degrees Fahrenheit from engine starting and reaches a minimum temperature of at least 160 degrees Fahrenheit.

A trip means vehicle operation (following an engine-off period) of duration and driving mode such that all components and systems are monitored at least once by the diagnostic system except catalyst efficiency or evaporative system monitoring when a steady-speed check is used, subject to the limitation that the manufacturer-defined trip monitoring conditions shall all be encountered at least once during the first engine start portion of the applicable FTP cycle.

- Diagnostic Trouble Code (SAE J2012)
- DTCs used in OBD-II vehicles will begin with a letter and are followed by four numbers.

The letter of the beginning of the DTC identifies the function of the monitored device that has failed. A "P" indicates a powertrain device, "C" indicates a chassis device. "B" is for body device and "U" indicates a network or data link code. The first number indicates if the code is generic (common to all manufacturers) or if it is manufacturer specific. A "0" & "2" indicates generic, "1" indicates manufacturer-specific. The second number indicates the system that is affected with a number between 1 and 7.

The following is a list showing what numbers are assigned to each system.

1) Fuel and air metering
2) Fuel and air metering(injector circuit malfunction only)
3) Ignition system or misfire
4) Auxiliary emission controls
5) Vehicle speed controls and idle control system
6) Computer output circuits
7) Transmission

The last two numbers of the DTC indicates the component or section of the system where the fault is located.

When a freeze frame event is triggered by an emission related DTC, the ECM or PCM stores various vehicle information as it existed the moment the fault ocurred. The DTC number along with the engine data can be useful in aiding a technician in locating the cause of the fault. Once the data from the 1st driving cycle DTC ocurrence is stored in the freeze frame memory, it will remain there even when the fault ocurrs again (2nd driving cycle) and the MIL is illuminated.

- Freeze Frame List
  1) Calculated Load Value
  2) Engine RPM
  3) Fuel Trim
  4) Fuel Pressure (if available)
  5) Vehicle Speed (if available)
  6) Coolant Temperature
  7) Intake Manifold Pressure (if available)
  8) Closed-or Open-loop operation
  9) Fault code

3. OBD-II SYSTEM READINESS TESTS

The catalyst efficiency monitor is a self-test strategy within the ECM or PCM that uses the downstream Heated Oxygen Sensor (HO2S) to determine when a catalyst has fallen below the minimum level of effectiveness in its ability to control exhaust emission.

Misfire is defined as the lack of proper combustion in the cylinder due to the absence of spark, poor fuel metering, or poor compression. Any combustion that does not occur within the cylinder at the proper time is also a misfire. The misfire detection monitor detects fuel, ignition or mechanically induced misfires. The intent is to protect the catalyst from permanent damage and to alert the customer of an emission failure or an inspection maintenance failure by illuminating the MIL . When a misfire is detected, special software called freeze frame data is enabled. The freeze frame data captures the operational state of the vehicle when a fault is detected from misfire detection monitor strategy.

The fuel system monitor is a self-test strategy within the ECM or PCM that monitors the adaptive fuel table The fuel control system uses the adaptive fuel table to compensate for normal variability of the fuel system components caused by wear or aging. During normal vehicle operation, if the fuel system appears biased lean or rich, the adaptive value table will shift the fuel delivery calculations to remove bias.

The cooling system monitoring is a self-test strategy within the ECM or PCM that monitors ECTS (Engine Coolant Temperature Sensor) and thermostat about circuit continuity, output range, rationality faults.

OBD-II regulations require monitoring of the upstream Heated O2 Sensor (H2OS) to detect if the deterioration of the sensor has exceeded thresholds. An additional HO2S is located downstream of the Warm-Up Three Way Catalytic Converter (WU-TWC) to determine the efficiency of the catalyst.

Although the downstream H2OS is similar to the type used for fuel control, it functions differently. The downstream HO2S is monitored to determine if a voltage is generated. That voltage is compared to a calibrated acceptable range.

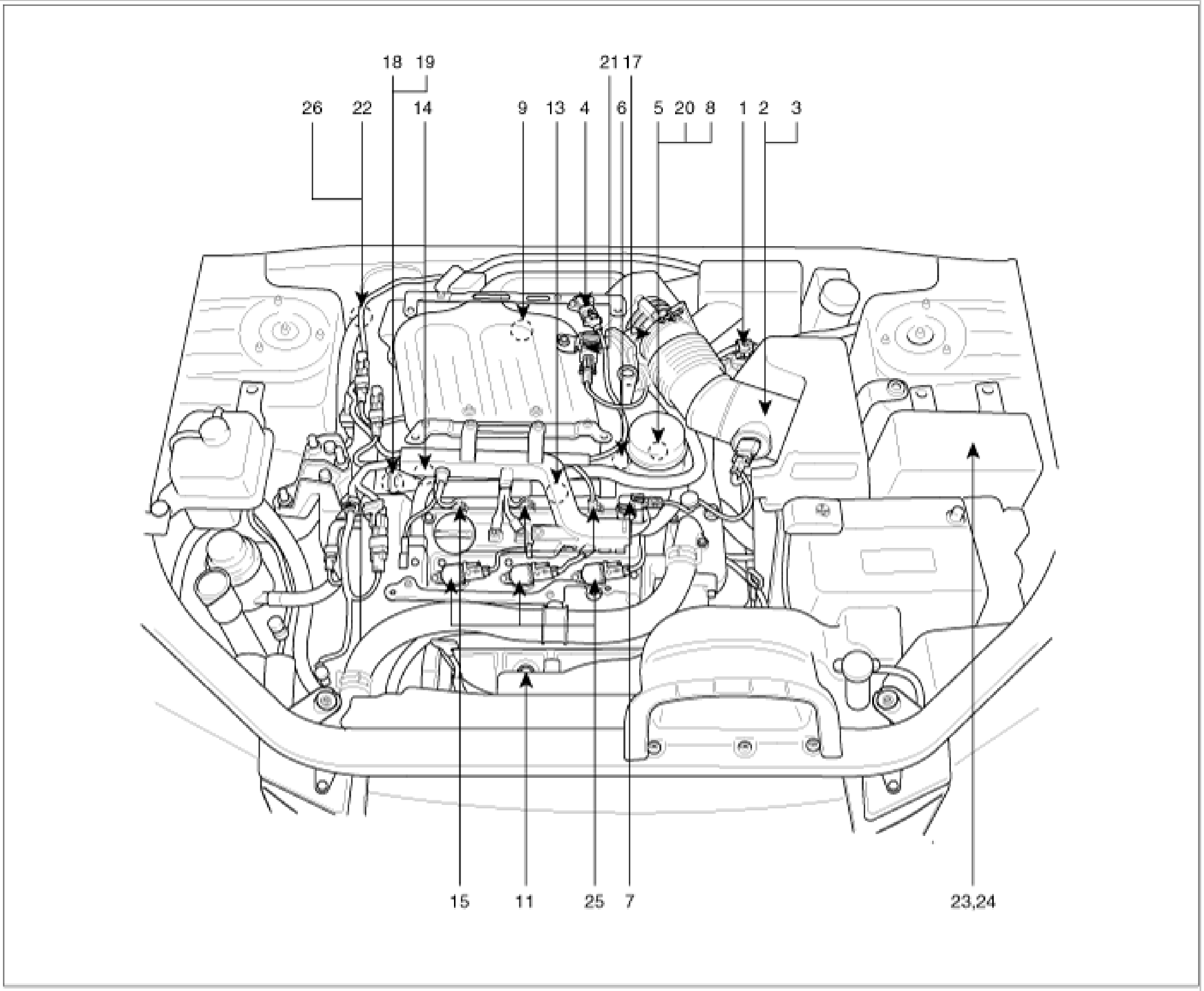
The EVAP. monitoring is a self-test strategy within the ECM or PCM that tests the integrity of the EVAP. system. The complete evaporative system detects a leak or leaks that cumulatively are greater than or equal to a leak caused by a 0.040 inch and 0.020 inch diameter orifice.

The A/C system monitoring is a self-test strategy within the ECM or PCM that monitors malfunction of all A/C system component at A/C ON.

The comprehensive components monitoring is a self-test strategy within the ECM or PCM that detects fault of any electronic powertrain components or system that provides input to the ECM or PCM and is not exclusively an input to any other OBD-II monitor.

Fuel System > Engine Control System > Components and Components Location

COMPONENT LOCATION



1. PCM (Powertrain Control Module)
2. Mass Air Flow Sensor (MAFS)
3. Intake Air Temperature Sensor (IATS)
4. Manifold Absolute Pressure Sensor (MAPS)
5. Engine Coolant Temperature Sensor (ECTS)
6. Camshaft Position Sensor (CMPS) [Bank 1]
7. Camshaft Position Sensor (CMPS) [Bank 2]
8. Crankshaft Position Sensor (CKPS)
9. Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 1]
10. Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 2]
11. Heated Oxygen Sensor (HO2S) [Bank 2 / Sensor 1]
12. Heated Oxygen Sensor (HO2S) [Bank 2 / Sensor 2]
13. Knock Sensor (KS) #1
14. Knock Sensor (KS) #2
15. Injector
16. Accelerator Position Sensor (APS)
17. ETC Module [Throttle Position Sensor (TPS) + ETC Motor]
18. CVVT Oil Control Valve (OCV) [Bank 1]
19. CVVT Oil Control Valve (OCV) [Bank 2]
20. CVVT Oil Temperature Sensor (OTS)
21. Purge Control Solenoid Valve (PCSV)
22. Variable Intake Solenoid (VIS) Valve
23. Fuel Pump Relay
24. Main Relay
25. Ignition Coil
26. Power Steering Pressure Sensor (PSPS)
27. Wheel Speed Sensor (WSS)
28. Fuel Tank Pressure Sensor (FTPS)
29. Canister Close Valve (CCV)

1. PCM (Powertrain Control Module)	2. Mass Air Flow Sensor (MAFS) 3. Intake Air Temperature Sensor (IATS)

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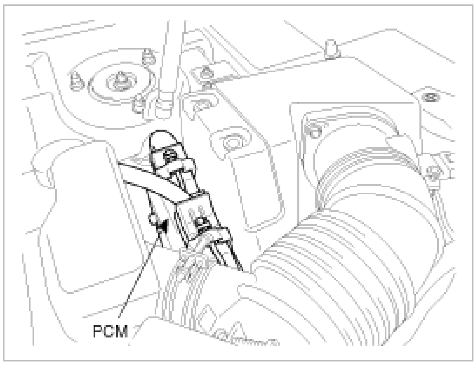
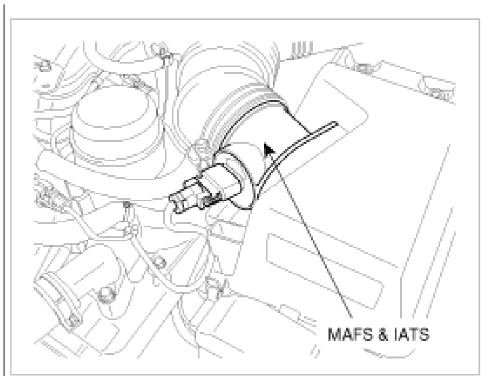
<tr><td>
</td><td>
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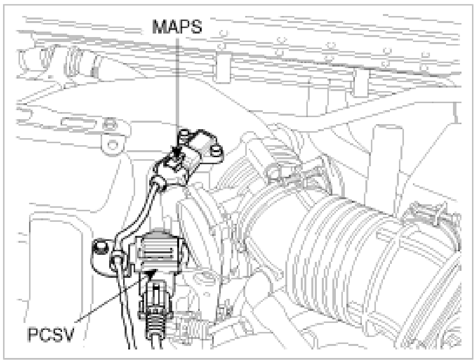
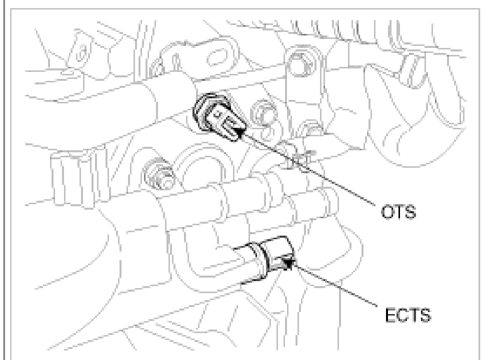
<tr><td>
</td><td>
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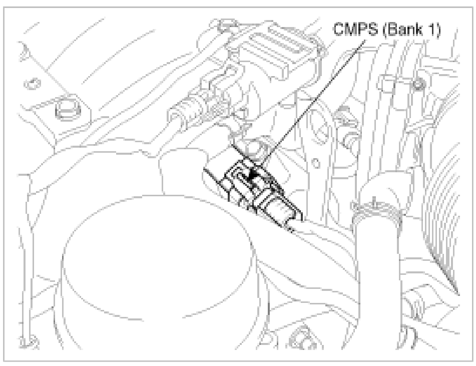
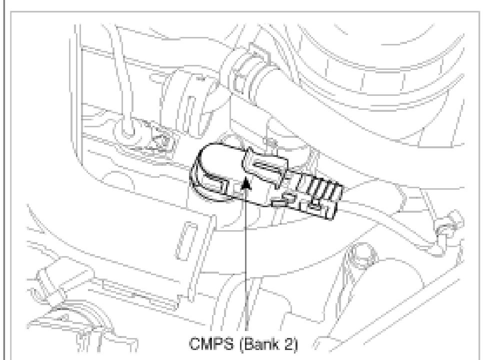
<tr><td>6. Camshaft Position Sensor (CMPS) [Bank 1]</td><td>7. Camshaft Position Sensor (CMPS) [Bank 2]</td></tr>
<tr><td>
</td><td>
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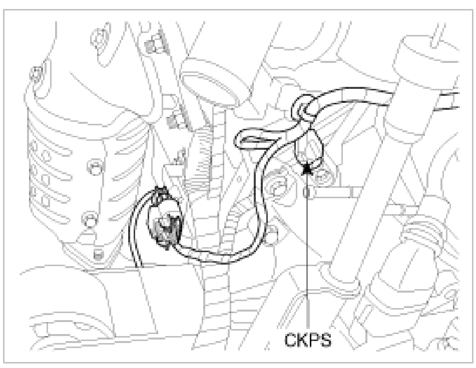
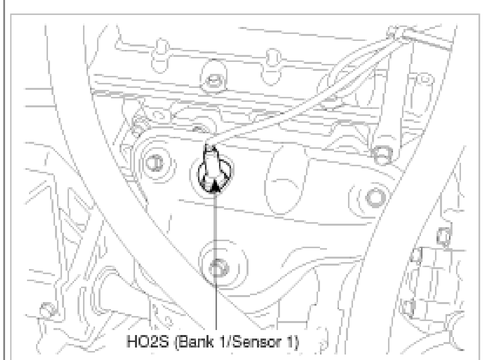
<tr><td>
</td><td>
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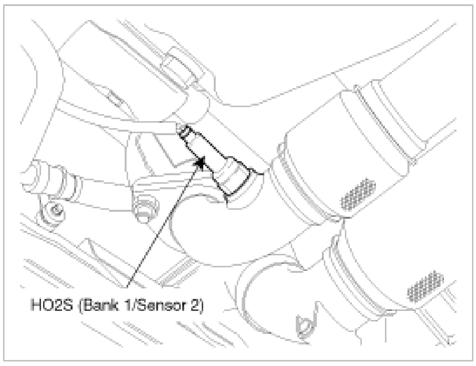
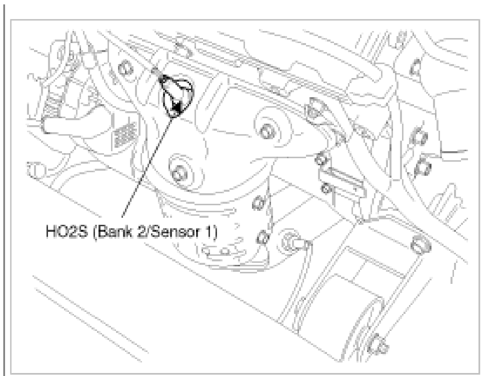
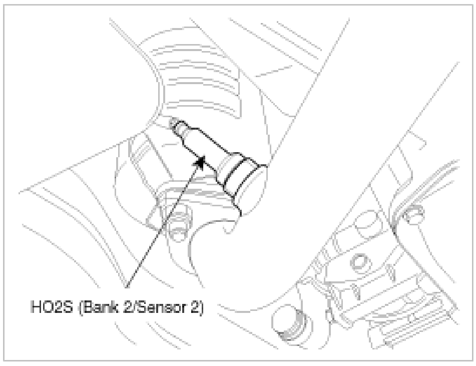
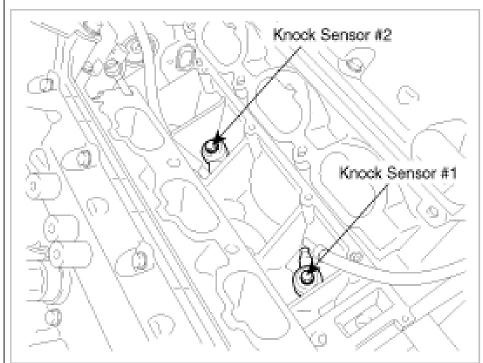
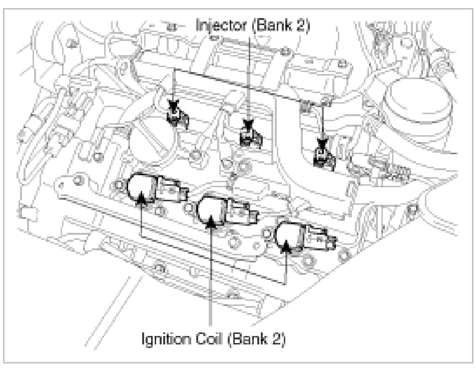
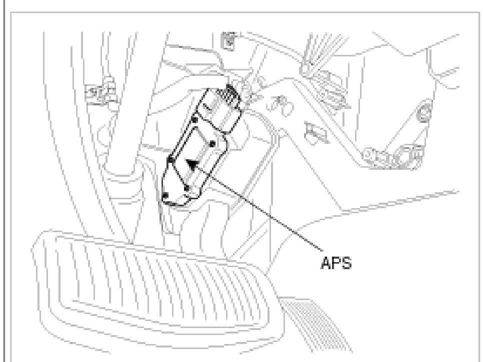
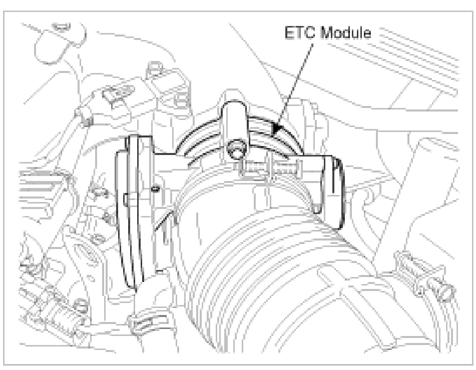
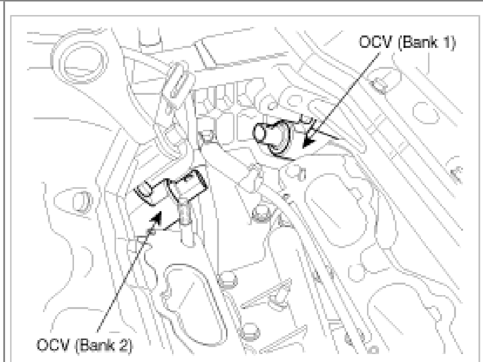
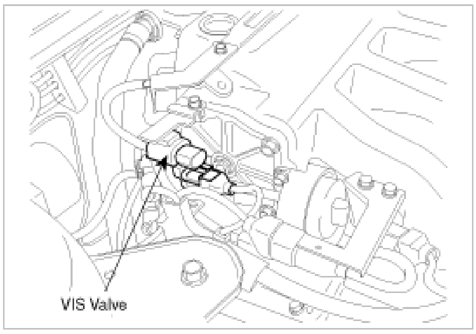
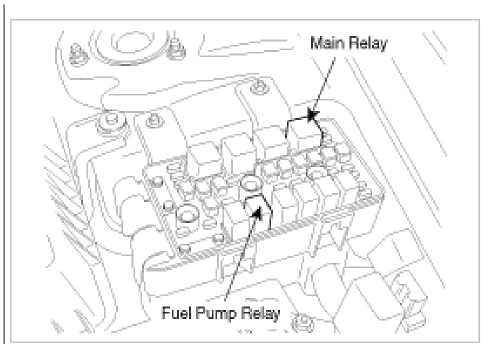
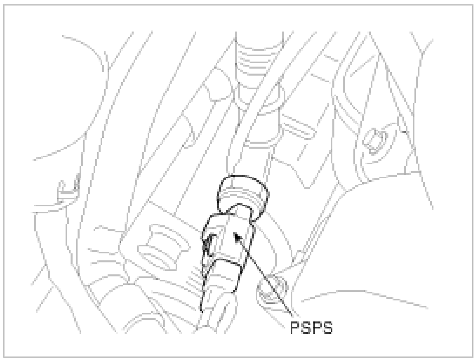
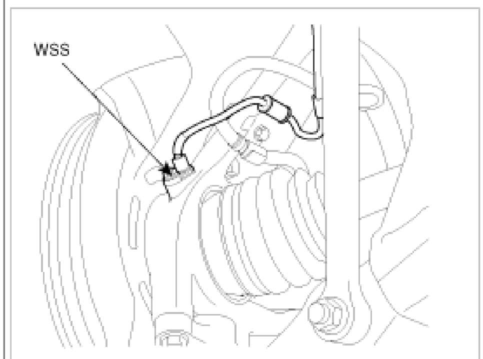
	
12. Heated Oxygen Sensor (HO2S) [Bank 2 / Sensor 2]	13. Knock Sensor (KS) #1 14. Knock Sensor (KS) #2
	
15. Injector 25. Ignition Coil	16. Accelerator Position Sensor (APS)
	
17. ETC Module [Throttle Position Sensor (TPS) + ETC Motor]	18. CVVT Oil Control Valve (OCV) [Bank 1] 19. CVVT Oil Control Valve (OCV) [Bank 2]
	
22. Variable Intake Solenoid (VIS) Valve	23. Fuel Pump Relay 24. Main Relay



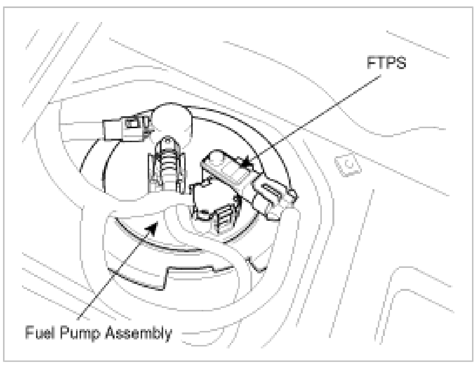


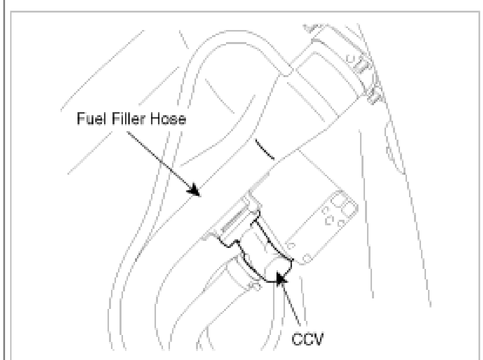
26. Power Steering Pressure Sensor (PSPS)	27. Wheel Speed Sensor (WSS)



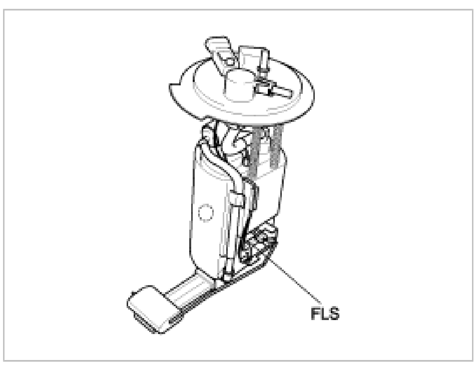


28. Fuel Tank Pressure Sensor (FTPS)	29. Canister Close Valve (CCV)





30. Fuel Level Sensor (FLS)	



Fuel System > Engine Control System > Troubleshooting

INSPECTION CHART FOR DIAGNOSTIC TROUBLE CODES (DTC)

DTC	Description	MIL	PAGE
P0011	"A" Camshaft Position-Timing Over-Advanced or System Performance (Bank 1)	●	
P0012	"A" Camshaft Position-Timing Over-Retarded (Bank 1)	●	

P0016	Crankshaft Position-Camshaft Position Correlation (Bank 1 / Sensor A)	●	
P0018	Crankshaft Position-Camshaft Position Correlation (Bank 2 / Sensor A)	●	
P0021	"A" Camshaft Position-Timing Over-Advanced or System Performance (Bank 2)	●	
P0022	"A" Camshaft Position-Timing Over-Retarded (Bank 2)	●	
P0026	Intake Valve Control Solenoid Circuit Range/Performance (Bank 1)	●	
P0028	Intake Valve Control Solenoid Circuit Range/Performance (Bank 2)	●	
P0031	HO2S Heater Circuit low (Bank 1 / Sensor 1)	●	
P0032	HO2S Heater Circuit high (Bank 1 / Sensor 1)	●	
P0037	HO2S Heater Circuit low (Bank 1 / Sensor 2)	●	
P0038	HO2S Heater Circuit high (Bank 1 / Sensor 2)	●	
P0051	HO2S Heater Circuit low (Bank 2 / Sensor 1)	●	
P0052	HO2S Heater Circuit high (Bank 2 / Sensor 1)	●	
P0057	HO2S Heater Circuit low (Bank 2 / Sensor 2)	●	
P0058	HO2S Heater Circuit high (Bank 2 / Sensor 2)	●	
P0076	Intake Valve Control Solenoid Circuit Low (Bank 1)	●	
P0077	Intake Valve Control Solenoid Circuit High (Bank 1)	●	
P0082	Intake Valve Control Solenoid Circuit Low (Bank 2)	●	
P0083	Intake Valve Control Solenoid Circuit High (Bank 2)	●	
P0101	Mass or Volume Air Flow Circuit Range/Performance	●	
P0102	Mass or Volume Air Flow Circuit Low Input	●	
P0103	Mass or Volume Air Flow Circuit high Input	●	
P0106	Manifold Absolute Pressure/Barometric Pressure Circuit Range/Performance	●	
P0107	Manifold Absolute Pressure/Barometric Pressure Circuit Low Input	●	
P0108	Manifold Absolute Pressure/Barometric Pressure Circuit High Input	●	
P0110	Intake Air Temperature Sensor 1 Circuit	●	
P0111	Intake Air Temperature Sensor 1 Circuit Range/Performance	●	
P0112	Intake Air Temperature Sensor 1 Circuit Low Input	●	
P0113	Intake Air Temperature Sensor 1 Circuit High Input	●	
P0115	Engine Coolant Temperature Circuit	●	
P0117	Engine Coolant Temperature Circuit Low Input	●	
P0118	Engine Coolant Temperature Circuit High Input	●	
P0122	Throttle/Pedal Position Sensor/Switch "A" Circuit Low Input	●	
P0123	Throttle/Pedal Position Sensor/Switch "A" Circuit High Input	●	
P0125	Insufficient Coolant Temperature for Closed Loop Fuel Control	●	
P0128	Coolant Thermostat (Coolant Temp. below Thermostat Regulating Temp.)	●	
P0131	HO2S Circuit Low Voltage (Bank 1 / Sensor 1)	●	
P0132	HO2S Circuit High Voltage (Bank 1 / Sensor 1)	●	
P0133	HO2S Circuit Slow Response (Bank 1 / Sensor 1)	●	
P0134	HO2S Circuit No Activity Detected (Bank 1 / Sensor 1)	●	
P0135	HO2S Heater Circuit (Bank 1 / Sensor 1)	●	
P0137	HO2S Circuit Low Voltage (Bank 1 / Sensor 2)	●	
P0138	HO2S Circuit High Voltage (Bank 1 / Sensor 2)	●	
P0139	HO2S Circuit Slow Response (Bank 1 / Sensor 2)	●	
P0140	HO2S Circuit No Activity Detected (Bank 1 / Sensor 2)	●	
P0141	HO2S Heater Circuit (Bank 1 / Sensor 2)	●	
P0151	HO2S Circuit Low Voltage (Bank 2 / Sensor 1)	●	

P0152	HO2S Circuit High Voltage (Bank 2 / Sensor 1)	●	
P0153	HO2S Circuit Slow Response (Bank 2 / Sensor 1)	●	
P0154	HO2S Circuit No Activity Detected (Bank 2 / Sensor 1)	●	
P0155	HO2S Heater Circuit (Bank 2 / Sensor 1)	●	
P0157	HO2S Circuit Low Voltage (Bank 2 / Sensor 2)	●	
P0158	HO2S Circuit High Voltage (Bank 2 / Sensor 2)	●	
P0159	HO2S Circuit Slow Response (Bank 2 / Sensor 2)	●	
P0160	HO2S Circuit No Activity Detected (Bank 2 / Sensor 2)	●	
P0161	HO2S Heater Circuit (Bank 2 / Sensor 2)	●	
P0171	System Too Lean (Bank 1)	●	
P0172	System Too Rich (Bank 1)	●	
P0174	System Too Lean (Bank 2)	●	
P0175	System Too Rich (Bank 2)	●	
P0196	Engine Oil Temp. Sensor Range / Performance	●	
P0197	Engine Oil Temp. Sensor Low Input	●	
P0198	Engine Oil Temp. Sensor High Input	●	
P0217	Engine Coolant Over Temperature Condition	●	
P0222	Throttle/Pedal Position Sensor/Switch "B" Circuit Low Input	●	
P0223	Throttle/Pedal Position Sensor/Switch "B" Circuit High Input	●	
P0230	Fuel Pump Primary Circuit	▲	
P0261	Cylinder 1-Injector Circuit Low	●	
P0262	Cylinder 1-Injector Circuit High	●	
P0264	Cylinder 2-Injector Circuit Low	●	
P0265	Cylinder 2-Injector Circuit High	●	
P0267	Cylinder 3-Injector Circuit Low	●	
P0268	Cylinder 3-Injector Circuit High	●	
P0270	Cylinder 4-Injector Circuit Low	●	
P0271	Cylinder 4-Injector Circuit High	●	
P0273	Cylinder 5-Injector Circuit Low	●	
P0274	Cylinder 5-Injector Circuit High	●	
P0276	Cylinder 6-Injector Circuit Low	●	
P0277	Cylinder 6-Injector Circuit High	●	
P0300	Random/Multiple Cylinder Misfire Detected	●	
P0301	Cylinder 1-Misfire detected	●	
P0302	Cylinder 2-Misfire detected	●	
P0303	Cylinder 3-Misfire detected	●	
P0304	Cylinder 4-Misfire detected	●	
P0305	Cylinder 5-Misfire detected	●	
P0306	Cylinder 6-Misfire detected	●	
P0315	Segment Time Acquisition Incorrect	▲	
P0325	Knock Sensor 1 Circuit	●	
P0326	Knock Sensor 1 Circuit Range/Performance (Bank 1)	●	
P0330	Knock Sensor 2 Circuit	●	
P0331	Knock Sensor 2 Circuit Range/Performance (Bank 2)	●	
P0335	Crankshaft Position Sensor A Circuit	●	
P0336	Crankshaft Position Sensor A Circuit Range/Performance	●	

P0340	Camshaft Position Sensor A Circuit Malfunction (Bank 1 or Signal Sensor)	●	
P0341	Camshaft Position Sensor A Circuit Range/Performance (Bank 1 or Single Sensor)	●	
P0346	Camshaft Position Sensor A Circuit Range/Performance (Bank 2)	●	
P0351	Ignition Coil 'A' Primary / Secondary Circuit	●	
P0352	Ignition Coil 'B' Primary / Secondary Circuit	●	
P0353	Ignition Coil 'C' Primary / Secondary Circuit	●	
P0354	Ignition Coil 'D' Primary / Secondary Circuit	●	
P0355	Ignition Coil 'E' Primary / Secondary Circuit	●	
P0356	Ignition Coil 'F' Primary / Secondary Circuit	●	
P0420	Catalyst System Efficiency below Threshold (Bank 1)	●	
P0430	Catalyst System Efficiency below Threshold (Bank 2)	●	
P0441	Evap. Emission System Incorrect Purge Flow	●	
P0442	Evap. Emission System-Leak detected (Small leak)	●	
P0444	Evap. Emission System-Purge Ctrl. Valve Circuit Open	●	
P0445	Evap. Emission System-Purge Ctrl. Valve Circuit Shorted	●	
P0447	Evap. Emission System-Vent Control Circuit Open	●	
P0448	Evap. Emission System-Vent Control Circuit Shorted	●	
P0451	Evap. Emission System-Pressure Sensor Range / Performance	●	
P0452	Evap. Emission System-Pressure Sensor Low Input	●	
P0453	Evap. Emission System-Pressure Sensor High Input	●	
P0454	Evap. Emission System-Pressure Sensor Intermittent	●	
P0455	Evap. Emission System-Leak detected (Large leak)	●	
P0456	Evap. Emission System-Leak detected (Very small leak)	●	
P0461	Fuel Level Sensor "A" Circuit Range/Performance	●	
P0462	Fuel Level Sensor "A" Circuit Low Input	●	
P0463	Fuel Level Sensor "A" Circuit High Input	●	
P0464	Fuel Level Sensor "A" Circuit Intermittent	●	
P0480	Fan 1 Control Circuit Malfunction	●	
P0501	Vehicle Speed Sensor A Range/Performance	●	
P0504	Brake Switch "A"/"B" Correlation	●	
P0506	Idle Air Control System-RPM lower than expected	●	
P0507	Idle Air Control System-RPM higher than expected	●	
P0532	A/C Refrigerant Pressure Sensor "A" Circuit Low Input	▲	
P0533	A/C Refrigerant Pressure Sensor "A" Circuit High Input	▲	
P0552	Power Steering Pressure Sensor/Switch Circuit Low Input	●	
P0553	Power Steering Pressure Sensor/Switch Circuit High Input	●	
P0562	System Voltage Low	●	
P0563	System Voltage High	●	
P0571	Brake Switch "A" Circuit	●	
P0601	EEPROM-Check sum Error	●	
P0602	EEPROM-Programming Error	●	
P0604	Internal Control Module Random Access Memory (RAM) Error	●	
P0606	ECM/PCM Processor(ECM-SELF TEST Failed)	●/▲	
P061B	Internal Control Module Torque Calculation Performance	●	
P0630	VIN not Programmed or Incompactible-ECM/PCM	●	
P0638	Throttle Actuator Control Range/Performance	●	

P0641	Sensor Reference Voltage "A" Circuit Open	●	
P0646	A/C Clutch Relay Control Circuit Low	▲	
P0647	A/C Clutch Relay Control Circuit High	▲	
P0650	Malfunction Indicator Lamp(MIL) Control Circuit	▲	
P0651	Sensor Reference Voltage "B" Circuit Open	●	
P0660	Intake Manifold Tuning Valve Control Circuit/Open (Bank 1)	●	
P0685	ECM/PCM Power Relay Control Circuit /Open	▲	
P1106	Manifold Absolute Pressure Sensor Circuit Short - Intermittent High Input	▲	
P1107	Manifold Absolute Pressure Sensor Circuit Short - Intermittent Low Input	▲	
P1111	Intake Air Temperature Sensor Circuit Short - Intermittent High Input	▲	
P1112	Intake Air Temperature Sensor Circuit Short - Intermittent Low Input	▲	
P1114	Engine Coolant Temperature Sensor Circuit - Intermittent Low Input	▲	
P1115	Engine Coolant Temperature Sensor Circuit - Intermittent High Input	▲	
P1295	ETC (Electronic Throttle Control) System Malfunction - Power Management	●	
P1523	ETC (Electronic Throttle Control) System Malfunction - Throttle Valve Stuck	▲	
P161B	PCM Internal Error - Torque Calculating	●	
P2104	ETC (Electronic Throttle Control) System Malfunction - Forced Idle	●	
P2105	ETC (Electronic Throttle Control) System Malfunction - Forced Engine Shutdown	●	
P2106	ETC (Electronic Throttle Control) System Malfunction - Forced Limited Power	●	
P2122	Throttle/Pedal Position Sensor/Switch "D" Circuit Low Input	●	
P2123	Throttle/Pedal Position Sensor/Switch "D" Circuit High Input	●	
P2127	Throttle/Pedal Position Sensor/Switch "E" Circuit Low Input	●	
P2128	Throttle/Pedal Position Sensor/Switch "E" Circuit High Input	●	
P2135	Throttle/Pedal Position Sensor/Switch "A" / "B" Voltage Correlation	●	
P2138	Throttle/Pedal Position Sensor/Switch "D" / "E" Voltage Correlation	●	
P2173	ETC (Electronic Throttle Control) System Malfunction - High Air flow Detected.	●	
P2187	System Too Lean at Idle (←Additive) (Bank 1)	●	
P2188	System Too Rich at Idle (Bank 1)	●	
P2189	System Too Lean at Idle (←Additive) (Bank 2)	●	
P2190	System Too Rich at Idle (Bank 2)	●	
P2195	HO2S Signal Stuck Lean (Bank 1 / Sensor 1)	●	
P2196	HO2S Signal Stuck Rich (Bank 1 / Sensor 1)	●	
P2197	HO2S Signal Stuck Lean (Bank 2 / Sensor 1)	●	
P2198	HO2S Signal Stuck Rich (Bank 2 / Sensor 1)	●	
P2270	HO2S Signal Stuck Lean (Bank 1 / Sensor 2)	●	
P2271	HO2S Signal Stuck Rich (Bank 1 / Sensor 2)	●	
P2272	HO2S Signal Stuck Lean (Bank 2 / Sensor 2)	●	
P2273	HO2S Signal Stuck Rich (Bank 2 / Sensor 2)	●	
P2422	Evap. Emission System-Canister Clogging	●	
P2610	ECM/PCM Internal Engine Off Timer Performance	●	
P2A00	02 Sensor Not Ready (Bank 1 / Sensor 1)	●	
P2A03	02 Sensor Not Ready (Bank 1 / Sensor 2)	●	
U0001	CAN Communication Malfunction	●	

NOTE

● : MIL ON & MEMORY
▲ : MIL OFF & MEMORY

Fuel System > Engine Control System > Power train Control Module (PCM) > Repair procedures

PCM PROBLEM INSPECTION PROCEDURE

1. TEST PCM GROUND CIRCUIT: Measure resistance between PCM and chassis ground using the backside of PCM harness connector as PCM side check point. If the problem is found, repair it.

   Specification (Resistance): 1Ω or less

2. TEST PCM CONNECTOR: Disconnect the PCM connector and visually check the ground terminals on PCM side and harness side for bent pins or poor contact pressure. If the problem is found, repair it.
3. If problem is not found in Step 1 and 2, the PCM could be faulty. If so, replace the PCM with a new one, and then check the vehicle again. If the vehicle operates normally then the problem was likely with the PCM.
4. RE-TEST THE ORIGINAL PCM : Install the original PCM (may be broken) into a known-good vehicle and check the vehicle. If the problem occurs again, replace the original PCM with a new one. If problem does not occur, this is intermittent problem (Refer to INTERMITTENT PROBLEM PROCEDURE in BASIC INSPECTION PROCEDURE).

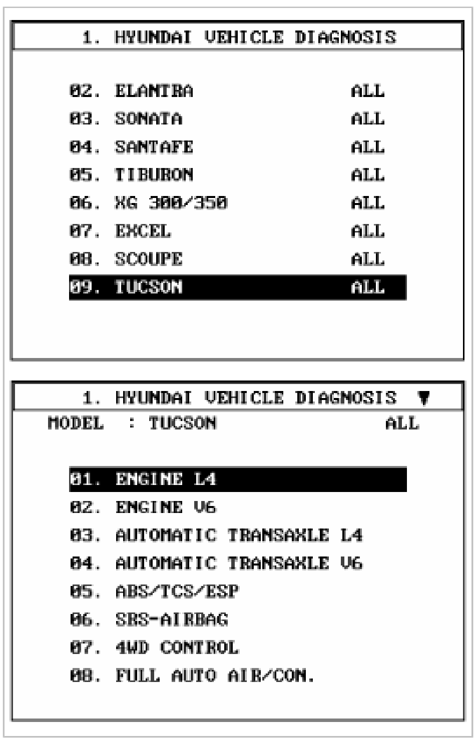
VIN PROGRAMMING PROCEDURE

VIN (Vehicle Identification Number) is a number that has the vehicle's information (Maker, Vehicle Type, Vehicle Line/Series, Body Type, Engine Type, Transmission Type, Model Year, Plant Location and so forth. For more information, please refer to the group "GI" in this SERVICE MANUAL). When replacing an PCM, the VIN must be programmed in the PCM. If there is no VIN in PCM memory, the fault code (DTC P0630) is set.

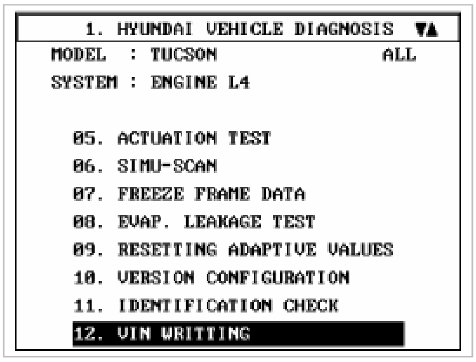
CAUTION

The programmed VIN cannot be changed. When writing the VIN, confirm the VIN carefully

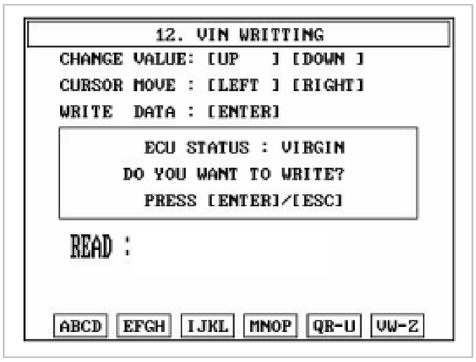
1. Select "Vehicle" and "Engine" (For example, TUCSON 2.0L L4).



2. Select "VIN WRITING".



3. Check the PCM status.



NOTE

- VIRGIN: VIN is not programmed
- LEARNT: VIN has been already programmed

Is the PCM status "VIRGIN"?

YES

▸ Go to next step 4.

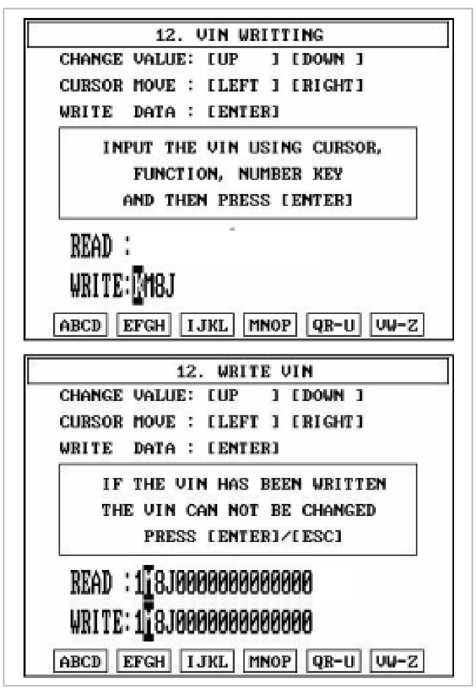
NO

▸ END

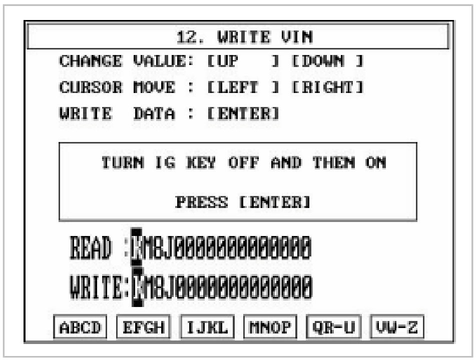
4. Write the VIN with cursor, function and number keys.

WARNING

Before pressing the "ENTER" key, confirm the VIN again because the programmed VIN cannot be changed.



5. After verifying the written VIN, press the "ENTER" key.
6. Turn the ignition switch OFF, and then turn ON.

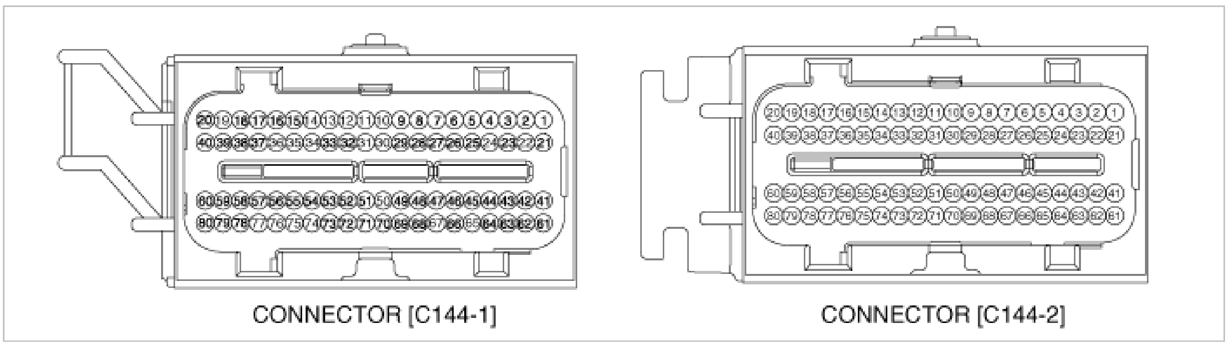


7. Verify the programmed VIN in the PCM memory.

Fuel System > Engine Control System > Power train Control Module (PCM) > Specifications

POWERTRAIN CONTROL MODULE (PCM)

1. PCM HARNESS CONNECTOR



2. PCM TERMINAL FUNCTION

CONNECTOR [C144-1]

PinNo.	Description	Connected to
1	2nd CAN [High]	Multi-Purpose Check Connector
2	2nd CAN [Low]	Multi-Purpose Check Connector
3	For Autotransaxle Control	
4	For Autotransaxle Control	
5	For Autotransaxle Control	
6	For Autotransaxle Control	
7	For Autotransaxle Control	
8	For Autotransaxle Control	
9	Clutch Switch signal input	Cruise Clutch Pedal Position Switch
10	For Autotransaxle Control	
11	For Autotransaxle Control	
12	-	
13	For Autotransaxle Control	
14	-	
15	Alternator load signal input	Alternator
16	Cruise Switch ground	Cruise Switch
17	Fuel Tank Pressure Sensor ground	Fuel Tank Pressure Sensor (FTPS)
18	Air conditioner switch "ON" signal input	Air Conditioner Switch
19	-	

20	For Autotransaxle Control	
21	Brake switch signal input	Brake Switch
22	For Autotransaxle Control	
23	Brake lamp signal input	Brake Lamp
24	For Autotransaxle Control	
25	Cruise Switch signal input	Cruise Switch
26	Air conditioner thermal switch signal input	Air Conditioner Thermal Switch
27	Diagnostic Data Line (K-Line)	Data Link Connector (DLC)
28	Fuel Tank Pressure Sensor signal input	Fuel Tank Pressure Sensor (FTPS)
29	Fuel level signal input	Fuel Sender (in Fuel Pump Assembly)
30	-	
31	-	
32	Air Conditioner Pressure Sensor signal input	Air Conditioner Pressure Sensor
33	Sensor ground	Air Conditioner Pressure Sensor, Power Steering Pressure Sensor (PSPS)
34	-	
35	For Autotransaxle Control	
36	-	
37	Canister Close Valve control output	Canister Close Valve (CCV)
38	Battery voltage supply after main relay	Main Relay
39	Battery voltage supply after main relay	Main Relay
40	Battery voltage supply after main relay	Main Relay
41	CAN [High]	ABS Control Module, ESP Control Module
42	CAN [Low]	ABS Control Module, ESP Control Module
43	Main Relay control output	Main Relay
44	Intake Air Temperature Sensor signal input	Intake Air Temperature Sensor (IATS)
45	Immobilizer communication line	Immobilizer
46	Power Steering Pressure Sensor signal input	Power Steering Pressure Sensor (PSPS)
47	Mass Air Flow Sensor signal input	Mass Air Flow Sensor (MAFS)
48	Accelerator Position Sensor #2 ground	Accelerator Position Sensor (APS) #2
49	Accelerator Position Sensor #2 signal input	Accelerator Position Sensor (APS) #2
50	For Autotransaxle Control	
51	Cruise "SET" lamp control output	(Cruise "SET" Lamp)
52	Vehicle speed signal input	ABS Control Module, ESP Control Module [With ABS/ESP]
53	Intake Air Temperature Sensor ground	Intake Air Temperature Sensor (IATS)
54	Accelerator Position Sensor #1 signal input	Accelerator Position Sensor (APS) #1
55	Accelerator Position Sensor #1 ground	Accelerator Position Sensor (APS) #1
56	Fuel Tank Pressure Sensor sensor power supply	Fuel Tank Pressure Sensor (FTPS)
57	Accelerator Position Sensor #2 power supply	Accelerator Position Sensor (APS) #2
58	Sensor Power Supply (+5V)	Air Conditioner Pressure Sensor, Power Steering Pressure Sensor (PSPS)
59	Accelerator Position Sensor #1 power supply	Accelerator Position Sensor (APS) #1
60	For Autotransaxle Control	
61	Engine speed signal output	Cluster (Tachometer)
62	Fuel consumption signal output	Trip Computer
63	Malfunction Indicator Lamp (MIL) control output	Cluster (Malfunction Indicator Lamp)

64	Air Conditioner Compressor Relay control output	Air Conditioner Compressor Relay
65	For Autotransaxle Control	
66	Cooling Fan control output (PWM)	Cooling Fan Control Module
67	For Autotransaxle Control	
68	Throttle Position Sensor signal (PWM) output	ABS Control Module, ESP Control Module
69	Cruise "MAIN" lamp control output	Cruise "MAIN" Lamp
70	Fuel Pump Relay control output	Fuel Pump Relay
71	Variable Intake Solenoid Valve control output	Variable Intake Solenoid (VIS) Valve
72	Immobilizer lamp control output	Immobilizer Lamp
73	For Autotransaxle Control	
74	For Autotransaxle Control	
75	For Autotransaxle Control	
76	For Autotransaxle Control	
77	For Autotransaxle Control	
78	Purge Control Solenoid Valve control output	Purge Control Solenoid Valve (PCSV)
79	Wheel Speed Sensor [Low] signal input	Wheel Speed Sensor (WSS)[Without ABS/ESP]
80	Wheel Speed Sensor [High] signal input	Wheel Speed Sensor (WSS)[Without ABS/ESP]

CONNECTOR [C144-2]

PinNo.	Description	Connected to
1	ETC Motor [-] control output	ETC Motor (in ETC Module)
2	ETC Motor [+] control output	ETC Motor (in ETC Module)
3	For Autotransaxle Control	
4	CVVT Oil Temperature Sensor signal input	CVVT Oil Temperature Sensor (OTS)
5	-	
6	For Autotransaxle Control	
7	Engine Coolant Temperature Sensor signal input	Engine Coolant Temperature Sensor (ECTS)
8	Manifold Absolute Pressure Sensor signal input	Manifold Absolute Pressure Sensor (MAPS)
9	For Autotransaxle Control	
10	For Autotransaxle Control	
11	Manifold Absolute Pressure Sensor power supply	Manifold Absolute Pressure Sensor (MAPS)
12	Battery voltage supply after ignition switch	Ignition Switch
13	Throttle Position Sensor #2 power supply	Throttle Position Sensor (TPS) #2
14	Throttle Position Sensor #1 ground	Throttle Position Sensor (TPS) #1
15	Camshaft Position Sensor [Bank 2] power supply	Camshaft Position Sensor (CMPS) [Bank 2]
16	Throttle Position Sensor #1 power supply	Throttle Position Sensor (TPS) #1
17	Camshaft Position Sensor [Bank 2] ground	Camshaft Position Sensor (CMPS) [Bank 2]
18	Camshaft Position Sensor [Bank 1] ground	Camshaft Position Sensor (CMPS) [Bank 1]
19	Ignition Coil (Cylinder #6) control output	Ignition Coil (Cylinder #6)
20	-	
21	Crankshaft Position Sensor [High] signal input	Crankshaft Position Sensor (CKPS)
22	For Autotransaxle Control	
23	Sensor Shield	Crankshaft Position Sensor (CKPS), Knock Sensor (KS) #1,2
24	Camshaft Position Sensor [Bank 2] signal input	Camshaft Position Sensor (CMPS) [Bank 2]
25	Camshaft Position Sensor [Bank 1] signal input	Camshaft Position Sensor (CMPS) [Bank 1]

26	-	
27	-	
28	Heated Oxygen Sensor [Bank 2 / Sensor 1] ground	Heated Oxygen Sensor (HO2S) [Bank 2 / Sensor 1]
29	Heated Oxygen Sensor [Bank 2 / Sensor 2] ground	Heated Oxygen Sensor (HO2S) [Bank 2 / Sensor 2]
30	Heated Oxygen Sensor [Bank 1 / Sensor 1] ground	Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 1]
31	Heated Oxygen Sensor [Bank 1 / Sensor 2] ground	Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 2]
32	Camshaft Position Sensor [Bank 1] power supply	Camshaft Position Sensor (CMPS) [Bank 1]
33	Engine Coolant Temperature Sensor ground	Engine Coolant Temperature Sensor (ECTS)
34	Sensor ground	Manifold Absolute Pressure Sensor (MAPS), CVVT Oil Temperature Sensor (OTS)
35	Power ground	Chassis Ground
36	Power ground	Chassis Ground
37	Power ground	Chassis Ground
38	Power ground	Chassis Ground
39	Power ground	Chassis Ground
40	Ignition Coil (Cylinder #4) control output	Ignition Coil (Cylinder #4)
41	Crankshaft Position Sensor [Low] signal input	Crankshaft Position Sensor (CKPS)
42	For Autotransaxle Control	
43	For Autotransaxle Control	
44	For Autotransaxle Control	
45	For Autotransaxle Control	
46	-	
47	-	
48	Throttle Position Sensor #1 signal input	Throttle Position Sensor (TPS) #1
49	Heated Oxygen Sensor [Bank 1 / Sensor 1] signal input	Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 1]
50	Heated Oxygen Sensor [Bank 1 / Sensor 2] signal input	Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 2]
51	Heated Oxygen Sensor [Bank 2 / Sensor 1] signal input	Heated Oxygen Sensor (HO2S) [Bank 2 / Sensor 1]
52	Heated Oxygen Sensor [Bank 2 / Sensor 2] signal input	Heated Oxygen Sensor (HO2S) [Bank 2 / Sensor 2]
53	Knock Sensor (KS) #2 [High] signal input	Knock Sensor (KS) #2 [High]
54	Knock Sensor (KS) #2 [Low] signal input	Knock Sensor (KS) #2 [Low]
55	Knock Sensor (KS) #1 [Low] signal input	Knock Sensor (KS) #1 [Low]
56	Knock Sensor (KS) #1 [High] signal input	Knock Sensor (KS) #1 [High]
57	Throttle Position Sensor #2 signal input	Throttle Position Sensor (TPS) #2
58	Throttle Position Sensor #2 ground	Throttle Position Sensor (TPS) #2
59	For Autotransaxle Control	
60	Ignition Coil (Cylinder #2) control output	Ignition Coil (Cylinder #2)
61	CVVT Oil Control Valve [Bank 2] control output	CVVT Oil Control Valve (OCV) [Bank 2]
62	CVVT Oil Control Valve [Bank 1] control output	CVVT Oil Control Valve (OCV) [Bank 1]
63	Injector (Cylinder #2) control output	Injector (Cylinder #2)
64	Injector (Cylinder #3) control output	Injector (Cylinder #3)
65	-	
66	-	
67	Heated Oxygen Sensor [Bank 2 / Sensor 1] Heater control output	Heated Oxygen Sensor (HO2S) [Bank 2 / Sensor 1]
68	Injector (Cylinder #4) control output	Injector (Cylinder #4)
69	Injector (Cylinder #5) control output	Injector (Cylinder #5)

70	Heated Oxygen Sensor [Bank 1 / Sensor 1] Heater control output	Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 1]
71	Injector (Cylinder #6) control output	Injector (Cylinder #6)
72	Injector (Cylinder #1) control output	Injector (Cylinder #1)
73	Heated Oxygen Sensor [Bank 2 / Sensor 2] Heater control output	Heated Oxygen Sensor (HO2S) [Bank 2 / Sensor 2]
74	Heated Oxygen Sensor [Bank 1 / Sensor 2] Heater control output	Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 2]
75	For Autotransaxle Control	
76	Battery Power	Battery
77	Ignition Coil (Cylinder #3) control output	Ignition Coil (Cylinder #3)
78	Ignition Coil (Cylinder #5) control output	Ignition Coil (Cylinder #5)
79	Ignition Coil (Cylinder #1) control output	Ignition Coil (Cylinder #1)
80	-	

3. PCM TERMINAL INPUT/OUTPUT SIGNAL
CONNECTOR [C144-1]

PinNo.	Description	Condition	Type	Level	Test Result
1	2nd CAN [High]	Idle	DC	2.0 ~ 3.0V	2.5V
2	2nd CAN [Low]	Idle	DC	2.0 ~ 3.0V	2.5V
3	For Autotransaxle Control				
4	For Autotransaxle Control				
5	For Autotransaxle Control				
6	For Autotransaxle Control				
7	For Autotransaxle Control				
8	For Autotransaxle Control				
9	Clutch Switch signal input				
10	For Autotransaxle Control				
11	For Autotransaxle Control				
12	-				
13	For Autotransaxle Control				
14	-				
15	Alternator load signal input	Idle	PULSE	High: Battery Voltage	13.6V
				Low: Max. 1.5V	0V
				140 ~ 190Hz	160Hz
16	Cruise Switch ground				
17	Fuel Tank Pressure Sensor ground	Idle	DC	Max. 50mV	30mV
18	Air conditioner switch "ON" signal input	A/CON Relay OFF	DC	Battery Voltage	9.1V
		A/CON Relay ON		Max. 1.0V	0.1V
19	-				
20	For Autotransaxle Control				

21	Brake switch signal input	Brake pedal releasing	DC	Battery Voltage	12.7V
		Brake pedal pressing		Max. 0.5V	0.03V
22	For Autotransaxle Control				
23	Brake lamp signal input	Brake pedal releasing	DC	Max. 0.5V	0V
		Brake pedal pressing		Battery Voltage	13.0V
24	For Autotransaxle Control				
25	Cruise Switch signal input				
26	Air conditioner thermal switch signal input	A/CON OFF	DC	Max. 1.0V	0V
		A/CON ON		Battery Voltage	11.9V
27	Diagnostic Data Line (K-Line)	When transmitting	PULSE	High: Min. Vbatt * 80%	11.3V
				Low: Max. Vbatt * 20%	0.14V
		When receiving		High: Min. Vbatt * 70%	11.3V
				Low: Max. Vbatt * 30%	0.32V
28	Fuel Tank Pressure Sensor signal input				
29	Fuel level signal input				
30	-				
31	-				
32	Air Conditioner Pressure Sensor signal input	A/CON OFF	DC	0 ~ 5.0V	
		A/CON ON			1.85 ~ 2.2V
33	Sensor ground	Idle	DC	Max. 50mV	40mV
34	-				
35	For Autotransaxle Control				
36	-				
37	Canister Close Valve control output				
38	Battery voltage supply after main relay	IG OFF	DC	Max. 1.0V	0V
		IG ON		Battery Voltage	12.1V
39	Battery voltage supply after main relay	IG OFF	DC	Max. 1.0V	0V
		IG ON		Battery Voltage	12.1V
40	Battery voltage supply after main relay	IG OFF	DC	Max. 1.0V	0V
		IG ON		Battery Voltage	12.1V
41	CAN [High]	RECESSIVE	PULSE	2.0 ~ 3.0V	3.85V
		DOMINANT		2.75~4.5V	2.5V
42	CAN [Low]	RECESSIVE	PULSE	2.0 ~ 3.0V	2.55V

		DOMINANT		2.75~4.5V	1.34V
43	Main Relay control output	Relay ON	DC	Battery Voltage	12.3V
		Relay OFF		Max. 1.0V	0.87V
44	Intake Air Temperature Sensor signal input	Idle	Analog	0 ~ 5.0V	1.86V
45	Immobilizer communication line				
46	Power Steering Pressure Sensor signal input	Neutral	Analog	0 ~ 5.0V	0.89V
		Full-Turn			4.16V
47	Mass Air Flow Sensor signal input	Idle	PULSE	High: Vref	5.04V
				Low: Max. 0.5V	0.27V
				Idle: 3.0KHz	
		3,000 rpm		High: Vref	5.04V
				Low: Max. 0.5V	0.27V
				3000rpm: 4.5 kHz	
48	Accelerator Position Sensor #2 ground	Idle	DC	Max. 50mV	35mV
49	Accelerator Position Sensor #2 signal input	C.T	Analog	0.3 ~ 0.9V	0.4V
		W.O.T		1.5 ~ 3.0V	2.1V
50	For Autotransaxle Control				
51	Cruise "SET" lamp control output				
52	Vehicle speed signal input	Vehicle running	PULSE	High: Min. 5.0V	12.6V
				Low: Max. 1.0V	0.2V
53	Intake Air Temperature Sensor ground	Idle	DC	Max. 50mV	34mV
54	Accelerator Position Sensor #1 signal input	C.T	Analog	0.3 ~ 0.9V	0.77V
		W.O.T		4.0 ~ 4.8V	4.23V
55	Accelerator Position Sensor #1 ground	Idle	DC	Max. 50mV	36mV
56	Fuel Tank Pressure Sensor sensor supply				
57	Accelerator Position Sensor #2 power supply	IG OFF	DC	Max. 0.5V	0V
		IG ON		4.9 ~ 5.1V	5.08V
58	Sensor Power Supply (+5V)	IG OFF	DC	Max. 0.5V	0V
		IG ON		4.9 ~ 5.1V	5.08V
59	Accelerator Position Sensor #1 power supply	IG OFF	DC	Max. 0.5V	0V
		IG ON		4.9 ~ 5.1V	5.08V
60	For Autotransaxle Control				
61	Engine speed signal output	Idle	PULSE	High: Battery Voltage	13.0V
				Low: Max. 0.5V	0V
				20~26Hz	35Hz
				High: Battery	12.8V

62	Fuel consumption signal output	Idle	PULSE	Voltage or Vref	
				Low: Max. 0.5V	0V
63	Malfunction Indicator Lamp (MIL) control output	MIL OFF	DC	High: Battery Voltage	4.24V
		MIL ON		Low: Max. 2.0V	0V
64	Air Conditioner Compressor Relay control output	A/CON OFF	DC	Battery Voltage	13.0V
		A/CON ON		Max. 1.0V	0.14V
65	For Autotransaxle Control				
66	Cooling Fan control output (PWM)	A/CON ON	PULSE	High: Vref	12.3V
				Low: 0 ~ 0.5 V	0V
					300Hz
67	For Autotransaxle Control				
68	Throttle Position Sensor signal (PWM) output	Idle	PULSE	High: Battery Voltage	12.3V
				Low: 0 ~ 0.5 V	0V
					100Hz
69	Cruise "CRUISE" lamp control output				
70	Fuel Pump Relay control output	Relay OFF	DC	Battery Voltage	12.5V
		Relay ON		Max. 1.0V	0.09V
71	Variable Intake Solenoid Valve control output	Active	DC	Max. 1.0V	0.1V
		Inactive		Battery Voltage	12.4V
72	Immobilizer lamp control output				
73	For Autotransaxle Control				
74	For Autotransaxle Control				
75	For Autotransaxle Control				
76	For Autotransaxle Control				
77	For Autotransaxle Control				
78	Purge Control Solenoid Valve control output	Inactive Active	PULSE	High: Battery Voltage	13.2V
				Low: Max. 1.0V	0.08V
					16Hz
79	Wheel Speed Sensor [Low] signal input				
80	Wheel Speed Sensor [High] signal input				

CONNECTOR [C144-2]

PinNo.	Description	Condition	Type	Level	Test Result
				High: Battery	13.3V

1	ETC Motor [-] control output	Idle	PULSE	Voltage	
				Low: Max. 1.0V	0.3V
					3.14KHz
2	ETC Motor [+] control output	Idle	PULSE	High: Battery Voltage	13.3V
				Low: Max. 1.0V	0.4V
					3.14KHz
3	For Autotransaxle Control				
4	CVVT Oil Temperature Sensor signal input	Idle	Analog	0.5 ~ 4.5V	1.68V
5	-				
6	For Autotransaxle Control				
7	Engine Coolant Temperature Sensor signal input	Idle	Analog	0.5 ~ 4.5V	0.47V
8	Manifold Absolute Pressure Sensor signal input	IG ON	Analog	3.9 ~ 4.1V	4.01V
		Idle		0.8 ~ 1.6V	1.59V
9	For Autotransaxle Control				
10	For Autotransaxle Control				
11	Manifold Absolute Pressure Sensor power supply	IG OFF	DC	Max. 0.5V	0V
		IG ON		4.9 ~ 5.1V	5.08V
12	Battery voltage supply after ignition switch	IG OFF	DC	Max. 0.5V	0V
		IG ON		Battery Voltage	12.2V
13	Throttle Position Sensor #2 power supply	IG OFF	DC	Max. 0.5V	0V
		IG ON		4.9 ~ 5.1V	5.05V
14	Throttle Position Sensor #1 ground	Idle	DC	Max. 50mV	30mV
15	Camshaft Position Sensor [Bank 2] power supply	IG OFF	DC	Max. 0.5V	0V
		IG ON		4.9 ~ 5.1V	5.06V
16	Throttle Position Sensor #1 power supply	IG OFF	DC	Max. 0.5V	0V
		IG ON		4.9 ~ 5.1V	5.06V
17	Camshaft Position Sensor [Bank 2] ground	Idle	DC	Max. 50mV	30mV
18	Camshaft Position Sensor [Bank 1] ground	Idle	DC	Max. 50mV	30mV
19	Ignition Coil (Cylinder #6) control output	Idle	PULSE	1st: 300~400V	272V
				ON: Max. 2V	1.2V
					5.8Hz
20	-				
21	Crankshaft Position Sensor [High] signal input	Idle	Sine Wave	Vp_p: Min.1.0V	8V
					700Hz
22	For Autotransaxle Control				
23	Sensor Shield	Idle	DC	Max. 50mV	32mV
				High: Vref	5.08V

24	Camshaft Position Sensor [Bank 2] signal input	Idle	PULSE	Low: Max. 0.5V	0.06V
					40Hz
25	Camshaft Position Sensor [Bank 1] signal input	Idle	PULSE	High: Vref	5.08V
				Low: Max. 0.5V	0.06V
					40Hz
26	-				
27	-				
28	Heated Oxygen Sensor [Bank 2 / Sensor 1] ground	Idle	DC	Max. 50mV	27mV
29	Heated Oxygen Sensor [Bank 2 / Sensor 2] ground	Idle	DC	Max. 50mV	27mV
30	Heated Oxygen Sensor [Bank 1 / Sensor 1] ground	Idle	DC	Max. 50mV	26V
31	Heated Oxygen Sensor [Bank 1 / Sensor 2] ground	Idle	DC	Max. 50mV	27mV
32	Camshaft Position Sensor [Bank 1] power supply	IG OFF	DC	Max. 0.5V	0V
		IG ON		4.9 ~ 5.1V	5.06V
33	Engine Coolant Temperature Sensor ground	Idle	DC	Max. 50mV	13mV
34	Sensor ground	Idle	DC	Max. 50mV	13mV
35	Power ground	Idle	DC	Max. 50mV	0mV
36	Power ground	Idle	DC	Max. 50mV	0mV
37	Power ground	Idle	DC	Max. 50mV	0mV
38	Power ground	Idle	DC	Max. 50mV	2mV
39	Power ground	Idle	DC	Max. 50mV	2mV
40	Ignition Coil (Cylinder #4) control output	Idle	PULSE	1st: 300~400V	263V
				ON: Max. 2V	1.4V
					5.8Hz
41	Crankshaft Position Sensor [Low] signal input	Idle	Sine Wave	Vp_p: Min.1.0V	8V
					700Hz
42	For Autotransaxle Control				
43	For Autotransaxle Control				
44	For Autotransaxle Control				
45	For Autotransaxle Control				
46	-				
47	-				
48	Throttle Position Sensor #1 signal input	C.T	Analog	0.25 ~ 0.9V	
		W.O.T		Min. 4.0V	
				Rich: 0.6 ~	

49	Heated Oxygen Sensor [Bank 1 / Sensor 1] signal input	Engine Running	DC	1.0V	0.95V
				Lean: 0 ~ 0.4V	0.13V
50	Heated Oxygen Sensor [Bank 1 / Sensor 2] signal input	Engine Running	DC	Rich: 0.6 ~ 1.0V	0.88V
				Lean: 0 ~ 0.4V	0.21V
51	Heated Oxygen Sensor [Bank 2 / Sensor 1] signal input	Engine Running	DC	Rich: 0.6 ~ 1.0V	0.91V
				Lean: 0 ~ 0.4V	0.18V
52	Heated Oxygen Sensor [Bank 2 / Sensor 2] signal input	Engine Running	DC	Rich: 0.6 ~ 1.0V	0.89V
				Lean: 0 ~ 0.4V	0.22V
53	Knock Sensor (KS) #2 [High] signal input	Knocking	Variable Frequency	-0.3 ~ 0.3 V	1.7V
		Normal		0 V	
54	Knock Sensor (KS) #2 [Low] signal input	Knocking	Variable Frequency	-0.3 ~ 0.3 V	1.7V
		Normal		0 V	
55	Knock Sensor (KS) #1 [Low] signal input	Knocking	Variable Frequency	-0.3 ~ 0.3 V	1.7V\
		Normal		0 V	
56	Knock Sensor (KS) #1 [High] signal input	Knocking	Variable Frequency	-0.3 ~ 0.3 V	1.7V
		Normal		0 V	
57	Throttle Position Sensor #2 signal input	C.T	Analog	Min. 4.0V	
		W.O.T		0.25 ~ 0.9V	
58	Throttle Position Sensor #2 ground	Idle	DC	Max. 50mV	17mV
59	For Autotransaxle Control				
60	Ignition Coil (Cylinder #2) control output	Idle	PULSE	1st: 300~400V	266V
				ON: Max. 2V	1.3V
					5.8Hz
61	CVVT Oil Control Valve [Bank 2] control output	Idle	PULSE	Battery Voltage	14.5V
				Max. 1.0V	0.1V
				Duty variance when operating the accelerator	128Hz
62	CVVT Oil Control Valve [Bank 1] control output	Idle	PULSE	Battery Voltage	14.3V
				Max. 1.0V	0.1V
				Duty variance when	

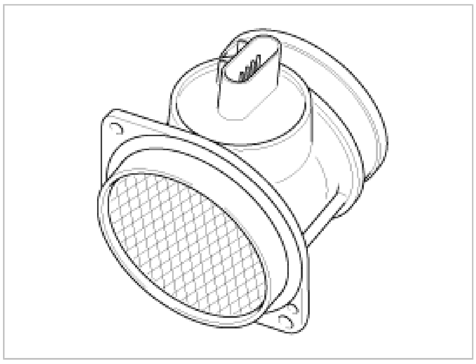
				operating the accelerator	128Hz
63	Injector (Cylinder #2) control output	Idle	PULSE	High: Battery Voltage	13.8V
				Low: Max. 1.0V	0.13V
				Vpeak: Max. 80V	57.5V
					5.8Hz
64	Injector (Cylinder #3) control output	Idle	PULSE	High: Battery Voltage	13.8V
				Low: Max. 1.0V	0.13V
				Vpeak: Max. 80V	56.8V
					5.8Hz
65	-				
66	-				
67	Heated Oxygen Sensor [Bank 2 / Sensor 1] Heater control output	Engine Running	PULSE	High: Battery Voltage	13.8V
				Low: Max. 1.0V	0.17V
					16Hz
68	Injector (Cylinder #4) control output	Idle	PULSE	High: Battery Voltage	13.8V
				Low: Max. 1.0V	0.13V
				Vpeak: Max. 80V	56.8V
					5.8Hz
69	Injector (Cylinder #5) control output	Idle	PULSE	High: Battery Voltage	13.7V
				Low: Max. 1.0V	0.13V
				Vpeak: Max. 80V	56.8V
					5.8Hz
70	Heated Oxygen Sensor [Bank 1 / Sensor 1] Heater control output	Engine Running	PULSE	High: Battery Voltage	13.8V
				Low: Max. 1.0V	0.17V
					16Hz
71	Injector (Cylinder #6) control output	Idle	PULSE	High: Battery Voltage	13.8V
				Low: Max. 1.0V	0.13V

				Vpeak: Max. 80V	56.8V
					5.8Hz
72	Injector (Cylinder #1) control output	Idle	PULSE	High: Battery Voltage	13.8V
				Low: Max. 1.0V	0.13V
				Vpeak: Max. 80V	56.8V
					5.8Hz
73	Heated Oxygen Sensor [Bank 2 / Sensor 2] Heater control output	Engine Running	PULSE	High: Battery Voltage	13.9V
				Low: Max. 1.0V	0.19V
					16Hz
74	Heated Oxygen Sensor [Bank 1 / Sensor 2] Heater control output	Engine Running	PULSE	High: Battery Voltage	13.9V
				Low: Max. 1.0V	0.18V
					16Hz
75	For Autotransaxle Control				
76	Battery Power	Always	DC	Battery Voltage	13.0V
77	Ignition Coil (Cylinder #3) control output	Idle	PULSE	1st: 300~400V	266V
				ON: Max. 2V	1.4V
					5.8Hz
78	Ignition Coil (Cylinder #5) control output	Idle	PULSE	1st: 300~400V	267V
				ON: Max. 2V	1.4V
					5.8Hz
79	Ignition Coil (Cylinder #1) control output	Idle	PULSE	1st: 300~400V	268V
				ON: Max. 2V	1.4V
					5.8Hz
80	-				

Fuel System > Engine Control System > Mass Air Flow Sensor (MAFS) > Description and Operation

DESCRIPTION

Mass Air Flow Sensor (MAFS) is a hot-film type sensor and is located in between the air cleaner and the throttle body. It consists of a tube, a sensor assembly and honey cell and detects intake air quantity flowing into the intake manifold. While the intake air coming out of the air cleaner flows by the honey cell, it becomes laminar flow, and then it passes the hot-film. At this time, heat transfer is generated by convection and this sensor loses its energy. This sensor detects the mass air flow by using the energy loss and transfers the information to the PCM by frequency. The PCM calculates fuel quantity and ignition timing.

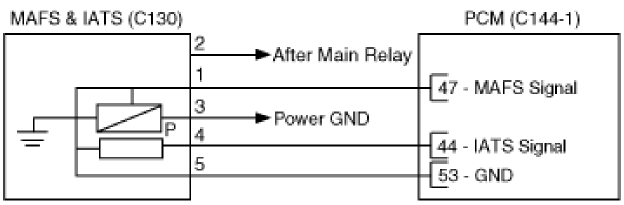


SPECIFICATION

Air Flow (kg/h)	Output Frequency (Hz)
12.6 kg/h	2,617Hz
18.0 kg/h	2,958Hz
23.4 kg/h	3,241Hz
32.4 kg/h	3,653Hz
43.2 kg/h	4,024Hz
57.6 kg/h	4,399Hz
72.0 kg/h	4,704Hz
108.0 kg/h	5,329Hz
144.0 kg/h	5,897Hz
198.0 kg/h	6,553Hz
270.0 kg/h	7,240Hz
360.0 kg/h	7,957Hz
486.0 kg/h	8,738Hz
666.0 kg/h	9,644Hz
900.0 kg/h	10,590Hz

SCHEMATIC DIAGRAM

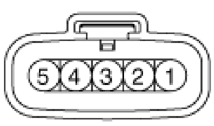
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

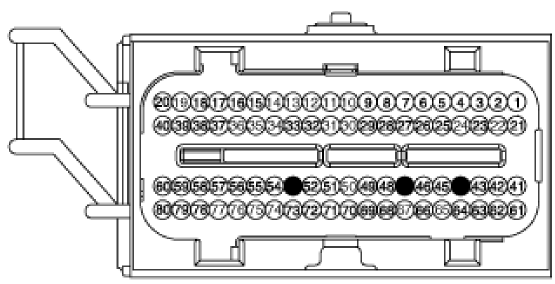
Terminal	Connected to	Funtion
1	PCM C144-1 (47)	MAFS Signal
2	Main Relay	Battery Voltage (B+)
3	Chassis Ground	Ground
4	PCM C144-1 (44)	IATS Signal
5	PCM C144-1 (53)	Sensor Ground

[HARNESS CONNECTORS]



C130

MAFS & IATS

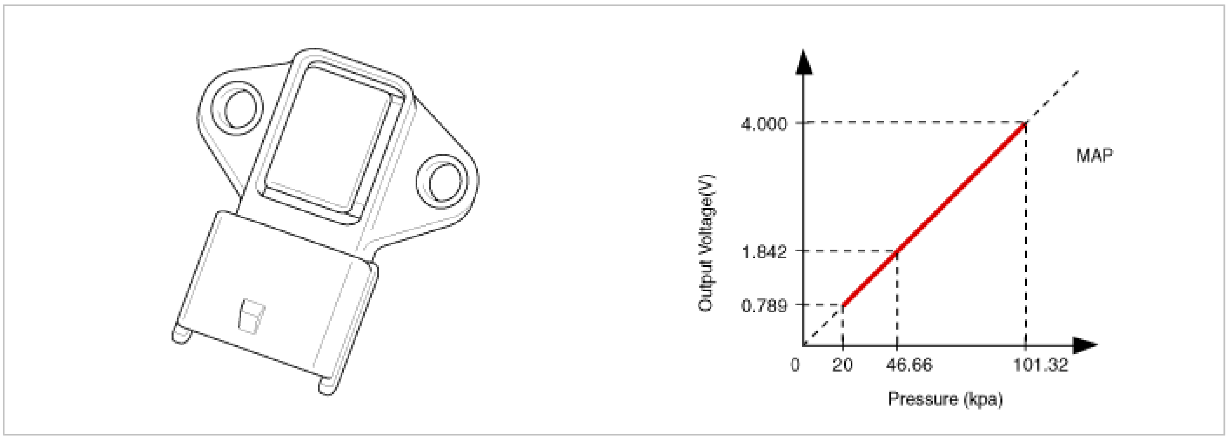


C144-1

PCM

Fuel System > Engine Control System > Manifold Absolute Pressure Sensor (MAPS) > Description and Operation

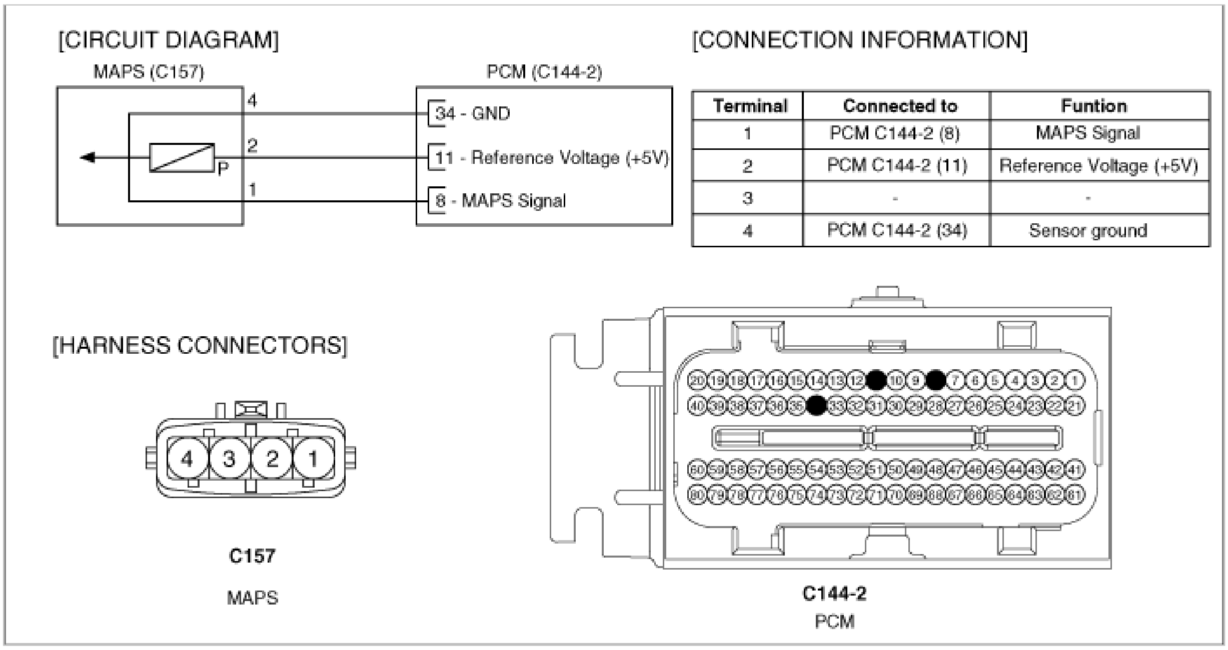
DESCRIPTION



Manifold Absolute Pressure Sensor (MAPS) is speed-density type sensor and is installed on the surge tank. This MAPS senses absolute pressure in surge tank and transfers this analog signal proportional to the pressure to the PCM. The PCM calculates the intake air quantity and engine speed based on this signal. This MAPS consists of piezo-electric element and hybrid IC that amplifies the element output signal. The element is silicon diaphragm type and adapts pressure sensitive variable resistor effect of semi-conductor. 100% vacuum and the manifold pressure applies to both sides of it respectively. That is, this sensor outputs the silicon variation proportional to pressure change by voltage.

SPECIFICATION

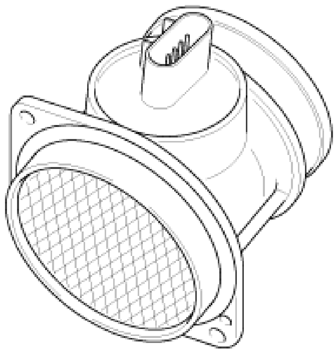
Pressure(kPa)	Output Voltage (V)
20.0kPa	0.79V
46.66kPa	1.84V
101.32kPa	4.00V

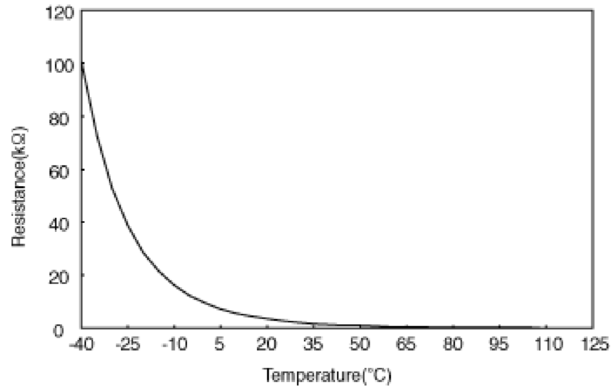


Terminal	Connected to	Funtion
1	PCM C144-2 (8)	MAPS Signal
2	PCM C144-2 (11)	Reference Voltage (+5V)
3	-	-
4	PCM C144-2 (34)	Sensor ground

Fuel System > Engine Control System > Intake Air Temperature Sensor (IATS) > Description and Operation

DESCRIPTION





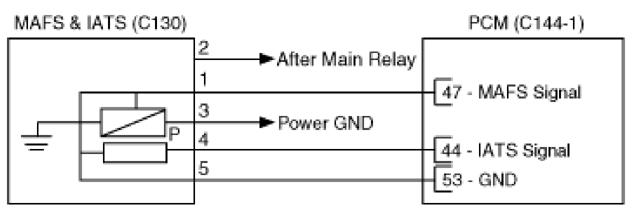
Intake Air Temperature Sensor (IATS) is installed inside the Mass Air Flow Sensor (MAFS) and detects the intake air temperature. To calculate precise air quantity, correction of the air temperature is needed because air density varies according to the temperature. So the PCM uses not only MAFS signal but also IATS signal. This sensor has a Negative Temperature Coefficient (NTC) and its resistance is in inverse proportion to the temperature.

SPECIFICATION

Temperature		Resistance (kΩ)
°C	°F	
-40	-40	100.87kΩ
-20	-4	28.58kΩ
0	32	9.40kΩ
10	50	5.66kΩ
20	68	3.51kΩ
40	104	1.47kΩ
60	140	0.67kΩ
80	176	0.33kΩ

SCHEMATIC DIAGRAM

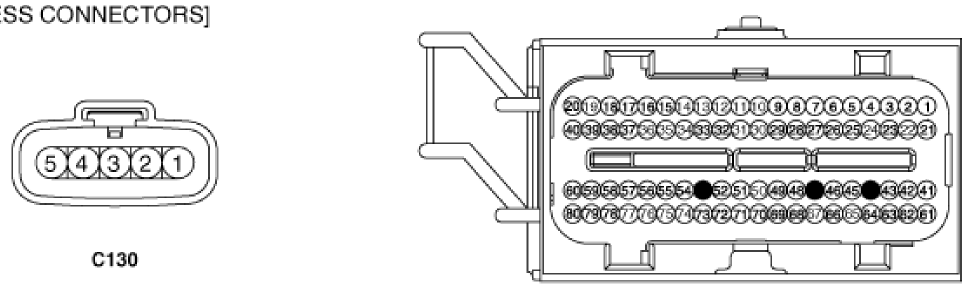
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Funtion
1	PCM C144-1 (47)	MAFS Signal
2	Main Relay	Battery Voltage (B+)
3	Chassis Ground	Ground
4	PCM C144-1 (44)	IATS Signal
5	PCM C144-1 (53)	Sensor Ground

[HARNESS CONNECTORS]



C130

MAFS & IATS

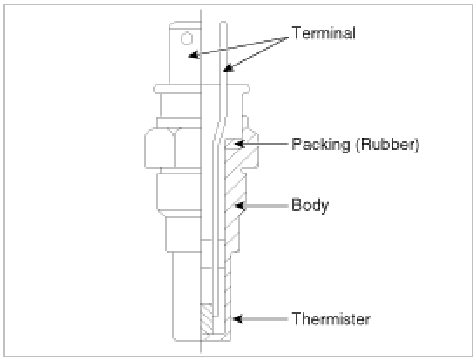
C144-1

PCM

Fuel System > Engine Control System > Engine Coolant Temperature Sensor (ECTS) > Description and Operation

DESCRIPTION

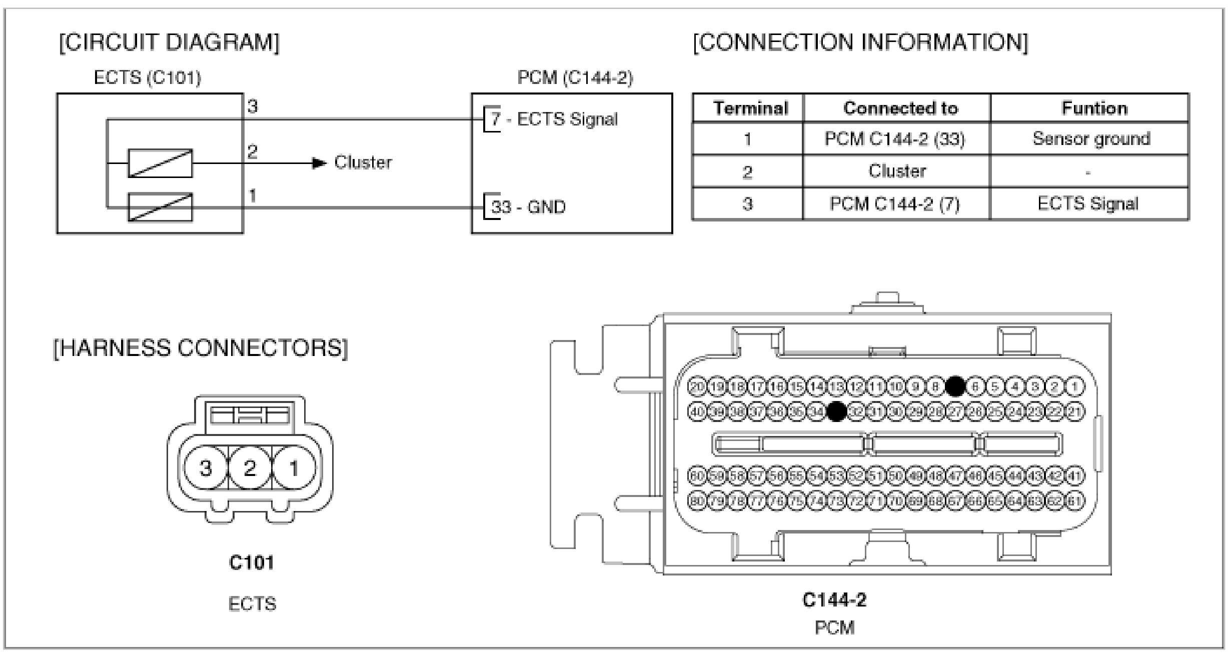
Engine Coolant Temperature Sensor (ECTS) is located in the engine coolant passage of the cylinder head for detecting the engine coolant temperature. The ECTS uses a thermistor whose resistance changes with the temperature. The electrical resistance of the ECTS decreases as the temperature increases, and increases as the temperature decreases. The reference 5 V in the PCM is supplied to the ECTS via a resistor in the PCM.That is, the resistor in the PCM and the thermistor in the ECTS are connected in series. When the resistance value of the thermistor in the ECTS changes according to the engine coolant temperature, the output voltage also changes. During cold engine operation the PCM increases the fuel injection duration and controls the ignition timing using the information of engine coolant temperature to avoid engine stalling and improve drivability.



SPECIFICATION

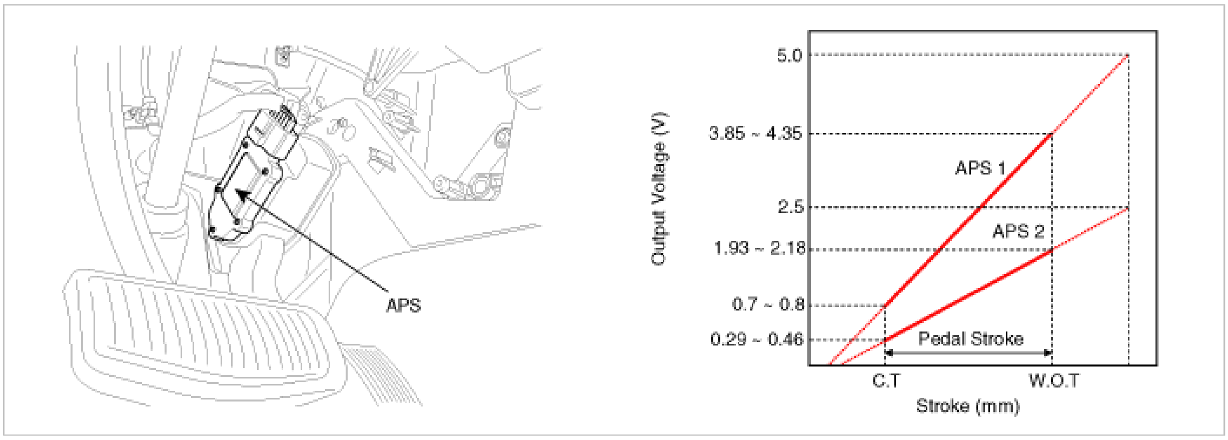
Temperature		Resistance(kΩ)
°C	°F	
-40	-40	48.14kΩ
-20	-4	14.13 ~ 16.83kΩ
0	32	5.79kΩ
20	68	2.31 ~ 2.59kΩ
40	104	1.15kΩ
60	140	0.59kΩ
80	176	0.32kΩ

SCHEMATIC DIAGRAM



Fuel System > Engine Control System > Accelerator Position Sensor (APS) > Description and Operation

DESCRIPTION



Accelerator Position Sensor (APS) is installed on the accelerator pedal module and detects the rotation angle of the accelerator pedal. The APS is one of the most important sensors in engine control system, so it consists of the two sensors which adapt individual sensor power and ground line. The second sensor monitors the first sensor and its output voltage is half of the first one. If the ratio of the sensor 1 and 2 is out of the range (approximately 1/2), the diagnostic system judges that it is abnormal.

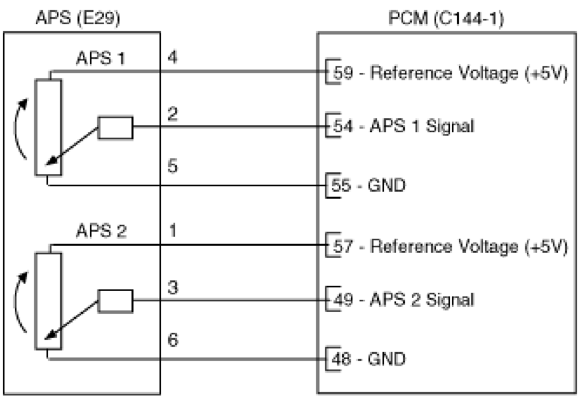
SPECIFICATION

Pedal Position	Output Voltage (V) [Vref = 5.0V]	
	APS1	APS2
C.T	0.7 ~ 0.8V	0.29 ~ 0.46V
W.O.T	3.85 ~ 4.35V	1.93 ~ 2.18V

Item	Sensor Resistance
APS1	0.7 ~ 1.3kΩ at 20°C (68°F)
APS2	1.4 ~ 2.6kΩ at 20°C (68°F)

SCHEMATIC DIAGRAM

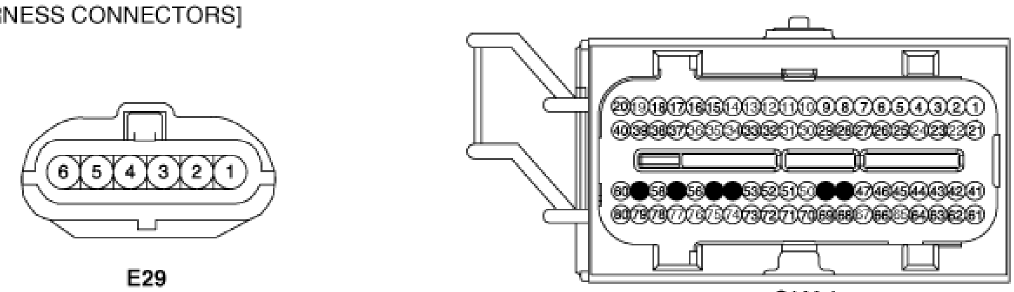
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Funtion
1	PCM C144-1 (57)	APS 2 Reference Voltage (+5V)
2	PCM C144-1 (54)	APS 1 Signal
3	PCM C144-1 (49)	APS 2 Signal
4	PCM C144-1 (59)	APS 1 Reference Voltage (+5V)
5	PCM C144-1 (55)	APS 1 Ground
6	PCM C144-1 (48)	APS 2 Ground

[HARNESS CONNECTORS]

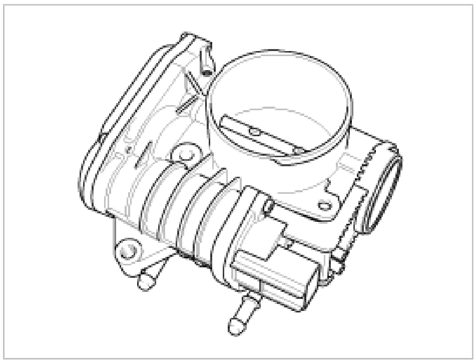


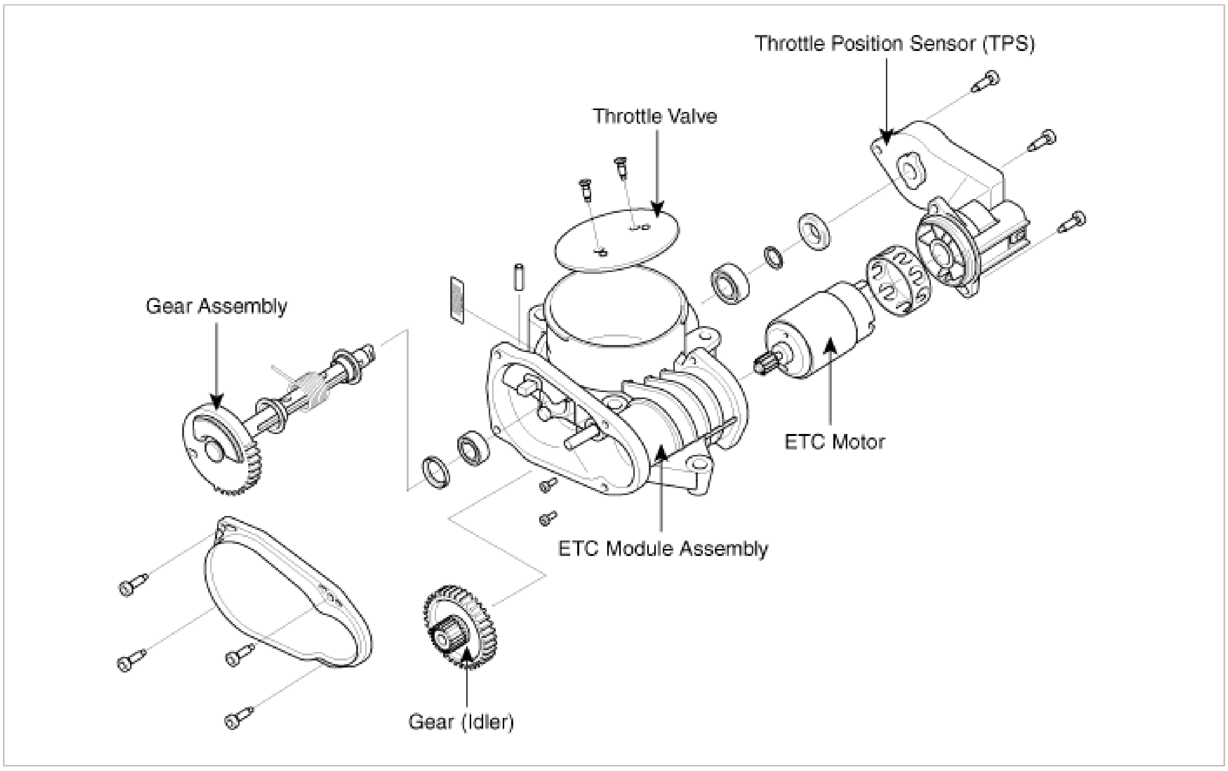
Fuel System > Engine Control System > ETC (Electric Throttle control) System > Description

and Operation

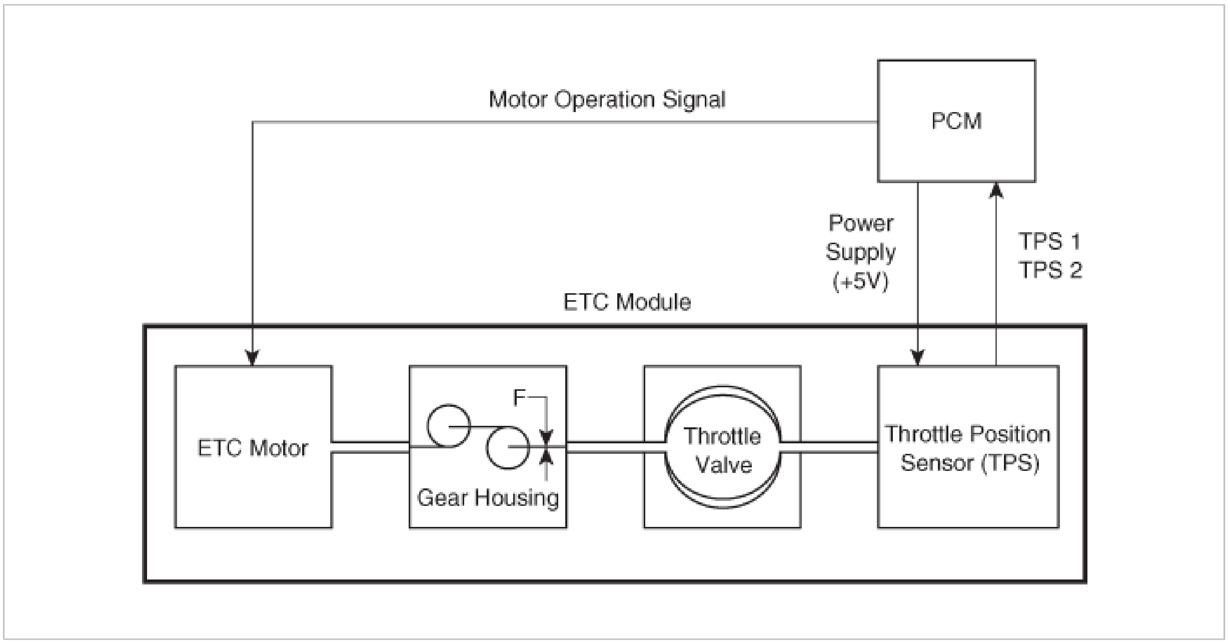
DESCRIPTION

ETC (Electronic Throttle Control) system is electronically controlled throttle device which controls the throttle valve. It consists of ETC motor, throttle body and throttle position sensor (TPS). A mechanical throttle control system receives a driver's intention via a wire cable between the accelerator and the throttle valve, while this ETC system does the signal from the Accelerator Position Sensor (APS) installed on the accelerator pedal. After the PCM receives the APS signal and calculates the throttle opening angle, it activates the throttle valve by using the ETC motor. Additionally, it can materialize cruise control function without any special devices.





COMPONENTS

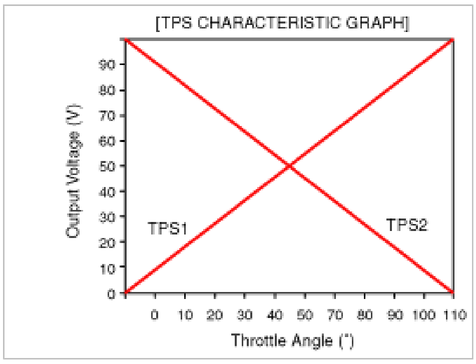


SPECIFICATION

[THROTTLE POSITION SENSOR]

Throttle Angle(°)	Output Voltage(V) [Vref = 5.0V]	
	TPS1	TPS2
0°	0V	5.0V
10°	0.5V	4.5V
20°	0.9V	4.1V
30°	1.4V	3.6V
40°	1.8V	3.2V
50°	2.3V	2.7V
60°	2.7V	2.3V
70°	3.2V	1.8V
80°	3.6V	1.4V
90°	4.1V	0.9V
100°	4.5V	0.5V
110°	5.0V	0V

Item	Sensor Resistance
TPS1	4.0 ~ 6.0kΩ at 20°C (68°F)
TPS2	2.72 ~ 4.08kΩ at 20°C (68°F)



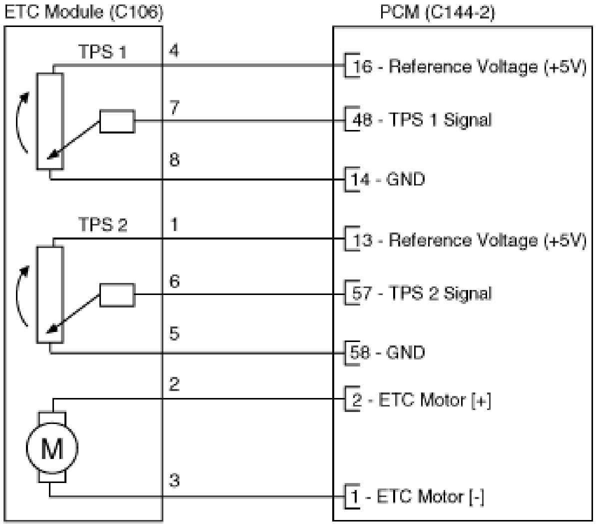
[ETC MOTOR]

Item	Sensor Resistance

Coil Resistance (Ω)	1.275 ~ 1.725Ω at 20°C (68°F)

SCHEMATIC DIAGRAM

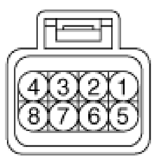
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

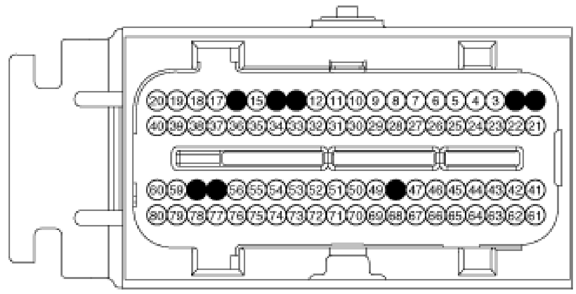
Terminal	Connected to	Funtion
1	PCM C144-2 (13)	TPS 2 Reference Voltage (+5V)
2	PCM C144-2 (2)	ETC Motor [+] Control
3	PCM C144-2 (1)	ETC Motor [-] Control
4	PCM C144-2 (16)	TPS 1 Reference Voltage (+5V)
5	PCM C144-2 (58)	TPS 2 Ground
6	PCM C144-2 (57)	TPS 2 Signal
7	PCM C144-2 (48)	TPS 1 Signal
8	PCM C144-2 (14)	TPS 1 Ground

[HARNESS CONNECTORS]



C106

ETC MODULE



C144-2

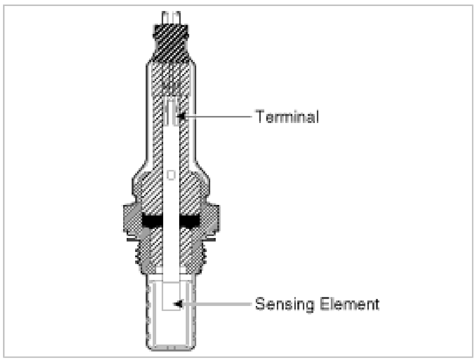
PCM

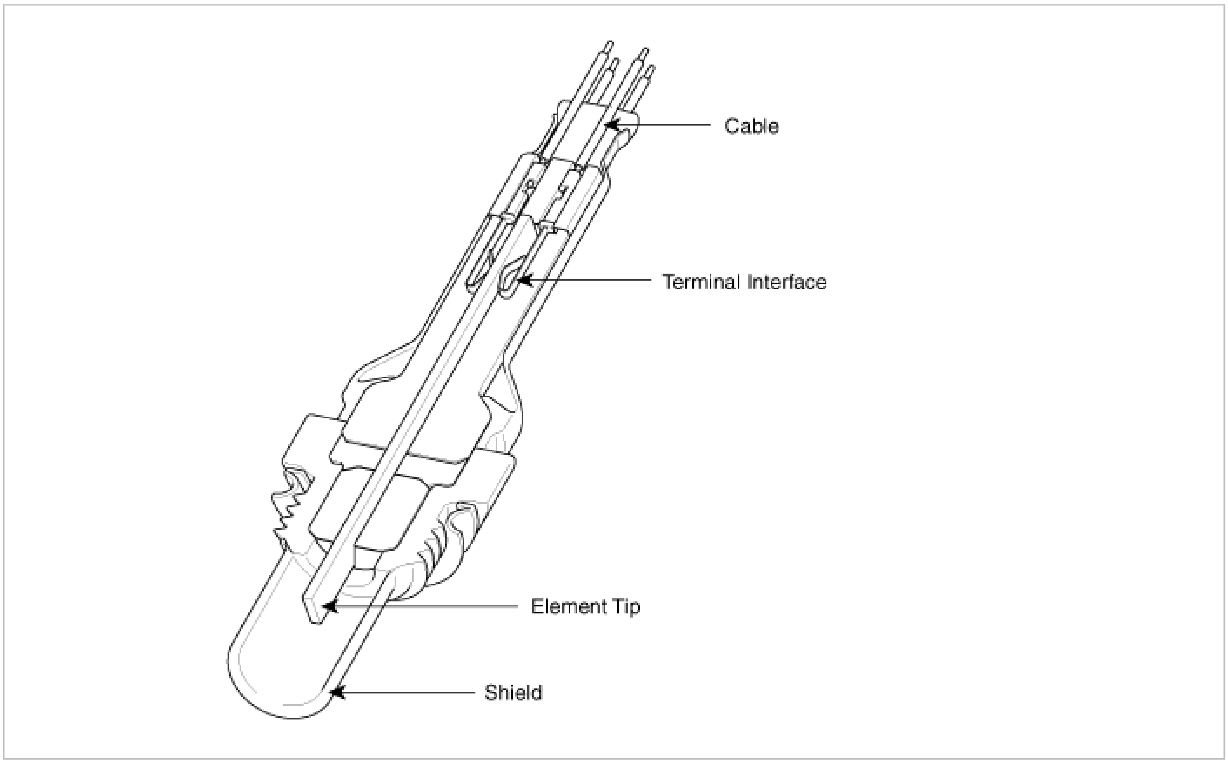
FAIL-SAFE MODE

Mode	Description	Symptom	Possible Cause
MODE 1	FORCED ENGINE SHUTDOWN	Engine stop	• ETC system can't proceed reliable algorithm procedure - Fatal PCM internal programming error - Faulty intake system or throttle body
MODE 2	FORCED IDLE & POWER MANAGEMENT	Forced idle state controlled by fuel quantity regulation and ignition timing adjustment	• ETC system can't control engine power via throttle device • Disabled throttle control or broken throttle position information
MODE 3	FORCED IDLE	Forced idle state and no response for accelerator activation	• No information about the accelerator position - Broken APS 1 and 2, faulty A/D converter or internal controller
MODE 4	LIMIT PERFORMANCE & POWER MANAGEMENT	Engine power is determined by accelerator position and idle power requirement (Limited vehicle running)	• ETC system can't securely control engine power
MODE 5	LIMIT PERFORMANCE	1. Engine power varies with accelerator position, but driver perceives lack of engine power. 2. MIL ON (Normal vehicle running)	• Not reliable accelerator position signal or bad maximum power generation - Faulty APS, ignition voltage or internal controller
MODE 6	NORMAL	Normal	

DESCRIPTION

Heated Oxygen Sensor (HO2S) consists of zirconium and alumina and is installed on upstream and downstream of the Manifold Catalyst Converter (MCC). After it compares oxygen consistency of the atmosphere with the exhaust gas, it transfers the oxygen consistency of the exhaust gas to the PCM. When A/F ratio is rich or lean, it generates approximately 1V or 0V respectively. In order that this sensor normally operates, the temperature of the sensor tip is higher than 370°C (698°F). So it has a heater which is controlled by the PCM duty signal. When the exhaust gas temperature is lower than the specified value, the heater warms the sensor tip.



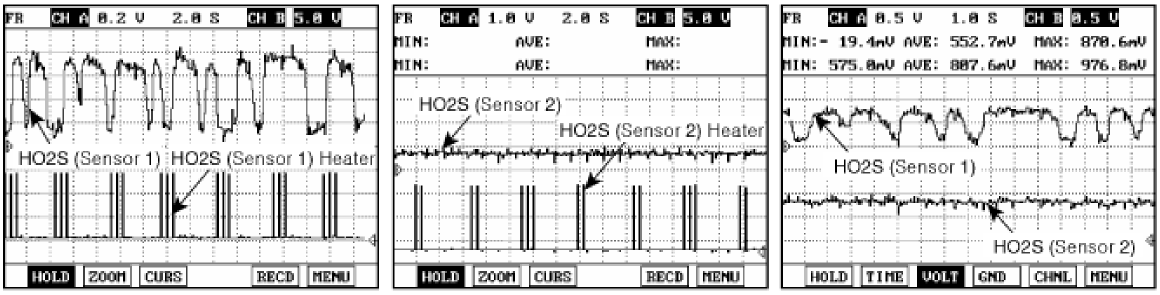


SPECIFICATION

A/F Ratio	Output Voltage (V)
RICH	0.75 ~ 1.00V
LEAN	0 ~ 0.12V

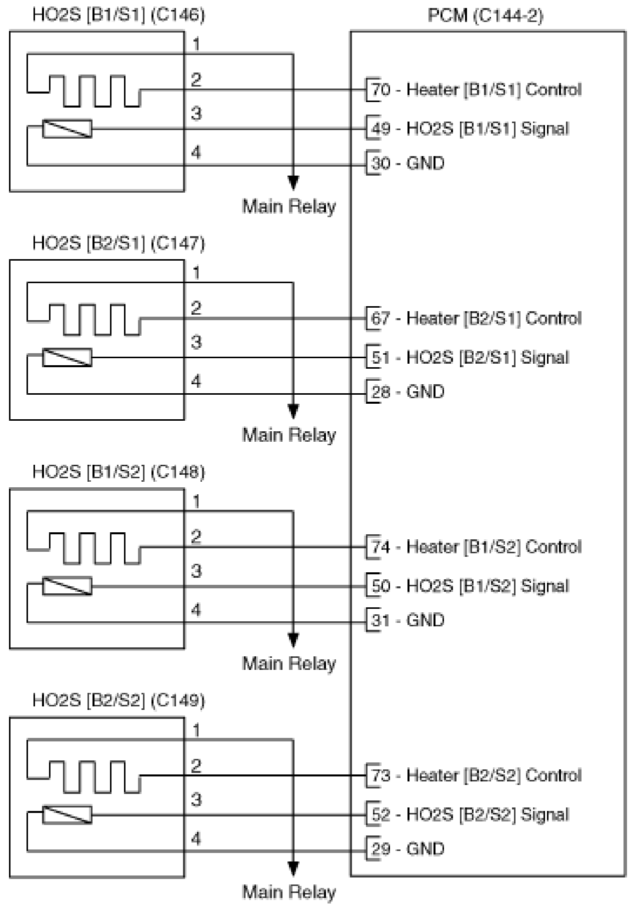
Item	Specification
Heater Resistance (Ω)	8.1 ~ 11.1Ω at 21°C (69.8°F)

WAVEFORM



SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

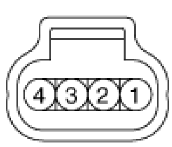
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

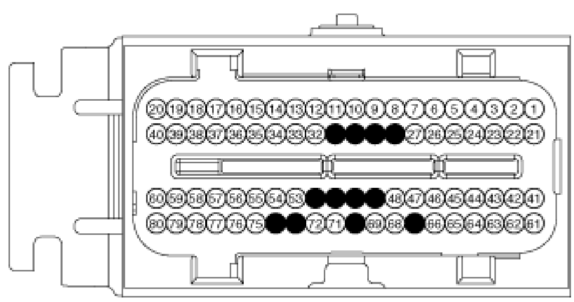
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C144-2

PCM

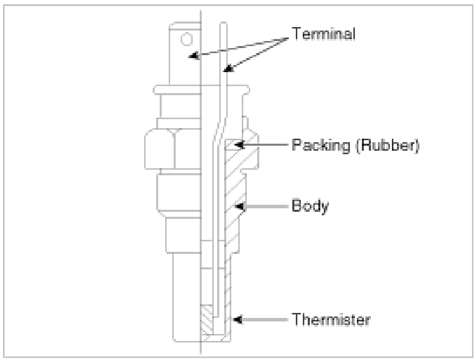
Fuel System > Engine Control System > CVVT Oil Temperature Sensor (OTS) > Description and Operation

DESCRIPTION

Continuously Variable Valve Timing (CVVT) system controls valve overlap by forcibly activating the camshaft and adjusts EGR

(Exhaust Gas Recirculation) amount. It decreases exhaust gas (NOx, HC) and improves fuel economy, idle state, torque in low speed and power in high speed. This system uses engine oil pressure and consists of the two CVVT Oil Control Valves (OCV) in each bank which supplies oil to cam phaser according to PWM (Pulse With Modulator) signal of the PCM, a CVVT Oil Temperature Sensor (OTS) which detects the oil temperature and a cam phaser which is installed on the end of the camshaft and converts camshaft phase. The oil getting out of the CVVT oil control valve flows into the cam phaser and rotates the rotor inside camphaser. At this time, the camshaft rotates with the rotor and the cam phase is changed.

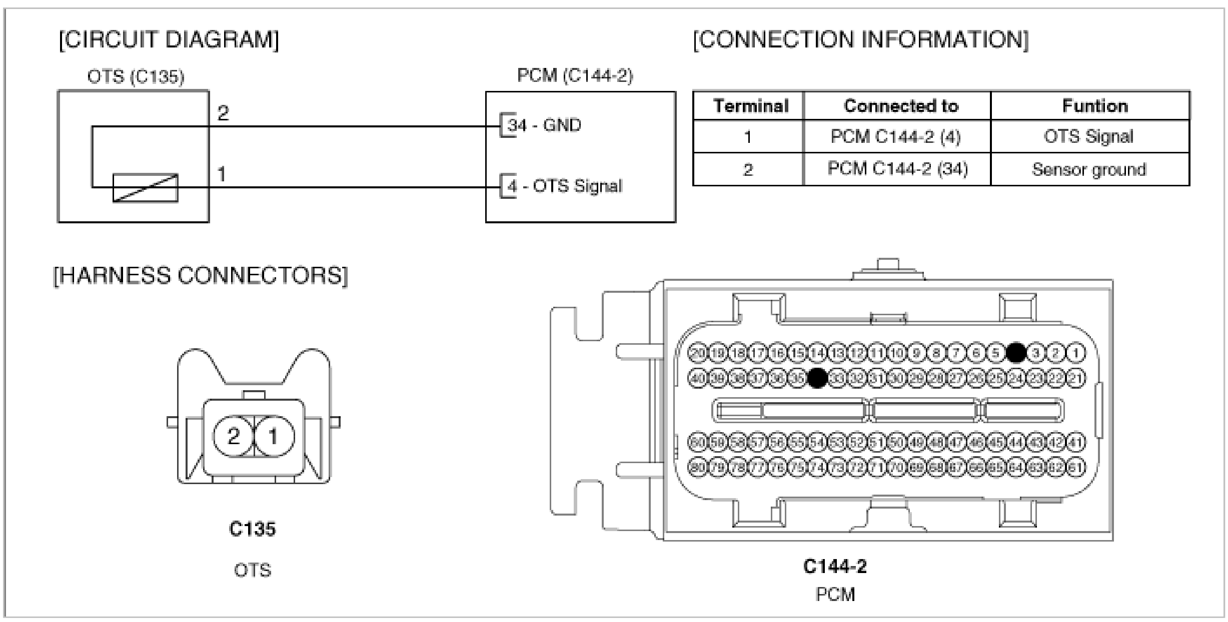
1. When camshaft rotates engine rotation-wise: Intake-Advance / Exhaust-Retard
2. When camshaft rotates counter engine rotation-wise: Intake- Retard / Exhaust- Advance



SPECIFICATION

Temperature		Resistance(kΩ)
°C	°F	
-20	-4	16.52kΩ
20	32	2.45kΩ
80	176	0.29kΩ

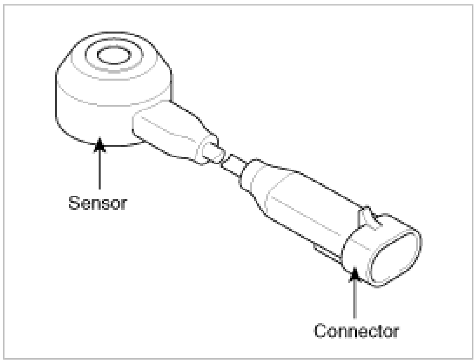
SCHEMATIC DIAGRAM

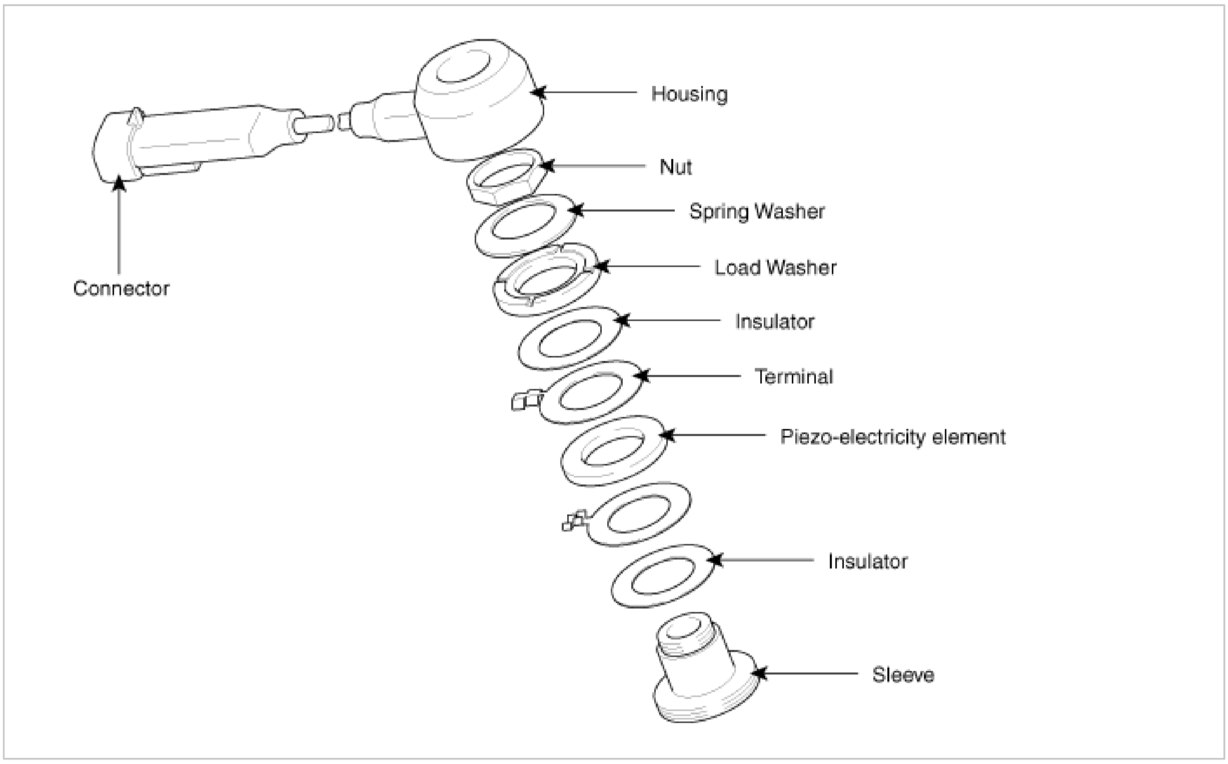


Fuel System > Engine Control System > Knock Sensor (KS) > Description and Operation

DESCRIPTION

Knocking is a phenomenon characterized by undesirable vibration and noise and can cause engine damage. Knock Sensor (KS) senses engine knocking and the two sensors are installed inside the V-valley of the cylinder block. When knocking occurs, the vibration from the cylinder block is applied as pressure to the piezoelectric element. At this time, this sensor transfers the voltage signal higher than the specified value to the PCM and the PCM retards the ignition timing. If the knocking disappears after retarding the ignition timing, the PCM will advance the ignition timing. This sequential control can improve engine power, torque and fuel economy.

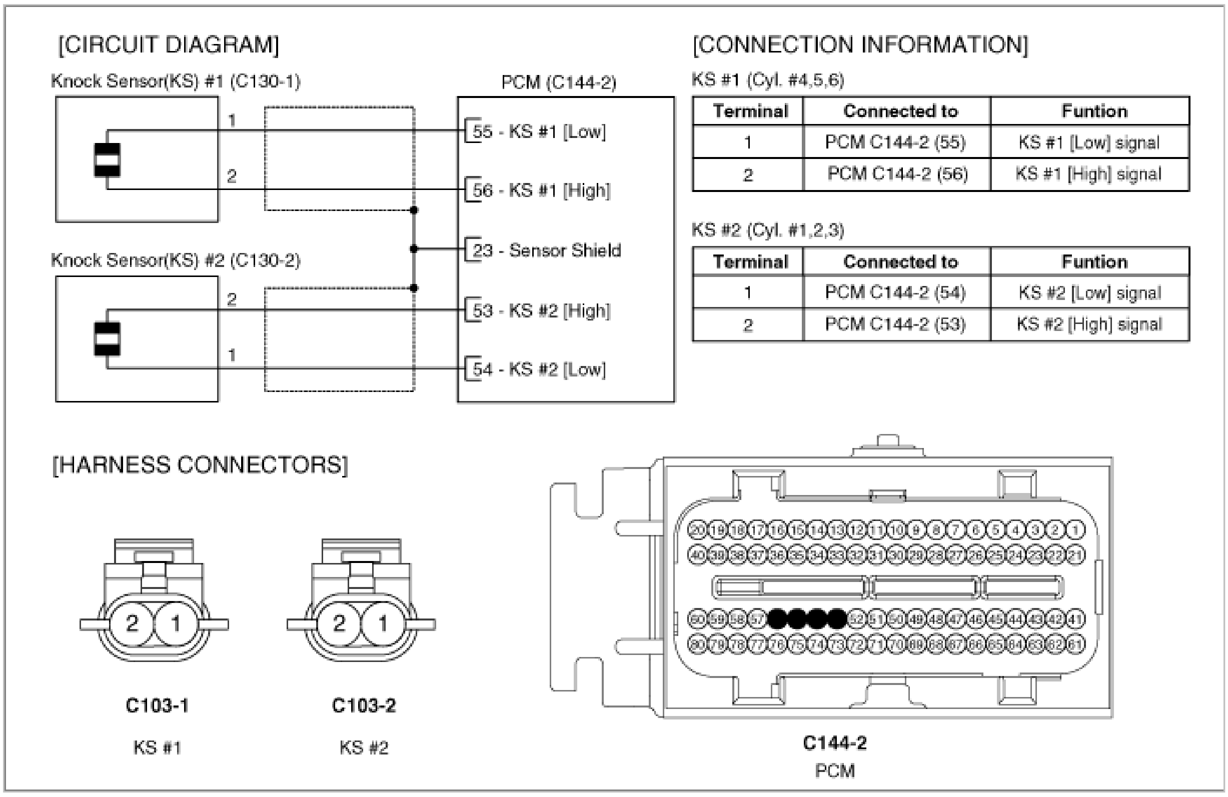




SPECIFICATION

Item	Specification
Capacitance (pF)	1,480 ~ 2,220pF

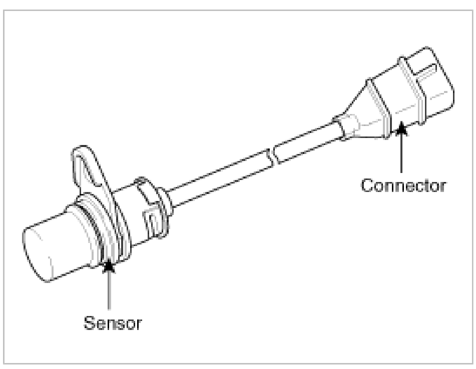
SCHEMATIC DIAGRAM



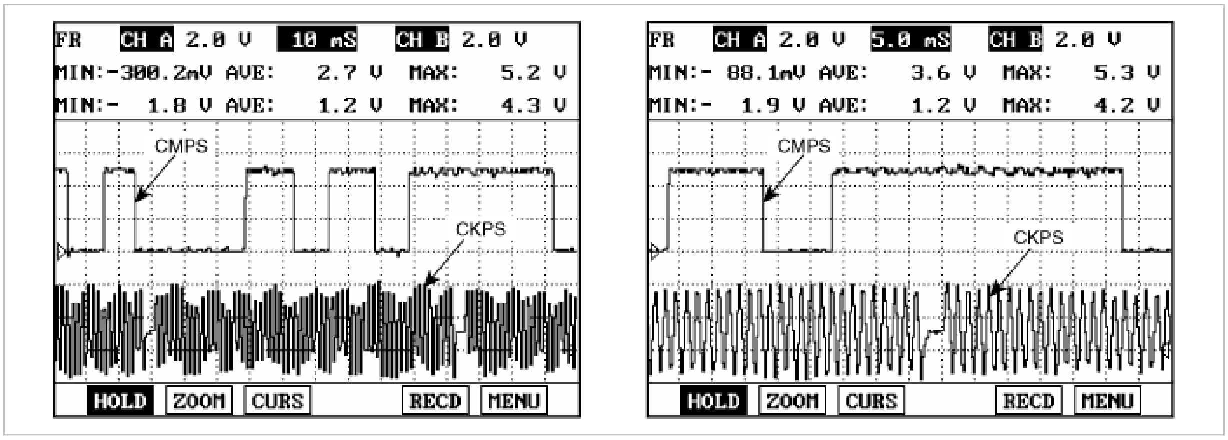
Fuel System > Engine Control System > Crankshaft Position Sensor (CKPS) > Description and Operation

DESCRIPTION

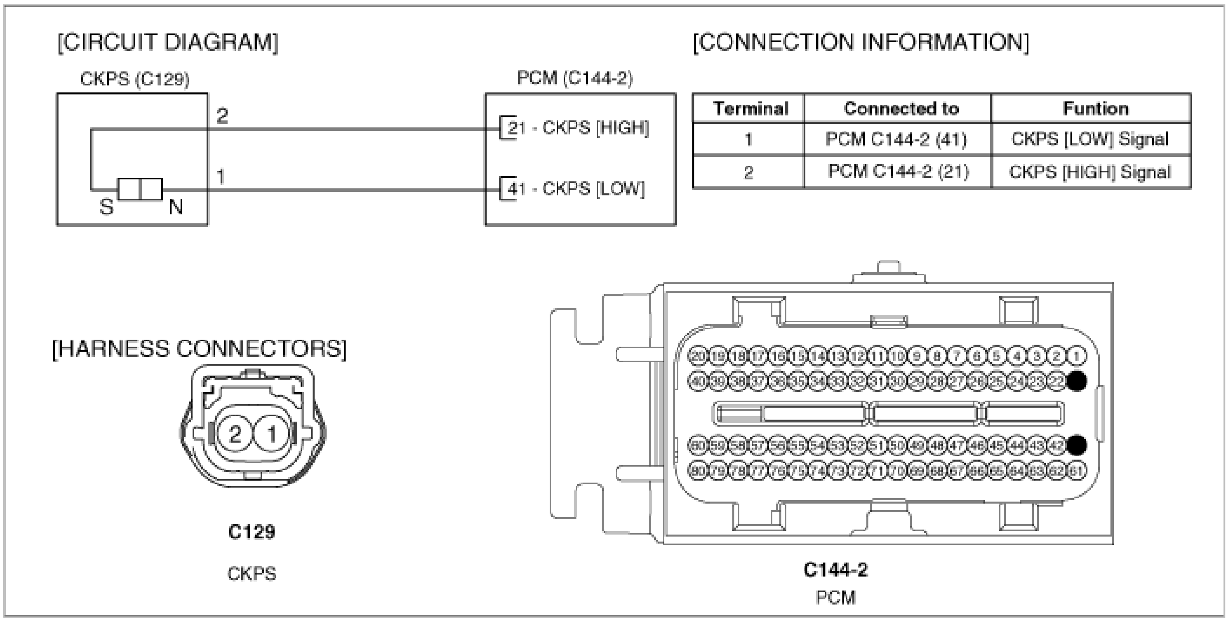
Crankshaft Position Sensor (CKPS) detects the crankshaft position and is one of the most important sensors of the engine control system. If there is no CKPS signal input, fuel is not supplied and the main relay does not operate. That is, vehicle can't run without CKPS signal. This sensor is installed on transaxle housing and generates alternating current by magnetic flux field which is made by the sensor and the target wheel when engine runs. The magnetic flux increases when the protrusion of the target wheel is getting near to the sensor and does not change in the most close position. When the protrusion becomes estranged from the sensor, magnetic flux disappears and alternating current is generated. The target wheel consists of 58 slots and 2 missing slots on 360 CA (Crank Angle).



WAVEFORM



SCHEMATIC DIAGRAM

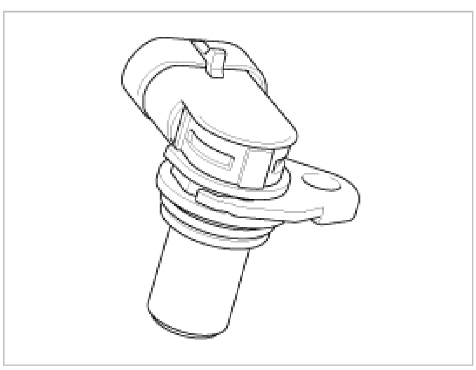


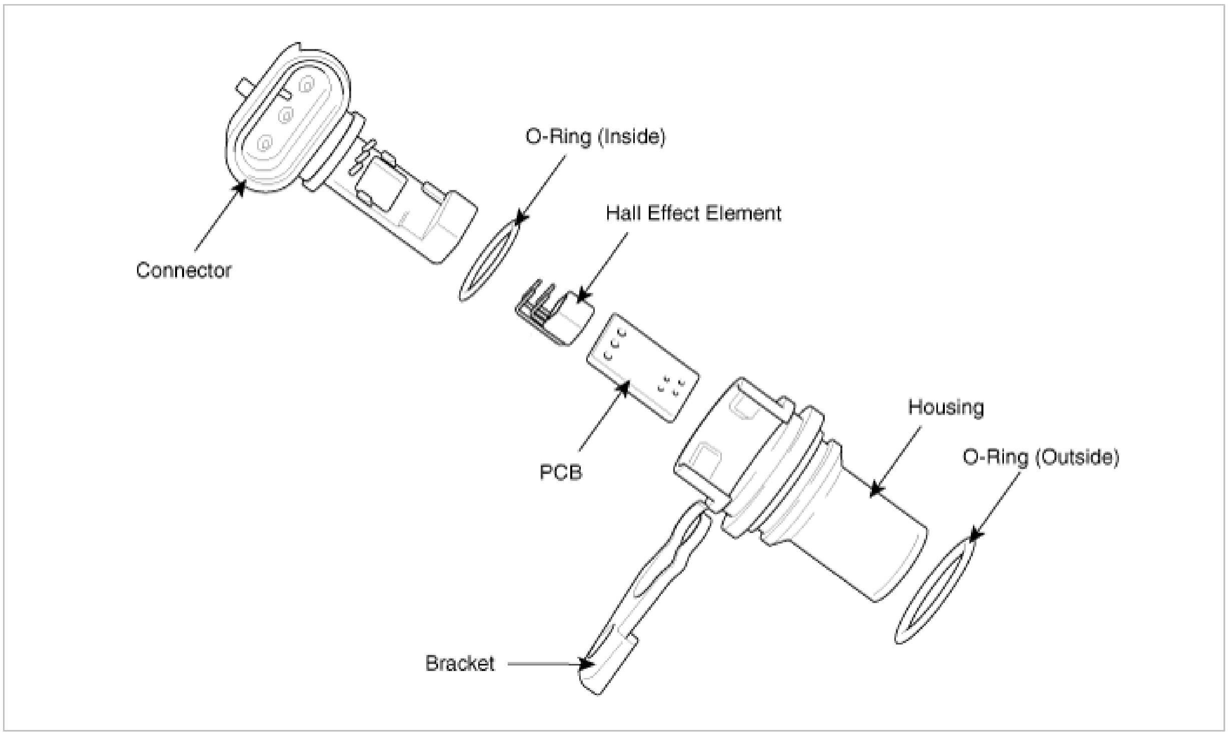
Terminal	Connected to	Funtion
1	PCM C144-2 (41)	CKPS [LOW] Signal
2	PCM C144-2 (21)	CKPS [HIGH] Signal

Fuel System > Engine Control System > Camshaft Position Sensor (CMPS) > Description and Operation

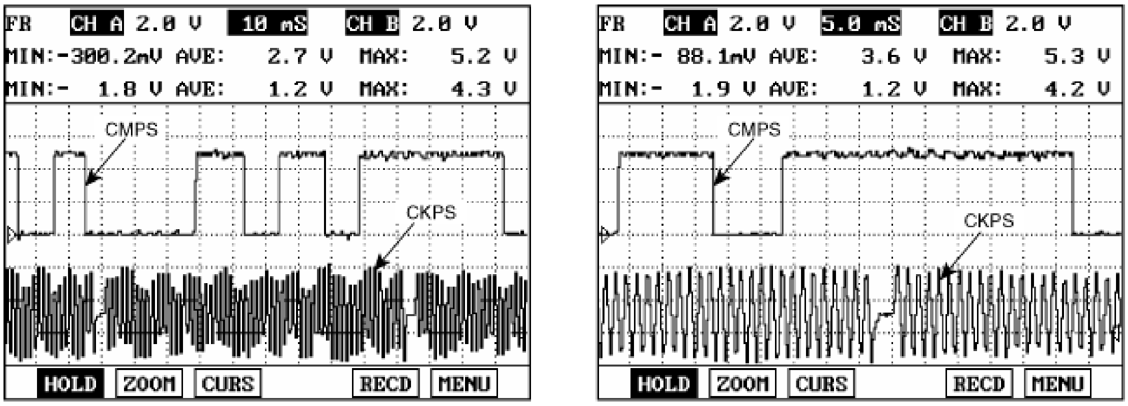
DESCRIPTION

Camshaft Position Sensor (CMPS) is a hall sensor and detects the camshaft position by using a hall element. It is related with Crankshaft Position Sensor (CKPS) and detects the piston position of each cylinder which the CKPS can't detect. The two CMPS are installed on engine head cover of bank 1 and 2 and uses a target wheel installed on the camshaft. This sensor has a hall-effect IC which output voltage changes when magnetic field is made on the IC with current flow. So the sequential injection of the 6 cylinders is impossible without CMPS signal.

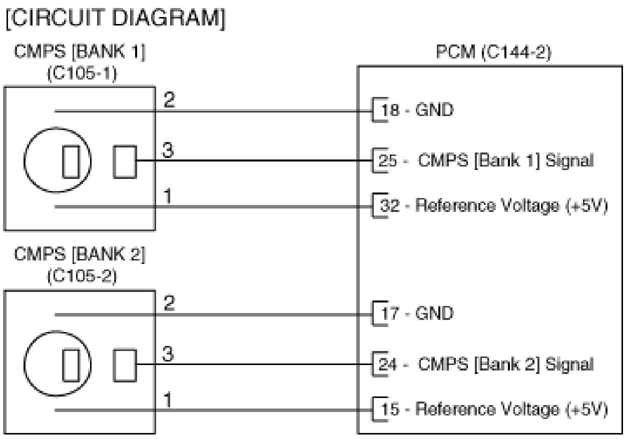




WAVEFORM



SCHEMATIC DIAGRAM



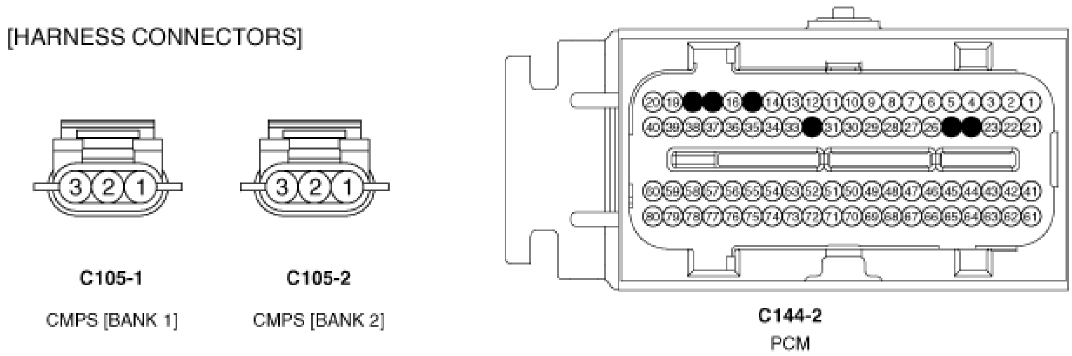
[CONNECTION INFORMATION]

CMPS [BANK 1]

Terminal	Connected to	Funtion
1	PCM C144-2 (32)	Reference Voltage (+5V)
2	PCM C144-2 (18)	Sensor ground
3	PCM C144-2 (25)	CMPS [Bank 1] control

CMPS [BANK 2]

Terminal	Connected to	Funtion
1	PCM C144-2 (15)	Reference Voltage (+5V)
2	PCM C144-2 (17)	Sensor ground
3	PCM C144-2 (24)	CMPS [Bank 2] control

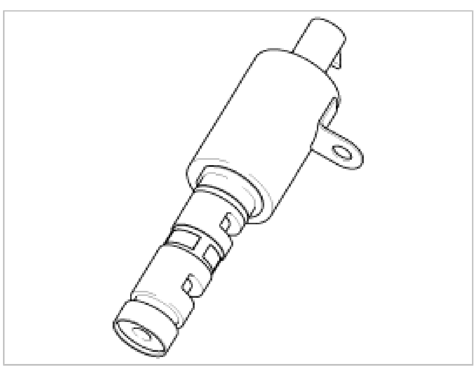


Fuel System > Engine Control System > CVVT Oil Control Valve (OCV) > Description and Operation

DESCRIPTION

Continuously Variable Valve Timing (CVVT) system controls valve overlap with forcibly activating the camshaft and adjusts EGR (Exhaust Gas Recirculation) amount. It decreases exhaust gas (NOx, HC) and improves fuel economy, idle state, torque in low speed and power in high speed. This system uses engine oil pressure and consists of the two CVVT Oil Control Valve (OCV) in each bank which supplies oil to cam phaser according to PWM (Pulse With Modulator) signal of the PCM, a CVVT Oil Temperature Sensor (OTS) which detects the oil temperature and a cam phaser which is installed on the end of the camshaft and converts camshaft phase. The oil getting out of the CVVT oil control valve flows into the cam phaser and rotates the rotor inside cam phaser. At this time, the camshaft rotates with the rotor and the cam phase is changed.

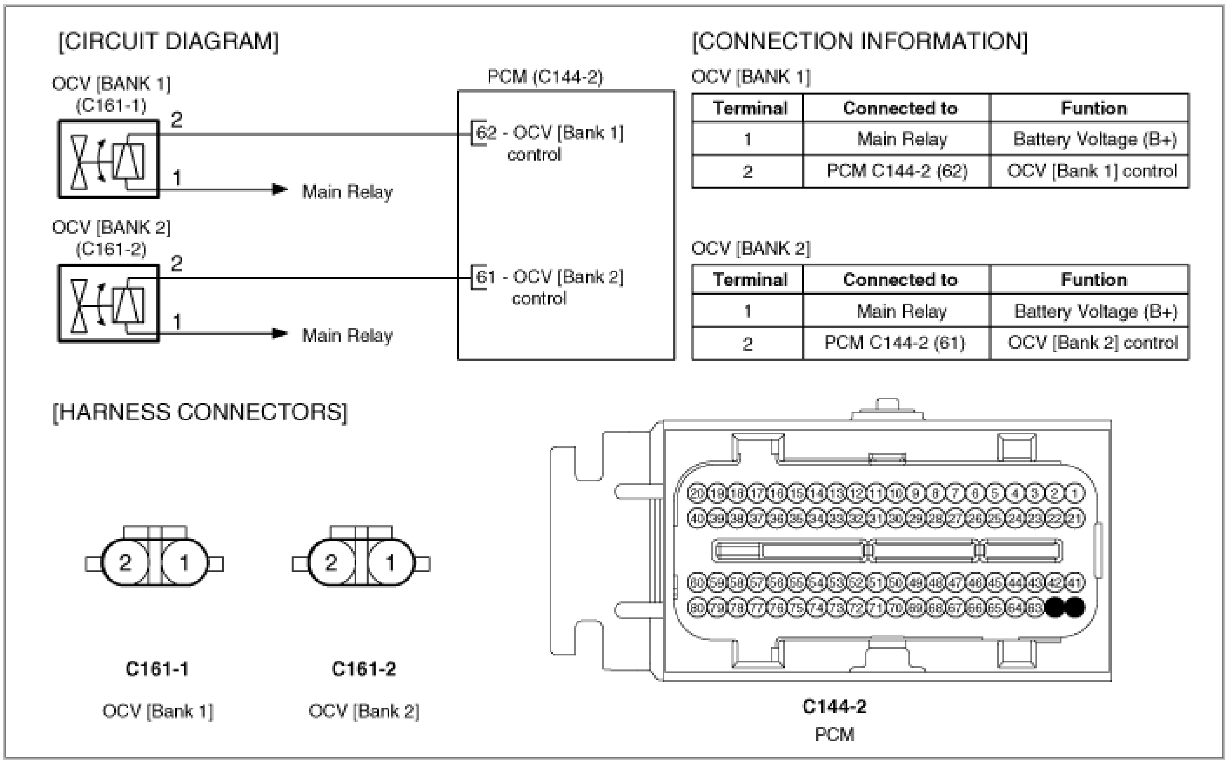
1. When camshaft rotates engine rotation-wise: Intake-Advance / Exhaust-Retard
2. When camshaft rotates counter engine rotation-wise: Intake- Retard / Exhaust- Advance



SPECIFICATION

Item	Specification
Coil Resistance (Ω)	6.7 ~ 7.7Ω at 20°C (68°F)

SCHEMATIC DIAGRAM



Fuel System > Engine Control System > CVVT Oil Control Valve (OCV) > Repair procedures

INSTALLATION

CAUTION

If the OCVs are installed incorrectly, the vehicle may be damaged.
So when installing them, be careful its connector color (Components and harness side).

[Bank and its color]

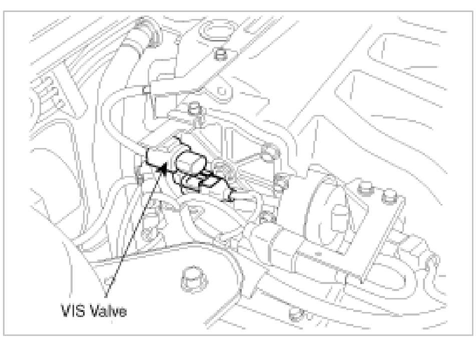
Bank	Component side	Harness side
Bank 1 (RH)	Grey	Grey
Bank 2 (LH)	Black	Black

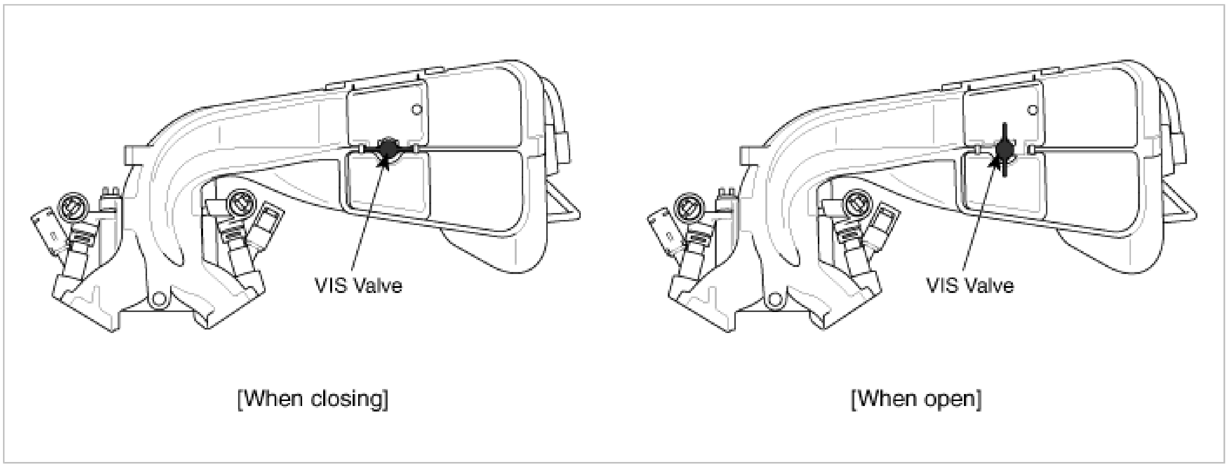
Fuel System > Engine Control System > Variable Intake Solenoid (VIS) Valve > Description and Operation

DESCRIPTION

Variable Intake Solenoid (VIS) Valve is installed on the intake manifold and isolates or not the one bank from the other banks to improve the intake efficiency.

1. Low/Middle Speed: VIS Valve Close → Resonation Effect → Improving Intake Efficiency
2. High Speed: VIS Valve Open → Improving Intake Inertia Effect → Improving Intake Efficiency



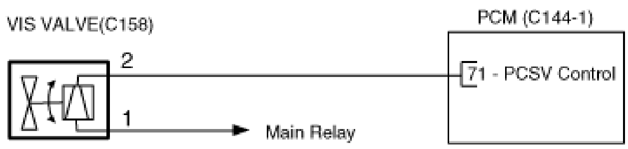


SPECIFICATION

Item	Specification
Coil Resistance (Ω)	30.0 ~ 35.0 Ω at 22°C (71.6°F)

SCHEMATIC DIAGRAM

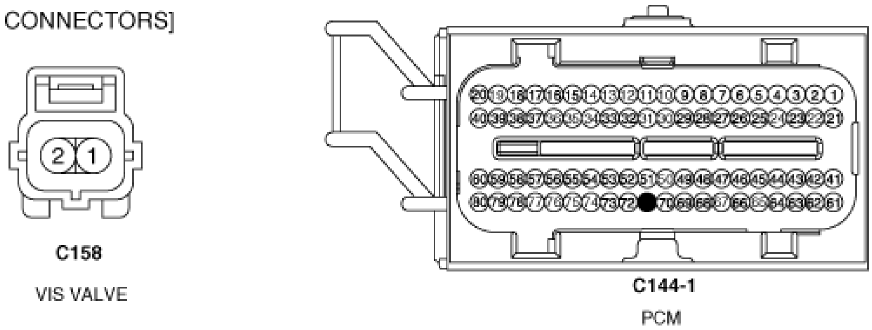
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

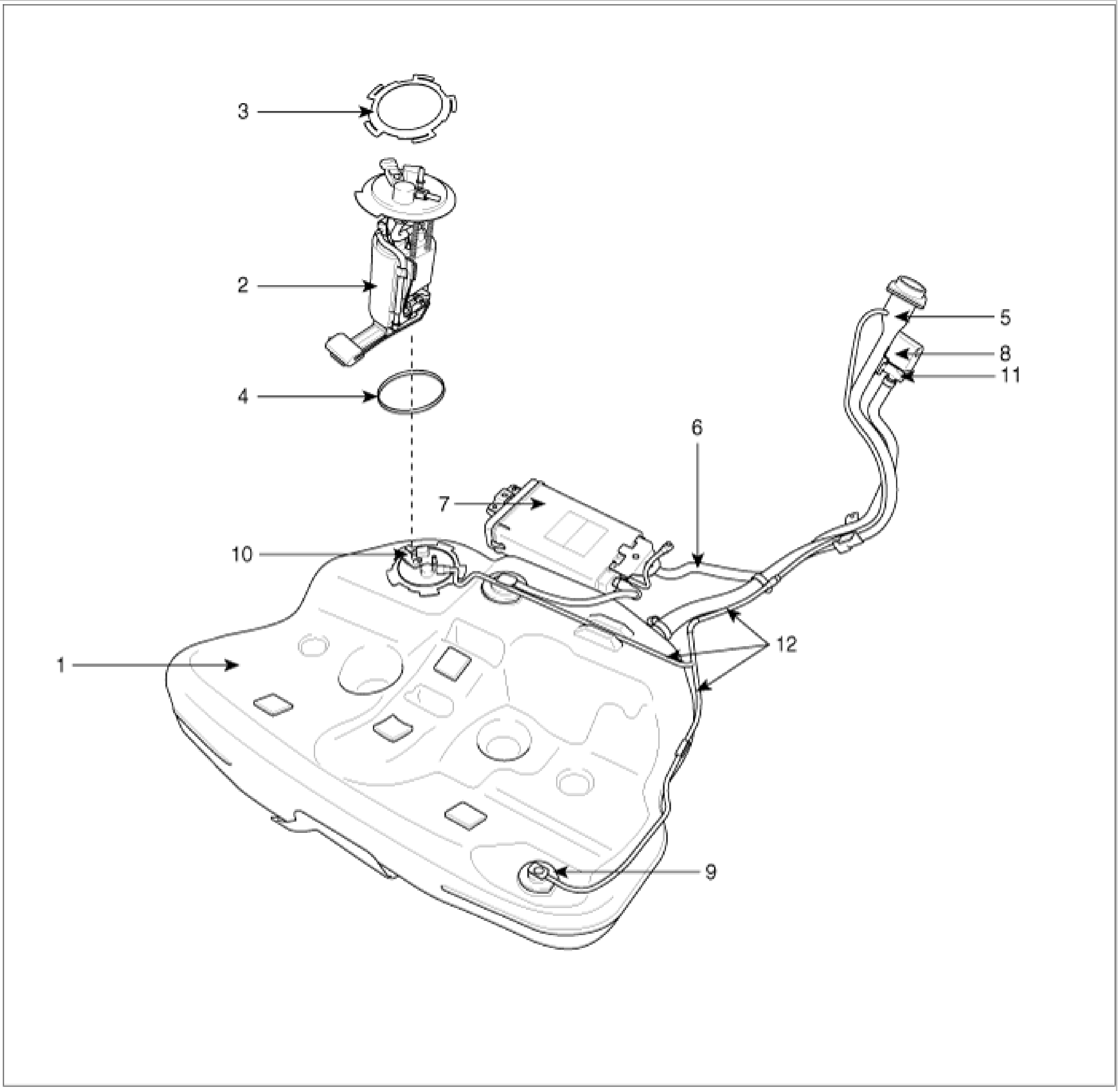
Terminal	Connected to	Funtion
1	Main Relay	Battery voltage (B+)
2	PCM C144-1 (71)	VIS Valve control

[HARNESS CONNECTORS]



Fuel System > Fuel Delivery System > Components and Components Location

COMPONENTS



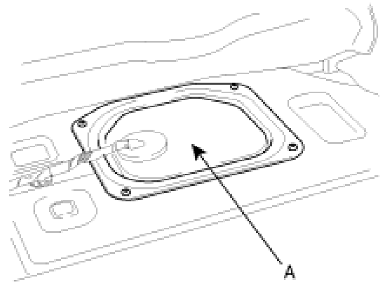
1. Fuel Tank
2. Fuel Pump (including Fuel Filter & Fuel Pressure Regulator)
3. Locking Ring-Fuel Pump
4. Packing-Fuel Pump Plate
5. Fuel Filler Neck Assembly
6. Hose (Canister ↔ Fuel Tank Filter)
7. Canister
8. Fuel Tank Air Filter
9. Fuel Cut Valve
10. Fuel Tank Pressure Sensor (FTPS)
11. Canister Close Valve (CCV)
12. Recirculation Line

Fuel System > Fuel Delivery System > Repair procedures

FUEL PRESSURE TEST

1. PREPARING

1. Open the service cover (A) in trunk.

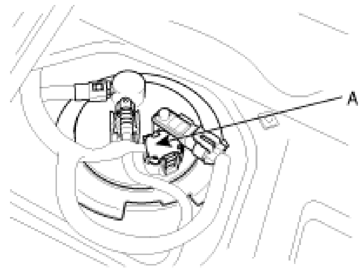


2. RELEASE THE INTERNAL PRESSURE

1. Disconnect the fuel pump connector(A).
2. Start the engine and wait until fuel in fuel line is exhausted.
3. After the engine stalls, turn the ignition switch to OFF position and disconnect the negative (-) terminal from the battery.

NOTE

Be sure to reduce the fuel pressure before disconnecting the fuel feed hose, otherwise fuel will spill out.



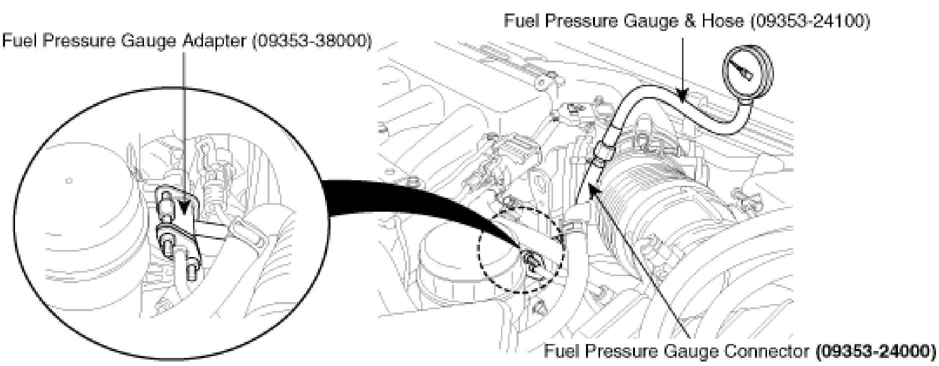
3. INSTALL THE SPECIAL SERVICE TOOL (SST) FOR MEASURING THE FUEL PRESSURE

1. Disconnect the fuel feed hose from the delivery pipe.

CAUTION

Cover the hose connection with a shop towel to prevent splashing of fuel caused by residual pressure in the fuel line.

2. Install the Fuel Pressure Gauge Adapter (09353-38000) between the delivery pipe and the fuel feed hose.
3. Connect the Fuel Pressure Gauge Connector (09353-24000) to the Fuel Pressure Gauge Adapter (09353-38000).
4. Connect the Fuel Pressure Gauge and Hose (09353-24100) to Fuel Pressure Gauge Connector (09353-24000).
5. Connect the fuel feed hose to the Fuel Pressure Gauge Adapter (09353-38000).



4. INSPECT FUEL LEAKAGE ON CONNECTION

1. Connect the battery negative (-) terminal.
2. Apply battery voltage to the fuel pump terminal and activate the fuel pump. With fuel pressure applied, check that there is no fuel leakage from the fuel pressure gauge or connection part.

5. FUEL PRESURE TEST

1. Disconnect the negative (-) terminal from the battery.
2. Connect the fuel pump connector.
3. Connect the battery negative (-) terminal.
4. Start the engine and measure the fuel pressure at idle.

Standard Value: 374 ~ 384 kpa (3.82 ~ 3.92 kgf/㎠, 54.3 ~ 55.8 psi)

- If the measured fuel pressure differs from the standard value, perform the necessary repairs using the table below.

Condition	Probable Cause	Suspected Area
Fuel Pressure too low	Clogged fuel filter	Fuel filter
	Fuel leak on the fuel-pressure regulator that is assembled on fuel pump because of poor seating of the fuel-pressure regulator.	Fuel Pressure Regulator
Fuel Pressure too High	Sticking fuel pressure regulator	Fuel Pressure Regulator

5. Stop the engine and check for a change in the fuel pressure gauge reading.

After engine stops, the gauge reading should hold for about 5 minutes

- Observing the declination of the fuel pressure when the gauge reading drops and perform the necessary repairs using the table below.

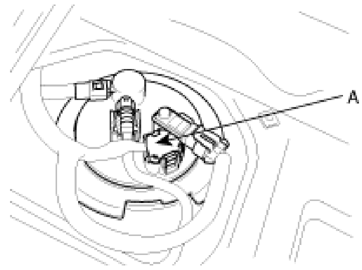
Condition	Probable Cause	Supected Area
Fuel pressure drops slowly after engine is stopped	Injector leak	Injector
Fuel pressure drops immediately after engine is stopped	The check valve within the fuel pump is open	Fuel Pump

6. RELEASE THE INTERNAL PRESSURE

1. Disconnect the fuel pump connector(A).
2. Start the engine and wait until fuel in fuel line is exhausted.
3. After the engine stalls, turn the ignition switch to OFF position and disconnect the negative (-) terminal from the battery.

NOTE

Be sure to reduce the fuel pressure before disconnecting the fuel feed hose, otherwise fuel will spill out.



7. REMOVE THE SPECIAL SERVICE TOOL (SST) AND CONNECT THE FUEL LINE

1. Disconnect the Fuel Pressure Gauge and Hose (09353-24100) from the Fuel Pressure Gauge Connector (09353-24000).
2. Disconnect the Fuel Pressure Gauge Connector (09353-24000) from the Fuel Pressure Gauge Adapter (09353-38000).
3. Disconnect the fuel feed hose from the Fuel Pressure Gauge Adapter (09353-38000).
4. Disconnect the Fuel Pressure Gauge Adapter (09353-38000) from the delivery pipe.

CAUTION

Cover the hose connection with a shop towel to prevent splashing of fuel caused by residual pressure in the fuel line.

5. Connect the fuel feed hose to the delivery pipe.

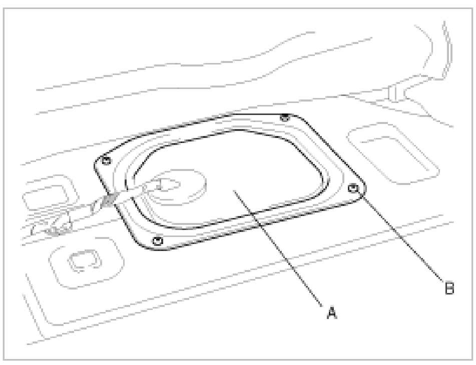
8. INSPECT FUEL LEAKAGE ON CONNECTION

1. Connect the battery negative (-) terminal.
2. Apply battery voltage to the fuel pump terminal and activate the fuel pump. With fuel pressure applied, check that there is no fuel leakage from the fuel pressure gauge or connection part.
3. If the vehicle is normal, connect the fuel pump connector.

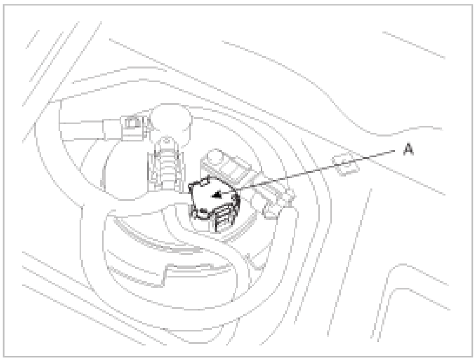
Fuel System > Fuel Delivery System > Fuel Tank > Repair procedures

REMOVAL

1. Preparation
   (1) Open the Service Cover (A) by unscrewing the bolts (B).



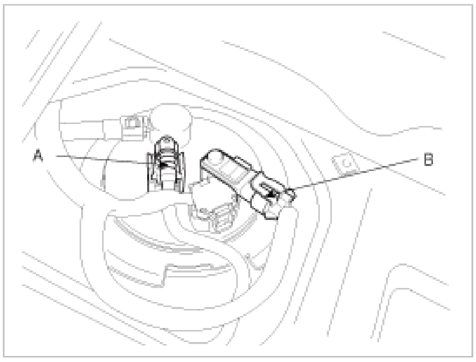
   (2) Disconnect the Fuel Pump Connector (A).



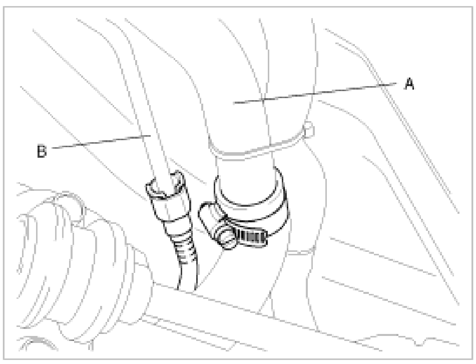
(3) Start the engine and wait until fuel in fuel line is exhausted.

(4) After the engine stalls, turn the ignition switch to OFF position.

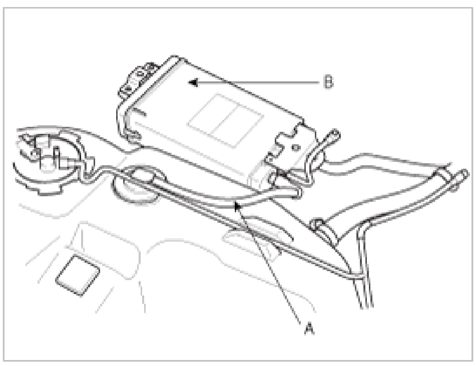
2. Disconnect the Fuel Feed Line (A) and Fuel Tank Pressure Sensor connector (B).



3. Lift the vehicle and support the fuel tank with a jack.
4. Remove the main and center muffler (Refer to the group "EM" in this SHOP MANUAL).
5. Disconnect the Fuel Filler Hose (A) and Recirculation Line (B).



6. Disconnect the Canister Hose (A) from the Canister (B).



7. Remove the fuel tank band mounting bolts (2), and then remove the Fuel Tank from the vehicle.

INSTALLATION

Install the Fuel Tank according to the reverse order of REMOVAL procedure.

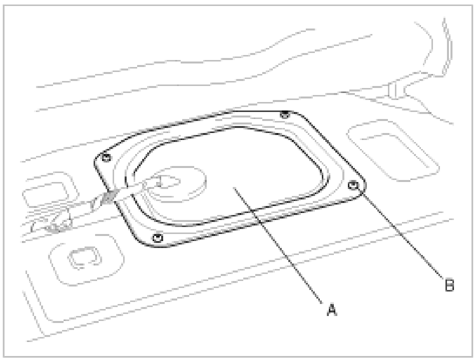
Fuel Tank Band Tightening Torques: 34.3 ~ 53.9 N·m (3.5 ~ 5.5 kgf·m, 25.3 ~ 39.8 lbf·ft)

Fuel System > Fuel Delivery System > Fuel Pump > Repair procedures

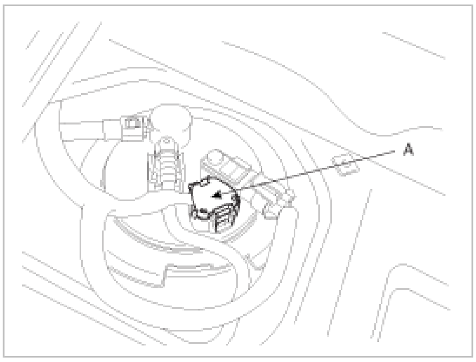
REMOVAL

1. Preparation

(1) Open the Service Cover (A) with unscrewing the bolts (B).



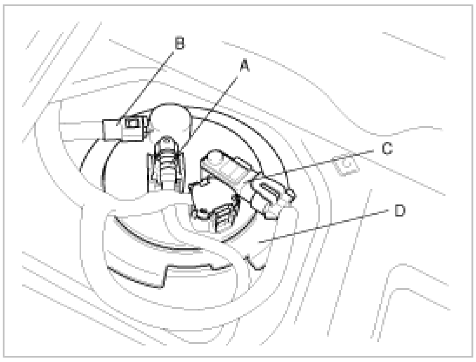
(2) Disconnect the Fuel Pump Connector (A).



(3) Start the engine and wait until fuel in fuel line is exhausted.

(4) After the engine stalls, turn the ignition switch to OFF position.

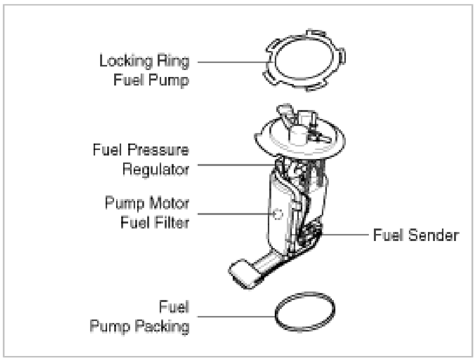
2. Disconnect the Fuel Feed Line (A), Recirculation Line (B) and Fuel Tank Pressure Sensor connector (C).



3. Unfasten the Fuel Pump Locking Ring (D) with the Special Service Tool (Refer to "SPECIAL SERVICE TOOL").

> CAUTION
>
> Be careful NOT TO damage the surface of the fuel rank.

4. Remove the Fuel Pump assembly from the Fuel Tank.



INSTALLATION

Install the Fuel Pump according to the reverse order of REMOVAL procedure.

NOTE

Replace the Fuel Pump Locking Ring and Fuel Pump Plate Packing with a new one when installing the fuel pump again.

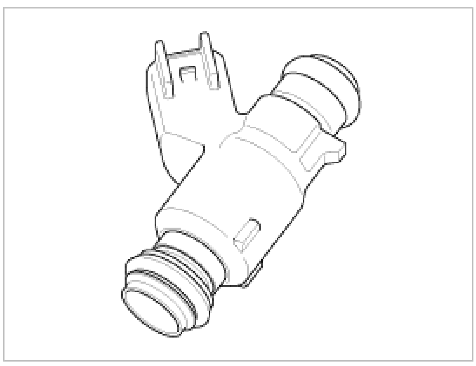
Fuel System > Fuel Delivery System > Injector > Description and Operation

DESCRIPTION

Based on information from various sensors, the PCM measures the fuel injection amount. The fuel injector is a solenoid-operated valve and the fuel injection amount is controlled by length of time that the fuel injector is held open. The PCM controls each injector by grounding the control circuit. When the PCM energizes the injector by grounding the control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the PCM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should be peak for a moment.

CAUTION

If an injector connector is disconnected for more than 46 seconds while the engine runs, the PCM will determine that the cylinder is misfired and cut fuel supply. So be careful not to exceed 46 seconds. But the engine runs normally in 10 seconds after turning the ignition key off.

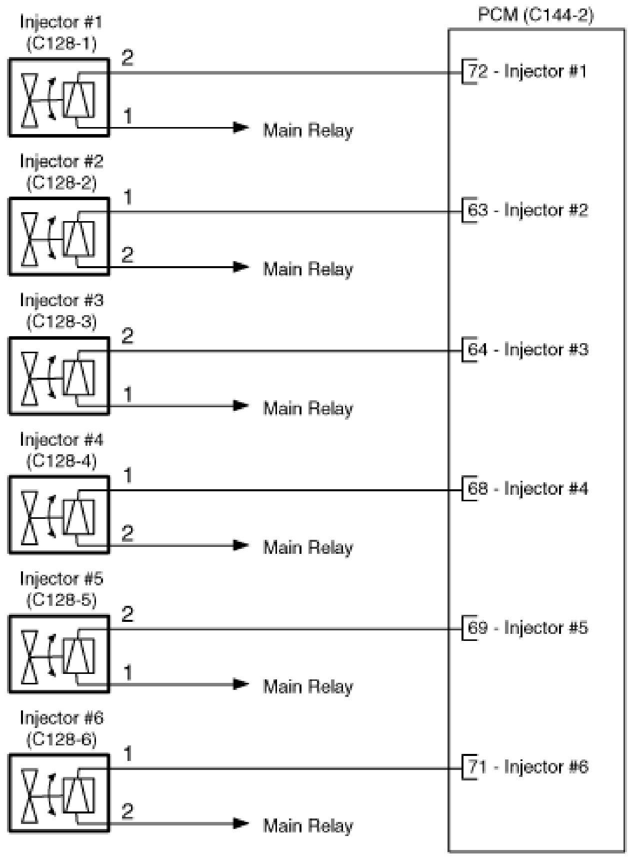


SPECIFICATION

Item	Specification
Coil Resistance (Ω)	11.4 ~ 12.6Ω at 20°C (68°F)

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Injector #1

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (72)	Injector #1 control

Injector #2

Terminal	Connected to	Funtion
1	PCM C144-2 (63)	Injector #2 control
2	Main Relay	Battery Voltage (B+)

Injector #3

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (64)	Injector #3 control

Injector #4

Terminal	Connected to	Funtion
1	PCM C144-2 (68)	Injector #4 control
2	Main Relay	Battery Voltage (B+)

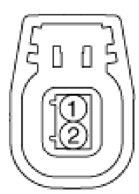
Injector #5

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (69)	Injector #5 control

Injector #6

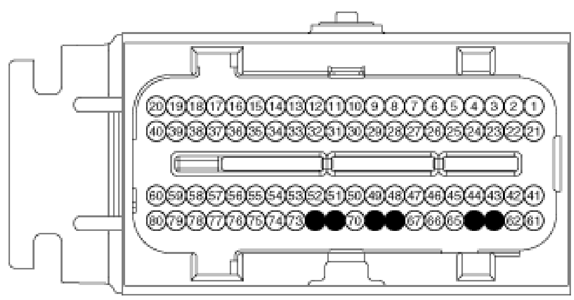
Terminal	Connected to	Funtion
1	PCM C144-2 (71)	Injector #6 control
2	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTORS]



C128-1,2,3,4,5,6

Injector #1,2,3,4,5,6

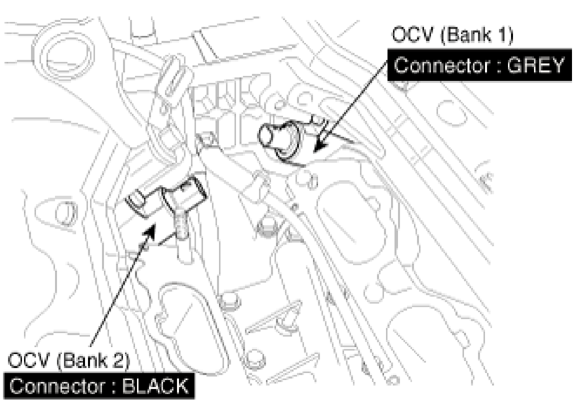


C144-2

PCM

Fuel System > Troubleshooting > P0011

COMPONENT LOCATION



GENERAL DESCRIPTION

Different from the existing fixed cam phase angle type, CVVT(Continuously Variable Valve Timing) is the device which varies cam phase angle continuously to be optimum. And with engine oil pressure, it operates. CVVT consists of OCV(Oil Control Valve) and cam phaser. OCV, mounted on cylinder head, controlls the amount and direction of oil delivered to cam phaser by oil valve which is connected to a solenoid. Cam phaser, rotating cam phaser rotor with pressure and amount of oil produced by OCV, rotates cam shaft forcefully for or against the rotating direction and finally, cam shaft phase changes. With the appliance of CVVT, engine power,fuel efficiency and the quality of exhause gas are improved.

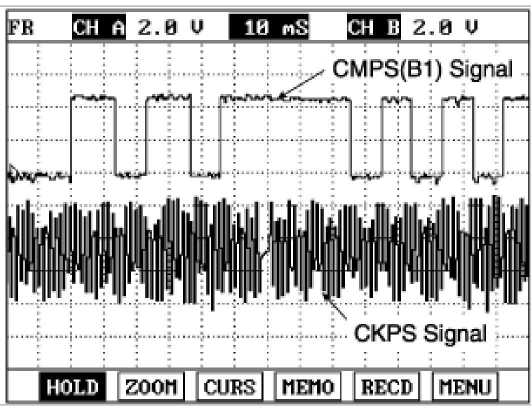
DTC DESCRIPTION

This diagnostic monitors the phasing response rate and determines whether the response rate is fast enough. A state machine is used to capture the response rate.The measured results are then compared to an allowable threshold. The threshold is a function of the oil temperature and the requested desired rate. Test of the phaser response rate requires an engine speed or engine load change.
PCM detects CAM phasing average rate while cam offset is available. If the CAM phasing rate is failure in 12 times out of 15 CAM phasing test PCM determines that a fault exists and a DTC is stored.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Determines if the phaser is moving at an expected rate	• Excessive phasing system leakage • Binding Oil Pressure (ex. Blockage in OCV filter) • Faulty PCM
Enable Conditions	• Cam Offset is available	
Threshold value	• Cam phasing average rate is out of threshold programmed in PCM	
Diagnosis Time	• Continuous (12 tests failure for 15 cam edge tests)	
MIL On Condition	• 2 driving cycles	

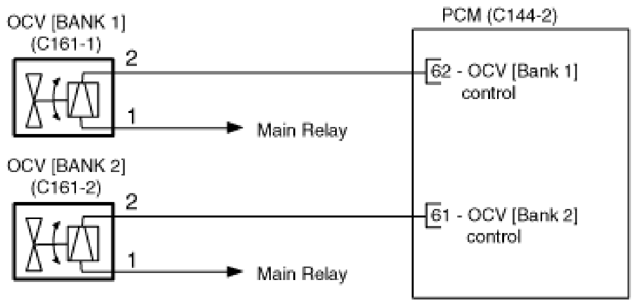
SIGNAL WAVEFORM AND DATA



This example shows a typical Crankshaft Position Sensor(CKPS) and Camshaft Position Sensor(CMPS) waveform at idle.
If the Cam Phasing is generated by PCM the offset of cam target wheel tooth varies against 58X reference tooth of CKPS.
Cam phasing can be detected from offset variation.

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

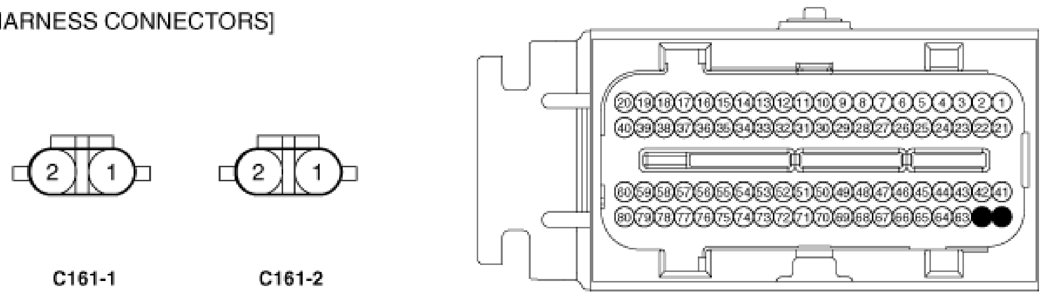
OCV [BANK 1]

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (62)	OCV [Bank 1] control

OCV [BANK 2]

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (61)	OCV [Bank 2] control

[HARNESS CONNECTORS]



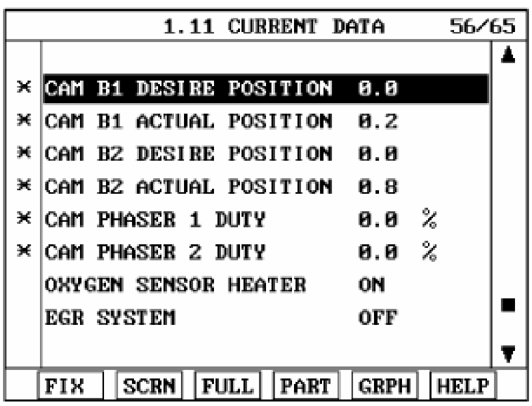
C161-1
OCV [Bank 1]

C161-2
OCV [Bank 2]

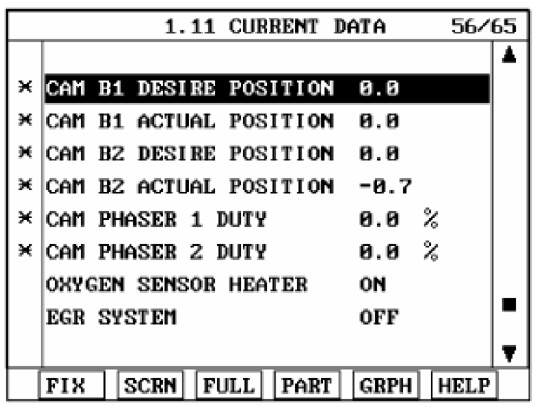
C144-2
PCM

MONITOR SCANTOOL DATA

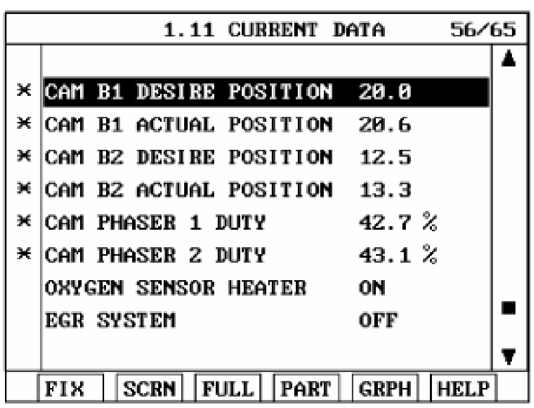
1. Connect scantool and ENG "ON".
2. Monitor "CMPS(B1)" on the service data.



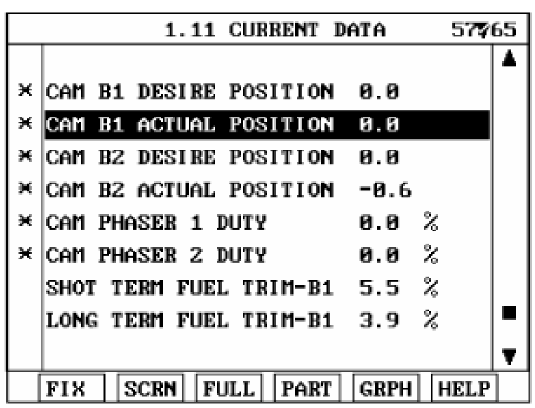
Normal data - idle



Open circuit - idle



Normal at accelleration



Open at accelleration

3. Are the "CMPS(B1)" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Go to "System Inspection" procedure.

SYSTEM INSPECTION

1. Visual Inspection
   (1) Check oil level is O.K.

   (2) Check oil level is contaminated.

   (3) Check that any oil leakage or blockage is occurred on the parts related to CVVT.

   (4) Has a problem been found ?

   YES

   ▸ Repair or replace as necessary and then, go to " Verification of Vehicle Repair" procedure.

   NO

   ▸ Go to "Component Inspection" procedure.

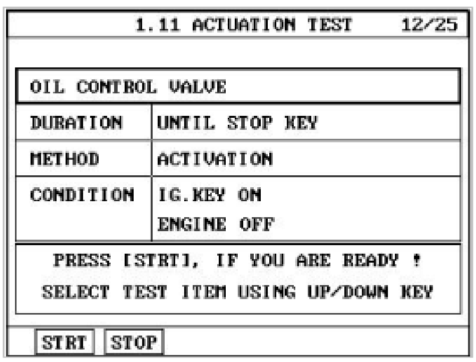
COMPONENT INSPECTION

1. Check OCV
   (1) connect scantool and IG "ON"

   (2) Select "OCV" on the Actuation Test

   (3) Activates "OCV" by pressing "STRT(F1)" key
   (should hear a faint click from Oil Control solenoid Valve)

   (4) Repeat this procedure 4 or 5 times to ensure intake valve control solenoid reliability



   (5) Has a problem been found ?

   YES

   ▸ Substitute with a known - good CVVT and check for proper operation. If the problem is corrected, replace CVVT and go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Substitute with a known - good OCV and check for proper operation. If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

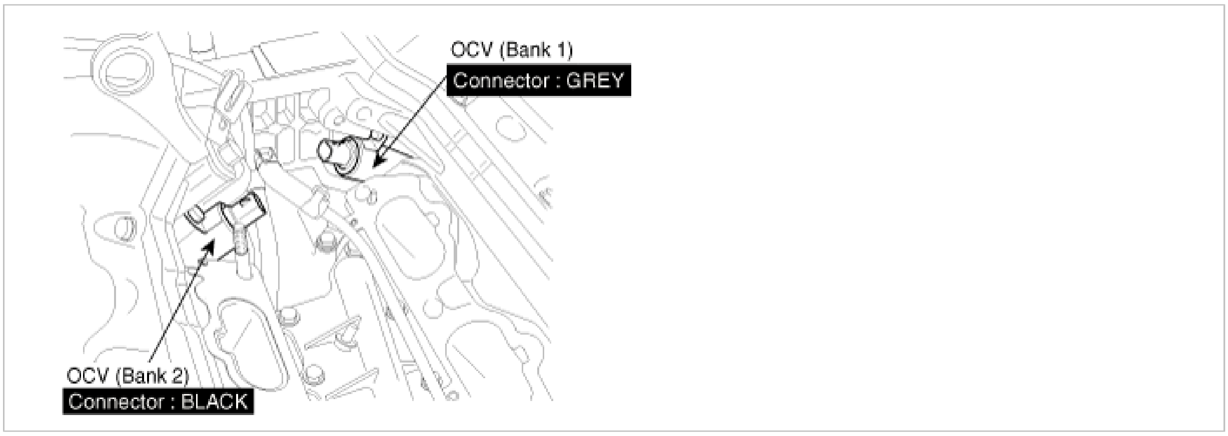
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0012

COMPONENT LOCATION



GENERAL DESCRIPTION

Different from the existing fixed cam phase angle type, CVVT(Continuously Variable Valve Timing) is the device which varies cam phase angle continuously to be optimum. And with engine oil pressure, it operates. CVVT consists of OCV(Oil Control Valve) and cam phaser. OCV, mounted on cylinder head, controlls the amount and direction of oil delivered to cam phaser by oil valve which is connected to a solenoid. Cam phaser, rotating cam phaser rotor with pressure and amount of oil produced by OCV, rotates cam shaft forcefully for or against the rotating direction and finally, cam shaft phase changes. With the appliance of CVVT, engine power,fuel efficiency and the quality of exhause gas are improved.

DTC DESCRIPTION

Figure1. illustrates the method for detecting unresolved phasing steady-state error.
The figure shows two cases, case 1 to the left of the dashed line, and case 2 to the right of the dashed line. In case 1,the duty cycle command is considered high, or above a calibration threshold memorized in PCM. This should cause the cam phaser to move toward the maximum position, but the position remains at a medium level. The range of positions considered 'medium' is defined by calibrations.
In case 2, the duty cycle command is considered low, or below a calibration threshold memorized in PCM. This should cause the cam phaser to move toward the minimum position, but the position remains at a medium level.
Each of these cases is a phaser position error failure. Each case is also considered to be due to a phaser seizure. When either case is detected, a timing counter begins to increment. If the counter exceeds a calibration threshold memorized in PCM, the failure criteria is TRUE.
Another similar diagnostic test is performed to check steady-state error. In this test, no consideration is given to the duty cycle command versus phaser position. This test is only a check of the phasing position error. It is a test of the phaser control logic. If there has been integral windup in the PID control,this test will detect it. In the test, if the phaser error is greater than a calibration threshold memorized in PCM,a timing counter increments. If the counter exceeds the calibration threshold memorized in PCM,the failure criteria is TRUE.

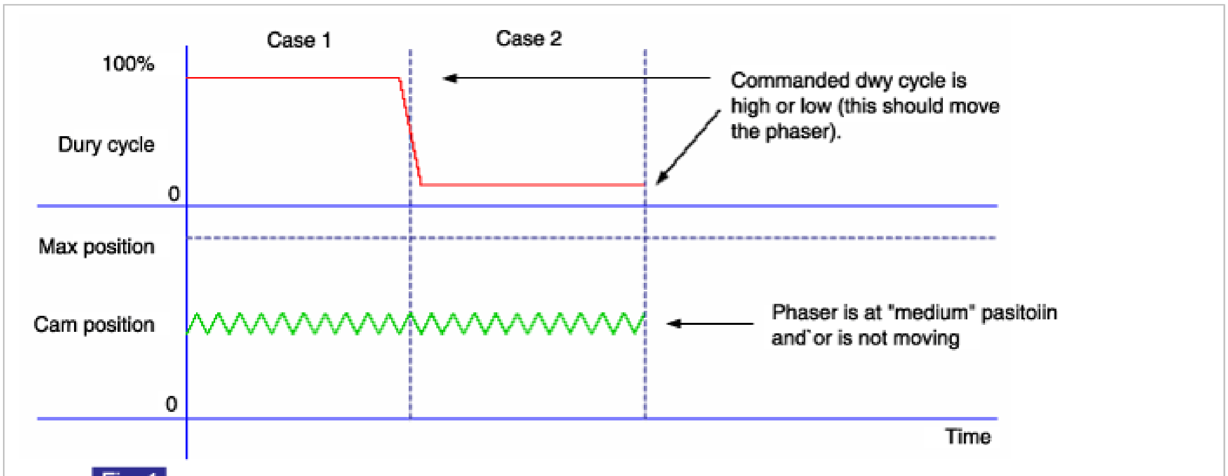


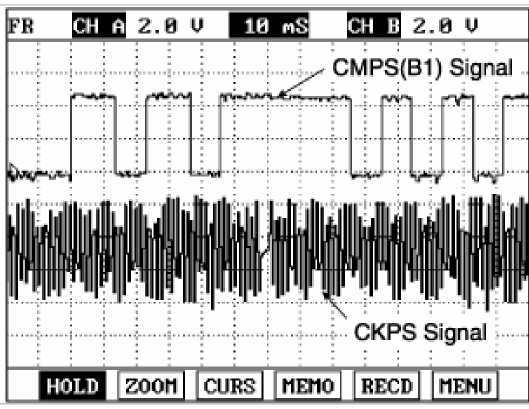
Fig. 1

PCM monitors CAM phaser error while both cam offset is available and cam velocity is below 15CAD/s .If the CAM phaser does not move although PCM commands OCV duty cycle PCM determines that a faultexists and a DTC is stored.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible cause
DTC Strategy		• Determines if the phaser is stuck or has steady-state error	• Engine Oil • OCV • CVVT stuck • PCM
Enable Conditions		• Offsets available • Cam velocity below threshold< 15 CAD/s	
Thresh old value	Case 1	• 5 CAD < Cam position< 50 CAD • Duty Cycle >90% • Duty Cycle< 10% • Timing Counter >80	
	Case 2	• Cam Position error >4 CAD • Timing Counter >80	
Diagnosis Time		• Continuous (More than 0.75sec. Test failure for every 90sec tests)	
MIL On Condition		• 2 Driving Cycles	

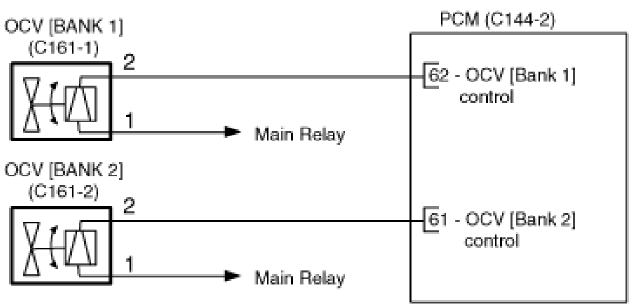
SIGNAL WAVEFORM AND DATA



This example shows a typical Crankshaft Position Sensor(CKPS) and Camshaft Position Sensor(CMPS) waveform at idle. If the Cam Phasing is generated by PCM the offset of cam target wheel tooth varies against 58X reference tooth of CKPS. Cam phasing can be detected from offset variation.

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

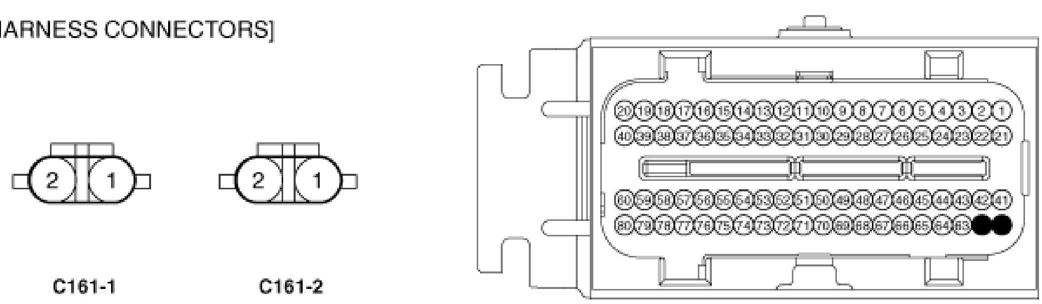
OCV [BANK 1]

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (62)	OCV [Bank 1] control

OCV [BANK 2]

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (61)	OCV [Bank 2] control

[HARNESS CONNECTORS]



C161-1

OCV [Bank 1]

C161-2

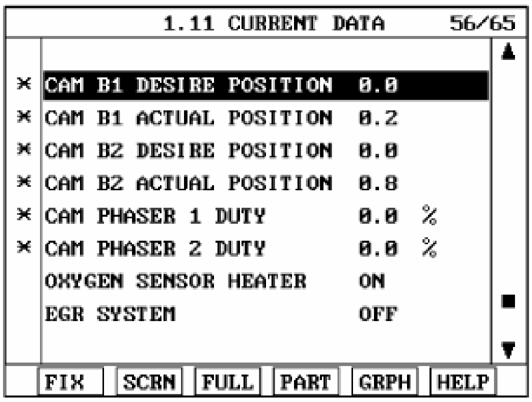
OCV [Bank 2]

C144-2

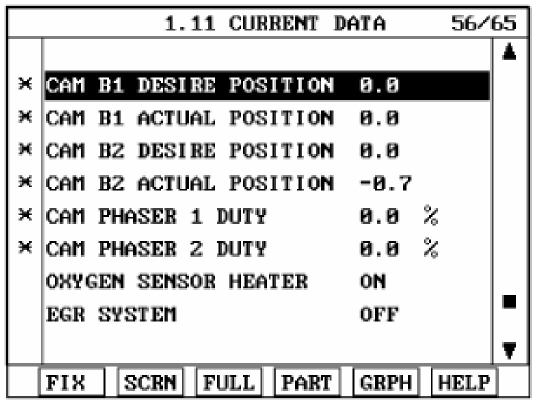
PCM

MONITOR SCANTOOL DATA

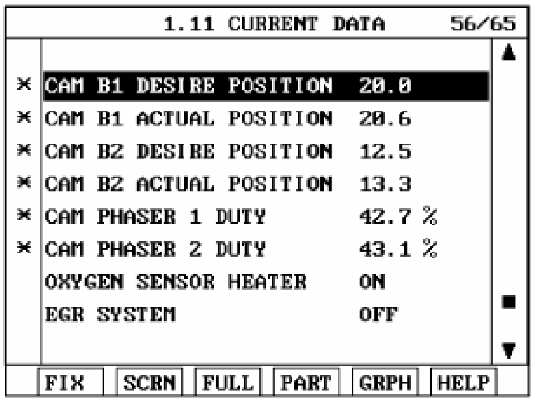
1. connect scantool and ENG "ON"
2. Monitor "CMPS(B1)" on the service date.



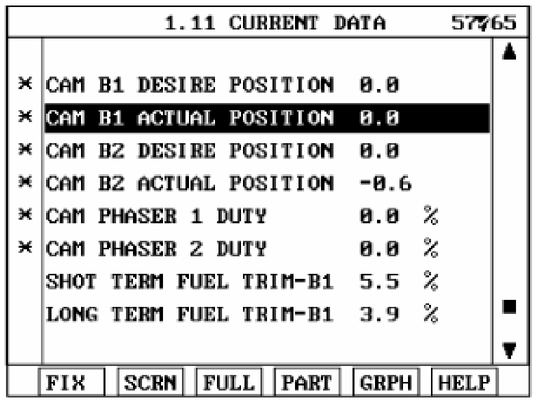
Normal data - idle



Open circuit - idle



Normal at accelleration



Open at accelleration

3. Are the "CMPS(B1)" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Go to "System Inspection" procedure.

SYSTEM INSPECTION

1. Visual Inspection
   (1) Check oil level is O.K.
   (2) Check oil level is contaminated.
   (3) Has a problem been found ?

   YES

   ▸ Repair or replace as necessary and then, go to " Verification of Vehicle Repair" procedure.

   NO

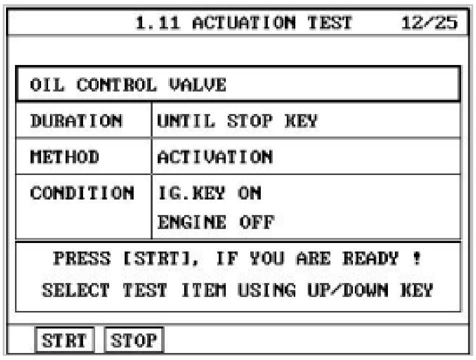
   ▸ Go to "Component Inspection" procedure.

COMPONENT INSPECTION

1. Check OCV
   (1) connect scantool and IG "ON"
   (2) Select "OCV" on the Actuation Test
   (3) Activates "OCV" by pressing "STRT(F1)" key

(should hear a faint click from Oil Control solenoid Valve)

(4) Repeat this procedure 4 or 5 times to ensure intake valve control solenoid reliability



(5) Has a problem been found ?

YES

▸ Substitute with a known - good CVVT and check for proper operation. If the problem is corrected, replace CVVT and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good OCV and check for proper operation. If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

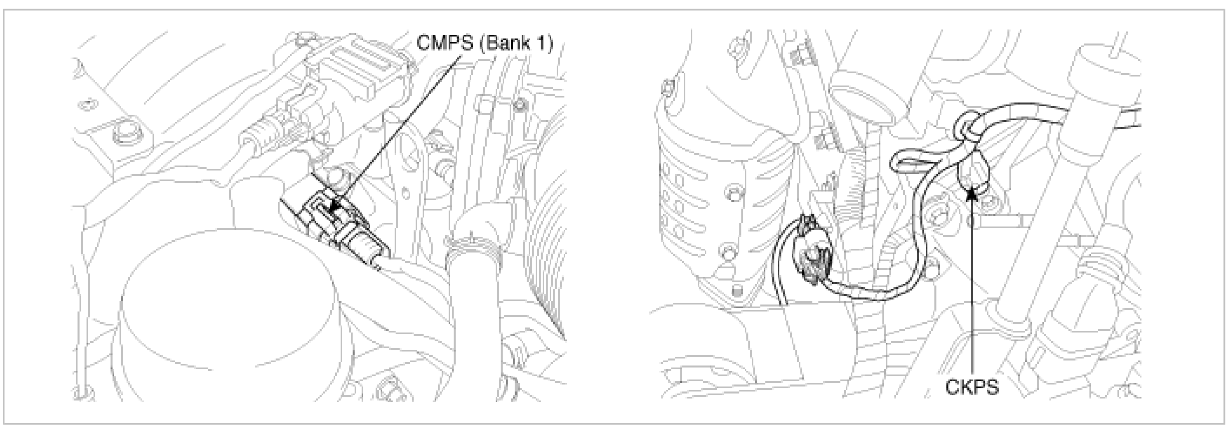
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0016

COMPONENT LOCATION



GENERAL DESCRIPTION

Different from the existing fixed cam phase angle type, CVVT(Continuously Variable Valve Timing) is the device which varies cam phase angle continuously to be optimum. And with engine oil pressure, it operates. CVVT consists of OCV(Oil Control Valve) and cam phaser. OCV, mounted on cylinder head, controlls the amount and direction of oil delivered to cam phaser by oil valve which is connected to a solenoid. Cam phaser, rotating cam phaser rotor with pressure and amount of oil produced by OCV, rotates cam shaft forcefully for or against the rotating direction and finally, cam shaft phase changes. With the appliance of CVVT, engine power,fuel efficiency and the quality of exhause gas are improved.

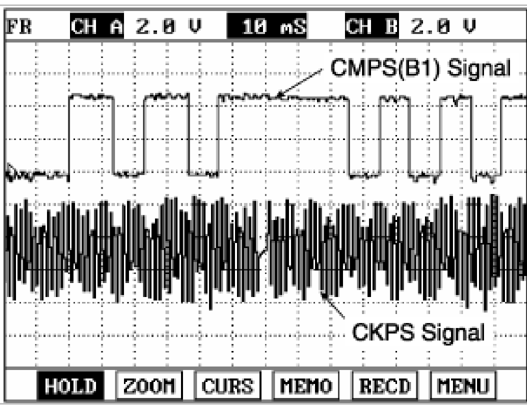
DTC DESCRIPTION

Tooth offsets are learned, updated, stored and initialized. For a given cam target wheel and systemcalibration, the tooth offsets should maintain relatively steady values. If the values of tooth offsets areobserved to drift outside of an established range, then a failure is present in the hardware or electronicsystem for measuring cam phasing.
This diagnosis is to verify that learned tooth offsets are within an acceptable range.
PCM monitors tooth offset while no active faults is present.If the tooth offsets is out of threshold more than 20 offset learning for 36 offset learning PCM determines that a faultexists and a DTC is stored.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible cause
DTC Strategy		• Determines if CAM target is aligned correctly to crank	• CKPS, CMPS • CVVT • Timing Misalignment • PCM
Enable Conditions		• No active faults	
Thresh old value	Case 1	• Real Offset Value< Min. Cam Offset array ratio (Refer to specificaton as below)	
	Case 2	• Real Offset Value >Min. Cam Offset array ratio (Refer to specificaton as below)	
Diagnosis Time		• Continuous (More than 20 offset learning failure for 36 offset learning)	
MIL On Condition		• 2 driving Cycles	

SIGNAL WAVEFORM AND DATA



This example shows a typical Crankshaft Position Sensor(CKPS) and Camshaft Position Sensor(CMPS) waveform at idle.
If the Cam Phasing is generated by PCM the offset of cam target wheel tooth varies against 58X reference tooth of CKPS. Cam phasing can be detected from offset variation.

SPECIFICATION

Min	Cylinder number	1	2	3	4	5	6
	Cam Offset Ratio	0.15	0.37	0.25	0.13	0.3	0.24
Max	Cylinder number	1	2	3	4	5	6
	Cam Offset Ratio	0.3	0.51	0.4	0.28	0.46	0.4

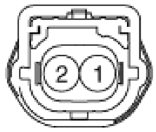
SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]

[CONNECTION INFORMATION]

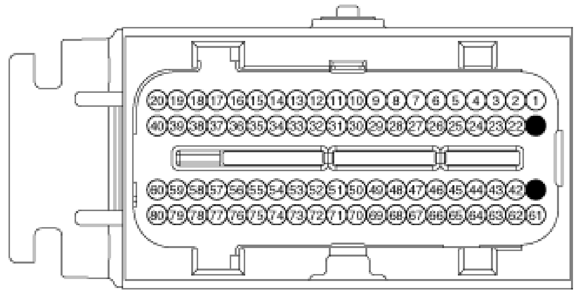
Terminal	Connected to	Funtion
1	PCM C144-2 (41)	CKPS [LOW] Signal
2	PCM C144-2 (21)	CKPS [HIGH] Signal

[HARNESS CONNECTORS]



C129

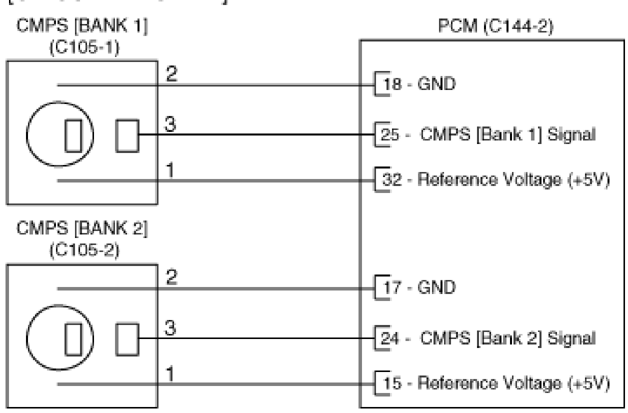
CKPS



C144-2

PCM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

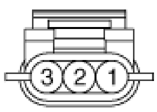
CMPS [BANK 1]

Terminal	Connected to	Funtion
1	PCM C144-2 (32)	Reference Voltage (+5V)
2	PCM C144-2 (18)	Sensor ground
3	PCM C144-2 (25)	CMPS [Bank 1] control

CMPS [BANK 2]

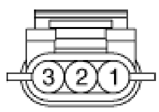
Terminal	Connected to	Funtion
1	PCM C144-2 (15)	Reference Voltage (+5V)
2	PCM C144-2 (17)	Sensor ground
3	PCM C144-2 (24)	CMPS [Bank 2] control

[HARNESS CONNECTORS]



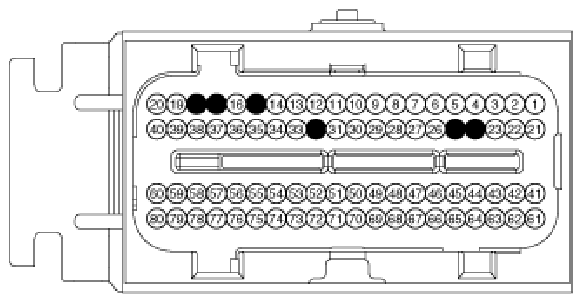
C105-1

CMPS [BANK 1]



C105-2

CMPS [BANK 2]

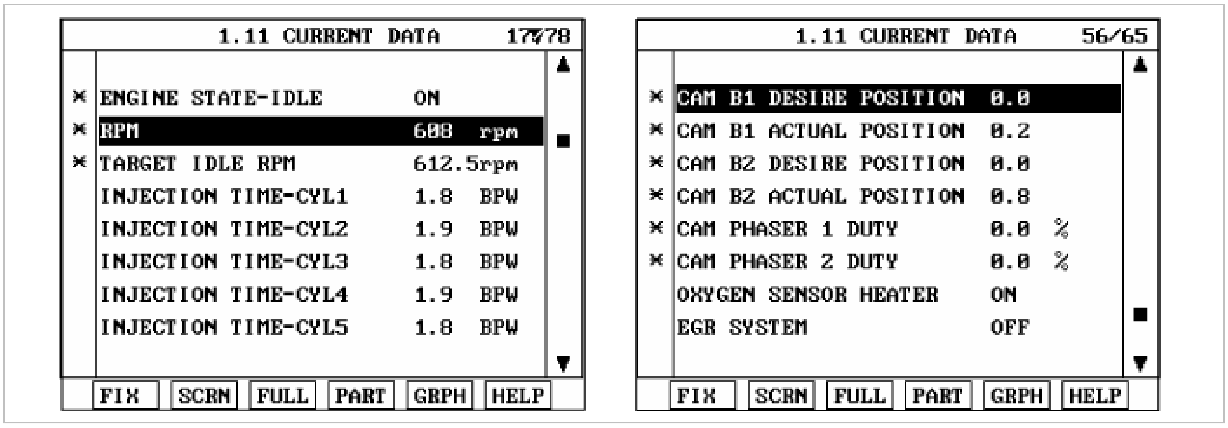


C144-2

PCM

MONITOR SCANTOOL DATA

1. Connect scantool and warm -up the engine until normal operating temperature.
2. Monitor "CAM, Engine speed" on service data.



3. Are the "CMPS(B1) & Engine RPM" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Go to "Terminaal and connector inpection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Go to "Terminal and connector inspection" procedure.

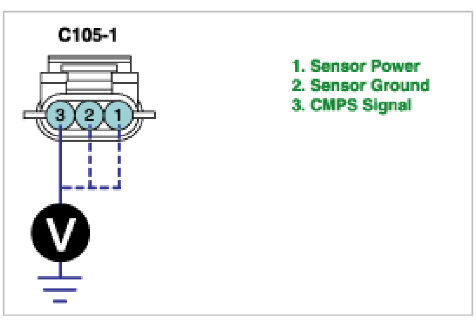
SYSTEM INSPECTION

1. Check CMPS

(1) IG "OFF" & Disconnect CMPS connector.

(2) IG "ON" & Measure voltage between terminal 1,2 & 3 of CMPS harness connector and chassis ground.

Specification :
Terminal 1. approx. 5V
Terminal 2. approx. below 1V
Terminal 3. approx. 5V



(3) Is the measured voltage within specification ?

YES

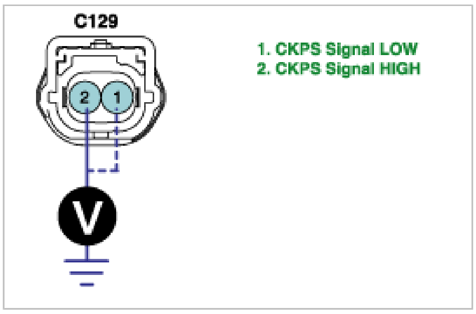
▸ Go to Check "CKPS" as follow.

NO

▸ Repair or replace as necessary and then go to " Verification of Vehicle Repair" procedure.

2. Check CKPS
   (1) IG "OFF" and disconnect CKPS connector.
   (2) IG "ON" & Measure voltage between terminal 1 & 2 of CKPS harness connecotor and chassis ground.

Specification : Approximately 1.4V



   (3) Is the measured voltage within specification ?

YES

▸ Go to "component Inspection" procedure.

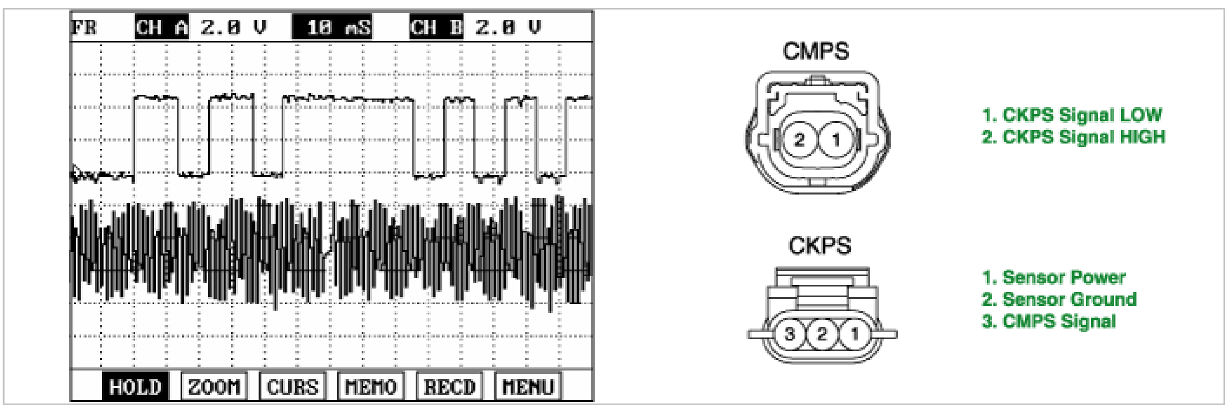
NO

▸ Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. CMPS, CKPS Inspection
   (1) IG "OFF" and connect scantool.
   (2) ENG "ON" and Measure signal waveform at terminal 3 of CMPS.
   (3) Measure signal waveform at terminal 1 or 2 of CKPS.

Specification :



   (4) Is the measured signal waveform O.K ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

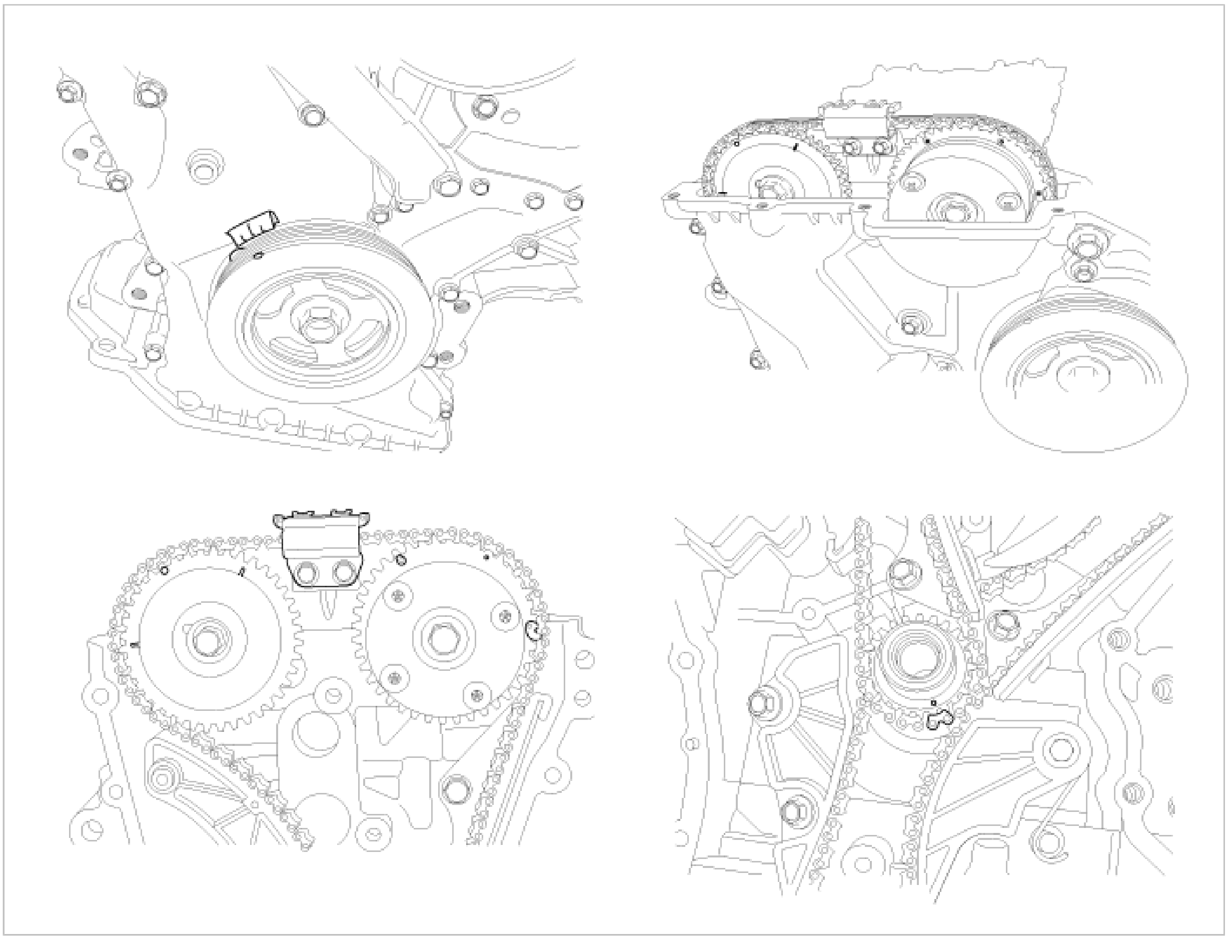
> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

NO

▸ Go to "Timing Mark Inspection" procedure as follow.

2. Timing Mark Inspection.
   (1) IG "OFF" and check the timing mark is correctly aligned.

Reference :



(2) Is the timing mark correctly aligned ?

YES

▸ Substitute with a known - good CVVT and check for proper operation. If the problem is corrected, replace CVVT and go to "Verification of Vehicle Repair" procedure.

(3) ▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

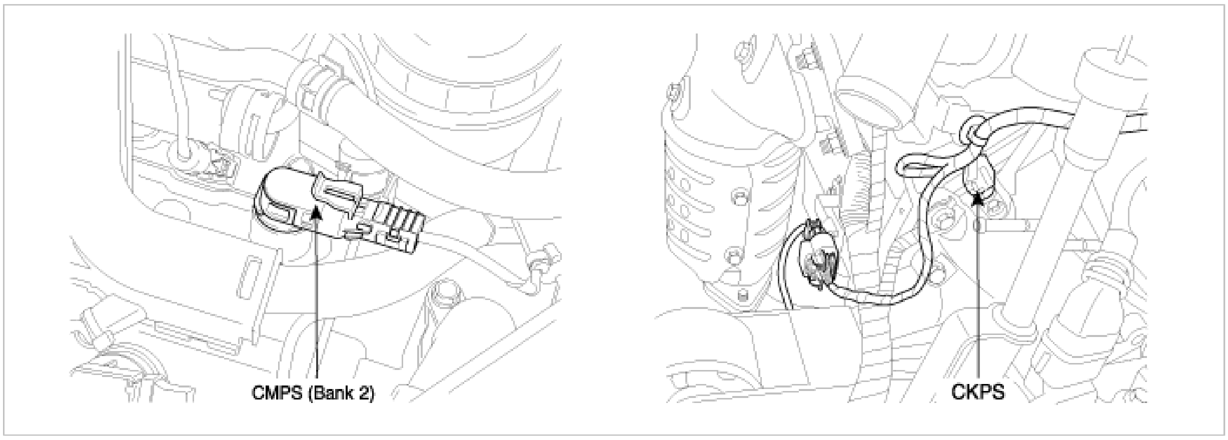
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0018

COMPONENT LOCATION



GENERAL DESCRIPTION

Different from the existing fixed cam phase angle type, CVVT(Continuously Variable Valve Timing) is the device which varies cam phase angle continuously to be optimum. And with engine oil pressure, it operates. CVVT consists of OCV(Oil Control Valve) and cam phaser. OCV, mounted on cylinder head, controlls the amount and direction of oil delivered to cam phaser by oil valve which is connected to a solenoid. Cam phaser, rotating cam phaser rotor with pressure and amount of oil produced by OCV, rotates cam shaft forcefully for or against the rotating direction and finally, cam shaft phase changes. With the appliance of CVVT, engine power,fuel efficiency and the quality of exhause gas are improved.

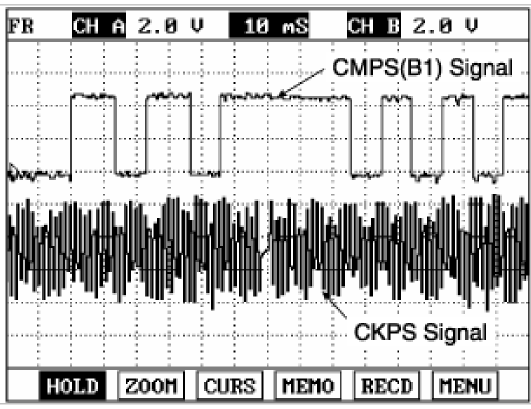
DTC DESCRIPTION

Tooth offsets are learned, updated, stored and initialized. For a given cam target wheel and systemcalibration, the tooth offsets should maintain relatively steady values. If the values of tooth offsets areobserved to drift outside of an established range, then a failure is present in the hardware or electronicsystem for measuring cam phasing.
This diagnosis is to verify that learned tooth offsets are within an acceptable range.
PCM monitors tooth offset while no active faults is present.If the tooth offsets is out of threshold more than 20 offset learning for 36 offset learning PCM determines that a faultexists and a DTC is stored.

DTC DETECTING CONDITION

<table>
<tr><th colspan="2">Item</th><th>Detecting Condition</th><th>Possible cause</th></tr>
<tr><td colspan="2">DTC Strategy</td><td>• Determines if CAM(B2) target is aligned correctly to crank</td><td rowspan="6">• CKPS, CMPS(B2)
• CVVT
• Timing Misalignment
• PCM</td></tr>
<tr><td colspan="2">Enable Conditions</td><td>• No active faults</td></tr>
<tr><td rowspan="2">Thresh old value</td><td>Case 1</td><td>• Real Offset Value< Min. Cam Offset array ratio
(Refer to specificaton as below)</td></tr>
<tr><td>Case 2</td><td>• Real Offset Value >Min. Cam Offset array ratio
(Refer to specificaton as below)</td></tr>
<tr><td colspan="2">Diagnosis Time</td><td>• Continuous
(More than 20 offset learning failure for 36 offset learning)</td></tr>
<tr><td colspan="2">MIL On Condition</td><td>• 2 driving Cycles</td></tr>
</table>

SIGNAL WAVEFORM AND DATA



This example shows a typical Crankshaft Position Sensor(CKPS) and Camshaft Position Sensor(CMPS) waveform at idle. If the Cam Phasing is generated by PCM the offset of cam target wheel tooth varies against 58X reference tooth of CKPS. Cam phasing can be detected from offset variation.

SPECIFICATION

Min	Cylinder number	1	2	3	4	5	6
	Cam Offset Ratio	0.15	0.37	0.25	0.13	0.3	0.24
Max	Cylinder number	1	2	3	4	5	6
	Cam Offset Ratio	0.3	0.51	0.4	0.28	0.46	0.4

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]

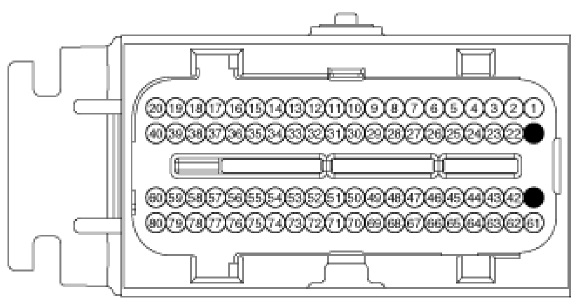
[CONNECTION INFORMATION]

Terminal	Connected to	Funtion
1	PCM C144-2 (41)	CKPS [LOW] Signal
2	PCM C144-2 (21)	CKPS [HIGH] Signal

[HARNESS CONNECTORS]

C129

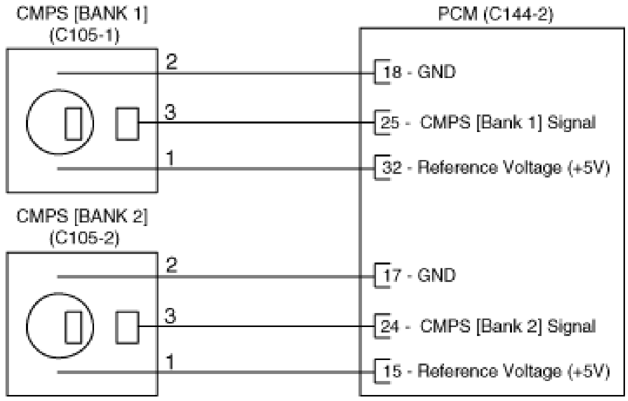
CKPS



C144-2

PCM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

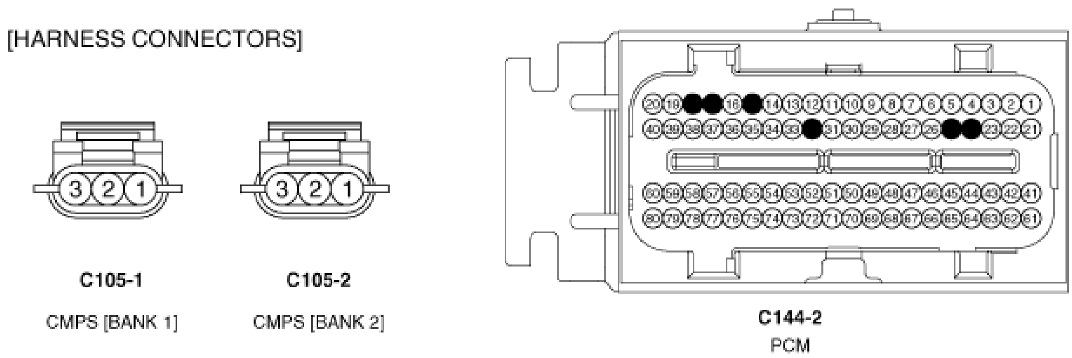
CMPS [BANK 1]

Terminal	Connected to	Funtion
1	PCM C144-2 (32)	Reference Voltage (+5V)
2	PCM C144-2 (18)	Sensor ground
3	PCM C144-2 (25)	CMPS [Bank 1] control

CMPS [BANK 2]

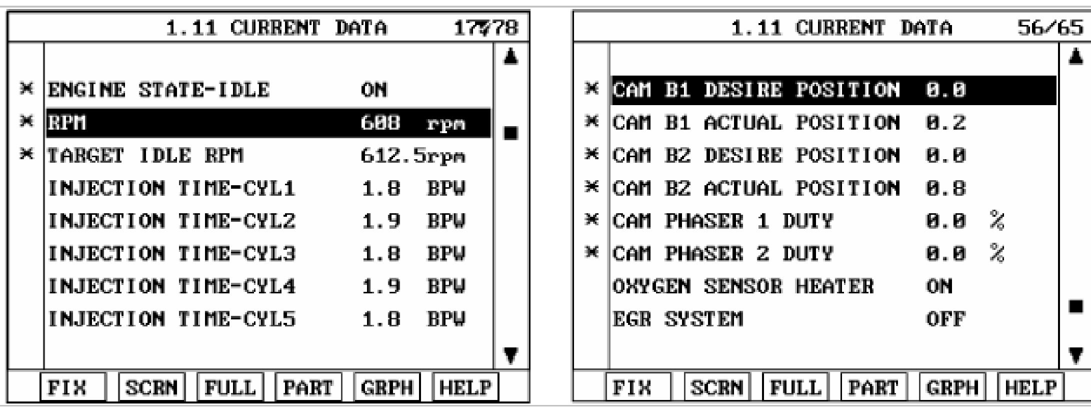
Terminal	Connected to	Funtion
1	PCM C144-2 (15)	Reference Voltage (+5V)
2	PCM C144-2 (17)	Sensor ground
3	PCM C144-2 (24)	CMPS [Bank 2] control

[HARNESS CONNECTORS]



MONITOR SCANTOOL DATA

1. Connect scantool and warm -up the engine until normal operating temperature.
2. Monitor "CAM, Engine speed" on service data.



3. Are the "CMPS(B2) & Engine RPM" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Go to "Terminaal and connector inpection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

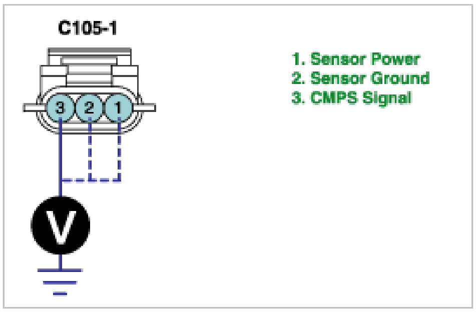
NO

▸ Go to " System Inspection " procedure.

SYSTEM INSPECTION

1. Check CMPS
   (1) IG "OFF" & Disconnect CMPS connector.
   (2) IG "ON" & Measure voltage between terminal 1,2 & 3 of CMPS(B2) harness connector and chassis ground.

Specification :
Terminal 1. approx. 5V
Terminal 2. approx. below 1V
Terminal 3. approx. 5V



   (3) Is the measured voltage within specification ?

YES

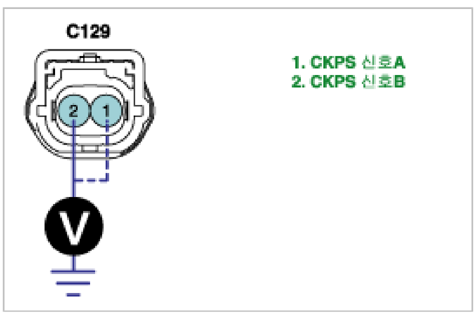
▸ Go to Check "CKPS" as follow.

NO

▸ Repair or replace as necessary and then go to " Verification of Vehicle Repair" procedure.

2. Check CKPS
   (1) IG "OFF" and disconnect CKPS connector.
   (2) IG "ON" & Measure voltage between terminal 1 & 2 of CKPS harness connecotor and chassis ground.

Specification : Approximately 1.4V



   (3) Is the measured voltage within specification ?

YES

▸Go to "component Inspection" procedure.

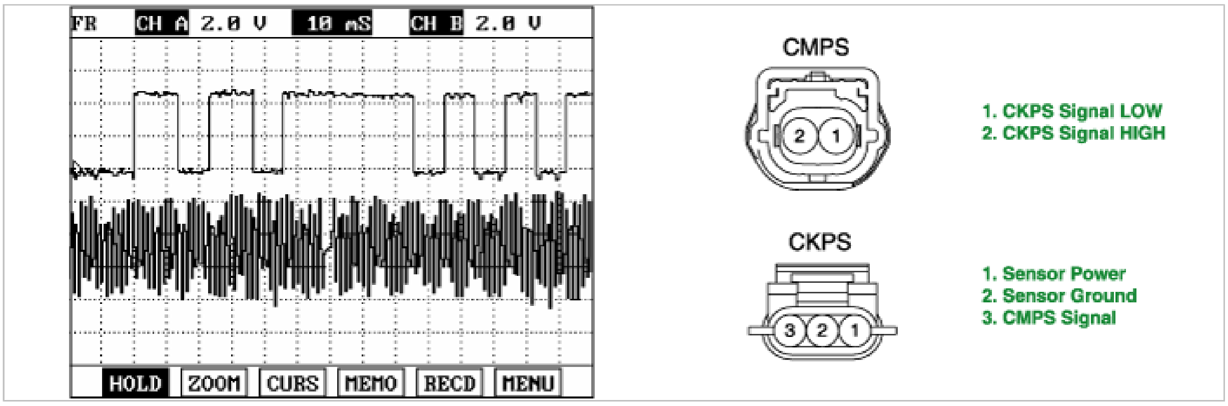
NO

▸Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. CMPS, CKPS Inspection
   (1) IG "OFF" and connect scantool.
   (2) ENG "ON" and Measure signal waveform at terminal 3 of CMPS.
   (3) Measure signal waveform at terminal 1 or 2 of CKPS.

Specification :



(4) Is the measured signal waveform O.K ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

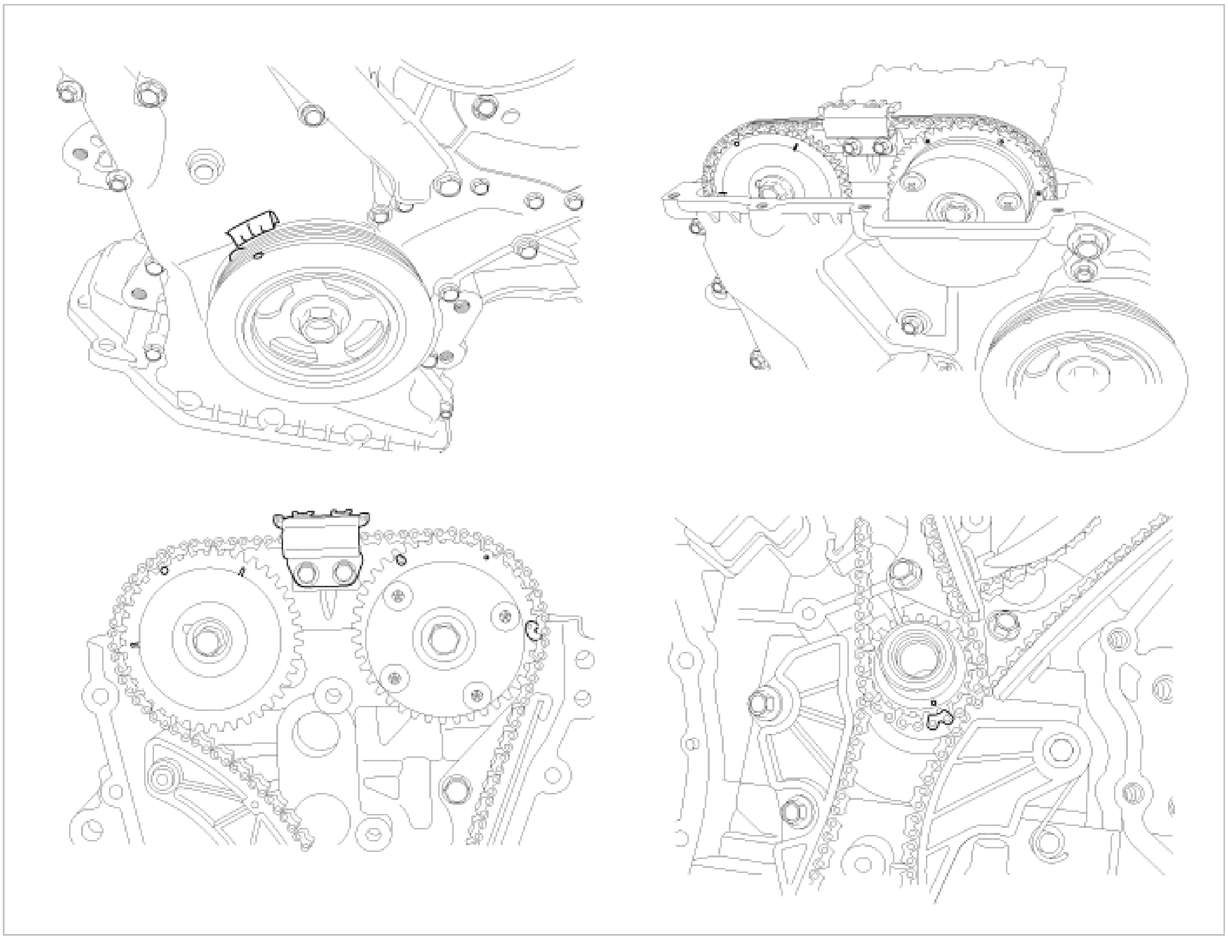
> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Go to "Timing Mark Inspection" procedure as follow.

2. Timing Mark Inspection
   (1) IG "OFF" and check the timing mark is correctly aligned.

Refernce :



(2) Is the timing mark correctly aligned ?

YES

▸ Substitute with a known - good CVVT and check for proper operation. If the problem is corrected, replace CVVT and go to "Verification of Vehicle Repair" procedure.

NO

▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

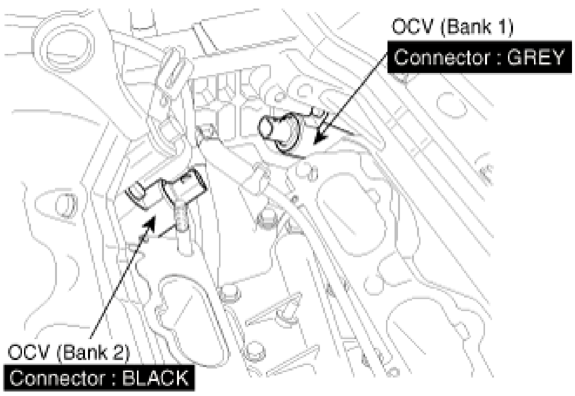
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0021

COMPONENT LOCATION



GENERAL DESCRIPTION

Different from the existing fixed cam phase angle type, CVVT(Continuously Variable Valve Timing) is the device which varies cam phase angle continuously to be optimum. And with engine oil pressure, it operates. CVVT consists of OCV(Oil Control Valve) and cam phaser. OCV, mounted on cylinder head, controlls the amount and direction of oil delivered to cam phaser by oil valve which is connected to a solenoid. Cam phaser, rotating cam phaser rotor with pressure and amount of oil produced by OCV, rotates cam shaft forcefully for or against the rotating direction and finally, cam shaft phase changes. With the appliance of CVVT, engine power,fuel efficiency and the quality of exhause gas are improved.

DTC DESCRIPTION

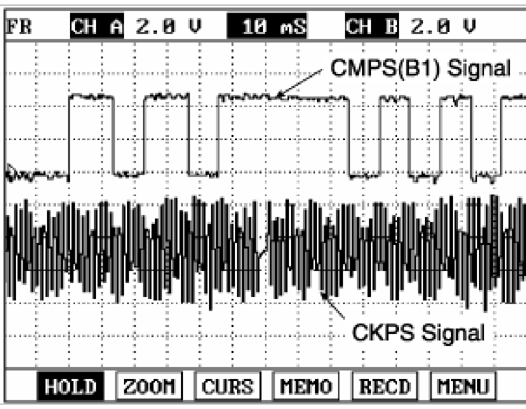
This diagnostic monitors the phasing response rate and determines whether the response rate is fast enough. A state machine is used to capture the response rate.The measured results are then compared to an allowable threshold. The threshold is a function of the oil temperature and the requested desired rate. Test of the phaser response rate requires an engine speed or engine load change.
PCM detects CAM phasing average rate while cam offset is available. If the CAM phasing rate is failure in 12 times out of 15 CAM phasing test PCM determines that a fault exists and a DTC is stored.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Determines if the phaser is moving at an expected rate	

Enable Conditions	• Cam Offset is available	• Excessive phasing system leakage • Binding Oil Pressure (ex. Blockage in OCV filter) • Faulty PCM
Threshold value	• Cam phasing average rate is out of threshold programmed in PCM	
Diagnosis Time	• Continuous (12 tests failure for 15 cam edge tests)	
MIL On Condition	• 2 driving cycles	

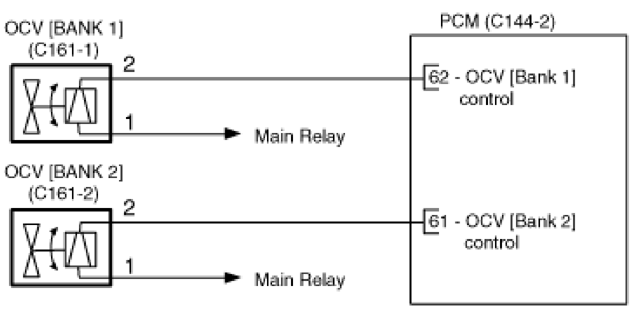
SIGNAL WAVEFORM AND DATA



This example shows a typical Crankshaft Position Sensor(CKPS) and Camshaft Position Sensor(CMPS) waveform at idle.
If the Cam Phasing is generated by PCM the offset of cam target wheel tooth varies against 58X reference tooth of CKPS.
Cam phasing can be detected from offset variation.

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

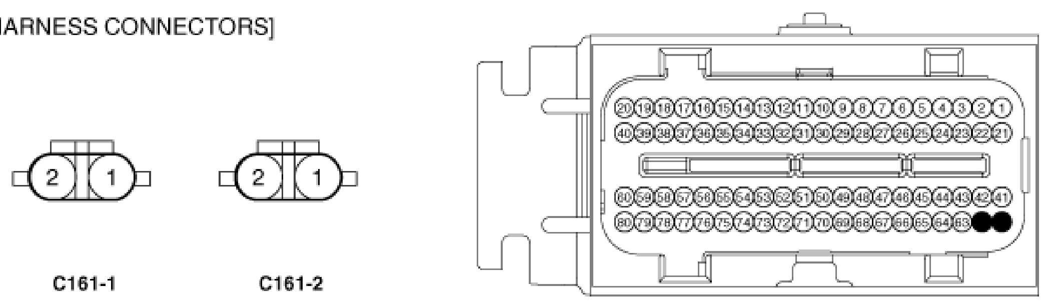
OCV [BANK 1]

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (62)	OCV [Bank 1] control

OCV [BANK 2]

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (61)	OCV [Bank 2] control

[HARNESS CONNECTORS]



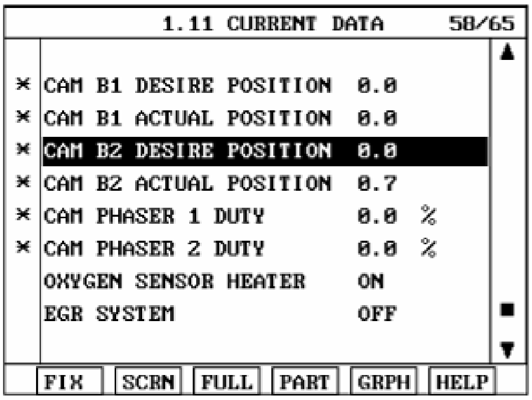
C161-1 OCV [Bank 1]

C161-2 OCV [Bank 2]

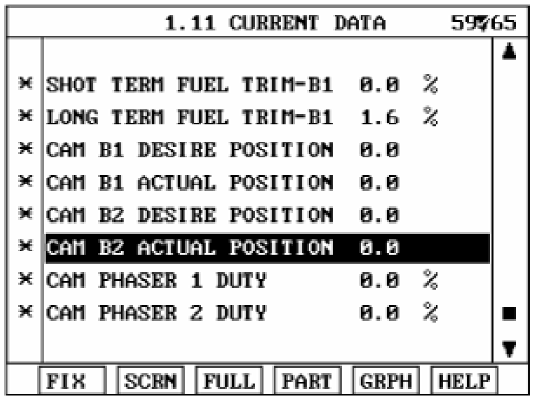
C144-2 PCM

MONITOR SCANTOOL DATA

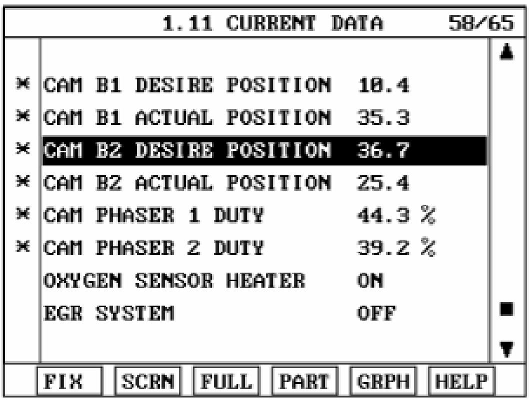
1. connect scantool and ENG "ON"
2. Monitor "CMPS(B2)" on the service data.



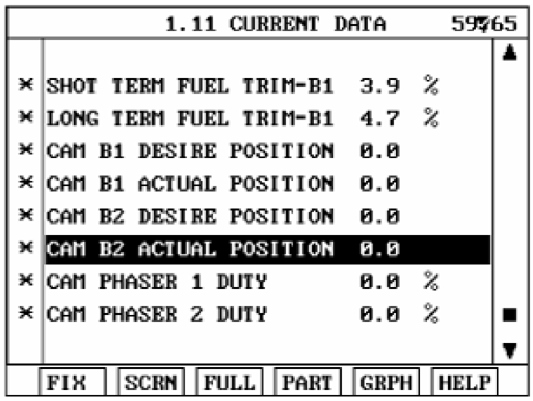
Normal data - idle



Open at idle



Open at accelleration



Open at acceleration

3. Are the "CMPS(B2)" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection,bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and goto "Verification of Vehicle Repair" procedure.

NO

▸ Go to "System Inspection" procedure.

SYSTEM INSPECTION

1. Visual Inspection
   (1) Check oil level is O.K.

   (2) Check oil level is contaminated.

   (3) Check that any oil leakage or blockage is occurred on the parts related to CVVT.

   (4) Has a problem been found ?

   YES

   ▸ Repair or replace as necessary and then, go to " Verification of Vehicle Repair" procedure.

   NO

   ▸ Go to "Component Inspection" procedure.

COMPONENT INSPECTION

1. Check OCV
   (1) connect scantool and IG "ON"

   (2) Select "OCV" on the Actuation Test

   (3) Activates "OCV" by pressing "STRT(F1)" key
   (should hear a faint click from Oil Control solenoid Valve)

   (4) Repeat this procedure 4 or 5 times to ensure intake valve control solenoid reliability

1.11 ACTUATION TEST	12/25
OIL CONTROL VALVE	
DURATION	UNTIL STOP KEY
METHOD	ACTIVATION
CONDITION	IG.KEY ON ENGINE OFF
PRESS [STRT], IF YOU ARE READY ! SELECT TEST ITEM USING UP/DOWN KEY	
STRT STOP	

(5) Has a problem been found ?

YES

▸ Substitute with a known - good CVVT and check for proper operation. If the problem is corrected, replace CVVT and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good OCV and check for proper operation. If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

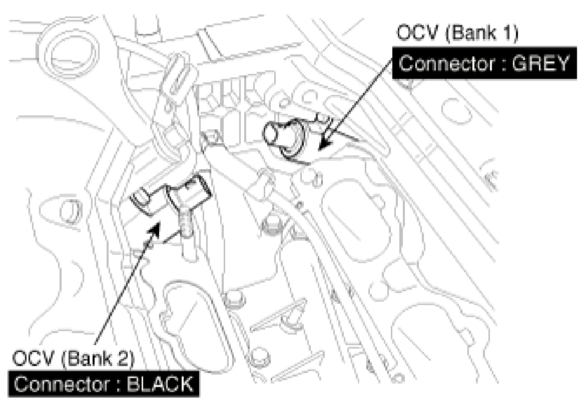
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0022

COMPONENT LOCATION



GENERAL DESCRIPTION

Different from the existing fixed cam phase angle type, CVVT(Continuously Variable Valve Timing) is the device which varies cam phase angle continuously to be optimum. And with engine oil pressure, it operates. CVVT consists of OCV(Oil Control Valve) and cam phaser. OCV, mounted on cylinder head, controlls the amount and direction of oil delivered to cam phaser by oil valve which is connected to a solenoid. Cam phaser, rotating cam phaser rotor with pressure and amount of oil produced by OCV, rotates cam shaft forcefully for or against the rotating direction and finally, cam shaft phase changes. With the appliance of CVVT, engine power,fuel efficiency and the quality of exhause gas are improved.

DTC DESCRIPTION

Figure1. illustrates the method for detecting unresolved phasing steady-state error.
The figure shows two cases, case 1 to the left of the dashed line, and case 2 to the right of the dashed line. In case 1,the duty cycle command is considered high, or above a calibration threshold memorized in PCM. This should cause the cam phaser to move toward the maximum position, but the position remains at a medium level. The range of positions considered ‘medium’ is defined by calibrations.
In case 2, the duty cycle command is considered low, or below a calibration threshold memorized in PCM. This should cause the cam phaser to move toward the minimum position, but the position remains at a medium level.
Each of these cases is a phaser position error failure. Each case is also considered to be due to a phaser seizure. When either case is detected, a timing counter begins to increment. If the counter exceeds a calibration threshold memorized in PCM, the failure criteria is TRUE.
Another similar diagnostic test is performed to check steady-state error. In this test, no consideration is given to the duty cycle command versus phaser position. This test is only a check of the phasing position error. It is a test of the phaser control logic. If there has been integral windup in the PID control,this test will detect it. In the test, if the phaser error is greater than a calibration threshold memorized in PCM,a timing counter increments. If the counter exceeds the calibration threshold memorized in PCM,the failure criteria is TRUE.

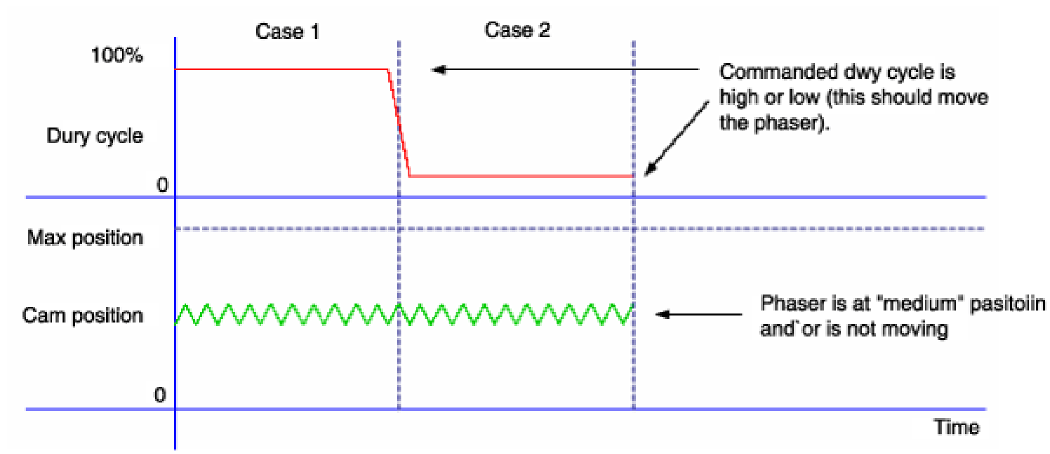


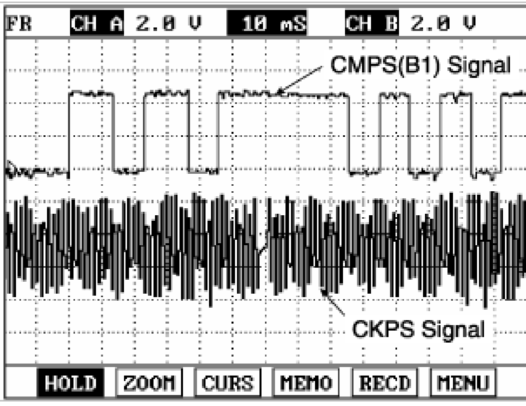
Fig. 1

PCM monitors CAM phaser error while both cam offset is available and cam velocity is below 15CAD/s .If the CAM phaser does not move although PCM commands OCV duty cycle PCM determines that a faultexists and a DTC is stored.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible cause
DTC Strategy		• Determines if the phaser is stuck or has steady-state error	• Engine Oil • OCV • CVVT stuck • PCM
Enable Conditions		• Offsets available • Cam velocity below threshold< 15 CAD/s	
Thresh old value	Case 1	• 5 CAD < Cam position< 50 CAD • Duty Cycle >90% • Duty Cycle< 10% • Timing Counter >80	
	Case 2	• Cam Position error >4 CAD • Timing Counter >80	
Diagnosis Time		• Continuous (More than 0.75sec. Test failure for every 90sec tests)	
MIL On Condition		• 2 Driving Cycles	

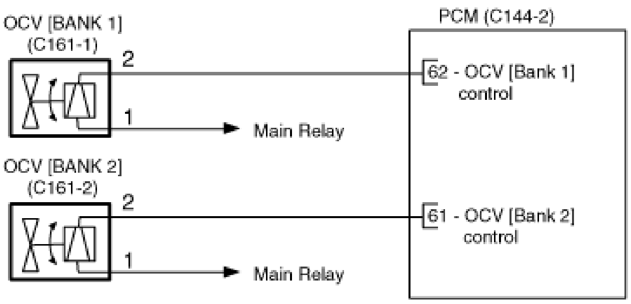
SIGNAL WAVEFORM AND DATA



This example shows a typical Crankshaft Position Sensor(CKPS) and Camshaft Position Sensor(CMPS) waveform at idle. If the Cam Phasing is generated by PCM the offset of cam target wheel tooth varies against 58X reference tooth of CKPS. Cam phasing can be detected from offset variation.

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

OCV [BANK 1]

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (62)	OCV [Bank 1] control

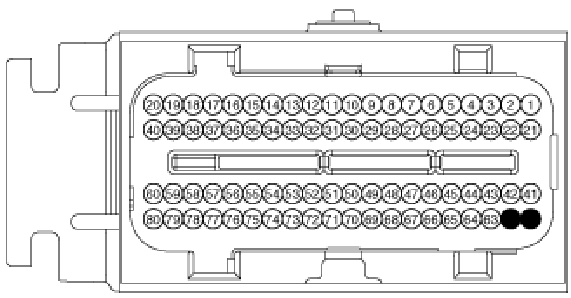
OCV [BANK 2]

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (61)	OCV [Bank 2] control

[HARNESS CONNECTORS]

C161-1
OCV [Bank 1]

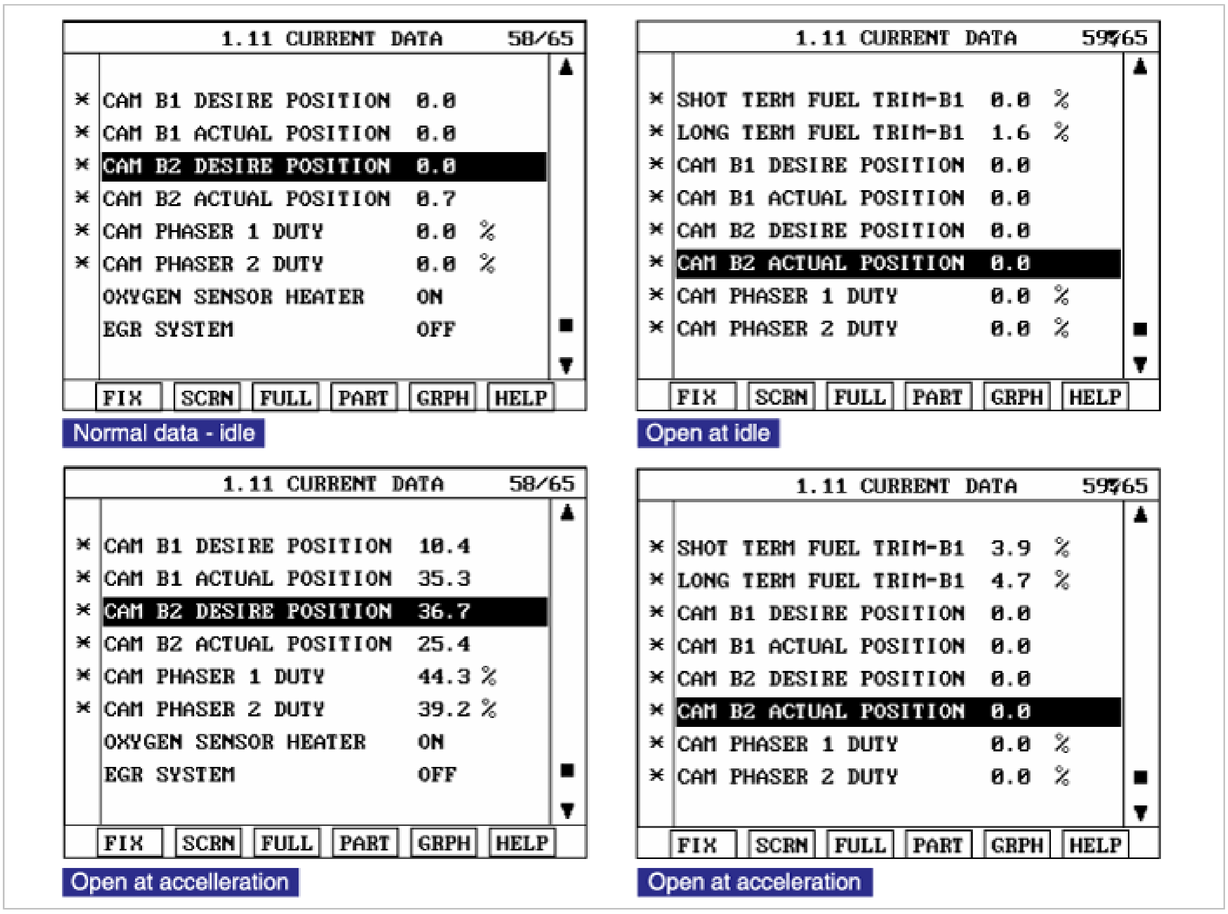
C161-2
OCV [Bank 2]



C144-2
PCM

MONITOR SCANTOOL DATA

1. connect scantool and ENG "ON"
2. Monitor "CMPS(B2)" on the service data.



3. Are the "CMPS(B2)" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection,bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and goto "Verification of Vehicle Repair" procedure.

NO

▸ Go to "System Inspection" procedure.

SYSTEM INSPECTION

1. Visual Inspection
   (1) Check oil level is O.K.
   (2) Check oil level is contaminated.
   (3) Has a problem been found ?

   YES

   ▸ Repair or replace as necessary and then, go to " Verification of Vehicle Repair" procedure.

   NO

   ▸ Go to "Component Inspection" procedure.

COMPONENT INSPECTION

1. Check OCV
   (1) connect scantool and IG "ON"
   (2) Select "OCV" on the Actuation Test
   (3) Activates "OCV" by pressing "STRT(F1)" key
   (should hear a faint click from Oil Control solenoid Valve)
   (4) Repeat this procedure 4 or 5 times to ensure intake valve control solenoid reliability

1.11 ACTUATION TEST 12/25	
OIL CONTROL VALVE	
DURATION	UNTIL STOP KEY
METHOD	ACTIVATION
CONDITION	IG.KEY ON ENGINE OFF
PRESS [STRT], IF YOU ARE READY ! SELECT TEST ITEM USING UP/DOWN KEY	
STRT STOP	

(5) Has a problem been found ?

YES

▸ Substitute with a known - good CVVT and check for proper operation. If the problem is corrected, replace CVVT and go to "Verification of Vehicle Repair" procedure.

NO

(6) ▸ Substitute with a known - good OCV and check for proper operation. If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

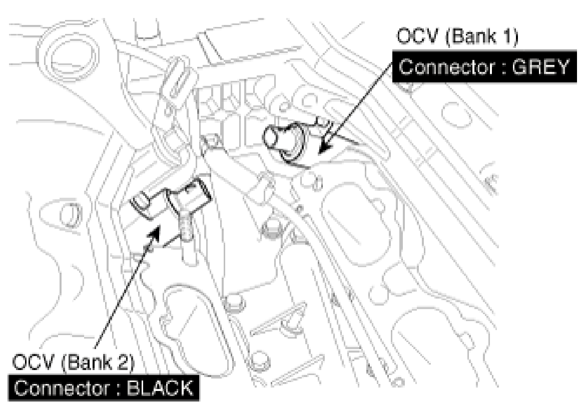
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0026

COMPONENT LOCATION



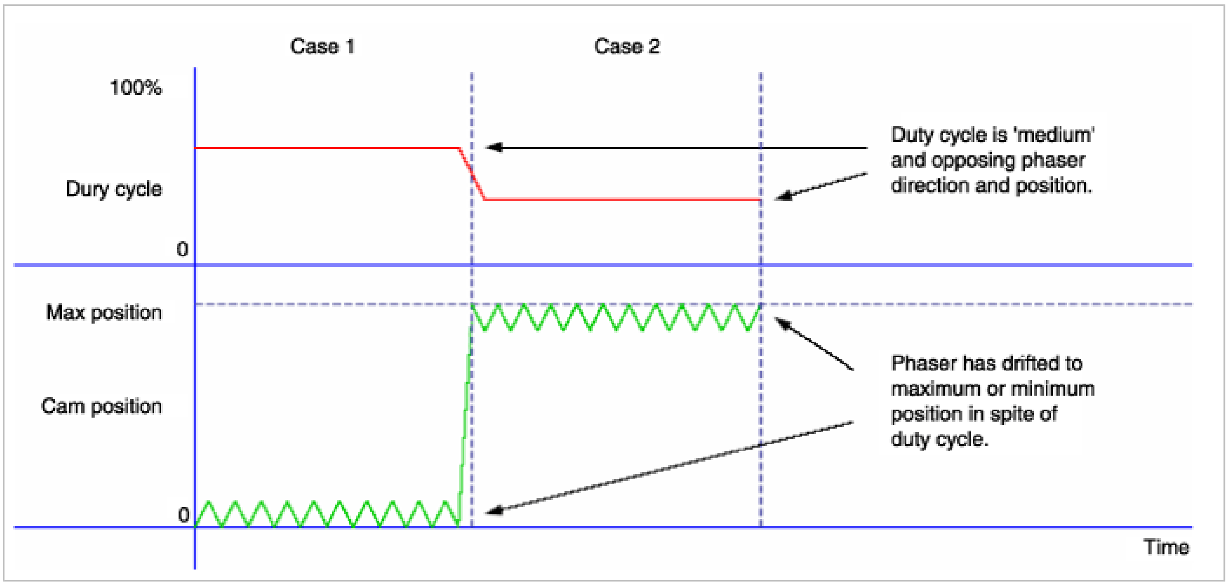
GENERAL DESCRIPTION

Different from the existing fixed cam phase angle type, CVVT(Continuously Variable Valve Timing) is the device which varies cam phase angle continuously to be optimum. And with engine oil pressure, it operates. CVVT consists of OCV(Oil Control Valve) and cam phaser. OCV, mounted on cylinder head, controlls the amount and direction of oil delivered to cam phaser by oil valve which is connected to a solenoid. Cam phaser, rotating cam phaser rotor with pressure and amount of oil produced by OCV, rotates cam shaft forcefully for or against the rotating direction and finally, cam shaft phase changes. With the appliance of CVVT, engine power,fuel efficiency and the quality of exhause gas are improved.

DTC DESCRIPTION

Small particles in the engine oil may cause the oil control valve to bind or otherwise get stuck atcertain spool positions. A test is used in this diagnostic to detect a stuck valve spool. A cleaningfunction is then used to try and free the spool. If unsuccessful, the diagnostic test is failed.

Figure 1. illustrates the principle of the valve stuck diagnostic test. As in the phaser error diagnosticillustration, there are two cases shown in the figure. The case on the left shows a case where the dutycycle is above a calibration threshold, yet the phaser position is near the minimum position. Undernormal operation, such a duty cycle command would move the phaser toward its maximum position.The case on the right shows the opposite situation. The duty cycle command is below a threshold, yetthe phaser position is near its maximum.



In the diagnostic test logic, duty cycle is not used. There are two reasons: 1) duty cycle is theparameter most closely related to result of the test, and should not be used in the test, and 2) it isdifficult to establish thresholds for duty cycle because of the variation of such thresholds. Instead ofduty cycle, position error is used. This indicates clearly the expected duty cycle behavior and allowsthresholds to be established without consideration for temperature, voltage and pressure conditions aswell as the strength or lack of strength in the gain calibration.

PCM monitors OCV stuck while cam offset is available and Valve cleaning is not in progress .If the PCM detects that CAM position angle is over 20 CAD(Crank Angle Degree) than expected cam positionthat PCM controls the OCV while cam position is in designated crank angle degree, PCM determines that a faultexists and a DTC is stored.

DTC DETECTING CONDITION

<table>
<tr><th colspan="2">Item</th><th>Detecting Condition</th><th>Possible cause</th></tr>
<tr><td colspan="2">DTC Strategy</td><td>• Determines if oil control valve is stuck</td><td rowspan="6">• Oil Pressure Loss
• OCV seizure
• PCM</td></tr>
<tr><td colspan="2">Enable Conditions</td><td>• Valve cleaning not in progress
• Offsets available</td></tr>
<tr><td rowspan="2">Thresh old value</td><td>Case 1</td><td>• Cam position > 50 CAD
• Cam position Error > 20 CAD
• Timing counter >56 count</td></tr>
<tr><td>Case 2</td><td>• Cam position< 5 CAD
• Cam position Error > 20 CAD
• Timing counter >56 count</td></tr>
<tr><td colspan="2">Diagnosis Time</td><td>• Continuous
(More than 0.75sec failure for every 56.25 sec. tests)</td></tr>
<tr><td colspan="2">MIL On Condition</td><td>• 2 driving Cycle</td></tr>
</table>

SIGNAL WAVEFORM AND DATA

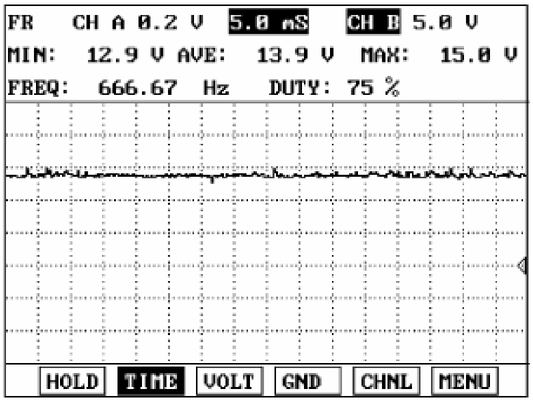


Fig. 1

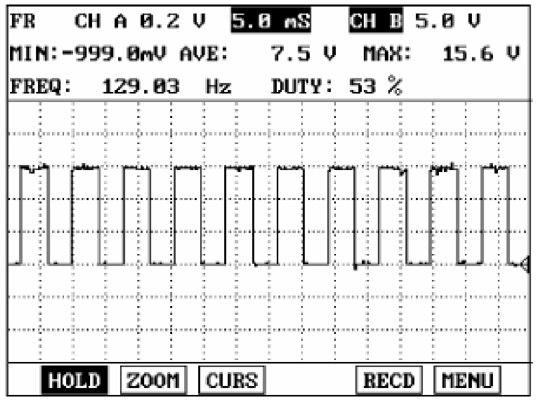


Fig. 2

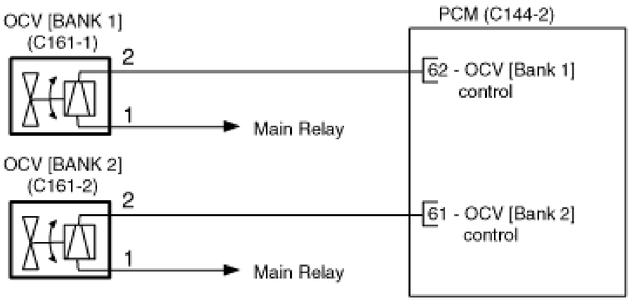
Fig. 1 : Idle - normal Condition
Fig. 2 : Acceleration

SPECIFICATION

Resistance (Ω)	6.7 ~ 7.7

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

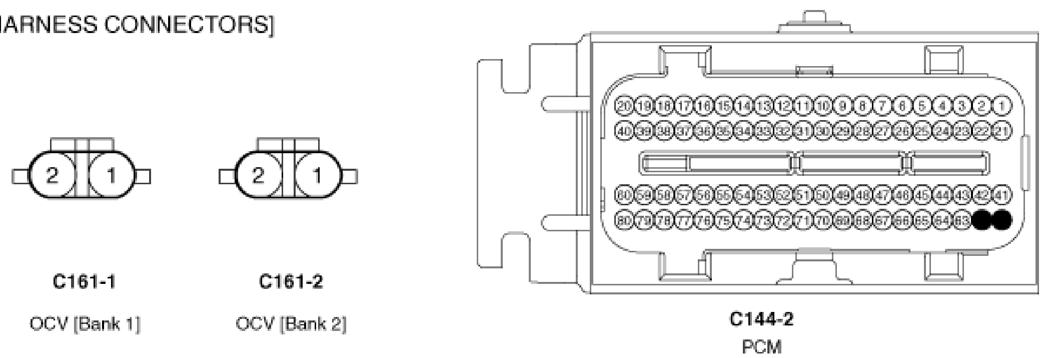
OCV [BANK 1]

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (62)	OCV [Bank 1] control

OCV [BANK 2]

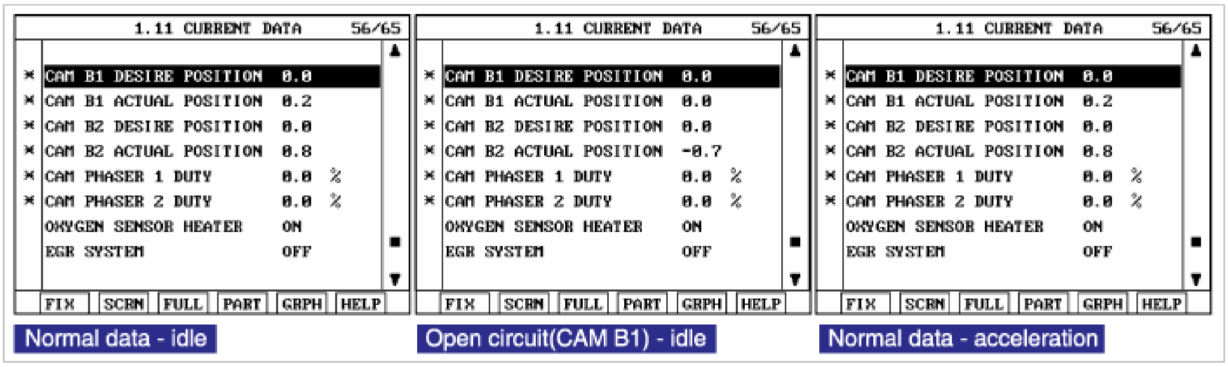
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (61)	OCV [Bank 2] control

[HARNESS CONNECTORS]



MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "CAM(B1)" status on the service data.



4. Are the "CMP(B1)" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, ending, corrosion, contamination, deterioration, or damage. Repair or replace asnecessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

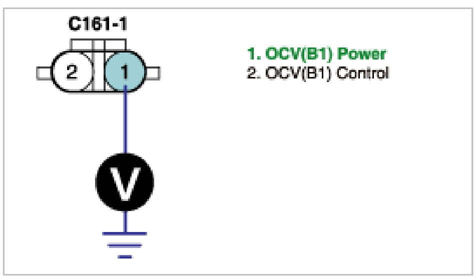
NO

▸ Go to " Power Circuit Inspection " as follow

POWER CIRCUIT INSPECTION

1. IG "OFF" and disconnect OCV connector.
2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 1 of OCV harness connector and chassis ground.

Specification : B+



4. Is the measured voltage within specification ?

YES

▸ Go to " Control Circuit Inspection " procedure.

NO

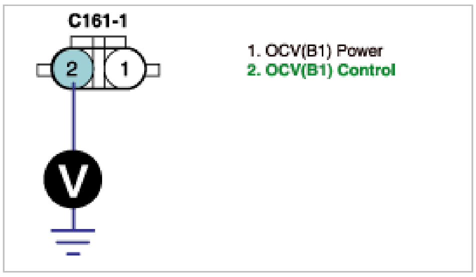
▸ Check that Fuse between Main Relay and OCV is open.
▸ Check open between main relay and OCV.
▸ Check short to ground between Main Relay and OCV.
▸ Repair or replace as necessay go to "Verification of Vehicle Repair " procedure.

CONTROL CIRCUIT INSPECTION

1. IG "OFF" and disconnect OCV connector.
2. IG "ON" & ENG "OFF".

3. Measure voltage between terminal 2 of OCV harness connector and chassis ground.

Specification : Approx. below 1V



4. Is the measured voltage within specification ?

YES

▸ Go to "System Inspection" procedure.

NO

▸ Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

SYSTEM INSPECTION

1. Visual Inspection

(1) Check oil level is O.K.

(2) Check oil level is contaminated.

(3) Check that any oil leakage is occurred around OCV.

(4) Has a problem been found ?

YES

▸ Repair or replace as necessary and then, go to " Verification of Vehicle Repair" procedure.

NO

▸ Go to "Component Inspection" procedure

COMPONENT INSPECTION

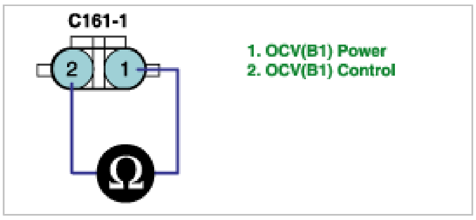
1. OCV Inspection

(1) IG "OFF" & Disconnect OCV connector.

(2) Measure resistance between terminal 1 and 2 of OCV connector (Component Side)

Specification :

Resistance (Ω)	6.7 ~ 7.7



(3) Is the measured resistance within specification?

YES

▸ Go to "Actuation Test" as follow.

NO

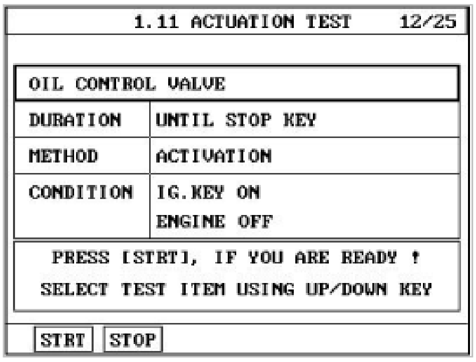
▸ Substitute with a known - good OCV and check for proper operation. If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

2. Actuation Test

(1) IG "OFF" and connect OCV connector

(2) IG "ON" & ENG "OFF"

(3) Check that click sound can be heard when actuation operates with scantool.



(4) Does the OCV operate corectly when actuation operates ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

NO

▸ Substitute with a known - good OCV and check for proper operation. If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

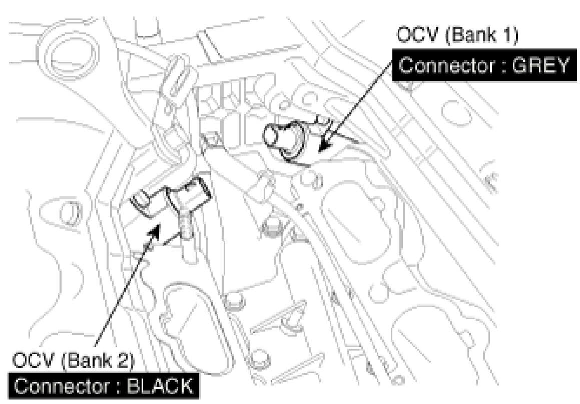
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0028

COMPONENT LOCATION

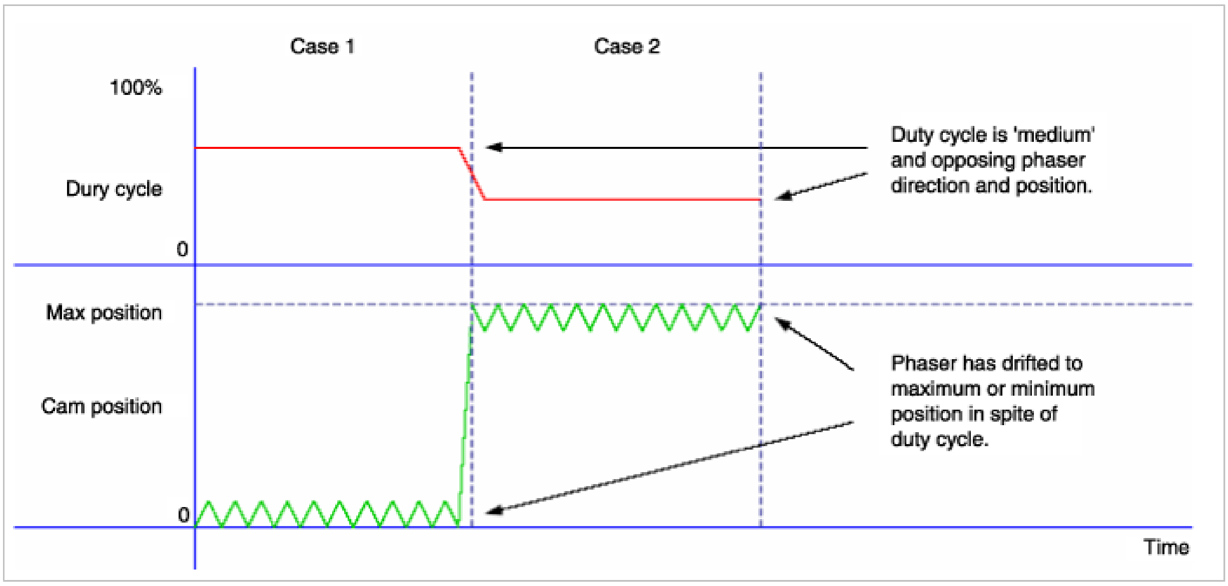


GENERAL DESCRIPTION

Different from the existing fixed cam phase angle type, CVVT(Continuously Variable Valve Timing) is the device which varies cam phase angle continuously to be optimum. And with engine oil pressure, it operates. CVVT consists of OCV(Oil Control Valve) and cam phaser. OCV, mounted on cylinder head, controlls the amount and direction of oil delivered to cam phaser by oil valve which is connected to a solenoid. Cam phaser, rotating cam phaser rotor with pressure and amount of oil produced by OCV, rotates cam shaft forcefully for or against the rotating direction and finally, cam shaft phase changes. With the appliance of CVVT, engine power,fuel efficiency and the quality of exhause gas are improved.

DTC DESCRIPTION

Small particles in the engine oil may cause the oil control valve to bind or otherwise get stuck atcertain spool positions. A test is used in this diagnostic to detect a stuck valve spool. A cleaningfunction is then used to try and free the spool. If unsuccessful, the diagnostic test is failed.
Figure 1. illustrates the principle of the valve stuck diagnostic test. As in the phaser error diagnosticillustration, there are two cases shown in the figure. The case on the left shows a case where the dutycycle is above a calibration threshold, yet the phaser position is near the minimum position. Undernormal operation, such a duty cycle command would move the phaser toward its maximum position.The case on the right shows the opposite situation. The duty cycle command is below a threshold, yetthe phaser position is near its maximum.



In the diagnostic test logic, duty cycle is not used. There are two reasons: 1) duty cycle is theparameter most closely related to result of the test, and should not be used in the test, and 2) it isdifficult to establish thresholds for duty cycle because of the variation of such thresholds. Instead ofduty cycle, position error is used. This indicates clearly the expected duty cycle behavior and allowsthresholds to be established without consideration for temperature, voltage and pressure conditions aswell as the strength or lack of strength in the gain calibration.
PCM monitors OCV stuck while cam offset is available and Valve cleaning is not in progress .If the PCM detects that CAM position angle is over 20 CAD(Crank Angle Degree) than expected cam positionthat PCM controls the OCV while cam position is in designated crank angle degree, PCM determines that a faultexists and a DTC is stored.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible cause
DTC Strategy		• Determines if oil control valve is stuck	• Oil Pressure Loss • OCV(B2) seizure • PCM
Enable Conditions		• Valve cleaning not in progress • Offsets available	
Thresh old value	Case 1	• Cam position > 50 CAD • Cam position Error > 20 CAD • Timing counter >56 count	
	Case 2	• Cam position< 5 CAD • Cam position Error > 20 CAD • Timing counter >56 count	
Diagnosis Time		• Continuous (More than 0.75sec failure for every 56.25 sec. tests)	
MIL On Condition		• 2 driving Cycle	

SIGNAL WAVEFORM AND DATA

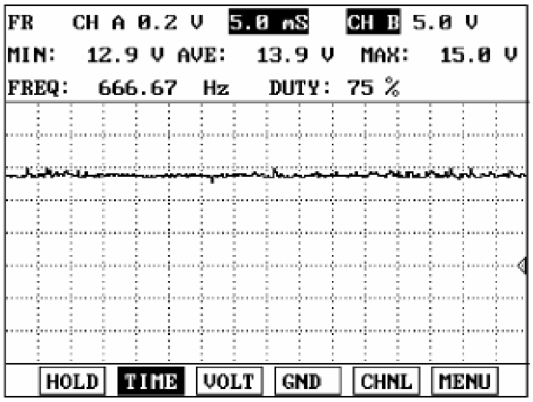


Fig. 1

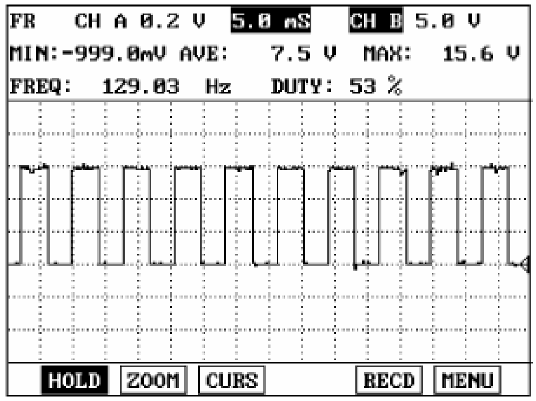


Fig. 2

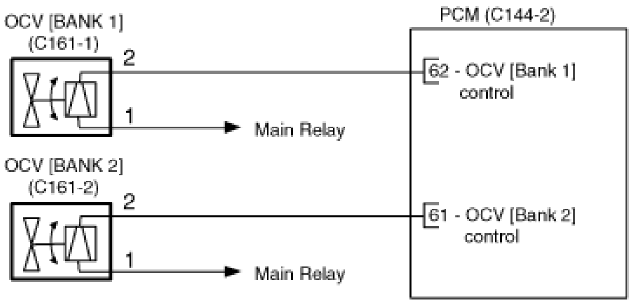
Fig. 1 : Idle - normal Condition
Fig. 2 : Acceleration

SPECIFICATION

Resistance (Ω)	6.7 ~ 7.7

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

OCV [BANK 1]

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (62)	OCV [Bank 1] control

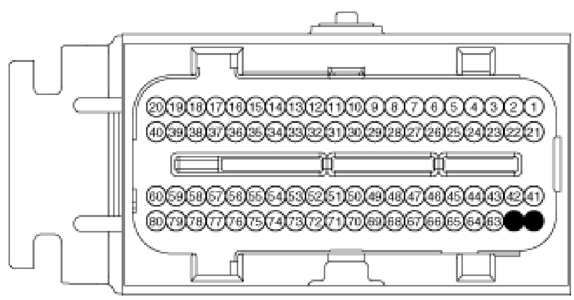
OCV [BANK 2]

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (61)	OCV [Bank 2] control

[HARNESS CONNECTORS]

C161-1
OCV [Bank 1]

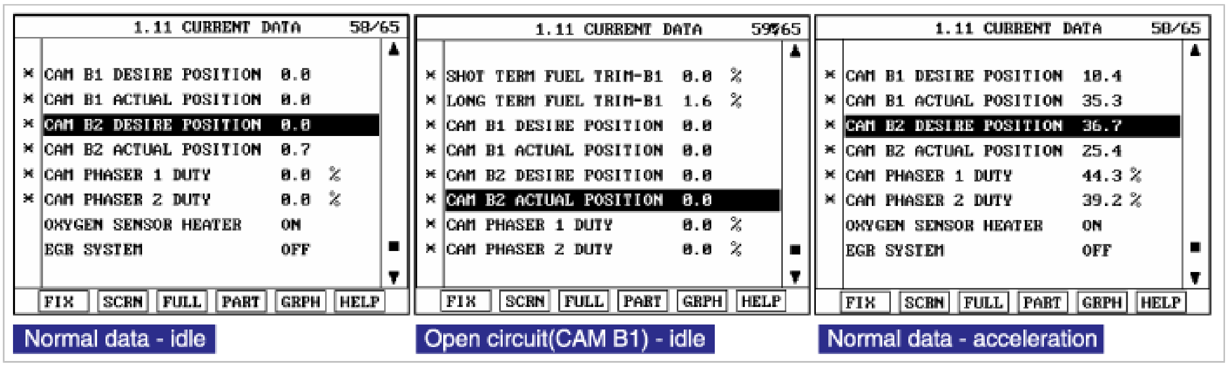
C161-2
OCV [Bank 2]



C144-2
PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "CAM(B2)" status on the service data.



4. Are the "CMP(B2)" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, ending, corrosion, contamination, deterioration, or damage. Repair or replace asnecessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

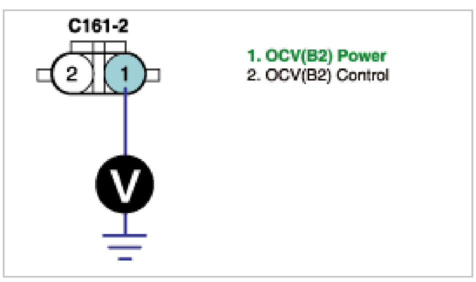
NO

▸ Go to " Power Circuit Inspection " as follow

POWER CIRCUIT INSPECTION

1. IG "OFF" and disconnect OCV connector.
2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 1 of OCV harness connector and chassis ground.

Specification : B+



4. Is the measured voltage within specification ?

YES

▸ Go to " Control Circuit Inspection " procedure.

NO

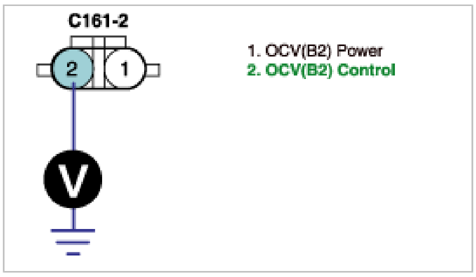
▸ Check that Fuse between Main Relay and OCV is open.
▸ Check open between main relay and OCV.
▸ Check short to ground between Main Relay and OCV.
▸ Repair or replace as necessay go to "Verification of Vehicle Repair " procedure.

CONTROL CIRCUIT INSPECTION

1. IG "OFF" and disconnect OCV connector.
2. IG "ON" & ENG "OFF".

3. Measure voltage between terminal 2 of OCV harness connector and chassis ground.

Specification : Approx. below 1V



4. Is the measured voltage within specification ?

YES

▸ Go to "System Inspection" procedure.

NO

▸ Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

SYSTEM INSPECTION

1. Visual Inspection
   (1) Check oil level is O.K.
   (2) Check oil level is contaminated.
   (3) Check that any oil leakage is occurred around OCV.
   (4) Has a problem been found ?

   YES

   ▸ Repair or replace as necessary and then, go to " Verification of Vehicle Repair" procedure.

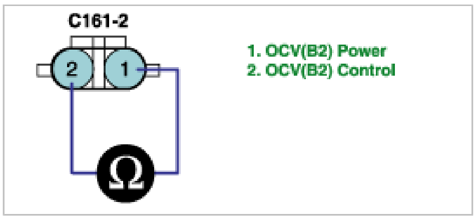
   NO

   ▸ Go to "Component Inspection" procedure

COMPONENT INSPECTION

1. OCV Inspection
   (1) IG "OFF" & Disconnect OCV connector.
   (2) Measure resistance between terminal 1 and 2 of OCV connector (Component Side)
   Specification :

Resistance (Ω)	6.7 ~ 7.7



   (3) Is the measured resistance within specification ?

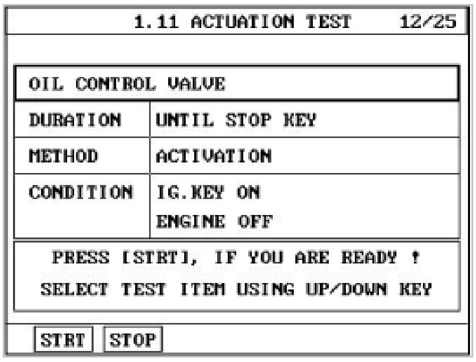
   YES

   ▸ Go to "Actuation Test" as follow.

   NO

   ▸ Substitute with a known - good OCV and check for proper operation. If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

2. Actuation Test
   (1) IG "OFF" and connect OCV connector
   (2) IG "ON" & ENG "OFF"
   (3) Check that click sound can be heard when actuation operates with scantool.



(4) Does the OCV operate corectly when actuation operates ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

NO

Substitute with a known - good OCV and check for proper operation. If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

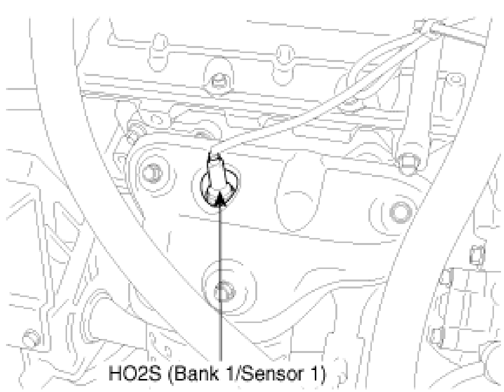
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0031

COMPONENT LOCATION



GENERAL DESCRIPTION

In order to control emissions of the CO, HC and NOx components of the exhaust gas, heated oxygen sensor (HO2S), mounted on the front side and rear side of catalytic converter, detects the oxygen content in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation.The HO2S requires a minimum temperature to operate properly and provide a closed loop fuel control system. The HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions.The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

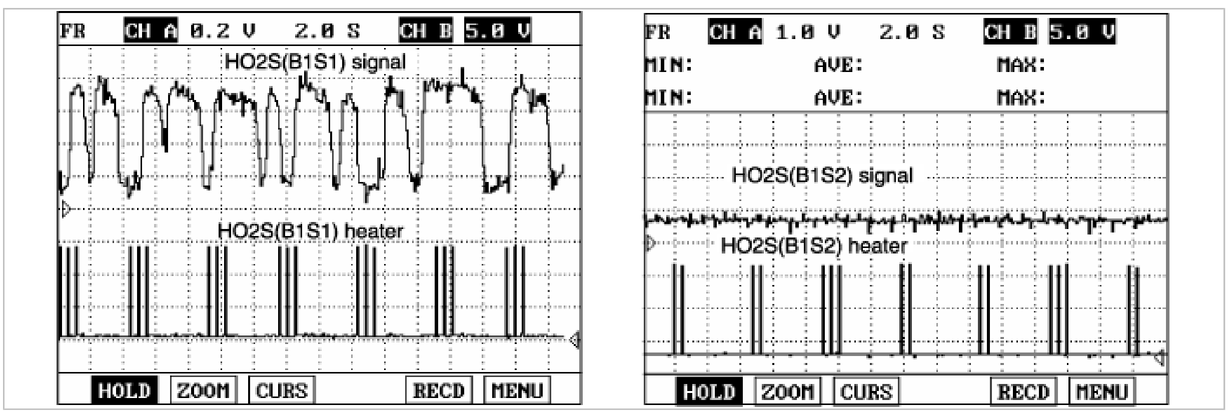
DTC DESCRIPTION

If the PCM detects heater output voltage is lower than threshold value for 5 seconds while enable condition is met PCM determines that a fault exists and a DTC is stored. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to ground or open circuit of O2 sensor heater circuit output	• Poor Connection • Open in Power Circuit • Open or short to ground in control circuit • HO2S(B1/S1) • PCM
Enable Conditions	• No disabling Faults Present • Engine Running • 11V ≤ Ignition Voltage ≤ 16V • Enable Time delay < 0.5sec	
Threshold value	• short to ground or open circuit	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA



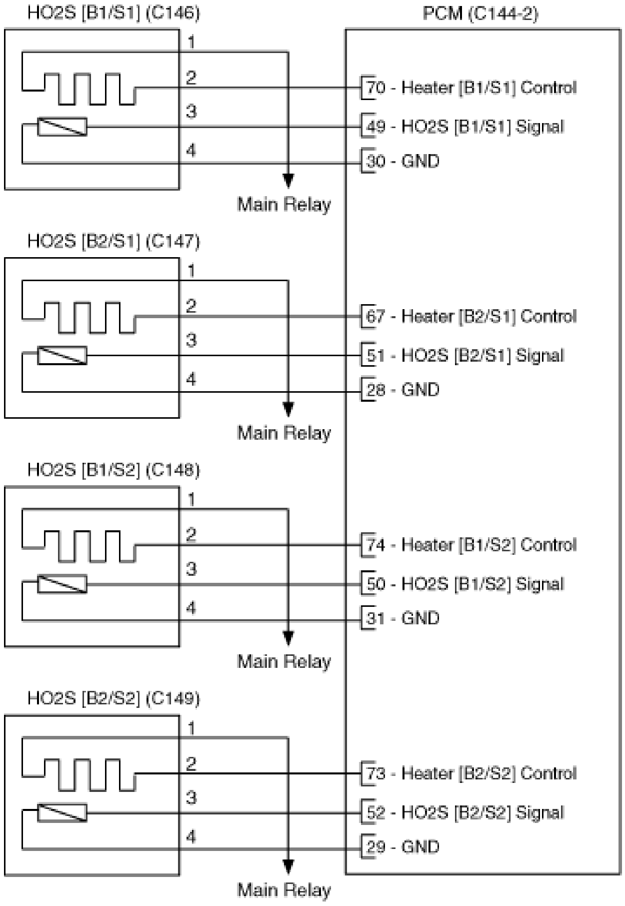
The HO2S requires a minimum temperature to provide a closed loop fuel control system. So the HO2S contains a heater element to reduce its warm-up time and ensure its performance during all driving conditions. The HO2S heater is controlled ON after engine start except for Cold condition and high speed accelleration. The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

SPECIFICATION

Heater	
Resistance (Ω)	9.6 ± 1.5

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

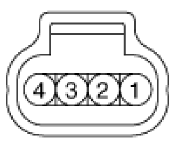
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

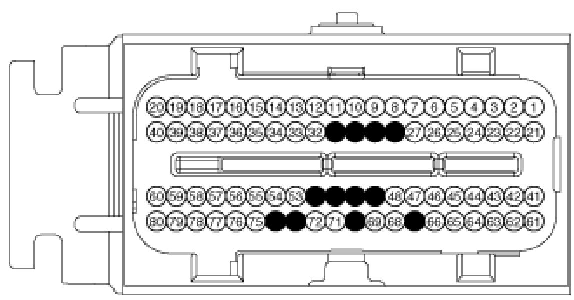
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]

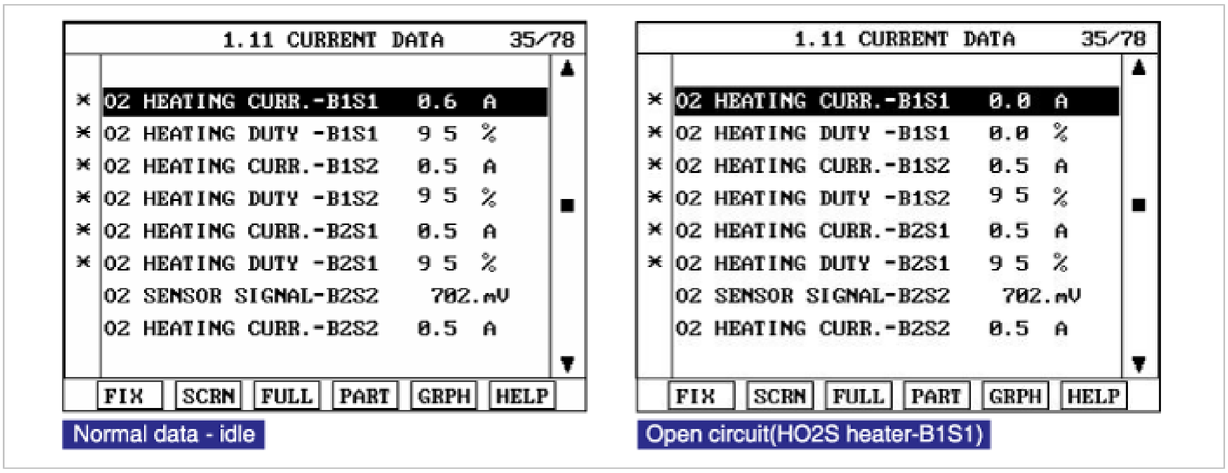


C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "HO2S(B1/S1)" status on the service data.



Normal data - idle

Open circuit(HO2S heater-B1S1)

4. Is the "HO2S Heater(B1/S1)" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

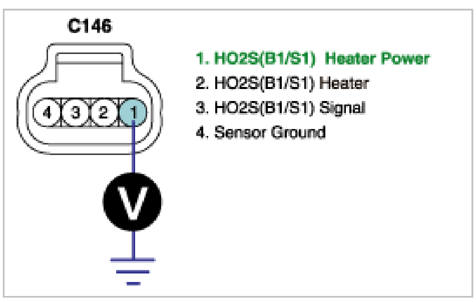
NO

▸ Go to " Power Circuit Inspection " procedure

POWER CIRCUIT INSPECTION

1. IG "OFF" & Disconnect HO2S(B1/S1) connector.
2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 1 of HO2S(B1/S1) harness connector and chassis ground.

Specification : B+



4. Is the measured voltage within specification ?

YES

▸ Go to HO2S(B1/S1) heater "Control Circuit Inspection" procedure.

NO

▸ Repair open or short to ground in HO2S(B1/S1) Heater power circuit then, go to "Verification of Vehicle Repair" procedure.

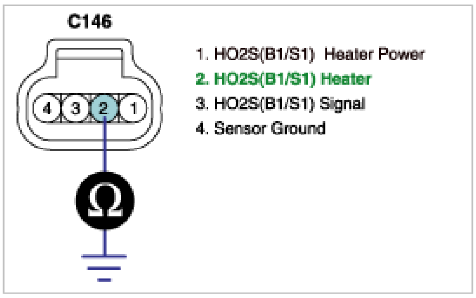
CONTROL CIRCUIT INSPECTION

1. Check short to ground in harness.

(1) IG "OFF" and disconnect HO2S(B1/S1) connector.

(2) Measure resistance between terminal 2 of HO2S(B1/S1) harness connector and chassis ground.

Specification : Infinite



(3) Is the measured resistance within specification ?

YES

▸ Go to HO2S(B1/S1) "Check Open in harness" as follows.

NO

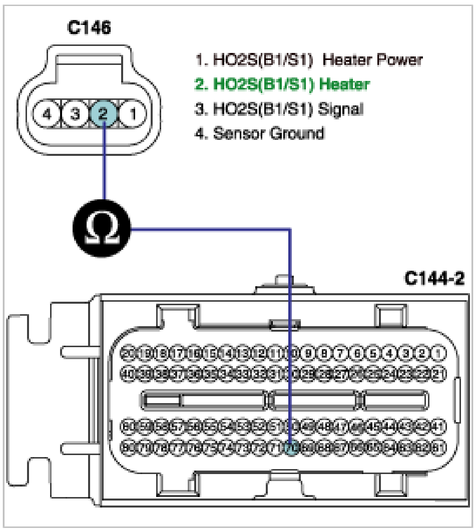
▸ Repair short to ground in HO2S (B1/S1) heater control circuit and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness

(1) IG "OFF" and disconnect HO2S(B1/S1) and PCM connector.

(2) Measure resistance between 2 of HO2S(B1/S1) harness connector and terminal 70 of PCM harness connector.

Specification : Approx. below 1Ω



(3) Is the measured resistance within specification ?

YES

▸ Go to HO2S(B1/S1) "Component Inspection" procedure.

NO

▸ Repair open in HO2S(B1/S1) heater control circuit and go to "Verifiction of Vehicle Repair" procedure.

COMPONENT INSPECTION

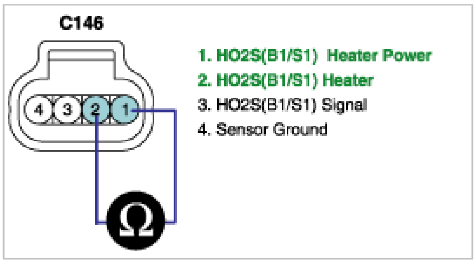
1. Check HO2S(B1/S1) Heater resistance.

(1) IG "OFF" and disconnect HO2S(B1/S1) connector.

(2) Measure resistance between terminal 1 and 2 of HO2S(B1/S1)connector (Component Side)

Specification :

Heater	
Resistance (Ω)	9.6 ± 1.5



(3) Is the measured resistance within specification ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

NO

▸ Substitute with a known - good HO2S(B1/S1) and check for proper operation. If the problem is corrected, replace HO2S (B1/S1) and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

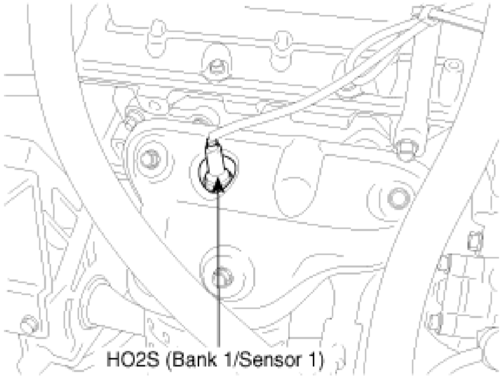
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0032

COMPONENT LOCATION



GENERAL DESCRIPTION

In order to control emissions of the CO, HC and NOx components of the exhaust gas, heated oxygen sensor (HO2S), mounted on the front side and rear side of catalytic converter, detects the oxygen content in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation.The HO2S requires a minimum temperature to operate properly and provide a closed loop fuel control system. The HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions.The

PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

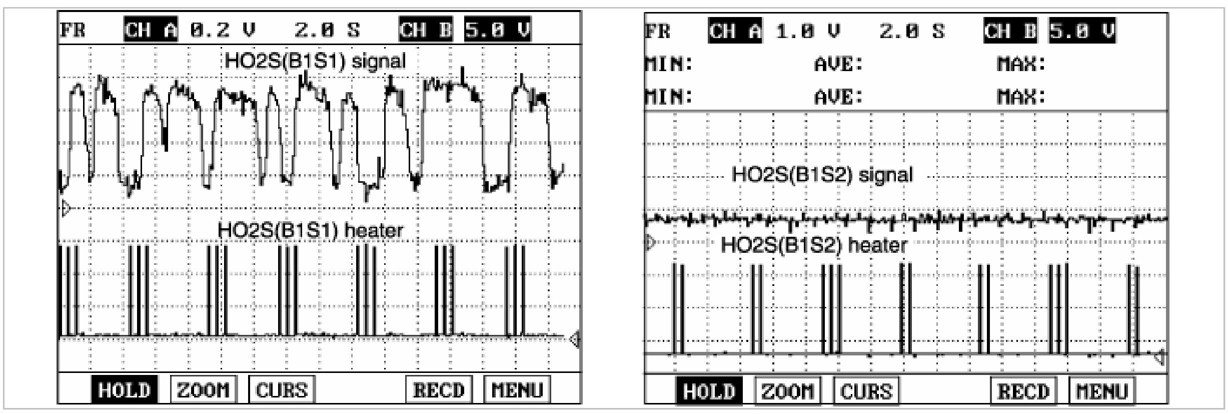
DTC DESCRIPTION

If the PCM detects heater output voltage is higher than threshold value for 5 seconds while enable condition is met PCM determines that a fault exists and a DTC is stored. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to battery O2 sensor heater circuit output	• Poor Connection • short to battery in control circuit • HO2S(B1/S1) • PCM
Enable Conditions	• No disabling Faults Present • Engine Running • 11V ≤ Ignition Voltage ≤ 16V • Enable Time delay < 0.5sec	
Threshold value	• short to battery	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA



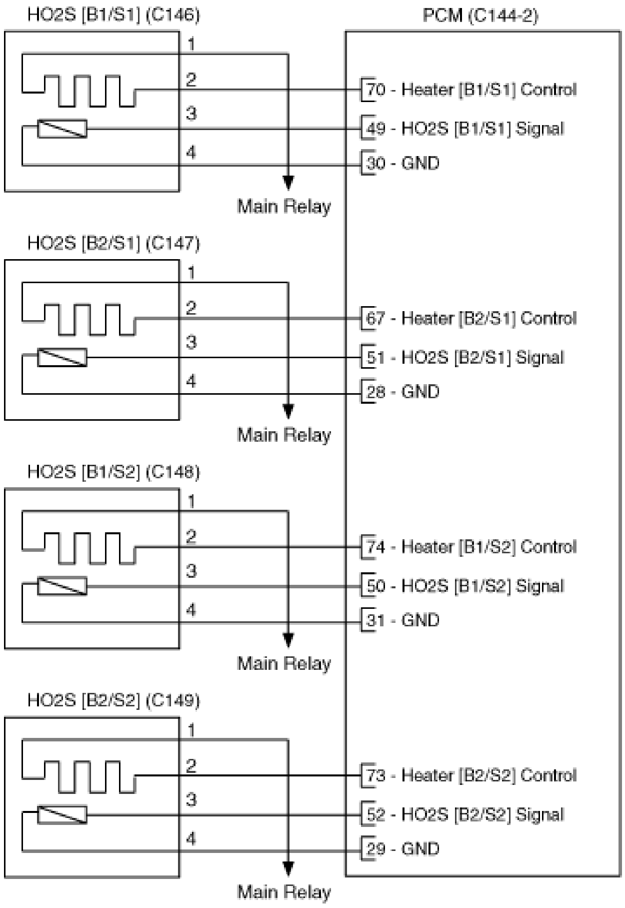
The HO2S requires a minimum temperature to provide a closed loop fuel control system. So the HO2S contains a heater element to reduce its warm-up time and ensure its performance during all driving conditions. The HO2S heater is controlled ON after engine start except for Cold condition and high speed accelleration. The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

SPECIFICATION

Heater	
Resistance (Ω)	9.6 ± 1.5

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

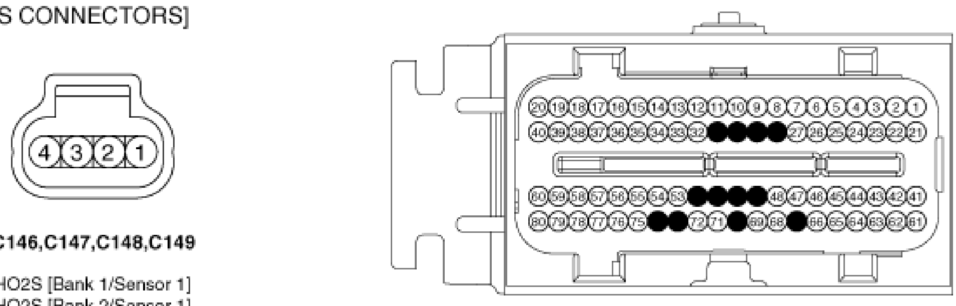
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

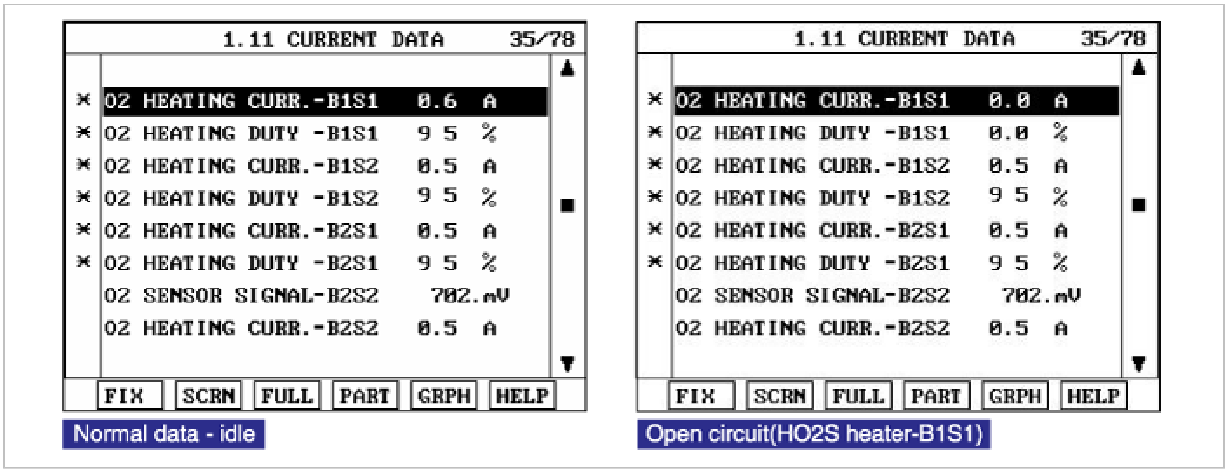
HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]

C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "HO2S(B1/S1)" status on the service data.



4. Is the "HO2S Heater(B1/S1)" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

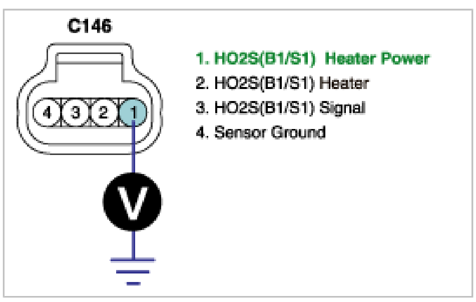
NO

▸ Go to " Power Circuit Inspection " procedure

POWER CIRCUIT INSPECTION

1. IG "OFF" & Disconnect HO2S(B1/S1) connector.
2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 1 of HO2S(B1/S1) harness connector and chassis ground.

Specification : B+



4. Is the measured voltage within specification ?

YES

▸ Go to HO2S(B1/S1) heater "Control Circuit Inspection" procedure.

NO

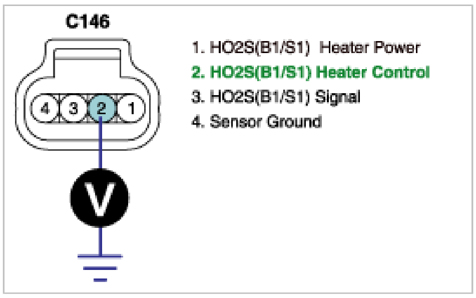
▸ Check output voltage from alternator then repair or replace as necessary. Go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. IG "OFF" & disconnect HO2S(B1/S1) connector.

2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 2 of HO2S(B1/S1) harness connector and chassis ground.

Specification : Approx. 0 V



4. Is the measured voltage within specification ?

YES

▸ Go to HO2S(B1/S1) "Component Inspection" procedure.

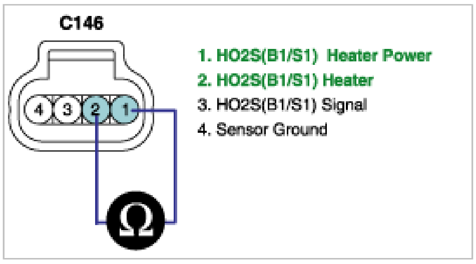
NO

▸ Repair short to battery in HO2S(B1/S1) Heater control circuit and go to "Verification of Vhicle Repair" procedure.

COMPONENT INSPECTION

1. Check HO2S(B1/S1) Heater resistance.
   (1) IG "OFF" and disconnect HO2S(B1/S1) connector.
   (2) Measure resistance between terminal 1 and 2 of HO2S(B1/S1)connector (Component Side)
   Specification :

Heater	
Resistance (Ω)	9.6 ± 1.5



   (3) Is the measured resistance within specification ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

NO

▸ Substitute with a known - good HO2S(B1/S1) and check for proper operation. If the problem is corrected, replace HO2S (B1/S1) and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.
1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "

5. Are any DTCs present ?

YES

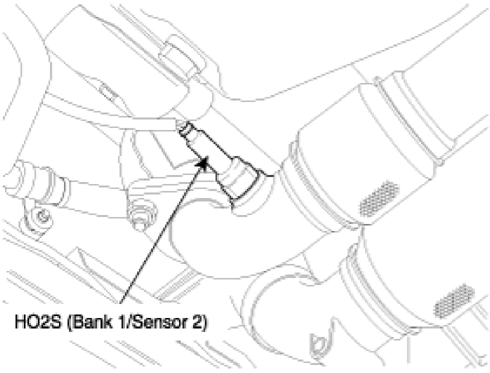
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0037

COMPONENT LOCATION



GENERAL DESCRIPTION

The rear heated oxygen sensor is mounted on the rear side of the Catalytic Converter which is able to detect the catalyst efficiency. The rear heated oxygen sensor (HO2S) produces a voltage between 0V and 1V. This rear heated oxygen sensor is used to estimate the oxygen storage capability. If a catalyst has good conversion properties, the oxygen fluctuations are smoothed by the oxygen storage capacity of the catalyst. If the conversion provided by the catalyst is low due to aging, poisoning or misfiring, then the oxygen fluctuations are similar to signals from the front oxygen sensor.

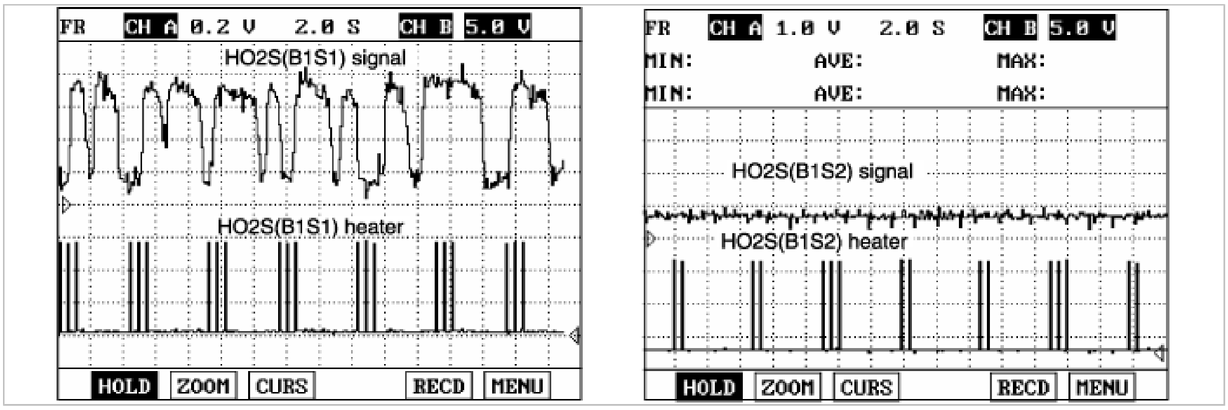
DTC DESCRIPTION

If the PCM detects heater output voltage is lower than threshold value for 5 seconds while enable condition is met PCM determines that a fault exists and a DTC is stored. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to ground or open circuit of O2 sensor heater circuit output	• Poor Connection • Open in Power Circuit • Open or short to ground in control circuit • HO2S(B1/S2) • PCM
Enable Conditions	• No disabling Faults Present • Engine Running • 11V ≤ Ignition Voltage ≤ 16V • Enable Time delay < 0.5sec	
Threshold value	• short to ground or open circuit	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA



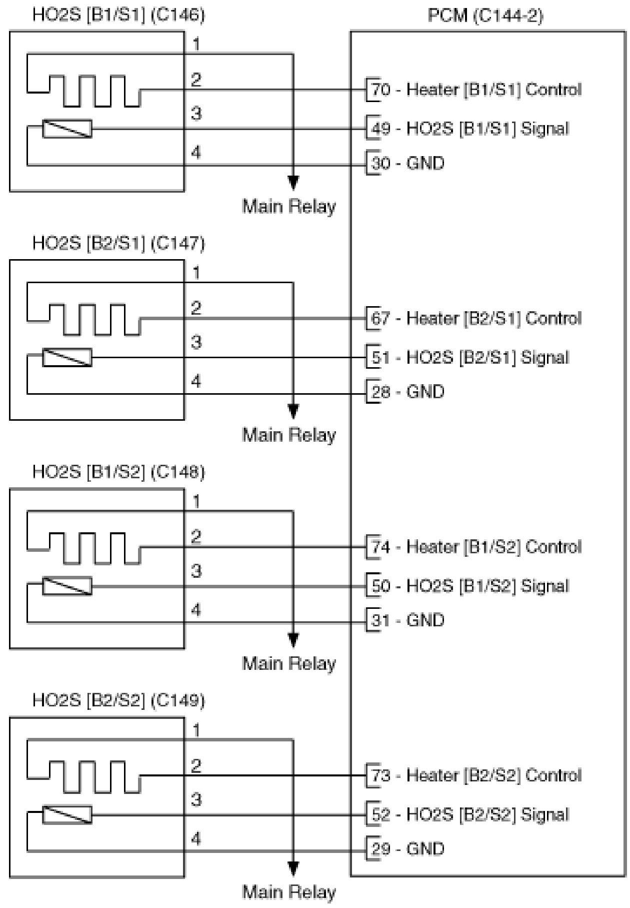
The HO2S requires a minimum temperature to provide a closed loop fuel control system. So the HO2S contains a heater element to reduce its warm-up time and ensure its performance during all driving conditions. The HO2S heater is controlled ON after engine start except for Cold condition and high speed accelleration. The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

SPECIFICATION

Heater	
Resistance (Ω)	9.6 ± 1.5

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

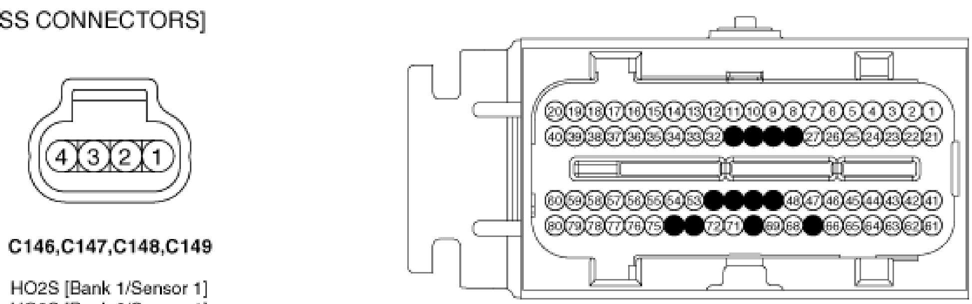
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

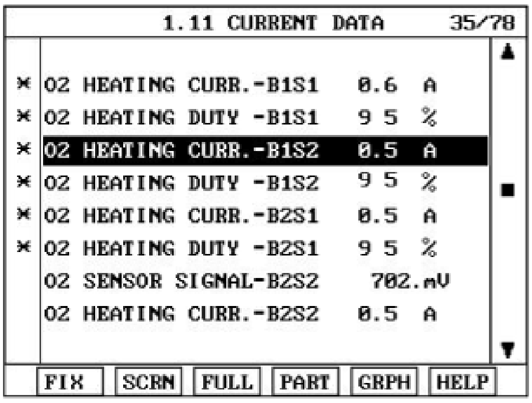
HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]

C144-2

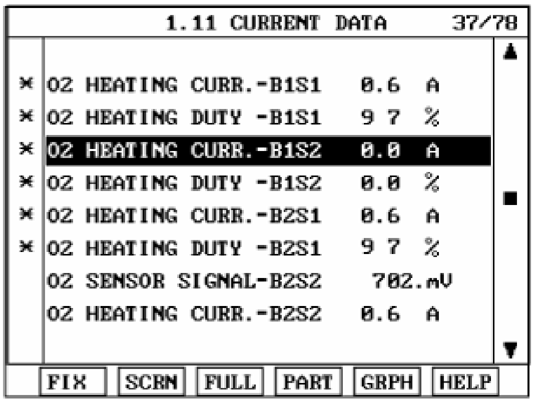
PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "HO2S(B1/S2)" status on the service data.



Normal data at idle



Open circuit(HO2S heater-B1S2)

4. Is the "HO2S Heater(B1/S2)" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

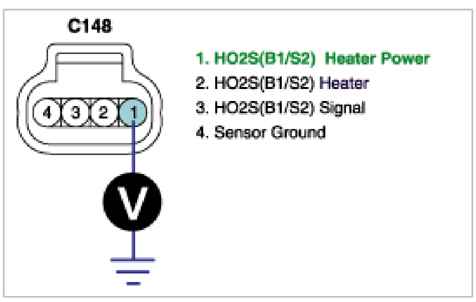
NO

▸ Go to " Power Circuit Inspection " procedure

POWER CIRCUIT INSPECTION

1. IG "OFF" & Disconnect HO2S(B1/S2) connector.
2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 1 of HO2S(B1/S2) harness connector and chassis ground.

Specification : B+



4. Is the measured voltage within specification ?

YES

▸ Go to HO2S(B1/S2) heater "Control Circuit Inspection" procedure.

NO

▸ Repair open or short to ground in HO2S(B1/S2) Heater power circuit then, go to "Verification of Vehicle Repair" procedure.

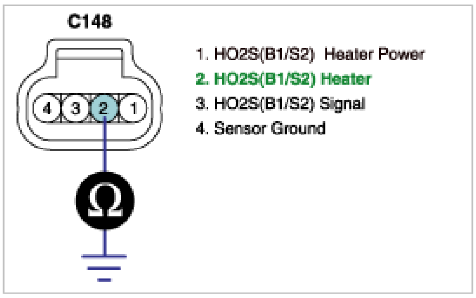
CONTROL CIRCUIT INSPECTION

1. Check short to ground in harness.

(1) IG "OFF" and disconnect HO2S(B1/S2) connector.

(2) Measure resistance between terminal 2 of HO2S(B1/S2) harness connector and chassis ground.

Specification : Infinite



(3) Is the measured resistance within specification ?

YES

▸ Go to HO2S(B1/S2) "Check Open in harness" as follows.

NO

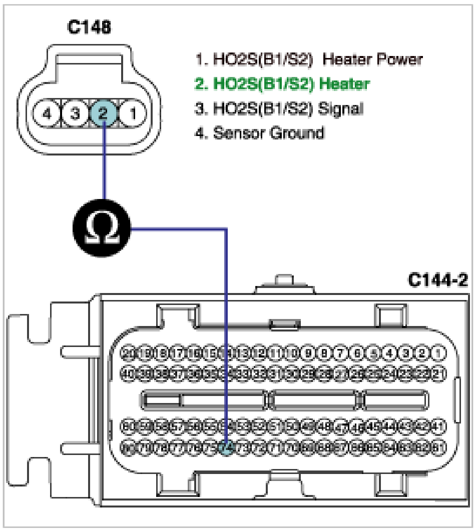
▸ Repair short to ground in HO2S (B1/S2) heater control circuit and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness

(1) IG "OFF" and disconnect HO2S(B1/S2) and PCM connector.

(2) Measure resistance between terminal 2 of HO2S(B1/S2) harness connector and terminal 74 of PCM harness connector.

Specification : Approx. below 1Ω



(3) Is the measured resistance within specification ?

YES

▸ Go to HO2S(B1/S2) "Component Inspection" procedure.

NO

▸ Repair open in HO2S(B1/S2) heater control circuit and go to "Verifiction of Vehicle Repair" procedure.

COMPONENT INSPECTION

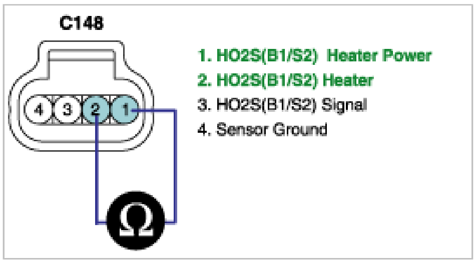
1. Check HO2S(B1/S2) Heater resistance

(1) IG "OFF" and disconnect HO2S(B1/S2) connector

(2) Measure resistance between terminal 1 and 2 of HO2S(B1/S2)(Component Side)

Specification :

Heater	
Resistance (Ω)	9.6 ± 1.5



(3) Is the measured resistance within specification ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

NO

▸ Substitute with a known - good HO2S(B1/S2) and check for proper operation. If the problem is corrected, replace HO2S (B1/S2) and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

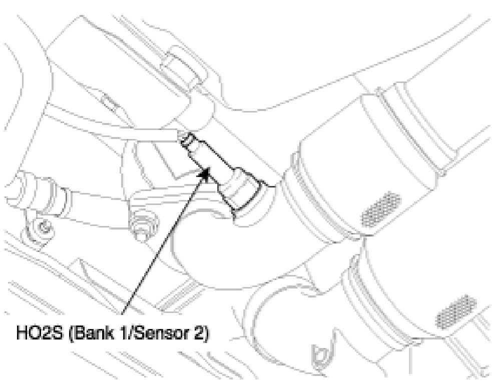
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0038

COMPONENT LOCATION



GENERAL DESCRIPTION

The rear heated oxygen sensor is mounted on the rear side of the Catalytic Converter which is able to detect the catalyst efficiency. The rear heated oxygen sensor (HO2S) produces a voltage between 0V and 1V. This rear heated oxygen sensor is used to estimate the oxygen storage capability. If a catalyst has good conversion properties, the oxygen fluctuations are smoothed by the oxygen storage capacity of the catalyst. If the conversion provided by the catalyst is low due to aging, poisoning or misfiring, then the oxygen fluctuations are similar to signals from the front oxygen sensor.

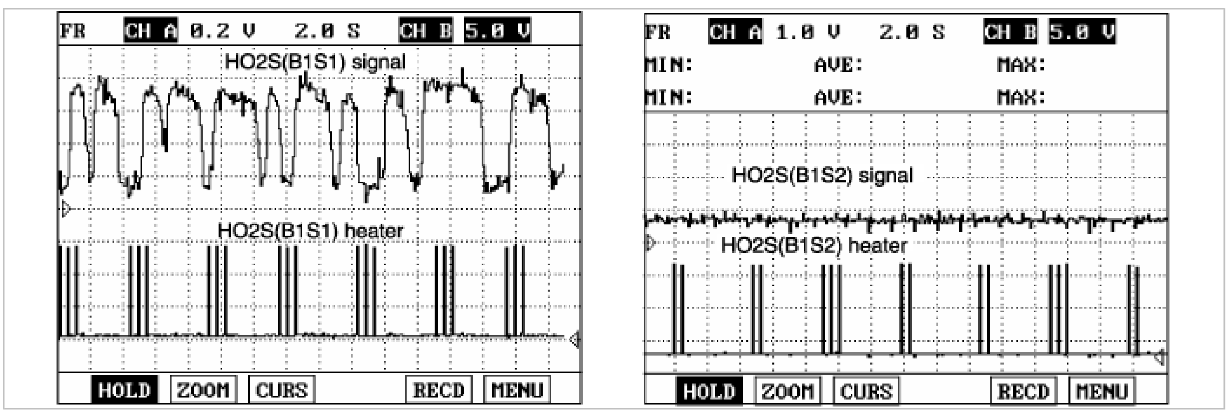
DTC DESCRIPTION

If the PCM detects heater output voltage is higher than threshold value for 5 seconds while enable condition is met PCM determines that a fault exists and a DTC is stored. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to ground or open circuit of O2 sensor heater circuit output	• Poor Connection • short to battery in control circuit • HO2S(B1/S2) • PCM
Enable Conditions	• No disabling Faults Present • Engine Running • 11V ≤ Ignition Voltage ≤ 16V • Enable Time delay < 0.5sec	
Threshold value	• short to battery	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA



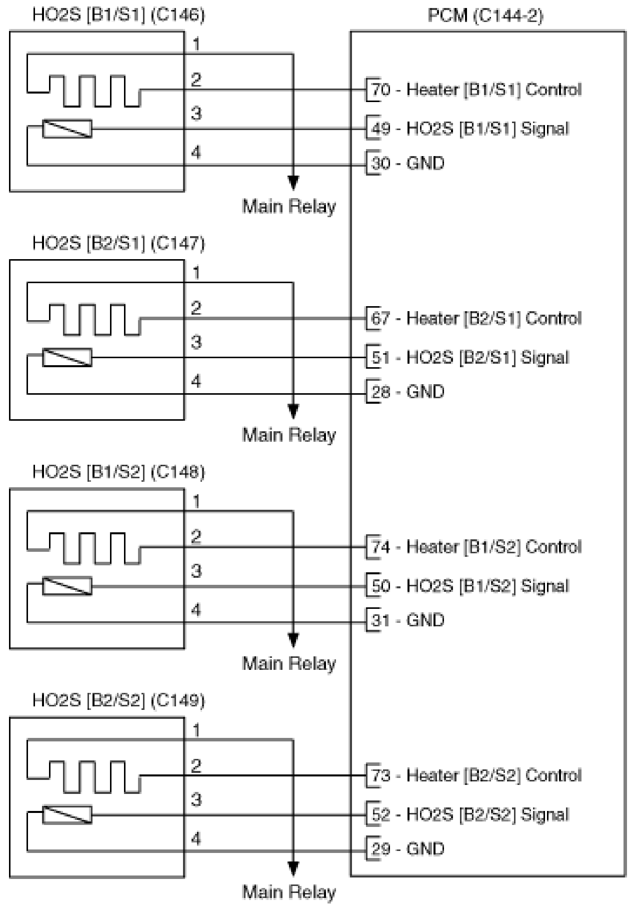
The HO2S requires a minimum temperature to provide a closed loop fuel control system. So the HO2S contains a heater element to reduce its warm-up time and ensure its performance during all driving conditions. The HO2S heater is controlled ON after engine start except for Cold condition and high speed accelleration. The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

SPECIFICATION

Heater	
Resistance (Ω)	9.6 ± 1.5

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

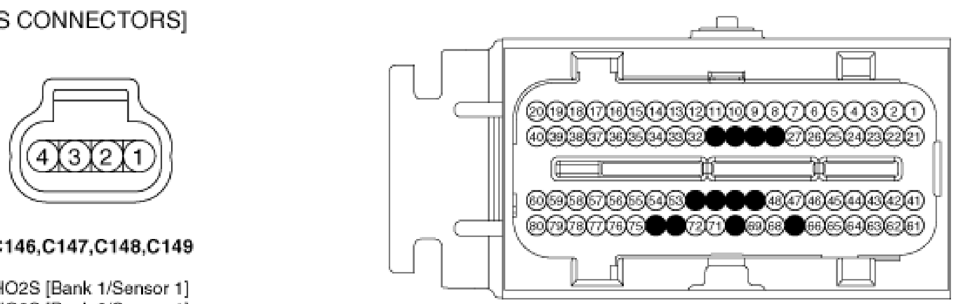
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

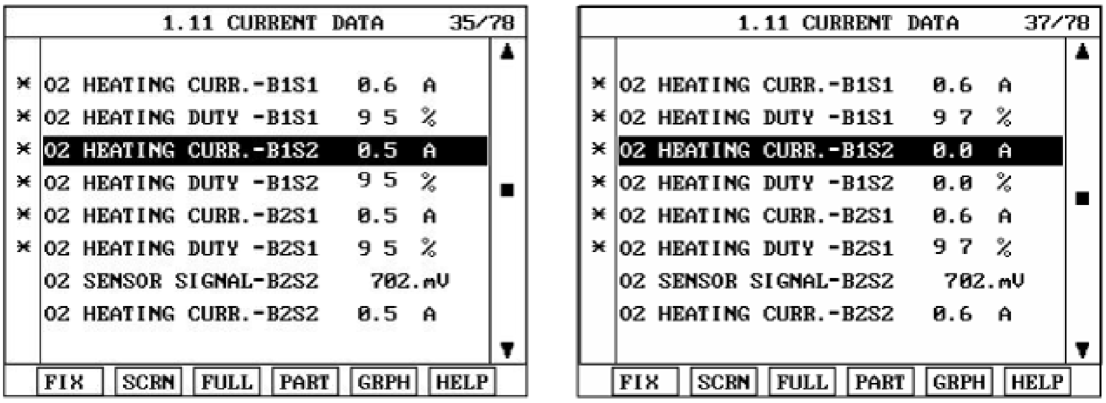
HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]

C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "HO2S(B1/S2)" status on the service data.



Normal data at idle

Open circuit(HO2S heater-B1S2)

4. Is the "HO2S Heater(B1/S2)" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

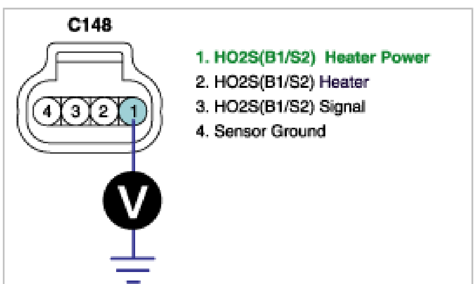
NO

▸ Go to " Power Circuit Inspection " procedure

POWER CIRCUIT INSPECTION

1. IG "OFF" & Disconnect HO2S(B1/S2) connector.
2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 1 of HO2S(B1/S2) harness connector and chassis ground.

Specification : B+



4. Is the measured voltage within specification ?

YES

▸ Go to HO2S(B1/S2) heater "Control Circuit Inspection" procedure.

NO

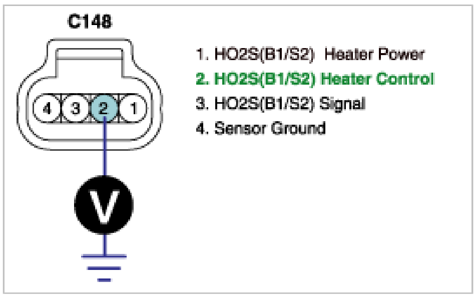
▸ Repair open or short to ground in HO2S(B1/S2) Heater power circuit then, go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. IG "OFF" & disconnect HO2S(B1/S2) connector.

2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 2 of HO2S(B1/S2) harness connector and chassis ground.

Specification : Approx. 0 V



4. Is the measured voltage within specification ?

YES

▸ Go to HO2S(B1/S2) "Component Inspection" procedure.

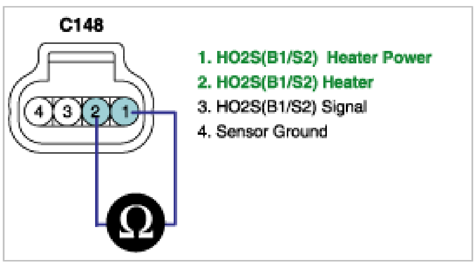
NO

▸ Repair short to battery in HO2S (B1/S2) heater control circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check HO2S(B1/S2) Heater resistance
   (1) IG "OFF" and disconnect HO2S(B1/S2) connector
   (2) Measure resistance between terminal 1 and 2 of HO2S(B1/S2)(Component Side)
   Specification :

Heater	
Resistance (Ω)	9.6 ± 1.5



   (3) Is the measured resistance within specification ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

NO

▸ Substitute with a known - good HO2S(B1/S2) and check for proper operation. If the problem is corrected, replace HO2S (B1/S2) and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.
1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "

5. Are any DTCs present ?

YES

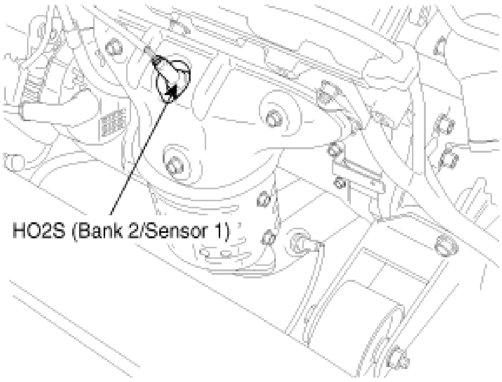
▸ Go to the applicable troubleshooooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0051

COMPONENT LOCATION



GENERAL DESCRIPTION

In order to control emissions of the CO, HC and NOx components of the exhaust gas, heated oxygen sensor (HO2S), mounted on the front side and rear side of catalytic converter, detects the oxygen content in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation.The HO2S requires a minimum temperature to operate properly and provide a closed loop fuel control system. The HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions.The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

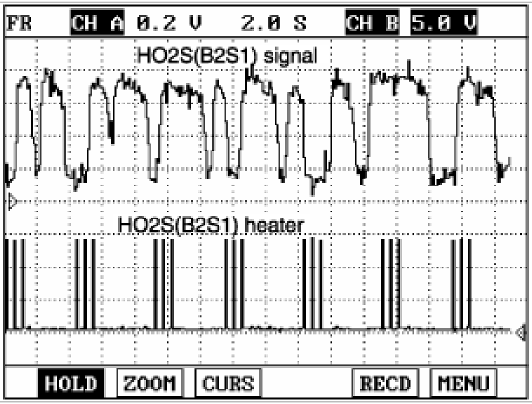
DTC DESCRIPTION

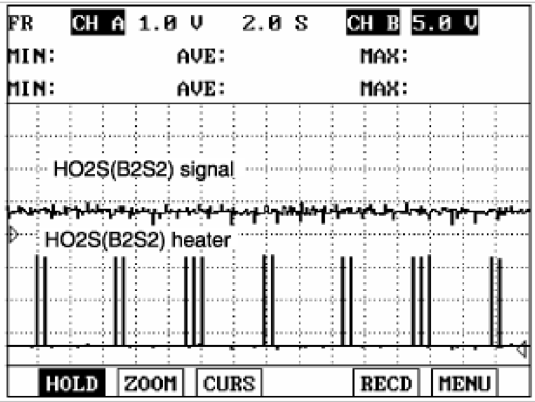
If the PCM detects heater output voltage is lower than threshold value for 5 seconds while enable condition is met PCM determines that a fault exists and a DTC is stored. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to ground or open circuit of O2 sensor heater circuit output	• Poor Connection • Open in Power Circuit • Open or short to ground in control circuit • HO2S(B2/S1) • PCM
Enable Conditions	• No disabling Faults Present • Engine Running • 11V ≤ Ignition Voltage ≤ 16V • Enable Time delay < 0.5sec	
Threshold value	• short to ground or open circuit	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA





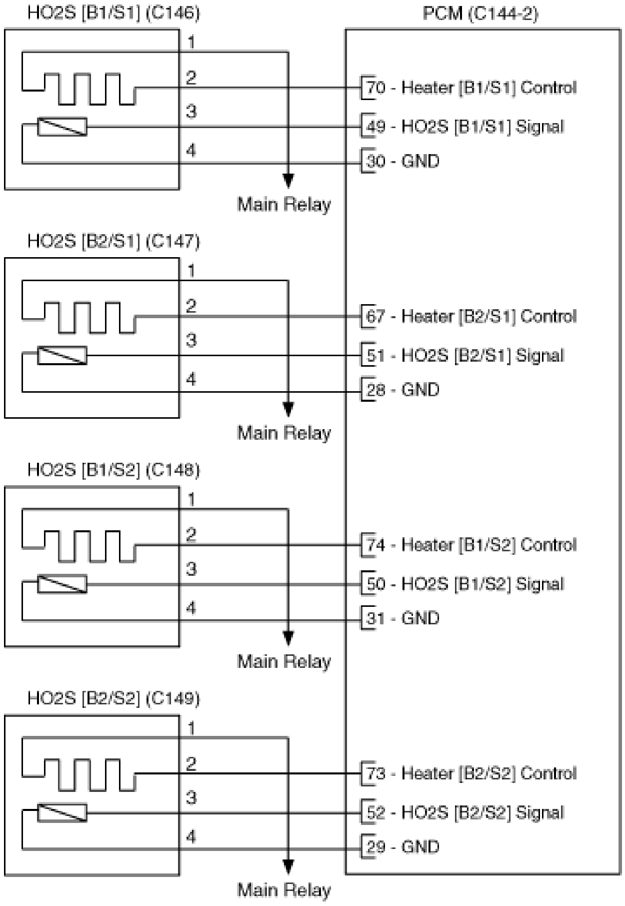
The HO2S requires a minimum temperature to provide a closed loop fuel control system. So the HO2S contains a heater element to reduce its warm-up time and ensure its performance during all driving conditions. The HO2S heater is controlled ON after engine start except for Cold condition and high speed accelleration. The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

SPECIFICATION

Heater	
Resistance (Ω)	9.6 ± 1.5

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

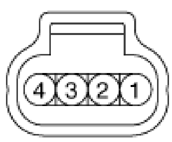
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

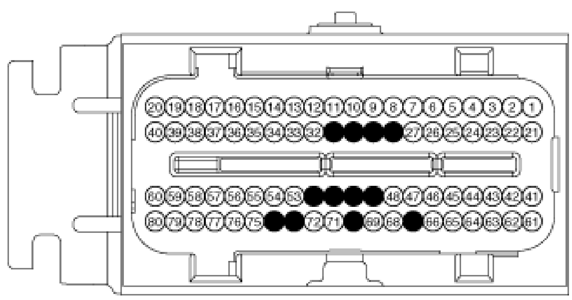
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

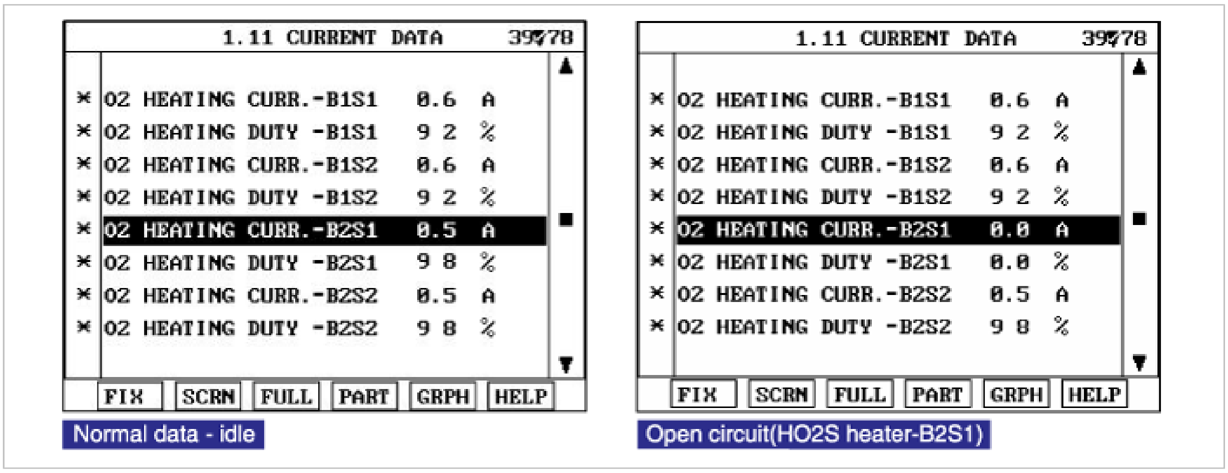
HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C144-2
PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "HO2S(B2/S1)" status on the service data.



4. Is the "HO2S Heater(B2/S1)" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

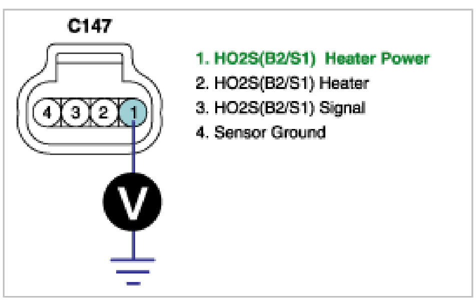
NO

▸ Go to " Power Circuit Inspection " as follows

POWER CIRCUIT INSPECTION

1. IG "OFF" & Disconnect HO2S(B2/S1) connector.
2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 1 of HO2S(B2/S1) harness connector and chassis ground.

Specification : B+



4. Is the measured voltage within specification ?

YES

▸ Go to HO2S(B2/S1) heater "Control Circuit Inspection" procedure.

NO

▸ Repair open or short to ground in HO2S(B2/S1) Heater power circuit then, go to "Verification of Vehicle Repair" procedure.

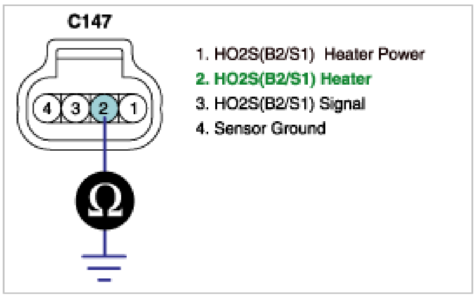
CONTROL CIRCUIT INSPECTION

1. Check short to ground in harness.

(1) IG "OFF" and disconnect HO2S(B2/S1) connector.

(2) Measure resistance between terminal 2 of HO2S(B2/S1) harness connector and chassis ground.

Specification : Infinite



(3) Is the measured resistance within specification ?

YES

▸ Go to HO2S(B2/S1) "Check Open in harness" as follows.

NO

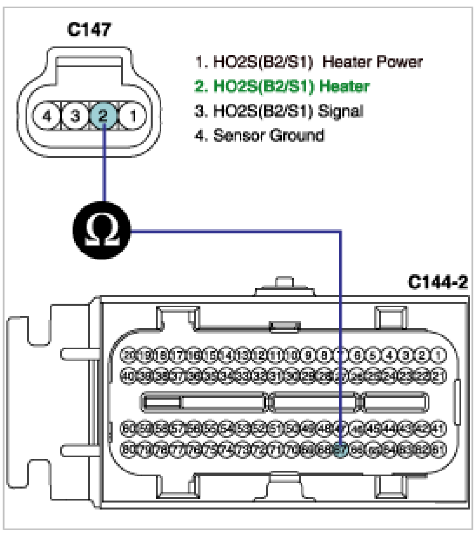
▸ Repair short to ground in HO2S (B2/S1) heater control circuit and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness

(1) IG "OFF" and disconnect HO2S(B2/S1) and PCM connector.

(2) Measure resistance between terminal 2 of HO2S(B2/S1) harness connector and terminal 67 of PCM harness connector.

Specification : Approx. below 1Ω



(3) Is the measured resistance within specification ?

YES

▸ Go to HO2S(B2/S1) "Component Inspection" procedure.

NO

▸ Repair open in HO2S(B2/S1) heater control circuit and go to "Verifiction of Vehicle Repair" procedure.

COMPONENT INSPECTION

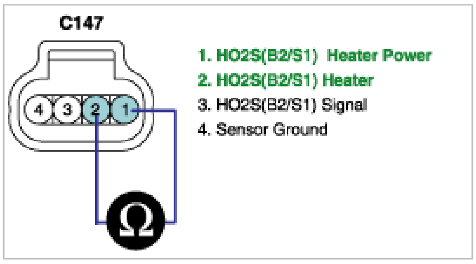
1. Check HO2S(B2/S1) Heater resistance

(1) IG "OFF" and disconnect HO2S(B2/S1) connector

(2) Measure resistance between terminal 1 and 2 of HO2S(B2/S1)(Component Side)

Specification :

Heater	
Resistance (Ω)	9.6 ± 1.5



(3) Is the measured resistance within specification ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

NO

▸ Substitute with a known - good HO2S(B2/S1) and check for proper operation. If the problem is corrected, replace HO2S (B2/S1) and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs.
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Monitor that all rediness test have been verified as " Complete ".
5. Are any DTCs present ?

YES

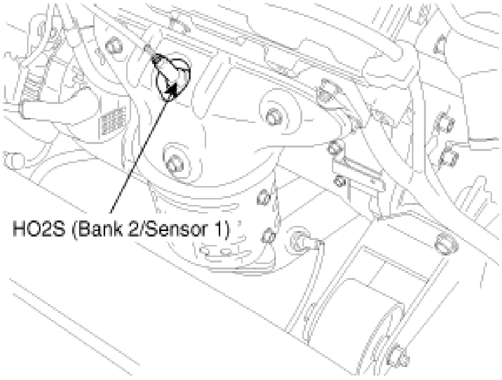
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0052

COMPONENT LOCATION



GENERAL DESCRIPTION

In order to control emissions of the CO, HC and NOx components of the exhaust gas, heated oxygen sensor (HO2S), mounted on the front side and rear side of catalytic converter, detects the oxygen content in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation.The HO2S requires a minimum temperature to operate properly and provide a closed loop fuel control system. The HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions.The

PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

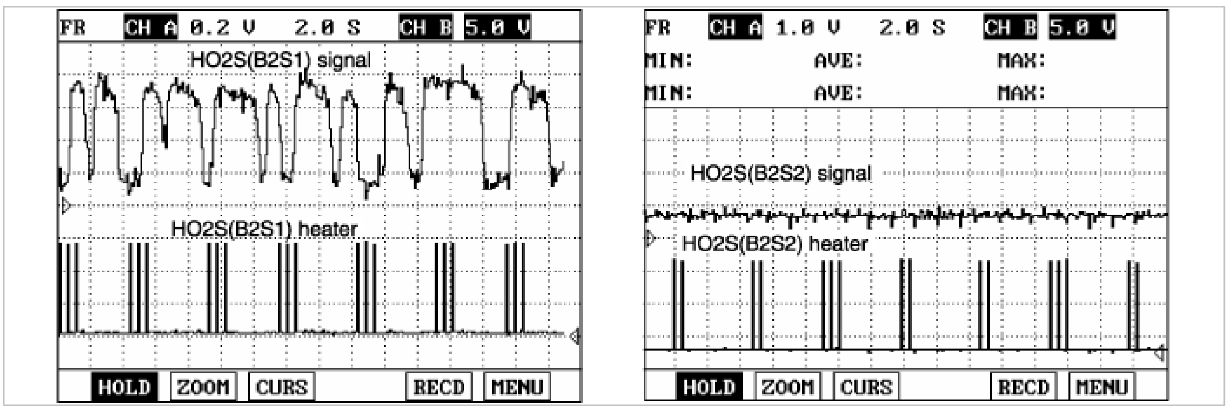
DTC DESCRIPTION

If the PCM detects heater output voltage is higher than threshold value for 5 seconds while enable condition is met PCM determines that a fault exists and a DTC is stored. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to ground or open circuit of O2 sensor heater circuit output	• Poor Connection • Open or short to battery in control circuit • HO2S(B2/S1) • PCM
Enable Conditions	• No disabling Faults Present • Engine Running • 11V ≤ Ignition Voltage ≤ 16V • Enable Time delay < 0.5sec	
Threshold value	• short to battery	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA



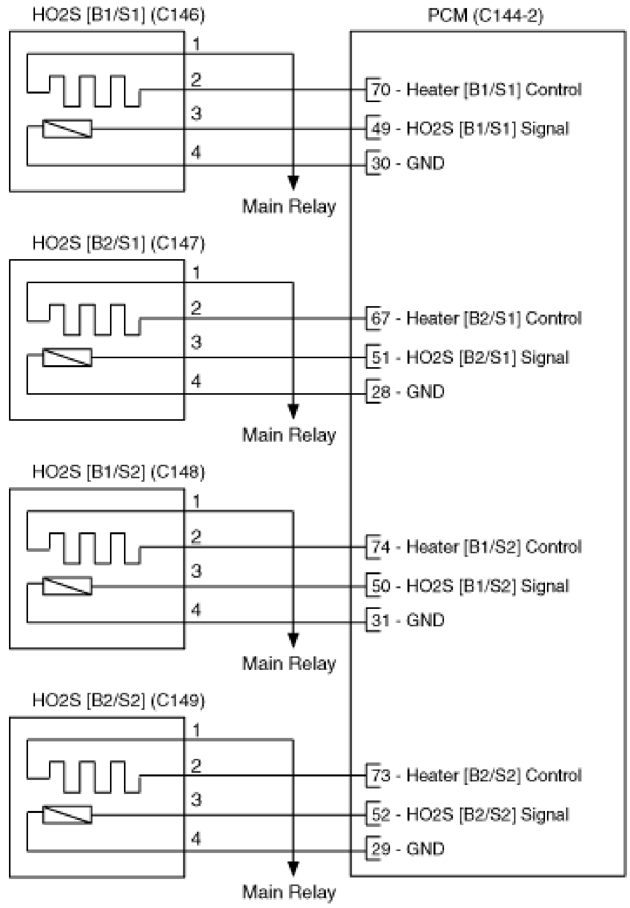
The HO2S requires a minimum temperature to provide a closed loop fuel control system. So the HO2S contains a heater element to reduce its warm-up time and ensure its performance during all driving conditions. The HO2S heater is controlled ON after engine start except for Cold condition and high speed accelleration. The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

SPECIFICATION

Heater	
Resistance (Ω)	9.6 ± 1.5

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

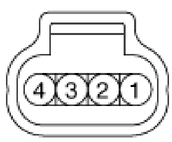
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

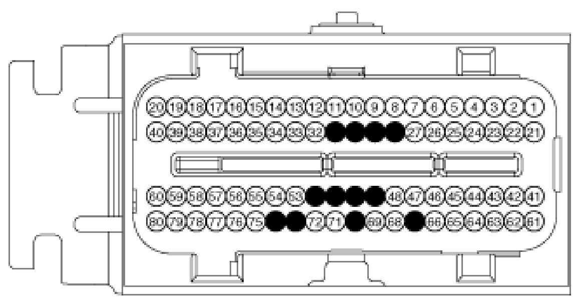
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

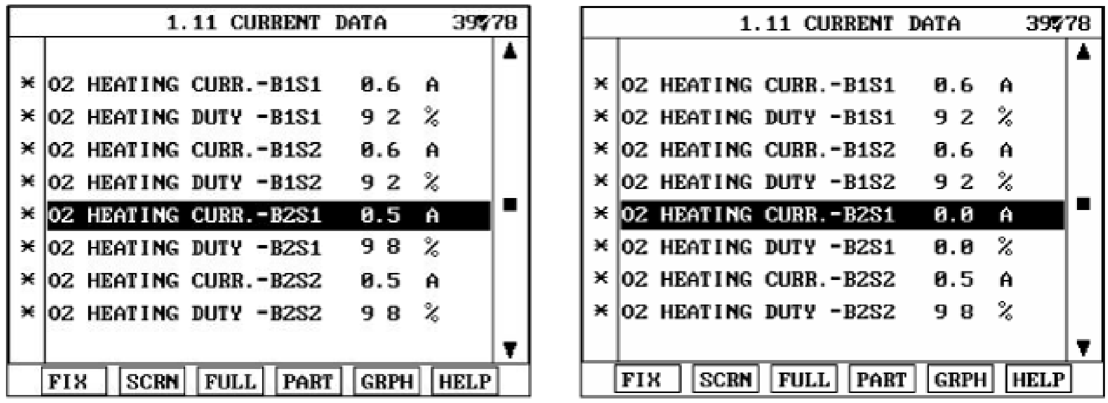
HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C144-2
PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "HO2S(B2/S1)" status on the service data.



Normal data - idle

Open circuit(HO2S heater-B2S1)

4. Is the "HO2S Heater(B2/S1)" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

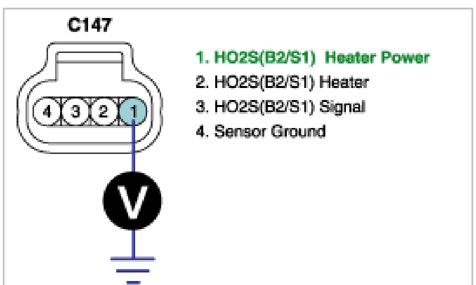
NO

▸ Go to " Power Circuit Inspection " as follows

POWER CIRCUIT INSPECTION

1. IG "OFF" & Disconnect HO2S(B2/S1) connector.
2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 1 of HO2S(B2/S1) harness connector and chassis ground.

Specification : B+



4. Is the measured voltage within specification ?

YES

▸ Go to HO2S(B2/S1) heater "Control Circuit Inspection" procedure.

NO

▸ Repair open or short to ground in HO2S(B2/S1) Heater power circuit then, go to "Verification of Vehicle Repair" procedure.

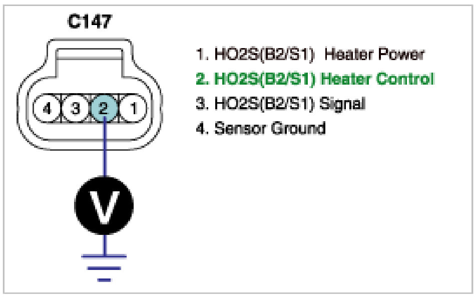
CONTROL CIRCUIT INSPECTION

1. IG "OFF" & disconnect HO2S(B2/S1) connector.

2. IG "ON" & ENG "OFF".

3. Measure voltage between terminal 2 of HO2S(B2/S1) harness connector and chassis ground.

Specification : Approx. 0 V



4. Is the measured voltage within specification ?

YES

▸ Go to HO2S(B2/S1) "Component Inspection" procedure.

NO

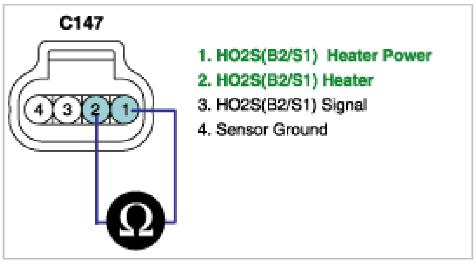
▸ Repair short to battery in HO2S(B2/S1) Heater control circuit and go to "Verification of Vhicle Repair" procedure.

COMPONENT INSPECTION

1. Check HO2S(B2/S1) Heater resistance
   (1) IG "OFF" and disconnect HO2S(B2/S1) connector

   (2) Measure resistance between terminal 1 and 2 of HO2S(B2/S1)(Component Side)
   Specification :

Heater	
Resistance (Ω)	9.6 ± 1.5



   (3) Is the measured resistance within specification ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

NO

▸ Substitute with a known - good HO2S(B2/S1) and check for proper operation. If the problem is corrected, replace HO2S (B2/S1) and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.

2. Using a Scantool, Clear the DTCs

3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions

4. Monitor that all rediness test have been verified as " Complete "

5. Are any DTCs present ?

YES

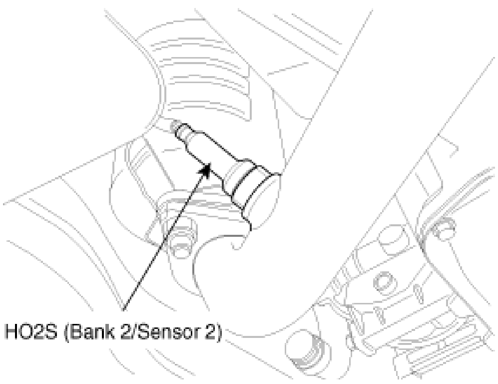
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0057

COMPONENT LOCATION



GENERAL DESCRIPTION

The rear heated oxygen sensor is mounted on the rear side of the Catalytic Converter which is able to detect the catalyst efficiency. The rear heated oxygen sensor (HO2S) produces a voltage between 0V and 1V. This rear heated oxygen sensor is used to estimate the oxygen storage capability. If a catalyst has good conversion properties, the oxygen fluctuations are smoothed by the oxygen storage capacity of the catalyst. If the conversion provided by the catalyst is low due to aging, poisoning or misfiring, then the oxygen fluctuations are similar to signals from the front oxygen sensor.

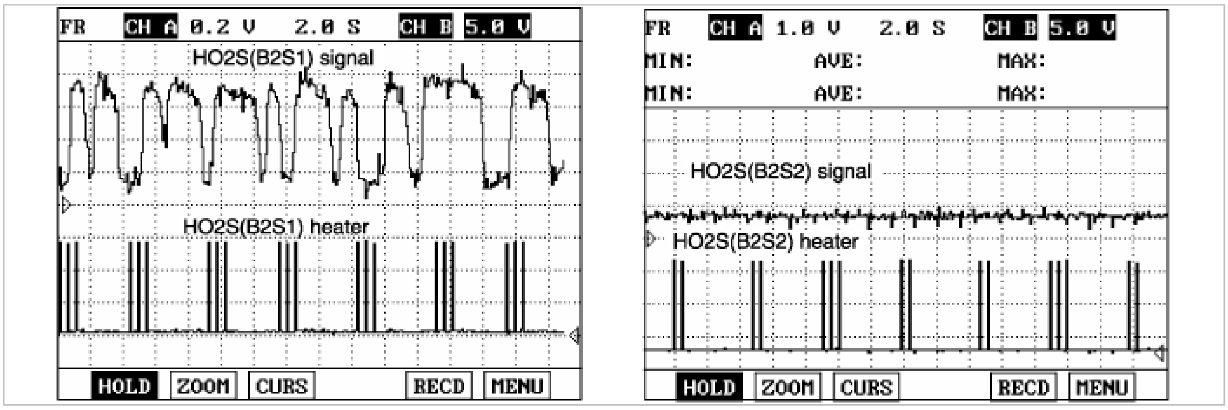
DTC DESCRIPTION

If the PCM detects heater output voltage is lower than threshold value for 5 seconds while enable condition is met PCM determines that a fault exists and a DTC is stored. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to ground or open circuit of O2 sensor heater circuit output	• Poor Connection • Open in Power Circuit • Open or short to ground in control circuit • HO2S(B2/S2) • PCM
Enable Conditions	• No disabling Faults Present • Engine Running • 11V ≤ Ignition Voltage ≤ 16V • Enable Time delay < 0.5sec	
Threshold value	• short to ground or open circuit	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA



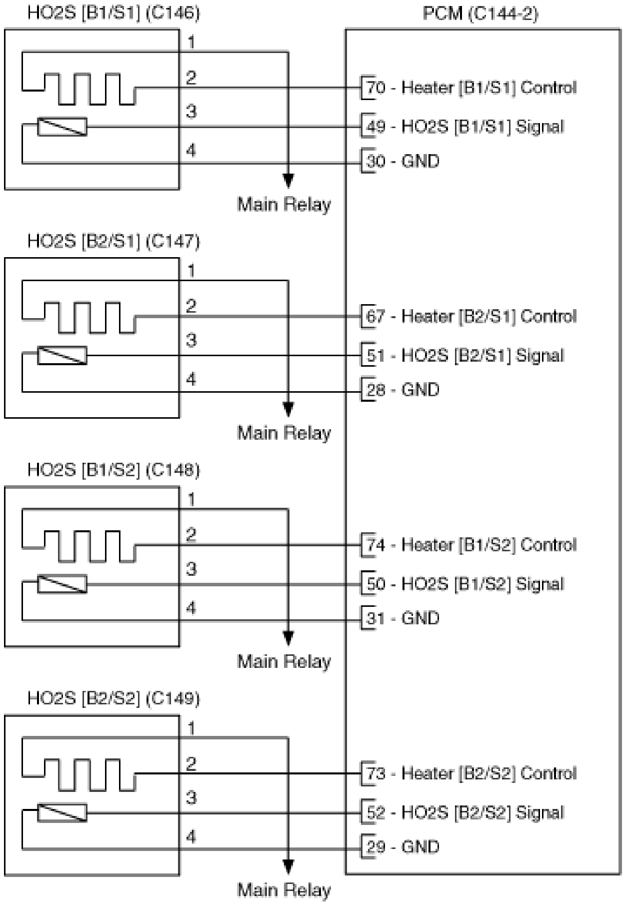
The HO2S requires a minimum temperature to provide a closed loop fuel control system. So the HO2S contains a heater element to reduce its warm-up time and ensure its performance during all driving conditions. The HO2S heater is controlled ON after engine start except for Cold condition and high speed accelleration. The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

SPECIFICATION

Heater	
Resistance (Ω)	9.6 ± 1.5

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

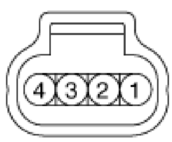
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

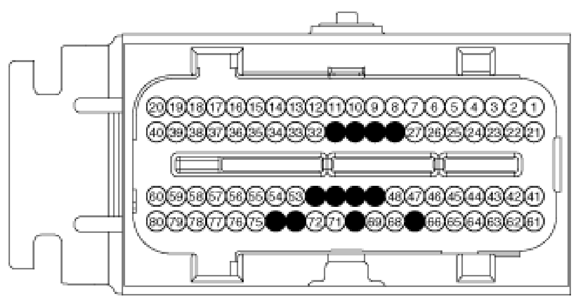
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]

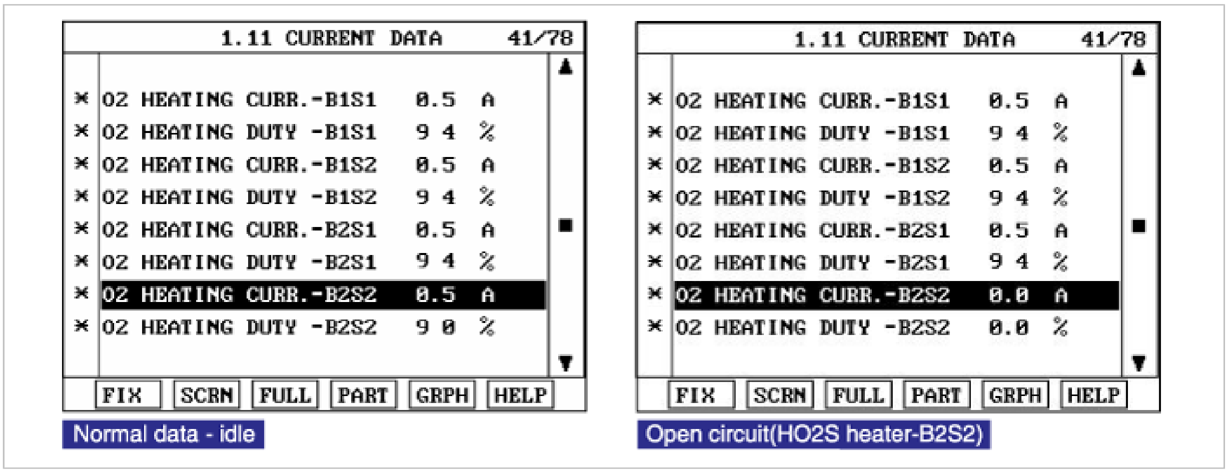


C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "HO2S(B2/S2)" status on the service data.



4. Is the "HO2S Heater(B2/S2)" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

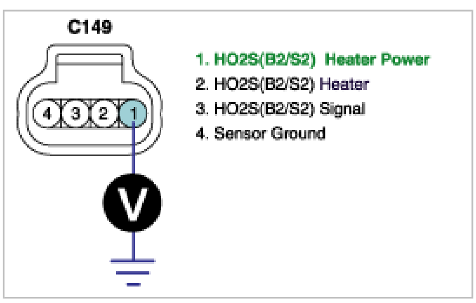
NO

▸ Go to " Power Circuit Inspection " procedure

POWER CIRCUIT INSPECTION

1. IG "OFF" & Disconnect HO2S(B2/S2) connector.
2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 1 of HO2S(B2/S2) harness connector and chassis ground.

Specification : B+



4. Is the measured voltage within specification ?

YES

▸ Go to HO2S(B2/S2) heater "Control Circuit Inspection" procedure.

NO

▸ Repair open or short to ground in HO2S(B2/S2) Heater power circuit then, go to "Verification of Vehicle Repair" procedure.

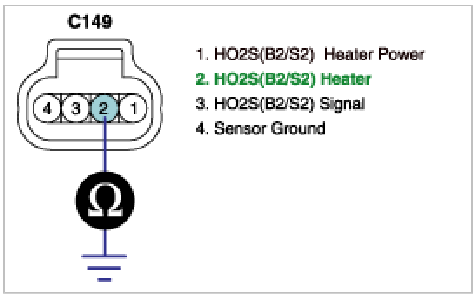
CONTROL CIRCUIT INSPECTION

1. Check short to ground in harness.

(1) IG "OFF" and disconnect HO2S(B2/S2) connector.

(2) Measure resistance between terminal 2 of HO2S(B2/S2) harness connector and chassis ground.

Specification : Infinite



(3) Is the measured resistance within specification ?

YES

▸ Go to HO2S(B2/S2) "Check Open in harness" as follows.

NO

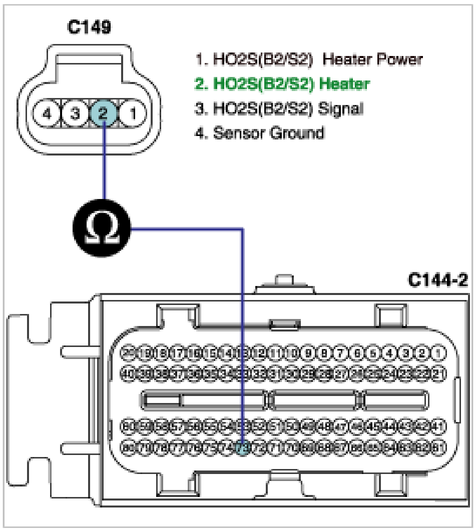
▸ Repair short to ground in HO2S (B2/S2) heater control circuit and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness

(1) IG "OFF" and disconnect HO2S(B2/S2) and PCM connector.

(2) Measure resistance between terminal 2 of HO2S(B2/S2) harness connector and terminal 73 of PCM harness connector.

Specification : Approx. below 1Ω



(3) Is the measured resistance within specification ?

YES

▸ Go to HO2S(B2/S2) "Component Inspection" procedure.

NO

▸ Repair open in HO2S(B2/S2) heater control circuit and go to "Verifiction of Vehicle Repair" procedure.

COMPONENT INSPECTION

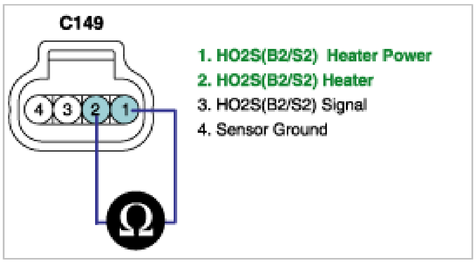
1. Check HO2S(B2/S2) Heater resistance

(1) IG "OFF" and disconnect HO2S(B2/S2) connector

(2) Measure resistance between terminal 1 and 2 of HO2S(B2/S2)(Component Side)

Specification :

Heater	
Resistance (Ω)	9.6 ± 1.5



(3) Is the measured resistance within specification ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

NO

▸ Substitute with a known - good HO2S(B2/S2) and check for proper operation. If the problem is corrected, replace HO2S (B2/S2) and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

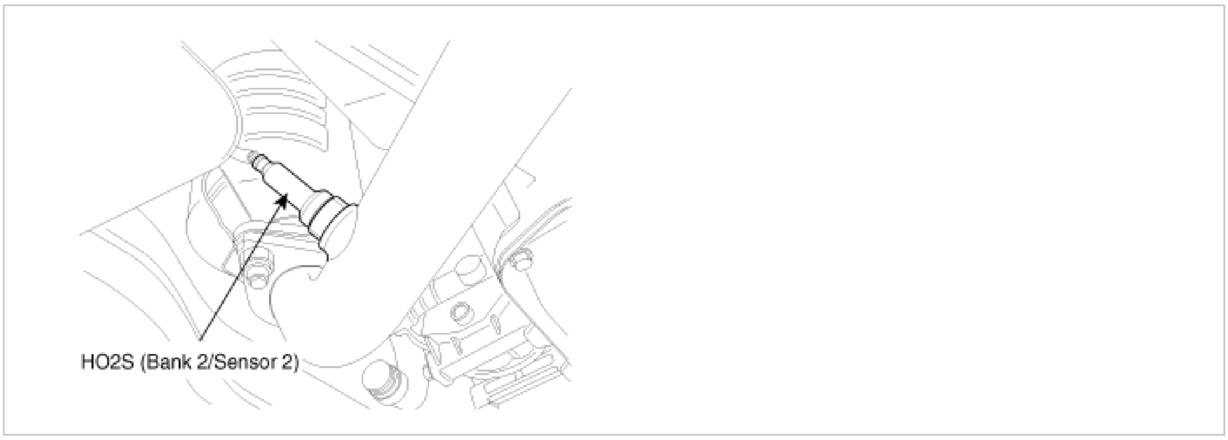
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0058

COMPONENT LOCATION



GENERAL DESCRIPTION

The rear heated oxygen sensor is mounted on the rear side of the Catalytic Converter which is able to detect the catalyst efficiency. The rear heated oxygen sensor (HO2S) produces a voltage between 0V and 1V. This rear heated oxygen sensor is used to estimate the oxygen storage capability. If a catalyst has good conversion properties, the oxygen fluctuations are smoothed by the oxygen storage capacity of the catalyst. If the conversion provided by the catalyst is low due to aging, poisoning or misfiring, then the oxygen fluctuations are similar to signals from the front oxygen sensor.

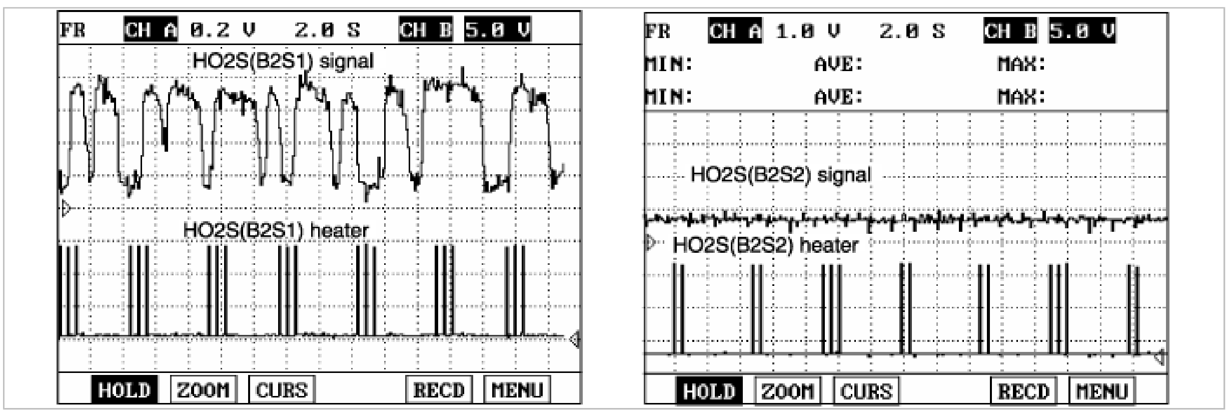
DTC DESCRIPTION

If the PCM detects heater output voltage is higher than threshold value for 5 seconds while enable condition is met PCM determines that a fault exists and a DTC is stored. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to ground or open circuit of O2 sensor heater circuit output	• Poor Connection • Open or short to battery in control circuit • HO2S(B2/S2) • PCM
Enable Conditions	• No disabling Faults Present • Engine Running • 11V ≤ Ignition Voltage ≤ 16V • Enable Time delay < 0.5sec	
Threshold value	• Short to battery	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA



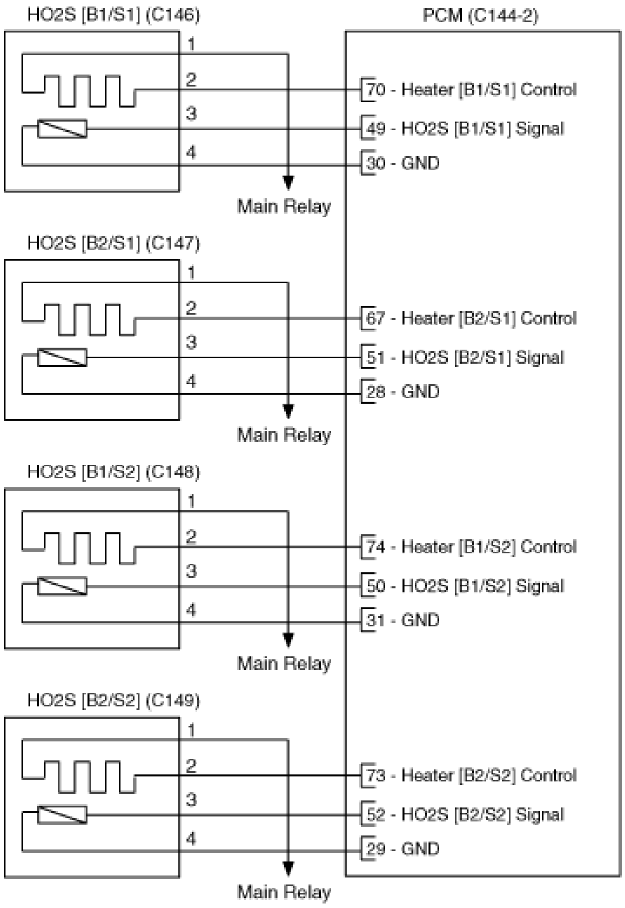
The HO2S requires a minimum temperature to provide a closed loop fuel control system. So the HO2S contains a heater element to reduce its warm-up time and ensure its performance during all driving conditions. The HO2S heater is controlled ON after engine start except for Cold condition and high speed accelleration. The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

SPECIFICATION

Heater	
Resistance (Ω)	9.6 ± 1.5

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

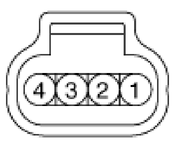
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

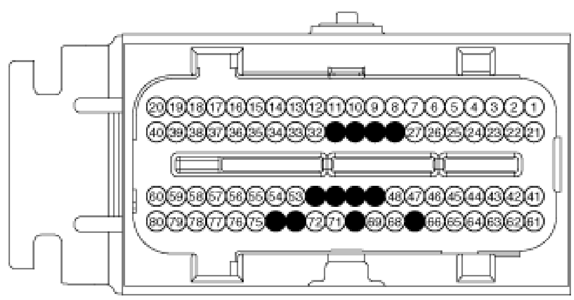
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

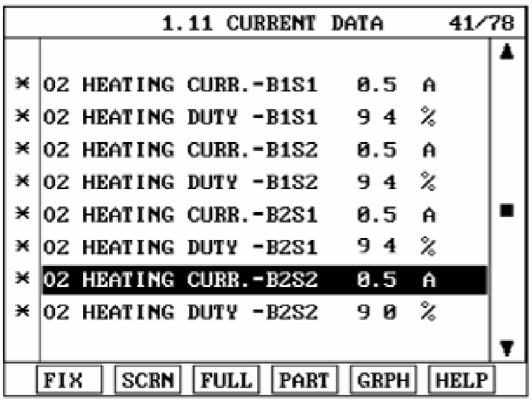
HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



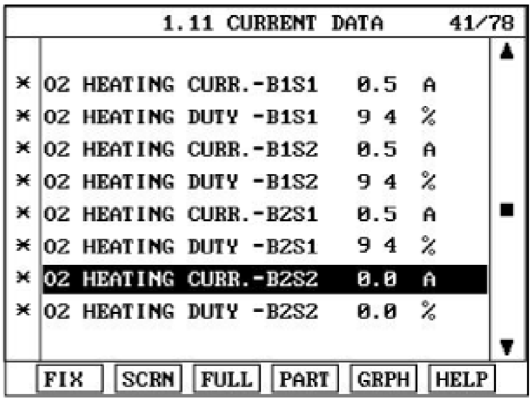
C144-2
PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "HO2S(B2/S2)" status on the service data.



Normal data - idle



Open circuit(HO2S heater-B2S2)

4. Is the "HO2S Heater(B2/S2)" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

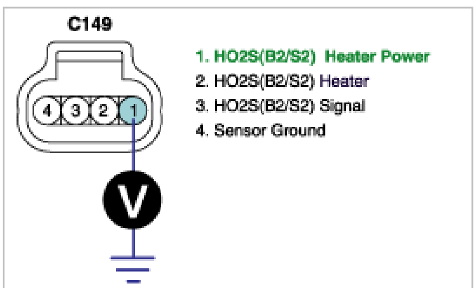
NO

▸ Go to " Power Circuit Inspection " procedure

POWER CIRCUIT INSPECTION

1. IG "OFF" & Disconnect HO2S(B2/S2) connector.
2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 1 of HO2S(B2/S2) harness connector and chassis ground.

Specification : B+



4. Is the measured voltage within specification ?

YES

▸ Go to HO2S(B2/S2) heater "Control Circuit Inspection" procedure.

NO

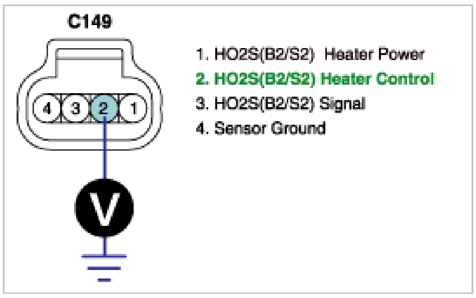
▸ Repair open or short to ground in HO2S(B2/S2) Heater power circuit then, go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. IG "OFF" & disconnect HO2S(B2/S2) connector.

2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 2 of HO2S(B2/S2) harness connector and chassis ground.

Specification : Approx. 0 V



4. Is the measured voltage within specification ?

YES

▸ Go to HO2S(B2/S2) "Component Inspection" procedure.

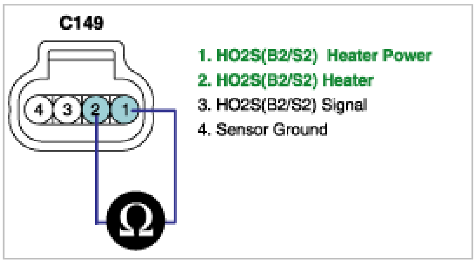
NO

▸ Repair short to battery in HO2S (B2/S2) heater control circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check HO2S(B2/S2) Heater resistance
   (1) IG "OFF" and disconnect HO2S(B2/S2) connector
   (2) Measure resistance between terminal 1 and 2 of HO2S(B2/S2)(Component Side)
   Specification :

Heater	
Resistance (Ω)	9.6 ± 1.5



   (3) Is the measured resistance within specification ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

NO

▸ Substitute with a known - good HO2S(B2/S2) and check for proper operation. If the problem is corrected, replace HO2S (B2/S2) and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.
1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "

5. Are any DTCs present ?

YES

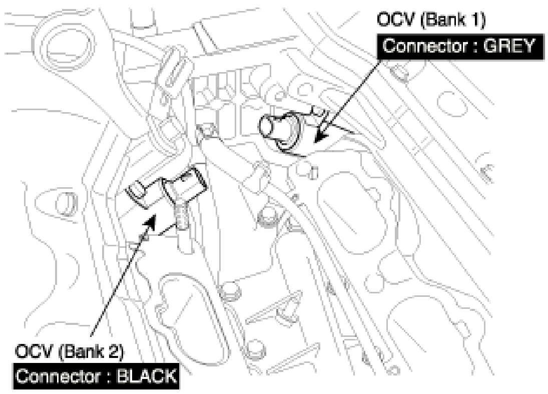
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0076

COMPONENT LOCATION



GENERAL DESCRIPTION

PCM controls OCV(Oil Contol Valve) with PWM (Pulse Width Modulator) signal to change oil passages supplying oil to CVVT that makes CAM postion changes (advance or retard). OCV is integrated with oil filter and located at the nearest CVVT on the engine block.

The oil control valve is commanded by a pulse-width-modulated signal from the engine control unit. A duty cycle of zero commands the cam phaser to its default position. A duty cycle of 100% commands the phaser to its maximum phased position. When the phaser must be controlled to an intermediate position, the duty cycle is maintained in the region of the 'hold position'. This is a medium duty cycle, usually between 35% and 65%, depending on temperature and voltage conditions. As the cam phaser is advanced and retarded, its position is measured using a toothed wheel.

The wheel is attached to the camshaft, or to the cam phaser rotor. A sensor picks up the signal from the wheel and its output is read by the engine control unit. A cam signal is generated for each cam phaser on the engine. This requires a separate toothed wheel and cam sensor combination for each cam phaser. The cam signal and crankwheel signal are compared as the engine turns, and the phasing position is determined. The position is displayed in crank angle degrees, relative position from default. This position measurement is used as feedback for the position control software, which determines the required percent duty cycle commanded to the oil control valve.

DTC DESCRIPTION

When the enable condition is satisfied The PCM checks that high and low outputs (Voltage level) are observed when OCVs are commanded. When a OCV output failure is detected, the appropriate fail counter is incremented.

If the failure threshold is exceeded 5 seconds during one diagnostic test(10second), the test is failed and DTC is stored. MIL (Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to ground or open circuit of VCPD Bank 1 Intake circuit output	• Poor Connection • Open in Power Circuit • Open or short to ground in control circuit • OCV • PCM
Enable Conditions	• No disabling Faults Present • Engine Running • 11V ≤ Ignition Voltage ≤ 16V • Enable Time delay ≥ 0.5sec	
Threshold value	• Short to ground or open circuit	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA

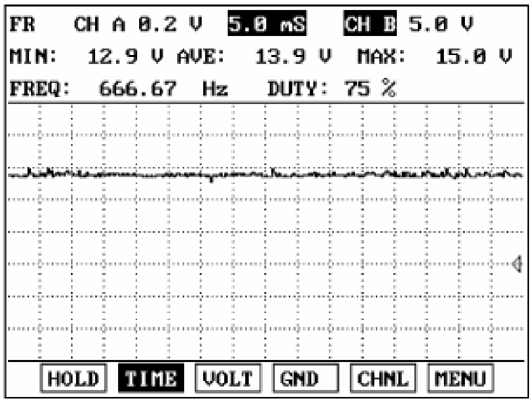


Fig. 1

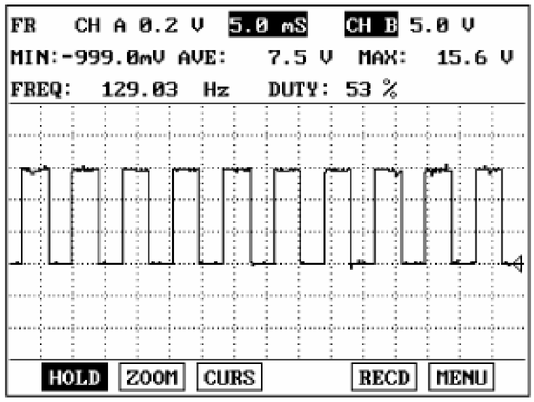


Fig. 2

Fig. 1 : Idle
Fig. 2 : Accelleration

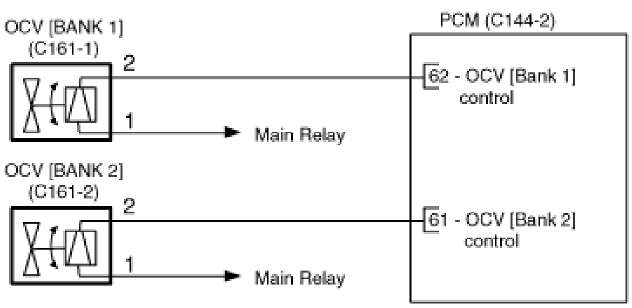
The oil control valve is commanded by a pulse-width-modulated signal from the engine control unit. A duty cycle of zero commands the cam phaser to its default position. A duty cycle of 100% commands the phaser to its maximum phased position. When the phaser must be controlled to an intermediate position, the duty cycle is maintained in the region of the ‘hold position’. This is a medium duty cycle, usually between 35% and 65%, depending on temperature and voltage conditions.

SPECIFICATION

Resistance (Ω)	6.7 ~ 7.7

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

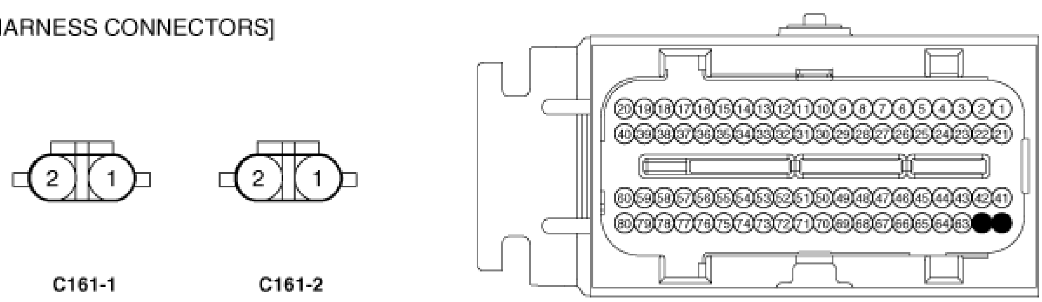
OCV [BANK 1]

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (62)	OCV [Bank 1] control

OCV [BANK 2]

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (61)	OCV [Bank 2] control

[HARNESS CONNECTORS]



C161-1
OCV [Bank 1]

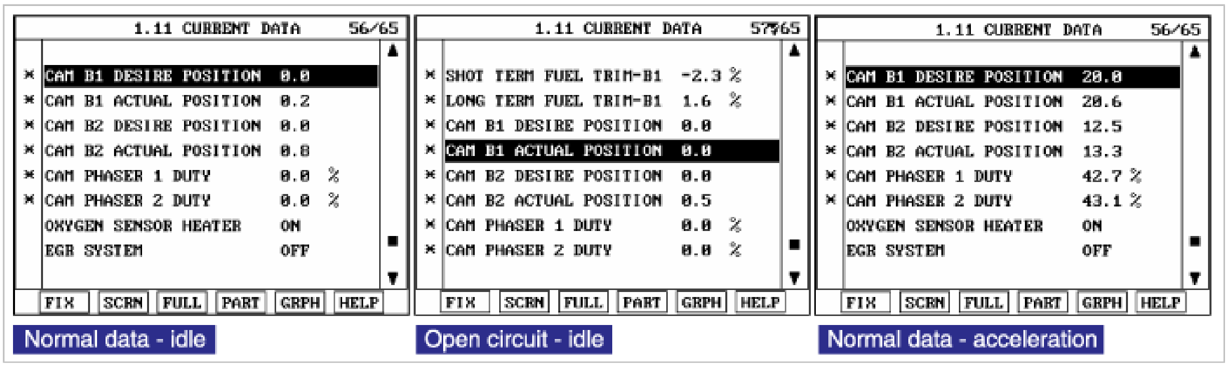
C161-2
OCV [Bank 2]

C144-2
PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.

3. Monitor "Cam Duty1, Cam Desired Position and Cam Actual Position" on the service data.



4. Are the "CAM" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

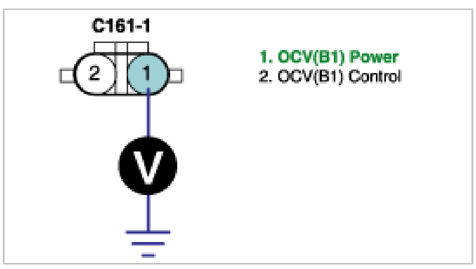
NO

▸ Go to " Power Circuit Inspection " procedure

POWER CIRCUIT INSPECTION

1. IG "OFF" & Disconnect OCV(B1) connector.
2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 1 of OCV(B1) harness connector and chassis ground.

Specification : B+



4. Is the measured voltage within specification ?

YES

▸ Go to "Control Circuit Inspection" procedure.

NO

▸ Check fuse between Main Relay and OCV is open or not installed.
▸ Check open in power circuit between Main Relay and OCV power circuit.
▸ Repair or repalce as necessary and then go to "Verification of Vehicle Repair" procedure.

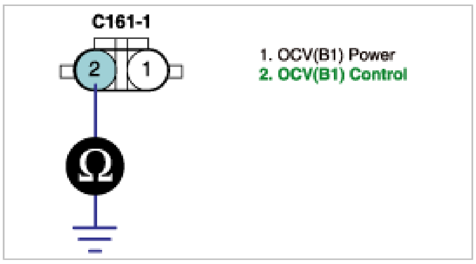
CONTROL CIRCUIT INSPECTION

1. Check short to ground in harness.
   (1) IG "OFF" and disconnect OCV connector.

(2) IG "ON" & ENG "OFF".

(3) Measure resistance between terminal 2 of OCV harness connector and chassis ground.

Specification : Infinite



(4) Is the measured resistance within specification ?

YES

▸ Go to "Check open in harness" as follows

NO

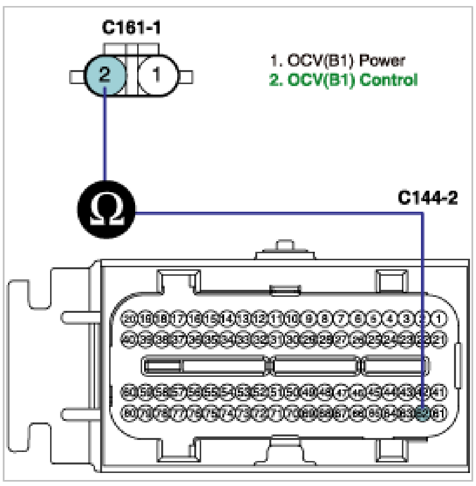
▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness

(1) IG "OFF" and disconnect OCV and PCM connector.

(2) Measure resistance between terminal 2 of OCV harness connector and terminal 62 of PCM harness connector.

Specification : Approx. below 1Ω



(3) Is the measured resistance within specification ?

YES

▸ Go to "Component Inspection" procedure.

NO

(4) ▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

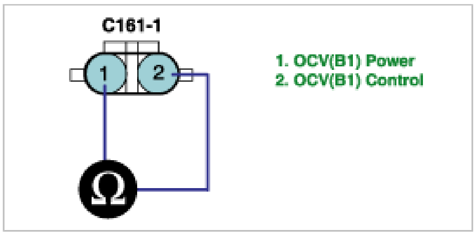
1. Check OCV

(1) IG "OFF" and disconnect OCV connector.

(2) Measure resistance between terminal 1 and 2 of OCV. (Component Side)

Specification :

Resistance (Ω)	6.7 ~ 7.7



(3) Is the measured resistance within specification ?

YES

▸ Go to "OCV Actuation Test" as follows.

NO

▸ Substitute with a known - good OCV and check for proper operation. If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

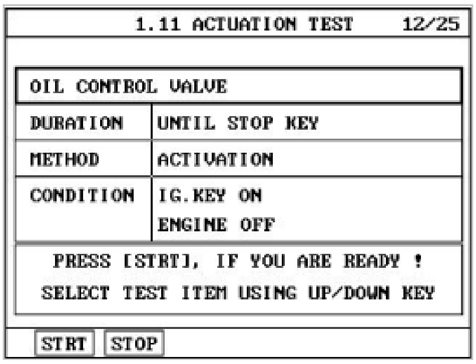
2. OCV Actuation Test

(1) Connect scantool and IG "ON".

(2) Select "OCV" on the Actuation Test.

(3) Activates "OCV" by pressing "STRT(F1)" key.
(should hear a faint click from Oil Control solenoid Valve)

(4) Repeat this procedure 4 or 5 times to ensure intake valve control solenoid reliability



(5) Does OCV generate clik sound during acutation test ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Substitute with a known - good OCV and check for proper operation. If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

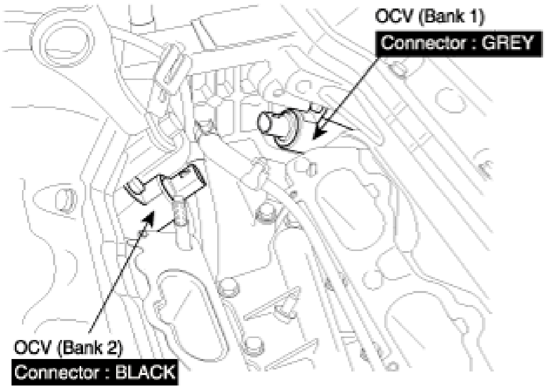
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0077

COMPONENT LOCATION



GENERAL DESCRIPTION

PCM controls OCV(Oil Contol Valve) with PWM (Pulse Width Modulator) signal to change oil passages supplying oil to CVVT that makes CAM postion changes (advance or retard). OCV is integrated with oil filter and located at the nearest CVVT on the engine block.
The oil control valve is commanded by a pulse-width-modulated signal from the engine control unit. A duty cycle of zero commands the cam phaser to its default position. A duty cycle of 100% commands the phaser to its maximum phased position. When the phaser must be controlled to an intermediate position, the duty cycle is maintained in the region of the ‘hold position’. This is a medium duty cycle, usually between 35% and 65%, depending on temperature and voltage conditions. As the cam phaser is advanced and retarded, its position is measured using a toothed wheel.
The wheel is attached to the camshaft, or to the cam phaser rotor. A sensor picks up the signal from the wheel and its output is read by the engine control unit. A cam signal is generated for each cam phaser on the engine. This requires a separate toothed wheel and cam sensor combination for each cam phaser. The cam signal and crankwheel signal are compared as the engine turns, and the phasing position is determined. The position is displayed in crank angle degrees, relative position from default. This position measurement is used as feedback for the position control software, which determines the required percent duty cycle commanded to the oil control valve.

DTC DESCRIPTION

When the enable condition is satisfied The PCM checks that high and low outputs (Voltage level) are observed when OCVs are commanded. When a OCV output failure is detected, the appropriate fail counter is incremented.
If the failure threshold is exceeded 5 seconds during one diagnostic test(10second),the test is failed and DTC is stored. MIL (Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to battery of VCPD Bank 1 Intake circuit output	• Poor Connection • Short to battery in Control Circuit • OCV • PCM
Enable Conditions	• No disabling Faults Present • Engine Running • 11V ≤ Ignition Voltage ≤ 16V • Enable Time delay ≥ 0.5sec	
Threshold value	• Short to battery	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA

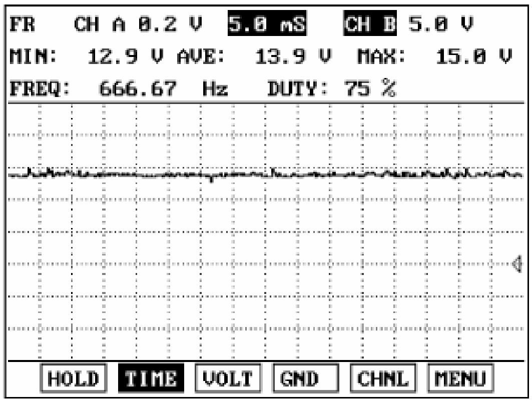


Fig. 1

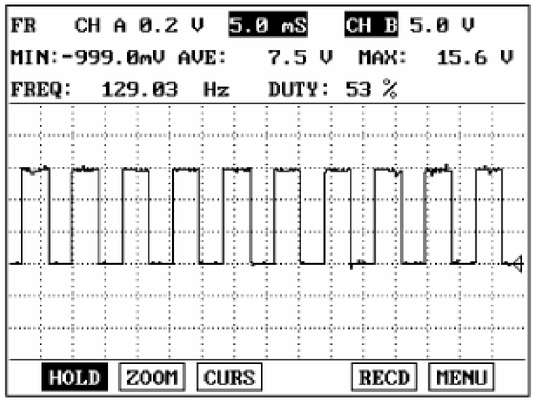


Fig. 2

Fig. 1 : Idle
Fig. 2 : Accelleration

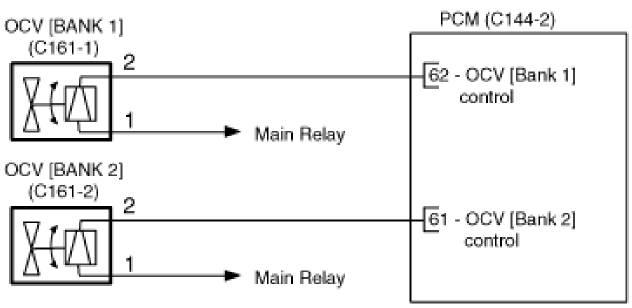
The oil control valve is commanded by a pulse-width-modulated signal from the engine control unit. A duty cycle of zero commands the cam phaser to its default position. A duty cycle of 100% commands the phaser to its maximum phased position. When the phaser must be controlled to an intermediate position, the duty cycle is maintained in the region of the 'hold position'. This is a medium duty cycle, usually between 35% and 65%, depending on temperature and voltage conditions.

SPECIFICATION

Resistance (Ω)	6.7 ~ 7.7

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

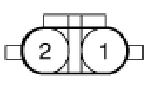
OCV [BANK 1]

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (62)	OCV [Bank 1] control

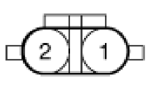
OCV [BANK 2]

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (61)	OCV [Bank 2] control

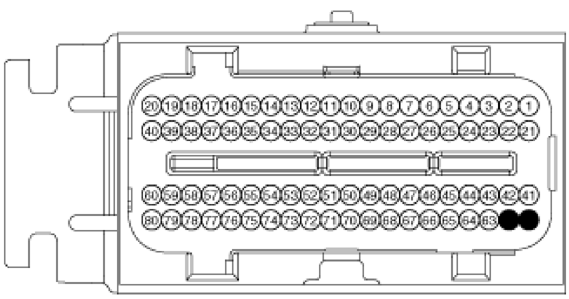
[HARNESS CONNECTORS]



C161-1
OCV [Bank 1]



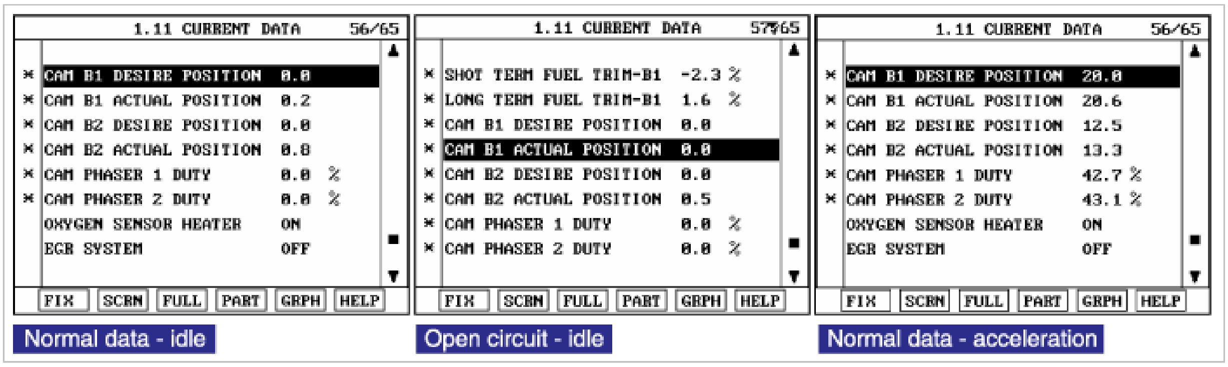
C161-2
OCV [Bank 2]



C144-2
PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "Cam Duty1, Cam Desired Position and Cam Actual Position" on the service data.



4. Are the "CAM" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

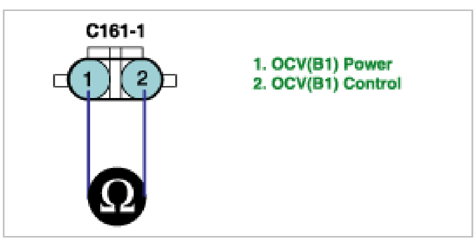
NO

▸ Go to " Control Circuit Inspection " procedure.

CONTROL CIRCUIT INSPECTION

1. IG "OFF" and Disconnect OCV connector.
2. Measure resistance between terminal 1 and 2 of OCV harness connector.

Specification : Infinite



3. Is the measured resistance within specification ?

YES

▸ Go to "Component Inspection" procedure.

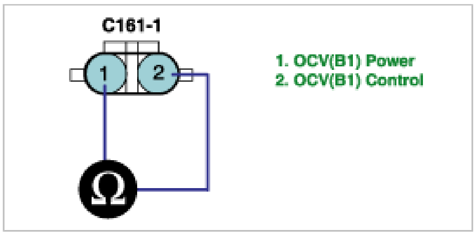
NO

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check OCV
   (1) IG "OFF" and disconnect OCV connector.
   (2) Measure resistance between terminal 1 and 2 of OCV. (Component Side)
   Specification :

Resistance (Ω)	6.7 ~ 7.7



(3) Is the measured resistance within specification ?

YES

▸ Go to "OCV Actuation Test" as follows.

NO

▸ Substitute with a known - good OCV and check for proper operation. If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

2. OCV Actuation Test
   (1) Connect scantool and IG "ON".
   (2) Select "OCV" on the Actuation Test.
   (3) Activates "OCV" by pressing "STRT(F1)" key.
   (should hear a faint click from Oil Control solenoid Valve)
   (4) Repeat this procedure 4 or 5 times to ensure intake valve control solenoid reliability

1.11 ACTUATION TEST 12/25	
OIL CONTROL VALVE	
DURATION	UNTIL STOP KEY
METHOD	ACTIVATION
CONDITION	IG.KEY ON ENGINE OFF
PRESS [STRT], IF YOU ARE READY ! SELECT TEST ITEM USING UP/DOWN KEY	
STRT	STOP

(5) Does OCV generate clik sound during acutation test ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Substitute with a known - good OCV and check for proper operation. If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

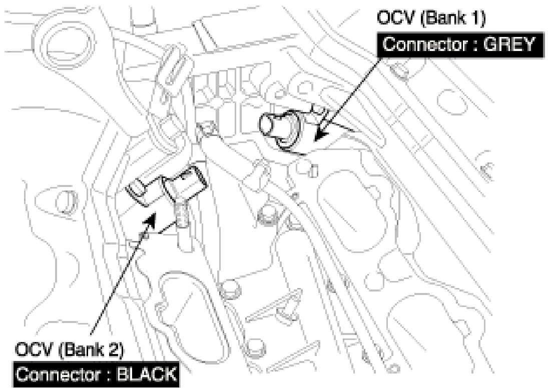
YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

COMPONENT LOCATION



GENERAL DESCRIPTION

PCM controls OCV(Oil Contol Valve) with PWM (Pulse Width Modulator) signal to change oil passages supplying oil to CVVT that makes CAM postion changes (advance or retard). OCV is integrated with oil filter and located at the nearest CVVT on the engine block.
The oil control valve is commanded by a pulse-width-modulated signal from the engine control unit. A duty cycle of zero commands the cam phaser to its default position. A duty cycle of 100% commands the phaser to its maximum phased position. When the phaser must be controlled to an intermediate position, the duty cycle is maintained in the region of the ‘hold position’. This is a medium duty cycle, usually between 35% and 65%, depending on temperature and voltage conditions. As the cam phaser is advanced and retarded, its position is measured using a toothed wheel.
The wheel is attached to the camshaft, or to the cam phaser rotor. A sensor picks up the signal from the wheel and its output is read by the engine control unit. A cam signal is generated for each cam phaser on the engine. This requires a separate toothed wheel and cam sensor combination for each cam phaser. The cam signal and crankwheel signal are compared as the engine turns, and the phasing position is determined. The position is displayed in crank angle degrees, relative position from default. This position measurement is used as feedback for the position control software, which determines the required percent duty cycle commanded to the oil control valve.

DTC DESCRIPTION

When the enable condition is satisfied The PCM checks that high and low outputs (Voltage level) are observed when OCVs are commanded. When a OCV output failure is detected, the appropriate fail counter is incremented.
If the failure threshold is exceeded 5 seconds during one diagnostic test(10second), the test is failed and DTC is stored. MIL (Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to ground or open circuit of VCPD Bank 1 Intake circuit output	• Poor Connection • Open in Power circuit • Open or short to ground in Control Circuit • OCV • PCM
Enable Conditions	• No disabling Faults Present • Engine Running • 11V ≤ Ignition Voltage ≤ 16V • Enable Time delay ≥ 0.5sec	
Threshold value	• Short to ground or open circuit	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA

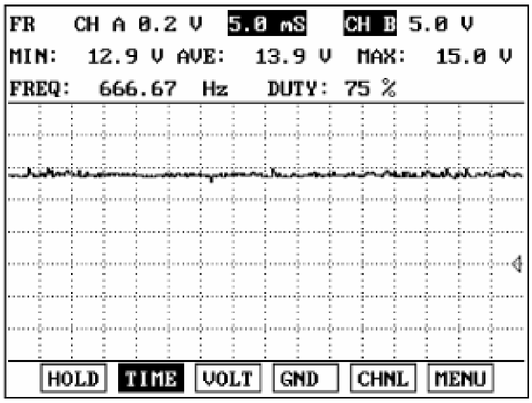


Fig. 1

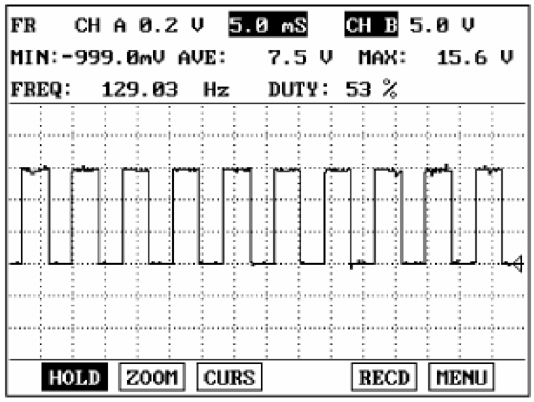


Fig. 2

Fig. 1 : Idle
Fig. 2 : Accelleration

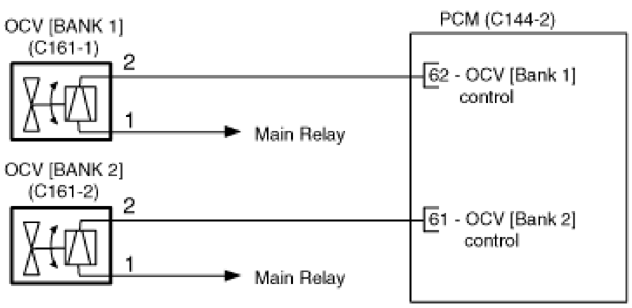
The oil control valve is commanded by a pulse-width-modulated signal from the engine control unit. A duty cycle of zero commands the cam phaser to its default position. A duty cycle of 100% commands the phaser to its maximum phased position. When the phaser must be controlled to an intermediate position, the duty cycle is maintained in the region of the ‘hold position’. This is a medium duty cycle, usually between 35% and 65%, depending on temperature and voltage conditions.

SPECIFICATION

Resistance (Ω)	6.7 ~ 7.7

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

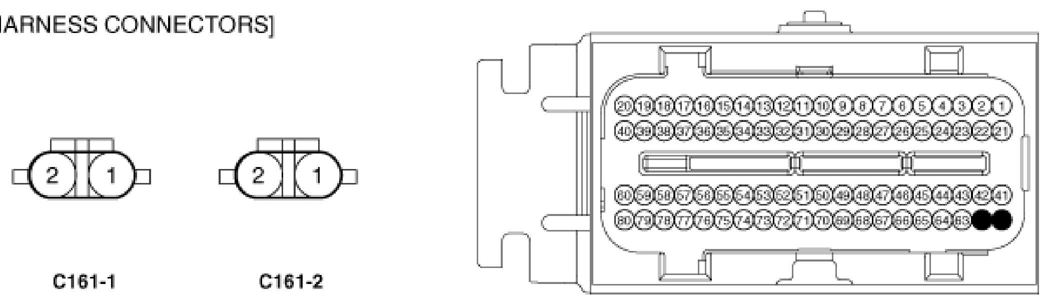
OCV [BANK 1]

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (62)	OCV [Bank 1] control

OCV [BANK 2]

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (61)	OCV [Bank 2] control

[HARNESS CONNECTORS]



C161-1
OCV [Bank 1]

C161-2
OCV [Bank 2]

C144-2
PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "Cam Duty2, Cam Desired Position(B2) and Cam Actual Position(B2)" on the service data.

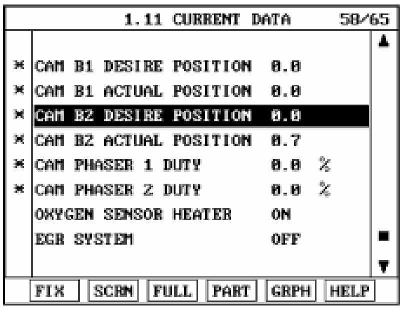


Fig.1

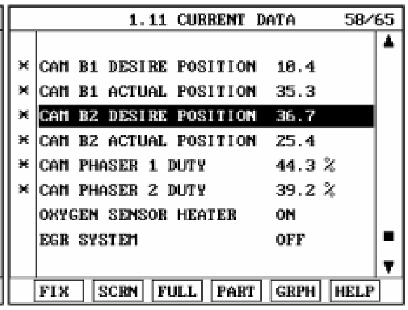


Fig.2

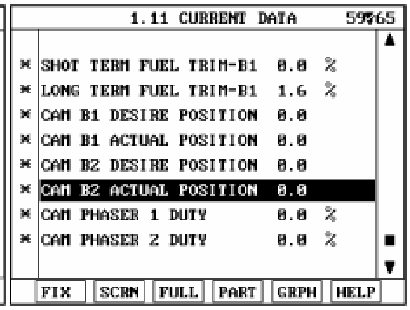


Fig.3

Fig. 1 : Normal at idle
Fig. 2 : Accelleration at idle
Fig. 3 : Open at idle

4. Are the "CAM" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

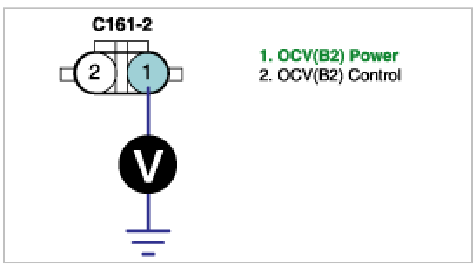
NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. IG "OFF" & Disconnect OCV(B2) connector.
2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 1 of OCV(B2) harness connector and chassis ground.

Specification : B+



4. Is the measured voltage within specification ?

YES

▸ Go to "Control Circuit Inspection " procedure.

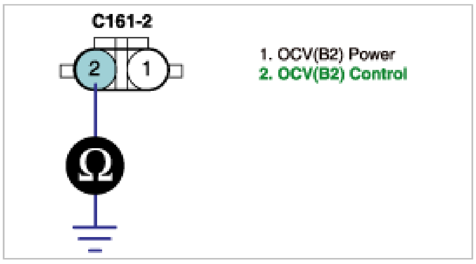
NO

▸ Check fuse between Main Relay and OCV is open or not installed.
▸ Check open in power circuit between Main Relay and OCV power circuit.
▸ Repair or repalce as necessary and then go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check short to ground in harness
    (1) IG "OFF" and disconnect OCV connector.
    (2) IG "ON" & ENG "OFF".
    (3) Measure resistance between terminal 2 of OCV harness connector and chassis ground.

Specification : Infinite



    (4) Is the measured resistance within specification ?

YES

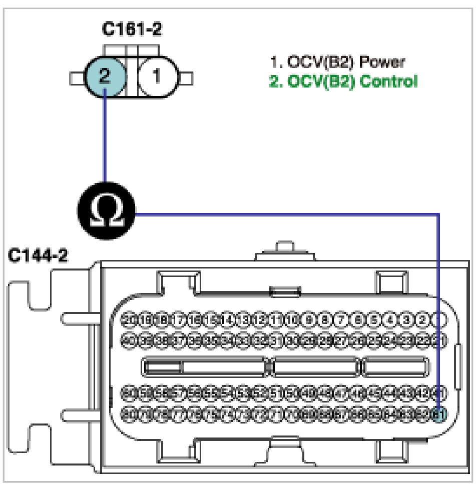
▶ Go to "Check open in harness" as follows

NO

▶ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness
    (1) IG "OFF" and disconnect OCV and PCM connector.
    (2) Measure resistance between terminal 2 of OCV harness connector and terminal 61 of PCM harness connector.

Specification : Approx. below 1Ω



    (3) Is the measured resistance within specification ?

YES

▶ Go to "Component Inspection" procedure.

NO

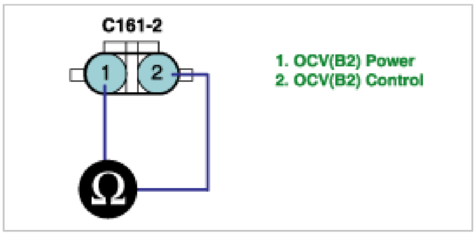
▶ Repair or replace as necessary and then go to " Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check OCV
    (1) IG "OFF" and disconnect OCV connector.
    (2) Measure resistance between terminal 1 and 2 of OCV. (Component Side)

Specification :

Resistance (Ω)	6.7 ~ 7.7



(3) Is the measured resistance within specification ?

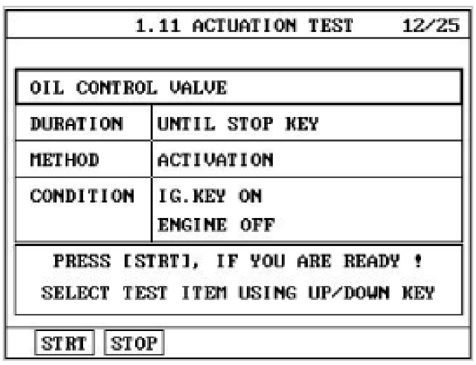
YES

(4) ▸ Go to "OCV Actuation Test" as follows.

NO

▸ Substitute with a known - good OCV and check for proper operation. If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

2. OCV Actuation Test
   (1) Connect scantool and IG "ON"
   (2) Select "OCV" on the Actuation Test
   (3) Activates "OCV" by pressing "STRT(F1)" key
   (should hear a faint click from Oil Control solenoid Valve)
   (4) Repeat this procedure 4 or 5 times to ensure intake valve control solenoid reliability



(5) Does OCV generate clik sound during acutation test ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Substitute with a known - good OCV and check for proper operation. If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

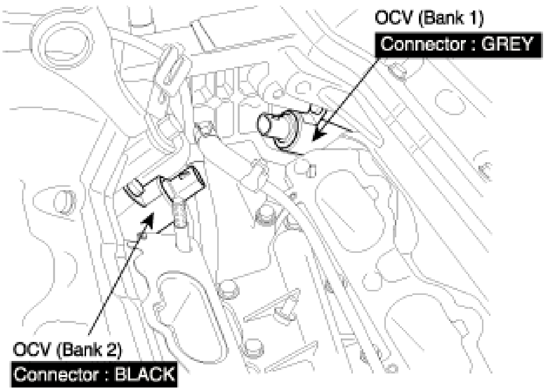
YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

COMPONENT LOCATION



GENERAL DESCRIPTION

PCM controls OCV(Oil Contol Valve) with PWM (Pulse Width Modulator) signal to change oil passages supplying oil to CVVT that makes CAM postion changes (advance or retard). OCV is integrated with oil filter and located at the nearest CVVT on the engine block.
The oil control valve is commanded by a pulse-width-modulated signal from the engine control unit. A duty cycle of zero commands the cam phaser to its default position. A duty cycle of 100% commands the phaser to its maximum phased position. When the phaser must be controlled to an intermediate position, the duty cycle is maintained in the region of the ‘hold position’. This is a medium duty cycle, usually between 35% and 65%, depending on temperature and voltage conditions. As the cam phaser is advanced and retarded, its position is measured using a toothed wheel.
The wheel is attached to the camshaft, or to the cam phaser rotor. A sensor picks up the signal from the wheel and its output is read by the engine control unit. A cam signal is generated for each cam phaser on the engine. This requires a separate toothed wheel and cam sensor combination for each cam phaser. The cam signal and crankwheel signal are compared as the engine turns, and the phasing position is determined. The position is displayed in crank angle degrees, relative position from default. This position measurement is used as feedback for the position control software, which determines the required percent duty cycle commanded to the oil control valve.

DTC DESCRIPTION

When the enable condition is satisfied The PCM checks that high and low outputs (Voltage level) are observed when OCVs are commanded. When a OCV output failure is detected, the appropriate fail counter is incremented.
If the failure threshold is exceeded 5 seconds during one diagnostic test(10second), the test is failed and DTC is stored. MIL (Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to battery of VCPD Bank 1 Intake circuit output	• Poor Connection • Short to battery in Control Circuit • OCV • PCM
Enable Conditions	• No disabling Faults Present • Engine Running • 11V ≤ Ignition Voltage ≤ 16V • Enable Time delay ≥ 0.5sec	
Threshold value	• Short to battery	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA

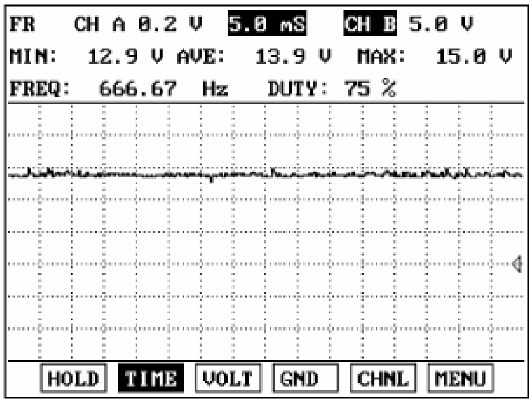


Fig. 1

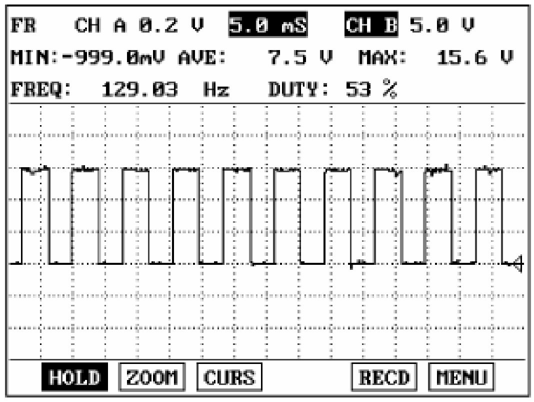


Fig. 2

Fig. 1 : Idle
Fig. 2 : Accelleration

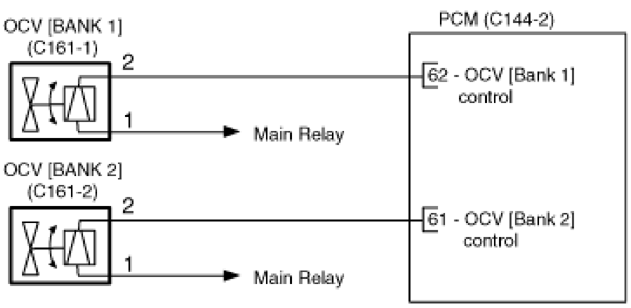
The oil control valve is commanded by a pulse-width-modulated signal from the engine control unit. A duty cycle of zero commands the cam phaser to its default position. A duty cycle of 100% commands the phaser to its maximum phased position. When the phaser must be controlled to an intermediate position, the duty cycle is maintained in the region of the ‘hold position’. This is a medium duty cycle, usually between 35% and 65%, depending on temperature and voltage conditions.

SPECIFICATION

Resistance (Ω)	6.7 ~ 7.7

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

OCV [BANK 1]

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (62)	OCV [Bank 1] control

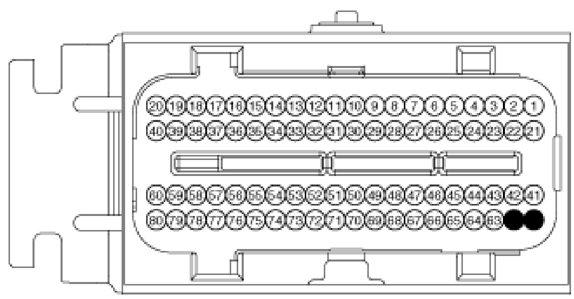
OCV [BANK 2]

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (61)	OCV [Bank 2] control

[HARNESS CONNECTORS]

C161-1
OCV [Bank 1]

C161-2
OCV [Bank 2]



C144-2
PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "Cam Duty2, Cam Desired Position(B2) and Cam Actual Position(B2)" on the service data.

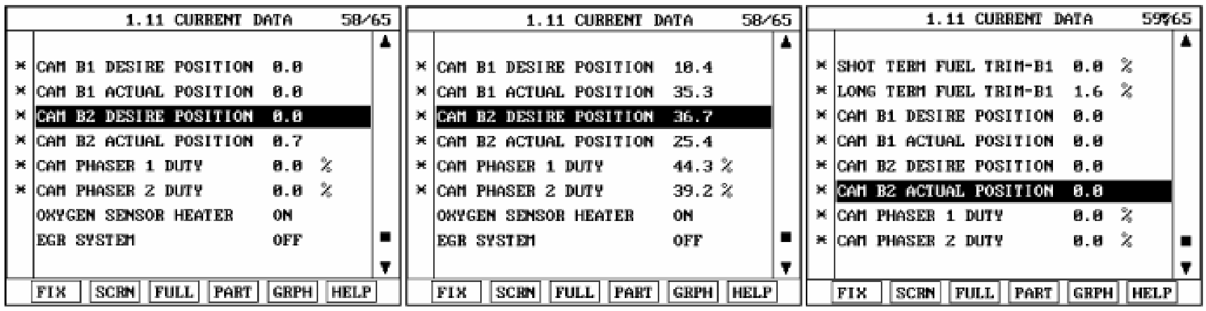


Fig.1 Fig.2 Fig.3

Fig. 1 : Normal at idle
Fig. 2 : Accelleration at idle
Fig. 3 : Open at idle

4. Are the "CAM" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

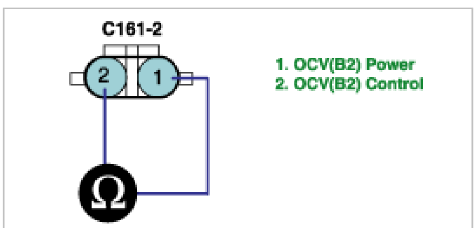
NO

▸ Go to " Control Circuit Inspection " procedure.

CONTROL CIRCUIT INSPECTION

1. IG "OFF" and Disconnect OCV connector.
2. Measure resistance between terminal 1 and 2 of OCV harness connector.

Specification : Infinite



3. Is the measured resistance within specification ?

YES

▸ Go to "Component Inspection" procedure.

NO

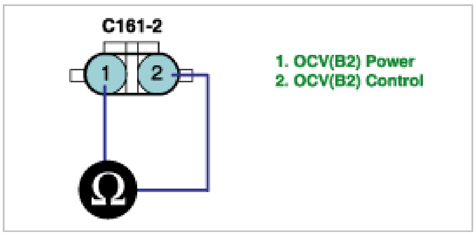
▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check OCV
   (1) IG "OFF" and disconnect OCV connector.
   (2) Measure resistance between terminal 1 and 2 of OCV. (Component Side)

Specification :

Resistance (Ω)	6.7 ~ 7.7



(3) Is the measured resistance within specification ?

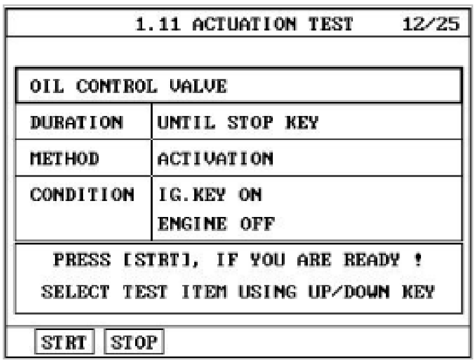
YES

(4) ▸ Go to "OCV Actuation Test" as follows.

NO

▸ Substitute with a known - good OCV and check for proper operation. If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

2. OCV Actuation Test
   (1) Connect scantool and IG "ON"
   (2) Select "OCV" on the Actuation Test
   (3) Activates "OCV" by pressing "STRT(F1)" key
   (should hear a faint click from Oil Control solenoid Valve)
   (4) Repeat this procedure 4 or 5 times to ensure intake valve control solenoid reliability



(5) Does OCV generate clik sound during acutation test ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Substitute with a known - good OCV and check for proper operation. If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

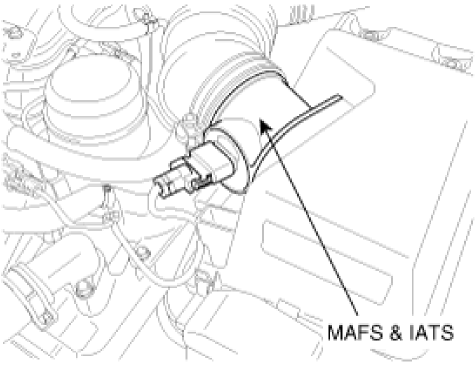
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0101

COMPONENT LOCATION



GENERAL DESCRIPTION

The Delphi MAF Sensor is an air mass flowmeter, which operates on the principle of hot film anemometry. A heated element is placed within the air stream, and maintained at a constant temperature above the air temperature. The amount of electrical power required to maintain the heated element at the proper temperature is a direct function of the flow rate of the air mass past the element. PCM uses this information to determine the injection duration and ignition timing for the desired air/fuel ratio.

DTC DESCRIPTION

The difference between values coming from the MAF Sensor and those are calculated is analyzed. This difference, or error, is then compared to high and low limit calibration values, which are functions of engine speed. PCM compares the difference between MAFS output and calculated flow rate value while enable condition is met.
If the acutal air flow is higher than Maximum threshold, or lower than Minimum threshold for more than 75 seconds failure for every 125 seconds test. PCM determines that a fault exists and a DTC is stored. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• The MAF Rationality Diagnostic compares the difference between MAF Sensor output and calculated flow rate value to a calibration value	• Poor connection • Open or short in harness • Clogged air cleaner • MAFS • PCM
Enable Conditions	• Barometric Pressure enable conditions criteria met • Engine Coolant Temperature ≥ 60°C • 600rpm < Engine Speed < 3000rpm • Air Conditioning Clutch not transitioning • Torque Control is not Active • Traction Control is not Active • Brake switch is not active • Current Transmission Torque Converter Clutch State same as previous • Power Steering is not Cramped • Engine Speed difference ≤ 300rpm • TPS value difference ≤ 5% • MAP value difference ≤ 7 kPa • Idle Airflow difference ≤ 10% • VCPC changes ≤ 10% • MAP TPS Rationality High Power Condition Fail Criteria Not Met • MAP TPS Rationality Low Power Condition Fail Criteria Not	

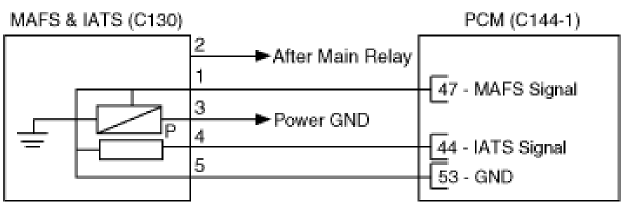
		Met • MAP TPS Rationality Decel. Condition Fail Criteria Not Met • BARO Update Enable Criteria Met • Enable Timer ≥ 1.5s	
Thresh old value	Case 1	• Acutal Air Mass Value < Positive Memorized Value	
	Case 2	• Acutal Air Mass Value > Negative Memorized Value	
Diagnosis Time		• Continuous (More than 75 seconds failure for every 125 seconds test)	
MIL On Condition		• 2 Driving Cycles	

SPECIFICATION

Air Flow (kg/h)	Frequency (Hz)
12.6 kg/h	2,617Hz
18.0 kg/h	2,958Hz
23.4 kg/h	3,241Hz
32.4 kg/h	3,653Hz
43.2 kg/h	4,024Hz
57.6 kg/h	4,399Hz
72.0 kg/h	4,704Hz
108.0 kg/h	5,329Hz
144.0 kg/h	5,897Hz
198.0 kg/h	6,553Hz
270.0 kg/h	7,240Hz
360.0 kg/h	7,957Hz
486.0 kg/h	8,738Hz
666.0 kg/h	9,644Hz
900.0 kg/h	10,590Hz

SCHEMATIC DIAGRAM

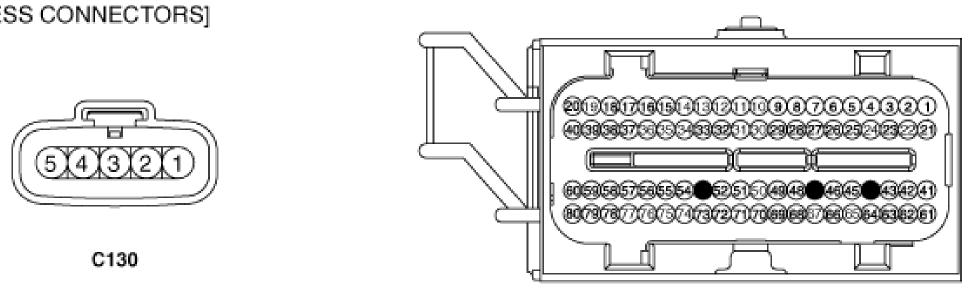
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Funtion
1	PCM C144-1 (47)	MAFS Signal
2	Main Relay	Battery Voltage (B+)
3	Chassis Ground	Ground
4	PCM C144-1 (44)	IATS Signal
5	PCM C144-1 (53)	Sensor Ground

[HARNESS CONNECTORS]



C130

MAFS & IATS

C144-1

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "Air Flow" status on the service data.

Specification :

Air Flow (kg/h)	Frequency (Hz)
12.6 kg/h	2,617Hz
18.0 kg/h	2,958Hz
23.4 kg/h	3,241Hz
32.4 kg/h	3,653Hz
43.2 kg/h	4,024Hz
57.6 kg/h	4,399Hz
72.0 kg/h	4,704Hz
108.0 kg/h	5,329Hz
144.0 kg/h	5,897Hz
198.0 kg/h	6,553Hz
270.0 kg/h	7,240Hz
360.0 kg/h	7,957Hz
486.0 kg/h	8,738Hz
666.0 kg/h	9,644Hz
900.0 kg/h	10,590Hz

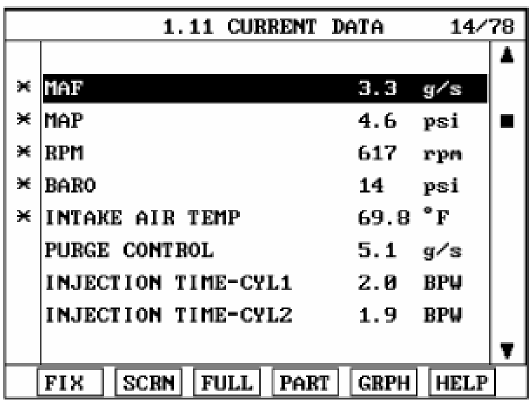


Fig.1

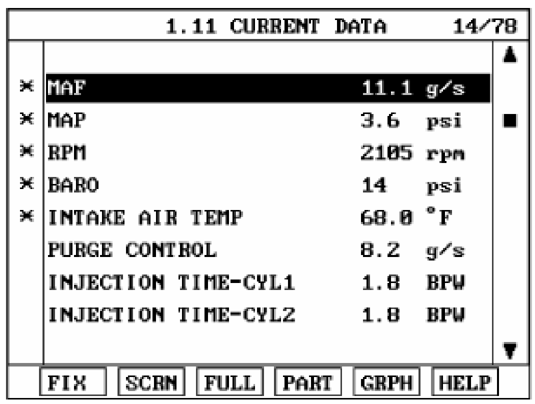


Fig.2

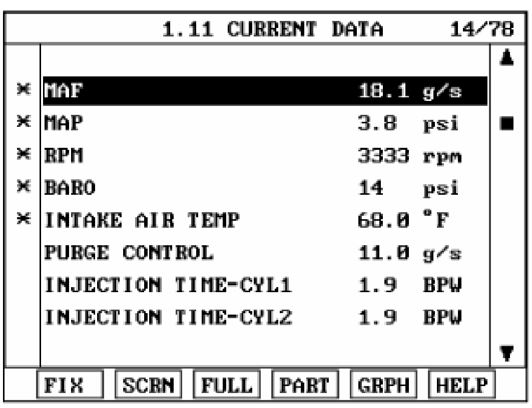


Fig.3

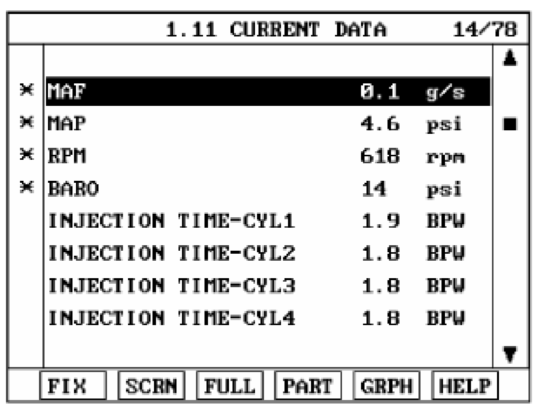


Fig.4

Fig.1: Idle
Fig.3: 3000 rpm

Fig.2: 2000 rpm
Fig.4: Open in signal harness

4. Are the "Air Flow" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

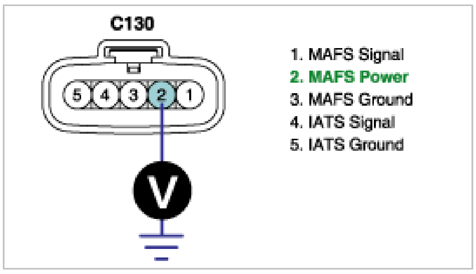
NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. IG "OFF" and Disconnect MAFS connector.
2. IG "ON" & ENG "OFF"
3. Measure voltage between terminal 2 of MAFS harness connector and chassis ground

Specification : B+



4. Is the measured resistance within specification ?

YES

▸ Go to "Ground Circuit Inspection" proceudure.

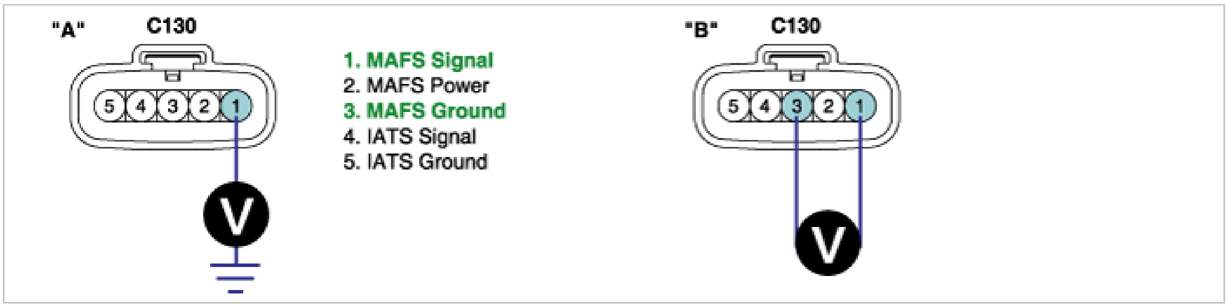
NO

▸ Check that fuse between MAFS and Main Relay is open or not installed.
▸ Check open in power circuit between MAFS and Main Relay.
▸ Go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF" and disconnect MAFS connector.
2. Measure voltage between terminal 1 of MAFS harness connector and chassis ground.
3. Measure voltage between terminal 1 and 3 of MAFS harness connector.

Specification : Voltage difference between Measurement "A" and "B" is below 200mV.



4. Is the measured voltage within specification ?

YES

▸ Go to "Signal Circuit Inspection" procedure.

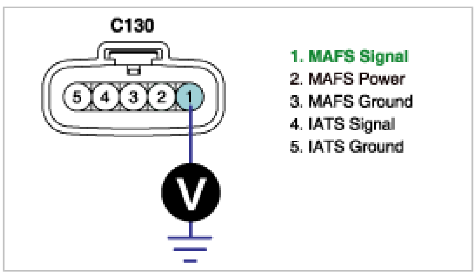
NO

▸ Repair contact resistance or open in harnesss and then go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. IG "OFF" and disconnect MAFS connector.
2. IG "ON' & ENG "OFF".
3. Measure voltage between terminal 1 of MAFS harness connector and chassis ground.

Specification : Approx. 5V



4. Is the measured voltage within specification ?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Visual Inspection
   (1) Check that MAFS is damaged, contaminated or deformed.
   (2) Check tha air cleaner is clogged.
   (3) Has a problem been found ?

   YES

   ▸ Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Go to "Check MAFS" as follows

2. Check MAFS
   (1) IG "OFF" and install a scantool
   (2) ENG "ON" and monitor "MAFS" data on the service data.
   (3) Monitor signal waveform at terminal 1 of MAFS with scantool.

   Specification :Signal waveform will be displayed as follows. (Be aware that the signal of MAFS is not voltage display but frequency display.)

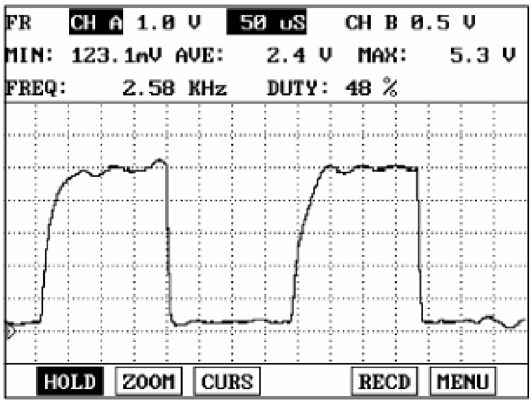


Fig. 1

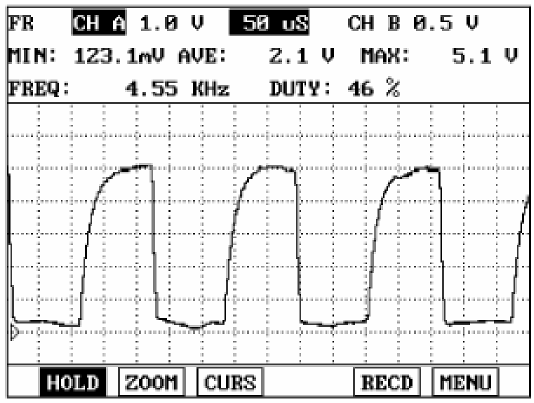


Fig. 2

Fig. 1 : Idle
Fig. 2 : Acceleration

(4) Are both service data and signalwave form dispayed correctly ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Substitute with a known - good MAFS and check for proper operation. If the problem is corrected, replace MAFS and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

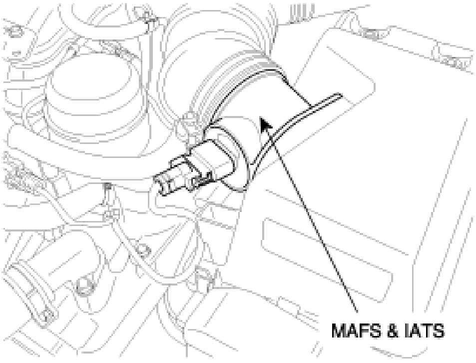
▸ Go to the applicable troubleshooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0102

COMPONENT LOCATION



GENERAL DESCRIPTION

The Delphi MAF Sensor is an air mass flowmeter, which operates on the principle of hot film anemometry. A heated element is placed within the air stream, and maintained at a constant temperature above the air temperature. The amount of electrical power required to maintain the heated element at the proper temperature is a direct function of the flow rate of the air mass past the element. PCM uses this information to determine the injection duration and ignition timing for the desired air/fuel ratio.

DTC DESCRIPTION

The MAF Frequency Airmeter Circuit Diagnostic compares the airmeter input frequency to low and high limits. When the frequency is outside the allowable limits, the circuit is determined to be failed. When a MAF Sensor fails, it may cause the fuel control subsystem to deliver an incorrect quantity of fuel. The most probable failure modes of the MAF Sensor system are an open or short circuit, resulting in a low frequency code setting.
If PCM detects that output of MAFS is lower than 720Hz for more than 75 second failure during one dignostic test(125 second) while enable condition is met PCM determines that a fault exists and a DTC is stored.MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

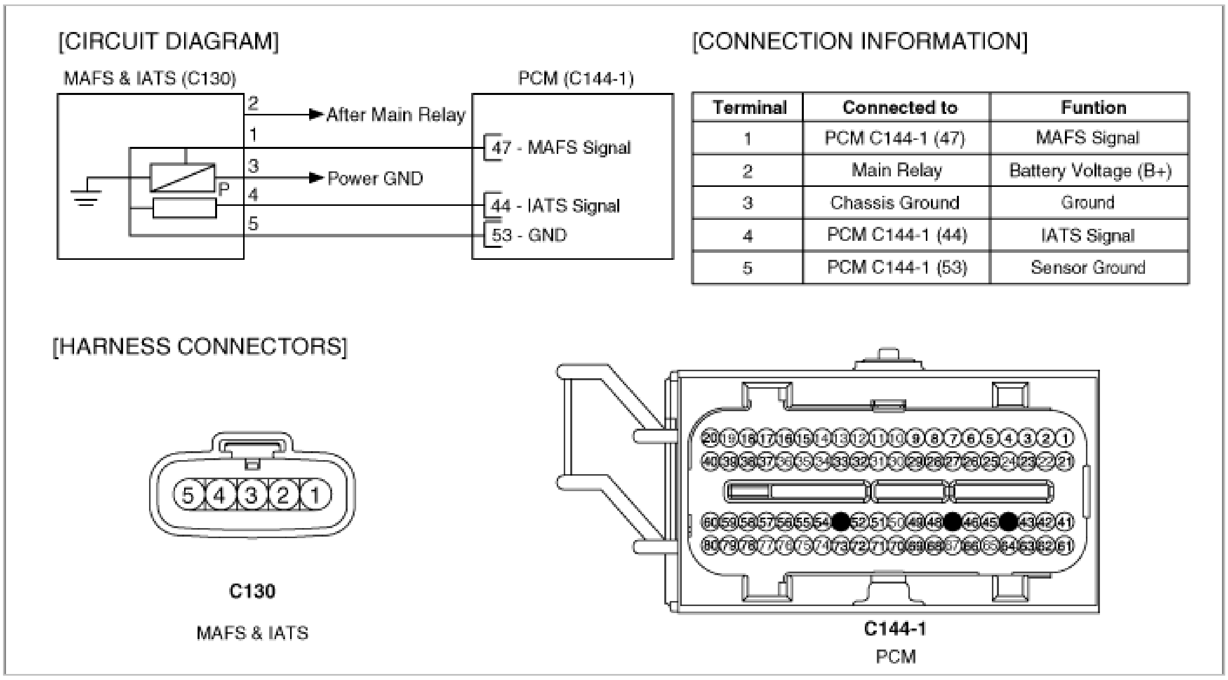
Item	Detecting Condition	Possible cause
DTC Strategy	• The MAF Frequency Airmeter Circuit Diagnostic compares the airmeter input frequency to a low limit	• Poor Connection • Open or short in harness • Clogged air cleaner • MAFS • PCM
Enable Conditions	• Engine Speed ≥ 500 rpm • Engine Running Time ≥ 5 second • Ignition Voltage ≥ 11V • Conditions met delay time ≥ 1 second	
Threshold value	• MAF frequency signal < 1000Hz	
Diagnosis Time	• Continuous (More than 75 second failure for every 125 second tests)	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION

Air Flow (kg/h)	Frequency (Hz)
12.6 kg/h	2,617Hz
18.0 kg/h	2,958Hz
23.4 kg/h	3,241Hz
32.4 kg/h	3,653Hz
43.2 kg/h	4,024Hz
57.6 kg/h	4,399Hz
72.0 kg/h	4,704Hz
108.0 kg/h	5,329Hz
144.0 kg/h	5,897Hz

198.0 kg/h	6,553Hz
270.0 kg/h	7,240Hz
360.0 kg/h	7,957Hz
486.0 kg/h	8,738Hz
666.0 kg/h	9,644Hz
900.0 kg/h	10,590Hz

SCHEMATIC DIAGRAM



MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "Air Flow" status on the service data.
   Specification :

Air Flow (kg/h)	Frequency (Hz)
12.6 kg/h	2,617Hz
18.0 kg/h	2,958Hz
23.4 kg/h	3,241Hz
32.4 kg/h	3,653Hz
43.2 kg/h	4,024Hz
57.6 kg/h	4,399Hz
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108.0 kg/h	5,329Hz
144.0 kg/h	5,897Hz
198.0 kg/h	6,553Hz
270.0 kg/h	7,240Hz
360.0 kg/h	7,957Hz
486.0 kg/h	8,738Hz
666.0 kg/h	9,644Hz

900.0 kg/h	10,590Hz

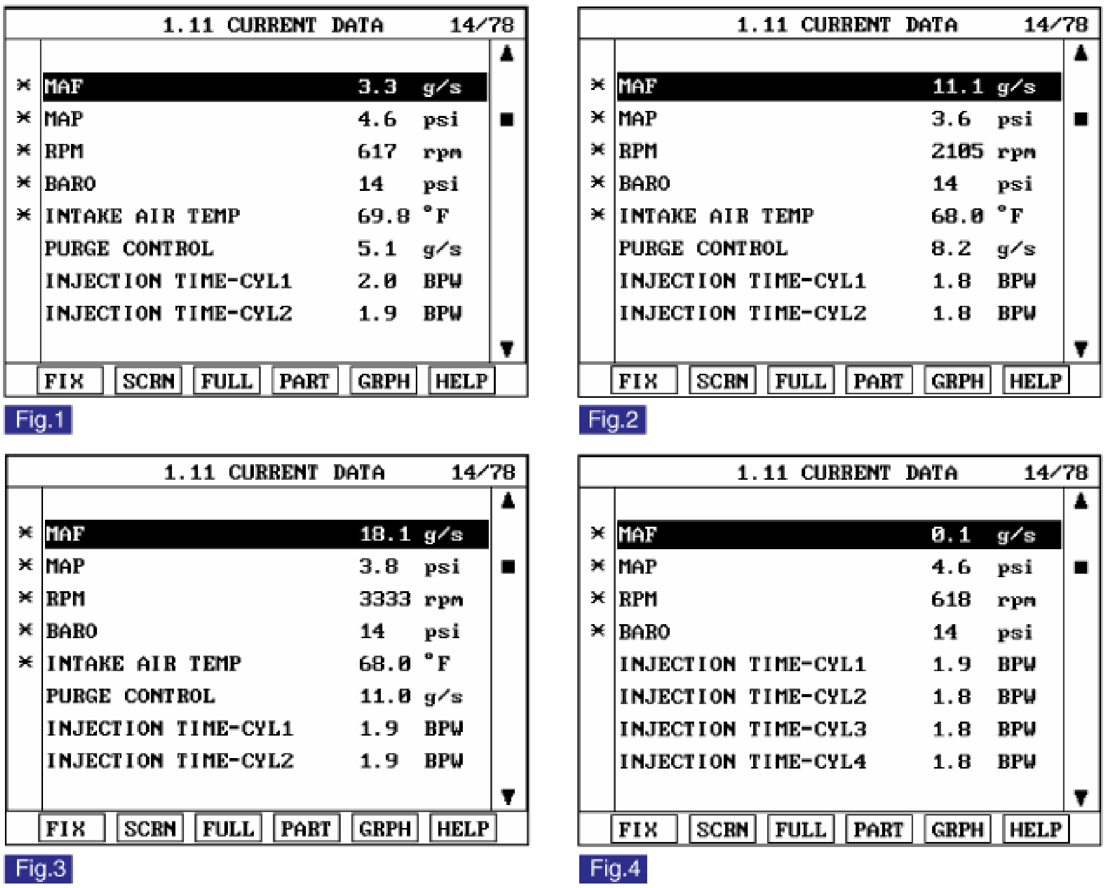


Fig.1: Idle
Fig.2: 2000 rpm
Fig.3: 3000 rpm
Fig.4: Open in signal harness

4. Are the "Air Flow" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

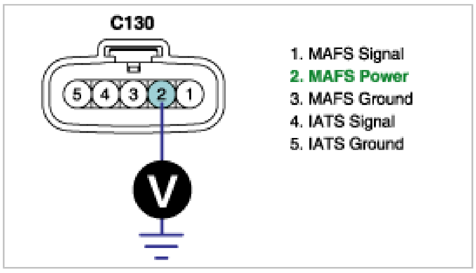
NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. IG "OFF" and Disconnect MAFS connector.
2. IG "ON" & ENG "OFF"
3. Measure voltage between terminal 2 of MAFS harness connector and chassis ground

Specification : B+



4. Is the measured voltage within specification ?

YES

▸ Go to "Signal Circuit Inspection" Procedure.

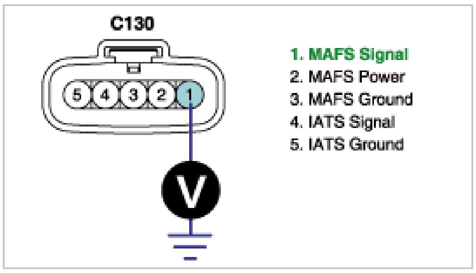
NO

▸ Check fuse between MAFS and main relay is open or not installed.
▸ Repair open in power harness between MAFS and main relay and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF" and disconnect MAFS connector.
   (2) IG "ON' & ENG "OFF".
   (3) Measure voltage between terminal 1 of MAFS harness connector and chassis ground.

Specification : Approx. 5V



   (4) Is the measured voltage within specification ?

YES

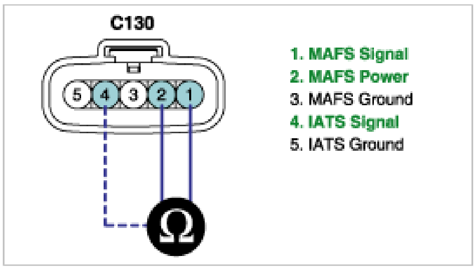
▸ Go to "Ground circuit inspection" procedure.

NO

▸ If the measured voltage is "0", go to "Check open in harness" as follows. If the measured voltage is over "5V", go to " Check short to battery in harness" as follows.

2. Check short to battery in harness
   (1) IG "OFF" and disconnect MAFS and PCM connector.
   (2) Measure resistance between terminal 1 and 2 of MAFS harness connector.
   (3) Measure resistance between terminal 1 and 4 of MAFS harness connector.

Specification : Infinite



   (4) Is the measured voltage within specification ?

YES

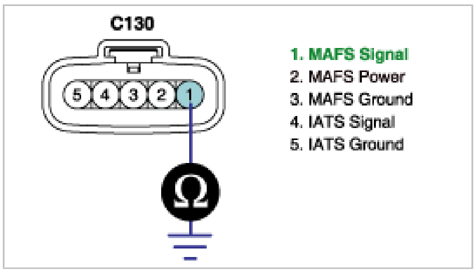
▸ Go to "Check short to ground in harness" as follows.

NO

▸ Repair short to battery in harness and go to "Verification of Vehicle Repair" procedure.

3. Check short to ground in harness
   (1) IG "OFF" and disconnect MAFS and PCM connector.
   (2) Measure resistance between terminal 1 of MAFS harness connector and chassis ground.

Specification : Infinite



   (3) Is the measured resistance within specification ?

YES

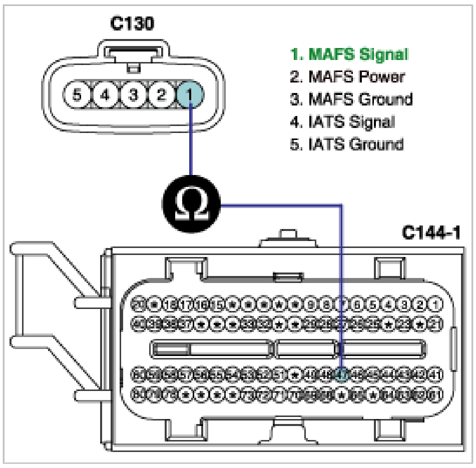
▸ Go to "Check open in harness" as follows.

NO

▸ epair short to ground in harness and go to "Verification of Vehicle Repair" procedure.

4. Check open in harness
   (1) IG "OFF" and disconnect MAFS and PCM connector.
   (2) Measure resistance between terminal 1 of MAFS harness connector and terminal 47 of PCM harness connector.

Specification : Approx. below 1Ω.



   (3) Is the measured resistance within specification ?

YES

▸ Go to "Ground circuit Inspection" procedure.

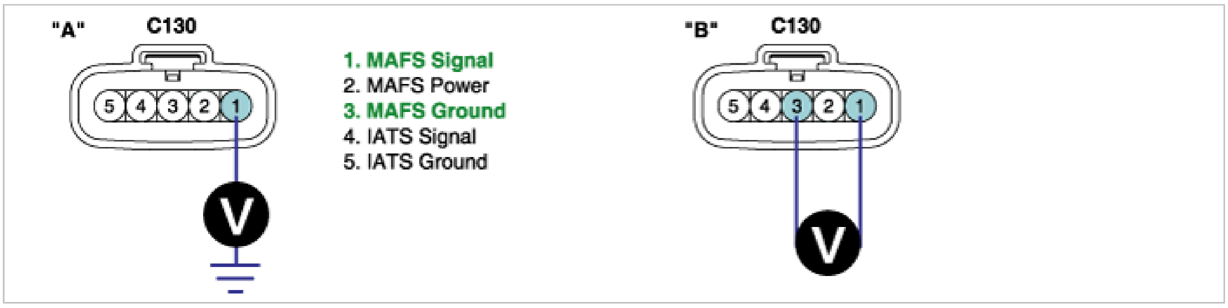
NO

▸ Repair open in harness and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF" and disconnect MAFS connector.
2. Measure voltage between terminal 1 of MAFS harness connector and chassis ground.
3. Measure voltage between terminal 1 and 3 of MAFS harness connector.

Specification : Voltage difference between Measurement "A" and "B" is below 200mV.



4. Is the measured voltage within specification ?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair contact resistance or open in harnesss and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Visual Inspection
   (1) Check that MAFS is damaged, contaminated or deformed.
   (2) Check tha air cleaner is clogged.
   (3) Has a problem been found ?

   YES

   ▸ Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Go to "Check MAFS" as follows

2. Check MAFS
   (1) IG "OFF" and install a scantool
   (2) ENG "ON" and monitor "MAFS" data on the service data.
   (3) Monitor signal waveform at terminal 1 of MAFS with scantool.

   Specification :Signal waveform will be displayed as follows. (Be aware that the signal of MAFS is not voltage display but frequency display.)

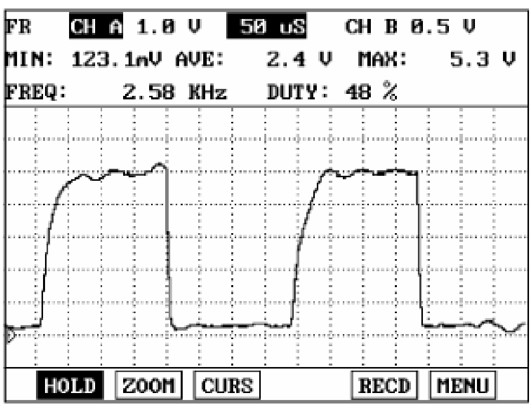


Fig. 1

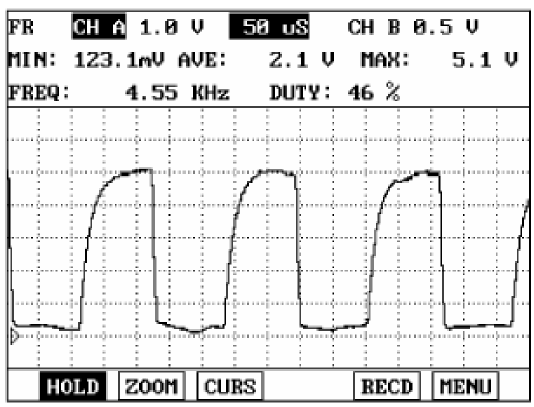


Fig. 2

Fig. 1 : Idle
Fig. 2 : Acceleration

   (4) Are both service data and signalwave form dispayed correctly ?

   YES

   ▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

   NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Substitute with a known - good MAFS and check for proper operation. If the problem is corrected, replace MAFS and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

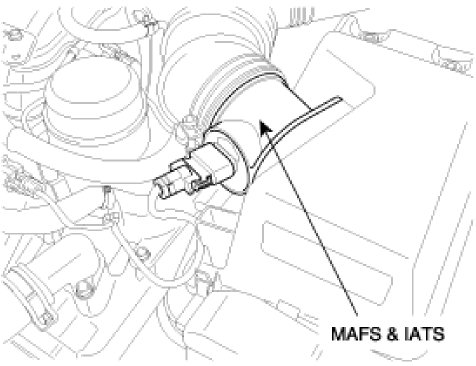
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0103

COMPONENT LOCATION



GENERAL DESCRIPTION

The Delphi MAF Sensor is an air mass flowmeter, which operates on the principle of hot filmanemometry. A heated element is placed within the air stream, and maintained at a constanttemperature above the air temperature. The amount of electrical power required to maintain theheated element at the proper temperature is a direct function of the flow rate of the air mass pastthe element. PCM uses this information to determine the injection duration and ignition timing for the desired air/fuel ratio.

DTC DESCRIPTION

The MAF Frequency Airmeter Circuit Diagnostic compares the airmeter input frequency to low and high limits. When the frequency is outside the allowable limits, the circuit is determined to be failed. When a MAF Sensor fails, it may cause the fuel control subsystem to deliver an incorrect quantity of fuel. The most probable failure modes of the MAF Sensor system are an open or short circuit, resulting in a low frequency code setting.
If PCM detects that output of MAFS is higher thatn 12000Hz for more than 75 second failure during 125 second dignostic test while enable condition is met PCM determines that a fault exists and a DTC is stored.MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• The MAF Frequency Airmeter Circuit Diagnostic compares the airmeter input frequency to a high limit	

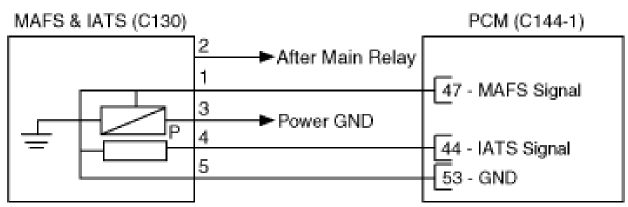
Enable Conditions	• Engine Speed ≥ 500 rpm • Engine Running Time ≥ 5 second • Ignition Voltage ≥ 11V • Conditions met delay time ≥ 1 second	• Noise • MAFS • PCM
Threshold value	• MAF frequency signal > 11900Hz	
Diagnosis Time	• Continuous (More than 75 second failure for every 125 second tests)	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION

Air Flow (kg/h)	Frequency (Hz)
12.6 kg/h	2,617Hz
18.0 kg/h	2,958Hz
23.4 kg/h	3,241Hz
32.4 kg/h	3,653Hz
43.2 kg/h	4,024Hz
57.6 kg/h	4,399Hz
72.0 kg/h	4,704Hz
108.0 kg/h	5,329Hz
144.0 kg/h	5,897Hz
198.0 kg/h	6,553Hz
270.0 kg/h	7,240Hz
360.0 kg/h	7,957Hz
486.0 kg/h	8,738Hz
666.0 kg/h	9,644Hz
900.0 kg/h	10,590Hz

SCHEMATIC DIAGRAM

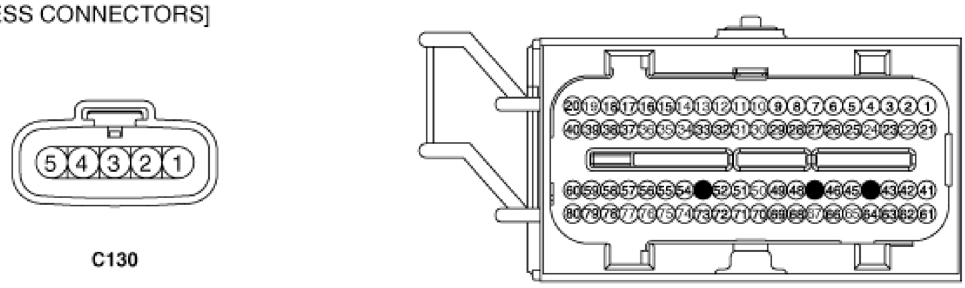
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Funtion
1	PCM C144-1 (47)	MAFS Signal
2	Main Relay	Battery Voltage (B+)
3	Chassis Ground	Ground
4	PCM C144-1 (44)	IATS Signal
5	PCM C144-1 (53)	Sensor Ground

[HARNESS CONNECTORS]



C130

MAFS & IATS

C144-1

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "Air Flow" status on the service data.

Specification :

Air Flow (kg/h)	Frequency (Hz)
12.6 kg/h	2,617Hz
18.0 kg/h	2,958Hz
23.4 kg/h	3,241Hz
32.4 kg/h	3,653Hz
43.2 kg/h	4,024Hz
57.6 kg/h	4,399Hz
72.0 kg/h	4,704Hz
108.0 kg/h	5,329Hz
144.0 kg/h	5,897Hz
198.0 kg/h	6,553Hz
270.0 kg/h	7,240Hz
360.0 kg/h	7,957Hz
486.0 kg/h	8,738Hz
666.0 kg/h	9,644Hz
900.0 kg/h	10,590Hz

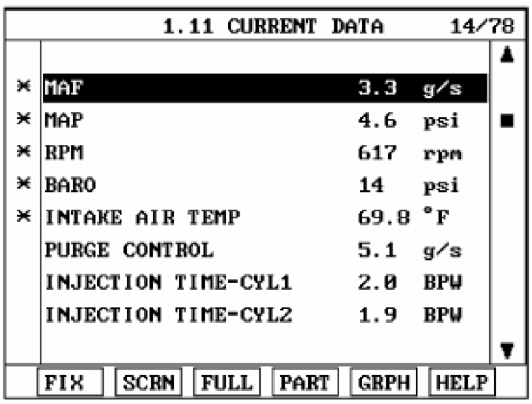


Fig.1

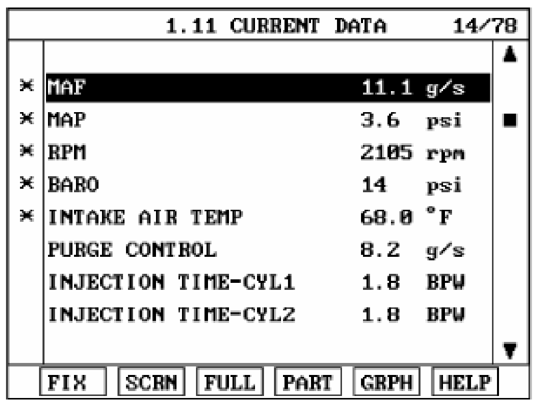


Fig.2

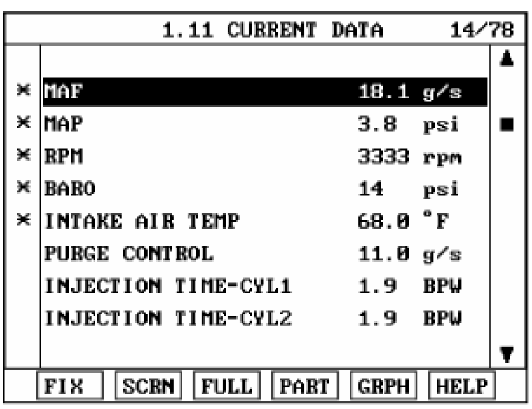


Fig.3

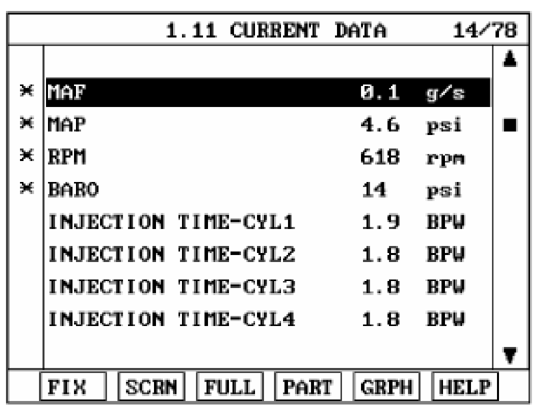


Fig.4

Fig.1: Idle
Fig.2: 2000 rpm
Fig.3: 3000 rpm
Fig.4: Open in signal harness

4. Are the "Air Flow" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure

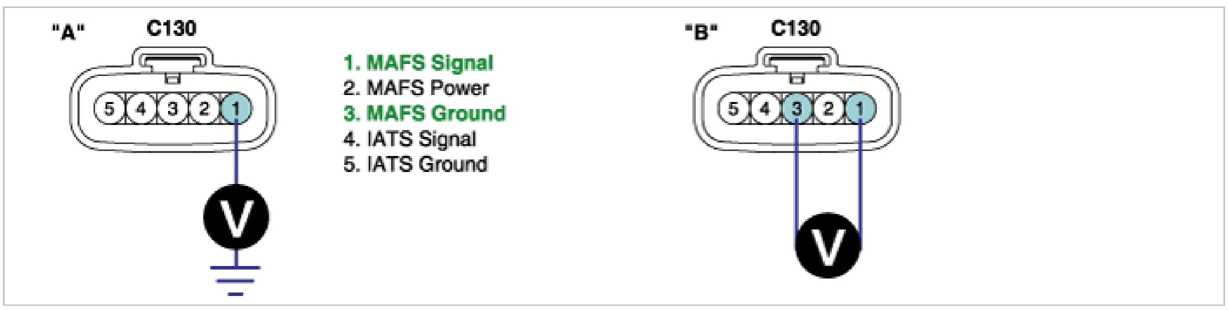
NO

▸ Go to "Ground Circuit Inspection" procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF"
2. Disconnector MAFS connector.
3. Measure the voltage between terminal 1 of MAFS harness connector.
4. Measure the voltage between terminal 1 and 3 of MAFS harness connector.

Specification : Voltage difference and "A" and B" is below 200mV



5. Is the measured voltage within the specification?

YES

▸ Go to "Component Inspection".

NO

▸ After repairing or replacing contact resistance in ground circuit and open in the MAFS circuit, go to "Verification and Vehicle Repair".

COMPONENT INSPECTION

1. Visual Inspection
   (1) Check that MAFS is damaged, contaminated or deformed.
   (2) Check tha air cleaner is clogged.
   (3) Has a problem been found ?

   YES

   ▸ Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Go to "Check MAFS" as follows

2. Check MAFS
   (1) IG "OFF" and install a scantool
   (2) ENG "ON" and monitor "MAFS" data on the service data.

(3) Monitor signal waveform at terminal 1 of MAFS with scantool.

Specification :Signal waveform will be displayed as follows. (Be aware that the signal of MAFS is not voltage display but frequency display.)

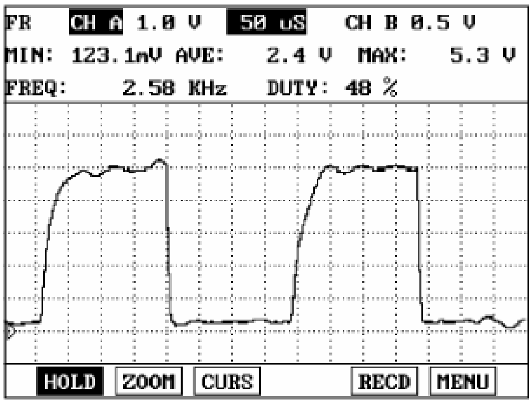


Fig. 1

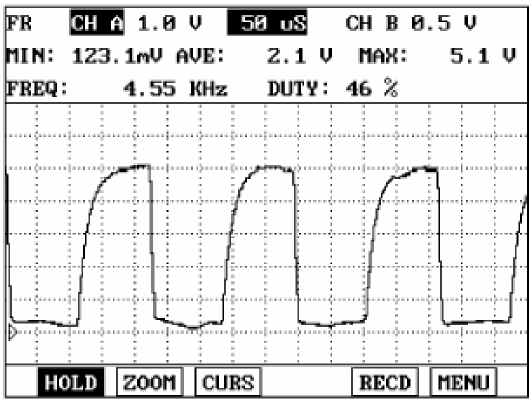


Fig. 2

Fig. 1 : Idle
Fig. 2 : Acceleration

(4) Are both service data and signalwave form dispayed correctly ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Substitute with a known - good MAFS and check for proper operation. If the problem is corrected, replace MAFS and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

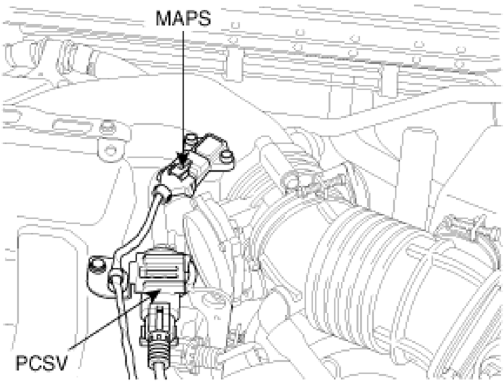
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0106

COMPONENT LOCATION



GENERAL DESCRIPTION

The amount of intake air flow must be inputted to PCM in order to determine the fuel injection quantity. To measure the pressure inside of intake manifold, MAFS is used at idle and MAPS is required at accelerating. MAPS(Manifold Absolute Pressure) calculates the amount of air indirectly as measuring the pressure inside of intake manifold. This mechanism is alsl called Speed-Density Type.MAPS transfers analog output signal which is proportional to the change of intake manifold pressure, then, with this signal and RPM, PCM calculates the amount of intake air flow. MAPS is mounted on surge tank to measure the pressure inside of intake manifold, and it consists of a piezo electric element and hybrid IC which amplifies output signal from the element. A piezo electric element is a sort of a diaphragm using piezo electric effect. One side of the diaphragm is surrounded with vacuum chamber while intake pressure is applied to the other side. Thus, signals are output by the transformation of diagphragm according to the change of pressure inside of intake manifold.

DTC DESCRIPTION

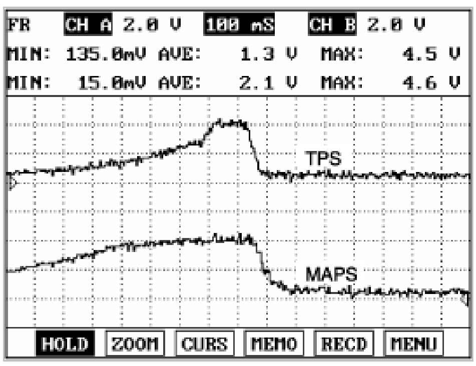
The MAP/TPS Rationality Diagnostic is comprised of two tests. A deceleration test is performedto provide a robust method for detection of an altitude compensated MAP value that is too high for the deceleration condition. The second test compares the altitude compensated MAP value to both high and low limits, dependent upon throttle position and engine speed. When the MAP value is out of the threshold range, the MAP/TPS system is determined to be failed.
When the MAP/TPS Rationality Diagnostic fails, the effects may cause the fuel control subsystem to deliver an incorrect quantity of fuel. The most probable failure modes of the MAP Sensor system are a skewed MAP or TPS sensor, resulting in a poor correlation between MAP and TPS
To ensure the vehicle is not performing in a transient maneuver, input signals and control parametersare monitored for stability for both the deceleration test and the power test. A large enough change inany of these stability parameters indicates that either the actual airflow rate or the calculated airflowrate may be misrepresented during the transient condition. Inclusion of this check for stability allowsbetter separation of passing and failing systems.
PCM compares the difference between MAPS output and calculated MAPS value while enable condition ismet. If the acutal MAP value is higher than Maximum threshold or lower than Minimum threshold for 15 secondfailure during one diagnostic test(32 second),PCM determines that a fault exists and a DTC is stored.MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible cause
DTC Strategy		• The MAP reading is compared to expected MAP high and low limits based on engine speed & Throttle Position	
	Case 1	**Decel Stable Conditions Criteria** • Engine State = Run • MAP_TPS_Rationality Fault is not present • Valid barometric pressure update • 1300rpm ≤ Engine speed ≤ 4500rpm • Idle Airflow Stable ≤ 4.9988% • -10°C< Coolant Temperature above minimum threshold	
		Power Stable Conditions Criteria • Engine State = Run • MAP_TPS_Rationality Fault is not present • Valid barometric pressure update • 1300rpm ≤ Engine speed ≤ 4000rpm	

Enable Conditions	Case 2	• HVAC Clutch not transitioning • Traction control not active • Torque fuel reduction not active • Brake Switch Not Activated • Coolant Temperature ≥ 60°C • TPS value difference ≤ 4.9988% • MAP value difference ≤ 5kPa • Idle Airflow Stable ≤ 4.9988% • Bank 1 VCPC ≤ 10 degree • Bank 2 VCPC ≤ 10 degree	
	Case 3	**Decel Enable Conditions Criteria** • Decel Stable Conditions Present • Throttle position < 0.2991% • Vehicle Speed ≥ 30kph • The minimum consecutive time that the engine operating conditions must meet the enable criteria	• Poor connection • Open or short in harness • MAPS • PCM
	Case 4	**Power Enable Conditions Criteria** • Power Stable Conditions Present • The minimum consecutive time that the engine operating conditions must meet the enable criteria > 3 second	
Threshold value	Case 1	**Power Test** • Altitude compensated MAP < Memorized min. MAP data • Altitude compensated MAP > Memorized max. MAP data	
	Case 2	**Decelleration Test** • Altitude compensated MAP < Memorized MAP data	
Diagnosis Time		• Continuous (More than 15 seconds failure for every 32 seconds test)	
MIL On Condition		• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA



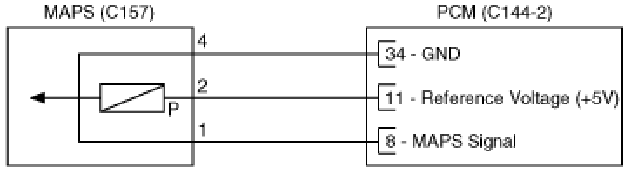
It is necessary that MAPS should be checked along with TPS. Because The MAP/TPS Rationality Diagnostic is comprised of two tests. A deceleration test is performed to provide a robust method for detection of an altitude compensated MAP value that is too high for the deceleration condition. The second test compares the altitude compensated MAP value to both high and low limits, dependent upon throttle position and engine speed. When the MAP value is out of the threshold range, the MAP/TPS system is determined to be failed.

SPECIFICATION

Pressure (kPa)	20	35	60	95	101.32
Voltage (V)	0.789	1.382	2.369	3.75	4
Tolerance (V)	± 0.045				

SCHEMATIC DIAGRAM

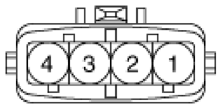
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

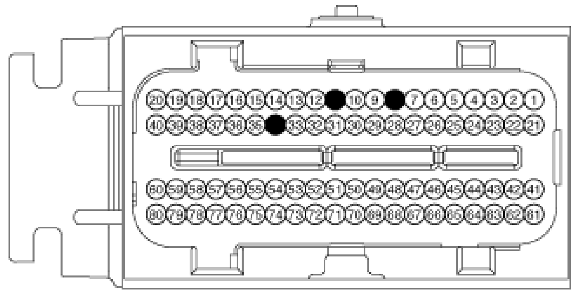
Terminal	Connected to	Funtion
1	PCM C144-2 (8)	MAPS Signal
2	PCM C144-2 (11)	Reference Voltage (+5V)
3	-	-
4	PCM C144-2 (34)	Sensor ground

[HARNESS CONNECTORS]



C157

MAPS



C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "MAPS" status on the service data.

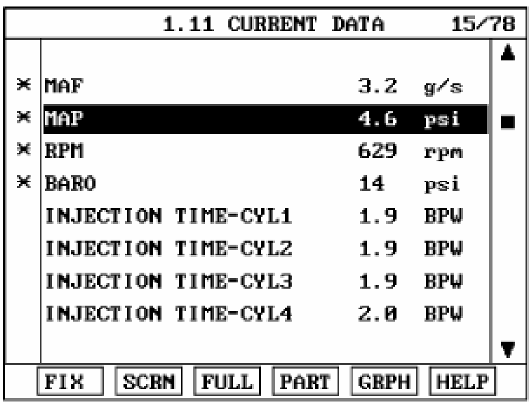


Fig. 1

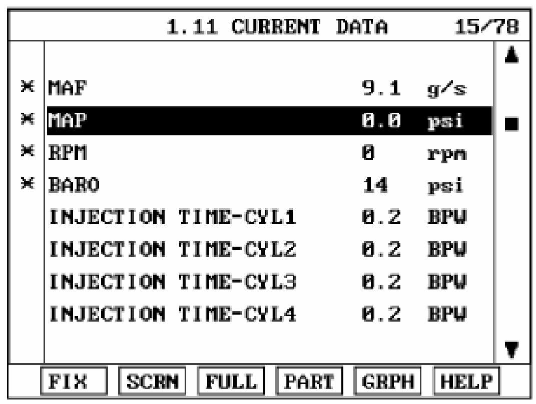


Fig. 2

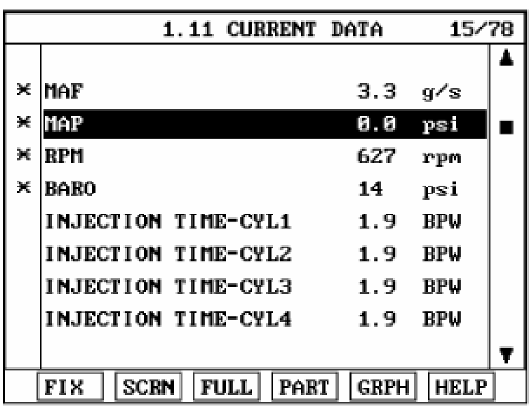


Fig. 3

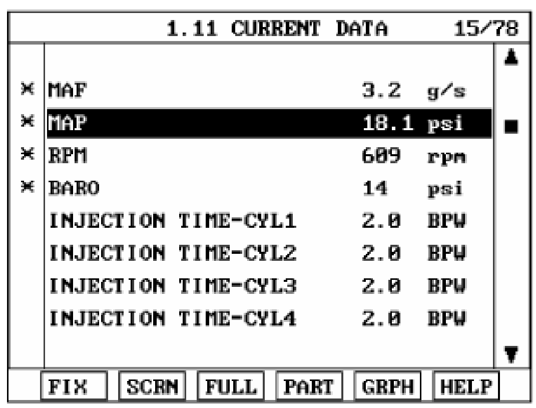


Fig. 4

Fig. 1 : Normal at idle
Fig. 2 : Open at idle
Fig. 3 : Short to ground at idle
Fig. 4 : Shrot to 5V at idle

4. Are the "MAPS" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

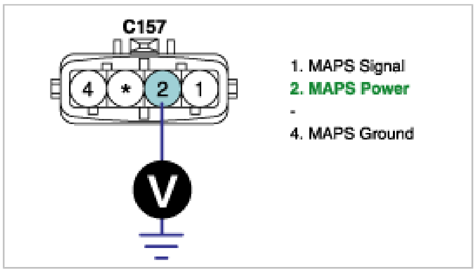
NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. IG "OFF" and disconnect MAPS connector.
2. IG "ON" & ENG "OFF"
3. Measure voltage between terminal 2 of MAPS harness connector and chassis ground.

Specification : Approx. 5V



4. Is the measured voltage within specification ?

YES

▸ Go to "Ground circuit inspection" procedure.

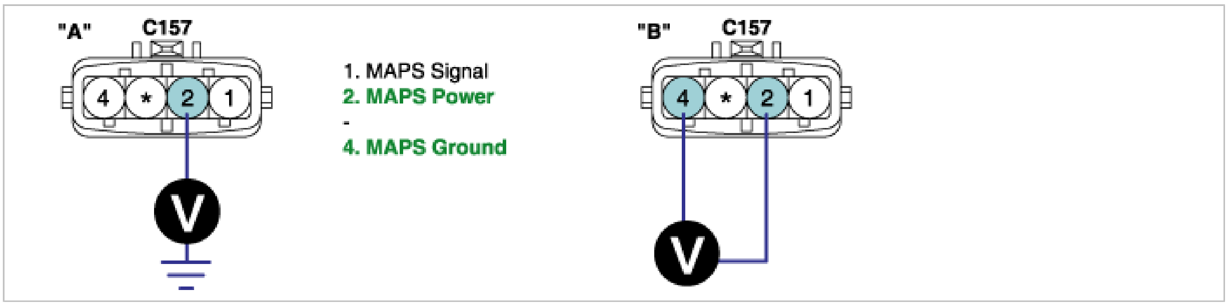
NO

▸ Repair open or short to ground in harness and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF" and disconnect MAPS connector.
2. Measure voltage between terminal 2 of MAPS harness connector and chassis ground.
3. Measure voltage between terminal 2 and 4 of MAPS harness connector.

Specification : Voltage difference between Measurement "A" and "B" is below 200mV.



4. Is the measured voltage within specification ?

YES

▸ Go to "Signal Circuit Inspection" procedure.

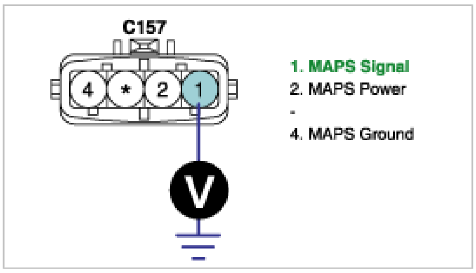
NO

▸ Repair contact reistance or open in harness and then go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF" and disconnect MAPS connector.
   (2) IG "ON" & ENG "OFF"
   (3) Measure voltage between terminal 1 of MAPS harness connector and chassis ground.

Specification : Approx. 0V



   (4) Is the measured voltage within specification ?

YES

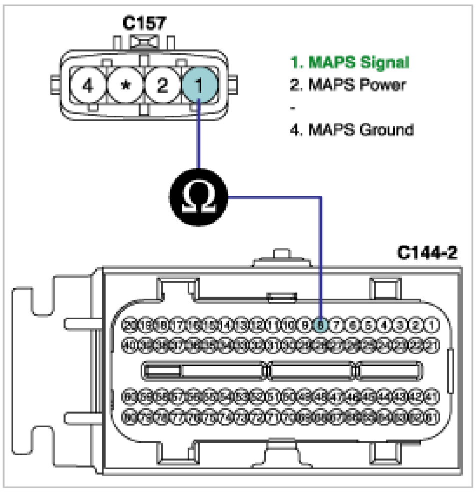
▸ Go to "Check open in harness" as follows.

NO

▸ Repair short to ground in harness and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness
   (1) IG "OFF" and disconnet MAPS and PCM connector.
   (2) Measure resistance between terminal 1 of MAPS harness connector and terminal 8 of PCM harness connector.

Specification : Approx. Below 1 Ω



   (3) Is the measured resistance within specification ?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair open in harness and go to "Verification of Vehicle Repair" procedure.

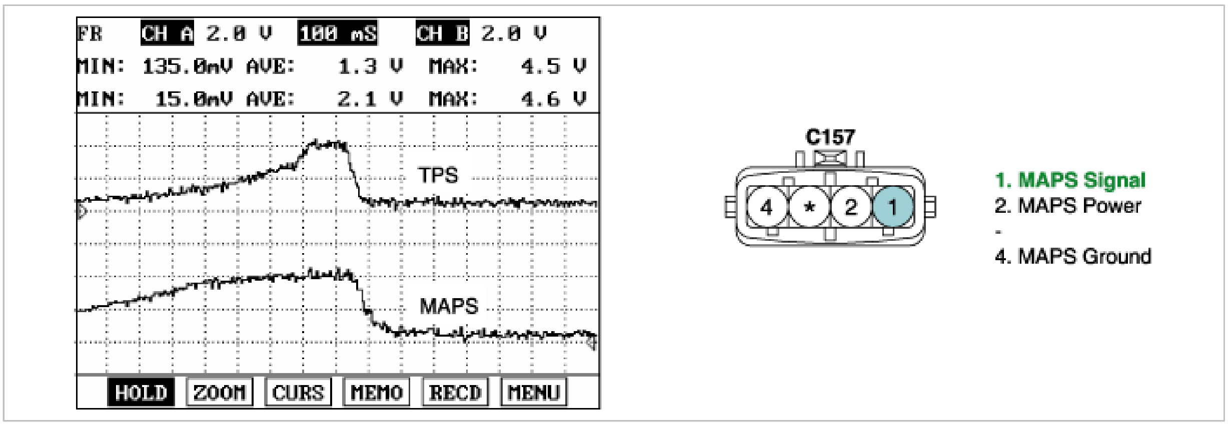
COMPONENT INSPECTION

1. Check MAPS Performance
   (1) IG "OFF" and install scatool.
   (2) Connect probe to MAPS and TPS to check signal waveform by using oscilloscope function.

(3) ENG "ON" and monitor signal waveform during accelleration and decelleration.

Specificaton :

Pressure (kPa)	20	35	60	95	101.32
Voltage (V)	0.789	1.382	2.369	3.75	4
Tolerance (V)	± 0.045				



(4) Is the measured signal waveform(MAP/TPS Rationality) O.K ?

YES

▸ Go to "Check PCM" as follows.

NO

▸ Substitute with a known - good MAPS and check for proper operation. If the problem is corrected, replace MAPS and go to "Verification of Vehicle Repair" procedure.

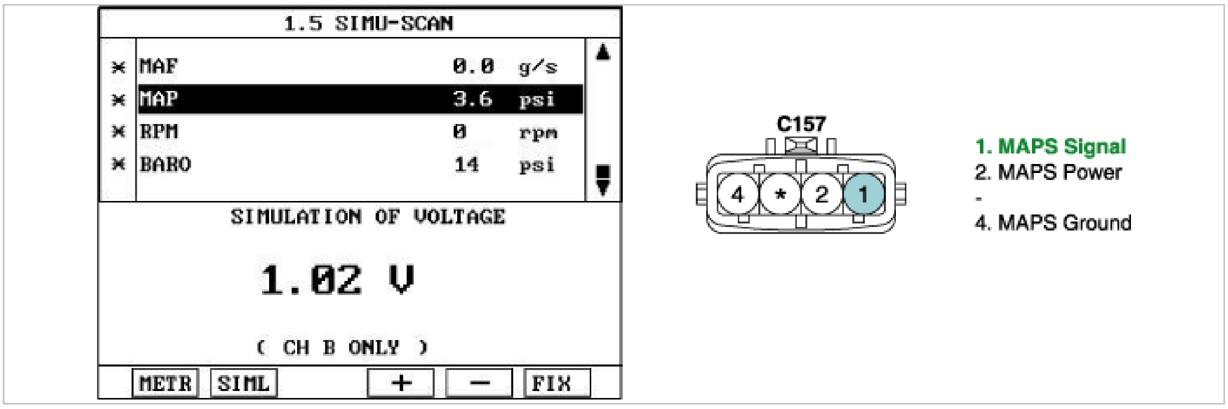
2. Check PCM

(1) IG "OFF" disconnect MAPS connector

(2) Connect Scantool and IG "ON" & ENG "OFF"

(3) Select simulation function on scantool.

(4) Simulate voltage at terminal 1 of MAPS harness connector.



(5) Does the signal value of MAP sensor change according to simulation voltage ?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

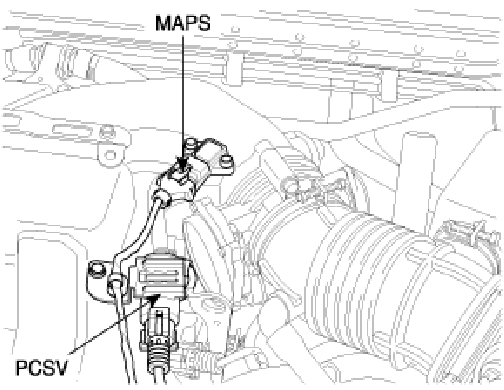
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0107

COMPONENT LOCATION



GENERAL DESCRIPTION

The amount of intake air flow must be inputted to PCM in order to determine the fuel injection quantity. To measure the pressure inside of intake manifold, MAFS is used at idle and MAPS is required at accelerating. MAPS(Manifold Absolute Pressure) calculates the amount of air indirectly as measuring the pressure inside of intake manifold. This mechanism is alsl called Speed-Density Type.
MAPS transfers analog output signal which is proportional to the change of intake manifold pressure, then, with this signal and RPM, PCM calculates the amount of intake air flow.
MAPS is mounted on surge tank to measure the pressure inside of intake manifold, and it consists of a piezo electric element and hybrid IC which amplifies output signal from the element. A piezo electric element is a sort of a diaphragm using piezo electric effect. One side of the diaphragm is surrounded with vacuum chamber while intake pressure is applied to the other side. Thus, signals are output by the transformation of diagphragm according to the change of pressure inside of intake manifold.

DTC DESCRIPTION

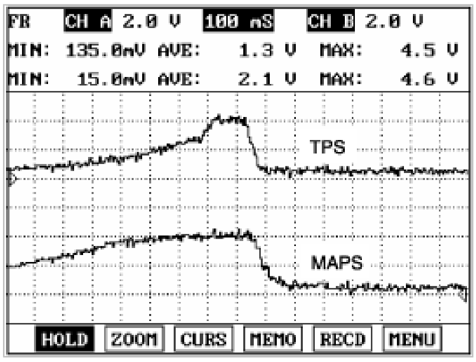
Checking output signals of MAPS every 5 sec. under detecting condition, if an output signal is below 0.25V for more than 2.5 sec., PCM sets P0107. Warning lamp turns on when the malfunction lasts till continuous 2 driving cycle.

DTC DETECTING CONDITION

<table>
<tr><th colspan="2">Item</th><th>Detecting Condition</th><th>Possible cause</th></tr>
<tr><td colspan="2">DTC Strategy</td><td>• This code detects a continuous short to low or open in either the signal circuit or the MAP</td><td rowspan="3">• Connecting condition
• Open or short to ground in power circuit
• Open or short to ground in signal circuit
• MAPS</td></tr>
<tr><td rowspan="2">Enable Conditions</td><td>Case 1</td><td>• No TPS Active Fault Present
• Ignition Voltage ≥ 11V
• Engine Speed ≤ 1000rpm
• Throttle Position ≥ 0%</td></tr>
<tr><td>Case 2</td><td>• No TPS Active Fault Present
• Ignition Voltage ≥ 11V
• Engine Speed >1000rpm
• Throttle Position ≥ 30%</td></tr>
</table>

Threshold value	• MAP Signal < 0.25V	• PCM
Diagnosis Time	• Contineous (More than 2.5 seconds failure for every 5 seconds test)	
MIL On Condition	• 2 Driving Cycle	

SIGNAL WAVEFORM AND DATA

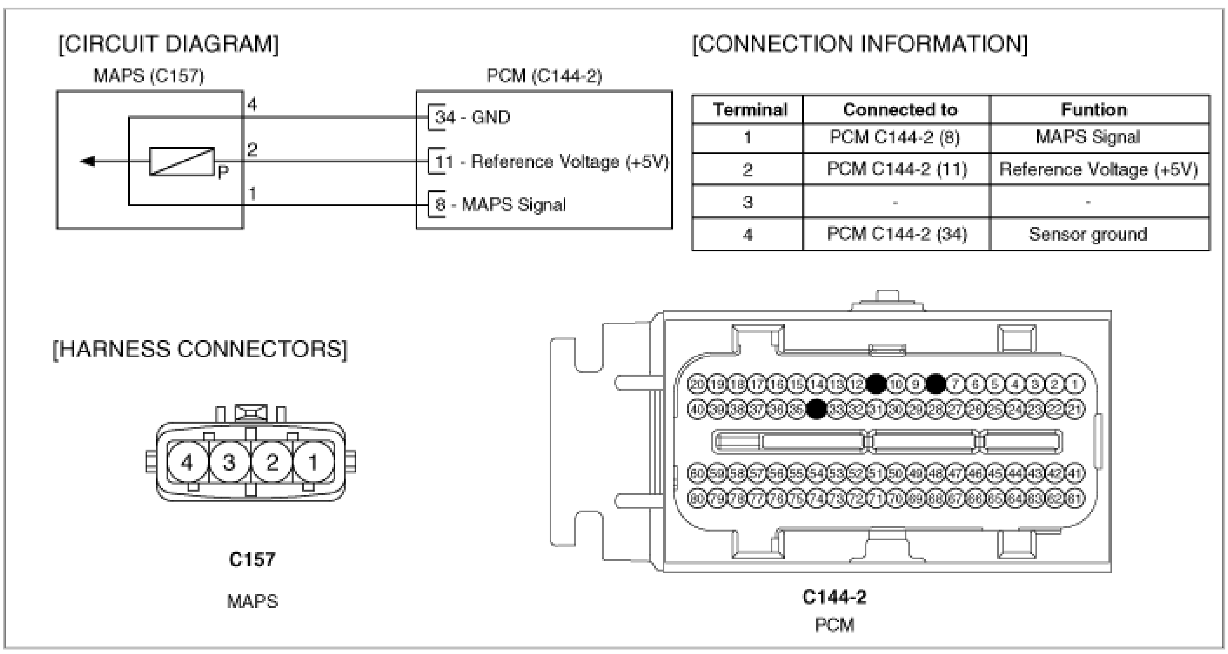


Comparing MAPS and TPS, The signals of MAPS and TPS increasess and decrease simultaneously.

SPECIFICATION

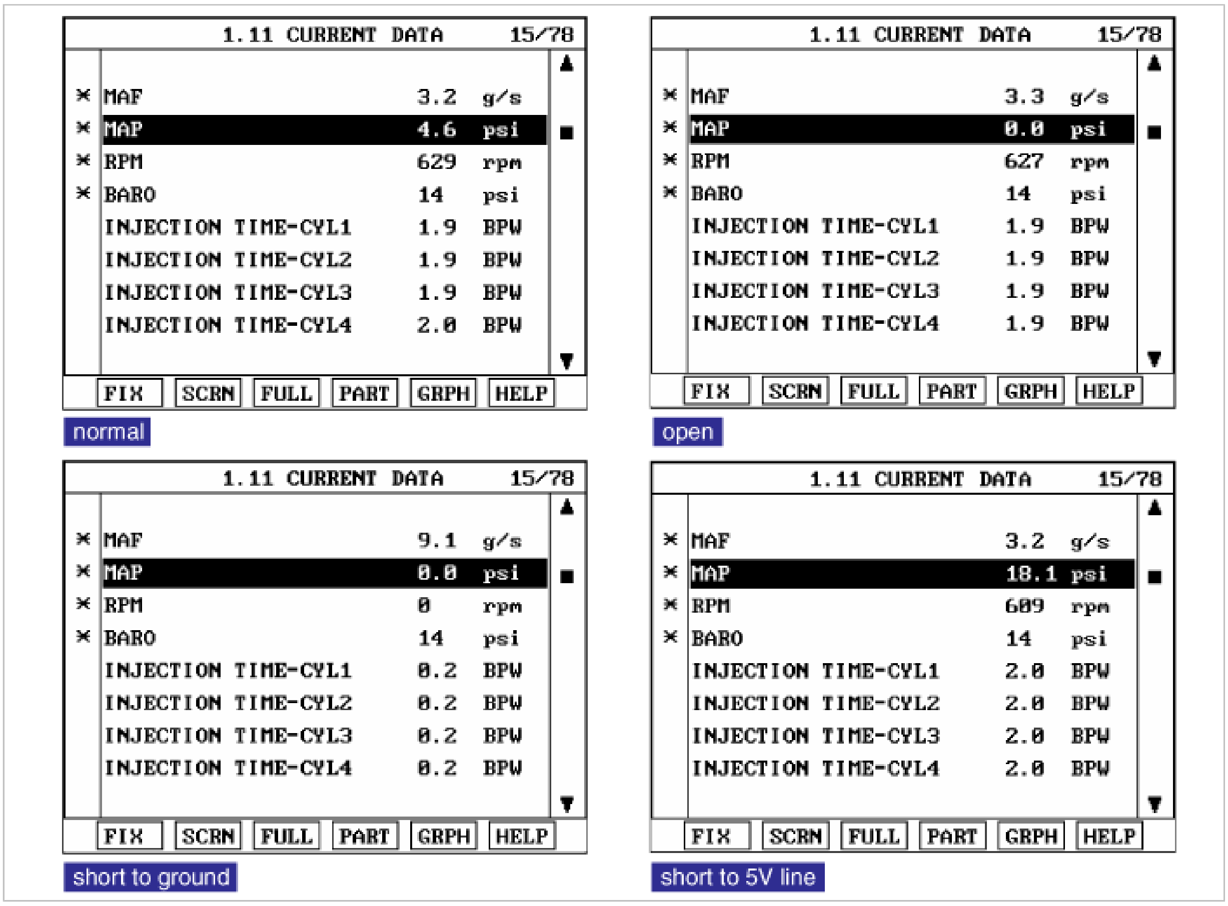
Pressure (kPa)	20	35	60	95	101.32
Voltage (V)	0.789	1.382	2.369	3.75	4
Tolerance (V)	± 0.045				

SCHEMATIC DIAGRAM



MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Cable (DLC)
2. Warm up engine to normal operating temperature
3. Monitor "MAPS" parameter on the scantool.



4. Is the current data displayed correctly ?

YES

▸ Fault is intermittently caused by poor contact in the sensor and/or PCM connector or non cleared PCM memory after repair. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace if necessary and go to "Verification of vehicle Repair" .

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure

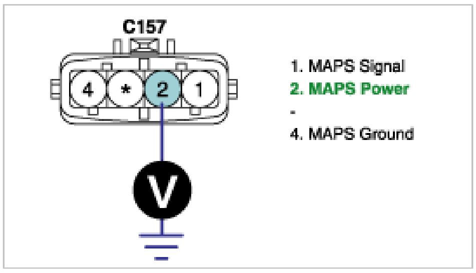
NO

▸ Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION

1. IG "OFF"
2. Disconnect MAPS connector.
3. IG "ON"
4. Measure the voltage between terminal 2 of MAPS harness connector and ground.

Specification : Approx. 5V



5. Is the measured voltage within specification ?

YES

▶ Go to "Signal Circuit Inspection" of MAPS.

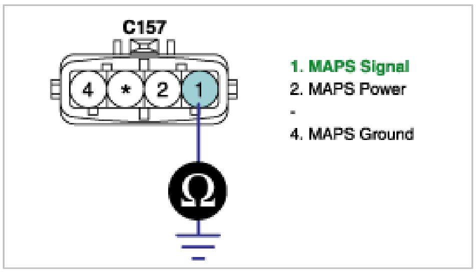
NO

▶ After repairing open or short to ground in circuits and go to "Verification of Vehicle Repair"

SIGNAL CIRCUIT INSPECTION

1. Check short to ground in harness.
   (1) IG "OFF"
   (2) Disconnect MAPS and PCM connector.
   (3) Measure the resistance between terminal 1 of MAPS harness connector and ground.

   Specification : Infinite



   (4) Is the measured resistance within the specification?

   YES

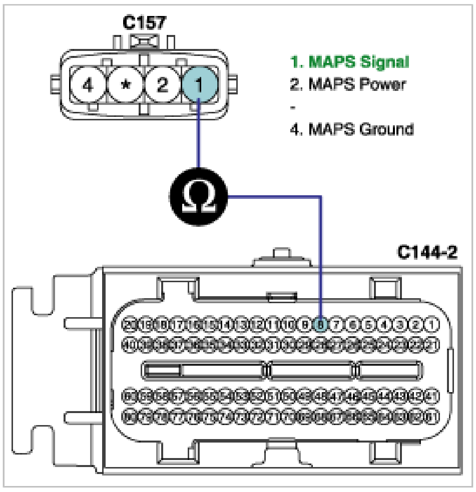
   ▶ Go to "Check open in the harness" procedure.

   NO

   ▶ After repairing short to ground in harness and go to "Verification of Vehicle Repair"

2. Check open in the harness
   (1) IG "OFF"
   (2) Disconnect MAPS and PCM connector.
   (3) Measure the resistance between terminal 1 of MAPS harness connector and terminal 8 of PCM harness connector

   Specification : Approx. below 1 Ω



(4) Is the measured resistance within the specification?

YES

▸ Go to "Component Inspection" procedure.

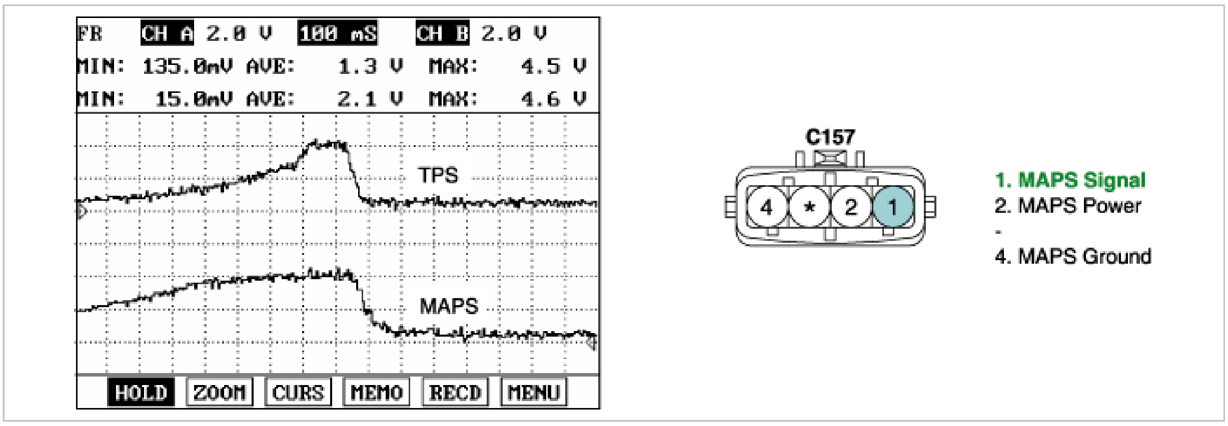
NO

▸ Repair open in the harness and go to "Verification of Vehicle Repair".

COMPONENT INSPECTION

1. MAPS performance test
   (1) IG "OFF"
   (2) Connect scantool to Data Link Connector(DLC) and selest "Oscilloscope" then, connect probes to output signal lines of MAPS and TPS.Turn engine "ON" and monitor the waveforms accelerating or decelerating
   (3) ENG "ON" and monitor signal waveform during accelleration and decelleration.
   Specificaton :

Pressure (kPa)	20	35	60	95	101.32
Voltage (V)	0.789	1.382	2.369	3.75	4
Tolerance (V)	± 0.045				



   (4) Is the waveform displayed correctly?(Compare the response time of TPS and MAPS)

YES

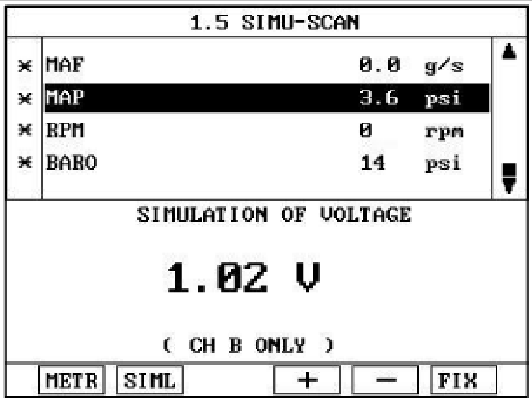
▸ Go to "Check PCM".

NO

▸ After replacing MAPS with new one, if it operates normally, replace MAPS and go to "Verification of Vehicle Repair".

2. Check PCM
   (1) IG "OFF" disconnect MAPS connector
   (2) Connect Scantool and IG "ON" & ENG "OFF"
   (3) Select simulation function on scantool.

(4) Simulate voltage at terminal 1 of MAPS harness connector.



(5) Does the output voltage response to the change of signal by simulation?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

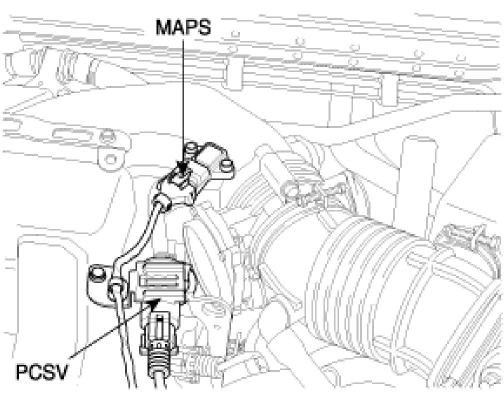
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0108

COMPONENT LOCATION



GENERAL DESCRIPTION

The amount of intake air flow must be inputted to PCM in order to determine the fuel injection quantity. To measure the pressure inside of intake manifold, MAFS is used at idle and MAPS is required at accelerating. MAPS(Manifold Absolute Pressure) calculates the amount of air indirectly as measuring the pressure inside of intake manifold. This mechanism is alsl called Speed-Density Type.
MAPS transfers analog output signal which is proportional to the change of intake manifold pressure, then, with this signal and RPM, PCM calculates the amount of intake air flow.
MAPS is mounted on surge tank to measure the pressure inside of intake manifold, and it consists of a piezo electric element and hybrid IC which amplifies output signal from the element. A piezo electric element is a sort of a diaphragm using piezo electric effect. One side of the diaphragm is surrounded with vacuum chamber while intake pressure is applied to the other side. Thus, signals are output by the transformation of diagphragm according to the change of pressure inside of intake manifold.

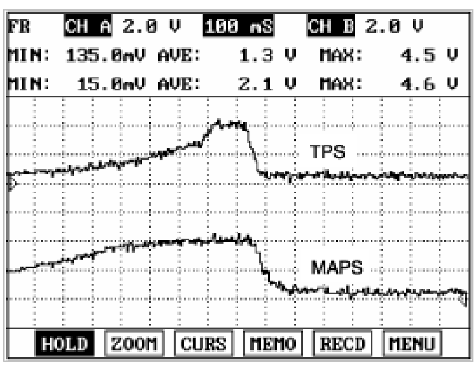
DTC DESCRIPTION

Checking output signals of MAPS every 5 sec. under detecting condition, if an output signal is above 4.5V for more than 2.5 sec., PCM sets P0108. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible cause
DTC Strategy		• This code detects a continuous short to high in either the signal circuit or the MAP sensor	• Connecting condition • Short in Signal Circuit • Open in Ground Circuit • Faulty MAPS • Faulty PCM
Enable Conditions	Case 1	• No TPS Active Fault Present • Engine Running Time >10sec. • Engine Speed ≤ 2500rpm • Throttle Position ≤ 30%	
	Case 2	• No TPS Active Fault Present • Engine Running Time >10sec. • Engine Speed >2500rpm • Throttle Position ≤ 40%	
Threshold value		• MAP Signal >4.5V	
Diagnosis Time		• Contineous (More than 2.5 seconds failure for every 5 seconds test)	
MIL On Condition		• 2 Driving Cycle	

SIGNAL WAVEFORM AND DATA



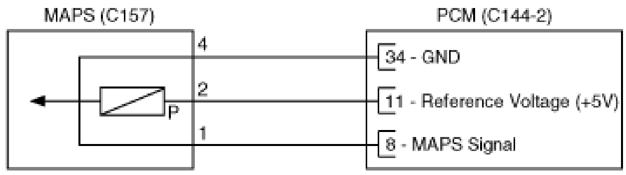
Comparing MAPS and TPS, The signals of MAPS and TPS increasess and decrease simultaneously.

SPECIFICATION

Pressure (kPa)	20	35	60	95	101.32
Voltage (V)	0.789	1.382	2.369	3.75	4
Tolerance (V)	± 0.045				

SCHEMATIC DIAGRAM

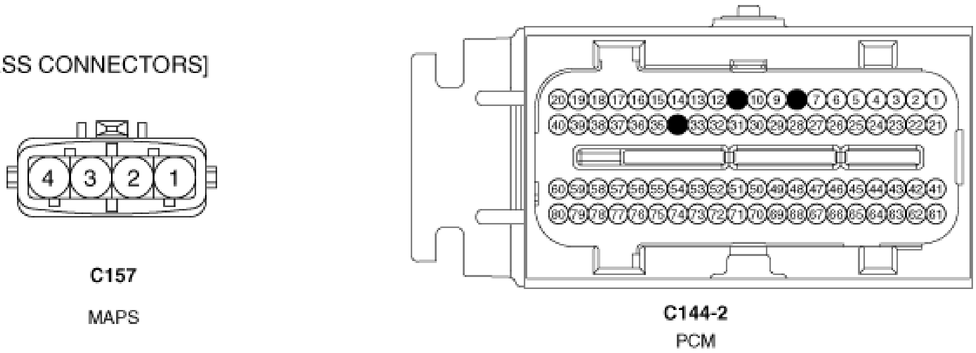
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

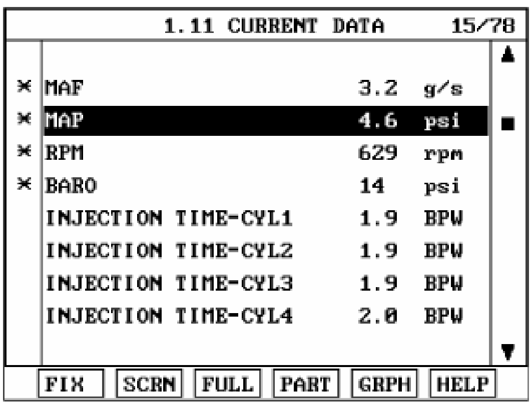
Terminal	Connected to	Funtion
1	PCM C144-2 (8)	MAPS Signal
2	PCM C144-2 (11)	Reference Voltage (+5V)
3	-	-
4	PCM C144-2 (34)	Sensor ground

[HARNESS CONNECTORS]

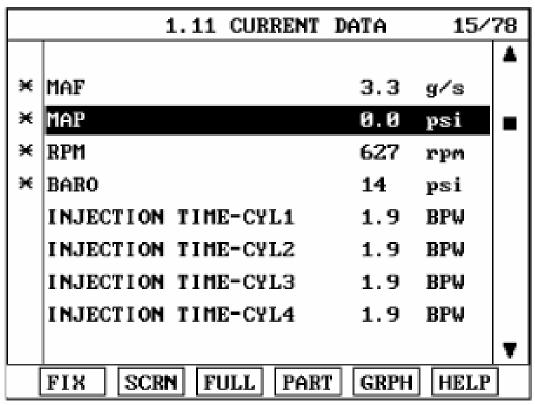


MONITOR SCANTOOL DATA

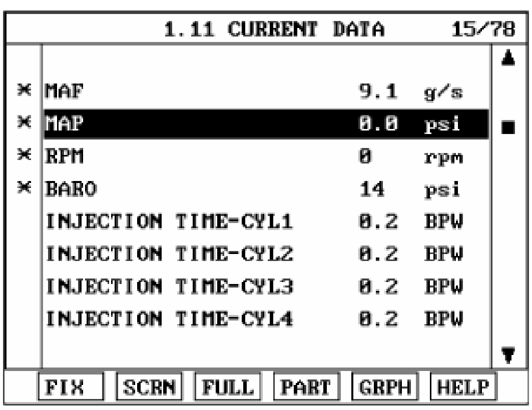
1. Connect scantool to Data Link Cable (DLC)
2. Warm up engine to normal operating temperature
3. Monitor "MAPS" parameter on the scantool.



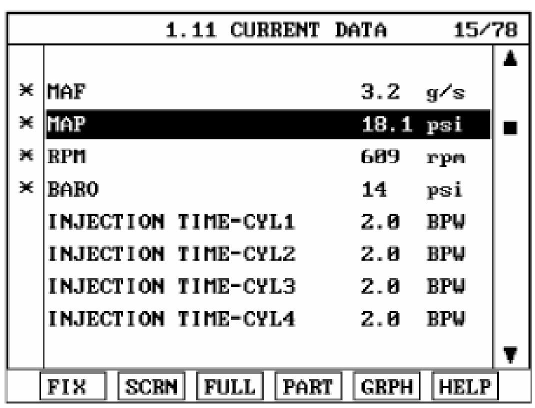
normal



open



short to ground



short to 5V line

4. Is the current data displayed correctly ?

YES

▸ Fault is intermittently caused by poor contact in the sensor and/or PCM connector or non cleared PCM memory after repair. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace if necessary and go to "Verification of vehicle Repair" .

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found ?

YES

▸ Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure

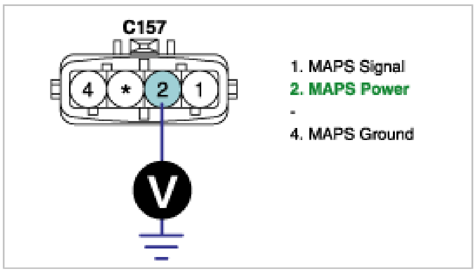
NO

▸ Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION

1. IG "OFF"
2. Disconnect MAPS connector
3. IG "ON"
4. Measure the voltage between terminal 2 of MAPS harness connector and ground.

Specification : Approx. 5V



5. Is the measured voltage within specification ?

YES

▸ Go to "Ground Circuit Inspection" procedure.

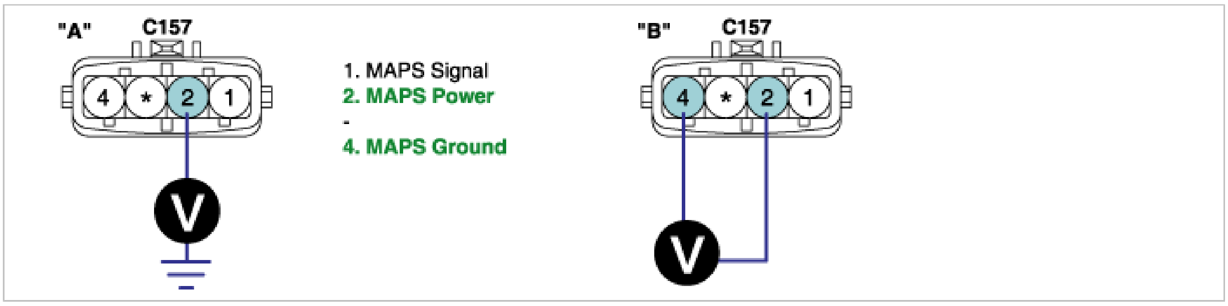
NO

▸ If the voltage is over 5.1V, check short to battery in harness.
▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF".
2. Disconnect MAPS connector.
3. IG "ON" & ENG "OFF"
4. Measure the voltage between terminal 2 of MAPS harness connector and chassis ground.
5. Measure the voltage between terminal 2 and 4 of MAPS harness connector.

Specification : "A" - "B" = : Approx. below 200mV



6. Is the measured voltage within specification ?

YES

▸ Go to "Signal Circuit Inspection" procedure.

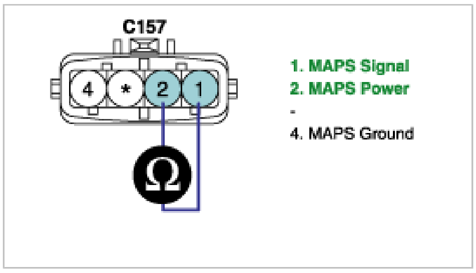
NO

▸ Repair contact reistance or open in harness and then go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. IG "OFF"
2. Disconnect MAPS and PCM connector.
3. Measure resistance between terminal 1 and 2 of MAPS harness connector.

Specification : Infinite



4. Is the measured resistance within specification ?

YES

▸ Go to "Component Inspection" procedure.

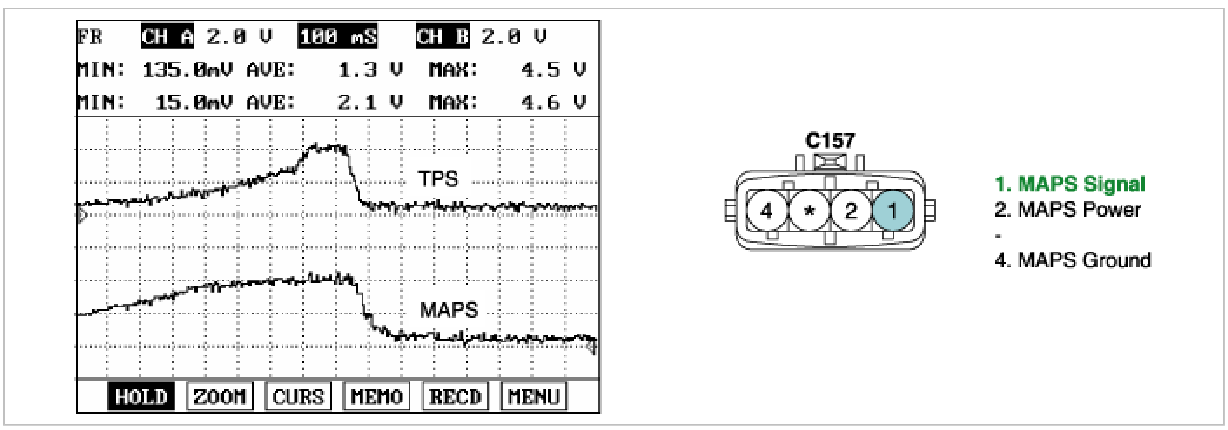
NO

▸ Repair contact reistance or open in harness and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. MAPS performance test
   (1) IG "OFF"
   (2) Connect scantool to Data Link Connector(DLC) and selest "Oscilloscope" then, connect probes to output signal lines of MAPS and TPS.Turn engine "ON" and monitor the waveforms accelerating or decelerating
   (3) ENG "ON" and monitor signal waveform during accelleration and decelleration.
   Specificaton :

Pressure (kPa)	20	35	60	95	101.32
Voltage (V)	0.789	1.382	2.369	3.75	4
Tolerance (V)	± 0.045				



   (4) Is the waveform displayed correctly?(Compare the response time of TPS and MAPS)

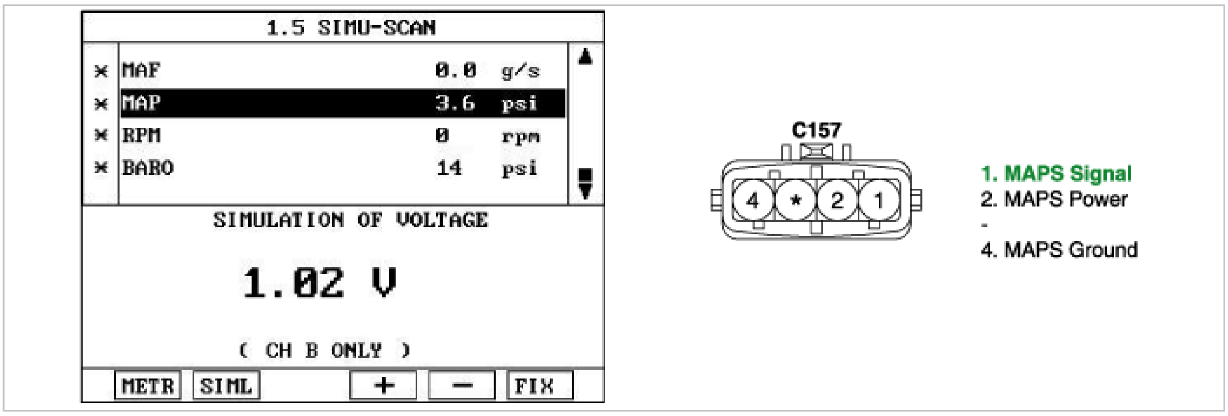
YES

▸ Go to "Check PCM".

NO

▸ After replacing MAPS with new one, if it operates normally, replace MAPS and go to "Verification of Vehicle Repair".

2. Check PCM
   (1) IG "OFF" disconnect MAPS connector
   (2) Connect Scantool and IG "ON" & ENG "OFF"
   (3) Select simulation function on scantool.
   (4) Simulate voltage at terminal 1 of MAPS harness connector.



   (5) Does the output voltage response to the change of signal by simulation?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

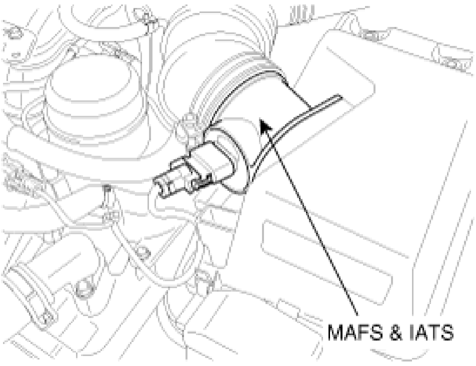
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0110

COMPONENT LOCATION



GENERAL DESCRIPTION

The Intake Air Temperature (IAT) sensor measures the temperature of engine intake air. The Intake Air Temperature (IAT) sensor is a thermistor (a variable resistor that changes along with outside air temperature) in series with a fixed resistor in the PCM. The PCM applies 5volts to the IAT sensor. The PCM monitors the voltage across the IAT sensor and converts it into a temperature reading. When the outside air temperature is cold the IAT sensor resistance is high, and when the outside air temperature is warm the IAT sensor resistance is low. Therefore, when the air temperature is cold the PCM will receive a high voltage input, and when the air temperature is warm the PCM will receive a low voltage input. The signal from IAT sensor is used for injection time correction (Cold post start correction), ignition angle correction(Air temperature correction) and idle speed correction(Air-density correction).

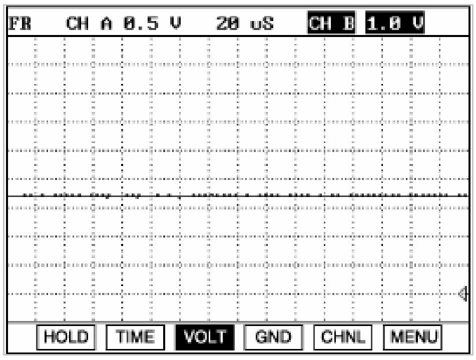
DTC DESCRIPTION

This test has two parts – the Stuck Start Test and the Stuck Drive test. The logic checks for movements in the IAT by comparing the min and max IAT values. If a sufficient difference is present, both parts of the test declare a PASS. Otherwise, the startup portion of the stuck test sets a “sensor stuck” flag and increments a counter while monitoring the min and max IAT. If the stuck condition persists, the counter eventually reaches its’ threshold and the startup test completes with the sensorstuck flag set.
If a PASS is not declared as mentioned above, the Drive portion of the stuck test also sets a “sensor stuck” flag and then checks for enough engine load to be present and if it is, it increments a counter. If the stuck condition persists and the engine continues to experience at least the minimum load, the counter eventually reaches its threshold indicating that enough engine heating as well as airflow introduction has taken place and sets a drive conditions complete flag. It then waits for the engine to return to idle. Once at idle, an idle counter is incremented until it reaches its threshold (as long as the stuck conditions persists). This completes the drive test and also the entire Stuck Test.
PCM monitors difference MAX. and MIN IATS in order to detect movement in IATS therough Start Test and Drive Test while enable condition is met. If PCM detects intake air temperature does not change PCM determines that a fault exists and a DTC is stored.
MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible cause
DTC Strategy	Case 1	• Start Test: Monitors the difference between max and min IAT in order to detect movement in IAT for a certain time.	• Poor connection • Open or short in harness • IATS • PCM
	Case 2	• Drive test: Performs the max and min delta check while driving under load for a length of time followed by an idle for a certain time.	
Enable Conditions		• Engine soaked time > 480min • Engine Running State • No disabling fault present • IAT stored previous trip • No IAT Tests pending	
Thresh old value	Case 1	• Max IAT - Min IAT ≤ 1°C • Start Test Counter ≥ 120	
	Case 2	• Max IAT - Min IAT ≤ 1°C • Idle Test Counter ≥ 120	
MIL On Condition		• 2 driving Cycles	

SIGNAL WAVEFORM AND DATA

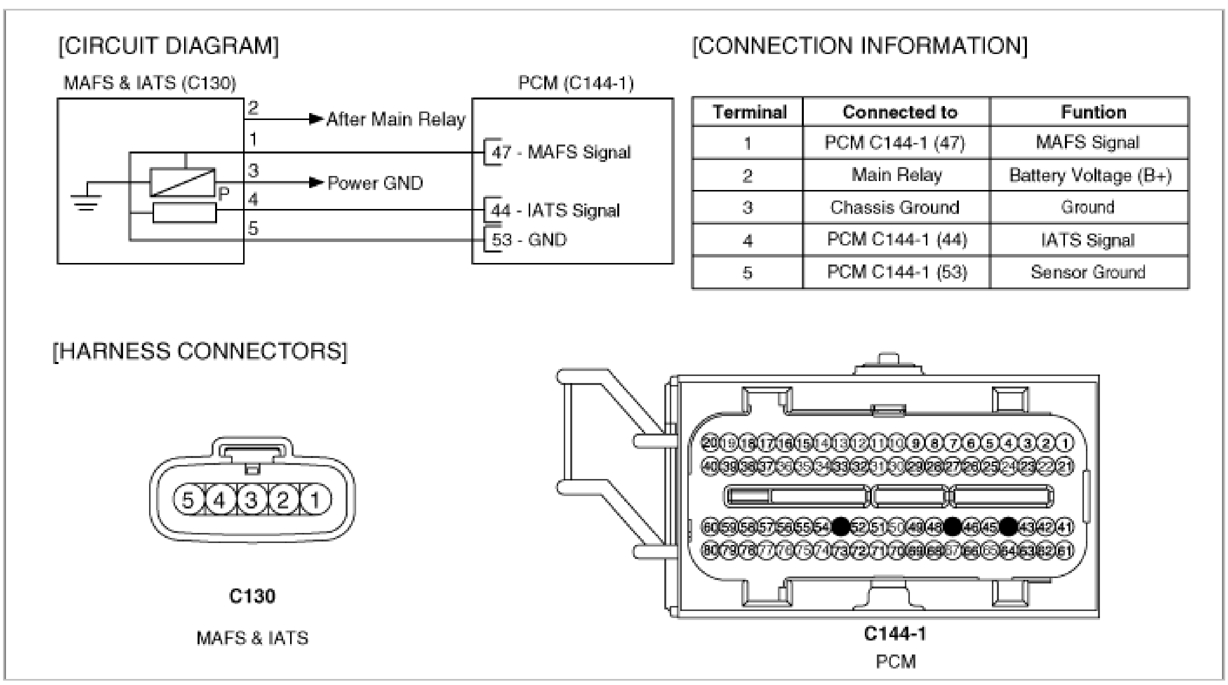


The output signals of IATS & ECTS change smoothly without any rapid changes. Those have almost same characteristic signal during the early period after start. It means that the temperatures of intake air and engine coolant are depended on the temperature of atmosphere. Meanwhile, during the warming up, the output signal of ECTS is going up increasingly. but, the output signal of IATS changes a little bit. even it may not change almost. It means that the heat of engine does not affect on the temperature of intake air.

SPECIFICATION

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	95.95 ~ 105.78	20(68)	3.42 ~ 3.61
-20(-4)	27.4 ~ 29.77	40(104)	1.43 ~ 1.5
0(32)	9.08 ~ 9.72	60(140)	0.66 ~ 0.69
10(50)	5.49 ~ 5.83	80(176)	0.33 ~ 0.34

SCHEMATIC DIAGRAM



MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "IATS" item on the service data.

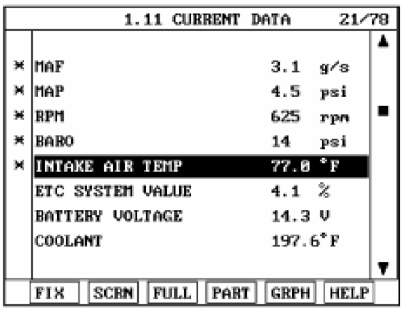


Fig. 1

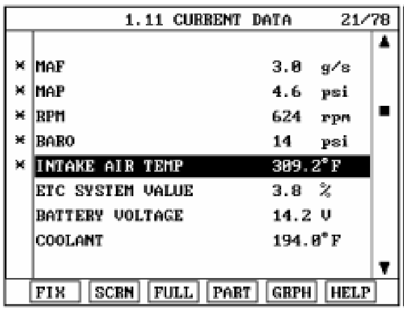


Fig. 2

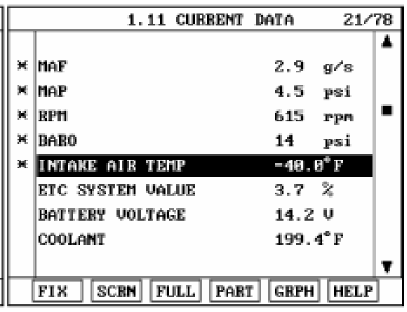


Fig. 3

Fig. 1 : Open at idle
Fig. 2 : Short to ground
Fig. 3 : Short to battery

4. Is the "IATS" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found ?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

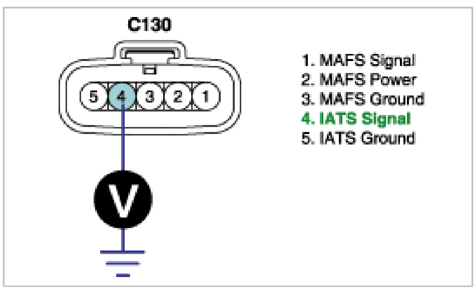
NO

▸ Go to " Signal Circuit Inspection " procedure.

SIGNAL CIRCUIT INSPECTION

1. IG "OFF" and disconnect IATS connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 4 of IATS harness connector and chassis ground.

Specification : Approx. 5V



4. Is the measured voltage within specification ?

YES

▸ Check short to battery in harness.
▸ If O.K, go to "Ground Circuit Inspection" procedure.
▸ If N.G, repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

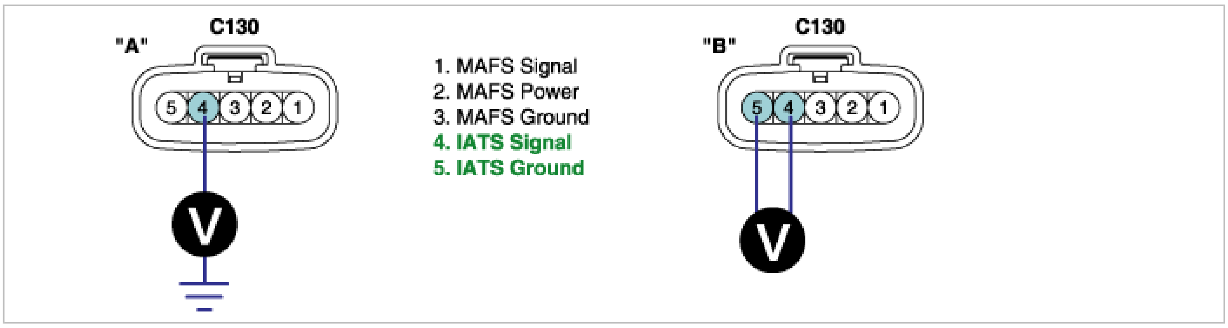
NO

▸ Repair open or short to ground in harness and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF" and disconnect IATS connector.
2. Measure voltage terminal 4 of IATS harness connector and chassis ground.
3. Measure voltage terminal 4 and 5 of IATS harness connector.

Specification : Voltage difference between measurement "A" and "B" is below 200mV.



4. Is the measured voltage within specification ?

YES

▸ Go to "Component Inspection" procedure.

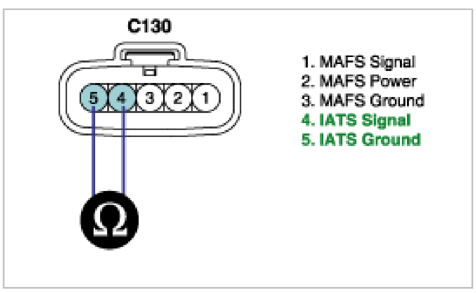
NO

▸ Repair contact resistance or open in harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check resistance of IATS
   (1) IG "OFF" and disconnect IATS connector.
   (2) Measure resistance between terminal 4 and 5 of IATS connector.(Component Side)
   Specificaton :

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	95.95 ~ 105.78	20(68)	3.42 ~ 3.61
-20(-4)	27.4 ~ 29.77	40(104)	1.43 ~ 1.5
0(32)	9.08 ~ 9.72	60(140)	0.66 ~ 0.69
10(50)	5.49 ~ 5.83	80(176)	0.33 ~ 0.34



   (3) Is the measured resistance within specification ?

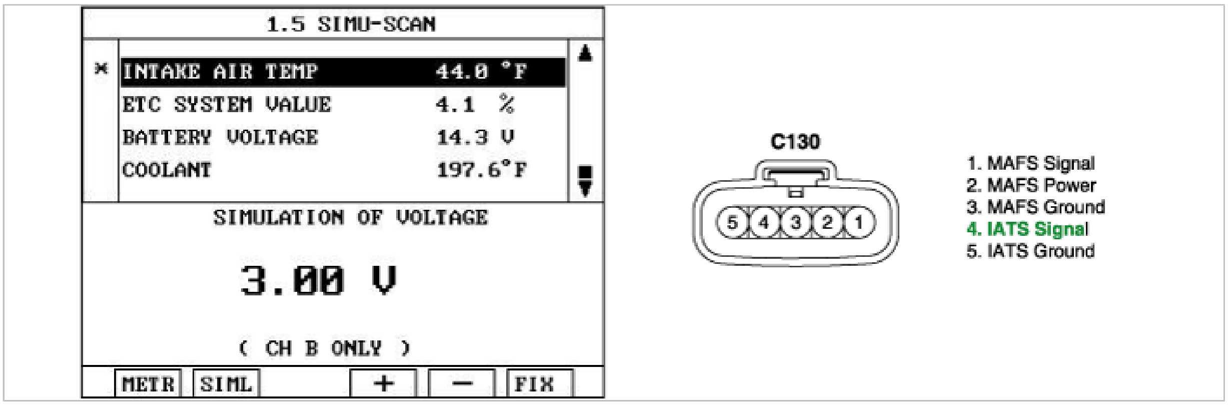
YES

▸ Go to "Check PCM" as follows.

NO

▸ Substitute with a known - good IATS and check for proper operation. If the problem is corrected, replace IATS and go to "Verification of Vehicle Repair" procedure.

2. Check PCM
   (1) IG "OFF" and connect scantool.
   (2) Disconnect IATS connector and connect probe to terminal 4 of IATS harness connector.
   (3) IG "ON" and ENG "OFF" and simulation Function on scantool.
   (4) Simulate voltage at terminal 4 of IATS harness connector.



(5) Does the signal value of IAT sensor change according to simulation voltage ?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

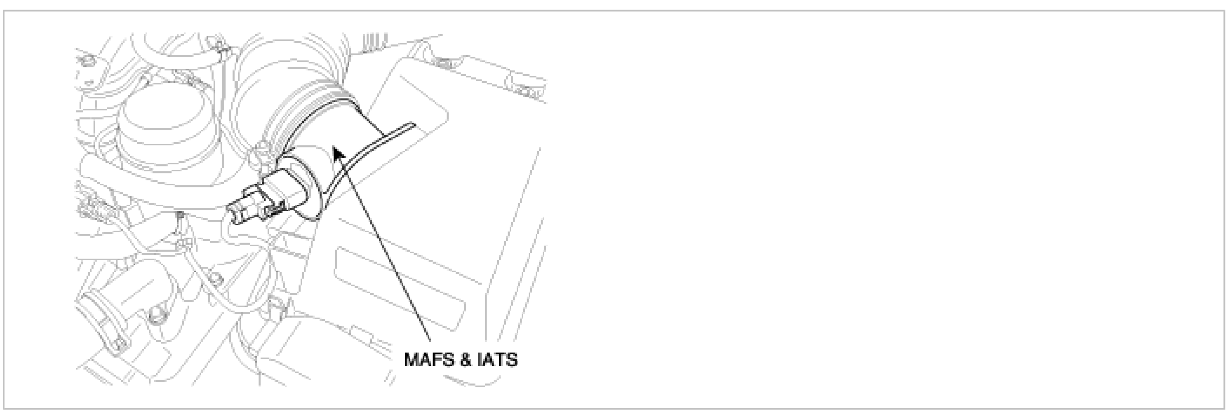
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0111

COMPONENT LOCATION



GENERAL DESCRIPTION

The Intake Air Temperature (IAT) sensor measures the temperature of engine intake air. The Intake Air Temperature (IAT) sensor is a thermistor (a variable resistor that changes along with outside air temperature) in series with a fixed resistor in the PCM. The

PCM applies 5volts to the IAT sensor. The PCM monitors the voltage across the IAT sensor and converts it into a temperature reading. When the outside air temperature is cold the IAT sensor resistance is high, and when the outside air temperature is warm the IAT sensor resistance is low. Therefore, when the air temperature is cold the PCM will receive a high voltage input, and when the air temperature is warm the PCM will receive a low voltage input. The signal from IAT sensor is used for injection time correction (Cold post start correction), ignition angle correction(Air temperature correction) and idle speed correction(Air-density correction).

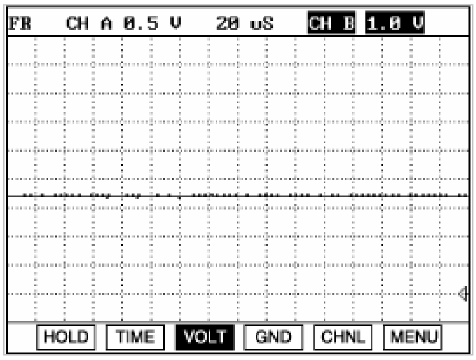
DTC DESCRIPTION

Determine if the IAT sensor reading is skewed high or low. As in the stuck test, the IAT sensor is exposed to conditions such as ample airflow introduction and engine heating that enhance the possibility of ambient temperature change. That helps the diagnostic in its' analysis
A skewed condition is suspected only if the IAT at startup differs from the coolant temperature by a minimum threshold on either the high or the low side. If it does not, the skew test declares a PASS.Otherwise, if IAT & ECT and the coolant temperature is greater than an allowed minimum, the Skew Low Test is executed. This test checks for enough engine load to be present and introduces a delay as long as the skewed condition persists. This allows sufficient airflow introduction and engine heating, and also allows time for the IAT reading to stabilize. If at any time during this delay the absolute difference between the startup and current IAT exceeds a maximum allowed value (drift check), no reporting is done and the test is disabled (case of vehicle being driven out of a heated garage in to a colder ambience, etc.). Otherwise, once the delay period is over, a fail counter isincremented and as it reaches its threshold, the low test completes and indicates a failure.On the other hand if a passing condition is not present and IAT & ECT, the Skew High Test is called. This test checks for enough engine load to be present and introduces a delay as long as the skewed condition persists. This allows sufficient airflow introduction and engine heating and also allows time for the IAT reading to stabilize. If at any time during this delay the absolute difference between the startup and current IAT exceeds a maximum allowed value (drift check), no reporting is done and the test is disabled (case of vehicle being driven out of an air conditioned garage into a warmer ambience, etc.). Once the delay period is over and the IAT is greater than a minimum threshold, a fail counter is incremented and as it reaches its threshold, the high test completes and indicates a failure. But if the IAT is less than this threshold, no reporting is done and test is disabled (again protection against case of vehicle being driven out of an air conditioned garage into a warmer ambience and setting a false MIL).
PCM monitors difference MAX. and MIN IATS in order to detect movement in IATS therough Start Test and Drive Test while enable condition is met. If PCM detects intake air temperature does not change PCM determines that a fault exists and a DTC is stored. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

DTC DETECTING CONDITION

Item		Detection condition	Possible cause
DTC Strategy	Case 1	• Skew Low Test: Monitors the difference between the startup coolant and IAT values	• Poor Connection • Open or short in harness • IATS • PCM
	Case 2	• Skew High Test: Monitors the difference between the startup IAT and coolant values	
EnableConditions	Case 1	• Engine soaked time ≥ 480min • Engine running state • No disabling faults present • IAT stored previous trip • IAT Skewed Test Not Complete • Startup Coolant Temperature >-20°C • Airflow >15 g/s • Vehicle speed >40kph	
	Case 2	• Engine soaked time ≥ 480min • Engine running state • No disabling faults present • IAT stored previous trip • IAT Skewed Test Not Complete • Airflow >15 g/s • Vehicle speed >40kph	
Threshold value	Case 1	• Startup Coolant - Startup IAT ≥ 30°C	
	Case 2	• Startup IAT - Startup Coolant ≥ 20°C	
Diagnosis Time		• Continuous (More than 1.25 second failure)	
MIL On Condition		• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA

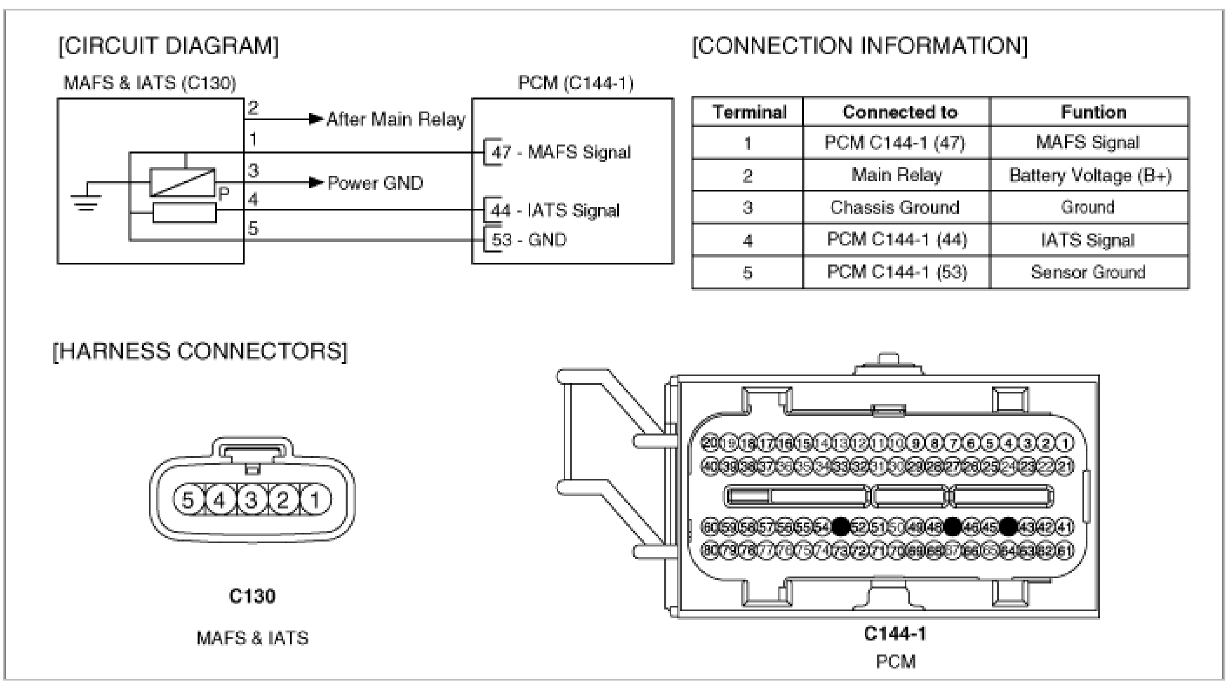


The output signals of IATS & ECTS change smoothly without any rapid changes. Those have almost same characteristic signal during the early period after start. It means that the temperatures of intake air and engine coolant are depended on the temperature of atmosphere. Meanwhile, during the warming up, the output signal of ECTS is going up increasingly. but, the output signal of IATS changes a little bit. even it may not change almost. It means that the heat of engine does not affect on the temperature of intake air.

SPECIFICATION

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	95.95 ~ 105.78	20(68)	3.42 ~ 3.61
-20(-4)	27.4 ~ 29.77	40(104)	1.43 ~ 1.5
0(32)	9.08 ~ 9.72	60(140)	0.66 ~ 0.69
10(50)	5.49 ~ 5.83	80(176)	0.33 ~ 0.34

SCHEMATIC DIAGRAM



Terminal	Connected to	Funtion
1	PCM C144-1 (47)	MAFS Signal
2	Main Relay	Battery Voltage (B+)
3	Chassis Ground	Ground
4	PCM C144-1 (44)	IATS Signal
5	PCM C144-1 (53)	Sensor Ground

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "IATS" item on the service data.

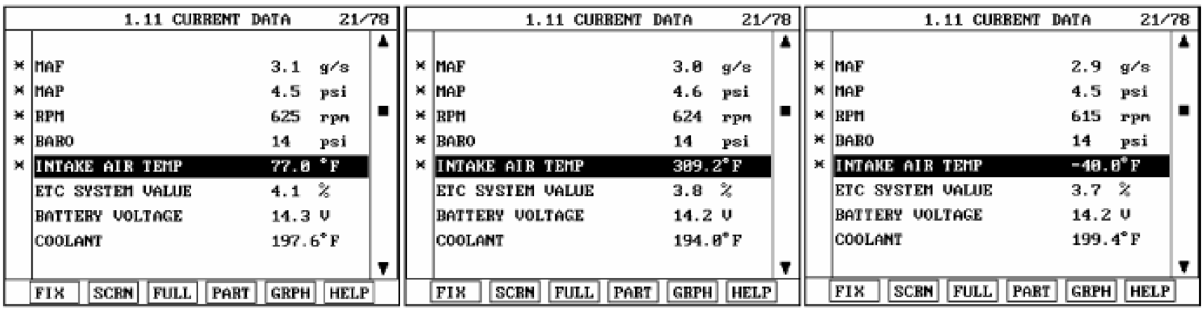


Fig. 1 Fig. 2 Fig. 3

Fig. 1 : Open at idle
Fig. 2 : Short to ground
Fig. 3 : Short to battery

4. Is the "IATS" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal & Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found ?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

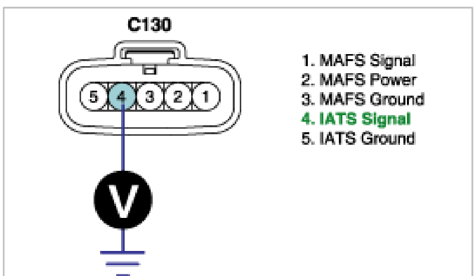
NO

▸ Go to "Terminaal and connector inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. IG "OFF" and disconnect IATS connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 4 of IATS harness connector and chassis ground.

Specification : Approx. 5V



4. Is the measured voltage within specification ?

YES

▸ Check short to battery in harness.
▸ If O.K, go to "Ground Circuit Inspection" procedure.
▸ If N.G, repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

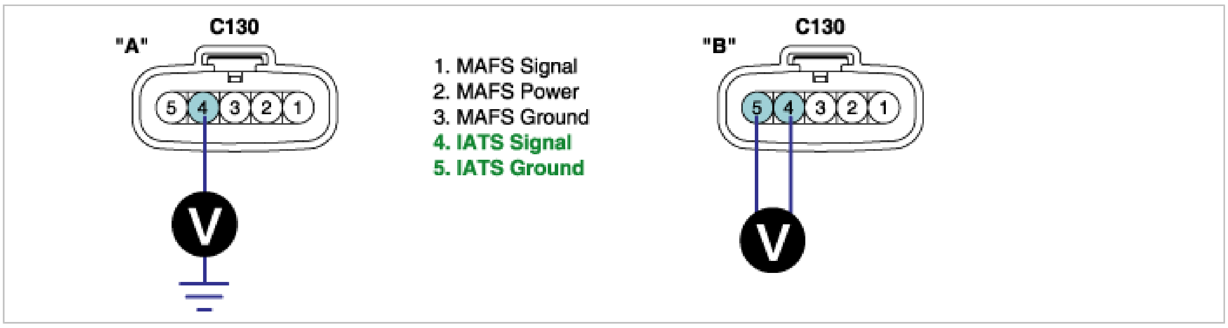
NO

▸ Repair open or short to ground in harness and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF" and disconnect IATS connector.
2. Measure voltage terminal 4 of IATS harness connector and chassis ground.
3. Measure voltage terminal 4 and 5 of IATS harness connector.

Specification : Voltage difference between measurement "A" and "B" is below 200mV.



4. Is the measured voltage within specification ?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair contact resistance or open in harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check resistance of IATS
   (1) IG "OFF" and disconnect IATS connector.

   (2) Measure resistance between terminal 4 and 5 of IATS connector.(Component Side)

   Specificaton :

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	95.95 ~ 105.78	20(68)	3.42 ~ 3.61
-20(-4)	27.4 ~ 29.77	40(104)	1.43 ~ 1.5
0(32)	9.08 ~ 9.72	60(140)	0.66 ~ 0.69
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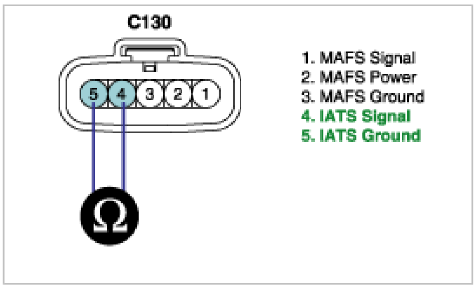


   (3) Is the measured resistance within specification ?

   YES

   ▸ Go to "Check PCM" as follows.

   NO

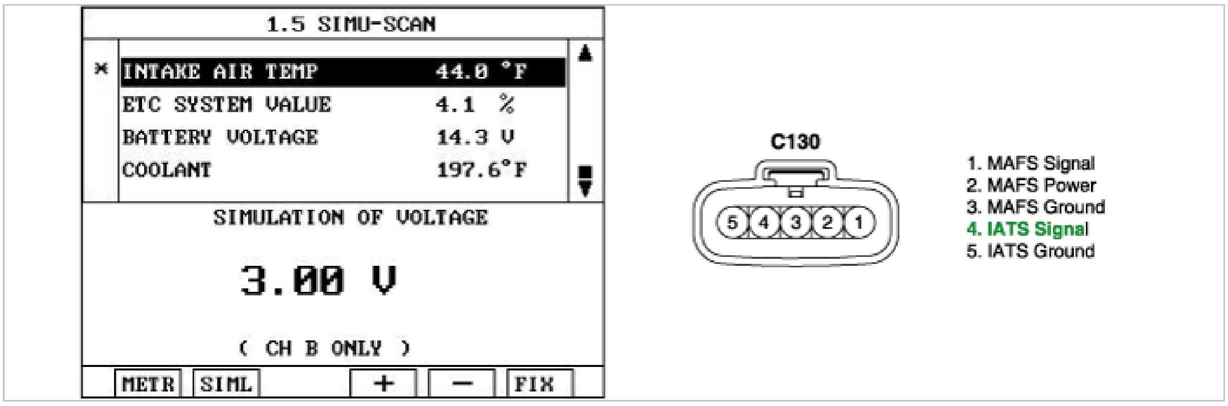
   ▸ Substitute with a known - good IATS and check for proper operation. If the problem is corrected, replace IATS and go to "Verification of Vehicle Repair" procedure.

2. Check PCM
   (1) IG "OFF" and connect scantool.

   (2) Disconnect IATS connector and connect probe to terminal 4 of IATS harness connector.

   (3) IG "ON" and ENG "OFF" and simulation Function on scantool.

   (4) Simulate voltage at terminal 4 of IATS harness connector.



(5) Does the signal value of IAT sensor change according to simulation voltage ?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

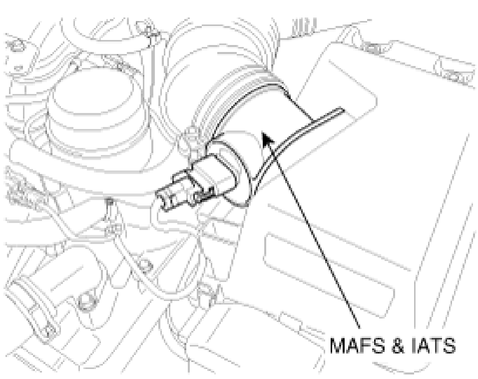
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0112

COMPONENT LOCATION



GENERAL DESCRIPTION

The Intake Air Temperature (IAT) sensor measures the temperature of engine intake air. The Intake Air Temperature (IAT) sensor is a thermistor (a variable resistor that changes along with outside air temperature) in series with a fixed resistor in the PCM. The PCM applies 5volts to the IAT sensor. The PCM monitors the voltage across the IAT sensor and converts it into a temperature reading. When the outside air temperature is cold the IAT sensor resistance is high, and when the outside air temperature is warm the IAT sensor resistance is low. Therefore, when the air temperature is cold the PCM will receive a high voltage input, and when the air temperature is warm the PCM will receive a low voltage input. The signal from IAT sensor is used for injection time correction (Cold post start correction), ignition angle correction(Air temperature correction) and idle speed correction(Air-density correction).

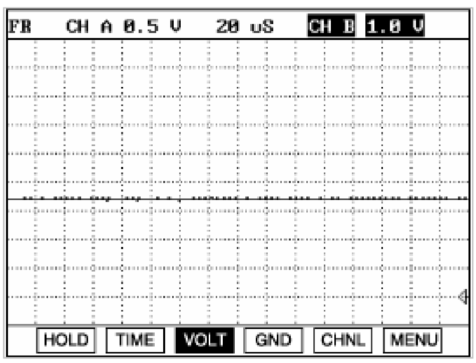
DTC DESCRIPTION

Checking output signals of IATS every 20 sec. under detecting condition, if an ouput signal is below 0.1V for more than 10 sec., PCM sets P0112. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible Cause
DTC Strategy		• This code detects a continuous short to ground in either the signal circuit or the sensor	• Poor connection • Short to ground in harness • IATS • PCM
EnableConditions	Case 1	• Engine running state • No Vehicle speed sensor fault • Vehicle speed >50kph(30mph)	
	Case 2	• Engine running time >120 sec. • Time from IG "OFF" to IG "ON" >360 min.	
Threshold value		• Intake air temperature sensor's voltage< 0.1V	
Diagnosis Time		• Continuous (More than 10 seconds failure for every 20 seconds test)	
MIL On Condition		• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA



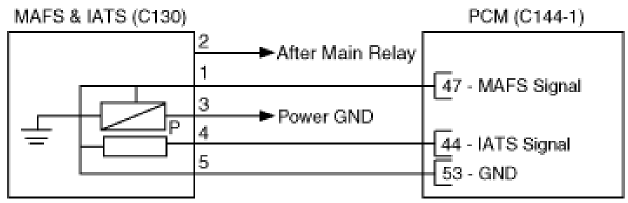
The output signals of IATS & ECTS change smoothly without any rapid changes. Those have almost same characteristic signal during the early period after start. It means that the temperatures of intake air and engine coolant are depended on the temperature of atmosphere. Meanwhile, during the warming up, the output signal of ECTS is going up increasingly. but, the output signal of IATS changes a little bit. even it may not change almost. It means that the heat of engine does not affect on the temperature of intake air.

SPECIFICATION

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	95.95 ~ 105.78	20(68)	3.42 ~ 3.61
-20(-4)	27.4 ~ 29.77	40(104)	1.43 ~ 1.5
0(32)	9.08 ~ 9.72	60(140)	0.66 ~ 0.69
10(50)	5.49 ~ 5.83	80(176)	0.33 ~ 0.34

SCHEMATIC DIAGRAM

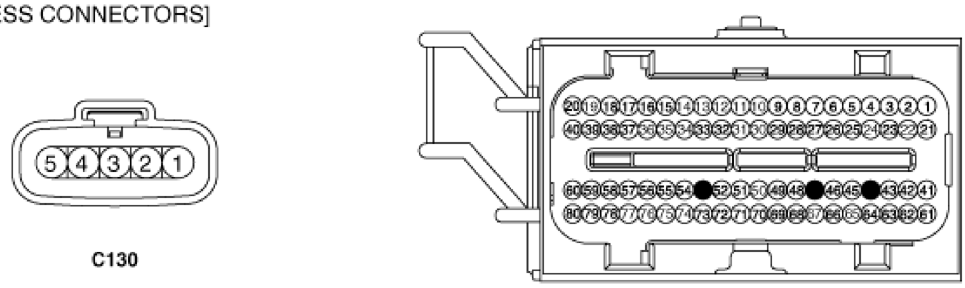
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Funtion
1	PCM C144-1 (47)	MAFS Signal
2	Main Relay	Battery Voltage (B+)
3	Chassis Ground	Ground
4	PCM C144-1 (44)	IATS Signal
5	PCM C144-1 (53)	Sensor Ground

[HARNESS CONNECTORS]



C130

MAFS & IATS

C144-1

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "IATS" item on the service data.

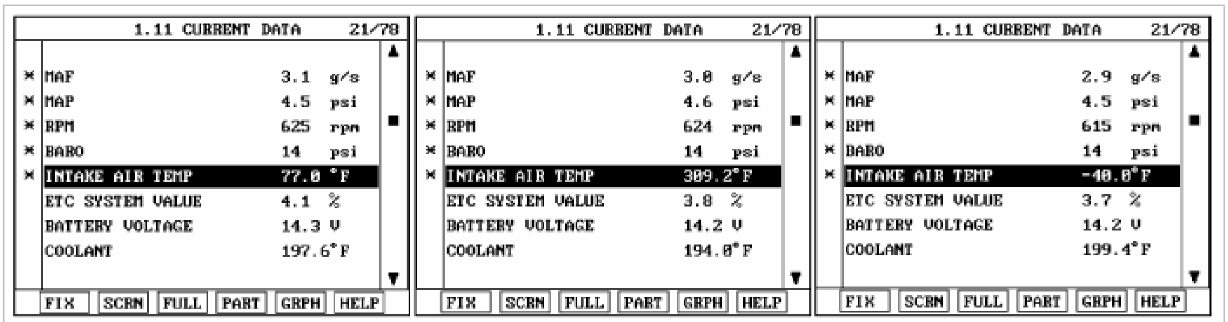


Fig. 1 Fig. 2 Fig. 3

Fig. 1 : Open at idle
Fig. 2 : Short to ground
Fig. 3 : Short to battery

4. Is the "IATS" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

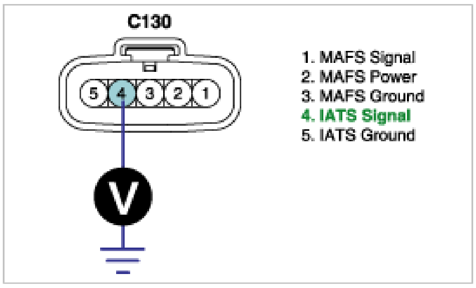
NO

▸ Go to " Signal Circuit Inspection " procedure.

SIGNAL CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF" and disconnect IATS connector.
   (2) IG "ON" and ENG "OFF"
   (3) Measure voltage between terminal 4 of IATS harness connector and chassis ground.

Specification : Approx. 5V



   (4) Is the measured voltage within specification ?

YES

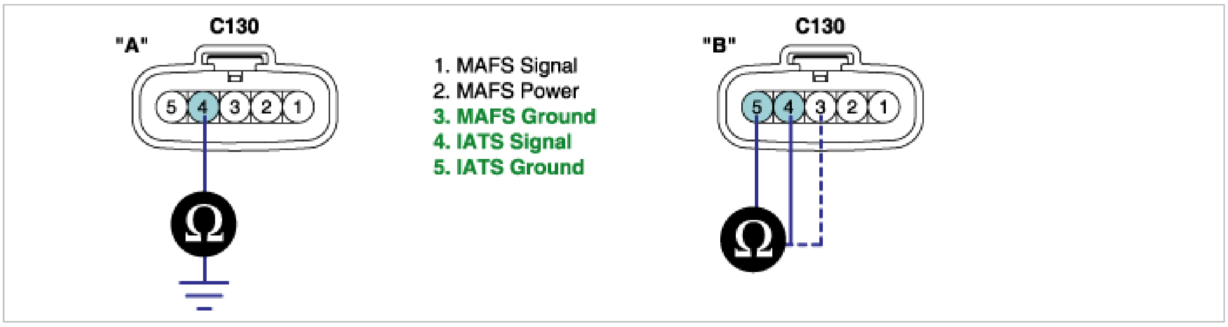
▸ Go to "Component Inspection" procedure.

NO

▸ Go to " Check short to ground in harness" procedure.

2. Check short to ground in harness
   (1) IG "OFF" and disconnect IATS connector and PCM connector.
   (2) Measure resistance between terminal 4 of IATS harness connector and chassis ground.
   (3) Measure resistance between terminals 4 and 5 of IATS harness connector.
   (4) Measure resistance between terminals 4 and 3 of IATS harness connector.

Specification : Infinite



   (5) Is the measured resistance within specification?

YES

▸ Go to "Component inspection" procedure.

NO

▸ Repair short to ground in harness and go to "Verification of Vehicle Repair" procedure.

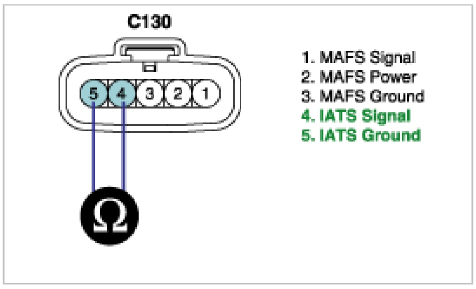
COMPONENT INSPECTION

1. Check IATS
   (1) IG "OFF" and disconnect IATS connector.
   (2) Measure resistance between teminals 4 and 5 of IATS connector.(Component side)

Specificaton :

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	95.95 ~ 105.78	20(68)	3.42 ~ 3.61

-20(-4)	27.4 ~ 29.77	40(104)	1.43 ~ 1.5
0(32)	9.08 ~ 9.72	60(140)	0.66 ~ 0.69
10(50)	5.49 ~ 5.83	80(176)	0.33 ~ 0.34



(3) Is the measured resistance within specification ?

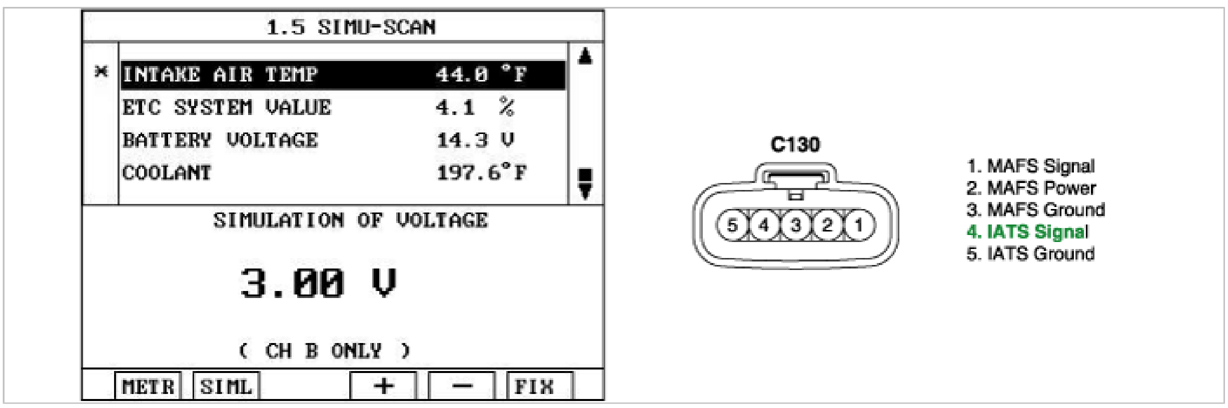
YES

▶ Go to "Check PCM" as follows.

NO

▶ Substitute with a known - good IATS and check for proper operation. If the problem is corrected, replace IATS and go to "Verification of Vehicle Repair" procedure.

2. Check PCM
   (1) IG "OFF" and connect scantool.
   (2) Disconnect IATS connector and connect probe to terminal 4 of IATS harness connector.
   (3) IG "ON" and ENG "OFF" and simulation Function on scantool.
   (4) Simulate voltage at terminal 4 of IATS harness connector.



(5) Does the signal value of IAT sensor change according to simulation voltage ?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "

5. Are any DTCs present ?

YES

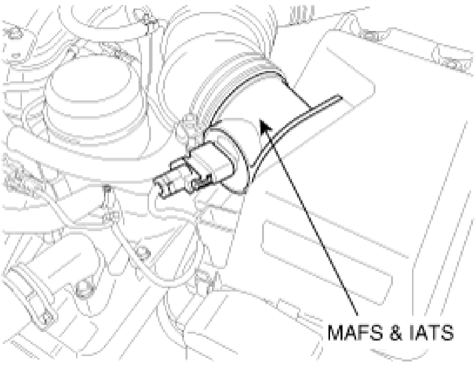
▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

Fuel System > Troubleshooting > P0113

COMPONENT LOCATION



GENERAL DESCRIPTION

The Intake Air Temperature (IAT) sensor measures the temperature of engine intake air. The Intake Air Temperature (IAT) sensor is a thermistor (a variable resistor that changes along with outside air temperature) in series with a fixed resistor in the PCM. The PCM applies 5volts to the IAT sensor. The PCM monitors the voltage across the IAT sensor and converts it into a temperature reading. When the outside air temperature is cold the IAT sensor resistance is high, and when the outside air temperature is warm the IAT sensor resistance is low. Therefore, when the air temperature is cold the PCM will receive a high voltage input, and when the air temperature is warm the PCM will receive a low voltage input. The signal from IAT sensor is used for injection time correction (Cold post start correction), ignition angle correction(Air temperature correction) and idle speed correction(Air-density correction).

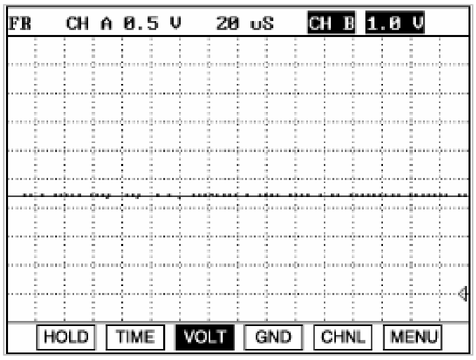
DTC DESCRIPTION

Checking output signals of IATS every 20 sec. under detecting condition, if an ouput signal is over 4.9V for more than 10 sec., PCM sets P0113. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• This code detects a continuous short to high in either the signal circuit or the sensor	• Poor connection • Open or short to battery in harness • Open in ground harness • IATS • PCM
Enable Conditions	• Engine running state • No Vehicle speed sensor fault • No ECTS fault • No MAFS fault • Intake airflow< 15 g/s • Vehicle speed< 25kph(9.3mph) • Engine coolant temperature >50°C(122°F)	
Threshold value	• Intake air temperature sensor's voltage >4.9V	
Diagnosis Time	• Continuous (More than 10 seconds failure for every 20 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA

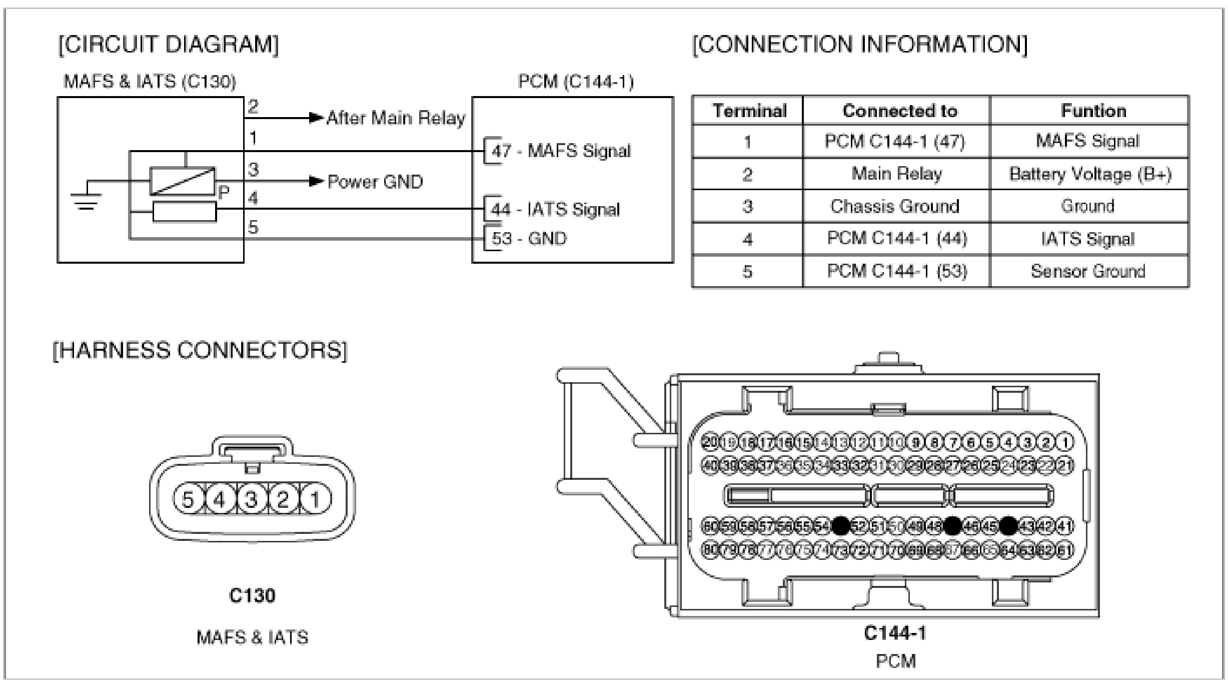


The output signals of IATS & ECTS change smoothly without any rapid changes. Those have almost same characteristic signal during the early period after start. It means that the temperatures of intake air and engine coolant are depended on the temperature of atmosphere. Meanwhile, during the warming up, the output signal of ECTS is going up increasingly. but, the output signal of IATS changes a little bit. even it may not change almost. It means that the heat of engine does not affect on the temperature of intake air.

SPECIFICATION

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	95.95 ~ 105.78	20(68)	3.42 ~ 3.61
-20(-4)	27.4 ~ 29.77	40(104)	1.43 ~ 1.5
0(32)	9.08 ~ 9.72	60(140)	0.66 ~ 0.69
10(50)	5.49 ~ 5.83	80(176)	0.33 ~ 0.34

SCHEMATIC DIAGRAM



MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "IATS" item on the service data.

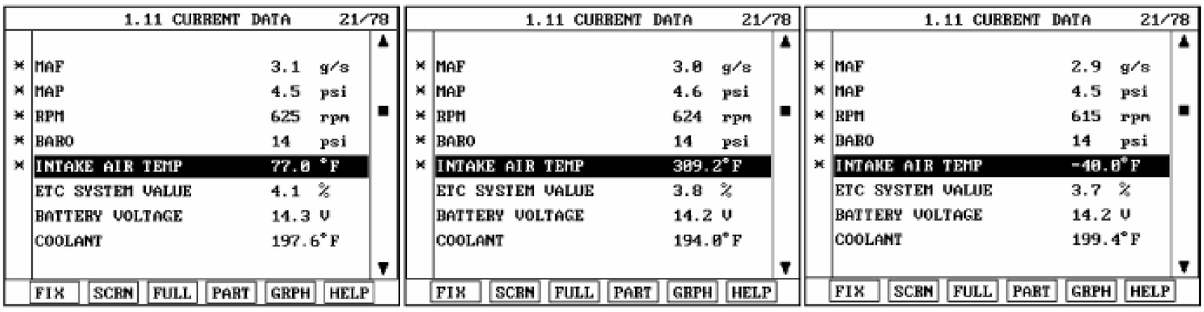


Fig. 1 Fig. 2 Fig. 3

Fig. 1 : Open at idle
Fig. 2 : Short to ground
Fig. 3 : Short to battery

4. Is the "IATS" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

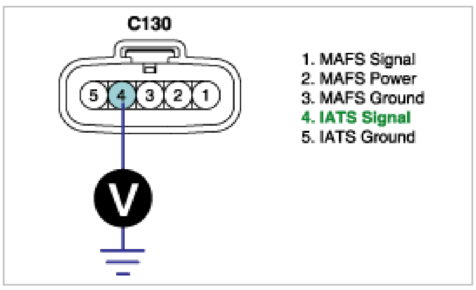
1. Check voltage

(1) IG "OFF" and disconnect IATS connector.

(2) IG "ON" and ENG "OFF"

(3) Measure voltage between terminal 4 of IATS harness connector and chassis ground.

Specification : Approx. 5V



(4) Is the measured voltage within specification ?

YES

▸ Go to "Ground Circuit Inspection" procedure.

NO

▸ If the voltage is 0V, go to "Check open in harness" as follows. If the voltage is more than 5.1V, go to "Check short to battery in harness" as follows.

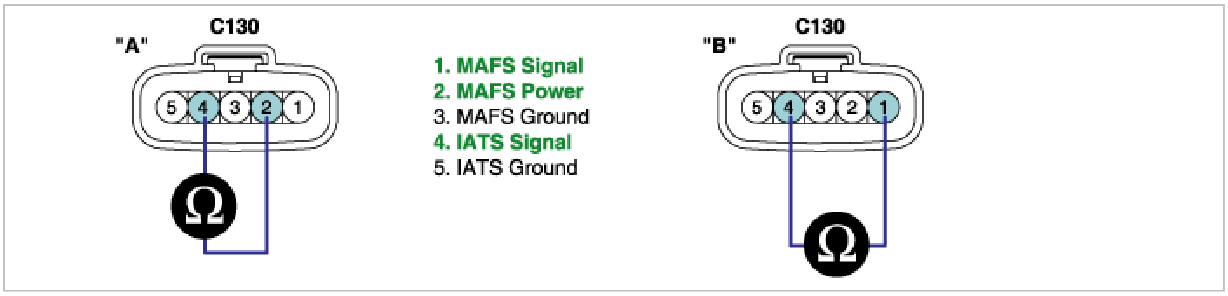
2. Check short to battery in harness

(1) IG "OFF" and disconnect IATS connector and PCM connector.

(2) Measure resistance between terminals 2 and 4 of IATS harness connector.

(3) Measure resistance between terminals 1 and 4 of IATS harness connector.

Specification : Infinite



(4) Is the measured resistance within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

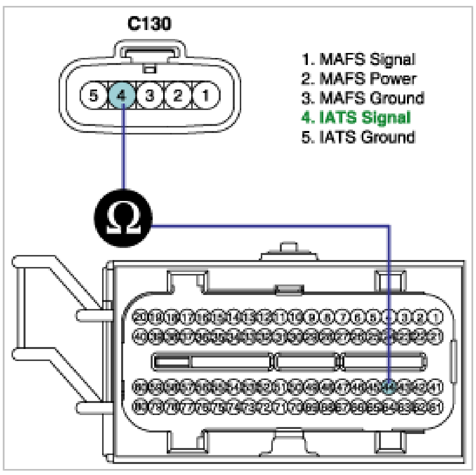
▸ Repair short to battery in harness and go to "Verification of Vehicle Repair" procedure.

3. Check open in harness

(1) IG "OFF" and disconnect IATS connector and PCM connctor.

(2) Measure resistance between terminal 4 of IATS harness connector and 44 of PCM harness connector.

Specification : below 1Ω



(3) Is the measured resistance within specification?

YES

▸ Go to "Ground Circuit Inspection" procedure.

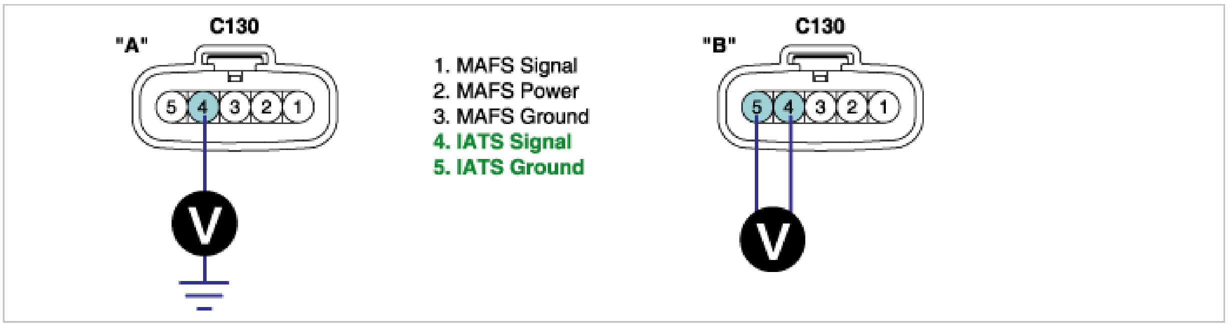
NO

▸ Repair open in harness and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF" and disconnect IATS connector.
2. Measure voltage between terminal 4 of IATS harness connector and chassis ground.
3. Measure voltage between terminals 4 and 5 of IATS harness connector.

Specification : Voltage difference between measurement "A" and "B" is below 200mV.



4. Is the measured voltage within specification ?

YES

▸ Go to "Component Inspection" procedure.

NO

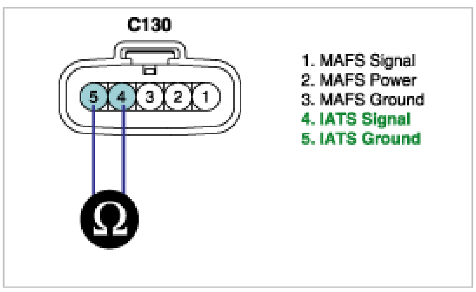
▸ Repair contact resistance or open in harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check IATS
   (1) IG "OFF" and disconnect IATS connector.

   (2) Measure resistance between teminals 4 and 5 of IATS connector.(Component side)
   Specificaton :

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	95.95 ~ 105.78	20(68)	3.42 ~ 3.61
-20(-4)	27.4 ~ 29.77	40(104)	1.43 ~ 1.5
0(32)	9.08 ~ 9.72	60(140)	0.66 ~ 0.69
10(50)	5.49 ~ 5.83	80(176)	0.33 ~ 0.34



   (3) Is the measured resistance within specification ?

YES

▸ Go to "Check PCM" as follows.

NO

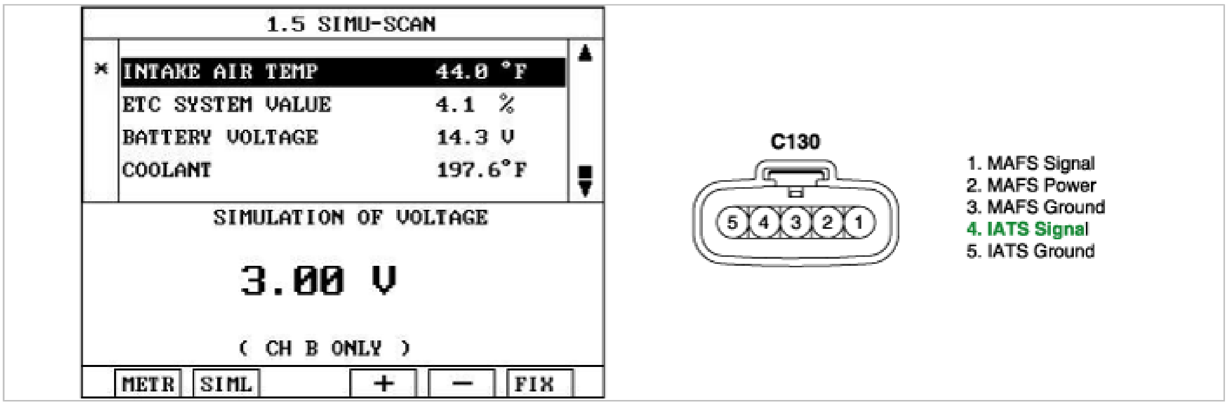
▸ Substitute with a known - good IATS and check for proper operation. If the problem is corrected, replace IATS and go to "Verification of Vehicle Repair" procedure.

2. Check PCM
   (1) IG "OFF" and connect scantool.

   (2) Disconnect IATS connector and connect probe to terminal 4 of IATS harness connector.

   (3) IG "ON" and ENG "OFF" and simulation Function on scantool.

   (4) Simulate voltage at terminal 4 of IATS harness connector.



(5) Does the signal value of IAT sensor change according to simulation voltage ?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

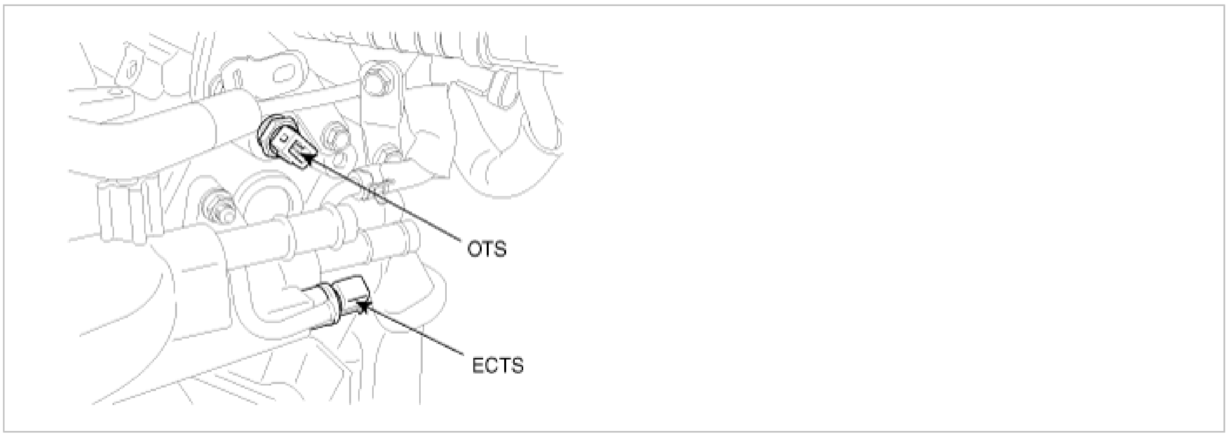
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0115

COMPONENT LOCATION



GENERAL DESCRIPTION

The Engine Coolant Temperature(ECT) Sensor measures the temperature of engine coolant. The Engine Coolant Temperature

(ECT) Sensor is located near the thermostat housing of the cylinder head. ECT Sensor is a thermistor (A Variable Resistor that Changes Along with ECT) in series with a fixed resistor in the Engine Control Module (PCM). The PCM applies 5 volts to the ECT sensor. The PCM monitors the voltage across the ECT sensor and converts it into a temperature reading. When the engine is cold the ECT sensor resistance is high, and when the engine is warm the ECT sensor resistance is low. Therefore, when the engine is cold the PCM will receive a high voltage input, and when the engine is warm the PCM will receive a low voltage input. The signal from ECT sensor is used for Injection, ignition timing, idle speed and cooling fan control.

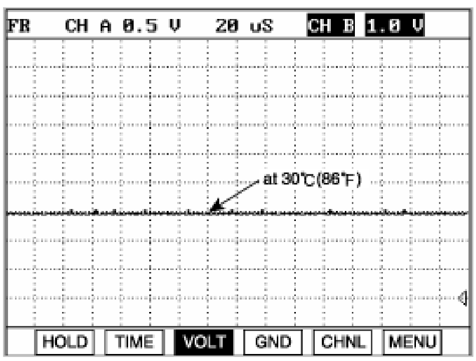
DTC DESCRIPTION

Failure mode is the coolant sensor output stuck. When this failure mode occurs, no change is observed in the ECT Sensor reading, even though the engine may be warming up from a cold start. It calculates the difference between the startup and current coolant temperatures and compares against the threshold. Insufficient change over this period of time indicates a failure.
PCM monitors difference between the startup and current coolant temperature and compares agaist the threshold while enable condition is met. If the PCM detects that the coolant temperature sensor signal change is less than 3°C for 120 second, PCM determines that a fault exists and a DTC is stored.
MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Rationality	• Poor connection • Low level of Engine Coolant • Improperly installed ECTS • Open or short in circuit • ECTS • PCM
Enable Conditions	• Engine Run state • Vehicle soak time >360min • No Disabling Faults Present	
Threshold value	• This code detects a coolant temp sensor that is stuck within an expected range of movement< 3 °C(37.4°F)	
Diagnosis Time	• Continuous (More than 120 seconds failure within 150 second test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA



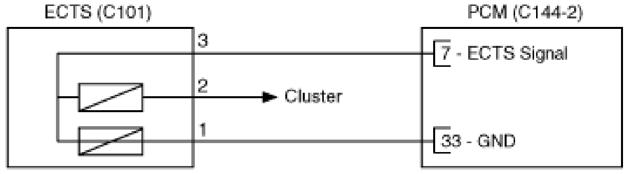
The output signals of IATS & ECTS change smoothly without any rapid changes. Those have almost same characteristic signal during the early period after start. It means that the temperatures of intake air and engine coolant are depended on the temperature of atmosphere. Meanwhile, during the warming up, the output signal of ECTS is going up increasingly. but, the output signal of IATS changes a little bit. even it may not change almost. It means that the heat of engine does not affect on the temperature of intake air.

SPECIFICATION

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59
0(32)	5.79	80(176)	0.32
20(68)	2.31 ~ 2.59		

SCHEMATIC DIAGRAM

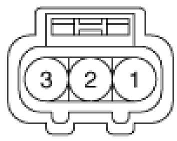
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

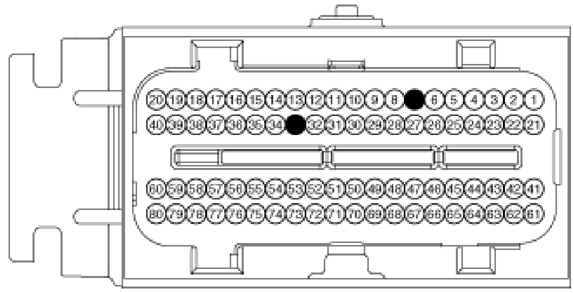
Terminal	Connected to	Funtion
1	PCM C144-2 (33)	Sensor ground
2	Cluster	-
3	PCM C144-2 (7)	ECTS Signal

[HARNESS CONNECTORS]



C101

ECTS



C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "Monitor "ECTS" status on the service data." item on the service data.

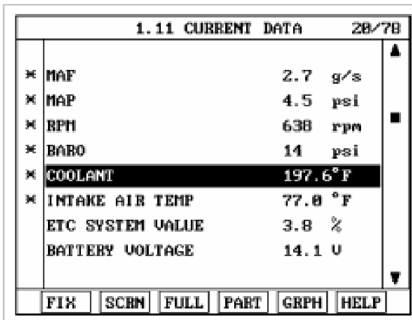


Fig. 1

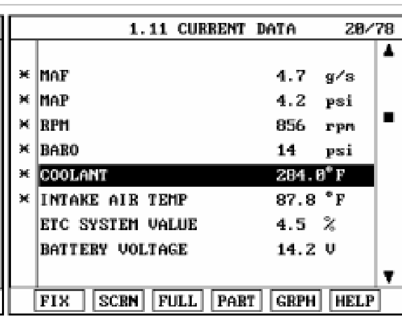


Fig. 2

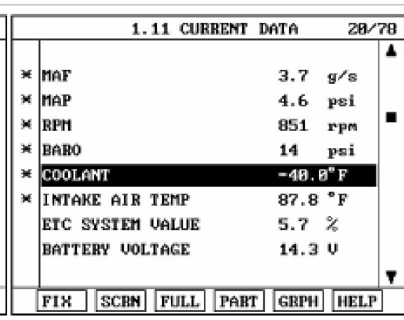


Fig. 3

Fig. 1 : Normal at Idle
Fig. 2 : Short to ground at idle
Fig. 3 : Open or short to battery at idle

4. Is the "ECTS" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

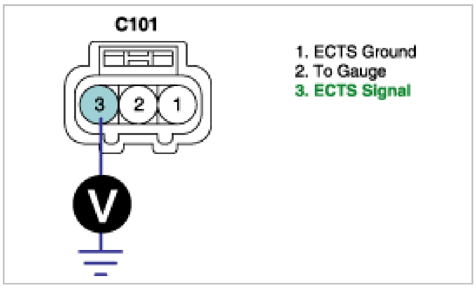
NO

▸ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. IG "OFF" and disconnect ECTS connector.
2. IG "ON" & ENG "OFF"
3. Measure voltage between terminal 3 of ECTS harness connector and chassis ground.

Specification : Approx. 5V



4. Is the measured voltage within specification ?

YES

▸ Go to "Ground Circuit Inspection" procedure.

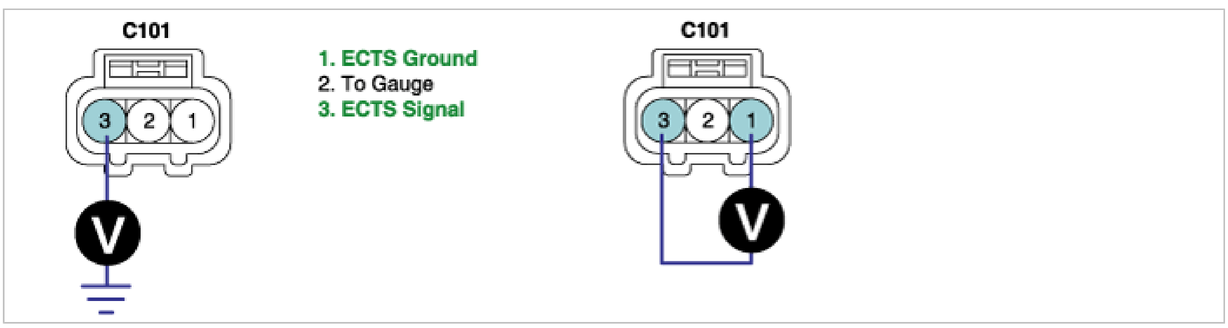
NO

▸ Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF" and disconnect ECTS connector.
2. Measure voltage between terminal 3 of ECTS harness connector and chassis ground.
3. Measure voltage between terminal 1 and 3 of ECTS harness connector.

Specification : Voltage difference between measurement "A" and "B" is below 200mV.



4. Is the measured voltage within specification ?

YES

▸ Go to "System Inspection" procedure.

NO

▸ Repair contact resistance and open in harness and go to "Verification of Vehicle Repair" procedure.

SYSTEM INSPECTION

1. Check Engine coolant level is O.K
2. Check that ECTS is correctly installed.
3. Has a problem been found ?

YES

▸ Repair or replace as necessary and then go to "Verification of Vehicle Repair"procedure.

NO

▸ Go to "Component Inspection" procedure.

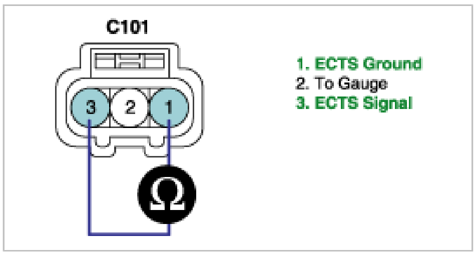
COMPONENT INSPECTION

1. Check resistance of ECTS
   (1) IG "OFF" and disconnect ECTS connector.

   (2) Measure resistance between terminal 1 and 3 of ECTS connector. (Component Side)

   Specificaton :

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59
0(32)	5.79	80(176)	0.32
20(68)	2.31 ~ 2.59		



   (3) Is the measured resistance within specification ?

   YES

   ▸ Go to "Check PCM" as follows.

   NO

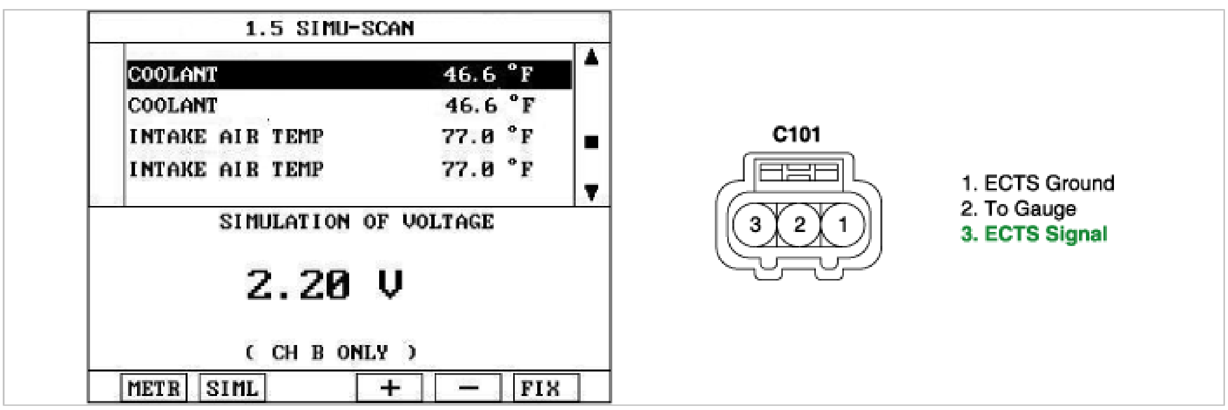
   ▸ Substitute with a known - good ECTS and check for proper operation. If the problem is corrected, replace ECTS and go to "Verification of Vehicle Repair" procedure.

2. Check PCM
   (1) IG "OFF" and connect scantool.

   (2) Connect probe to terminal 3 of ECTS harness connector.

   (3) IG "ON" and ENG "OFF" and simulation Function on scantool.

   (4) Simulate voltage at terminal 3 of ECTS harness connector.



   (5) Does the signal value of ECT sensor change according to simulation voltage ?

   YES

   ▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

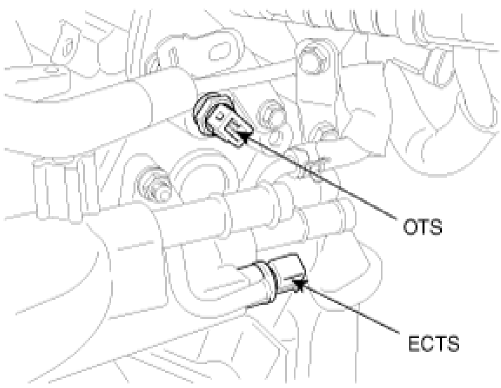
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0117

COMPONENT LOCATION



GENERAL DESCRIPTION

The Engine Coolant Temperature(ECT) Sensor measures the temperature of engine coolant. The Engine Coolant Temperature (ECT) Sensor is located near the thermostat housing of the cylinder head. ECT Sensor is a thermistor (A Variable Resistor that Changes Along with ECT) in series with a fixed resistor in the Engine Control Module (PCM). The PCM applies 5 volts to the ECT sensor. The PCM monitors the voltage across the ECT sensor and converts it into a temperature reading. When the engine is cold the ECT sensor resistance is high, and when the engine is warm the ECT sensor resistance is low. Therefore, when the engine is cold the PCM will receive a high voltage input, and when the engine is warm the PCM will receive a low voltage input. The signal from ECT sensor is used for Injection, ignition timing, idle speed and cooling fan control.

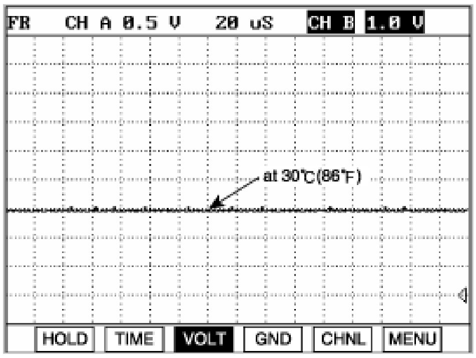
DTC DESCRIPTION

Checking output signals from ECTS every 20 sec. under detecting condition, if an output signal is below 0.1V for more than 10 sec., PCM sets P0117. Warning lamp turns on when the malfunction lasts till continuous 2 driving cycle. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible cause
DTC Strategy		• Signal low	• Poor connection • Short to ground in harness • ECTS • PCM
Enable Conditions	Case 1	• Time after start-up >120 sec.	
	Case 2	• Time from IG "OFF" to IG "ON" >360 min. • Engine running state	
Threshold value		• Engine coolant temperature sensor's voltage< 0.1V	
Diagnosis Time		• Contineous (More than 10 seconds failure for every 20 second test)	
MIL On Condition		• 2 Driving Cycle	

SIGNAL WAVEFORM AND DATA

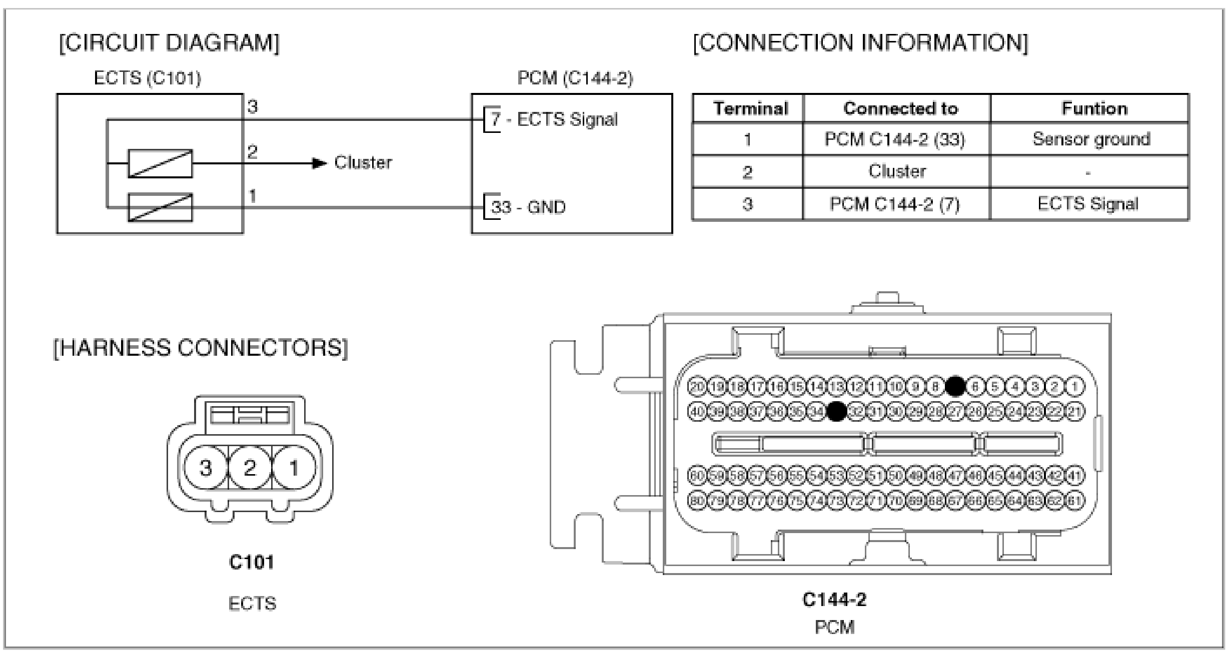


The output signals of IATS & ECTS change smoothly without any rapid changes. Those have almost same characteristic signal during the early period after start. It means that the temperatures of intake air and engine coolant are depended on the temperature of atmosphere. Meanwhile, during the warming up, the output signal of ECTS is going up increasingly. but, the output signal of IATS changes a little bit. even it may not change almost. It means that the heat of engine does not affect on the temperature of intake air.

SPECIFICATION

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59
0(32)	5.79	80(176)	0.32
20(68)	2.31 ~ 2.59		

SCHEMATIC DIAGRAM



MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "Monitor "ECTS" status on the service data." item on the service data.

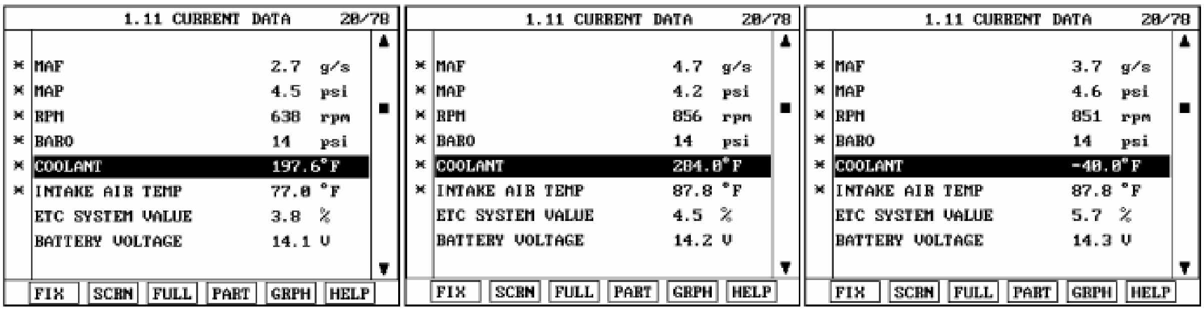


Fig. 1 Fig. 2 Fig. 3

Fig. 1 : Normal at Idle
Fig. 2 : Short to ground at idle
Fig. 3 : Open or short to battery at idle

4. Is the "ECTS" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal & Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

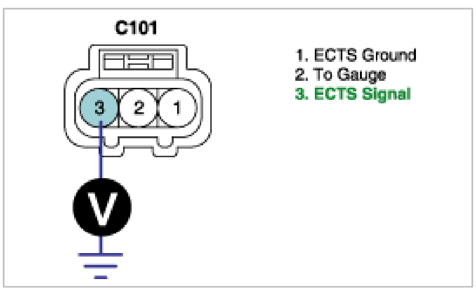
NO

▸ Go to "Terminaal and connector inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF" and disconnect ECTS connector.
   (2) IG "ON" and ENG "OFF"
   (3) Measure voltage between terminal 3 of ECTS harness connector and chassis ground.

   Specification : Approx. 5V



   (4) Is the measured voltage within specification ?

   YES

   ▸ Go to "Component Inspection" procedure.

   NO

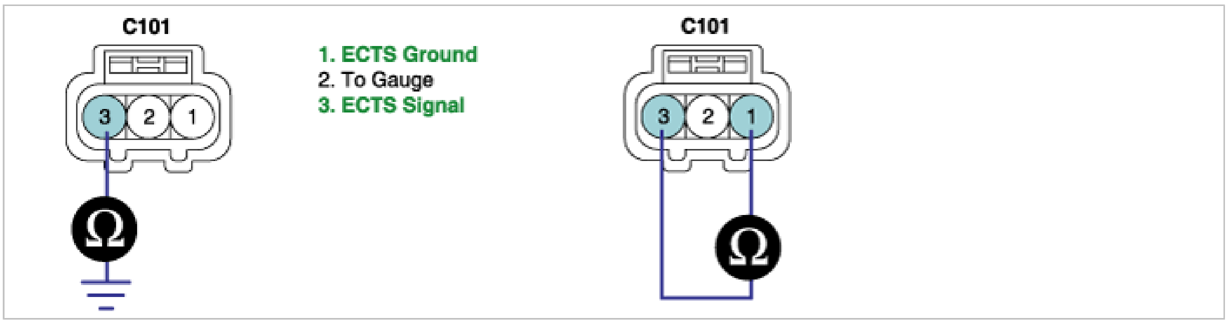
   ▸ Go to "Check short to ground in harness" as follows.

2. Check short to ground in harness
   (1) IG "OFF" and disconnect ECTS connector and PCM connector.

(2) Measure resistance between terminal 3 of ECTS harness connector and chassis ground.

(3) Measure resistance between terminals 1 and 3 of ECTS harness connector.

Specification : Infinite



(4) Is the measured resistance within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check ECTS

(1) IG "OFF" and disconnect ECTS connector.

(2) Measure resistance between terminals 1 and 3 of ECTS connector.(Component side)

Specificaton :

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59
0(32)	5.79	80(176)	0.32
20(68)	2.31 ~ 2.59		

(3) Is the measured resistance within specification?

YES

▸ Go to "Check PCM" as follows.

NO

▸ Substitute with a known - good ECTS and check for proper operation. If the problem is corrected, replace ECTS and go to "Verification of Vehicle Repair" procedure.

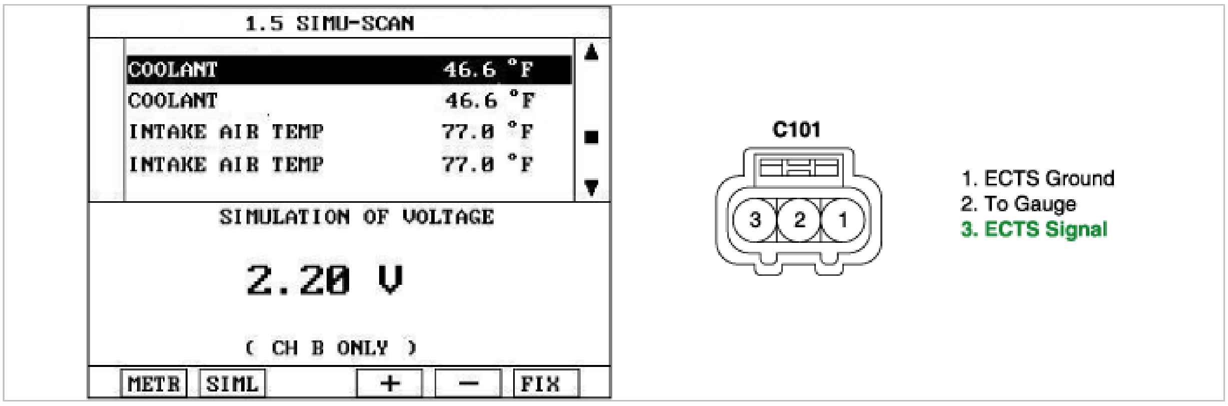
2. Check PCM

(1) IG "OFF" and connect scantool.

(2) Connect probe to terminal 3 of ECTS harness connector.

(3) IG "ON" and ENG "OFF" and simulation Function on scantool.

(4) Simulate voltage at terminal 3 of ECTS harness connector.



(5) Does the signal value of ECT sensor change according to simulation voltage ?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

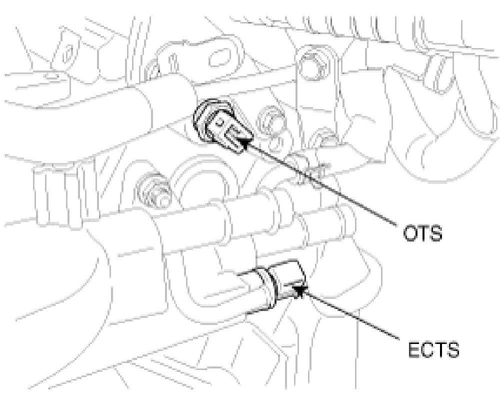
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0118

COMPONENT LOCATION



GENERAL DESCRIPTION

The Engine Coolant Temperature(ECT) Sensor measures the temperature of engine coolant. The Engine Coolant Temperature

(ECT) Sensor is located near the thermostat housing of the cylinder head. ECT Sensor is a thermistor (A Variable Resistor that Changes Along with ECT) in series with a fixed resistor in the Engine Control Module (PCM). The PCM applies 5 volts to the ECT sensor. The PCM monitors the voltage across the ECT sensor and converts it into a temperature reading. When the engine is cold the ECT sensor resistance is high, and when the engine is warm the ECT sensor resistance is low. Therefore, when the engine is cold the PCM will receive a high voltage input, and when the engine is warm the PCM will receive a low voltage input. The signal from ECT sensor is used for Injection, ignition timing, idle speed and cooling fan control.

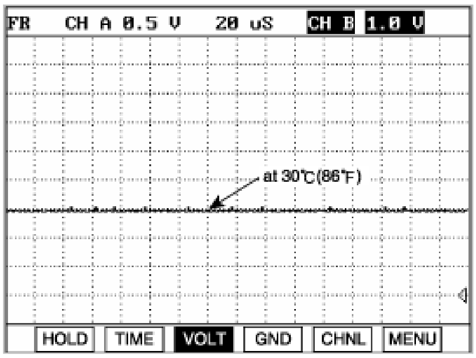
DTC DESCRIPTION

Checking output signals from ECTS every 20 sec. under detecting condition, if an output signal is above 4.9V for more than 10 sec., PCM sets P0118. Warning lamp turns on when the malfunction lasts till continuous 2 driving cycle. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible cause
DTC Strategy		• Open, Signal high	• Poor connection • Open or short to battery in signal harness • Open in ground harness • ECTS • PCM
Enable Conditions	Case 1	• Time after start-up >120 sec.	
	Case 2	• Time from IG "OFF" to IG "ON" > 360 min. • Intake air temperature ≥ -10°C(14°F) • Engine running state	
Threshold value		• Engine coolant temperature sensor's voltage >4.9V	
Diagnosis Time		• Contineous (More than 10 sec. failure for every 20 sec. test)	
MIL On Condition		• 2 Driving Cycle	

SIGNAL WAVEFORM AND DATA



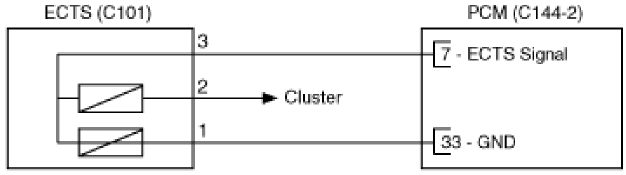
The output signals of IATS & ECTS change smoothly without any rapid changes. Those have almost same characteristic signal during the early period after start. It means that the temperatures of intake air and engine coolant are depended on the temperature of atmosphere. Meanwhile, during the warming up, the output signal of ECTS is going up increasingly. but, the output signal of IATS changes a little bit. even it may not change almost. It means that the heat of engine does not affect on the temperature of intake air.

SPECIFICATION

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59
0(32)	5.79	80(176)	0.32
20(68)	2.31 ~ 2.59		

SCHEMATIC DIAGRAM

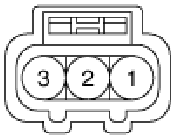
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

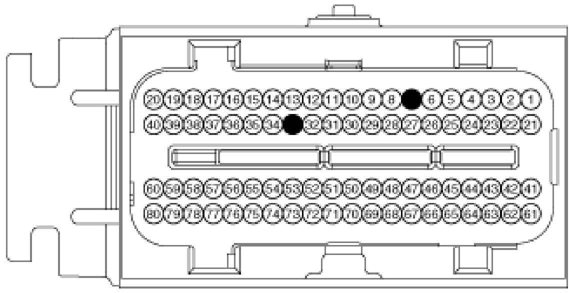
Terminal	Connected to	Funtion
1	PCM C144-2 (33)	Sensor ground
2	Cluster	-
3	PCM C144-2 (7)	ECTS Signal

[HARNESS CONNECTORS]



C101

ECTS



C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "Monitor "ECTS" status on the service data." item on the service data.

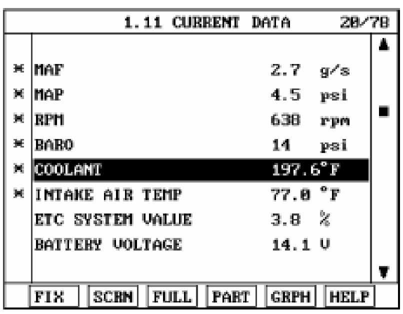


Fig. 1

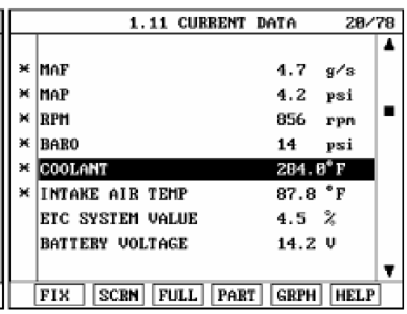


Fig. 2

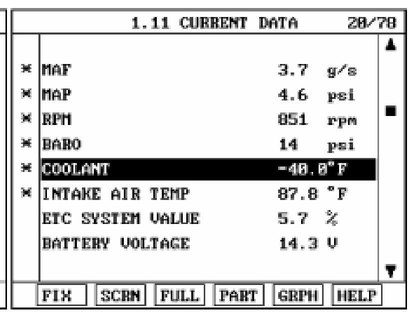


Fig. 3

Fig. 1 : Normal at Idle
Fig. 2 : Short to ground at idle
Fig. 3 : Open or short to battery at idle

4. Is the "ECTS" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Signal Circuit Inspection" procedure.

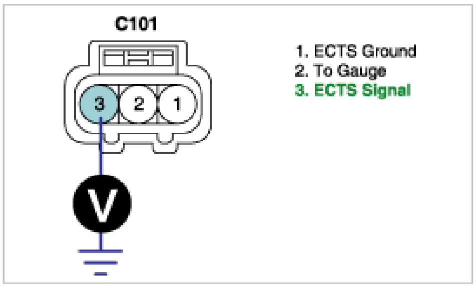
SIGNAL CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF" and disconnect ECTS connector.

   (2) IG "ON" and ENG "OFF"

   (3) Measure voltage between terminal 3 of ECTS harness connector and chassis ground.

   Specification : Approx. 5V



   (4) Is the measured voltage within specification ?

   YES

   ▸ Go to "Ground Circuit Inspection" procedure.

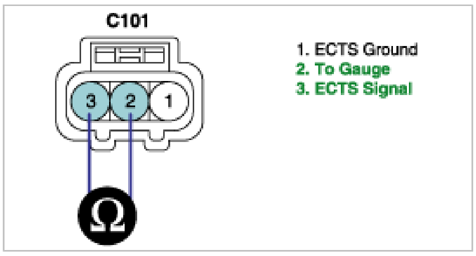
   NO

   ▸ If voltage is 0V, go to "Check open in harness" as follows. If it is more than 5.1V, go to "Check short to battery in harness" as follows

2. Check short to battery in harness
   (1) IG "OFF" and disconnect ECTS connector and PCM connector.

   (2) Measure resistance between terminals 2 and 3 of ECTS harness connector.

   Specification : Infinite



   (3) Is the measured resistance within specification?

   YES

   ▸ Go to "Component Inspection" procedure.

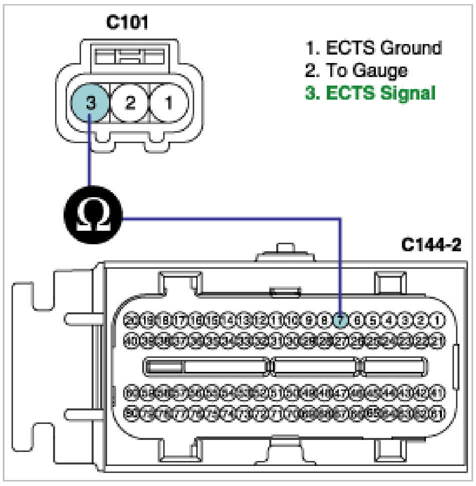
   NO

   ▸ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

3. Check open in harness
   (1) IG "OFF" and disconnect ECTS connector and PCM connector.

   (2) Measure resistance between terminal 3 of ECTS harness connector and terminal 7 of PCM harness connector.

   Specification : Below 1Ω



(3) Is the measured resistance within specification?

YES

▸ Go to "Ground Circuit Inspection" procedure.

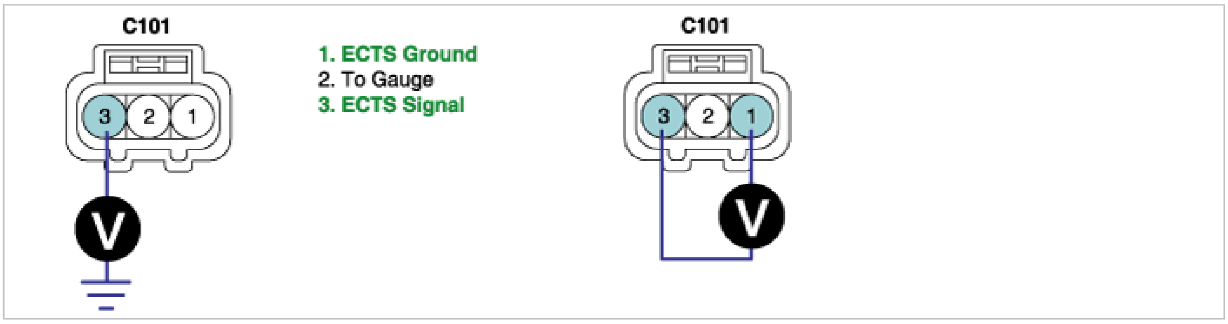
NO

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF" and disconnect ECTS connector.
2. Measure voltage between terminal 3 of ECTS harness connector and chassis ground.
3. Measure voltage between terminals 1 and 3 of ECTS harness connector.

Specification : Voltage difference between measurement "A" and "B" is below 200mV.



4. Is the measured voltage within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair open or contact resistance in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check ECTS
   (1) IG "OFF" and disconnect ECTS connector.
   (2) Measure resistance between terminals 1 and 3 of ECTS connector.(Component side)
   Specificaton :

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59
0(32)	5.79	80(176)	0.32
20(68)	2.31 ~ 2.59		

(3) Is the measured resistance within specification?

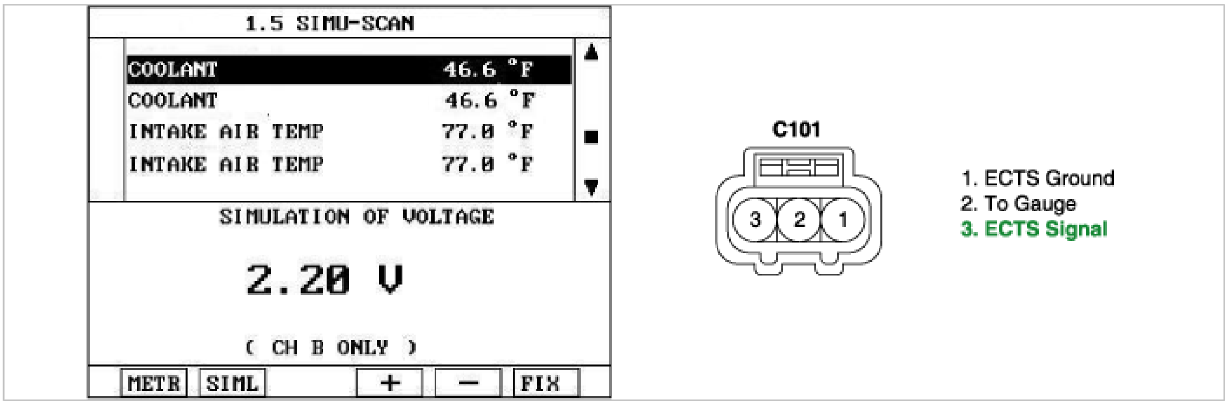
YES

▸ Go to "Check PCM" as follows.

NO

▸ Substitute with a known - good ECTS and check for proper operation. If the problem is corrected, replace ECTS and go to "Verification of Vehicle Repair" procedure.

2. Check PCM
   (1) IG "OFF" and connect scantool.
   (2) Connect probe to terminal 3 of ECTS harness connector.
   (3) IG "ON" and ENG "OFF" and simulation Function on scantool.
   (4) Simulate voltage at terminal 3 of ECTS harness connector.



(5) Does the signal value of ECT sensor change according to simulation voltage ?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

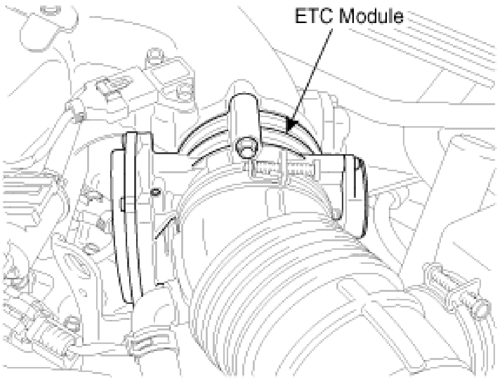
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0122

COMPONENT LOCATION



GENERAL DESCRIPTION

ETC(Electronic Throttle Control Valve) is the device controlling amount of air to engine acccording to driver's intension. Different from the existing mechanical throttle valve which is composed of accelerator pecal and connecting wire cable, ETC consists of a motor, a throttle body and a throttle position sensor. Receiving input signals from electronic accelerator pedal module, PCM lets ETC motor control throttle valve. With ETC, cruise control system works without any additional device.

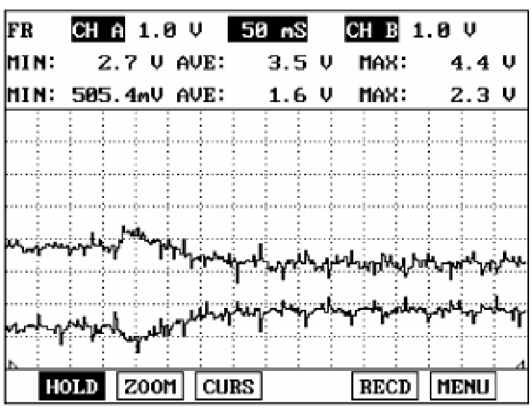
DTC DESCRIPTION

Checking output signals from TPS1 every 8.5 sec. under detecting condition, if an output signal is below 0.25V for more than 0.1 sec., PCM sets P0122. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

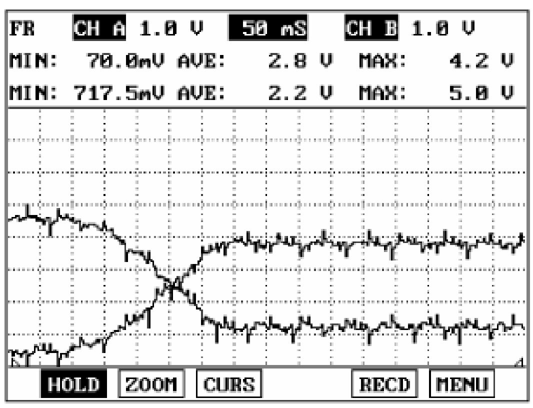
DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• signal low	• Poor connection • Open or short to ground in power harness • Short to ground in signal harness • TPS • PCM
Enable condition	• IG "ON	
threshold value	• The voltage of TPS< 0.25V	
diagnosis time	• Continuous (more than 0.1 sec. failure for every 8.5 sec.test)	
MIL ON condition	• 2 driving cycles	

SIGNAL WAVEFORM AND DATA



Hit the accelerator at IG ON



Open the throttle valve by force at IG ON

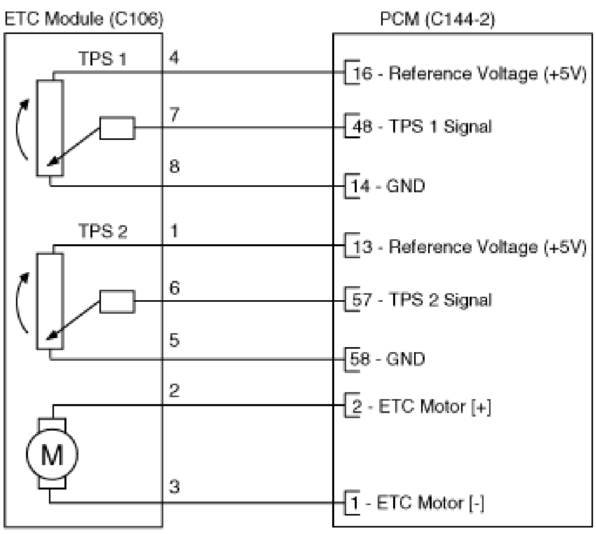
SPECIFICATION

Throttle opening (°)	Output voltage(V) [Vref=5.0]	
	TPS1	TPS2
0°	0.0V	5.0V

10°	0.5V	4.5V
20°	0.9V	4.1V
30°	1.4V	3.6V
40°	1.8V	3.2V
50°	2.3V	2.7V
60°	2.7V	2.3V
70°	3.2V	1.8V
80°	3.6V	1.4V
90°	4.1V	0.9V
100°	4.5V	0.5V
110°	5.0V	0.0V

SCHEMATIC DIAGRAM

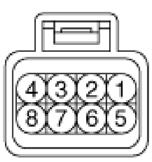
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

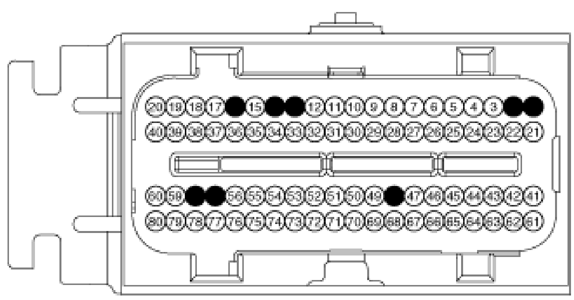
Terminal	Connected to	Funtion
1	PCM C144-2 (13)	TPS 2 Reference Voltage (+5V)
2	PCM C144-2 (2)	ETC Motor [+] Control
3	PCM C144-2 (1)	ETC Motor [-] Control
4	PCM C144-2 (16)	TPS 1 Reference Voltage (+5V)
5	PCM C144-2 (58)	TPS 2 Ground
6	PCM C144-2 (57)	TPS 2 Signal
7	PCM C144-2 (48)	TPS 1 Signal
8	PCM C144-2 (14)	TPS 1 Ground

[HARNESS CONNECTORS]



C106

ETC MODULE

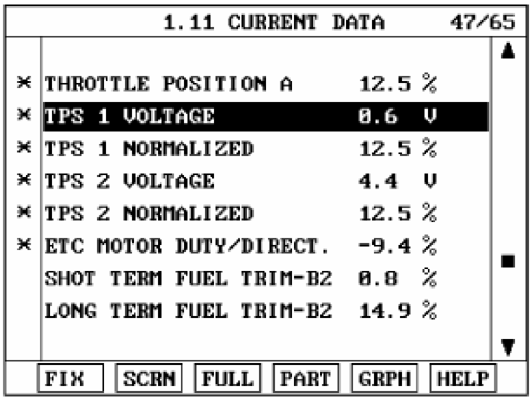


C144-2

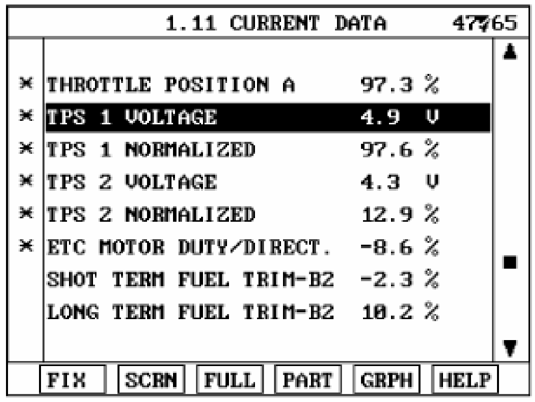
PCM

MONITOR SCANTOOL DATA

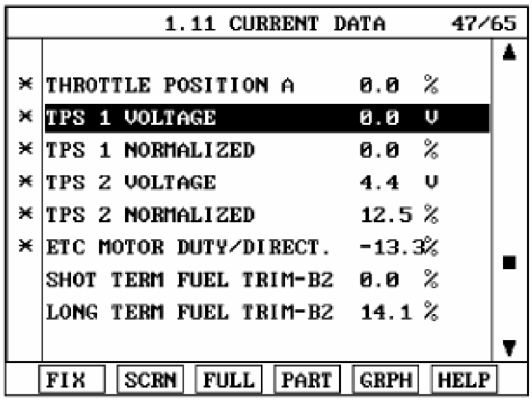
1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "TPS1" item on the service data.



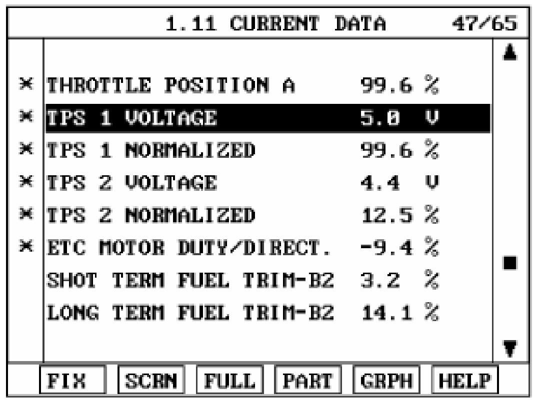
Normal data at idle



Data at open in TPS1



Data at short to ground in TPS1



Data at short to battery in TPS1

CAUTION

※ Procedure of ETS Initialization

1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10 second)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

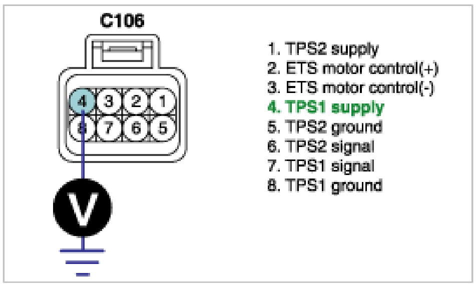
NO

▸ Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION

1. IG "OFF" and disconnect TPS connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 4 of TPS harness connector and chassis ground.

Specification : Approx. 5V



4. Is the measured voltage within specification ?

YES

▸ Go to "Signal circuit inspection" procedure.

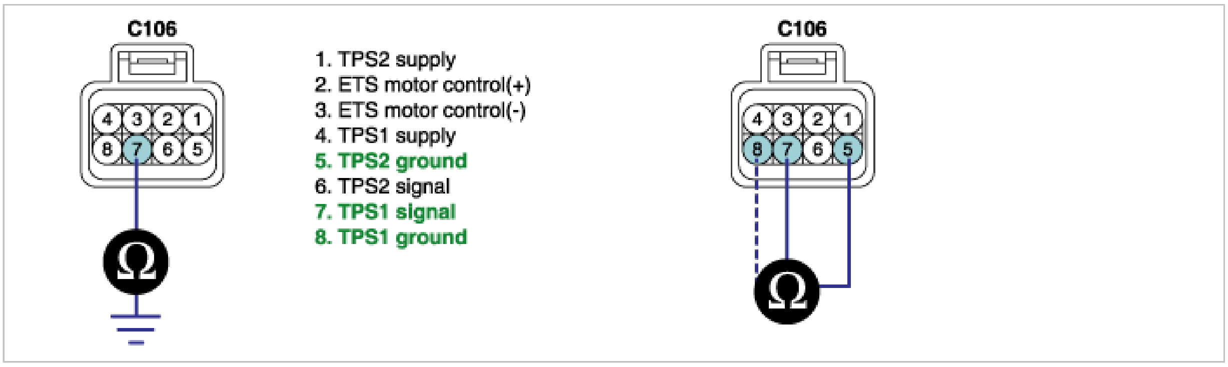
NO

▸ Repair open or short to ground in power harness, and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check short to ground in harness
   (1) IG "OFF" and disconnect TPS connector and PCM connector.
   (2) Measure resistance between terminal 7 of TPS harness connector and chassis ground.
   (3) Measure resistance between terminals 7 and 5(8) of TPS harness connector.

Specification : Infinite



   (4) Is the measured resistance within specification?

YES

▸ Go to "Component Inspection" procedure.

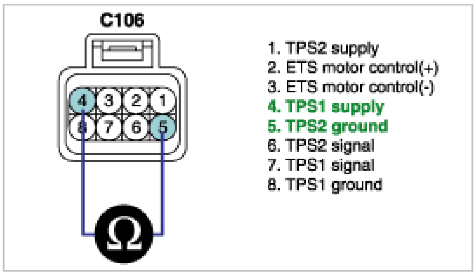
NO

▸ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check TPS
   (1) IG "OFF" and disconnect TPS connector.
   (2) Measure resistance between terminals 4 and 5 of TPS connector.(component side)

Specificaton : 4 ~ 6kΩ



(3) Is the measured resistance within specification?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good ECT motor & TPS and check for proper operation. If the problem is corrected, replace ECT motor & TPS and go to "Verification of Vehicle Repair" procedure.

CAUTION

Procedure of ETS Initialization

1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10sec.)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

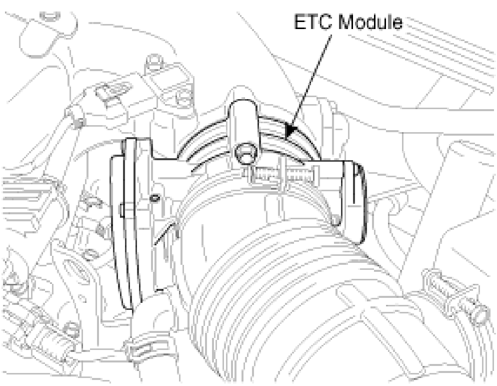
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0123

COMPONENT LOCATION



GENERAL DESCRIPTION

ETC(Electronic Throttle Control Valve) is the device controlling amount of air to engine acccording to driver's intension. Different from the existing mechanical throttle valve which is composed of accelerator pecal and connecting wire cable, ETC consists of a motor, a throttle body and a throttle position sensor. Receiving input signals from electronic accelerator pedal module, PCM lets

ETC motor control throttle valve. With ETC, cruise control system works without any additional device.

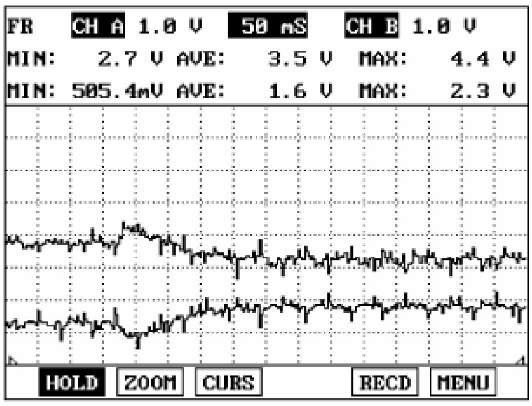
DTC DESCRIPTION

Checking output signals from TPS1 every 8.5 sec. under detecting condition, if an output signal is above 4.75V for more than 0.1 sec., PCM sets P0123. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

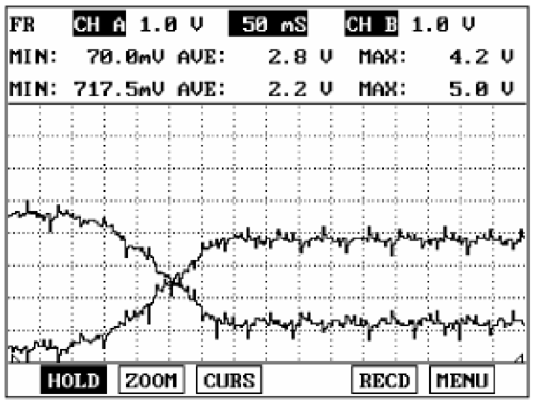
DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• signal low	• Poor connection • Open or short to battery in signal harness • Open in ground harness • TPS • PCM
Enable condition	• IG "ON	
threshold value	• The voltage of TPS >4.75V	
diagnosis time	• Continuous (more than 0.1 sec. failure for every 8.5 sec.test)	
MIL ON condition	• 2 driving cycles	

SIGNAL WAVEFORM AND DATA



Hit the accelerator at IG ON



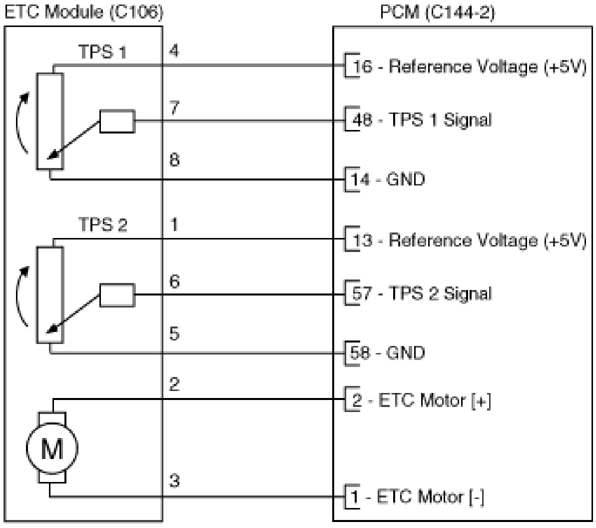
Open the throttle valve by force at IG ON

SPECIFICATION

Throttle opening (°)	Output voltage(V) [Vref=5.0]	
	TPS1	TPS2
0°	0.0V	5.0V
10°	0.5V	4.5V
20°	0.9V	4.1V
30°	1.4V	3.6V
40°	1.8V	3.2V
50°	2.3V	2.7V
60°	2.7V	2.3V
70°	3.2V	1.8V
80°	3.6V	1.4V
90°	4.1V	0.9V
100°	4.5V	0.5V
110°	5.0V	0.0V

SCHEMATIC DIAGRAM

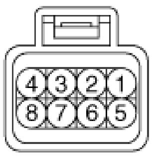
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

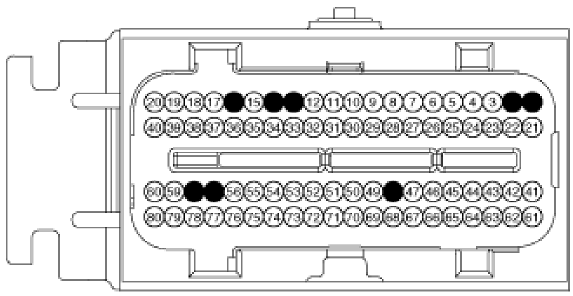
Terminal	Connected to	Funtion
1	PCM C144-2 (13)	TPS 2 Reference Voltage (+5V)
2	PCM C144-2 (2)	ETC Motor [+] Control
3	PCM C144-2 (1)	ETC Motor [-] Control
4	PCM C144-2 (16)	TPS 1 Reference Voltage (+5V)
5	PCM C144-2 (58)	TPS 2 Ground
6	PCM C144-2 (57)	TPS 2 Signal
7	PCM C144-2 (48)	TPS 1 Signal
8	PCM C144-2 (14)	TPS 1 Ground

[HARNESS CONNECTORS]



C106

ETC MODULE

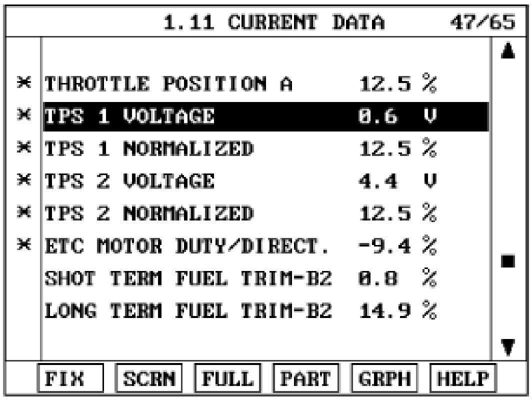


C144-2

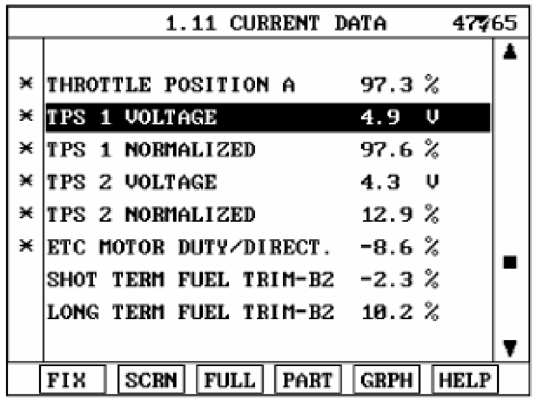
PCM

MONITOR SCANTOOL DATA

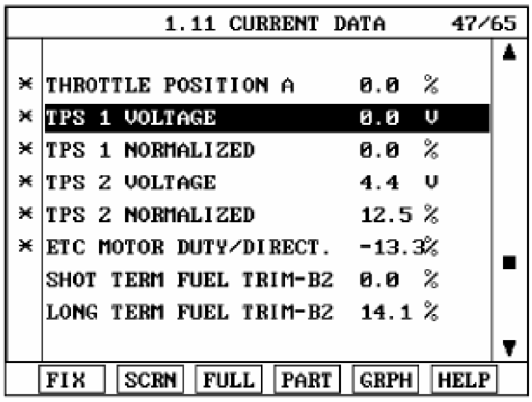
1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "TPS1" item on the service data.



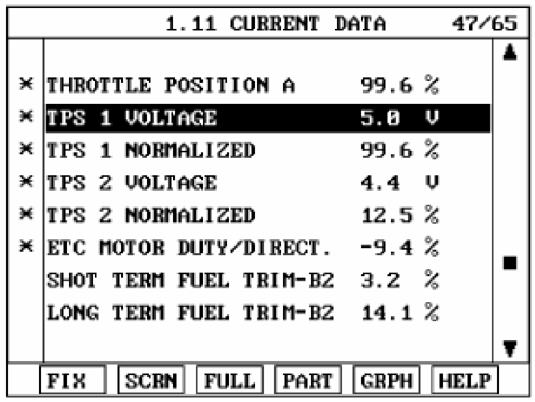
Normal data at idle



Data at open in TPS1



Data at short to ground in TPS1



Data at short to battery in TPS1

CAUTION

Procedure of ETS Initialization

1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10 second)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

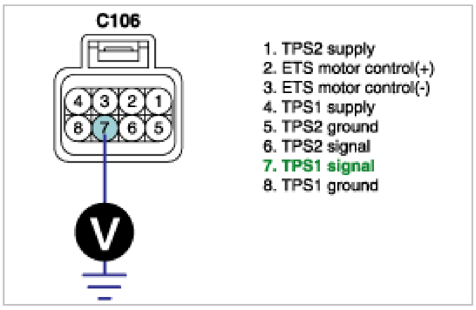
▸ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check voltgae
   (1) IG "OFF" and disconnect TPS connector.
   (2) IG "ON" and ENG "OFF"

(3) Measure voltage between terminal 7 of TPS harness connector and chassis ground.

Specification : Approx. 5V



(4) Is the measured voltage within specification?

YES

▶ Go to "Check open in harness" as follows.

NO

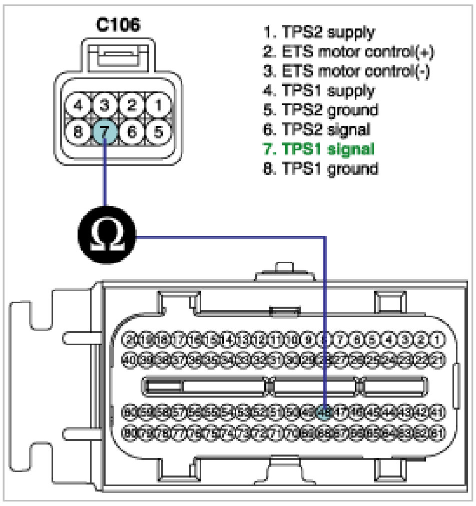
▶ Go to "Check short to battery in harness" as follows.

2. Check open in harness

(1) IG "OFF" and disconnect TPS connector and PCM connector.

(2) Measure resistance between terminal 7 of TPS harness connector and terminal 48 of PCM harness connector.

Specification : Below 1Ω



(3) Is the measured resistance within specification?

YES

▶ Go to "Ground Circuit Inspection" procedure.

NO

▶ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

3. Check short to battery in harness

(1) IG "OFF" and disconnect TPS connector and PCM connector.

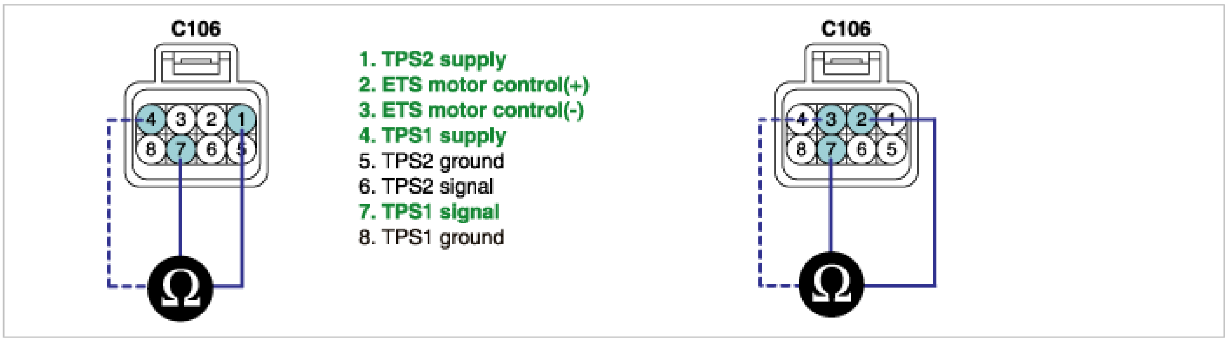
(2) Measure resistance between terminals 4 and 7 of TPS harness connector.

(3) Measure resistance between terminals 1 and 7 of TPS harness connector.

(4) Measure resistance between terminals 2 and 7 of TPS harness connector.

(5) Measure resistance between terminals 3 and 7 of TPS harness connector.

Specification : Infinite



(6) Is the measured resistance within specification?

YES

▸ Go to "Ground circuit inspection " procedure.

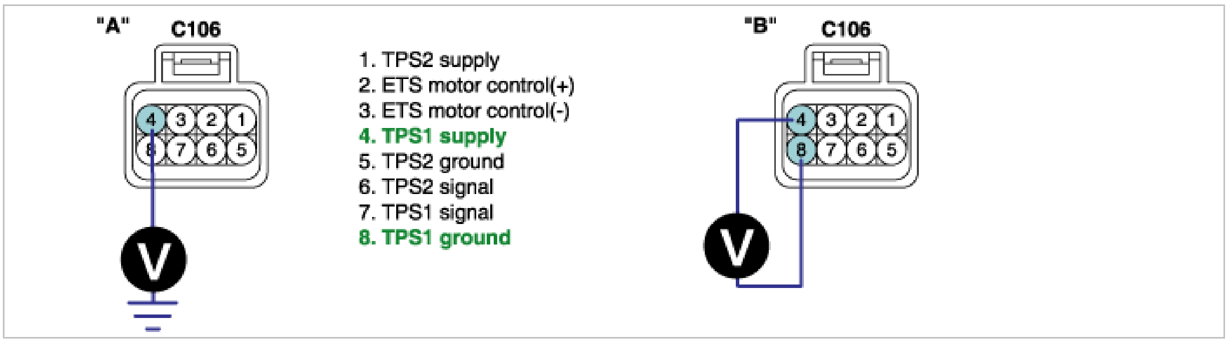
NO

▸ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF" and disconnect TPS connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 4 of TPS harness connector and chassis ground.
4. Measure voltage between terminals 4 and 8 of TPS harness connector.

Specification : Voltage difference between measurement "A" and "B" is below 200mV.



5. Is the measured voltage within specification?

YES

▸ Go to "Component inspection" procedure.

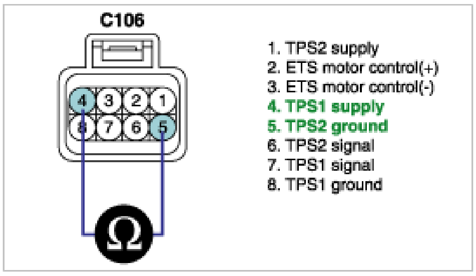
NO

▸ Repair open or contact resistance in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check TPS
   (1) IG "OFF" and disconnect TPS connector.
   (2) Measure resistance between terminals 4 and 5 of TPS connector.(component side)

Specificaton : 4 ~ 6kΩ



(3) Is the measured resistance within specification?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good ECT motor & TPS and check for proper operation. If the problem is corrected, replace ECT motor & TPS and go to "Verification of Vehicle Repair" procedure.

> **CAUTION**
>
> Procedure of ETS Initialization
> 1. Erase the trouble codes on PCM
> 2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10sec.)
> 3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

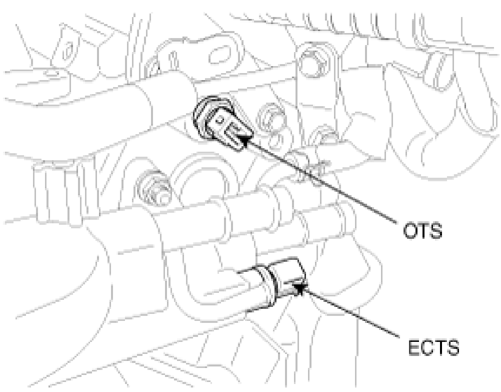
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0125

COMPONENT LOCATION



GENERAL DESCRIPTION

An Engine Coolant Temperature Sensor (ECTS) monitors the temperature of the coolant. This input is used by the PCM for engine control and as an enabling criteria for same diagnostics. The air flow coming into the engine is accumulated and used to determine if the engine has been driven within conditions that would allow the engine coolant to heat up normally to the thermostat regulating temperature. If the coolant temperature does not reach regulating temperature of the thermostat, diagnostics that use the engine coolant temperature as enabling criteria may not run when expected.

DTC DESCRIPTION

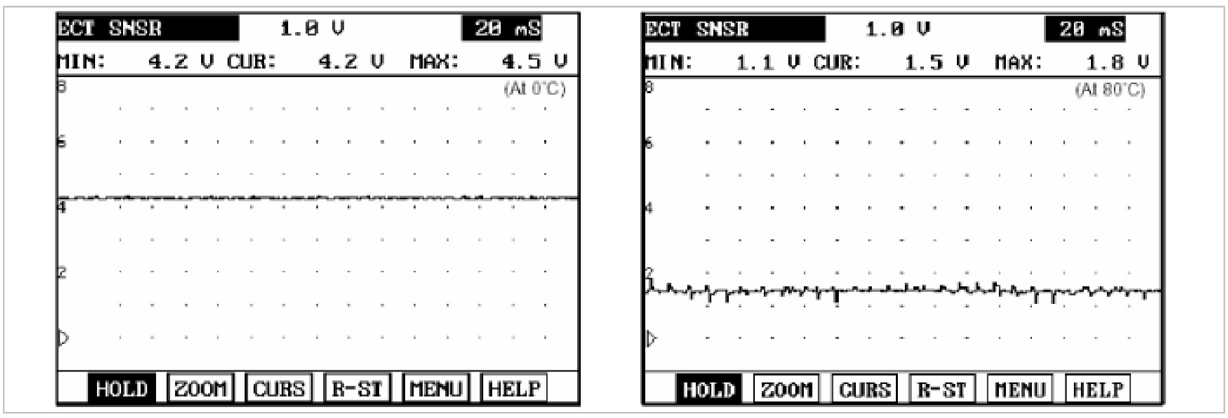
The Engine Coolant Temperature Time to Closed Loop Diagnostic monitors the time it takes the coolant to reach the temperature required for closed loop engine operation and compares it against a maximum limit dependent on the difference between the startup coolant temperature and the closed loop coolant temperature for that warm up cycle. If it takes longer than this allowed limit, a failure has occurred.

If the coolant temperature does not reach the specified value within the established time parameters, the PCM determines that a malfunction exists and a DTC is stored. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• This diagnostic monitors the time it takes for the coolant temperature to reach the closed loop temperature and compares against a maximum threshold in order to make a PASS/FAIL determination, provided airflow and idle conditions are met.	• Poor connection • Improper coolant level • Malfunctioning Cooling System • Faulty ECTS
Enable Conditions	• No disabling faults present • Coolant sensor within range • Startup coolant temp ≤ 34°C(86 °F) • Engine running	
Threshold value	• Undefaulted coolant temperature ≥ Threshold Value(°C) • Test Time = Threshold (second)	
Diagnosis Time	• More than 5 second failure.	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA



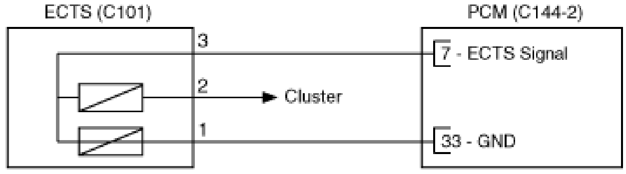
The output signals of IATS & ECTS change smoothly without any rapid changes. Those have almost same characteristic signal during the early period after start. It means that the temperatures of intake air and engine coolant are depended on the temperature of atmosphere. Meanwhile, during the warming up, the output signal of ECTS is going up increasingly. but, the output signal of IATS changes a little bit. even it may not change almost. It means that the heat of engine does not affect on the temperature of intake air.

SPECIFICATION

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59
0(32)	5.79	80(176)	0.32
20(68)	2.31 ~ 2.59		

SCHEMATIC DIAGRAM

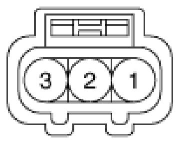
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

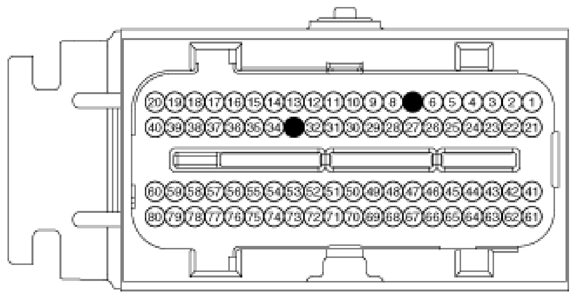
Terminal	Connected to	Funtion
1	PCM C144-2 (33)	Sensor ground
2	Cluster	-
3	PCM C144-2 (7)	ECTS Signal

[HARNESS CONNECTORS]



C101

ECTS



C144-2

PCM

MONITOR SCANTOOL DATA

1. Engine "ON"
2. Monitor Engine Coolant Temperature Sensor parameter on Current data
3. After the engine has been starting, Check that ECT rises steadly to about 82±2°C(176~ 183.2 °F) and ECT stabilizes when the thermostat opens.

Specification : ECT rises steadly to about 82±2°C(176~ 183.2 °F) and ECT stabilizes when the thermostat opens.

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59
0(32)	5.79	80(176)	0.32
20(68)	2.31 ~ 2.59		

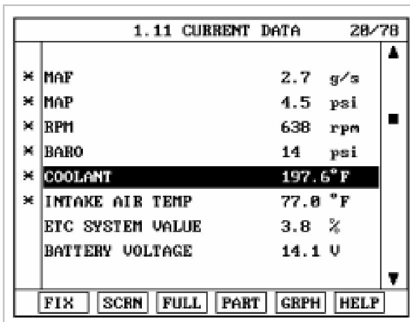


Fig. 1

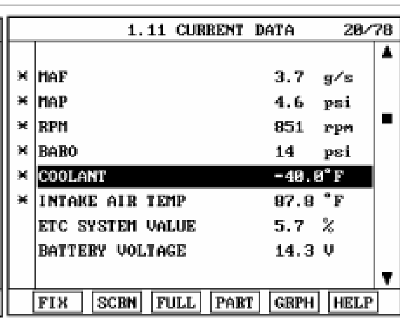


Fig. 2

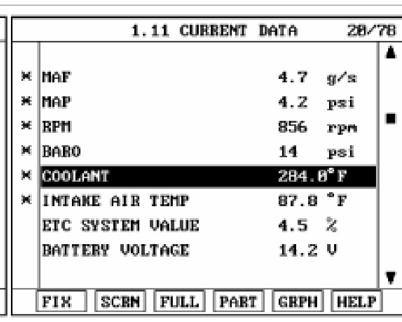


Fig. 3

Fig. 1 : Sensor data at normal
Fig. 2 : Sensor data at open
Fig. 3 : Sensor data at short

4. Is the measured ECTS parameter displayed within specifications ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "System Inspection" procedure

SYSTEM INSPECTION

1. Check cooling system coolant level and fill if low.
2. Check that cooling fan is operating continuously.
3. Has a problem been found ?

YES

▸ Repair or repalce as necessary and go to "Verification of Vehicle Repair" procedure.

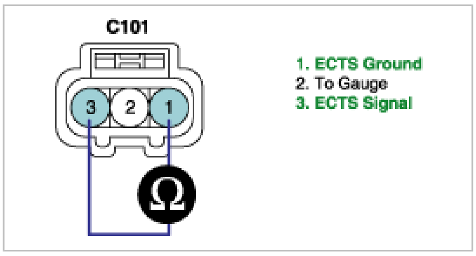
NO

▸ Go to "Component Inspection" procedure.

COMPONENT INSPECTION

1. Check ECTS.
   (1) Ignition "OFF"
   (2) Disconnect ECTS connector
   (3) Measure resistance between terminals "1" and "3" of the ECT sensor (to ECT sensor side).
   Specificaton :

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59
0(32)	5.79	80(176)	0.32
20(68)	2.31 ~ 2.59		



   (4) Is the measured resistance within specifications ?

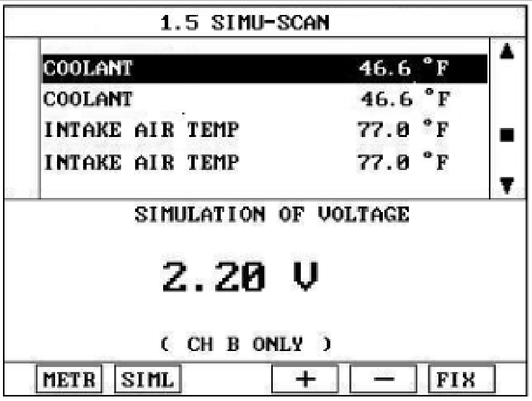
YES

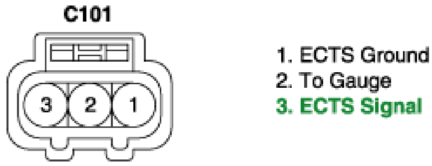
▸ Go to "Check PCM" as below.

NO

▸ Substitute with a known - good ECT sensor and check for proper operation. If the problem is corrected, replace ECT sensor and go to "Verification of Vehicle Repair" procedure.

2. Check PCM
   (1) Ignition "OFF".
   (2) Connect Scantool and Ignition "ON" & Engine "OFF "
   (3) Select simulation function on scantool.
   (4) Simulate voltage at terminal "3" of ECT sensor signal connector.





(5) Does the signal value of ECT sensor changes according to simulation voltage ?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

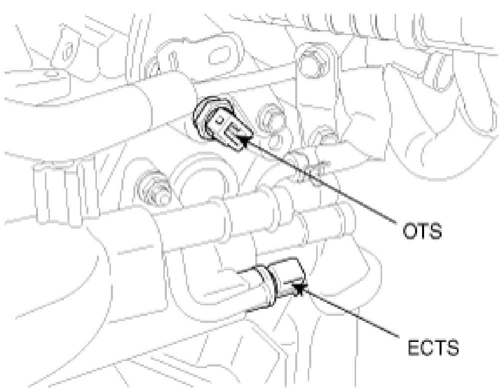
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0128

COMPONENT LOCATION



GENERAL DESCRIPTION

The Thermostat is a mechanical (thermal) device located in an engine coolant passage that allows passage of coolant into the radiator once the coolant has reached a manufacturer specified temperature called the Regulating Temperature. It has a metallic frame with a spring-loaded,centrally mounted, wax filled cylinder/piston assembly that expands and contracts with changes in temperature, thereby controlling the passage of coolant into the radiator.

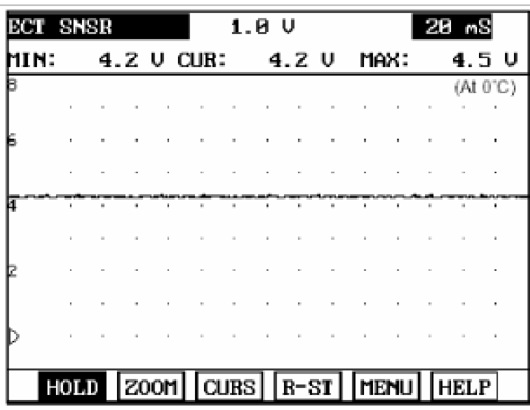
DTC DESCRIPTION

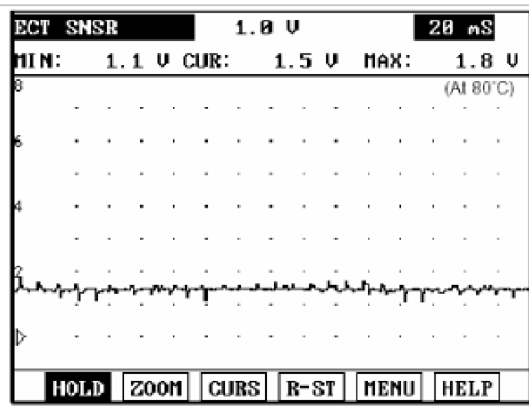
If the engine coolant temperature does not reach the specified value within the allocated period of time, the PCM determines that a malfunction exists and a DTC is stored. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• The Thermostat Diagnostic monitors the time it takes for the coolant temperature to reach either the maximum temperature required to enable other diagnostics or the Thermostat Regulating Temperature, and compares it against a threshold in order to make a PASS/FAIL determination, provided airflow and idle conditions are met.	• Poor connection • Improper coolant level • Faulty Thermostat
Enable Conditions	• No disabling faults present • Coolant sensor within range • Thermostat target temp - Startup coolant temp ≥ 20°C(68°F) • Intake air temperature >-6.6641°C(20°F) • Engine Running	
Threshold value	• Undefaulted coolant temperature ≥ Threshold Value(°C) • Test Time = Threshold (second)	
Diagnosis Time	• Continuous (More than 5 second failure.)	
MIL On Condition	• 2 driving cycles	

SIGNAL WAVEFORM AND DATA





The output signals of IATS & ECTS change smoothly without any rapid changes. Those have almost same characteristic signal during the early period after start. It means that the temperatures of intake air and engine coolant are depended on the temperature of atmosphere. Meanwhile, during the warming up, the output signal of ECTS is going up increasingly. but, the output signal of IATS changes a little bit. even it may not change almost. It means that the heat of engine does not affect on the temperature of intake air.

MONITOR SCANTOOL DATA

1. Engine "OFF"
2. Monitor Engine Coolant Temperature Sensor parameter on Current data

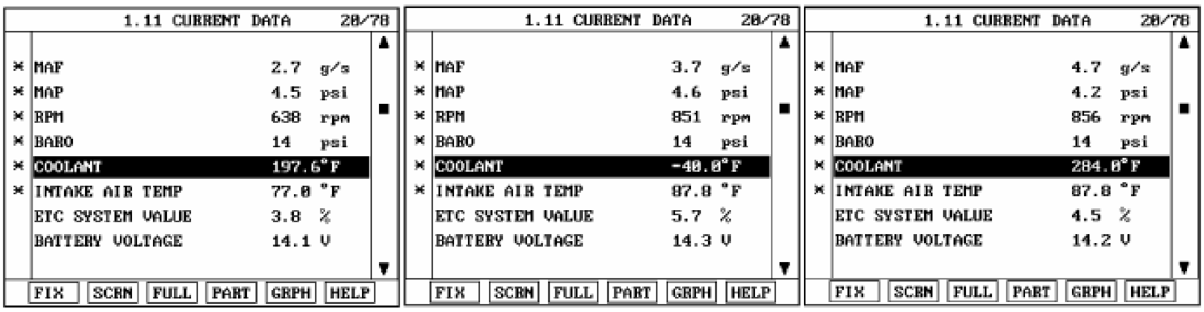


Fig. 1 Fig. 2 Fig. 3

Fig. 1 : Sensor data at normal
Fig. 2 : Sensor data at open
Fig. 3 : Sensor data at short

3. Is the measured ECTS parameter displayed within specifications ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Component Inspection" procedure

COMPONENT INSPECTION

1. Check Thermostat
   (1) Check cooling system coolant level and fill if low.
   (2) Check for a proper cooling system operation. Especially check that cooling and condenser fan working normally.
   (3) Remove the thermostat and check the following items:
      (1) Stuck or damaged
      (2) Verify the temperature at which the valve is open : 80 ~84°C(176~183.2°F)
   (4) Has a problem been found ?

   YES

   ▸ Substitute with a known - good Thermostat and check for proper operation. If the problem is corrected, replace Thermostat and go to "Verification of Vehicle Repair" proprocedure.

   NO

   ▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

   > NOTE
   >
   > There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

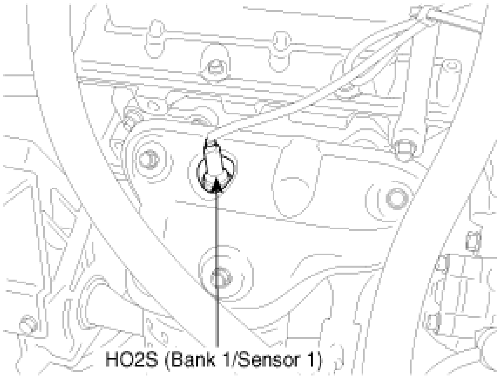
YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

COMPONENT LOCATION



GENERAL DESCRIPTION

In order to control emissions of the CO, HC and NOx components of the exhaust gas, heated oxygen sensor (HO2S), mounted on the front side and rear side of catalytic converter, detects the oxygen content in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation.
The HO2S requires a minimum temperature to operate properly and provide a closed loop fuel control system. The HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions.
The oxygen sensor generates a voltage that indicates the difference between the oxygen content of the exhaust stream and the oxygen content of ambient air. When the exhaust stream is “rich,” there is more oxygen in the ambient air than in the exhaust stream, so the voltage will be higher.
Some oxygen sensor varieties use a “bias” voltage to achieve better resolution of the exhaust stream signal. Some oxygen sensor varieties use a “pumping circuit” to force ambient air into the sensor to maintain a more pure environment for comparison.
In either case, a cold sensor will tend to indicate voltage values near the open circuit value. For the “pumping current” sensors, this open circuit value can be near 3.5 V.Since the Fuel control logic would incorrectly consider this reading to indicate a very rich mixture for an extended time, the fuel control logic can not use the oxygen sensor reading under such conditions.
The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

DTC DESCRIPTION

Checking output signals from HO2S every 15 sec. under detecting condition, if an output signal is below 0.04V for more than 12.5 sec., PCM sets P0131. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Signal low	• Poor Connection • Short to ground in harness • HO2S(B1/S1) • PCM
Enable Conditions	• Battery voltage ≥ 10V • The minimum airflow ≥ 2g/s • Engine running state ≥ 30sec. • The coolant temperature ≥ 60°C(140°F) • The feed-back control (the closed loop) state • No fuel-cut state • Above conditions are met >5 sec.	
Threshold value	• The voltage of HO2S(B1/S1)< 0.04V	
Diagnosis Time	• Continuous (more than 12.5 sec. failure for every 15 sec.test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA

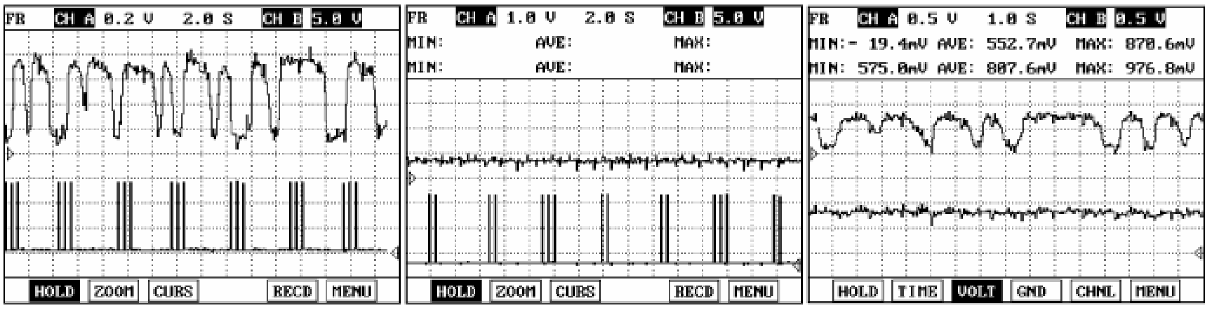


Fig. 1 Fig. 2 Fig. 3

Fig. 1 : HO2S(B1S1) & Heater
Fig. 2 : HO2S(B1S2) & Heater
Fig. 3 : HO2S(B1S1) & HO2S(B1S2)

After warming-up, if accelerator pedal is released suddenly around 4000rpm, the HO2S signal reading will be lower than 200mV resulting from Fuel cut-off for the moment. Conversely, if suddenly accelerator pedal is depressed, HO2S signal reading will be around 0.6V ~1.0V. At idle, HO2S signal will switch from lean to rich normally.

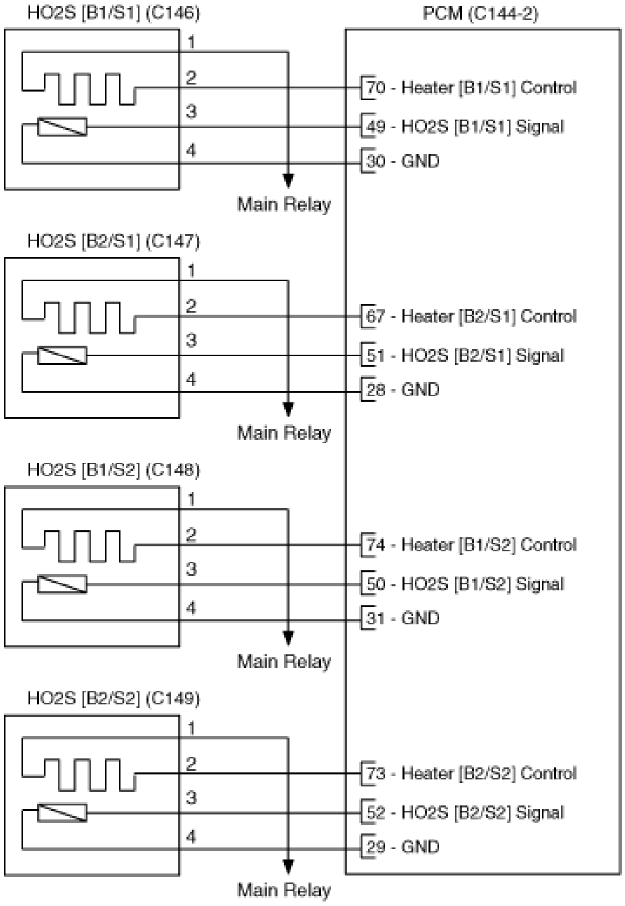
SPECIFICATION

Air/fuel mixture	Voltage(V)
Rich	0.75 ~ 1V
Lean	0 ~ 0.12V

※In case of open circuit, voltage is set to 0.45V(Pumping current OFF) or 3.5V(Pumping current ON)

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

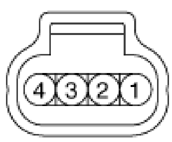
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

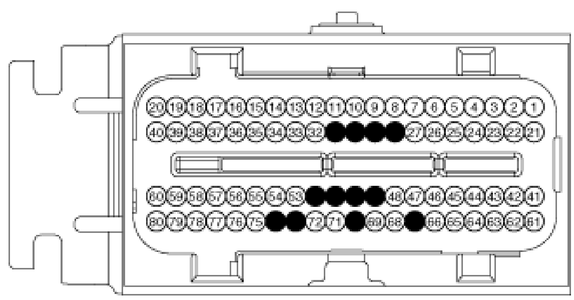
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C144-2
PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "HO2S(B1/S1)" status on the service data.

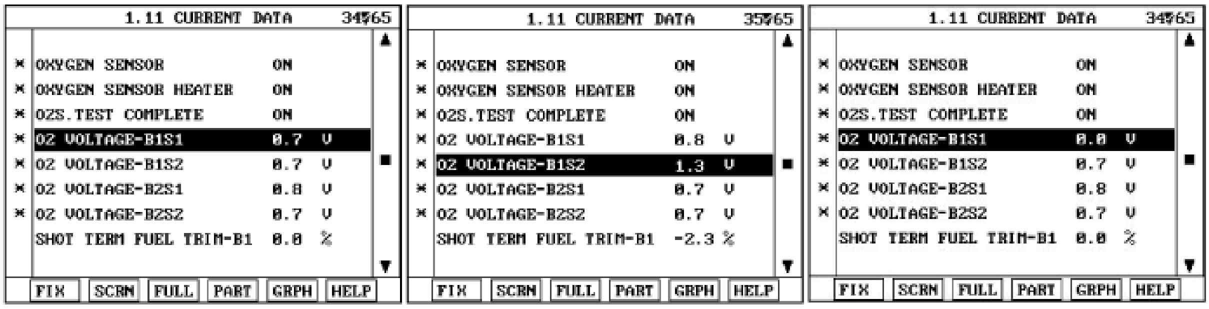


Fig. 1 Fig. 2 Fig. 3

Fig. 1 : Normal data
Fig. 2 : Open or Short to battery in HO2S(B1/S1)
Fig. 3 : Short to ground in HO2S(B1/S1)

4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

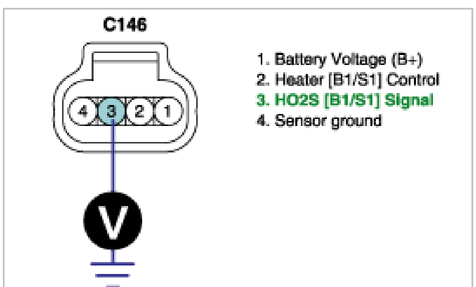
NO

▸ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. IG "OFF" and disconnect HO2S(B1/S1) connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 3 of HO2S(B1/S1) harness connector and chassis ground.

Specification : Approx. 3.5V - when pumping current is ON
Approx. 0.45V - when pumping current is OFF



4. Is the measured voltage within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check HO2S(B1/S1)
   (1) IG "OFF" and disconnect HO2S(B1/S1) connector.
   (2) Check HO2S(B1/S1) for damage or contamination caused by a foreign substance.
   (3) Is the HO2S(B1/S1) normal?

   YES

   ▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Substitute with a known - good HO2S(B1/S1) and check for proper operation. If the problem is corrected, replace HO2S (B1/S1) and go to "Verification of Vehicle Repair" procedure

   > **NOTE**
   >
   > There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

   YES

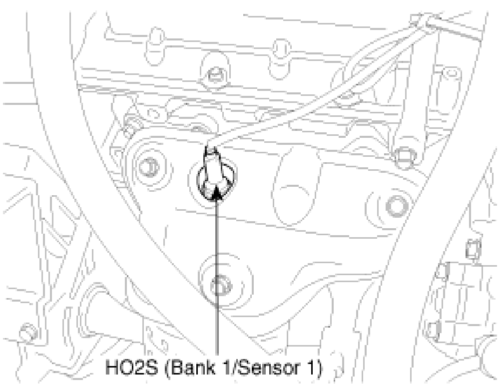
   ▸ Go to the applicable troubleshoooting procedure.

   NO

   ▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0132

COMPONENT LOCATION



GENERAL DESCRIPTION

In order to control emissions of the CO, HC and NOx components of the exhaust gas, heated oxygen sensor (HO2S), mounted on the front side and rear side of catalytic converter, detects the oxygen content in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation.

The HO2S requires a minimum temperature to operate properly and provide a closed loop fuel control system. The HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions.

The oxygen sensor generates a voltage that indicates the difference between the oxygen content of the exhaust stream and the oxygen content of ambient air. When the exhaust stream is “rich,” there is more oxygen in the ambient air than in the exhaust stream, so the voltage will be higher.

Some oxygen sensor varieties use a “bias” voltage to achieve better resolution of the exhaust stream signal. Some oxygen sensor varieties use a “pumping circuit” to force ambient air into the sensor to maintain a more pure environment for comparison.

In either case, a cold sensor will tend to indicate voltage values near the open circuit value. For the “pumping current” sensors, this open circuit value can be near 3.5 V.Since the Fuel control logic would incorrectly consider this reading to indicate a very rich mixture for an extended time, the fuel control logic can not use the oxygen sensor reading under such conditions.
The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

DTC DESCRIPTION

Checking output signals from O2 sensor every 15 sec. under detecting condition, if an output signal is below 1.3V for more than 12.5 sec., PCM sets P0132. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Signal high	• Poor Connection • Short to battery in harness • HO2S(B1/S1) • PCM
Enable Conditions	• Battery voltage ≥ 10V • The minimum airflow ≥ 2g/s • Engine running state ≥ 30sec. • The coolant temperature ≥ 60°C(140°F) • The feed-back control (closed loop) state • No fuel-cut state • Above conditions are met >5 sec.	
Threshold value	• The voltage of HO2S(B1/S1) >1.3V	
Diagnosis Time	• Continuous (more than 12.5 sec. failure for every 15 sec.test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA

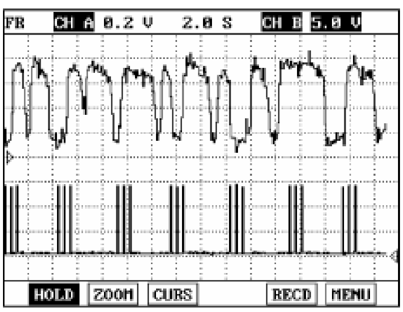


Fig. 1

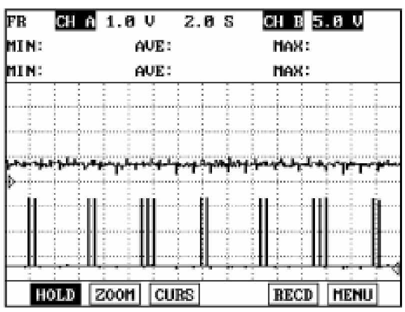


Fig. 2

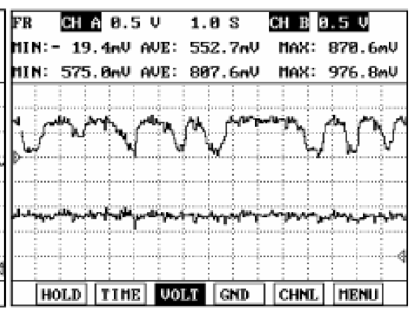


Fig. 3

Fig. 1 : HO2S(B1S1) & Heater
Fig. 2 : HO2S(B1S2) & Heater
Fig. 3 : HO2S(B1S1) & HO2S(B1S2)

After warming-up, if accelerator pedal is released suddenly around 4000rpm, the HO2S signal reading will be lower than 200mV resulting from Fuel cut-off for the moment. Conversely, if suddenly accelerator pedal is depressed, HO2S signal reading will be around 0.6V ~1.0V. At idle, HO2S signal will switch from lean to rich normally.

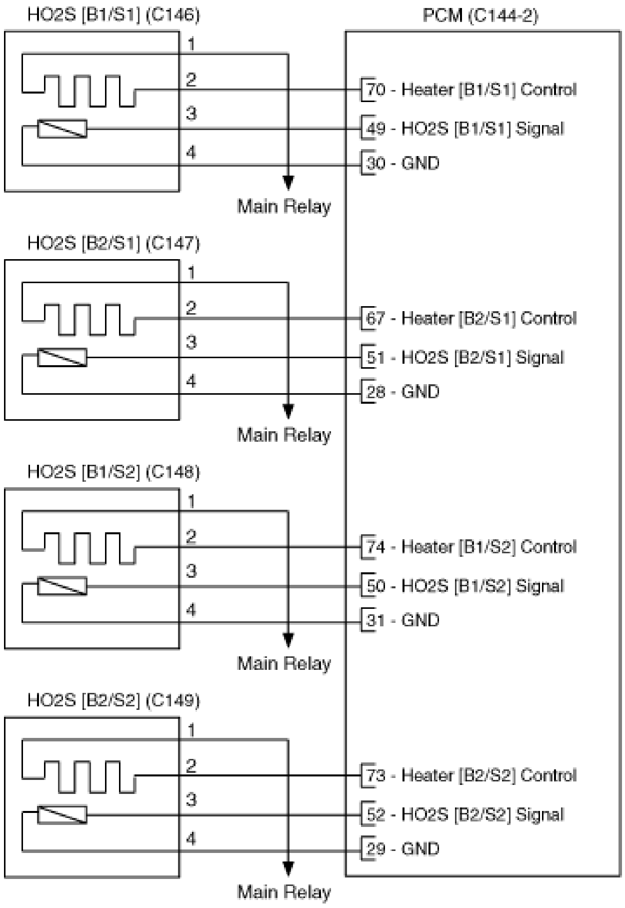
SPECIFICATION

Air/fuel mixture	Voltage(V)
Rich	0.75 ~ 1V
Lean	0 ~ 0.12V

※In case of open circuit, voltage is set to 0.45V(Pumping current OFF) or 3.5V(Pumping current ON)

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

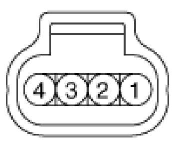
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

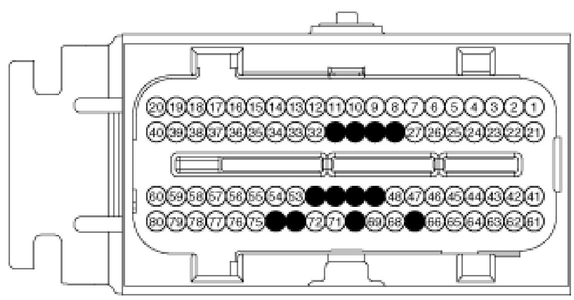
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "HO2S(B1/S1)" status on the service data.

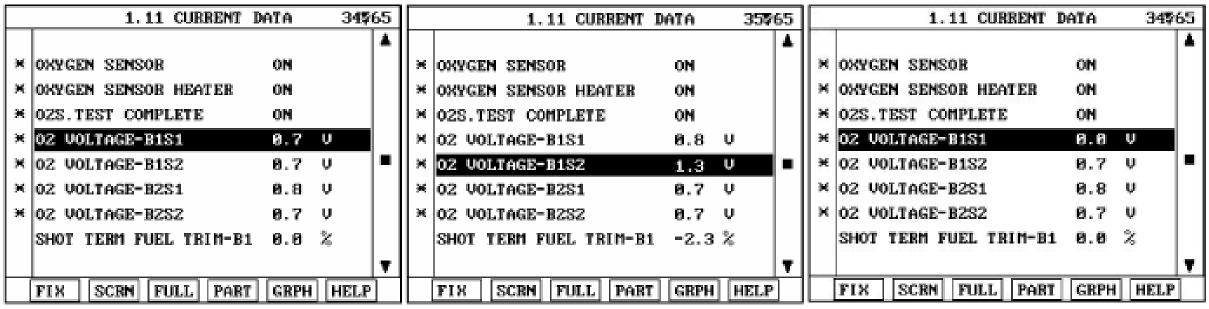


Fig. 1 Fig. 2 Fig. 3

Fig. 1 : Normal data
Fig. 2 : Open or Short to battery in HO2S(B1/S1)
Fig. 3 : Short to ground in HO2S(B1/S1)

4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

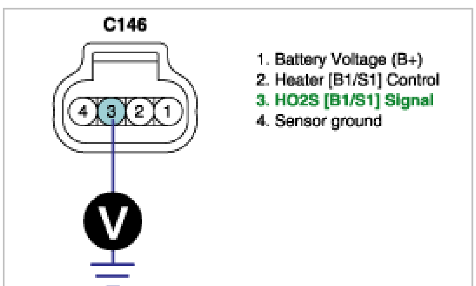
NO

▸ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. IG "OFF" and disconnect HO2S(B1/S1) connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 3 of HO2S(B1/S1) harness connector and chassis ground.

Specification : Approx. 3.5V - when pumping current is ON
Approx. 0.45V - when pumping current is OFF



4. Is the measured voltage within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check HO2S(B1/S1)
   (1) IG "OFF" and disconnect HO2S(B1/S1) connector.
   (2) Check HO2S(B1/S1) for damage or contamination caused by a foreign substance.
   (3) Is the HO2S(B1/S1) normal?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good HO2S(B1/S1) and check for proper operation. If the problem is corrected, replace HO2S (B1/S1) and go to "Verification of Vehicle Repair" procedure

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

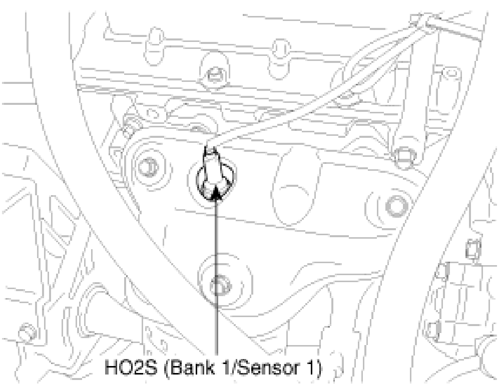
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0133

COMPONENT LOCATION



GENERAL DESCRIPTION

The HO2S is used to supply the PCM with information regarding the composition of the air/fuel mixture. The HO2S is positioned in the exhaust pipe ahead of the TWC. To measure the oxygen content, the HO2S requires a supply of ambient air as a reference. The HO2S produces a voltage that varies between 0.1V and 0.9V under normal operating conditions. The Powertrain Control Module (PCM) monitors this voltage and determines if the exhaust gas is lean or rich. If the voltage input at the PCM is under approx. 0.45V the exhaust is lean, and if the voltage input is over approx. 0.45V the exhaust is rich. The PCM constantly monitors the HO2S signal during closed loop operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary.
This oxygen sensor varieties use a “bias” voltage to achieve better resolution of the exhaust stream signal. Some oxygen sensor varieties use a “pumping circuit” to forceambient air into the sensor to maintain a more pure environment for comparison. In either case, a cold sensor will tend to indicate voltage values near the open circuit value. For the “pumping current” sensors, this open circuit value can be near 3.5 V. Since the Fuel control logic would incorrectly consider this reading to indicate a very rich mixture

for an extended time, the fuel control logic can not use the oxygen sensor reading under such conditions.

DTC DESCRIPTION

The response time of an O2 sensor can be impacted by two factors: temperature and poisoning. Poisoning of the O2 sensor is the primary failure mode of O2 sensor response time. Poisoning can come from many sources: silicone from gaskets or even in the fuel, phosphorous from engine oil, carbon from operating in a cooler environment or lead from the fuel. Most poisoning failures have the potential to clear up after the source of the poisoning has been removed. However, sometimes the poisoning may be so severe that the damage is irreversible.
Checking output signals from HO2S under detecting condition, if an output signal is out of threshold, PCM sets P0133.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Determines O2 sensor functionality by checking its response rate	• Poor connection • Faulty HO2S • Faulty PCM
Enable Conditions	• 1200 ≤ Engine RPM ≤ 4300 • 7.5g/s ≤ Air Flow ≤ 40g/s • Engine run time >60sec • Engine Coolant >70°C(158 °F) • No Decel Fuel Cut-Off Exit with Rich Bias Fueling • No torque Fuel Reduction in effect • No Disabling Faults • All of the conditions above met for more than 2 sec.	
Threshold value	• Switching counter lean to rich ≥ 13 • Switching counter rich to lean ≥ 13 • Response Lean Rich Transition Counter/Response Lean Rich Switch Counter < 29 • Response Rich Lean Transition Counter/Response Rich Lean Switch Counter < 35 • Response Rich Lean Average/Response Lean Rich Average >0.3809 • Response Rich Lean Average/Response Lean Rich Average< 3	
Diagnosis Time	• -	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA

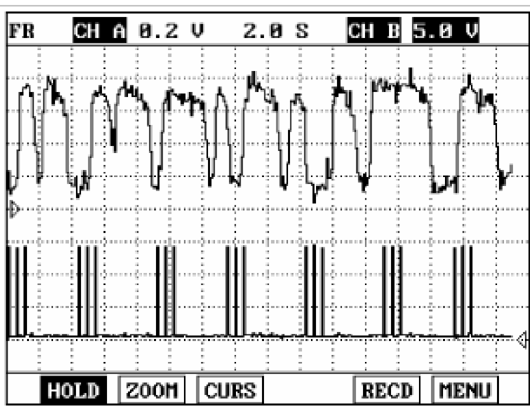


Fig. 1

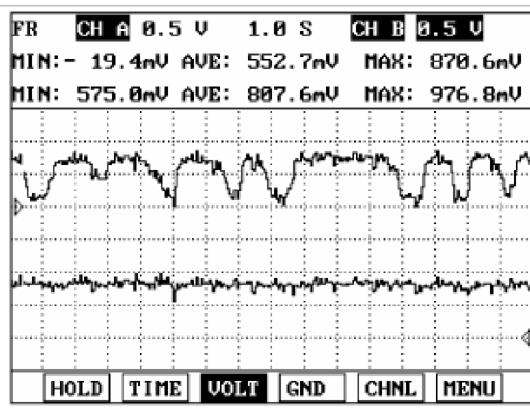


Fig. 2

Fig. 1 : HO2S(B1S1) & Heater
Fig. 2 : HO2S(B1S1) & HO2S(B1S2)

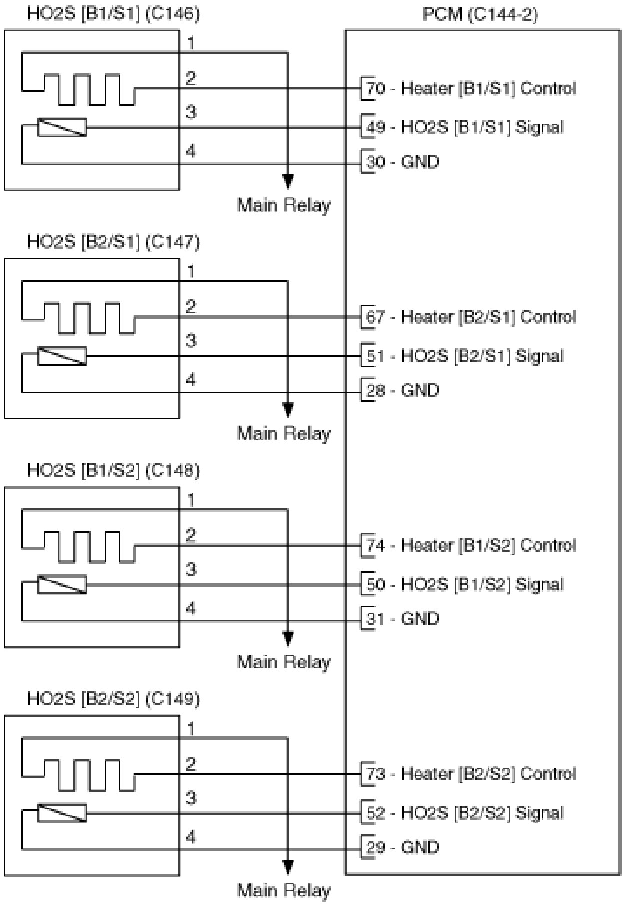
After warming-up, if accelerator pedal is released suddenly around 4000rpm, the HO2S signal reading will be lower than 200mV resulting from Fuel cut-off for the moment. Conversely, if suddenly accelerator pedal is depressed, HO2S signal reading will be around 0.6V ~1.0V. At idle, HO2S signal will switch from lean to rich normally.

SPECIFICATION

HO2S	Response Time (70% Duty at 10Hz)
	lean to rich(Less than 65ms) rich to lean(Less than 80ms)

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

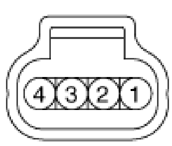
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

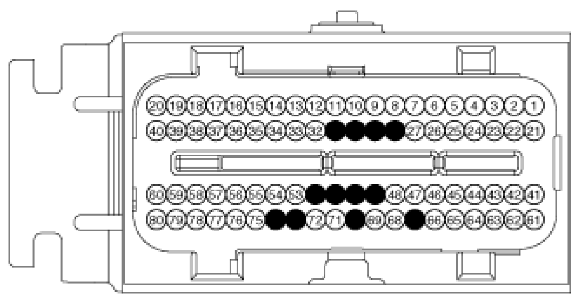
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]

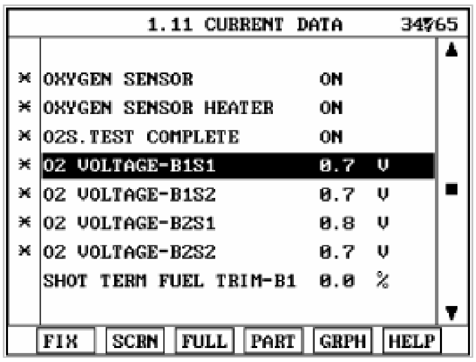


C144-2
PCM

MONITOR SCANTOOL DATA

1. Connect Scantool & Engine "ON"
2. Warm up the engine to normal operating temperature.
3. Monitor HO2S voltage(B1/S1) parameter on scantool

Specification : Voltage will vary from 0.1 to 0.9 V



4. Is the HO2S parameter displayed within specifications ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Component Inspection" procedure

COMPONENT INSPECTION

1. Visual Inspection of HO2S
   (1) Visually/physically inspect following items:
   - Inspect the front HO2S for Contaminated, deteriorated or aged Front HO2S
   - If contamination is evident on the HO2S, replace contaminated sensor

   (2) Is the HO2S visually / physically O.K ?

   YES

   ▸ Go to "Check Performance of H02S" as follows

   NO

   ▸ Substitute with a known - good HO2S and check for proper operation. If the problem is corrected, replace HO2S and go to "Verification of Vehicle Repair" procedure.

2. Check performance of HO2S
   (1) Connect scantool & Engine "ON"

   (2) Warm-up the engine to normal engine temperature.

   (3) Monitor signal waveform of HO2S with scantool.

   Specification : Response times :

HO2S	Response Time (70% Duty at 10Hz)
	lean to rich(Less than 65ms) rich to lean(Less than 80ms)

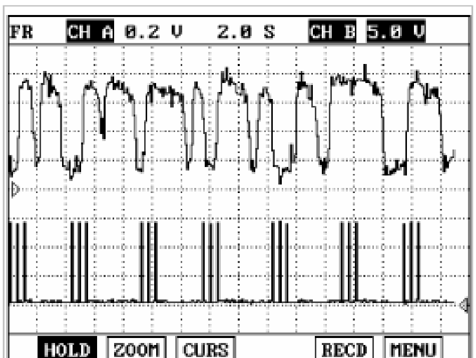


Fig. 1

Fig. 1 : HO2S(B1S1) & Heater

   (4) Is the sensor signal switching properly ?

   YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good HO2S and check for proper operation. If the problem is corrected, replace HO2S and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

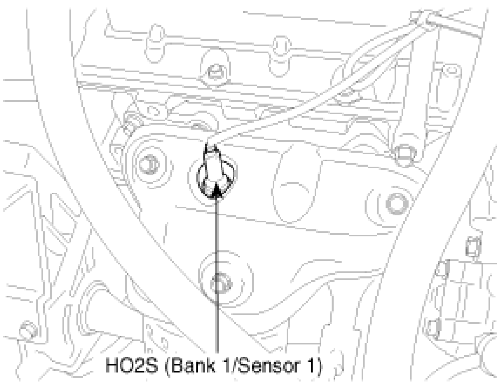
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0134

COMPONENT LOCATION



GENERAL DESCRIPTION

In order to control emissions of the CO, HC and NOx components of the exhaust gas, heated oxygen sensor (HO2S), mounted on the front side and rear side of catalytic converter, detects the oxygen content in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation.
The HO2S requires a minimum temperature to operate properly and provide a closed loop fuel control system. The HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions.
The oxygen sensor generates a voltage that indicates the difference between the oxygen content of the exhaust stream and the oxygen content of ambient air. When the exhaust stream is “rich,” there is more oxygen in the ambient air than in the exhaust stream, so the voltage will be higher.
Some oxygen sensor varieties use a “bias” voltage to achieve better resolution of the exhaust stream signal. Some oxygen sensor varieties use a “pumping circuit” to force ambient air into the sensor to maintain a more pure environment for comparison.
In either case, a cold sensor will tend to indicate voltage values near the open circuit value. For the “pumping current” sensors, this open circuit value can be near 3.5 V.Since the Fuel control logic would incorrectly consider this reading to indicate a very rich mixture for an extended time, the fuel control logic can not use the oxygen sensor reading under such conditions.
The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

DTC DESCRIPTION

Checking output signals from HO2S every 90 sec. under detecting condition, if an output signal indicating open in the circuit lasts for more than 76.5 sec., PCM sets P0134. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

<table>
<tr><th colspan="2">Item</th><th>Detecting Condition</th><th>Possible cause</th></tr>
<tr><td colspan="2">DTC Strategy</td><td>• Open</td><td rowspan="7">• Poor connection
• Open in harness
• HO2S(B1/S1)
• PCM</td></tr>
<tr><td colspan="2">Enable Conditions</td><td>• No sensor cooled status
• The minimum airflow ≥ 2g/s
• The battery voltage ≥ 10V
• Engine running state >30 sec.
• Coolant temperature ≥ 60°C(140°F)</td></tr>
<tr><td rowspan="2">Thresh old value</td><td>Case 1</td><td>• At pumping current ON
• 1.2V ≤ Voltage of HO2S ≤ 3.9V</td></tr>
<tr><td>Case 2</td><td>• At pumping current OFF
• 0.415V ≤ Voltage of HO2S ≤ 0.515V</td></tr>
<tr><td colspan="2">Diagnosis Time</td><td>• Continuous
(more than 76.5 sec.failure for every 90 sec.test)</td></tr>
<tr><td colspan="2">MIL On Condition</td><td>• 2 Driving Cycles</td></tr>
</table>

SIGNAL WAVEFORM AND DATA

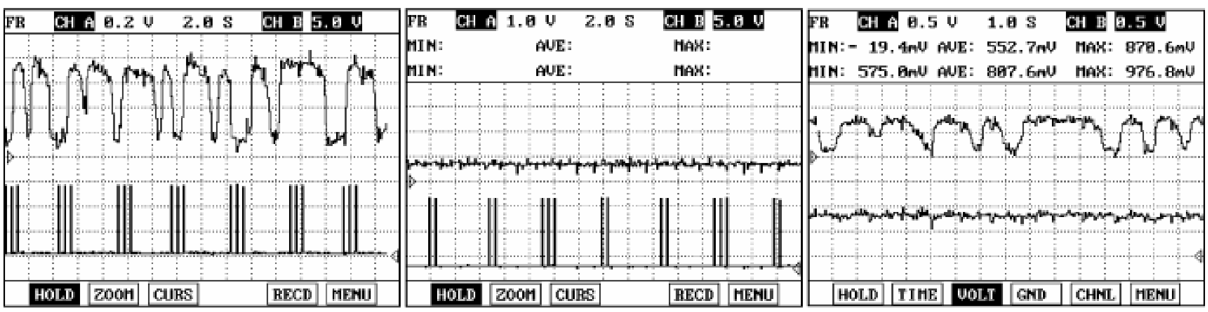


Fig. 1 Fig. 2 Fig. 3

Fig. 1 : HO2S(B1S1) & Heater
Fig. 2 : HO2S(B1S2) & Heater
Fig. 3 : HO2S(B1S1) & HO2S(B1S2)

After warming-up, if accelerator pedal is released suddenly around 4000rpm, the HO2S signal reading will be lower than 200mV resulting from Fuel cut-off for the moment. Conversely, if suddenly accelerator pedal is depressed, HO2S signal reading will be around 0.6V ~1.0V. At idle, HO2S signal will switch from lean to rich normally.

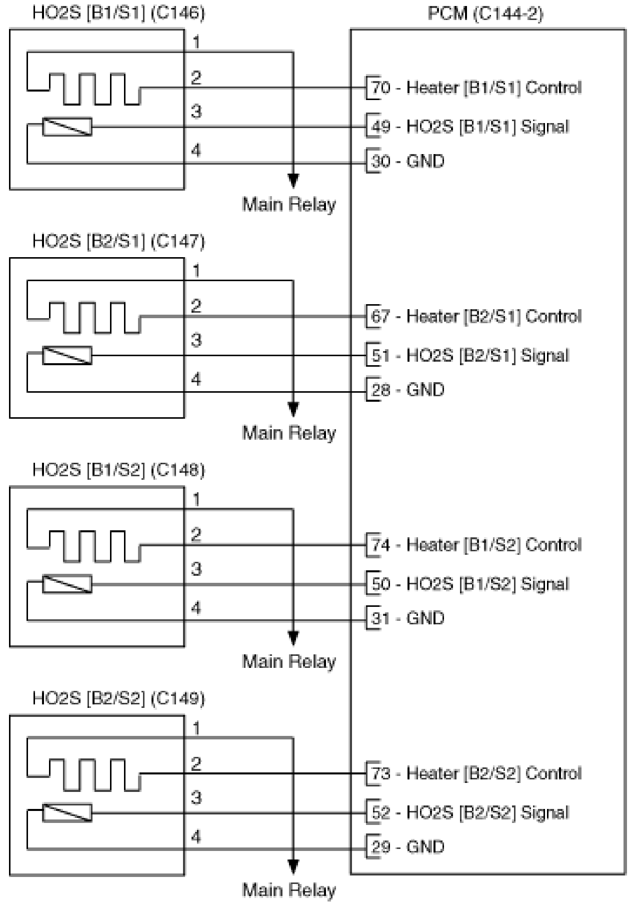
SPECIFICATION

Air/fuel mixture	Voltage(V)
Rich	0.75 ~ 1V
Lean	0 ~ 0.12V

※In case of open circuit, voltage is set to 0.45V(Pumping current OFF) or 3.5V(Pumping current ON)

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

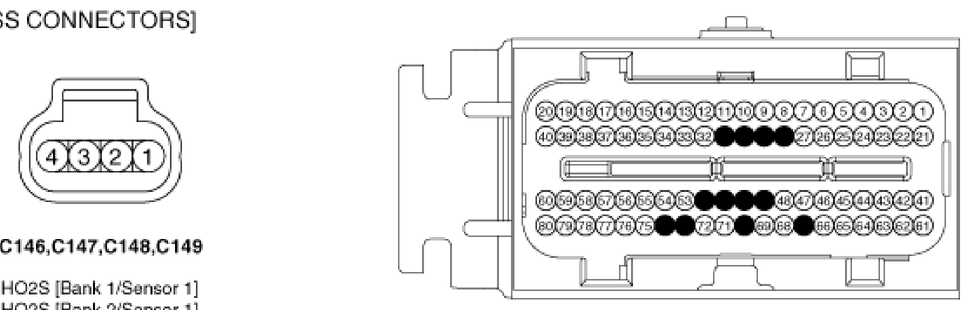
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]

C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "HO2S(B1/S1)" status on the service data.

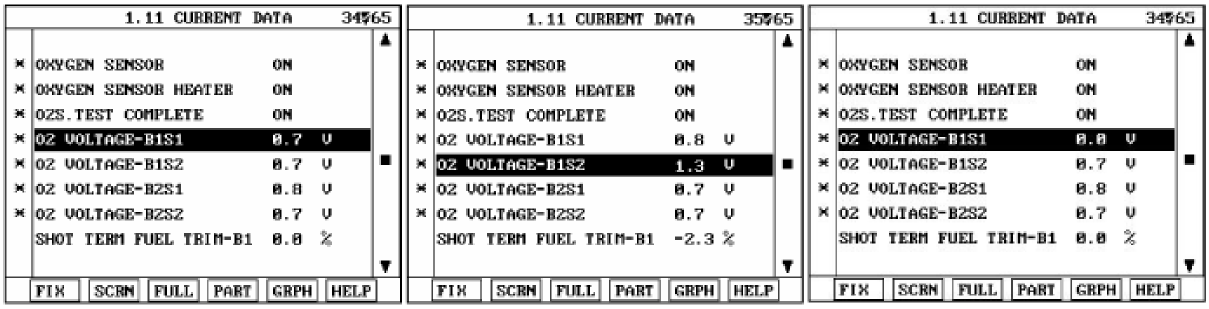


Fig. 1 Fig. 2 Fig. 3

Fig. 1 : Normal data
Fig. 2 : Open or Short to battery in HO2S(B1/S1)
Fig. 3 : Short to ground in HO2S(B1/S1)

4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

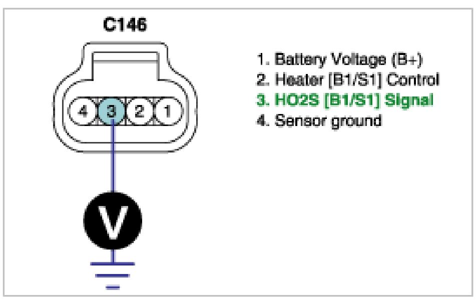
NO

▸ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. IG "OFF" and disconnect HO2S(B1/S1) connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 3 of HO2S(B1/S1) harness connector and chassis ground.

Specification : Approx. 3.5V - when pumping current is ON
Approx. 0.45V - when pumping current is OFF



4. Is the measured voltage within specification?

YES

▸ Go to "Ground circuit inspection" procedure.

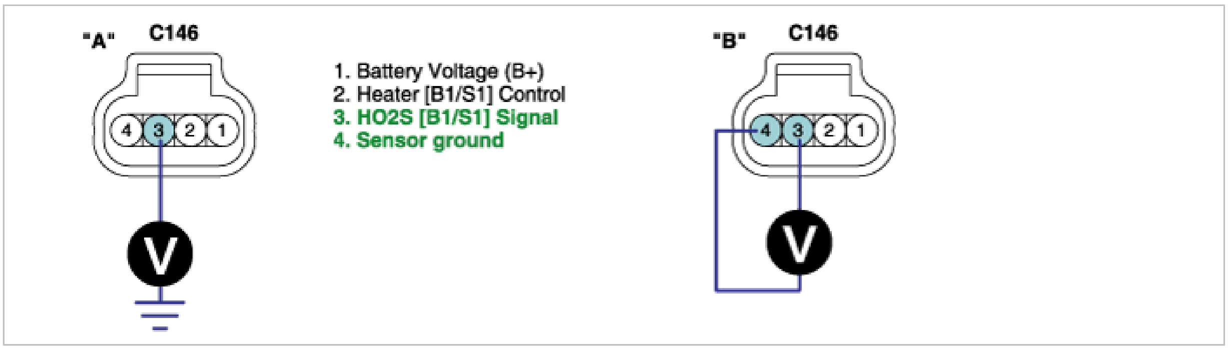
NO

▸ Repair open in harness, and go to "Verification of Vehicle Repair" prcedure.

GROUND CIRCUIT INSPECTION

1. IG "ON" and disconnect HO2S(B1/S1) connector.
2. Measure voltage between terminal 3 of HO2S(B1/S1) harness connector and chassis ground.
3. Measure voltage between terminals 3 and 4 of HO2S(B1/S1) harness connector.

Specification : Voltage difference between measurement "A" and "B" is below 200mV.



4. Is the measured voltage within specification?

YES

▸ Go to "Component inspection" procedure.

NO

▸ Repair open or contact resistance in harness, and go to "Verification of Vehicle Repair" prcedure.

COMPONENT INSPECTION

1. Check HO2S(B1/S1)
   (1) IG "OFF" and disconnect HO2S(B1/S1) connector.
   (2) Check HO2S(B1/S1) for damage or contamination caused by a foreign substance.
   (3) Is the HO2S(B1/S1) normal?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good HO2S(B1/S1) and check for proper operation. If the problem is corrected, replace HO2S (B1/S1) and go to "Verification of Vehicle Repair" procedure

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

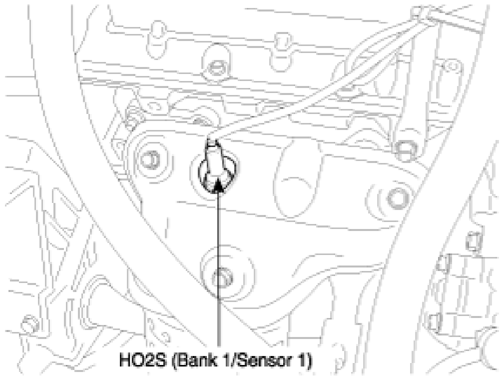
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0135

COMPONENT LOCATION



GENERAL DESCRIPTION

In order to control emissions of the CO, HC and NOx components of the exhaust gas, heated oxygen sensor (HO2S), mounted on the front side and rear side of catalytic converter, detects the oxygen content in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation.
The HO2S requires a minimum temperature to operate properly and provide a closed loop fuel control system. The HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions.
The oxygen sensor generates a voltage that indicates the difference between the oxygen content of the exhaust stream and the oxygen content of ambient air. When the exhaust stream is “rich,” there is more oxygen in the ambient air than in the exhaust stream, so the voltage will be higher.
Some oxygen sensor varieties use a “bias” voltage to achieve better resolution of the exhaust stream signal. Some oxygen sensor varieties use a “pumping circuit” to force ambient air into the sensor to maintain a more pure environment for comparison.
In either case, a cold sensor will tend to indicate voltage values near the open circuit value. For the “pumping current” sensors, this open circuit value can be near 3.5 V.Since the Fuel control logic would incorrectly consider this reading to indicate a very rich mixture for an extended time, the fuel control logic can not use the oxygen sensor reading under such conditions.
The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

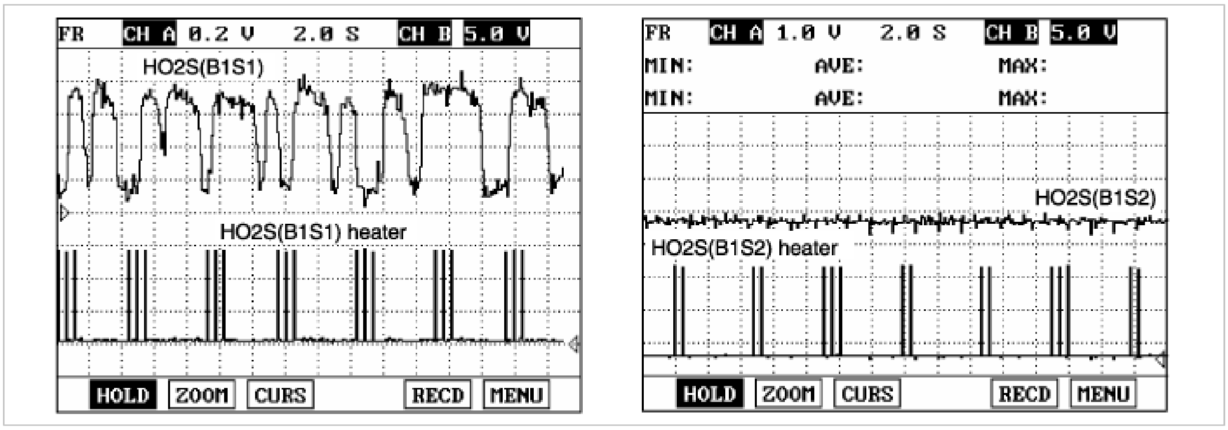
DTC DESCRIPTION

The O2 Heater diagnostic compares the current that is passing through the O2 Heater to a low limit. When the current is too low, the O2 Heater is considered failed.A failed O2 Heater will have an affect on vehicle emissions, especially on cold starts. The O2 Heater allows the O2 Sensor to work properly more quickly after the engine starts. If the PCM detects heater current is lower than threshold value for 2.5 seconds or over while enable condition is met PCM determines that a fault exists and a DTC is stored.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Compares the current that is passing through the O2 Heater to a low limit	• Poor Connection • Contact Resistance • HO2S(B1/S1) • PCM
Enable Conditions	• Ignition ON • Engine Running >60s • Heater Duty Cycle >0.4% • Max. Duty Cycle - Min. Duty Cycle< 0.05% • Delay Time ≥ 5s	
Threshold value	• Filtered O2 Heater Current < threshold value	
Diagnosis Time	• Continuous (More than 2.5 second failure for every 5 second test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA



The HO2S requires a minimum temperature to provide a closed loop fuel control system. So the HO2S contains a heater element to reduce its warm-up time and ensure its performance during all driving conditions. The HO2S heater is controlled ON after engine start except for Cold condition and high speed accelleration. The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

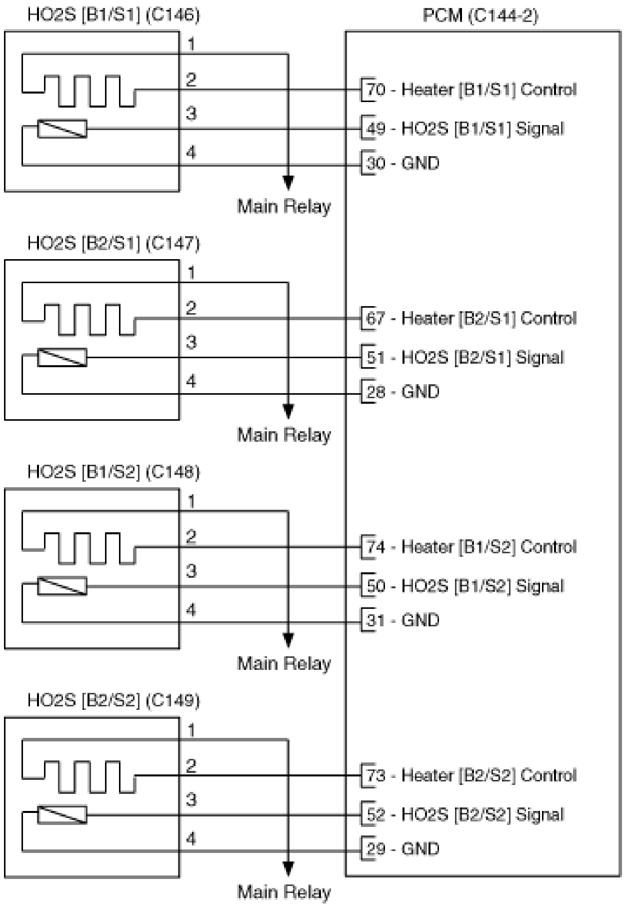
SPECIFICATION

For reference only

Condition	Current(A)
Heater Current at 13.5V, 450°C(842°F) Exhaust	0.52 ± 0.1
Heater In-rush Current at 21°C(69.8°F), 13.5V	1.7 MAX
Heater In-rush Current at -40°C(-40°F), 13.5V	2.2 MAX

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

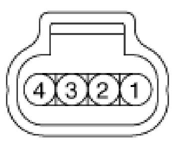
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

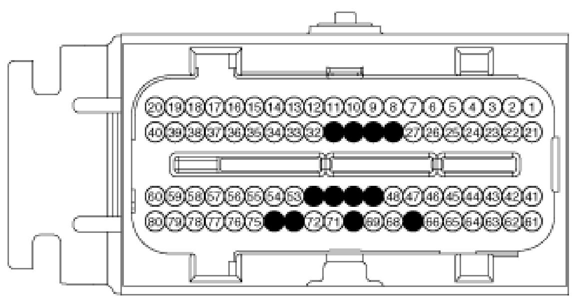
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]

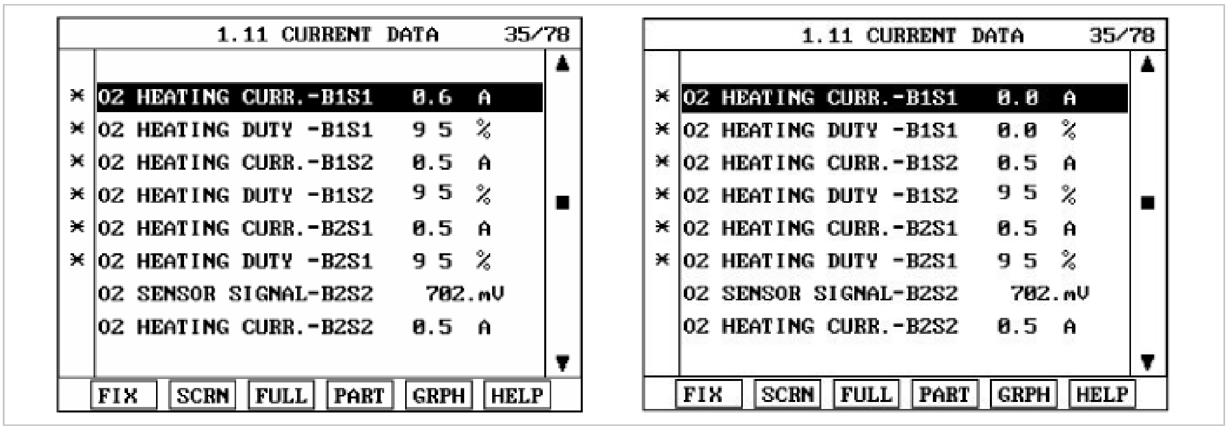


C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "HO2S(B1/S1) Heater" status on the service data.



4. Is the "HO2S Heater(B1/S1)" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

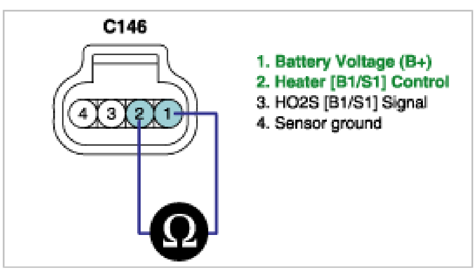
▸ Go to " Component Inspection " procedure.

COMPONENT INSPECTION

1. Check HO2S(B1/S1) Heater resistance
   (1) IG "OFF" and disconnect HO2S(B1/S1) connector
   (2) Measure resistance between terminal 1 and 2 of HO2S(B1/S1)(Component Side)

Specification :

Heater	
Resistance (Ω)	9.6 ± 1.5 at 21°C(69.8°F)



(3) Is the measured resistance within specification ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Substitute with a known - good HO2S(B1/S1) and check for proper operation. If the problem is corrected, replace HO2S (B1/S1) and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

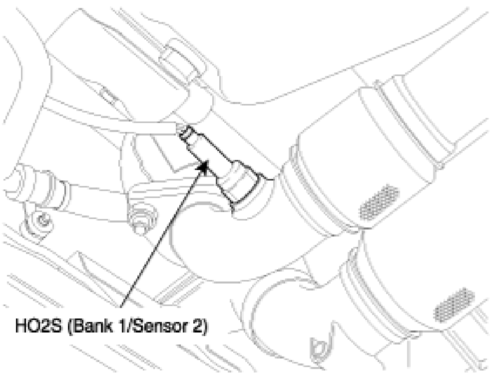
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0137

COMPONENT LOCATION



GENERAL DESCRIPTION

HO2S(B1/S2) is in the back of Catalytic Converter to check the proper operation of catalyst. As Exhaust gas already passed through catalyst, oxygen density in it is within specific range. If the oxygen density changes in accordance with HO2S(B1/S2), it means the poor performance of catalytic converter.

DTC DESCRIPTION

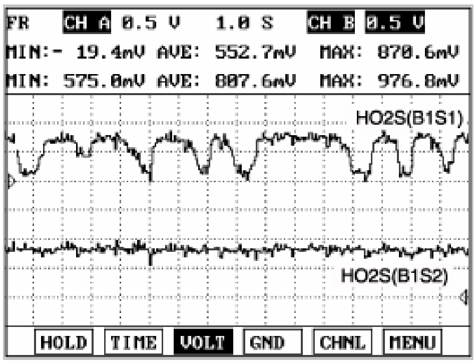
Checking output signals from HO2S every 15 sec. under detecting condition, if an output signal is below 0.05V for more than 12.5 sec. PCM sets P0137. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Signal low	• Poor Connection • Short to ground in harness • HO2S(B1/S2) • PCM
Enable Conditions	• Battery voltage ≥ 10V • The minimum airflow ≥ 2g/s • Engine running state ≥ 30 sec • The coolant temperature ≥ 60°C(140°F) • The feed-back control (the closed loop) state • No fuel-cut state • Above conditions are met >5 sec	
Threshold value	• The voltage of HO2S(B1/S2)< 0.04V	

Diagnosis Time	• Continuous (more than 12.5 sec. failure for every 15 sec.test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA



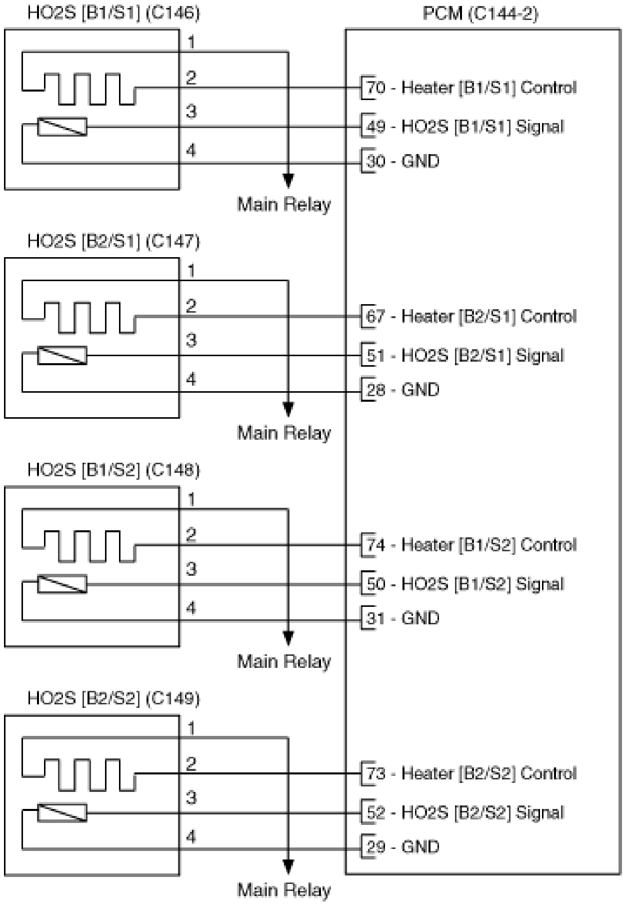
The amplitude of the signal output of the rear HO2S is small compared to the front HO2S because the rear HO2S detects emission gas purified by the catalytic converter. This is the normal signal waveform of the rear HO2S at idle.

SPECIFICATION

Air/fuel mixture	Voltage(V)
Rich	0.75 ~ 1V
Lean	0 ~ 0.12V

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

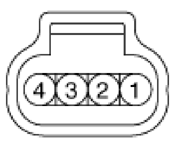
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

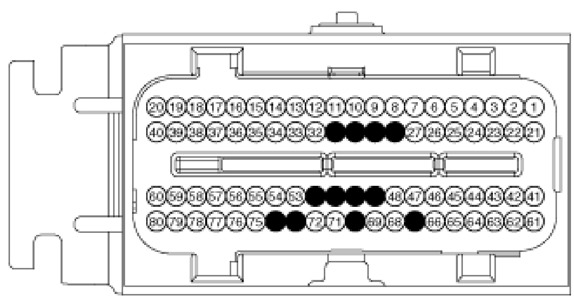
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C144-2
PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "HO2S(B1/S2)" item on the service data.

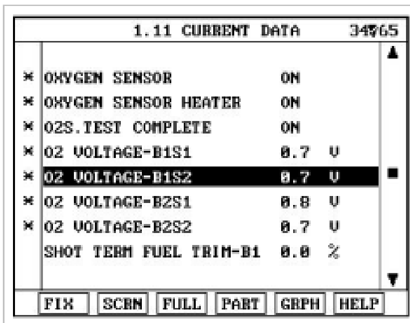


Fig. 1

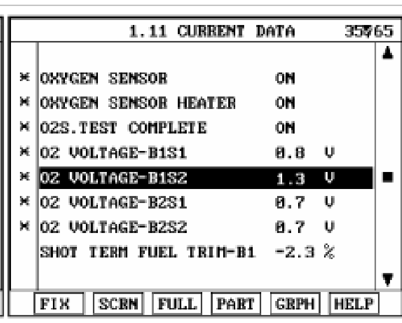


Fig. 2

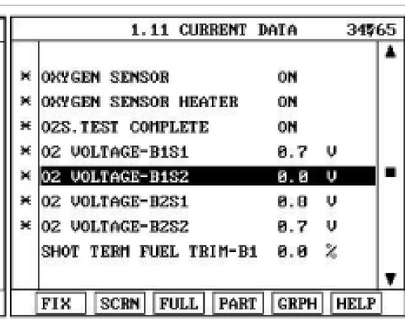


Fig. 3

4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

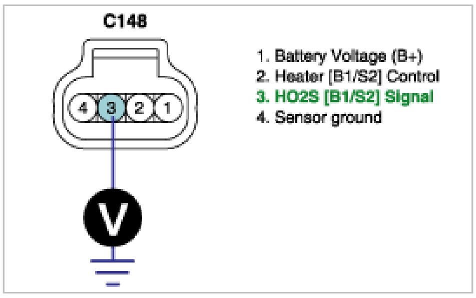
NO

▸ Go to " Signal Circuit Inspection " procedure.

SIGNAL CIRCUIT INSPECTION

1. IG "OFF" and disconnect HO2S(B1/S2)
2. IG "ON"
3. Measure voltage between terminal 3 of HO2S(B1/S2) harness connector and chassis ground.

Specification : Approx. 3.5V - when pumping current is ON
Approx. 0.45V - when pumping current is OFF



4. Is the measured voltage within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Visual Inspection of HO2S
   Visually/physically inspect following items:
   A. Inspect the Rear HO2S for Contaminated, deteriorated or aged Rear HO2S
   B. If contamination is evident on the HO2S, replace contaminated sensor
2. Is the HO2S(B1/S2) normal?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good HO2S(B1/S2) and check for proper operation. If the problem is corrected, replace HO2S (B1/S1) and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

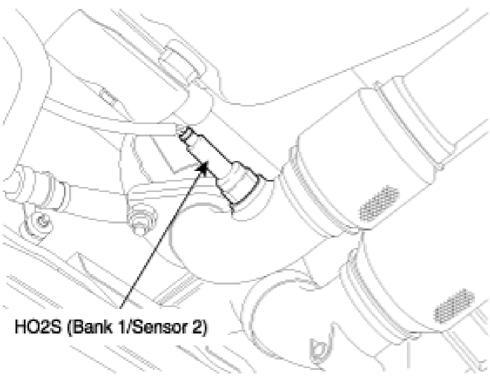
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0138

COMPONENT LOCATION



GENERAL DESCRIPTION

HO2S(B1/S2) is in the back of Catalytic Converter to check the proper operation of catalyst. As Exhaust gas already passed through catalyst, oxygen density in it is within specific range. If the oxygen density changes in accordance with HO2S(B1/S2), it means the poor performance of catalytic converter.

DTC DESCRIPTION

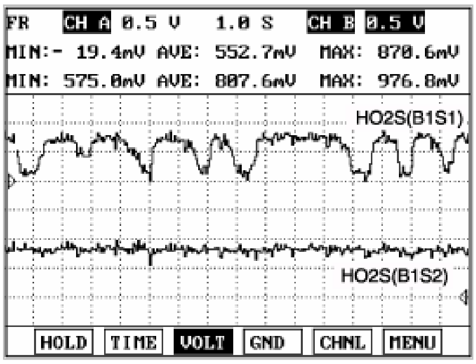
Checking output signals from HO2S every 15 sec. under detecting condition, if an output signal is above 1.3V for more than 12.5 sec. PCM sets P0138. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Signal high	• Poor connection • Short to battery in harness • HO2S(B1/S2) • PCM
Enable Conditions	• Battery voltage ≥ 10V • The minimum airflow ≥ 2g/s • Engine running state ≥ 30 sec • The coolant temperature ≥ 60°C(140°F) • Feed-back control(Closed loop) state • No fuel-cut state • Above conditions are met > 5 sec	
Threshold value	• The voltage of HO2S(B1/S2) > 1.3V	
Diagnosis Time	• Continuous	

	(more than 12.5 sec.failure for every 15 sec.test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA



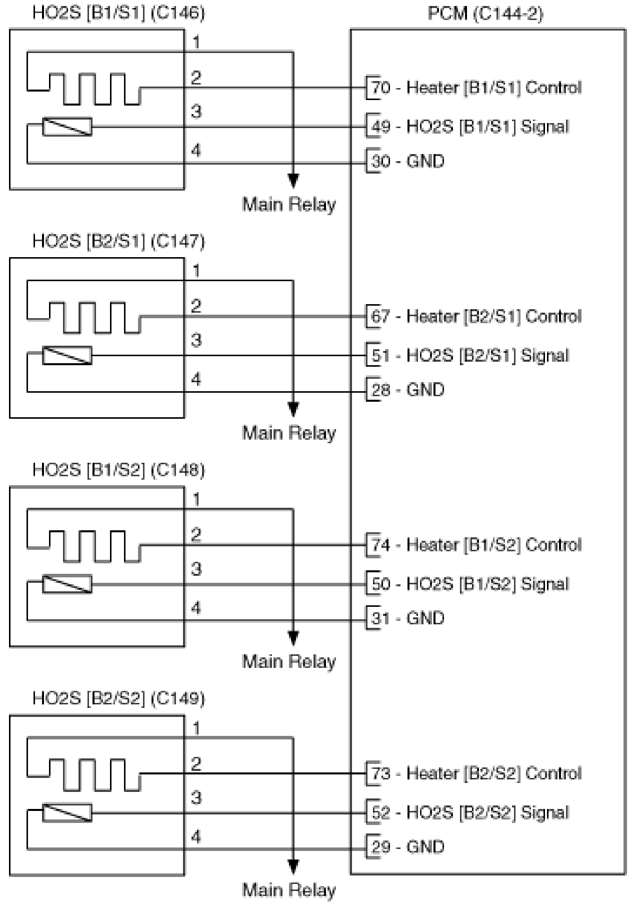
The amplitude of the signal output of the rear HO2S is small compared to the front HO2S because the rear HO2S detects emission gas purified by the catalytic converter. This is the normal signal waveform of the rear HO2S at idle.

SPECIFICATION

Air/fuel mixture	Voltage(V)
Rich	0.75 ~ 1V
Lean	0 ~ 0.12V

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

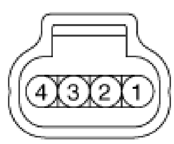
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

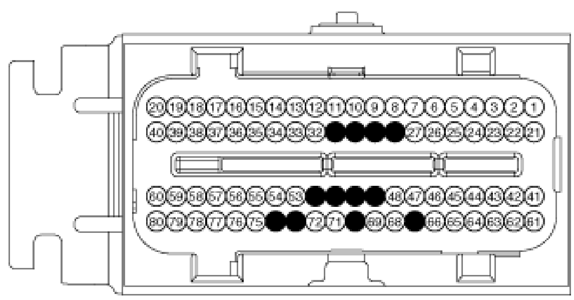
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C144-2
PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "HO2S(B1/S2)" item on the service data.

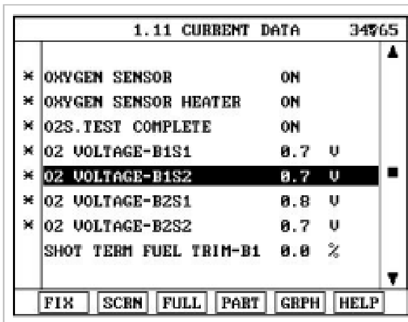


Fig. 1

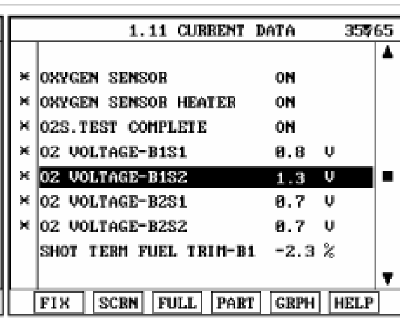


Fig. 2

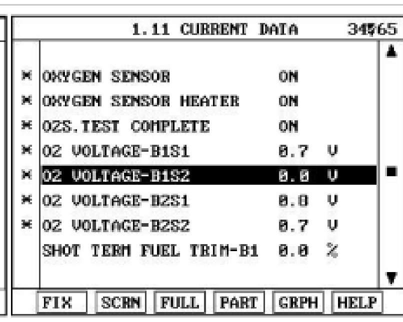


Fig. 3

4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

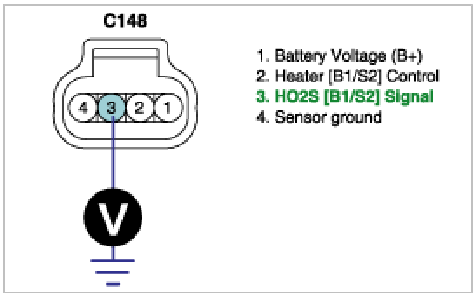
NO

▸ Go to " Signal Circuit Inspection " procedure.

SIGNAL CIRCUIT INSPECTION

1. IG "OFF" and disconnect HO2S(B1/S2) connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 3 of HO2S(B1/S2) harness connector and chassis ground.

Specification : Approx. 3.5V - when pumping current is ON
Approx. 0.45V - when pumping current is OFF



4. Is the measured voltage within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Visual Inspection of HO2S
   Visually/physically inspect following items:
   A. Inspect the Rear HO2S for Contaminated, deteriorated or aged Rear HO2S
   B. If contamination is evident on the HO2S, replace contaminated sensor
2. Is the HO2S(B1/S2) normal?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good HO2S(B1/S2) and check for proper operation. If the problem is corrected, replace HO2S (B1/S1) and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

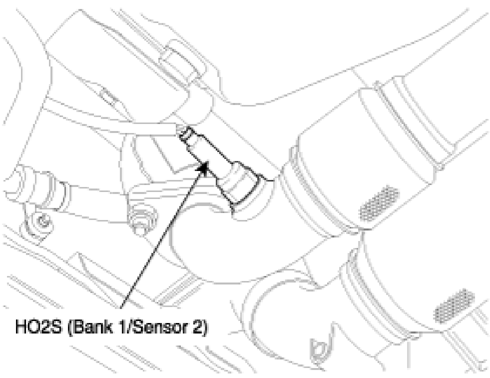
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0139

COMPONENT LOCATION



GENERAL DESCRIPTION

The rear heated oxygen sensor is mounted on the rear side of the Catalytic Converter (warm-up catalytic converter) or in the rear exhaust pipe, which is able to detect the catalyst efficiency. The rear heated oxygen sensor (HO2S) produces a voltage between 0V and 1V. This rear heated oxygen sensor is used to estimate the oxygen storage capability. If a catalyst has good conversion properties, the oxygen fluctuations are smoothed by the oxygen storage capacity of the catalyst. If the conversion provided by the catalyst is low due to aging, poisoning or misfiring, then the oxygen fluctuations are similar to signals from the front oxygen sensor.

DTC DESCRIPTION

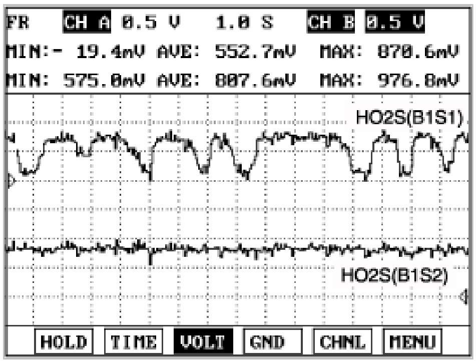
Since the Catalyst Diagnostic uses the oxygen sensors to determine the quality of the catalyst, and since an extended period of time with the rear oxygen sensor value steady is interpreted as a “good” catalyst, the Catalyst Diagnostic can be rendered inaccurate by an improperly functioning oxygen sensor. This diagnostic will extend the period of time that the Catalyst diagnostic requests a fuel shift. If the oxygen sensor still fails to respond after this extended time, then there is a fault with the sensor. Checking the Maximum time allowed between the front sensor response and the rear sensor response to the Stage1 or 2 fuel shift under detecting condition, if the fuel shift time is higher than 25sec, PCM determines a fault and sets DTC P0139. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Determines if Rear O2 Sensor is acceptable for Idle Catalyst Monitor use	
Enable Conditions	• If Idle Catalyst Monitor Diagnostic is enabled HO2S Bank 1 Sensor 2 Response Diagnostic Enable Criteria Met	

Threshold value	• Maximum time allowed between the front sensor response and the rear sensor response to the Stage1(Forced to lean) ICMD(Idle Catalyst Monitor Diagnostic)fuel shift ≥ 25sec • Maximum time allowed between the front sensor response and the rear sensor response to the Stage 2(Forced to rich) ICMD(Idle Catalyst Monitor Diagnostic) fuel shift ≥ 25sec	• Poor connection • Faulty HO2S • Faulty PCM
Diagnosis Time	• -	
MIL On Condition	• 2 driving cycles	

SIGNAL WAVEFORM AND DATA



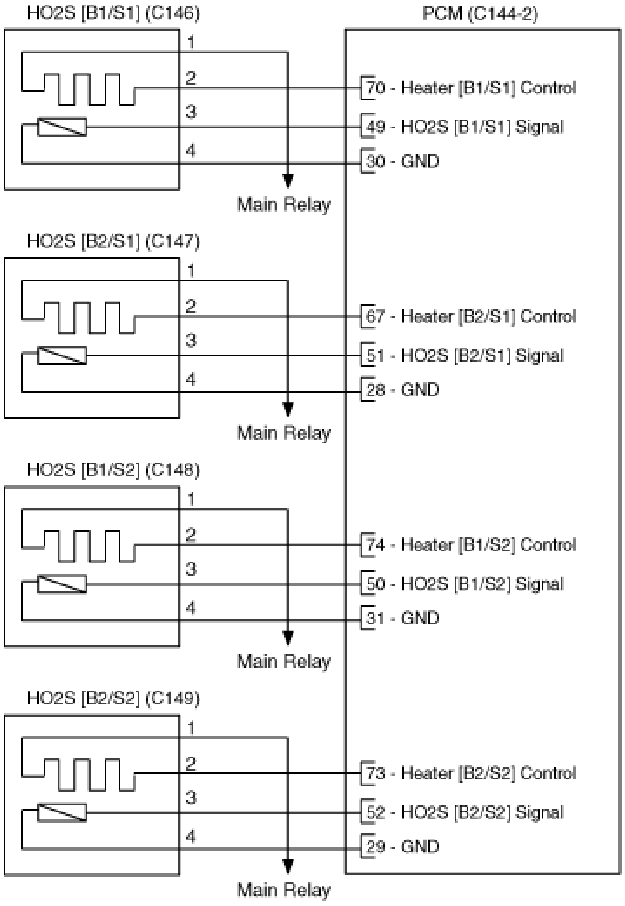
The amplitude of the signal output of the rear HO2S is small compared to the front HO2S because the rear HO2S detects emission gas purified by the catalytic converter. This is the normal signal waveform of the rear HO2S at idle.

SPECIFICATION

Air/fuel mixture	Voltage(V)
Rich	0.75 ~ 1V
Lean	0 ~ 0.12V

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

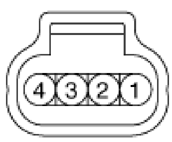
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

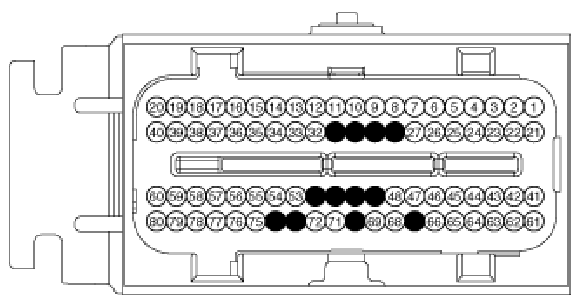
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



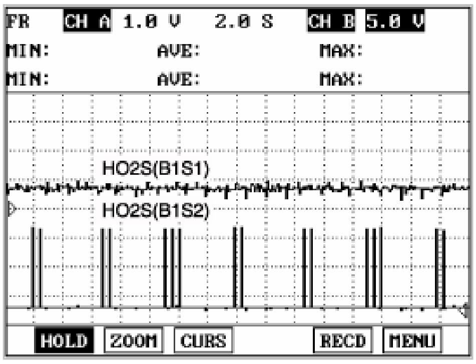
C144-2

PCM

MONITOR SCANTOOL DATA

1. Connect Scantool then Engine "ON"
2. Warm up the engine to normal operating temperature.
3. Monitor the signal waveform of HO2S(B1S2) with scantool

Specification : 0.1 ~ 0.9V



4. Is the shift time from signal waveform within specifications ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to " Component Inspection" procedure.

COMPONENT INSPECTION

1. Visual Inspection of HO2S
   Visually/physically inspect following items:
   A. Inspect the Rear HO2S for Contaminated, deteriorated or aged Rear HO2S
   B. If contamination is evident on the HO2S, replace contaminated sensor
2. Is the HO2S(B1/S2) O.K ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.

NO

▸ Substitute with a known - good HO2S(B1S2) and check for proper operation. If the problem is corrected, replace HO2S (B1S2) and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

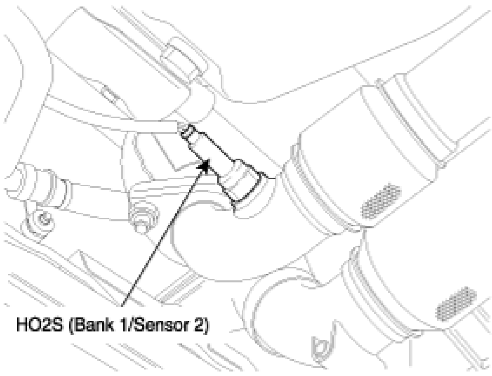
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0140

COMPONENT LOCATION



GENERAL DESCRIPTION

HO2S(B1/S2) is in the back of Catalytic Converter to check the proper operation of catalyst. As Exhaust gas already passed through catalyst, oxygen density in it is within specific range. If the oxygen density changes in accordance with HO2S(B1/S2), it means the poor performance of catalytic converter.

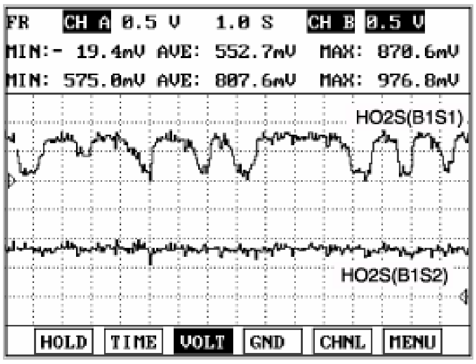
DTC DESCRIPTION

Checking output signals from HO2S every 10 sec. under detecting condition, if an output signal indicating open in the circuit lasts for more than 6.3 sec., PCM sets P0140. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

<table>
<tr><th colspan="2">Item</th><th>Detecting Condition</th><th>Possible cause</th></tr>
<tr><td colspan="2">DTC Strategy</td><td>• Open</td><td rowspan="7">• Poor Connection
• Open in harness
• HO2S(B1/S2)
• PCM</td></tr>
<tr><td colspan="2">Enable Conditions</td><td>• No sensor cooled status
• The minimum airflow ≥ 2g/s
• The battery voltage ≥ 10V
• Engine running state >30 sec.
• Coolant temperature ≥ 60°C(140°F)</td></tr>
<tr><td rowspan="2">Threshold value</td><td>Case 1</td><td>• At pumping current ON
• 1.2V ≤ Voltage of HO2S ≤ 3.9V</td></tr>
<tr><td>Case 2</td><td>• At pumping current OFF
• 0.415V ≤ Voltage of HO2S ≤ 0.515V</td></tr>
<tr><td colspan="2">Diagnosis Time</td><td>• Continuous
(more than 6.3 sec.failure for every 10 sec.test)</td></tr>
<tr><td colspan="2">MIL On Condition</td><td>• 2 driving cycles</td></tr>
</table>

SIGNAL WAVEFORM AND DATA



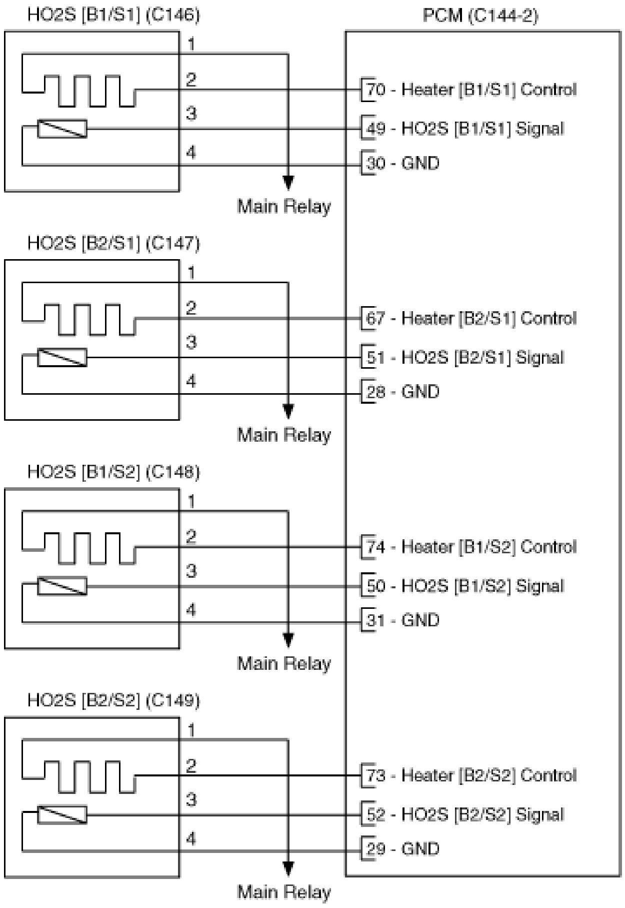
The amplitude of the signal output of the rear HO2S is small compared to the front HO2S because the rear HO2S detects emission gas purified by the catalytic converter. This is the normal signal waveform of the rear HO2S at idle.

SPECIFICATION

Air/fuel mixture	Voltage(V)
Rich	0.75 ~ 1V
Lean	0 ~ 0.12V

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

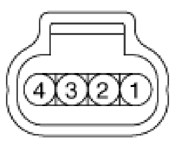
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

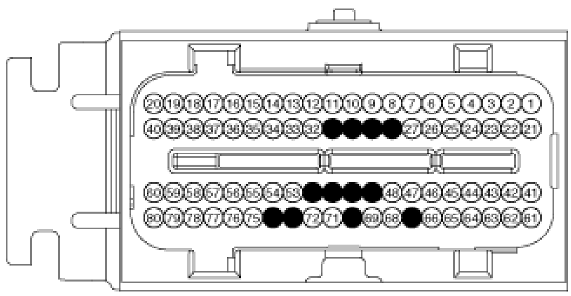
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C144-2
PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "HO2S(B1/S2)" item on the service data.

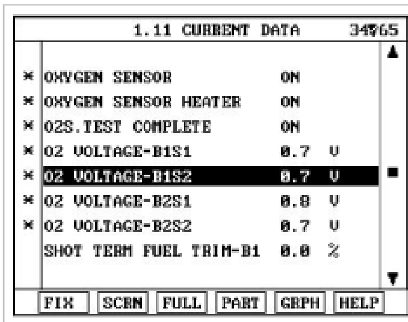


Fig. 1

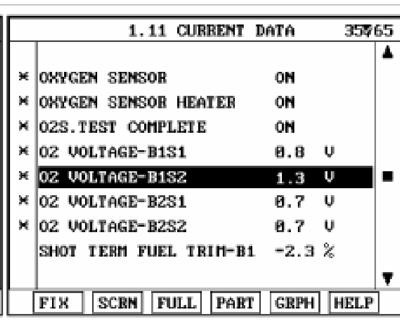


Fig. 2

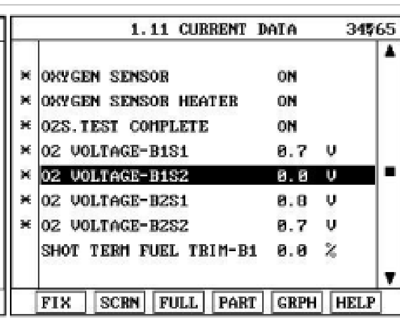


Fig. 3

4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

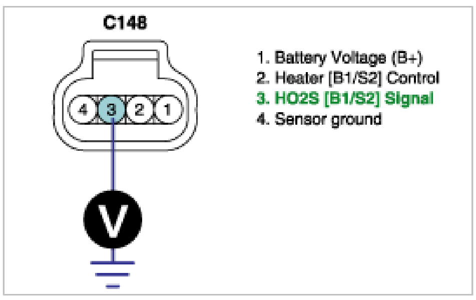
NO

▸ Go to " Signal Circuit Inspection " procedure.

SIGNAL CIRCUIT INSPECTION

1. IG "OFF" and disconnect HO2S(B1/S2) connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 3 of HO2S(B1/S2) harness connector and chassis ground.

Specification : Approx. 3.5V - when pumping current is ON
Approx. 0.45V - when pumping current is OFF



4. Is the measured voltage within specification?

YES

▸ Go to "Ground Circuit Inspection" procedure.

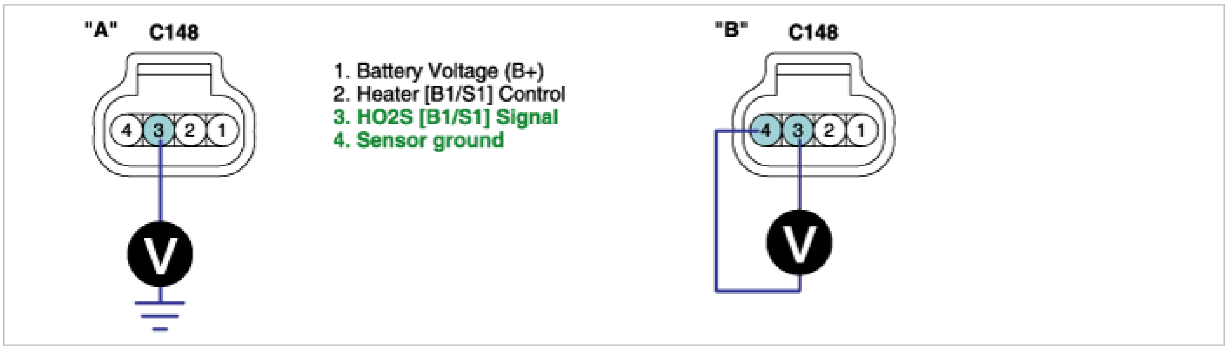
NO

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "ON" and disconnect HO2S(B1/S2) connector.
2. Measure voltage between terminal 3 of HO2S(B1/S2) harness connector and chassis ground.
3. Measure voltage between terminals 3 and 4 of HO2S(B1/S2) harness connector.

Specification : Voltage difference between measurement "A" and "B" is below 200mV.



4. Is the measured voltage within specification?

YES

▸ Go to "Component inspection" procedure.

NO

▸ Repair open or contact resistance in harness, and go to "Verification of Vehicle Repair" prcedure.

COMPONENT INSPECTION

1. Visual Inspection of HO2S
   Visually/physically inspect following items:
   A. Inspect the Rear HO2S for Contaminated, deteriorated or aged Rear HO2S
   B. If contamination is evident on the HO2S, replace contaminated sensor
2. Is the HO2S(B1/S2) normal?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good HO2S(B1/S2) and check for proper operation. If the problem is corrected, replace HO2S (B1/S1) and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

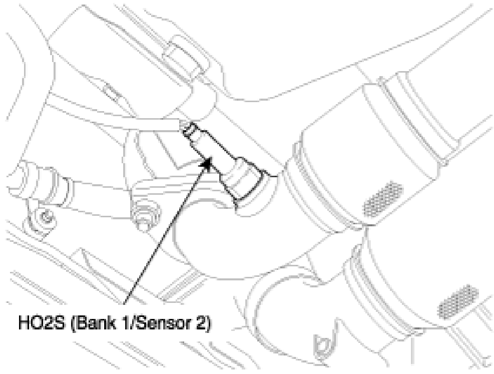
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0141

COMPONENT LOCATION



GENERAL DESCRIPTION

HO2S(B1/S2) is in the back of Catalytic Converter to check the proper operation of catalyst. As Exhaust gas already passed through catalyst, oxygen density in it is within specific range. If the oxygen density changes in accordance with HO2S(B1/S2), it means the poor performance of catalytic converter.

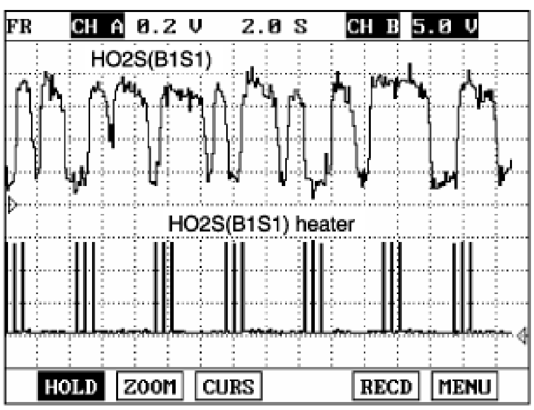
DTC DESCRIPTION

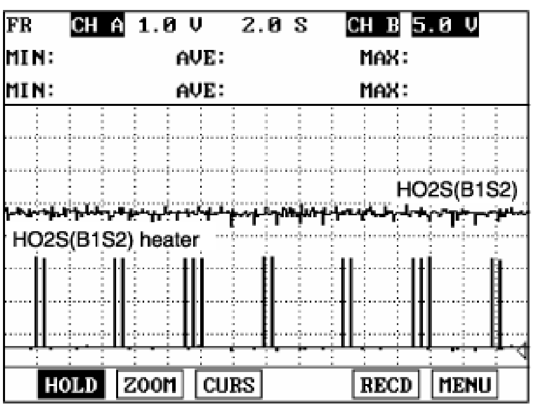
The O2 Heater diagnostic compares the current that is passing through the O2 Heater to a low limit. When the current is too low, the O2 Heater is considered failed.A failed O2 Heater will have an affect on vehicle emissions, especially on cold starts. The O2 Heater allows the O2 Sensor to work properly more quickly after the engine starts. If the PCM detects heater output voltage is lower than threshold value for 5 seconds while enable condition is met PCM determines that a fault exists and a DTC is stored.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Compares the current that is passing through the O2 Heater to a low limit	• Poor Connection • Contact Resistance • HO2S(B1/S2) • PCM
Enable Conditions	• Ignition ON • Engine Running >60s • Heater Duty Cycle >0.4% • Max. Duty Cycle - Min. Duty Cycle< 0.05% • Delay Time ≥ 5s	
Threshold value	• Filtered O2 Heater Current < 0.02A	
Diagnosis Time	• Continuous (More than 2.5 second failure for every 5 second test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA





The HO2S requires a minimum temperature to provide a closed loop fuel control system. So the HO2S contains a heater element to reduce its warm-up time and ensure its performance during all driving conditions. The HO2S heater is controlled ON after

engine start except for Cold condition and high speed accelleration. The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

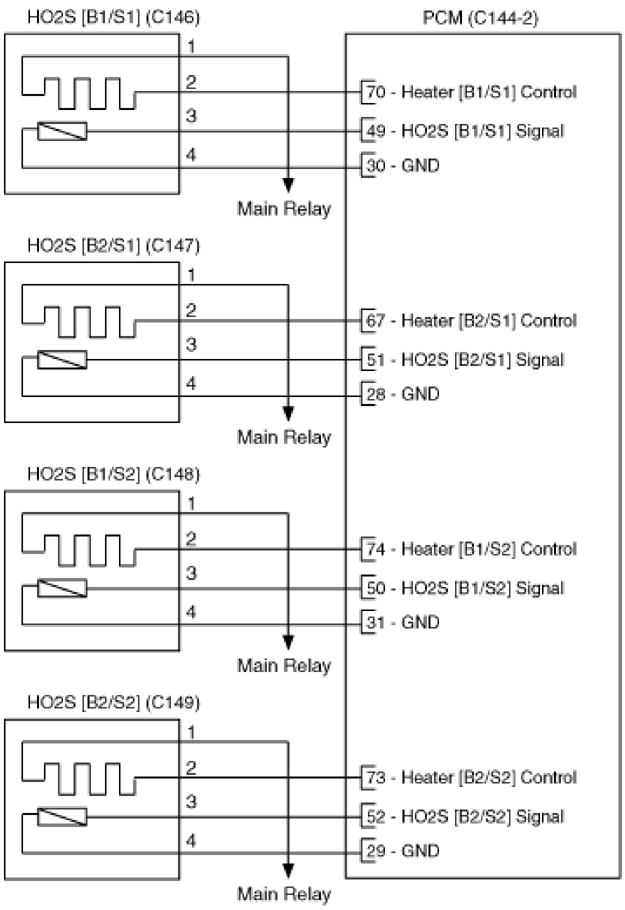
SPECIFICATION

For reference only

Condition	Current(A)
Heater Current at 13.5V, 450°C(842°F) Exhaust	0.52 ± 0.1
Heater In-rush Current at 21°C(69.8°F), 13.5V	1.7 MAX
Heater In-rush Current at -40°C(-40 °F), 13.5V	2.2 MAX

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

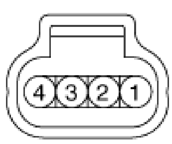
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

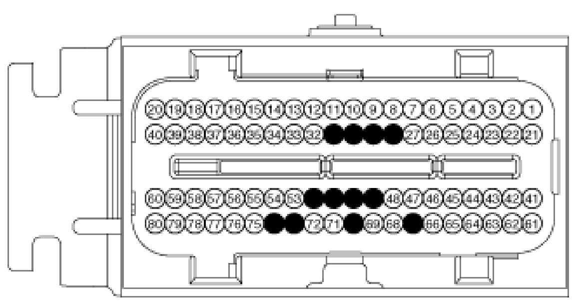
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]

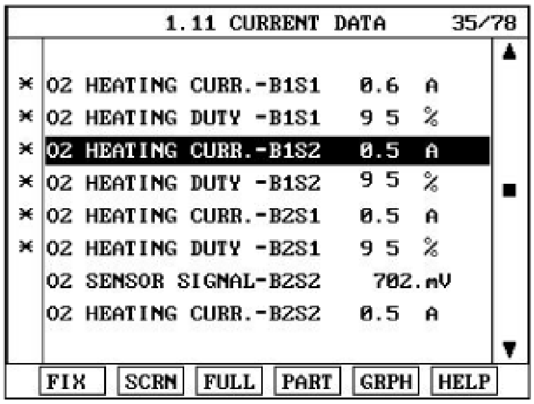


C144-2
PCM

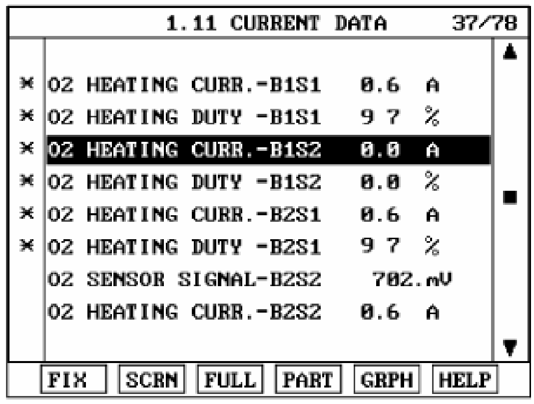
MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.

2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "HO2S(B1/S2) Heater" item on the service data.



Normal data



Open circuit in HO2S heater

4. Is the "HO2S Heater(B1/S2)" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

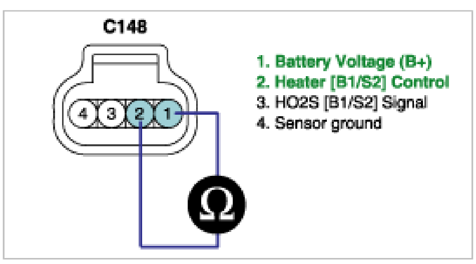
NO

▸ Go to " Component Inspection " procedure.

COMPONENT INSPECTION

1. Check HO2S(B1/S2) Heater resistance
   (1) IG "OFF" and disconnect HO2S(B1/S2) connector
   (2) Measure resistance between terminal 1 and 2 of HO2S(B1/S2)(Component Side)
   Specification :

Heater	
Resistance (Ω)	9.6 ± 1.5 at 21°C(69.8°F)



   (3) Is the measured resistance within specification ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Substitute with a known - good HO2S(B1/S2) and check for proper operation. If the problem is corrected, replace HO2S (B1/S2) and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

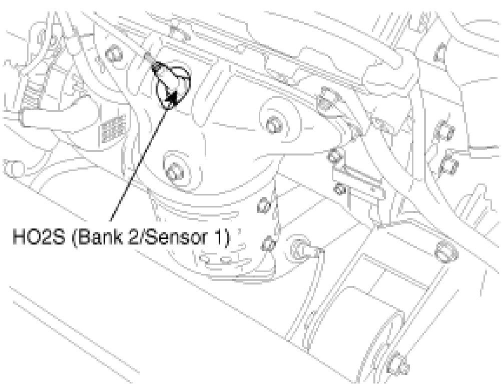
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0151

COMPONENT LOCATION



GENERAL DESCRIPTION

In order to control emissions of the CO, HC and NOx components of the exhaust gas, heated oxygen sensor (HO2S), mounted on the front side and rear side of catalytic converter, detects the oxygen content in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation.
The HO2S requires a minimum temperature to operate properly and provide a closed loop fuel control system. The HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions.
The oxygen sensor generates a voltage that indicates the difference between the oxygen content of the exhaust stream and the oxygen content of ambient air. When the exhaust stream is “rich,” there is more oxygen in the ambient air than in the exhaust stream, so the voltage will be higher.
Some oxygen sensor varieties use a “bias” voltage to achieve better resolution of the exhaust stream signal. Some oxygen sensor varieties use a “pumping circuit” to force ambient air into the sensor to maintain a more pure environment for comparison.
In either case, a cold sensor will tend to indicate voltage values near the open circuit value. For the “pumping current” sensors, this open circuit value can be near 3.5 V.Since the Fuel control logic would incorrectly consider this reading to indicate a very rich mixture for an extended time, the fuel control logic can not use the oxygen sensor reading under such conditions.
The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

DTC DESCRIPTION

Checking output signals from HO2S every 15 sec. under detecting condition, if an output signal is below 0.05V for more than 12.5 sec., PCM sets P0151. MI (Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Signal low	• Poor connection • Short to ground in harness • HO2S(B2/S1) • PCM
Enable Conditions	• Battery voltage ≥ 10V • The minimum airflow ≥ 2g/s • Engine running state ≥ 30sec • The coolant temperature ≥ 60°C(140°F) • The feed-back control (the closed loop) state • No fuel-cut state • Above conditions are met >5 sec.	
Threshold value	• The voltage of HO2S(B2/S1)< 0.04V	
Diagnosis Time	• Continuous (more than 12.5 sec. failure for every 15 sec.test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA

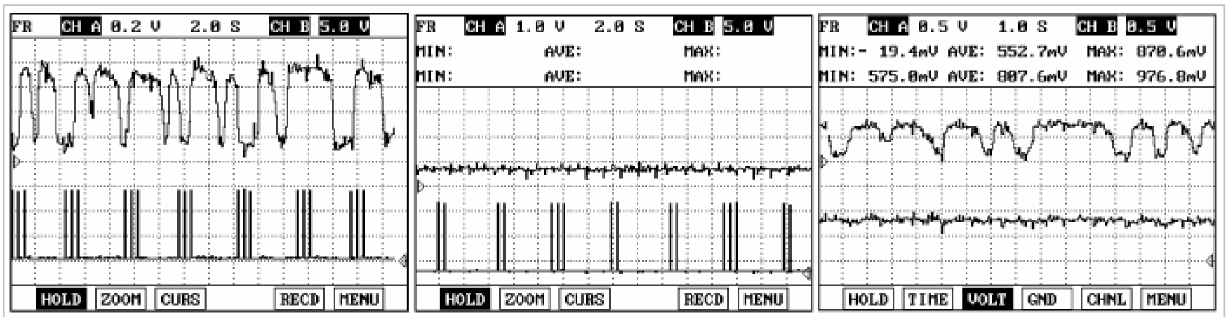


Fig. 1 Fig. 2 Fig. 3

Fig. 1 : HO2S(B2S1) & Heater
Fig. 2 : HO2S(B2S2) & Heater
Fig. 3 : HO2S(B2S1) & HO2S(B2S2)

After warming-up, if accelerator pedal is released suddenly around 4000rpm, the HO2S signal reading will be lower than 200mV resulting from Fuel cut-off for the moment. Conversely, if suddenly accelerator pedal is depressed, HO2S signal reading will be around 0.6V ~1.0V. At idle, HO2S signal will switch from lean to rich normally.

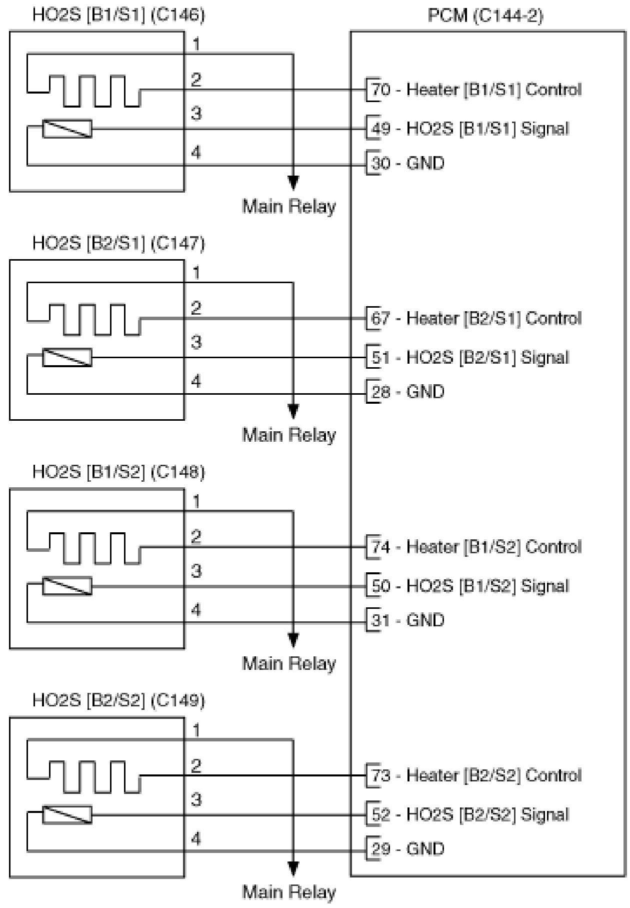
SPECIFICATION

Air/fuel mixture	Voltage(V)
Rich	0.75 ~ 1V
Lean	0 ~ 0.12V

※In case of open circuit, voltage is set to 0.45V(Pumping current OFF) or 3.5V(Pumping current ON)

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

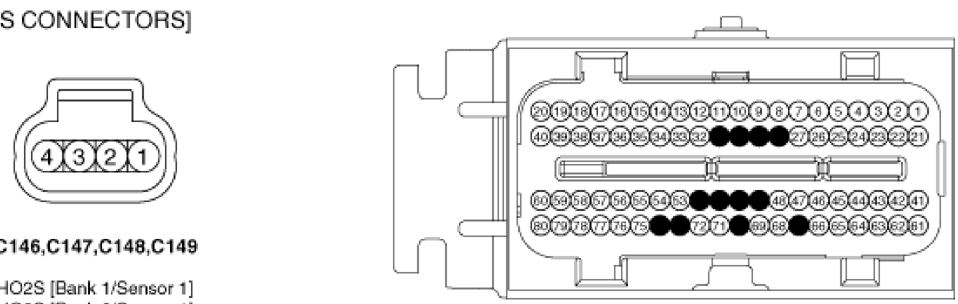
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]

C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "HO2S(B2/S1)" item on the service data.

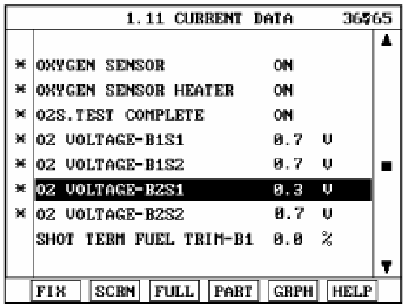


Fig. 1

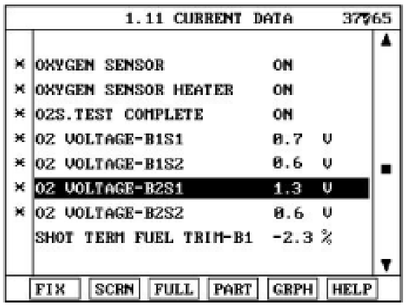


Fig. 2

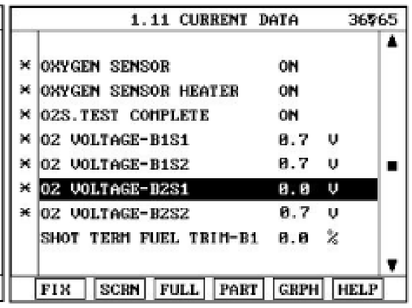


Fig. 3

Fig. 1 : Normal data
Fig. 2 : Open or Short to battery in HO2S(B2/S1)
Fig. 3 : Short to ground in HO2S(B2/S1)

4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found ?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

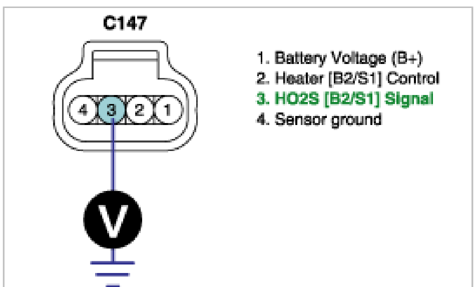
NO

▸ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. IG "OFF" and disconnect HO2S(B2/S1) connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 3 of HO2S(B2/S1) harness connector and chassis ground.

Specification :
Approx. 3.5V - when pumping current is ON
Approx. 0.45V - when pumping current is OFF



4. Is the measured voltage within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check HO2S(B2/S1)
   (1) IG "OFF" and disconnect HO2S(B2/S1) connector.
   (2) Check HO2S(B2/S1) for damage or contamination caused by a foreign substance.
   (3) Is the HO2S(B2/S1) normal?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good HO2S(B2/S1) and check for proper operation. If the problem is corrected, replace HO2S (B2/S1) and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

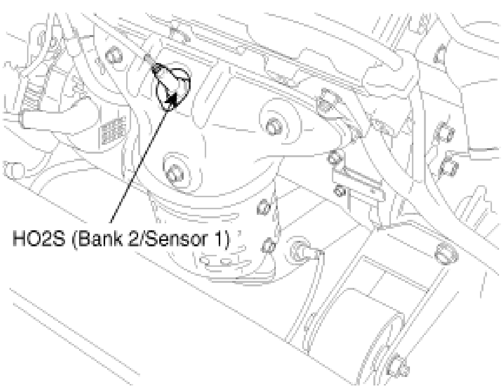
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0152

COMPONENT LOCATION



GENERAL DESCRIPTION

In order to control emissions of the CO, HC and NOx components of the exhaust gas, heated oxygen sensor (HO2S), mounted on the front side and rear side of catalytic converter, detects the oxygen content in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation.
The HO2S requires a minimum temperature to operate properly and provide a closed loop fuel control system. The HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions.
The oxygen sensor generates a voltage that indicates the difference between the oxygen content of the exhaust stream and the oxygen content of ambient air. When the exhaust stream is “rich,” there is more oxygen in the ambient air than in the exhaust stream, so the voltage will be higher.

Some oxygen sensor varieties use a “bias” voltage to achieve better resolution of the exhaust stream signal. Some oxygen sensor varieties use a “pumping circuit” to force ambient air into the sensor to maintain a more pure environment for comparison.
In either case, a cold sensor will tend to indicate voltage values near the open circuit value. For the “pumping current” sensors, this open circuit value can be near 3.5 V.Since the Fuel control logic would incorrectly consider this reading to indicate a very rich mixture for an extended time, the fuel control logic can not use the oxygen sensor reading under such conditions.
The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

DTC DESCRIPTION

Checking output signals from HO2S every 15 sec. under detecting condition, if an output signal is above 1.3V for more than 12.5 sec., PCM sets P0152. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Signal high	• Poor connection • Short to battery in harness • HO2S(B2/S1) • PCM
Enable Conditions	• Battery voltage ≥ 10V • The minimum airflow ≥ 2g/s • Engine running state ≥ 30 sec • The coolant temperature ≥ 60°C(140°F) • Feed-back control(Closed loop) state • No fuel-cut state • Above conditions are met >5 sec	
Threshold value	• The voltage of HO2S(B2/S1) >1.3V	
Diagnosis Time	• Continuous (more than 12.5 sec.failure for every 15 sec.test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA

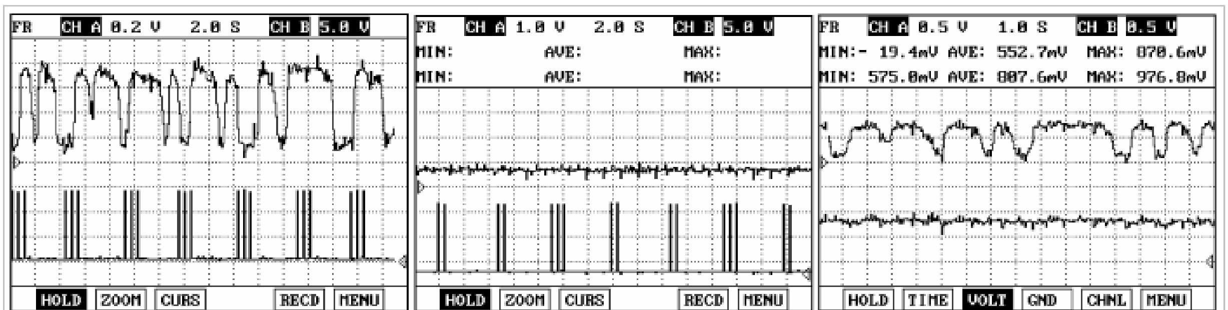


Fig. 1 Fig. 2 Fig. 3

Fig. 1 : HO2S(B2S1) & Heater
Fig. 2 : HO2S(B2S2) & Heater
Fig. 3 : HO2S(B2S1) & HO2S(B2S2)

After warming-up, if accelerator pedal is released suddenly around 4000rpm, the HO2S signal reading will be lower than 200mV resulting from Fuel cut-off for the moment. Conversely, if suddenly accelerator pedal is depressed, HO2S signal reading will be around 0.6V ~1.0V. At idle, HO2S signal will switch from lean to rich normally.

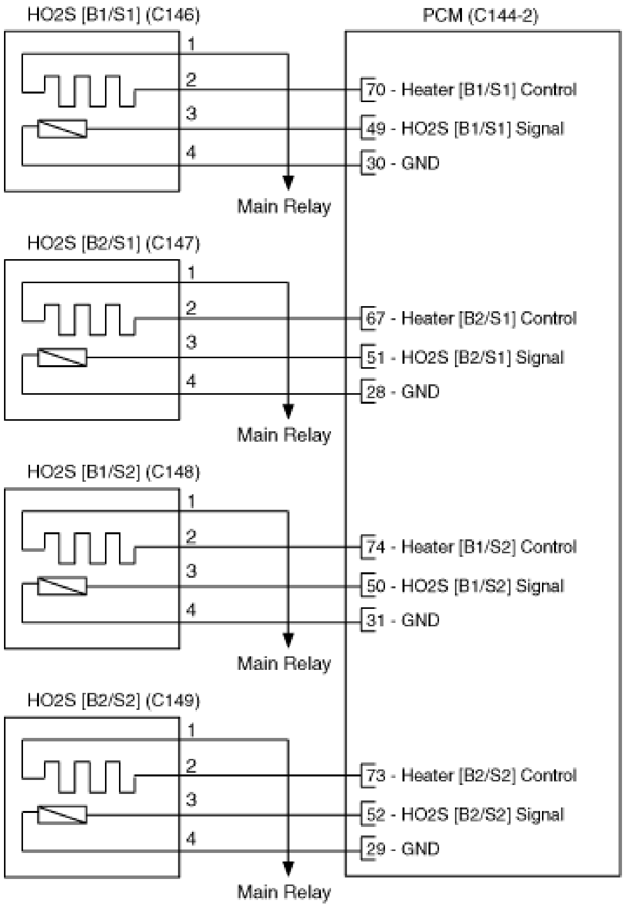
SPECIFICATION

Air/fuel mixture	Voltage(V)
Rich	0.75 ~ 1V
Lean	0 ~ 0.12V

※In case of open circuit, voltage is set to 0.45V(Pumping current OFF) or 3.5V(Pumping current ON)

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

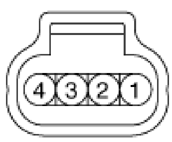
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

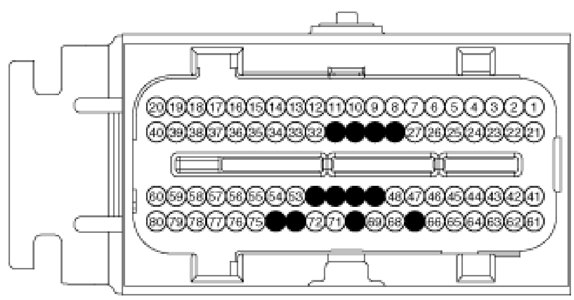
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "HO2S(B2/S1)" item on the service data.

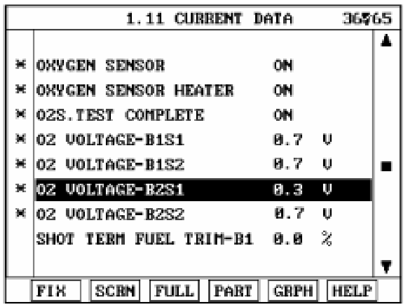


Fig. 1

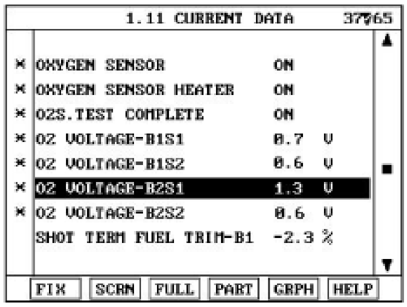


Fig. 2

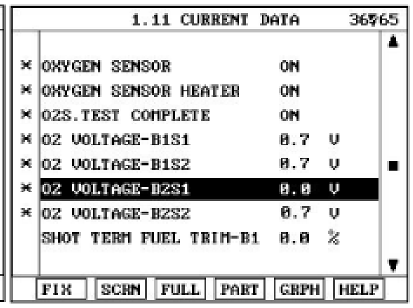


Fig. 3

Fig. 1 : Normal data
Fig. 2 : Open or Short to battery in HO2S(B2/S1)
Fig. 3 : Short to ground in HO2S(B2/S1)

4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

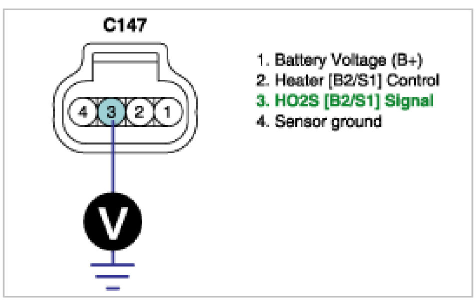
NO

▸ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. IG "OFF" and disconnect HO2S(B2/S1) connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 3 of HO2S(B2/S1) harness connector and chassis ground.

Specification :
Approx. 3.5V - when pumping current is ON
Approx. 0.45V - when pumping current is OFF



4. Is the measured voltage within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check HO2S(B2/S1)
   (1) IG "OFF" and disconnect HO2S(B2/S1) connector.
   (2) Check HO2S(B2/S1) for damage or contamination caused by a foreign substance.
   (3) Is the HO2S(B2/S1) normal?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good HO2S(B2/S1) and check for proper operation. If the problem is corrected, replace HO2S (B2/S1) and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.
1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

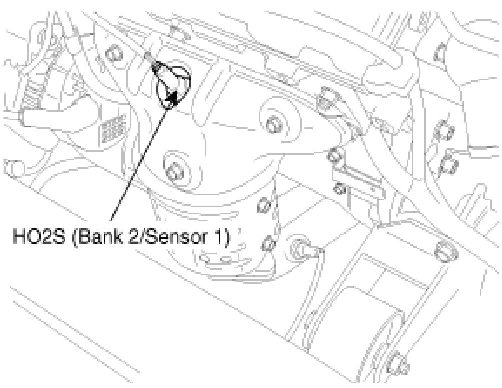
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0153

COMPONENT LOCATION



GENERAL DESCRIPTION

The HO2S is used to supply the PCM with information regarding the composition of the air/fuel mixture. The HO2S is positioned in the exhaust pipe ahead of the TWC. To measure the oxygen content, the HO2S requires a supply of ambient air as a reference. The HO2S produces a voltage that varies between 0.1V and 0.9V under normal operating conditions. The Powertrain Control Module (PCM) monitors this voltage and determines if the exhaust gas is lean or rich. If the voltage input at the PCM is under approx. 0.45V the exhaust is lean, and if the voltage input is over approx. 0.45V the exhaust is rich. The PCM constantly monitors the HO2S signal during closed loop operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary.
This oxygen sensor varieties use a “bias” voltage to achieve better resolution of the exhaust stream signal. Some oxygen sensor varieties use a “pumping circuit” to forceambient air into the sensor to maintain a more pure environment for comparison. In either

case, a cold sensor will tend to indicate voltage values near the open circuit value. For the “pumping current” sensors, this open circuit value can be near 3.5 V. Since the Fuel control logic would incorrectly consider this reading to indicate a very rich mixture for an extended time, the fuel control logic can not use the oxygen sensor reading under such conditions.

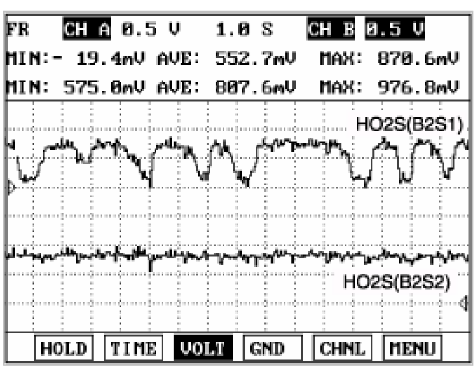
DTC DESCRIPTION

The response time of an O2 sensor can be impacted by two factors: temperature and poisoning. Poisoning of the O2 sensor is the primary failure mode of O2 sensor response time. Poisoning can come from many sources: silicone from gaskets or even in the fuel, phosphorous from engine oil, carbon from operating in a cooler environment or lead from the fuel. Most poisoning failures have the potential to clear up after the source of the poisoning has been removed. However, sometimes thepoisoning may be so severe that the damage is irreversible. Checking output signals from HO2S under detecting condition, if an output signal is out of threshold, PCM sets P0153.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Determines O2 sensor functionality by checking its response rate	• Poor connection • Faulty HO2S • Faulty PCM
Enable Conditions	• 1200 ≤ Engine RPM ≤ 4300 • 40g/s ≤ Air Flow ≤ 7.5g/s • Engine run time >60sec • Engine Coolant >70°C(158 °F) • No DFCO(Decel Fuel Cut-Off) Exit with Rich Bias Fueling • No TORQ Fuel Reduction in effect • No Disabling Faults • All of the conditions above met for more than 2sec	
Threshold value	• Switching counter lean to rich ≥ 13 • Switching counter rich to lean ≥ 13 • Response Lean Rich Transition Counter/Response Lean Rich Switch Counter < 29 • Response Rich Lean Transition Counter/Response Rich Lean Switch Counter < 35 • Response Rich Lean Average/Response Lean Rich Average > 0.3809 • Response Rich Lean Average/Response Lean Rich Average < 3	
Diagnosis Time	• -	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA



After warming-up, Releasing accellerator pedal suddenly around 4000rpm the HO2S signal reading will be lower than 200mV resulting from Fuel cut-off. Conversely, sudden depressing accellerator pedal HO2S signal reading will be around 0.6V ~1.0V. At idle, HO2S signal will be switching between lean(0.12 ~ 0.74V) to rich(above 0.75V) normally.

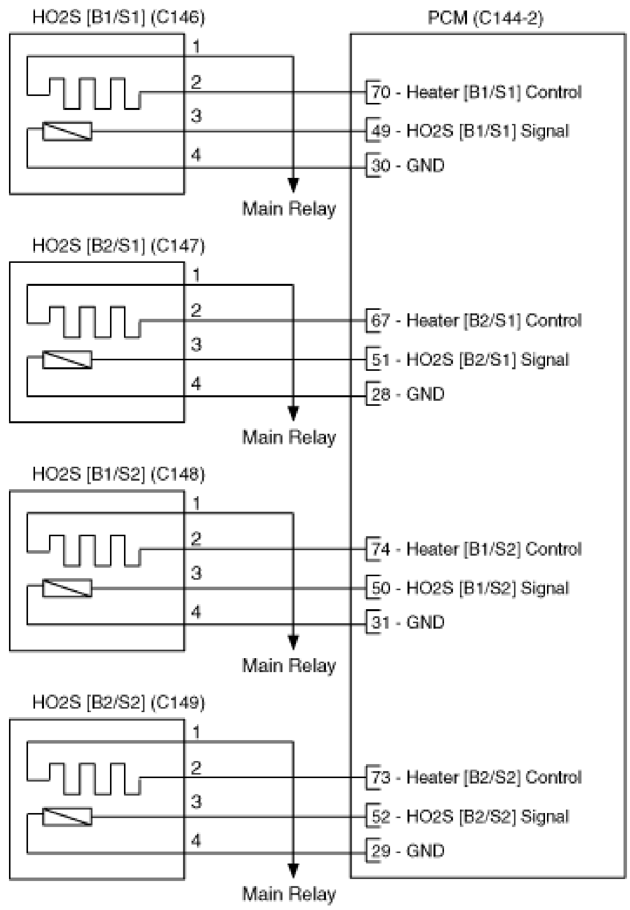
SPECIFICATION

	Response Time (70% Duty at 10Hz)

HO2S	lean to rich(Less than 0.65sec) rich to lean(Less than 0.8sec)

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

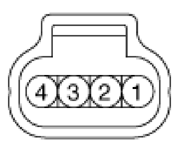
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

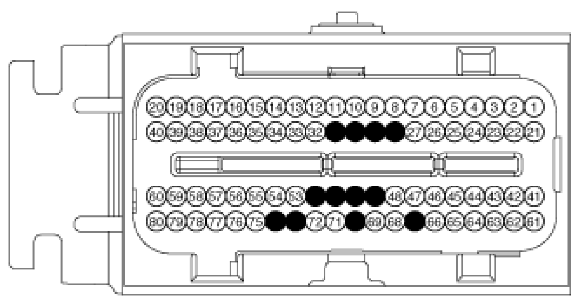
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]

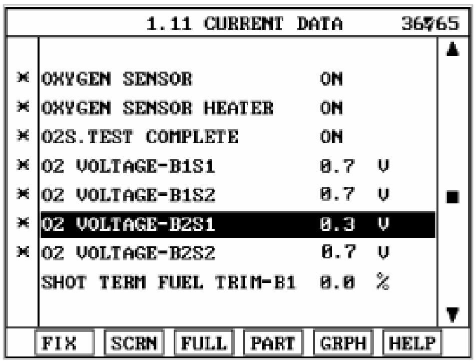


C144-2
PCM

MONITOR SCANTOOL DATA

1. Connect Scantool & Engine "ON"
2. Warm up the engine to normal operating temperature.
3. Monitor HO2S voltage(B2/S1) parameter on scantool

Specification : Voltage will vary from 0.1 to 0.9 V



4. Is the HO2S parameter displayed within specifications ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Component Inspection" procedure

COMPONENT INSPECTION

1. Visual Inspection of HO2S
   (1) Visually/physically inspect following items:
   - Inspect the front HO2S for Contaminated, deteriorated or aged Front HO2S
   - If contamination is evident on the HO2S, replace contaminated sensor

   (2) Is the HO2S visually / physically O.K ?

   YES

   ▸ Go to "Check Performance of H02S" as follows

   NO

   ▸ Substitute with a known - good HO2S and check for proper operation. If the problem is corrected, replace HO2S and go to "Verification of Vehicle Repair" procedure.

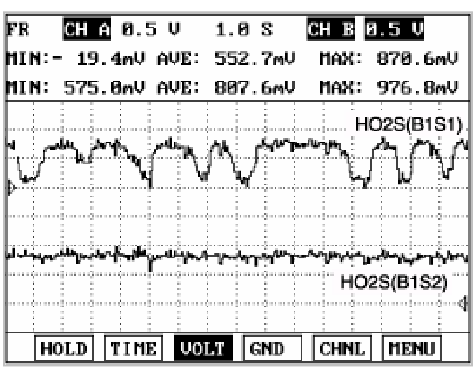
2. Check performance of HO2S
   (1) Connect scantool & Engine "ON"

   (2) Warm-up the engine to normal engine temperature.

   (3) Monitor signal waveform of HO2S with scantool

   Specification : Response times :

HO2S	Response Time (70% Duty at 10Hz)
	lean to rich(Less than 0.65sec) rich to lean(Less than 0.8sec)



   (4) Is the sensor signal switching properly ?

   YES

   ▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

   NO

▸ Substitute with a known - good HO2S and check for proper operation. If the problem is corrected, replace HO2S and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

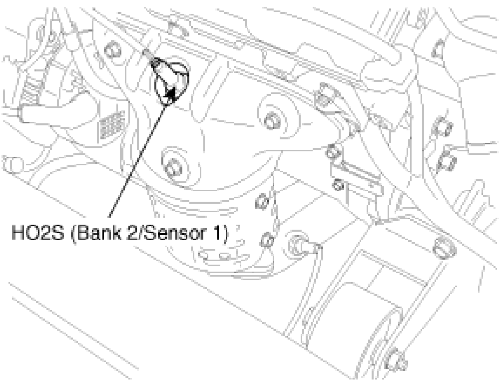
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0154

COMPONENT LOCATION



GENERAL DESCRIPTION

In order to control emissions of the CO, HC and NOx components of the exhaust gas, heated oxygen sensor (HO2S), mounted on the front side and rear side of catalytic converter, detects the oxygen content in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation.
The HO2S requires a minimum temperature to operate properly and provide a closed loop fuel control system. The HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions.
The oxygen sensor generates a voltage that indicates the difference between the oxygen content of the exhaust stream and the oxygen content of ambient air. When the exhaust stream is “rich,” there is more oxygen in the ambient air than in the exhaust stream, so the voltage will be higher.
Some oxygen sensor varieties use a “bias” voltage to achieve better resolution of the exhaust stream signal. Some oxygen sensor varieties use a “pumping circuit” to force ambient air into the sensor to maintain a more pure environment for comparison.
In either case, a cold sensor will tend to indicate voltage values near the open circuit value. For the “pumping current” sensors, this open circuit value can be near 3.5 V.Since the Fuel control logic would incorrectly consider this reading to indicate a very rich mixture for an extended time, the fuel control logic can not use the oxygen sensor reading under such conditions.
The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

DTC DESCRIPTION

Checking output signals from HO2S every 90 sec. under detecting condition, if an output signal indicating open in the circuit lasts for more than 76.5 sec., PCM sets P0154. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible cause
DTC Strategy		• Open	• Poor connection • Open in harness • HO2S(B2/S1) • PCM
Enable Conditions		• No sensor cooled status • The minimum airflow ≥ 2g/s • The battery voltage ≥ 10V • Engine running state >30 sec. • Coolant temperature ≥ 60°C(140°F)	
Threshold value	Case 1	• At pumping current ON • 1.2V ≤ Voltage of HO2S ≤ 3.9V	
	Case 2	• At pumping current OFF • 0.415V ≤ Voltage of HO2S ≤ 0.515V	
Diagnosis Time		• Continuous (more than 76.5 sec.failure for every 90 sec.test)	
MIL On Condition		• 2 driving cycles	

SIGNAL WAVEFORM AND DATA

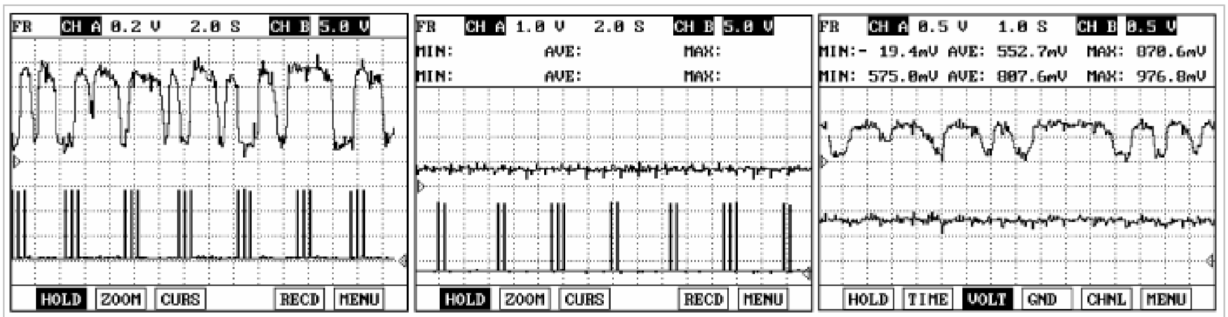


Fig. 1 Fig. 2 Fig. 3

Fig. 1 : HO2S(B2S1) & Heater
Fig. 2 : HO2S(B2S2) & Heater
Fig. 3 : HO2S(B2S1) & HO2S(B2S2)

After warming-up, if accelerator pedal is released suddenly around 4000rpm, the HO2S signal reading will be lower than 200mV resulting from Fuel cut-off for the moment. Conversely, if suddenly accelerator pedal is depressed, HO2S signal reading will be around 0.6V ~1.0V. At idle, HO2S signal will switch from lean to rich normally.

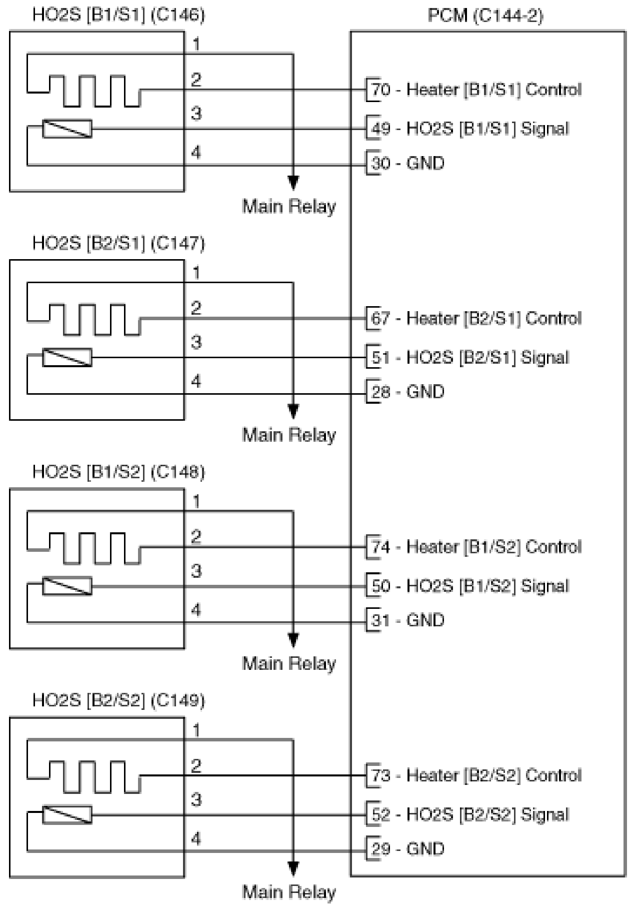
SPECIFICATION

Air/fuel mixture	Voltage(V)
Rich	0.75 ~ 1V
Lean	0 ~ 0.12V

※In case of open circuit, voltage is set to 0.45V(Pumping current OFF) or 3.5V(Pumping current ON)

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

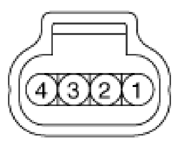
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

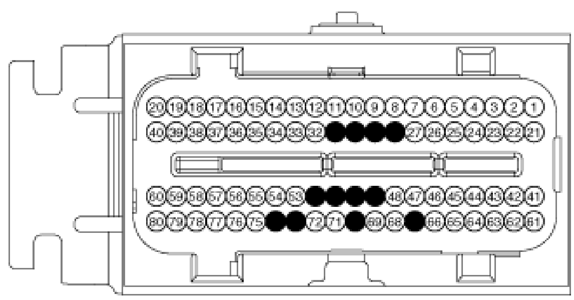
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "HO2S(B2/S1)" item on the service data.

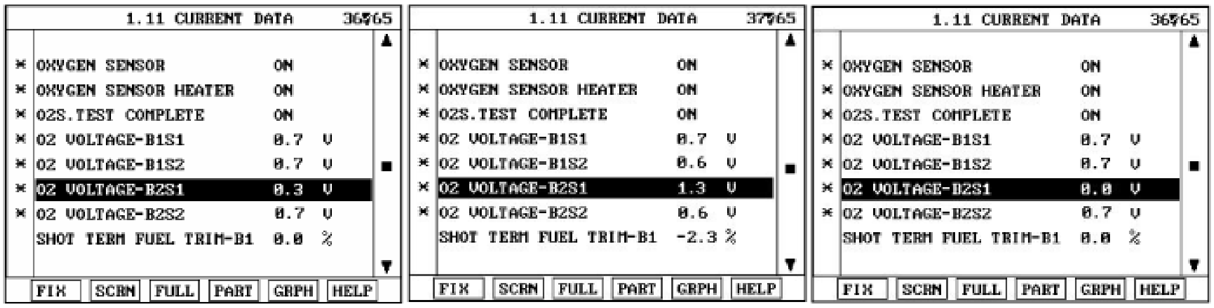


Fig. 1 Fig. 2 Fig. 3

Fig. 1 : Normal data
Fig. 2 : Open or Short to battery in HO2S(B2/S1)
Fig. 3 : Short to ground in HO2S(B2/S1)

4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

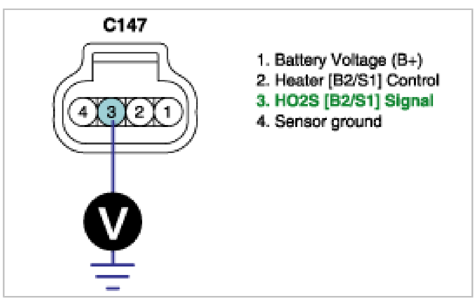
NO

▸ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. IG "OFF" and disconnect HO2S(B2/S1) connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between termianl 3 of HO2S(B2/S1) harness connector and chassis ground.

Specification :
Approx. 3.5V - when pumping current is ON
Approx. 0.45V - when pumping current is OFF



4. Is the measured voltage within specification?

YES

▸ Go to "Ground circuit inspection" procedure.

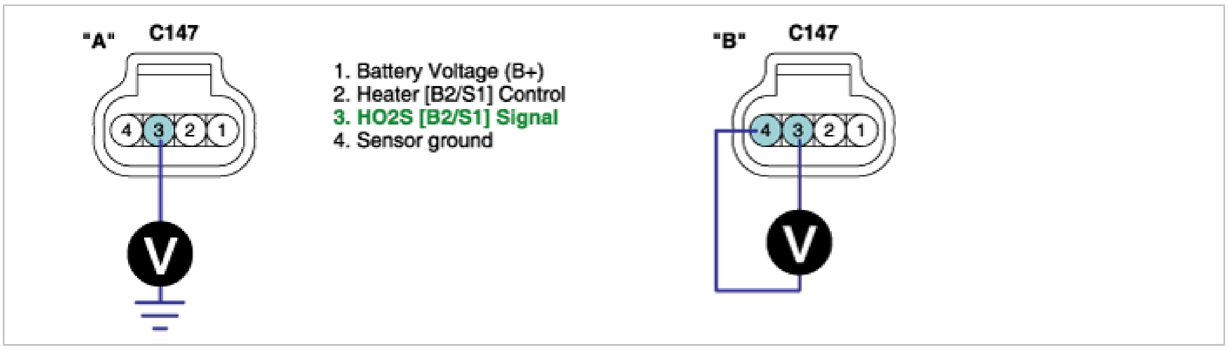
NO

▸ Repair open in harness, and go to "Verification of Vehicle Repair" prcedure.

GROUND CIRCUIT INSPECTION

1. IG "ON" and disconnect HO2S(B2/S1) connector.
2. Measure voltage between terminal 3 of HO2S(B2/S1) harness connector and chassis ground.
3. Measure voltage between terminals 3 and 4 of HO2S(B2/S1) harness connector.

Specification : Voltage difference between measurement "A" and "B" is below 200mV.



4. Is the measured voltage within specification?

YES

▸ Go to "Component inspection" procedure.

NO

▸ Repair open or contact resistance in harness, and go to "Verification of Vehicle Repair" prcedure.

COMPONENT INSPECTION

1. Check HO2S(B2/S1)
   (1) IG "OFF" and disconnect HO2S(B2/S1) connector.
   (2) Check HO2S(B2/S1) for damage or contamination caused by a foreign substance.
   (3) Is the HO2S(B2/S1) normal?

   YES

   ▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Substitute with a known - good HO2S(B2/S1) and check for proper operation. If the problem is corrected, replace HO2S (B2/S1) and go to "Verification of Vehicle Repair" procedure.

   NOTE

   There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

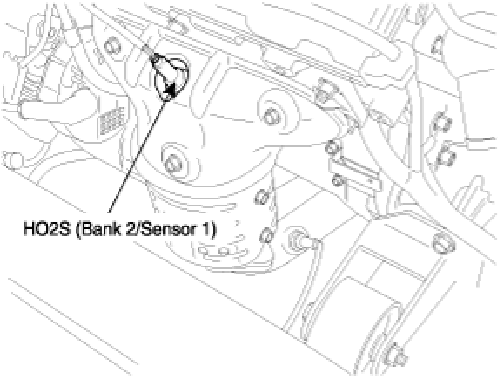
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0155

COMPONENT LOCATION



GENERAL DESCRIPTION

In order to control emissions of the CO, HC and NOx components of the exhaust gas, heated oxygen sensor (HO2S), mounted on the front side and rear side of catalytic converter, detects the oxygen content in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation.
The HO2S requires a minimum temperature to operate properly and provide a closed loop fuel control system. The HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions.
The oxygen sensor generates a voltage that indicates the difference between the oxygen content of the exhaust stream and the oxygen content of ambient air. When the exhaust stream is “rich,” there is more oxygen in the ambient air than in the exhaust stream, so the voltage will be higher.
Some oxygen sensor varieties use a “bias” voltage to achieve better resolution of the exhaust stream signal. Some oxygen sensor varieties use a “pumping circuit” to force ambient air into the sensor to maintain a more pure environment for comparison.
In either case, a cold sensor will tend to indicate voltage values near the open circuit value. For the “pumping current” sensors, this open circuit value can be near 3.5 V.Since the Fuel control logic would incorrectly consider this reading to indicate a very rich mixture for an extended time, the fuel control logic can not use the oxygen sensor reading under such conditions.
The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

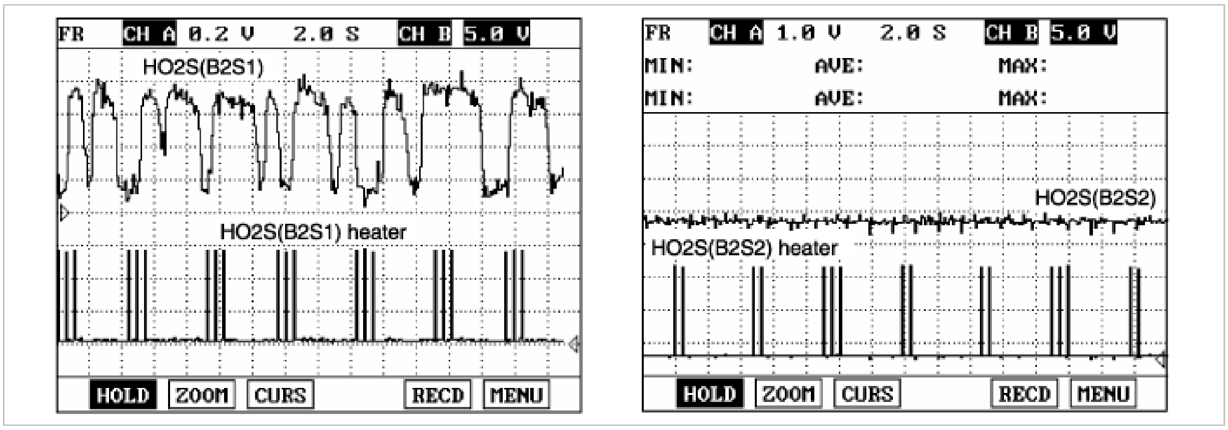
DTC DESCRIPTION

The O2 Heater diagnostic compares the current that is passing through the O2 Heater to a low limit. When the current is too low, the O2 Heater is considered failed.A failed O2 Heater will have an affect on vehicle emissions, especially on cold starts. The O2 Heater allows the O2 Sensor to work properly more quickly after the engine starts. If the PCM detects heater output voltage is lower than threshold value for 5 seconds while enable condition is met PCM determines that a fault exists and a DTC is stored.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Compares the current that is passing through the O2 Heater to a low limit	• Poor Connection • Contact Resistance • HO2S(B2/S1) • PCM
Enable Conditions	• Ignition ON • Engine Running >60sec • Heater Duty Cycle >0.4% • Max. Duty Cycle - Min. Duty Cycle< 0.05% • Delay Time ≥ 5sec	
Threshold value	• Filtered O2 Heater Current< threshold value	
Diagnosis Time	• Continuous (More than 2.5 second failure for every 5 second test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA



The HO2S requires a minimum temperature to provide a closed loop fuel control system. So the HO2S contains a heater element to reduce its warm-up time and ensure its performance during all driving conditions. The HO2S heater is controlled ON after engine start except for Cold condition and high speed accelleration. The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

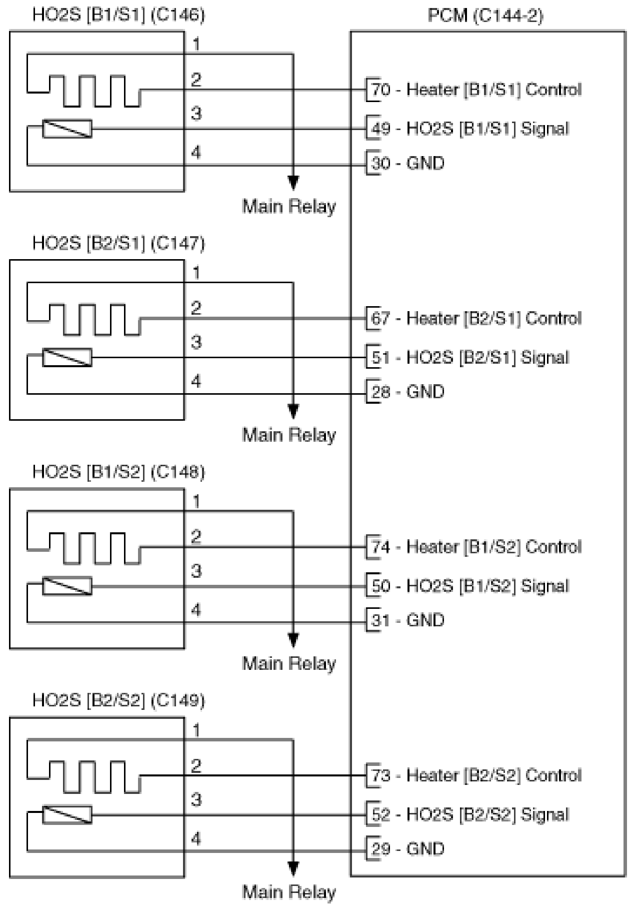
SPECIFICATION

For reference only

Condition	Current(A)
Heater Current at 13.5V, 450°C(842°F) Exhaust	0.25 ± 0.1
Heater In-rush Current at 21°C(69.8°F), 13.5V	1.7 MAX
Heater In-rush Current at -40°C(-40 °F), 13.5V	2.2 MAX

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

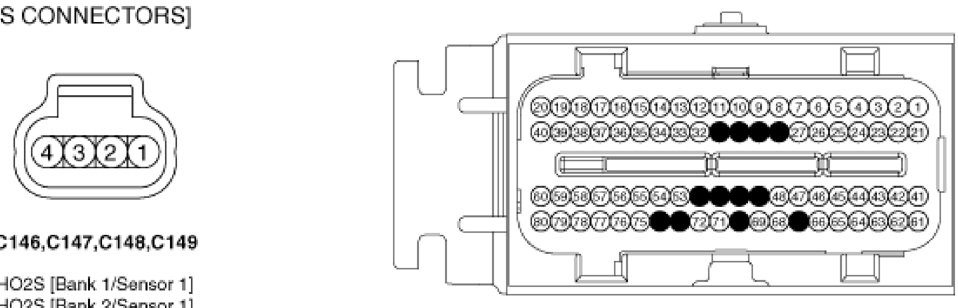
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

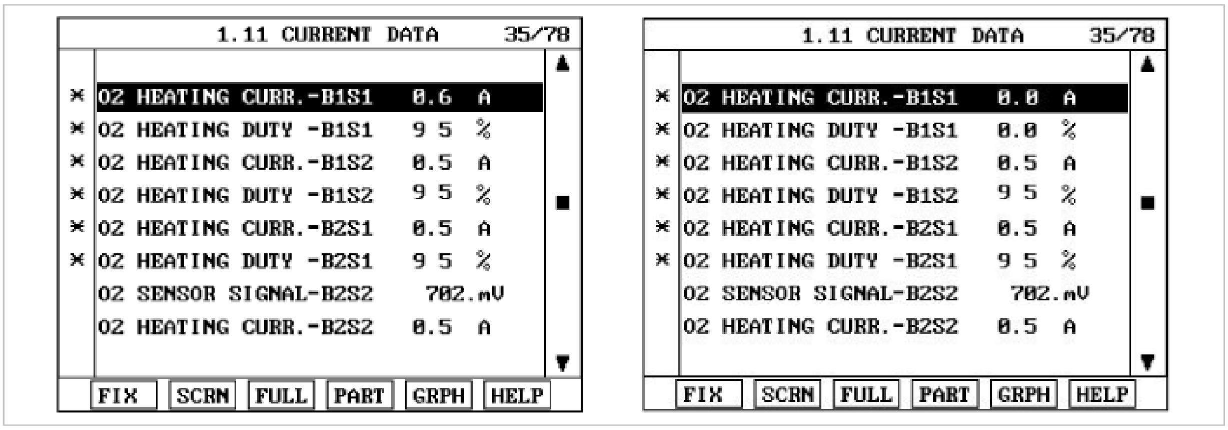
HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]

C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "HO2S(B2/S1) Heater" status on the service data.



4. Is the "HO2S Heater(B2/S1)" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

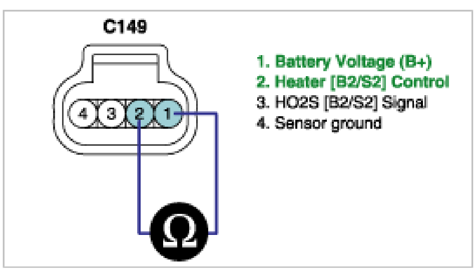
NO

▸ Go to "Component Inspection" procedure.

COMPONENT INSPECTION

1. Check HO2S(B2/S1) Heater resistance
   (1) IG "OFF" and disconnect HO2S(B2/S1) connector
   (2) Measure resistance between terminal 1 and 2 of HO2S(B2/S1)(Component Side)
   Specification :

Heater	
Resistance (Ω)	9.6 ± 1.5 at 21°C(69.8°F)



   (3) Is the measured resistance within specification ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Substitute with a known - good HO2S(B2/S1) and check for proper operation. If the problem is corrected, replace HO2S (B2/S1) and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

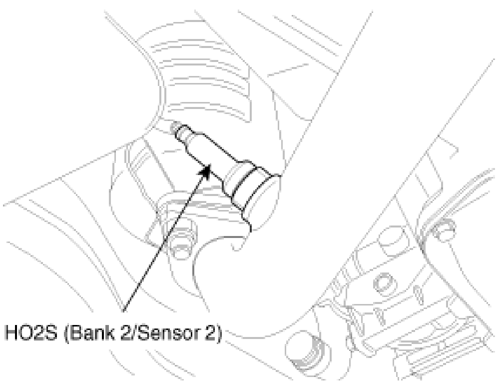
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0157

COMPONENT LOCATION



GENERAL DESCRIPTION

HO2S(B2/S2) is in the back of Catalytic Converter to check the proper operation of catalyst. As Exhaust gas already passed through catalyst, oxygen density in it is within specific range. If the oxygen density changes in accordance with HO2S(B2/S2), it means the poor performance of catalytic converter.

DTC DESCRIPTION

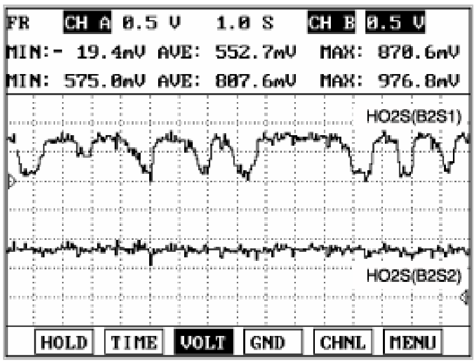
Checking output signals from HO2S every 15 sec. under detecting condition, if an output signal is below 0.05V for more than 12.5 sec., PCM sets P0157. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Signal low	• Poor connection • Short to ground in harness • HO2S(B2/S2) • PCM
Enable Conditions	• Battery voltage ≥ 10V • The minimum airflow ≥ 2g/s • Engine running state ≥ 30 sec. • The coolant temperature ≥ 60°C(140°F) • The feed-back control (the closed loop) state • No fuel-cut state • Above conditions are met >5 sec.	
Threshold value	• The voltage of HO2S(B2/S2)< 0.04V	

Diagnosis Time	• Continuous (more than 12.5 sec. failure for every 15 sec.test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA

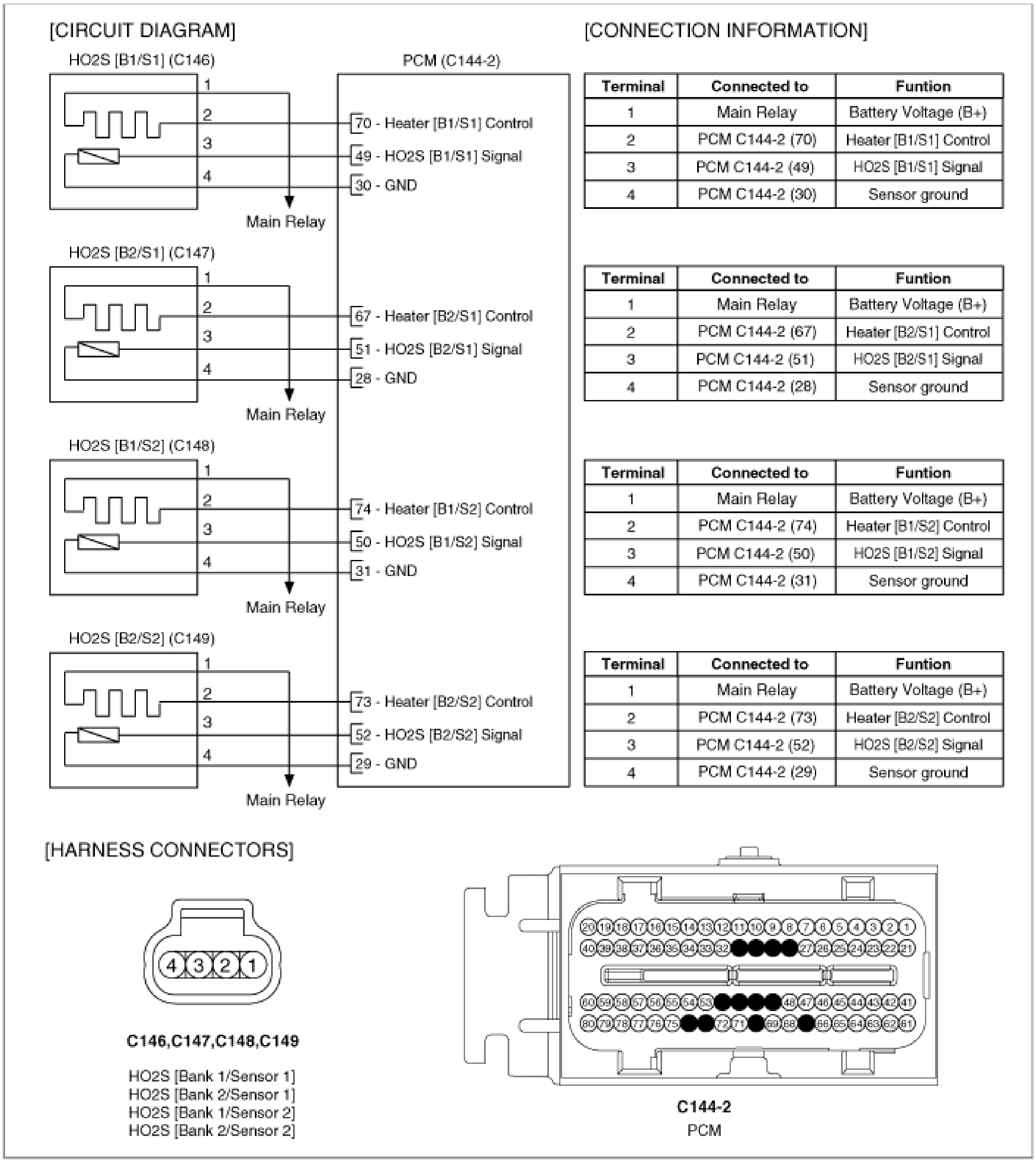


The amplitude of the signal output of the rear HO2S is small compared to the front HO2S because the rear HO2S detects emission gas purified by the catalytic converter. This is the normal signal waveform of the rear HO2S at idle.

SPECIFICATION

Air/fuel mixture	Voltage(V)
Rich	0.75 ~ 1V
Lean	0 ~ 0.12V

SCHEMATIC DIAGRAM



Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "HO2S(B2/S2)" item on the service data.

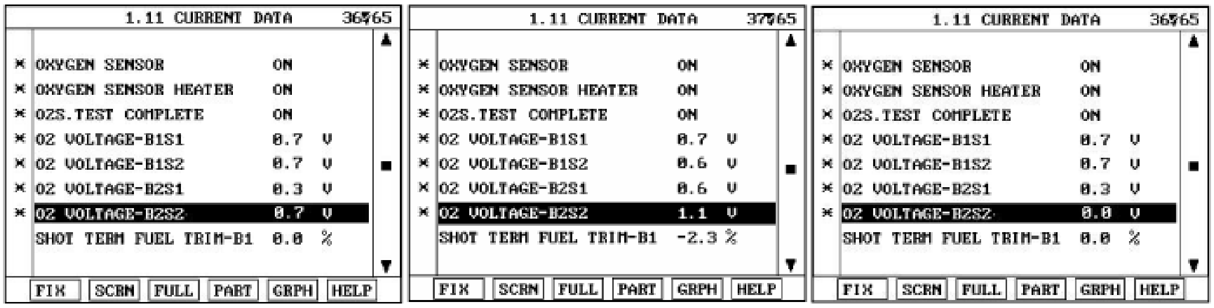


Fig. 1 Fig. 2 Fig. 3

Fig. 1 : Normal data
Fig. 2 : Open or Short to battery in HO2S(B2/S2)
Fig. 3 : Short to ground in HO2S(B2/S2)

4. Is the service data displayed correctly?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

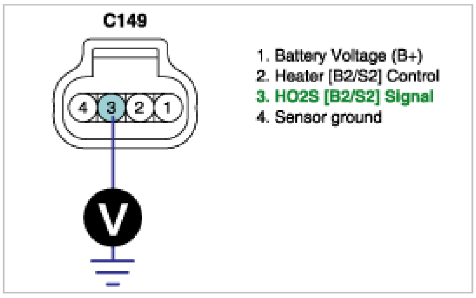
NO

▸ Go to " Signal Circuit Inspection " procedure.

SIGNAL CIRCUIT INSPECTION

1. IG "OFF" and disconnect HO2S(B2/S2)
2. IG "ON"
3. Measure voltage between terminal 3 of HO2S(B2/S2) harness connector and chassis ground.

Specification : Approx. 3.5V - when pumping current is ON
Approx. 0.45V - when pumping current is OFF



4. Is the measured voltage within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Visual Inspection of HO2S
   Visually/physically inspect following items:
   A. Inspect the Rear HO2S for Contaminated, deteriorated or aged Rear HO2S
   B. If contamination is evident on the HO2S, replace contaminated sensor
2. Is the HO2S(B2/S2) normal?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good HO2S(B2/S2) and check for proper operation. If the problem is corrected, replace HO2S (B2/S2) and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

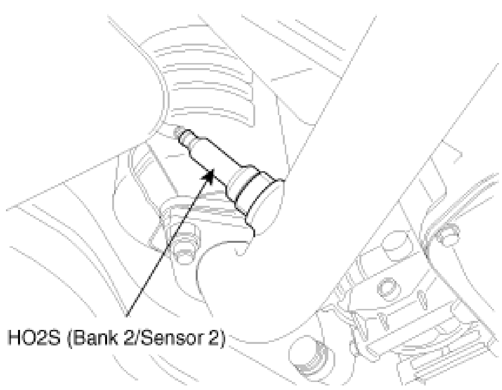
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0158

COMPONENT LOCATION



GENERAL DESCRIPTION

HO2S(B2/S2) is in the back of Catalytic Converter to check the proper operation of catalyst. As Exhaust gas already passed through catalyst, oxygen density in it is within specific range. If the oxygen density changes in accordance with HO2S(B2/S2), it means the poor performance of catalytic converter.

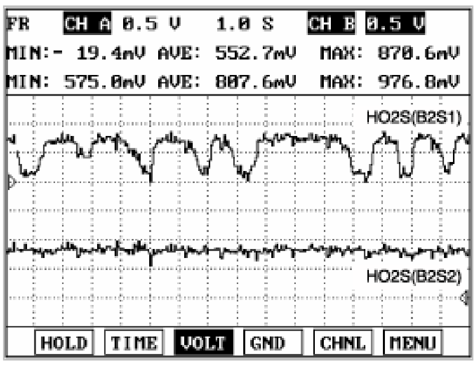
DTC DESCRIPTION

Checking output signals from HO2S every 15 sec. under detecting condition, if an output signal is above 1.3V for more than 12.5 sec, PCM sets P0158. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Signal low	• Poor connection • Short to battery in harness • HO2S(B2/S2) • PCM
Enable Conditions	• Battery voltage ≥ 10V • The minimum airflow ≥ 2g/s • Engine running state ≥ 30 sec. • The coolant temperature ≥ 60°C(140°F) • The feed-back control (the closed loop) state • No fuel-cut state • Above conditions are met >5 sec.	
Threshold value	• The voltage of HO2S(B2/S2) > 1.3V	
Diagnosis Time	• Continuous (more than 12.5 sec. failure for every 15 sec.test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA



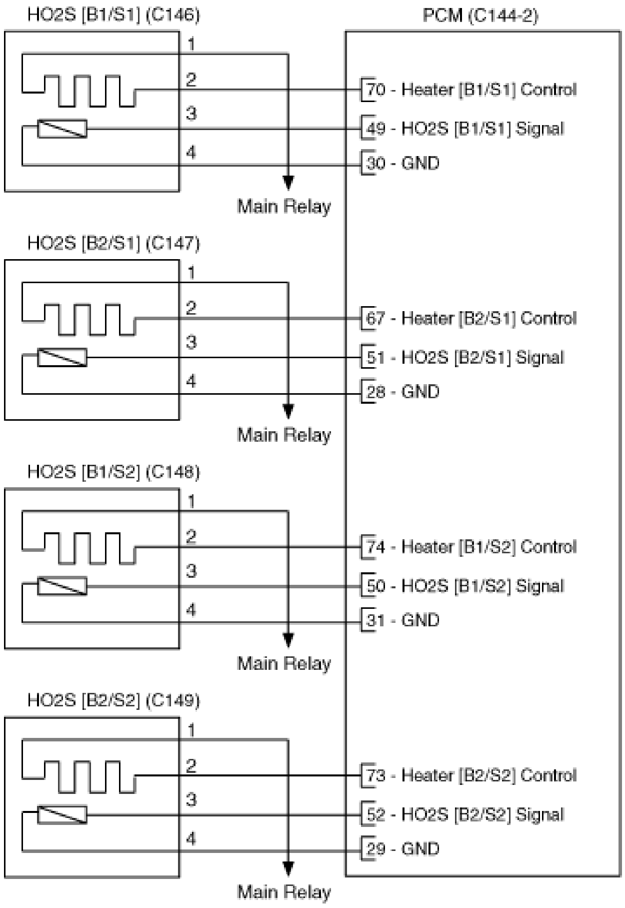
The amplitude of the signal output of the rear HO2S is small compared to the front HO2S because the rear HO2S detects emission gas purified by the catalytic converter. This is the normal signal waveform of the rear HO2S at idle.

SPECIFICATION

Air/fuel mixture	Voltage(V)
Rich	0.75 ~ 1V
Lean	0 ~ 0.12V

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

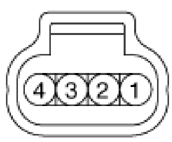
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

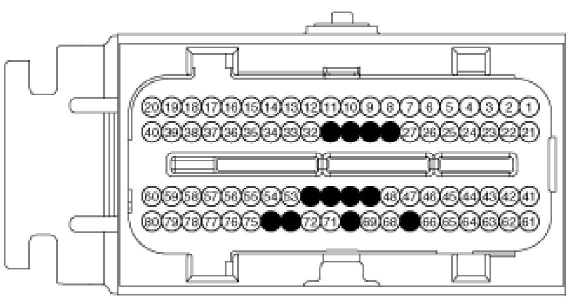
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "HO2S(B2/S2)" item on the service data.

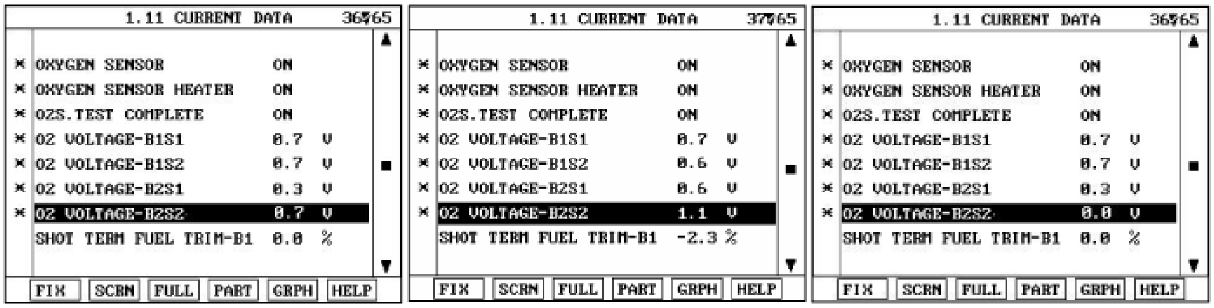


Fig. 1 Fig. 2 Fig. 3

Fig. 1 : Normal data
Fig. 2 : Open or Short to battery in HO2S(B2/S2)
Fig. 3 : Short to ground in HO2S(B2/S2)

4. Is the service data displayed correctly?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

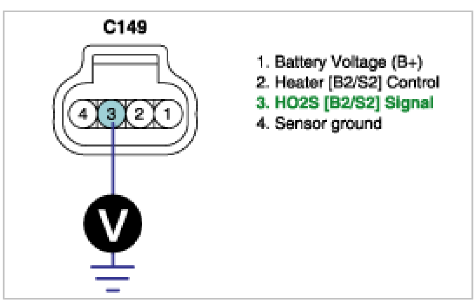
NO

▸ Go to " Signal Circuit Inspection " procedure.

SIGNAL CIRCUIT INSPECTION

1. IG "OFF" and disconnect HO2S(B2/S2) connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 3 of HO2S(B2/S2) harness connector and chassis ground.

Specification :
Approx. 3.5V - when pumping current is ON
Approx. 0.45V - when pumping current is OFF



4. Is the measured voltage within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Visual Inspection of HO2S
   Visually/physically inspect following items:
   A. Inspect the Rear HO2S for Contaminated, deteriorated or aged Rear HO2S
   B. If contamination is evident on the HO2S, replace contaminated sensor
2. Is the HO2S(B2/S2) normal?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good HO2S(B2/S2) and check for proper operation. If the problem is corrected, replace HO2S (B2/S2) and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

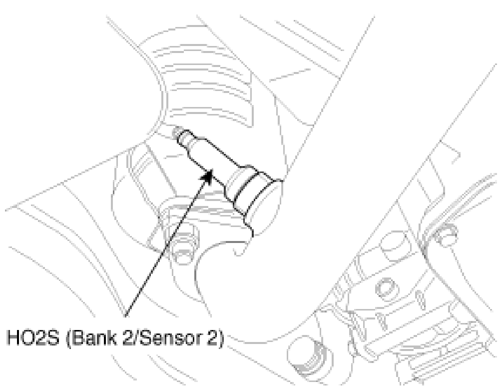
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0159

COMPONENT LOCATION



GENERAL DESCRIPTION

The rear heated oxygen sensor is mounted on the rear side of the Catalytic Converter (warm-up catalytic converter) or in the rear exhaust pipe, which is able to detect the catalyst efficiency. The rear heated oxygen sensor (HO2S) produces a voltage between 0V and 1V. This rear heated oxygen sensor is used to estimate the oxygen storage capability. If a catalyst has good conversion properties, the oxygen fluctuations are smoothed by the oxygen storage capacity of the catalyst. If the conversion provided by the catalyst is low due to aging, poisoning or misfiring, then the oxygen fluctuations are similar to signals from the front oxygen sensor.

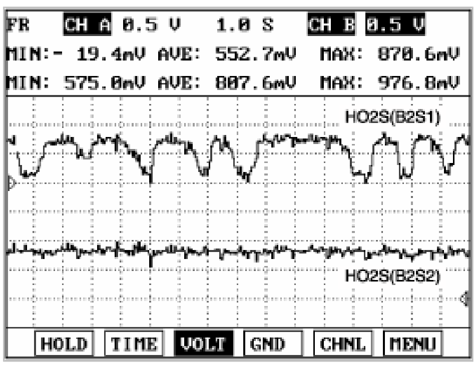
DTC DESCRIPTION

Since the Catalyst Diagnostic uses the oxygen sensors to determine the quality of the catalyst, and since an extended period of time with the rear oxygen sensor value steady is interpreted as a “good” catalyst, the Catalyst Diagnostic can be rendered inaccurate by an improperly functioning oxygen sensor. This diagnostic will extend the period of time that the Catalyst diagnostic requests a fuel shift. If the oxygen sensor still fails to respond after this extended time, then there is a fault with the sensor. Checking the Maximum time allowed between the front sensor response and the rear sensor response to the Stage1 or 2 fuel shift under detecting condition, if the fuel shift time is higher than 25sec, PCM determines a fault and sets DTC P0159. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Determines if Rear O2 Sensor is acceptable for Idle Catalyst Monitor use	• Poor connection • Faulty HO2S • Faulty PCM
Enable Conditions	• If Idle Catalyst Monitor Diagnostic is enabled HO2S Bank 1 Sensor 2 Response Diagnostic Enable Criteria Met	
Threshold value	• Maximum time allowed between the front sensor response and the rear sensor response to the Stage 1(Forced to rich) ICMD(Idle Catalyst Monitor Diagnostic)fuel shift ≥ 25sec • Maximum time allowed between the front sensor response and the rear sensor response to the Stage 2(Forced to lean) ICMD(Idle Catalyst Monitor Diagnostic) fuel shift ≥ 25sec	
Diagnosis Time	• -	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA



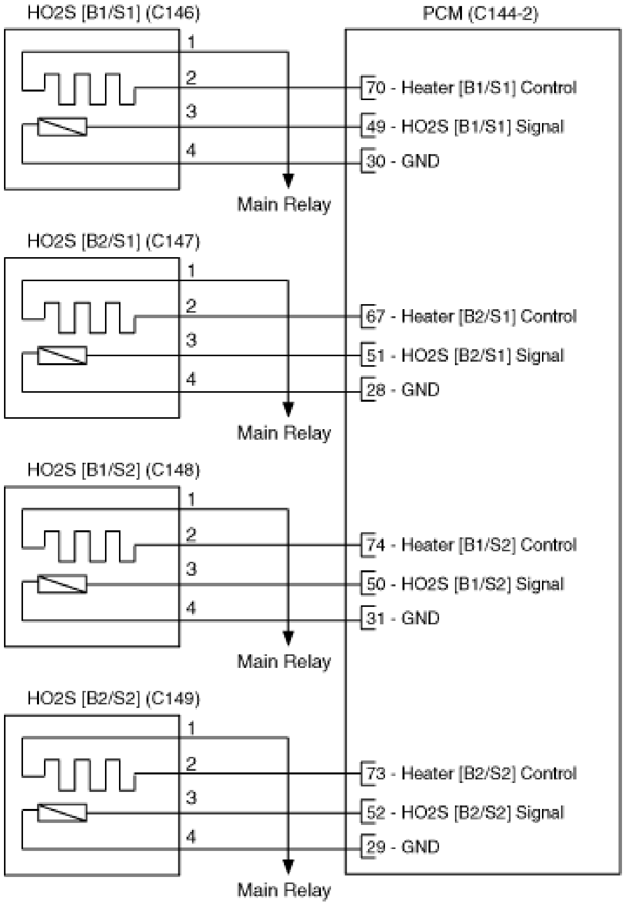
The amplitude of the signal output of the rear HO2S is small compared to the front HO2S because the rear HO2S detects emission gas purified by the catalytic converter. This is the normal signal waveform of the rear HO2S at idle.

SPECIFICATION

Air/fuel mixture	Voltage(V)
Rich	0.75 ~ 1V
Lean	0 ~ 0.12V

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

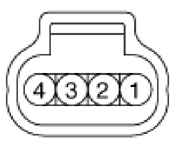
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

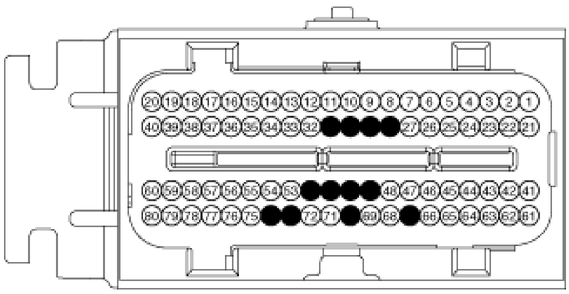
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



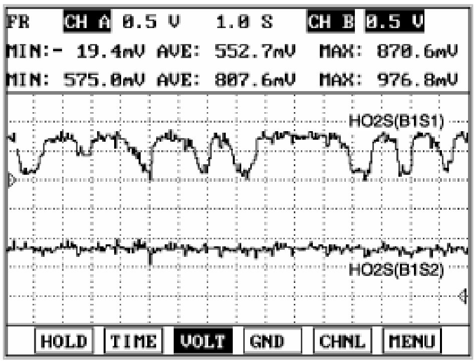
C144-2

PCM

MONITOR SCANTOOL DATA

1. Connect Scantool then Engine "ON"
2. Warm up the engine to normal operating temperature.
3. Monitor the signal waveform of HO2S(B2S2) with scantool

Specification : 0.1 ~ 0.9V



4. Is the HO2S parameter displayed within specifications ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to " Component Inspection " procedure.

COMPONENT INSPECTION

1. Visual Inspection of HO2S
   Visually/physically inspect following items:
   A. Inspect the Rear HO2S for Contaminated, deteriorated or aged Rear HO2S
   B. If contamination is evident on the HO2S, replace contaminated sensor
2. Is the HO2S(B2S2) O.K ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.

NO

▸ Substitute with a known - good HO2S(B2S2) and check for proper operation. If the problem is corrected, replace HO2S (B2S2) and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

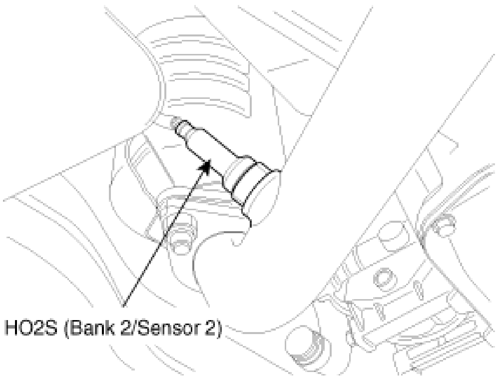
▸ Go to the applicable troubleshooooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0160

COMPONENT LOCATION



GENERAL DESCRIPTION

HO2S(B2/S2) is in the back of Catalytic Converter to check the proper operation of catalyst. As Exhaust gas already passed through catalyst, oxygen density in it is within specific range. If the oxygen density changes in accordance with HO2S(B2/S2), it means the poor performance of catalytic converter.

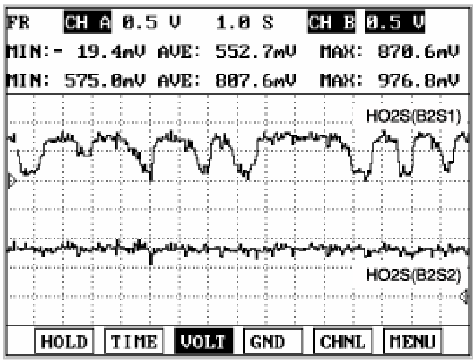
DTC DESCRIPTION

Checking output signals from HO2S every 10 sec. under detecting condition, if an output signal indicating open in the circuit lasts for more than 6.3 sec. PCM sets P0160. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

<table>
<tr><th colspan="2">Item</th><th>Detecting Condition</th><th>Possible cause</th></tr>
<tr><td colspan="2">DTC Strategy</td><td>• Open</td><td rowspan="7">• Poor connection
• Open in harness
• HO2S(B2/S2)
• PCM</td></tr>
<tr><td colspan="2">Enable Conditions</td><td>• No sensor cooled status
• The minimum airflow ≥ 2g/s
• The battery voltage ≥ 10V
• Engine running state >30 sec.
• Coolant temperature ≥ 60°C(140°F)</td></tr>
<tr><td rowspan="2">Threshold value</td><td>Case 1</td><td>• At pumping current ON
• 1.2V ≤ Voltage of HO2S ≤ 3.9V</td></tr>
<tr><td>Case 2</td><td>• At pumping current OFF
• 0.415V ≤ Voltage of HO2S ≤ 0.515V</td></tr>
<tr><td colspan="2">Diagnosis Time</td><td>• Continuous
(more than 6.3 sec.failure for every 10 sec.test)</td></tr>
<tr><td colspan="2">MIL On Condition</td><td>• 2 Driving Cycles</td></tr>
</table>

SIGNAL WAVEFORM AND DATA



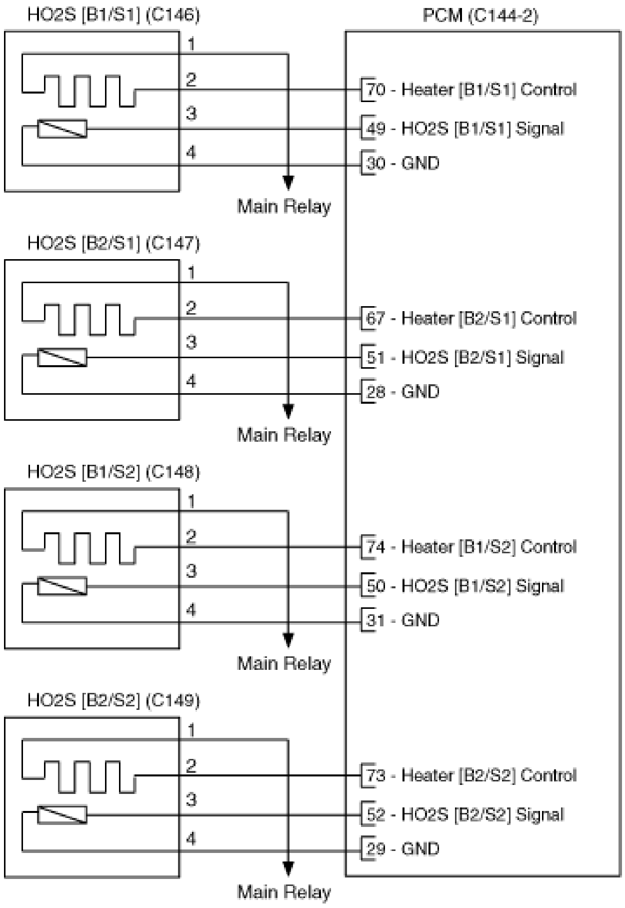
The amplitude of the signal output of the rear HO2S is small compared to the front HO2S because the rear HO2S detects emission gas purified by the catalytic converter. This is the normal signal waveform of the rear HO2S at idle.

SPECIFICATION

Air/fuel mixture	Voltage(V)
Rich	0.75 ~ 1V
Lean	0 ~ 0.12V

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

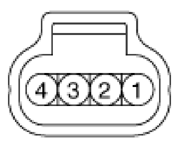
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

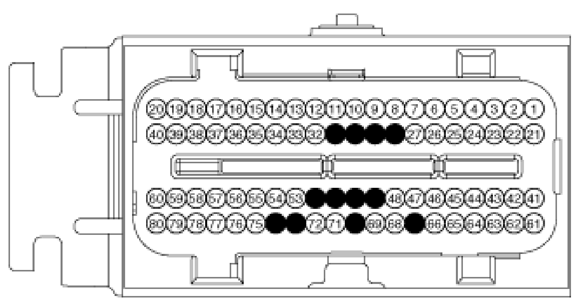
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "HO2S(B2/S2)" item on the service data.

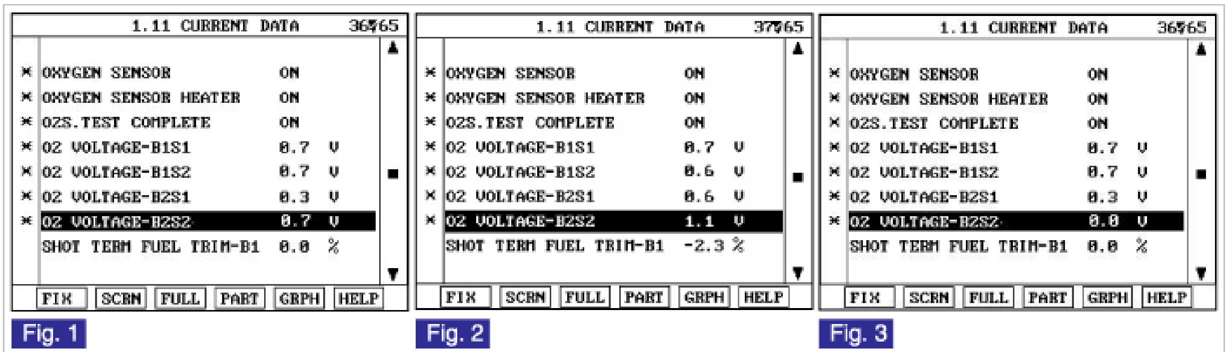


Fig. 1 : Normal data
Fig. 2 : Open or Short to battery in HO2S(B2/S2)
Fig. 3 : Short to ground in HO2S(B2/S2)

4. Is the service data displayed correctly?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found ?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

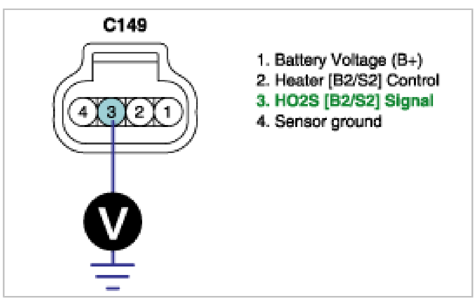
NO

▸ Go to " Signal Circuit Inspection " procedure.

SIGNAL CIRCUIT INSPECTION

1. IG "OFF" and disconnect HO2S(B2/S2) connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 3 of HO2S(B2/S2) harness connector and chassis ground.

Specification :
Approx. 3.5V - when pumping current is ON
Approx. 0.45V - when pumping current is OFF



4. Is the measured voltage within specification?

YES

▸ Go to "Ground Circuit Inspection" procedure.

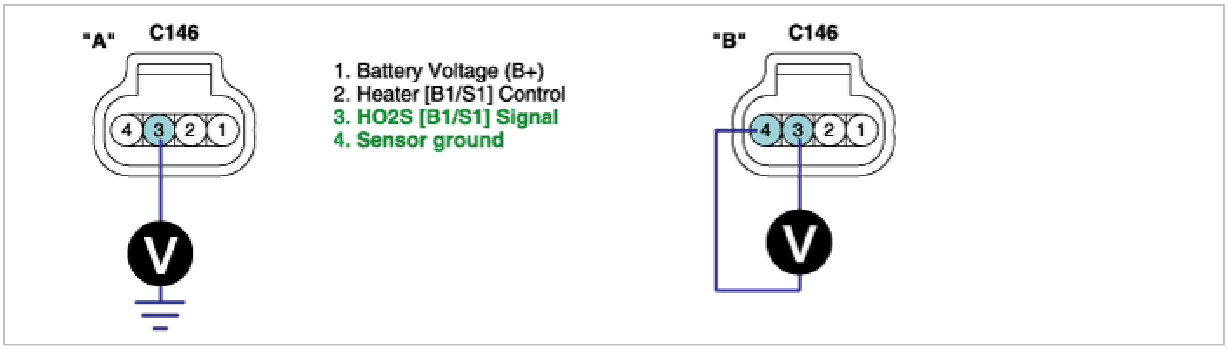
NO

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "ON" and disconnect HO2S(B2/S2) connector.
2. Measure voltage between terminal 3 of HO2S(B2/S2) harness connector and chassis ground.
3. Measure voltage between terminals 3 and 4 of HO2S(B2/S2) harness connector.

Specification : Voltage difference between measurement "A" and "B" is below 200mV.



4. Is the measured voltage within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Visual Inspection of HO2S
   Visually/physically inspect following items:
   A. Inspect the Rear HO2S for Contaminated, deteriorated or aged Rear HO2S
   B. If contamination is evident on the HO2S, replace contaminated sensor
2. Is the HO2S(B2/S2) normal?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good HO2S(B2/S2) and check for proper operation. If the problem is corrected, replace HO2S (B2/S2) and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

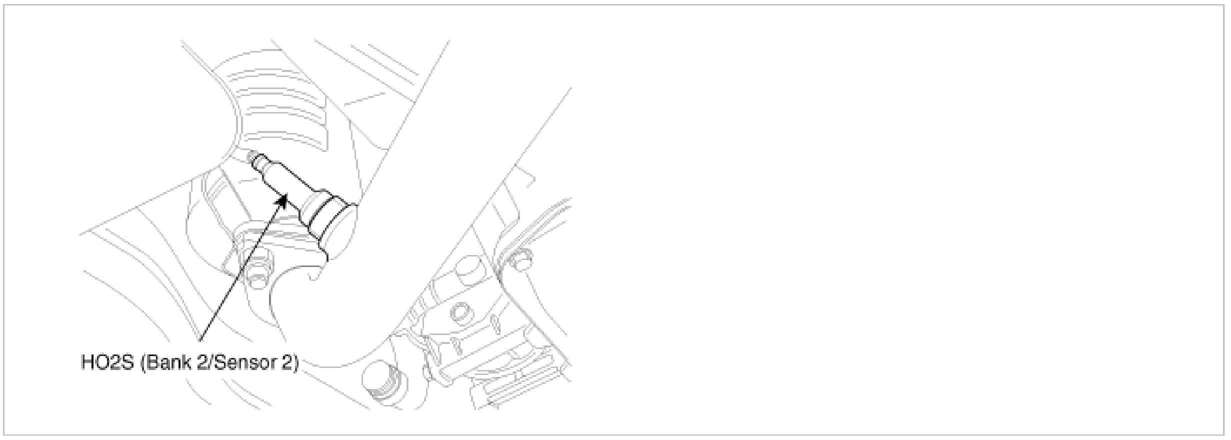
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0161

COMPONENT LOCATION



GENERAL DESCRIPTION

HO2S(B2/S2) is in the back of Catalytic Converter to check the proper operation of catalyst. As Exhaust gas already passed through catalyst, oxygen density in it is within specific range. If the oxygen density changes in accordance with HO2S(B2/S2), it means the poor performance of catalytic converter.

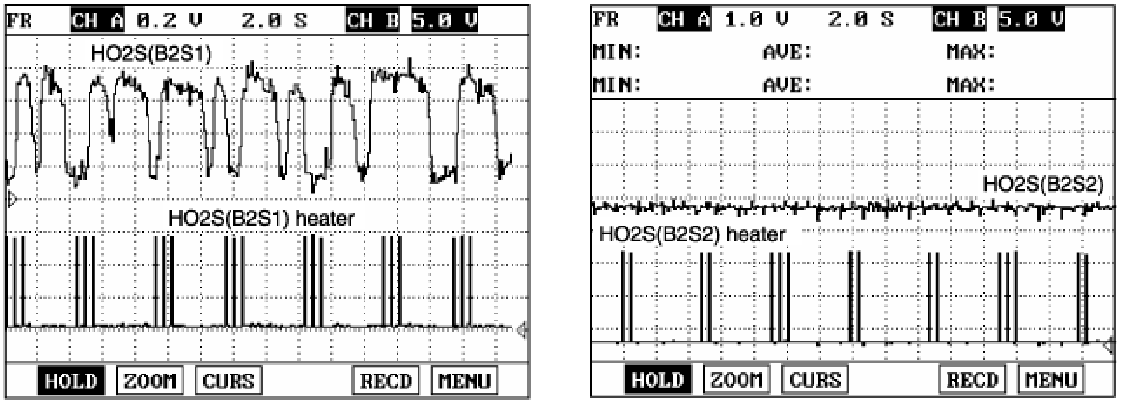
DTC DESCRIPTION

The O2 Heater diagnostic compares the current that is passing through the O2 Heater to a low limit. When the current is too low, the O2 Heater is considered failed.A failed O2 Heater will have an affect on vehicle emissions, especially on cold starts. The O2 Heater allows the O2 Sensor to work properly more quickly after the engine starts.If the PCM detects heater output voltage is lower than threshold value for 5 seconds while enable condition is met PCM determines that a fault exists and a DTC is stored.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Compares the current that is passing through the O2 Heater to a low limit	• Poor connection • Contact Resistance • HO2S(B2/S2) • PCM
Enable Conditions	• Ignition ON • Engine Running > 60s • Heater Duty Cycle > 0.4% • Max. Duty Cycle - Min. Duty Cycle < 0.05% • Delay Time ≥ 5s	
Threshold value	• Filtered O2 Heater Current < 0.02A	
Diagnosis Time	• Continuous (More than 2.5 second failure for every 5 second test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA



The HO2S requires a minimum temperature to provide a closed loop fuel control system. So the HO2S contains a heater element to reduce its warm-up time and ensure its performance during all driving conditions. The HO2S heater is controlled ON after

engine start except for Cold condition and high speed accelleration. The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

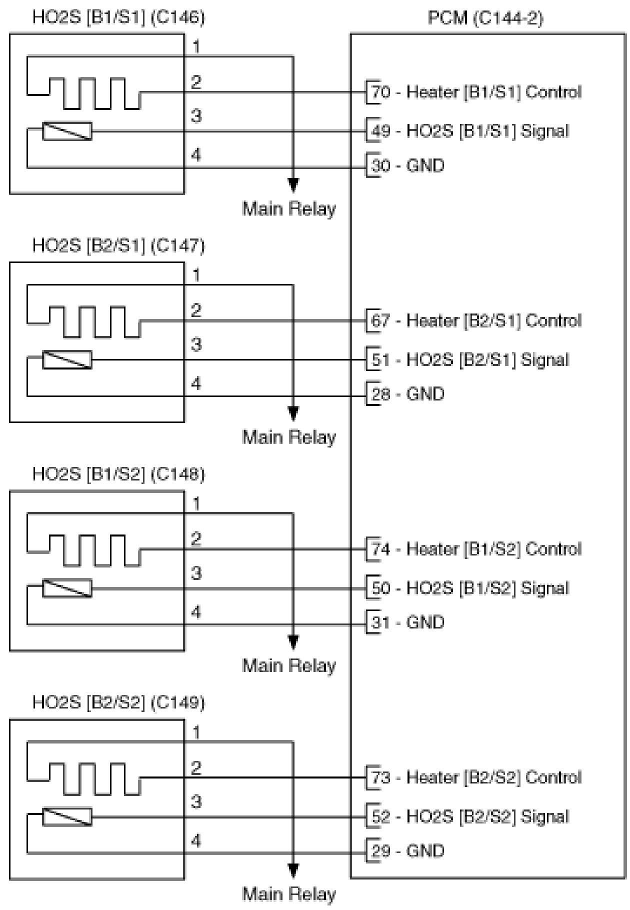
SPECIFICATION

(For reference only)

Condition	Current(A)
Heater Current at 13.5V, 450°C(842°F) Exhaust	0.52 ± 0.1
Heater In-rush Current at 21°C(69.8°F), 13.5V	1.7 MAX
Heater In-rush Current at -40°C(-40°F), 13.5V	2.2 MAX

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

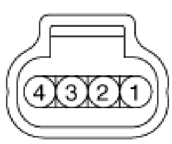
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

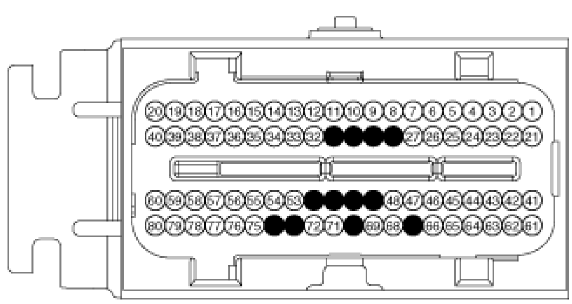
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]

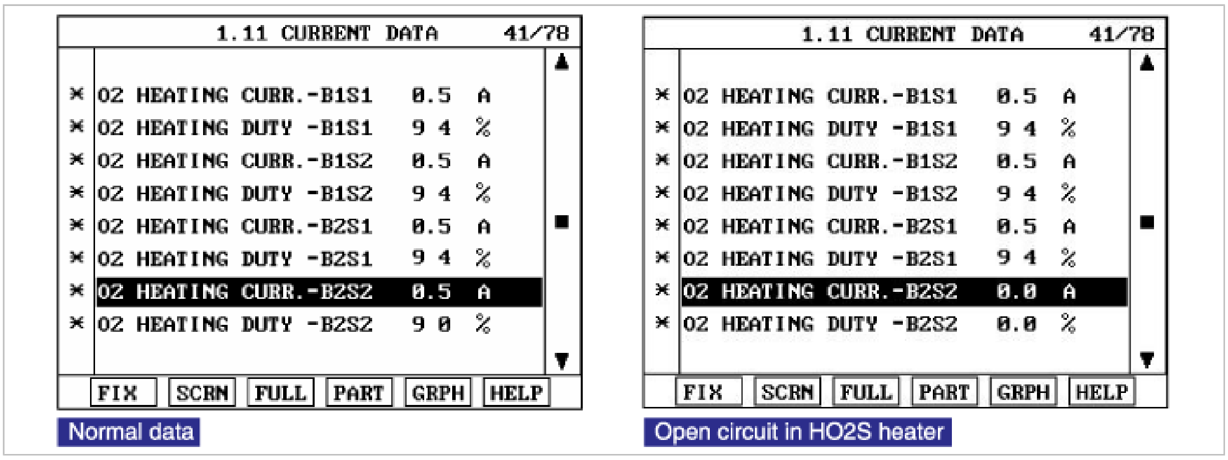


C144-2
PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.

2. Warm -up the engine to normal operating temperature.
3. Monitor "HO2S(B2/S2) Heater" item on the service data.



4. Is the "HO2S Heater(B2/S2)" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

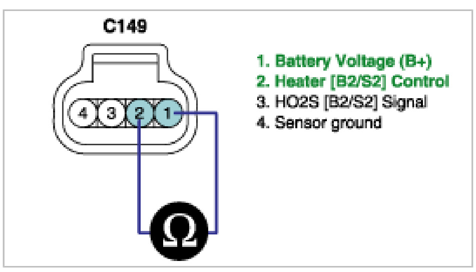
NO

▸ Go to " Component Inspection " procedure.

COMPONENT INSPECTION

1. Check HO2S(B2/S2) Heater resistance
   (1) IG "OFF" and disconnect HO2S(B2/S2) connector
   (2) Measure resistance between terminal 1 and 2 of HO2S(B2/S2)(Component Side)
   Specification :

Heater	
Resistance (Ω)	9.6 ± 1.5 at 21°C(69.8°F)



2. Is the measured resistance within specification ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Substitute with a known - good HO2S(B2/S2) and check for proper operation. If the problem is corrected, replace HO2S (B2/S2) and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0171

GENERAL DESCRIPTION

In order to provide the best possible combination of drivability, fuel economy and emission control, the PCM uses a closed loop air/fuel metering system. The PCM monitors the HO2S signal voltage and adjusts fuel delivery based it in closed loop fuel control. Changes in fuel delivery will be indicated by the long-term and the short-term fuel trim values. The ideal fuel trim value is around 0%. The PCM will add fuel when the HO2S signal is indicating a lean condition. Additional fuel is indicated by fuel trim values that are above 0%. The PCM will reduce fuel when the HO2S signal is indicating a rich condition. Reduction in fuel is indicated by fuel trim values that are below 0%. The DTC relevant to fuel trim will be set when the amount reaches excessive levels because of a lean or rich condition.

DTC DESCRIPTION

Checking air-fuel ratio correction value every 0.75 sec. under detecting condition, if an value is within detecting condition for more than 0.3 sec., PCM sets P0171. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

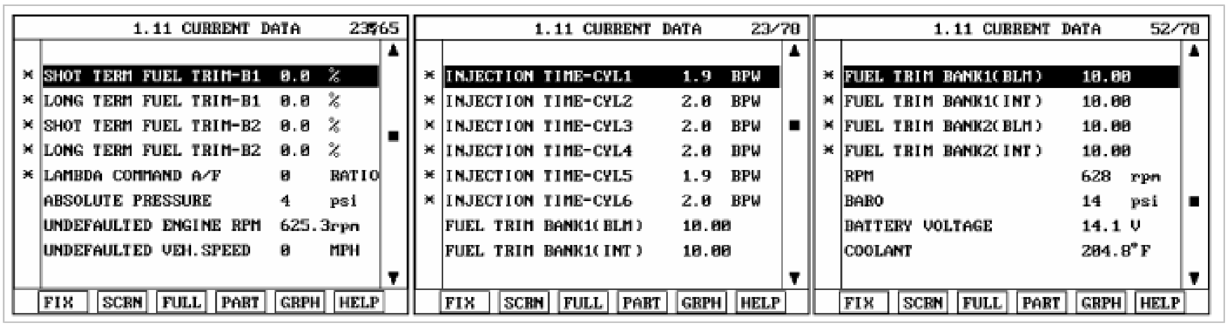
DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Fuel Trim Limits Exceeded	• Poor connection • Relevant sensor/actuator • Air leakage • PCM
Enable Conditions	• 550rpm ≤ Engine speed ≤ 4000rpm • 60°C(140°F) ≤ Engine coolant temperature ≤ 115°C(239°F) • -10°C(14°F) ≤ Intake air temperature ≤ 60°C(140°F) • 0° ≤ Throttle position ≤ 80° • 25kPa ≤ Engine load ≤ 90kPa • 1.5g/s ≤ Intake air flow ≤ 80g/s • Barometric pressure ≥ 72kPa • Vehicle speed ≤ 130km/h • System voltage ≥ 11V • Feed-back control state • No other diagnostic fault	
Threshold value	• Lean limit average < 0.8 (Average of short term fuel trim) and < 1.2(Average of long term fuel trim)	
Diagnosis Time	• Continuous (More than 0.3 second failure for every 0.75 second test)	

MIL On Condition	• 2 Driving Cycles	

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. Warm -up the engine to normal operating temperature.
3. Monitor "Sensor/actuator related to fuel system(HO2S, MAFS, MAPS, TPS, ECTS, PSCA, Injector, and so on)" items on the service data.



4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found ?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to " System Inspection " procedure.

SYSTEM INSPECTION

1. Check air leakage
   (1) Visually/physically inspect the air leakage in intake/exhaust system for following items
   - ▸ Vacuum hoses for splits, kinks and improper connections.
   - ▸ Throttle body gasket
   - ▸ Gasket between intake manifold and cylinder head
   - ▸ Seals between intake manifold and fuel injectors
   - ▸ Exhaust system between HO2S and three way catalyst for air leakage

   (2) Has a problem found in this procedure?

   YES

   ▸ Repair or replace it which has a problem, and go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Go to "Check the fuel line" as follows

2. Check the fuel line
   (1) Check the fuel line for following items
   - ▸ Connector connection state
   - ▸ Damage/ connection state for vacuum hoses connected to fuel line
   - ▸ Bent/ pressed/ twisted fuel line or fuel leakage

(2) Has a problem found in this procedure?

YES

▸ Repair or replace it which has a problem, and go to " Verification of Vehicle Repair" procedure.

NO

▸ Go to "Check fuel pressure" as follows

3. Check fuel pressure

> **NOTE**
>
> - Be cautious that Fuel is explosive and an empty fuel tank can still contain explosive gases.When working on fuel system make sure to supply adequate ventilationto the work area. Do not smoke, and keep sparks and open flames away.
> - The fuel system remains under pressure when the engine is not running. Release fuel system pressure before disconnecting any fuel line to reduce the chance of presonal injury or fire damage to vehicle components.

(1) IG "OFF" and disconnect Fuel Pump Relay in Junction Box.

(2) Start-up and wait until it stops itself.

(3) IG "OFF" and connect Fuel Pump Relay.

(4) Install the fuel pressure gauge to the delivery pipe with the fuel pressure gauge adaptor.

(5) Activate the fuel pump, and with fuel pressure applied, check that there is no fuel leakage from the pressure gauge or connection part.

(6) Disconnect the vacuum hose from the pressure regulator, and plug the hose end.

(7) Measure the fuel pressure at idle.

Specification : 374.6 ~ 384.4 kPa(3.82 ~ 3.92 kg/cm², 54.3 ~ 55.8 psi)

(8) Is the measured fuel pressure within specifications ?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair or replace according to the below table. And then, go to " Verification of Vehicle Repair"procedure.

Condition	Possible Cause
Fuel Pressure is too low	Fuel filter,fuel pressure regulator, in-tank fuel hose or the fuel pump
Fuel Pressure is too high	Fuel pressure regulator, hose or pipe
No different fuel pressure when vacuum hose is connected or not	The vacuum hose or the nipple

COMPONENT INSPECTION

1. Check PCV

(1) IG "OFF" and remove PCV valve from cylinder head

(2) With engine idling, block PCV valve and confirm that vacuum is felt.

(3) Insert thin stick into the screwed PCV valve and verify that the plunger is moving.

(4) Is the PCV valve normally moving?

YES

▸ Go to "Check PCSV as follows.

NO

▸ Replace it, and go to "Verification of Vehicle Repair" procedure.

2. Check PCSV

(1) IG "OFF" and disconnect PCSV and vacuum hose.

(2) Connect hand-vacuum gage with PCSV and supply vacuum to it.

(3) Is the vacuum maintained ?

YES

▸ Go to " Check injector" as follows.

NO

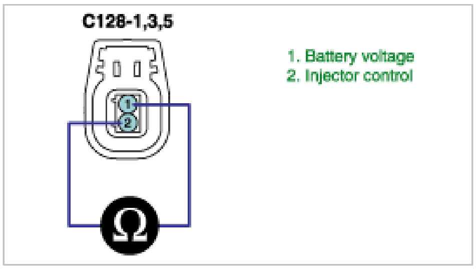
▸ Repair or replace it, and go to " Verification of Vehicle Repair" procedure.

3. Check injector
   (1) IG "OFF" and disconnect injector.

   (2) Check it for blocking caused by any foreign substance.

   (3) Measure resistance between terminals 1 and 2 of Injector connector.(Component side)
   Specification :

Temp	Coil's resistance
20°C(68°F)	11.4 ~ 12.6 Ω



   (4) Is the measured resistance within specification?

YES

▸ Go to "Check sensor/actuator related to fuel system" as follows

NO

▸ Repair or replace it, and go to "Verification of Vehicle Repair" procedure.

4. Check sensor/actuator related to fuel system
   (1) Check the signal of sensor/actuator related to fuel system(HO2S, MAFS,MAPS, TPS, ECTS, PCSV, Injector and so on)
   (Refer to each DTC diagnostic procedure)

   (2) Are all of these items normal ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Repair it, and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.
1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0172

GENERAL DESCRIPTION

In order to provide the best possible combination of drivability, fuel economy and emission control, the PCM uses a closed loop air/fuel metering system. The PCM monitors the HO2S signal voltage and adjusts fuel delivery based it in closed loop fuel control. Changes in fuel delivery will be indicated by the long-term and the short-term fuel trim values. The ideal fuel trim value is around 0%. The PCM will add fuel when the HO2S signal is indicating a lean condition. Additional fuel is indicated by fuel trim values that are above 0%. The PCM will reduce fuel when the HO2S signal is indicating a rich condition. Reduction in fuel is indicated by fuel trim values that are below 0%. The DTC relevant to fuel trim will be set when the amount reaches excessive levels because of a lean or rich condition.

DTC DESCRIPTION

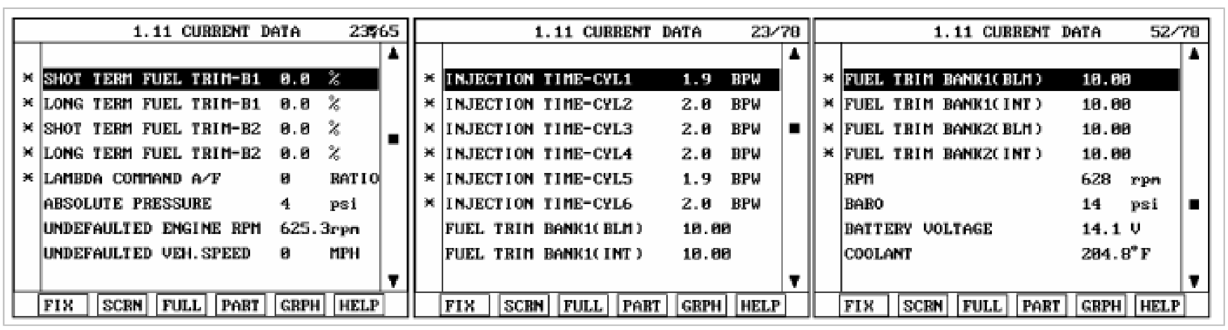
Checking air-fuel ratio correction value every 0.75 sec. under detecting condition, if an value is within detecting condition for more than 0.3 sec., PCM sets P0172. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Fuel Trim Limits Exceeded	• Poor connection • Relevant sensor/actuator • Blocking of Intake system • Fuel leakage in injector • Improper fuel line pressure • PCM
Enable Conditions	• 550rpm ≤ Engine speed ≤ 4000rpm • 60°C(140°F) ≤ Engine coolant temperature ≤ 115°C(239°F) • -10°C(14°F) ≤ Intake air temperature ≤ 60°C(140°F) • 0° ≤ Throttle position ≤ 80° • 25kPa ≤ Engine load ≤ 90kPa • 1.5g/s ≤ Intake air flow ≤ 80g/s • Barometric pressure ≥ 72kPa • Vehicle speed ≤ 130km/h • System voltage ≥ 11V • Feed-back control state • No other diagnostic fault	
Threshold value	• Lean limit average >1.2 (Average of short term fuel trim) and< 0.8(Average of long term fuel trim)	
Diagnosis Time	• Continuous (More than 0.3 second failure for every 0.75 second test)	
MIL On Condition	• 2 Driving Cycles	

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. Warm -up the engine to normal operating temperature.
3. Monitor "Sensor/actuator related to fuel system(HO2S, MAFS, MAPS, TPS, ECTS, PSCA, Injector, and so on)" items on the service data.



4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by

interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to " System Inspection " procedure.

SYSTEM INSPECTION

1. Check blocking of intake system
   (1) Visually/physically inspect the blocking in intake system for following items
   - ▸ Throttle body gasket and damage
   - ▸ Clogging of Air cleaner
   - ▸ Blocking in intake manifold and injector caused by any foreign substance

   (2) Has a problem found?

   YES

   ▸ Repair or replace it, and go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Go to " Check fuel pressure" as follows.

2. Check fuel pressure

> **NOTE**
>
> - Be cautious that Fuel is explosive and an empty fuel tank can still contain explosive gases.When working on fuel system make sure to supply adequate ventilationto the work area. Do not smoke, and keep sparks and open flames away.
> - The fuel system remains under pressure when the engine is not running. Release fuel systempressure before disconnecting any fuel line to reduce the chance of presonal injury orfire damage to vehicle components.

   (1) IG "OFF" and disconnect Fuel Pump Relay in Junction Box.

   (2) Start-up and wait until it stops itself.

   (3) IG "OFF" and connect Fuel Pump Relay.

   (4) Install the fuel pressure gauge to the delivery pipe with the fuel pressure gauge adaptor.

   (5) Activate the fuel pump, and with fuel pressure applied, check that there is no fuel leakage from the pressure gauge or connection part.

   (6) Disconnect the vacuum hose from the pressure regulator, and plug the hose end.

   (7) Measure the fuel pressure at idle.

   Specification : 374.6 ~ 384.4 kPa(3.82 ~ 3.92 kg/cm², 54.3 ~ 55.8 psi)

   (8) Is the measured fuel pressure within specifications ?

   YES

   ▸ Go to "Component Inspection" procedure.

   NO

   ▸ Repair or replace according to the below table. And then, go to " Verification of Vehicle Repair"procedure.

Condition	Possible Cause
Fuel Pressure is too low	Fuel filter,fuel pressure regulator, in-tank fuel hose or the fuel pump
Fuel Pressure is too high	Fuel pressure regulator, hose or pipe
No different fuel pressure when vacuum hose is connected or not	The vacuum hose or the nipple

3. Check fuel leakage in injector
   (1) IG "OFF" after checking the fuel pressure test.

   (2) Stop engine and check for a change in the fuel pressure gauge reading for 5 minutes.

Specification : After engine stops, fuel gauge reading is maintained for 5 minutes.

(3) Is the fuel gauge reading within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ There is a fuel leakage in injector. Repair or replace it, and go to " Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check PCV
   (1) IG "OFF" and remove PCV valve from cylinder head

   (2) With engine idling, block PCV valve and confirm that vacuum is felt.

   (3) Insert thin stick into the screwed PCV valve and verify that the plunger is moving.

   (4) Is the PCV valve normally moving?

   YES

   ▸ Go to "Check PCSV as follows.

   NO

   ▸ Replace it, and go to "Verification of Vehicle Repair" procedure.

2. Check PCSV
   (1) IG "OFF" and disconnect PCSV and vacuum hose.

   (2) Connect hand-vacuum gage with PCSV and supply vacuum to it.

   (3) Is the vacuum maintained ?

   YES

   ▸ Go to " Check injector" as follows.

   NO

   ▸ Repair or replace it, and go to " Verification of Vehicle Repair" procedure.

3. Check injector
   (1) IG "OFF" and disconnect injector.

   (2) Check it for blocking caused by any foreign substance.

   (3) Measure resistance between terminals 1 and 2 of Injector connector.(Component side)
   Specification :

Temp	Coil's resistance
20°C(68°F)	11.4 ~ 12.6 Ω

   (4) Is the measured resistance within specification?

   YES

   ▸ Go to "Check sensor/actuator related to fuel system" as follows

   NO

   ▸ Repair or replace it, and go to "Verification of Vehicle Repair" procedure.

4. Check sensor/actuator related to fuel system
   (1) Check the signal of sensor/actuator related to fuel system(HO2S, MAFS,MAPS, TPS, ECTS, PCSV, Injector and so on)
   (Refer to each DTC diagnostic procedure)

   (2) Are all of these items normal ?

   YES

   ▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Repair it, and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0174

GENERAL DESCRIPTION

In order to provide the best possible combination of drivability, fuel economy and emission control, the PCM uses a closed loop air/fuel metering system. The PCM monitors the HO2S signal voltage and adjusts fuel delivery based it in closed loop fuel control. Changes in fuel delivery will be indicated by the long-term and the short-term fuel trim values. The ideal fuel trim value is around 0%. The PCM will add fuel when the HO2S signal is indicating a lean condition. Additional fuel is indicated by fuel trim values that are above 0%. The PCM will reduce fuel when the HO2S signal is indicating a rich condition. Reduction in fuel is indicated by fuel trim values that are below 0%. The DTC relevant to fuel trim will be set when the amount reaches excessive levels because of a lean or rich condition.

DTC DESCRIPTION

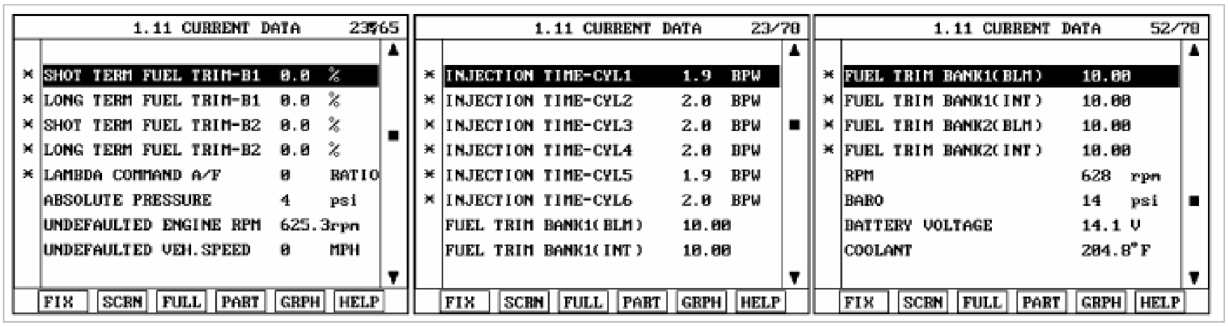
Checking air-fuel ratio correction value every 0.75 sec. under detecting condition, if an value is within detecting condition for more than 0.3 sec., PCM sets P0174. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

<table>
<tr><th>Item</th><th>Detecting Condition</th><th>Possible cause</th></tr>
<tr><td>DTC Strategy</td><td>• Fuel Trim Limits Exceeded</td><td rowspan="5">• Poor connection
• Relevant sensor/actuator
• Air leakage
• Improper fuel line pressure
• PCM</td></tr>
<tr><td>Enable Conditions</td><td>• 550rpm ≤ Engine speed ≤ 4000rpm
• 60°C(140°F) ≤ Engine coolant temperature ≤ 115°C(239°F)
• -10°C(14°F) ≤ Intake air temperature ≤ 60°C(140°F)
• 0° ≤ Throttle position ≤ 80°
• 25kPa ≤ Engine load ≤ 90kPa
• 1.5g/s ≤ Intake air flow ≤ 80g/s
• Barometric pressure ≥ 72kPa
• Vehicle speed ≤ 130km/h
• System voltage ≥ 11V
• Feed-back control state
• No other diagnostic fault</td></tr>
<tr><td>Threshold value</td><td>• Lean limit average< 0.8 (Average of short term fuel trim) and< 1.2(Average of long term fuel trim)</td></tr>
<tr><td>Diagnosis Time</td><td>• Continuous
(More than 0.3 second failure for every 0.75 second test)</td></tr>
<tr><td>MIL On Condition</td><td>• 2 Driving Cycles</td></tr>
</table>

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. Warm -up the engine to normal operating temperature.
3. Monitor "Sensor/actuator related to fuel system(HO2S, MAFS, MAPS, TPS, ECTS, PSCA, Injector, and so on)" items on the service data.



4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to " System Inspection " procedure.

SYSTEM INSPECTION

1. Check air leakage
   (1) Visually/physically inspect the air leakage in intake/exhaust system for following items
   - ▸ Vacuum hoses for splits, kinks and improper connections.
   - ▸ Throttle body gasket
   - ▸ Gasket between intake manifold and cylinder head
   - ▸ Seals between intake manifold and fuel injectors
   - ▸ Exhaust system between HO2S and three way catalyst for air leakage

   (2) Has a problem found in this procedure?

   YES

   ▸ Repair or replace it which has a problem, and go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Go to "Check the fuel line" as follows

2. Check the fuel line
   (1) Check the fuel line for following items
   - ▸ Connector connection state
   - ▸ Damage/ connection state for vacuum hoses connected to fuel line
   - ▸ Bent/ pressed/ twisted fuel line or fuel leakage

   (2) Has a problem found in this procedure?

   YES

   ▸ Repair or replace it which has a problem, and go to " Verification of Vehicle Repair" procedure.

   NO

   ▸ Go to "Check fuel pressure" as follows

3. Check fuel pressure

> **NOTE**
>
> - Be cautious that Fuel is explosive and an empty fuel tank can still contain explosive gases.When working on fuel

system make sure to supply adequate ventilationto the work area. Do not smoke, and keep sparks and open flames away.
- The fuel system remains under pressure when the engine is not running. Release fuel system pressure before disconnecting any fuel line to reduce the chance of presonal injury or fire damage to vehicle components.

(1) IG "OFF" and disconnect Fuel Pump Relay in Junction Box.

(2) Start-up and wait until it stops itself.

(3) IG "OFF" and connect Fuel Pump Relay.

(4) Install the fuel pressure gauge to the delivery pipe with the fuel pressure gauge adaptor.

(5) Activate the fuel pump, and with fuel pressure applied, check that there is no fuel leakage from the pressure gauge or connection part.

(6) Disconnect the vacuum hose from the pressure regulator, and plug the hose end.

(7) Measure the fuel pressure at idle.

Specification : 374.6 ~ 384.4 kPa(3.82 ~ 3.92 kg/cm², 54.3 ~ 55.8 psi)

(8) Is the measured fuel pressure within specifications ?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair or replace according to the below table. And then, go to " Verification of Vehicle Repair"procedure.

Condition	Possible Cause
Fuel Pressure is too low	Fuel filter,fuel pressure regulator, in-tank fuel hose or the fuel pump
Fuel Pressure is too high	Fuel pressure regulator, hose or pipe
No different fuel pressure when vacuum hose is connected or not	The vacuum hose or the nipple

COMPONENT INSPECTION

1. Check PCV

(1) IG "OFF" and remove PCV valve from cylinder head

(2) With engine idling, block PCV valve and confirm that vacuum is felt.

(3) Insert thin stick into the screwed PCV valve and verify that the plunger is moving.

(4) Is the PCV valve normally moving?

YES

▶ Go to "Check PCSV as follows.

NO

▶ Replace it, and go to "Verification of Vehicle Repair" procedure.

2. Check PCSV

(1) IG "OFF" and disconnect PCSV and vacuum hose.

(2) Connect hand-vacuum gage with PCSV and supply vacuum to it.

(3) Is the vacuum maintained ?

YES

▶ Go to " Check injector" as follows.

NO

▶ Repair or replace it, and go to " Verification of Vehicle Repair" procedure.

3. Check injector

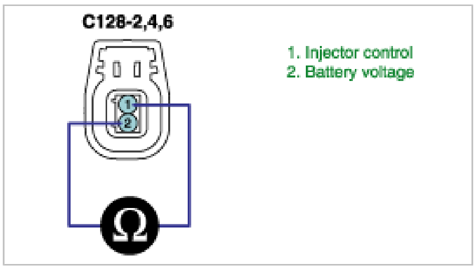
(1) IG "OFF" and disconnect injector.

(2) Check it for blocking caused by any foreign substance.

(3) Measure resistance between terminals 1 and 2 of Injector connector.(Component side)

Specification :

Temp	Coil's resistance
20°C(68°F)	11.4 ~ 12.6 Ω



(4) Is the measured resistance within specification?

YES

▸ Go to "Check sensor/actuator related to fuel system" as follows

NO

▸ Repair or replace it, and go to "Verification of Vehicle Repair" procedure.

4. Check sensor/actuator related to fuel system
   (1) Check the signal of sensor/actuator related to fuel system(HO2S, MAFS,MAPS, TPS, ECTS, PCSV, Injector and so on) (Refer to each DTC diagnostic procedure)

   (2) Are all of these items normal ?

   YES

   ▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Repair it, and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0175

GENERAL DESCRIPTION

In order to provide the best possible combination of drivability, fuel economy and emission control, the PCM uses a closed loop air/fuel metering system. The PCM monitors the HO2S signal voltage and adjusts fuel delivery based it in closed loop fuel control. Changes in fuel delivery will be indicated by the long-term and the short-term fuel trim values. The ideal fuel trim value is around 0%. The PCM will add fuel when the HO2S signal is indicating a lean condition. Additional fuel is indicated by fuel trim values that are above 0%. The PCM will reduce fuel when the HO2S signal is indicating a rich condition. Reduction in fuel is indicated by fuel trim values that are below 0%. The DTC relevant to fuel trim will be set when the amount reaches excessive levels because of a lean or rich condition.

DTC DESCRIPTION

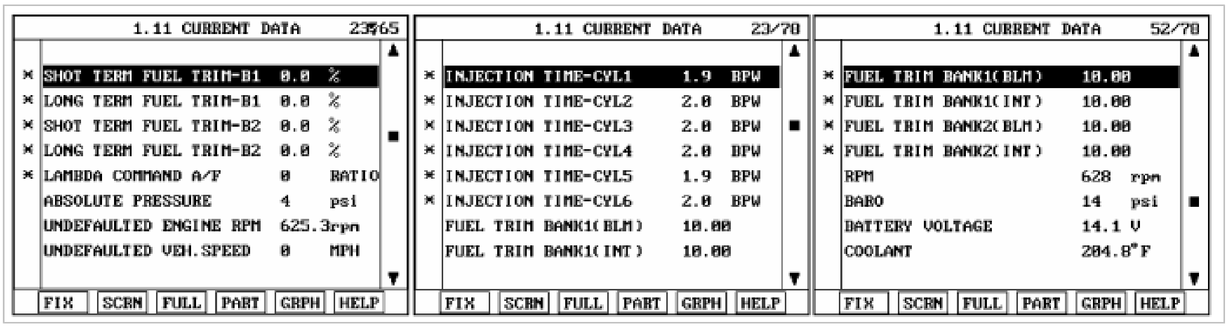
Checking air-fuel ratio correction value every 0.75 sec. under detecting condition, if an value is within detecting condition for more than 0.3 sec., PCM sets P0175. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Fuel Trim Limits Exceeded	• Poor connection • Relevant sensor/actuator • Blocking of Intake system • Fuel leakage in injector • Improper fuel line pressure • PCM
Enable Conditions	• 550rpm ≤ Engine speed ≤ 4000rpm • 60°C(140°F) ≤ Engine coolant temperature ≤ 115°C(239°F) • -10°C(14°F) ≤ Intake air temperature ≤ 60°C(140°F) • 0° ≤ Throttle position ≤ 80° • 25kPa ≤ Engine load ≤ 90kPa • 1.5g/s ≤ Intake air flow ≤ 80g/s • Barometric pressure ≥ 72kPa • Vehicle speed ≤ 130km/h • System voltage ≥ 11V • Feed-back control state • No other diagnostic fault	
Threshold value	• Lean limit average >1.2 (Average of short term fuel trim) and < 0.8(Average of long term fuel trim)	
Diagnosis Time	• Continuous (More than 0.3 second failure for every 0.75 second test)	
MIL On Condition	• 2 Driving Cycles	

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. Warm -up the engine to normal operating temperature.
3. Monitor "Sensor/actuator related to fuel system(HO2S, MAFS, MAPS, TPS, ECTS, PSCA, Injector, and so on)" items on the service data.



4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to " System Inspection " procedure.

SYSTEM INSPECTION

1. Check blocking of intake system
   (1) Visually/physically inspect the blocking in intake system for following items
   - Throttle body gasket and damage
   - Clogging of Air cleaner
   - Blocking in intake manifold and injector caused by any foreign substance

   (2) Has a problem found?

   YES
   - Repair or replace it, and go to "Verification of Vehicle Repair" procedure.

   NO
   - Go to " Check fuel pressure" as follows.

2. Check fuel pressure

> **NOTE**
>
> - Be cautious that Fuel is explosive and an empty fuel tank can still contain explosive gases.When working on fuel system make sure to supply adequate ventilationto the work area. Do not smoke, and keep sparks and open flames away.
> - The fuel system remains under pressure when the engine is not running. Release fuel system pressure before disconnecting any fuel line to reduce the chance of presonal injury or fire damage to vehicle components.

   (1) IG "OFF" and disconnect Fuel Pump Relay in Junction Box.

   (2) Start-up and wait until it stops itself.

   (3) IG "OFF" and connect Fuel Pump Relay.

   (4) Install the fuel pressure gauge to the delivery pipe with the fuel pressure gauge adaptor.

   (5) Activate the fuel pump, and with fuel pressure applied, check that there is no fuel leakage from the pressure gauge or connection part.

   (6) Disconnect the vacuum hose from the pressure regulator, and plug the hose end.

   (7) Measure the fuel pressure at idle.

   Specification : 374.6 ~ 384.4 kPa(3.82 ~ 3.92 kg/cm², 54.3 ~ 55.8 psi)

   (8) Is the measured fuel pressure within specifications ?

   YES
   - Go to "Component Inspection" procedure.

   NO
   - Repair or replace according to the below table. And then, go to " Verification of Vehicle Repair"procedure.

Condition	Possible Cause
Fuel Pressure is too low	Fuel filter,fuel pressure regulator, in-tank fuel hose or the fuel pump
Fuel Pressure is too high	Fuel pressure regulator, hose or pipe
No different fuel pressure when vacuum hose is connected or not	The vacuum hose or the nipple

3. Check fuel leakage in injector
   (1) IG "OFF" after checking the fuel pressure test.

   (2) Stop engine and check for a change in the fuel pressure gauge reading for 5 minutes.

   Specification : After engine stops, fuel gauge reading is maintained for 5 minutes.

   (3) Is the fuel gauge reading within specification?

   YES
   - Go to "Component Inspection" procedure.

   NO
   - There is a fuel leakage in injector. Repair or replace it, and go to " Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check PCV
   (1) IG "OFF" and remove PCV valve from cylinder head
   (2) With engine idling, block PCV valve and confirm that vacuum is felt.
   (3) Insert thin stick into the screwed PCV valve and verify that the plunger is moving.
   (4) Is the PCV valve normally moving?

YES

▸ Go to "Check PCSV as follows.

NO

▸ Replace it, and go to "Verification of Vehicle Repair" procedure.

2. Check PCSV
   (1) IG "OFF" and disconnect PCSV and vacuum hose.
   (2) Connect hand-vacuum gage with PCSV and supply vacuum to it.
   (3) Is the vacuum maintained ?

YES

▸ Go to " Check injector" as follows.

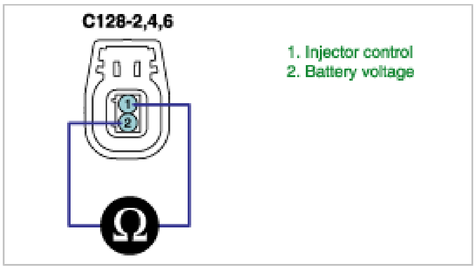
NO

▸ Repair or replace it, and go to " Verification of Vehicle Repair" procedure.

3. Check injector
   (1) IG "OFF" and disconnect injector.
   (2) Check it for blocking caused by any foreign substance.
   (3) Measure resistance between terminals 1 and 2 of Injector connector.(Component side)

Specification :

Temp	Coil's resistance
20°C(68°F)	11.4 ~ 12.6 Ω



   (4) Is the measured resistance within specification?

YES

▸ Go to "Check sensor/actuator related to fuel system" as follows

NO

▸ Repair or replace it, and go to "Verification of Vehicle Repair" procedure.

4. Check sensor/actuator related to fuel system
   (1) Check the signal of sensor/actuator related to fuel system(HO2S, MAFS,MAPS, TPS, ECTS, PCSV, Injector and so on) (Refer to each DTC diagnostic procedure)
   (2) Are all of these items normal ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Repair it, and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

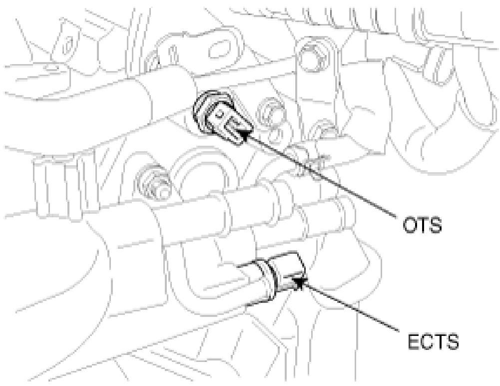
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0196

COMPONENT LOCATION



GENERAL DESCRIPTION

In CVVT system, the working fluid is engine oil. But its density varies according to temperature, PCM performs oil quantity correction based on the signal from engine oil temperature sensor over the various range of temperature. Main function of Oil Pressure Sensor is as follows.

1. intake air valve control solenoid(oil control valve) duty correction : As coil resistance varies according to oil temperature, excessive current flows at low temperture and low current at high temperature without duty correction. Therefore, PCM performs duty correction properly according to output signal from oil temperature sensor to supply constant current which is free from the change of oil temperature.
2. CVVT system operation starting temperature determination : As CVVT response gets weaker due to the friction of engine components such as valve at low temperature, PCM operates CVVT at above specific temperture based on output signal from oil temperture sensor.
3. improved CVVT controllability : CVVT response speed varies as oil temperature, PCM improves controllability throughout estimating response speed with oil temperture sensor output signal.

DTC DESCRIPTION

Checking the oil temperture , coolant temperature and intake air temperature every 25 sec. under detecting condition, if the difference in temperature at start-up exceeds threshold value, PCM sets P0196. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

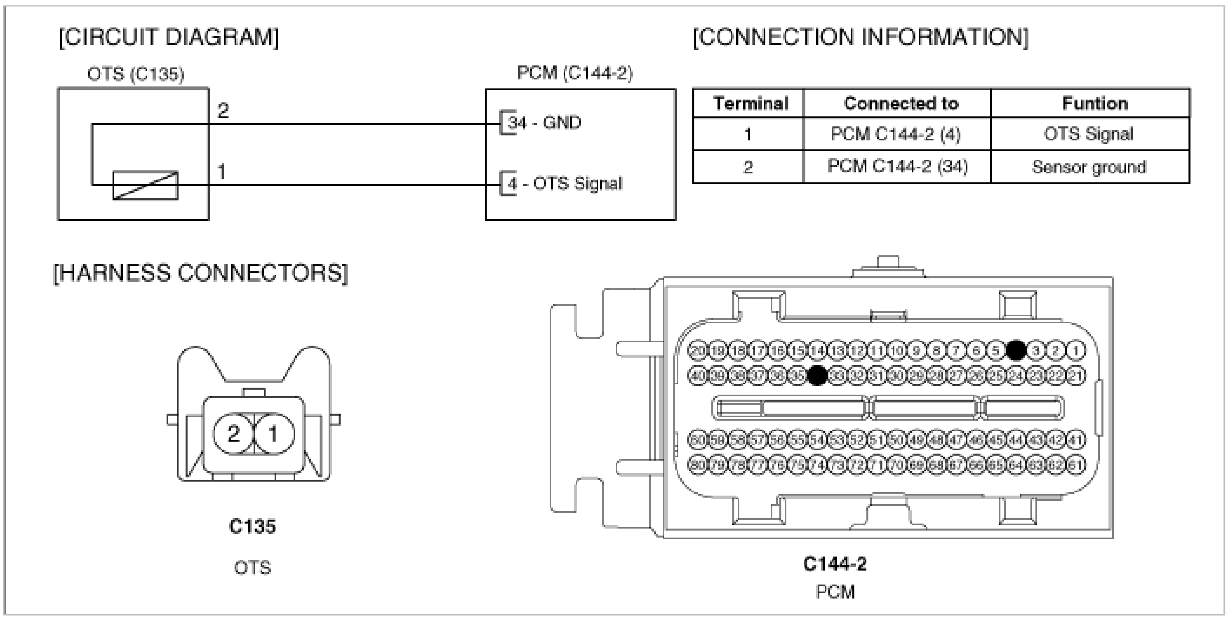
<table>
<tr><th colspan="2">Item</th><th>Detecting Condition</th><th>Possible cause</th></tr>
<tr><td colspan="2">DTC Strategy</td><td>• Determines if the oil temperature value is rational, compared to coolant and intake air temperature.</td><td rowspan="5">• Poor connection
• Open or short in harness
• Faulty OTS</td></tr>
<tr><td rowspan="2">Enable Conditions</td><td>Case 1</td><td>• Engine run time after startup< 30 sec
• Minimum soak period required >270 min</td></tr>
<tr><td>Case 2</td><td>• Minimum engine run time >800 sec</td></tr>
<tr><td rowspan="2"></td><td>Case 1</td><td>• The difference in temperature between oil and coolant temperatures at startup. > 35°C(63°F)</td></tr>
<tr><td></td><td></td></tr>
</table>

Threshold value	Case 2	• The difference in temperature between oil temperature and intake air temperature at startup >35°C(63°F)	• PCM
Diagnosis Time		• Continuous (More than 12.5 sec.failure for every 25 sec.test)	
MIL On Condition		• 2 Driving Cycles	

SPECIFICATION

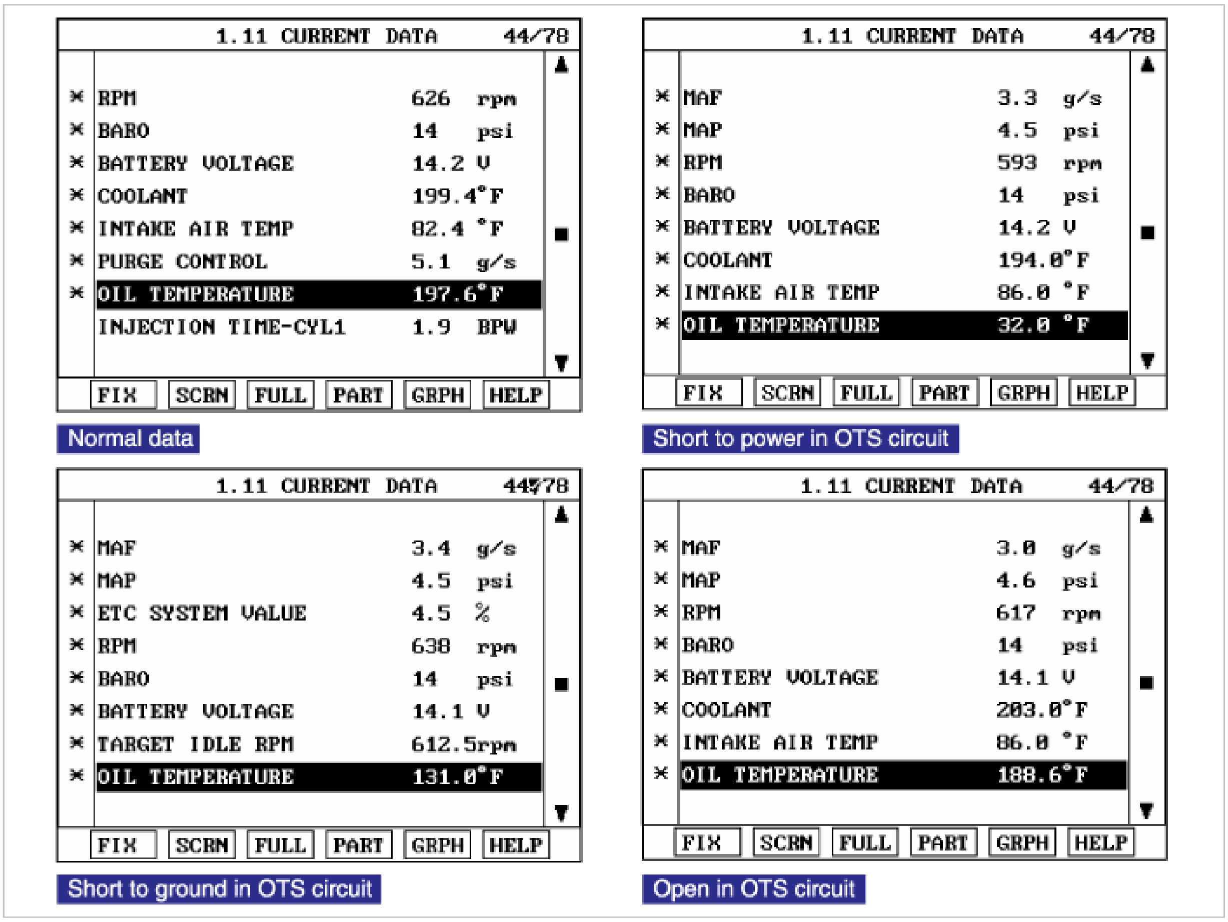
Temperature(°C/°F)	Resistance(kΩ)
-20°C/ -4°F	16.52kΩ
20°C/ 68°F	2.45kΩ
80°C/ 176°F	0.29kΩ

SCHEMATIC DIAGRAM



MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector (DLC)
2. Warm up engine to normal operating temperature
3. Monitor "Oil Temperature" parameter on the scantool.



Normal data / Short to power in OTS circuit / Short to ground in OTS circuit / Open in OTS circuit

4. Is the current data displayed correctly ?

YES

▸ Fault is intermittently caused by poor contact in the sensor and/or PCM connector or non cleared PCM memory after repair. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace if necessary and go to "Verification of vehicle Repair" .

NO

▸ Go to "Terminal and connector inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure

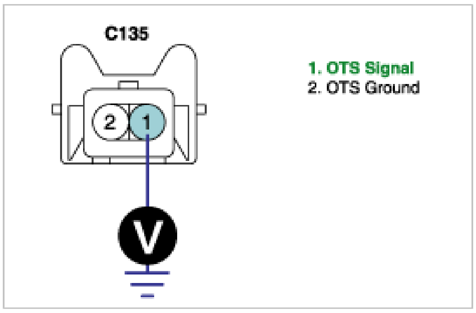
NO

▸ Go to "signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check Voltage
   (1) IG "OFF" & ENG "OFF"
   (2) Disconnect OTS connector
   (3) IG "ON" & ENG "OFF"
   (4) Measure voltage between harness terminal 1 of OTS and chassis ground.

Specification : Approx. 5V



(5) Is the measured voltage within specification ?

YES

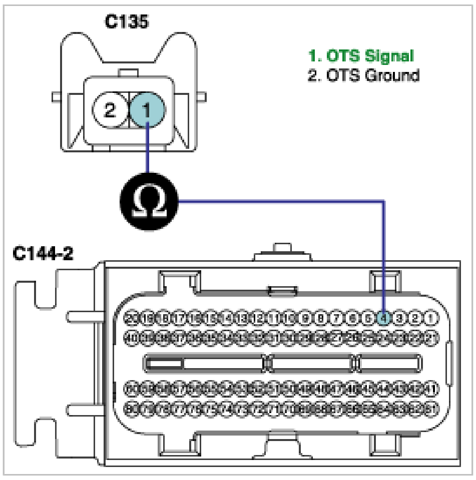
▸ Go to "Ground Circuit Inspection" procedure.

NO

▸ Go to "Check open in harness" as follow.

2. Check open in harness
   (1) IG "OFF" & ENG "OFF"
   (2) Disconnect OTS and PCM connector.
   (3) Measure resistance between terminal 1 of OTS harness connector and terminal 4 of PCM harness connector.

Specification : Approx. below 1Ω



(4) Is the measured resistance within specification ?

YES

▸ Go to "Ground Circuit Inspection" procedure.

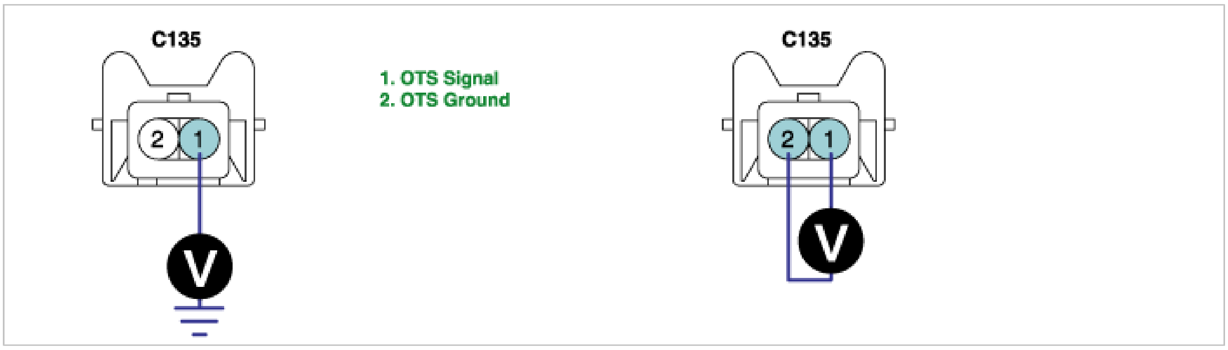
NO

▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF" & ENG "OFF"
2. Disconnect OTS connector
3. Measure voltage between terminal 1 of OTS harness connector and chassis ground.
4. Measure voltage between terminals 1 and 2 of OTS harness connector.

Specification : Measurement "A" - Measurement 'B' = Approx. below 200mV



5. Is the measured voltage within specification ?

YES

▸ Go to "Component Inspection" procedure

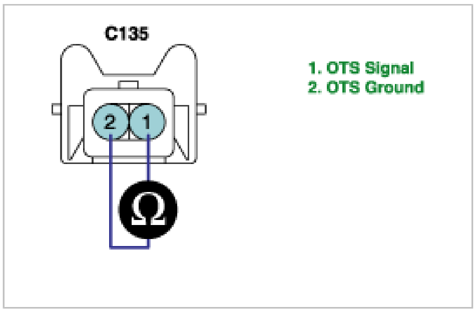
NO

▸ Repair or replace contact resistance or open in harness and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check resistance of OTS
   (1) IG "ON" & ENG "OFF"
   (2) Monitor Oil Temperature parameter on the scantool
   (3) IG "OFF" & ENG "OFF"
   (4) Disconnect OTS connector.
   (5) Measure resistance between terminal 1 and 2 of OTS connector(Component Side)
   Specification :

Temperature(°C/°F)	Resistance(kΩ)
-20°C/ -4°F	16.52kΩ
20°C/ 68°F	2.45kΩ
80°C/ 176°F	0.29kΩ



   (6) Is the measured resistance within specification ?

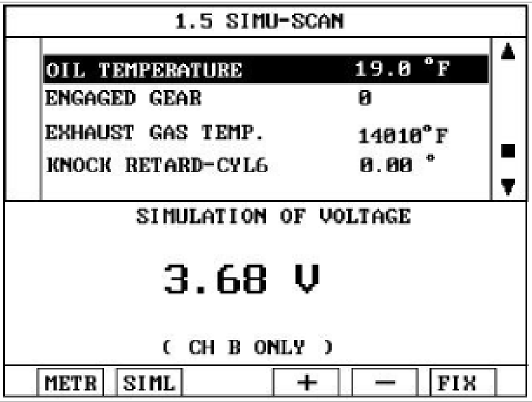
YES

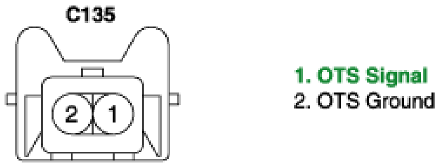
▸ Go to "Check PCM" as follows.

NO

▸ Substitute with a known - good OTS and check for proper operation. If the problem is corrected, replace OTS and go to "Verification of Vehicle Repair" procedure.

2. Check PCM
   (1) Ignition "OFF" and Connect Scantool
   (2) Ignition"ON " & Engine "OFF"
   (3) Select simulation function on scantool.
   (4) Simulate voltage at terminal "1" of OTS signal connector.





(5) Does the OTS signal value changes according to simulation voltage ?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

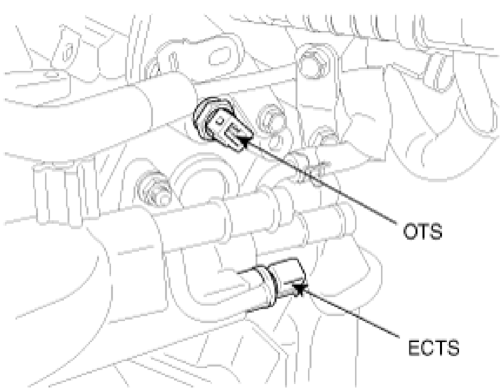
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0197

COMPONENT LOCATION



GENERAL DESCRIPTION

In CVVT system, the working fluid is engine oil. But its density varies according to temperature, PCM performs oil quantity correction based on the signal from engine oil temperature sensor over the various range of temperature. Main function of Oil Pressure Sensor is as follows.

1. intake air valve control solenoid(oil control valve) duty correction : As coil resistance varies according to oil temperature, excessive current flows at low temperture and low current at high temperature without duty correction. Therefore, PCM performs duty correction properly according to output signal from oil temperature sensor to supply constant current which is free from the change of oil temperature.
2. CVVT system operation starting temperature determination : As CVVT response gets weaker due to the friction of engine components such as valve at low temperature, PCM operates CVVT at above specific temperture based on output signal from oil temperture sensor.
3. improved CVVT controllability : CVVT response speed varies as oil temperature, PCM improves controllability throughout estimating response speed with oil temperture sensor output signal.

DTC DESCRIPTION

Checking output signals from oil temperture sensor every 15 sec. under detecting condition, if an signal is low for more than 12.5 sec., PCM sets P0197. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

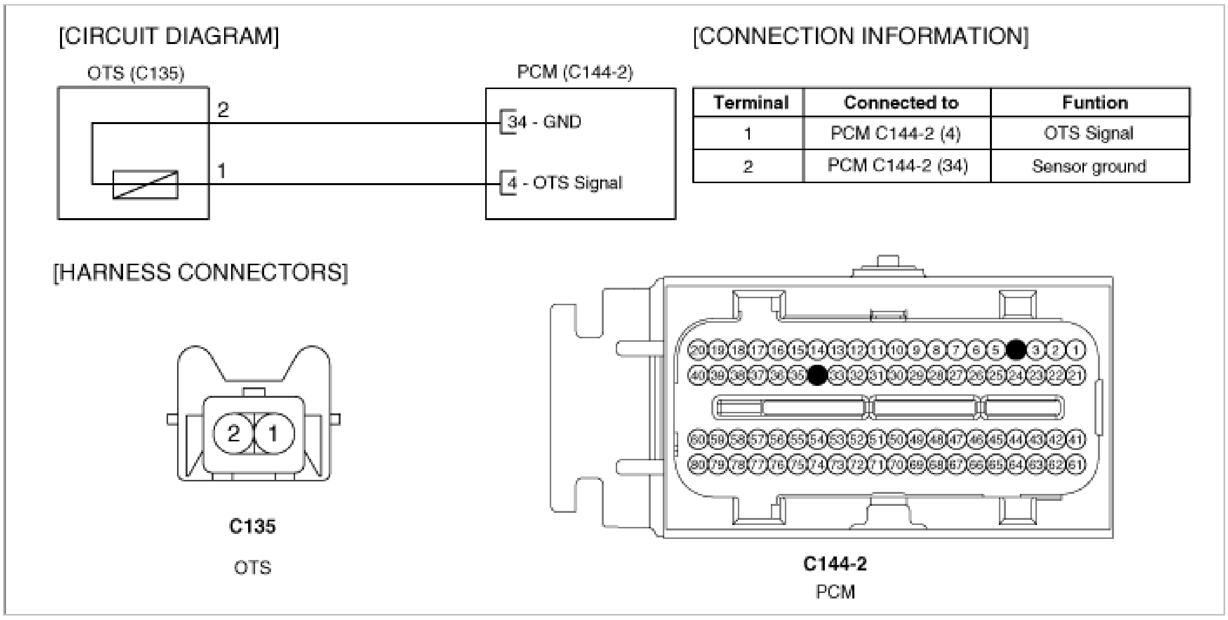
DTC DETECTING CONDITION

<table>
<tr><th colspan="2">Item</th><th>Detecting Condition</th><th>Possible cause</th></tr>
<tr><td colspan="2">DTC Strategy</td><td>• Signal low</td><td rowspan="7">• Poor connection
• Short to ground in harness
• Oil temp.sensor
• PCM</td></tr>
<tr><td rowspan="2">Enable Conditions</td><td>Case 1</td><td>• Engine running state >60 sec
• Coolant temperature < 110 °C(230°F)</td></tr>
<tr><td>Case 2</td><td>• Engine running state >90 sec.</td></tr>
<tr><td colspan="2">Thresh old value</td><td>• Oil temperature sensor's signal< 0.1V</td></tr>
<tr><td colspan="2">Diagnosis Time</td><td>• Continuous
(More than 12.5 sec.failure for every 15 sec.test)</td></tr>
<tr><td colspan="2">MIL On Condition</td><td>• 2 Driving Cycles</td></tr>
</table>

SPECIFICATION

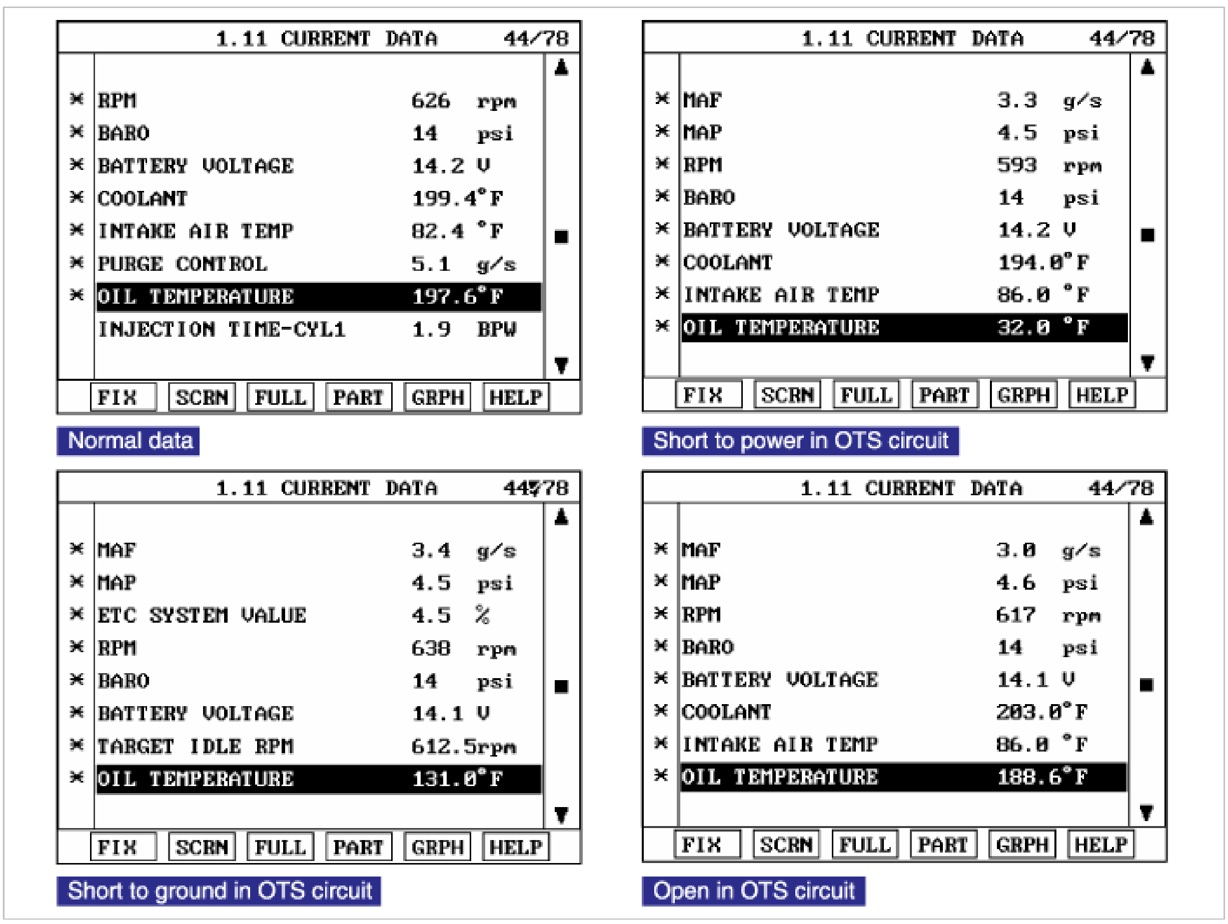
Temperature(°C/°F)	Resistance(kΩ)
-20°C/ -4°F	16.52kΩ
20°C/ 68°F	2.45kΩ
80°C/ 176°F	0.29kΩ

SCHEMATIC DIAGRAM



MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector (DLC)
2. Warm up engine to normal operating temperature
3. Monitor "Oil Temperature" parameter on the scantool.



4. Is the current data displayed correctly ?

YES

▸ Fault is intermittently caused by poor contact in the sensor and/or PCM connector or non cleared PCM memory after repair. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace if necessary and go to "Verification of vehicle Repair".

NO

▸ Go to "Terminal and connector inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure

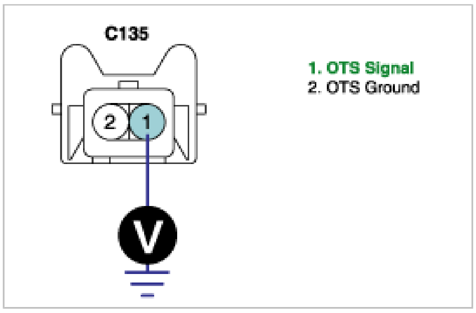
NO

▸ Go to "signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check Voltage
   (1) IG "OFF" & ENG "OFF"
   (2) Disconnect OTS connector
   (3) IG "ON" & ENG "OFF"
   (4) Measure voltage between harness terminal 1 of OTS and chassis ground.

Specification : Approx. 5V



   (5) Is the measured voltage within specification ?

YES

▸ Go to " Component Inspection" procedure.

NO

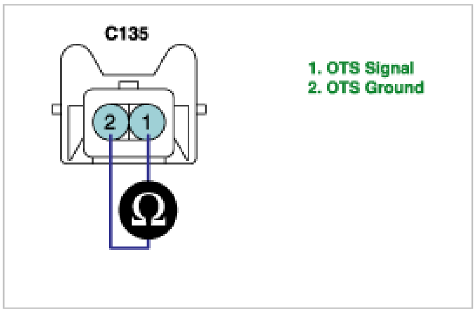
▸ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check resistance of OTS
   (1) IG "ON" & ENG "OFF"
   (2) Monitor Oil Temperature parameter on the scantool
   (3) IG "OFF" & ENG "OFF"
   (4) Disconnect OTS connector.
   (5) Measure resistance between terminal 1 and 2 of OTS connector(Component Side)

Specification :

Temperature(°C/°F)	Resistance(kΩ)
-20°C/ -4°F	16.52kΩ
20°C/ 68°F	2.45kΩ
80°C/ 176°F	0.29kΩ



(6) Is the measured resistance within specification ?

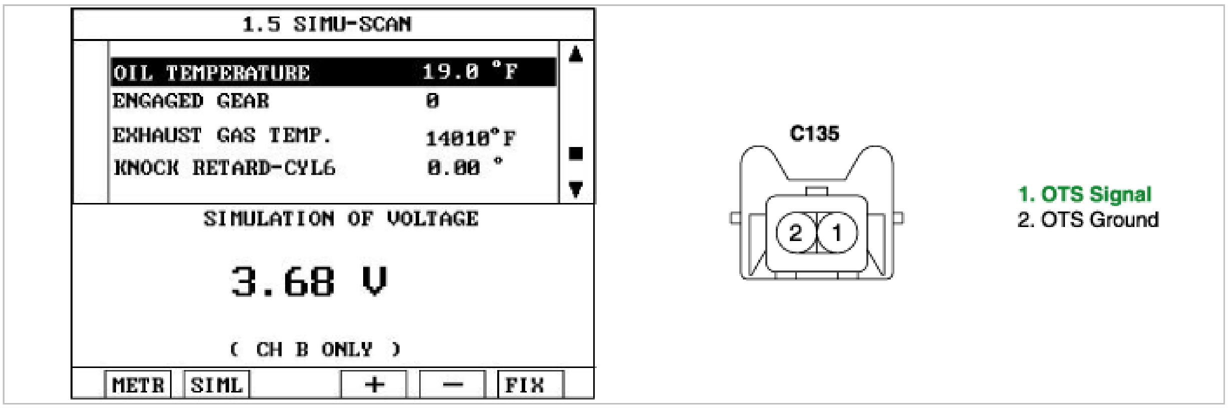
YES

▸ Go to "Check PCM" as follows.

NO

▸ Substitute with a known - good OTS and check for proper operation. If the problem is corrected, replace OTS and go to "Verification of Vehicle Repair" procedure.

2. Check PCM
   (1) Ignition "OFF" and Connect Scantool
   (2) Ignition"ON " & Engine "OFF"
   (3) Select simulation function on scantool.
   (4) Simulate voltage at terminal "1" of OTS signal connector.



(5) Does the OTS signal value changes according to simulation voltage ?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

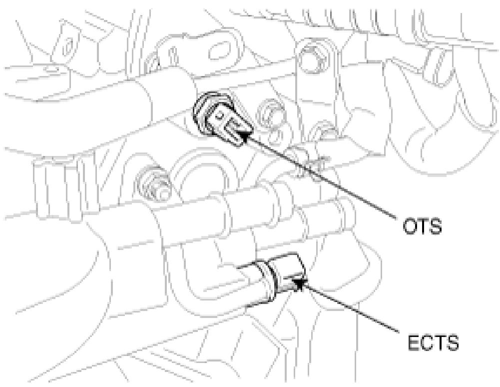
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0198

COMPONENT LOCATION



GENERAL DESCRIPTION

In CVVT system, the working fluid is engine oil. But its density varies according to temperature, PCM performs oil quantity correction based on the signal from engine oil temperature sensor over the various range of temperature. Main function of Oil Pressure Sensor is as follows.

1. intake air valve control solenoid(oil control valve) duty correction : As coil resistance varies according to oil temperature, excessive current flows at low temperture and low current at high temperature without duty correction. Therefore, PCM performs duty correction properly according to output signal from oil temperature sensor to supply constant current which is free from the change of oil temperature.
2. CVVT system operation starting temperature determination : As CVVT response gets weaker due to the friction of engine components such as valve at low temperature, PCM operates CVVT at above specific temperture based on output signal from oil temperture sensor.
3. improved CVVT controllability : CVVT response speed varies as oil temperature, PCM improves controllability throughout estimating response speed with oil temperture sensor output signal.

DTC DESCRIPTION

Checking output signals from oil temperture sensor every 15 sec. under detecting condition, if an signal is high for more than 12.5 sec., PCM sets P0198. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible cause
DTC Strategy		• Signal low	• Poor connection • Open or short to battery in signal harness • Open in ground harness • Oil temp.sensor • PCM
Enable Conditions	Case 1	• Engine running state >60 sec • Coolant temperature < 110 °C(230°F)	
	Case 2	• Engine running state >90 sec.	
Thresh old value		• Oil temperature sensor's signal >4.9V	
Diagnosis Time		• Continuous (More than 12.5 sec.failure for every 15 sec.test)	
MIL On Condition		• 2 Driving Cycles	

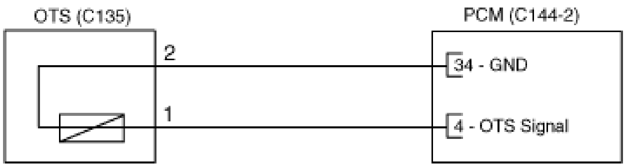
SPECIFICATION

Temperature(°C/°F)	Resistance(kΩ)
-20°C/ -4°F	16.52kΩ

20°C/ 68°F	2.45kΩ
80°C/ 176°F	0.29kΩ

SCHEMATIC DIAGRAM

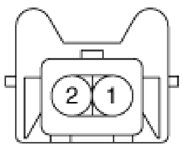
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

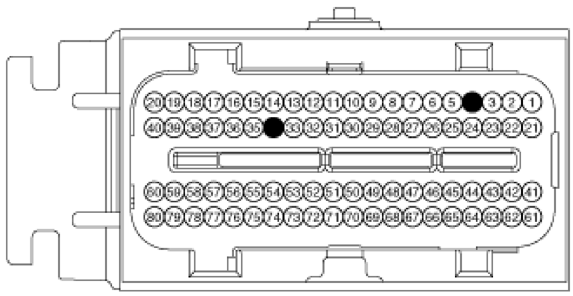
Terminal	Connected to	Funtion
1	PCM C144-2 (4)	OTS Signal
2	PCM C144-2 (34)	Sensor ground

[HARNESS CONNECTORS]



C135

OTS

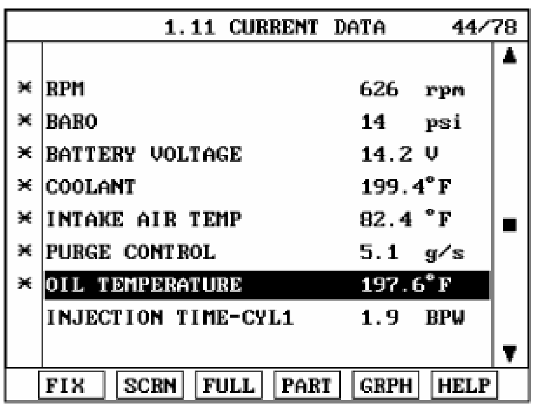


C144-2

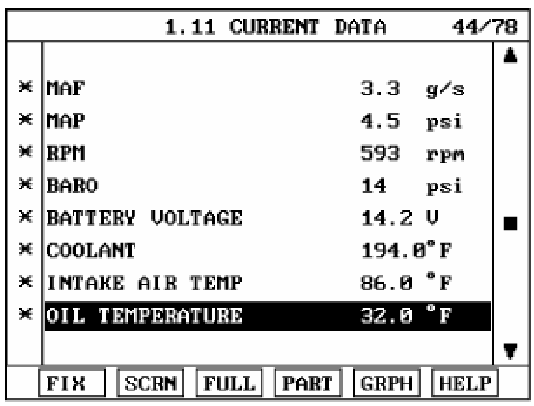
PCM

MONITOR SCANTOOL DATA

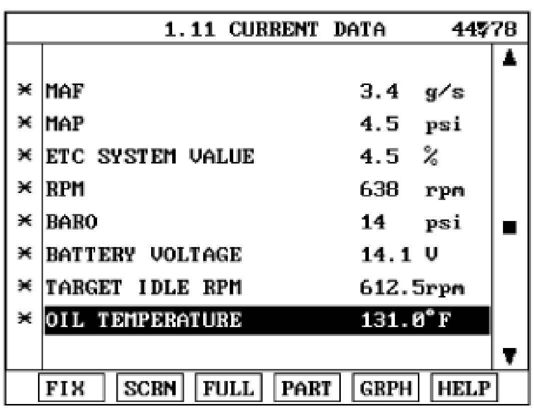
1. Connect scantool to Data Link Connector (DLC)
2. Warm up engine to normal operating temperature
3. Monitor "Oil Temperature" parameter on the scantool.



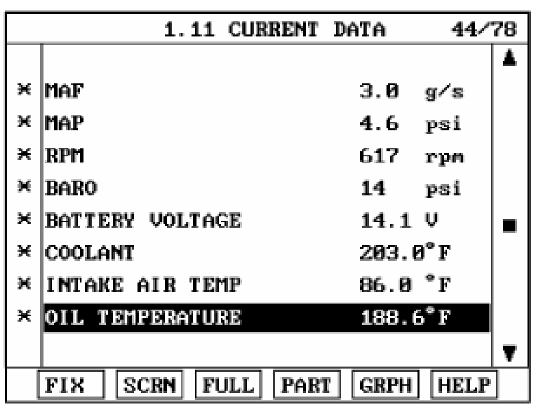
Normal data



Short to power in OTS circuit



Short to ground in OTS circuit



Open in OTS circuit

4. Is the current data displayed correctly ?

YES

▸ Fault is intermittently caused by poor contact in the sensor and/or PCM connector or non cleared PCM memory after repair. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace if necessary and go to "Verification of vehicle Repair".

NO

▸ Go to "Terminal and connector inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure

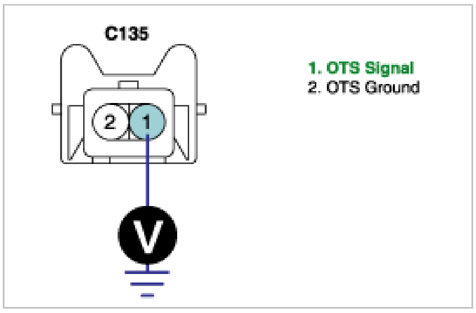
NO

▸ Go to "signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check Voltage
   (1) IG "OFF" & ENG "OFF"
   (2) Disconnect OTS connector
   (3) IG "ON" & ENG "OFF"
   (4) Measure voltage between harness terminal 1 of OTS and chassis ground.

Specification : Approx. 5V



   (5) Is the measured voltage within specification ?

YES

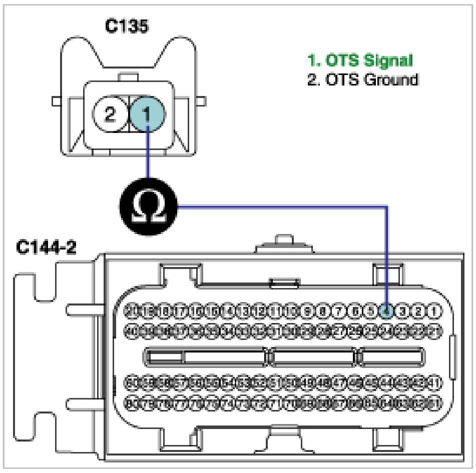
▸ Go to "Ground Circuit Inspection" procedure.

NO

▸ Go to "Check open in harness" as follow.

2. Check open in harness
   (1) IG "OFF" & ENG "OFF"
   (2) Disconnect OTS and PCM connector.
   (3) Measure resistance between terminal 1 of OTS harness connector and terminal 4 of PCM harness connector.

Specification : Approx. below 1Ω



(4) Is the measured resistance within specification ?

YES

▸ Go to "Ground Circuit Inspection" procedure.

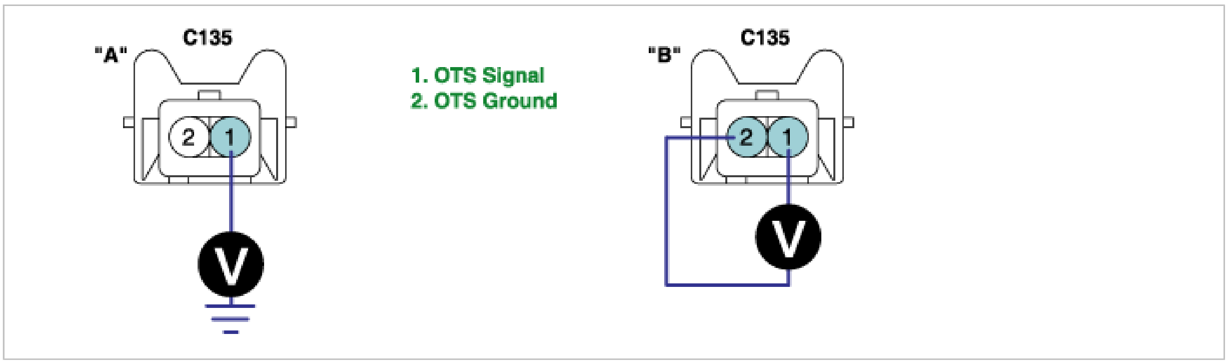
NO

▸ Repair or replace open in harness, and then go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF" & ENG "OFF"
2. Disconnect OTS connector
3. Measure voltage between terminal 1 of OTS harness connector and chassis ground.
4. Measure voltage between terminals 1 and 2 of OTS harness connector.

Specification : Measurement "A" - Measurement 'B' = Approx. below 200mV



5. Is the measured voltage within specification ?

YES

▸ Go to "Component Inspection" procedure

NO

▸ Repair or replace contact resistance or open in harness and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check resistance of OTS

(1) IG "ON" & ENG "OFF"

(2) Monitor Oil Temperature parameter on the scantool

(3) IG "OFF" & ENG "OFF"

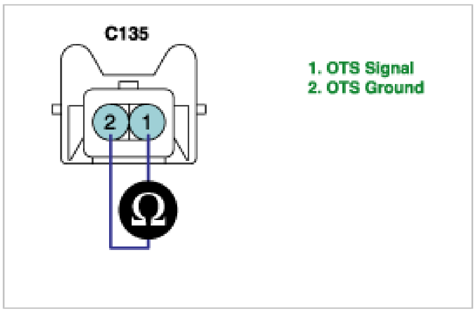
(4) Disconnect OTS connector.

(5) Measure resistance between terminal 1 and 2 of OTS connector(Component Side)

Specification :

Temperature(°C/°F)	Resistance(kΩ)

-20°C/ -4°F	16.52kΩ
20°C/ 68°F	2.45kΩ
80°C/ 176°F	0.29kΩ



(6) Is the measured resistance within specification ?

YES

▸ Go to "Check PCM" as follows.

NO

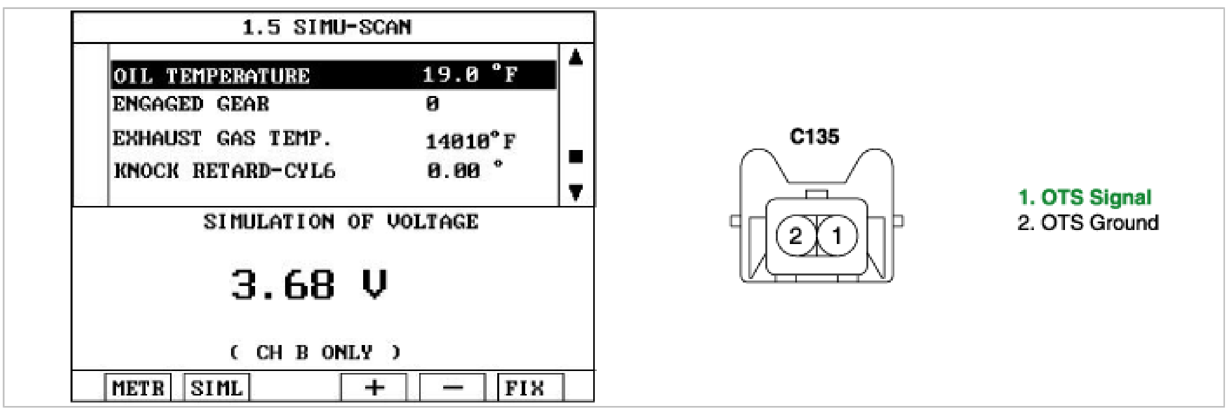
▸ Substitute with a known - good OTS and check for proper operation. If the problem is corrected, replace OTS and go to "Verification of Vehicle Repair" procedure.

2. Check PCM
   (1) Ignition "OFF" and Connect Scantool

   (2) Ignition"ON " & Engine "OFF"

   (3) Select simulation function on scantool.

   (4) Simulate voltage at terminal "1" of OTS signal connector.



(5) Does the OTS signal value changes according to simulation voltage ?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions

4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

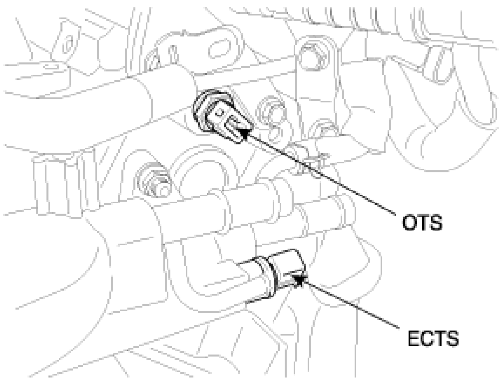
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0217

COMPONENT LOCATION



GENERAL DESCRIPTION

The Engine Coolant Temperature(ECT) Sensor measures the temperature of engine coolant. The Engine Coolant Temperature (ECT) Sensor is located near the thermostat housing of the cylinder head. ECT Sensor is a thermistor (A Variable Resistor that Changes Along with ECT) in series with a fixed resistor in the Engine Control Module (PCM). The PCM applies 5 volts to the ECT sensor. The PCM monitors the voltage across the ECT sensor and converts it into a temperature reading. When the engine is cold the ECT sensor resistance is high, and when the engine is warm the ECT sensor resistance is low. Therefore, when the engine is cold the PCM will receive a high voltage input, and when the engine is warm the PCM will receive a low voltage input. The signal from ECT sensor is used for Injection, ignition timing, idle speed and cooling fan control.

DTC DESCRIPTION

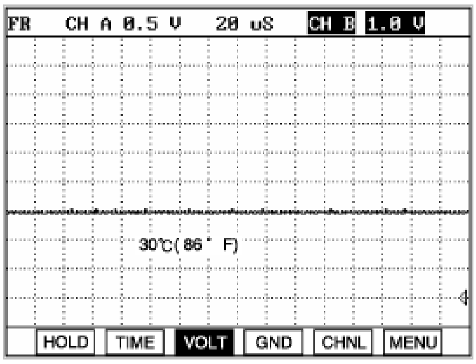
The Engine Coolant Temperature High Rationality Diagnostic checks for unusually high engine coolant temperatures under normal operating loads and if the temperature is found to be higher than a certain limit, the diagnostic declares a failure.
PCM monitors difference between the startup and current coolant temperature and compares agaist the threshold while enable condition is met. If the PCM detects that the coolant temperature exceeds the limit under normal operating condition, PCM determines that a fault exists and a DTC is stored.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• This diagnostic introduces a calibratable delay and simultaneously looks out for excessive engine loads. Once the delay period passes and excessive loads have not been experienced, the diagnostic checks whether the undefaulted coolant temperature has exceeded a maximum threshold in order to make a PASS/FAIL determination.	• Poor connection • Lack of engine coolant • Water pump • ECTS • PCM
Enable Conditions	• Engine Running status • No disabling faults present • Coolant Sensor within range • Undefaulted Coolant Temp ≥ 50°C(122 °F) • ndefaulted IAT ≥ 35°C(95 °F) • Soak time ≥ 360min or Undeafaulted Coolant temp ≤ 45°C(113 °F)	
Thresh old	• Coolant temperature above which High Rationality fail criteria is satisfied ≥ 110°C (230 °F) (Vehicle has been under high airflow	

value	conditions that may cause the High Rationality diagnostic to false fail) - To detect a failure, Average airflow must be< 30 g/sec and EWMA Airflow must be< 50 g/sec)	
Diagnosis Time	• Continuous (More than 12.5 sec.failure for every 15 sec.test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFORM AND DATA

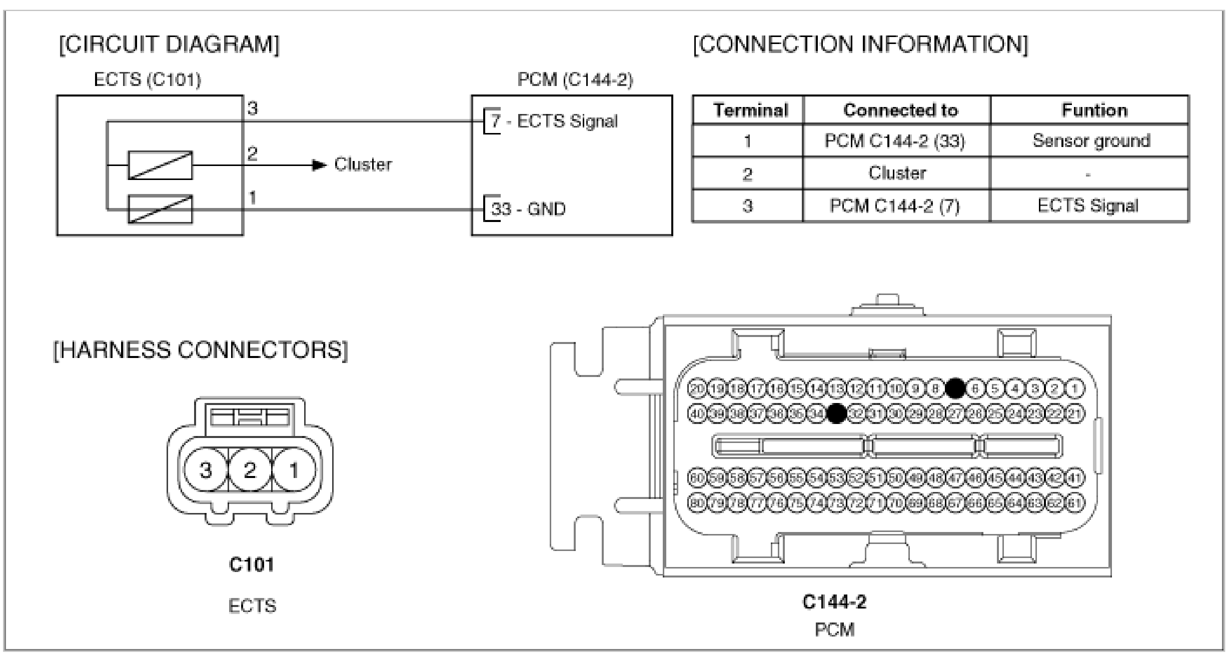


The output signals of IATS & ECTS change smoothly without any rapid changes. Those have almost same characteristic signal during the early period after start. It means that the temperatures of intake air and engine coolant are depended on the temperature of atmosphere. Meanwhile, during the warming up, the output signal of ECTS is going up increasingly. but, the output signal of IATS changes a little bit. even it may not change almost. It means that the heat of engine does not affect on the temperature of intake air.

SPECIFICATION

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59
0(32)	5.79	80(176)	0.32
20(68)	2.31 ~ 2.59		

SCHEMATIC DIAGRAM



MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "ECTS" item on the service data.

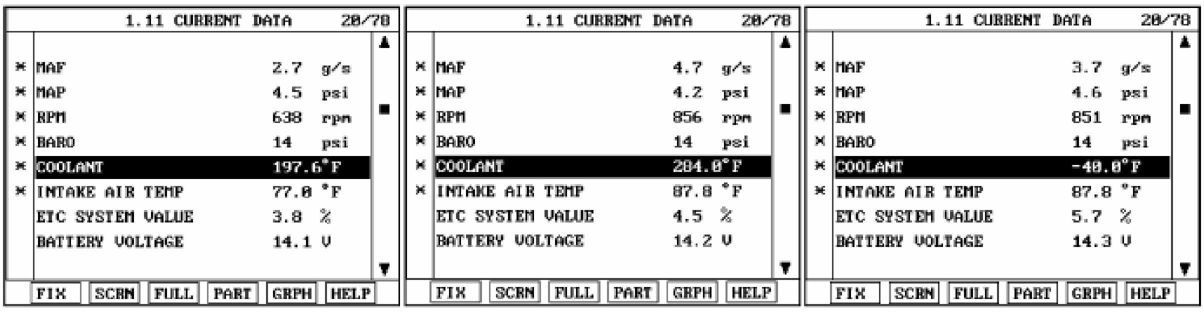


Fig. 1 Fig. 2 Fig. 3

Fig. 1 : Normal at Idle
Fig. 2 : Short to ground at idle
Fig. 3 : Open or short to battery at idle

4. Is the "ECTS" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

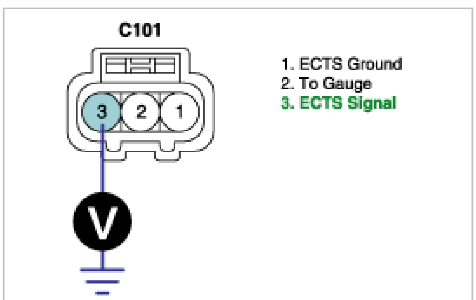
NO

▸ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. IG "OFF" and disconnect ECTS connector.
2. IG "ON" & ENG "OFF"
3. Measure voltage between terminal 3 of ECTS harness connector and chassis ground.

Specification : Approx. 5V



4. Is the measured voltage within specification ?

YES

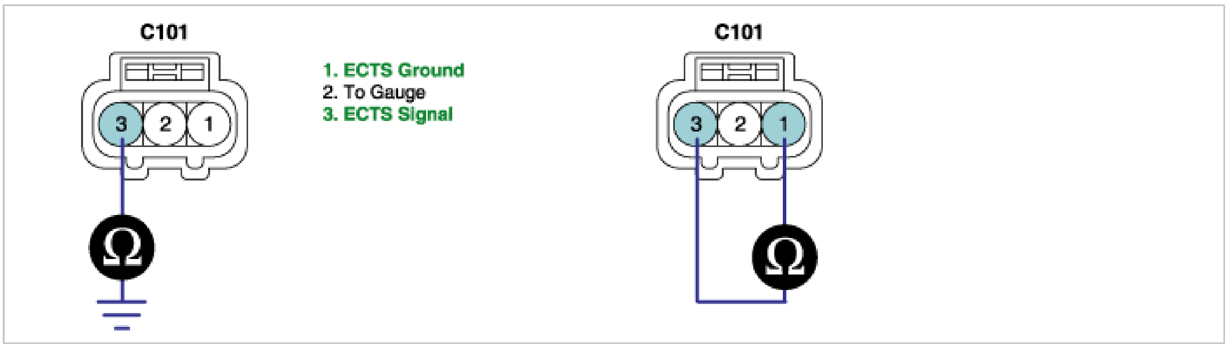
▸ Go to "System Inspection" procedure.

NO

▸ Go to "Check short to ground in harness" as follows.

5. Check short to ground in harness
   (1) IG "OFF" and disconnect ECTS connector and PCM connector.
   (2) Measure resistance between terminal 3 of ECTS harness connector and chassis ground.
   (3) Measure resistance between terminals 1 and 3 of ECTS harness connector.

Specification : Infinite



   (4) Is the measured resistance within specification?

YES

▸ Go to "System Inspection" procedure.

NO

▸ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

SYSTEM INSPECTION

1. Check if Engine coolant level is O.K
2. Check if that water pump is operating correctly.
3. Has a problem been found ?

YES

▸ Repair or replace as necessary and then go to "Verification of Vehicle Repair"procedure.

NO

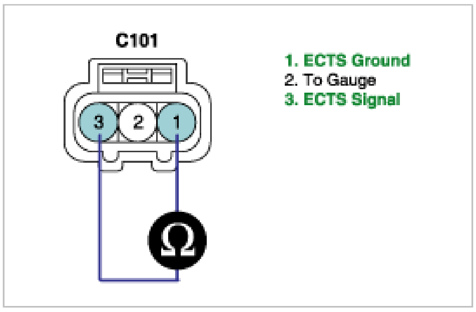
▸ Go to "Component Inspection" procedure.

COMPONENT INSPECTION

1. Check resistance of ECTS
   (1) IG "OFF" and disconnect ECTS connector.
   (2) Measure resistance between terminal 1 and 3 of ECTS connector. (Component Side)

Specification :

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59
0(32)	5.79	80(176)	0.32
20(68)	2.31 ~ 2.59		



(3) Is the measured resistance within specification ?

YES

▶ Go to "Check PCM" procedure.

NO

▶ Substitute with a known - good ECTS and check for proper operation. If the problem is corrected, replace ECTS and go to "Verification of Vehicle Repair" procedure.

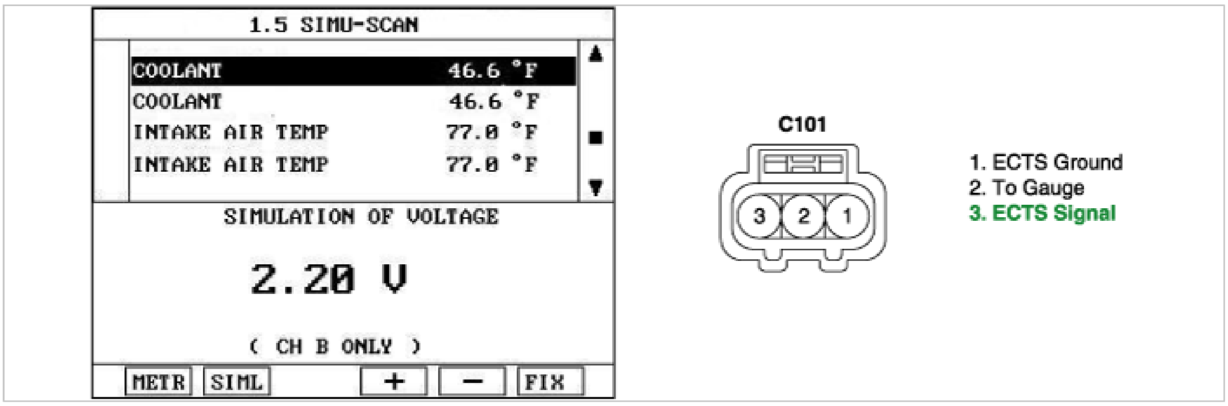
2. Check PCM

(1) IG "OFF" and connect scantool.

(2) Connect probe to terminal 3 of ECTS harness connector.

(3) IG "ON" and ENG "OFF" and simulation Function on scantool.

(4) Simulate voltage at terminal 3 of ECTS harness connector.



(5) Does the signal value of ECT sensor change according to simulation voltage ?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

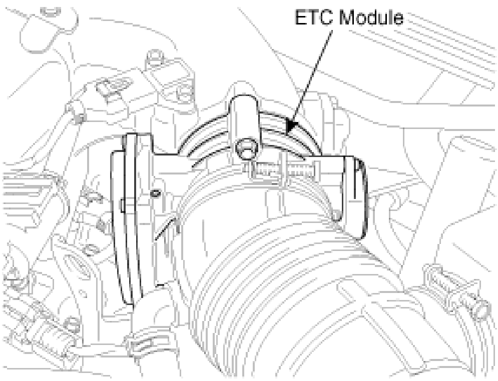
▶ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0222

COMPONENT LOCATION



GENERAL DESCRIPTION

ETC(Electronic Throttle Control Valve) is the device controlling amount of air to engine acccording to driver's intension. Different from the existing mechanical throttle valve which is composed of accelerator pecal and connecting wire cable, ETC consists of a motor, a throttle body and a throttle position sensor. Receiving input signals from electronic accelerator pedal module, PCM lets ETC motor control throttle valve. With ETC, cruise control system works without any additional device.

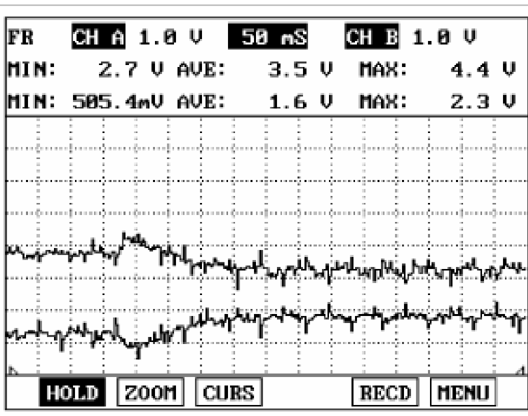
DTC DESCRIPTION

Checking output signals from TPS2 every 8.5 sec. under detecting condition, if an output signal is below 0.25V for more than 0.1 sec, PCM sets P0222. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

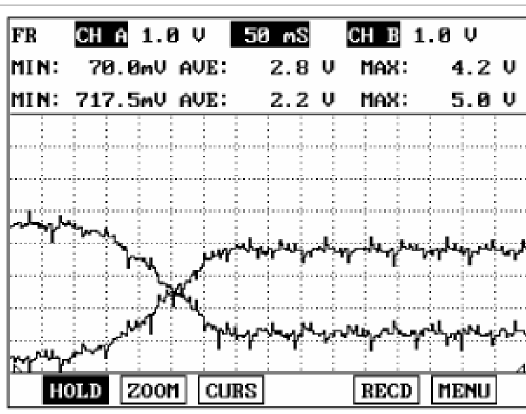
DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• signal low	• Poor connection • Open or short to ground in power harness • Open or short to ground in signal harness • TPS • PCM
Enable condition	• IG "ON"	
threshold value	• The signal voltage of TPS < 0.25V	
diagnosis time	• Continuous (more than 0.1 sec. failure for every 8.5 sec.test)	
MIL ON condition	• 2 driving cycles	

SIGNAL WAVEFORM AND DATA



Hit the accelerator at IG ON



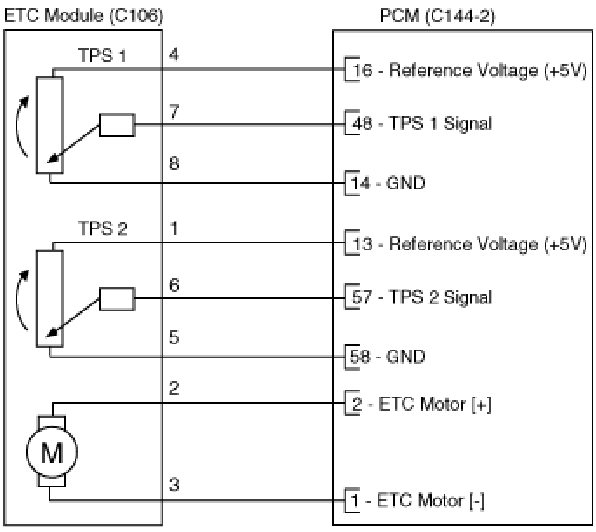
Open the throttle valve by force at IG ON

SPECIFICATION

Throttle opening (°)	Output voltage(V) [Vref=5.0]	
	TPS1	TPS2
0°	0.0V	5.0V
10°	0.5V	4.5V
20°	0.9V	4.1V
30°	1.4V	3.6V
40°	1.8V	3.2V
50°	2.3V	2.7V
60°	2.7V	2.3V
70°	3.2V	1.8V
80°	3.6V	1.4V
90°	4.1V	0.9V
100°	4.5V	0.5V
110°	5.0V	0.0V

SCHEMATIC DIAGRAM

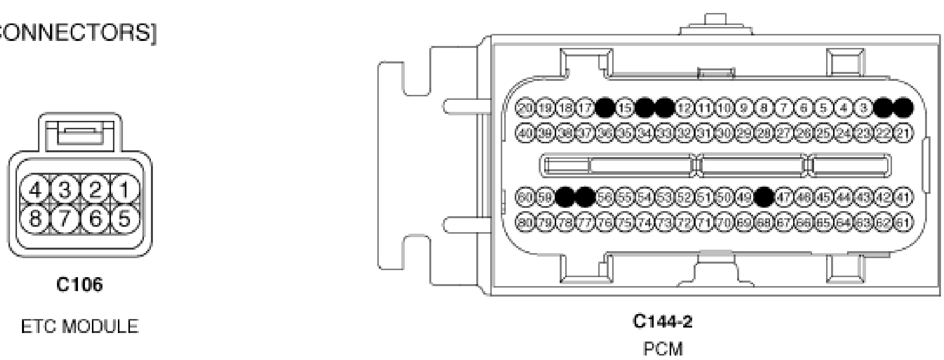
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Funtion
1	PCM C144-2 (13)	TPS 2 Reference Voltage (+5V)
2	PCM C144-2 (2)	ETC Motor [+] Control
3	PCM C144-2 (1)	ETC Motor [-] Control
4	PCM C144-2 (16)	TPS 1 Reference Voltage (+5V)
5	PCM C144-2 (58)	TPS 2 Ground
6	PCM C144-2 (57)	TPS 2 Signal
7	PCM C144-2 (48)	TPS 1 Signal
8	PCM C144-2 (14)	TPS 1 Ground

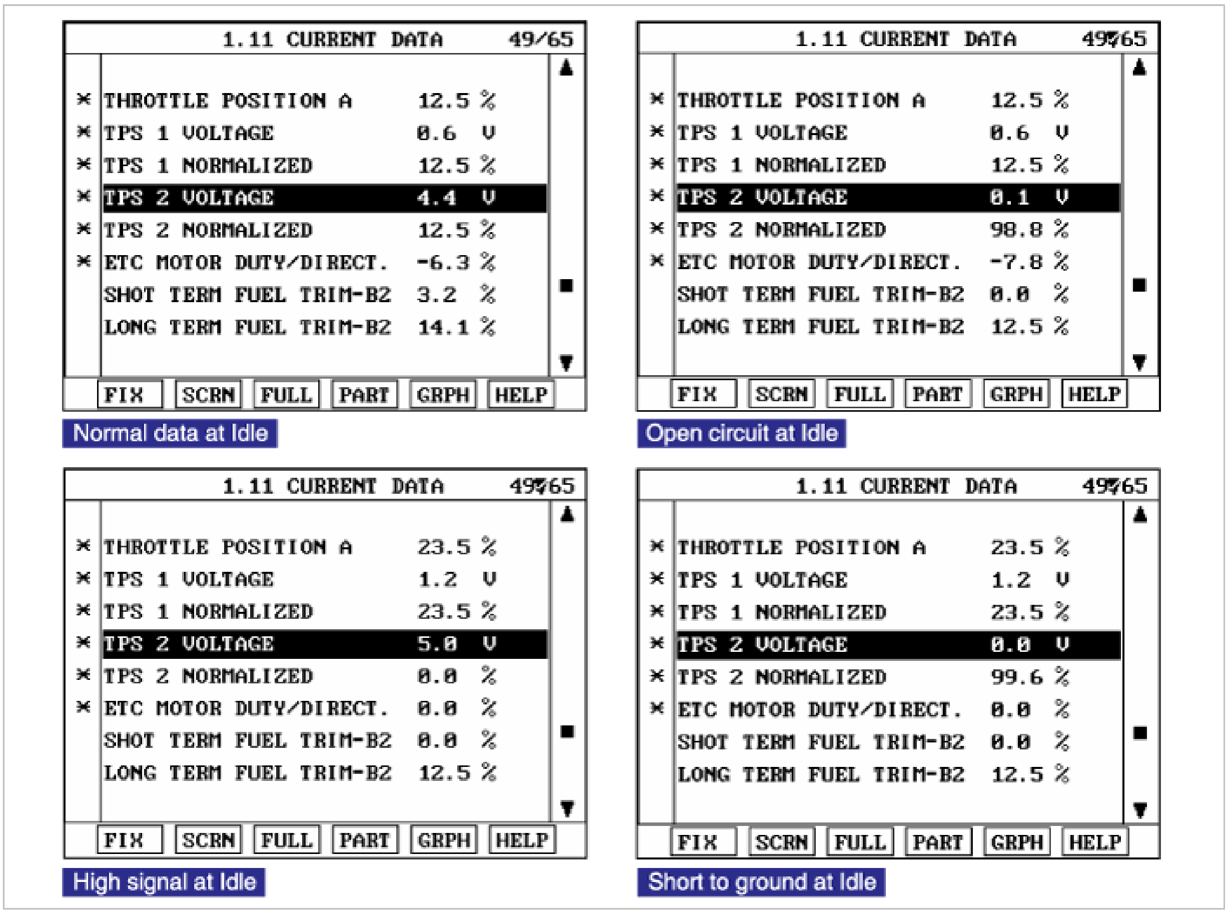
[HARNESS CONNECTORS]



MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.

3. Monitor "TPS" item on the service data.



Normal data at Idle

Open circuit at Idle

High signal at Idle

Short to ground at Idle

4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

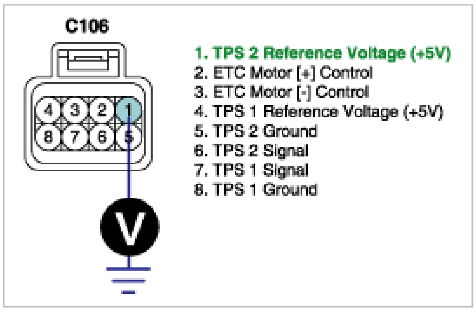
NO

▸ Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION

1. IG "OFF" and disconnect TPS connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of TPS harness connector and chassis ground.

Specification : Approx. 5V



4. Is the measured voltage within specification ?

YES

▸ Go to "Signal circuit inspection" procedure.

NO

▸ Repair open or short to ground in power harness, and go to "Verification of Vehicle Repair" procedure.

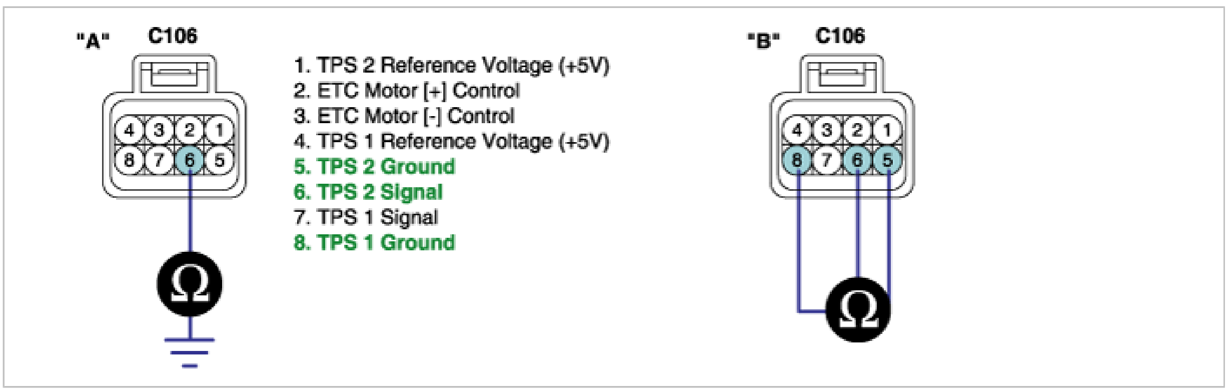
SIGNAL CIRCUIT INSPECTION

1. Check short to ground in harness
   (1) IG "OFF" and disconnect TPS connector and PCM connector.

   (2) Measure resistance between terminal 6 of TPS harness connector and chassis ground.

   (3) Measure resistance between terminals 6 and 5(8) of TPS harness connector.

   Specification : Infinite



   (4) Is the measured resistance within specification?

   YES

   ▸ Go to "Check open in harness" as follows

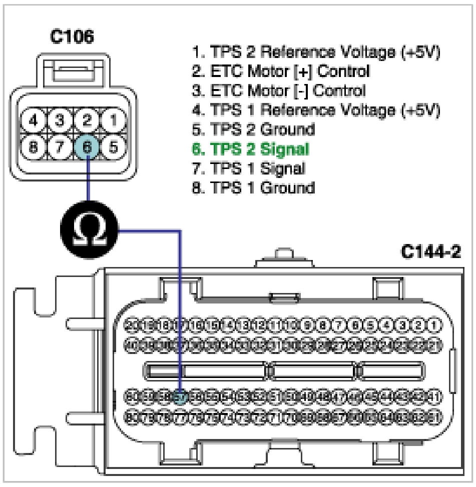
   NO

   ▸ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness
   (1) IG "OFF" and disconnect TPS connector and PCM connector.

   (2) Measure resistance between terminal 6 of TPS harness connector and terminal 57 of PCM harness connector.

   Specification : Below 1Ω



(3) Is the measured resistance within specification?

YES

▸ Go to " Component Inspection" procedure.

NO

▸ Repair open in harness, and go to "Verification of Repair" procedure.

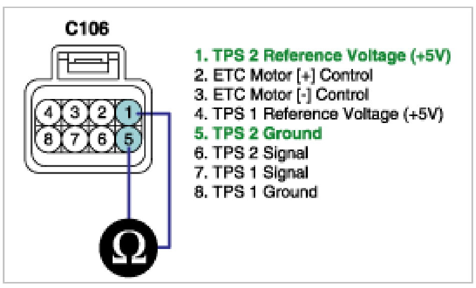
COMPONENT INSPECTION

1. Check TPS

(1) IG "OFF" and disconnect TPS connector.

(2) Measure resistance between terminals 1 and 5 of TPS connector.(Component side)

Specification : 2.7 ~ 4.1kΩ



(3) Is the measured resistance within specification?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good TPS and check for proper operation. If the problem is corrected, replace TPS and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

CAUTION

Procedure of ETS Initialization

1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10sec.)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

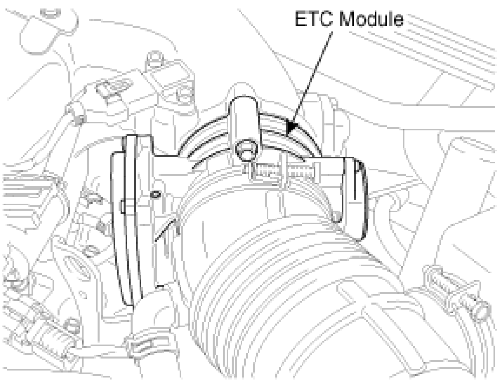
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0223

COMPONENT LOCATION



GENERAL DESCRIPTION

ETC(Electronic Throttle Control Valve) is the device controlling amount of air to engine acccording to driver's intension. Different from the existing mechanical throttle valve which is composed of accelerator pecal and connecting wire cable, ETC consists of a motor, a throttle body and a throttle position sensor. Receiving input signals from electronic accelerator pedal module, PCM lets ETC motor control throttle valve. With ETC, cruise control system works without any additional device.

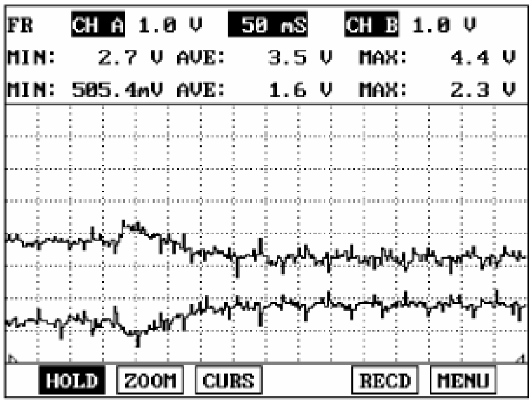
DTC DESCRIPTION

Checking output signals from TPS2 every 8.5 sec. under detecting condition, if an output signal is above 4.75V for more than 0.1 sec., PCM sets P0223. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

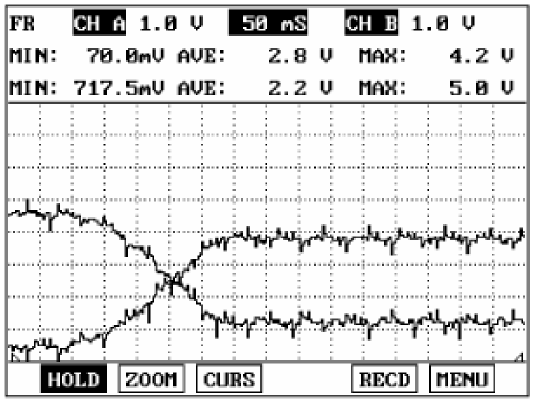
DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal High	• Poor connection • Short to battery in signal harness • Open in ground harness • TPS • PCM
Enable condition	• IG "ON"	
threshold value	• The signal voltage of TPS >4.75V	
diagnosis time	• Continuous (more than 0.1 sec. failure for every 8.5 sec.test)	
MIL ON condition	• 2 driving cycles	

SIGNAL WAVEFORM AND DATA



Hit the accelerator at IG ON



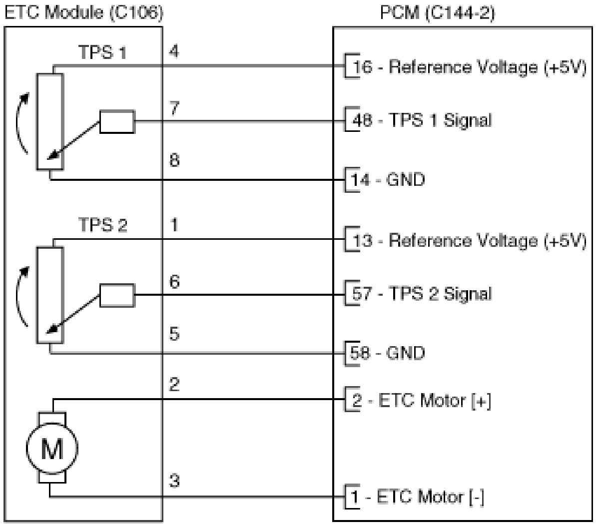
Open the throttle valve by force at IG ON

SPECIFICATION

Throttle opening (°)	Output voltage(V) [Vref=5.0]	
	TPS1	TPS2
0°	0.0V	5.0V
10°	0.5V	4.5V
20°	0.9V	4.1V
30°	1.4V	3.6V
40°	1.8V	3.2V
50°	2.3V	2.7V
60°	2.7V	2.3V
70°	3.2V	1.8V
80°	3.6V	1.4V
90°	4.1V	0.9V
100°	4.5V	0.5V
110°	5.0V	0.0V

SCHEMATIC DIAGRAM

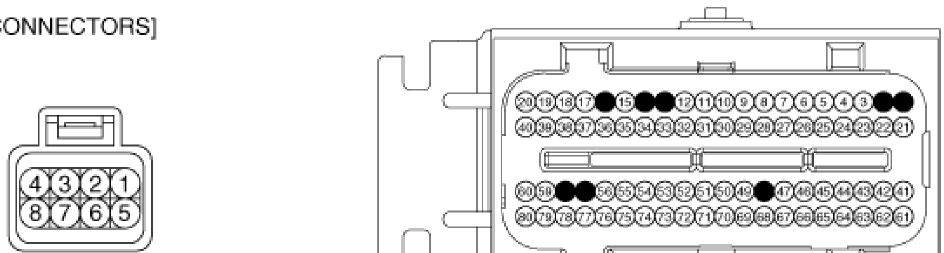
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Funtion
1	PCM C144-2 (13)	TPS 2 Reference Voltage (+5V)
2	PCM C144-2 (2)	ETC Motor [+] Control
3	PCM C144-2 (1)	ETC Motor [-] Control
4	PCM C144-2 (16)	TPS 1 Reference Voltage (+5V)
5	PCM C144-2 (58)	TPS 2 Ground
6	PCM C144-2 (57)	TPS 2 Signal
7	PCM C144-2 (48)	TPS 1 Signal
8	PCM C144-2 (14)	TPS 1 Ground

[HARNESS CONNECTORS]



C106

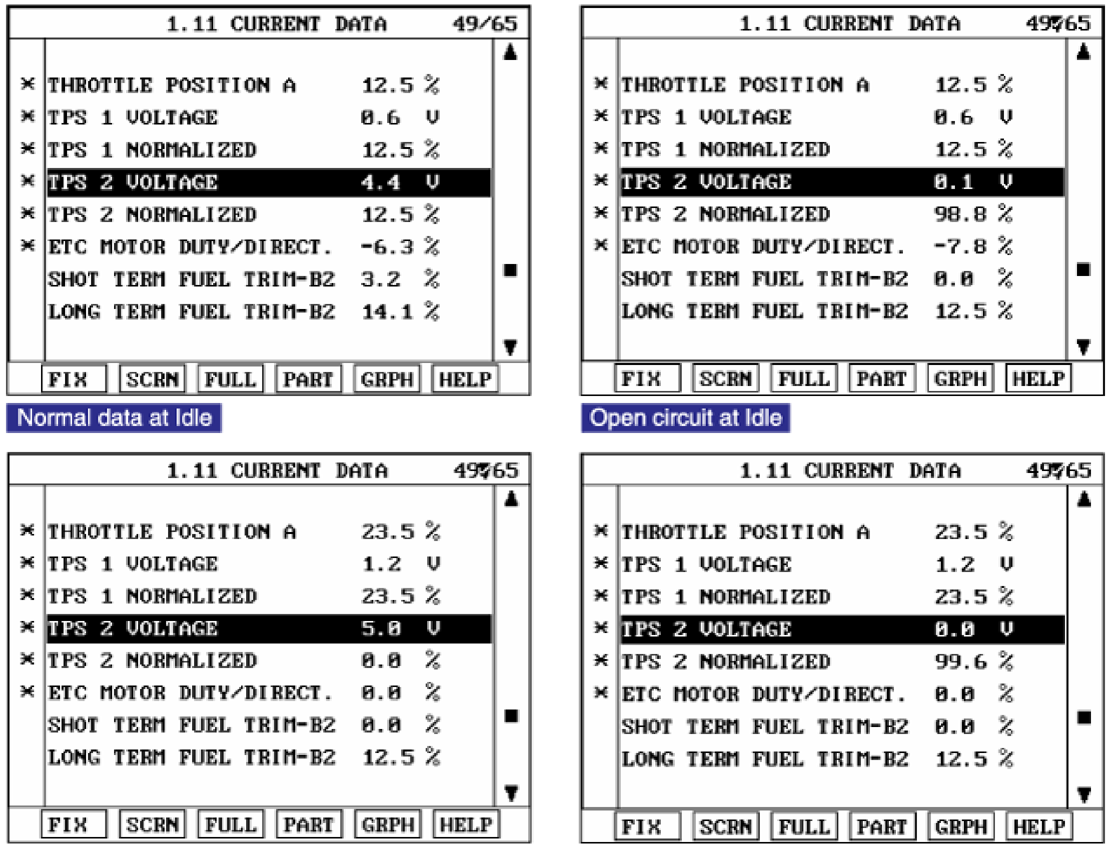
ETC MODULE

C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "TPS" item on the service data.



Normal data at Idle | Open circuit at Idle | High signal at Idle | Short to ground at Idle

4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

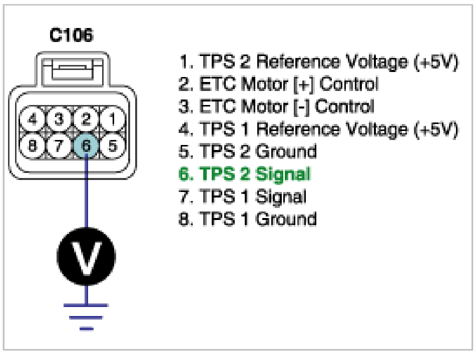
NO

▸ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF" and disconnect TPS connector.
   (2) IG "ON and ENG "OFF"
   (3) Measure voltage between terminal 6 of TPS harness connector and chassis ground.

Specification : Approx. 0V



(4) Is the measured voltage within specification?

YES

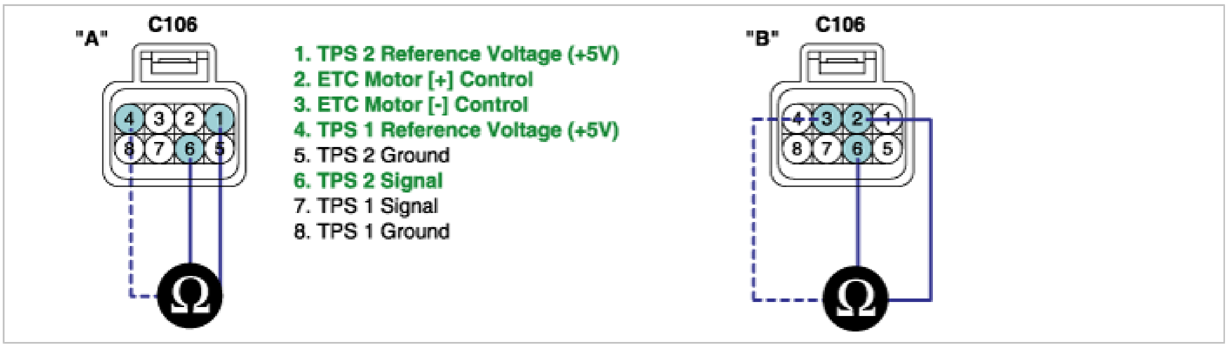
▸ Go to "Ground Circuit Inspection" procedure.

NO

▸ Go to "Check short to battery in harness" as follows.

2. Check short to battery in harness
   (1) IG "OFF" and disconnect TPS connector and PCM connector.
   (2) Measure resistance between terminals 1 and 6 of TPS harness connector.
   (3) Measure resistance between terminals 4 and 6 of TPS harness connector.
   (4) Measure resistance between terminals 2 and 6 of TPS harness connector.
   (5) Measure resistance between terminals 3 and 6 of TPS harness connector.

Specification : Infinite



(6) Is the measured resistance within specification?

YES

▸ Go to " Ground Circuit Inspection" procedure.

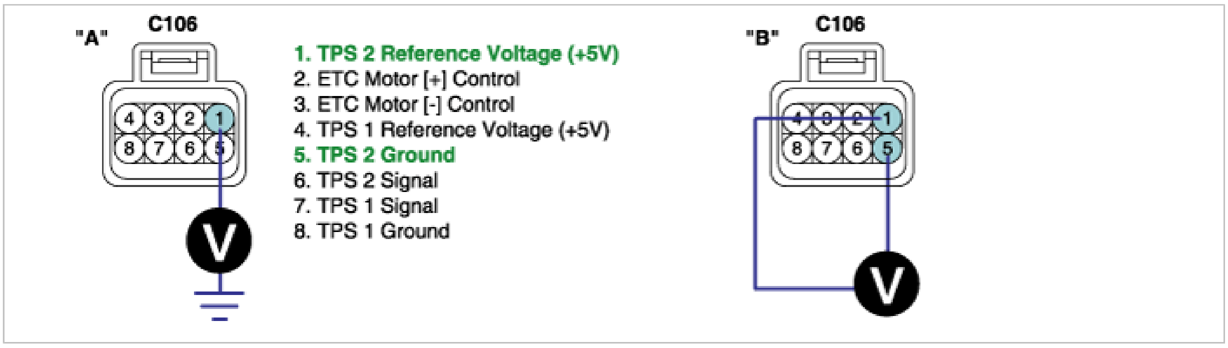
NO

▸ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF" and disconnect TPS connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of TPS harness connector and chassis ground.
4. Measure voltage between terminals 1 and 5 of TPS harness connector.

Specification : Measurement "A" - Measurement 'B' = Approx. below 200mV



5. Is the measured voltage within specification?

YES

▸ Go to "Component Inspection" procedure.

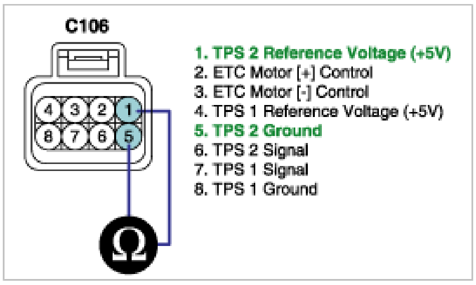
NO

▸ Repair open or contact resistance inharness, and go to "Verification of Vehicle Repair: procedure.

COMPONENT INSPECTION

1. Check TPS
   (1) IG "OFF" and disconnect TPS connector.
   (2) Measure resistance between terminals 1 and 5 of TPS connector.(Component side)

Specification : 2.7 ~ 4.1kΩ



   (3) Is the measured resistance within specification?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good TPS and check for proper operation. If the problem is corrected, replace TPS and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

CAUTION

Procedure of ETS Initialization

1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10sec.)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions

4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

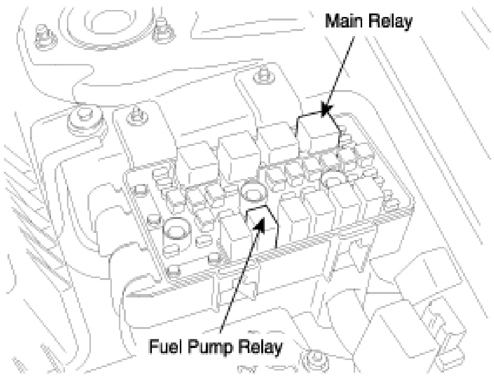
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0230

COMPONENT LOCATION



GENERAL DESCRIPTION

The PCM provides ground to one side of the coil in the fuel pump relay to control the fuel pump relay. The other side of the fuel pump relay coil is connected to fuel pump relay, which activates when the ignition switch is ON. The PCM monitors the control circuit between the fuel pump relay and the ECM. When the ignition switch is turned ON, the PCM energizes the fuel pump relay, which sends power to the fuel pump.

DTC DESCRIPTION

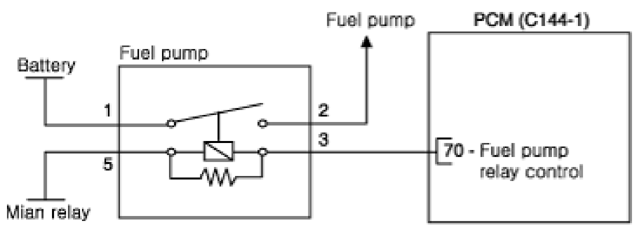
Checking fuel pump relay circuit continuously under detecting condition, if open or short in the circuit is detected PCM sets P0230.In addition, Take note that open circuit in Main Relay may cause this P0230 code.
※ In addition, Take note that open circuit in Main Relay may cause this P0230 code.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal Low or High	• Poor connection • Open or short in fuel pump relay circuit • Open in Main Relay circuit • Fuel Pump Relay • PCM
Enable condition	• 11V ≤ Battery Voltage ≤ 16V	
threshold value	• Open or short	
diagnosis time	• Continuous	
MIL ON condition	• NO MIL ON(DTC only)	

SCHEMATIC DIAGRAM

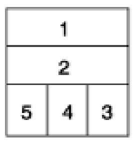
[CIRCUIT DIAGRAM]

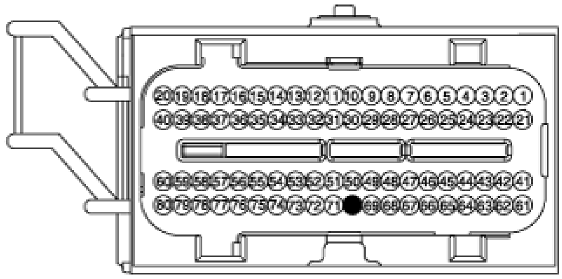


[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	Battery	Battery power (B+)
2	Fuel pump	Power Supply to fuel pump (B+)
3	PCM C144-1 (70)	Relay control
5	Mian relay	Battery power (B+)

[HARNESS CONNECTOR]

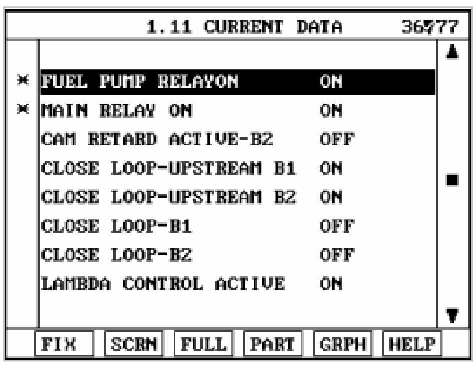




C144-1
PCM

MONITOR SCANTOOL DATA

1. Connect Scantool to Data Link Cable(DLC).
2. ENG "ON"
3. Monitor "Fuel Pump Relay" item on the scantool.



4. Is the service data displayed correctly ?

YES

▸ Fault is intermittently caused by poor contact in the sensor and/or PCM connector or non cleared PCM memory after repair. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace if necessary and go to "Verification of vehicle Repair" .

NO

▸ Go to "Terminal and connector inspection" procedure.

▸ In case of open in Main Relay, this DTC can be set. so, check it for open before going next procedure.(Refer to DTC relating to Main relay)

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure

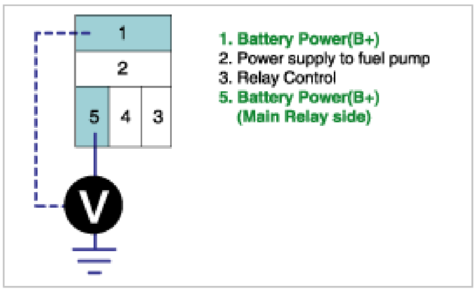
NO

▸ Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION

1. IG "OFF" & ENG "OFF"
2. Disconnect fuel pump relay.
3. IG "ON" & ENG "OFF"
4. Measure voltage between harness terminal 1(5) of chassis ground.

Specification : B+



5. Is the measured voltage within specification ?

YES

▸ Go to "Control Circuit Inspection" procedure.

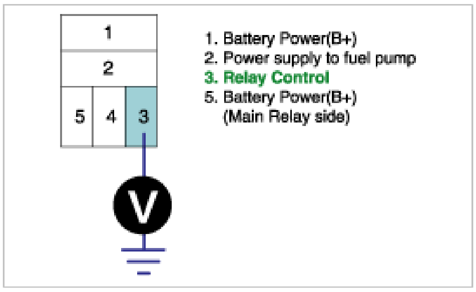
NO

▸ Check "Fuse" between fuel pump relay and main relay is not installed or blown off
▸ Check "Fuse" between fuel pump relay and battery is not installed or blown off
▸ Especially, if battery voltage at terminal 5 is not detected, replace the Main Relay.
▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. IG "OFF"
2. Disconnect fuel pump relay.
3. IG "ON" & ENG "OFF"
4. Measure voltage between harness terminal 5 and chassis ground.

Specification : Approx. 2.5V



5. Is the measured voltage within specification ?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair or repalce as necessary and then, go to "Verification of Vehicle Repair" procedure.

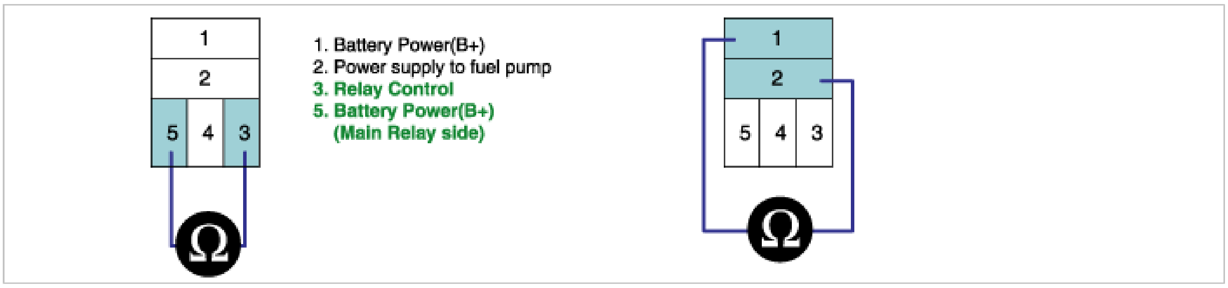
COMPONENT INSPECTION

1. Check fuel pump relay
   (1) IG "OFF"
   (2) Disconnect Fuel Pump Relay
   (3) Measure resistance between terminal 1 and 2 of Fuel Pump Relay

(4) Measure resistance between terminal 3 and 5 of Fuel Pump Relay

Specification :

Terminal	continuity
1~2	NO
3~5	YES (Approx. 70Ω ~ 120Ω)



(5) Is the measured resistance within specification ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Substitute with a known - good Fuel Pump Relay and check for proper operation.If the problem is corrected, replace Fuel Pump Relay and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

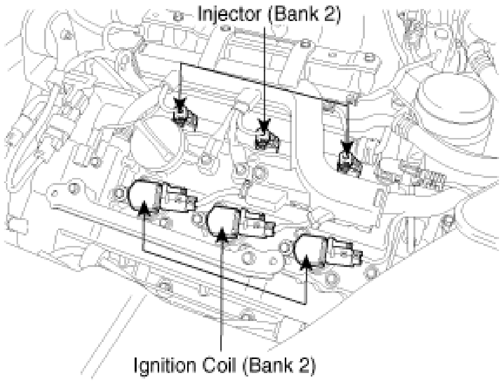
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0261

COMPONENT LOCATION



GENERAL DESCRIPTION

Electronically controlled fuel injector is a solenoid valve which supplies exactly calculated amount of fuel to engine for optimum conbustion under various engine load and speed. To meat air-fuel ratio required in system, PCM regulates fuel injection quantity as controlling injector solenoid operating duration referring air flow to cylinders and output signals from HO2S. For this precise control, quick response of solenoid is required and for perfect combustion, injection characteristic is important.

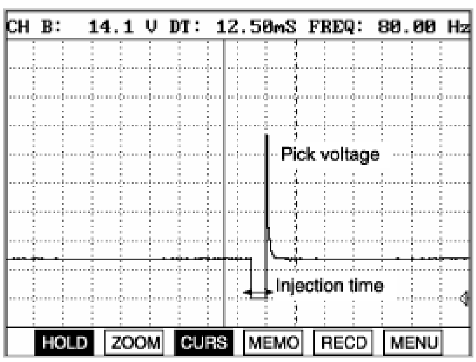
DTC DESCRIPTION

Checking output signals from injectors every 10 sec. under detecting condition, if an output signal is low for more than 5 sec., PCM sets P0261. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal Low	• Poor connection • Open or short to ground in power harness • Open or short to ground in control harness • Injector • PCM
Enable condition	• Engine running state • 11V ≤ Battery voltage ≤ 16V • Above conditions are met > 0.5sec.	
threshold value	• Open or short to ground	
diagnosis time	• Continuous (More than 2 sec.failure for every 4 sec.test)	
MIL ON condition	• 2 driving cycles	

SIGNAL WAVEFROM AND DATA



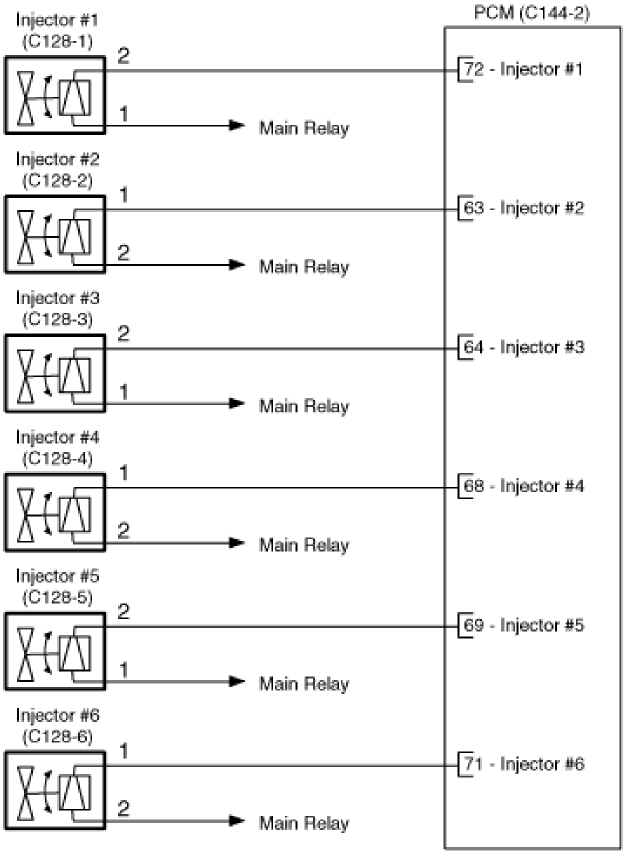
When the PCM energizes the injector by grounding control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the PCM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should be peak at a moment.

SPECIFICATION

Item	Coil resistance(Ω)
Injector	11.4 ~ 12.6Ω (at 20°C/ 68°F)

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Injector #1

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (72)	Injector #1 control

Injector #2

Terminal	Connected to	Funtion
1	PCM C144-2 (63)	Injector #2 control
2	Main Relay	Battery Voltage (B+)

Injector #3

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (64)	Injector #3 control

Injector #4

Terminal	Connected to	Funtion
1	PCM C144-2 (68)	Injector #4 control
2	Main Relay	Battery Voltage (B+)

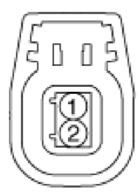
Injector #5

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (69)	Injector #5 control

Injector #6

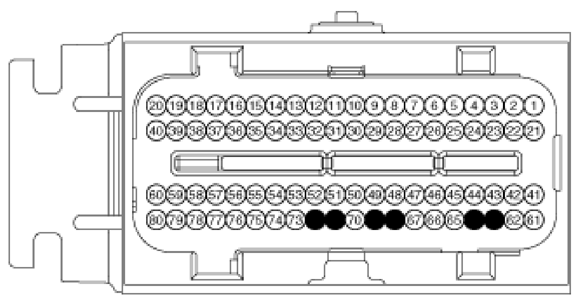
Terminal	Connected to	Funtion
1	PCM C144-2 (71)	Injector #6 control
2	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTORS]



C128-1,2,3,4,5,6

Injector #1,2,3,4,5,6

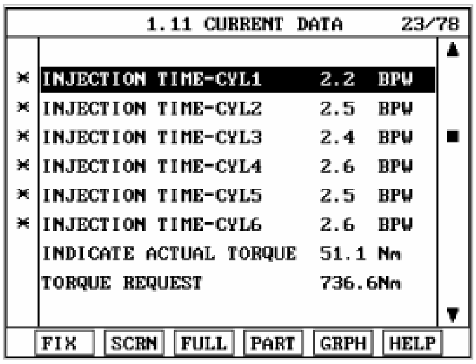


C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "fuel injection time" item on the service data.



4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

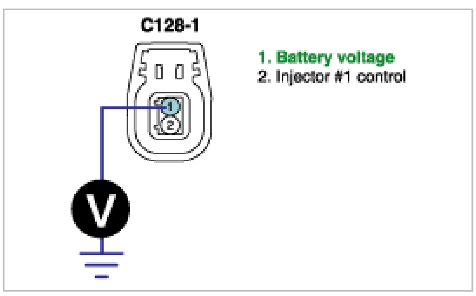
NO

▸ Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION

1. IG "ON" and disconnect injector connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of injector harness connector and chassis ground.

Specification : B+



4. Is the measured voltage within specification?

YES

▸ Go to "Control Circuit Inspection" procedure.

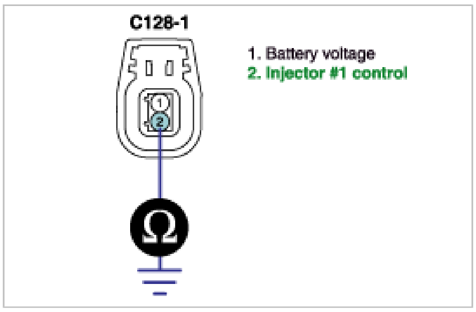
NO

▸ Check open or connection of the fuse connected to injector power supply.
▸ Repair open or short to ground in harness, and go to "Verification of Vehicle Repair' procedure.

CONTROL CIRCUIT INSPECTION

1. Check short to ground in harness
   (1) IG "OFF" and disconnect injector connector and PCM connector.
   (2) Measure resistance between terminal 2 of injector harness connector and chassis ground.

Specification : Infinite



(3) Is the measured resistance within specification?

YES

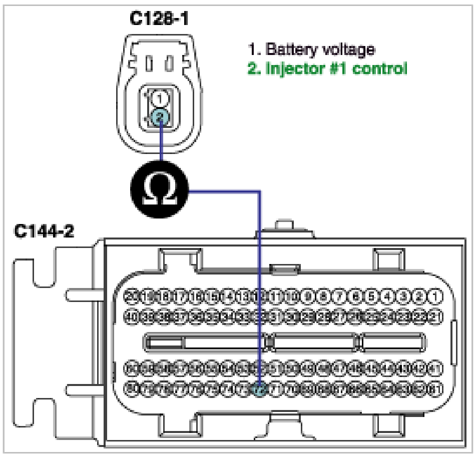
▸ Go to "Check open in harness" as follows.

NO

▸ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness
   (1) IG "OFF" and disconnect injector connector and PCM connector.
   (2) Measure resistance between terminal 2 of injector harness connector and 72 of PCM harness connector.

Specification : Below 1Ω



(3) Is the measured resistance within specification?

YES

▸ Go to "Component Inspection" procedure.

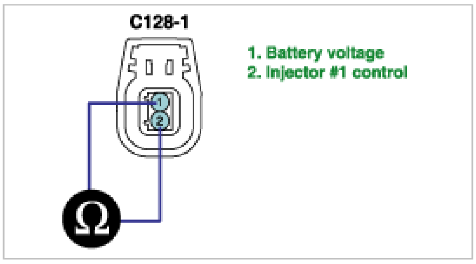
NO

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check injector
   (1) IG "OFF" and disconnect injector connector.
   (2) Measure resistance between terminals 1 and 2 of injector connector.(Component side)
   Specification :

Item	Coil resistance(Ω)
Injector	11.4 ~ 12.6Ω (at 20°C/ 68°F)



(3) Is the measured resistance within specification?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good injector and check for proper operation. If the problem is corrected, replace injector and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

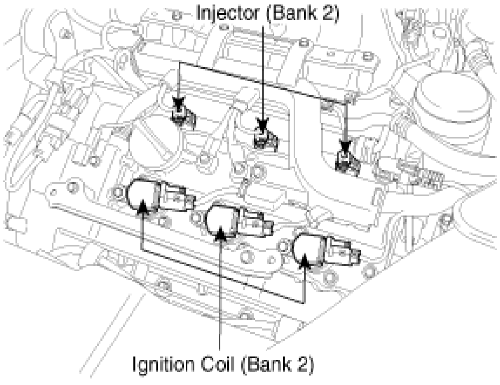
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0262

COMPONENT LOCATION



GENERAL DESCRIPTION

Electronically controlled fuel injector is a solenoid valve which supplies exactly calculated amount of fuel to engine for optimum conbustion under various engine load and speed. To meat air-fuel ratio required in system, PCM regulates fuel injection quantity as controlling injector solenoid operating duration referring air flow to cylinders and output signals from HO2S. For this precise control, quick response of solenoid is required and for perfect combustion, injection characteristic is important.

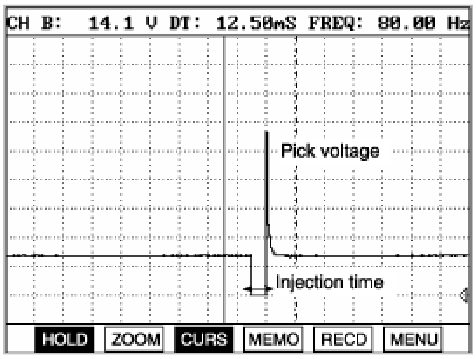
DTC DESCRIPTION

Checking output signals from injectors every 10 sec. under detecting condition, if an output signal is high for more than 5 sec., PCM sets P0262. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal High	• Poor connection • Short to battery in harness • Injector • PCM
Enable condition	• Engine running state • 11V ≤ Battery voltage ≤ 16V • Above conditions are met >0.5sec.	
threshold value	• Short to battery	
diagnosis time	• Continuous (More than 2 sec.failure for every 4 sec.test)	
MIL ON condition	• 2 driving cycles	

SIGNAL WAVEFROM AND DATA



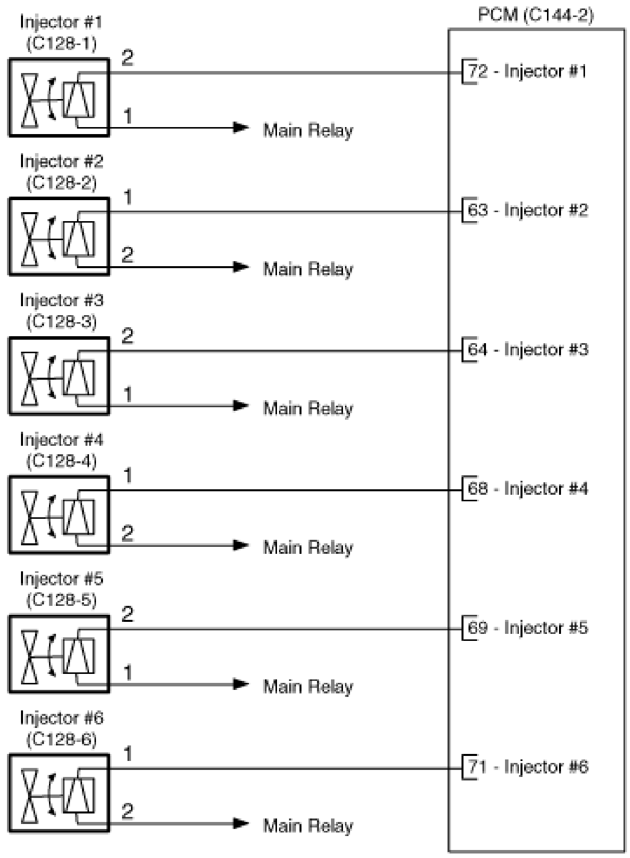
When the PCM energizes the injector by grounding control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the PCM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should be peak at a moment.

SPECIFICATION

Item	Coil resistance(Ω)
Injector	11.4 ~ 12.6Ω (at 20°C/ 68°F)

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Injector #1

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (72)	Injector #1 control

Injector #2

Terminal	Connected to	Funtion
1	PCM C144-2 (63)	Injector #2 control
2	Main Relay	Battery Voltage (B+)

Injector #3

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (64)	Injector #3 control

Injector #4

Terminal	Connected to	Funtion
1	PCM C144-2 (68)	Injector #4 control
2	Main Relay	Battery Voltage (B+)

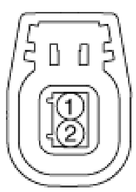
Injector #5

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (69)	Injector #5 control

Injector #6

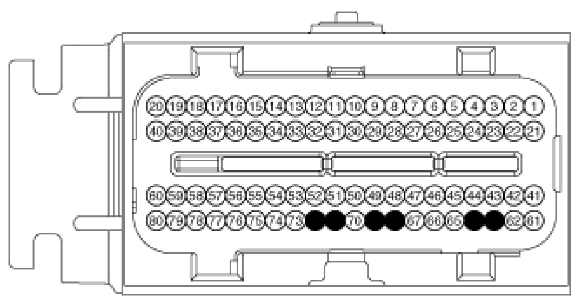
Terminal	Connected to	Funtion
1	PCM C144-2 (71)	Injector #6 control
2	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTORS]



C128-1,2,3,4,5,6

Injector #1,2,3,4,5,6

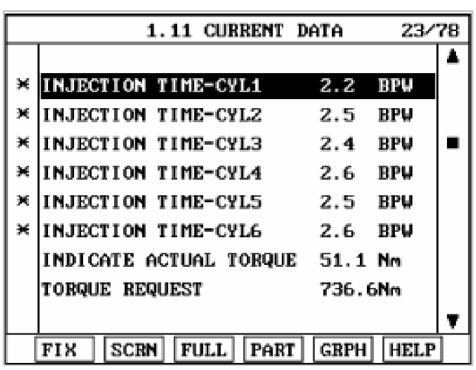


C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "fuel injection time" item on the service data.



4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

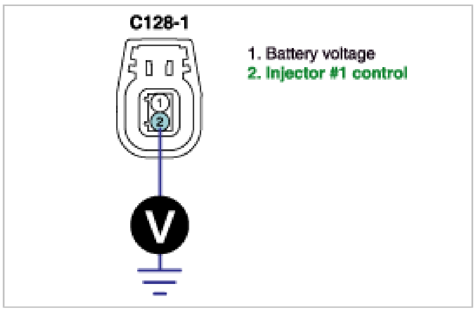
NO

▸ Go to "Control Circuit Inspection" procedure.

CONTROL CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF" and disconnect injector connector.
   (2) IG "ON" and ENG "OFF"
   (3) Measure voltage between terminal 2 of injector harness connector and chassis ground.

Specification : Approx. 0V



   (4) Is the measured voltage within specification?

YES

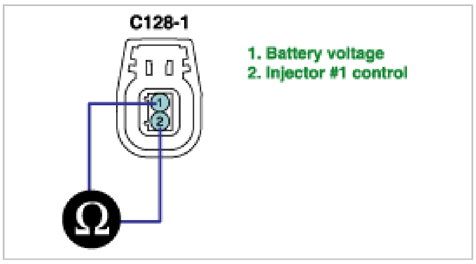
▸ Go to "Component Inspection" procedure.

NO

▸ Go to "Check short to battery in harness" as follows.

2. Check short to battery in harness
   (1) IG "OFF" and disconnect injector connector and PCM connector.
   (2) Measure resistance between terminals 1 and 2 of injector harness connector.

Specification : Below 1Ω



   (3) Is the measured resistance within specification?

YES

▸ Go to "Component Inspection" procedure.

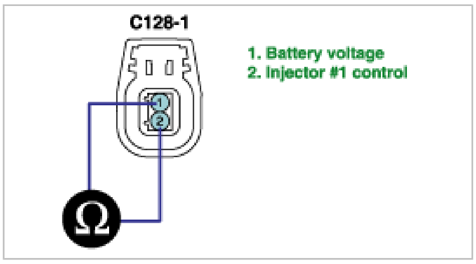
NO

▸ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check injector
   (1) IG "OFF" and disconnect injector connector.
   (2) Measure resistance between terminals 1 and 2 of injector connector.(Component side)
   Specification :

Item	Coil resistance(Ω)
Injector	11.4 ~ 12.6Ω (at 20°C/ 68°F)



   (3) Is the measured resistance within specification?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good injector and check for proper operation. If the problem is corrected, replace injector and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

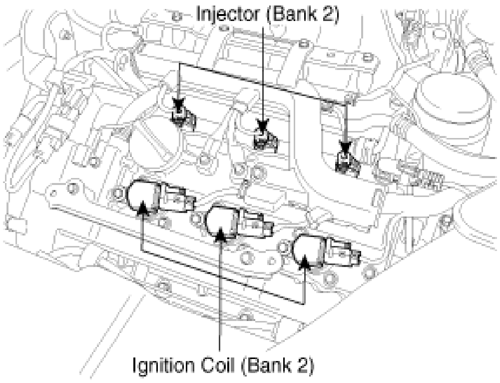
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0264

COMPONENT LOCATION



GENERAL DESCRIPTION

Electronically controlled fuel injector is a solenoid valve which supplies exactly calculated amount of fuel to engine for optimum conbustion under various engine load and speed. To meat air-fuel ratio required in system, PCM regulates fuel injection quantity as controlling injector solenoid operating duration referring air flow to cylinders and output signals from HO2S. For this precise control, quick response of solenoid is required and for perfect combustion, injection characteristic is important.

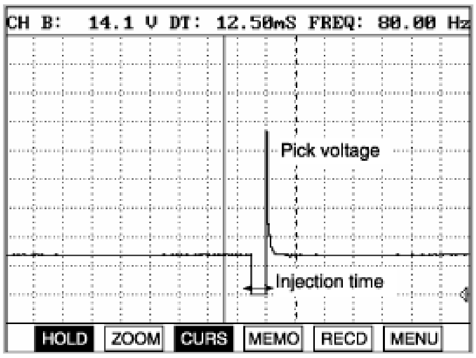
DTC DESCRIPTION

Checking output signals from injectors every 10 sec. under detecting condition, if an output signal is low for more than 5 sec., PCM sets P0264. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal Low	• Poor connection • Open or short to ground in power harness • Open or short to ground in control harness • Injector • PCM
Enable condition	• Engine running state • 11V ≤ Battery voltage ≤ 16V • Above conditions are met >0.5sec.	
threshold value	• Open or short to ground	
diagnosis time	• Continuous (More than 2 sec.failure for every 4 sec.test)	
MIL ON condition	• 2 driving cycles	

SIGNAL WAVEFROM AND DATA



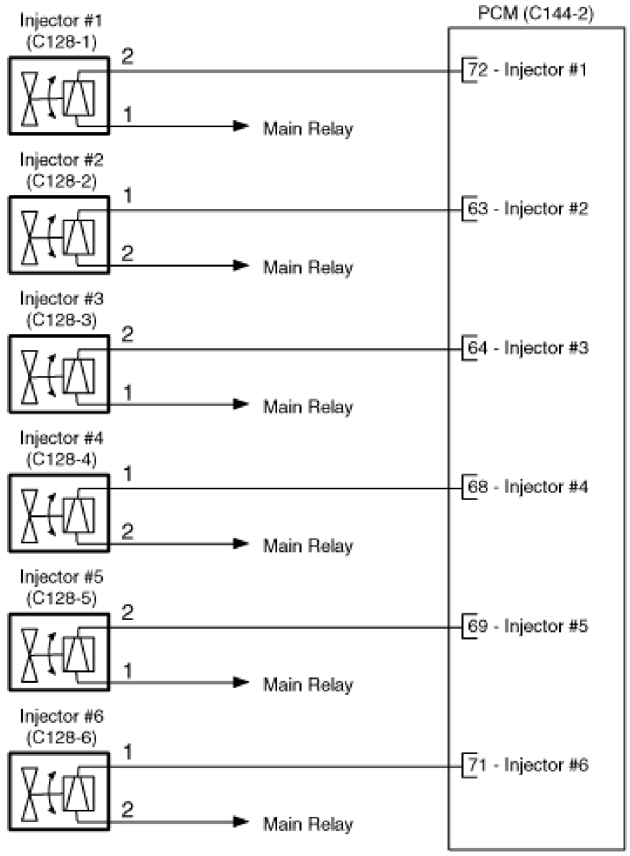
When the PCM energizes the injector by grounding control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the PCM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should be peak at a moment.

SPECIFICATION

Item	Coil resistance(Ω)
Injector	11.4 ~ 12.6Ω (at 20°C/ 68°F)

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Injector #1

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (72)	Injector #1 control

Injector #2

Terminal	Connected to	Funtion
1	PCM C144-2 (63)	Injector #2 control
2	Main Relay	Battery Voltage (B+)

Injector #3

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (64)	Injector #3 control

Injector #4

Terminal	Connected to	Funtion
1	PCM C144-2 (68)	Injector #4 control
2	Main Relay	Battery Voltage (B+)

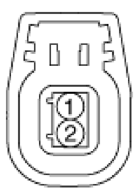
Injector #5

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (69)	Injector #5 control

Injector #6

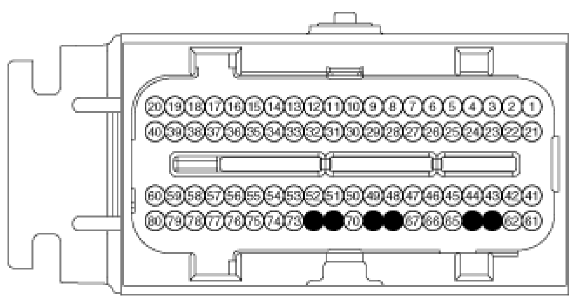
Terminal	Connected to	Funtion
1	PCM C144-2 (71)	Injector #6 control
2	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTORS]



C128-1,2,3,4,5,6

Injector #1,2,3,4,5,6

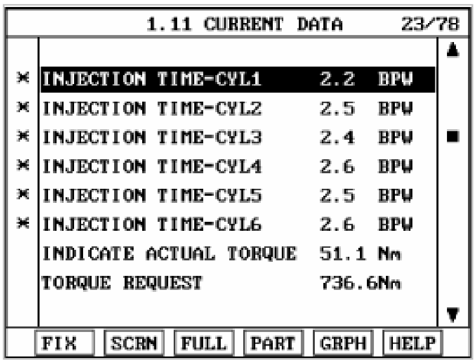


C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "fuel injection time" item on the service data.



4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

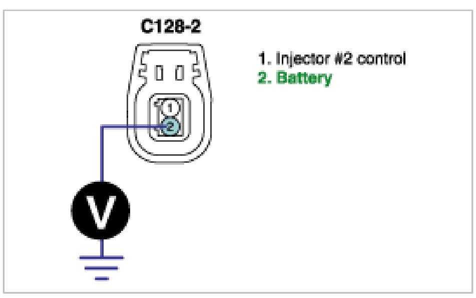
NO

▸ Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION

1. IG "ON" and disconnect injector connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 2 of injector harness connector and chassis ground.

Specification : B+



4. Is the measured voltage within specification?

YES

▸ Go to "Control Circuit Inspection" procedure.

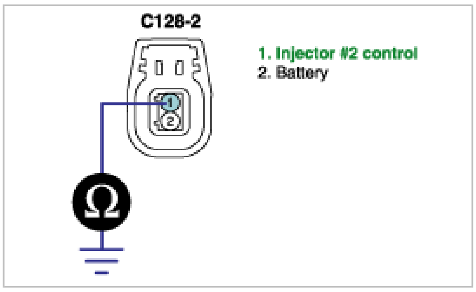
NO

▸ Check open or connection of the fuse connected to injector power supply.
▸ Repair open or short to ground in harness, and go to "Verification of Vehicle Repair' procedure.

CONTROL CIRCUIT INSPECTION

1. Check short to ground in harness
   (1) IG "OFF" and disconnect injector connector and PCM connector.
   (2) Measure resistance between terminal 1 of injector harness connector and chassis ground.

Specification : Infinite



(3) Is the measured resistance within specification?

YES

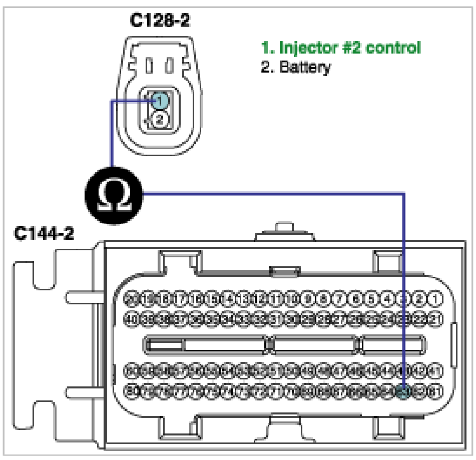
▸ Go to "Check open in harness" as follows.

NO

▸ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness
   (1) IG "OFF" and disconnect injector connector and PCM connector.
   (2) Measure resistance between terminal 1 of injector harness connector and 63 of PCM harness connector.

Specification : Below 1Ω



(3) Is the measured resistance within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

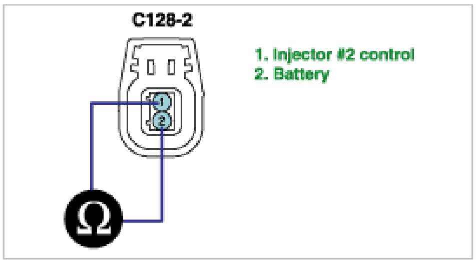
▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check injector
   (1) IG "OFF" and disconnect injector connector.
   (2) Measure resistance between terminals 1 and 2 of injector connector.(Component side)

Specification :

Item	Coil resistance(Ω)
Injector	11.4 ~ 12.6Ω (at 20°C/ 68°F)



(3) Is the measured resistance within specification?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good injector and check for proper operation. If the problem is corrected, replace injector and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

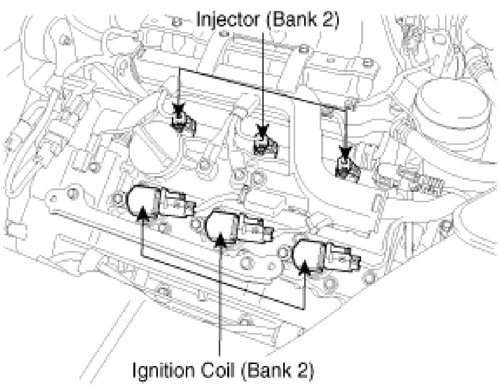
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0265

COMPONENT LOCATION



GENERAL DESCRIPTION

Electronically controlled fuel injector is a solenoid valve which supplies exactly calculated amount of fuel to engine for optimum conbustion under various engine load and speed. To meat air-fuel ratio required in system, PCM regulates fuel injection quantity as controlling injector solenoid operating duration referring air flow to cylinders and output signals from HO2S. For this precise control, quick response of solenoid is required and for perfect combustion, injection characteristic is important.

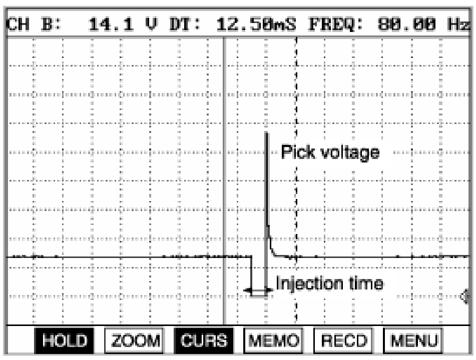
DTC DESCRIPTION

Checking output signals from injectors every 10 sec. under detecting condition, if an output signal is high for more than 5 sec., PCM sets P0265. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal High	• Poor connection • Short to battery in harness • Injector • PCM
Enable condition	• Engine running state • 11V ≤ Battery voltage ≤ 16V • Above conditions are met >0.5sec.	
threshold value	• Short to battery	
diagnosis time	• Continuous (More than 2 sec.failure for every 4 sec.test)	
MIL ON condition	• 2 driving cycles	

SIGNAL WAVEFROM AND DATA



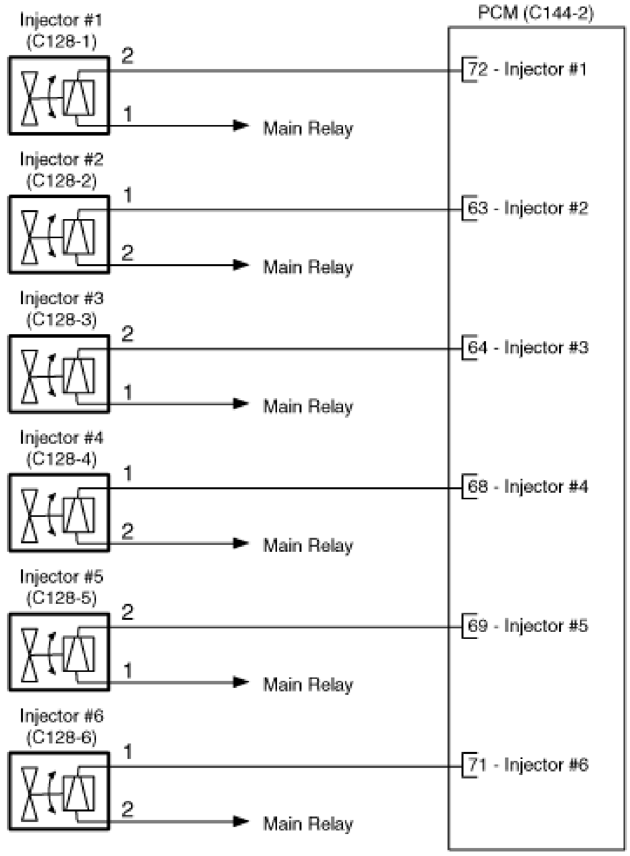
When the PCM energizes the injector by grounding control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the PCM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should be peak at a moment.

SPECIFICATION

Item	Coil resistance(Ω)
Injector	11.4 ~ 12.6Ω (at 20°C/ 68°F)

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Injector #1

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (72)	Injector #1 control

Injector #2

Terminal	Connected to	Funtion
1	PCM C144-2 (63)	Injector #2 control
2	Main Relay	Battery Voltage (B+)

Injector #3

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (64)	Injector #3 control

Injector #4

Terminal	Connected to	Funtion
1	PCM C144-2 (68)	Injector #4 control
2	Main Relay	Battery Voltage (B+)

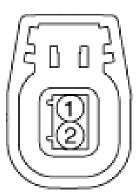
Injector #5

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (69)	Injector #5 control

Injector #6

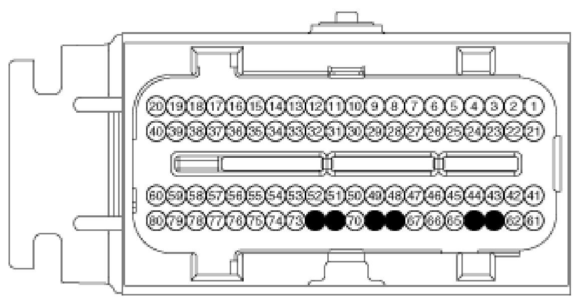
Terminal	Connected to	Funtion
1	PCM C144-2 (71)	Injector #6 control
2	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTORS]



C128-1,2,3,4,5,6

Injector #1,2,3,4,5,6

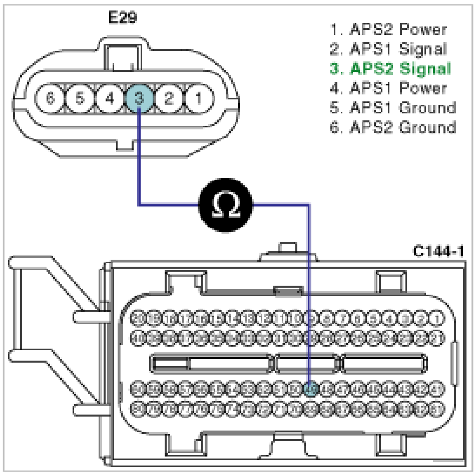


C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "fuel injection time" item on the service data.



4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Control Circuit Inspection" procedure.

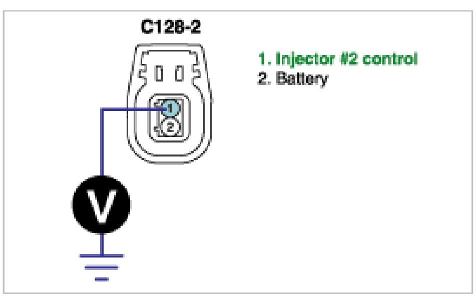
CONTROL CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF" and disconnect injector connector.

   (2) IG "ON" and ENG "OFF"

   (3) Measure voltage between terminal 1 of injector harness connector and chassis ground.

   Specification : Approx. 0V



   (4) Is the measured voltage within specification?

   YES

   ▸ Go to "Component Inspection" procedure.

   NO

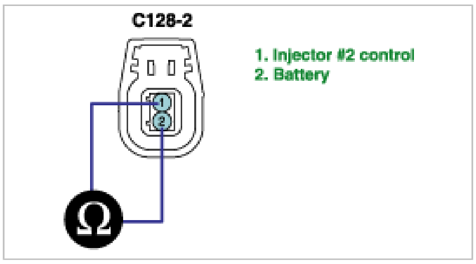
   ▸ Go to "Check short to battery in harness" as follows.

2. Check short to battery in harness

(1) IG "OFF" and disconnect injector connector and PCM connector.

(2) Measure resistance between terminals 1 and 2 of injector harness connector.

Specification : Below 1Ω



(3) Is the measured resistance within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

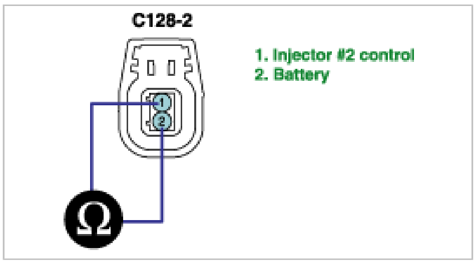
1. Check injector

(1) IG "OFF" and disconnect injector connector.

(2) Measure resistance between terminals 1 and 2 of injector connector.(Component side)

Specification :

Item	Coil resistance(Ω)
Injector	11.4 ~ 12.6Ω (at 20°C/ 68°F)



(3) Is the measured resistance within specification?

YES

▶ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known - good injector and check for proper operation. If the problem is corrected, replace injector and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

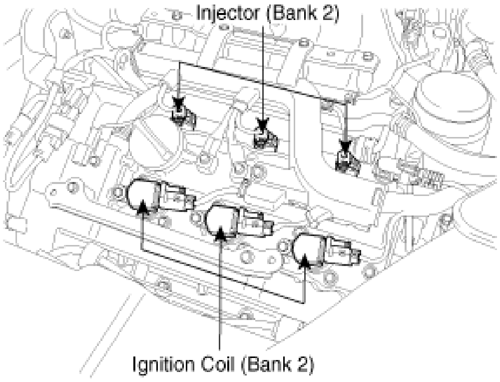
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0267

COMPONENT LOCATION



GENERAL DESCRIPTION

Electronically controlled fuel injector is a solenoid valve which supplies exactly calculated amount of fuel to engine for optimum conbustion under various engine load and speed. To meat air-fuel ratio required in system, PCM regulates fuel injection quantity as controlling injector solenoid operating duration referring air flow to cylinders and output signals from HO2S. For this precise control, quick response of solenoid is required and for perfect combustion, injection characteristic is important.

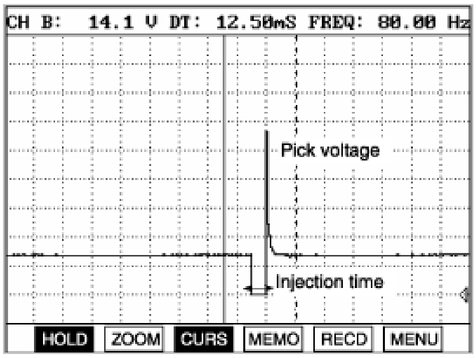
DTC DESCRIPTION

Checking output signals from injectors every 10 sec. under detecting condition, if an output signal is low for more than 5 sec., PCM sets P0267. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal Low	• Poor connection • Open or short to ground in power harness • Open or short to ground in control harness • Injector • PCM
Enable condition	• Engine running state • 11V ≤ Battery voltage ≤ 16V • Above conditions are met > 0.5sec.	
threshold value	• Open or short to ground	
diagnosis time	• Continuous (More than 2 sec.failure for every 4 sec.test)	
MIL ON condition	• 2 driving cycles	

SIGNAL WAVEFROM AND DATA



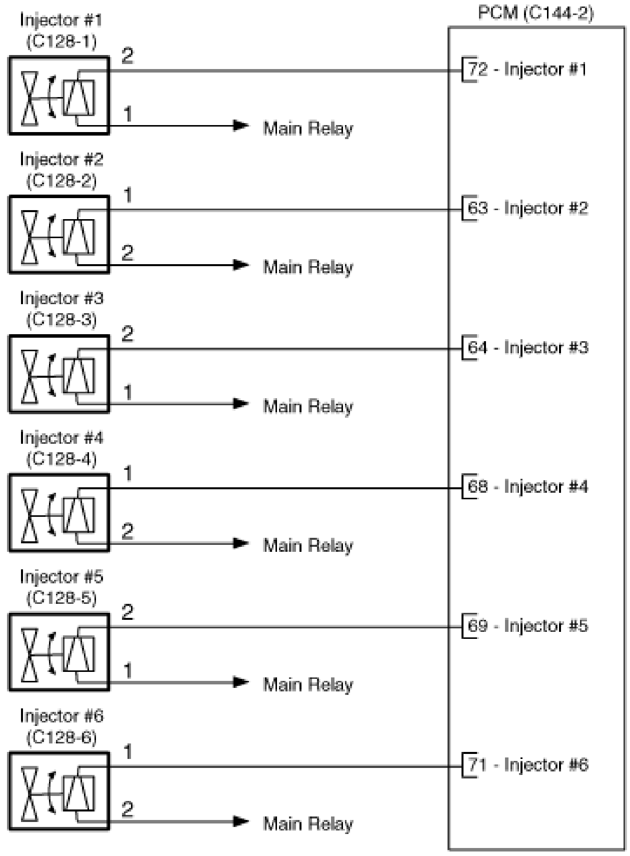
When the PCM energizes the injector by grounding control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the PCM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should be peak at a moment.

SPECIFICATION

Item	Coil resistance(Ω)
Injector	11.4 ~ 12.6Ω (at 20°C/ 68°F)

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Injector #1

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (72)	Injector #1 control

Injector #2

Terminal	Connected to	Funtion
1	PCM C144-2 (63)	Injector #2 control
2	Main Relay	Battery Voltage (B+)

Injector #3

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (64)	Injector #3 control

Injector #4

Terminal	Connected to	Funtion
1	PCM C144-2 (68)	Injector #4 control
2	Main Relay	Battery Voltage (B+)

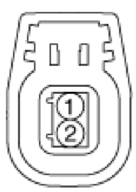
Injector #5

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (69)	Injector #5 control

Injector #6

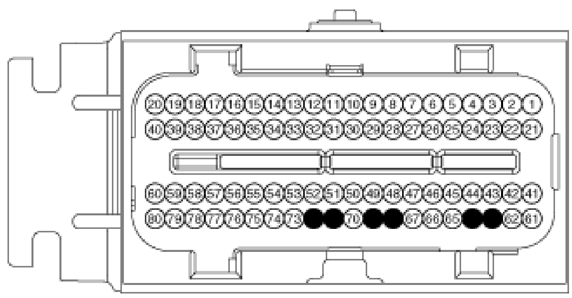
Terminal	Connected to	Funtion
1	PCM C144-2 (71)	Injector #6 control
2	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTORS]



C128-1,2,3,4,5,6

Injector #1,2,3,4,5,6

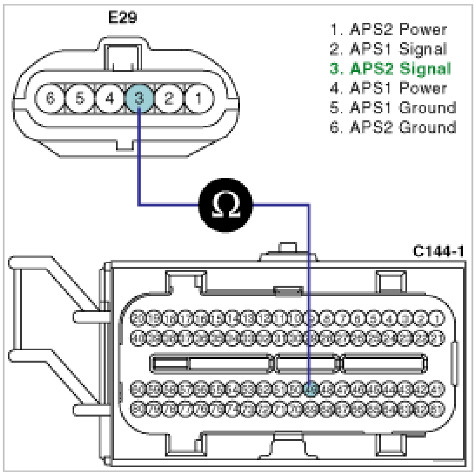


C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "fuel injection time" item on the service data.



4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

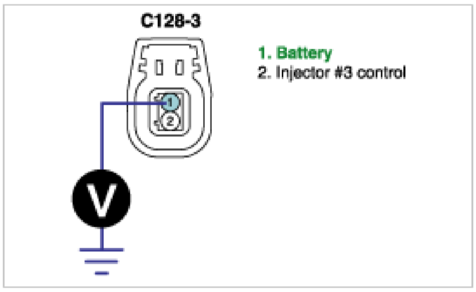
NO

▸ Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION

1. IG "ON" and disconnect injector connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of injector harness connector and chassis ground.

Specification : B+



4. Is the measured voltage within specification?

YES

▸ Go to "Control Circuit Inspection" procedure.

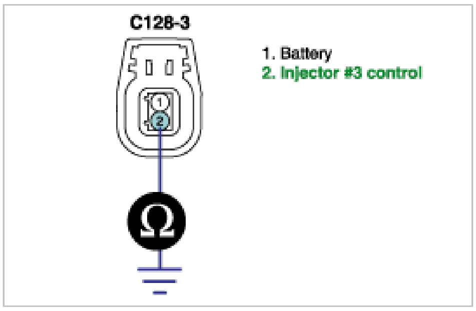
NO

▸ Check open or connection of the fuse connected to injector power supply.
▸ Repair open or short to ground in harness, and go to "Verification of Vehicle Repair' procedure.

CONTROL CIRCUIT INSPECTION

1. Check short to ground in harness
   (1) IG "OFF" and disconnect injector connector and PCM connector.
   (2) Measure resistance between terminal 2 of injector harness connector and chassis ground.

Specification : Infinite



   (3) Is the measured resistance within specification?

YES

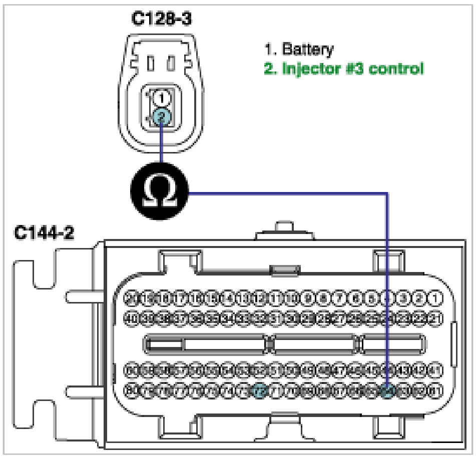
▸ Go to "Check open in harness" as follows.

NO

▸ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness
   (1) IG "OFF" and disconnect injector connector and PCM connector.
   (2) Measure resistance between terminal 2 of injector harness connector and 64 of PCM harness connector.

Specification : Below 1Ω



   (3) Is the measured resistance within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

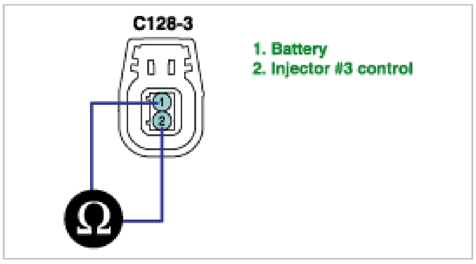
▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check injector
   (1) IG "OFF" and disconnect injector connector.
   (2) Measure resistance between terminals 1 and 2 of injector connector.(Component side)

Specification :

Item	Coil resistance(Ω)
Injector	11.4 ~ 12.6Ω (at 20°C/ 68°F)



(3) Is the measured resistance within specification?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good injector and check for proper operation. If the problem is corrected, replace injector and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

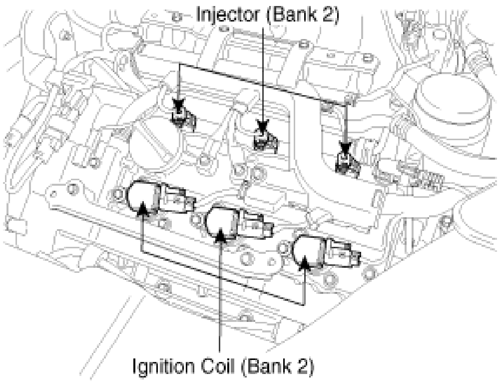
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0268

COMPONENT LOCATION



GENERAL DESCRIPTION

Electronically controlled fuel injector is a solenoid valve which supplies exactly calculated amount of fuel to engine for optimum conbustion under various engine load and speed. To meat air-fuel ratio required in system, PCM regulates fuel injection quantity as controlling injector solenoid operating duration referring air flow to cylinders and output signals from HO2S. For this precise control, quick response of solenoid is required and for perfect combustion, injection characteristic is important.

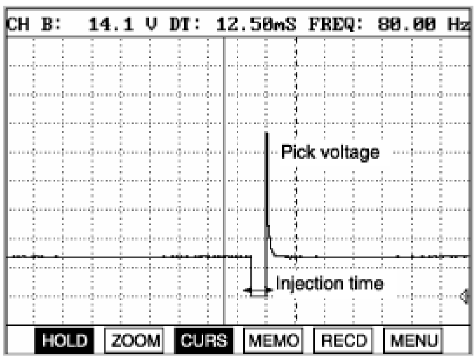
DTC DESCRIPTION

Checking output signals from injectors every 10 sec. under detecting condition, if an output signal is high for more than 5 sec., PCM sets P0268. Warning lamp turns on when the malfunction lasts till continuous 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal High	• Poor connection • Short to battery in harness • Injector • PCM
Enable condition	• Engine running state • 11V ≤ Battery voltage ≤ 16V • Above conditions are met >0.5sec.	
threshold value	• Short to battery	
diagnosis time	• Continuous (More than 2 sec.failure for every 4 sec.test)	
MIL ON condition	• 2 driving cycles	

SIGNAL WAVEFROM AND DATA



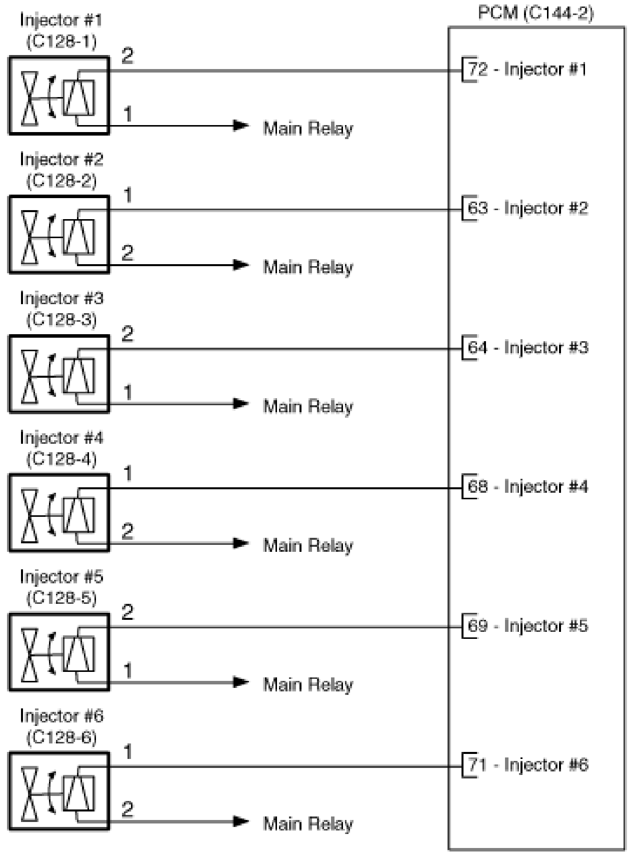
When the PCM energizes the injector by grounding control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the PCM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should be peak at a moment.

SPECIFICATION

Item	Coil resistance(Ω)
Injector	11.4 ~ 12.6Ω (at 20°C/ 68°F)

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Injector #1

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (72)	Injector #1 control

Injector #2

Terminal	Connected to	Funtion
1	PCM C144-2 (63)	Injector #2 control
2	Main Relay	Battery Voltage (B+)

Injector #3

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (64)	Injector #3 control

Injector #4

Terminal	Connected to	Funtion
1	PCM C144-2 (68)	Injector #4 control
2	Main Relay	Battery Voltage (B+)

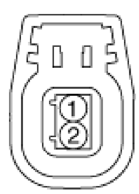
Injector #5

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (69)	Injector #5 control

Injector #6

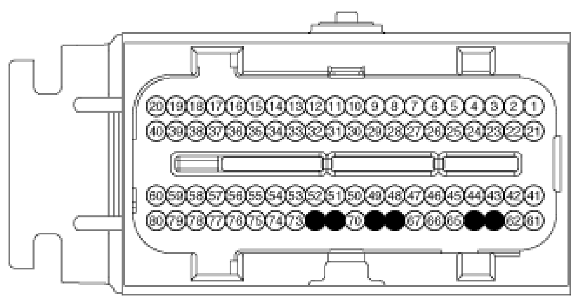
Terminal	Connected to	Funtion
1	PCM C144-2 (71)	Injector #6 control
2	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTORS]



C128-1,2,3,4,5,6

Injector #1,2,3,4,5,6

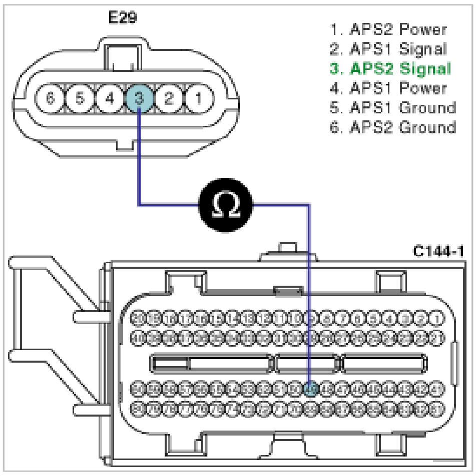


C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "fuel injection time" item on the service data.



4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

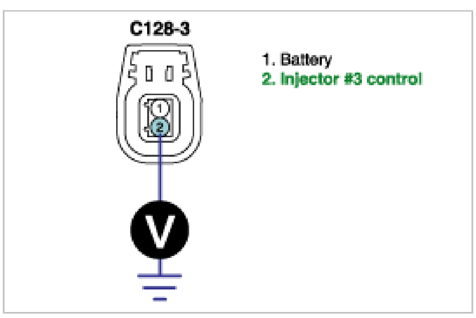
NO

▸ Go to "Control Circuit Inspection" procedure.

CONTROL CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF" and disconnect injector connector.
   (2) IG "ON" and ENG "OFF"
   (3) Measure voltage between terminal 2 of injector harness connector and chassis ground.

Specification : Approx. 0V



   (4) Is the measured voltage within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

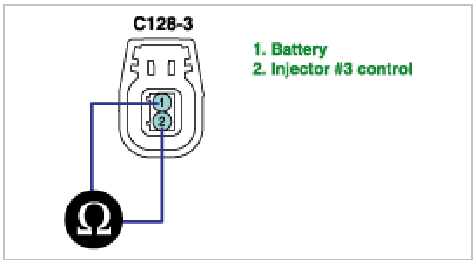
▸ Go to "Check short to battery in harness" as follows.

2. Check short to battery in harness

(1) IG "OFF" and disconnect injector connector and PCM connector.

(2) Measure resistance between terminals 1 and 2 of injector harness connector.

Specification : Below 1Ω



(3) Is the measured resistance within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

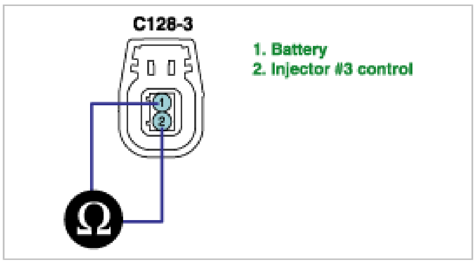
1. Check injector

(1) IG "OFF" and disconnect injector connector.

(2) Measure resistance between terminals 1 and 2 of injector connector.(Component side)

Specification :

Item	Coil resistance(Ω)
Injector	11.4 ~ 12.6Ω (at 20°C/ 68°F)



(3) Is the measured resistance within specification?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good injector and check for proper operation. If the problem is corrected, replace injector and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

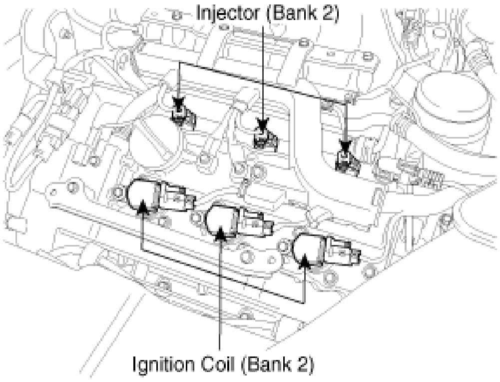
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0270

COMPONENT LOCATION



GENERAL DESCRIPTION

Electronically controlled fuel injector is a solenoid valve which supplies exactly calculated amount of fuel to engine for optimum conbustion under various engine load and speed. To meat air-fuel ratio required in system, PCM regulates fuel injection quantity as controlling injector solenoid operating duration referring air flow to cylinders and output signals from HO2S. For this precise control, quick response of solenoid is required and for perfect combustion, injection characteristic is important.

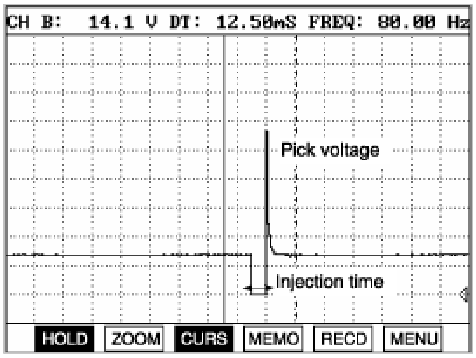
DTC DESCRIPTION

Checking output signals from injectors every 10 sec. under detecting condition, if an output signal is low for more than 5 sec., PCM sets P0270. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal Low	• Poor connection • Open or short to ground in power harness • Open or short to ground in control harness • Injector • PCM
Enable condition	• Engine running state • 11V ≤ Battery voltage ≤ 16V • Above conditions are met >0.5sec.	
threshold value	• Open or short to ground	
diagnosis time	• Continuous (More than 2 sec.failure for every 4 sec.test)	
MIL ON condition	• 2 driving cycles	

SIGNAL WAVEFROM AND DATA



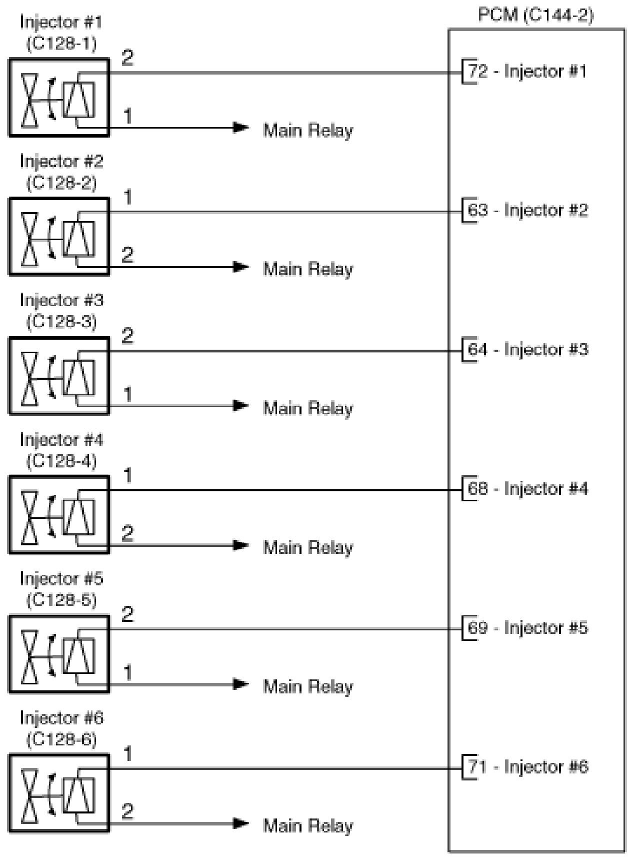
When the PCM energizes the injector by grounding control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the PCM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should be peak at a moment.

SPECIFICATION

Item	Coil resistance(Ω)
Injector	11.4 ~ 12.6Ω (at 20°C/ 68°F)

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Injector #1

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (72)	Injector #1 control

Injector #2

Terminal	Connected to	Funtion
1	PCM C144-2 (63)	Injector #2 control
2	Main Relay	Battery Voltage (B+)

Injector #3

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (64)	Injector #3 control

Injector #4

Terminal	Connected to	Funtion
1	PCM C144-2 (68)	Injector #4 control
2	Main Relay	Battery Voltage (B+)

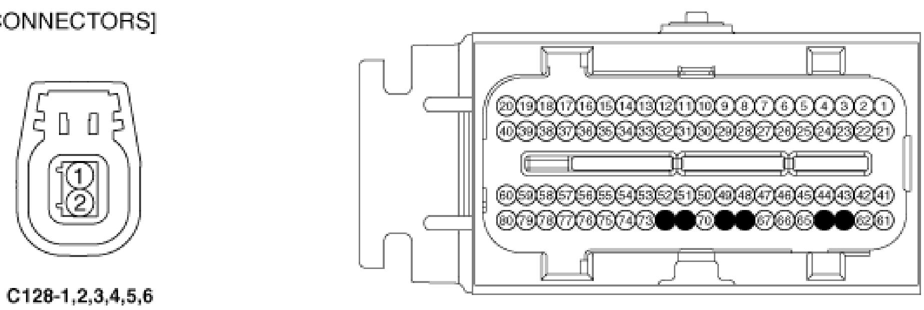
Injector #5

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (69)	Injector #5 control

Injector #6

Terminal	Connected to	Funtion
1	PCM C144-2 (71)	Injector #6 control
2	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTORS]



C128-1,2,3,4,5,6

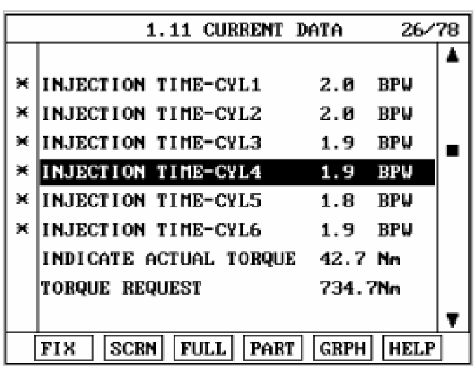
Injector #1,2,3,4,5,6

C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "fuel injection time" item on the service data.



4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

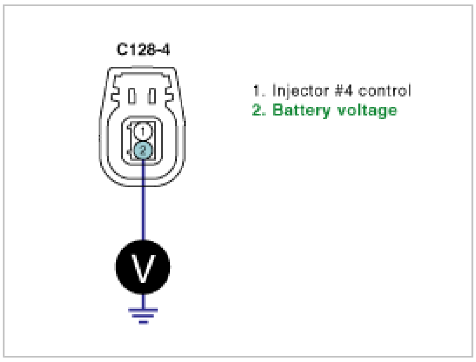
NO

▸ Go to "Terminaal and connector inspection" procedure.

POWER CIRCUIT INSPECTION

1. IG "ON" and disconnect injector connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 2 of injector harness connector and chassis ground.

Specification : B+



4. Is the measured voltage within specification?

YES

▸ Go to "Control Circuit Inspection" procedure.

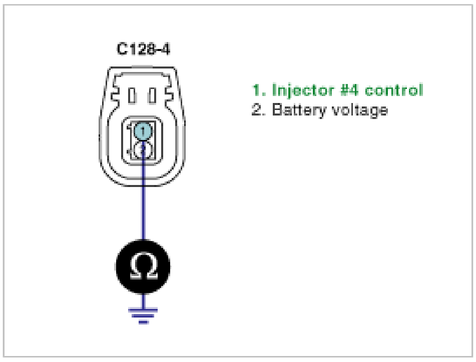
NO

▸ Check open or connection of the fuse connected to injector power supply.
▸ Repair open or short to ground in harness, and go to "Verification of Vehicle Repair' procedure.

CONTROL CIRCUIT INSPECTION

1. Check short to ground in harness
   (1) IG "OFF" and disconnect injector connector and PCM connector.
   (2) Measure resistance between terminal 1 of injector harness connector and chassis ground.

   Specification : Infinite



(3) Is the measured resistance within specification?

YES

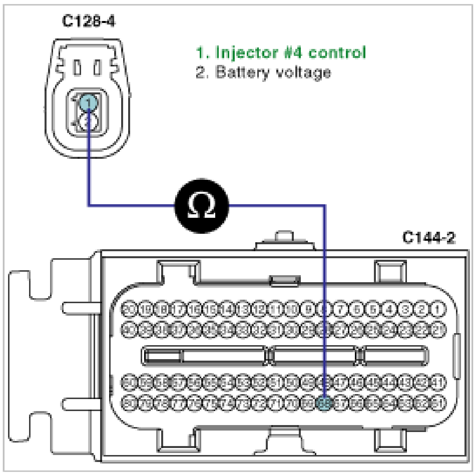
▸ Go to "Check open in harness" as follows.

NO

▸ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness
   (1) IG "OFF" and disconnect injector connector and PCM connector.
   (2) Measure resistance between terminal 1 of injector harness connector and 68 of PCM harness connector.

Specification : Below 1Ω



(3) Is the measured resistance within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

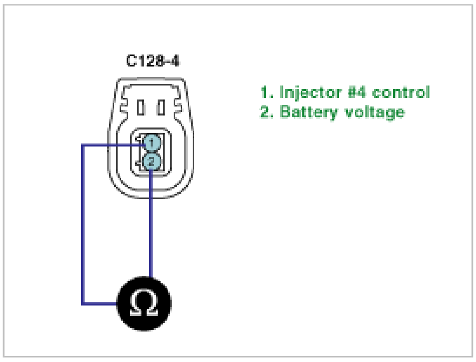
▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check injector
   (1) IG "OFF" and disconnect injector connector.
   (2) Measure resistance between terminals 1 and 2 of injector connector.(Component side)

Specification :

Item	Coil resistance(Ω)
Injector	11.4 ~ 12.6Ω (at 20°C/ 68°F)



(3) Is the measured resistance within specification?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good injector and check for proper operation. If the problem is corrected, replace injector and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

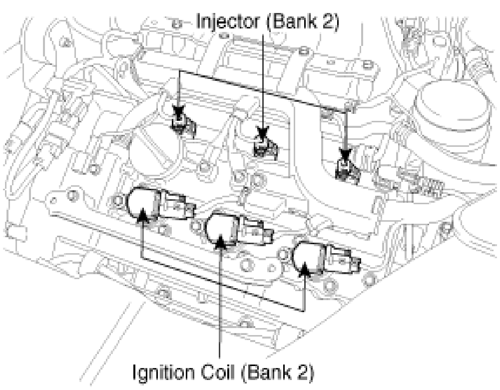
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0271

COMPONENT LOCATION



GENERAL DESCRIPTION

Electronically controlled fuel injector is a solenoid valve which supplies exactly calculated amount of fuel to engine for optimum conbustion under various engine load and speed. To meat air-fuel ratio required in system, PCM regulates fuel injection quantity

as controlling injector solenoid operating duration referring air flow to cylinders and output signals from HO2S. For this precise control, quick response of solenoid is required and for perfect combustion, injection characteristic is important.

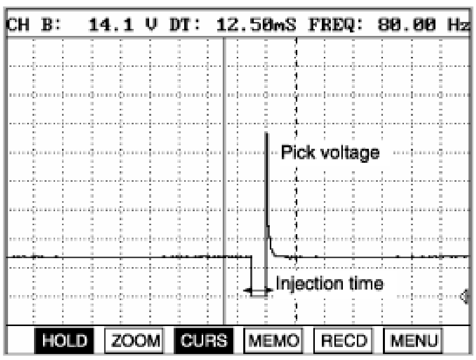
DTC DESCRIPTION

Checking output signals from injectors every 10 sec. under detecting condition, if an output signal is high for more than 5 sec., PCM sets P0271. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal High	• Poor connection • Short to battery in harness • Injector • PCM
Enable condition	• Engine running state • 11V ≤ Battery voltage ≤ 16V • Above conditions are met >0.5sec.	
Threshold value	• Short to battery	
Diagnosis time	• Continuous (More than 2 sec.failure for every 4 sec.test)	
MIL ON condition	• 2 driving cycles	

SIGNAL WAVEFROM AND DATA



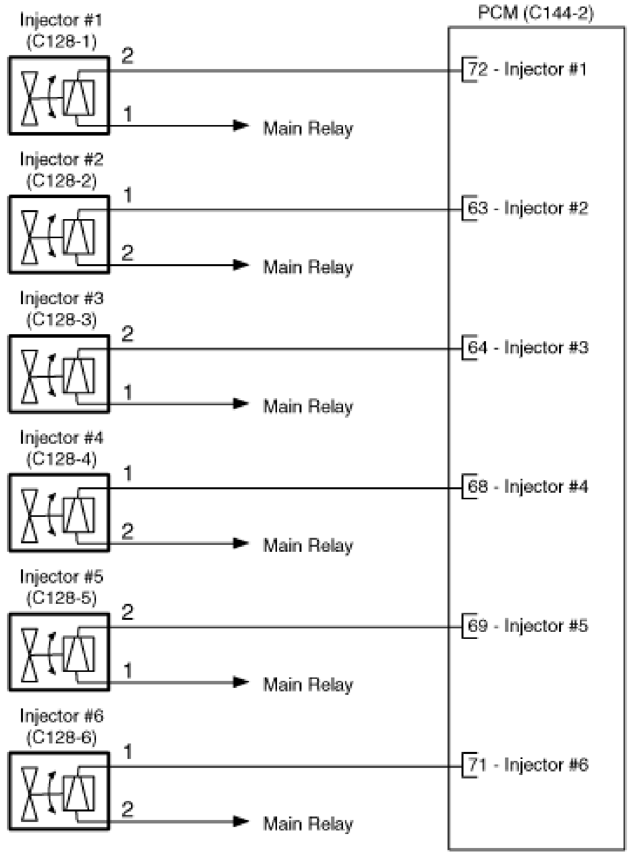
When the PCM energizes the injector by grounding control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the PCM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should be peak at a moment.

SPECIFICATION

Item	Coil resistance(Ω)
Injector	11.4 ~ 12.6Ω (at 20°C/ 68°F)

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Injector #1

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (72)	Injector #1 control

Injector #2

Terminal	Connected to	Funtion
1	PCM C144-2 (63)	Injector #2 control
2	Main Relay	Battery Voltage (B+)

Injector #3

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (64)	Injector #3 control

Injector #4

Terminal	Connected to	Funtion
1	PCM C144-2 (68)	Injector #4 control
2	Main Relay	Battery Voltage (B+)

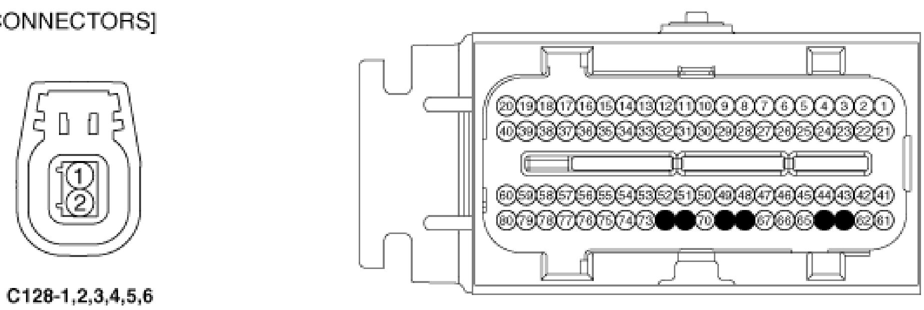
Injector #5

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (69)	Injector #5 control

Injector #6

Terminal	Connected to	Funtion
1	PCM C144-2 (71)	Injector #6 control
2	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTORS]



C128-1,2,3,4,5,6

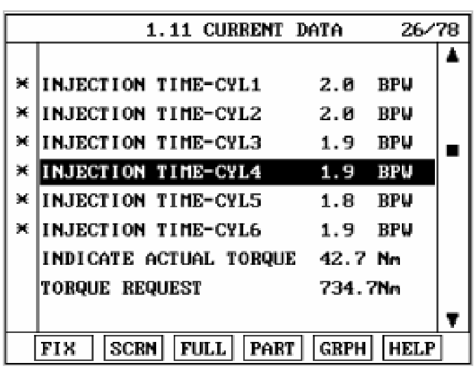
Injector #1,2,3,4,5,6

C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "fuel injection time" item on the service data.



4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

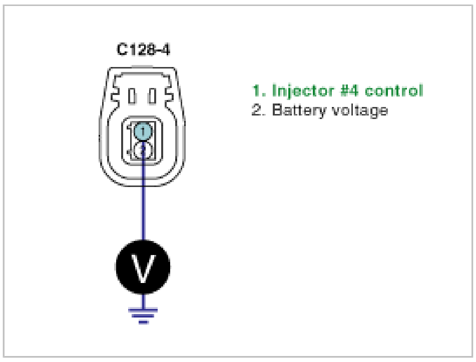
NO

▸ Go to "Control Circuit Inspection" procedure.

CONTROL CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF" and disconnect injector connector.
   (2) IG "ON" and ENG "OFF"
   (3) Measure voltage between terminal 1 of injector harness connector and chassis ground.

   Specification : Approx. 0V



   (4) Is the measured voltage within specification?

   YES

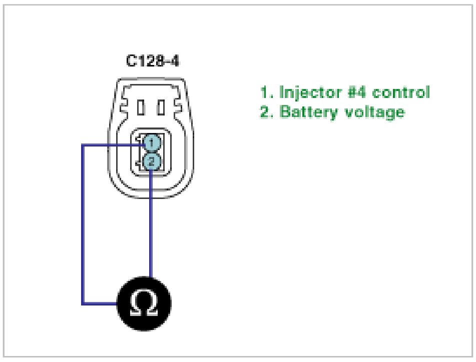
   ▸ Go to "Component Inspection" procedure.

   NO

   ▸ Go to "Check short to battery in harness" as follows.

2. Check short to battery in harness
   (1) IG "OFF" and disconnect injector connector and PCM connector.
   (2) Measure resistance between terminals 1 and 2 of injector harness connector.

   Specification : Below 1Ω



(3) Is the measured resistance within specification?

YES

▸ Go to "Component Inspection" procedure.

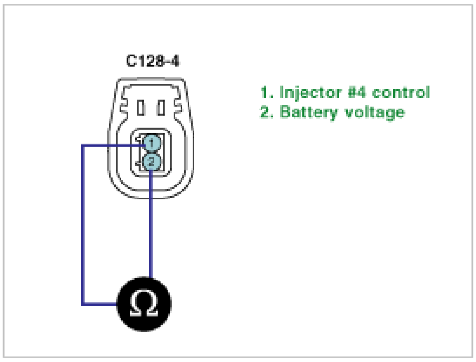
NO

▸ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check injector
   (1) IG "OFF" and disconnect injector connector.
   (2) Measure resistance between terminals 1 and 2 of injector connector.(Component side)
   Specification :

Item	Coil resistance(Ω)
Injector	11.4 ~ 12.6Ω (at 20°C/ 68°F)



(3) Is the measured resistance within specification?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good injector and check for proper operation. If the problem is corrected, replace injector and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "

5. Are any DTCs present ?

YES

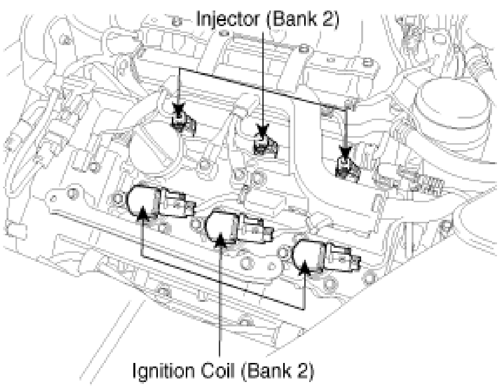
▸ Go to the applicable troubleshooooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0273

COMPONENT LOCATION



GENERAL DESCRIPTION

Electronically controlled fuel injector is a solenoid valve which supplies exactly calculated amount of fuel to engine for optimum conbustion under various engine load and speed. To meat air-fuel ratio required in system, PCM regulates fuel injection quantity as controlling injector solenoid operating duration referring air flow to cylinders and output signals from HO2S. For this precise control, quick response of solenoid is required and for perfect combustion, injection characteristic is important.

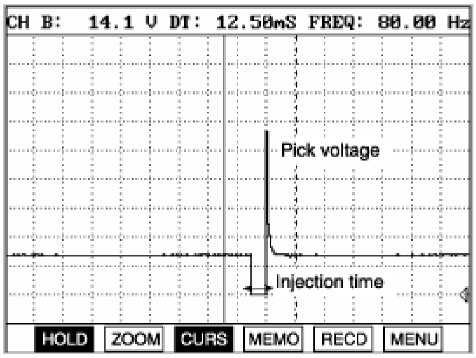
DTC DESCRIPTION

Checking output signals from injectors every 10 sec. under detecting condition, if an output signal is low for more than 5 sec., PCM sets P0273. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal Low	• Poor connection • Open or short to ground in power harness • Open or short to ground in control harness • Injector • PCM
Enable condition	• Engine running state • 11V ≤ Battery voltage ≤ 16V • Above conditions are met >0.5sec.	
Threshold value	• Open or short to ground	
Diagnosis time	• Continuous (More than 2 sec.failure for every 4 sec.test)	
MIL ON condition	• 2 driving cycles	

SIGNAL WAVEFROM AND DATA



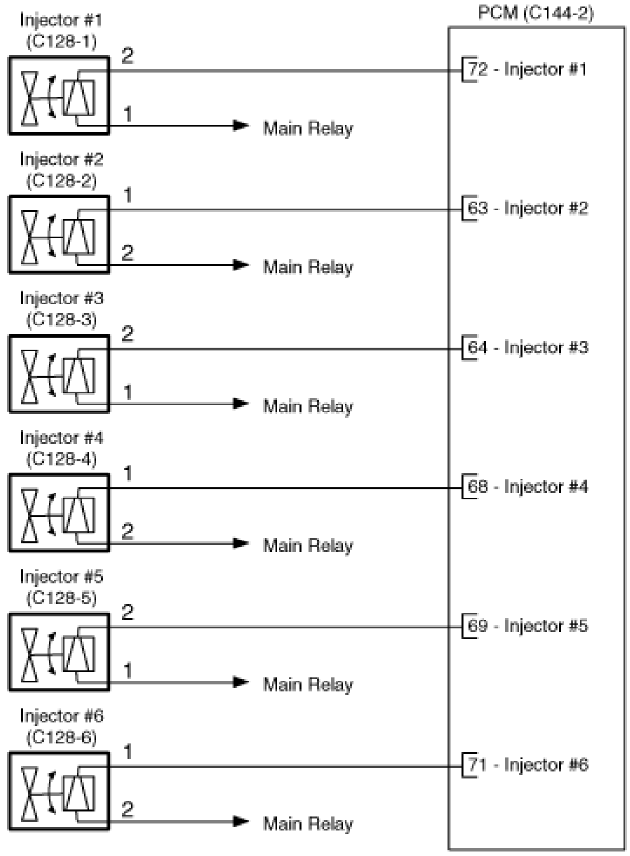
When the PCM energizes the injector by grounding control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the PCM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should be peak at a moment.

SPECIFICATION

Item	Coil resistance(Ω)
Injector	11.4 ~ 12.6Ω (at 20°C/ 68°F)

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Injector #1

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (72)	Injector #1 control

Injector #2

Terminal	Connected to	Funtion
1	PCM C144-2 (63)	Injector #2 control
2	Main Relay	Battery Voltage (B+)

Injector #3

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (64)	Injector #3 control

Injector #4

Terminal	Connected to	Funtion
1	PCM C144-2 (68)	Injector #4 control
2	Main Relay	Battery Voltage (B+)

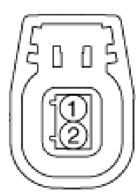
Injector #5

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (69)	Injector #5 control

Injector #6

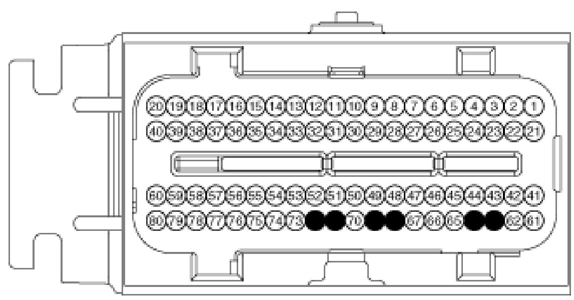
Terminal	Connected to	Funtion
1	PCM C144-2 (71)	Injector #6 control
2	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTORS]



C128-1,2,3,4,5,6

Injector #1,2,3,4,5,6

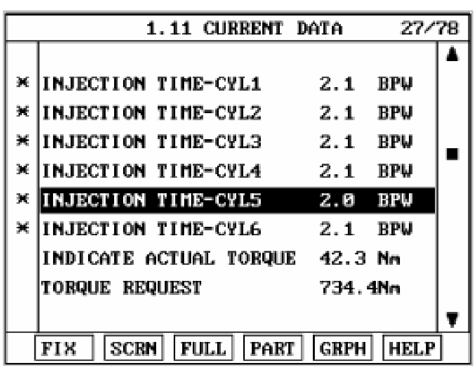


C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "fuel injection time" item on the service data.



4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

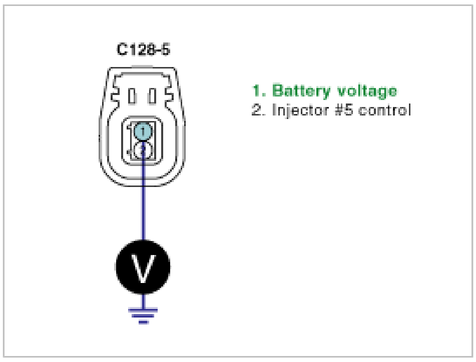
NO

▸ Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION

1. IG "ON" and disconnect injector connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of injector harness connector and chassis ground.

Specification : B+



4. Is the measured voltage within specification?

YES

▸ Go to "Control Circuit Inspection" procedure.

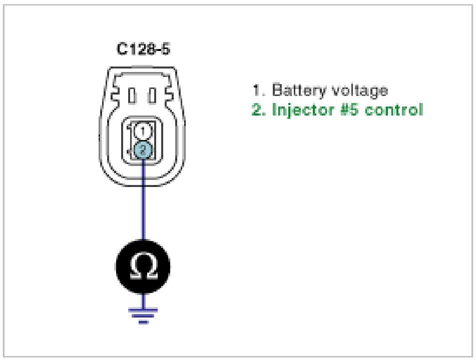
NO

▸ Check open or connection of the fuse connected to injector power supply.
▸ Repair open or short to ground in harness, and go to "Verification of Vehicle Repair' procedure.

CONTROL CIRCUIT INSPECTION

1. Check short to ground in harness
   (1) IG "OFF" and disconnect injector connector and PCM connector.
   (2) Measure resistance between terminal 2 of injector harness connector and chassis ground.

   Specification : Infinite



(3) Is the measured resistance within specification?

YES

▸ Go to "Check open in harness" as follows.

NO

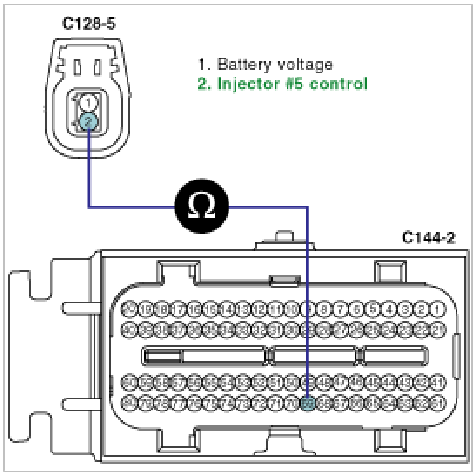
▸ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness

(1) IG "OFF" and disconnect injector connector and PCM connector.

(2) Measure resistance between terminal 2 of injector harness connector and 69 of PCM harness connector.

Specification : Below 1Ω



(3) Is the measured resistance within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

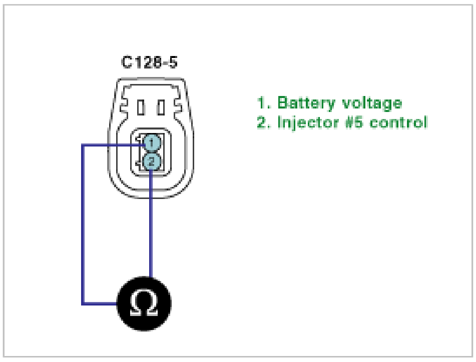
1. Check injector

(1) IG "OFF" and disconnect injector connector.

(2) Measure resistance between terminals 1 and 2 of injector connector.(Component side)

Specification :

Item	Coil resistance(Ω)
Injector	11.4 ~ 12.6Ω (at 20°C/ 68°F)



(3) Is the measured resistance within specification?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good injector and check for proper operation. If the problem is corrected, replace injector and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

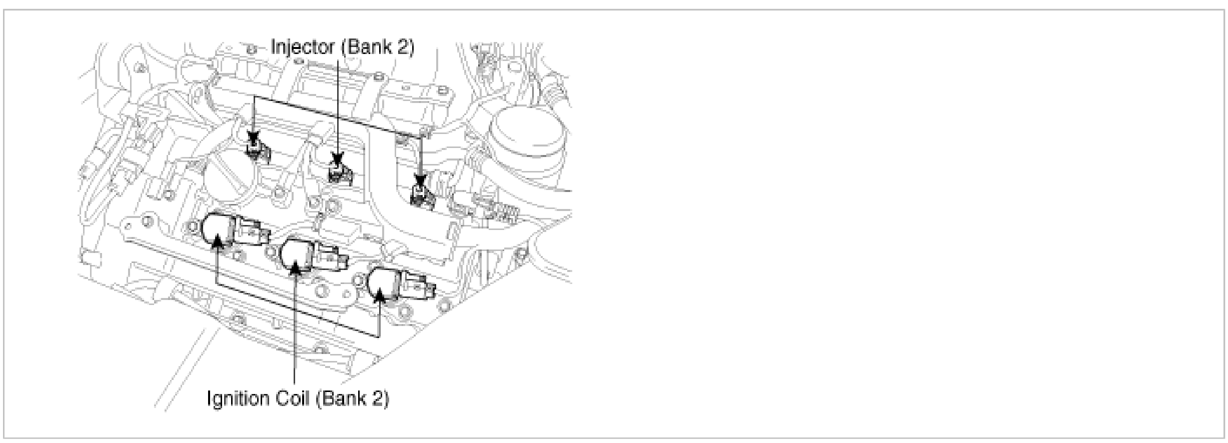
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0274

COMPONENT LOCATION



GENERAL DESCRIPTION

Electronically controlled fuel injector is a solenoid valve which supplies exactly calculated amount of fuel to engine for optimum conbustion under various engine load and speed. To meat air-fuel ratio required in system, PCM regulates fuel injection quantity

as controlling injector solenoid operating duration referring air flow to cylinders and output signals from HO2S. For this precise control, quick response of solenoid is required and for perfect combustion, injection characteristic is important.

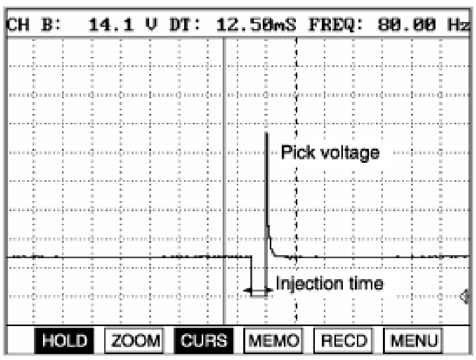
DTC DESCRIPTION

Checking output signals from injectors every 10 sec. under detecting condition, if an output signal is high for more than 5 sec., PCM sets P0274. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal High	• Poor connection • Short to battery in harness • Injector • PCM
Enable condition	• Engine running state • 11V ≤ Battery voltage ≤ 16V • Above conditions are met >0.5sec.	
Threshold value	• Short to battery	
Diagnosis time	• Continuous (More than 2 sec.failure for every 4 sec.test)	
MIL ON condition	• 2 driving cycles	

SIGNAL WAVEFROM AND DATA



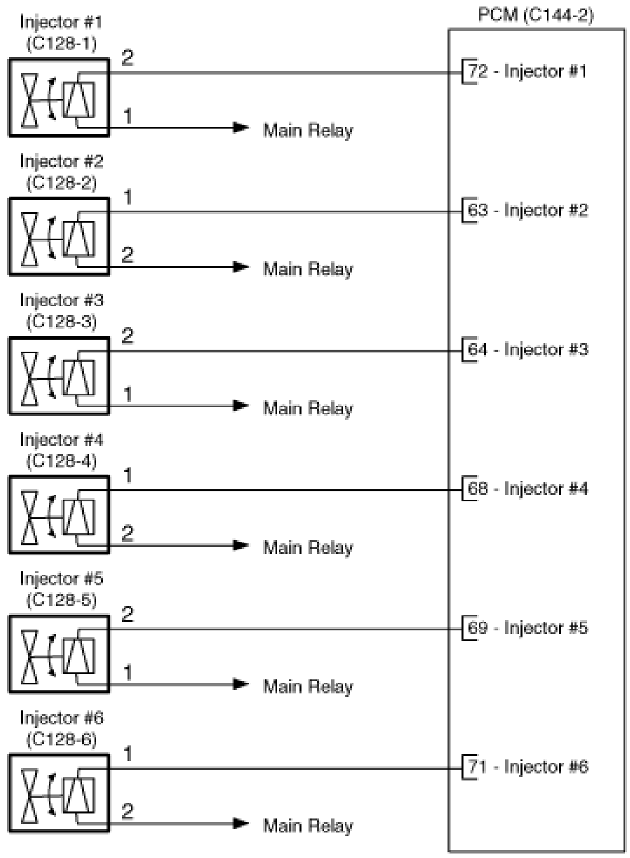
When the PCM energizes the injector by grounding control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the PCM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should be peak at a moment.

SPECIFICATION

Item	Coil resistance(Ω)
Injector	11.4 ~ 12.6Ω (at 20°C/ 68°F)

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Injector #1

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (72)	Injector #1 control

Injector #2

Terminal	Connected to	Funtion
1	PCM C144-2 (63)	Injector #2 control
2	Main Relay	Battery Voltage (B+)

Injector #3

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (64)	Injector #3 control

Injector #4

Terminal	Connected to	Funtion
1	PCM C144-2 (68)	Injector #4 control
2	Main Relay	Battery Voltage (B+)

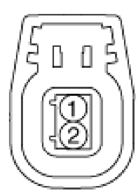
Injector #5

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (69)	Injector #5 control

Injector #6

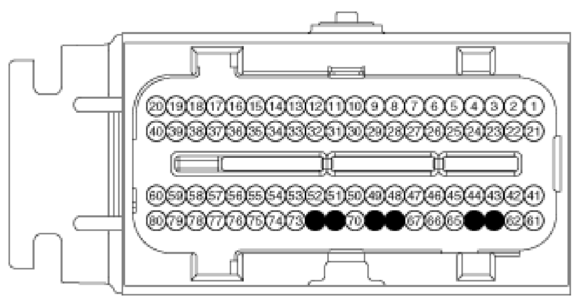
Terminal	Connected to	Funtion
1	PCM C144-2 (71)	Injector #6 control
2	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTORS]



C128-1,2,3,4,5,6

Injector #1,2,3,4,5,6

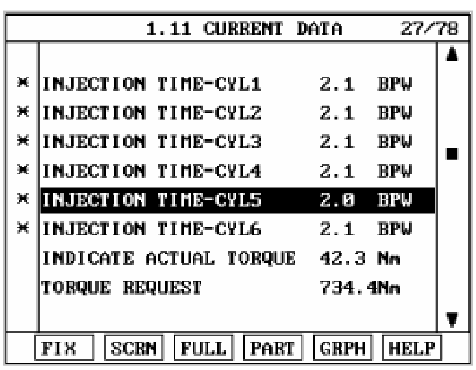


C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "fuel injection time" item on the service data.



4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

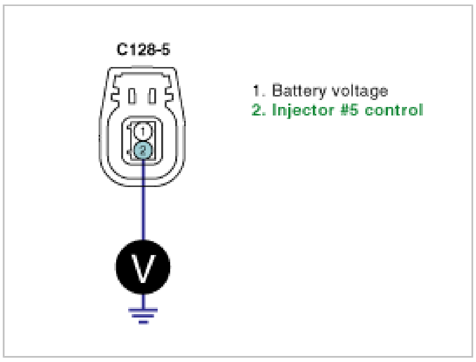
NO

▸ Go to "Control Circuit Inspection" procedure.

CONTROL CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF" and disconnect injector connector.
   (2) IG "ON" and ENG "OFF"
   (3) Measure voltage between terminal 2 of injector harness connector and chassis ground.

   Specification : Approx. 0V



   (4) Is the measured voltage within specification?

   YES

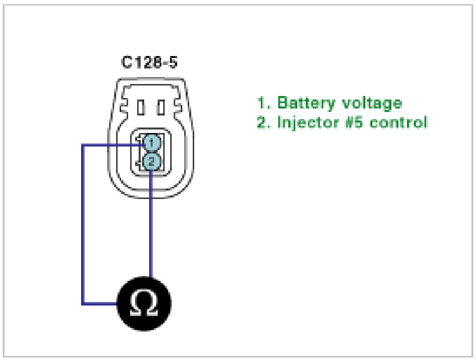
   ▸ Go to "Component Inspection" procedure.

   NO

   ▸ Go to "Check short to battery in harness" as follows.

2. Check short to battery in harness
   (1) IG "OFF" and disconnect injector connector and PCM connector.
   (2) Measure resistance between terminals 1 and 2 of injector harness connector.

   Specification : Below 1Ω



(3) Is the measured resistance within specification?

YES

▸ Go to "Component Inspection" procedure.

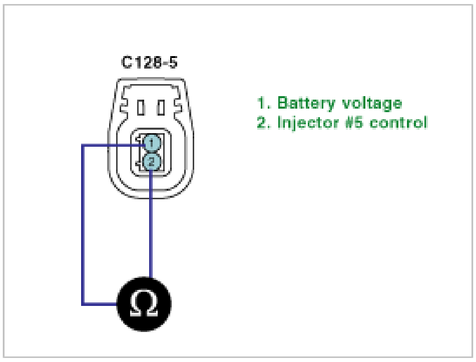
NO

▸ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check injector
   (1) IG "OFF" and disconnect injector connector.
   (2) Measure resistance between terminals 1 and 2 of injector connector.(Component side)
   Specification :

Item	Coil resistance(Ω)
Injector	11.4 ~ 12.6Ω (at 20°C/ 68°F)



(3) Is the measured resistance within specification?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good injector and check for proper operation. If the problem is corrected, replace injector and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "

5. Are any DTCs present ?

YES

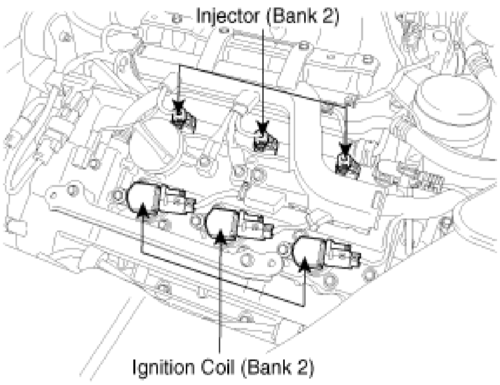
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0276

COMPONENT LOCATION



GENERAL DESCRIPTION

Electronically controlled fuel injector is a solenoid valve which supplies exactly calculated amount of fuel to engine for optimum conbustion under various engine load and speed. To meat air-fuel ratio required in system, PCM regulates fuel injection quantity as controlling injector solenoid operating duration referring air flow to cylinders and output signals from HO2S. For this precise control, quick response of solenoid is required and for perfect combustion, injection characteristic is important.

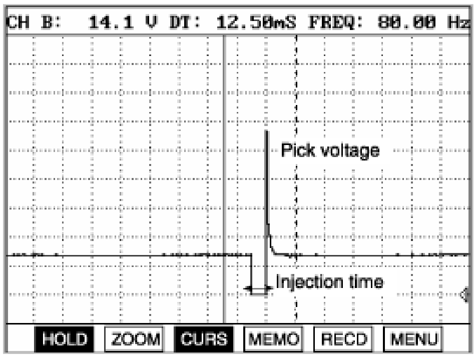
DTC DESCRIPTION

Checking output signals from injectors every 10 sec. under detecting condition, if an output signal is low for more than 5 sec., PCM sets P0276. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal Low	• Poor connection • Open or short to ground in power harness • Open or short to ground in control harness • Injector • PCM
Enable condition	• Engine running state • 11V ≤ Battery voltage ≤ 16V • Above conditions are met > 0.5sec.	
Threshold value	• Open or short to ground	
Diagnosis time	• Continuous (More than 2 sec.failure for every 4 sec.test)	
MIL ON condition	• 2 driving cycles	

SIGNAL WAVEFROM AND DATA



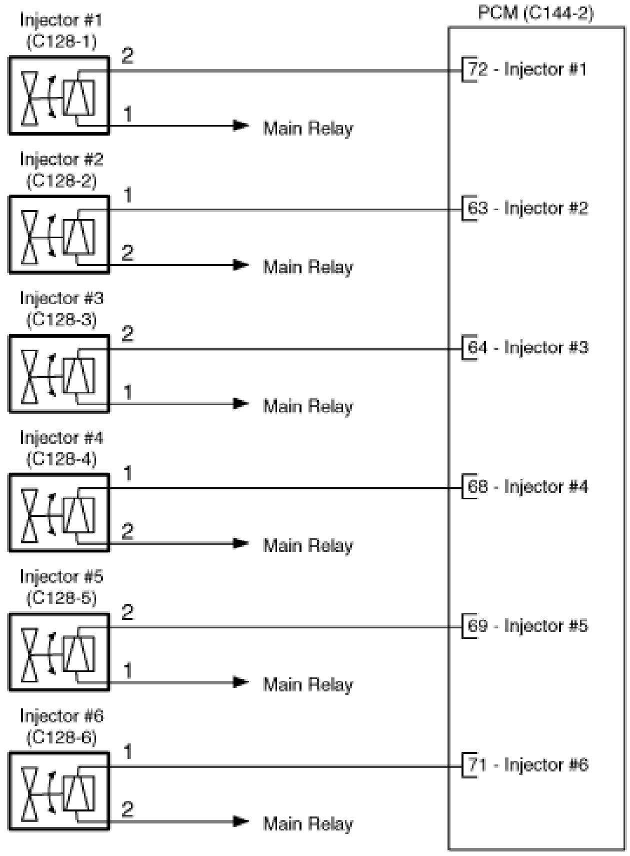
When the PCM energizes the injector by grounding control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the PCM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should be peak at a moment.

SPECIFICATION

Item	Coil resistance(Ω)
Injector	11.4 ~ 12.6Ω (at 20°C/ 68°F)

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Injector #1

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (72)	Injector #1 control

Injector #2

Terminal	Connected to	Funtion
1	PCM C144-2 (63)	Injector #2 control
2	Main Relay	Battery Voltage (B+)

Injector #3

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (64)	Injector #3 control

Injector #4

Terminal	Connected to	Funtion
1	PCM C144-2 (68)	Injector #4 control
2	Main Relay	Battery Voltage (B+)

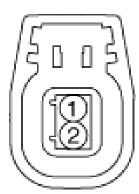
Injector #5

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (69)	Injector #5 control

Injector #6

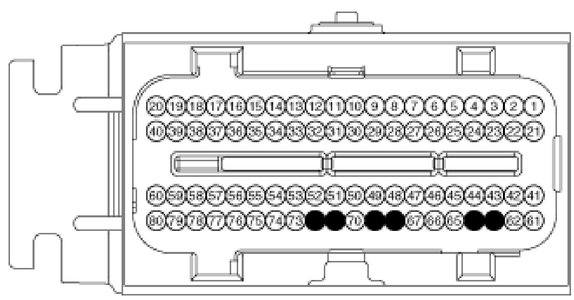
Terminal	Connected to	Funtion
1	PCM C144-2 (71)	Injector #6 control
2	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTORS]



C128-1,2,3,4,5,6

Injector #1,2,3,4,5,6

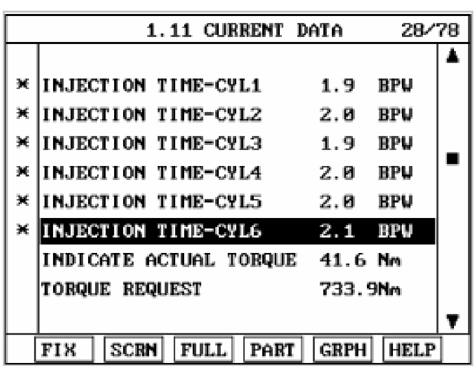


C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "fuel injection time" item on the service data.



4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

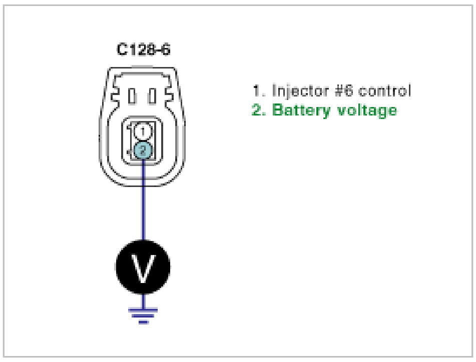
NO

▸ Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION

1. IG "ON" and disconnect injector connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 2 of injector harness connector and chassis ground.

Specification : B+



4. Is the measured voltage within specification?

YES

▸ Go to "Control Circuit Inspection" procedure.

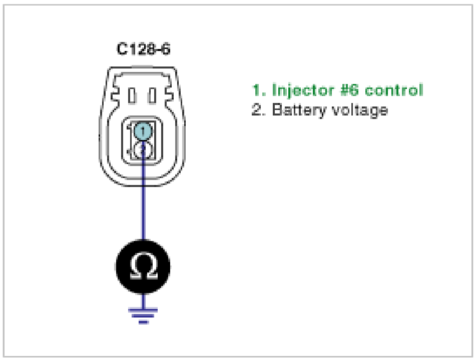
NO

▸ Check open or connection of the fuse connected to injector power supply.
▸ Repair open or short to ground in harness, and go to "Verification of Vehicle Repair' procedure.

CONTROL CIRCUIT INSPECTION

1. Check short to ground in harness
   (1) IG "OFF" and disconnect injector connector and PCM connector.
   (2) Measure resistance between terminal 1 of injector harness connector and chassis ground.

   Specification : Infinite



(3) Is the measured resistance within specification?

YES

▸ Go to "Check open in harness" as follows.

NO

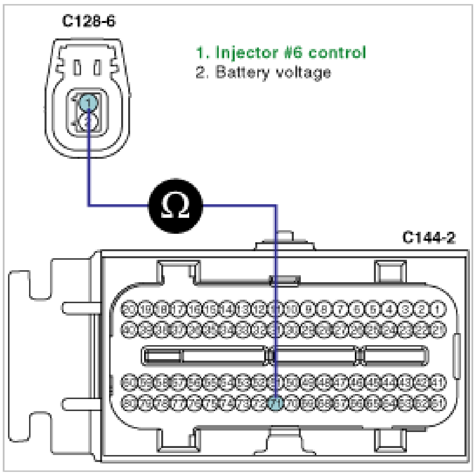
▸ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness

(1) IG "OFF" and disconnect injector connector and PCM connector.

(2) Measure resistance between terminal 1 of injector harness connector and 71 of PCM harness connector.

Specification : Below 1Ω



(3) Is the measured resistance within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

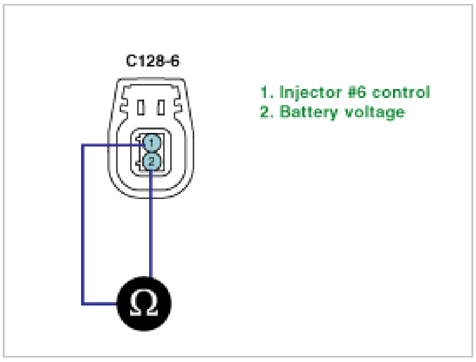
1. Check injector

(1) IG "OFF" and disconnect injector connector.

(2) Measure resistance between terminals 1 and 2 of injector connector.(Component side)

Specification :

Item	Coil resistance(Ω)
Injector	11.4 ~ 12.6Ω (at 20°C/ 68°F)



(3) Is the measured resistance within specification?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good injector and check for proper operation. If the problem is corrected, replace injector and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

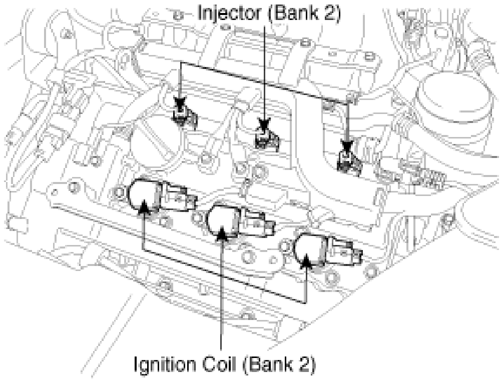
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0277

COMPONENT LOCATION



GENERAL DESCRIPTION

Electronically controlled fuel injector is a solenoid valve which supplies exactly calculated amount of fuel to engine for optimum conbustion under various engine load and speed. To meat air-fuel ratio required in system, PCM regulates fuel injection quantity

as controlling injector solenoid operating duration referring air flow to cylinders and output signals from HO2S. For this precise control, quick response of solenoid is required and for perfect combustion, injection characteristic is important.

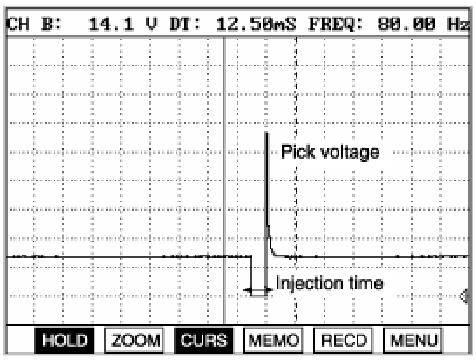
DTC DESCRIPTION

Checking output signals from injectors every 10 sec. under detecting condition, if an output signal is high for more than 5 sec., PCM sets P0277. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal High	• Poor connection • Short to battery in harness • Injector • PCM
Enable condition	• Engine running state • 11V ≤ Battery voltage ≤ 16V • Above conditions are met >0.5sec.	
Threshold value	• Short to battery	
Diagnosis time	• Continuous (More than 2 sec.failure for every 4 sec.test)	
MIL ON condition	• 2 driving cycles	

SIGNAL WAVEFROM AND DATA



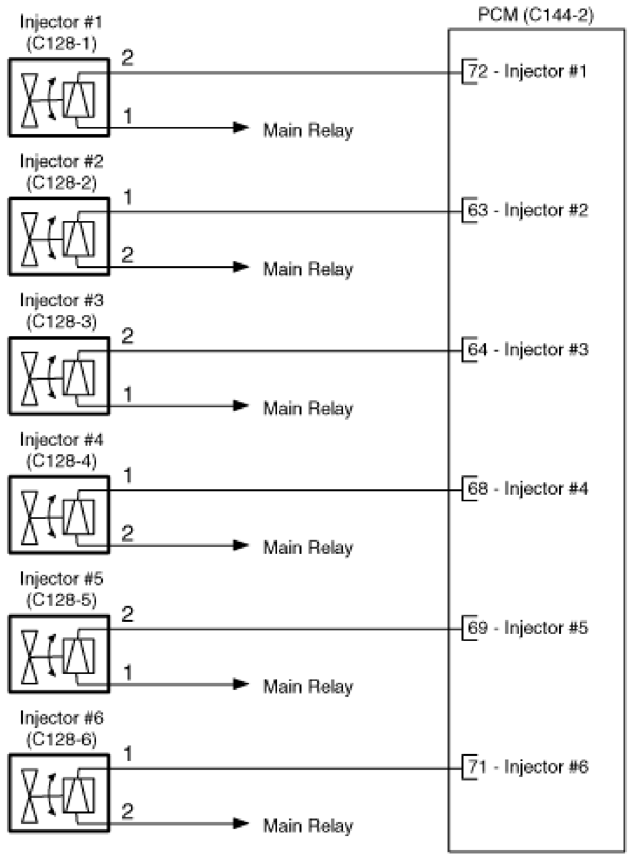
When the PCM energizes the injector by grounding control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the PCM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should be peak at a moment.

SPECIFICATION

Item	Coil resistance(Ω)
Injector	11.4 ~ 12.6Ω (at 20°C/ 68°F)

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Injector #1

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (72)	Injector #1 control

Injector #2

Terminal	Connected to	Funtion
1	PCM C144-2 (63)	Injector #2 control
2	Main Relay	Battery Voltage (B+)

Injector #3

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (64)	Injector #3 control

Injector #4

Terminal	Connected to	Funtion
1	PCM C144-2 (68)	Injector #4 control
2	Main Relay	Battery Voltage (B+)

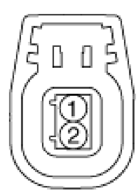
Injector #5

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (69)	Injector #5 control

Injector #6

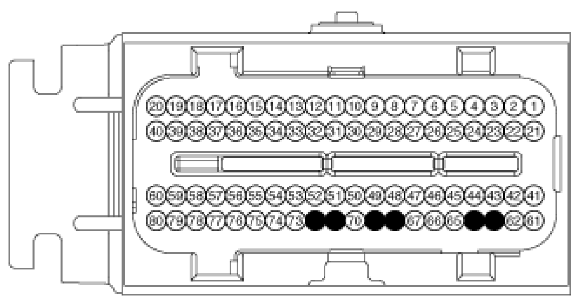
Terminal	Connected to	Funtion
1	PCM C144-2 (71)	Injector #6 control
2	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTORS]



C128-1,2,3,4,5,6

Injector #1,2,3,4,5,6

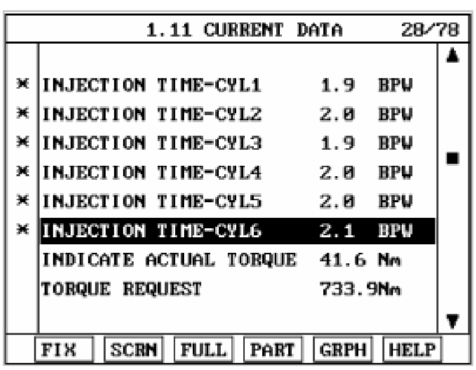


C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "fuel injection time" item on the service data.



4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

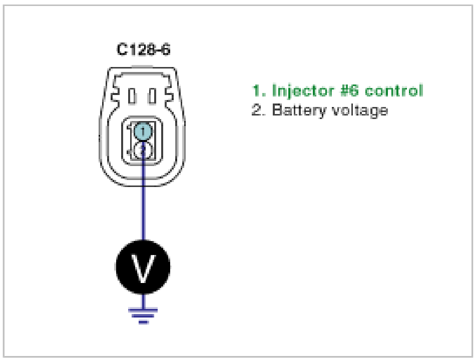
NO

▸ Go to "Control Circuit Inspection" procedure.

CONTROL CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF" and disconnect injector connector.
   (2) IG "ON" and ENG "OFF"
   (3) Measure voltage between terminal 1 of injector harness connector and chassis ground.

   Specification : Approx. 0V



   (4) Is the measured voltage within specification?

YES

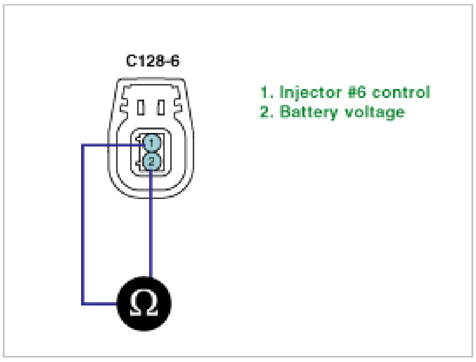
▸ Go to "Component Inspection" procedure.

NO

▸ Go to "Check short to battery in harness" as follows.

2. Check short to battery in harness
   (1) IG "OFF" and disconnect injector connector and PCM connector.
   (2) Measure resistance between terminals 1 and 2 of injector harness connector.

   Specification : Below 1Ω



(3) Is the measured resistance within specification?

YES

▸ Go to "Component Inspection" procedure.

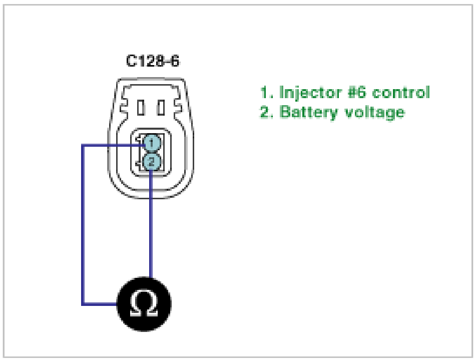
NO

▸ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check injector
   (1) IG "OFF" and disconnect injector connector.
   (2) Measure resistance between terminals 1 and 2 of injector connector.(Component side)
   Specification :

Item	Coil resistance(Ω)
Injector	11.4 ~ 12.6Ω (at 20°C/ 68°F)



(3) Is the measured resistance within specification?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good injector and check for proper operation. If the problem is corrected, replace injector and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "

5. Are any DTCs present ?

YES

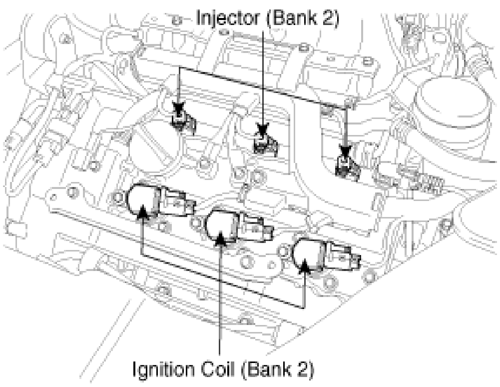
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0300

COMPONENT LOCATION



GENERAL DESCRIPTION

Misfires can be caused by lack of combustion in a cylinder due to absence of spark, poor fuel metering, poor compression, or many other causes. Even a small number of misfires may result in excessive exhaust emissions due to the unburned mixture. Increased misfire rates cause damage to the catalytic converter. The PCM monitors the crankshaft speed variation to determine if any misfiring generated. The PCM identifies the specific cylinder in which the misfire has occurred and counts individual misfire events by monitoring changes in the crankshaft rotation for each cylinder. A random misfire indicates two or more cylinders are misfiring.

DTC DESCRIPTION

The misfire diagnostic measures reference event times and calculates the positive and negative acceleration of the crank wheel to detrmine whether a misfire has occurred.
When the rate of misfire exceeds a threshold where the catalyst reaches a temperature where permanent damage can ocur, to the point that tail pipe emissions reach 1.5 times the tailpipe standard or where a cylinder misfire cause a loss of torque produced from that cylinder. PCM sets P0300. In case that misfire affects Catalyst damage, MIL(Malfunction Indicatin Lamp) will be illuminating and blinking at 1HZ frequency. However, In case of Indivisual and Emission damaging misfire, MIL will be turned on when the malfunction is detected.
Especially, if injector connector is disconnected for more than 46 sec., PCM sets DTC relating to misfire and conducts the fuel-cut to protect the catalyst.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible Cause
DTC Strategy		• Determine if a multiple cylinder misfire or a cylinder specific misfire is occurring by monitoring crankshaft acceleration.	
	Case 1	• Misfre Not Delayed (No active delays) • All delays expired (Misfire Delay Counter = 0) • Not the Air Conditioning Clutch is changing state • The number of engine cycles to delay misfire detection after the air conditioner has changed states.	
	Case 2	• The number of engine cycles to delay misfire detection if the engine is operating in a region where misfire is undetectable ≥ 10 engine cycles	
		• The time that most delays will not be enabled ≥ 10sec • If the engine load ≥ thrshold (based on vehicle speed) then the engine is considered to	

Enable condition	Case 3	be operation under negative torque conditions • Number of engine cycles to delay the misfire diagnostic ≥ 11 engine cycles (If negative torque load condition is detected. Negative torque is determined by load conditions less than a 'zero torque' line which is determined by engine speed and engine coolant temperature.) • The vehicle is in the manufacturing plant. • This is not first crank • Engine Runtime >30 (Amount of time to delay the Misfire Diagnostic on the initial vehicle start when the vehicle is being manufactured in the plant. This delay will only occur once in the life of the vehicle and is used to prevent misfire on the initial start due to a lack of fuel) • The misfire diagnostic is synchronization with the cam event. • The number of engine cycles to delay misfire detection if a cam synchronization problem is detected internal to the Misfire diagnostic >30 engine cycles If false information is received, a false misfire could be diagnosed. • Intrusive diagnostics not enabled (EGR FLOW) • Number of engine cycles to delay the misfire diagnostic if any intrusive diagnostic test that could potentially interfere with the misfire diagnostic detectability has been determined to be active • Fuel Level(Present) >0.15% • No fuel level fault • Vehicle not in plant • Engine cycles ≥ 500 • All cylinders fueled = 6 • Non in Fuel cut off not DFCO(Decelleration Fuel Cut Off) or not High Vehicle Speed Fuel Shut Off or not High RPM Fuel Shut Off • Transmission Shift in progress • Engine cycles ≥ 0 Increasing Throttle • Current Thorttle opening(WTHROT) >31ms old throttle opening(VVTHROT 31ms old) • VVTHROT - VVTHROT 31ms old< 64.9994% (Maximum positive delta throttle movement allowed in a 125 ms period (31.25 ms if using ETC). If the throttle position increases more than this threshold, the misfire diagnostic will be inhibited.) Decreasing Throttle • VVTHROT 31ms old >VVTHROT • VVTHROT 31ms old - VVTHROT < 100% • For engine cycles ≥ 5 • Engine RPM ≥ 7100 • Engine cycles >4999 • Crankshaft speed patterns normal • The seconds that most delays will not be enabled ≥ 10 • The number of consecutive positive delta times < 60 events • For engine cycles ≥ 8 • The number of consecutive negative delta times < 30 events • For engine cycles ≥ 8 • The seconds that most delays will not be enabled ≥ 10 • This is the value which is multiplied The number of consecutive positive delta times with multiple values of the number of consecutive negative delta times and The	• Faulty Spark plugs • Faulty Spark plug cables • Air Leakage • Belt deflection and Air gap of

		number of consecutive positive delta times while within the power-up no-delay timer.< 200 * 1 events • For engine cycles ≥ 8 • This is the value which is multiplied The number of consecutive positive delta times with multiple values of the number of consecutive negative delta times and The number of consecutive positive delta times while within the power-up no-delay timer.< 200 * 1 events • For engine cycles ≥ 8 Not negative torque driving conditions • throttle not less than threshold < 0% • while vehicle speed > 511KPH • For engine cycles ≥ 7 Engine Speed with in range • Run Time ≥ 10 • 470 < Engine RPM < 6600 • For engine cycles ≥ 15 • TEC(Tooth Error Correction) factor not learned • RPM >1600 • For engine Cycles ≥ 40 Ignition Voltage in range • Run Time > 10 • 10.9936 < Battery Voltage < 15.9907 • For engine cycles ≥ 15 Coolant Temperature in range If (start up coolant temperature < cold start thresh and coolant temperature greater that after cold start thresh) • Coolant temperature at start-up < -7°C(19.4 °F) • Calculated coolant temperature with default applied > 21°C (69.8 °F) Else if(coolant temperature greater that lo threshold and coolant temperature less than High threshold) • Calculated coolant temperature with default applied > -7°C (19.4 °F) • Calculated coolant temperature with default applied > 120°C(248 °F) • For engine cycles ≥ 15 Power Up delay not active • Run time > 0 Misfire not requesting TCC unlock and TCC still locked • For engine cycles ≥ 0 no disabling faults present / no disabiling Active Faults • P0340 / P0341 / P0118 / P0117 / P0115 / P0336 / P0335 / P1295 / P0103 / P0102 / 0108 / P0107 / P0106 / P0501 • Run Time< 10 • Engine Load is below zero torque line. • RPM < 1500 • For engine cycles ≥ 11	CKPS • Incorrect timing • Faulty injector • Improper fuel pressure • Improper engine compression • Faulty PCM
Thresh old value	Case 1	• Individual event misfire detection > Threshold	
	Case 2	• Emissions damaging >Threshold	
	Case 3	• Catalyst damaging > Threshold	
Diagnosis time		• Continuous	
MIL ON condition		• 2 driving cycles	

MONITOR SCANTOOL DATA

1. Is the power balance test done?

YES

▸ If injector connector for power balance test is disconnect for over 46 sec., this can cause DTC relating to misfire. Stop the test and connect it and delete DTC and then go to "Verification of Vehicle repair" procedure.

▸ If power balance test is finished within 46 sec., go to next procedure.

NO

▸ Go to "Monitor scantool data" as follows.

2. Monitor scantool data
   (1) Ignition "OFF"

   (2) Connect Scantool and Engine "ON"

   (3) Monitor parameters related to "Random Misfire Detected" on CURRENT DATA

   Specification :

Ignition	BTDC 10° ± 5°		
Idle speed	A/CON OFF	Neutral, N, R, P-range	620 ± 100 rpm
		D-range	
	A/CON ON	Neutral, N, R, P-range	
		D-range	

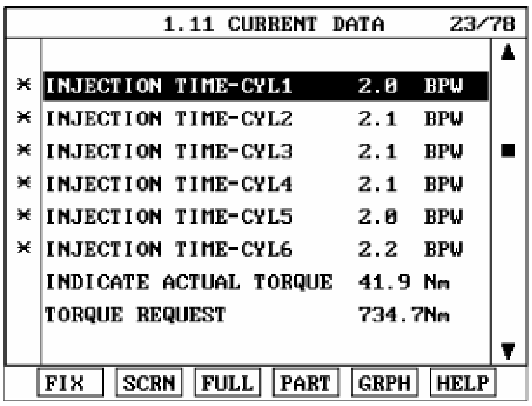


Fig. 1

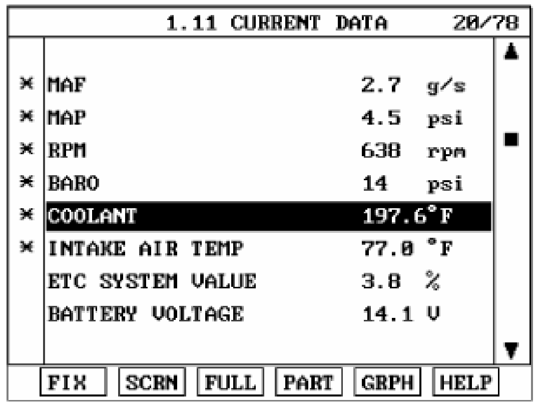


Fig. 2

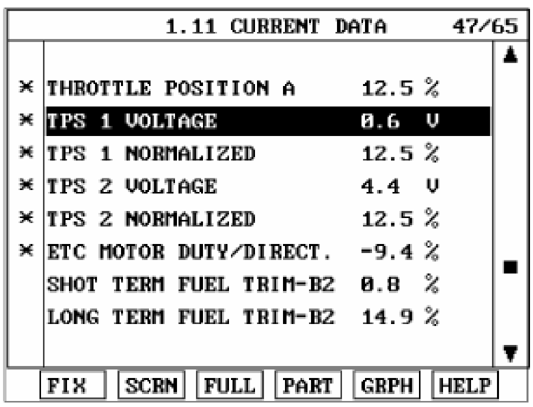


Fig. 3

   (4) Are the parameters related to "Random/Multi Misfire Detected" displayed correctly on Current Data ?

   YES

   ▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

   NO

   ▸ Go to "System Inspection " procedure

SYSTEM INSPECTION

1. Check Spark Pulg

(1) Remove cylinder's spark plugs

(2) Visually/physically inspect the following items:
- Damaged insulation, Worn electrodes, Oil or fuel fouled, Loose terminals and cracks
- Check for plug gap : 1.0 - 1.1 mm (0.039 - 0.043 in.)
- Check if the spark plug for the relevant cylinder is lighter in color than the other plugs.

(3) Has a problem been found in any of the above areas?

YES

▶ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▶ Go to "Check Air Leakage " as below

2. Check Air Leakage
(1) Visually/physically inspect the air leakage in intake/exhaust system as following items,
- Vacuum hoses for splits, kinks and improper connections.
- Throttle body gasket
- Gasket between intake manifold and cylinder head
- Seals between intake manifold and fuel injectors
- Exhaust system between HO2S and Three way catalyst for air leakage

(2) Has a problem been found in any of the above areas?

YES

▶ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▶ Go to "Check for air leakage in Positive Crankcase Ventilation Valve(PCV)

3. Check for air leakage in Positive Crankcase Ventilation Valve(PCV)
(1) Remove PCV valve from cylinder head cover by puling ventilation hose

(2) With engine idling block PCV valve opening

(3) Verify that vacuum is felt

(4) Remove PCV valve

(5) Blow through valve from prot "A" and verify that air comes out of prot "B"

(6) Blow through valve from prot "B" and verifty that no air comes out of port "A"

(7) Has a problem been found ?

YES

▶ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▶ Go to "Check Compression pressure" as below

4. Check Compression pressure
(1) Warm up the engine to normal operating temperature

(2) Disconnect the spark plug cables and remove the spark plugs.

(3) Crank the engine to remove any foreign material in the cylinders.

(4) Put compression pressure gauge into spark pulg hole

(5) Crank the engine with widely opend throttle valve and check compression pressure at each cylinder

(6) Is compression pressure for each cylinder displayed within specifications ?

Specification : 1323kPa(13.5 kg/cm²,192 psi)

YES

▶ Go to "Check Timing " as below

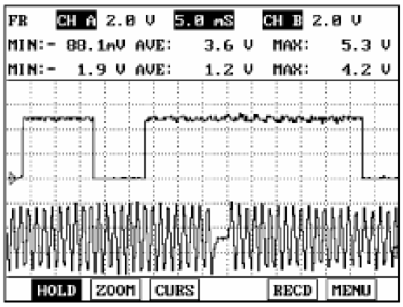
NO

▶ Add a small amount of oil through the spark plug hole, and repeat above steps. If the addition of oil causes the compression to rise, the cause is a worn or damaged piston ring or cylinder inner surface.
▶ If the compression remains the same, the cause is a burnt or defective valve seat, or pressure is leaking from the gasket. Repair as necessary and go to "Verification of Vehicle Repair" procedure

5. Check Timing
(1) Ignition "OFF"

(2) Check that Cam, Crank and Oil pump sprocket timing marks are correctly in alignment

(3) Monitor these signal waveforms from CAM and Crank shaft position Sensor are correctly in alignment



(4) Are all timing marks alligned correctly ?

YES

▸ Go to "Check Fuel Pressure Test" as below

NO

▸ Repair or readjust as necessary and go to "Verification of Vehicle Repair" procedure

6. Check Fuel Pressure Test
   (1) Refer to "Fuel pressure test" in "Fuel delivery system"
   (2) Are the measured fuel pressure within specifications ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Repair or replace as necessary above and then, go to " Verification of Vehicle Repair"procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

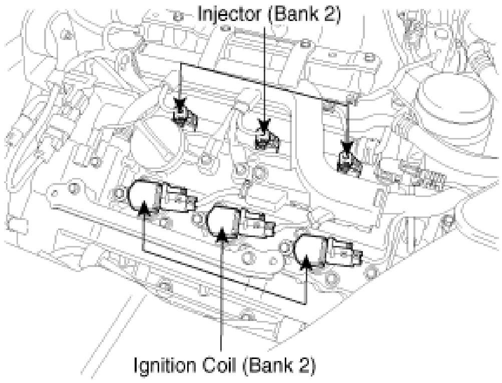
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0301

COMPONENT LOCATION



GENERAL DESCRIPTION

Misfires can be caused by lack of combustion in a cylinder due to absence of spark, poor fuel metering, poor compression, or many other causes. Even a small number of misfires may result in excessive exhaust emissions due to the unburned mixture. Increased misfire rates cause damage to the catalytic converter. The PCM monitors the crankshaft speed variation to determine if any misfiring generated. The PCM identifies the specific cylinder in which the misfire has occurred and counts individual misfire events by monitoring changes in the crankshaft rotation for each cylinder. A random misfire indicates two or more cylinders are misfiring.

DTC DESCRIPTION

The misfire diagnostic measures reference event times and calculates the positive and negative acceleration of the crank wheel to detrmine whether a misfire has occurred.
When the rate of misfire exceeds a threshold where the catalyst reaches a temperature where permanent damage can ocur, to the point that tail pipe emissions reach 1.5 times the tailpipe standard or where a cylinder misfire cause a loss of torque produced from that cylinder. PCM sets P0301. In case that misfire affects Catalyst damage, MIL(Malfunction Indicatin Lamp) will be illuminating and blinking at 1HZ frequency. However, In case of Indivisual and Emission damaging misfire, MIL will be turned on when the malfunction is detected.
Especially, if injector connector is disconnected for more than 46 sec., PCM sets DTC relating to misfire and conducts the fuel-cut to protect the catalyst.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible Cause
DTC Strategy		• determine if a multiple cylinder misfire or a cylinder specific misfire is occurring by monitoring crankshaft acceleration.	
	Case 1	• Misifre Not Delayed (No active delays) • All delays expired (Misfire Delay Counter = 0) • Not the Air Conditioning Clutch is changing state • The number of engine cycles to delay misfire detection after the air conditioner has changed states.	
	Case 2	• The number of engine cycles to delay misfire detection if the engine is operating in a region where misfire is undetectable ≥ 10 engine cycles	
		• The time that most delays will not be enabled ≥ 10sec • If the engine load ≥ thrshold(based on vehicle speed) then the engine is considered to beoperation under negative torque conditions • Number of engine cycles to delay the misfire diagnostic ≥11 engine cycles(if negative torque load condition is detected. Negative torque isdetermined by load conditions less than a 'zero torque' line whichis determined by engine speed and engine coolant temperature.) • The vehicle is in the manufacturing plant. • This is not first crank • Engine Runtime >30 (Amount of time to delay the Misfire Diagnostic on the initial	

Enable condition	Case 3	vehicle start when the vehicle is being manufactured in the plant. This delay will only occur once in the life of the vehicle and is used to prevent misfire on the initial start due to a lack of fuel) • The misfire diagnostic is synchronization with the cam event. • The number of engine cycles to delay misfire detection if a camsynchronization problem is detected internal to the Misfirediagnostic > 30 engine cyclesIf false information is received, a false misfire could bediagnosed. • Intrusive diagnostics not enabled (EGRFLOW) • Number of engine cycles to delay the misfire diagnostic ifany intrusive diagnostic test that could potentially interferewith the misfire diagnostic detectability has been determined to beactive • Fuel Level(Present) >0.15% • No fuel level fault • Vehicle not in plant • Engine cycles ≥ 500 • All cylinders fueled = 6 • Non in Fuel cut off not DFCO(Decelleration Fuel Cut Off) or not High Vehicle Speed Fuel Shut Off or not High RPM Fuel Shut Off • Transmission Shift in progress • Engine cycles ≥ 0 Increasing Throttle • Current Thorttle opening(WTHROT) >31ms old throttle opening(VVTHROT 31ms old) • VVTHROT - VVTHROT 31ms old< 64.9994% (Maximum positive delta throttle movement allowed in a 125 ms period (31.25 ms if using ETC). If the throttle position increases more than this threshold, the misfire diagnostic will be inhibited.) Decreasing Throttle • VVTHROT 31ms old >VVTHROT • VVTHROT 31ms old - VVTHROT < 100% • For engine cycles ≥ 5 • Engine RPM ≥ 7100 • Engine cycles >4999 • Crankshaft speed patterns normal • The seconds that most delays will not be enabled ≥ 10 • The number of consecutive positive delta times< 60 events • For engine cycles ≥ 8 • The number of consecutive negative delta times< 30 events • For engine cycles ≥ 8 • The seconds that most delays will not be enabled ≥ 10 • This is the value which is multiplied The number of consecutive positive delta times with multiple values of the number of consecutive negative delta times and The number of consecutive positive delta times while within the power-up no-delay timer.< 200 * 1 events • For engine cycles ≥ 8 • This is the value which is multiplied The number of consecutive positive delta times with multiple values of the number of consecutive negative delta times and The number of consecutive positive delta times while within the power-up no-delay timer.< 200 * 1 events • For engine cycles ≥ 8 Not negative torque driving conditions • throttle not less than threshold < 0% • while vehicle speed > 511KPH	• Faulty Spark plugs • Faulty Spark plug cables • Air Leakage • Belt deflection and Air gap of CKPS • Incorrect timing • Faulty injector • Improper fuel pressure • Improper engine compression • Faulty PCM

		• For engine cycles ≥ 7 Engine Speed with in range • Run Time ≥ 10 • 470 < Engine RPM < 6600 • For engine cycles ≥ 15 • TEC(Tooth Error Correction) factor not learned • RPM >1600 • For engine Cycles ≥ 40 Ignition Voltage in range • Run Time > 10 • 10.9936 < Battery Voltage < 15.9907 • For engine cycles ≥ 15 Coolant Temperature in range If (start up coolant temperature < cold start thresh and coolant temperature greater that after cold start thresh) • Coolant temperature at start-up < -7°C(19.4 °F) • Calculated coolant temperature with default applied > 21°C (69.8 °F) Else if(coolant temperature greater that lo threshold and coolant temperature less than High threshold) • Calculated coolant temperature with default applied > -7°C (19.4 °F) • Calculated coolant temperature with default applied > 120°C(248 °F) • For engine cycles ≥ 15 Power Up delay not active • Run time > 0 Misfire not requesting TCC unlock and TCC still locked • For engine cycles ≥ 0 no disabling faults present / no disabiling Active Faults • P0340 / P0341 / P0118 / P0117 / P0115 / P0336 / P0335 / P1295 / P0103 / P0102 / 0108 / P0107 / P0106 / P0501 • Run Time< 10 • Engine Load is below zero torque line. • RPM < 1500 • For engine cycles ≥ 11	
Thresh old value	Case 1	• Individual event misfire detection > Threshold	
	Case 2	• Emissions damaging >Threshold	
	Case 3	• Catalyst damaging > Threshold	
Diagnosis time		• Continuous	
MIL ON condition		• 2 driving cycles	

MONITOR SCANTOOL DATA

1. Is the power balance test done?

YES

▸ If injector connector for power balance test is disconnect for over 46 sec., this can cause DTC relating to misfire. Stop the test and connect it and delete DTC and then go to "Verification of Vehicle repair" procedure.
▸ If power balance test is finished within 46 sec., go to next procedure.

NO

▸ Go to "Monitor scantool data" as follows.

2. Monitor scantool data
   (1) Ignition "OFF"
   (2) Connect Scantool and Engine "ON"
   (3) Monitor parameters related to " Cylinder 1 Misfire Detected" on CURRENT DATA
   Specification :

Ignition	BTDC 10° ± 5°		
Idle speed	A/CON OFF	Neutral, N, R, P-range	620 ± 100 rpm
		D-range	
	A/CON ON	Neutral, N, R, P-range	
		D-range	

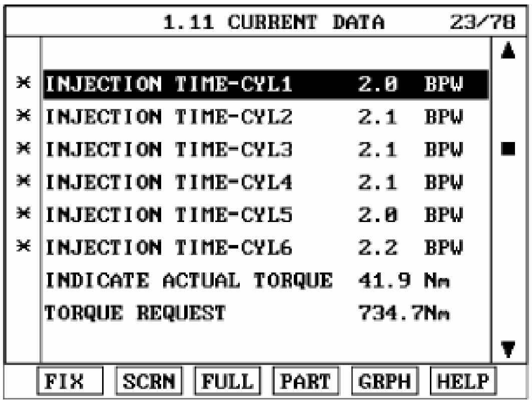


Fig. 1

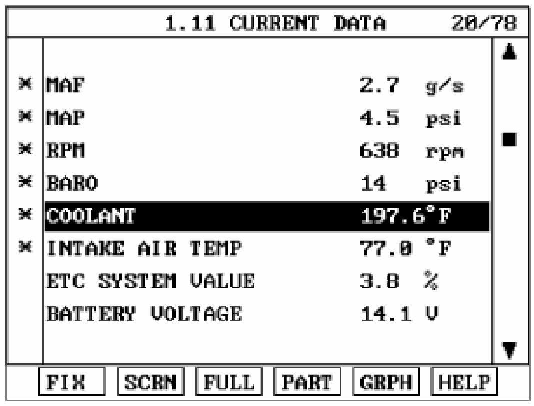


Fig. 2

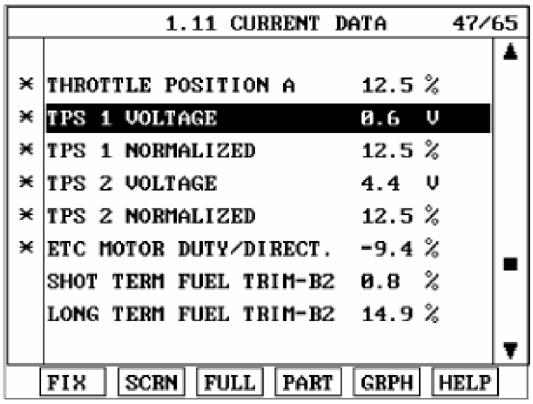


Fig. 3

(4) Are the parameters related to "Cylinder 1 Misfire Detected" displayed correctly on Current Data ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "System Inspection " procedure

SYSTEM INSPECTION

1. Check Spark Pulg

(1) Remove cylinder's spark plugs

(2) Visually/physically inspect the following items:

- Damaged insulation, Worn electrodes, Oil or fuel fouled, Loose terminals and cracks
- Check for plug gap : 1.0 - 1.1 mm (0.039 - 0.043 in.)
- Check if the spark plug for the relevant cylinder is lighter in color than the other plugs.

(3) Has a problem been found in any of the above areas?

YES

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Check Air Leakage " as below

2. Check Air Leakage

(1) Visually/physically inspect the air leakage in intake/exhaust system as following items,
- Vacuum hoses for splits, kinks and improper connections.
- Throttle body gasket
- Gasket between intake manifold and cylinder head
- Seals between intake manifold and fuel injectors
- Exhaust system between HO2S and Three way catalyst for air leakage

(2) Has a problem been found in any of the above areas?

YES

▶ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▶ Go to "Check for air leakage in Positive Crankcase Ventilation Valve(PCV)

3. Check for air leakage in Positive Crankcase Ventilation Valve(PCV)

(1) Remove PCV valve from cylinder head cover by puling ventilation hose

(2) With engine idling block PCV valve opening

(3) Verify that vacuum is felt

(4) Remove PCV valve

(5) Blow through valve from prot "A" and verify that air comes out of prot "B"

(6) Blow through valve from prot "B" and verifty that no air comes out of port "A"

(7) Has a problem been found ?

YES

▶ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▶ Go to "Check Compression pressure" as below

4. Check Compression pressure

(1) Warm up the engine to normal operating temperature

(2) Disconnect the spark plug cables and remove the spark plugs.

(3) Crank the engine to remove any foreign material in the cylinders.

(4) Put compression pressure gauge into spark pulg hole

(5) Crank the engine with widely opend throttle valve and check compression pressure at each cylinder

Specification : 1323kPa(13.5 kg/cm²,192 psi)

(6) Is compression pressure for each cylinder displayed within specifications ?

YES

▶ Go to "Check Timing " as below

NO

▶ Add a small amount of oil through the spark plug hole, and repeat above steps. If the addition of oil causes the compression to rise, the cause is a worn or damaged piston ring or cylinder inner surface.

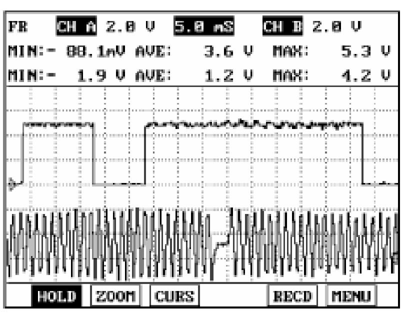
▶ If the compression remains the same, the cause is a burnt or defective valve seat, or pressure is leaking from the gasket. Repair as necessary and go to "Verification of Vehicle Repair" procedure

5. Check Timing

(1) Ignition "OFF"

(2) Check that Cam, Crank and Oil pump sprocket timing marks are correctly in alignment

(3) Monitor these signal waveforms from CAM and Crank shaft position Sensor are correctly in alignment



(4) Are all timing marks alligned correctly ?

YES

▸ Go to "Check Fuel Pressure Test" as below

NO

(5) ▸ Repair or readjust as necessary and go to "Verification of Vehicle Repair" procedure

6. Check Fuel Pressure Test

(1) Refer to "Fuel pressure test" in "Fuel delivery system"

(2) Are the measured fuel pressure within specifications ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Repair or replace as necessary above and then, go to " Verification of Vehicle Repair"procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

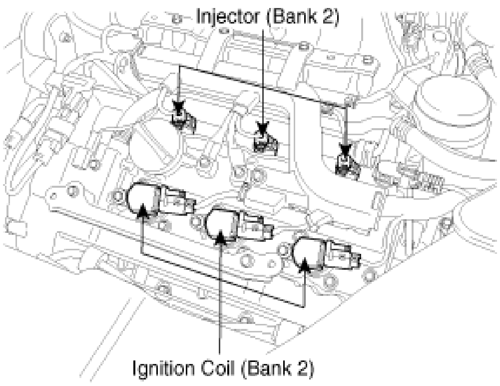
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0302

COMPONENT LOCATION



GENERAL DESCRIPTION

Misfires can be caused by lack of combustion in a cylinder due to absence of spark, poor fuel metering, poor compression, or many other causes. Even a small number of misfires may result in excessive exhaust emissions due to the unburned mixture. Increased misfire rates cause damage to the catalytic converter. The PCM monitors the crankshaft speed variation to determine if any misfiring generated. The PCM identifies the specific cylinder in which the misfire has occurred and counts individual misfire events by monitoring changes in the crankshaft rotation for each cylinder. A random misfire indicates two or more cylinders are misfiring.

DTC DESCRIPTION

The misfire diagnostic measures reference event times and calculates the positive and negative acceleration of the crank wheel to detrmine whether a misfire has occurred.
When the rate of misfire exceeds a threshold where the catalyst reaches a temperature where permanent damage can ocur, to the point that tail pipe emissions reach 1.5 times the tailpipe standard or where a cylinder misfire cause a loss of torque produced from that cylinder. PCM sets P0302. In case that misfire affects Catalyst damage, MIL(Malfunction Indicatin Lamp) will be illuminating and blinking at 1HZ frequency. However, In case of Indivisual and Emission damaging misfire, MIL will be turned on when the malfunction is detected.
Especially, if injector connector is disconnected for more than 46 sec., PCM sets DTC relating to misfire and conducts the fuel-cut to protect the catalyst.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible Cause
DTC Strategy		• determine if a multiple cylinder misfire or a cylinder specific misfire is occurring by monitoring crankshaft acceleration.	
	Case 1	• Misifre Not Delayed (No active delays) • All delays expired (Misfire Delay Counter = 0) • Not the Air Conditioning Clutch is changing state • The number of engine cycles to delay misfire detection after the air conditioner has changed states.	
	Case 2	• The number of engine cycles to delay misfire detection if the engine is operating in a region where misfire is undetectable ≥ 10 engine cycles	
		• The time that most delays will not be enabled ≥ 10sec • If the engine load ≥ thrshold(based on vehicle speed) then the engine is considered to beoperation under negative torque conditions • Number of engine cycles to delay the misfire diagnostic ≥11 engine cycles(if negative torque load condition is detected. Negative torque isdetermined by load conditions less than a 'zero torque' line whichis determined by engine speed and engine coolant temperature.) • The vehicle is in the manufacturing plant. • This is not first crank • Engine Runtime >30 (Amount of time to delay the Misfire Diagnostic on the initial vehicle start when the vehicle is being manufactured in the plant. This delay will only occur once in the life of the vehicle and is used to prevent misfire on the initial start due to a lack of fuel) • The misfire diagnostic is synchronization with the cam event. • The number of engine cycles to delay misfire detection if a camsynchronization problem is detected internal to the Misfirediagnostic > 30 engine cyclesIf false information is received, a false misfire could bediagnosed. • Intrusive diagnostics not enabled (EGRFLOW) • Number of engine cycles to delay the misfire diagnostic ifany intrusive diagnostic test that could potentially interferewith the misfire diagnostic detectability has been determined to beactive • Fuel Level(Present) >0.15% • No fuel level fault • Vehicle not in plant • Engine cycles ≥ 500 • All cylinders fueled = 6 • Non in Fuel cut off not DFCO(Decelleration Fuel Cut Off) or not High Vehicle Speed Fuel Shut Off or not High RPM Fuel	

Enable condition	Case 3	Shut Off • Transmission Shift in progress • Engine cycles ≥ 0 Increasing Throttle • Current Thorttle opening(WTHROT) >31ms old throttle opening(VVTHROT 31ms old) • VVTHROT - VVTHROT 31ms old< 64.9994% (Maximum positive delta throttle movement allowed in a 125 ms period (31.25 ms if using ETC). If the throttle position increases more than this threshold, the misfire diagnostic will be inhibited.) Decreasing Throttle • VVTHROT 31ms old >VVTHROT • VVTHROT 31ms old - VVTHROT < 100% • For engine cycles ≥ 5 • Engine RPM ≥ 7100 • Engine cycles >4999 • Crankshaft speed patterns normal • The seconds that most delays will not be enabled ≥ 10 • The number of consecutive positive delta times< 60 events • For engine cycles ≥ 8 • The number of consecutive negative delta times< 30 events • For engine cycles ≥ 8 • The seconds that most delays will not be enabled ≥ 10 • This is the value which is multiplied The number of consecutive positive delta times with multiple values of the number of consecutive negative delta times and The number of consecutive positive delta times while within the power-up no-delay timer.< 200 * 1 events • For engine cycles ≥ 8 • This is the value which is multiplied The number of consecutive positive delta times with multiple values of the number of consecutive negative delta times and The number of consecutive positive delta times while within the power-up no-delay timer.< 200 * 1 events • For engine cycles ≥ 8 Not negative torque driving conditions • throttle not less than threshold < 0% • while vehicle speed > 511KPH • For engine cycles ≥ 7 Engine Speed with in range • Run Time ≥ 10 • 470 < Engine RPM < 6600 • For engine cycles ≥ 15 • TEC(Tooth Error Correction) factor not learned • RPM >1600 • For engine Cycles ≥ 40 Ignition Voltage in range • Run Time > 10 • 10.9936 < Battery Voltage < 15.9907 • For engine cycles ≥ 15 Coolant Temperature in range If (start up coolant temperature < cold start thresh and coolant temperature greater that after cold start thresh) • Coolant temperature at start-up < -7°C(19.4 °F) • Calculated coolant temperature with default applied > 21°C (69.8 °F) Else if(coolant temperature greater that lo threshold and coolant temperature less than High threshold) • Calculated coolant temperature with default applied > -7°C (19.4 °F)	• Faulty Spark plugs • Faulty Spark plug cables • Air Leakage • Belt deflection and Air gap of CKPS • Incorrect timing • Faulty injector • Improper fuel pressure • Improper engine compression • Faulty PCM

		• Calculated coolant temperature with default applied > 120° C(248 °F) • For engine cycles ≥ 15 Power Up delay not active • Run time > 0 Misfire not requesting TCC unlock and TCC still locked • For engine cycles ≥ 0 no disabling faults present / no disabiling Active Faults • P0340 / P0341 / P0118 / P0117 / P0115 / P0336 / P0335 / P1295 / P0103 / P0102 / 0108 / P0107 / P0106 / P0501 • Run Time< 10 • Engine Load is below zero torque line. • RPM < 1500 • For engine cycles ≥ 11	
Thresh old value	Case 1	• Individual event misfire detection > Threshold	
	Case 2	• Emissions damaging >Threshold	
	Case 3	• Catalyst damaging > Threshold	
Diagnosis time		• Continuous	
MIL ON condition		• 2 driving cycles	

MONITOR SCANTOOL DATA

1. Is the power balance test done?

YES

▸ If injector connector for power balance test is disconnect for over 46 sec., this can cause DTC relating to misfire. Stop the test and connect it and delete DTC and then go to "Verification of Vehicle repair" procedure.
▸ If power balance test is finished within 46 sec., go to next procedure.

NO

▸ Go to "Monitor scantool data" as follows.

2. Monitor scantool data
   (1) Ignition "OFF"
   (2) Connect Scantool and Engine "ON"
   (3) Monitor parameters related to " Cylinder 2 Misfire Detected" on CURRENT DATA
   Specification :

Ignition	BTDC 10° ± 5°		
Idle speed	A/CON OFF	Neutral, N, R, P-range	620 ± 100 rpm
		D-range	
	A/CON ON	Neutral, N, R, P-range	
		D-range	

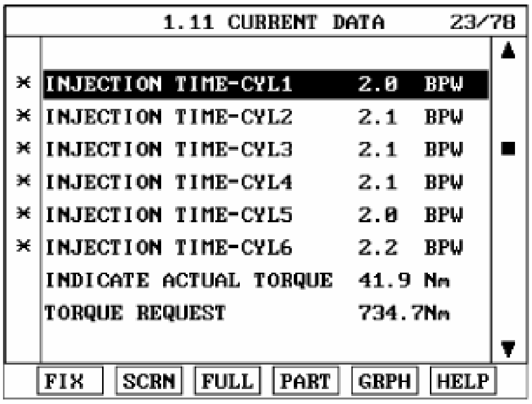


Fig. 1

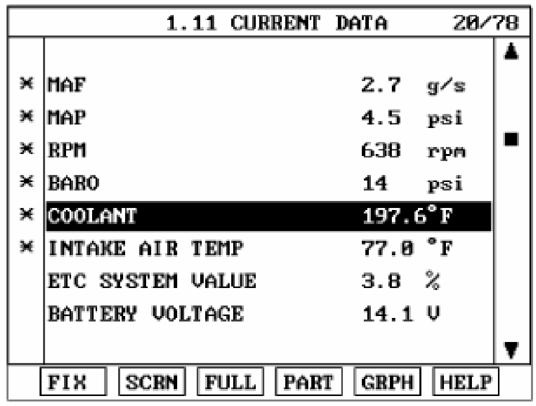


Fig. 2

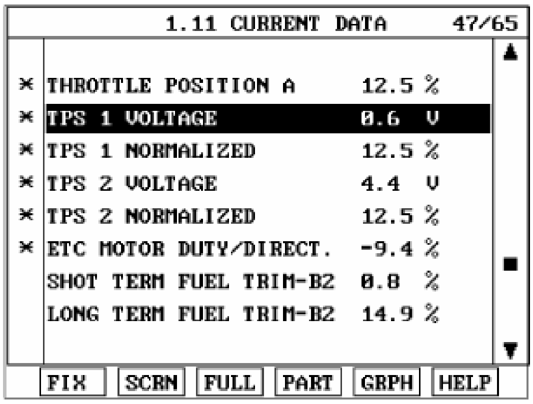


Fig. 3

(4) Are the parameters related to "Cylinder 2 Misfire Detected" displayed correctly on Current Data ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "System Inspection " procedure

SYSTEM INSPECTION

1. Check Spark Pulg
   (1) Remove cylinder's spark plugs
   (2) Visually/physically inspect the following items:
   - Damaged insulation, Worn electrodes, Oil or fuel fouled, Loose terminals and cracks
   - Check for plug gap : 1.0 - 1.1 mm (0.039 - 0.043 in.)
   - Check if the spark plug for the relevant cylinder is lighter in color than the other plugs.

   (3) Has a problem been found in any of the above areas?

   YES

   ▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

   NO

   ▸ Go to "Check Air Leakage " as below

2. Check Air Leakage
   (1) Visually/physically inspect the air leakage in intake/exhaust system as following items,
   - Vacuum hoses for splits, kinks and improper connections.
   - Throttle body gasket
   - Gasket between intake manifold and cylinder head
   - Seals between intake manifold and fuel injectors
   - Exhaust system between HO2S and Three way catalyst for air leakage

   (2) Has a problem been found in any of the above areas?

YES

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Check for air leakage in Positive Crankcase Ventilation Valve(PCV)

3. Check for air leakage in Positive Crankcase Ventilation Valve(PCV)
   (1) Remove PCV valve from cylinder head cover by puling ventilation hose

   (2) With engine idling block PCV valve opening

   (3) Verify that vacuum is felt

   (4) Remove PCV valve

   (5) Blow through valve from prot "A" and verify that air comes out of prot "B"

   (6) Blow through valve from prot "B" and verifty that no air comes out of port "A"

   (7) Has a problem been found ?

YES

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Check Compression pressure" as below

4. Check Compression pressure
   (1) Warm up the engine to normal operating temperature

   (2) Disconnect the spark plug cables and remove the spark plugs.

   (3) Crank the engine to remove any foreign material in the cylinders.

   (4) Put compression pressure gauge into spark pulg hole

   (5) Crank the engine with widely opend throttle valve and check compression pressure at each cylinder

Specification : 1323kPa(13.5 kg/cm²,192 psi)

   (6) Is compression pressure for each cylinder displayed within specifications ?

YES

▸ Go to "Check Timing " as below

NO

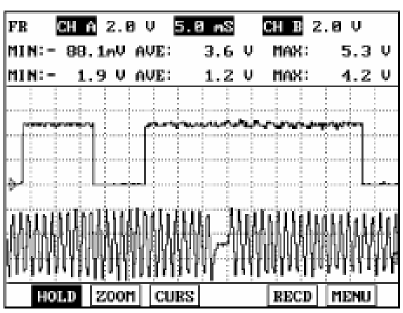
▸ Add a small amount of oil through the spark plug hole, and repeat above steps. If the addition of oil causes the compression to rise, the cause is a worn or damaged piston ring or cylinder inner surface.

▸ If the compression remains the same, the cause is a burnt or defective valve seat, or pressure is leaking from the gasket. Repair as necessary and go to "Verification of Vehicle Repair" procedure

5. Check Timing
   (1) Ignition "OFF"

   (2) Check that Cam, Crank and Oil pump sprocket timing marks are correctly in alignment

   (3) Monitor these signal waveforms from CAM and Crank shaft position Sensor are correctly in alignment



   (4) Are all timing marks alligned correctly ?

YES

▸ Go to "Check Fuel Pressure Test" as below

NO

   (5) ▸ Repair or readjust as necessary and go to "Verification of Vehicle Repair" procedure

6. Check Fuel Pressure Test
   (1) Refer to "Fuel pressure test" in "Fuel delivery system"
   (2) Are the measured fuel pressure within specifications ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Repair or replace as necessary above and then, go to " Verification of Vehicle Repair"procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

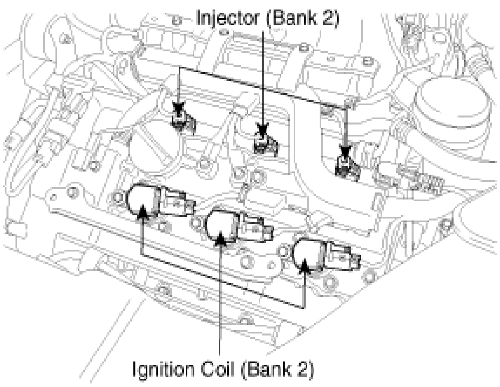
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0303

COMPONENT LOCATION



GENERAL DESCRIPTION

Misfires can be caused by lack of combustion in a cylinder due to absence of spark, poor fuel metering, poor compression, or many other causes. Even a small number of misfires may result in excessive exhaust emissions due to the unburned mixture. Increased misfire rates cause damage to the catalytic converter. The PCM monitors the crankshaft speed variation to determine if any misfiring generated. The PCM identifies the specific cylinder in which the misfire has occurred and counts individual misfire events by monitoring changes in the crankshaft rotation for each cylinder. A random misfire indicates two or more cylinders are misfiring.

DTC DESCRIPTION

The misfire diagnostic measures reference event times and calculates the positive and negative acceleration of the crank wheel to detrmine whether a misfire has occurred.
When the rate of misfire exceeds a threshold where the catalyst reaches a temperature where permanent damage can ocur, to the point that tail pipe emissions reach 1.5 times the tailpipe standard or where a cylinder misfire cause a loss of torque produced from that cylinder. PCM sets P0303. In case that misfire affects Catalyst damage, MIL(Malfunction Indicatin Lamp) will be illuminating

and blinking at 1HZ frequency. However, In case of Indivisual and Emission damaging misfire, MIL will be turned on when the malfunction is detected.
Especially, if injector connector is disconnected for more than 46 sec., PCM sets DTC relating to misfire and conducts the fuel-cut to protect the catalyst.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible Cause
DTC Strategy		• determine if a multiple cylinder misfire or a cylinder specific misfire is occurring by monitoring crankshaft acceleration.	
	Case 1	• Misifre Not Delayed (No active delays) • All delays expired (Misfire Delay Counter = 0) • Not the Air Conditioning Clutch is changing state • The number of engine cycles to delay misfire detection after the air conditioner has changed states.	
	Case 2	• The number of engine cycles to delay misfire detection if the engine is operating in a region where misfire is undetectable ≥ 10 engine cycles	
		• The time that most delays will not be enabled ≥ 10sec • If the engine load ≥ thrshold(based on vehicle speed) then the engine is considered to beoperation under negative torque conditions • Number of engine cycles to delay the misfire diagnostic ≥11 engine cycles(if negative torque load condition is detected. Negative torque isdetermined by load conditions less than a 'zero torque' line whichis determined by engine speed and engine coolant temperature.) • The vehicle is in the manufacturing plant. • This is not first crank • Engine Runtime >30 (Amount of time to delay the Misfire Diagnostic on the initial vehicle start when the vehicle is being manufactured in the plant. This delay will only occur once in the life of the vehicle and is used to prevent misfire on the initial start due to a lack of fuel) • The misfire diagnostic is synchronization with the cam event. • The number of engine cycles to delay misfire detection if a camsynchronization problem is detected internal to the Misfirediagnostic > 30 engine cyclesIf false information is received, a false misfire could bediagnosed. • Intrusive diagnostics not enabled (EGRFLOW) • Number of engine cycles to delay the misfire diagnostic ifany intrusive diagnostic test that could potentially interferewith the misfire diagnostic detectability has been determined to beactive • Fuel Level(Present) >0.15% • No fuel level fault • Vehicle not in plant • Engine cycles ≥ 500 • All cylinders fueled = 6 • Non in Fuel cut off not DFCO(Decelleration Fuel Cut Off) or not High Vehicle Speed Fuel Shut Off or not High RPM Fuel Shut Off • Transmission Shift in progress • Engine cycles ≥ 0 Increasing Throttle • Current Thorttle opening(WTHROT) >31ms old throttle opening(VVTHROT 31ms old) • VVTHROT - VVTHROT 31ms old< 64.9994% (Maximum positive delta throttle movement allowed in a 125 ms period	

Enable condition	Case 3	(31.25 ms if using ETC). If the throttle position increases more than this threshold, the misfire diagnostic will be inhibited.) Decreasing Throttle • VVTHROT 31ms old >VVTHROT • VVTHROT 31ms old - VVTHROT < 100% • For engine cycles ≥ 5 • Engine RPM ≥ 7100 • Engine cycles >4999 • Crankshaft speed patterns normal • The seconds that most delays will not be enabled ≥ 10 • The number of consecutive positive delta times< 60 events • For engine cycles ≥ 8 • The number of consecutive negative delta times< 30 events • For engine cycles ≥ 8 • The seconds that most delays will not be enabled ≥ 10 • This is the value which is multiplied The number of consecutive positive delta times with multiple values of the number of consecutive negative delta times and The number of consecutive positive delta times while within the power-up no-delay timer.< 200 * 1 events • For engine cycles ≥ 8 • This is the value which is multiplied The number of consecutive positive delta times with multiple values of the number of consecutive negative delta times and The number of consecutive positive delta times while within the power-up no-delay timer.< 200 * 1 events • For engine cycles ≥ 8 Not negative torque driving conditions • throttle not less than threshold < 0% • while vehicle speed > 511KPH • For engine cycles ≥ 7 Engine Speed with in range • Run Time ≥ 10 • 470 < Engine RPM < 6600 • For engine cycles ≥ 15 • TEC(Tooth Error Correction) factor not learned • RPM >1600 • For engine Cycles ≥ 40 Ignition Voltage in range • Run Time > 10 • 10.9936 < Battery Voltage < 15.9907 • For engine cycles ≥ 15 Coolant Temperature in range If (start up coolant temperature < cold start thresh and coolant temperature greater that after cold start thresh) • Coolant temperature at start-up < -7°C(19.4 °F) • Calculated coolant temperature with default applied > 21°C (69.8 °F) Else if(coolant temperature greater that lo threshold and coolant temperature less than High threshold) • Calculated coolant temperature with default applied > -7°C (19.4 °F) • Calculated coolant temperature with default applied > 120°C(248 °F) • For engine cycles ≥ 15 Power Up delay not active • Run time > 0 Misfire not requesting TCC unlock and TCC still locked • For engine cycles ≥ 0 no disabling faults present / no disabiling Active Faults	• Faulty Spark plugs • Faulty Spark plug cables • Air Leakage • Belt deflection and Air gap of CKPS • Incorrect timing • Faulty injector • Improper fuel pressure • Improper engine compression • Faulty PCM

		• P0340 / P0341 / P0118 / P0117 / P0115 / P0336 / P0335 / P1295 / P0103 / P0102 / 0108 / P0107 / P0106 / P0501 • Run Time< 10 • Engine Load is below zero torque line. • RPM < 1500 • For engine cycles ≥ 11	
Thresh old value	Case 1	• Individual event misfire detection > Threshold	
	Case 2	• Emissions damaging >Threshold	
	Case 3	• Catalyst damaging > Threshold	
Diagnosis time		• Continuous	
MIL ON condition		• 2 driving cycles	

MONITOR SCANTOOL DATA

1. Is the power balance test done?

YES

▶ If injector connector for power balance test is disconnect for over 46 sec., this can cause DTC relating to misfire. Stop the test and connect it and delete DTC and then go to "Verification of Vehicle repair" procedure.
▶ If power balance test is finished within 46 sec., go to next procedure.

NO

▶ Go to "Monitor scantool data" as follows.

2. Monitor scantool data
   (1) Ignition "OFF"
   (2) Connect Scantool and Engine "ON"
   (3) Monitor parameters related to " Cylinder 3 Misfire Detected" on CURRENT DATA
   Specification :

Ignition	BTDC 10° ± 5°		
Idle speed	A/CON OFF	Neutral, N, R, P-range	620 ± 100 rpm
		D-range	
	A/CON ON	Neutral, N, R, P-range	
		D-range	

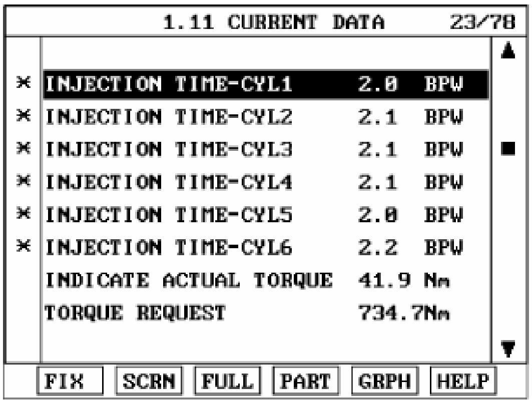


Fig. 1

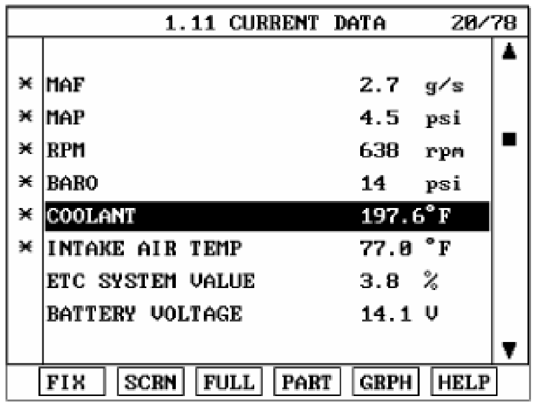


Fig. 2

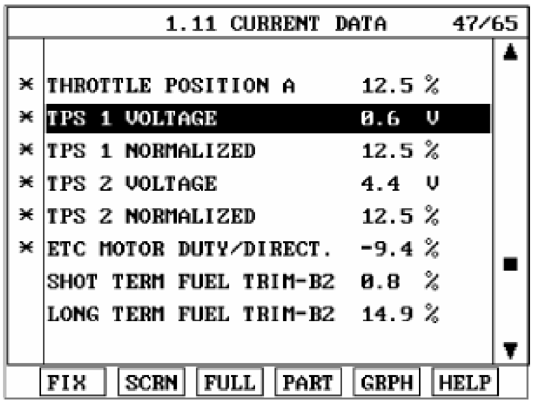


Fig. 3

(4) Are the parameters related to "Cylinder 3 Misfire Detected" displayed correctly on Current Data ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "System Inspection " procedure

SYSTEM INSPECTION

1. Check Spark Pulg
   (1) Remove cylinder's spark plugs
   (2) Visually/physically inspect the following items:
   - Damaged insulation, Worn electrodes, Oil or fuel fouled, Loose terminals and cracks
   - Check for plug gap : 1.0 - 1.1 mm (0.039 - 0.043 in.)
   - Check if the spark plug for the relevant cylinder is lighter in color than the other plugs.

   (3) Has a problem been found in any of the above areas?

   YES

   ▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

   NO

   ▸ Go to "Check Air Leakage " as below

2. Check Air Leakage
   (1) Visually/physically inspect the air leakage in intake/exhaust system as following items,
   - Vacuum hoses for splits, kinks and improper connections.
   - Throttle body gasket
   - Gasket between intake manifold and cylinder head
   - Seals between intake manifold and fuel injectors
   - Exhaust system between HO2S and Three way catalyst for air leakage

   (2) Has a problem been found in any of the above areas?

YES

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Check for air leakage in Positive Crankcase Ventilation Valve(PCV)

3. Check for air leakage in Positive Crankcase Ventilation Valve(PCV)
   (1) Remove PCV valve from cylinder head cover by puling ventilation hose

   (2) With engine idling block PCV valve opening

   (3) Verify that vacuum is felt

   (4) Remove PCV valve

   (5) Blow through valve from prot "A" and verify that air comes out of prot "B"

   (6) Blow through valve from prot "B" and verifty that no air comes out of port "A"

   (7) Has a problem been found ?

YES

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Check Compression pressure" as below

4. Check Compression pressure
   (1) Warm up the engine to normal operating temperature

   (2) Disconnect the spark plug cables and remove the spark plugs.

   (3) Crank the engine to remove any foreign material in the cylinders.

   (4) Put compression pressure gauge into spark pulg hole

   (5) Crank the engine with widely opend throttle valve and check compression pressure at each cylinder

Specification : 1323kPa(13.5 kg/cm²,192 psi)

   (6) Is compression pressure for each cylinder displayed within specifications ?

YES

▸ Go to "Check Timing " as below

NO

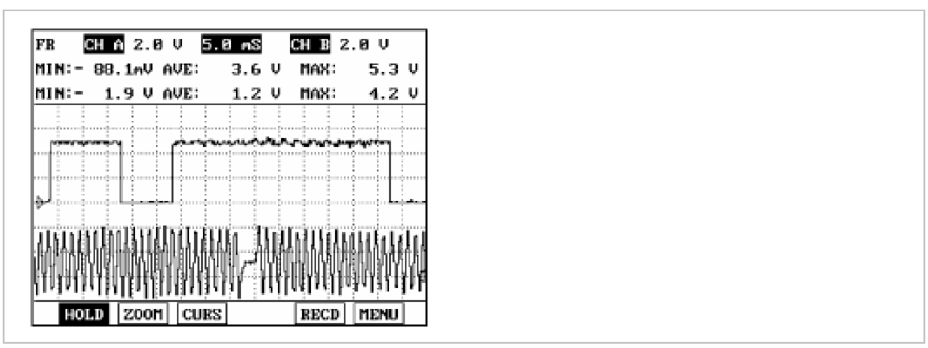
▸ Add a small amount of oil through the spark plug hole, and repeat above steps. If the addition of oil causes the compression to rise, the cause is a worn or damaged piston ring or cylinder inner surface.

▸ If the compression remains the same, the cause is a burnt or defective valve seat, or pressure is leaking from the gasket. Repair as necessary and go to "Verification of Vehicle Repair" procedure

5. Check Timing
   (1) Ignition "OFF"

   (2) Check that Cam, Crank and Oil pump sprocket timing marks are correctly in alignment

   (3) Monitor these signal waveforms from CAM and Crank shaft position Sensor are correctly in alignment



   (4) Are all timing marks alligned correctly ?

YES

▸ Go to "Check Fuel Pressure Test" as below

NO

   (5) ▸ Repair or readjust as necessary and go to "Verification of Vehicle Repair" procedure

6. Check Fuel Pressure Test
   (1) Refer to "Fuel pressure test" in "Fuel delivery system"
   (2) Are the measured fuel pressure within specifications ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Repair or replace as necessary above and then, go to " Verification of Vehicle Repair"procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

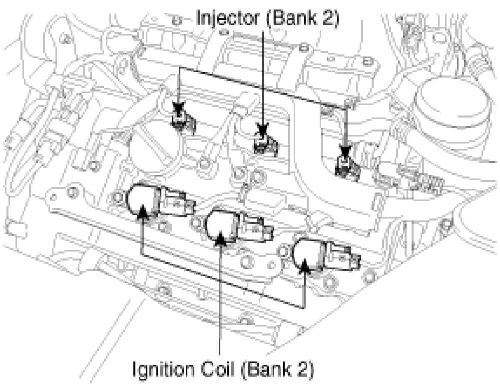
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0304

COMPONENT LOCATION



GENERAL DESCRIPTION

Misfires can be caused by lack of combustion in a cylinder due to absence of spark, poor fuel metering, poor compression, or many other causes. Even a small number of misfires may result in excessive exhaust emissions due to the unburned mixture. Increased misfire rates cause damage to the catalytic converter. The PCM monitors the crankshaft speed variation to determine if any misfiring generated. The PCM identifies the specific cylinder in which the misfire has occurred and counts individual misfire events by monitoring changes in the crankshaft rotation for each cylinder. A random misfire indicates two or more cylinders are misfiring.

DTC DESCRIPTION

The misfire diagnostic measures reference event times and calculates the positive and negative acceleration of the crank wheel to detrmine whether a misfire has occurred.
When the rate of misfire exceeds a threshold where the catalyst reaches a temperature where permanent damage can ocur, to the point that tail pipe emissions reach 1.5 times the tailpipe standard or where a cylinder misfire cause a loss of torque produced from that cylinder. PCM sets P0304. In case that misfire affects Catalyst damage, MIL(Malfunction Indicatin Lamp) will be illuminating

and blinking at 1HZ frequency. However, In case of Indivisual and Emission damaging misfire, MIL will be turned on when the malfunction is detected.
Especially, if injector connector is disconnected for more than 46 sec., PCM sets DTC relating to misfire and conducts the fuel-cut to protect the catalyst.

DTC DETECTING CONDITION

<table>
<tr><th colspan="2">Item</th><th>Detecting Condition</th><th>Possible Cause</th></tr>
<tr><td colspan="2">DTC Strategy</td><td>• determine if a multiple cylinder misfire or a cylinder specific misfire is occurring by monitoring crankshaft acceleration.</td><td rowspan="4"></td></tr>
<tr><td rowspan="3"></td><td>Case 1</td><td>• Misifre Not Delayed (No active delays)
• All delays expired (Misfire Delay Counter = 0)
• Not the Air Conditioning Clutch is changing state
• The number of engine cycles to delay misfire detection after the air conditioner has changed states.</td></tr>
<tr><td>Case 2</td><td>• The number of engine cycles to delay misfire detection if the engine is operating in a region where misfire is undetectable ≥ 10 engine cycles</td></tr>
<tr><td></td><td>• The time that most delays will not be enabled ≥ 10sec
• If the engine load ≥ thrshold(based on vehicle speed) then the engine is considered to beoperation under negative torque conditions
• Number of engine cycles to delay the misfire diagnostic ≥11 engine cycles(if negative torque load condition is detected. Negative torque isdetermined by load conditions less than a 'zero torque' line whichis determined by engine speed and engine coolant temperature.)
• The vehicle is in the manufacturing plant.
• This is not first crank
• Engine Runtime >30
(Amount of time to delay the Misfire Diagnostic on the initial vehicle start when the vehicle is being manufactured in the plant. This delay will only occur once in the life of the vehicle and is used to prevent misfire on the initial start due to a lack of fuel)
• The misfire diagnostic is synchronization with the cam event.
• The number of engine cycles to delay misfire detection if a camsynchronization problem is detected internal to the Misfirediagnostic > 30 engine cyclesIf false information is received, a false misfire could bediagnosed.
• Intrusive diagnostics not enabled (EGRFLOW)
• Number of engine cycles to delay the misfire diagnostic ifany intrusive diagnostic test that could potentially interferewith the misfire diagnostic detectability has been determined to beactive
• Fuel Level(Present) >0.15%
• No fuel level fault
• Vehicle not in plant
• Engine cycles ≥ 500
• All cylinders fueled = 6
• Non in Fuel cut off not DFCO(Decelleration Fuel Cut Off) or not High Vehicle Speed Fuel Shut Off or not High RPM Fuel Shut Off
• Transmission Shift in progress
• Engine cycles ≥ 0
Increasing Throttle
• Current Thorttle opening(WTHROT) >31ms old throttle opening(VVTHROT 31ms old)
• VVTHROT - VVTHROT 31ms old< 64.9994% (Maximum positive delta throttle movement allowed in a 125 ms period</td></tr>
</table>

Enable condition	Case 3	(31.25 ms if using ETC). If the throttle position increases more than this threshold, the misfire diagnostic will be inhibited.) Decreasing Throttle • VVTHROT 31ms old >VVTHROT • VVTHROT 31ms old - VVTHROT < 100% • For engine cycles ≥ 5 • Engine RPM ≥ 7100 • Engine cycles >4999 • Crankshaft speed patterns normal • The seconds that most delays will not be enabled ≥ 10 • The number of consecutive positive delta times< 60 events • For engine cycles ≥ 8 • The number of consecutive negative delta times< 30 events • For engine cycles ≥ 8 • The seconds that most delays will not be enabled ≥ 10 • This is the value which is multiplied The number of consecutive positive delta times with multiple values of the number of consecutive negative delta times and The number of consecutive positive delta times while within the power-up no-delay timer.< 200 * 1 events • For engine cycles ≥ 8 • This is the value which is multiplied The number of consecutive positive delta times with multiple values of the number of consecutive negative delta times and The number of consecutive positive delta times while within the power-up no-delay timer.< 200 * 1 events • For engine cycles ≥ 8 Not negative torque driving conditions • throttle not less than threshold < 0% • while vehicle speed > 511KPH • For engine cycles ≥ 7 Engine Speed with in range • Run Time ≥ 10 • 470 < Engine RPM < 6600 • For engine cycles ≥ 15 • TEC(Tooth Error Correction) factor not learned • RPM >1600 • For engine Cycles ≥ 40 Ignition Voltage in range • Run Time > 10 • 10.9936 < Battery Voltage < 15.9907 • For engine cycles ≥ 15 Coolant Temperature in range If (start up coolant temperature < cold start thresh and coolant temperature greater that after cold start thresh) • Coolant temperature at start-up < -7°C(19.4 °F) • Calculated coolant temperature with default applied > 21°C (69.8 °F) Else if(coolant temperature greater that lo threshold and coolant temperature less than High threshold) • Calculated coolant temperature with default applied > -7°C (19.4 °F) • Calculated coolant temperature with default applied > 120°C(248 °F) • For engine cycles ≥ 15 Power Up delay not active • Run time > 0 Misfire not requesting TCC unlock and TCC still locked • For engine cycles ≥ 0 no disabling faults present / no disabiling Active Faults	• Faulty Spark plugs • Faulty Spark plug cables • Air Leakage • Belt deflection and Air gap of CKPS • Incorrect timing • Faulty injector • Improper fuel pressure • Improper engine compression • Faulty PCM

		• P0340 / P0341 / P0118 / P0117 / P0115 / P0336 / P0335 / P1295 / P0103 / P0102 / 0108 / P0107 / P0106 / P0501 • Run Time< 10 • Engine Load is below zero torque line. • RPM < 1500 • For engine cycles ≥ 11	
Thresh old value	Case 1	• Individual event misfire detection > Threshold	
	Case 2	• Emissions damaging >Threshold	
	Case 3	• Catalyst damaging > Threshold	
Diagnosis time		• Continuous	
MIL ON condition		• 2 driving cycles	

MONITOR SCANTOOL DATA

1. Is the power balance test done?

YES

▸ If injector connector for power balance test is disconnect for over 46 sec., this can cause DTC relating to misfire. Stop the test and connect it and delete DTC and then go to "Verification of Vehicle repair" procedure.

▸ If power balance test is finished within 46 sec., go to next procedure.

NO

▸ Go to "Monitor scantool data" as follows.

2. Monitor scantool data

(1) Ignition "OFF"

(2) Connect Scantool and Engine "ON"

(3) Monitor parameters related to " Cylinder 4 Misfire Detected" on CURRENT DATA

Specification :

Ignition	BTDC 10° ± 5°		
Idle speed	A/CON OFF	Neutral, N, R, P-range	620 ± 100 rpm
		D-range	
	A/CON ON	Neutral, N, R, P-range	
		D-range	

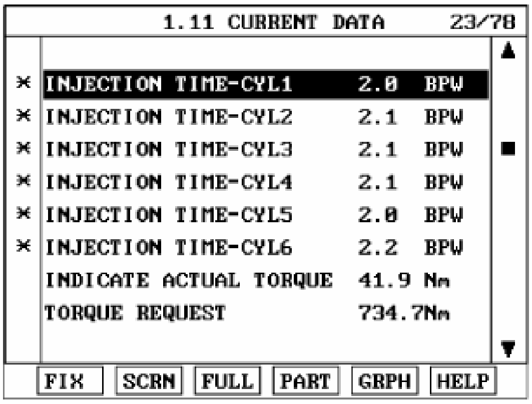


Fig. 1

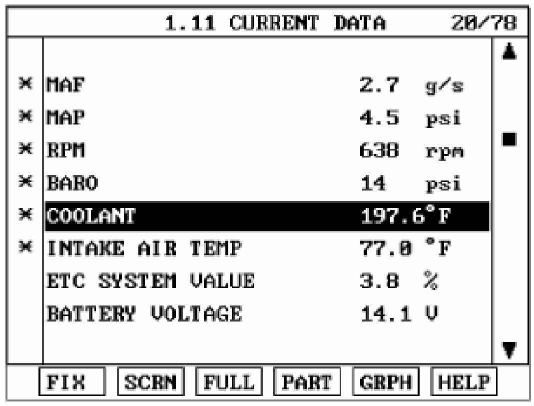


Fig. 2

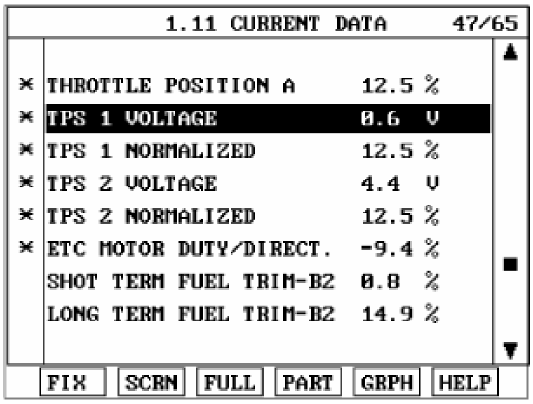


Fig. 3

(4) Are the parameters related to "Cylinder 4 Misfire Detected" displayed correctly on Current Data ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "System Inspection " procedure

SYSTEM INSPECTION

1. Check Spark Pulg
   (1) Remove cylinder’s spark plugs
   (2) Visually/physically inspect the following items:
   - Damaged insulation, Worn electrodes, Oil or fuel fouled, Loose terminals and cracks
   - Check for plug gap : 1.0 - 1.1 mm (0.039 - 0.043 in.)
   - Check if the spark plug for the relevant cylinder is lighter in color than the other plugs.

   (3) Has a problem been found in any of the above areas?

   YES

   ▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

   NO

   ▸ Go to "Check Air Leakage " as below

2. Check Air Leakage
   (1) Visually/physically inspect the air leakage in intake/exhaust system as following items,
   - Vacuum hoses for splits, kinks and improper connections.
   - Throttle body gasket
   - Gasket between intake manifold and cylinder head
   - Seals between intake manifold and fuel injectors
   - Exhaust system between HO2S and Three way catalyst for air leakage

   (2) Has a problem been found in any of the above areas?

YES

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Check for air leakage in Positive Crankcase Ventilation Valve(PCV)

3. Check for air leakage in Positive Crankcase Ventilation Valve(PCV)
   (1) Remove PCV valve from cylinder head cover by puling ventilation hose

   (2) With engine idling block PCV valve opening

   (3) Verify that vacuum is felt

   (4) Remove PCV valve

   (5) Blow through valve from prot "A" and verify that air comes out of prot "B"

   (6) Blow through valve from prot "B" and verifty that no air comes out of port "A"

   (7) Has a problem been found ?

YES

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Check Compression pressure" as below

4. Check Compression pressure
   (1) Warm up the engine to normal operating temperature

   (2) Disconnect the spark plug cables and remove the spark plugs.

   (3) Crank the engine to remove any foreign material in the cylinders.

   (4) Put compression pressure gauge into spark pulg hole

   (5) Crank the engine with widely opend throttle valve and check compression pressure at each cylinder

Specification : 1323kPa(13.5 kg/cm²,192 psi)

   (6) Is compression pressure for each cylinder displayed within specifications ?

YES

▸ Go to "Check Timing " as below

NO

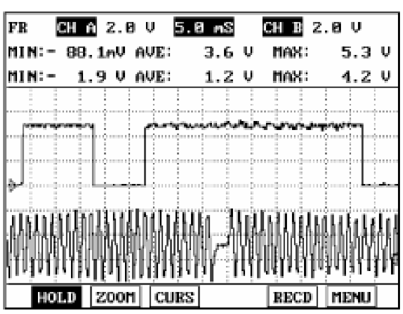
▸ Add a small amount of oil through the spark plug hole, and repeat above steps. If the addition of oil causes the compression to rise, the cause is a worn or damaged piston ring or cylinder inner surface.

▸ If the compression remains the same, the cause is a burnt or defective valve seat, or pressure is leaking from the gasket. Repair as necessary and go to "Verification of Vehicle Repair" procedure

5. Check Timing
   (1) Ignition "OFF"

   (2) Check that Cam, Crank and Oil pump sprocket timing marks are correctly in alignment

   (3) Monitor these signal waveforms from CAM and Crank shaft position Sensor are correctly in alignment



   (4) Are all timing marks alligned correctly ?

YES

▸ Go to "Check Fuel Pressure Test" as below

NO

   (5) ▸ Repair or readjust as necessary and go to "Verification of Vehicle Repair" procedure

6. Check Fuel Pressure Test
   (1) Refer to "Fuel pressure test" in "Fuel delivery system"
   (2) Are the measured fuel pressure within specifications ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Repair or replace as necessary above and then, go to " Verification of Vehicle Repair"procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

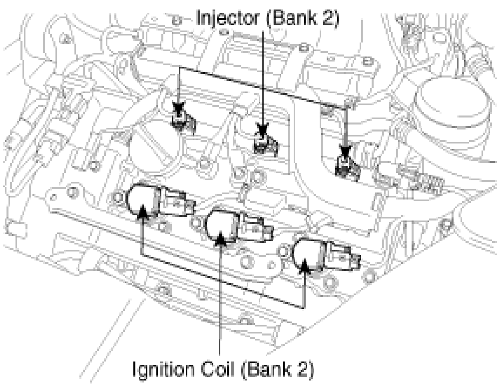
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0305

COMPONENT LOCATION



GENERAL DESCRIPTION

Misfires can be caused by lack of combustion in a cylinder due to absence of spark, poor fuel metering, poor compression, or many other causes. Even a small number of misfires may result in excessive exhaust emissions due to the unburned mixture. Increased misfire rates cause damage to the catalytic converter. The PCM monitors the crankshaft speed variation to determine if any misfiring generated. The PCM identifies the specific cylinder in which the misfire has occurred and counts individual misfire events by monitoring changes in the crankshaft rotation for each cylinder. A random misfire indicates two or more cylinders are misfiring.

DTC DESCRIPTION

The misfire diagnostic measures reference event times and calculates the positive and negative acceleration of the crank wheel to detrmine whether a misfire has occurred.
When the rate of misfire exceeds a threshold where the catalyst reaches a temperature where permanent damage can ocur, to the point that tail pipe emissions reach 1.5 times the tailpipe standard or where a cylinder misfire cause a loss of torque produced from that cylinder. PCM sets P0305. In case that misfire affects Catalyst damage, MIL(Malfunction Indicatin Lamp) will be illuminating

and blinking at 1HZ frequency. However, In case of Indivisual and Emission damaging misfire, MIL will be turned on when the malfunction is detected.
Especially, if injector connector is disconnected for more than 46 sec., PCM sets DTC relating to misfire and conducts the fuel-cut to protect the catalyst.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible Cause
DTC Strategy		• determine if a multiple cylinder misfire or a cylinder specific misfire is occurring by monitoring crankshaft acceleration.	
	Case 1	• Misifre Not Delayed (No active delays) • All delays expired (Misfire Delay Counter = 0) • Not the Air Conditioning Clutch is changing state • The number of engine cycles to delay misfire detection after the air conditioner has changed states.	
	Case 2	• The number of engine cycles to delay misfire detection if the engine is operating in a region where misfire is undetectable ≥ 10 engine cycles	
		• The time that most delays will not be enabled ≥ 10sec • If the engine load ≥ thrshold(based on vehicle speed) then the engine is considered to beoperation under negative torque conditions • Number of engine cycles to delay the misfire diagnostic ≥11 engine cycles(if negative torque load condition is detected. Negative torque isdetermined by load conditions less than a 'zero torque' line whichis determined by engine speed and engine coolant temperature.) • The vehicle is in the manufacturing plant. • This is not first crank • Engine Runtime >30 (Amount of time to delay the Misfire Diagnostic on the initial vehicle start when the vehicle is being manufactured in the plant. This delay will only occur once in the life of the vehicle and is used to prevent misfire on the initial start due to a lack of fuel) • The misfire diagnostic is synchronization with the cam event. • The number of engine cycles to delay misfire detection if a camsynchronization problem is detected internal to the Misfirediagnostic > 30 engine cyclesIf false information is received, a false misfire could bediagnosed. • Intrusive diagnostics not enabled (EGRFLOW) • Number of engine cycles to delay the misfire diagnostic ifany intrusive diagnostic test that could potentially interferewith the misfire diagnostic detectability has been determined to beactive • Fuel Level(Present) >0.15% • No fuel level fault • Vehicle not in plant • Engine cycles ≥ 500 • All cylinders fueled = 6 • Non in Fuel cut off not DFCO(Decelleration Fuel Cut Off) or not High Vehicle Speed Fuel Shut Off or not High RPM Fuel Shut Off • Transmission Shift in progress • Engine cycles ≥ 0 Increasing Throttle • Current Thorttle opening(WTHROT) >31ms old throttle opening(VVTHROT 31ms old) • VVTHROT - VVTHROT 31ms old< 64.9994% (Maximum positive delta throttle movement allowed in a 125 ms period	

Enable condition	Case 3	(31.25 ms if using ETC). If the throttle position increases more than this threshold, the misfire diagnostic will be inhibited.) Decreasing Throttle • VVTHROT 31ms old >VVTHROT • VVTHROT 31ms old - VVTHROT < 100% • For engine cycles ≥ 5 • Engine RPM ≥ 7100 • Engine cycles >4999 • Crankshaft speed patterns normal • The seconds that most delays will not be enabled ≥ 10 • The number of consecutive positive delta times< 60 events • For engine cycles ≥ 8 • The number of consecutive negative delta times< 30 events • For engine cycles ≥ 8 • The seconds that most delays will not be enabled ≥ 10 • This is the value which is multiplied The number of consecutive positive delta times with multiple values of the number of consecutive negative delta times and The number of consecutive positive delta times while within the power-up no-delay timer.< 200 * 1 events • For engine cycles ≥ 8 • This is the value which is multiplied The number of consecutive positive delta times with multiple values of the number of consecutive negative delta times and The number of consecutive positive delta times while within the power-up no-delay timer.< 200 * 1 events • For engine cycles ≥ 8 Not negative torque driving conditions • throttle not less than threshold < 0% • while vehicle speed > 511KPH • For engine cycles ≥ 7 Engine Speed with in range • Run Time ≥ 10 • 470 < Engine RPM < 6600 • For engine cycles ≥ 15 • TEC(Tooth Error Correction) factor not learned • RPM >1600 • For engine Cycles ≥ 40 Ignition Voltage in range • Run Time > 10 • 10.9936 < Battery Voltage < 15.9907 • For engine cycles ≥ 15 Coolant Temperature in range If (start up coolant temperature < cold start thresh and coolant temperature greater that after cold start thresh) • Coolant temperature at start-up < -7°C(19.4 °F) • Calculated coolant temperature with default applied > 21°C (69.8 °F) Else if(coolant temperature greater that lo threshold and coolant temperature less than High threshold) • Calculated coolant temperature with default applied > -7°C (19.4 °F) • Calculated coolant temperature with default applied > 120° C(248 °F) • For engine cycles ≥ 15 Power Up delay not active • Run time > 0 Misfire not requesting TCC unlock and TCC still locked • For engine cycles ≥ 0 no disabling faults present / no disabiling Active Faults	• Faulty Spark plugs • Faulty Spark plug cables • Air Leakage • Belt deflection and Air gap of CKPS • Incorrect timing • Faulty injector • Improper fuel pressure • Improper engine compression • Faulty PCM

		• P0340 / P0341 / P0118 / P0117 / P0115 / P0336 / P0335 / P1295 / P0103 / P0102 / 0108 / P0107 / P0106 / P0501 • Run Time< 10 • Engine Load is below zero torque line. • RPM < 1500 • For engine cycles ≥ 11	
Thresh old value	Case 1	• Individual event misfire detection > Threshold	
	Case 2	• Emissions damaging >Threshold	
	Case 3	• Catalyst damaging > Threshold	
Diagnosis time		• Continuous	
MIL ON condition		• 2 driving cycles	

MONITOR SCANTOOL DATA

1. Is the power balance test done?

YES

▸ If injector connector for power balance test is disconnect for over 46 sec., this can cause DTC relating to misfire. Stop the test and connect it and delete DTC and then go to "Verification of Vehicle repair" procedure.
▸ If power balance test is finished within 46 sec., go to next procedure.

NO

▸ Go to "Monitor scantool data" as follows.

2. Monitor scantool data
   (1) Ignition "OFF"
   (2) Connect Scantool and Engine "ON"
   (3) Monitor parameters related to " Cylinder 5 Misfire Detected" on CURRENT DATA

   Specification :

Ignition	BTDC 10° ± 5°		
Idle speed	A/CON OFF	Neutral, N, R, P-range	620 ± 100 rpm
		D-range	
	A/CON ON	Neutral, N, R, P-range	
		D-range	

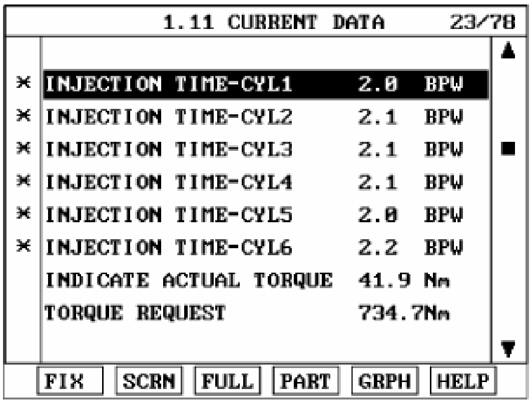


Fig. 1

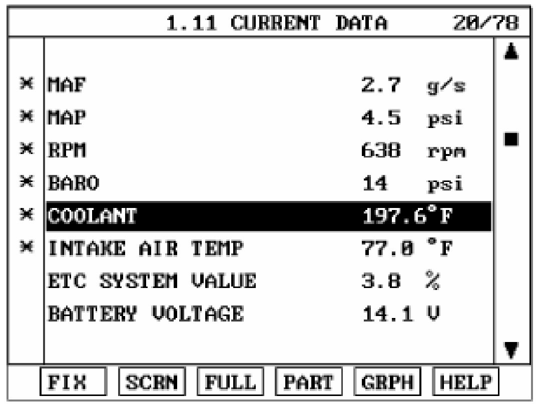


Fig. 2

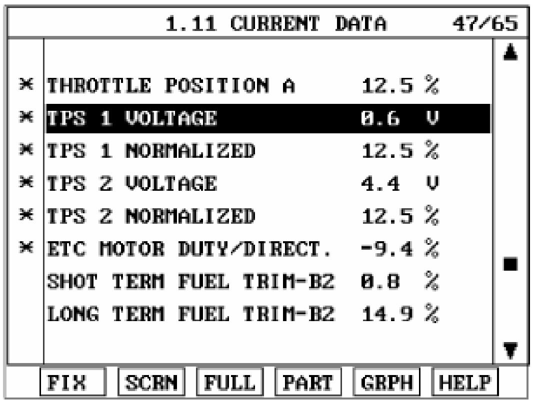


Fig. 3

(4) Are the parameters related to "Cylinder 5 Misfire Detected" displayed correctly on Current Data ?

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▶ Go to "System Inspection " procedure

SYSTEM INSPECTION

1. Check Spark Pulg
   (1) Remove cylinder's spark plugs
   (2) Visually/physically inspect the following items:
   - Damaged insulation, Worn electrodes, Oil or fuel fouled, Loose terminals and cracks
   - Check for plug gap : 1.0 - 1.1 mm (0.039 - 0.043 in.)
   - Check if the spark plug for the relevant cylinder is lighter in color than the other plugs.

   (3) Has a problem been found in any of the above areas?

   YES

   ▶ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

   NO

   ▶ Go to "Check Air Leakage " as below

2. Check Air Leakage
   (1) Visually/physically inspect the air leakage in intake/exhaust system as following items,
   - Vacuum hoses for splits, kinks and improper connections.
   - Throttle body gasket
   - Gasket between intake manifold and cylinder head
   - Seals between intake manifold and fuel injectors
   - Exhaust system between HO2S and Three way catalyst for air leakage

   (2) Has a problem been found in any of the above areas?

YES

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Check for air leakage in Positive Crankcase Ventilation Valve(PCV)

3. Check for air leakage in Positive Crankcase Ventilation Valve(PCV)
   (1) Remove PCV valve from cylinder head cover by puling ventilation hose
   (2) With engine idling block PCV valve opening
   (3) Verify that vacuum is felt
   (4) Remove PCV valve
   (5) Blow through valve from prot "A" and verify that air comes out of prot "B"
   (6) Blow through valve from prot "B" and verifty that no air comes out of port "A"
   (7) Has a problem been found ?

YES

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Check Compression pressure" as below

4. Check Compression pressure
   (1) Warm up the engine to normal operating temperature
   (2) Disconnect the spark plug cables and remove the spark plugs.
   (3) Crank the engine to remove any foreign material in the cylinders.
   (4) Put compression pressure gauge into spark pulg hole
   (5) Crank the engine with widely opend throttle valve and check compression pressure at each cylinder

Specification : 1323kPa(13.5 kg/cm²,192 psi)

   (6) Is compression pressure for each cylinder displayed within specifications ?

YES

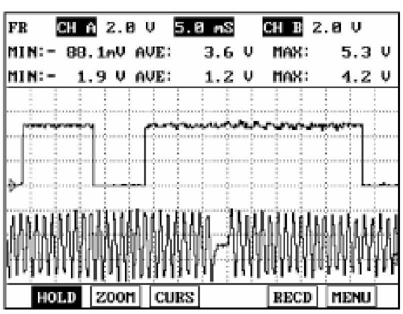
▸ Go to "Check Timing " as below

NO

▸ Add a small amount of oil through the spark plug hole, and repeat above steps. If the addition of oil causes the compression to rise, the cause is a worn or damaged piston ring or cylinder inner surface.

▸ If the compression remains the same, the cause is a burnt or defective valve seat, or pressure is leaking from the gasket. Repair as necessary and go to "Verification of Vehicle Repair" procedure

5. Check Timing
   (1) Ignition "OFF"
   (2) Check that Cam, Crank and Oil pump sprocket timing marks are correctly in alignment
   (3) Monitor these signal waveforms from CAM and Crank shaft position Sensor are correctly in alignment



   (4) Are all timing marks alligned correctly ?

YES

▸ Go to "Check Fuel Pressure Test" as below

NO

   (5) ▸ Repair or readjust as necessary and go to "Verification of Vehicle Repair" procedure

6. Check Fuel Pressure Test
   (1) Refer to "Fuel pressure test" in "Fuel delivery system"
   (2) Are the measured fuel pressure within specifications ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Repair or replace as necessary above and then, go to " Verification of Vehicle Repair"procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

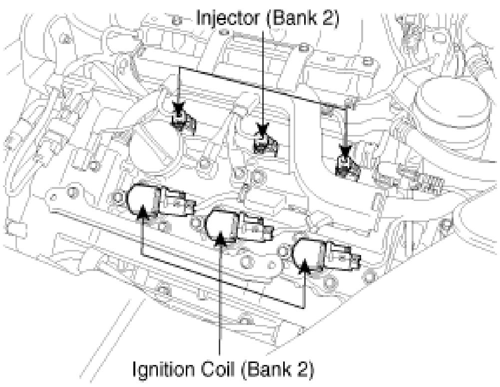
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0306

COMPONENT LOCATION



GENERAL DESCRIPTION

Misfires can be caused by lack of combustion in a cylinder due to absence of spark, poor fuel metering, poor compression, or many other causes. Even a small number of misfires may result in excessive exhaust emissions due to the unburned mixture. Increased misfire rates cause damage to the catalytic converter. The PCM monitors the crankshaft speed variation to determine if any misfiring generated. The PCM identifies the specific cylinder in which the misfire has occurred and counts individual misfire events by monitoring changes in the crankshaft rotation for each cylinder. A random misfire indicates two or more cylinders are misfiring.

DTC DESCRIPTION

The misfire diagnostic measures reference event times and calculates the positive and negative acceleration of the crank wheel to detrmine whether a misfire has occurred.
When the rate of misfire exceeds a threshold where the catalyst reaches a temperature where permanent damage can ocur, to the point that tail pipe emissions reach 1.5 times the tailpipe standard or where a cylinder misfire cause a loss of torque produced from that cylinder. PCM sets P0306. In case that misfire affects Catalyst damage, MIL(Malfunction Indicatin Lamp) will be illuminating

and blinking at 1HZ frequency. However, In case of Indivisual and Emission damaging misfire, MIL will be turned on when the malfunction is detected.
Especially, if injector connector is disconnected for more than 46 sec., PCM sets DTC relating to misfire and conducts the fuel-cut to protect the catalyst.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible Cause
DTC Strategy		• determine if a multiple cylinder misfire or a cylinder specific misfire is occurring by monitoring crankshaft acceleration.	
	Case 1	• Misifre Not Delayed (No active delays) • All delays expired (Misfire Delay Counter = 0) • Not the Air Conditioning Clutch is changing state • The number of engine cycles to delay misfire detection after the air conditioner has changed states.	
	Case 2	• The number of engine cycles to delay misfire detection if the engine is operating in a region where misfire is undetectable ≥ 10 engine cycles	
		• The time that most delays will not be enabled ≥ 10sec • If the engine load ≥ thrshold(based on vehicle speed) then the engine is considered to beoperation under negative torque conditions • Number of engine cycles to delay the misfire diagnostic ≥11 engine cycles(if negative torque load condition is detected. Negative torque isdetermined by load conditions less than a 'zero torque' line whichis determined by engine speed and engine coolant temperature.) • The vehicle is in the manufacturing plant. • This is not first crank • Engine Runtime >30 (Amount of time to delay the Misfire Diagnostic on the initial vehicle start when the vehicle is being manufactured in the plant. This delay will only occur once in the life of the vehicle and is used to prevent misfire on the initial start due to a lack of fuel) • The misfire diagnostic is synchronization with the cam event. • The number of engine cycles to delay misfire detection if a camsynchronization problem is detected internal to the Misfirediagnostic > 30 engine cyclesIf false information is received, a false misfire could bediagnosed. • Intrusive diagnostics not enabled (EGRFLOW) • Number of engine cycles to delay the misfire diagnostic ifany intrusive diagnostic test that could potentially interferewith the misfire diagnostic detectability has been determined to beactive • Fuel Level(Present) >0.15% • No fuel level fault • Vehicle not in plant • Engine cycles ≥ 500 • All cylinders fueled = 6 • Non in Fuel cut off not DFCO(Decelleration Fuel Cut Off) or not High Vehicle Speed Fuel Shut Off or not High RPM Fuel Shut Off • Transmission Shift in progress • Engine cycles ≥ 0 Increasing Throttle • Current Thorttle opening(WTHROT) >31ms old throttle opening(VVTHROT 31ms old) • VVTHROT - VVTHROT 31ms old< 64.9994% (Maximum positive delta throttle movement allowed in a 125 ms period	

Enable condition	Case 3	(31.25 ms if using ETC). If the throttle position increases more than this threshold, the misfire diagnostic will be inhibited.) Decreasing Throttle • VVTHROT 31ms old >VVTHROT • VVTHROT 31ms old - VVTHROT < 100% • For engine cycles ≥ 5 • Engine RPM ≥ 7100 • Engine cycles >4999 • Crankshaft speed patterns normal • The seconds that most delays will not be enabled ≥ 10 • The number of consecutive positive delta times< 60 events • For engine cycles ≥ 8 • The number of consecutive negative delta times< 30 events • For engine cycles ≥ 8 • The seconds that most delays will not be enabled ≥ 10 • This is the value which is multiplied The number of consecutive positive delta times with multiple values of the number of consecutive negative delta times and The number of consecutive positive delta times while within the power-up no-delay timer.< 200 * 1 events • For engine cycles ≥ 8 • This is the value which is multiplied The number of consecutive positive delta times with multiple values of the number of consecutive negative delta times and The number of consecutive positive delta times while within the power-up no-delay timer.< 200 * 1 events • For engine cycles ≥ 8 Not negative torque driving conditions • throttle not less than threshold < 0% • while vehicle speed > 511KPH • For engine cycles ≥ 7 Engine Speed with in range • Run Time ≥ 10 • 470 < Engine RPM < 6600 • For engine cycles ≥ 15 • TEC(Tooth Error Correction) factor not learned • RPM >1600 • For engine Cycles ≥ 40 Ignition Voltage in range • Run Time > 10 • 10.9936 < Battery Voltage < 15.9907 • For engine cycles ≥ 15 Coolant Temperature in range If (start up coolant temperature < cold start thresh and coolant temperature greater that after cold start thresh) • Coolant temperature at start-up < -7°C(19.4 °F) • Calculated coolant temperature with default applied > 21°C (69.8 °F) Else if(coolant temperature greater that lo threshold and coolant temperature less than High threshold) • Calculated coolant temperature with default applied > -7°C (19.4 °F) • Calculated coolant temperature with default applied > 120°C(248 °F) • For engine cycles ≥ 15 Power Up delay not active • Run time > 0 Misfire not requesting TCC unlock and TCC still locked • For engine cycles ≥ 0 no disabling faults present / no disabiling Active Faults	• Faulty Spark plugs • Faulty Spark plug cables • Air Leakage • Belt deflection and Air gap of CKPS • Incorrect timing • Faulty injector • Improper fuel pressure • Improper engine compression • Faulty PCM

		• P0340 / P0341 / P0118 / P0117 / P0115 / P0336 / P0335 / P1295 / P0103 / P0102 / 0108 / P0107 / P0106 / P0501 • Run Time< 10 • Engine Load is below zero torque line. • RPM < 1500 • For engine cycles ≥ 11	
Thresh old value	Case 1	• Individual event misfire detection > Threshold	
	Case 2	• Emissions damaging >Threshold	
	Case 3	• Catalyst damaging > Threshold	
Diagnosis time		• Continuous	
MIL ON condition		• 2 driving cycles	

MONITOR SCANTOOL DATA

1. Is the power balance test done?

YES

▸ If injector connector for power balance test is disconnect for over 46 sec., this can cause DTC relating to misfire. Stop the test and connect it and delete DTC and then go to "Verification of Vehicle repair" procedure.

▸ If power balance test is finished within 46 sec., go to next procedure.

NO

▸ Go to "Monitor scantool data" as follows.

2. Monitor scantool data
   (1) Ignition "OFF"
   (2) Connect Scantool and Engine "ON"
   (3) Monitor parameters related to " Cylinder 6 Misfire Detected" on CURRENT DATA

   Specification :

Ignition	BTDC 10° ± 5°		
Idle speed	A/CON OFF	Neutral, N, R, P-range	620 ± 100 rpm
		D-range	
	A/CON ON	Neutral, N, R, P-range	
		D-range	

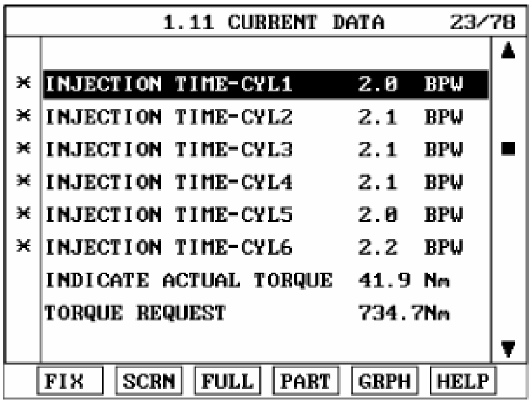


Fig. 1

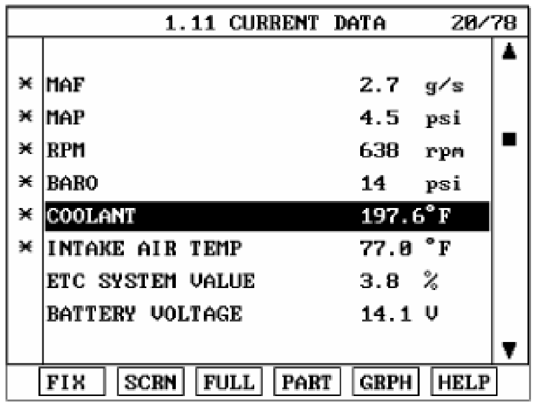


Fig. 2

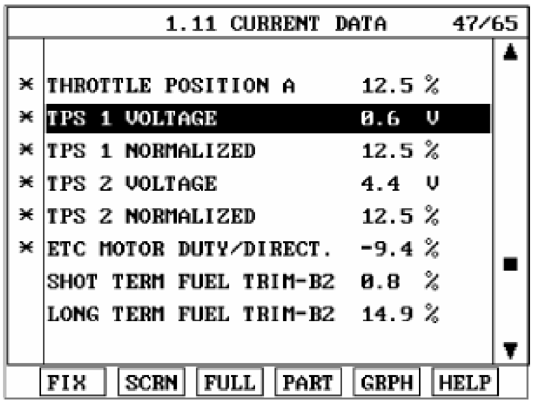


Fig. 3

(4) Are the parameters related to "Cylinder 6 Misfire Detected" displayed correctly on Current Data ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "System Inspection " procedure

SYSTEM INSPECTION

1. Check Spark Pulg
   (1) Remove cylinder's spark plugs
   (2) Visually/physically inspect the following items:
   - Damaged insulation, Worn electrodes, Oil or fuel fouled, Loose terminals and cracks
   - Check for plug gap : 1.0 - 1.1 mm (0.039 - 0.043 in.)
   - Check if the spark plug for the relevant cylinder is lighter in color than the other plugs.

   (3) Has a problem been found in any of the above areas?

   YES

   ▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

   NO

   ▸ Go to "Check Air Leakage " as below

2. Check Air Leakage
   (1) Visually/physically inspect the air leakage in intake/exhaust system as following items,
   - Vacuum hoses for splits, kinks and improper connections.
   - Throttle body gasket
   - Gasket between intake manifold and cylinder head
   - Seals between intake manifold and fuel injectors
   - Exhaust system between HO2S and Three way catalyst for air leakage

   (2) Has a problem been found in any of the above areas?

YES

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Check for air leakage in Positive Crankcase Ventilation Valve(PCV)

3. Check for air leakage in Positive Crankcase Ventilation Valve(PCV)
   (1) Remove PCV valve from cylinder head cover by puling ventilation hose

   (2) With engine idling block PCV valve opening

   (3) Verify that vacuum is felt

   (4) Remove PCV valve

   (5) Blow through valve from prot "A" and verify that air comes out of prot "B"

   (6) Blow through valve from prot "B" and verifty that no air comes out of port "A"

   (7) Has a problem been found ?

YES

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Check Compression pressure" as below

4. Check Compression pressure
   (1) Warm up the engine to normal operating temperature

   (2) Disconnect the spark plug cables and remove the spark plugs.

   (3) Crank the engine to remove any foreign material in the cylinders.

   (4) Put compression pressure gauge into spark pulg hole

   (5) Crank the engine with widely opend throttle valve and check compression pressure at each cylinder

---

Specification : 1323kPa(13.5 kg/cm²,192 psi)

---

   (6) Is compression pressure for each cylinder displayed within specifications ?

YES

▸ Go to "Check Timing " as below

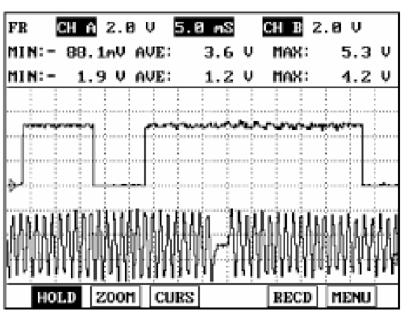
NO

▸ Add a small amount of oil through the spark plug hole, and repeat above steps. If the addition of oil causes the compression to rise, the cause is a worn or damaged piston ring or cylinder inner surface.
▸ If the compression remains the same, the cause is a burnt or defective valve seat, or pressure is leaking from the gasket. Repair as necessary and go to "Verification of Vehicle Repair" procedure

5. Check Timing
   (1) Ignition "OFF"

   (2) Check that Cam, Crank and Oil pump sprocket timing marks are correctly in alignment

   (3) Monitor these signal waveforms from CAM and Crank shaft position Sensor are correctly in alignment



   (4) Are all timing marks alligned correctly ?

YES

▸ Go to "Check Fuel Pressure Test" as below

NO

   (5) ▸ Repair or readjust as necessary and go to "Verification of Vehicle Repair" procedure

6. Check Fuel Pressure Test
   (1) Refer to "Fuel pressure test" in "Fuel delivery system"
   (2) Are the measured fuel pressure within specifications ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Repair or replace as necessary above and then, go to " Verification of Vehicle Repair"procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

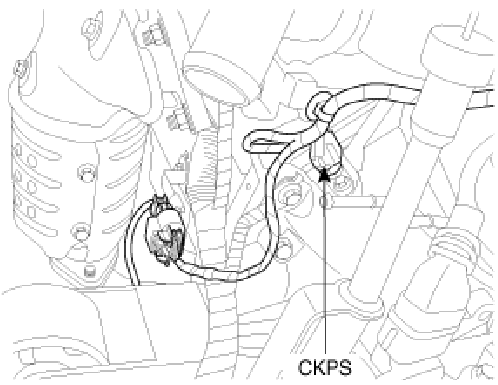
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0315

COMPONENT LOCATION



GENERAL DESCRIPTION

The Tooth Error Correction (TEC) Learn Algorithm determines engine-specific variation in crankshaft position sensing. The largest factor of variation is geometric tooth spacing although other factors, such as bearing run out, may also be present. Once TEC is learned, compensation factors are then calculated and used by the Misfire Diagnostic algorithm to improve the accuracy of engine positiondeterminations.Tooth error correction factors are normally learned only once during the life of a vehicle. However, if a vehicle controller, engine crankshaft, target wheel, or crank sensor is replaced or serviced, tooth error correction factors must be re-learned. This can be performed in a service environment with serial data commands.

DTC DESCRIPTION

It is impossible to forge or machine a perfectly proportioned crankshaft wheel. Therefore, each crankshaft wheel produced will have minor variations in the spacing and/or width of its gear teeth.These variations (tooth error), if not compensated for, can cause false misfire detection. In order to account for tooth error, the tooth error correction algorithm measures the variation in crankshaft wheel teeth and calculates a compensation factor, which is applied to the reference periods when the misfire detection algorithm runs. This compensation factor is learned once, early in the life of the vehicle, and need never be learned again unless the crank

wheel is replaced or the vehicle's PCM EEPROM or similar storage device is erased.
Checking tooth error correction under detecting condition, if the TEC is out of Threshold value, PCM sets P0315.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• This DTC indicates that crankwheel tooth error has not been learned.	• CKPS • Target wheel • PCM
Enable Conditions	• 11.4932 ≤ Ignition Voltage ≤15.9907 • 10.0006 ≤ Engine load< 89.9993 • 2000 ≤ engine speed ≤ 4000 • Vehicle speed < 5kph(3.106856 mph) • Tec RPM stability timer >10sec • 0°C(32°F)< coolant temp< 110°C(230°F) • Not active disabling faults • Not key on disabling faults	
Threshold value	• Distance driven without learning tooth error ≥ 4000km (2485.484769 mile) • Maximum allowed number of tooth error correction samples taken in the On The Road(OTR)learning mode< 50 counts • Individual tooth error factors outside calibratable range = True • Sum of tooth error factors variation outside calibratable range ≥ 50 counts	
Diagnosis Time	• Continuous (More than 0.15sec failure)	
MIL On Condition	• DTC only	

COMPONENT INSPECTION

1. Visually check CKPS and target wheel
   (1) IG "OFF"
   (2) Check CKPS and target wheel for deformation or damage visually
   (3) Is the above items normal ?

   YES

   ▸ Go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

   > **NOTE**
   >
   > There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

   YES

   ▸ Go to the applicable troubleshoooting procedure.

   NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0325

COMPONENT LOCATION

GENERAL DESCRIPTION

Knocking is a phenomenon characterized by undesirable vibration and noise that can cause engine damage. A knock sensor (KS) is mounted on the cylinder block and senses engine knocking. A knocking vibration from the cylinder block is applied as pressure to the piezoelectric element. A knock sensor (KS) detects vibration when RPM rises or drops and generates voltages based on this vibration. The PCM controls the ignition timing based on the amplitude and frequency of the knock sensor signal. For example, if engine knocking occurs, the ignition timing is retarded to prevent it.

DTC DESCRIPTION

Checking the range of input signal with a knock sensor under detecting condition, PCM senses open or short in knock sensor circuit or malfunction of sensor. If a knock signal or noise level is without the specified value during standard duration, PCM sets P0325. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Signal open	• Poor connection • Open in harness • Knock sensor • PCM
Enable Conditions	• Pressure in intake manifold is normal. • Engine speed ≤ 1600rpm	
Threshold value	• Filter coefficient < 0.8	
Diagnosis Time	• Continuous (More than 12.5 sec.failure for every 25 sec.test)	
MIL On Condition	• 2 driving cycles	

SIGNAL WAVEFROM AND DATA

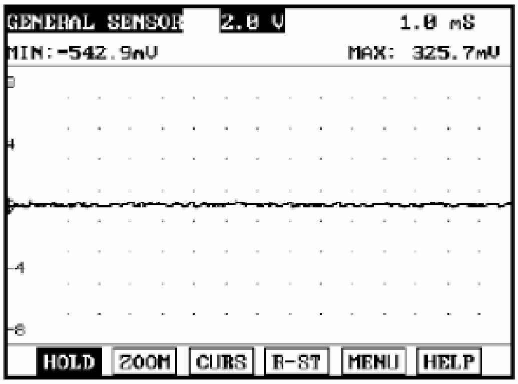
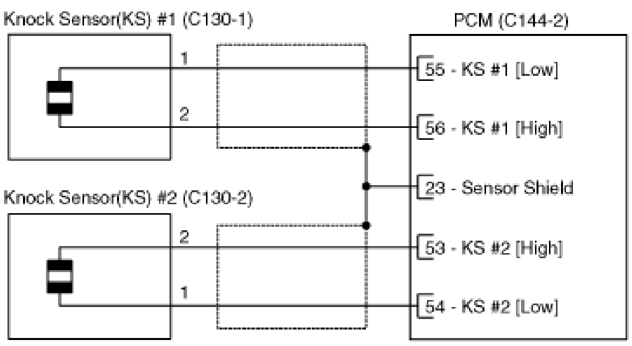


Fig. 1

The knock sensor is installed at cycliner block to detect the vibration effectively during engine running.
The above waveform shows the signal waveform of knock sensor when knock dosen't happen. Generally, knock signal has more noise than other sensor.

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

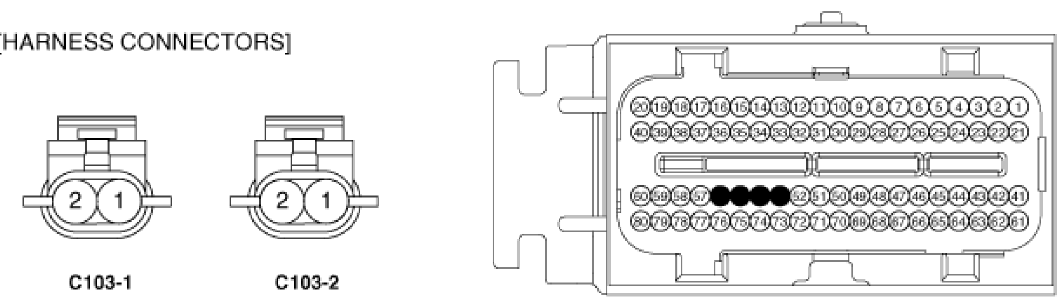
KS #1 (Cyl. #4,5,6)

Terminal	Connected to	Funtion
1	PCM C144-2 (55)	KS #1 [Low] signal
2	PCM C144-2 (56)	KS #1 [High] signal

KS #2 (Cyl. #1,2,3)

Terminal	Connected to	Funtion
1	PCM C144-2 (54)	KS #2 [Low] signal
2	PCM C144-2 (53)	KS #2 [High] signal

[HARNESS CONNECTORS]



C103-1

KS #1

C103-2

KS #2

C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor item related to knock sensor on the service data.

Normal data at idle

4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

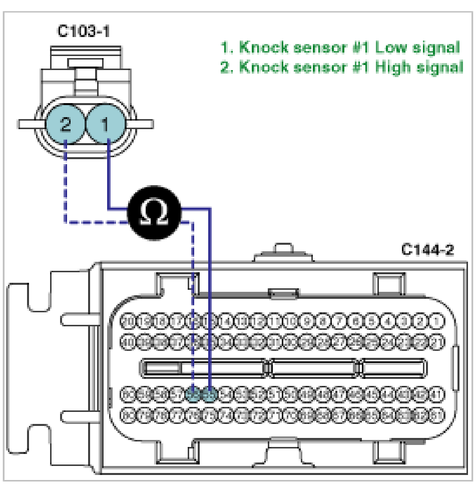
1. Check open in harness

(1) IG "OFF" and disconnect knock sensor connector and PCM connector.

(2) Measure resistance between terminal 1 of knock sensor harness connector and terminal 55 of PCM harness connector.

(3) Measure resistance between terminal 2 of knock sensor harness connector and terminal 56 of PCM harness connector.

Specification : Below 1Ω



(4) Is the measured resistance within specification?

YES

- If the problem is corrected after substituting with a known - good knock sensor, replace it. If the problem is pending, check for proper operating after substituting with a known - good PCM. and then if the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

- Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

- Go to the applicable troubleshoooting procedure.

NO

- System is performing to specification at this time.

Fuel System > Troubleshooting > P0326

COMPONENT LOCATION

GENERAL DESCRIPTION

Knocking is a phenomenon characterized by undesirable vibration and noise that can cause engine damage. A knock sensor (KS) is mounted on the cylinder block and senses engine knocking. A knocking vibration from the cylinder block is applied as pressure to the piezoelectric element. A knock sensor (KS) detects vibration when RPM rises or drops and generates voltages based on this vibration. The PCM controls the ignition timing based on the amplitude and frequency of the knock sensor signal. For example, if engine knocking occurs, the ignition timing is retarded to prevent it.

DTC DESCRIPTION

Checking the range of input signal with a knock sensor under detecting condition, PCM senses open or short in knock sensor circuit or malfunction of sensor. If a knock signal or noise level is without the specified value during standard duration, PCM sets P0326. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy		

	• Signal short	• Poor connection • Short in harness • Knock sensor • PCM
Enable Conditions	• Pressure in intake manifold is normal. • Engine speed ≤ 1600rpm	
Threshold value	• Knock Filtered Value < 5 or > 65	
Diagnosis Time	• Continuous (More than 12.5 sec.failure for every 25 sec.test)	
MIL On Condition	• 2 driving cycles	

SIGNAL WAVEFROM AND DATA

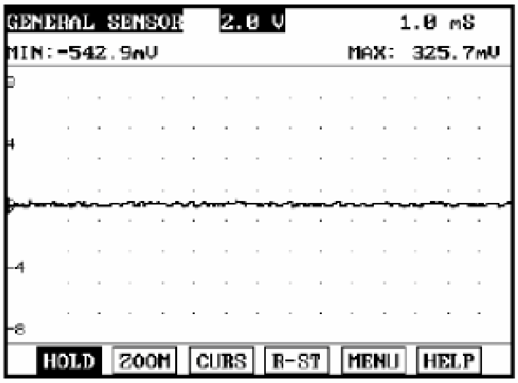
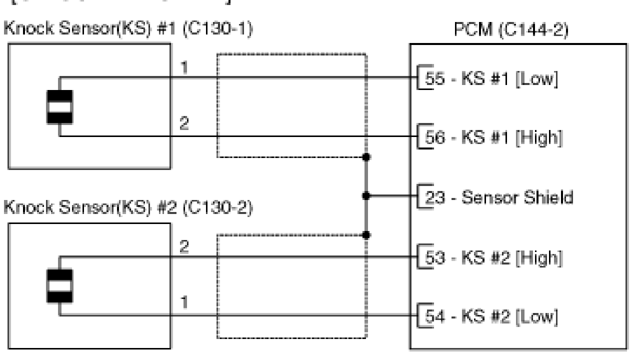


Fig. 1

The knock sensor is installed at cycliner block to detect the vibration effectively during engine running.
The above waveform shows the signal waveform of knock sensor when knock dosen't happen. Generally, knock signal has more noise than other sensor.

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

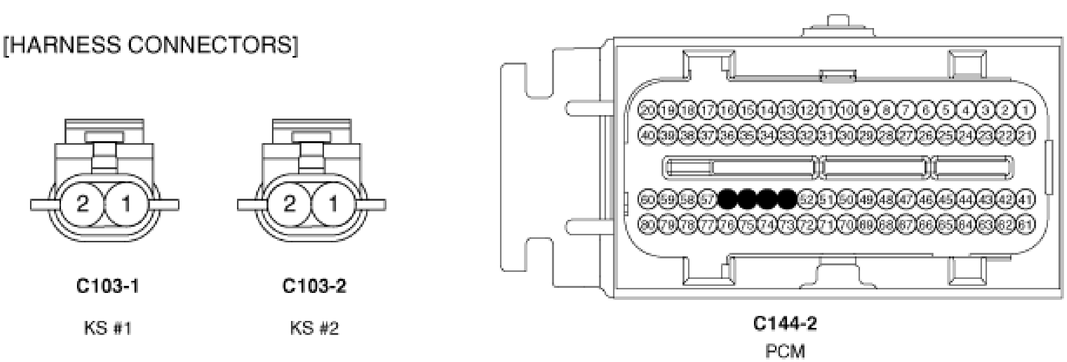
KS #1 (Cyl. #4,5,6)

Terminal	Connected to	Funtion
1	PCM C144-2 (55)	KS #1 [Low] signal
2	PCM C144-2 (56)	KS #1 [High] signal

KS #2 (Cyl. #1,2,3)

Terminal	Connected to	Funtion
1	PCM C144-2 (54)	KS #2 [Low] signal
2	PCM C144-2 (53)	KS #2 [High] signal

[HARNESS CONNECTORS]



MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.

2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor item related to knock sensor on the service data.

Normal data at idle

4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

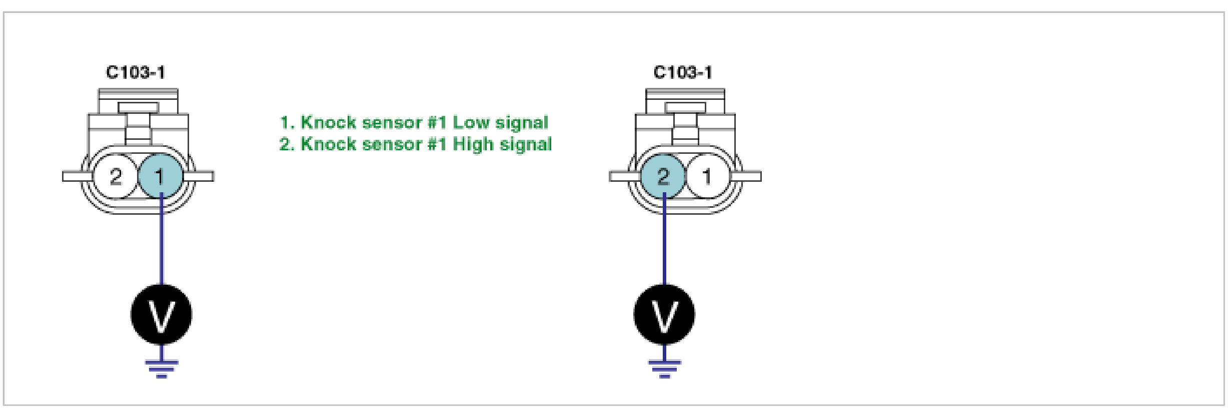
NO

▸ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check short to battery in harness
   (1) IG "OFF" and disconnect knock sensor connector.
   (2) IG "ON" and ENG "OFF"
   (3) Measure voltage between terminal 1 of knock sensor harness connector and chassis ground.
   (4) Measure voltage between terminal 2 of knock sensor harness connector and chassis ground.

Specification : Approx. 1.5V



   (5) Is the measured voltage within specification?

YES

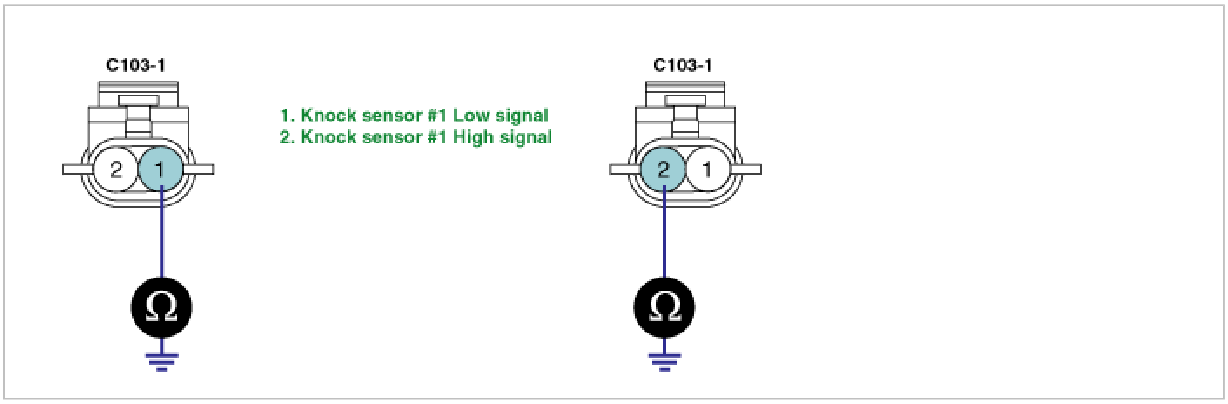
▸ Go to "Check short to ground in harness" as follows.

NO

▸ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check short to ground in harness
   (1) IG "OFF" and disconnect knock sensor connector and PCM connector.
   (2) Measure resistance between terminal 1 of knock sensor harness connector and chassis ground.
   (3) Measure resistance between terminal 2 of knock sensor harness connector and chassis ground.

Specification : Infinite



   (4) Is the measured resistance within specification ?

YES

▸ If the problem is corrected after substituting with a known - good knock sensor, replace it. If the problem is pending, check for proper operating after substituting with a known - good PCM. and then if the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0330

COMPONENT LOCATION

GENERAL DESCRIPTION

Knocking is a phenomenon characterized by undesirable vibration and noise that can cause engine damage. A knock sensor (KS) is mounted on the cylinder block and senses engine knocking. A knocking vibration from the cylinder block is applied as pressure to the piezoelectric element. A knock sensor (KS) detects vibration when RPM rises or drops and generates voltages based on this vibration. The PCM controls the ignition timing based on the amplitude and frequency of the knock sensor signal. For example, if engine knocking occurs, the ignition timing is retarded to prevent it.

DTC DESCRIPTION

Checking the range of input signal with a knock sensor under detecting condition, PCM senses open or short in knock sensor circuit or malfunction of sensor. If a knock signal or noise level is without the specified value during standard duration, PCM sets P0330. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Signal open	• Poor connection • Open in harness • Knock sensor • PCM
Enable Conditions	• Pressure in intake manifold is normal. • Engine speed ≤ 1600rpm	
Threshold value	• Filter coefficient < 0.8	
Diagnosis Time	• Continuous (More than 12.5 sec.failure for every 25 sec.test)	
MIL On Condition	• 2 driving cycles	

SIGNAL WAVEFROM AND DATA

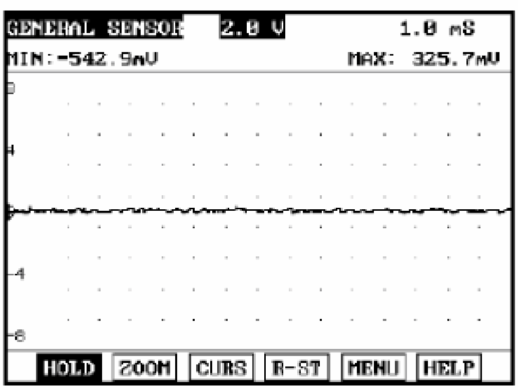
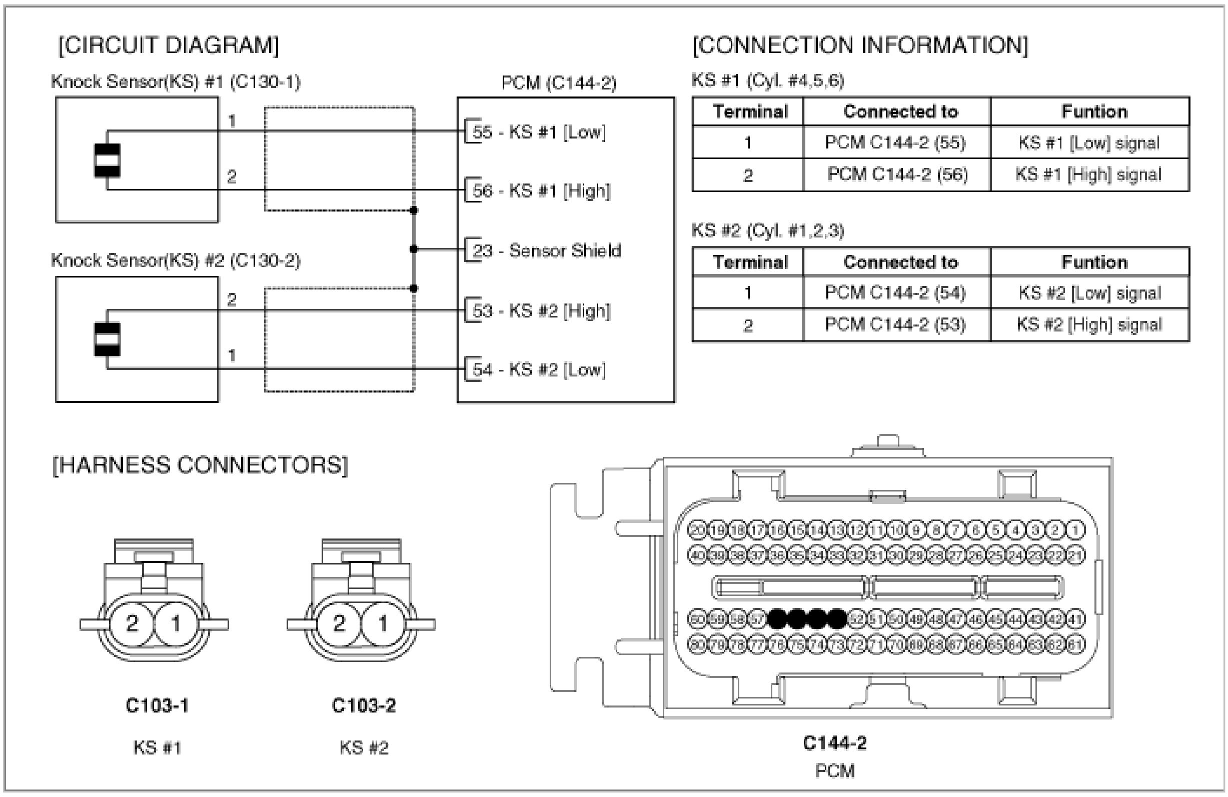


Fig. 1

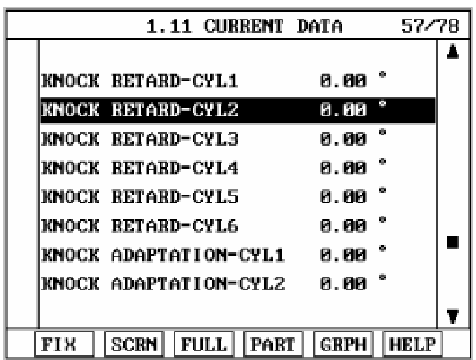
The knock sensor is installed at cycliner block to detect the vibration effectively during engine running.
The above waveform shows the signal waveform of knock sensor when knock dosen't happen. Generally, knock signal has more noise than other sensor.

SCHEMATIC DIAGRAM



MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor item related to knock sensor on the service data.



Normal data at idle

4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

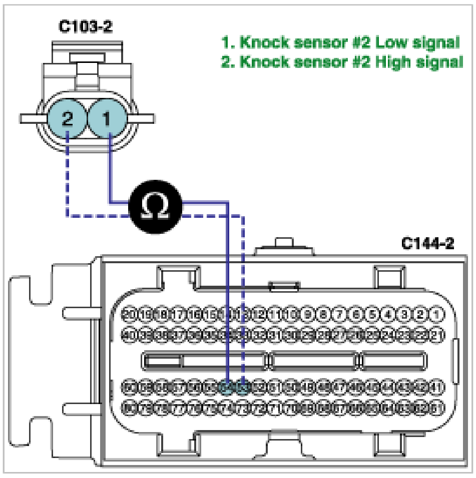
NO

▸ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check open in harness
   (1) IG "OFF" and disconnect knock sensor connector and PCM connector.
   (2) Measure resistance between terminal 1 of knock sensor harness connector and terminal 54 of PCM harness connector.
   (3) Measure resistance between terminal 2 of knock sensor harness connector and terminal 53 of PCM harness connector.

Specification : Below 1Ω



   (4) Is the measured resistance within specification?

YES

▸ If the problem is corrected after substituting with a known - good knock sensor, replace it. If the problem is pending, check for proper operating after substituting with a known - good PCM. and then if the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0331

COMPONENT LOCATION

GENERAL DESCRIPTION

Knocking is a phenomenon characterized by undesirable vibration and noise that can cause engine damage. A knock sensor (KS) is mounted on the cylinder block and senses engine knocking. A knocking vibration from the cylinder block is applied as pressure to the piezoelectric element. A knock sensor (KS) detects vibration when RPM rises or drops and generates voltages based on this vibration. The PCM controls the ignition timing based on the amplitude and frequency of the knock sensor signal. For example, if engine knocking occurs, the ignition timing is retarded to prevent it.

DTC DESCRIPTION

Checking the range of input signal with a knock sensor under detecting condition, PCM senses open or short in knock sensor circuit or malfunction of sensor. If a knock signal or noise level is without the specified value during standard duration, PCM sets P0331. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Signal short	• Poor connection • Short in harness • Knock sensor • PCM
Enable Conditions	• Pressure in intake manifold is normal. • Engine speed ≤ 1600rpm	
Threshold value	• Knock Filtered Value < 5 or > 65	
Diagnosis Time	• Continuous (More than 12.5 sec.failure for every 25 sec.test)	
MIL On Condition	• 2 driving cycles	

SIGNAL WAVEFROM AND DATA

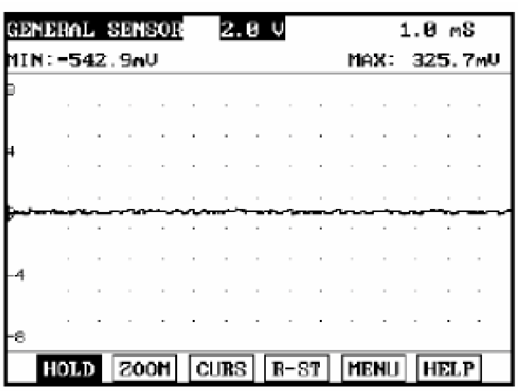
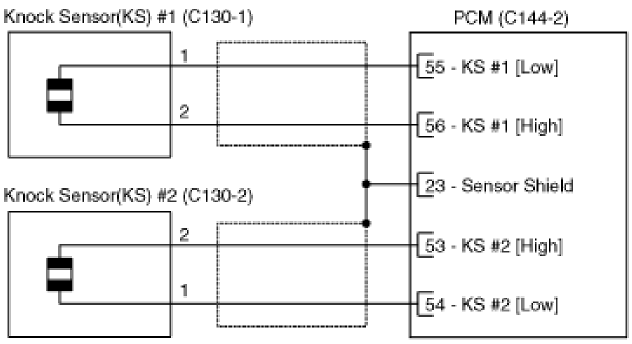


Fig. 1

The knock sensor is installed at cycliner block to detect the vibration effectively during engine running.
The above waveform shows the signal waveform of knock sensor when knock dosen't happen. Generally, knock signal has more noise than other sensor.

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

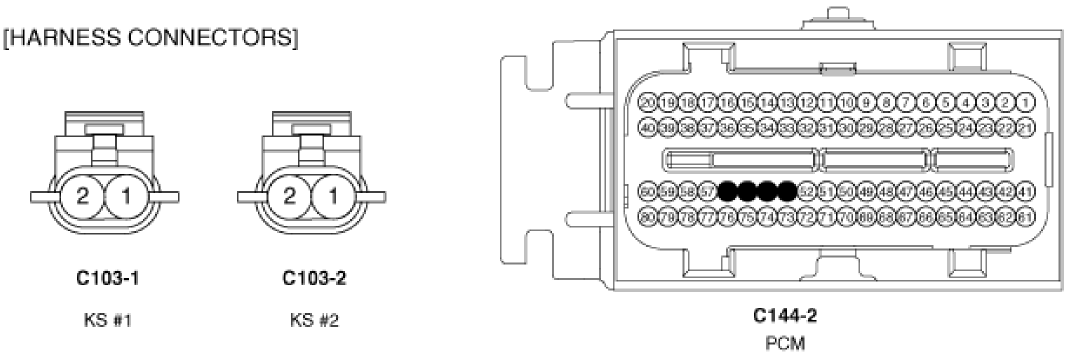
KS #1 (Cyl. #4,5,6)

Terminal	Connected to	Funtion
1	PCM C144-2 (55)	KS #1 [Low] signal
2	PCM C144-2 (56)	KS #1 [High] signal

KS #2 (Cyl. #1,2,3)

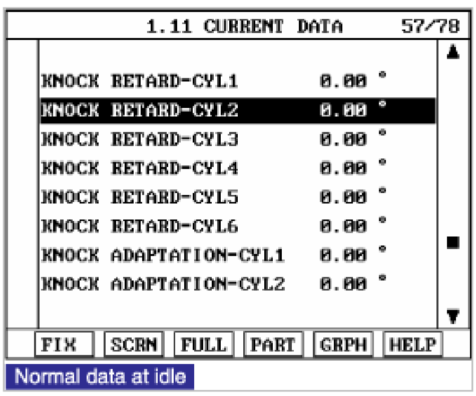
Terminal	Connected to	Funtion
1	PCM C144-2 (54)	KS #2 [Low] signal
2	PCM C144-2 (53)	KS #2 [High] signal

[HARNESS CONNECTORS]



MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor item related to knock sensor on the service data.



4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

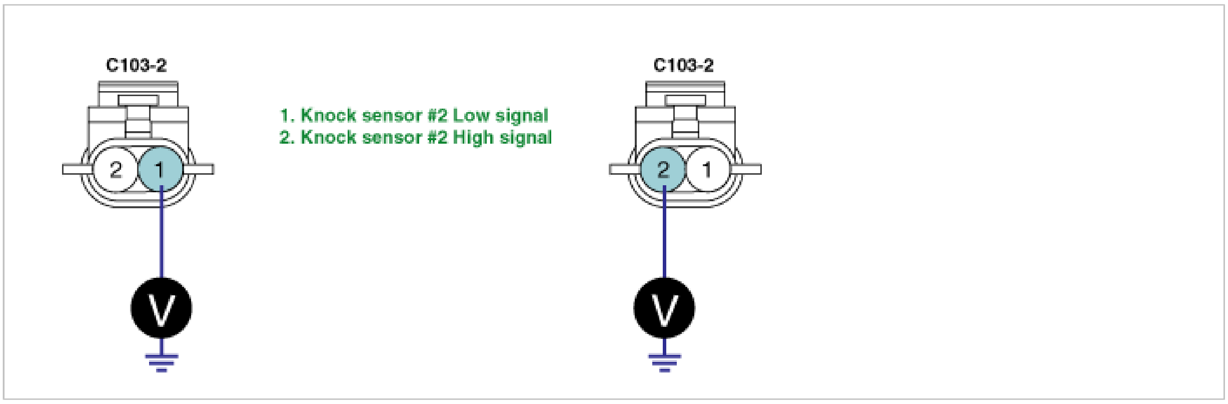
NO

▸ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check short to battery in harness
   (1) IG "OFF" and disconnect knock sensor connector.
   (2) IG "ON" and ENG "OFF"
   (3) Measure voltage between terminal 1 of knock sensor harness connector and chassis ground
   (4) Measure voltage between terminal 2 of knock sensor harness connector and chassis ground.

   Specification : Approx. 1.5V



   (5) Is the measured voltage within specification?

   YES

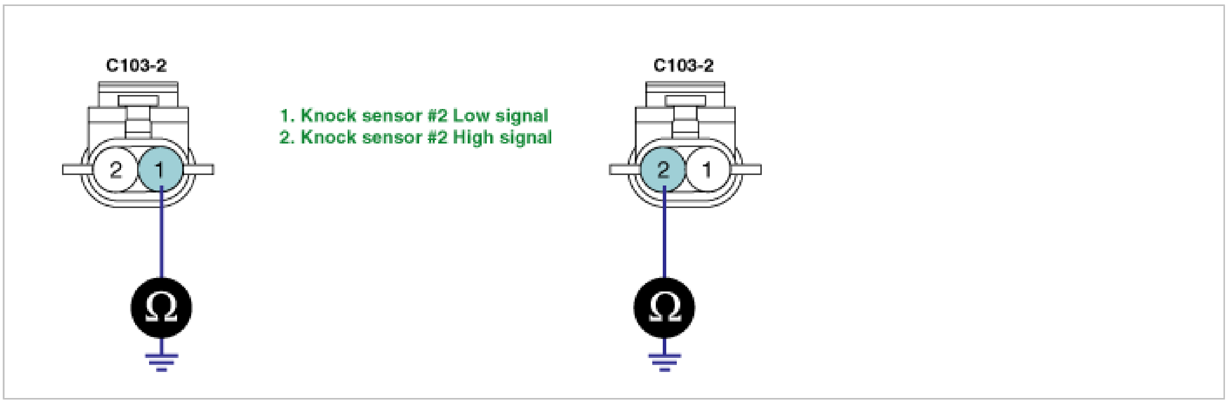
   ▸ Go to "Check short to ground in harness" as follows.

   NO

   ▸ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check short to ground in harness
   (1) IG "OFF" and disconnect knock sensor connector and PCM connector.
   (2) Measure resistance between terminal 1 of knock sensor harness connector and chassis ground.
   (3) Measure resistance between terminal 2 of knock sensor harness connector and chassis ground.

   Specification : Infinite



   (4) Is the measured resistance within specification?

   YES

   ▸ If the problem is corrected after substituting with a known - good knock sensor, replace it. If the problem is pending, check for proper operating after substituting with a known - good PCM. and then if the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

   NO

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

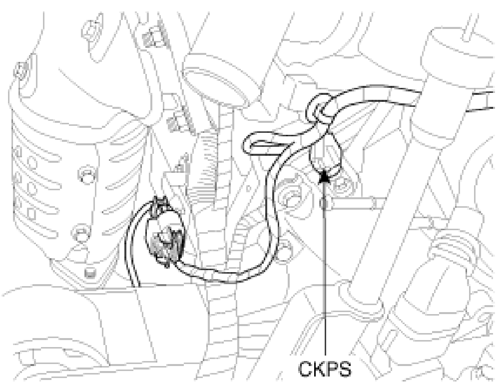
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0335

COMPONENT LOCATION



GENERAL DESCRIPTION

Crankshaft Position Sensor (58X) derives its name from the fact that current systems utilize a Crankshaft Position Sensor, coupled with a 58-tooth crankshaft wheel, to determine crankshaft angular position. Each edge of the wheel corresponds to a change in crank sensor output voltage as a tooth edge passes the sensor. The sensor will produce 58 pulses with one rotation of the crankshaft.

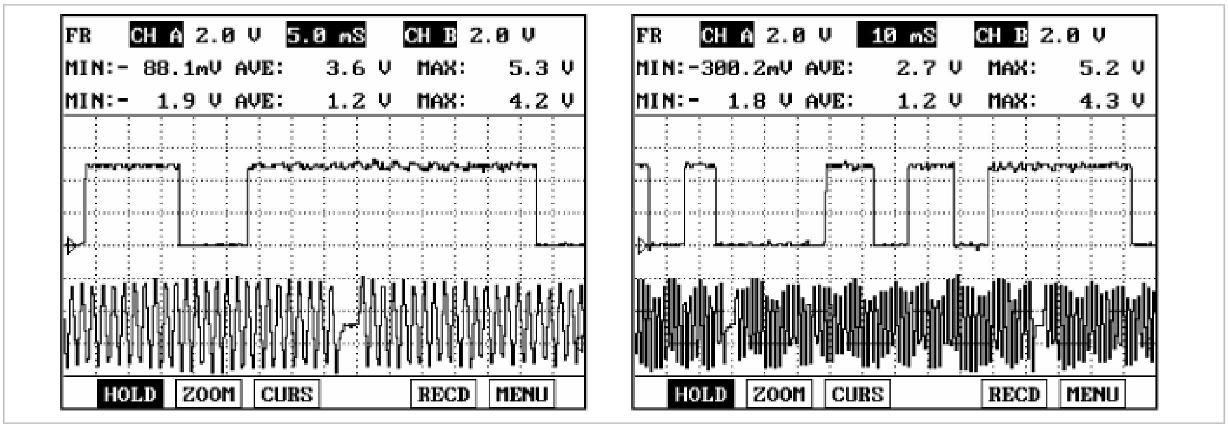
DTC DESCRIPTION

Checking reference signals from CKPS under detecting condition, if any signal is detected for more than 0.15 sec., PCM sets P0335. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Check reference wave during cranking	• Poor connection • Open in harness • CKP sensor • PCM
Enable Conditions	• IG "ON", Cranking or engine-off during driving • No DTC related to CAM	
Threshold value	• No reference signal over 0.15 sec.	
Diagnosis Time	• 0.15 sec.	
MIL On Condition	• 2 driving cycles	

SIGNAL WAVEFROM AND DATA



SPECIFICATION

Resistance	700 ± 70Ω

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]

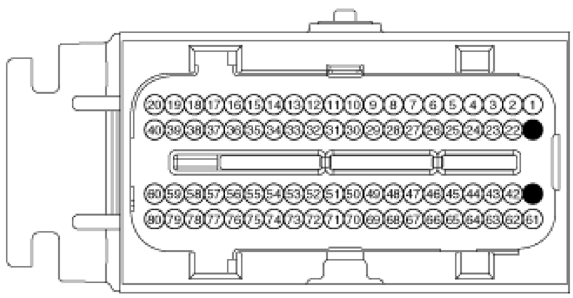
[CONNECTION INFORMATION]

Terminal	Connected to	Funtion
1	PCM C144-2 (41)	CKPS [LOW] Signal
2	PCM C144-2 (21)	CKPS [HIGH] Signal

[HARNESS CONNECTORS]

C129

CKPS



C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor engine speed item on the service data.

Specification : 620 ± 100 rpm

4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

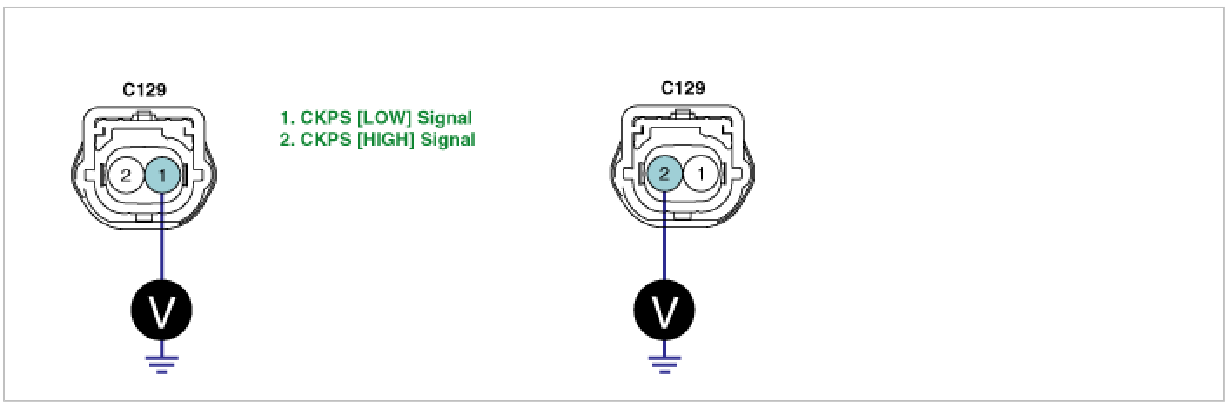
NO

▸ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF" and disconnect CKPS connector.
   (2) IG "ON" and ENG "OFF"
   (3) Measure voltage between terminal 1 of CKPS harness connector and chassis ground.
   (4) Measure voltage between terminal 2 of CKPS harness connector and chassis ground.

Specification : Approx. 1.4V



(5) Is the measured voltage within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Go to "Check openn in harness" as follows.

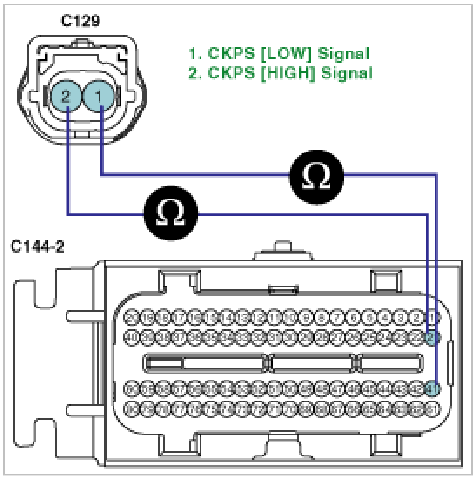
2. Check open in harness

(1) IG "OFF" and disconnect CKPS connector and PCM connector.

(2) Measure resistance between terminal 1 of CKPS harness connector and terminal 41 of PCM harness connector.

(3) Measure resistance between terminal 2 of CKPS harness connector and terminal 21 of PCM harness connector.

Specification : Below 1Ω



(4) Is the measured resistance within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

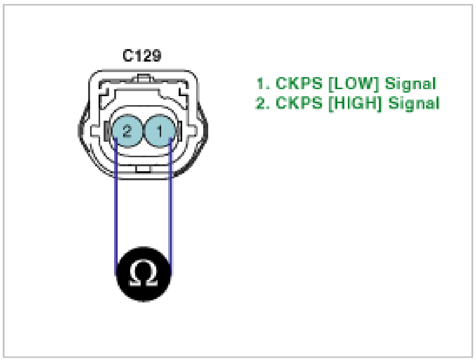
1. Check CKPS

(1) IG "OFF" and disconnect CKPS connector.

(2) Measure resistance between terminals 1 and 2 of CKPS connector.(Component side)

Specifiation :

Resistance	700 ± 70Ω



(3) Is the measured resistance within specification?

YES

▸ Go to "Check signal waveform of CKPS" as follows.

NO

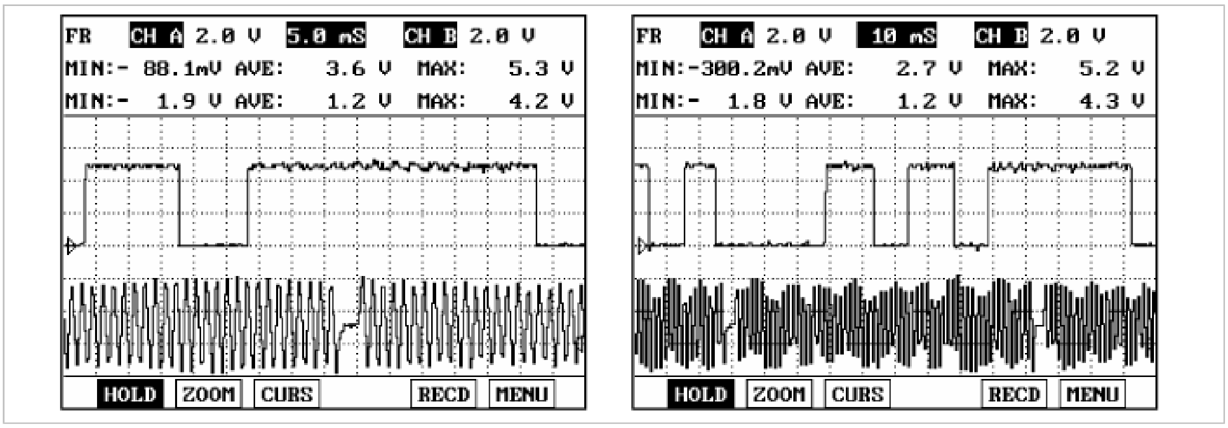
▸ Substitute with a known - good CKPS and check for proper operation. If the problem is corrected, replace CKPS and go to "Verification of Vehicle Repair" procedure.

2. Check signal waveform of CKPS

(1) IG "OFF" and connect scantool.

(2) ENG "ON" and Measure signal waveform at terminal 1 or 2 of CKPS.

Reference signal waveform :



(3) Is the measured siganl waveform normal?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary, and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

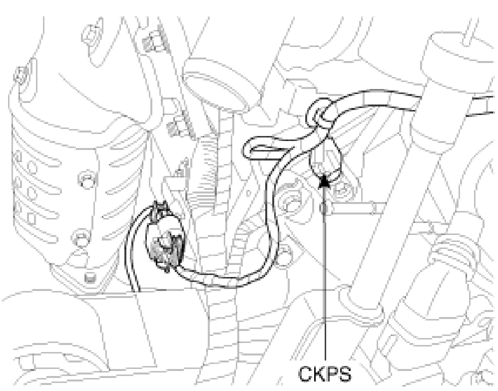
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0336

COMPONENT LOCATION



GENERAL DESCRIPTION

Crankshaft Position Sensor (58X) derives its name from the fact that current systems utilize a Crankshaft Position Sensor, coupled with a 58-tooth crankshaft wheel, to determine crankshaft angular position. Each edge of the wheel corresponds to a change in crank sensor output voltage as a tooth edge passes the sensor. The sensor will produce 58 pulses with one rotation of the crankshaft.

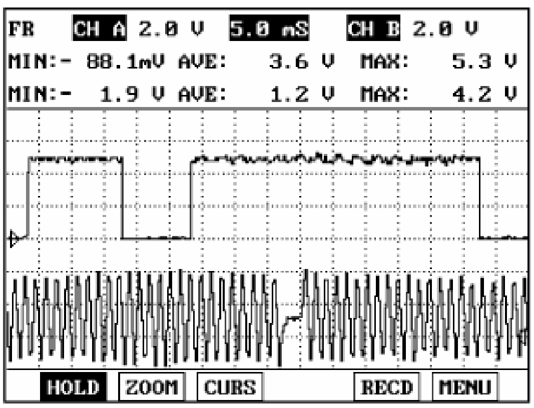
DTC DESCRIPTION

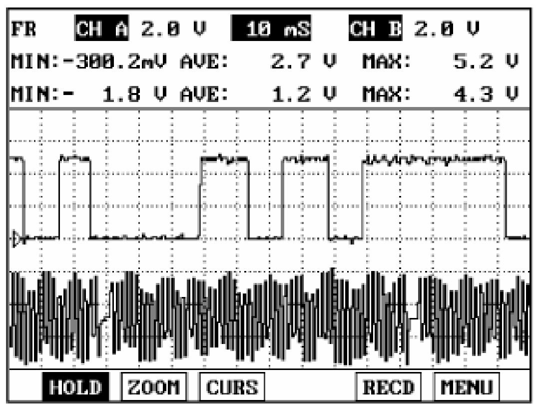
Checking output signals from CKPS every 7.8 sec. under detecting condition, if an output signal is missing or redundant for more than 1.56 sec., PCM sets P0336. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detecting extra/missing pulses between consecutive 58X reference pulses	• Poor connection • Noise • Short in harness • Target wheel • PCM
Enable Conditions	• Engine running state	
Threshold value	• Extra/ missing pulses > 2 pulses and > 1.56 sec.	
Diagnosis Time	• Continuous (More than 1.56 sec.failure for every 7.8 sec.test)	
MIL On Condition	• 2 driving cycles	

SIGNAL WAVEFROM AND DATA





SPECIFICATION

Resistance	700 ± 70Ω

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]

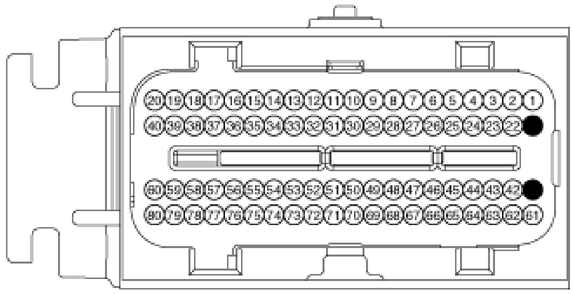
[CONNECTION INFORMATION]

Terminal	Connected to	Funtion
1	PCM C144-2 (41)	CKPS [LOW] Signal
2	PCM C144-2 (21)	CKPS [HIGH] Signal

[HARNESS CONNECTORS]

C129

CKPS



C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor engine speed item on the service data.

Specification : 620 ± 100 rpm

4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

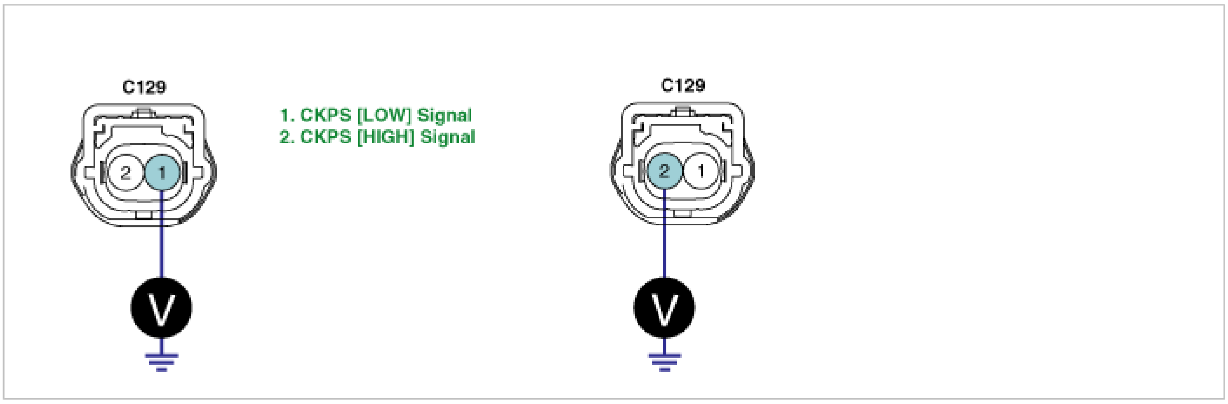
NO

▸ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF" and disconnect CKPS connector.
   (2) IG "ON" and ENG "OFF"
   (3) Measure voltage between terminal 1 of CKPS harness connector and chassis ground.
   (4) Measure voltage between terminal 2 of CKPS harness connector and chassis ground.

Specification : Approx. 1.4V



   (5) Is the measured voltage within specification?

YES

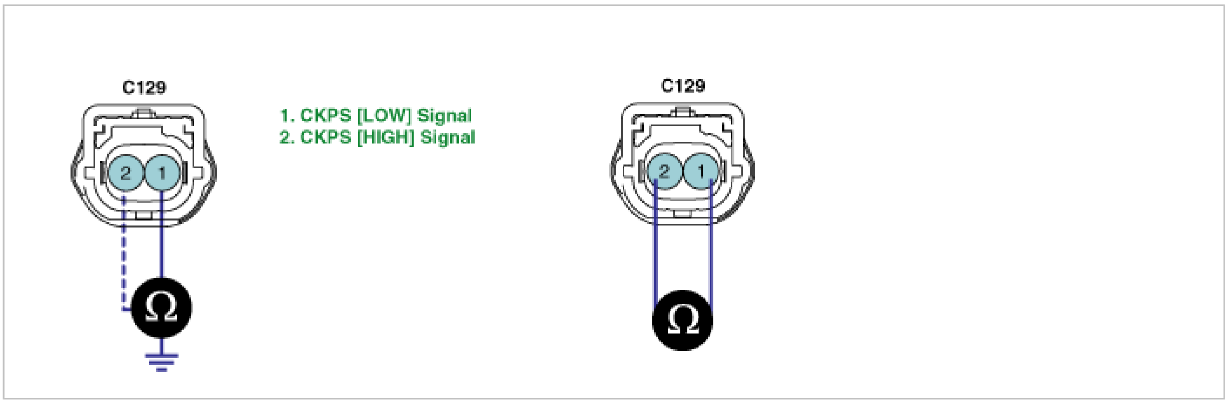
▸ Go to "Component Inspection" procedure.

NO

▸ Go to "Check short in harness" as follows.

2. Check short in harness
   (1) IG "OFF" and disconnect CKPS connector and PCM connector.
   (2) Measure resistance between terminal 1(2) of CKPS harness connector and chassis ground.
   (3) Measure resistance between terminals 1 and 2 of CKPS harness connector.

Specification : Infinite



   (4) Is the measured resistance within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair short in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Visually check CKPS and Target wheel
   (1) IG "OFF"
   (2) Check CKPS and target wheel for deformation or damage visually
   (3) Is the above items normal ?

YES

▸ Go to "Check CKPS resistance" as follows.

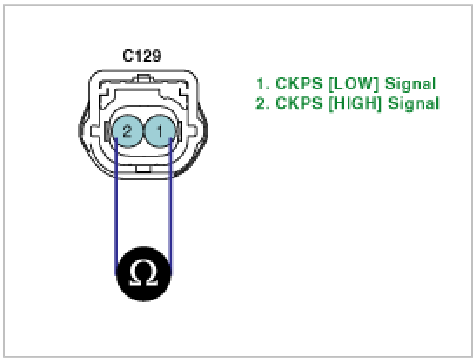
NO

▸ Repair or replace it, and go to "Verification of Vehicle Repair" procedure.

2. Check CKPS resistance
   (1) IG "OFF" and disconnect CKPS connector.
   (2) Measure resistance between terminals 1 and 2 of CKPS connector. (Component side)

Specifiation :

Resistance	700 ± 70Ω



   (3) Is the measured resistance within specification?

YES

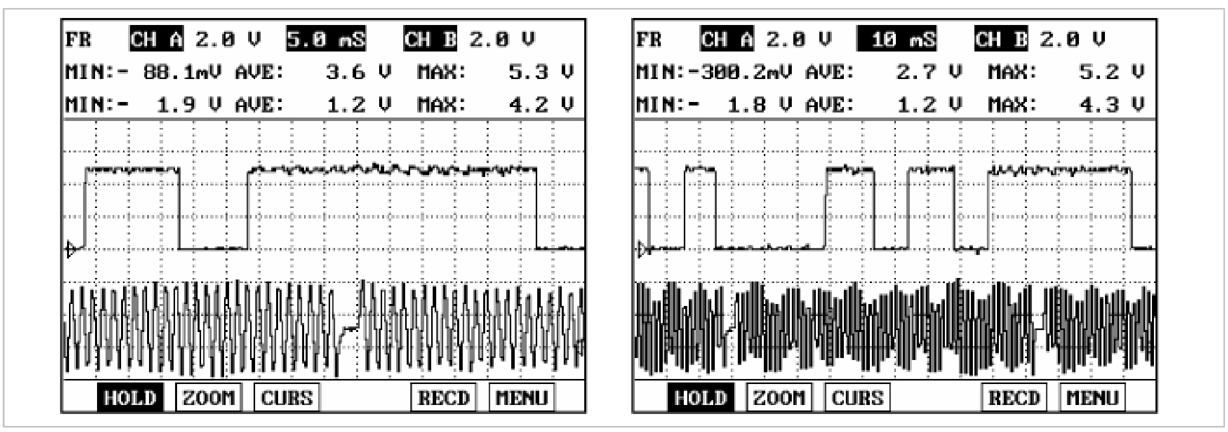
▸ Go to "Check signal waveform of CKPS" as follows.

NO

▸ Substitute with a known - good CKPS and check for proper operation. If the problem is corrected, replace CKPS and go to "Verification of Vehicle Repair" procedure.

3. Check signal waveform of CKPS
   (1) IG "OFF" and connect scantool.
   (2) ENG "ON" and Measure signal waveform at terminal 1 or 2 of CKPS.

Reference signal waveform :



   (3) Is the measured siganl waveform normal?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary, and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

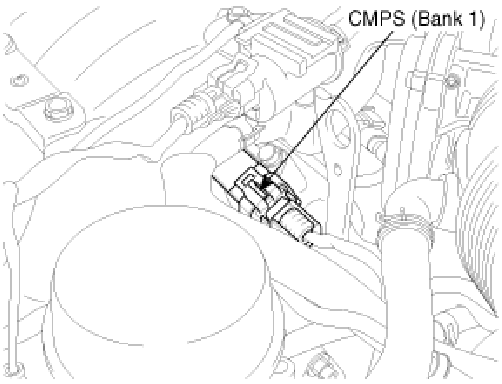
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0340

COMPONENT LOCATION



GENERAL DESCRIPTION

Camshaft Position Sensor (CMPS) is a hall sensor and detects the camshaft position by using a hall element. It is related with Crankshaft Position Sensor (CKPS) and detects the piston position of the each cylinder which the CKPS can't detect. The two CMPS are installed on engine head cover of bank 1 and 2 and uses a target wheel installed on the camshaft. This sensor has a hall-effect IC which output voltage changes when magnetic field is made on the IC with current flow. When teeth on the target wheel trigger the sensor, output voltage is 5V. If not, it is 0V. These CMPS signal is sent to the PCM and it uses CMPS signals for determining the ignition timing with CKPS signals. CMPS makes Sequential Injection possible.

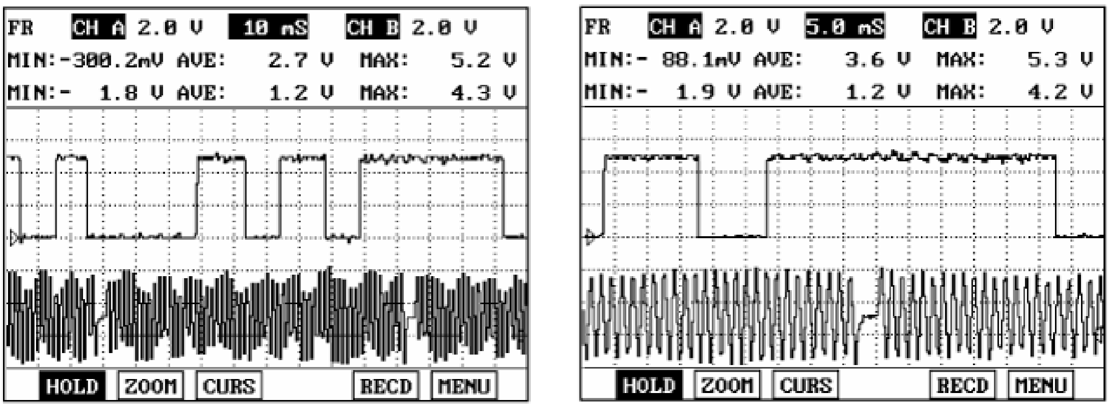
DTC DESCRIPTION

If signals from CMPS is not synchronised with CKPS for more than 3 times under detecting condition, PCM sets P0340. MIL (Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Check if CAM sensor is synchronized correctly	• Poor connection • Open in harness • CMPS(Bank 1) • PCM
Enable Conditions	• Engine running state	
Threshold value	• The number of time that CAM signal is not synchronized ≥ 3	
Diagnosis Time	• Continuous	
MIL On Condition	• 2 driving cycles	

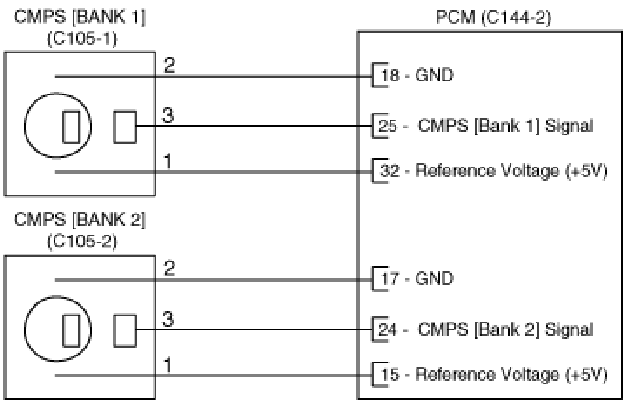
SIGNAL WAVEFROM AND DATA



This example shows a typical Crankshaft Position Sensor(CKPS) and Camshaft Position Sensor(CMPS) waveform at idle. The PCM controls the injection and ignition timing by using these signals. Generally CKPS signal is used to detect the piston's position and CMPS signal is used to detect the Top Dead Center of each cylinder.

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

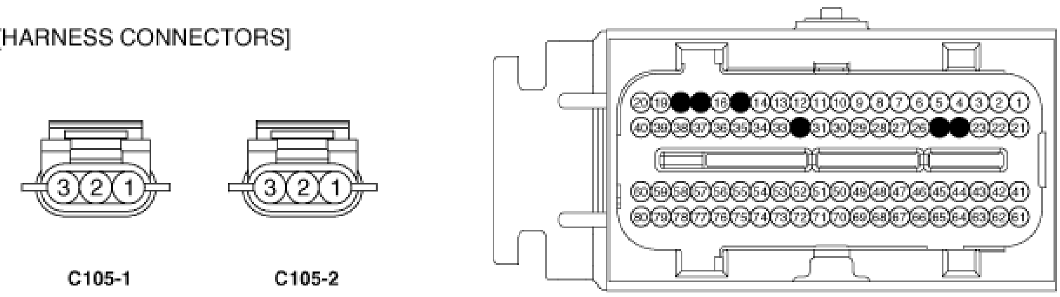
CMPS [BANK 1]

Terminal	Connected to	Funtion
1	PCM C144-2 (32)	Reference Voltage (+5V)
2	PCM C144-2 (18)	Sensor ground
3	PCM C144-2 (25)	CMPS [Bank 1] control

CMPS [BANK 2]

Terminal	Connected to	Funtion
1	PCM C144-2 (15)	Reference Voltage (+5V)
2	PCM C144-2 (17)	Sensor ground
3	PCM C144-2 (24)	CMPS [Bank 2] control

[HARNESS CONNECTORS]



C105-1

CMPS [BANK 1]

C105-2

CMPS [BANK 2]

C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor items related to CMPS on the service data.

4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

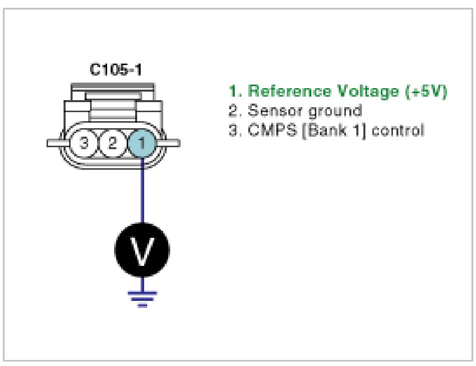
NO

▸ Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION

1. IG "OFF" and disconnect CMPS connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of CMPS(B1) harness connector and chassis ground.

Specification : Approx. 5V



4. Is the measured voltage within specification?

YES

▸ Go to "Signal Circuit Inspection" procedure.

NO

▸ Repair open or short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

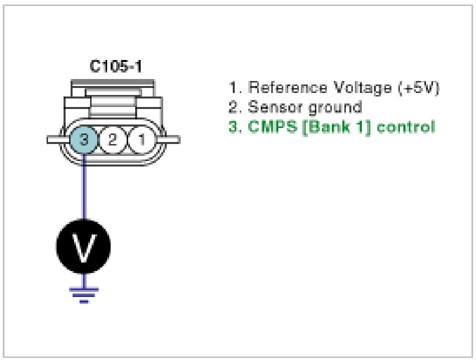
SIGNAL CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF" and disconnect CMPS connector.

(2) IG "ON" and ENG "OFF"

(3) Measure voltage between terminal 3 of CMPS(B1) harness connector and chassis ground.

Specification : Approx. 5V



(4) Is the measured voltage within specification?

YES

▸ Go to "Component Inspection" as follows.

NO

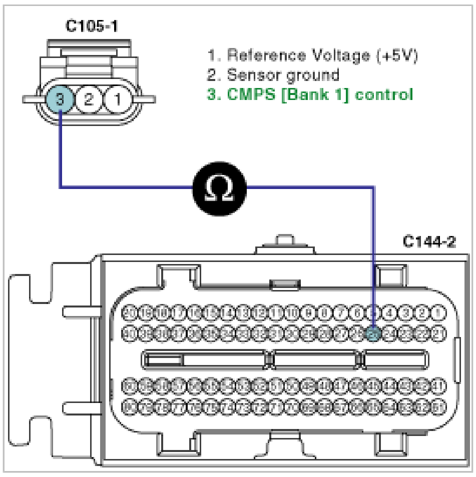
▸ Go to "Check open in harness' as follows.

2. Check open in harness

(1) IG "OFF" and disconnect CMPS connector and PCM connector.

(2) Measure resistance between terminal 3 of CMPS harness connector and terminal 25 of PCM harness connector.

Specification : Below 1Ω



(3) Is the measured resistance within specification?

YES

▸ Go to "Ground Circuit Inspection" procedure.

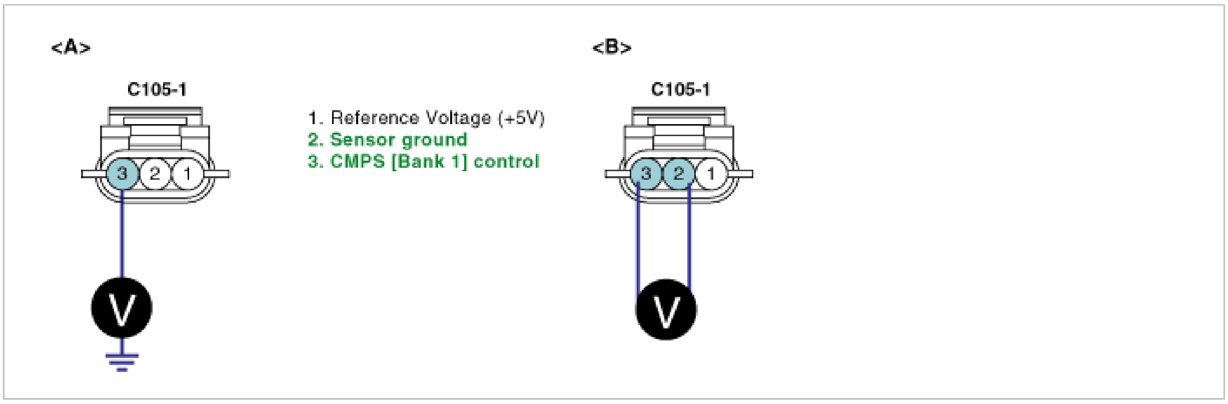
NO

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF" and disconnect CMPS connector.
2. Measure voltage between terminal 3 of CMPS harness connector and chassis ground.
3. Measure voltage between terminals 2 and 3 of CMPS harness connector.

Specification : Measurement "A" - Measurement 'B' = Approx. below 200mV



4. Is the measured voltage within specification?

YES

▸ Go to "Component Inspection" procedure.

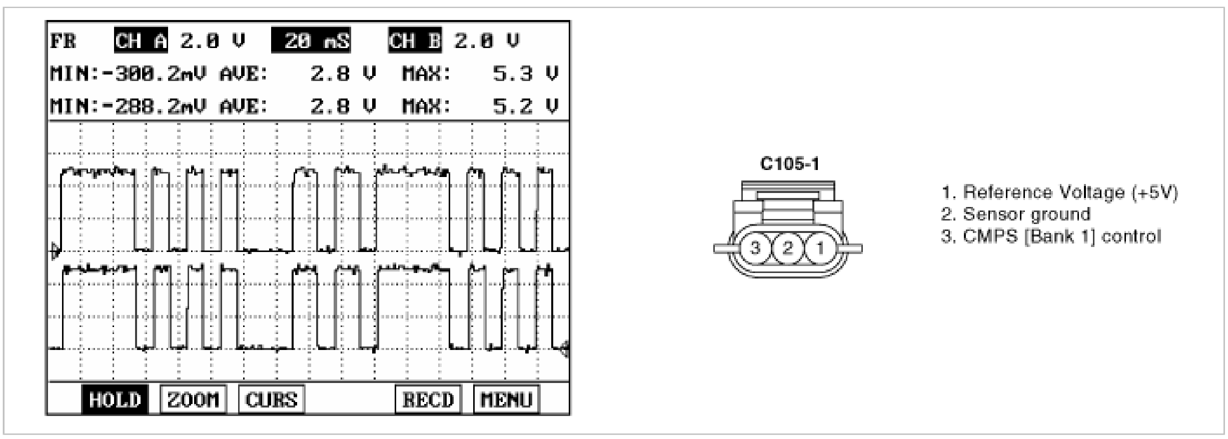
NO

▸ Repair open or contact resistance in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check CMPS
   (1) IG "OFF" and connect scantool.
   (2) ENG "ON" and Measure signal waveform at terminal 3 of CMPS.

Reference signal waveform :



   (3) Is the measured siganl waveform normal?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good CMPS and check for proper operation. If the problem is corrected, replace CMPS and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "

5. Are any DTCs present ?

YES

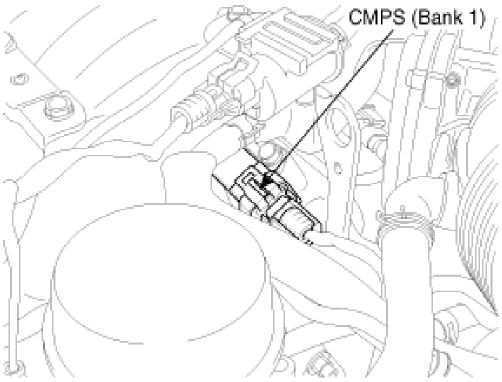
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0341

COMPONENT LOCATION



GENERAL DESCRIPTION

Camshaft Position Sensor (CMPS) is a hall sensor and detects the camshaft position by using a hall element. It is related with Crankshaft Position Sensor (CKPS) and detects the piston position of the each cylinder which the CKPS can't detect. The two CMPS are installed on engine head cover of bank 1 and 2 and uses a target wheel installed on the camshaft. This sensor has a hall-effect IC which output voltage changes when magnetic field is made on the IC with current flow. When teeth on the target wheel trigger the sensor, output voltage is 5V. If not, it is 0V. These CMPS signal is sent to the PCM and it uses CMPS signals for determining the ignition timing with CKPS signals. CMPS makes Sequential Injection possible.

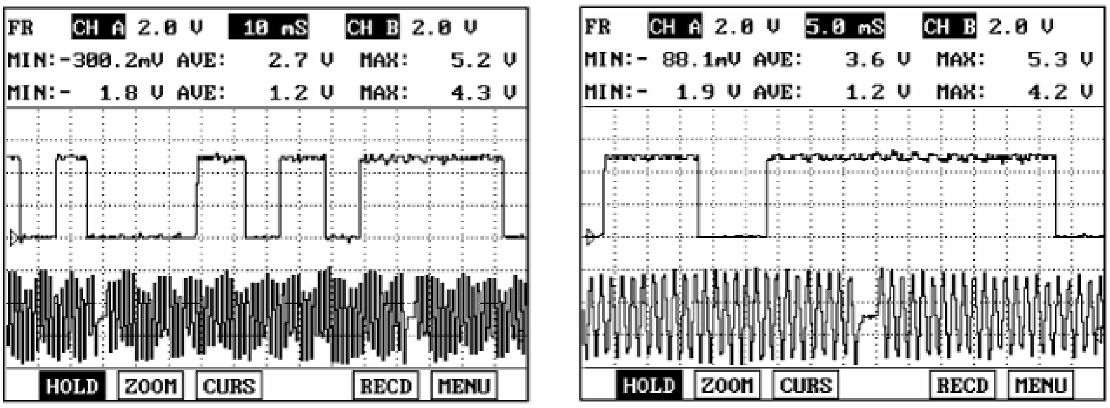
DTC DESCRIPTION

Checking oputput signals from CMP during engine running, if 15 out of 25 signals is abnormal, PCM sets P0341. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Check if CAM sensor is synchronized correctly	• Poor connection • Short in harness • electrical noise • Target wheel • CMPS • PCM
Enable Conditions	• Engine running state	
Threshold value	• Cam tooth count ≠ 6	
Diagnosis Time	• Continuous (More than 15 times failure out of 25 times test)	
MIL On Condition	• 2 driving cycles	

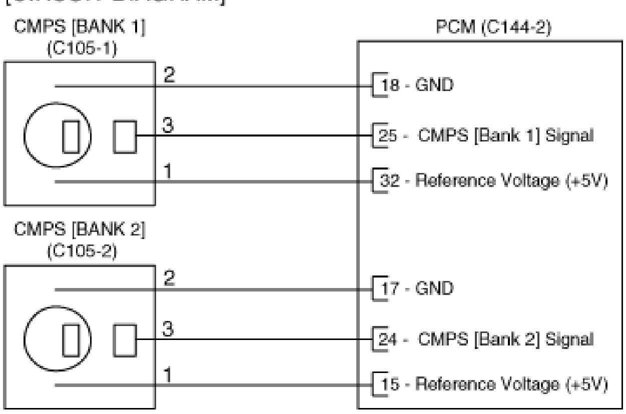
SIGNAL WAVEFROM AND DATA



This example shows a typical Crankshaft Position Sensor(CKPS) and Camshaft Position Sensor(CMPS) waveform at idle. The PCM controls the injection and ignition timing by using these signals. Generally CKPS signal is used to detect the piston's position and CMPS signal is used to detect the Top Dead Center of each cylinder.

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

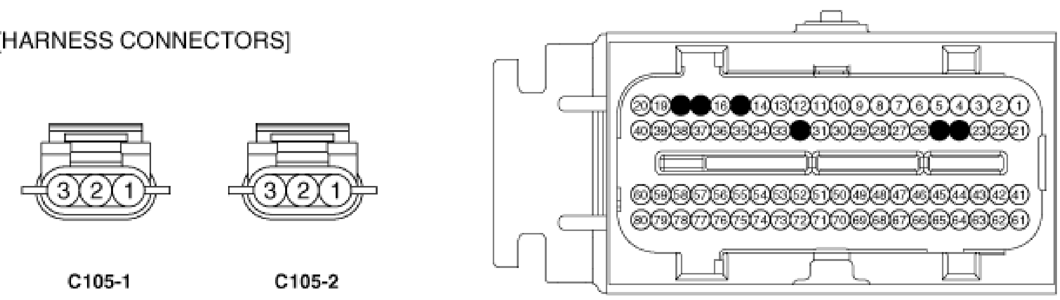
CMPS [BANK 1]

Terminal	Connected to	Funtion
1	PCM C144-2 (32)	Reference Voltage (+5V)
2	PCM C144-2 (18)	Sensor ground
3	PCM C144-2 (25)	CMPS [Bank 1] control

CMPS [BANK 2]

Terminal	Connected to	Funtion
1	PCM C144-2 (15)	Reference Voltage (+5V)
2	PCM C144-2 (17)	Sensor ground
3	PCM C144-2 (24)	CMPS [Bank 2] control

[HARNESS CONNECTORS]



C105-1

CMPS [BANK 1]

C105-2

CMPS [BANK 2]

C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor items related to CMPS on the service data

4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

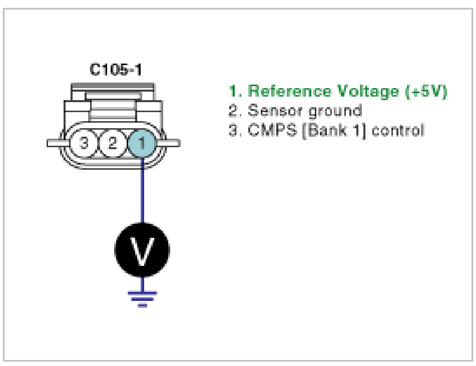
NO

▸ Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION

1. IG "OFF" and disconnect CMPS connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of CMPS(B1) harness connector and chassis ground.

Specification : Approx. 5V



4. Is the measured voltage within specification?

YES

▸ Go to "Signal Circuit Inspection" procedure.

NO

▸ Repair open or short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

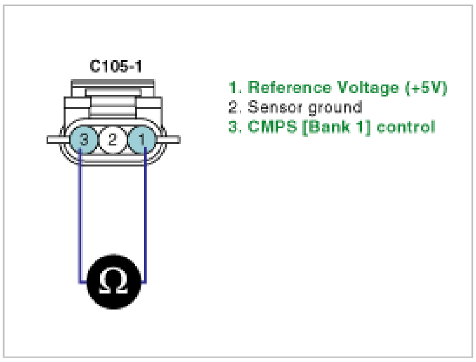
SIGNAL CIRCUIT INSPECTION

1. Check short in harness

   (1) IG "OFF" and disconnect CMPS connector.

(2) Measure resistance between terminals 1 and 3 of CMPS(B1) harness connector.

Specification : Infinite



(3) Is the measured voltage within specification?

YES

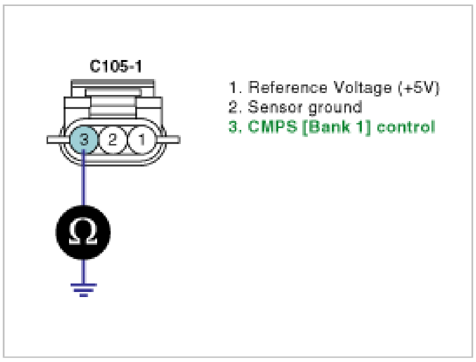
▸ Go to "Check short to ground in harness' as follows.

NO

▸ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check short to ground in harness
   (1) IG "OFF" and disconnect CMPS connector and PCM connector.
   (2) Measure resistance between terminal 3 of CMPS(B1) harness connector and chassis ground.

Specification : Infinite



(3) Is the measured resistance within specification?

YES

▸ Go to "Component Inspection" procedure.

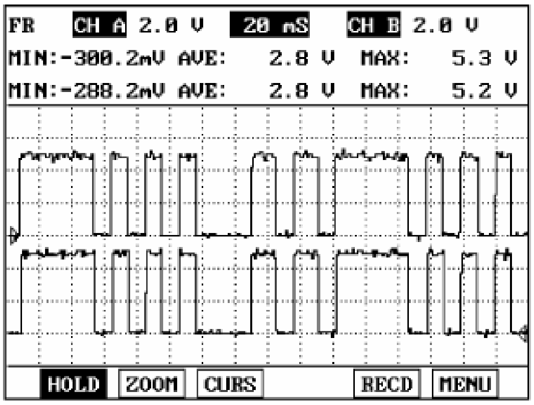
NO

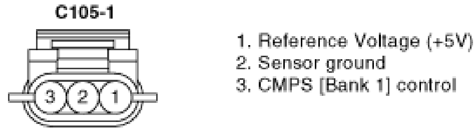
▸ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check CMPS
   (1) IG "OFF" and connect scantool.
   (2) ENG "ON" and Measure signal waveform at terminal 3 of CMPS.

Reference signal waveform :





(3) Is the measured siganl waveform normal?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good CMPS and check for proper operation. If the problem is corrected, replace CMPS and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

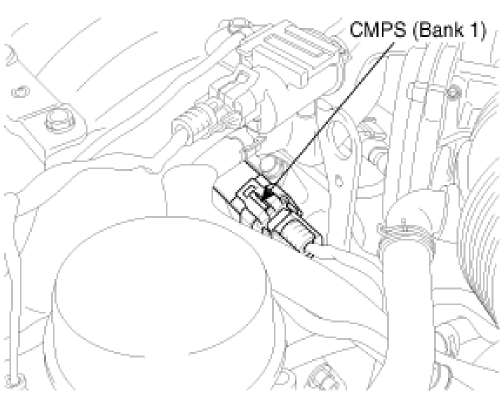
▸ Go to the applicable troubleshooooting procedure.

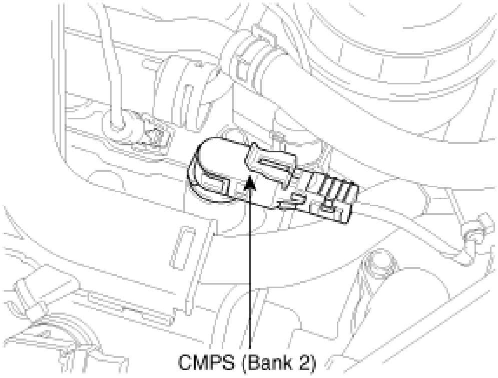
NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0346

COMPONENT LOCATION





GENERAL DESCRIPTION

Camshaft Position Sensor (CMPS) is a hall sensor and detects the camshaft position by using a hall element. It is related with Crankshaft Position Sensor (CKPS) and detects the piston position of the each cylinder which the CKPS can’t detect. The two CMPS are installed on engine head cover of bank 1 and 2 and uses a target wheel installed on the camshaft. This sensor has a hall-effect IC which output voltage changes when magnetic field is made on the IC with current flow. When teeth on the target wheel trigger the sensor, output voltage is 5V. If not, it is 0V. These CMPS signal is sent to the PCM and it uses CMPS signals for determining the ignition timing with CKPS signals. CMPS makes Sequential Injection possible.

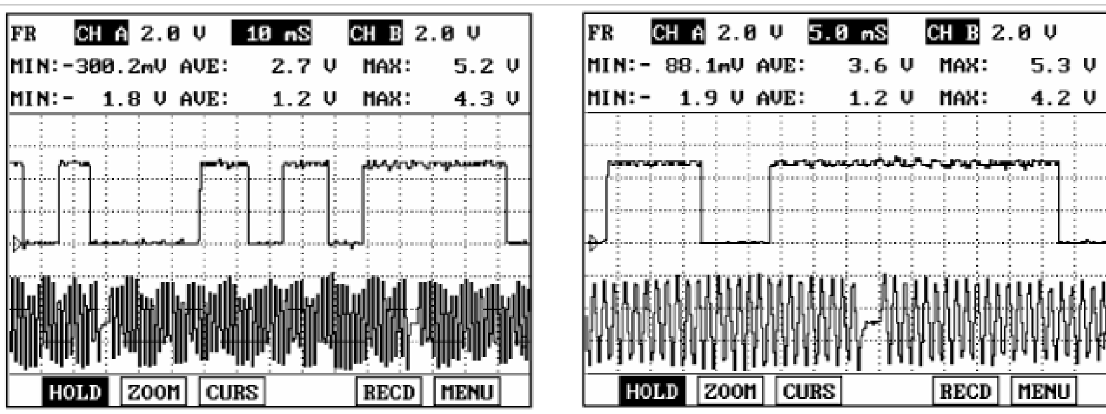
DTC DESCRIPTION

Checking oputput signals from CMP during engine running, if 15 out of 25 signals is abnormal, PCM sets P0346. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Check if CAM sensor is synchronized correctly	• Poor connection • Open or short in harness • electrical noise • Target wheel • CMPS • PCM
Enable Conditions	• Engine running state	
Threshold value	• Cam tooth count ≠ 6	
Diagnosis Time	• Continuous (More than 15 times failure out of 25 times test)	
MIL On Condition	• 2 driving cycles	

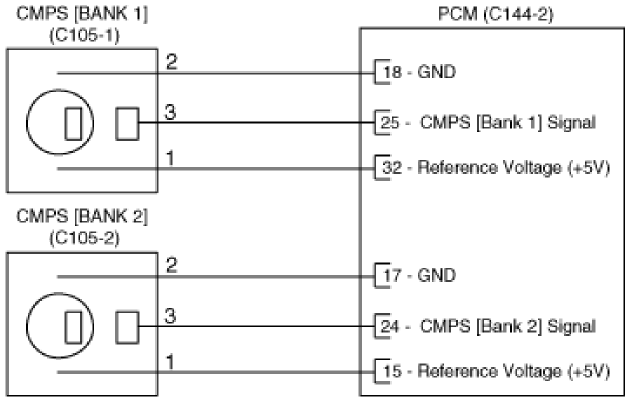
SIGNAL WAVEFROM AND DATA



This example shows a typical Crankshaft Position Sensor(CKPS) and Camshaft Position Sensor(CMPS) waveform at idle. The PCM controls the injection and ignition timing by using these signals. Generally CKPS signal is used to detect the piston's position and CMPS signal is used to detect the Top Dead Center of each cylinder.

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

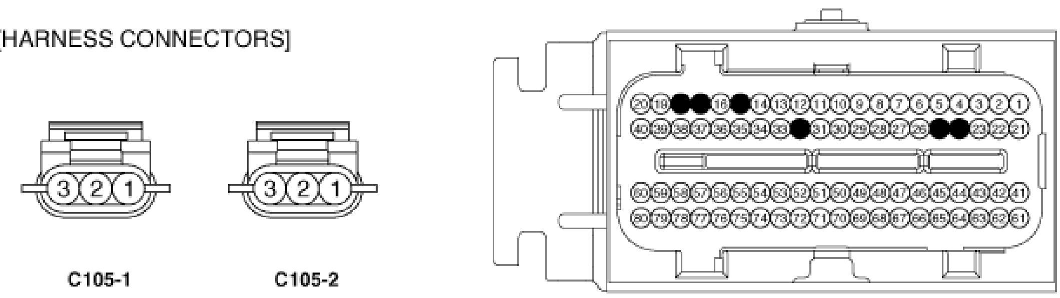
CMPS [BANK 1]

Terminal	Connected to	Funtion
1	PCM C144-2 (32)	Reference Voltage (+5V)
2	PCM C144-2 (18)	Sensor ground
3	PCM C144-2 (25)	CMPS [Bank 1] control

CMPS [BANK 2]

Terminal	Connected to	Funtion
1	PCM C144-2 (15)	Reference Voltage (+5V)
2	PCM C144-2 (17)	Sensor ground
3	PCM C144-2 (24)	CMPS [Bank 2] control

[HARNESS CONNECTORS]



MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor items related to CMPS on the service data
4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

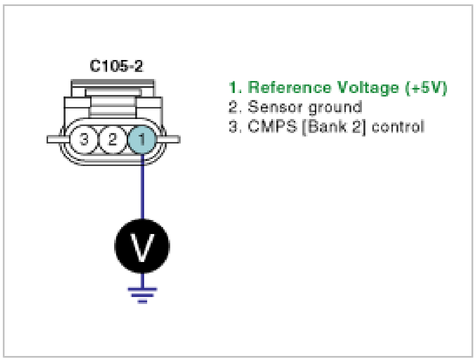
NO

▸ Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION

1. IG "OFF" and disconnect CMPS connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of CMPS(B2) harness connector and chassis ground.

Specification : Approx. 5V



4. Is the measured voltage within specification?

YES

▸ Go to "Signal Circuit Inspection" procedure.

NO

▸ Repair open or short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

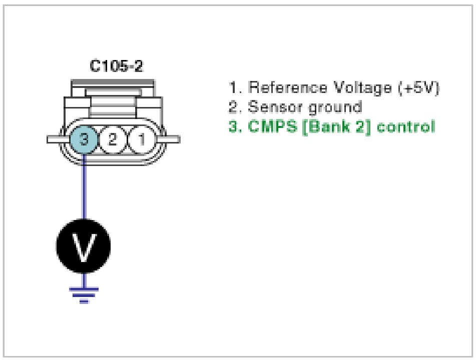
SIGNAL CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF" and disconnect CMPS connector.

   (2) IG "ON" and ENG "OFF"

   (3) Measure voltage between terminal 3 of CMPS(B2) harness connector and chassis ground.

   Specification : Approx. 5V



   (4) Is the measured voltage within specification?

   YES

   ▸ Go to "Check short in harness" as follows.

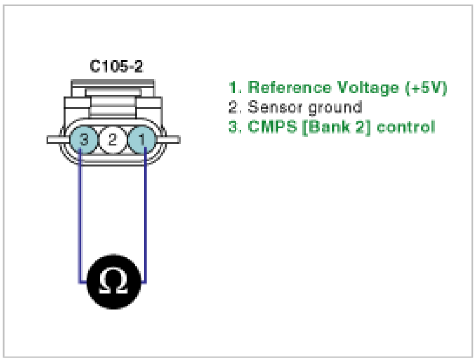
   NO

   ▸ Go to "Check open in harness" as follows.

2. Check short in harness
   (1) IG "OFF" and disconnect CMPS connector.

   (2) Measure resistance between terminals 1 and 3 of CMPS(B2) harness connector.

   Specification : Infinite



(3) Is the measured resistance within specification?

YES

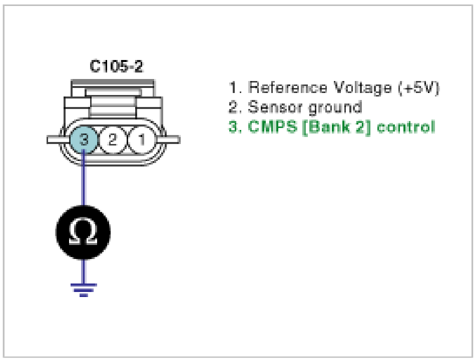
▶ Go to "Check short to ground in harness" as follows.

NO

▶ Repair short in harness, and go to "Verification of Vehicle Repair" procedure.

3. Check short to ground in harness
   (1) IG "OFF" and disconnect CMPS connector and PCM connector.
   (2) Measure resistance between terminal 3 of CMPS(B2) harness connector and chassis ground.

Specification : Infinite



(3) Is the measured resistance within specification?

YES

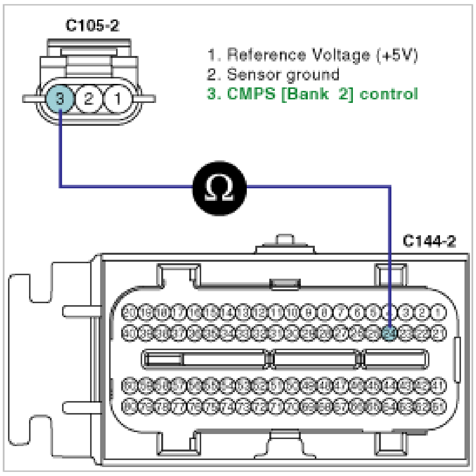
▶ Go to "Ground Circuit Inspection" procedure.

NO

▶ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

4. Check open in harness
   (1) IG "OFF" and disconnect CMPS connector and PCM connector.
   (2) Measure resistance between terminal 3 of CMPS harness connector and terminal 24 of PCM harness connector.

Specification : Below 1Ω



(3) Is the measured resistance within specification?

YES

▸ Go to "Ground Circuit Inspection" procedure.

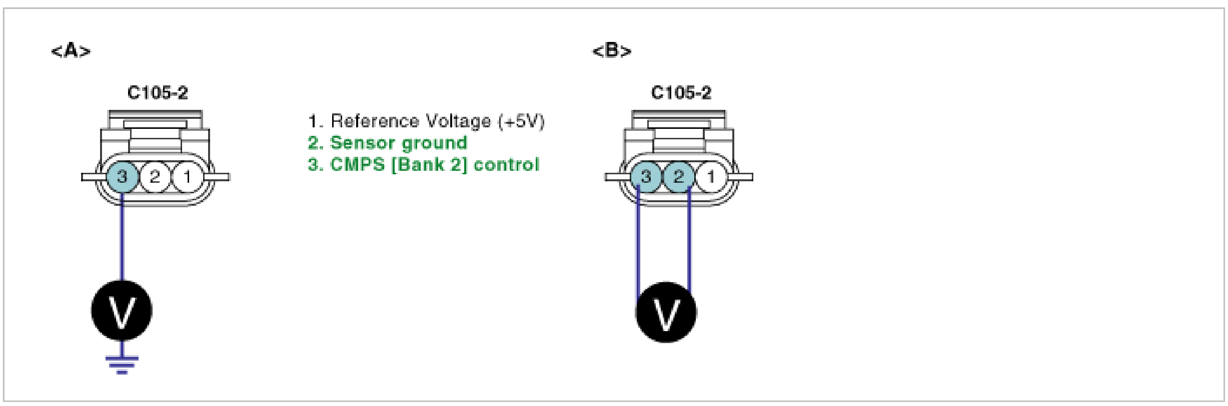
NO

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF" and disconnect CMPS connector.
2. Measure voltage between terminal 3 of CMPS harness connector and chassis ground.
3. Measure voltage between terminals 2 and 3 of CMPS harness connector.

Specification : Measurement "A" - Measurement 'B' = Approx. below 200mV



4. Is the measured voltage within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair open or contact resistance in harness, and go to "Verification of Vehicle Repair" procedure.

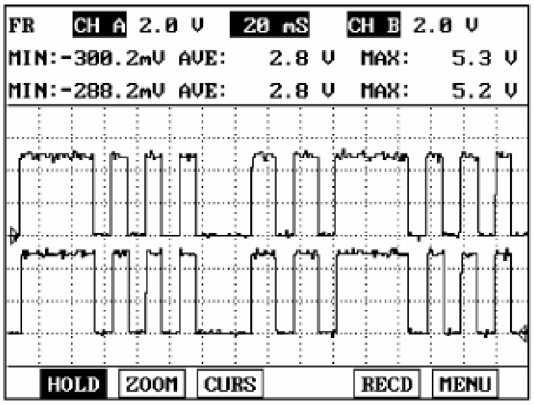
COMPONENT INSPECTION

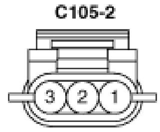
1. Check CMPS

(1) IG "OFF" and connect scantool.

(2) ENG "ON" and Measure signal waveform at terminal 3 of CMPS.

Reference signal waveform :





1. Reference Voltage (+5V)
2. Sensor ground
3. CMPS [Bank 2] control

(3) Is the measured siganl waveform normal?

YES

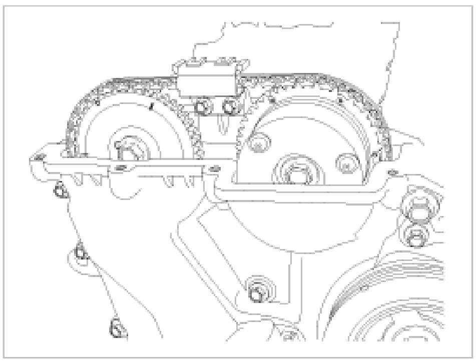
▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Check the electrical noise of siganl waveform, and go to "Check target wheel of CAM shaft" as follows.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

2. Check target wheel of CAM shaft
   (1) IG "OFF"
   (2) Remove the cover of cylinder head and check target wheel state of bank 2.



(3) Is the target wheel state normal?

YES

▸ Substitute with a known - good CMPS and check for proper operation. If the problem is corrected, replace CMPS and go to "Verification of Vehicle Repair" procedure.

NO

▸ Repair or replace it, and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0351

COMPONENT LOCATION

GENERAL DESCRIPTION

When the ignition switch is ON or START position, voltage is applied to the ignition coil. Each ignition coil consists of two coils. High tension leads go to each cylinder from ignition coils. Ignition coils fire two spark plugs on every power stroke (the cylinder under compression and the one on the exhaust stroke). PCM provides ground to a switching circuit for energizing the primary ignition coils. PCM uses the crankshaft position sensor and camshaft position sensor signals to meet the timing of energizing coil. When a primary ignition coil is energized or de-energized, the secondary coil produces a high voltage spike to the attached spark plugs.

DTC DESCRIPTION

Checking output signals from ignition coils every 10 sec. under detecting condition, if signals indicating open of short in the circuit are detected for more than 10 sec., PCM sets P0351. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

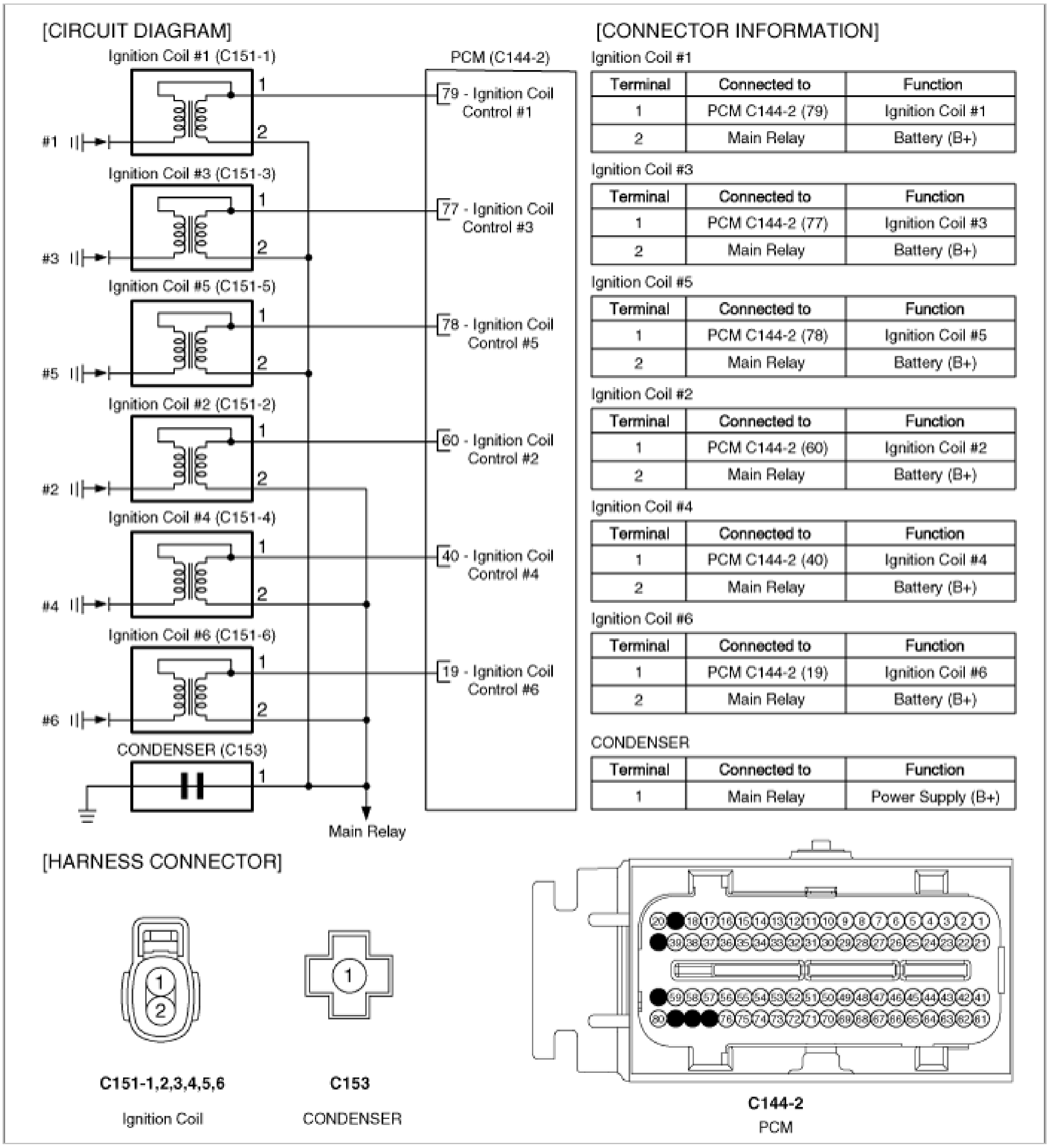
DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to ground, to battery or open circuit	• Poor connection • Open or short in harness • Ignition Coil • PCM
EnableConditions	• NO DTC related to this item • Engine running state • 11V ≤ Battery voltage ≤ 16V • The above conditions are met > 0.5 sec.	
Threshold value	• Open or short	
DiagnosisTime	• Continuous (More than 5 sec.failure for every 10 sec.test)	
MIL On Condition	• 2 driving cycles	

SPECIFICATION

Resistance (Ω)	Primary Coil	Secondary Coil
	0.62 ± 10%	7.0k ± 15%

SCHEMATIC DIAGRAM



Ignition Coil #1

Terminal	Connected to	Function
1	PCM C144-2 (79)	Ignition Coil #1
2	Main Relay	Battery (B+)

Ignition Coil #3

Terminal	Connected to	Function
1	PCM C144-2 (77)	Ignition Coil #3
2	Main Relay	Battery (B+)

Ignition Coil #5

Terminal	Connected to	Function
1	PCM C144-2 (78)	Ignition Coil #5
2	Main Relay	Battery (B+)

Ignition Coil #2

Terminal	Connected to	Function
1	PCM C144-2 (60)	Ignition Coil #2
2	Main Relay	Battery (B+)

Ignition Coil #4

Terminal	Connected to	Function
1	PCM C144-2 (40)	Ignition Coil #4
2	Main Relay	Battery (B+)

Ignition Coil #6

Terminal	Connected to	Function
1	PCM C144-2 (19)	Ignition Coil #6
2	Main Relay	Battery (B+)

CONDENSER

Terminal	Connected to	Function
1	Main Relay	Power Supply (B+)

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor items related to Ignition on the service data.

Specification : BTDC 10° ± 5°

4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, ending, corrosion, contamination, deterioration, or damage. Repair or replace asnecessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSEPCTION

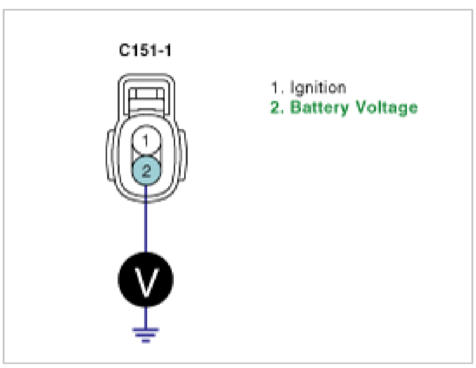
1. Check voltage

(1) IG "OFF" and disconnect Ignition Coil connector.

(2) IG "ON" and ENG "OFF"

(3) Measure voltage between terminal 2 of ignition coil harness connector and chassis ground.

Specification : Approx. B+



(4) Is the measured voltage within specification ?

YES

▸ Go to "Control Circuit Inspection" procedure.

NO

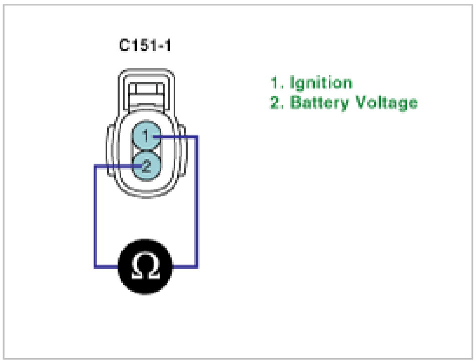
▸ Check fuse connected to ignition coil for open.

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check short to battery in harness.
   (1) IG "OFF" and disconnect ignitioncoil connector and PCM connector.
   (2) Measure resistance between terminals 1 and 2 of ignition coil harness connector.

Specification : Infinite



   (3) Is the measured resistance within specification?

YES

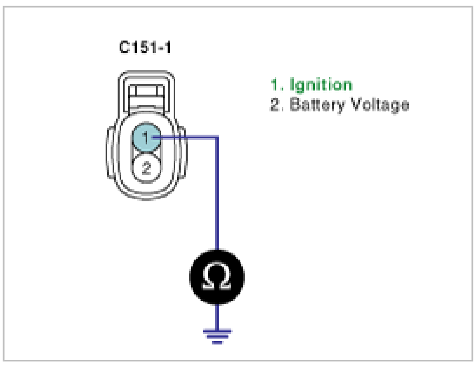
▸ Go to "Check short to ground in harness" as follows.

NO

▸ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check short to ground in harness
   (1) IG "OFF" and disconnect ignition coil connector and PCM connector.
   (2) Measure resistance between terminal 1 of ignition coil harness connector and chassis ground.

Specification : Infinite



   (3) Is the measured resistance within specification?

YES

▸ Go to "Check open in harness" as follows.

NO

▸ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

3. Check open in harness
   (1) IG "OFF" and disconnect Ignition Coil connector and PCM connector.
   (2) Measure resistance between terminal 1 of Ignition Coil harness connector and terminal 79 of PCM harness connector.

Specification : Below 1Ω

   (3) Is the measured resistance within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

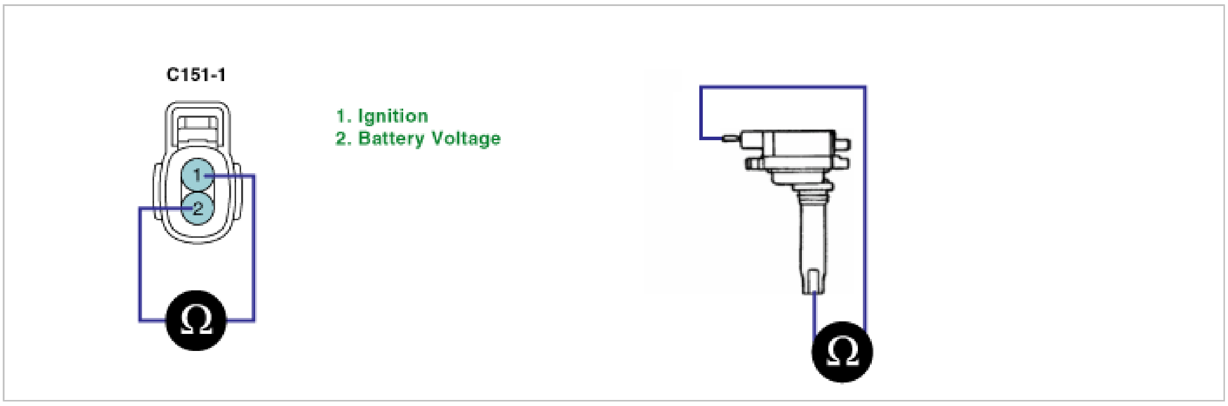
COMPONENT INSPECTION

1. Check Ignition Coil
   (1) IG "OFF" and disconnect ignition coil connector.

   (2) Measure resistance between terminals 1 and 2 of ignition coil connector.(Component side)

   (3) Measure resistance between terminal 1 of ignition coil connector and out terminal of secondary ignition coil.
   Specification :

Resistance (Ω)	Primary Coil	Secondary Coil
	0.62 ± 10%	7.0k ± 15%



   (4) Is the measured resistance within specification?

YES

▸ Substitute with a known - good PCM and check for proper operation
▸ If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good Ignition Coil and check for proper operation.
▸ If the problem is corrected, replace Ignition Coil and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0352

COMPONENT LOCATION

GENERAL DESCRIPTION

When the ignition switch is ON or START position, voltage is applied to the ignition coil. Each ignition coil consists of two coils. High tension leads go to each cylinder from ignition coils. Ignition coils fire two spark plugs on every power stroke (the cylinder under compression and the one on the exhaust stroke). PCM provides ground to a switching circuit for energizing the primary ignition coils. PCM uses the crankshaft position sensor and camshaft position sensor signals to meet the timing of energizing coil. When a primary ignition coil is energized or de-energized, the secondary coil produces a high voltage spike to the attached spark plugs.

DTC DESCRIPTION

Checking output signals from ignition coils every 10 sec. under detecting condition, if signals indicating open of short in the circuit are detected for more than 10 sec., PCM sets P0352. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

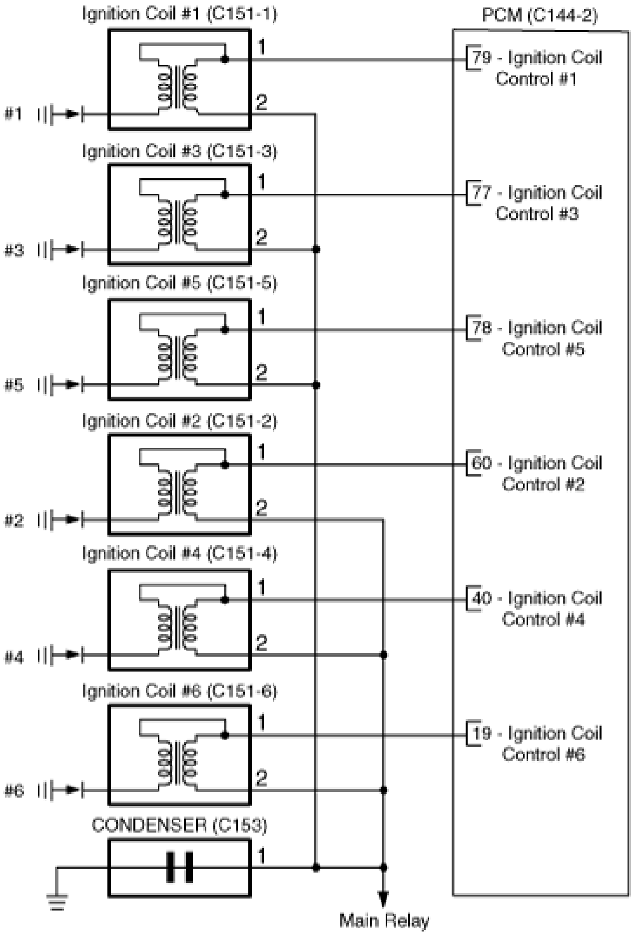
<table>
<tr><th>Item</th><th>Detecting Condition</th><th>Possible cause</th></tr>
<tr><td>DTC Strategy</td><td>• Detects a short to ground, to battery or open circuit</td><td rowspan="5">• Poor connection
• Open or short in harness
• Ignition Coil
• PCM</td></tr>
<tr><td>EnableConditions</td><td>• NO DTC related to this item
• Engine running state
• 11V ≤ Battery voltage ≤ 16V
• The above conditions are met > 0.5 sec.</td></tr>
<tr><td>Threshold value</td><td>• Open or short</td></tr>
<tr><td>DiagnosisTime</td><td>• Continuous
(More than 5 sec.failure for every 10 sec.test)</td></tr>
<tr><td>MIL On Condition</td><td>• 2 driving cycles</td></tr>
</table>

SPECIFICATION

Resistance (Ω)	Primary Coil	Secondary Coil
	0.62 ± 10%	7.0k ± 15%

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTOR INFORMATION]

Ignition Coil #1

Terminal	Connected to	Function
1	PCM C144-2 (79)	Ignition Coil #1
2	Main Relay	Battery (B+)

Ignition Coil #3

Terminal	Connected to	Function
1	PCM C144-2 (77)	Ignition Coil #3
2	Main Relay	Battery (B+)

Ignition Coil #5

Terminal	Connected to	Function
1	PCM C144-2 (78)	Ignition Coil #5
2	Main Relay	Battery (B+)

Ignition Coil #2

Terminal	Connected to	Function
1	PCM C144-2 (60)	Ignition Coil #2
2	Main Relay	Battery (B+)

Ignition Coil #4

Terminal	Connected to	Function
1	PCM C144-2 (40)	Ignition Coil #4
2	Main Relay	Battery (B+)

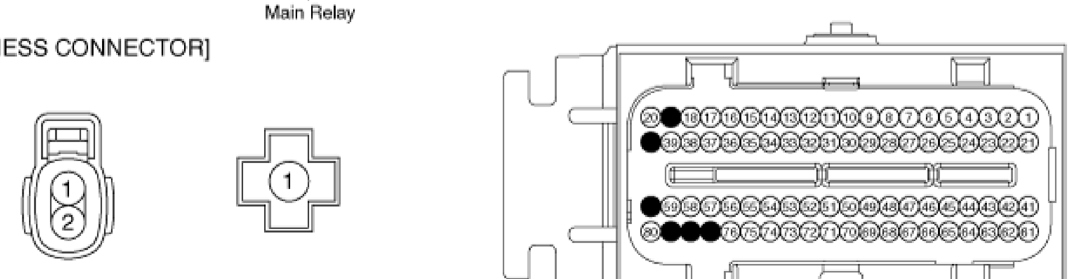
Ignition Coil #6

Terminal	Connected to	Function
1	PCM C144-2 (19)	Ignition Coil #6
2	Main Relay	Battery (B+)

CONDENSER

Terminal	Connected to	Function
1	Main Relay	Power Supply (B+)

[HARNESS CONNECTOR]



C151-1,2,3,4,5,6
Ignition Coil

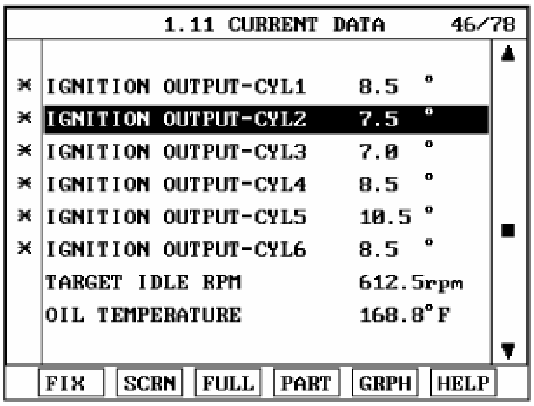
C153
CONDENSER

C144-2
PCM

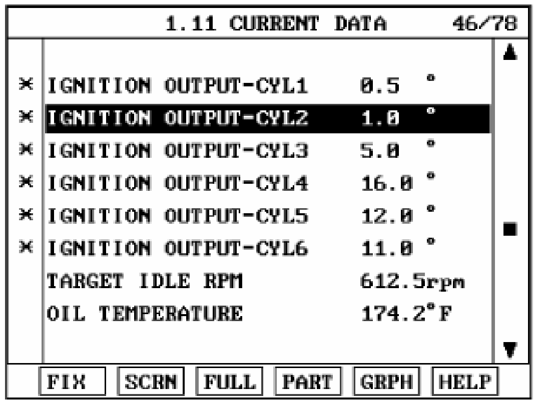
MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor items related to Ignition on the service data.

Specification : BTDC 10° ± 5°



Normal at idle



Open at idle

4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, ending, corrosion, contamination, deterioration, or damage. Repair or replace asnecessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSEPCTION

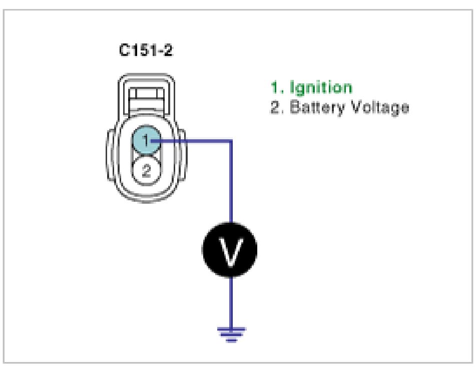
1. Check voltage

(1) IG "OFF" and disconnect Ignition Coil connector.

(2) IG "ON" and ENG "OFF"

(3) Measure voltage between terminal 1 of ignition coil harness connector and chassis ground.

Specification : Approx. B+



(4) Is the measured voltage within specification ?

YES

▸ Go to "Control Circuit Inspection" procedure.

NO

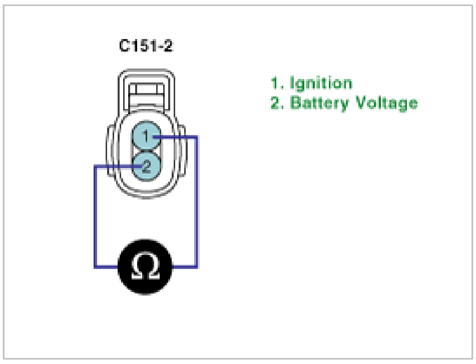
▸ Check fuse connected to ignition coil for open.

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check short to battery in harness.
   (1) IG "OFF" and disconnect ignitioncoil connector and PCM connector.
   (2) Measure resistance between terminals 1 and 2 of ignition coil harness connector.

Specification : Infinite



   (3) Is the measured resistance within specification?

YES

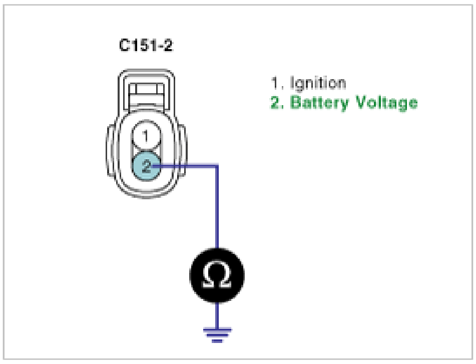
▸ Go to "Check short to ground in harness" as follows.

NO

▸ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check short to ground in harness
   (1) IG "OFF" and disconnect ignition coil connector and PCM connector.
   (2) Measure resistance between terminal 2 of ignition coil harness connector and chassis ground.

Specification : Infinite



   (3) Is the measured resistance within specification?

YES

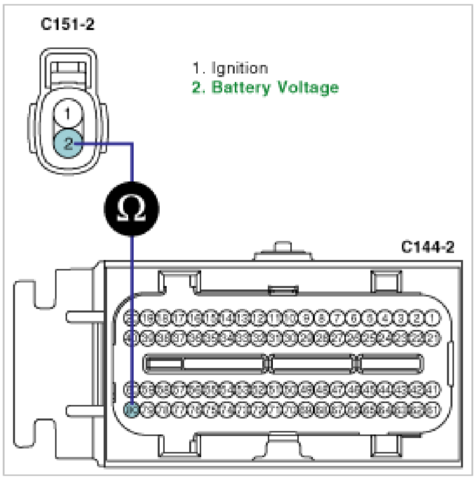
▸ Go to "Check open in harness" as follows.

NO

▸ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

3. Check open in harness
   (1) IG "OFF" and disconnect Ignition Coil connector and PCM connector.
   (2) Measure resistance between terminal 2 of Ignition Coil harness connector and terminal 60 of PCM harness connector.

Specification : Below 1Ω



(3) Is the measured resistance within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check Ignition Coil

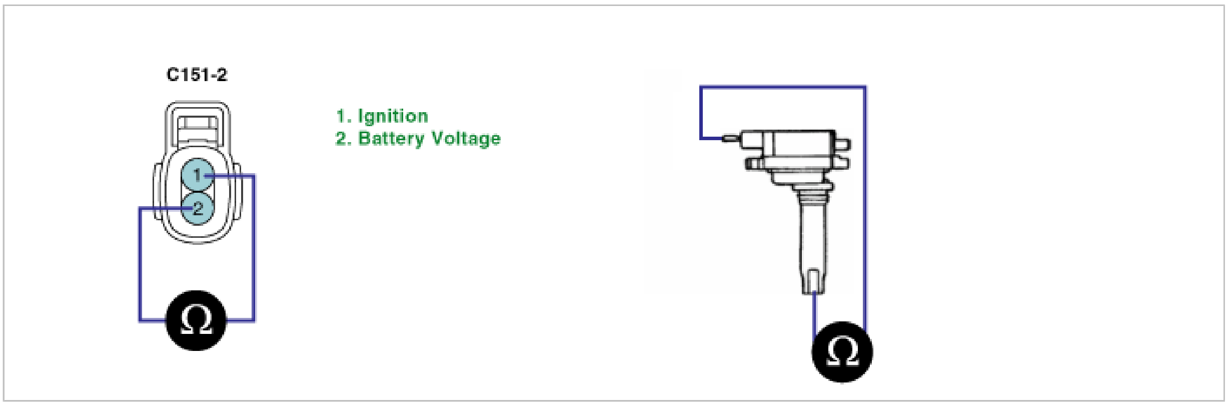
(1) IG "OFF" and disconnect ignition coil connector.

(2) Measure resistance between terminals 1 and 2 of ignition coil connector.(Component side)

(3) Measure resistance between terminal 1 of ignition coil connector and out terminal of secondary ignition coil.

Specification :

Resistance (Ω)	Primary Coil	Secondary Coil
	0.62 ± 10%	7.0k ± 15%



(4) Is the measured resistance within specification?

YES

▸ Substitute with a known - good PCM and check for proper operation
▸ If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good Ignition Coil and check for proper operation.
▸ If the problem is corrected, replace Ignition Coil and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0353

COMPONENT LOCATION

GENERAL DESCRIPTION

When the ignition switch is ON or START position, voltage is applied to the ignition coil. Each ignition coil consists of two coils. High tension leads go to each cylinder from ignition coils. Ignition coils fire two spark plugs on every power stroke (the cylinder under compression and the one on the exhaust stroke). PCM provides ground to a switching circuit for energizing the primary ignition coils. PCM uses the crankshaft position sensor and camshaft position sensor signals to meet the timing of energizing coil. When a primary ignition coil is energized or de-energized, the secondary coil produces a high voltage spike to the attached spark plugs.

DTC DESCRIPTION

Checking output signals from ignition coils every 10 sec. under detecting condition, if signals indicating open of short in the circuit are detected for more than 10 sec., PCM sets P0353. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

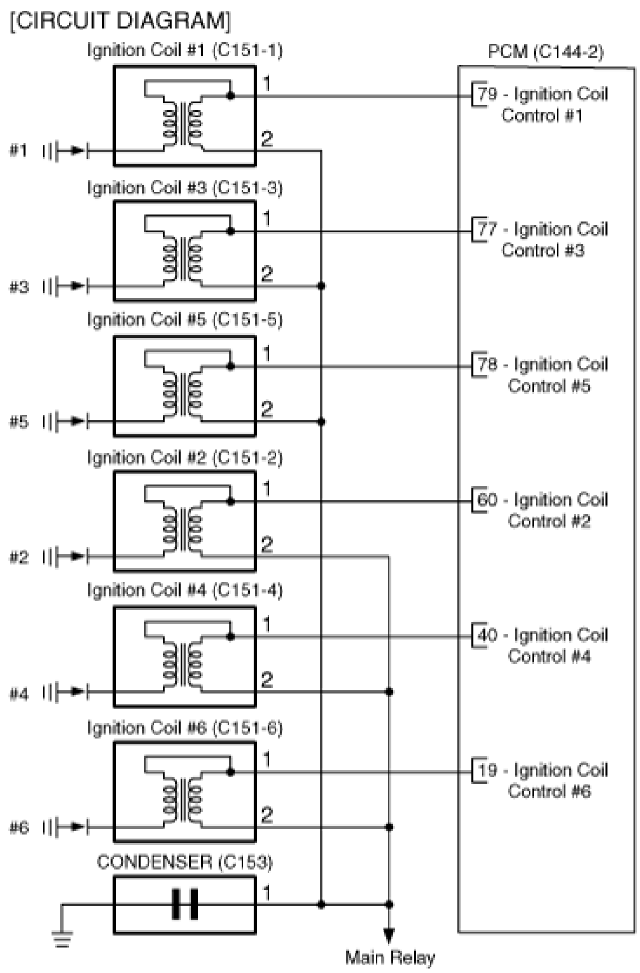
DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to ground, to battery or open circuit	• Poor connection • Open or short in harness • Ignition Coil • PCM
EnableConditions	• NO DTC related to this item • Engine running state • 11V ≤ Battery voltage ≤ 16V • The above conditions are met > 0.5 sec.	
Threshold value	• Open or short	
DiagnosisTime	• Continuous (More than 5 sec.failure for every 10 sec.test)	
MIL On Condition	• 2 driving cycles	

SPECIFICATION

	Primary Coil	Secondary Coil
Resistance (Ω)	0.62 ± 10%	7.0k ± 15%

SCHEMATIC DIAGRAM



[CONNECTOR INFORMATION]

Ignition Coil #1

Terminal	Connected to	Function
1	PCM C144-2 (79)	Ignition Coil #1
2	Main Relay	Battery (B+)

Ignition Coil #3

Terminal	Connected to	Function
1	PCM C144-2 (77)	Ignition Coil #3
2	Main Relay	Battery (B+)

Ignition Coil #5

Terminal	Connected to	Function
1	PCM C144-2 (78)	Ignition Coil #5
2	Main Relay	Battery (B+)

Ignition Coil #2

Terminal	Connected to	Function
1	PCM C144-2 (60)	Ignition Coil #2
2	Main Relay	Battery (B+)

Ignition Coil #4

Terminal	Connected to	Function
1	PCM C144-2 (40)	Ignition Coil #4
2	Main Relay	Battery (B+)

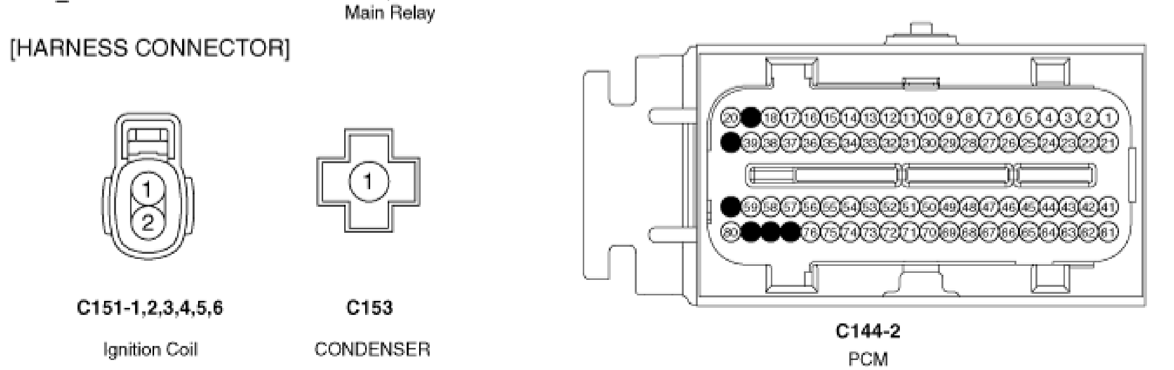
Ignition Coil #6

Terminal	Connected to	Function
1	PCM C144-2 (19)	Ignition Coil #6
2	Main Relay	Battery (B+)

CONDENSER

Terminal	Connected to	Function
1	Main Relay	Power Supply (B+)

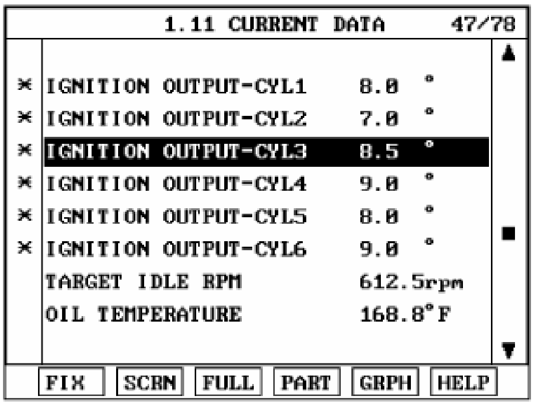
[HARNESS CONNECTOR]



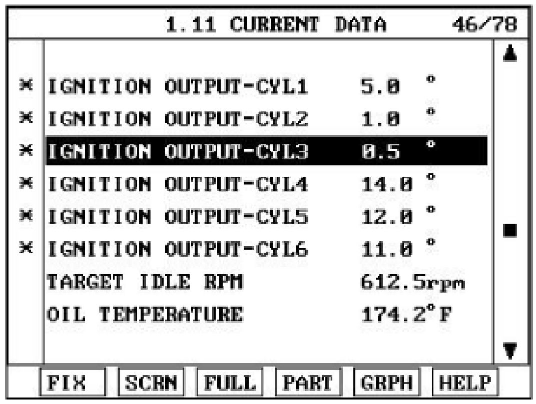
MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor items related to Ignition on the service data.

Specification : BTDC 10° ± 5°



Normal at idle



Open at idle

4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, ending, corrosion, contamination, deterioration, or damage. Repair or replace asnecessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

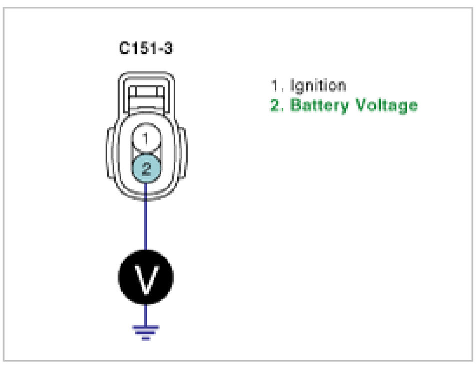
NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSEPCTION

1. Check voltage
   (1) IG "OFF" and disconnect Ignition Coil connector.
   (2) IG "ON" and ENG "OFF"
   (3) Measure voltage between terminal 2 of ignition coil harness connector and chassis ground.

Specification : Approx. B+



   (4) Is the measured voltage within specification ?

YES

▸ Go to "Control Circuit Inspection" procedure.

NO

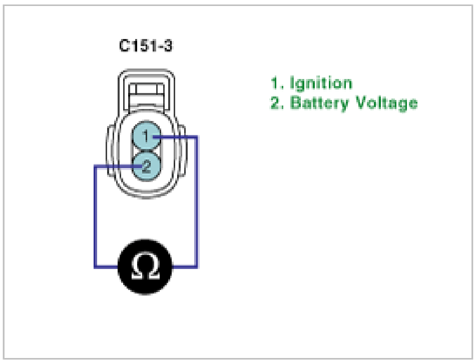
▸ Check fuse connected to ignition coil for open.

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check short to battery in harness.
   (1) IG "OFF" and disconnect ignitioncoil connector and PCM connector.
   (2) Measure resistance between terminals 1 and 2 of ignition coil harness connector.

Specification : Infinite



   (3) Is the measured resistance within specification?

YES

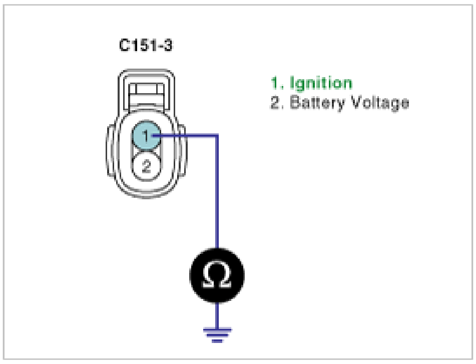
▸ Go to "Check short to ground in harness" as follows.

NO

▸ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check short to ground in harness
   (1) IG "OFF" and disconnect ignition coil connector and PCM connector.
   (2) Measure resistance between terminal 1 of ignition coil harness connector and chassis ground.

Specification : Infinite



   (3) Is the measured resistance within specification?

YES

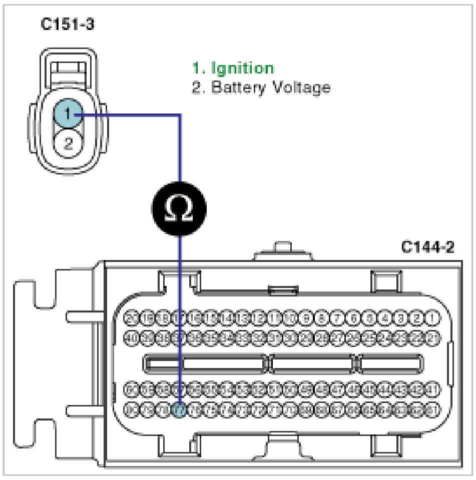
▸ Go to "Check open in harness" as follows.

NO

▸ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

3. Check open in harness
   (1) IG "OFF" and disconnect Ignition Coil connector and PCM connector.
   (2) Measure resistance between terminal 1 of Ignition Coil harness connector and terminal 77 of PCM harness connector.

Specification : Below 1Ω



(3) Is the measured resistance within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check Ignition Coil

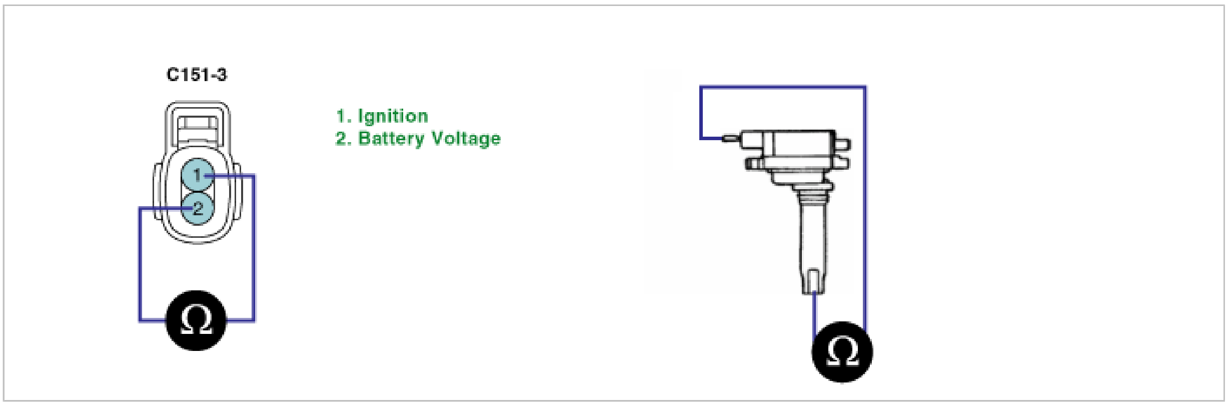
(1) IG "OFF" and disconnect ignition coil connector.

(2) Measure resistance between terminals 1 and 2 of ignition coil connector.(Component side)

(3) Measure resistance between terminal 1 of ignition coil connector and out terminal of secondary ignition coil.

Specification :

Resistance (Ω)	Primary Coil	Secondary Coil
	0.62 ± 10%	7.0k ± 15%



(4) Is the measured resistance within specification?

YES

▸ Substitute with a known - good PCM and check for proper operation

▸ If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good Ignition Coil and check for proper operation.

▸ If the problem is corrected, replace Ignition Coil and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0354

COMPONENT LOCATION

GENERAL DESCRIPTION

When the ignition switch is ON or START position, voltage is applied to the ignition coil. Each ignition coil consists of two coils. High tension leads go to each cylinder from ignition coils. Ignition coils fire two spark plugs on every power stroke (the cylinder under compression and the one on the exhaust stroke). PCM provides ground to a switching circuit for energizing the primary ignition coils. PCM uses the crankshaft position sensor and camshaft position sensor signals to meet the timing of energizing coil. When a primary ignition coil is energized or de-energized, the secondary coil produces a high voltage spike to the attached spark plugs.

DTC DESCRIPTION

Checking output signals from ignition coils every 10 sec. under detecting condition, if signals indicating open of short in the circuit are detected for more than 10 sec., PCM sets P0354. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

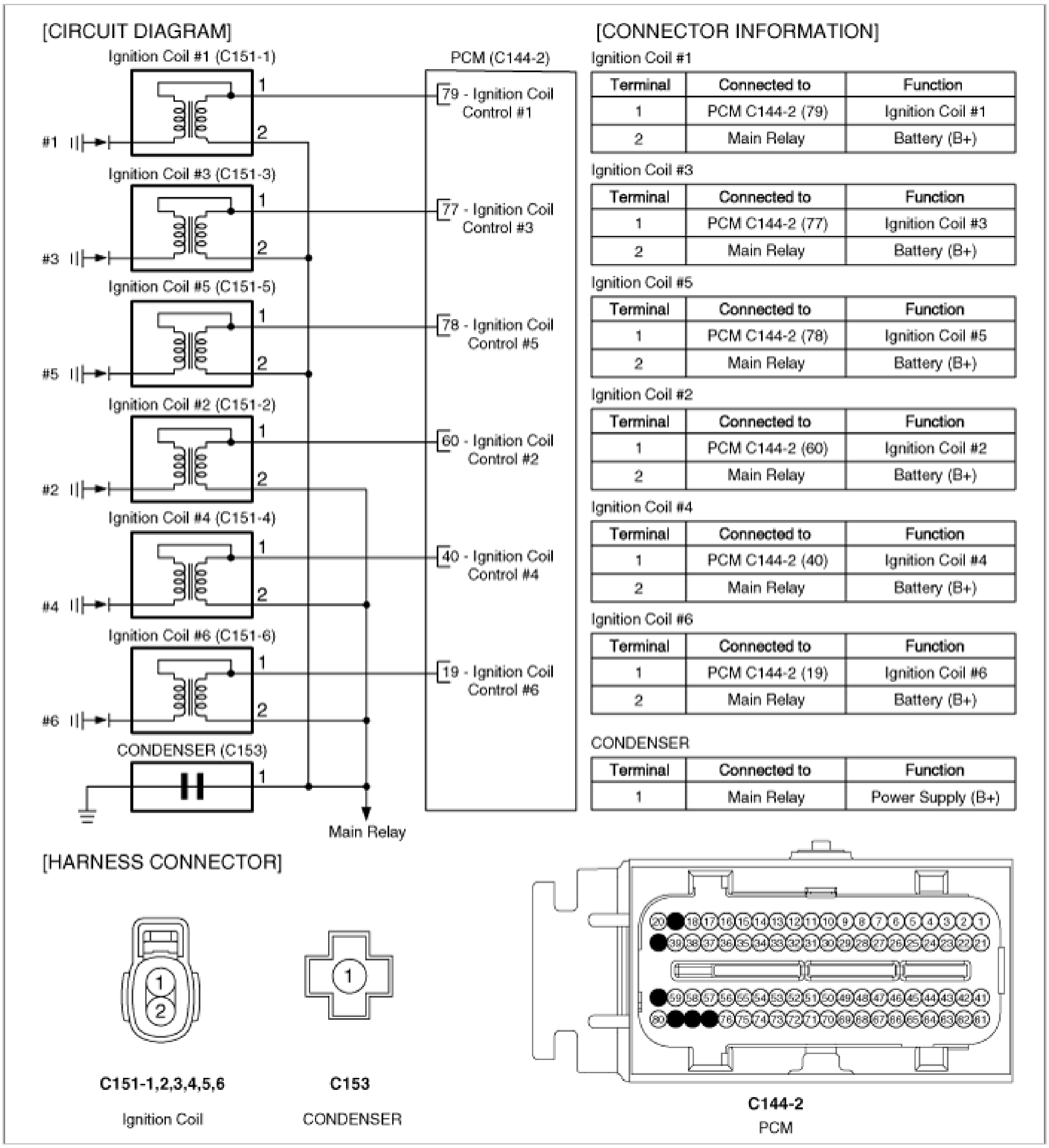
DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to ground, to battery or open circuit	• Poor connection • Open or short in harness • Ignition Coil • PCM
EnableConditions	• NO DTC related to this item • Engine running state • 11V ≤ Battery voltage ≤ 16V • The above conditions are met > 0.5 sec.	
Threshold value	• Open or short	
DiagnosisTime	• Continuous (More than 5 sec.failure for every 10 sec.test)	
MIL On Condition	• 2 driving cycles	

SPECIFICATION

Resistance (Ω)	Primary Coil	Secondary Coil
	0.62 ± 10%	7.0k ± 15%

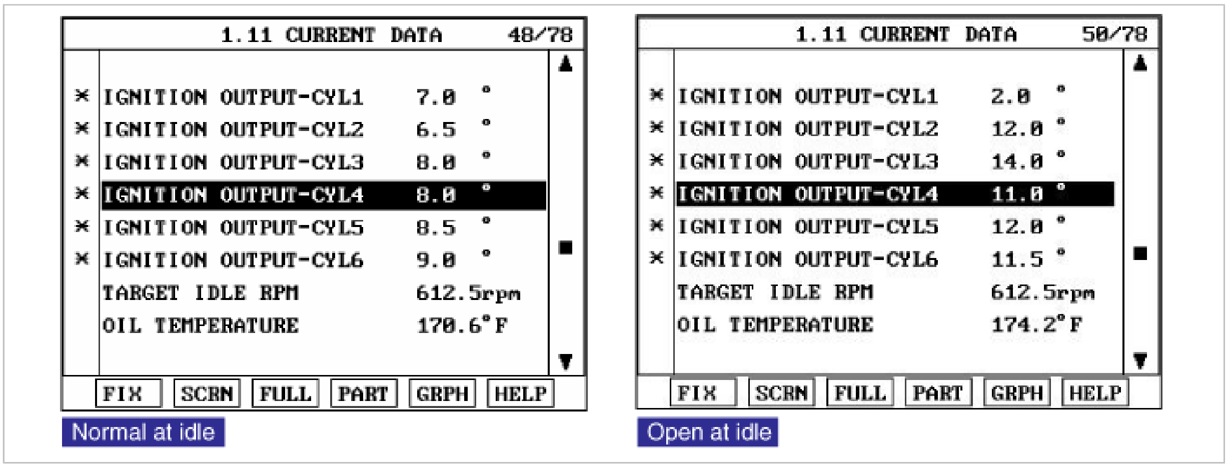
SCHEMATIC DIAGRAM



MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor items related to Ignition on the service data.

Specification : BTDC 10° ± 5°



4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, ending, corrosion, contamination, deterioration, or damage. Repair or replace asnecessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

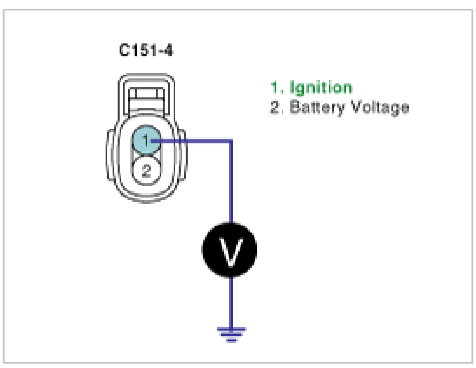
NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSEPCTION

1. Check voltage
   (1) IG "OFF" and disconnect Ignition Coil connector.
   (2) IG "ON" and ENG "OFF"
   (3) Measure voltage between terminal 1 of ignition coil harness connector and chassis ground.

Specification : Approx. B+



(4) Is the measured voltage within specification ?

YES

▸ Go to "Control Circuit Inspection" procedure.

NO

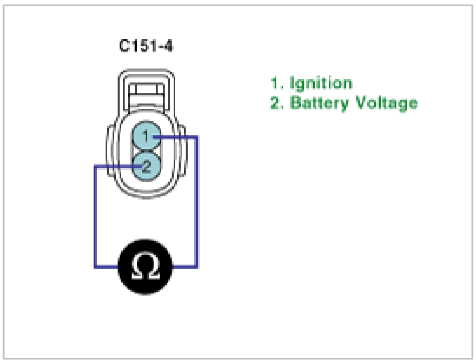
▸ Check fuse connected to ignition coil for open.

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check short to battery in harness.
   (1) IG "OFF" and disconnect ignitioncoil connector and PCM connector.
   (2) Measure resistance between terminals 1 and 2 of ignition coil harness connector.

Specification : Infinite



   (3) Is the measured resistance within specification?

YES

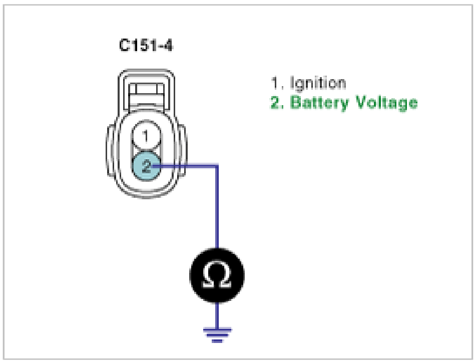
▸ Go to "Check short to ground in harness" as follows.

NO

▸ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check short to ground in harness
   (1) IG "OFF" and disconnect ignition coil connector and PCM connector.
   (2) Measure resistance between terminal 2 of ignition coil harness connector and chassis ground.

Specification : Infinite



   (3) Is the measured resistance within specification?

YES

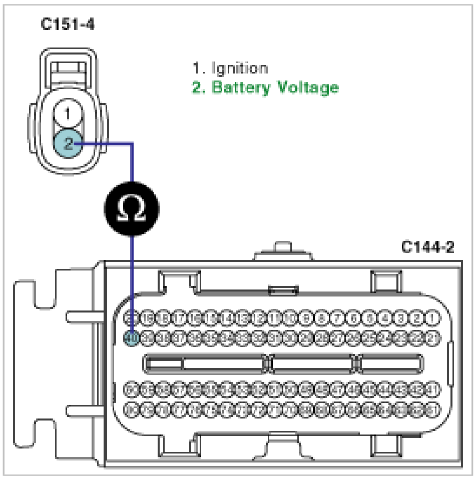
▸ Go to "Check open in harness" as follows.

NO

▸ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

3. Check open in harness
   (1) IG "OFF" and disconnect Ignition Coil connector and PCM connector.
   (2) Measure resistance between terminal 2 of Ignition Coil harness connector and terminal 40 of PCM harness connector.

Specification : Below 1Ω



(3) Is the measured resistance within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

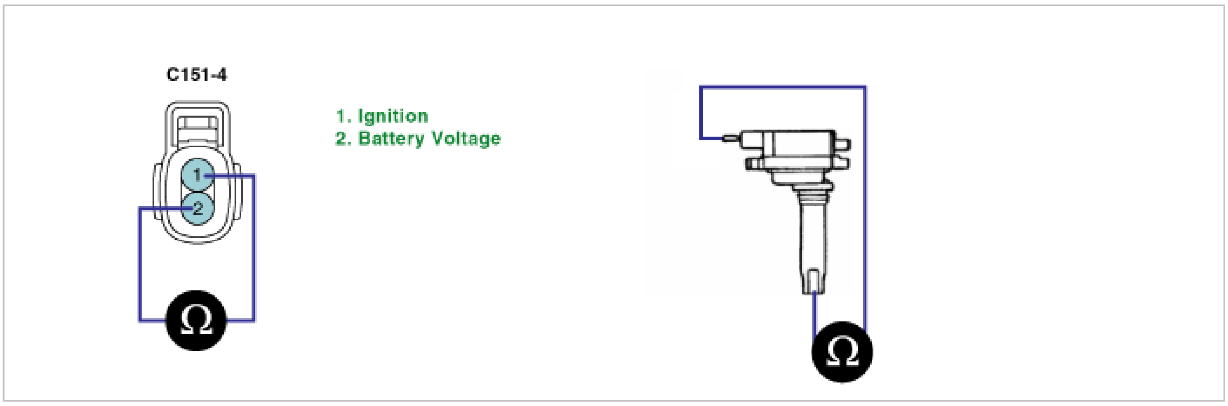
▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check Ignition Coil
   (1) IG "OFF" and disconnect ignition coil connector.
   (2) Measure resistance between terminals 1 and 2 of ignition coil connector.(Component side)
   (3) Measure resistance between terminal 1 of ignition coil connector and out terminal of secondary ignition coil.

Specification :

Resistance (Ω)	Primary Coil	Secondary Coil
	0.62 ± 10%	7.0k ± 15%



(4) Is the measured resistance within specification?

YES

▸ Substitute with a known - good PCM and check for proper operation
▸ If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good Ignition Coil and check for proper operation.
▸ If the problem is corrected, replace Ignition Coil and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0355

COMPONENT LOCATION

GENERAL DESCRIPTION

When the ignition switch is ON or START position, voltage is applied to the ignition coil. Each ignition coil consists of two coils. High tension leads go to each cylinder from ignition coils. Ignition coils fire two spark plugs on every power stroke (the cylinder under compression and the one on the exhaust stroke). PCM provides ground to a switching circuit for energizing the primary ignition coils. PCM uses the crankshaft position sensor and camshaft position sensor signals to meet the timing of energizing coil. When a primary ignition coil is energized or de-energized, the secondary coil produces a high voltage spike to the attached spark plugs.

DTC DESCRIPTION

Checking output signals from ignition coils every 10 sec. under detecting condition, if signals indicating open of short in the circuit are detected for more than 10 sec., PCM sets P0355. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

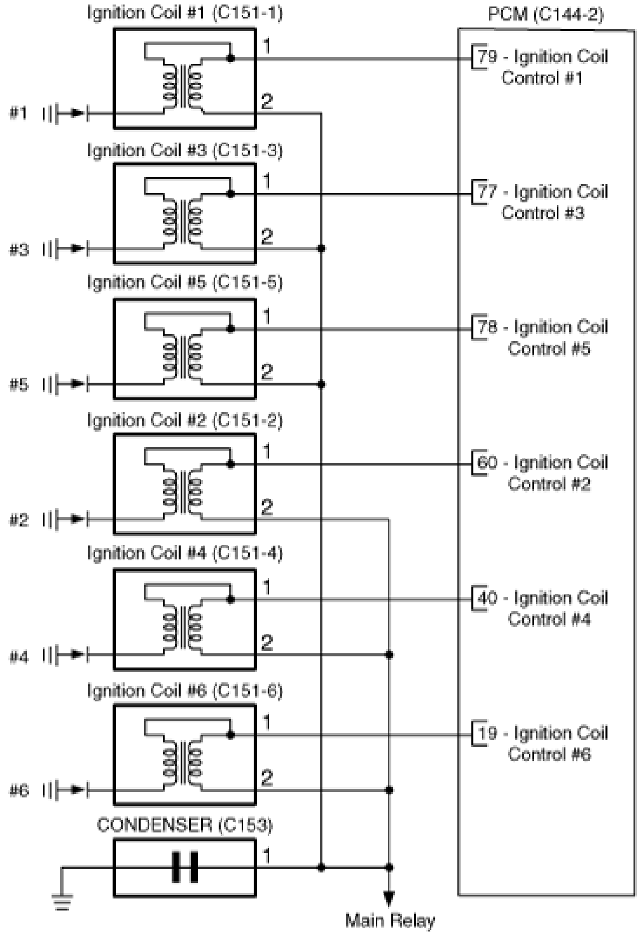
Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to ground, to battery or open circuit	• Poor connection • Open or short in harness • Ignition Coil • PCM
EnableConditions	• NO DTC related to this item • Engine running state • 11V ≤ Battery voltage ≤ 16V • The above conditions are met > 0.5 sec.	
Threshold value	• Open or short	
DiagnosisTime	• Continuous (More than 5 sec.failure for every 10 sec.test)	
MIL On Condition	• 2 driving cycles	

SPECIFICATION

Resistance (Ω)	Primary Coil	Secondary Coil
	0.62 ± 10%	7.0k ± 15%

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTOR INFORMATION]

Ignition Coil #1

Terminal	Connected to	Function
1	PCM C144-2 (79)	Ignition Coil #1
2	Main Relay	Battery (B+)

Ignition Coil #3

Terminal	Connected to	Function
1	PCM C144-2 (77)	Ignition Coil #3
2	Main Relay	Battery (B+)

Ignition Coil #5

Terminal	Connected to	Function
1	PCM C144-2 (78)	Ignition Coil #5
2	Main Relay	Battery (B+)

Ignition Coil #2

Terminal	Connected to	Function
1	PCM C144-2 (60)	Ignition Coil #2
2	Main Relay	Battery (B+)

Ignition Coil #4

Terminal	Connected to	Function
1	PCM C144-2 (40)	Ignition Coil #4
2	Main Relay	Battery (B+)

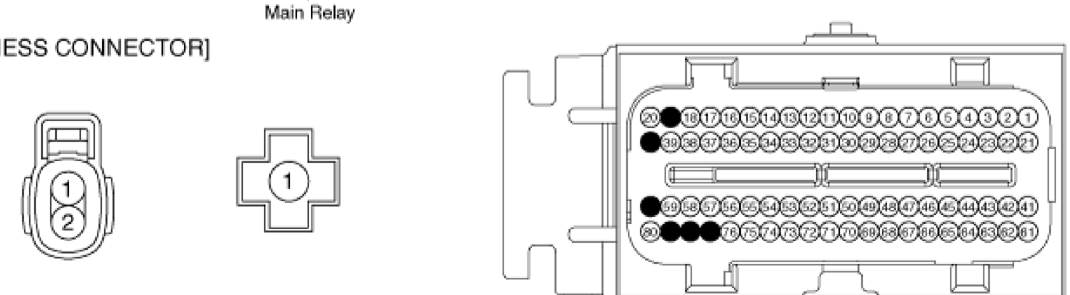
Ignition Coil #6

Terminal	Connected to	Function
1	PCM C144-2 (19)	Ignition Coil #6
2	Main Relay	Battery (B+)

CONDENSER

Terminal	Connected to	Function
1	Main Relay	Power Supply (B+)

[HARNESS CONNECTOR]



C151-1,2,3,4,5,6 Ignition Coil

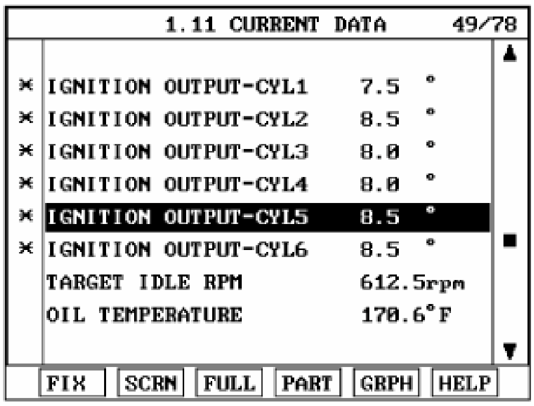
C153 CONDENSER

C144-2 PCM

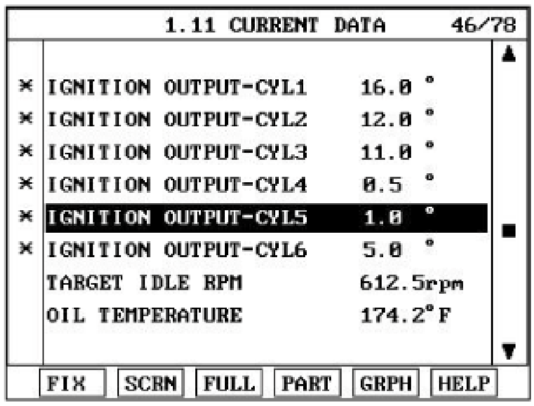
MONITOR SCANTOOL DATA

1. IG "OFF"& connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor items related to Ignition on the service data.

Specification : BTDC 10° ± 5°



Normal at idle



Open at idle

4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, ending, corrosion, contamination, deterioration, or damage. Repair or replace asnecessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

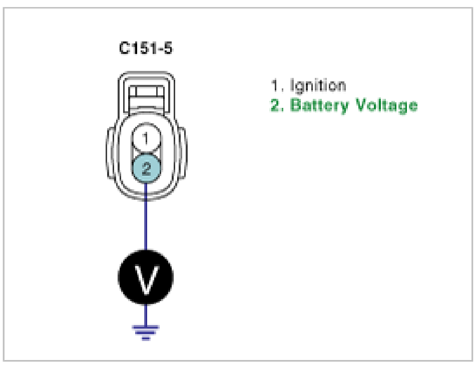
NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSEPCTION

1. Check voltage
   (1) IG "OFF" and disconnect Ignition Coil connector.
   (2) IG "ON" and ENG "OFF"
   (3) Measure voltage between terminal 2 of ignition coil harness connector and chassis ground.

Specification : Approx. B+



(4) Is the measured voltage within specification ?

YES

▸ Go to "Control Circuit Inspection" procedure.

NO

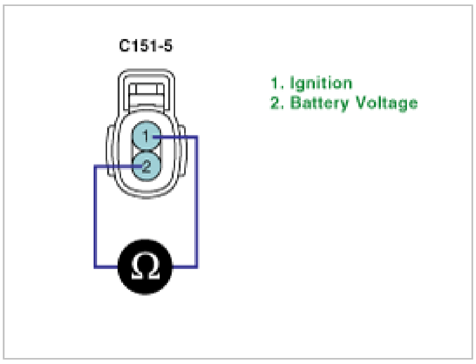
▸ Check fuse connected to ignition coil for open.

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check short to battery in harness.
   (1) IG "OFF" and disconnect ignitioncoil connector and PCM connector.
   (2) Measure resistance between terminals 1 and 2 of ignition coil harness connector.

Specification : Infinite



   (3) Is the measured resistance within specification?

YES

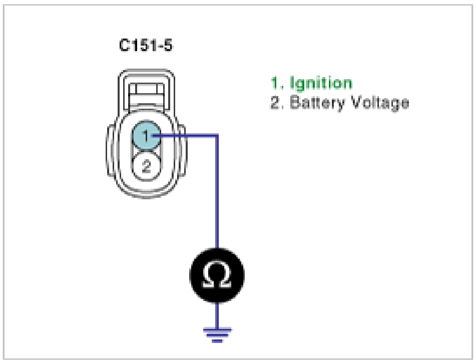
▸ Go to "Check short to ground in harness" as follows.

NO

▸ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check short to ground in harness
   (1) IG "OFF" and disconnect ignition coil connector and PCM connector.
   (2) Measure resistance between terminal 1 of ignition coil harness connector and chassis ground.

Specification : Infinite



   (3) Is the measured resistance within specification?

YES

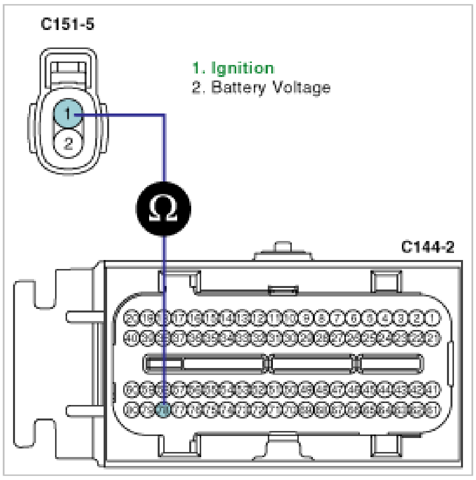
▸ Go to "Check open in harness" as follows.

NO

▸ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

3. Check open in harness
   (1) IG "OFF" and disconnect Ignition Coil connector and PCM connector.
   (2) Measure resistance between terminal 1 of Ignition Coil harness connector and terminal 78 of PCM harness connector.

Specification : Below 1Ω



(3) Is the measured resistance within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check Ignition Coil

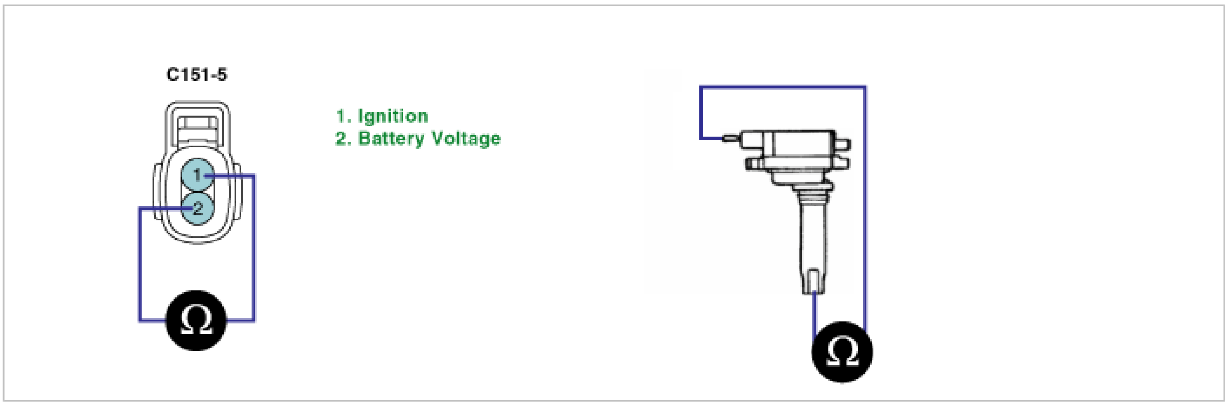
(1) IG "OFF" and disconnect ignition coil connector.

(2) Measure resistance between terminals 1 and 2 of ignition coil connector.(Component side)

(3) Measure resistance between terminal 1 of ignition coil connector and out terminal of secondary ignition coil.

Specification :

Resistance (Ω)	Primary Coil	Secondary Coil
	0.62 ± 10%	7.0k ± 15%



(4) Is the measured resistance within specification?

YES

▸ Substitute with a known - good PCM and check for proper operation

▸ If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good Ignition Coil and check for proper operation.

▸ If the problem is corrected, replace Ignition Coil and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0356

COMPONENT LOCATION

GENERAL DESCRIPTION

When the ignition switch is ON or START position, voltage is applied to the ignition coil. Each ignition coil consists of two coils. High tension leads go to each cylinder from ignition coils. Ignition coils fire two spark plugs on every power stroke (the cylinder under compression and the one on the exhaust stroke). PCM provides ground to a switching circuit for energizing the primary ignition coils. PCM uses the crankshaft position sensor and camshaft position sensor signals to meet the timing of energizing coil. When a primary ignition coil is energized or de-energized, the secondary coil produces a high voltage spike to the attached spark plugs.

DTC DESCRIPTION

Checking output signals from ignition coils every 10 sec. under detecting condition, if signals indicating open of short in the circuit are detected for more than 10 sec., PCM sets P0356. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

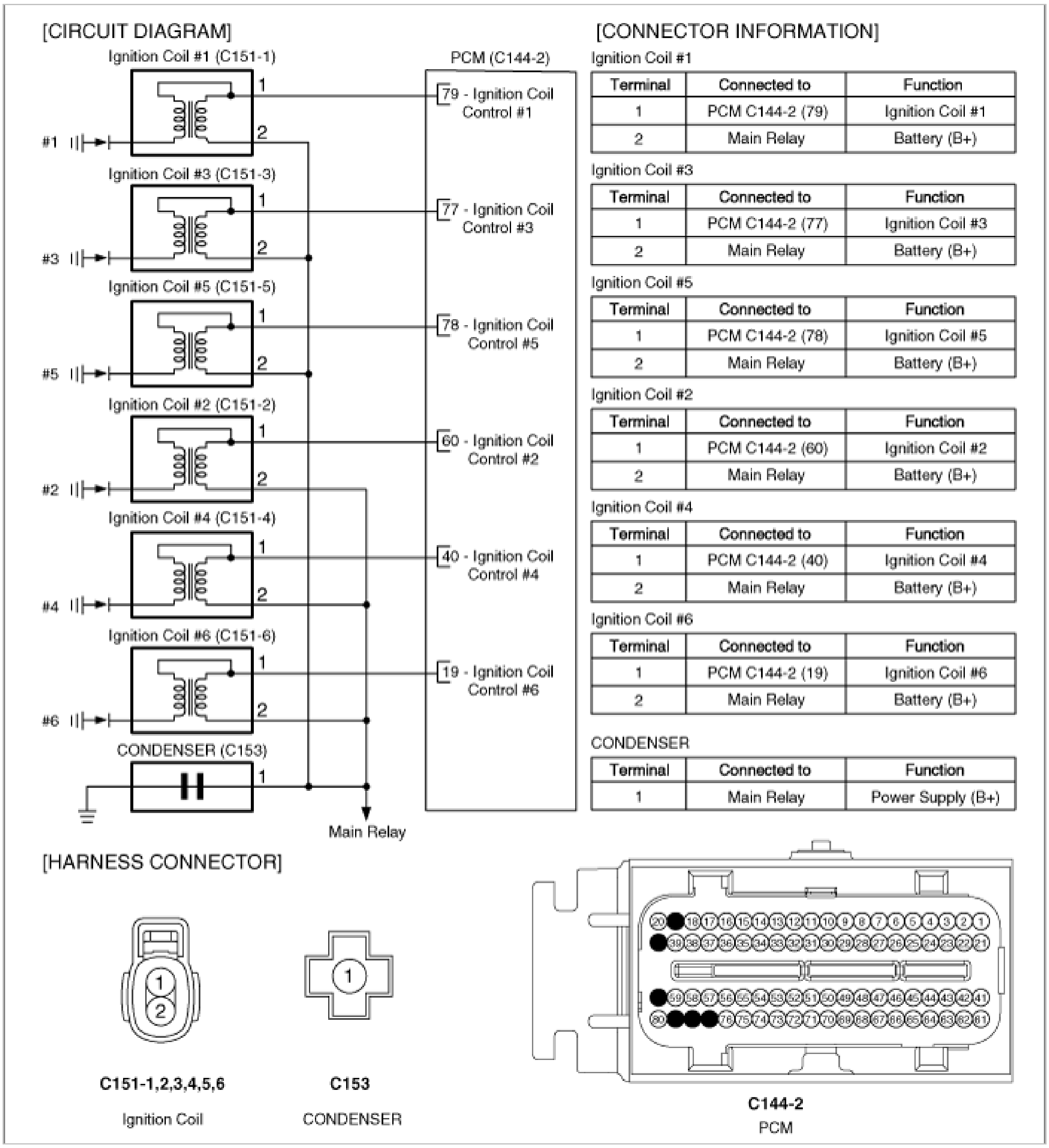
DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to ground, to battery or open circuit	• Poor connection • Open or short in harness • Ignition Coil • PCM
EnableConditions	• NO DTC related to this item • Engine running state • 11V ≤ Battery voltage ≤ 16V • The above conditions are met > 0.5 sec.	
Threshold value	• Open or short	
DiagnosisTime	• Continuous (More than 5 sec.failure for every 10 sec.test)	
MIL On Condition	• 2 driving cycles	

SPECIFICATION

Resistance (Ω)	Primary Coil	Secondary Coil
	0.62 ± 10%	7.0k ± 15%

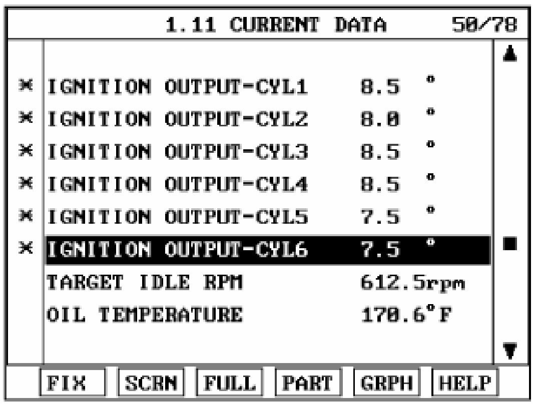
SCHEMATIC DIAGRAM



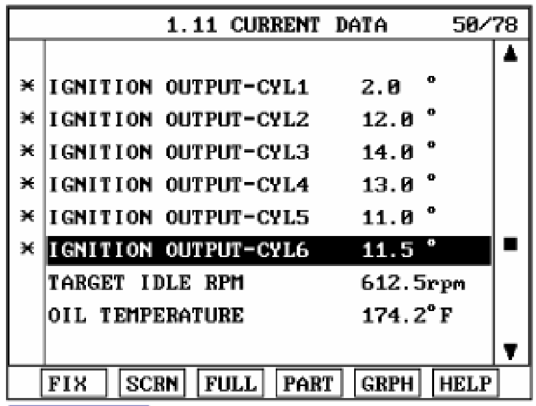
MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor items related to Ignition on the service data.

Specification : BTDC 10° ± 5°



Normal at idle



Open at idle

4. Is the service data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, ending, corrosion, contamination, deterioration, or damage. Repair or replace asnecessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

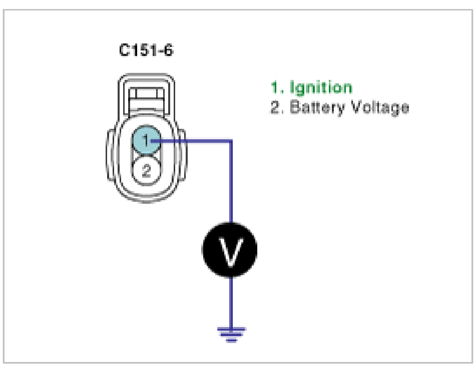
NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSEPCTION

1. Check voltage
   (1) IG "OFF" and disconnect Ignition Coil connector.
   (2) IG "ON" and ENG "OFF"
   (3) Measure voltage between terminal 1 of ignition coil harness connector and chassis ground.

Specification : Approx. B+



   (4) Is the measured voltage within specification ?

YES

▸ Go to "Control Circuit Inspection" procedure.

NO

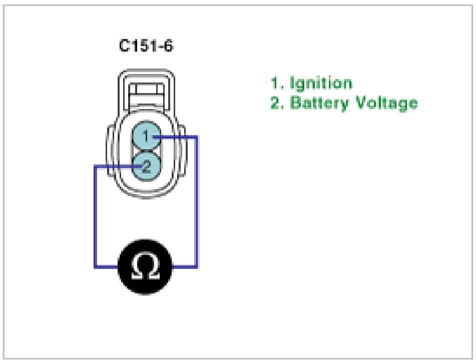
▸ Check fuse connected to ignition coil for open.

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check short to battery in harness.
   (1) IG "OFF" and disconnect ignitioncoil connector and PCM connector.
   (2) Measure resistance between terminals 1 and 2 of ignition coil harness connector.

Specification : Infinite



   (3) Is the measured resistance within specification?

YES

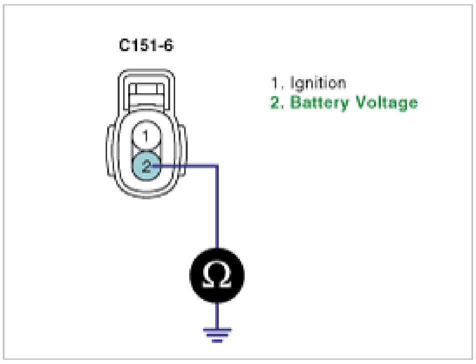
▸ Go to "Check short to ground in harness" as follows.

NO

▸ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check short to ground in harness
   (1) IG "OFF" and disconnect ignition coil connector and PCM connector.
   (2) Measure resistance between terminal 2 of ignition coil harness connector and chassis ground.

Specification : Infinite



   (3) Is the measured resistance within specification?

YES

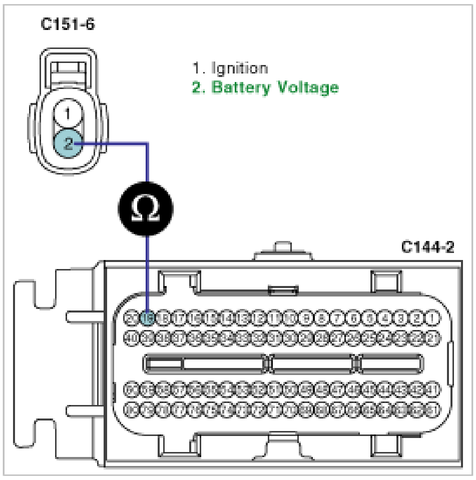
▸ Go to "Check open in harness" as follows.

NO

▸ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

3. Check open in harness
   (1) IG "OFF" and disconnect Ignition Coil connector and PCM connector.
   (2) Measure resistance between terminal 2 of Ignition Coil harness connector and terminal 19 of PCM harness connector.

Specification : Below 1Ω



(3) Is the measured resistance within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check Ignition Coil

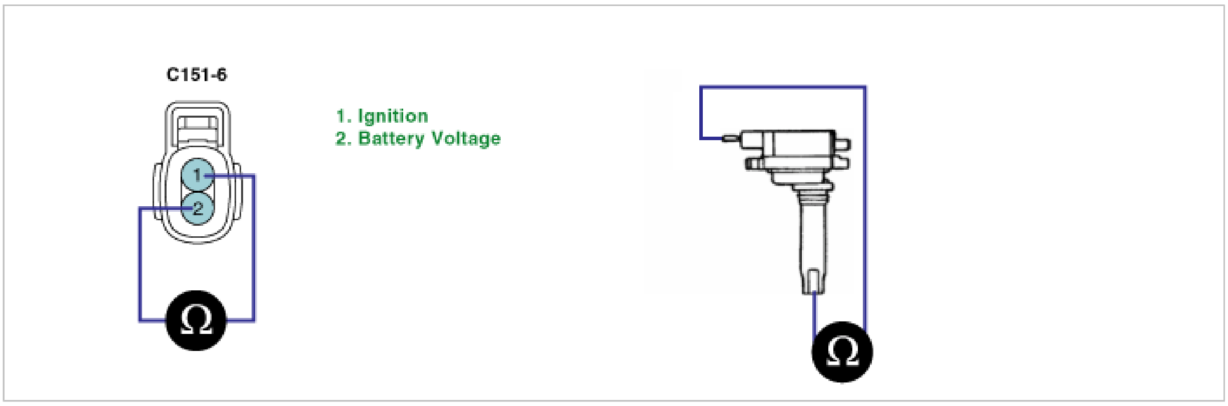
(1) IG "OFF" and disconnect ignition coil connector.

(2) Measure resistance between terminals 1 and 2 of ignition coil connector.(Component side)

(3) Measure resistance between terminal 1 of ignition coil connector and out terminal of secondary ignition coil.

Specification :

Resistance (Ω)	Primary Coil	Secondary Coil
	0.62 ± 10%	7.0k ± 15%



(4) Is the measured resistance within specification?

YES

▸ Substitute with a known - good PCM and check for proper operation

▸ If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good Ignition Coil and check for proper operation.

▸ If the problem is corrected, replace Ignition Coil and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0420

COMPONENT LOCATION

GENERAL DESCRIPTION

The catalyst’s efficiency is demonstrated by its ability to oxidize CO and hydrocarbon emissions. The Powertrain Control Module (PCM) compares the output signals of the front and rear oxygen sensors to determine whether the output of the rear sensor is beginning to match the output of the front oxygen sensor. Air/fuel mixture compensation keeps the frequency of the front oxygen sensor high due to the changes from rich-to-lean combusition. The catalyst causes the rear oxygen sensor to have a lower frequency. As the catalyst wears, the rear oxygen sensor’s signal trace begins to match the front oxygen sensor’s signal trace. That is because the catalyst becomes saturated with oxygen and cannot use the oxygen to convert hydrocarbon and CO into H_2O and CO_2 with the same efficiency as when it was new. A completely worn catalyst shows a 100% match between the frequency of the front and rear sensors.

DTC DESCRIPTION

If the oxygen storage time for B1 is higher than threshold , the PCM determines that a fault exists and a DTC is stored. MIL (Malfunction Indicatin Lamp) turns on when the malfunction lasts till 1 driving cycle.

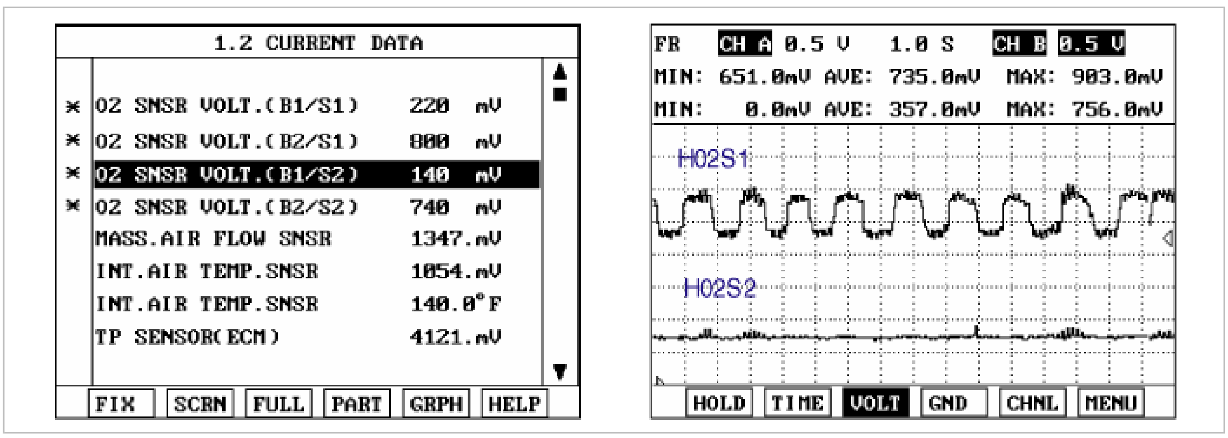
DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• The ICMD Diagnostic manipulates Airfuel and stores the times it takes for the pre and post converter oxygen sensors to switch. It then calculates EWMA values and compares them against calibratable thresholds in order to determine the PASS/FAIL status.	
	• Engine Runtime Sufficient ≥ 580sec • Purge Concentration Learned • 3g/s ≤ Airflow within range ≤ 10g/s • Throttle closed ≤ 1.5015% • 70°C(158 °°F) ≤ Coolant Temp ≤ 120°C(248 °F) • -7°C(19.4 °F) ≤ Ambient Temp ≤ 105°C(221 °F)	

EnableConditions	• Barometer ≥ 72kPa • Too many test attempts ≤ 12 • Closed Loop • 250°C(482 °F) ≤ Catalyst Temp ≤ 950°C(1742 °°F) • Fuel Integrator deviation from stoich below maximum ≤ 0.05 • Vehicle speed ≤ 3kph(1.864114mph) • BLM Learn completed • Low idle airflow not present (airflow delay complete) • Not airfuel ramping • Not idling for too long ≤ 60sec • Test not complete • No disabling faults present • No instrumentation slews active • No OFVC device control active	• Leakage in the exhaust system • Faulty Catalyst Converter • Faulty HO2S • Faulty PCM
Threshold value	• EWMA Oxygen Storage Time for Bank 1 ≥ 3.25s(Passing) 3.75s	
DiagnosisTime	• -	
MIL On Condition	• 1 Driving cycle	

MONITOR SCANTOOL DATA

1. Ignition "OFF"
2. Connect Scantool and Ignition "ON".
3. Monitor the HO2S parameters and signal waveform on scantool.



4. Are the signal of rear HO2S and waveform the same as that of the front HO2S?

YES

▸ Go to "System Inspection" procedure.

NO

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection,bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and goto "Verification vehicle Repair" procedure.

SYSTEM INSPECTION

1. Check Exhaust sytem.
   (1) Visually/physically inspect the following conditions:
      A. Exhaust system between HO2S and Three way catalyst for air leakage
      B. Damage, and for loose or missing hardware:

   (2) Has a problem been found in any of the above areas?

   YES

   ▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

   NO

▸ Go to "Component Inspection" procedure.

COMPONENT INSPECTION

1. Check Rear HO2S.
   (1) Visually/physically inspect the rear HO2S for the following conditions:
      A. Ensure that the HO2S is securely installed.
         (Pigtail and wiring harness not making contact with the exhaust pipe)
      B. Check for corrosion on terminals.
      C. Check for terminal tension (at the HO2S and at the PCM).
      D. Any damage.

   (2) Has a problem been found in any of the above areas?

   YES

   ▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Go to "Check TWC" as below.

2. Check TWC
   (1) Visually/physically inspect the three-way catalyst(TWC) converter for the following damage:
      A. Severe discoloration caused by excessive temperature
      B. Dents and holes
      C. Internal rattle caused by a damaged catalyst

   (2) Also, ensure that the TWC is a proper original equipment manufacturer part.

   (3) Has a problem been found?

   YES

   ▸ Substitute with a known - good TWC and check for proper operation.
   ▸ If the problem is corrected, replace TWC and go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Substitute with a known - good PCM and check for proper operation.
   ▸ If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

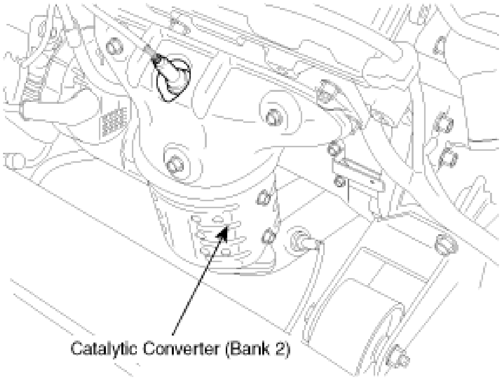
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0430

COMPONENT LOCATION



GENERAL DESCRIPTION

The catalyst's efficiency is demonstrated by its ability to oxidize CO and hydrocarbon emissions. The Powertrain Control Module (PCM) compares the output signals of the front and rear oxygen sensors to determine whether the output of the rear sensor is beginning to match the output of the front oxygen sensor. Air/fuel mixture compensation keeps the frequency of the front oxygen sensor high due to the changes from rich-to-lean combusition. The catalyst causes the rear oxygen sensor to have a lower frequency. As the catalyst wears, the rear oxygen sensor's signal trace begins to match the front oxygen sensor's signal trace. That is because the catalyst becomes saturated with oxygen and cannot use the oxygen to convert hydrocarbon and CO into H_2O and CO_2 with the same efficiency as when it was new. A completely worn catalyst shows a 100% match between the frequency of the front and rear sensors.

DTC DESCRIPTION

If the oxygen storage time for B2 is higher than threshold , the PCM determines that a fault exists and a DTC is stored. MIL (Malfunction Indicatin Lamp) turns on when the malfunction lasts till 1 driving cycle.

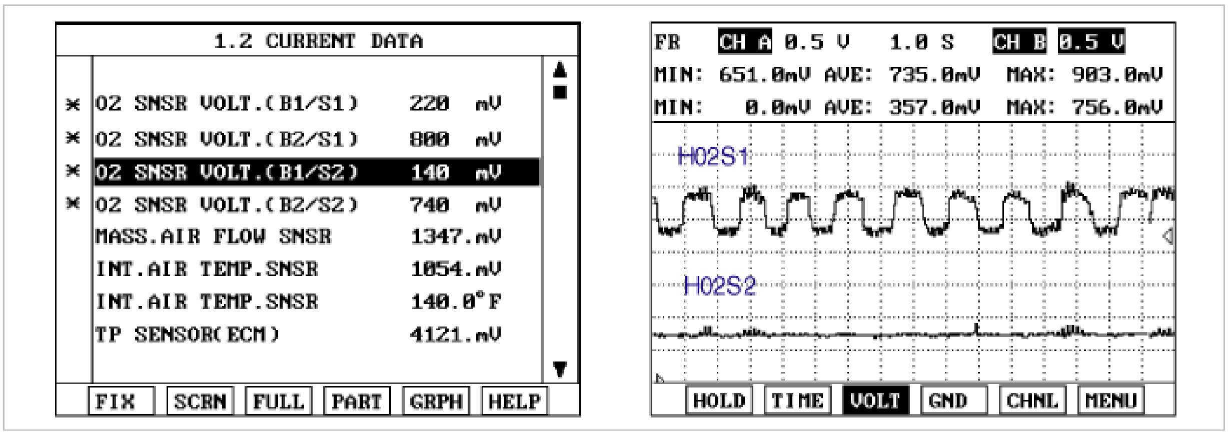
DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• The ICMD Diagnostic manipulates Airfuel and stores the times it takes for the pre and post converter oxygen sensors to switch. It then calculates EWMA values and compares them against calibratable thresholds in order to determine the PASS/FAIL status.	• Leakage in the exhaust system • Faulty Catalyst Converter • Faulty HO2S • Faulty PCM
EnableConditions	• Engine Runtime Sufficient ≥ 580sec • Purge Concentration Learned • 3g/s ≤ Airflow within range ≤ 10g/s • Throttle closed ≤ 1.5015% • 70°C(158 °°F) ≤ Coolant Temp ≤ 120°C(248 °F) • -7°C(19.4 °F) ≤ Ambient Temp ≤ 105°C(221 °F) • Barometer ≥ 72kPa • Too many test attempts ≤ 12 • Closed Loop • 250°C(482 °F) ≤ Catalyst Temp ≤ 950°C(1742 °°F) • Fuel Integrator deviation from stoich below maximum ≤ 0.05 • Vehicle speed ≤ 3kph(1.864114mph) • BLM Learn completed • Low idle airflow not present (airflow delay complete) • Not airfuel ramping • Not idling for too long ≤ 60sec • Test not complete • No disabling faults present • No instrumentation slews active • No OFVC device control active	
Threshold value	• EWMA Oxygen Storage Time for Bank 1 ≥ 3.25s(Passing)	

	3.75s	
DiagnosisTime	• -	
MIL On Condition	• 1 Driving cycle	

MONITOR SCANTOOL DATA

1. Ignition "OFF"
2. Connect Scantool and Ignition "ON".
3. Monitor the HO2S parameters and signal waveform on scantool.



4. Are the signal of rear HO2S and waveform the same as that of the front HO2S?

YES

▸ Go to "System Inspection" procedure.

NO

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection,bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and goto "Verification vehicle Repair" procedure.

SYSTEM INSPECTION

1. Check Exhaust sytem.
   (1) Visually/physically inspect the following conditions:
      A. Exhaust system between HO2S and Three way catalyst for air leakage
      B. Damage, and for loose or missing hardware:

   (2) Has a problem been found in any of the above areas?

   YES

   ▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Go to "Component Inspection" procedure.

COMPONENT INSPECTION

1. Check Rear HO2S.
   (1) Visually/physically inspect the rear HO2S for the following conditions:
      A. Ensure that the HO2S is securely installed.
         (Pigtail and wiring harness not making contact with the exhaust pipe)
      B. Check for corrosion on terminals.
      C. Check for terminal tension (at the HO2S and at the PCM).
      D. Any road damage.

   (2) Has a problem been found in any of the above areas?

   YES

   ▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

   NO

▸ Go to "Check TWC" as below.

2. Check TWC
   (1) Visually/physically inspect the three-way catalyst(TWC) converter for the following damage:
      A. Severe discoloration caused by excessive temperature
      B. Dents and holes
      C. Internal rattle caused by a damaged catalyst

   (2) Also, ensure that the TWC is a proper original equipment manufacturer part.

   (3) Has a problem been found?

YES

▸ Substitute with a known - good TWC and check for proper operation.
▸ If the problem is corrected, replace TWC and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good PCM and check for proper operation.
▸ If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0441

GENERAL DESCRIPTION

The evaporative emission control system prevents hydrocarbon (HC) vapors from the fuel tank from escaping into the atmosphere where they could form photochemical smog. Gasoline vapors are collected in the charcoal canister. The evaporative canister is designed to trap and store fuel vapor emissions from the fuel tank.
When the carbon in the canister is unsaturated, fuel vapor passing over and through the activated carbon surface is absorbed and fresh air can pass out through the vent system with very little residual fuel vapor. When fresh air is drawn through the canister from the vent system, fuel vapors recombine with the air and are metered into the engine.

DTC DESCRIPTION

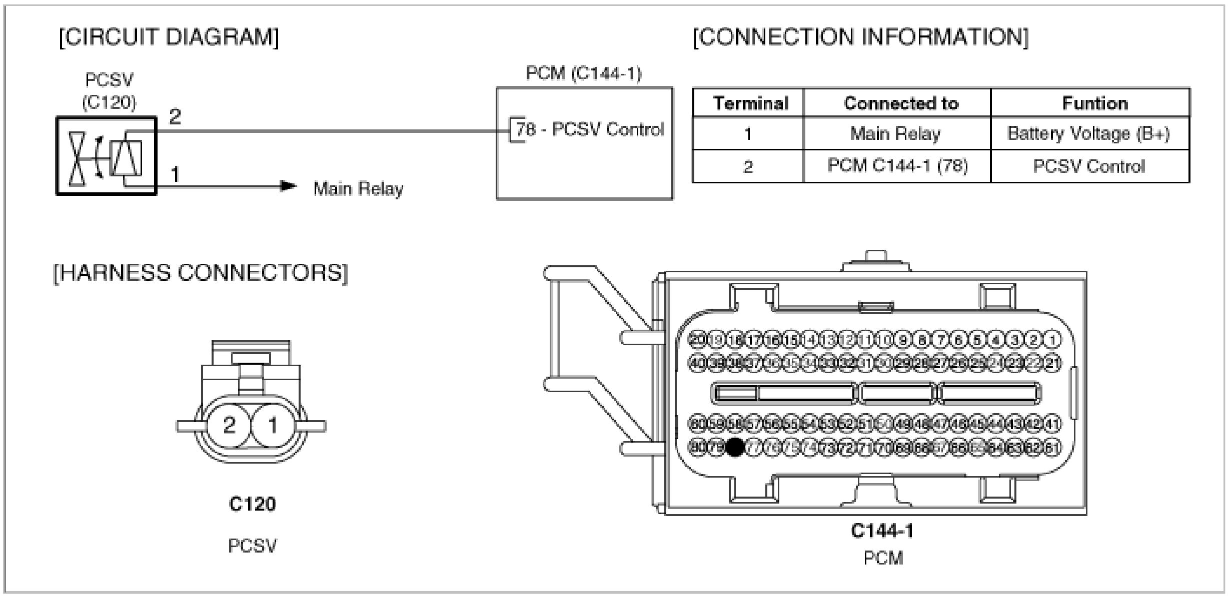
This test detects a leak across the purge valve by measuring an increase in evaporative system vacuum. A leak across the purge valve can allow hydrocarbons from the tank to leak to the atmosphere when the engine is off. The test should be calibrated to detect a 0.02” (0.5mm) leak path across the purge valve. This testdoes not require idle conditions to run.
Checking output signals from tank vaccum under detecting condition, if signals is high than threshold for more than 2 sec., PCM sets P0441. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till 1 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Test is failed if tank vacuum exceeds prescribed threshold, based on fuel level for a prescribed time	
	• 10 < Ignition Volt < 15.9907 • Barometric pressure > 72 kPa	

EnableConditions	• Engine off time > 720min or Startup IAT-Startup ECT < 12°C(53.6 °F) • Startup ECT -Startup IAT < 12°C(53.6 °F) • 0°C(32 °F) < Startup ECT < 40°C(104 °F) • 0°C(32 °F) < Startup IAT < 40°C(104 °F) • Start-up IAT-IAT < 1°C(33.8 °F) • 1s < Engine Run Time < 100s	• PCSV • PCM
Threshold value	• Tank vacuum ≥ 10 inH2O • Fail time > 2s	
DiagnosisTime	• Continuous	
MIL On Condition	• 1 driving cycle	

SCHEMATIC DIAGRAM

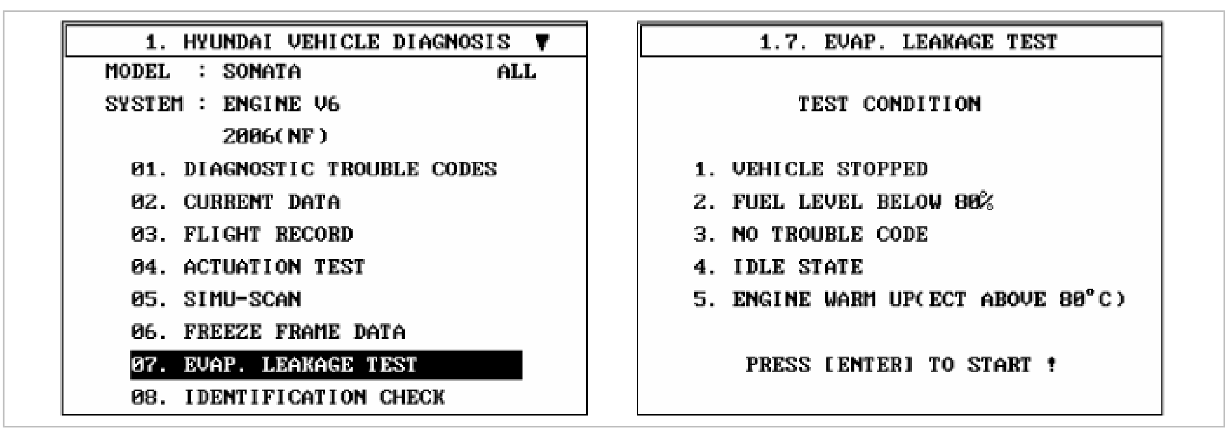


MONITOR SCANTOOL DATA

1. Warm-up engine to normal operating temperature.

> NOTE
>
> Evaporative Emissions Systems (EVAP) Leak Tests can be run by the Scan Tool.
> The tests are automated and provide either a pass-fail result or directions to check for DTCs.

2. Install scan tool and clear DTC
3. Perform "EVAP. LEAKAGE TEST" mode referring to enable conditions as below



4. Monitoring for (pending) DTC by performing " DIAGNOSTIC TROUBLE CODES" or "MONITORING TEST RESULTS". Is the

same DTC set ?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Fault is intermittent caused by poor contact in sensor’s and/or PCM’s connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection,bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and goto "Verification of vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check PCSV
   (1) Ignition "OFF"

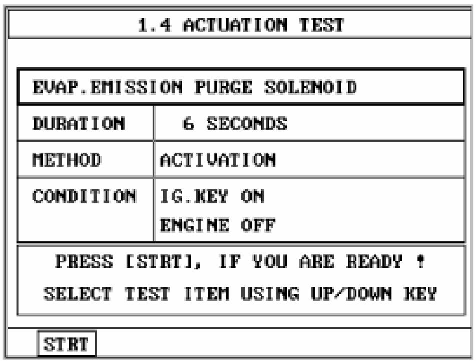
   (2) Remove PCSV and check it for open stuck or leak

   (3) Measure resistance between terminals "1" and "2" of the PCSV connector.

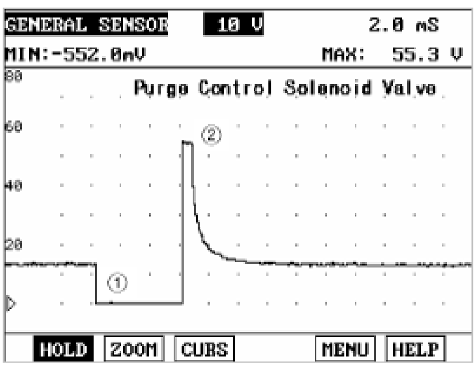
   Specification: Approx. 24.5 ~ 27.5Ω(20°C(68°F))

   (4) Connect Scantool and Perform ACTUATION TEST for PCSV with scantool

   (5) Check that clicking sound can be heard by actuation test.



   (6) Monitor the PCSV signal waveform and verify that the ground voltage is less than approx. 0.3V (①) and the surge voltage (②) is between 40 V and 60 V.



   (7) Is the PCSV normal?

YES

▸ Substitute with a known - good PCM and check for proper operation.
▸ If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Substitute with a known - good PCSV and check for proper operation.
▸ If the problem is corrected, replace PCSV and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0442

GENERAL DESCRIPTION

The Small Leak test determines the presence of a leak in the evaporative system that is 0.040”diameter (1.0 mm) or larger, as defined by CARB. The EVPD(Evaporative System Diagnostics) will only perform this test when idle conditions are present and the Large Leak test has reported a “pass” condition, indicating that the current tank vacuum level is approximately 10.2inH2O.

DTC DESCRIPTION

This test detects a leak across the purge valve by measuring an increase in evaporative system vacuum. A leak across the purge valve can allow hydrocarbons from the tank to leak to the atmosphere when the engine is off. The test should be calibrated to detect a 0.02” (0.5mm) leak path across the purge valve. This testdoes not require idle conditions to run.
Checking output signal from tank vaccum under detecting condition, if the signal is high than threshold, PCM sets P0442. MIL (Malfunction Indicatin Lamp) turns on when the malfunction lasts till 1 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• If a corrected vacuum decay slope and the individual segment slopes exceed their respective thresholds and the segment slopes are not convex then a small leak is present	• Leakage in each hose/fuel filler pipe • Leakage in PCSV/ CCV/Canister/ Fuel tank • PCM
EnableConditions	• 10 < Ignition Volt < 15.9907 • Barometric pressure > 72 kPa • Engine off time > 720min or Startup IAT-Startup ECT < 12°C(53.6 °F) • Startup ECT -Startup IAT < 12°C(53.6 °F) • 0°C(32 °F) < Startup ECT < 40°C(104 °F) • 0°C(32 °F) < Startup IAT < 40°C(104 °F) • Start-up IAT-IAT <1°C(33.8 °F) • 1s < Engine Run Time < 100s • Purge enabling Rum time < Threshold • Cold Test Timer < 300sec. • 0.03% < Fuel level < 0.97% **Under Idle conditions** • Engine RPM < 1500 • Vehicle Speed < 3KPH(1.864114 MPH) • Throttle Position < 1% **Creep Conditions** • Engine RPM < 1500 • Vehicle Speed < 6KPH(3.728227 MPH) • Throttle Position < 1.9989% **Fuel not Sloshing** • Vehicle Speed > 2KPH(1.242742 MPH) • Thorttle Postion > 1% • 125mS MAP change > 10KPa • 125mS Engine Speed > 100RPM • 125mS Fuel Level change > Threshold	
	• Decay slope (beginning at decay start < 10 inH2O and	

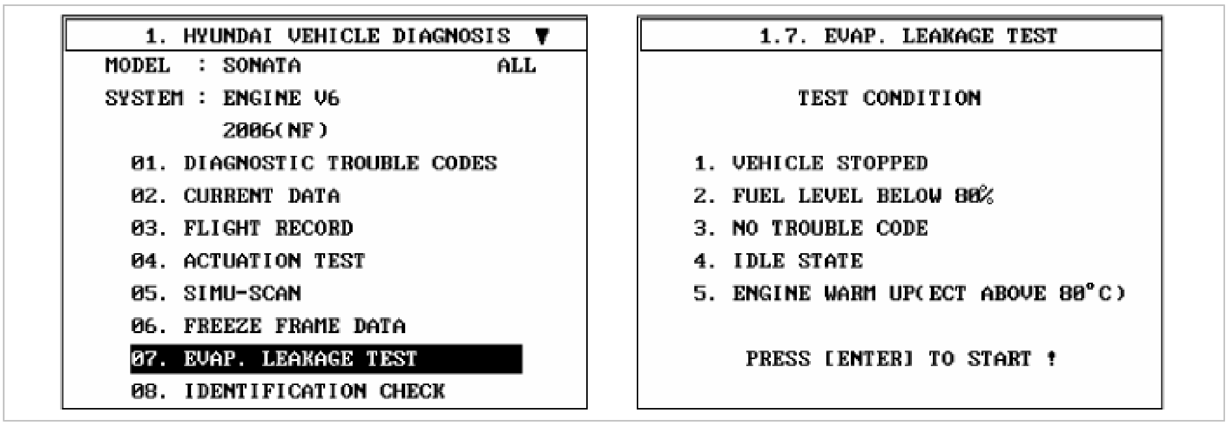
Threshold value	lasting for decay time < 10sec) minus the larger vapor correction term (purge leak vapor term OR Post decay vapor term) is greater than threshold (the product of a base term using fuel level AND a temperature bias term) • All segment slopes greater than their threshold(the product of a base term AND a temperature bias term AND a segment bias term)	
DiagnosisTime	• Continuous	
MIL On Condition	• 1 driving cycle	

MONITOR SCANTOOL DATA

1. Warm-up engine to normal operating temperature.

> NOTE
>
> Evaporative Emissions Systems (EVAP) Leak Tests can be run by the Scan Tool.
> The tests are automated and provide either a pass-fail result or directions to check for DTCs.

2. Install scan tool and clear DTC.
3. Perform "EVAP. LEAKAGE TEST" mode referring to enable conditions as below.



4. Monitoring for (pending) DTC by performing " DIAGNOSTIC TROUBLE CODES"or "MONITORING TEST RESULTS".
5. Is the same DTC set ?

YES

▸ Go to "System Inspection" procedure.

NO

▸ Fault is intermittent caused by poor contact in sensor's and/or PCM's connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection,bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and goto "Verification of vehicle Repair" procedure,

SYSTEM INSPECTION

1. Check vapor hoses for leakage in fuel system.
   (1) Check vapor hoses between the following components for leakage:
      A. Intake manifoled ~ Purge control solenoid valve (PCSV)
      B. Purge control solenoid valve (PCSV) ~ Canister
      C. Canister ~ Canister close valve (CCV)
      D. Canister ~ fuel tank

   (2) Does a leak exist?

   YES

   ▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Go to "Check fuel filler pipe for leakage" as below.

2. Check fuel filler pipe for crack or leakage.

(1) Check that there is crack or leakage in fuel filler pipe.

(2) Does a malfunction exist?

YES

▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

NO

▸ Go to "Component inspection" procedure.

COMPONENT INSPECTION

1. Check CCV for leakage.

(1) Disconnect the hose leading from the CCV to Canister at CCV.

(2) When the CCV is operated, apply a vacuum at the nipple and verify that the CCV holds vacuum.

(3) Does a leak exist?

YES

▸ Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Go to "Check Canister for leakage" as necessary.

2. Check Canister for leakage.

(1) Disconnect the hose leading from the CCV to Canister at Canister.

(2) When the other nipples are plugged, apply a vacuum at the vent nipple and verify that the Canister holds vacuum.

(3) Does a leak exist?

YES

▸ Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Go to "Check fuel tank for leakage" as below.

3. Check fuel tank for leakage.

(1) Check fuel tank for crack or leakage.

(2) Does a leak exist?

YES

▸ Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good PCM and check for proper operation.
▸ If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0444

COMPONENT LOCATION

GENERAL DESCRIPTION

The purge solenoid is a pneumatic device that meters the air and fuel (purge) vapor flow to thepurge port. In a sense, the purge solenoid is comparable to a fuel injector, because the meteredpurge flow follows the same slope and offset characteristics. However, the purge solenoidnormally runs with a duty cycle at a fixed frequency because the opening response is significantly slower than a fuel injector. It would not practical to run the solenoid synchronouslywith engine events except perhaps at very low RPM. The normal frequencies for the purgesolenoid are between 8 and 20 Hz.

DTC DESCRIPTION

Checking output signals from PCSV every 10 sec. under detecting condition, if signals indicating open or short to ground in the circuit are detected for more than 5 sec., PCM sets P0444. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Open, short to ground	• Poor connection • Open or short to ground in harness • PCSV • PCM
EnableConditions	• Engine running state • 11V ≤ Battery voltage ≤ 16V • Above enable conditions are met > 0.5 sec.	
Threshold value	• Open or short to ground	
DiagnosisTime	• Continuous (More than 5 sec.failure for every 10 sec.test)	
MIL On Condition	• 2 driving cycles	

SIGNAL WAVEFORM AND DATA

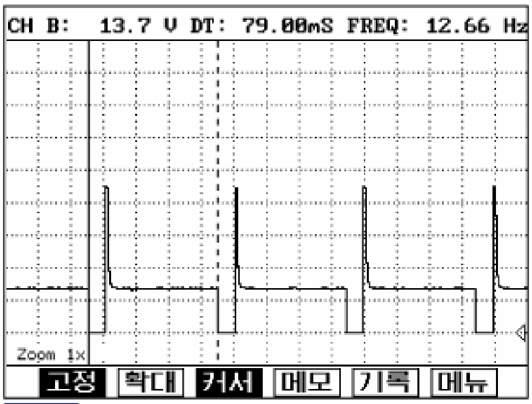


Fig. 1

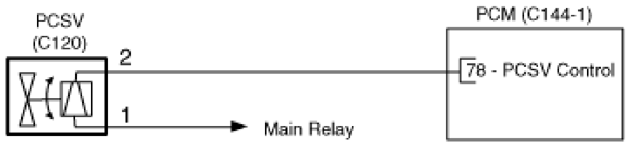
The Purge Control Solenoid Valve(PCSV) is open or closed by PCM and vacuum of intake manifold.
At opening, fuel vapor from canister enters into intake manifold. To prevent vacuum from forming inside canister, PCM controls to open it. This photo shows the signal waveform of PCSV operating normally.

SPECIFICATION

Item	Coil resistance(Ω)
PCSV	19.0 ~ 22.0Ω (at 20°C / 68°F)

SCHEMATIC DIAGRAM

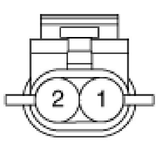
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

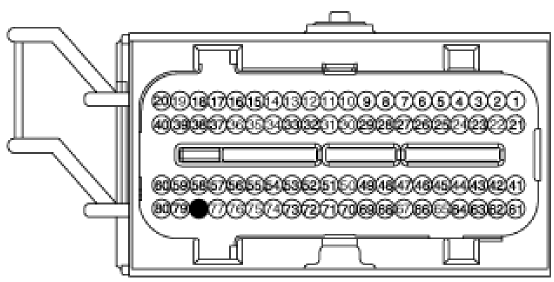
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-1 (78)	PCSV Control

[HARNESS CONNECTORS]



C120

PCSV



C144-1

PCM

MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Cable (DLC)
2. Warm up engine to normal operating temperature.
3. Monitor "PCSV" parameter on the scantool.

4. Is the current data displayed correctly?

YES

▸ Fault is intermittently caused by poor contact in the sensor and/or PCM connector or non cleared PCM memory after repair. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace if necessary and go to "Verification of vehicle Repair".

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

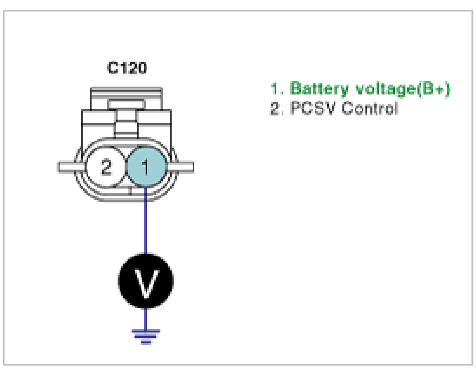
NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSEPCTION

1. IG "OFF" and disconnect PCSV connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of PCSV harness connector and chassis ground.

Specification : B+



4. Is the measured voltage within specification?

YES

▸ Go to "Control Circuit Inspection" procedure.

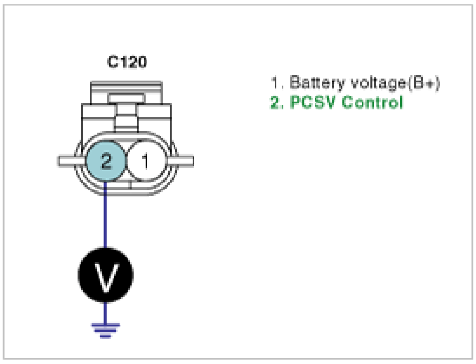
NO

▸ Repair open or short to ground in harness, and go to " Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check short to ground in harness.
   (1) IG "OFF" and disconnect PCSV connector.
   (2) IG "ON"
   (3) Measure voltage between terminal 2 of PCSV harness connector and chassis ground.

Specification : Approx. 0.5V



   (4) Is the measured resistance within specification?

YES

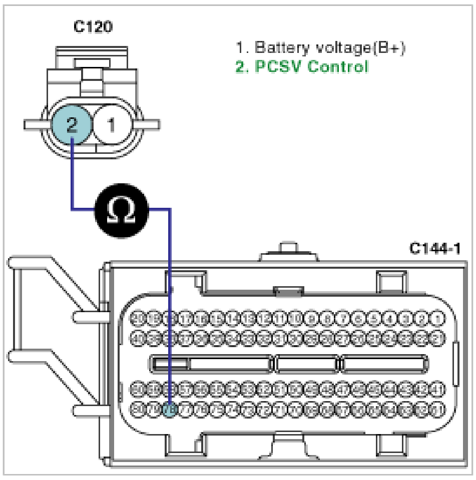
▸ Go to "Check open in harness" as follows.

NO

▸ Repair short to ground in harness, and go to " Verification of Vehicle Repair" procedure.

2. Check open in harness.
   (1) IG "OFF" and disconnect PCSV connector and PCM connector.
   (2) Measure resistance between terminal 2 of PCSV harness connector and terminal 78 of PCM harness connector.

Specification : Below 1Ω



   (3) Is the measured voltage within specification?

YES

▸ Go to " Component Inspection" procedure.

NO

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

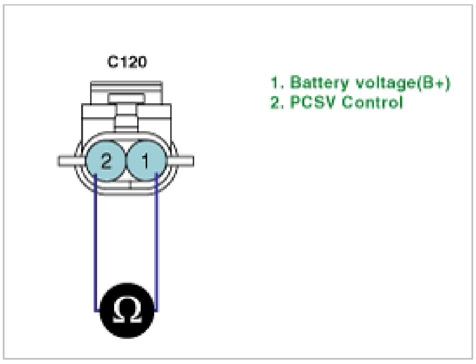
COMPONENT INSPECTION

1. Check PCSV
   (1) IG "OFF" and disconnect PCSV connector.
   (2) Measure resistance between terminals 1 and 2 of PCSV connector.(Component side)

Specification :

Item	Coil resistance(Ω)

PCSV	19.0 ~ 22.0Ω (at 20°C / 68°F)



(3) Is the measured resistance within specification?

YES

- Substitute with a known - good PCM and check for proper operation.
- If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

- Substitute with a known - good PCSV and check for proper operation.
- If the problem is corrected, replace PCSV and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

- Go to the applicable troubleshoooting procedure.

NO

- System is performing to specification at this time.

Fuel System > Troubleshooting > P0445

COMPONENT LOCATION

GENERAL DESCRIPTION

The purge solenoid is a pneumatic device that meters the air and fuel (purge) vapor flow to thepurge port. In a sense, the purge solenoid is comparable to a fuel injector, because the meteredpurge flow follows the same slope and offset characteristics. However, the purge solenoidnormally runs with a duty cycle at a fixed frequency because the opening response is significantly slower than a fuel injector. It would not practical to run the solenoid synchronouslywith engine events except perhaps at very low RPM. The normal frequencies for the purgesolenoid are between 8 and 20 Hz.

DTC DESCRIPTION

Checking output signals from PCSV every 10 sec. under detecting condition, if signals indicating short to battery in the circuit are detected for more than 5 sec., PCM sets P0445. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Short to battery	• Poor connection • Short to battery in harness • PCSV • PCM
EnableConditions	• Engine running state • 11V ≤ Battery voltage ≤ 16V • Above enable conditions are met > 0.5 sec.	
Threshold value	• Short to battery	
DiagnosisTime	• Continuous (More than 5 sec.failure for every 10 sec.test)	
MIL On Condition	• 2 driving cycles	

SIGNAL WAVEFORM AND DATA

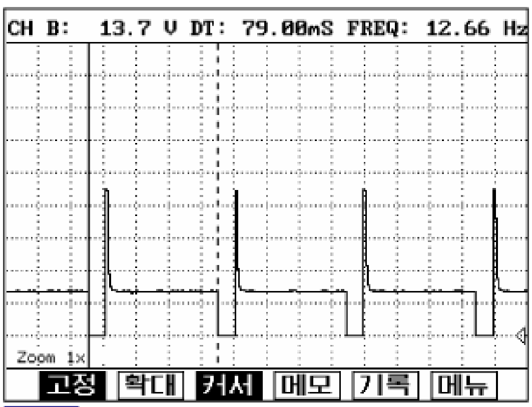


Fig. 1

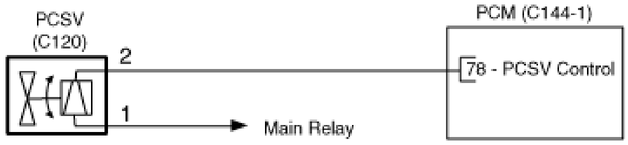
The Purge Control Solenoid Valve(PCSV) is open or closed by PCM and vacuum of intake manifold.
At opening, fuel vapor from canister enters into intake manifold. To prevent vacuum from forming inside canister, PCM controls to open it. This photo shows the signal waveform of PCSV operating normally.

SPECIFICATION

Item	Coil resistance(Ω)
PCSV	19.0 ~ 22.0Ω (at 20°C / 68°F)

SCHEMATIC DIAGRAM

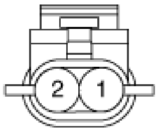
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

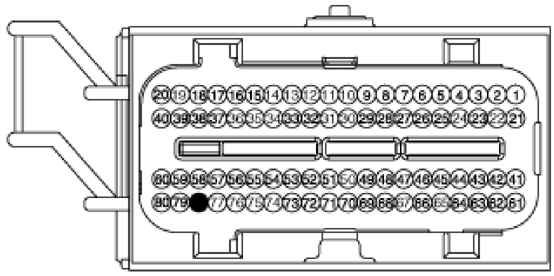
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-1 (78)	PCSV Control

[HARNESS CONNECTORS]



C120

PCSV



C144-1

PCM

MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Cable (DLC)
2. Warm up engine to normal operating temperature.
3. Monitor "PCSV" parameter on the scantool.

Normal data at idle

Normal data at accel.

4. Is the current data displayed correctly?

YES

▸ Fault is intermittently caused by poor contact in the sensor and/or PCM connector or non cleared PCM memory after repair. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace if necessary and go to "Verification of vehicle Repair".

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

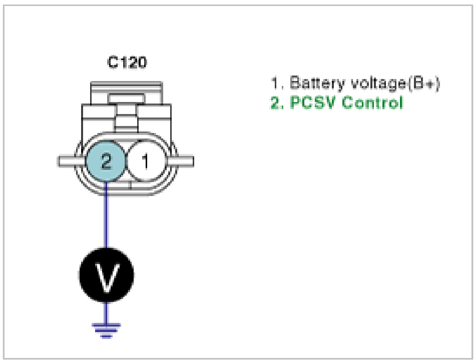
NO

▸ Go to " Control Circuit Inspection " procedure.

CONTROL CIRCUIT INSPECTION

1. IG "OFF" and disconnect PCSV connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 2 of PCSV harness connector and chassis ground.

Specification : Approx. 0.5V



4. Is the measured voltage within specification?

YES

▸ Go to "Component Insepction" procedure.

NO

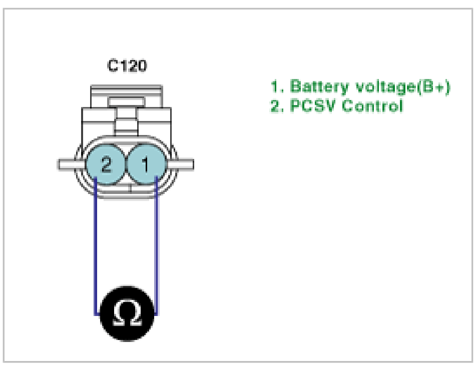
▸ Repair short to battery in harness, and go to " Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check PCSV
   (1) IG "OFF" and disconnect PCSV connector.
   (2) Measure resistance between terminals 1 and 2 of PCSV connector.(Component side)

   Specification :

Item	Coil resistance(Ω)
PCSV	19.0 ~ 22.0Ω (at 20°C / 68°F)



   (3) Is the measured resistance within specification?

YES

▸ Substitute with a known - good PCM and check for proper operation.
▸ If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good PCSV and check for proper operation.
▸ If the problem is corrected, replace PCSV and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

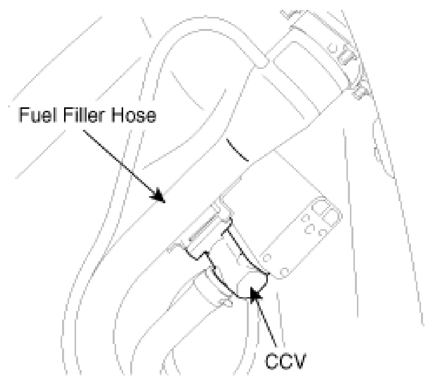
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0447

COMPONENT LOCATION



GENERAL DESCRIPTION

The vent valve is a device that is designed to close off the fresh air inlet to the canister. Currentvent valve designs are powered closed. An electrically operated vent valve solenoid is requiredfor OBD II compliant evaporative systems. Normally the vent valve is in the open (unpowered)state, but to control the vacuum levels in the fuel tank the EVPD will command the vent valvesolenoid to the closed position. This controlled vacuum level will allow the EVPD to determine the integrity of the evaporative system.
The vent valve orifice is much larger than the purge valve orifice or purge lines so that when thevent valve is open, the purge flow is not restricted. The fresh air inlet in the vent valve solenoid is normally filtered with a serviceable dust filter that helps to prevent contaminants from being drawn into the evaporative system (e.g. water, salt, silica, etc.).

DTC DESCRIPTION

Checking output signals from PCSV every 10 sec. under detecting condition, if signals indicating open or short to ground in the circuit are detected for more than 5 sec., PCM sets P0447. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

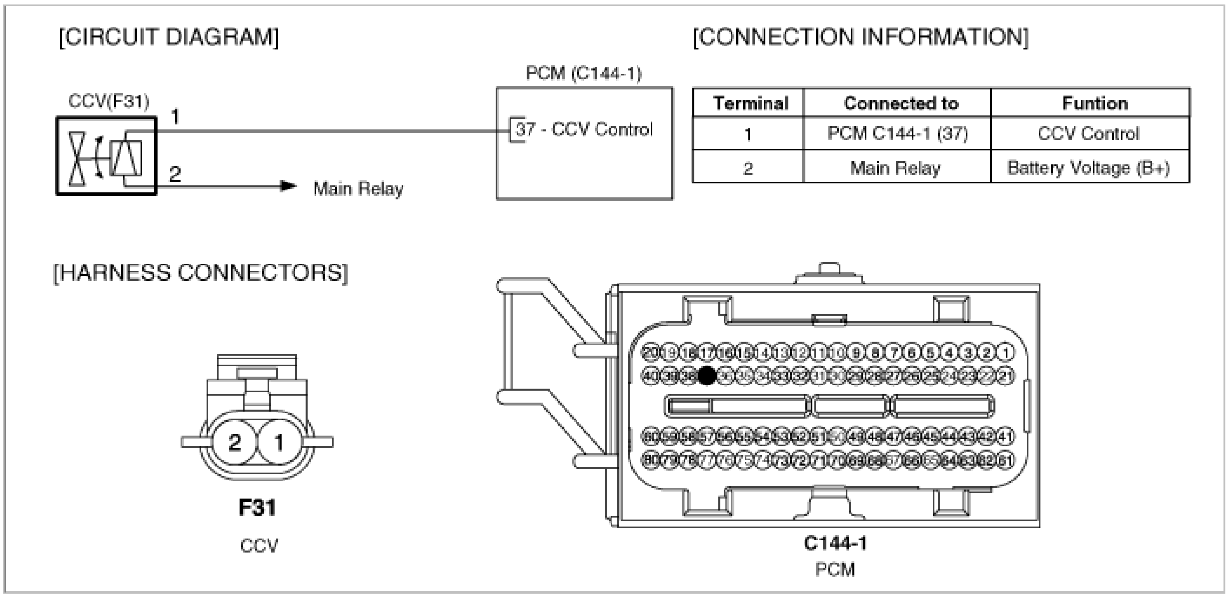
DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to ground or open circuit on Vent Valve output circuit. Fault information provided by an output driver chip.	• Poor Connection • Open or Short in Power Circuit • Open or short in Control Circuit • CCV • PCM
EnableConditions	No disabling Faults Present • Engine Running • 11V ≤ Ignition Voltage ≤ 16V • Enable Time delay ≥ 0.5sec.	
Threshold value	• Open or short to ground	
DiagnosisTime	• Continuous (More than 5sec.Test failure for every 10sec. tests)	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION

Item	Specification
Coil Resistance (Ω)	19.8 ~ 21.8Ω (20°C)

SCHEMATIC DIAGRAM



ACTUATION TEST

1. Connect scantool on the DLC(Data Link Connector).
2. Perform Actuation Test for Canister Vent Solenoid Valve with scantool.
3. Check that clicking sound can be heard by actuation test.
4. Is the CCV normal ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

- Repair as necessary and go to "Verification of Vehicle Repair" procedure

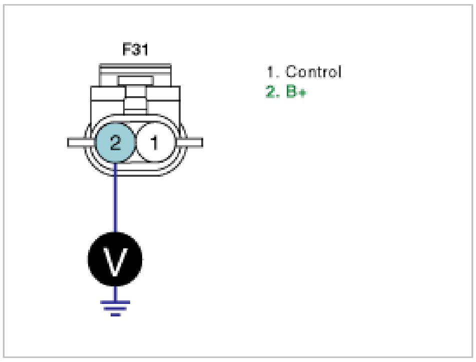
NO

- Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. Engine "OFF"
2. Disconnect CCV connector.
3. Ignition " ON " & Engine "OFF".
4. Measure voltage between terminal "2" of CCV harness connector and chassis ground.

Specification : B+



5. s the measured voltage within specifications?

YES

- Go to " Control Circuit Inspection" procedure.

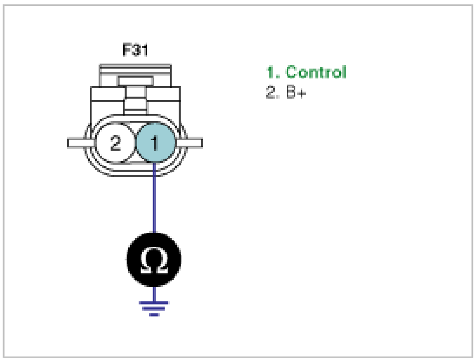
NO

- Check open or short to ground in harenss between control relay and CCV.
- Repair or replace as necessary and then, go to " Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check for short to ground in harness.
   (1) Ignition "OFF"
   (2) Disconnect CCV connector
   (3) Measure resistance between terminal "1" of CCV harness connector and chassis ground.

   Specification : Infinite



   (4) Is the measured resistance within specifications?

   YES

   - Go to " Check for open in harness" as below.

   NO

   - Check short to ground in signal harness.
   - Repair or replace as necessary and then, go to " Verification of Vehicle Repair" procedure.

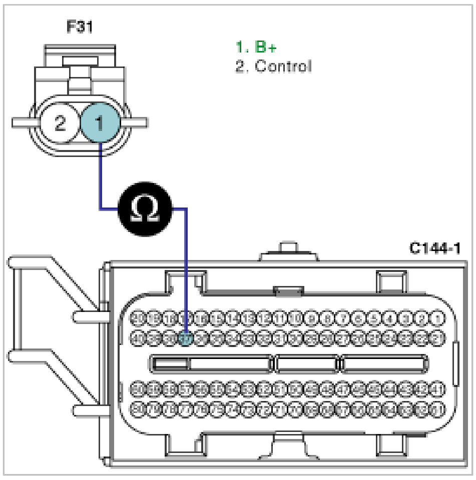
2. Check for open in harness.

(1) Ignition "OFF"

(2) Disconnect CCV and PCM connector

(3) Measure resistance between terminal "1" of CCV harness connector and terminal "37" of PCM harness connector.

Specification : Approx. below 1Ω



3. Is the measured resistance within specifications?

YES

▸ Go to " Component Inspection " procedure.

NO

▸ Check open in harenss between CCV connector and PCM connector.
▸ Repair or replace as necessary and then, go to " Verification of Vehicle Repair" procedure.

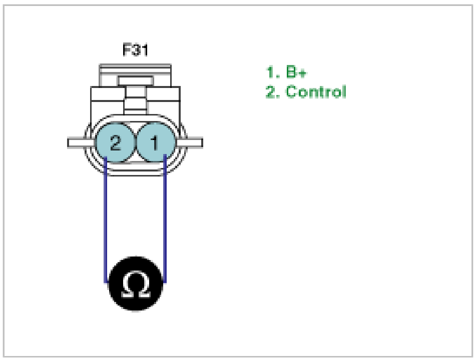
COMPONENT INSPECTION

1. Check CCV

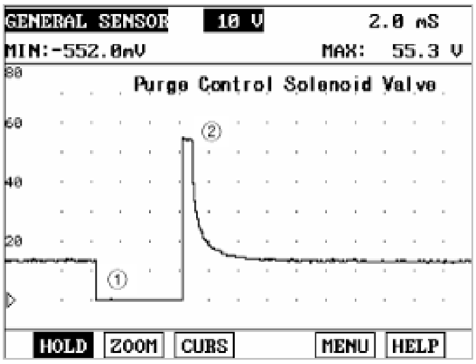
(1) Ignition "OFF"

(2) Measure resistance between terminals "1" and "2" of the CCV connector.

Specification: Approx. 19.8 ~21.8Ω(20°C(68°F))



(3) Monitor the CCV signal waveform and verify that the ground voltage is less than approx. 0.3V (①) and the surge voltage (②) is between 40 V and 60 V.



(4) Is the CCV normal?

YES

- Substitute with a known - good PCM and check for proper operation.
- If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

- Substitute with a known - good CCV and check for proper operation.
- If the problem is corrected, replace CCV and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

- Go to the applicable troubleshoooting procedure.

NO

- System is performing to specification at this time.

Fuel System > Troubleshooting > P0448

COMPONENT LOCATION

GENERAL DESCRIPTION

The vent valve is a device that is designed to close off the fresh air inlet to the canister. Currentvent valve designs are powered closed. An electrically operated vent valve solenoid is requiredfor OBD II compliant evaporative systems. Normally the vent valve

is in the open (unpowered)state, but to control the vacuum levels in the fuel tank the EVPD will command the vent valvesolenoid to the closed position. This controlled vacuum level will allow the EVPD to determine the integrity of the evaporative system.
The vent valve orifice is much larger than the purge valve orifice or purge lines so that when thevent valve is open, the purge flow is not restricted. The fresh air inlet in the vent valve solenoid is normally filtered with a serviceable dust filter that helps to prevent contaminants from being drawn into the evaporative system (e.g. water, salt, silica, etc.).

DTC DESCRIPTION

Checking output signals from PCSV every 10 sec. under detecting condition, if signals indicating short to battery in the circuit are detected for more than 5 sec., PCM sets P0448. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

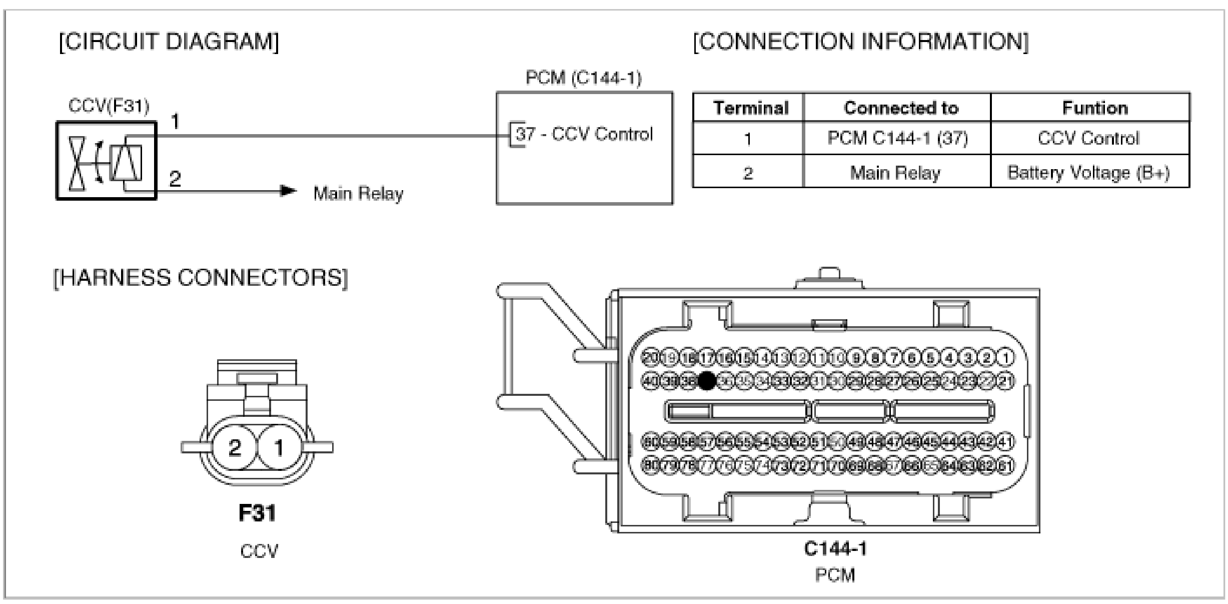
DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to battery on Vent Valve output circuit. Fault information provided by an output driver chip.	• Poor Connection • Short to battery in CCV circuit • CCV • PCM
EnableConditions	• No disabling Faults Present • Engine Running • 11V ≤ Ignition Voltage ≤ 16V • Enable Time delay ≥ 0.5sec.	
Threshold value	• Short to battery	
DiagnosisTime	• Continuous (More than 5sec.Test failure for every 10sec. tests)	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION

Item	Specification
Coil Resistance (Ω)	19.8 ~ 21.8Ω (20°C)

SCHEMATIC DIAGRAM



ACTUATION TEST

1. Connect scantool on the DLC(Data Link Connector).
2. Perform Action Test for Canister Vent Solenoid Valve with scantool.
3. Check that clicking sound can be heard by actuation test.

4. Is the CCV normal ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to " Control Circuit Inspection " procedure.

CONTROL CIRCUIT INSPECTION

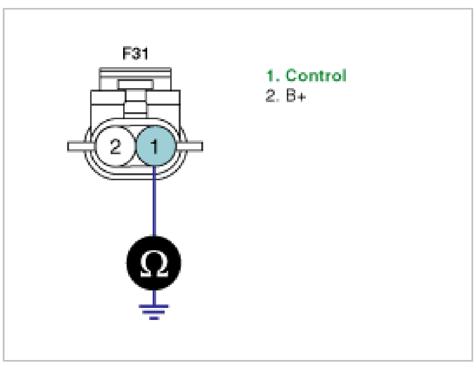
1. Check for short to ground in harness.

(1) Ignition "OFF"

(2) Disconnect CCV connector

(3) Measure resistance between terminal "1" of CCV harness connector and chassis ground.

Specification : Infinite



(4) Is the measured resistance within specifications?

YES

▸ Go to " Check for open in harness" as below.

NO

▸ Check short to ground in signal harness.

▸ Repair or replace as necessary and then, go to " Verification of Vehicle Repair" procedure.

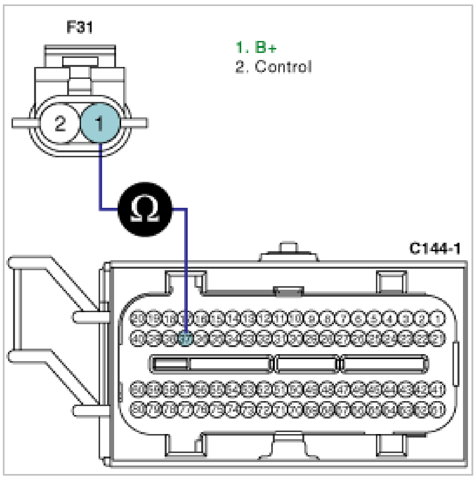
2. Check for open in harness.

(1) Ignition "OFF"

(2) Disconnect CCV and PCM connector

(3) Measure resistance between terminal "1" of CCV harness connector and terminal "37" of PCM harness connector.

Specification : Approx. below 1Ω



3. Is the measured resistance within specifications?

YES

▸ Go to " Component Inspection " procedure.

NO

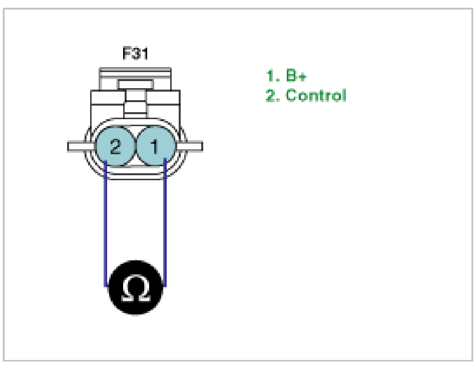
▸ Check open in harenss between CCV connector and PCM connector.
▸ Repair or replace as necessary and then, go to " Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

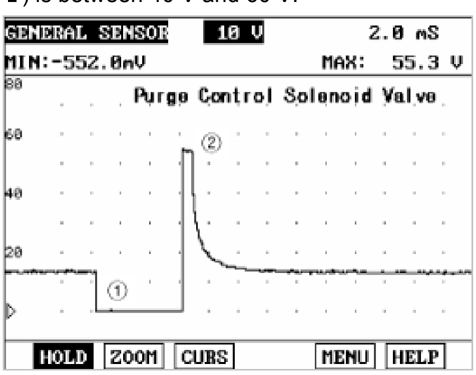
1. Check CCV
   (1) Ignition "OFF"

   (2) Measure resistance between terminals "1" and "2" of the CCV connector.

   Specification: Approx. 19.8 ~21.8Ω(20°C(68°F))



   (3) Monitor the CCV signal waveform and verify that the ground voltage is less than approx. 0.3V (①) and the surge voltage (②) is between 40 V and 60 V.



(4) Is the CCV normal?

YES

- Substitute with a known - good PCM and check for proper operation.
- If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

- Substitute with a known - good CCV and check for proper operation.
- If the problem is corrected, replace CCV and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

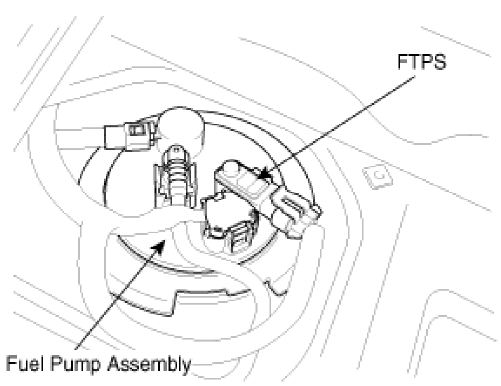
- Go to the applicable troubleshoooting procedure.

NO

- System is performing to specification at this time.

Fuel System > Troubleshooting > P0451

COMPONENT LOCATION



GENERAL DESCRIPTION

The Fuel Tank Pressure Sensor(FTPS) converts fuel tank pressure to a proportional analog voltage signal which is read by the engine controller for evaluation during execution of the Evaporative System Diagnostic. The Tank Pressure may be below atmospheric pressure (ie. a vacuum) or above atmospheric pressure.

The fuel tank pressure is used to measure the difference between the air pressure (or vacuum) in the fuel tank and the ambient air pressure. The Powertrain Control Module (ECM) supplies a 5-volt reference and a ground to the sensor, which allows the sensor’s output voltage to range from 0.1 to 4.9 volts. When the air pressure in the fuel tank is equal to the ambient air pressure, as when the fuel cap is removed, the output voltage of the sensor will be from 1.3 to 1.7 volts.

DTC DESCRIPTION

The Tank Pressure Sensor Stuck Diagnostic continuously monitors the fuel tank pressure sensor output for a stuck condition. It does this by comparing the maximum and minimum raw tank pressure voltages. If the difference between the two values exceeds a threshold, then the diagnostic is considered to have passed. The diagnostic is not allowed to fail unless (a) a significant portion of the EVPD(Evaporative Diagnostics) tank draw has occurred or (b) the tank pressure has not changed after purge transitions off from a flow level high enough to cause a change in the tank pressure.

Checking output signals of tank pressure under detecting condition, if the tank pressure difference between maximum and minimum is low than 0.9996 for 60 sec, PCM sets P0451 MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

DTC DETECTING CONDITION

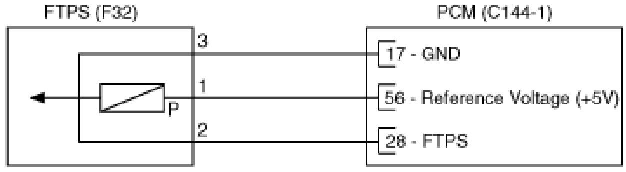
<table>
<tr><th colspan="2">Item</th><th>Detecting Condition</th><th>Possible cause</th></tr>
<tr><td colspan="2">DTC Strategy</td><td>• Continuously monitors the fuel tank pressure sensor output for a stuck condition</td><td rowspan="7">• Poor connection
• Open or short in FTPS circuit
• Faulty FTPS
• Faulty PCM</td></tr>
<tr><td rowspan="2">Enable Conditions</td><td>Case 1</td><td>Transiton Monitor LogicEnable Conditions when test is run during Normal Purge
• The type of canister purge duty cycle calculation and used as an input for the vent valve solenoid status = Not equal to 2
• EVAP system value during previous loop =0
• Required minimum purge flow rate immediately prior to a purge off transition to trigger the transition monitor portion of the tank pressure stuck diagnostic > 0.5g/s</td></tr>
<tr><td>Case 2</td><td>Diagnostic Mode Logic:
• The stuck diag completed during EVPD operation = False
• The type of canister purge duty cycle calculation and used as an input for the vent valve solenoid status = Not equal to 2</td></tr>
<tr><td rowspan="2">Threshold value</td><td>Case 1</td><td>Transiton Monitor Logic
• Minimum change in tank pressure required to pass the stuck diagnostic < 0.9995
• For Time period After Purge Duty Cycle is transitioned Off > 60sec.</td></tr>
<tr><td>Case 2</td><td>Diagnostic Mode Logic
• The signed vacuum integral increment used to calculate the signed incremented vacuum integral > 0.95
• Minimum change in tank pressure required to pass the stuck diagnostic < 0.9995</td></tr>
<tr><td colspan="2">Diagnosis Time</td><td>• Continuous
(More than 15 seconds failure for every 32 seconds test)</td></tr>
<tr><td colspan="2">MIL On Condition</td><td>• 2 Driving Cycles</td></tr>
</table>

SPECIFICATION

Pressure (kPa)	Output Voltage (V)
-2.5 kPA	0.5V
0 kPA	2.5V
2.5 kPa	4.5V

SCHEMATIC DIAGRAM

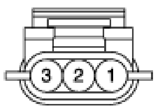
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

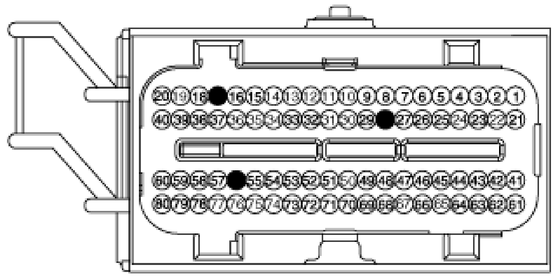
Terminal	Connected to	Funtion
1	PCM C144-1 (56)	Reference Voltage (+5V)
2	PCM C144-1 (28)	FTPS signal
3	PCM C144-1 (17)	Sensor ground

[HARNESS CONNECTORS]



F32

MAPS



C144-1

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "FTPS" parameter on the service data.

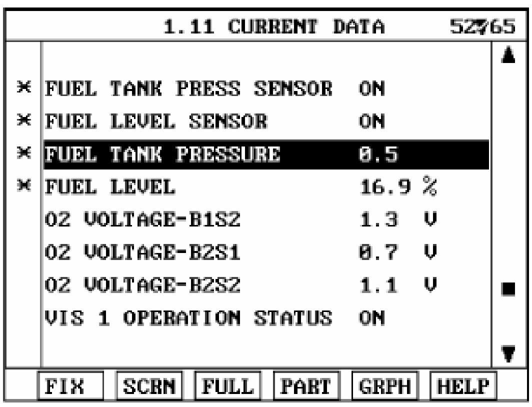


Fig. 1

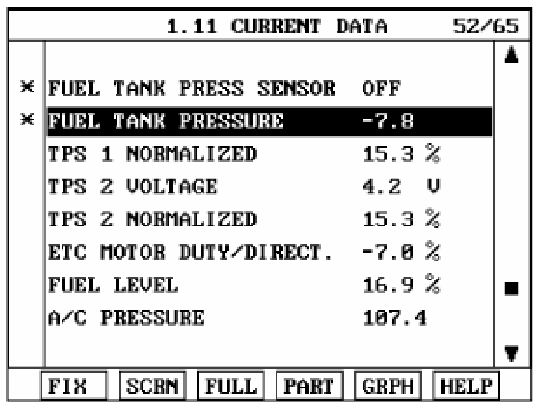


Fig. 2

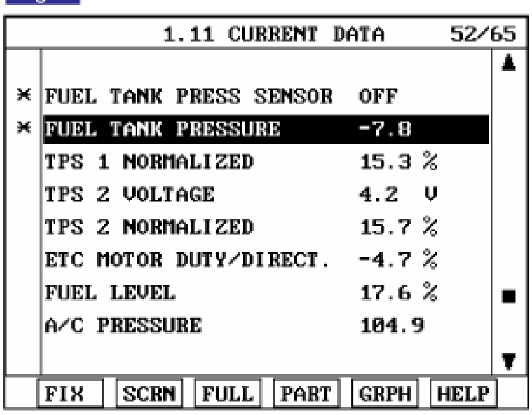


Fig. 3

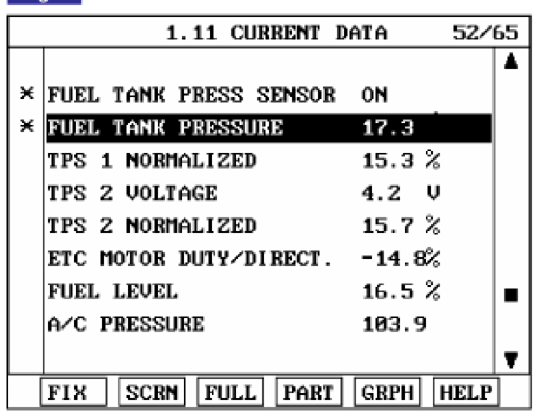


Fig. 3

Fig.1: Normal at idle
Fig.2: Open at idle
Fig.3: Short to ground at idle
Fig.4: Shrot to 5V at idle

4. Is the "FTPS" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, ending, corrosion, contamination, deterioration, or damage. Repair or replace asnecessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

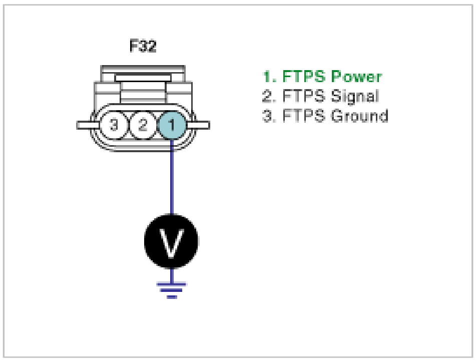
NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. IG "OFF" and disconnect FTPS connector.
2. IG "ON" & ENG "OFF"
3. Measure voltage between terminal 1 of FTPS harness connector and chassis ground.

Specification : Approx. 5V



4. Is the measured voltage within specification ?

YES

▸ Go to "Ground circuit inspection" procedure.

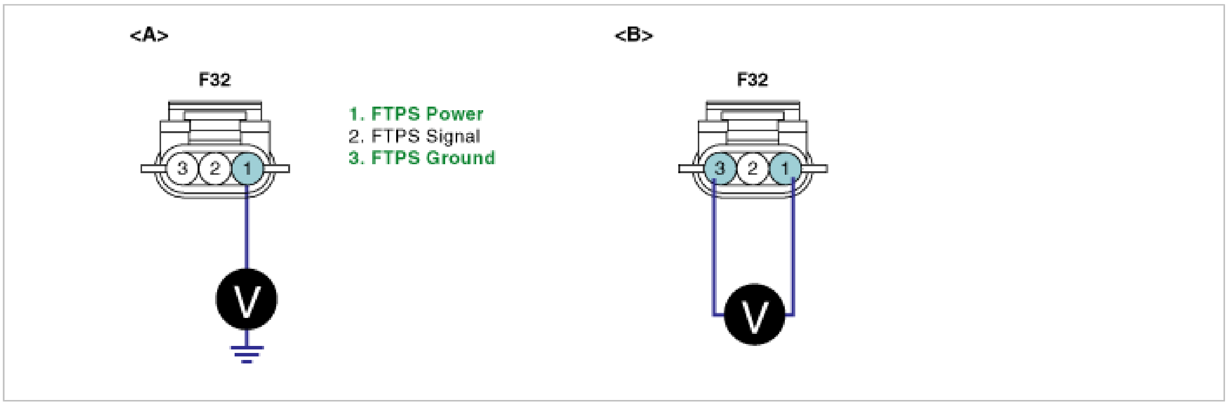
NO

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF" and disconnect FTPS connector.
2. Measure voltage between terminal 1 of FTPS harness connector and chassis ground.
3. Measure voltage between terminal 1 and 3 of FTPS harness connector.

Specification : Voltage difference between Measurement "A" and "B" is below 200mV.



4. Is the measured voltage within specification ?

YES

▸ Go to "Signal Circuit Inspection" procedure.

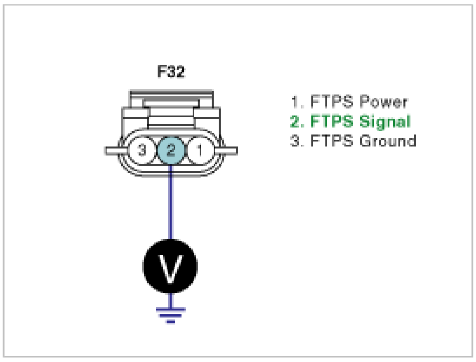
NO

▸ Repair contact reistance or open in harness and then go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check voltage.
   (1) IG "OFF" and disconnect FTPS connector.
   (2) IG "ON" & ENG "OFF"
   (3) Measure voltage between terminal 2 of FTPS harness connector and chassis ground.

   Specification : Approx. 0V



   (4) Is the measured voltage within specification ?

   YES

   ▸ Go to "Component Inspection" procedure.

   NO

   ▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check FTPS.
   (1) IG "OFF" and connect scatool to DLC(Data Link Connector).
   (2) Monitor "FTPS" parameter with accelleration on service data.

   Specification

Pressure (kPa)	Output Voltage (V)
-2.5 kPA	0.5V
0 kPA	2.5V
2.5 kPa	4.5V

   (3) Does the "FTPS" parameter with accelleraton on the service data change ?

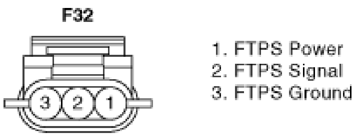
YES

▸ Go to "Check PCM" as follows.

NO

▸ Substitute with a known - good FTPS and check for proper operation.
▸ If the problem is corrected, replace FTPS and go to "Verification of Vehicle Repair" procedure.

2. Check PCM.
   (1) IG "OFF" disconnect FTPS connector
   (2) Connect Scantool and IG "ON" & ENG "OFF"
   (3) Select simulation function on scantool.
   (4) Simulate voltage at terminal 2 of FTPS harness connector.



   (5) Does the signal value of FTP sensor change according to simulation voltage ?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good PCM and check for proper operation.
If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

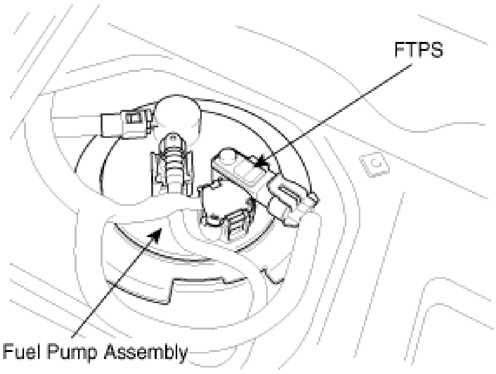
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0452

COMPONENT LOCATION



GENERAL DESCRIPTION

The Fuel Tank Pressure Sensor(FTPS) converts fuel tank pressure to a proportional analog voltage signal which is read by the engine controller for evaluation during execution of the Evaporative System Diagnostic. The Tank Pressure may be below atmospheric pressure (ie. a vacuum) or above atmospheric pressure.
The fuel tank pressure is used to measure the difference between the air pressure (or vacuum) in the fuel tank and the ambient air pressure. The Powertrain Control Module (ECM) supplies a 5-volt reference and a ground to the sensor, which allows the sensor's output voltage to range from 0.1 to 4.9 volts. When the air pressure in the fuel tank is equal to the ambient air pressure, as when the fuel cap is removed, the output voltage of the sensor will be from 1.3 to 1.7 volts.

DTC DESCRIPTION

The fuel tank pressure sensor diagnostic will detect a fuel tank pressure sensor signal that is outof range or malfunctioning. The Tank Pressure Sensor Circuit Diagnostic compares the sensor input voltage to low and high limits. When the analog voltage is outside the allowable limits, the circuit is determined to be failed.
Checking output signals of tank pressure under detecting condition, if the tank pressure is low than 2V PCM sets P0452. MIL (Malfunction Indicatin Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

DTC DETECTING CONDITION

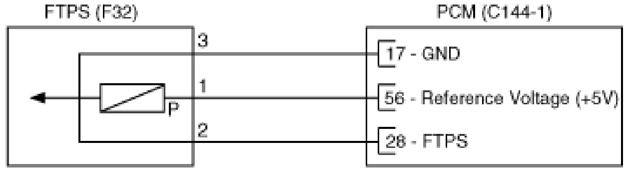
Item	Detecting Condition	Possible cause
DTC Strategy	• Detects sensor signal short to low voltage	• Poor connection • Open in Power Circuit • Open or short to ground in signal Ciruict • Faulty FTPS • Faulty PCM
Enable Conditions	• Ignition ON • The FTPS diagnostic has met all enable criteria and will begin fault processing	
Threshold value	• Raw Tank Pressure < 2V	
Diagnosis Time	• Continuous (More than 15 seconds failure for every 32 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION

Pressure (kPa)	Output Voltage (V)
-2.5 kPA	0.5V
0 kPA	2.5V
2.5 kPa	4.5V

SCHEMATIC DIAGRAM

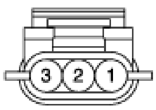
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

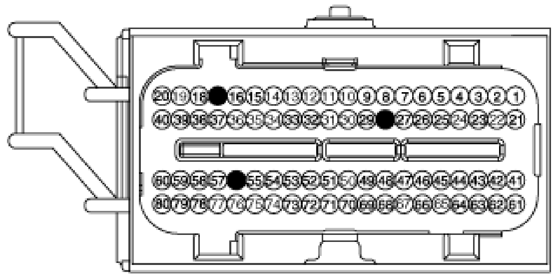
Terminal	Connected to	Funtion
1	PCM C144-1 (56)	Reference Voltage (+5V)
2	PCM C144-1 (28)	FTPS signal
3	PCM C144-1 (17)	Sensor ground

[HARNESS CONNECTORS]



F32

MAPS



C144-1

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "FTPS" parameter on the service data.

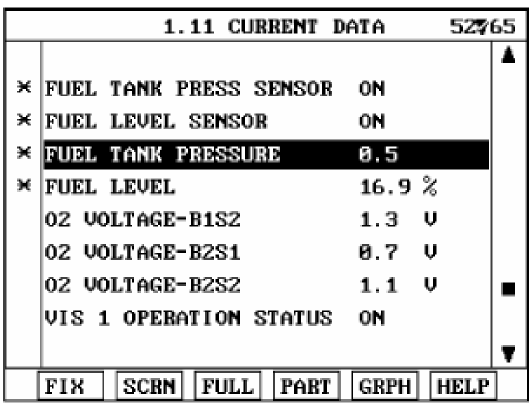


Fig. 1

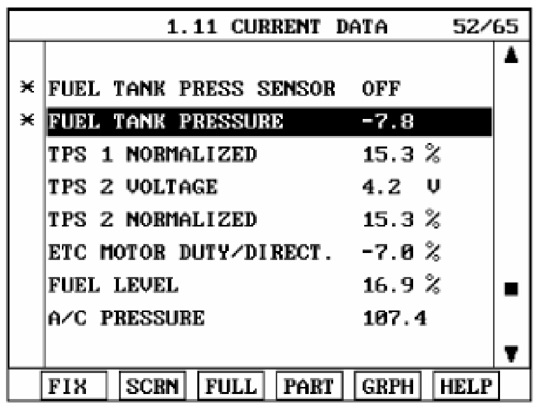


Fig. 2

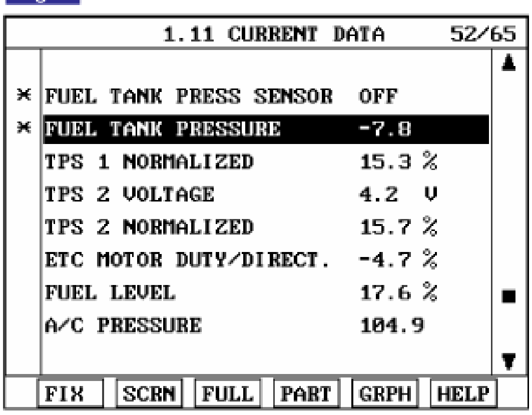


Fig. 3

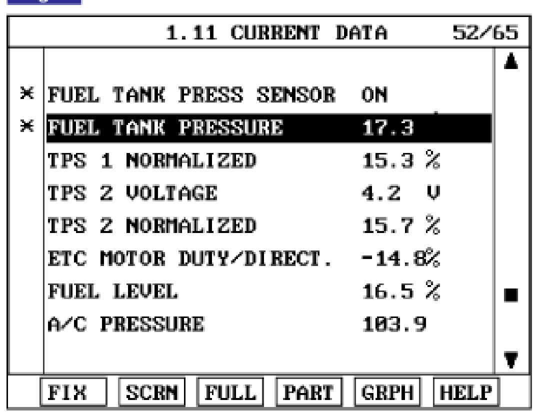


Fig. 3

Fig.1: Normal at idle
Fig.2: Open at idle

Fig.3: Short to ground at idle
Fig.4: Shrot to 5V at idle

4. Is the "FTPS" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, ending, corrosion, contamination, deterioration, or damage. Repair or replace asnecessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

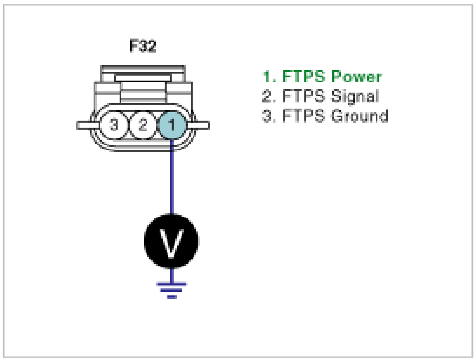
NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. IG "OFF" and disconnect FTPS connector.
2. IG "ON" & ENG "OFF"
3. Measure voltage between terminal 1 of FTPS harness connector and chassis ground.

Specification : Approx. 5V



4. Is the measured voltage within specification ?

YES

▸ Go to "Ground circuit inspection" procedure.

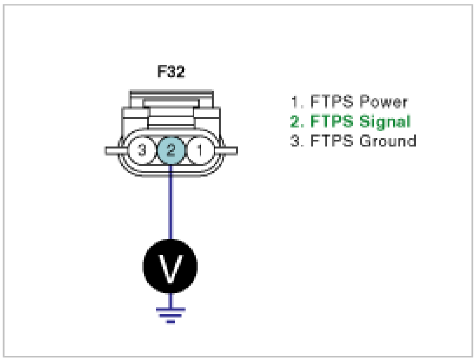
NO

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check voltage.
   (1) IG "OFF" and disconnect FTPS connector.
   (2) IG "ON" & ENG "OFF"
   (3) Measure voltage between terminal 2 of FTPS harness connector and chassis ground.

   Specification : Approx. 0V



(4) Is the measured voltage within specification ?

YES

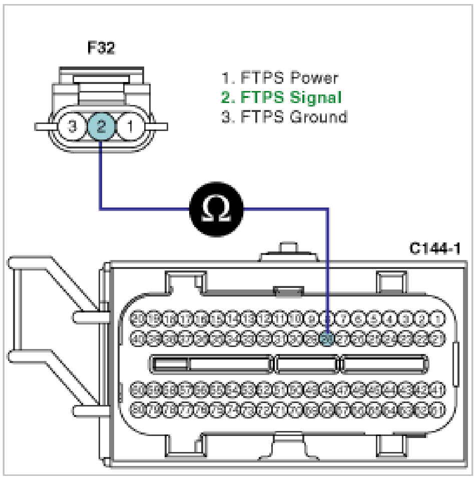
▸ Go to "Check open in harness" as follows.

NO

▸ Repair short to ground in harness and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness.
   (1) IG "OFF" and disconnet FTPS and PCM connector.
   (2) Measure resistance between terminal 2 of FTPS harness connector and terminal 28/C144-1 of PCM harness connector.

Specification : Approx. Below 1Ω



(3) Is the measured resistance within specification ?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair open in harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check FTPS.
   (1) IG "OFF" and connect scatool to DLC(Data Link Connector).
   (2) Monitor "FTPS" parameter with accelleration on service data.

Specification

Pressure (kPa)	Output Voltage (V)
-2.5 kPA	0.5V
0 kPA	2.5V
2.5 kPa	4.5V

(3) Does the "FTPS" parameter with accelleraton on the service data change ?

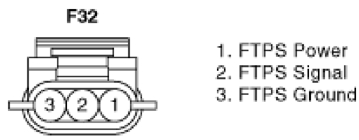
YES

▸ Go to "Check PCM" as follows.

NO

▸ Substitute with a known - good FTPS and check for proper operation.
▸ If the problem is corrected, replace FTPS and go to "Verification of Vehicle Repair" procedure.

2. Check PCM.
   (1) IG "OFF" disconnect FTPS connector
   (2) Connect Scantool and IG "ON" & ENG "OFF"
   (3) Select simulation function on scantool.
   (4) Simulate voltage at terminal 2 of FTPS harness connector.



   (5) Does the signal value of FTP sensor change according to simulation voltage ?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good PCM and check for proper operation.
If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

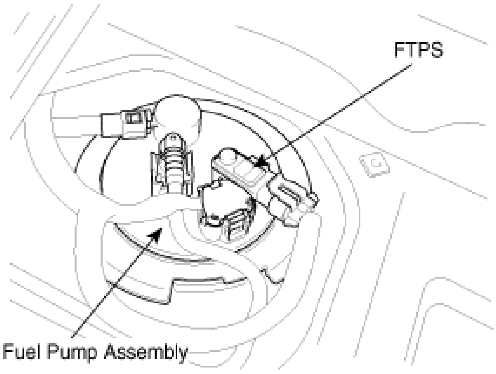
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0453

COMPONENT LOCATION



GENERAL DESCRIPTION

The Tank Pressure Sensor converts fuel tank pressure to a proportional analog voltage signal which is read by the engine controller for evaluation during execution of the Evaporative System Diagnostic. The Tank Pressure may be below atmospheric pressure (ie. a vacuum) or above atmospheric pressure.
The fuel tank pressure is used to measure the difference between the air pressure (or vacuum) in the fuel tank and the ambient air pressure. The Powertrain Control Module (ECM) supplies a 5-volt reference and a ground to the sensor, which allows the sensor's output voltage to range from 0.1 to 4.9 volts. When the air pressure in the fuel tank is equal to the ambient air pressure, as when the fuel cap is removed, the output voltage of the sensor will be from 1.3 to 1.7 volts.

DTC DESCRIPTION

The fuel tank pressure sensor diagnostic will detect a fuel tank pressure sensor signal that is outof range or malfunctioning. The Tank Pressure Sensor Circuit Diagnostic compares the sensor input voltage to low and high limits. When the analog voltage is outside the allowable limits, the circuit is determined to befailed.
Checking output signals of tank pressure under detecting condition, if the tank pressure is high than 2V PCM sets P0453. MIL (Malfunction Indicatin Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

DTC DETECTING CONDITION

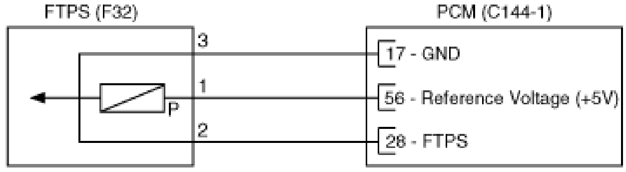
Item	Detecting Condition	Possible cause
DTC Strategy	• Detects sensor signal short to high voltage	• Poor connection • Short to battery in signal Cirucit • Faulty FTPS • Faulty PCM
Enable Conditions	• Ignition ON • The FTPS diagnostic has met all enable criteria and will begin fault processing	
Threshold value	• Raw Tank Pressure > 2V	
Diagnosis Time	• Continuous (More than 15 seconds failure for every 32 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION

Pressure (kPa)	Output Voltage (V)
-2.5 kPA	0.5V
0 kPA	2.5V
2.5 kPa	4.5V

SCHEMATIC DIAGRAM

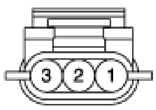
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

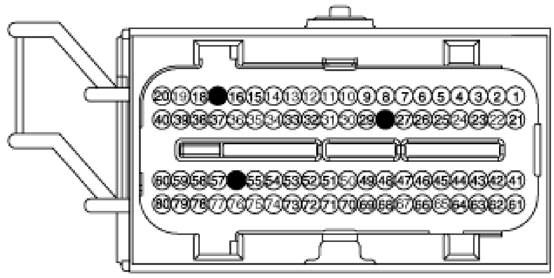
Terminal	Connected to	Funtion
1	PCM C144-1 (56)	Reference Voltage (+5V)
2	PCM C144-1 (28)	FTPS signal
3	PCM C144-1 (17)	Sensor ground

[HARNESS CONNECTORS]



F32

MAPS



C144-1

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "FTPS" parameter on the service data.

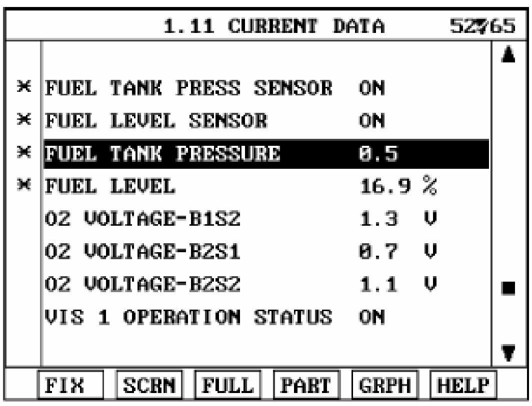


Fig. 1

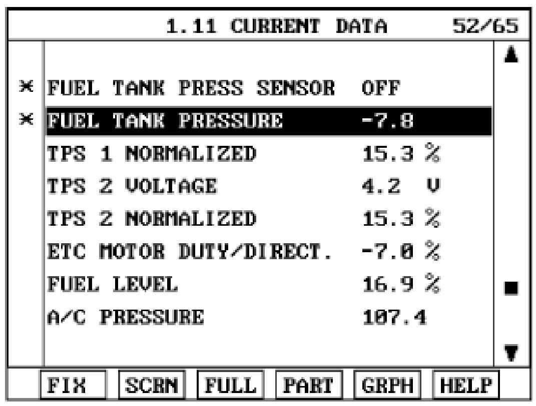


Fig. 2

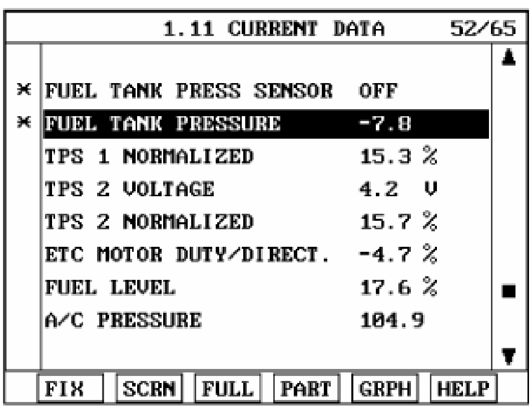


Fig. 3

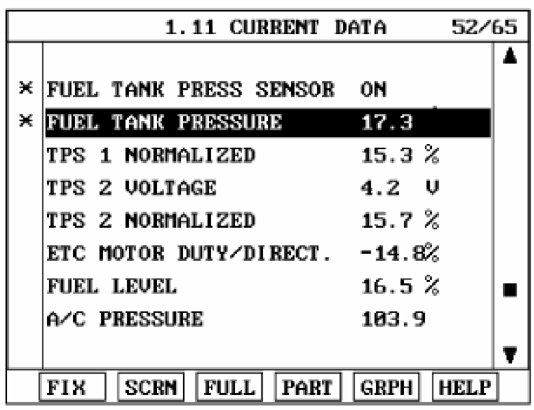


Fig. 3

Fig.1: Normal at idle
Fig.2: Open at idle
Fig.3: Short to ground at idle
Fig.4: Shrot to 5V at idle

4. Is the "FTPS" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, ending, corrosion, contamination, deterioration, or damage. Repair or replace asnecessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

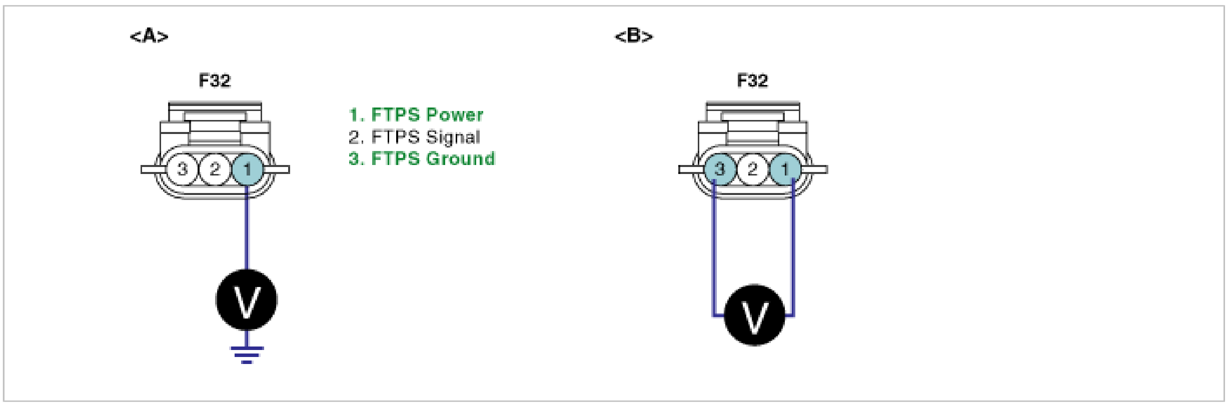
NO

▸ Go to " Ground Circuit Inspection " procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF" and disconnect FTPS connector.
2. Measure voltage between terminal 1 of FTPS harness connector and chassis ground.
3. Measure voltage between terminal 1 and 3 of FTPS harness connector.

Specification : Voltage difference between Measurement "A" and "B" is below 200mV.



4. Is the measured voltage within specification ?

YES

▸ Go to "Signal Circuit Inspection" procedure.

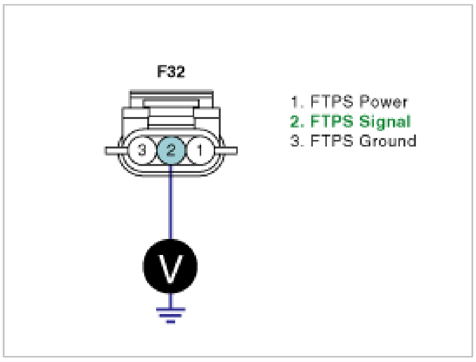
NO

▸ Repair contact reistance or open in harness and then go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check voltage.
   (1) IG "OFF" and disconnect FTPS connector.
   (2) IG "ON" & ENG "OFF"
   (3) Measure voltage between terminal 2 of FTPS harness connector and chassis ground.

   Specification : Approx. 0V



(4) Is the measured voltage within specification ?

YES

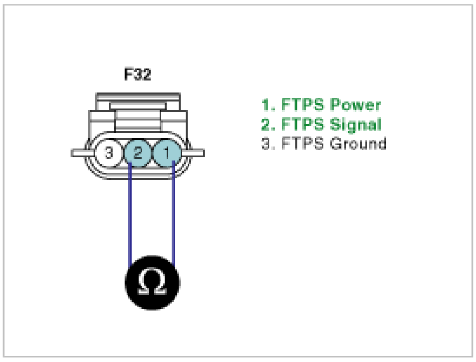
▶ Go to "Component Inspection" procedure.

NO

▶ Go to "Check short to battery in harness" as follows.

2. Check short to battery in harness
   (1) IG "OFF" and disconnet FTPS connector.
   (2) G "ON" & ENG "OFF"
   (3) Measure resistance between terminals 2 and 1 of FTPS harness connector.

Specification : Infinite



(4) Is the measured resistance within specification ?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair short to battery in harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check FTPS.
   (1) IG "OFF" and connect scatool to DLC(Data Link Connector).
   (2) Monitor "FTPS" parameter with accelleration on service data.

Specification

Pressure (kPa)	Output Voltage (V)
-2.5 kPA	0.5V
0 kPA	2.5V
2.5 kPa	4.5V

(3) Does the "FTPS" parameter with accelleraton on the service data change ?

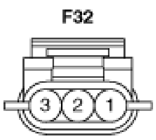
YES

▶ Go to "Check PCM" as follows.

NO

▸ Substitute with a known - good FTPS and check for proper operation.
▸ If the problem is corrected, replace FTPS and go to "Verification of Vehicle Repair" procedure.

2. Check PCM.
   (1) IG "OFF" disconnect FTPS connector
   (2) Connect Scantool and IG "ON" & ENG "OFF"
   (3) Select simulation function on scantool.
   (4) Simulate voltage at terminal 2 of FTPS harness connector.



   (5) Does the signal value of FTP sensor change according to simulation voltage ?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good PCM and check for proper operation.
If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

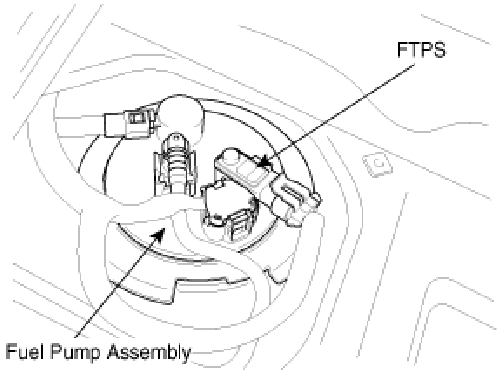
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0454

COMPONENT LOCATION



GENERAL DESCRIPTION

The Tank Pressure Sensor converts fuel tank pressure to a proportional analog voltage signal which is read by the engine controller for evaluation during execution of the Evaporative System Diagnostic. The Tank Pressure may be below atmospheric pressure (ie. a vacuum) or above atmospheric pressure.
The fuel tank pressure is used to measure the difference between the air pressure (or vacuum) in the fuel tank and the ambient air pressure. The Powertrain Control Module (ECM) supplies a 5-volt reference and a ground to the sensor, which allows the sensor's output voltage to range from 0.1 to 4.9 volts. When the air pressure in the fuel tank is equal to the ambient air pressure, as when the fuel cap is removed, the output voltage of the sensor will be from 1.3 to 1.7 volts.

DTC DESCRIPTION

The Tank Pressure Noisy Diagnostic continuously monitors the fuel tank pressure to determine if there is external noise impinging on the fuel tank pressure measurement.
Checking output signals from FTPS under detecting condition, if the stored previous - current signals is high than 33.0002., PCM sets P0454. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

DTC DETECTING CONDITION

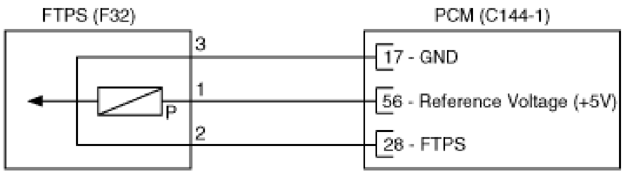
Item	Detecting Condition	Possible cause
DTC Strategy	• The Tank Pressure Noisy Diagnostic continuously monitors the fuel tank pressure to determine if there isexternal noise impinging on the fuel tank pressuremeasurement.	• Poor connection • Faulty FTPS • Faulty PCM
Enable Conditions	• Engine Running • Intake Air Temperature ≥ -4°C(24.8 °F) • Fuel Tank Vac Offset Update Completed • No Tank Pres Short Fault Present and Nosiy SignalDisabling Faults Present • Nosiy Signal Enable Criteria Met	
Threshold value	• Tank Pressure Difference > 33.0002	
Diagnosis Time	• Continuous (More than 15 seconds failure for every 32 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION

Pressure (kPa)	Output Voltage (V)
-2.5 kPA	0.5V
0 kPA	2.5V
2.5 kPa	4.5V

SCHEMATIC DIAGRAM

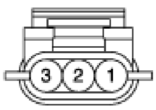
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

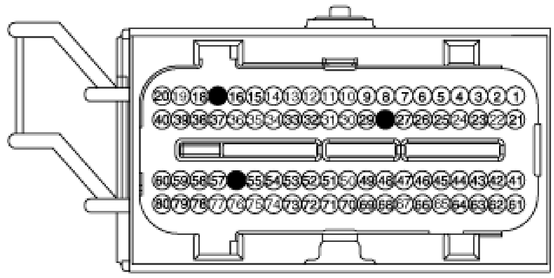
Terminal	Connected to	Funtion
1	PCM C144-1 (56)	Reference Voltage (+5V)
2	PCM C144-1 (28)	FTPS signal
3	PCM C144-1 (17)	Sensor ground

[HARNESS CONNECTORS]



F32

MAPS



C144-1

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "FTPS" parameter on the service data.

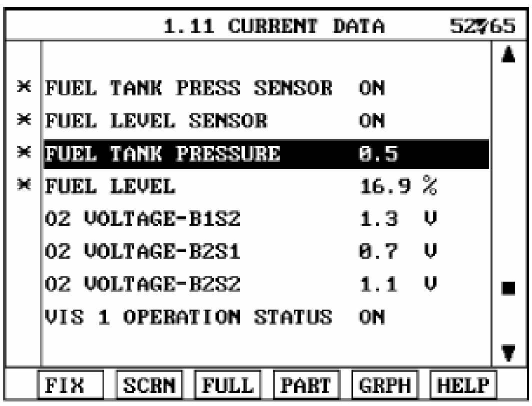


Fig. 1

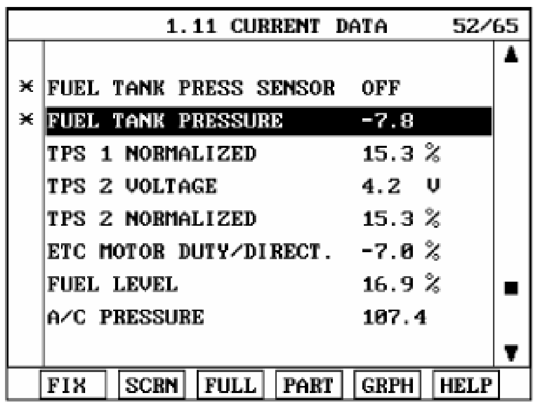


Fig. 2

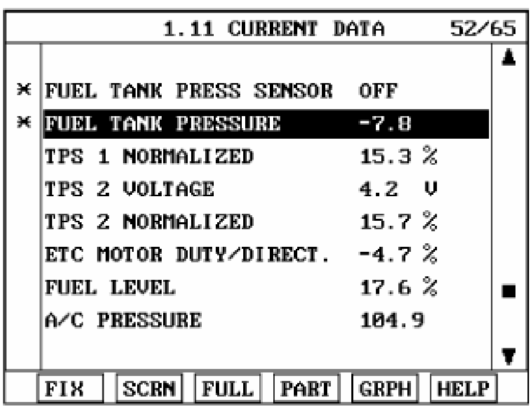


Fig. 3

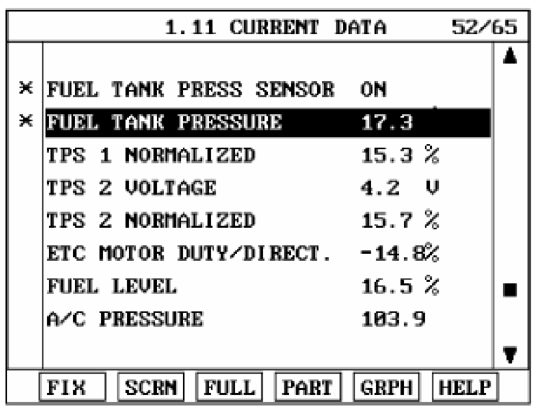


Fig. 3

Fig.1: Normal at idle
Fig.2: Open at idle
Fig.3: Short to ground at idle
Fig.4: Shrot to 5V at idle

4. Is the "FTPS" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, ending, corrosion, contamination, deterioration, or damage. Repair or replace asnecessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

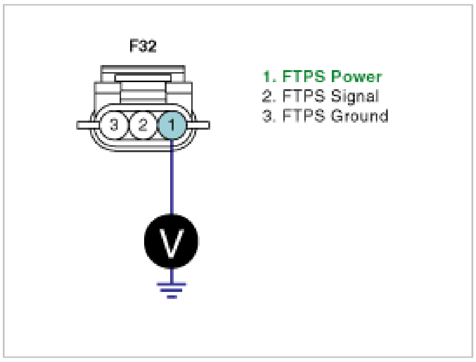
NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. IG "OFF" and disconnect FTPS connector.
2. IG "ON" & ENG "OFF"
3. Measure voltage between terminal 1 of FTPS harness connector and chassis ground.

Specification : Approx. 5V



4. Is the measured voltage within specification ?

YES

▸ Go to "Ground circuit inspection" procedure.

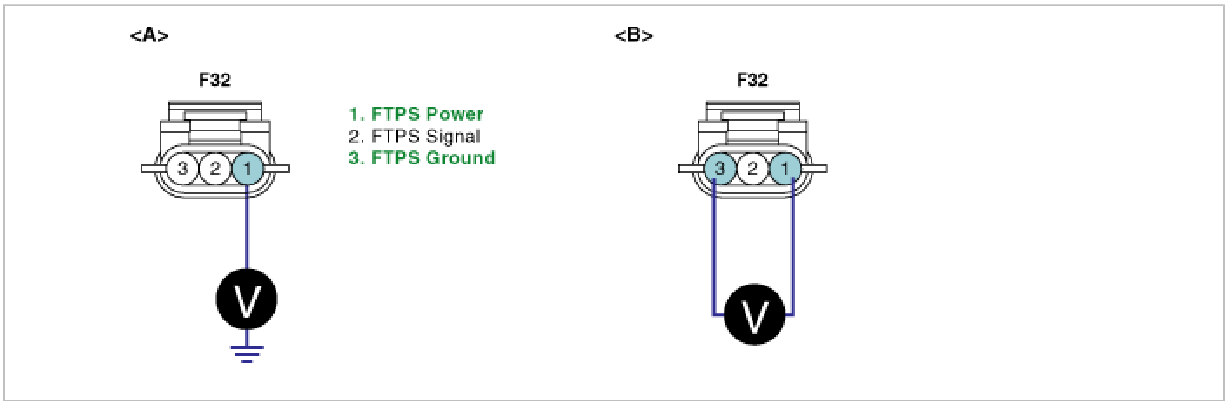
NO

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF" and disconnect FTPS connector.
2. Measure voltage between terminal 1 of FTPS harness connector and chassis ground.
3. Measure voltage between terminal 1 and 3 of FTPS harness connector.

Specification : Voltage difference between Measurement "A" and "B" is below 200mV.



4. Is the measured voltage within specification ?

YES

▸ Go to "Signal Circuit Inspection" procedure.

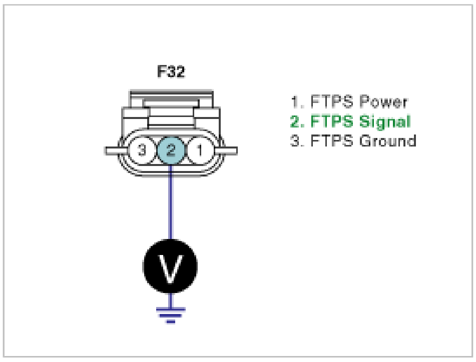
NO

▸ Repair contact reistance or open in harness and then go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF" and disconnect FTPS connector.
   (2) IG "ON" & ENG "OFF"
   (3) Measure voltage between terminal 2 of FTPS harness connector and chassis ground.

Specification : Approx. 0V



(4) Is the measured voltage within specification ?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check FTPS
   (1) IG "OFF" and connect scatool to DLC(Data Link Connector).
   (2) Monitor "FTPS" parameter with accelleration on service data.

Specification

Pressure (kPa)	Output Voltage (V)
-2.5 kPA	0.5V
0 kPA	2.5V
2.5 kPa	4.5V

(3) Does the "FTPS" parameter with accelleraton on the service data change ?

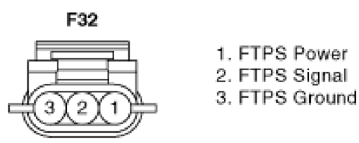
YES

▸ Go to "Check PCM" as follows.

NO

▸ Substitute with a known - good FTPS and check for proper operation.
▸ If the problem is corrected, replace FTPS and go to "Verification of Vehicle Repair" procedure.

2. Check PCM.
   (1) IG "OFF" disconnect FTPS connector
   (2) Connect Scantool and IG "ON" & ENG "OFF"
   (3) Select simulation function on scantool.
   (4) Simulate voltage at terminal 2 of FTPS harness connector.



   (5) Does the signal value of FTP sensor change according to simulation voltage ?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good PCM and check for proper operation.
▸ If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0455

GENERAL DESCRIPTION

This test determines the presence of a large leak, such as a fuel fill cap not installed or a hosedisconnected, by initially bringing the evaporative system to a vacuum level of10.2inH2O during idle conditions. This is done by commanding the vent valve toclose and requesting the Canister Purge Subsystem to enter the tank draw mode. Note: thisvacuum increase process is a continuation

of the preset mode process that was initiated duringthe Preset Large Leak Function.
During this vacuum level increase process, the vacuum level in the fuel tank is monitored using afuel tank pressure sensor for a duration that is determined by the accumulated purge volume thathas exited the evaporative system. This accumulated purge volume is determined by the vacuumindex tracking logic. A normally functioning or passing evaporative system will achieve thecalibration-specified vacuum level before the accumulated purge volume exceeds calibratedthreshold, but a failing evaporative system will not achieve this calibration-specified vacuum level.

DTC DESCRIPTION

This test detects a large leak (> 0.04”) in the evaporative system by measuring the time it takes to draw a pre-determined amount of vacuum in the evaporative system. The inability to draw a vacuum under controlled conditions is indicative of having a large leak. Test failures can be caused by either hardware failures (i.e. a hole, broken seal, etc) or by the customer not correctly reinstalling the gas cap following re-fueling.
The Large Leak test is split up in to two sub-tests, the Preset Large Leak Test and the Idle Large Leak Test. The Idle Large Leak test runs when the vehicle is at idle. The Preset Large Leak test runs when the vehicle is off idle and will report it’s results if the diagnostic times out and ends before the vehicle returns to idle.
Checking tank vaccum from tank pressure sensor under detecting condition, if tank vaccum signals is less than 10.0996 at idle condition or not after purge volume has been drawn from tank, PCM sets P0455. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till 1 driving cycle.

DTC DETECTING CONDITION

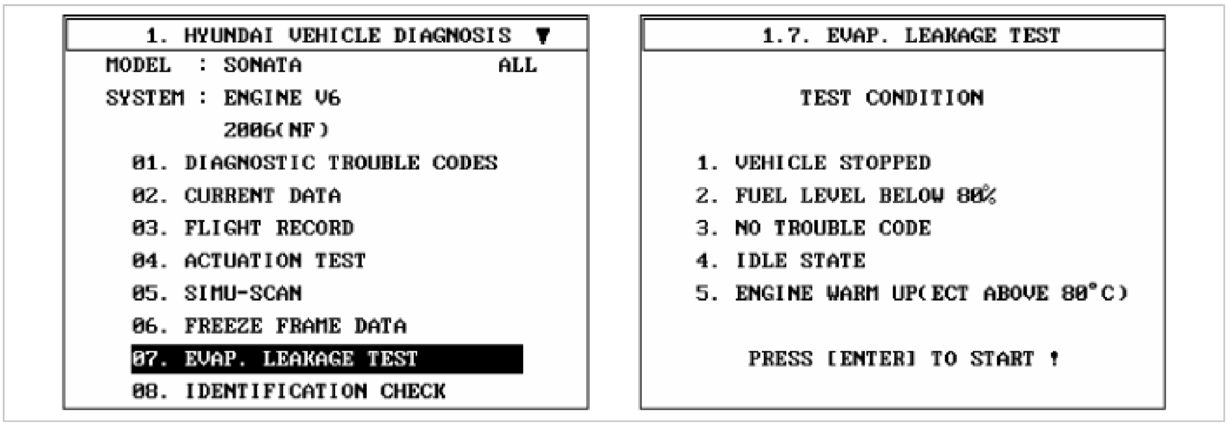
Item	Detecting Condition	Possible cause
DTC Strategy	• Test is failed if tank vacuum cannot reach prescribedvaccum after a prescribed purge volume has been drawn from the tank	
Enable Conditions	• 10 < Ignition Volt < 15.9907 • Barometric pressure > 72 kPa • Engine off time > 720min or Startup IAT-Startup ECT < 12°C(53.6 °F) • Startup ECT -Startup IAT < 12°C(53.6 °F) • 0°C(32 °F) < Startup ECT < 40°C(104 °F) • 0°C(32 °F) < Startup IAT < 40°C(104 °F) • Start-up IAT-IAT < 1°C(33.8 °F) • 1s < Engine Run Time < 100s • Purge enabling Rum time < Threshold • Cold Test Timer < 300sec. • 15% < Fuel level < 85% • Engine RPM < 1500 • Vehicle Speed < 3KPH(1.864114 MPH) • Throttle Position < 1% • Engine RPM < 1500 • Vehicle Speed < 6KPH(3.728227 MPH) • Throttle Position < 1.9989% • Vehicle Speed > 2KPH(1.242742 MPH)	• Leakage in each hose/fuel filler pipe • Leakage in CCV/Canister/ Fuel tank • Faulty PCM
Threshold value	At idle Condition • Tank Vaccum <10.0996 in HO2 • purge integral > Threshold	
Diagnosis Time	• -	
MIL On Condition	• 1 driving cycles	

MONITOR SCANTOOL DATA

1. Warm-up engine to normal operating temperature.

> **NOTE**
>
> Evaporative Emissions Systems (EVAP) Leak Tests can be run by the Scan Tool.
> The tests are automated and provide either a pass-fail result or directions to check for DTCs.

2. Install scan tool and clear DTC
3. Perform "EVAP. LEAKAGE TEST" mode referring to enable conditions as below



4. Monitoring for (pending) DTC by performing " DIAGNOSTIC TROUBLE CODES" or "MONITORING TEST RESULTS". Is the same DTC set ?

YES

▸Go to "System Inspection" procedure.

NO

▸ Fault is intermittent caused by poor contact in sensor’s and/or PCM’s connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection,bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and goto "Verification of vehicle Repair" procedure.

SYSTEM INSPECTION

1. Check vapor hoses for leakage in fuel system.
   (1) Check vapor hoses between the following components for leakage:
      A. Intake manifoled ~ Purge control solenoid valve (PCSV)
      B. Purge control solenoid valve (PCSV) ~ Canister
      C. Canister ~ Canister close valve (CCV)
      D. Canister ~ fuel tank

   (2) Does a leak exist?

   YES

   ▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Go to "Check fuel filler pipe for leakage" as below.

2. Check fuel filler pipe for crack or leakage.
   (1) Check that there is crack or leakage in fuel filler pipe

   (2) Is there any crack or leakage ?

   YES

   ▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Go to "Component inspection" procedure.

COMPONENT INSPECTION

1. Check CCV for leakage.
   (1) Disconnect the hose leading from the CCV to Canister at CCV.

   (2) Visually Check any tear of the hose leading from the CCV to Canister

   (3) When the CCV operates, apply a vacuum at the nipple and verify that the CCV holds vacuum.

   (4) Does a leak exist?

   YES

   ▸ Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Go to "Check Canister for leakage" as necessary.

2. Check Canister for leakage.
   (1) Disconnect the hose leading from the CCV to Canister at Canister.
   (2) When the other nipples are plugged, apply a vacuum at the vent nipple and verify that the Canister holds vacuum
   (3) Does a leak exist?

YES

▸ Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Go to "Check fuel tank for leakage" as below.

3. Check fuel tank for leakage.
   (1) Check fuel tank for crack or leakage.
   (2) Does a leak exist?

YES

▸ Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good PCM and check for proper operation.
▸ If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0456

GENERAL DESCRIPTION

Similar in operation to the Small Leak test, the Very Small Leak test will detect the presence of aleak that is 0.020” (0.5 mm) or larger in the evaporative system if the Small Leak test reports a“pass” condition. To prevent a possible misdiagnosis, the Very Small Leak test may use tighteroperational limits than required by the Small Leak test. If any of the Very Small Leak test enablingconditions are not met, such as coolant and intake air temperature, the Very Small Leak test willbe disabled for the current trip.

DTC DESCRIPTION

The EVPD(Evap. Leak Diagnostic) calculates some intermediate segment slopes for the Very Small Leak test as in theSmall Leak test. These segment slopes may result in the disablement of only the Very Small Leaktest, not the Small Leak test.
The very small leak test normally takes 25 seconds to complete. However, it may be allowed topass at the end of the small leak test if the decay slope is sufficiently small enough to pass thevery small leak slope criteria. This is allowed because the decay slope decreases with time.If the decay slope is passing after 10 seconds, then it will pass by an even greater marginafter 25 seconds.
Checking tank vaccum from tank pressure sensor under detecting condition, if tank vaccum signals is less than 10.0996 at idle condition or not after purge volume has been drawn from tank, PCM sets P0455. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till 1 driving cycle.

DTC DETECTING CONDITION

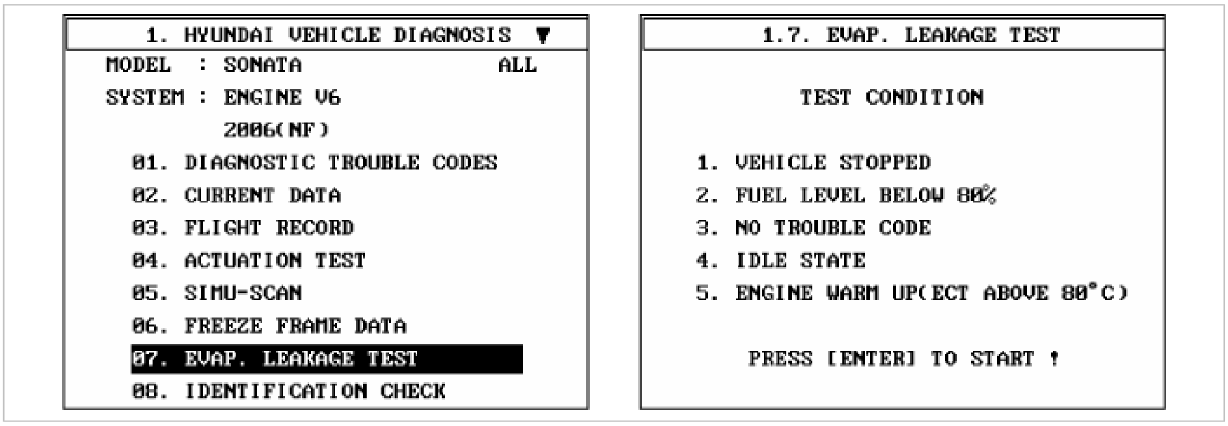
Item	Detecting Condition	Possible cause
DTC Strategy	• If a corrected vacuum decay slope and the individual segment slopes exceed their respective thresholds and the segment slopes are not convex then a small leak is present	• Leakage in each hose/fuel filler pipe • Leakage in CCV/Canister/ Fuel tank • Faulty PCM
Enable Conditions	• 10 < Ignition Volt < 15.9907 • Barometric pressure > 72 kPa • Engine off time > 720min or Startup IAT-Startup ECT < 12°C(53.6 °F) • Startup ECT -Startup IAT < 12°C(53.6 °F) • 0°C(32 °F) < Startup ECT < 40°C(104 °F) • 0°C(32 °F) < Startup IAT < 40°C(104 °F) • Start-up IAT-IAT < 1°C(33.8 °F) • 1s < Engine Run Time < 100s • Purge enabling Rum time < Threshold • Cold Test Timer < 300sec. • 15% < Fuel level < 85%Under Idle conditions • Engine RPM < 1500 • Vehicle Speed < 3KPH(1.864114 MPH) • Throttle Position < 1%Creep Conditions • Engine RPM < 1500 • Vehicle Speed < 6KPH(3.728227 MPH) • Throttle Position < 1.9989%Fuel not Sloshing • Vehicle Speed > 2KPH(1.242742 MPH)OR • Throttle position > 1.1%OR • 125ms MAP change > 10kPaOR • 125ms Engine speed > 100OR • 125ms Fuel level delta > Threshold(Creep delay time • Time vehicle speed > 2kph • divided by decay time = 25sec.	
Threshold value	• Decay slope(beginning at decay start < 10in HO2 and lasting 300sec for decay time) minus the larger vapor correction term ,(purge leak vapor term OR Post decay vapor term) greater than a threshold, (the product of a base term using fuel level AND a temperature bias term) • All segment slopes greater than their threshold(The product of bias term and temperature bias term,anda segment bias term) • The current segment slope minus the prior segment slope less thanthe convex threshold(in HO2)	
Diagnosis Time	• -	
MIL On Condition	• 1 driving cycles	

MONITOR SCANTOOL DATA

1. Warm-up engine to normal operating temperature.

> NOTE
>
> Evaporative Emissions Systems (EVAP) Leak Tests can be run by the Scan Tool.
> The tests are automated and provide either a pass-fail result or directions to check for DTCs.

2. Install scan tool and clear DTC
3. Perform "EVAP. LEAKAGE TEST" mode referring to enable conditions as below



4. Monitoring for (pending) DTC by performing " DIAGNOSTIC TROUBLE CODES" or "MONITORING TEST RESULTS". Is the same DTC set ?

YES

▸Go to "System Inspection" procedure.

NO

▸ Fault is intermittent caused by poor contact in sensor's and/or PCM's connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection,bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and goto "Verification of vehicle Repair" procedure.

SYSTEM INSPECTION

1. Check vapor hoses for leakage in fuel system.
   (1) Check vapor hoses between the following components for leakage:
      A. Intake manifoled ~ Purge control solenoid valve (PCSV)
      B. Purge control solenoid valve (PCSV) ~ Canister
      C. Canister ~ Canister close valve (CCV)
      D. Canister ~ fuel tank

   (2) Does a leak exist?

   YES

   ▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Go to "Check fuel filler pipe for leakage" as below.

2. Check fuel filler pipe for crack or leakage.
   (1) Check that there is crack or leakage in fuel filler pipe

   (2) Is there any crack or leakage ?

   YES

   ▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Go to "Component inspection" procedure.

COMPONENT INSPECTION

1. Check CCV for leakage.
   (1) Disconnect the hose leading from the CCV to Canister at CCV.

   (2) Visually Check any tear of the hose leading from the CCV to Canister

   (3) When the CCV operates, apply a vacuum at the nipple and verify that the CCV holds vacuum.

   (4) Does a leak exist?

   YES

   ▸ Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Go to "Check Canister for leakage" as necessary.

2. Check Canister for leakage.
   (1) Disconnect the hose leading from the CCV to Canister at Canister.

(2) When the other nipples are plugged, apply a vacuum at the vent nipple and verify that the Canister holds vacuum

(3) Does a leak exist?

YES

▸ Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Go to "Check fuel tank for leakage" as below.

3. Check fuel tank for leakage.

(1) Check fuel tank for crack or leakage.

(2) Does a leak exist?

YES

▸ Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good PCM and check for proper operation.

▸ If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

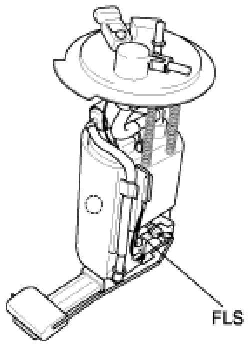
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0461

COMPONENT LOCATION



GENERAL DESCRIPTION

In order to measure the Fuel Level within the tank, the Fuel Level Sender consists of a variable resistor card mounted in the Fuel Pump and Sender unit (located in the fuel tank). A float located in the fuel tank swivels up and down as fuel level varies. A wiper is attached to the float and sweeps across the resistor card, thus providing a variable resistive input to the PCM. As the float sweeps across the Fuel Level Sender resistor card, the input voltage to the PCM varies accordingly. The PCM has calibrations and software which convert this analog voltage to a Fuel Level reading.

DTC DESCRIPTION

This function will check the difference between the current fuel level sender voltage and the previous fuel level sender voltage to determine the amount of fuel removed from the tank. This information, coupled with the distance traveled, can determine whether the fuel level sender is functioning correctly, or if it is stuck.
When the Fuel Level Sender fails, it may cause the Evaporative System Diagnostic to function improperly since it relies on Fuel Level in its leak detection algorithm. A failed Fuel Level Sender will also provide misleading Fuel Level information to the driver (in cases where the PCM drives the fuel gauge).
Checking fuel level change under detecting condition, if not only the fuel level difference between current and previous is lower than 0.035 but also odometer difference between present and previous is higher than 200km, PCM sets P0451. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

DTC DETECTING CONDITION

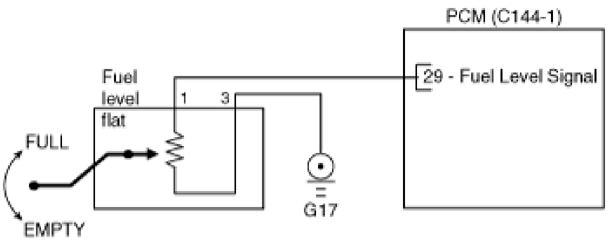
<table>
<tr><th>Item</th><th>Detecting Condition</th><th>Possible cause</th></tr>
<tr><td>DTC Strategy</td><td>• Detects a stuck fuel level sender</td><td rowspan="5">• Poor connection
• Faulty Fuel Level Sensor
• Faulty PCM</td></tr>
<tr><td>Enable Conditions</td><td>• Engine Running
• Fuel Level Fault Not Present
• Set Enable Criteria Met to True</td></tr>
<tr><td>Threshold value</td><td>• Current Raw Fuel Lvl Sender - Prev Raw Fuel Lvl Sender ≤ 0.035
• Present Odometer - Previous Odometer ≥ 200km (124.274238 mile)</td></tr>
<tr><td>Diagnosis Time</td><td>•</td></tr>
<tr><td>MIL On Condition</td><td>• 2 driving cycles</td></tr>
</table>

SPECIFICATION

FLS	Normal Parameter				
Float position	8/8	7/8	5/8	2/8	Warning Lamp ON
Resistance(Ω)	15.0±1	25.0±1	50±1	110±1.5	170±1.5
Fuel volume(ℓ)	63	56	42	21	9

SCHEMATIC DIAGRAM

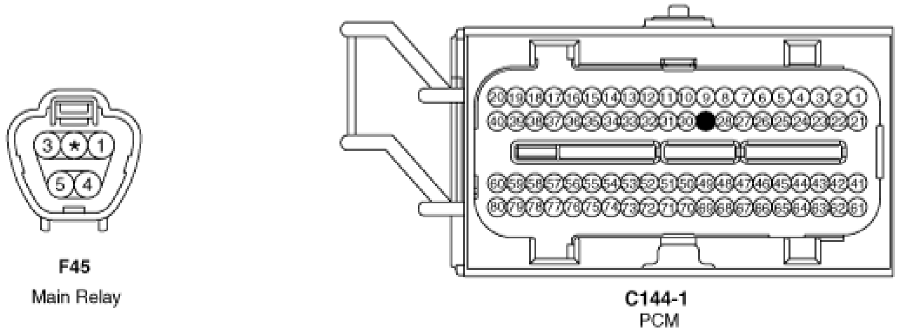
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	PCM C144-1 (29)	Fuel level signal
3	Chassis Ground (G17)	Sensor ground

[HARNESS CONNECTOR]



MONITOR SCANTOOL DATA

1. Ignition "OFF".
2. Connect Scantool and Engine "ON".
3. Monitor "FLS" parameter on Current Data.

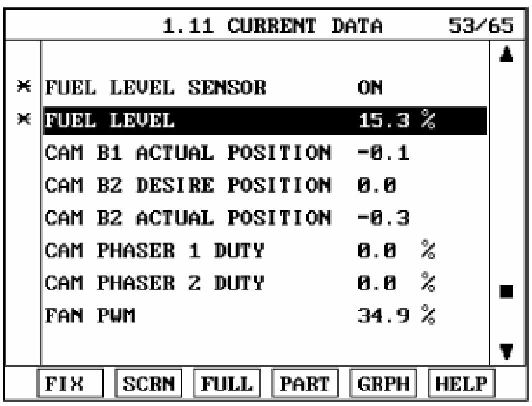


Fig.1 Normal

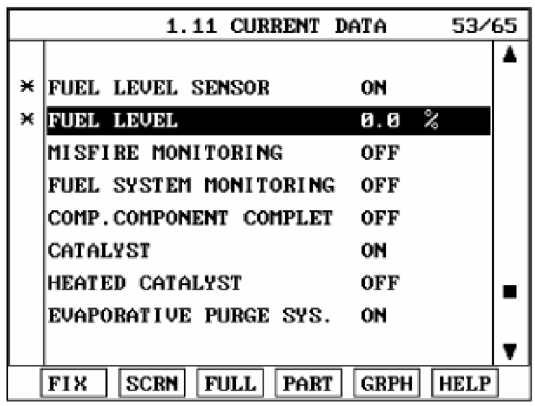


Fig.2 Short to ground in signal harness

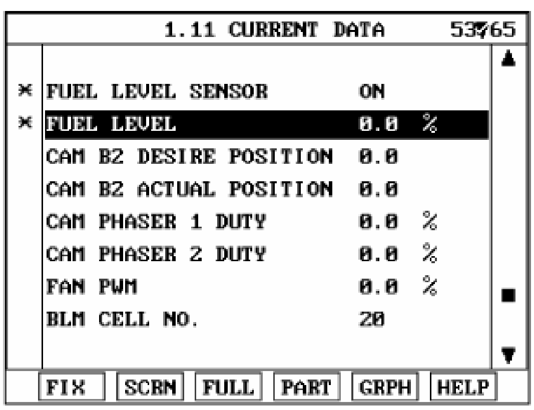


Fig.3 Open in signal harness

4. Is the "FLS" parameter displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor’s and/or PCM’s connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection,bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and goto "Verification of Vehicle Repair" procedure.

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

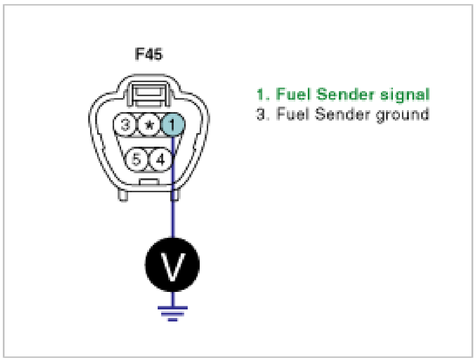
NO

▸ Go to " Signal Circuit Inspection " procedure.

SIGNAL CIRCUIT INSPECTION

1. IG "OFF" and disconnect FLS connector.
2. IG "ON" & ENG "OFF"
3. Measure voltage between terminal 1 of FLS harness connector and chassis ground.

Specification : Approx. 11.46V



4. Is the measured voltage within specification ?

YES

▸ Go to "Ground Circuit Inspection" procedure.

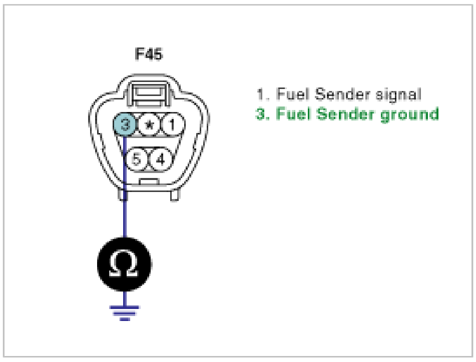
NO

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF"
2. Disconnect FLS & PCM connector.
3. Measure resistance between terminal 3 of FLS harness connector and chassis ground.

Specification : Approx. below 1Ω



4. Is the measured resistance within specification ?

YES

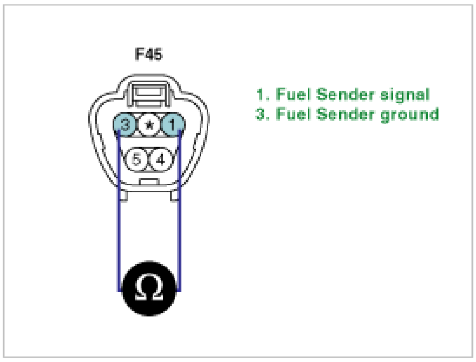
▸ Go to "Component Crcuit Inspection" procedure.

NO

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF"
2. Disconnect Fuel Level Sensor connector and Remove Fuel Sender from fuel tank.
3. Measure reistance between terminal 1 and 3 of Fuel Sender.(Component Side)



4. Does the resistance of FLS change as lifting up and down the fuel level float?

YES

▸ Substitute with a known - good PCM and check for proper operation.
▸ If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good Fuel Level Sensor and check for proper operation.
▸ If the problem is corrected, replace Fuel Level Sensor and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

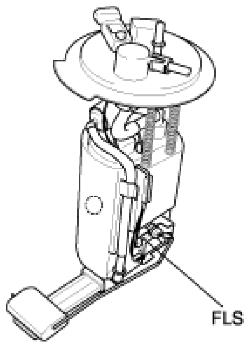
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0462

COMPONENT LOCATION



GENERAL DESCRIPTION

In order to measure the Fuel Level within the tank, the Fuel Level Sender consists of a variable resistor card mounted in the Fuel Pump and Sender unit (located in the fuel tank). A float located in the fuel tank swivels up and down as fuel level varies. A wiper is attached to the float and sweeps across the resistor card, thus providing a variable resistive input to the PCM. As the float sweeps across the Fuel Level Sender resistor card, the input voltage to the PCM varies accordingly. The PCM has calibrations and software which convert this analog voltage to a Fuel Level reading.

DTC DESCRIPTION

The Fuel Level Circuit Diagnostic compares the Fuel Level Sender voltage to low and high limits. When the voltage is outside the allowable limits, the circuit is determined to be failed.
When the Fuel Level Sender fails, it may cause the Evaporative System Diagnostic to function improperly since it relies on Fuel Level in its leak detection algorithm. A failed Fuel Level Sender will also provide misleading Fuel Level information to the driver (in cases where the PCM drives the fuel gauge).
Checking output signals of tank level sensor under detecting condition, if the fuel level voltage is low than 0.2V PCM sets P0462. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

DTC DETECTING CONDITION

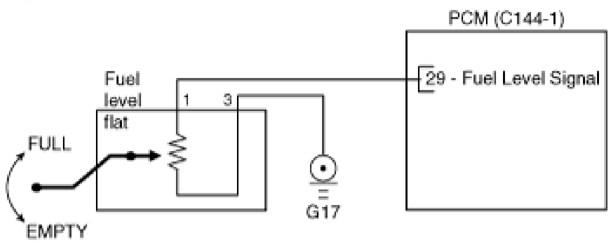
Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a continuous short to low or open in either the signal circuit or the fuel level sender	• Poor connection • Open or short to ground in signal Circuit • Faulty Fuel Level Sensor • Faulty PCM
Enable Conditions	• Engine Running • Set Short diagnostic Enable Criteria Met Flag	
Threshold value	• Raw fuel level sender output & 0.2V	
Diagnosis Time	• -	
MIL On Condition	• 2 driving cycles	

SPECIFICATION

FLS	Normal Parameter				
Float position	8/8	7/8	5/8	2/8	Warning Lamp ON
Resistance(Ω)	15.0±1	25.0±1	50±1	110±1.5	170±1.5
Fuel volume(ℓ)	63	56	42	21	9

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]

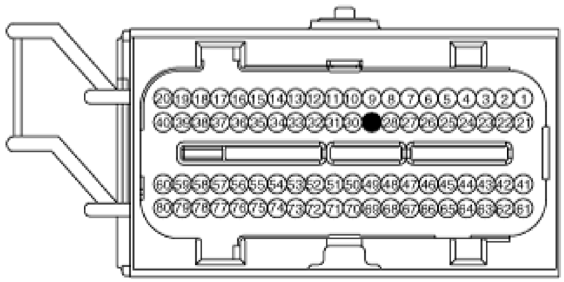


[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	PCM C144-1 (29)	Fuel level signal
3	Chassis Ground (G17)	Sensor ground

[HARNESS CONNECTOR]

F45
Main Relay



C144-1
PCM

MONITOR SCANTOOL DATA

1. Ignition "OFF"
2. Connect Scantool and Engine "ON"
3. Monitor "FLS" parameter on Current Data

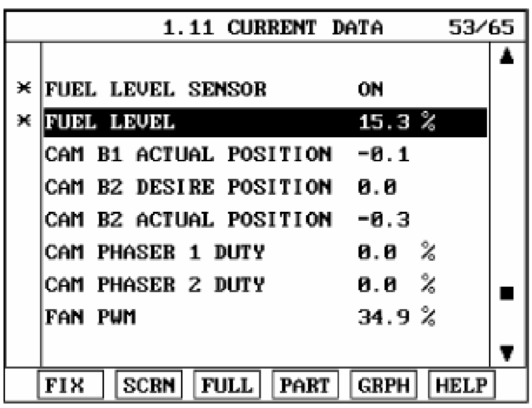


Fig.1 Normal

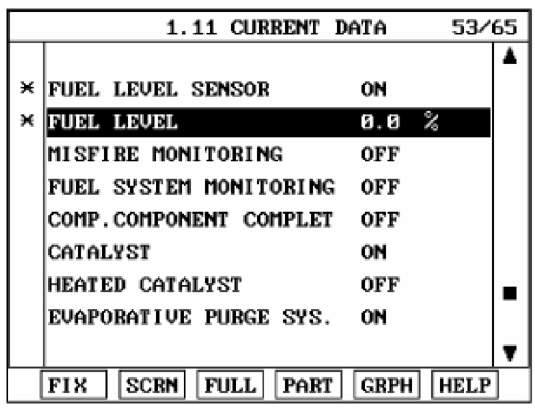


Fig.2 Short to ground in signal harness

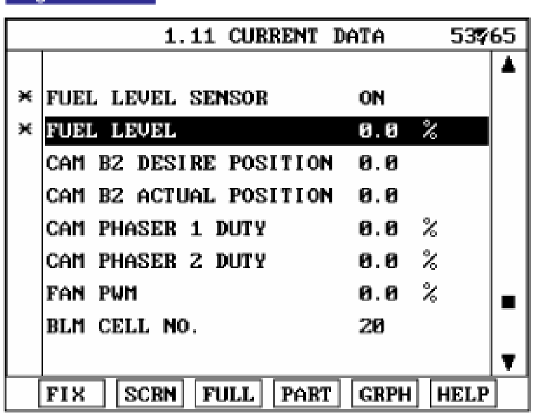


Fig.3 Open in signal harness

4. Is the "FLS" parameter displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

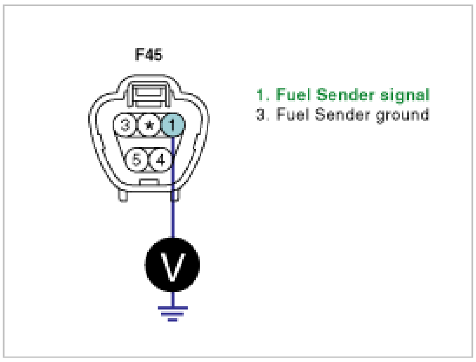
NO

▸ Go to " Signal Circuit Inspection " procedure

SIGNAL CIRCUIT INSPECTION

1. Check Voltage
   (1) IG "OFF" and disconnect FLS connector.
   (2) IG "ON" & ENG "OFF"
   (3) Measure voltage between terminal 1 of FLS harness connector and chassis ground.

Specification : Approx. 11.46V



   (4) Is the measured voltage within specification ?

YES

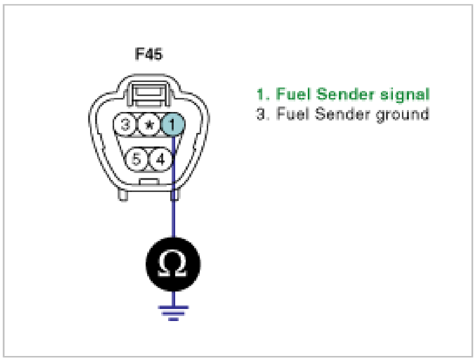
▸ Go to "Component Inspection" procedure.

NO

▸ Go to "Check short to ground in harness" as follows

2. Check short to ground in harness
   (1) IG "OFF" and disconnect FLS connector.
   (2) Measure resistance between terminal 1 of FLS harness connector and chassis ground.

Specification : Infinite



(3) Is the measured resistance within specification ?

YES

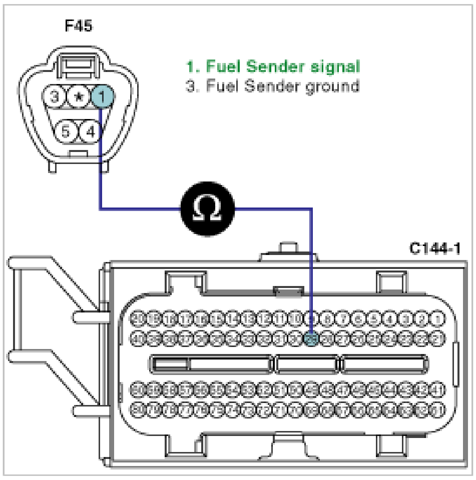
▸ Go to "Check open in harness" procedure.

NO

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

3. Check open in harness
   (1) IG "OFF" and disconnect FLS connector and PCM connector.
   (2) Measure resistance between terminal 1 of FLS harness connector and terminal 29 of PCM harness connector.

Specification : Approx. Below 1Ω



(3) Is the measured resistance within specification ?

YES

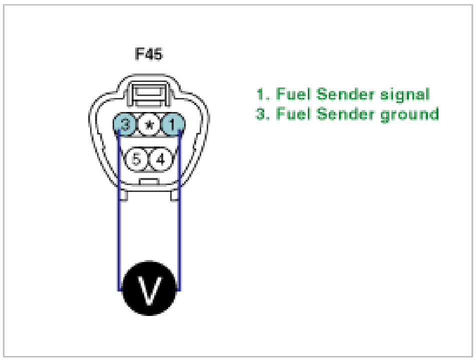
▸ Go to "Component Inspection" procedure.

NO

▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair"procedure.

COMPONENT INSPECTION

1. Ignition "OFF"
2. Disconnect Fuel Level Sensor connector and Remove Fuel Sender from fuel tank.
3. Measure reistance between terminal 1 and 3 of Fuel Sender.(Component Side)



4. Does the resistance of FLS change with lifting up and down the fuel level float ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good Fuel Level Sensor and check for proper operation. If the problem is corrected, replace Fuel Level Sensor and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

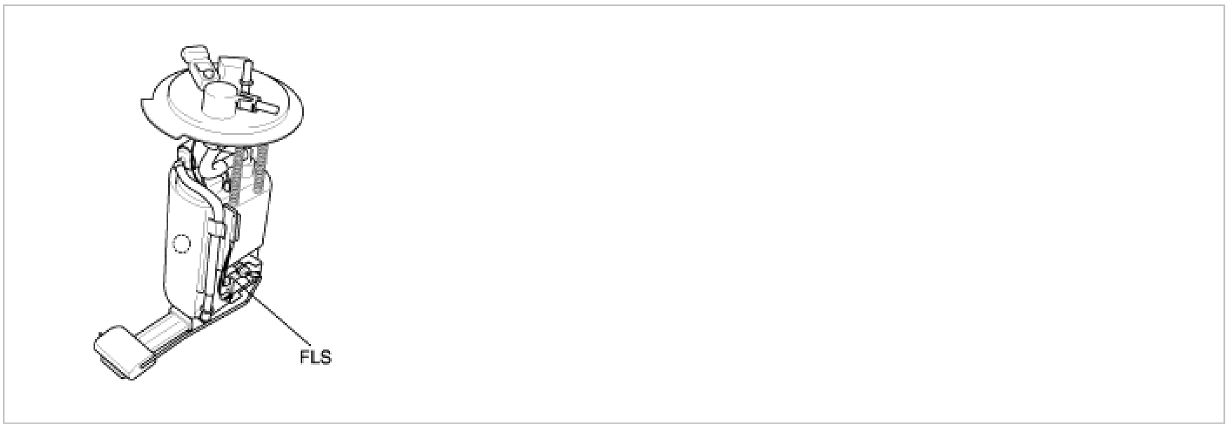
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0463

COMPONENT LOCATION



GENERAL DESCRIPTION

In order to measure the Fuel Level within the tank, the Fuel Level Sender consists of a variable resistor card mounted in the Fuel Pump and Sender unit (located in the fuel tank). A float located in the fuel tank swivels up and down as fuel level varies. A wiper is attached to the float and sweeps across the resistor card, thus providing a variable resistive input to the PCM. As the float sweeps

across the Fuel Level Sender resistor card, the input voltage to the PCM varies accordingly. The PCM has calibrations and software which convert this analog voltage to a Fuel Level reading.

DTC DESCRIPTION

The Fuel Level Circuit Diagnostic compares the Fuel Level Sender voltage to low and high limits. When the voltage is outside the allowable limits, the circuit is determined to be failed.
When the Fuel Level Sender fails, it may cause the Evaporative System Diagnostic to function improperly since it relies on Fuel Level in its leak detection algorithm. A failed Fuel Level Sender will also provide misleading Fuel Level information to the driver (in cases where the PCM drives the fuel gauge).
Checking output signals of tank level sensor under detecting condition, if the fuel level voltage is high than 4.41V PCM sets P0463. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

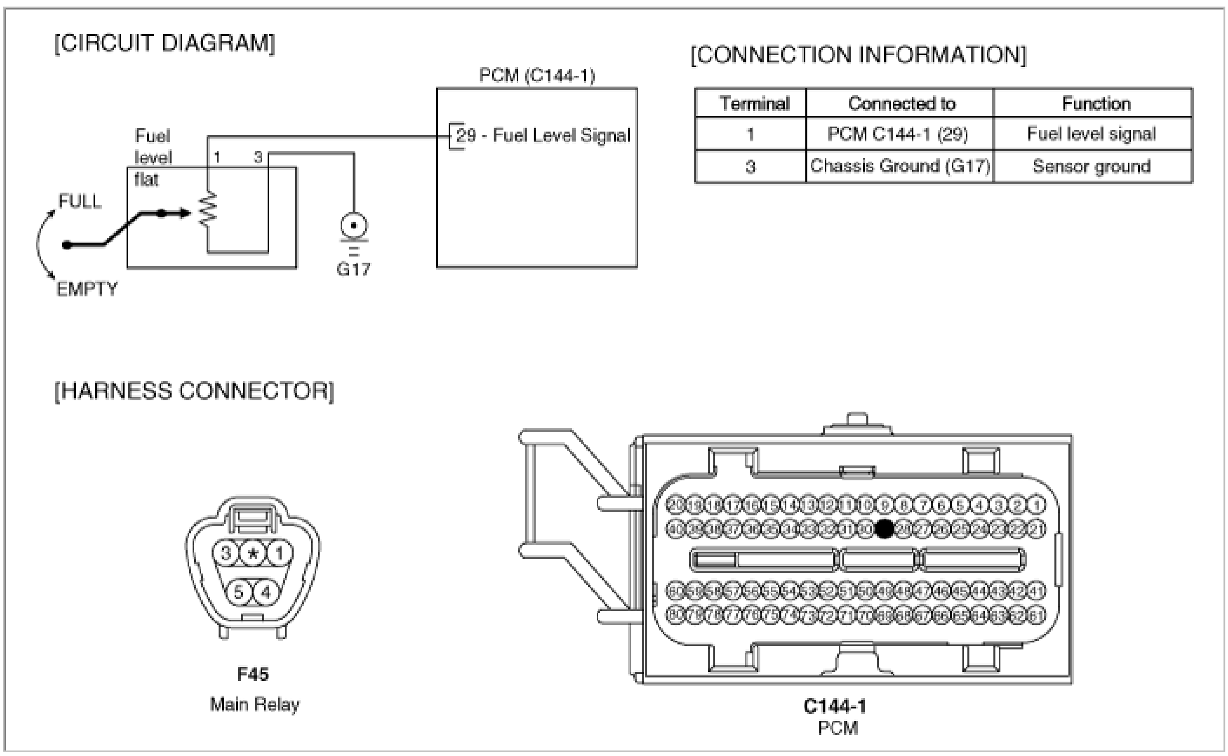
DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a continuous short to low or open in either the signal circuit or the fuel level sender	• Poor connection • Short to battery in signal Circuit • Faulty Fuel Level Sensor • Faulty PCM
Enable Conditions	• Engine Running • Set Short diagnostic Enable Criteria Met Flag	
Threshold value	• Raw fuel level sender output >4.5V	
Diagnosis Time	• -	
MIL On Condition	• 2 driving cycles	

SPECIFICATION

FLS	Normal Parameter				
Float position	8/8	7/8	5/8	2/8	Warning Lamp ON
Resistance(Ω)	15.0±1	25.0±1	50±1	110±1.5	170±1.5
Fuel volume(ℓ)	63	56	42	21	9

SCHEMATIC DIAGRAM



MONITOR SCANTOOL DATA

1. Ignition "OFF"
2. Connect Scantool and Engine "ON"
3. Monitor "FLS" parameter on Current Data

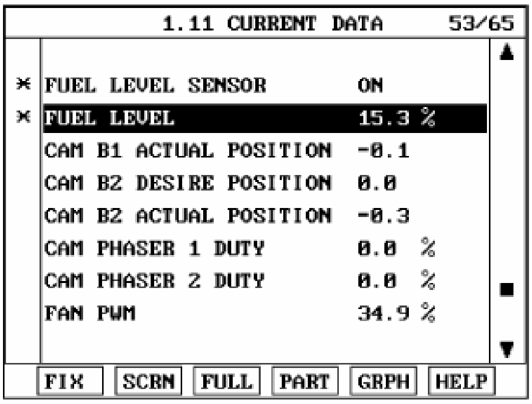


Fig.1 Normal

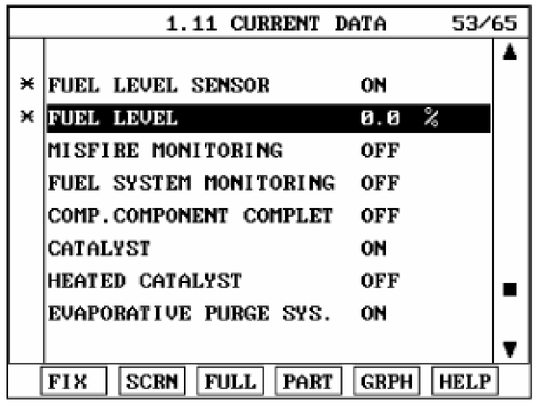


Fig.2 Short to ground in signal harness

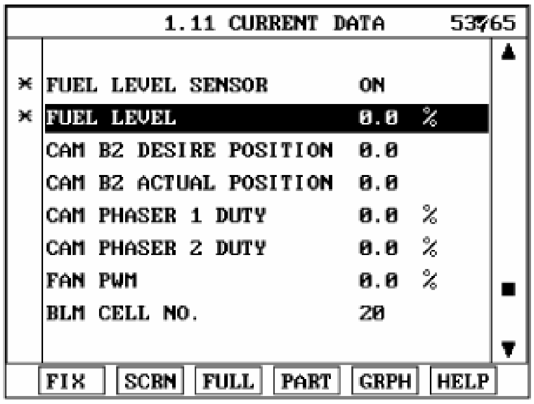


Fig.3 Open in signal harness

4. Is the "FLS" parameter displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

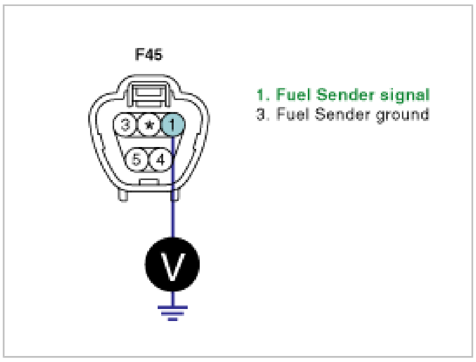
NO

▸ Go to " Signal Circuit Inspection " procedure

SIGNAL CIRCUIT INSPECTION

1. Check Voltage
   (1) IG "OFF" and disconnect FLS connector.
   (2) IG "ON" & ENG "OFF"
   (3) Measure voltage between terminal 1 of FLS harness connector and chassis ground.

Specification : Approx. 11.46V



(4) Is the measured voltage within specification ?

YES

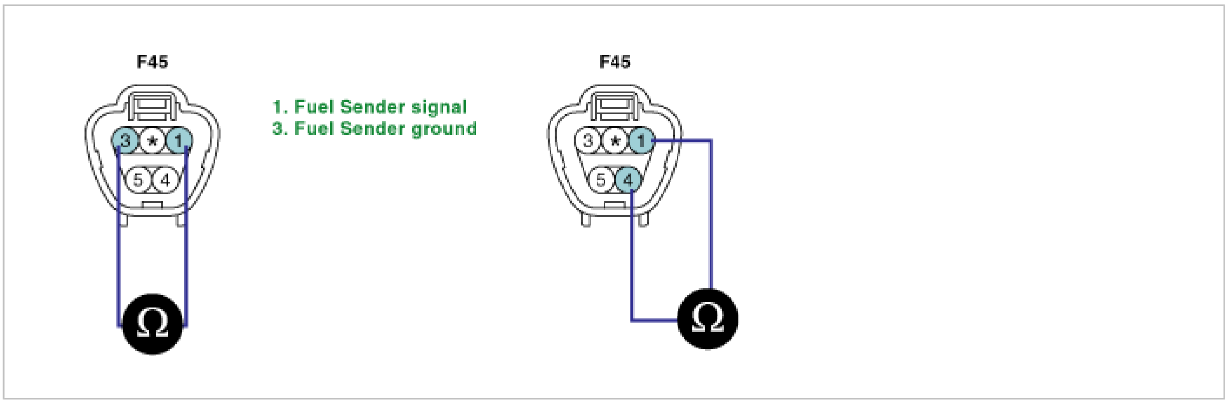
▸ Go to "Component Inspection" procedure.

NO

▸ Go to "Check short to battery in harness" as follows.

2. Check short to battery in harness
   (1) IG "OFF"
   (2) Disconnect FLS and PCM connector.
   (3) Measure resistance between terminals 1 and 3 of FLS harness connector.
   (4) Measure resistance between terminals 1 and 4 of FLS harness connector.

Specification : Infinite



(5) Is the measured resistance within specification ?

YES

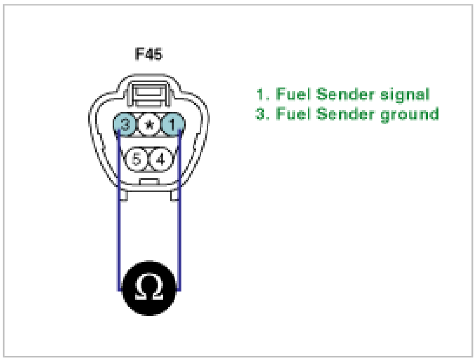
▸ Go to "Component Inspection" procedure.

NO

▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF"
2. Disconnect Fuel Level Sensor connector and Remove Fuel Sender from fuel tank.
3. Measure reistance between terminal 1 and 3 of Fuel Sender.(Component Side)



4. Does the resistance of FLS change with lifting up and down the fuel level float ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Substitute with a known - good Fuel Level Sensor and check for proper operation. If the problem is corrected, replace Fuel Level Sensor and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

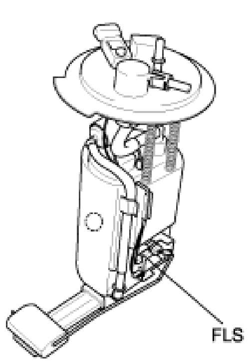
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0464

COMPONENT LOCATION



GENERAL DESCRIPTION

In order to measure the Fuel Level within the tank, the Fuel Level Sender consists of a variable resistor card mounted in the Fuel Pump and Sender unit (located in the fuel tank). A float located in the fuel tank swivels up and down as fuel level varies. A wiper is attached to the float and sweeps across the resistor card, thus providing a variable resistive input to the PCM. As the float sweeps

across the Fuel Level Sender resistor card, the input voltage to the PCM varies accordingly. The PCM has calibrations and software which convert this analog voltage to a Fuel Level reading.

DTC DESCRIPTION

The Fuel Level Noisy Signal Diagnostic monitors variations in Fuel Level and looks for erratic or irregular behavior. When the Fuel Level is determined to display unstable, the Fuel Level Sender is determined to be failed.
When the Fuel Level Sender fails, it may cause the Evaporative System Diagnostic to function improperly since it relies on Fuel Level in its leak detection algorithm. A failed Fuel Level Sender will also provide misleading Fuel Level information to the driver (in cases where the PCM drives the fuel gauge).
Checking output signals from FLS under detecting condition, if Difference between previous and current Fuel Level Signal is high than 0.8V , PCM sets P0464. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

DTC DETECTING CONDITION

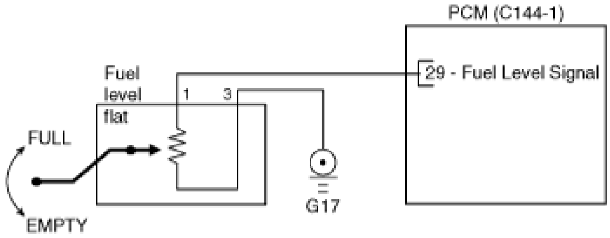
<table>
<tr><th colspan="2">Item</th><th>Detecting Condition</th><th>Possible cause</th></tr>
<tr><td colspan="2">DTC Strategy</td><td>• Detects a stuck fuel level sender</td><td rowspan="6">• Poor connection
• Faulty Fuel Level Sensor
• Faulty PCM</td></tr>
<tr><td rowspan="2">Enable Conditions</td><td>Case 1</td><td>Determination of Steady Conditions
Engine Running
• Delta MAP ≤ 10kPa
• Delay Time ≥ 5sec
• Set Delta MAP Condition Not Exceeded Flag to TRUE
OR
• Delta RPM ≤ 50
• Delay Time ≥ 5sec
• Set Delta RPM Conditon Not Exceeded Flag to TRUE
OR
• Thottle Position ≤ 1.9989%
• Delay Time ≥ 5sec
• Set TPS Condition Not Exceeded Flag to TRUE
OR
• Vehicle Speed ≥ 1kph(0.621371 mile)
• Delay Time ≥ 5sec
• Set V. Speed Condition Not Exceeded Flag to TRUE</td></tr>
<tr><td>Case 2</td><td>Determination of Noisy Signal Enable Conditons
• Engine Running
• Intake Air temperature > -10°C(14 °F)
• Fuel Level Active Not Present
• No Nosiy Signal Disabling Faults Present
• Delta MAP Condition Not Exceeded
• Delta RPM Conditon Not Exceeded
• TPS Conditon Not Exceeded
• Vehicle Speed Conditon Not Exceeded
• Set Enable Criteria Met Conditions are Satisfied</td></tr>
<tr><td colspan="2">Threshold value</td><td>• Difference between previous and current Fuel Level Raw Signal > 0.1667</td></tr>
<tr><td colspan="2">Diagnosis Time</td><td>• -</td></tr>
<tr><td colspan="2">MIL On Condition</td><td>• 2 driving cycles</td></tr>
</table>

SPECIFICATION

FLS	Normal Parameter				
Float position	8/8	7/8	5/8	2/8	Warning Lamp ON
Resistance(Ω)	15.0±1	25.0±1	50±1	110±1.5	170±1.5
Fuel volume(ℓ)	63	56	42	21	9

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]

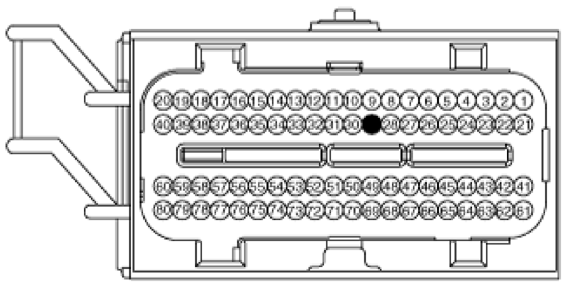


[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	PCM C144-1 (29)	Fuel level signal
3	Chassis Ground (G17)	Sensor ground

[HARNESS CONNECTOR]

F45
Main Relay



C144-1
PCM

MONITOR SCANTOOL DATA

1. Ignition "OFF"
2. Connect Scantool and Engine "ON"
3. Monitor "FLS" parameter on Current Data

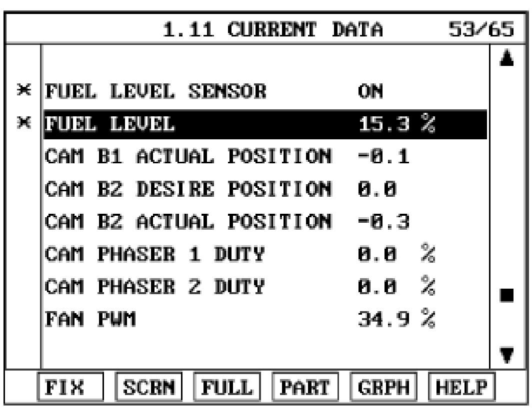


Fig.1 Normal

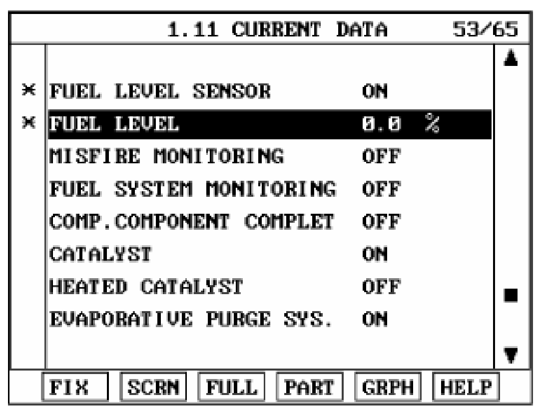


Fig.2 Short to ground in signal harness

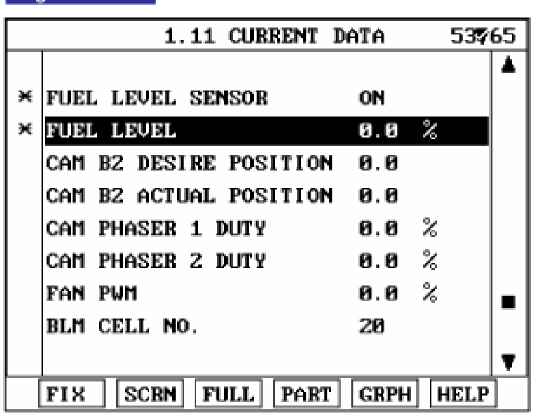


Fig.3 Open in signal harness

4. Is the "FLS" parameter displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

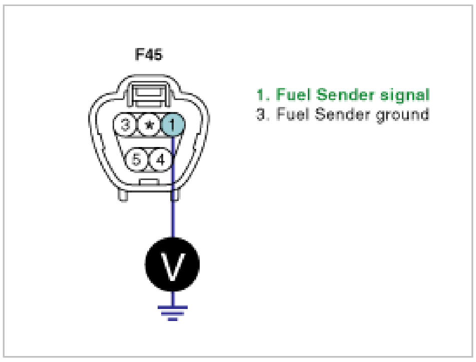
NO

▸ Go to " Signal Circuit Inspection " procedure

SIGNAL CIRCUIT INSPECTION

1. IG "OFF" and disconnect FLS connector.
2. IG "ON" & ENG "OFF"
3. Measure voltage between terminal 1 of FLS harness connector and chassis ground.

Specification : Approx. 11.46V



4. Is the measured voltage within specification ?

YES

▸ Go to "Ground Circuit Inspection" procedure.

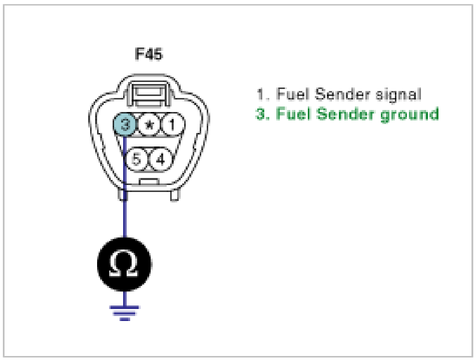
NO

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF"
2. Disconnect FLS & PCM connector.
3. Measure resistance between terminal 3 of FLS harness connector and chassis ground

Specification : Approx. below 1Ω



4. Is the measured resistance within specification ?

YES

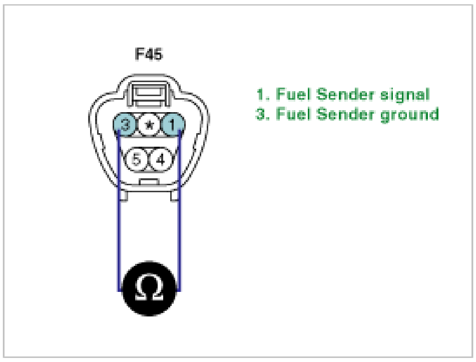
▶ Go to "Component Crcuit Inspection" procedure.

NO

▶ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF"
2. Disconnect Fuel Level Sensor connector and Remove Fuel Sender from fuel tank.
3. Measure reistance between terminal 1 and 3 of Fuel Sender.(Component Side)



4. Does the resistance of FLS change as lifting up and down the fuel level float ?

YES

▶ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known - good Fuel Level Sensor and check for proper operation. If the problem is corrected, replace Fuel Level Sensor and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▶ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0480

GENERAL DESCRIPTION

When the ambient air temperature is warm or the airflow across the engine is low, the enginecoolant temperature can become hot. If the coolant temperature becomes too hot, it is possiblethat the engine could be damaged. High coolant temperatures can also cause the A/C system tobe disabled, in order to reduce load on the engine and protect the A/C system components. Thepurpose of activating the engine compartment ventilation fan(s) is to help reduce the enginecoolant temperature to a level that is not threatening to engine performance and maintains the airconditioning system pressure at safe levels.
Electric fan responsible for causing air movement around the engine coolant radiator. The amount of air movement caused by the fan is controlled based on the Vehicle Speed, coolant temperature, A/C pressure status, A/C switch request status, and A/C clutch state. A duty cycle is determined based on these input parameters. This duty cycle corresponds to fan speed which correlates to the amount of air movement caused by the fan. The increased air movement enhances the heat exchanger function of the radiator in the confined space of the enginecompartment, thereby reducing the engine coolant temperature more quickly.This fan also causes air movement around the A/C Condenser, thereby enhancing condensationwithin the condenser, results in lower pressure within the A/C system.

DTC DESCRIPTION

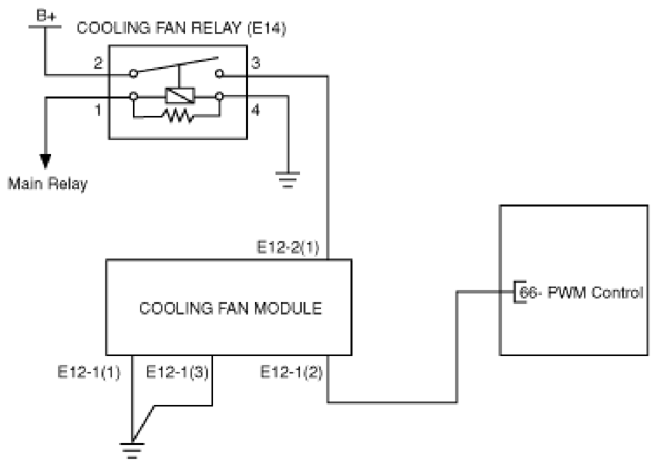
The Delphi EMS system provides for a method of electrically controlling when the fan(s) should beactivated and deactivated based on a variety of engine conditions, including the coolanttemperature, vehicle speed, air conditioning switch status and air conditioning pressurestatus. As the coolant temperature or air conditioning pressure rises, increased airflow is requiredto reduce the engine temperature and A/C system pressure. The engine cooling fan(s) areactivated to increase airflow across the engine components.
Checking power supply to cooling fan relay to cooling fan module and control signals under detecting condition, if the PCM detects short to ground, to battery or open circuit, PCM sets P0480. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• This will detect a short to ground, to battery or open circuit on Fan relay output. Fault information provided by an output driver chip.	• Poor connection • Open in Power circuit to cooling fan module • Open or short in control circuit to PCM • Faulty Fan Relay • Faulty cooling fan module • Faulty PCM
Enable Conditions	• No disabling Faults Present • Engine Running • 11V ≤ Ignition Voltage ≤ 16V • Enable Time delay ≥ 0.5sec.	
Threshold value	• Open or short on Fan relay output	
Diagnosis Time	• Continuous (More than 5sec. failure for every 10 sec. test.)	
MIL On Condition	• 2 driving cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

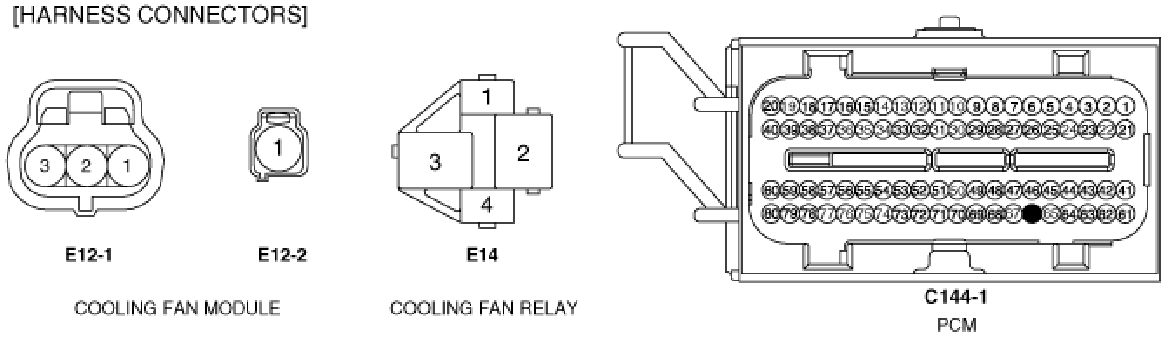
COOLING FAN MODULE (E12-1)

Terminal	Connected to	Funtion
1	Chassis Ground	Ground
2	PCM C144-1 (66)	PWM Control
3	Chassis Ground	Ground

COOLING FAN MODULE (E12-2)

Terminal	Connected to	Funtion
1	Cooling fan relay E14(3)	Battery Power (B+)

[HARNESS CONNECTORS]



MONITOR SCANTOOL DATA

1. Ignition "OFF"
2. Connect Scantool and Engine "ON"
3. Monitor "Fan PWM" parameter with scantool

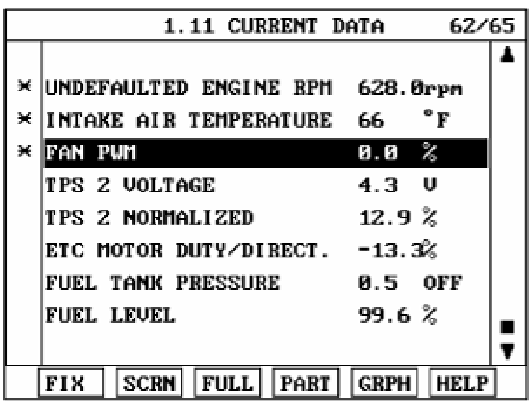


Fig.1 Fan OFF

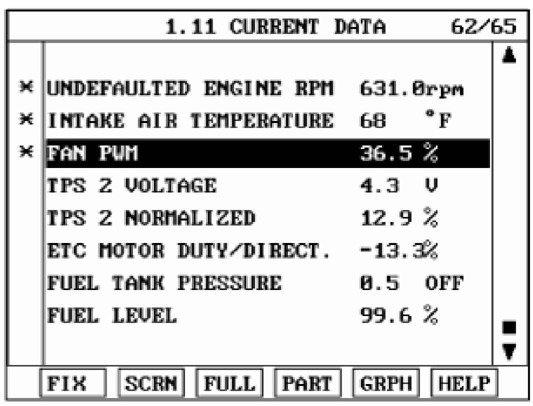


Fig.2 Fan ON

4. Is the "Fan PWM" parameter displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor's and/or PCM's connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection,bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and goto "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

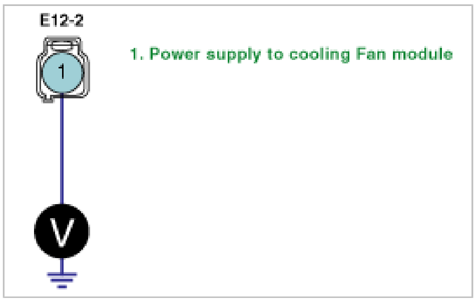
NO

▸ Go to " Power Circuit Inspection " procedure

POWER CIRCUIT INSPECTION

1. IG "OFF" and disconnect Cooling fan module connector.
2. IG "ON" & ENG "OFF"
3. Measure voltage between terminal 1 of Cooling fan module harness connector and chassis ground.

Specification : Approx. B+



4. Is the measured voltage within specification

YES

▸ Go to "Control Circuit Inspection" procedure.

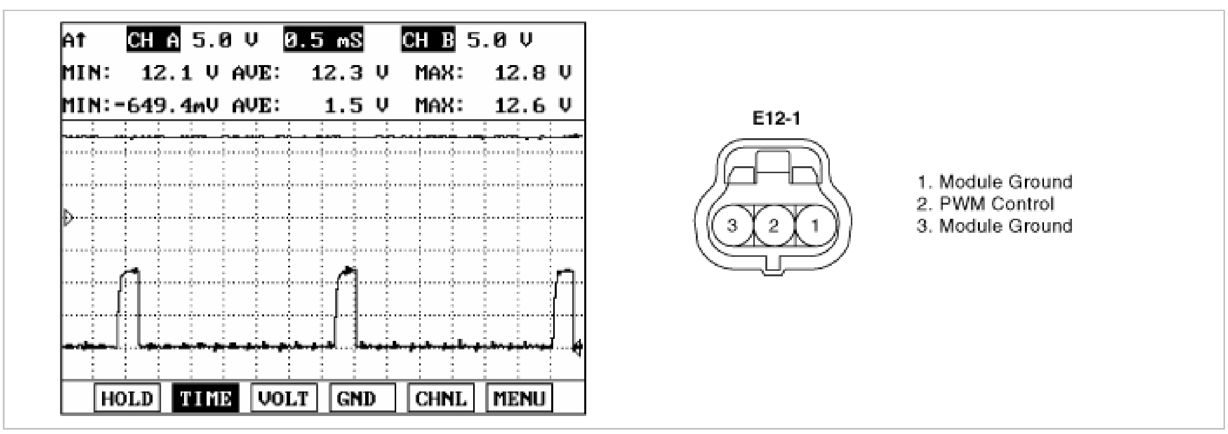
NO

▸ Check if cooling fan fusible link 60A is open or not installed.
▸ Check if cooling fan relay is not installed or faulty
▸ Check if the line between cooling fan relay and Cooling fan module is open.
▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. IG "OFF"
2. Disconnect Cooling fan module connector.
3. IG "ON" & ENG "OFF"
4. Measure signal waveform at terminal 2 of cooling fan module.

Reference signal waveform :



5. Is the measured signal waveform normal?

YES

▸ If the problem is corrected after substituting with a known - good Cooling Fan module, replace it. If the problem is pending, check for proper operating after substituting with a known - good PCM. and then if the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Check that harness connected at engine compartment junction block is disconnected or not.
▸ Check the line between terminal 2 of Cooling Fan module harness connector and terminal 66 of PCM harness connector for open.
▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0501

GENERAL DESCRIPTION

The wheel speed sensor is the essential component taht the PCM uses to calculate vehicle speed. This wheel speed sensor is the active hall-sensor type and good at temperature and noise chariteristic. Digital wave is produced as tone wheel rotate according as hall sensor principle. Frequency of duty wave is changed in proportion to rotation of tone wheel and PCM gets vehicle speed through ABS control unit or ESP control unit.

DTC DESCRIPTION

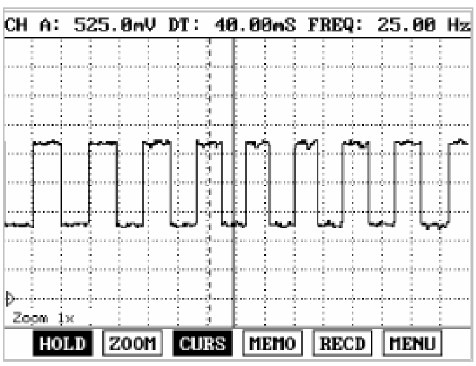
Checking vehicle speed signal every from wheel speed sensor or ABS control unit 30 sec. under detecting condition, if an signal is in the detecting condition for more than 20 sec., PCM sets P0501. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

DTC DETECTING CONDITION

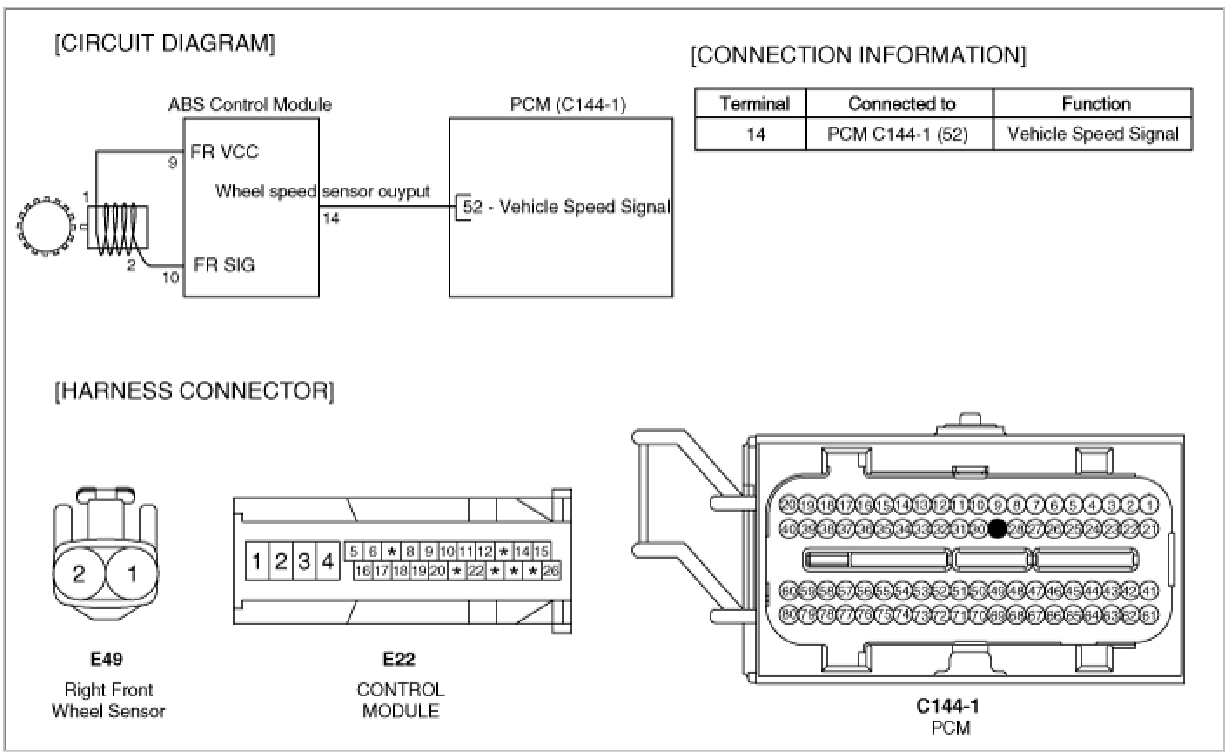
<table>
<tr><th colspan="2">Item</th><th>Detecting Condition</th><th>Possible cause</th></tr>
<tr><td colspan="2">DTC Strategy</td><td>• Detects the lack of vehicle speed signal to the PCM</td><td rowspan="3">• Poor connection
• Open or short in harness
• Wheel speed sensor(FR)</td></tr>
<tr><td rowspan="2">Enable Conditions</td><td>Case 1 (Power)</td><td>• Engine Running
• No VSS disabling malfunction present
• No TPS fault present
• No MAP fault present
• 11V< Ignition Voltage< 16V
• Engine Coolant Temperature >60°C
• MAP >55kPa
• 25% ≤ TPS ≤ 60%
• 1200rpm ≤ Engine Speed ≤ 4000rpm
• Vehicle Speed derived from TOSS (If TOSS available) ≥ 0KPH(0MPH)</td></tr>
<tr><td></td><td>• Engine Running
• No VSS disabling malfunction present
• No TPS fault present
• No MAP fault present</td></tr>
</table>

	Case 2 (Decel)	• 11V< Ignition Voltage< 16V • Engine Coolant Temperature >60°C • MAP< 32kPa • TPS< 1.001% • 1800rpm ≤ Engine Speed ≤ 6000rpm • Transmission in gear	• ABS or ESP control unit • PCM
Thresh old value	Case 1 (Power)	Power Enable Criteira Met • IF VSS Fault Vehicle Speed ≤ 10kph • ELSE Vehicle Speed< 5kph	
	Case 2 (Decel)	Decel. Enable Criteira Met • Vehicle Speed< 5kph • Delta Engine Speed ≥ 100rpm	
Diagnosis Time		• Continuous (More than 20 seconds failure for every 30 seconds test)	
MIL On Condition		• 2 driving cycles	

SIGNAL WAVEFROM AND DATA

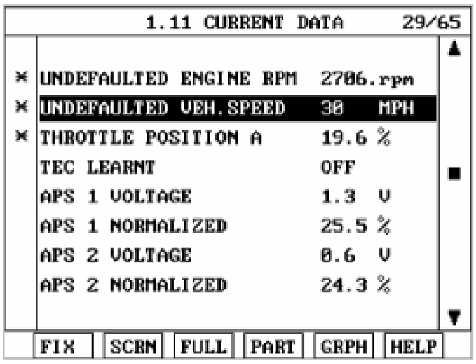


SCHEMATIC DIAGRAM



MONITOR SCANTOOL DATA

1. Ignition "OFF"
2. Connect Scantool and Engine "ON"
3. Drive vehicle in gear and monitor "vehicle speed" item on the scantool.



4. Are thsoe "VSS" parameters displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

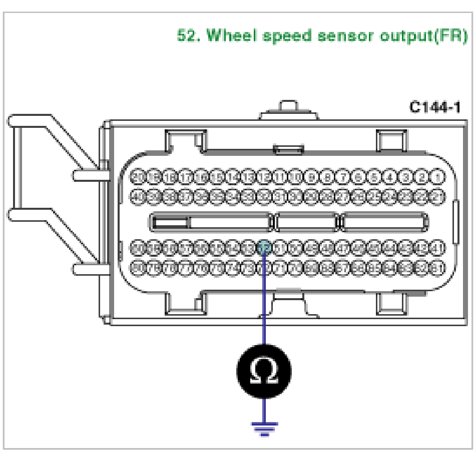
NO

▸ Go to " Signal Circuit Inspection " procedure.

SIGNAL CIRCUIT INSPECTION

> **WARNING**
>
> This procedure is applied to vehicle with ABS (or ESP). In case of no ABS(or ESP), refer to "C1203 Wheel speed sensor front-RH open/short".

1. Check short to ground in harness
   (1) IG "OFF"
   (2) Disconnect PCM connector and ABS or EPS control module connector.
   (3) Measure resistance between terminal 52 of PCM harness connector and chassis ground.



Specification : Infinite

(4) Is the measured resistance within specifications?

YES

▸ Go to "Check open in harness" as follows.

NO

▸ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

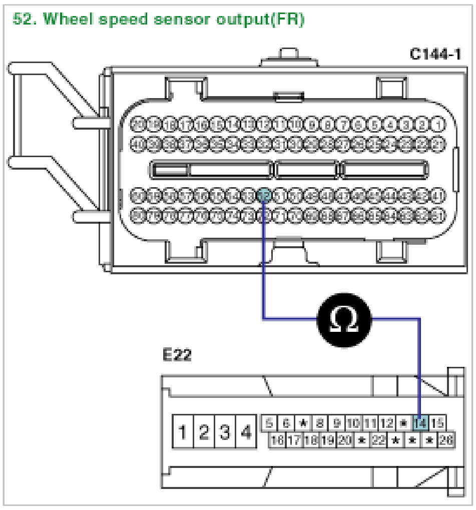
2. Check for open in harness

(1) Ignition "OFF"

(2) Disconnect PCM connector and ABS or ESP control module connector.

(3) Measure resistance between terminal "52" of PCM harness connector and terminal "14(With ESP: terminal 40)" of ABS control module harness connector.

Specification : Approx. below 1Ω



NOTE

Note: This picture is only applied to vehicle with ABS

(4) Is the measured resistance within specifications?

YES

▸ Go to " Check wheel speed sensor " procedure.

NO

▸ Check open in harenss.
▸ Repair or replace as necessary and then, go to " Verification of Vehicle Repair" procedure.

3. Check wheel speed sensor

(1) IG "OFF"

(2) Check open or short in wheel speed sensor (Refer to "C1203 Wheel speed sensor front-RH open/short")

(3) Is the wheel speed sensor normal?

YES

▸ Substitute with a known - good PCM/ ABS or ESP control unit and check for proper operation. If the problem is corrected, replace PCM/ ABS or ESP control unit and go to "Verification of Vehicle Repair" procedure.

NO

▸ Repair or replace it as necessary.
▸ And then go to " Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

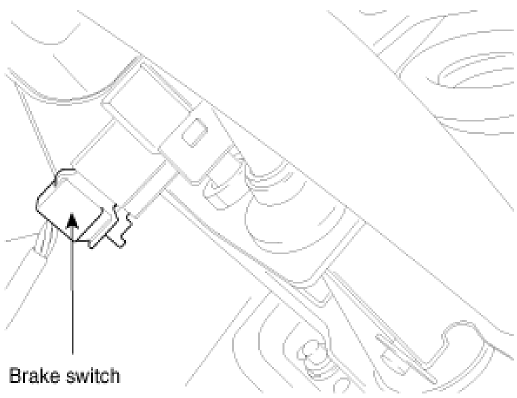
▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

Fuel System > Troubleshooting > P0504

COMPONENT LOCATION



GENERAL DESCRIPTION

Brake switch connected to brake pedal transfers brake operating state to ECM. For diagnosis of abnormal operation of Brake switch, two types of signals(one from Brake warning lamp switch, the other from Brake checking switch) are used and those two types output different signals at both condition, depressing or releasing brake pedal. When brake pedal is depressed brake checking switch outputs B+ voltage while brake warning lamp switch emits 0V. Conversly, when brake pedal is released, the output signals of each switch are opposite.

DTC DESCRIPTION

Checking output signals from both brake switch every 2.5 sec. when all of them are On or OFF simultaneously, if abnormal signal is detected for more than 0.5 sec., an error is recognized. And if this condition lasts for more than 4.8 sec., PCM sets P0504. MIL (Malfunction Indicatin Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

DTC DETECTING CONDITION

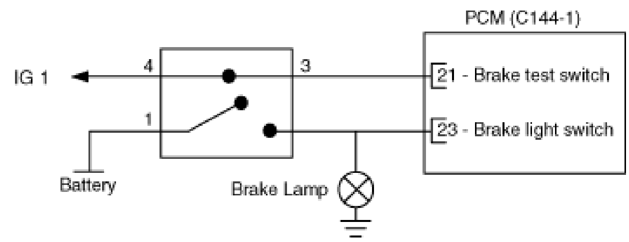
Item		Detecting Condition	Possible cause
DTC Strategy		• Comparing 2 brake signals during driving	• Poor connection • Open or Short • Faulty PCM
Enable Conditions	Case 1	• Engine works • Vehicle Speed Sensor is abnormal.	
	Case 2	• Engine works • Vehicle Speed Sensor is normal and Vehicle Speed is over 20kph dring 1sec or more.	
Threshold value		• The one brake signal's change duration when another signal has been changed < 0.5 sec	
Diagnosis Time		• Continuous (More than 1.625 seconds for every 2.5 seconds test)	
MIL On Condition		• 2 driving cycles	

SPECIFICATION

Item	During taking off the brake	During stepping on the brake
Brake Lamp Switch	0V	Battery voltage
Brake Switch	Battery voltage	0V

SCHEMATIC DIAGRAM

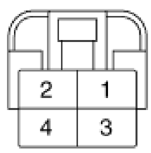
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

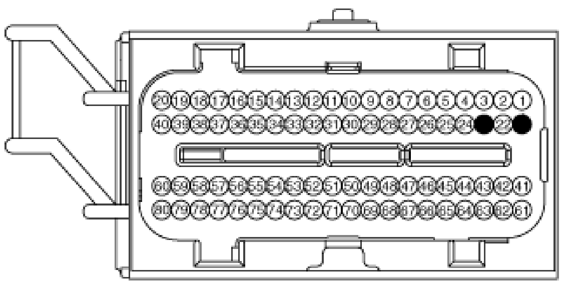
Terminal	Connected to	Function
1	PCM C144-1 (23)	Brake light switch
2	Battery	Power Supply (+5V)
3	PCM C208-A (21)	Brake test switch
4	Battery	Power Supply (+5V)

[HARNESS CONNECTOR]



E62

STOP LAMP SWITCH



C144-1

PCM

MONITOR SCANTOOL DATA

1. Ignition "OFF"
2. Connect Scantool and Engine "ON"
3. Monitor "Brake Switch" parameter on Current Data

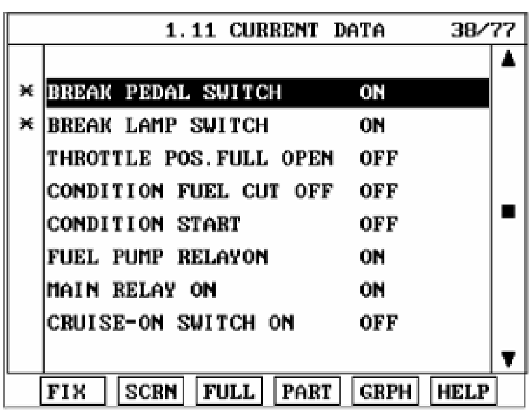


Fig. 1

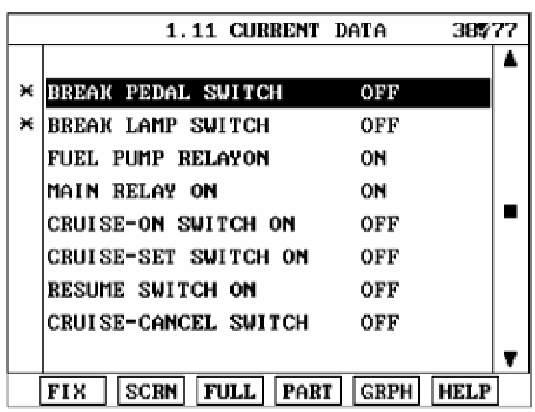


Fig. 2

4. Are those "Brake Switch" parameters displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

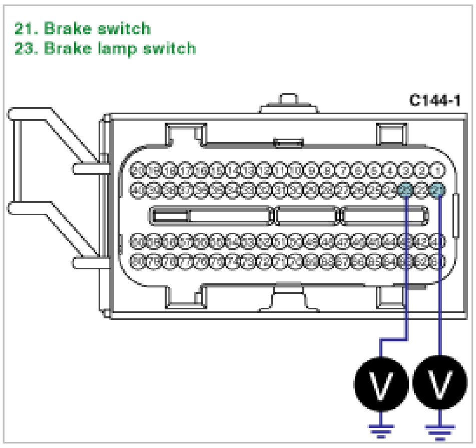
▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. Votage check
   (1) Key "OFF".
   (2) Disconnect the PCM connector.
   (3) Key "ON" and keep the brake taking off.
   (4) Measure the voltage between terminal 21 of PCM connector and chassis ground.
   (5) Measure the voltage between terminal 23 of PCM connector and chassis ground .
   (6) Keep the brake stepping on.
   (7) Measure the voltage between terminal 21 of PCM connector and chassis ground.
   (8) Measure the voltage between terminal 23 of PCM connector and chassis ground .

Specification :

Item	During taking off the brake	During stepping on the brake
Brake Lamp Switch	0V	Battery voltage
Brake Switch	Battery voltage	0V



   (9) Is the measured voltage within specification ?

YES

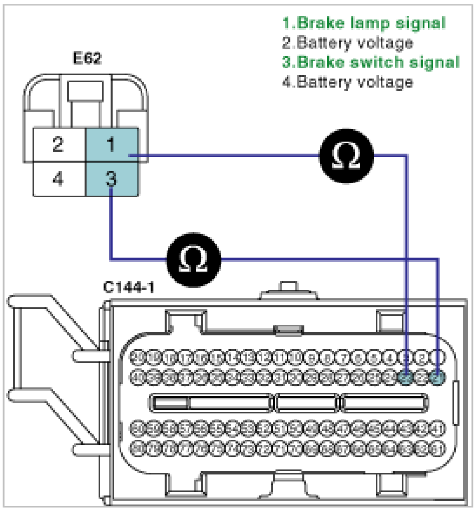
▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Go to "Check open in harness" as follows.

2. Check open in harness
   (1) Key "OFF".
   (2) Disconnect the brake switch and PCM connector.
   (3) Measure the resistance between terminal 21 of PCM harness connector and terminal 3 of Brake switch harness side.
   (4) Measure the resistance between terminal 23 of PCM harness connector and terminal 1 of Brake switch harness side.

Specification : Approx. below 1Ω



(5) Is the measured resistance within specification ?

YES

▸ Go to "Check voltagen" procedure.

NO

▸ Repair open in circuit and go to "Verification of Vehicle Repair" procedure.

3. Check voltage

(1) Key "OFF".

(2) Disconnect the brake switch connector.

(3) Measure the voltage between brake lamp switch terminal and chassis ground.

(4) Measure the voltage between brake switch terminal and chassis ground.

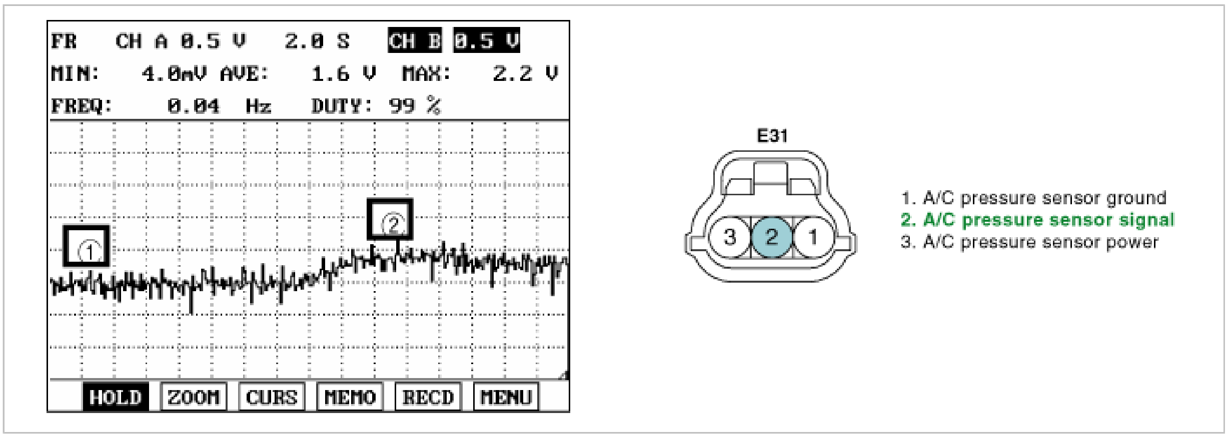
(5) Key "ON".

(6) Measure the voltage between brake lamp switch terminal and chassis ground.

(7) Measure the voltage between brake switch terminal and chassis ground.

Specification :

Item	During taking off the brake	During stepping on the brake
Brake Lamp Switch	0V	Battery voltage
Brake Switch	Battery voltage	0V



(8) Is the measured voltage within specification ?

YES

▸ Substitute with a known - good brake switch and check for proper operation. If the problem is corrected, replace brake switch and go to "Verification of Vehicle Repair" procedure.

NO

▸ Check the fuse between battery and brake switch.

▸ Repair open or short in power circuit of brake switch and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0506

GENERAL DESCRIPTION

The IAC System is designed to maintain a steady desired idle speed. Idle airflow is adjustedthrough the idle air actuator, which may be ETC throttle body, in order to maintain the desired idle speed under various load conditions. Load conditions vary due to numerous factors, such as engine temperature, air conditioning, electrical load and power steering load.

DTC DESCRIPTION

Checking idle RPM from ETC throttle body under detecting condition, if if the idle speed is 100RPM below desired idle speed for 10 sec., PCM sets P0506. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Determines if a low idle condition exists.	• Poor connection • Intake/Exhaust system for blockage • Throttle plate for carbon deposits • Faulty ETS motor • Faulty TPS • Faulty ETS system • Faulty PCM
Enable Conditions	• Normal Idle conditions • Canister Purge Fuel Flow ≤ 100 • Barometric Pressure > 72kPa • Engine running long enough • Air Intake Temperature • Coolant Temperature • 10V ≤ Ignition Voltage ≤ 16V • Above conditions met period • No intrumentation slew commanded • OFVC Device Control Not Active	
Thresh old value	• Real engine speed - Target engine speed< -100rpm	
Diagnosis Time	• Continuous	
MIL On Condition	• 2 driving cycles	

MONITOR SCANTOOL DATA

1. Ignition "OFF"
2. Connect Scantool and Engine "ON"
3. Monitor items which affect idle rpm on scantool.

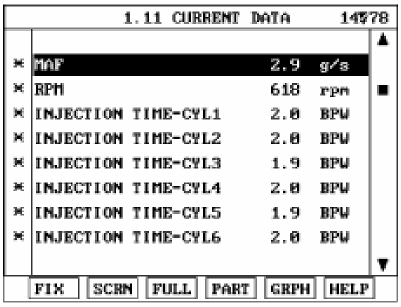


Fig. 1

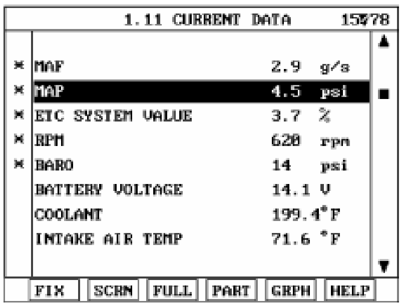


Fig. 2

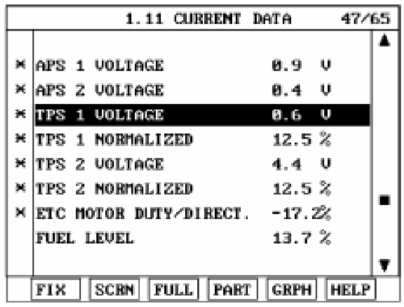


Fig. 3

4. Are those items on scantool displayed correctly ?

YES

▸ Go to "Terminal and Connector Inspection" procedure.

NO

▸ Check DTCs related to Mass airflow sensor(MAF),Injectors,Throttle position sensor(TPS), Purge control solenoid valve (PCSV), Acceleration position sensor(APS), Heated oxygen sensors(HO2S), ETS system

▸ Perform all repairs associated with those codes and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to " System Inspection " procedure

SYSTEM INSPECTION

1. Check intake/exhaust system for blockage

(1) Visually/physically inspect the following items:

- Air cleaner filter element for excessive dirt or for any foreign objects
- Hoses of intake system for blockage
- Throttle body inlet for damage or for any foreign objects
- Throttle plate for carbon deposits
- Restricted exhaust system

(2) Has a problem been found in any of the above areas?

YES

▸ Replace or repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Visually check ETS System" as below

2. Visually check ETS System

(1) Ignition "OFF"

(2) Remove the air hose between MAF sensor and Throttle body.

(3) Visually check the overall ETS system(Throttle valve,ETS motor,APS and TPS).

(4) Has a problem been found?

YES

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Go to " Component Inspection" procedure.

COMPONENT INSPECTION

1. Check ETS motor

(1) Ignition "OFF"

(2) Disconnect ETS motor connector

(3) Measure resistance between terminals "1" and "2" of the ETS motor connector.

Specification: Approx. 1.275 ~ 1.725Ω at 20°C(68 °F)

(4) Is the measured resistance within specifications?

YES

▸ Go to "Check TPS" as below

NO

▸ Substitute with a known-good ETS motor and check for proper operation. If the problem is corrected, replace ETS motor and then do "ETS Initialization" and go to "Verification of Vehicle Repair" procedure.

2. Check TPS

(1) Disconnect TPS connector and measure resistance between terminals 4 and 8 of the TPS connector.

Specification : Approx. 4.0~6.0kΩ(with throttle valve fully closed) at 20°C(68°F)

(2) Disconnect TPS connector and measure resistance between terminals 1 and 5 of the TPS connector.

Specification:

Item	Sensor Resistance
TPS 1	4.0 ~ 6.0 kΩ (20°C)
TPS 2	2.72 ~ 4.08 kΩ (20°C)

(3) Are the TPS resistance within specifications?

YES

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure. If PCM needs to be replaced, do "ETS Initialization" after it is replaced.

NO

▸ Substitute with a known-good TPS and check for proper operation.If the problem is corrected, replace TPS and then do "ETS Initialization". And go to "Verification of Vehicle Repair" procedure.

※ Procedure of ETS Initialization

1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10 second)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0507

GENERAL DESCRIPTION

The IAC System is designed to maintain a steady desired idle speed. Idle airflow is adjustedthrough the idle air actuator, which may be ETC throttle body, in order to maintain the desired idle speed under various load conditions. Load conditions vary due to numerous factors, such as engine temperature, air conditioning, electrical load and power steering load.

DTC DESCRIPTION

Checking idle RPM from ETC throttle body under detecting condition, if the idle speed is more than 200 RPM above desired idle speed for 10 sec., PCM sets P0507. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Determines if a high idle condition exists.	• Poor connection • Intake system/Vapor hoses for air leakage or disconnection • Faulty Accelerator cable • Faulty ETS motor • Faulty TPS • Faulty ETS system • Faulty PCM
Enable Conditions	• Normal Idle conditions • Canister Purge Fuel Flow ≤ 100 • Barometric Pressure > 72kPa • Engine running long enough • Air Intake Temperature • Coolant Temperature • 10V ≤ Ignition Voltage ≤ 16V • Above conditions met period • No intrumentation slew commanded • OFVC Device Control Not Active	
Thresh old value	• Real engine speed - Target engine speed >200rpm	
Diagnosis Time	• Continuous	
MIL On Condition	• 2 driving cycles	

MONITOR SCANTOOL DATA

1. Ignition "OFF"
2. Connect Scantool and Engine "ON"
3. Monitor items which affect idle rpm on scantool.

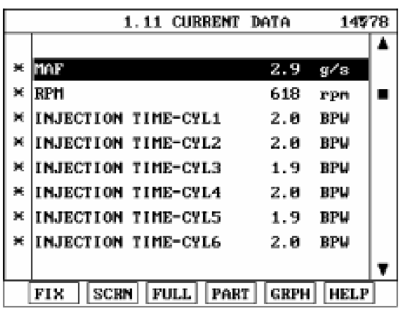


Fig. 1

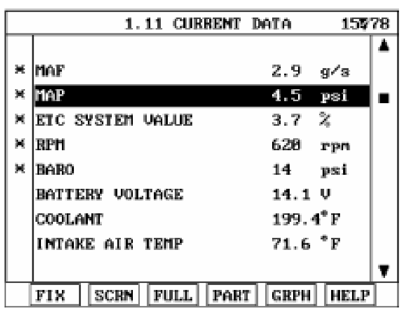


Fig. 2

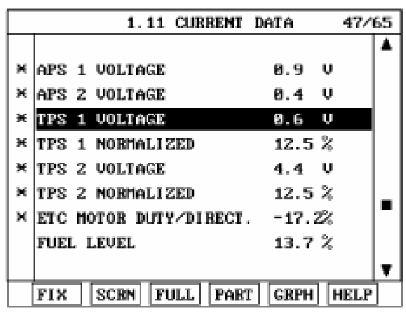


Fig. 3

4. Are those items on scantool displayed correctly ?

YES

▸ Go to "Terminal and Connector Inspection" procedure.

NO

▸ Check DTCs related to Mass airflow sensor(MAF),Injectors,Throttle position sensor(TPS), Purge control solenoid valve (PCSV), Acceleration position sensor(APS), Heated oxygen sensors(HO2S), ETS system
▸ Perform all repairs associated with those codes and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to " System Inspection " procedure

SYSTEM INSPECTION

1. Check intake/exhaust system for blockage
   (1) Visually/physically inspect the following items:
   - Intake system for air leakage
   - Vapor hoses for cracks or disconnection

   (2) Has a problem been found in any of the above areas?

   YES

   ▶ Replace or repair as necessary and go to "Verification of Vehicle Repair" procedure

   NO

   ▶ Go to "Visually check ETS System" as below

2. Visually check ETS System
   (1) Ignition "OFF"

   (2) Remove the air hose between MAF sensor and Throttle body.

   (3) Visually check the overall ETS system(Throttle valve,ETS motor,APS and TPS).

   (4) Has a problem been found?

   YES

   ▶ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

   NO

   ▶ Go to " Component Inspection" procedure.

COMPONENT INSPECTION

1. Check Accelerator Cable
   (1) Ignition "OFF" & Engine "OFF"

   (2) Check free play of accelerator Cable

   Specification 1.0 ~ 3.0mm(0.04 ~ 0.12 in)

   (3) Is the measured resistance within specifications?

   YES

   ▶ Go to "Check TPS" as below

   NO

   ▶ Substitute with a known-good ETS motor and check for proper operation. If the problem is corrected, replace ETS motor and then do "ETS Initialization" and go to "Verification of Vehicle Repair" procedure.

2. Check ETS motor
   (1) Ignition "OFF"

   (2) Disconnect ETS motor connector

   (3) Measure resistance between terminals "1" and "2" of the ETS motor connector.

   Specification: Approx. 1.275 ~ 1.725Ω at 20°C(68 °F)

Item	Sensor Resistance
Coll Resistance (Ω)	1.275 ~ 1.725Ω (20°C)

   (4) Are the TPS resistance within specifications?

   YES

   ▶ Go to "Check TPS" as below

   NO

   ▶ Substitute with a known-good ETS motor and check for proper operation. If the problem is corrected, replace ETS motor and then do "ETS Initialization" and go to "Verification of Vehicle Repair" procedure.

3. Check TPS
   (1) Disconnect TPS connector and measure resistance between terminals 4 and 8 of the TPS connector.

Specification : Approx. 4.0~6.0kΩ(with throttle valve fully closed) at 20°C(68°F)

(2) Disconnect TPS connector and measure resistance between terminals 1 and 5 of the TPS connector.
Specification:

Item	Sensor Resistance
TPS 1	4.0 ~ 6.0 kΩ (20°C)
TPS 2	2.72 ~ 4.08 kΩ (20°C)

(3) Are the TPS resistance within specifications?

YES

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure. If PCM needs to be replaced, do "ETS Initialization" after it is replaced.

NO

▸ Substitute with a known-good TPS and check for proper operation.If the problem is corrected, replace TPS and then do "ETS Initialization". And go to "Verification of Vehicle Repair" procedure.
※ Procedure of ETS Initialization
1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10 second)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.
1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

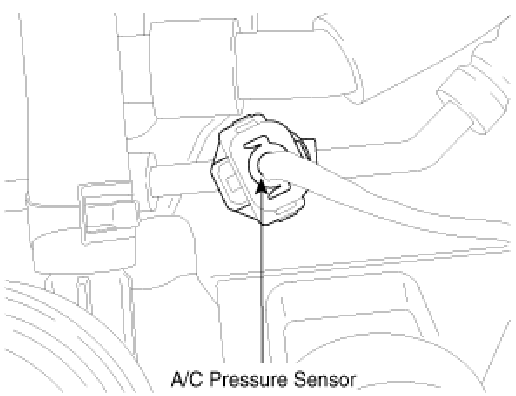
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0532

COMMPONENT LOCATION



GENERAL DESCRIPTION

A/C pressure sensor is installed betweem receiver driver and inflation valve. Sensing coolant pressure, this sensor converts pressure into voltage to input the value to PCM. With this signal, PCM performs idle control, cooling fan control, aircon compresser control.

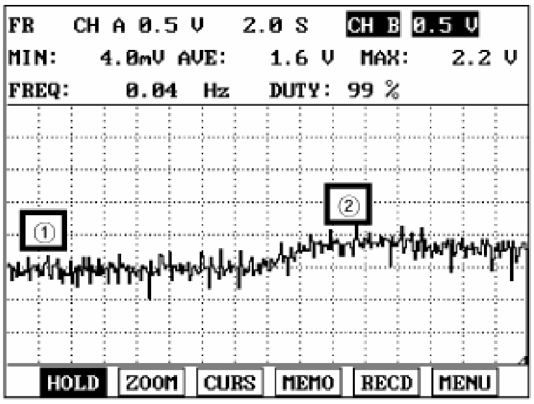
DTC DESCRIPTION

Checking output signals from A/C pressure sensor every 25 sec. under detecting condition, if an signal below 0.05V lasts for more than 12.5 sec., PCM sets P0532.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects sensor signal short to low voltage	• Poor connection • Open in power circuit • Open or short to ground in signal circuit • Faulty A/C pressure sensor • Faulty PCM
Enable Conditions	• Engine works	
Thresh old value	• Sensor output voltage< 0.05V	
Diagnosis Time	• Continuous (More than 12.5 seconds failure for every 25 seconds test)	
MIL On Condition	• DTC only (NO MIL ON)	

SIGNAL WAVEFORM AND DATA



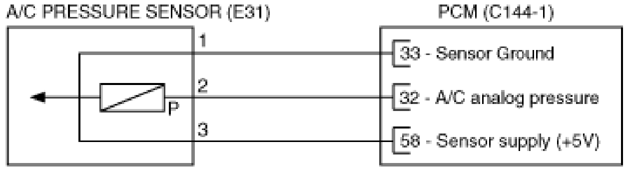
① - A/C OFF & idle state
② - A/C ON & idle state

SPECIFICATION

Pressure(psi)	14.7	56.7	250	439.7	465
Voltage(V)	0.203	0.629	2.633	4.649	4.8

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



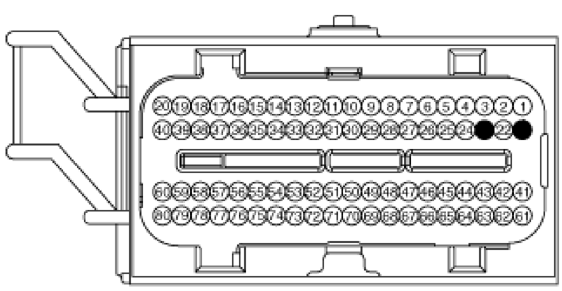
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	PCM C144-1 (33)	Sensor Ground
2	PCM C144-1 (32)	A/C analog pressure
3	PCM C144-1 (58)	Sensor supply (+5V)

[HARNESS CONNECTOR]

E31

A/C PRESSURE SENSOR



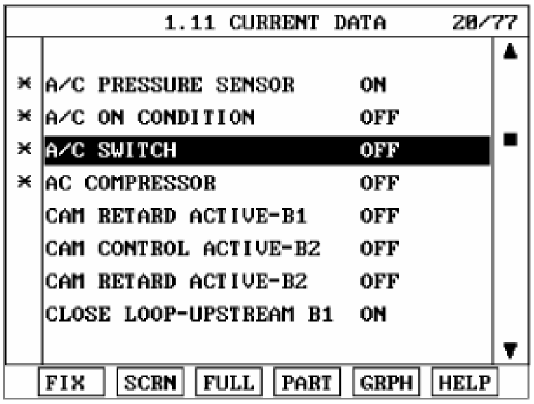
C144-1

PCM

MONITOR SCANTOOL DATA

1. Ignition "OFF"
2. Connect Scantool and Engine "ON"
3. Check whether Air-Con pressure is rising during accceleraing.

Fig : A/C - OFF



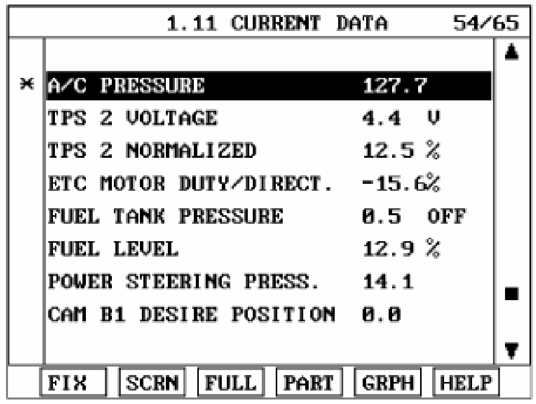
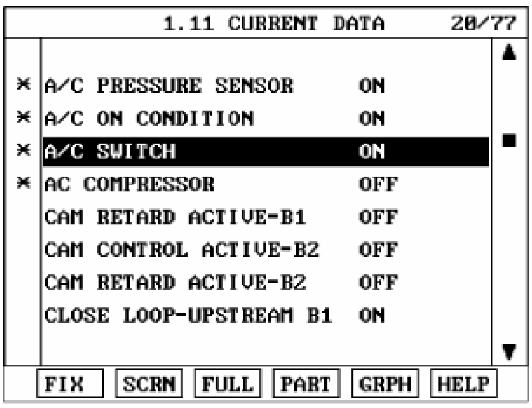


Fig : A/C Switch - ON



4. Are those items on scantool displayed correctly ?

YES

▶ Fault is intermittent caused by poor contact in Sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▶ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure

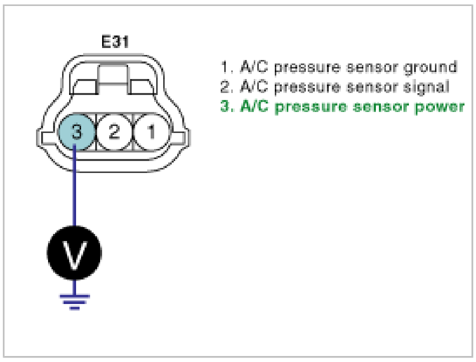
NO

▶ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. Key "OFF".
2. Disconnect the A/C pressure sensor connector.
3. Key "ON".
4. Measure the voltage between terminal 3 of A/C pressure sensor harness connector and chassis ground.

Specification : approx. 5V



5. Is the measured voltage within specification ?

YES

▸ Go to "Signal circuit inspection" procedure.

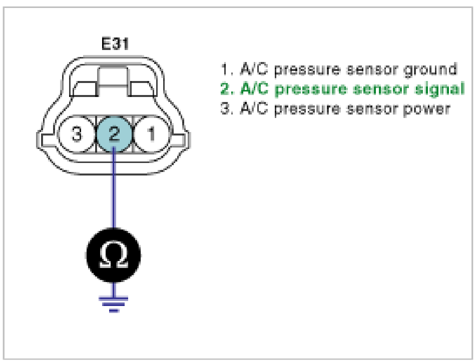
NO

▸ Repair Open or Short to ground in A/C pressure sensor power circuit and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check short to ground inspection
   (1) Key "OFF".
   (2) Disconnect A/C pressure sensor and PCM connector.
   (3) Measure the resistance between terminal 2 of A/C pressure sensor harness connector and chassis ground.

   Specification : Infinite



   (4) Is the measured resistance within specification ?

   YES

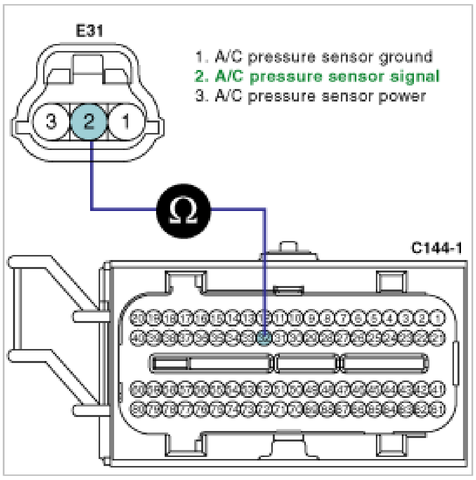
   ▸ Go to "Check open in harness" procedure.

   NO

   ▸ Repair Short to ground in A/C pressure sensor signal circuit and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness
   (1) Key "OFF".
   (2) Disconnect A/C pressure sensor and PCM connector.
   (3) Measure the resistance between terminal 2 of A/C pressure sensor harness connector and terminal 32/C144-1 of PCM harness connector.

   Specification : Approx. below 1Ω



(4) Is the measured resistance within specification ?

YES

▸ Go to "Component inspection" procedure.

NO

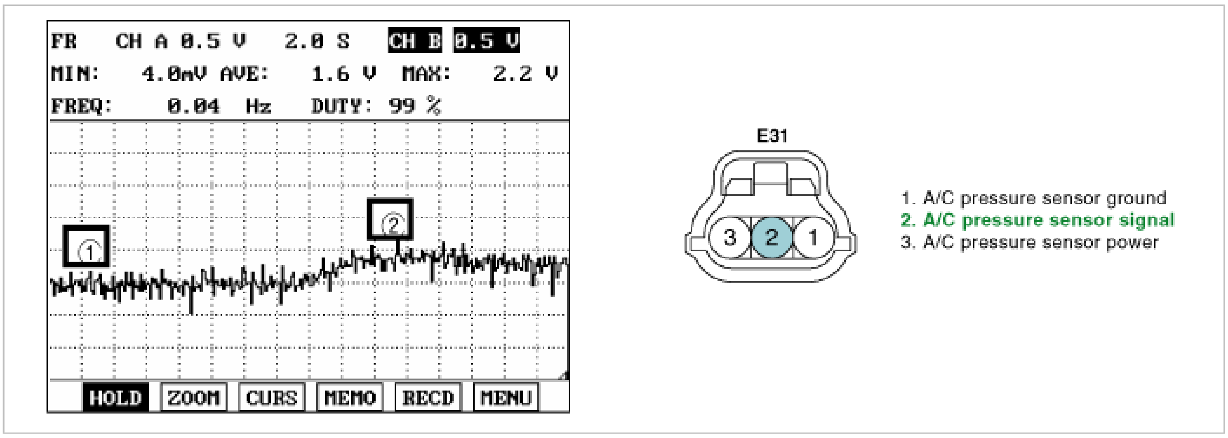
▸ Repair Open in A/C pressure signal circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. A/C pressure sensor inspection
   (1) Key "OFF" and connect the scantool.
   (2) Connect the probe to A/C pressure sensor signal and select the oscilloscope in the menu.
   (3) Check the waveform with acceleration and deceleration after engine start.

Specification :

Pressure(psi)	14.7	56.7	250	439.7	465
Voltage(V)	0.203	0.629	2.633	4.649	4.8



(4) Is the measured waveform of A/C pressure sensor normal?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good A/C pressure sensor and check for proper operation. If the problem is corrected, replace A/C pressure sensor and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

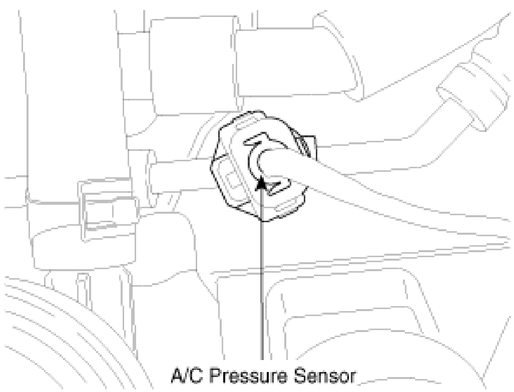
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0533

COMMPONENT LOCATION



GENERAL DESCRIPTION

A/C pressure sensor is installed betweem receiver driver and inflation valve. Sensing coolant pressure, this sensor converts pressure into voltage to input the value to PCM. With this signal, PCM performs idle control, cooling fan control, aircon compresser control.

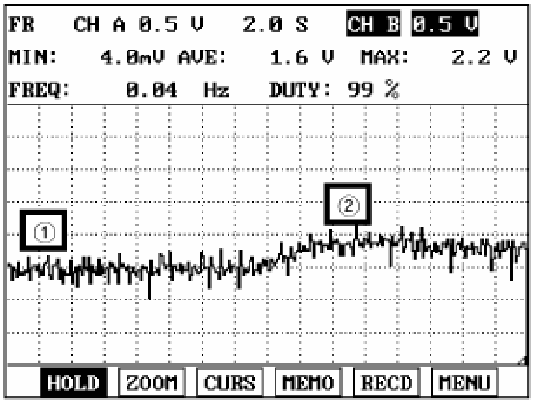
DTC DESCRIPTION

Checking output signals from A/C pressure sensor every 25 sec. under detecting condition, if an signal above 4.65V lasts for more than 12.5 sec., PCM sets P0533.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects sensor signal short to high voltage	• Poor connection • Short in signal circuit • Open in ground circuit • Faulty A/C pressure sensor • Faulty PCM
Enable Conditions	• Engine works	
Thresh old value	• Sensor output voltage< 4.65V	
Diagnosis Time	• Continuous (More than 12.5 seconds failure for every 25 seconds test)	
MIL On Condition	• DTC only (NO MIL ON)	

SIGNAL WAVEFORM AND DATA

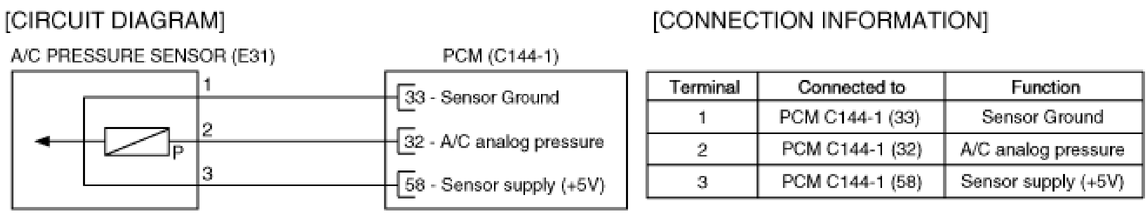


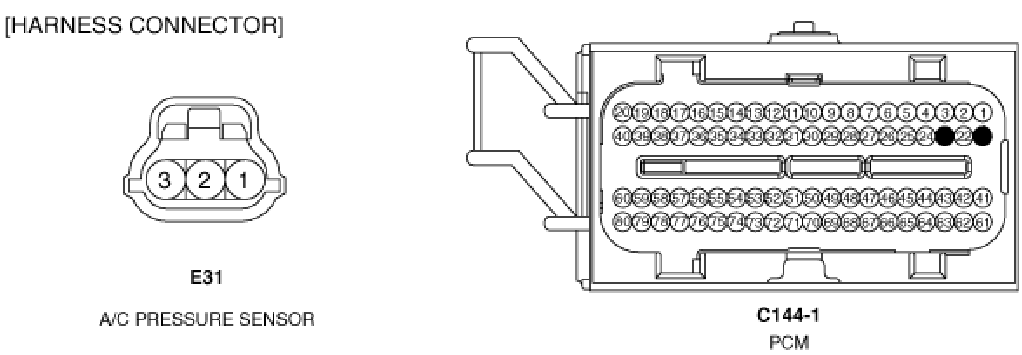
① - A/C OFF & idle state
② - A/C ON & idle state

SPECIFICATION

Pressure(psi)	14.7	56.7	250	439.7	465
Voltage(V)	0.203	0.629	2.633	4.649	4.8

SCHEMATIC DIAGRAM





MONITOR SCANTOOL DATA

1. Ignition "OFF"
2. Connect Scantool and Engine "ON"
3. Check whether Air-Con pressure is rising during acceclerating.

Fig : A/C - OFF

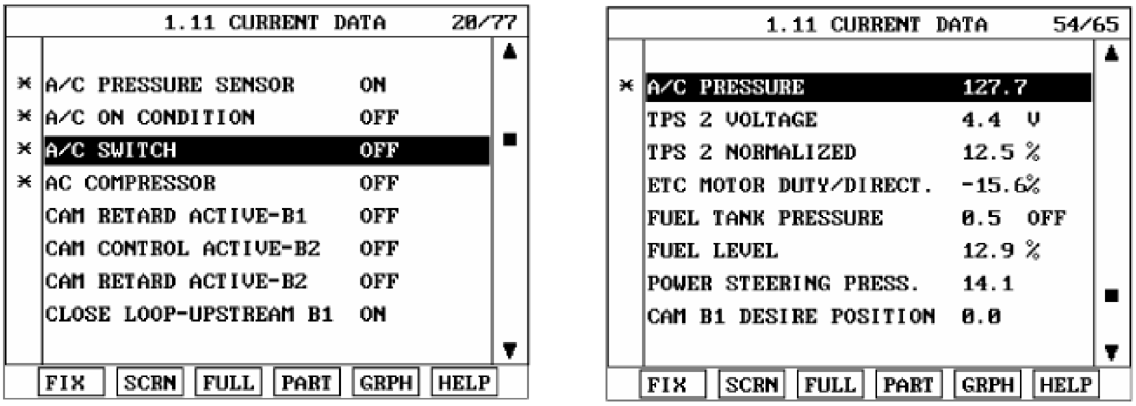
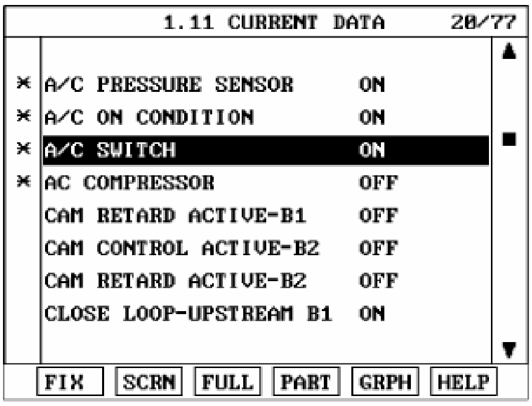


Fig : A/C Switch - ON



4. Are those items on scantool displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

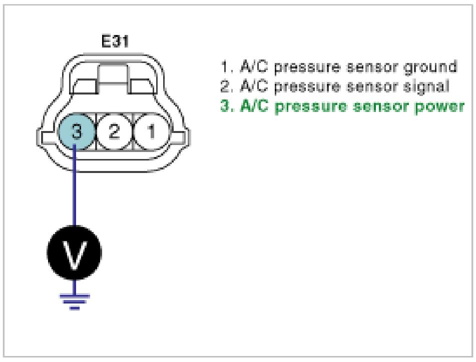
NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. Key "OFF".
2. Disconnect the A/C pressure sensor connector.
3. Key "ON".
4. Measure the voltage between terminal 3 of A/C pressure sensor harness connector and chassis ground.

Specification : approx. 5V



5. Is the measured voltage within specification ?

YES

▸ Go to "Ground inspection" procedure.

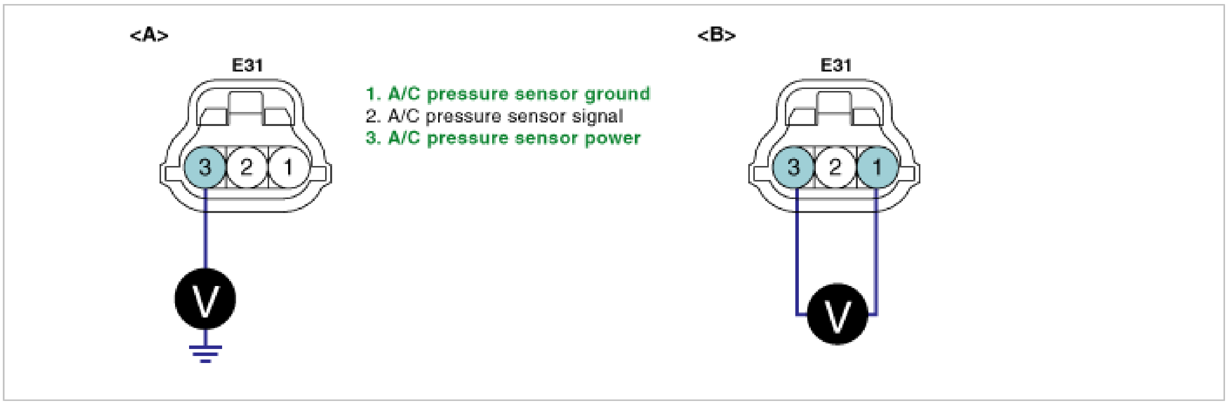
NO

▸ Repair Open in power circuit and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. Key "OFF".
2. Disconnect the A/C pressure sensor connector.
3. Key "ON".
4. Measure the voltage between terminal 3 of A/C pressure sensor harness connector and chassis ground. (Fig A)
5. Measure the voltage between terminal 3 and terminal 1 of A/C pressure sensor harness connector. (Fig B)

Specification : The Difference between "A" and "B" is below 200mV.



6. Is the measured voltage within specification ?

YES

▸ Go to "Signal circuit inspection" procedure.

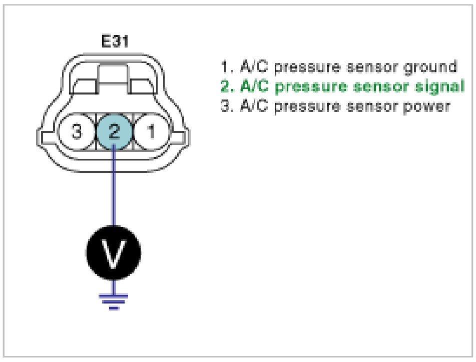
NO

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Voltage inspection
   (1) Key "OFF".
   (2) Disconnect the A/C pressure sensor connector.
   (3) Key "ON".
   (4) Measure the voltage between terminal 2 of A/C pressure sensor harness connector and chassis ground.

   Specification : Approx. 0V



(5) Is the measured voltage within specification ?

YES

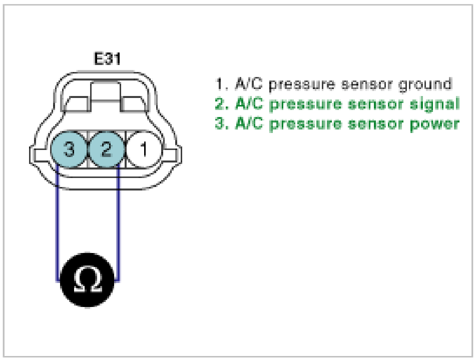
▸ Go to "Component inspection" procedure.

NO

▸ Go to "Short in circuit inspection" procedure.

2. Short in circuit inspection
   (1) Key "OFF".
   (2) Disconnect A/C pressure sensor connector and PCM connector.
   (3) Measure the resistance between terminal 2 and terminal 3 of A/C pressure sensor harness connector.

Specification : Infinite



(4) Is the measured resistance within specification ?

YES

▸ Go to "Component inspection" procedure.

NO

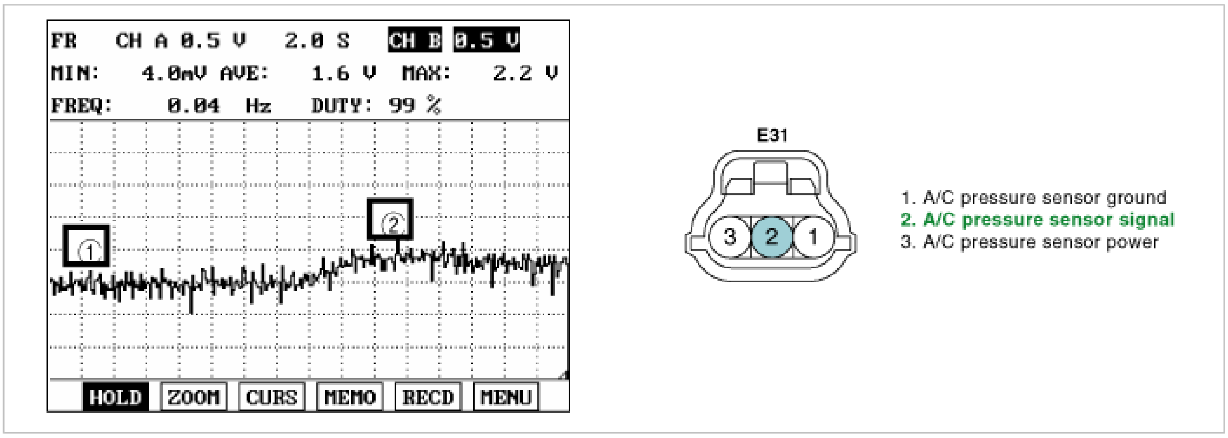
▸ Repair Short in signal circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. A/C pressure sensor inspection
   (1) Key "OFF" and connect the scantool.
   (2) Connect the probe to A/C pressure sensor signal and select the oscilloscope in the menu.
   (3) Check the waveform with acceleration and deceleration after engine start.

Specification :

Pressure(psi)	14.7	56.7	250	439.7	465
Voltage(V)	0.203	0.629	2.633	4.649	4.8



(4) Is the measured waveform of A/C pressure sensor normal?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good A/C pressure sensor and check for proper operation. If the problem is corrected, replace A/C pressure sensor and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

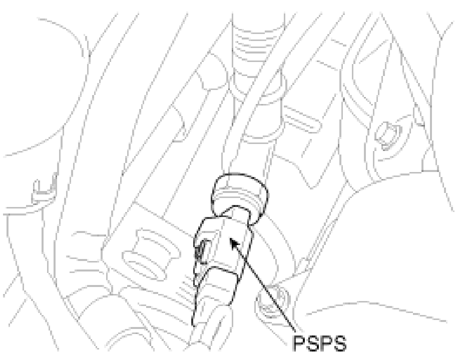
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0552

COMMPONENT LOCATION



GENERAL DESCRIPTION

To reduce the required power to manipulate steering wheel, hydraulic pressure is used in power steering system. A load is sensed at steering oil pressure sensor then inputted to PCM as a wheel position signal. Controlling idle speed valve, PCM performs appropriate electric load correction With this signal.

DTC DESCRIPTION

Checking output signals from P/S PS(power steering pressure sensor) every 2.5 sec. under detecting condition, if an signal below 0.05V lasts for more than 1.25 sec., PCM sets P0552. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

DTC DETECTING CONDITION

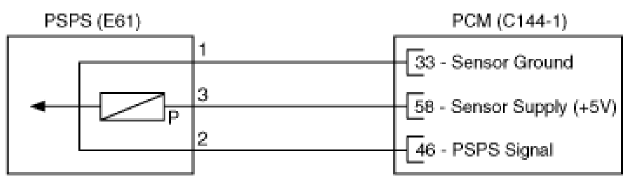
Item	Detecting Condition	Possible cause
DTC Strategy	• Detects sensor signal short to low voltage	• Poor connection • Open in power circuit • Open or short to ground in signal circuit • Faulty P/S pressure sensor • Faulty PCM
Enable Conditions	• Engine works • 11V ≤ Battery voltage ≤ 16V	
Thresh old value	• Sensor output voltage< 0.25V	
Diagnosis Time	• Continuous (More than 1.25 seconds failure for every 2.5 seconds test)	
MIL On Condition	• 2 driving cycles	

SPECIFICATION

Pressure(Kgf/cm²)	37.9	41.3	68.8	96.4
Voltage(V)	1	2	3	4

SCHEMATIC DIAGRAM

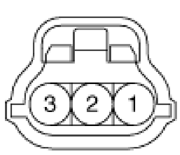
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

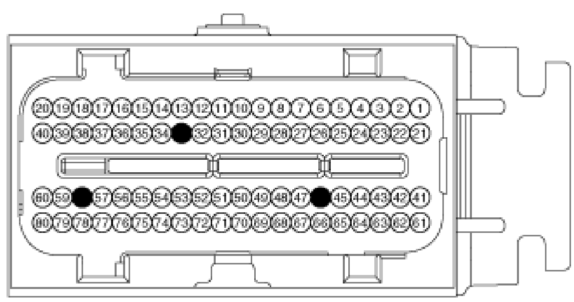
Terminal	Connected to	Function
1	PCM C144-1 (33)	Sensor Ground
2	PCM C144-1 (46)	PSPS Signal
3	PCM C144-1 (58)	Sensor supply (+5V)

[HARNESS CONNECTOR]



E31

PSPS



C144-1

PCM

MONITOR SCANTOOL DATA

1. Ignition "OFF"
2. Connect Scantool and Engine "ON"
3. Check whether steering pressure is rising during operating. (Keep the idling status)

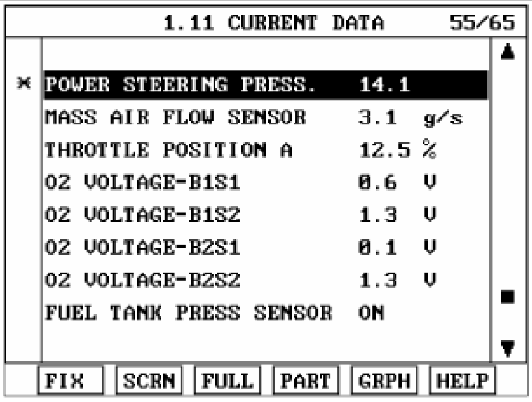


Fig.1

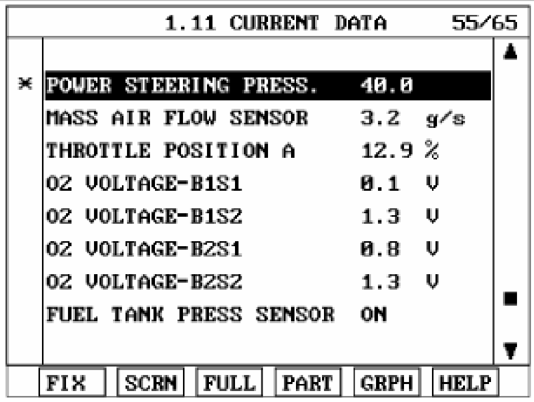


Fig.2

Fig1) Data with not turning steering wheel at idle
Fig2) Data with turning steering wheel at idle

4. Is the current data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

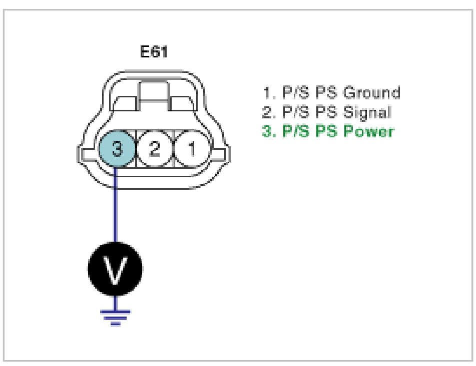
NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. Key "OFF".
2. Disconnect the P/S pressure sensor connector.
3. Key "ON".
4. Measure the voltage between terminal 3 of P/S pressure sensor harness connector and chassis ground.

Specification : approx. 5V



5. Is the measured voltage within specification ?

YES

▸ Go to "Signal circuit inspection" procedure.

NO

▸ Repair Open in power circuit and go to "Verification of Vehicle Repair" procedure.

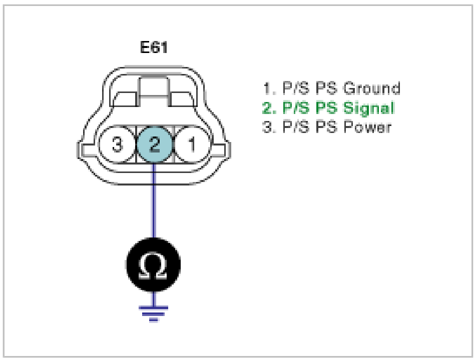
SIGNAL CIRCUIT INSPECTION

1. Check short to ground inspection
   (1) Key "OFF".

   (2) Disconnect P/S pressure sensor connector and PCM connector.

   (3) Measure the resistance between terminal 2 of P/S pressure sensor harness connector and chassis ground.

   Specification : Infinite

   (4) Is the measured resistance within specification ?

   YES

   ▸ Go to "Check open in harness" procedure.

   NO

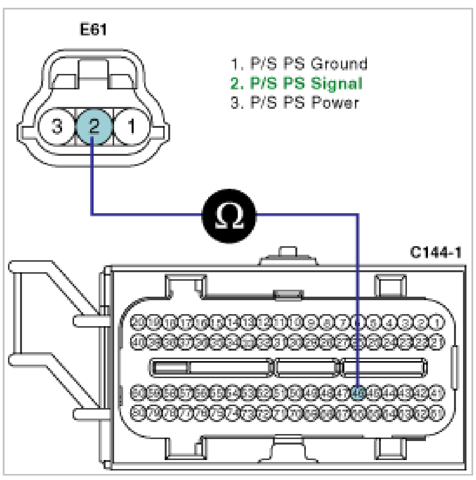
   ▸ Repair Short to ground in signal circuit and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness
   (1) Key "OFF".

   (2) Disconnect P/S pressure sensor connector and PCM connector.

   (3) Measure the resistance between terminal 2 of P/S pressure sensor harness connector and terminal 46 of PCM connector.

   Specification : Approx. below 1Ω

   (4) Is the measured resistance within specification ?

   YES

   ▸ Go to "Component inspection" procedure.

   NO

   ▸ Repair Open in signal circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. P/S pressure sensor inspection

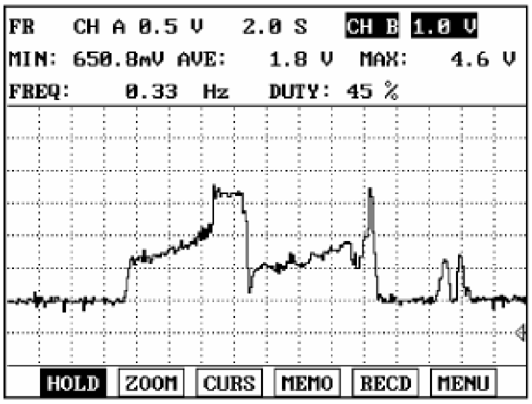
(1) Key "OFF" and connect the scantool.

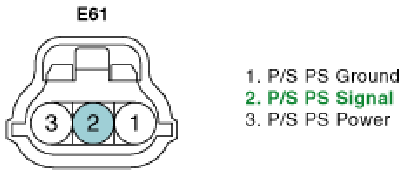
(2) Connect the probe to signal line of P/S pressure sensor and select the oscilloscope in menu.

(3) Check the waveform with steering handle movement after engine start.

Specification :

Pressure(Kgf/cm²)	37.9	41.3	68.8	96.4
Voltage(V)	1	2	3	4





(4) Is the measured waveform of P/S pressure sensor normal?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good P/S pressure sensor and check for proper operation. If the problem is corrected, replace P/S pressure sensor and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0553

COMMPONENT LOCATION

GENERAL DESCRIPTION

To reduce the required power to manipulate steering wheel, hydraulic pressure is used in power steering system. A load is sensed at steering oil pressure sensor then inputted to PCM as a wheel position signal. Controlling idle speed valve, PCM performs appropriate electric load correction With this signal.

DTC DESCRIPTION

Checking output signals from P/S PS(power steering pressure sensor) every 2.5 sec. under detecting condition, if an signal below 0.05V lasts for more than 1.25 sec., PCM sets P0552. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

DTC DETECTING CONDITION

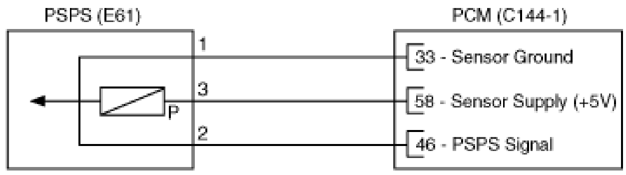
Item	Detecting Condition	Possible cause
DTC Strategy	• Detects sensor signal short to low voltage	• Poor connection • Short in signal circuit • Open in ground circuit • Faulty P/S pressure sensor • Faulty PCM
Enable Conditions	• Engine works • 11V ≤ Battery voltage ≤ 16V	
Thresh old value	• Sensor output voltage >4.65V	
Diagnosis Time	• Continuous (More than 1.25 seconds failure for every 2.5 seconds test)	
MIL On Condition	• 2 driving cycles	

SPECIFICATION

Pressure(Kgf/cm²)	37.9	41.3	68.8	96.4
Voltage(V)	1	2	3	4

SCHEMATIC DIAGRAM

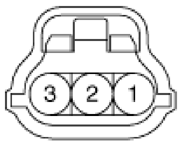
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

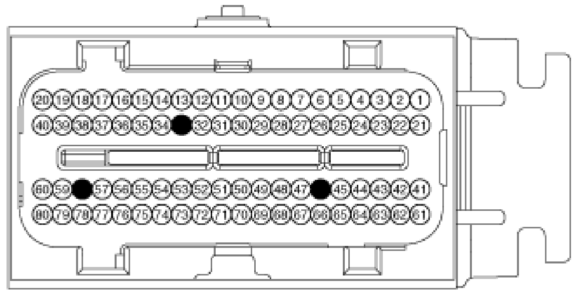
Terminal	Connected to	Function
1	PCM C144-1 (33)	Sensor Ground
2	PCM C144-1 (46)	PSPS Signal
3	PCM C144-1 (58)	Sensor supply (+5V)

[HARNESS CONNECTOR]



E31

PSPS



C144-1

PCM

MONITOR SCANTOOL DATA

1. Ignition "OFF"
2. Connect Scantool and Engine "ON"
3. Check whether steering pressure is rising during operating. (Keep the idling status)

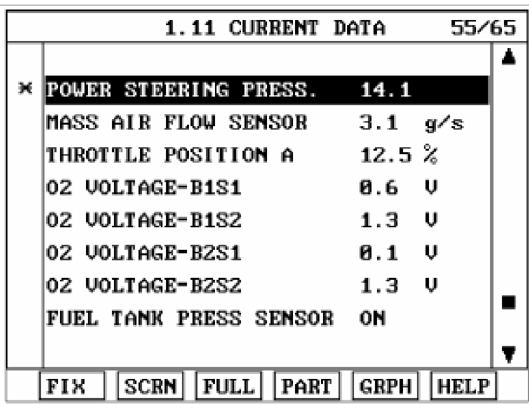


Fig.1

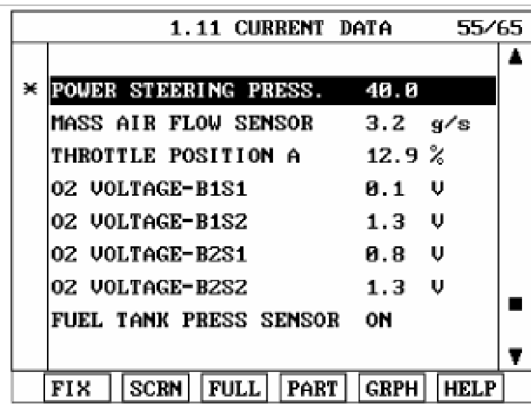


Fig.2

Fig1) Data with not turning steering wheel at idle
Fig2) Data with turning steering wheel at idle

4. Are those items on scantool displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

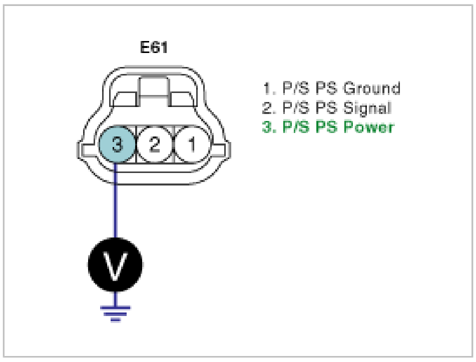
NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. Key "OFF".
2. Disconnect the P/S pressure sensor connector.
3. Key "ON".
4. Measure the voltage between terminal 3 of P/S pressure sensor harness connector and chassis ground.

Specification : approx. 5V



5. Is the measured voltage within specification ?

YES

▸ Go to "Ground circuit inspection" procedure.

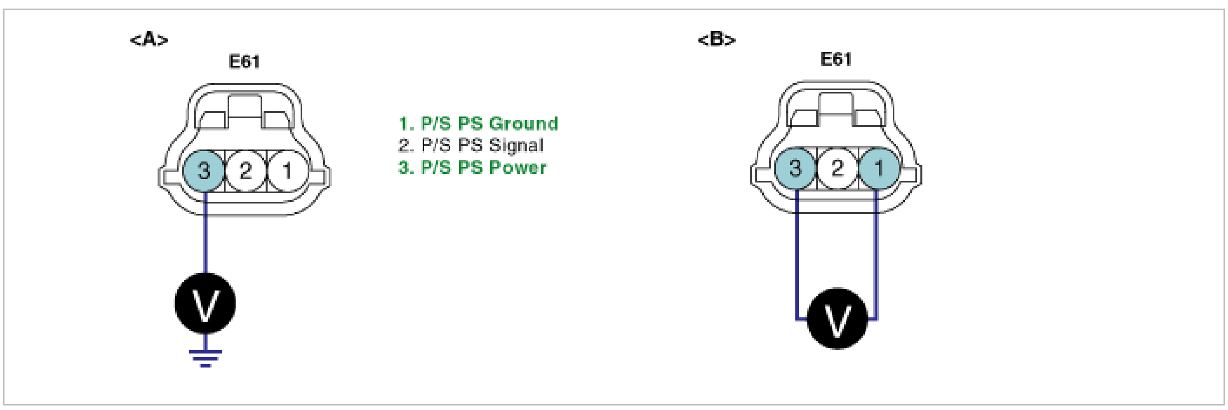
NO

▸ Repair Short in power circuit and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. Key "OFF".
2. Disconnect the P/S pressure sensor connector.
3. Key "ON"
4. Measure the voltage between terminal 3 of P/S pressure sensor harness connector and chassis ground. (Fig A)
5. Measure the voltage between terminal 3 and terminal 1 of P/S pressure sensor harness connector. (Fig B)

Specification : The Difference between "A" and "B" is below 200mV.



6. Is the measured voltage within specification ?

YES

▸ Go to "Signal circuit inspection" procedure.

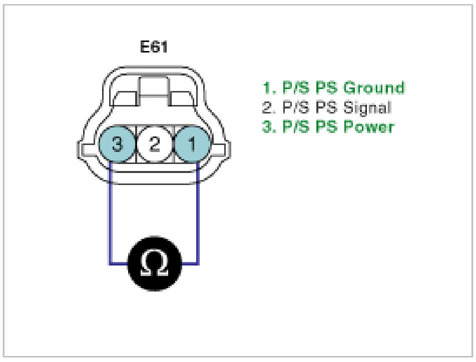
NO

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check short in harness
   (1) Key "OFF".
   (2) Disconnect P/S pressure sensor connector and PCM connector.
   (3) Measure the resistance between terminal 2 and terminal 3 of P/S pressure sensor harness connector.

Specification : Infinite



   (4) Is the measured resistance within specification ?

YES

▸ Go to "Component inspection" procedure.

NO

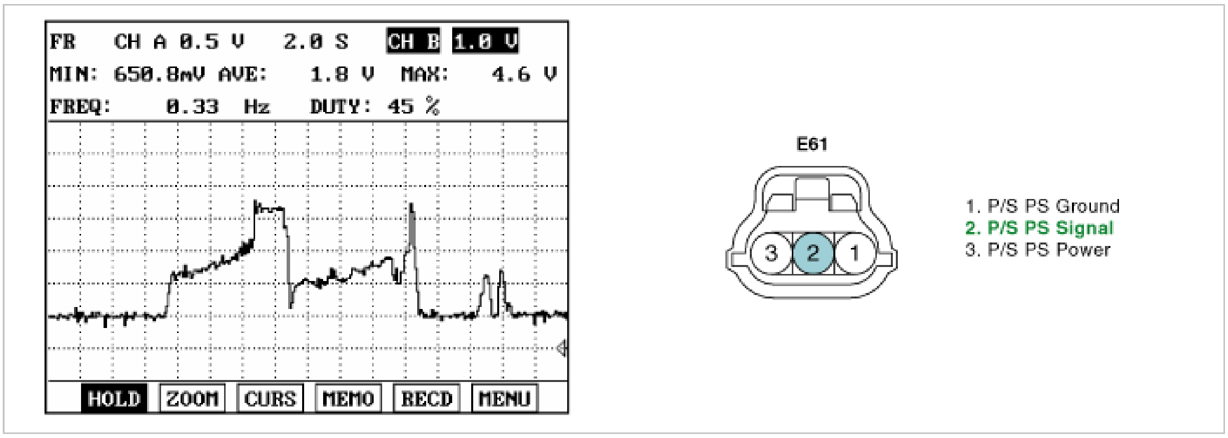
▸ Repair Short in signal circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. P/S pressure sensor inspection
   (1) Key "OFF" and connect the scantool.
   (2) Connect the probe to signal line of P/S pressure sensor and select the oscilloscope in menu.
   (3) Check the waveform with steering handle movement after engine start.

Specification :

Pressure(Kgf/cm^2)	37.9	41.3	68.8	96.4
Voltage(V)	1	2	3	4



   (4) Is the measured waveform of P/S pressure sensor normal?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good P/S pressure sensor and check for proper operation. If the problem is corrected, replace P/S pressure sensor and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

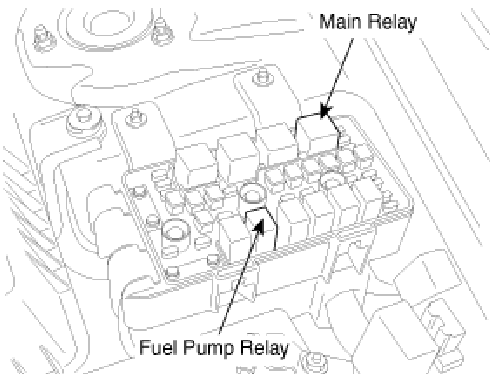
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0562

COMMPONENT LOCATION



GENERAL DESCRIPTION

The purpose of the System Voltage is to detect an excessively low or high system voltage that may be caused by a malfunctioning charging system.

DTC DESCRIPTION

System Voltage is the ignition voltage potential at the Powertrain Control Module (PCM).PCM measures and compares voltage from ignition key and each relay. With this mechanism, PCM knows if the main relay switch turns on after IG on or if turns OFF after IG off.
During engine running, if battery voltage is below 11V, PCM sets P0562. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

DTC DETECTING CONDITION

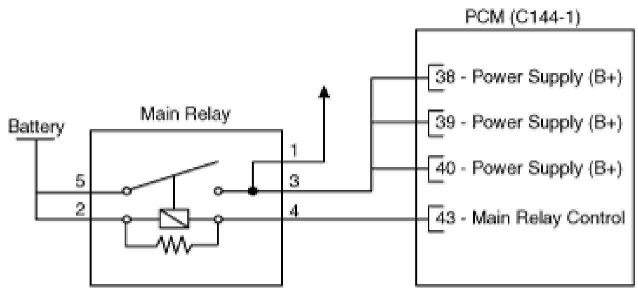
Item	Detecting Condition	Possible cause
DTC Strategy	• Detects circuit short to low voltage	• Poor connection • Open in power circuit • Faulty charging system • Faulty main relay • Faulty PCM
Enable Conditions	• Engine works • 11V ≤ Battery voltage ≤ 16V	
Thresh old value	• Battery voltage< 11V	
Diagnosis Time	• Continuous (More than 37.5 seconds failure for every 45 seconds test)	
MIL On Condition	• 2 driving cycles	

SPECIFICATION

Coil Resistance	70Ω ~ 120Ω

SCHEMATIC DIAGRAM

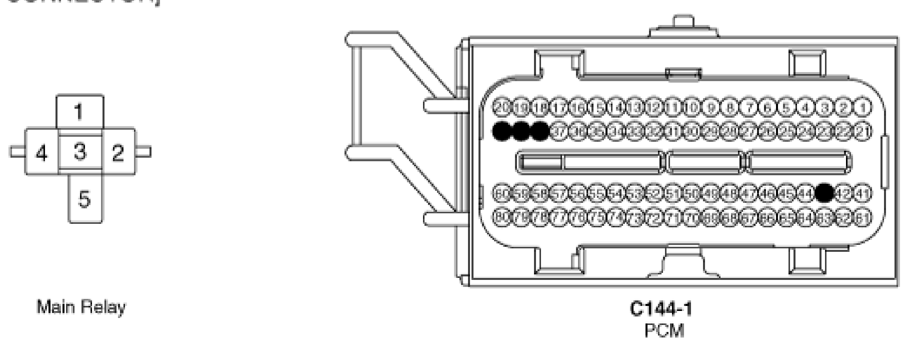
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	-	Power Supply (B+)
2	Battery	Battery Power (B+)
3	PCM C144-1 (38)	Power Supply (B+)
	PCM C144-1 (39)	
	PCM C144-1 (40)	
4	PCM C144-1 (43)	Main Relay Control
5	Battery	Battery Power (B+)

[HARNESS CONNECTOR]



MONITOR SCANTOOL DATA

1. Ignition "OFF"
2. Connect Scantool and Engine "ON"
3. Monitor "Main Relay" parameter on Current Data
4. Is the "Main Relay" parameter displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by

interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

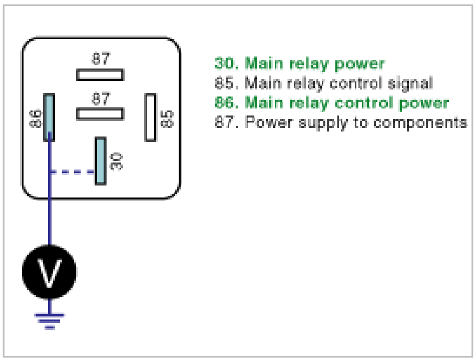
NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. Power circuit inspection
   (1) Key "OFF".
   (2) Disconnect the main relay connector.
   (3) Key "ON".
   (4) Measure the voltage between terminal 2 of main relay harness connector and chassis ground.
   (5) Measure the voltage between terminal 5 of main relay harness connector and chassis ground.

Specification : B+



   (6) Is the measured voltage within specification ?

YES

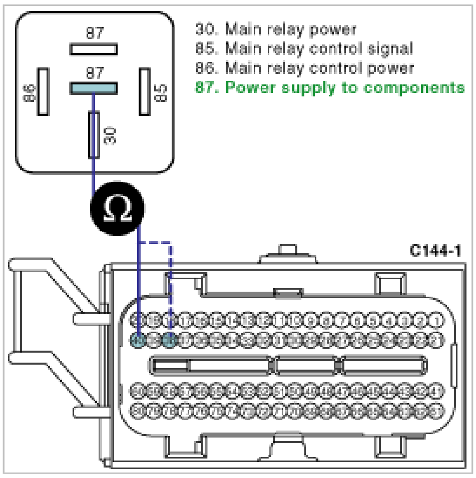
▸ Go to "Check open in harness" procedure.

NO

▸ Check the fuse between battery and main relay.
▸ Repair Open or Short to ground in power circuit and go to "Verification of Vehicle Repair" procedure

2. Check open in harness
   (1) Key "OFF".
   (2) Disconnect main relay and PCM connector.
   (3) Measure the resistance between terminal 3 of main relay harness connector and terminals 38,40 of PCM connector.

Specification : Approx. below 1Ω



(4) Is the measured resistance within specification ?

YES

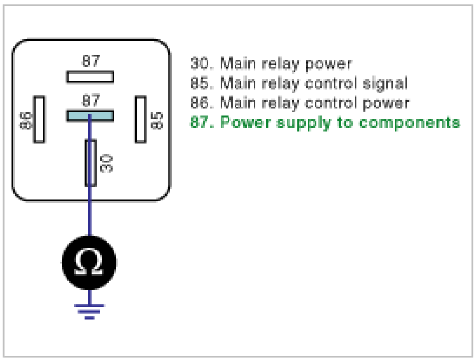
▶ Go to "Check short in harness" procedure.

NO

▶ Repair open in harness and go to "Verification of Vehicle Repair" procedure .

3. Check short in harness
   (1) Key "OFF".
   (2) Disconnect main relay and PCM connector.
   (3) Measure the resistance between terminal 3 of main relay harness connector and chassis ground.

Specification : Infinite



(4) Is the measured resistance within specification ?

YES

▶ Go to "Control circuit inspection" procedure.

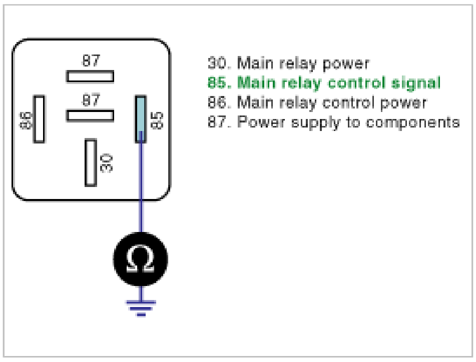
NO

▶ Repair short in harness and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check short in harness
   (1) Key "OFF".
   (2) Disconnect main relay and PCM connector.
   (3) Measure the resistance between terminal 4 of main relay harness connector and chasses ground.

Specification : Infinite



(4) Is the measured resistance within specification ?

YES

▶ Go to "Check open in harness" procedure.

NO

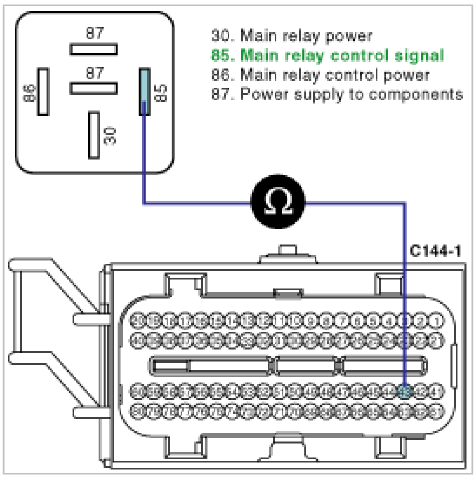
(5) ▶ Repair short in control harness and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness
   (1) Key "OFF".

(2) Disconnect main relay and PCM connector.

(3) Measure the resistance between terminal 4 of main relay harness connector and terminal 43 of PCM connector.

Specification : Approx. below 1Ω



(4) Is the measured resistance within specification ?

YES

▸ Go to "Ground circuit inspection" procedure.

NO

▸ Repair Open in control harness and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

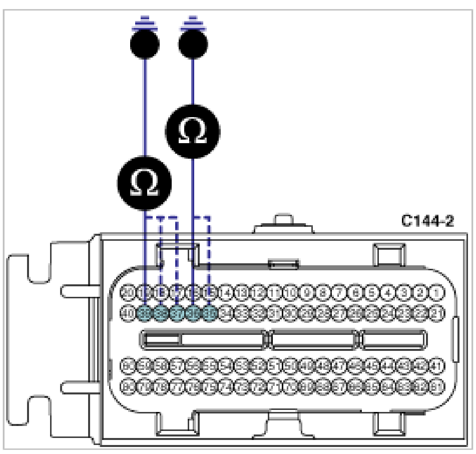
1. Open in circuit inspection
   (1) Key "OFF".

   (2) Disconnect PCM connector.

   (3) Measure the resistance between terminals 35,36 of PCM(C144-2) connector and chassis ground.

   (4) Measure the resistance between terminals 37,38,39 of PCM(C144-2) connector and chassis ground.

Specification : Approx. blow 1Ω



(5) Is the measured resistance within specification ?

YES

▸ Go to "System inspection" procedure.

NO

▸ Repair Open in control harness and go to "Verification of Vehicle Repair" procedure.

SYSTEM INSPECTION

1. Check Alternator circuit

(1) Key "OFF".

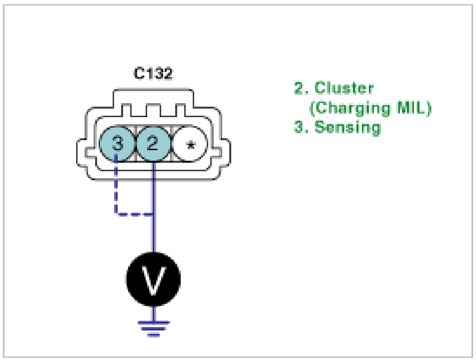
(2) Disconnect alternator connector.

(3) Key "ON".

(4) Measure the voltage between terminal 2 of alternator and chassis gound.

(5) Measure the voltage between terminal 3 of alternator and chassis gound.

Specification : B+



(6) Is the measured voltage within specification?

YES

▸ Go to "Component inspection" procedure.

NO

▸ In case terminal 2 : Repair MIL circuit, MIL resistor or Open in circuit and go to "Verification of Vehicle Repair" procedure.
▸ In case terminal 3 : Repair the fuse(30A IG2) between battery and Ignition switch, the fuse(10A IG3) between Ignition switch and alternator or Open in circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Main relay inspection
   (1) Key "OFF".

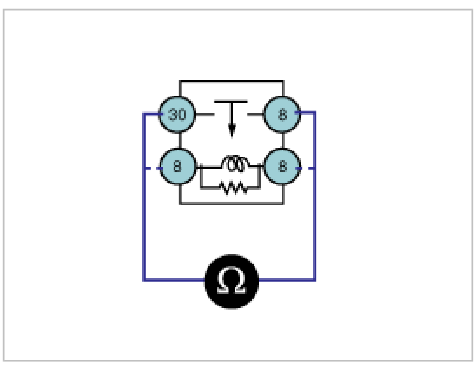
   (2) Disconnect the main relay.

   (3) Measure the resistance between terminal 3 and 5 of main relay.

   (4) Measure the resistance between terminal 2 and 4 of main relay.

Specification : 70 ~ 120Ω

Terminal	Power approval
3 ~ 5	NO
2 ~ 4	YES (Approx. 70Ω ~ 120Ω)



(5) Is the measured resistance within specification ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good Main relay and check for proper operation. If the problem is corrected, replace Main relay and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

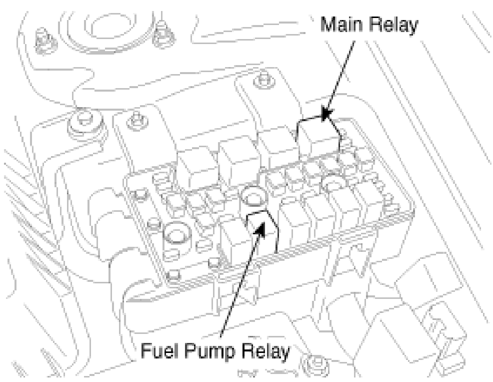
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0563

COMMPONENT LOCATION



GENERAL DESCRIPTION

The purpose of the System Voltage is to detect an excessively low or high system voltage that may be caused by a malfunctioning charging system.

DTC DESCRIPTION

System Voltage is the ignition voltage potential at the Powertrain Control Module (PCM).PCM measures and compares voltage from ignition key and each relay. With this mechanism, PCM knows if the main relay switch turns on after IG on or if turns OFF after IG off.
During engine running, if battery voltage is below 16V, PCM sets P0563. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects circuit short to high voltage	• Poor connection • Short in circuit • Faulty charging system
Enable Conditions	• Engine works	
Thresh old value	• Battery voltage >16V	

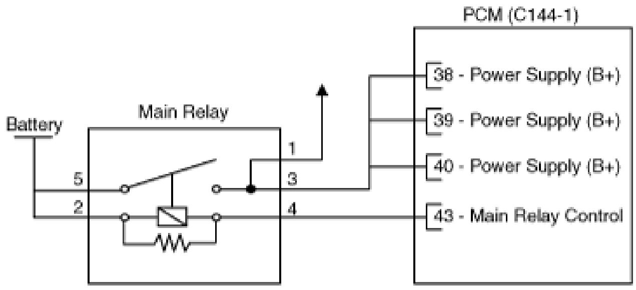
Diagnosis Time	• Continuous (More than 37.5 seconds failure for every 45 seconds test)	• Faulty main relay • Faulty PCM
MIL On Condition	• 2 driving cycles	

SPECIFICATION

Coil Resistance	70Ω ~ 120Ω

SCHEMATIC DIAGRAM

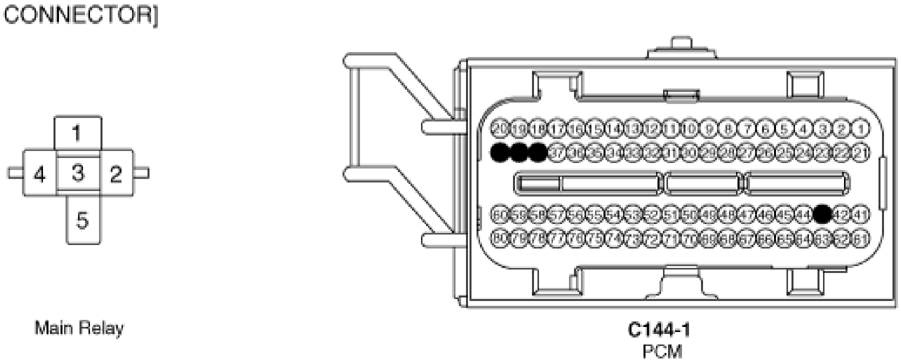
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	-	Power Supply (B+)
2	Battery	Battery Power (B+)
3	PCM C144-1 (38)	Power Supply (B+)
	PCM C144-1 (39)	
	PCM C144-1 (40)	
4	PCM C144-1 (43)	Main Relay Control
5	Battery	Battery Power (B+)

[HARNESS CONNECTOR]



MONITOR SCANTOOL DATA

1. Ignition "OFF"
2. Connect Scantool and Engine "ON"
3. Monitor "Main Relay" parameter on Current Data
4. Is the "Main Relay" parameter displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

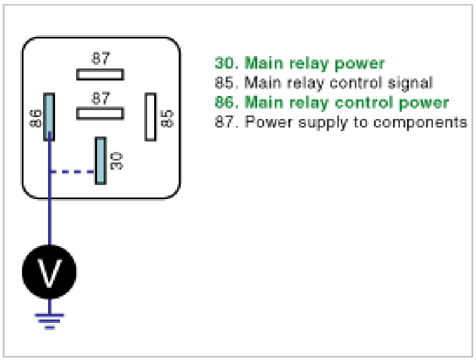
NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. Power circuit inspection
   (1) Key "OFF".
   (2) Disconnect the main relay connector.
   (3) Key "ON".
   (4) Measure the voltage between terminal 2 of main relay harness connector and chassis ground.
   (5) Measure the voltage between terminal 5 of main relay harness connector and chassis ground.

   Specification : B+

   (6) Is the measured voltage within specification ?

   YES

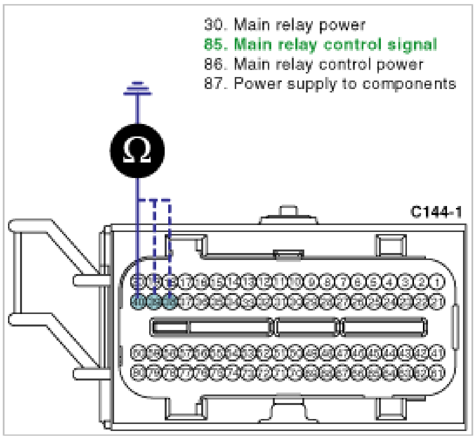
   ▸ Go to "Check short in harness" procedure.

   NO

   ▸ Repair Short in power harness and go to "Verification of Vehicle Repair" procedure.

2. Check short in harness
   (1) Key "ON".
   (2) Measure the voltage between terminal 38, 40 of PCM harness terminal and chassis ground.

   Specification : B+



(3) Is the measured voltage within specification ?

YES

▸ Go to "System inspection" procedure.

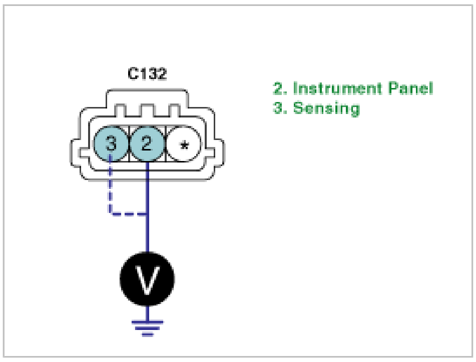
NO

▸ Repair short in power harness and go to "Verification of Vehicle Repair" procedure .

SYSTEM INSPECTION

1. Check Alternator circuit
   (1) Key "OFF".
   (2) Disconnect alternator connector.
   (3) Key "ON".
   (4) Measure the voltage between terminal 2 of alternator and chassis gound.
   (5) Measure the voltage between terminal 3 of alternator and chassis gound.

Specification : B+



(6) Is the measured voltage within specification?

YES

▸ Go to "Component inspection" procedure.

NO

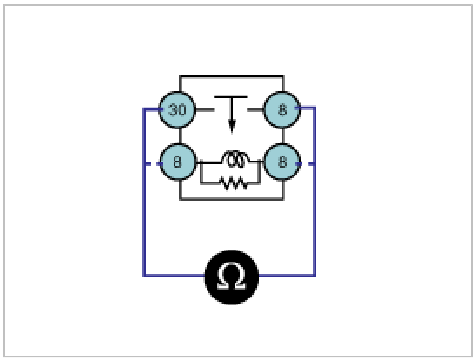
▸ Repair short in Sensing circuit or MIL circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Main relay inspection
   (1) Key "OFF".
   (2) Disconnect the main relay.
   (3) Measure the resistance between terminal 3 and 5 of main relay.
   (4) Measure the resistance between terminal 2 and 4 of main relay.

Specification : 70 ~ 120Ω

Terminal	Power approval
3 ~ 5	NO
2 ~ 4	YES (Approx. 70Ω ~ 120Ω)



(5) Is the measured resistance within specification ?

YES

▸ Go to "Check Alternator" procedure.

NO

▸ Substitute with a known - good Main relay and check for proper operation. If the problem is corrected, replace Main relay and go to "Verification of Vehicle Repair" procedure.

2. Check Alternator

(1) Key "OFF".

(2) Check the tension of the belt.

(3) Check Battery terminal and Alternator B+ terminal for looseness, corrosion or damage.

(4) Engine "ON".

(5) Operate electric equipments (Head lamp, Hot wire, etc).

(6) accelerate engine to 2000 RPM and measure the battery voltage.

Specification : Approx. 12.5V ~ 14.5V

(7) Is the measured voltage within specification ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good Alternator and check for proper operation. If the problem is corrected, replace Alternator and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

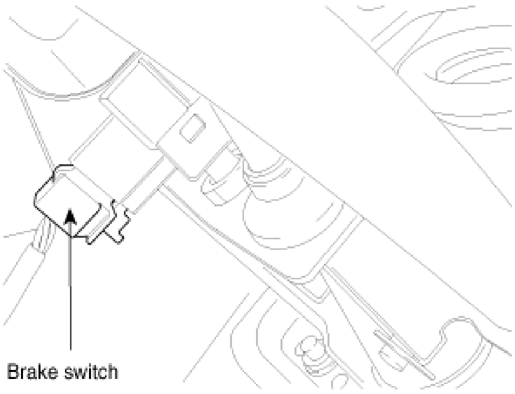
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0571

COMPONENT LOCATION



GENERAL DESCRIPTION

Brake switch connected to brake pedal transfers brake operating state to ECM. For diagnosis of abnormal operation of Brake switch, two types of signals(one from Brake warning lamp switch, the other from Brake checking switch) are used and those two types output different signals at both condition, depressing or releasing brake pedal. When brake pedal is depressed brake checking switch outputs B+ voltage while brake warning lamp switch emits 0V. Conversly, when brake pedal is released, the output signals of each switch are opposite.

DTC DESCRIPTION

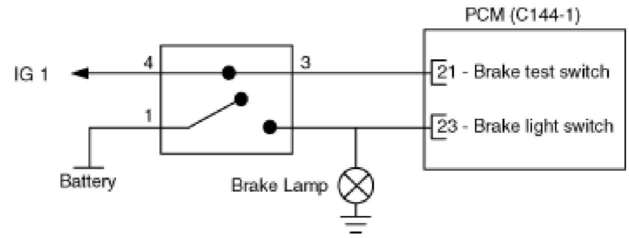
Checking input signals from brake lamp switch every 2 sec. under detecting condition, if the operation state of brake lamp switch does not change for more than 2 sec., PCM sets P0571. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• PCM detects brake lamp input signal when vehicle stops.	• Poor connection • Open or short to ground in signal circuit • Faulty PCM
Enable onditions	• Engine works • Vehicle speed signal is normal. • Vehicle speed >0kph (during 1sec or more)	
Threshold value	• Vehicle speed < 3kph • Vehicle acceleration< 20kph/s • Brake lamp "ON" • There should be a brake lamp change.	
Diagnosis Time	• Continuous (More than 2 seconds failure for every 2 seconds test)	
MIL On Condition	• 2 driving cycles	

SCHEMATIC DIAGRAM

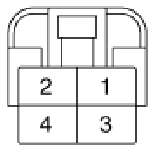
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

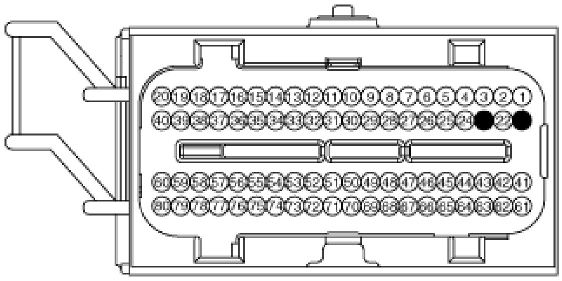
Terminal	Connected to	Function
1	PCM C144-1 (23)	Brake light switch
2	Battery	Power Supply (+5V)
3	PCM C208-A (21)	Brake test switch
4	Battery	Power Supply (+5V)

[HARNESS CONNECTOR]



E62

STOP LAMP SWITCH



C144-1

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "Brake Switch" parameter on the service data with stepping on and off the brake.

Fig. 1

Fig. 2

4. Are those related current data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

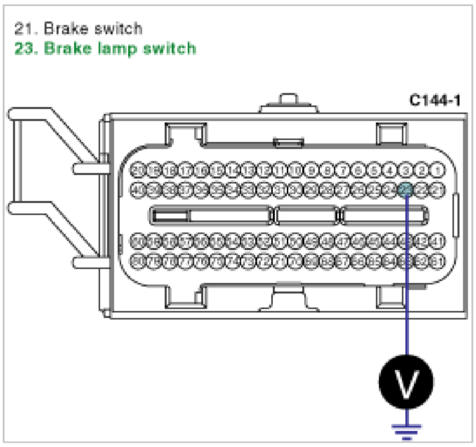
NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF".
   (2) Disconnect the PCM connector.
   (3) IG "ON" and ENG "OFF"
   (4) During taking off the brake : Measure the voltage between terminal 23 of PCM harness connector and chassis ground.
   (5) During stepping on the brake : Measure the voltage between terminal 23 of PCM harness connector and chassis ground.
   Specification :

Item	During taking off the brake	During stepping on the brake
Brake Lamp Switch	0V	Battery voltage
Brake Switch	Battery voltage	0V



   (6) Is the measured voltage within specification ?

YES

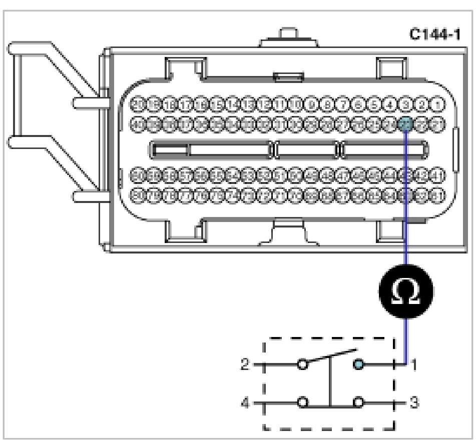
▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Go to "Check open in harness" as follows.

2. Check open in harness
   (1) IG "OFF".
   (2) Disconnect the brake switch and PCM connector.
   (3) Measure the resistance between terminal 23 of PCM harness connector and terminal 1 of Brake switch harness side.

Specification : Approx. below 1Ω



(4) Is the measured resistance within specification ?

YES

▸ o to "Check voltage" as follows.

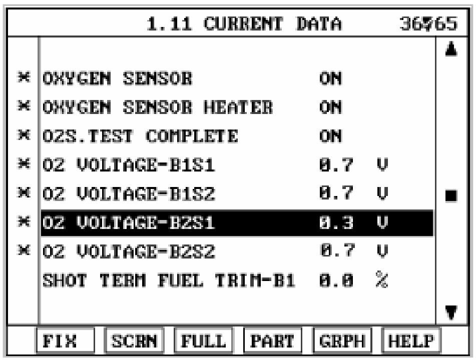
NO

▸ Repair open in circuit and go to "Verification of Vehicle Repair" procedure.

3. Check voltage
   (1) IG "OFF".
   (2) Disconnect the brake switch connector.
   (3) Measure the voltage between brake lamp switch terminal and chassis ground.
   (4) IG "ON" and ENG "OFF"
   (5) Measure the voltage between brake lamp switch terminal and chassis ground.

Specification :

Item	During taking off the brake	During stepping on the brake
Brake Lamp Switch	Battery voltage	Battery voltage
Brake Switch	0V	Battery voltage



(6) Is the measured voltage within specification ?

YES

▸ Substitute with a known - good brake switch and check for proper operation. If the problem is corrected, replace brake switch and go to "Verification of Vehicle Repair" procedure..

NO

▸ Check the fuse between battery and brake switch.
▸ Repair open or short in power circuit of brake switch and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

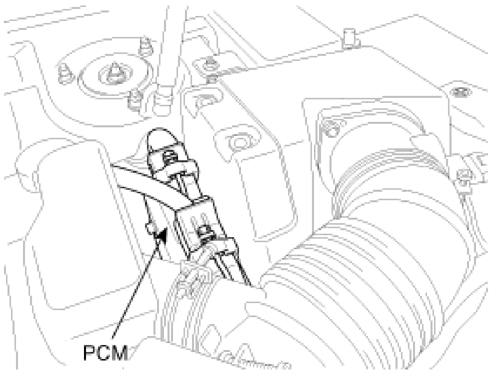
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0601

COMPONENT LOCATION



GENERAL DESCRIPTION

PCM monitors errors through checksum. Every information consists of the combination of 0 and 1, checksum means summing up all values in a row. Thus, errors are recognized comparing checksum value and the memory value at PCM.

DTC DESCRIPTION

If real checksum does not accord with memory checksum, PCM sets P0601 and MIL(Malfunction Indication Lamp) turns on.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Checksum check	• Faulty PCM
Enable onditions	• -	
Threshold value	• Discordance between the real checksum and the memorized checksum	
Diagnosis Time	• -	
MIL On Condition	• 1 driving cycle	

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "

5. Are any DTCs present ?

YES

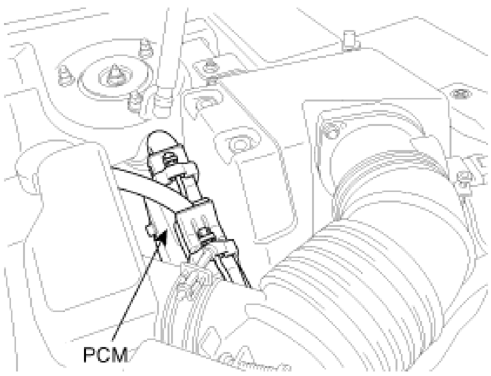
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0602

COMPONENT LOCATION



GENERAL DESCRIPTION

PCM monitors errors through checksum. Every information consists of the combination of 0 and 1, checksum means summing up all values in a row. Thus, errors are recognized comparing checksum value and the memory value at PCM.

DTC DESCRIPTION

If CPU software version dose not accord with main CPU, PCM sets P0602.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Check internal CPU	• Faulty PCM
Enable onditions	• -	
Threshold value	• The version discordance among PCU S/W or Calibration	
Diagnosis Time	• Continuous (More than 125 ms failure for every 125 ms test)	
MIL On Condition	• 1 driving cycle	

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by

PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

   YES

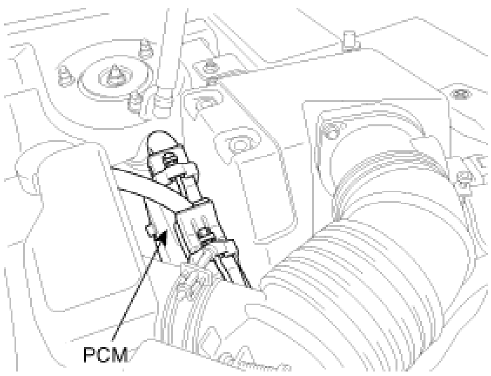
   ▸ Go to the applicable troubleshoooting procedure.

   NO

   ▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0604

COMPONENT LOCATION



GENERAL DESCRIPTION

PCM monitors errors through checksum. Every information consists of the combination of 0 and 1, checksum means summing up all values in a row. Thus, errors are recognized comparing checksum value and the memory value at PCM.

DTC DESCRIPTION

If real checksum does not accord with memory checksum, PCM sets P0604 and MIL(Malfunction Indicatin Lamp) turns on.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Check internal CPU	• Faulty PCM
Enable onditions	• -	
Threshold value	• Discordance between the real checksum and the memorized checksum	
Diagnosis Time	• -	
MIL On Condition	• 1 driving cycle	

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0606

COMPONENT LOCATION

GENERAL DESCRIPTION

The Controller Diagnostic receives data from several self-diagnosing devices onboard the powertrain control module. Conditions which are detected include supply voltage out of limits, acceptable temperature exceeded, low-power counter clock failure, and general device fault.

DTC DESCRIPTION

Checking PCM every 10 sec. under detecting condition, if internal error is detected for more than 5 sec., PCM sets P0606. And MIL(Malfunction Indicatin Lamp) turns on.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Check PCM internal error	
Enable onditions	• 7V< Battery voltage< 20V	

Threshold value	• PCM internal error (A/D unit error)	• Faulty PCM
Diagnosis Time	• Continuous (More than 0.5 seconds failure for every 9.3 seconds test)	
MIL On Condition	• 1 driving cycle	

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   ▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

   NO

   ▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

   YES

   ▸ Go to the applicable troubleshoooting procedure.

   NO

   ▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P061B

COMPONENT LOCATION

GENERAL DESCRIPTION

Checking torque control state and torque, torque calculation protect RAM. ROM, or ALU when the torque calculated inside of PCM is higher than actually required torque. This type of malfunction is very difficult to find, however if it happens, it influences safety a lot. Therefore, detecting and decreasing torque is strongly required.

DTC DESCRIPTION

If desired torque is calculated much higher than actual torque, PCM senses it and decreases desired torque. The causes of this error are abnormal operation of PCM (RAM,ROM, ALU errors) and hardware malfunction such that actual air flow enters the engine is more than the flow recognized by PCM.If actual checksum do not correspont with memory checksum, PCM sets P061B. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till 1 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Desired torque error	• Faulty PCM
Enable onditions	• Engine works	
Threshold value	• Desired torque is much higher than actual torque.	
Diagnosis Time	• Continuous	
MIL On Condition	• 1 driving cycle	

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0630

GENERAL DESCRIPTION

Regulations require that all 2005 and subsequent model year vehicles shall have the Vehicle Identification Number(VIN) available in a standardized format through the standardized data link connector in accordance with SAE J1979 specifications. Using a scan tool, PERFORM "VIN WRITING" procedure after replacing or reflashing a PCM.

DTC DESCRIPTION

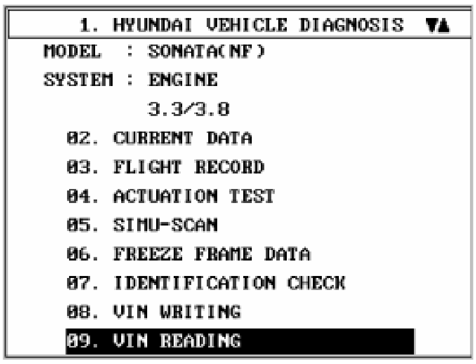
The purpose of this logic is to prevent a vehicle from leaving the assembly plant or service station without a VIN in its EEPROM memory.
If the VIN writing is not programmed or incompatible, the PCM determines that a fault exists and a DTC is stored.MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till 1 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• VIN not programmed or incompatible	1. VIN is not programmed. 2. Faulty PCM
Enable onditions	• None	
Threshold value	• Error Code: "ON"	
Diagnosis Time	• Continuous	
MIL On Condition	• 1 driving cycle	

MONITOR SCANTOOL DATA

1. Ignition "OFF"
2. Connect Scantool and Ignition "ON"
3. Monitor the ECM status by VIN reading whether it is virgin or learnt



4. Is the ECM status Virgin ?

YES

▸ Perform VIN writing procedure according to the direction on the scantool screen and go to "Verification of Vehicle Reapair" procedure.

NO

▸ Fault is intermittent caused by poor contact in Sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

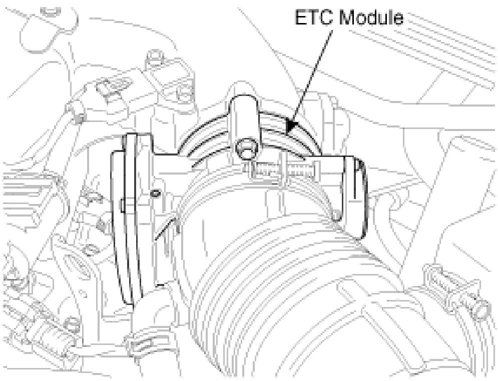
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0638

COMPONENT LOCATION



GENERAL DESCRIPTION

ETC(Electronic Throttle Control Valve) is the device controlling amount of air to engine acccording to driver's intension. Different from the existing mechanical throttle valve which is composed of accelerator pecal and connecting wire cable, ETC consists of a motor, a throttle body and a throttle position sensor. Receiving input signals from electronic accelerator pedal module, PCM lets ETC motor control throttle valve. With ETC, cruise control system works without any additional device.

DTC DESCRIPTION

Checking output signals from TPS every 8.5 sec. under detecting condition, if the difference between real and target throttle position is above the specified value, PCM sets P0638. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till 1 driving cycle.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible cause
DTC Strategy		• ETS position control malfunction	• Throttle stuck • Open in motor circuit • Faulty motor • Faulty PCM
Enable Conditions		• Engine works • Battery voltage >5V	
Threshold value	Case1	• l real ETS motor & TPS value - target ETS motor & TPS value l >4.5°	
	Case2	• When real Throttle position <36°, real throttle position - target throttle position < - 4.5°	
	Case3	• real throttle position - target throttle position < - 18°	
Diagnosis Time		• Continuous (More than 0.6 seconds failure for every 15.6 seconds test)	
MIL On Condition		• 1 driving cycle	

SIGNAL WAVEFORM AND DATA

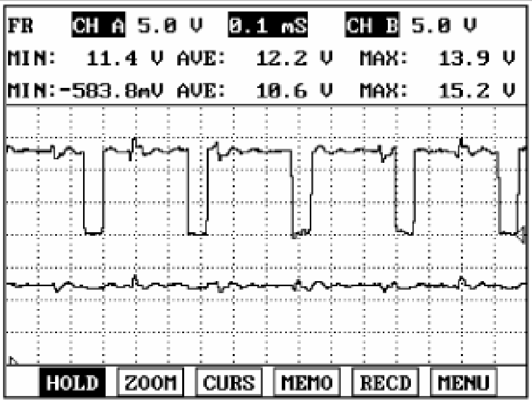


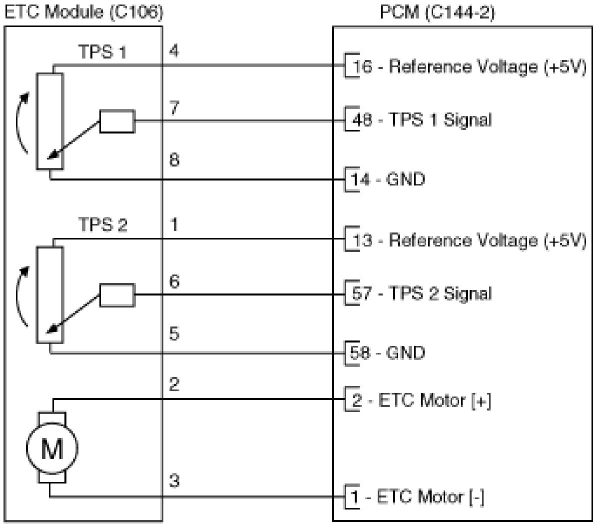
Fig. 1

SPECIFICATION

Throttle opening (°)	Output voltage (V) [Vref = 5.0V]	
	TPS1	**TPS2**
0°	0.0V	5.0V
10°	0.5V	4.5V
20°	0.9V	4.1V
30°	1.4V	3.6V
40°	1.8V	3.2V
50°	2.3V	2.7V
60°	2.7V	2.3V
70°	3.2V	1.8V
80°	3.6V	1.4V
90°	4.1V	0.9V
100°	4.5V	0.5V
110°	5.0V	0.0V

SCHEMATIC DIAGRAM

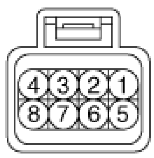
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

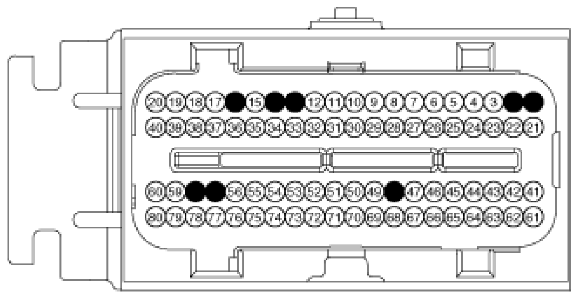
Terminal	Connected to	Funtion
1	PCM C144-2 (13)	TPS 2 Reference Voltage (+5V)
2	PCM C144-2 (2)	ETC Motor [+] Control
3	PCM C144-2 (1)	ETC Motor [-] Control
4	PCM C144-2 (16)	TPS 1 Reference Voltage (+5V)
5	PCM C144-2 (58)	TPS 2 Ground
6	PCM C144-2 (57)	TPS 2 Signal
7	PCM C144-2 (48)	TPS 1 Signal
8	PCM C144-2 (14)	TPS 1 Ground

[HARNESS CONNECTORS]



C106

ETC MODULE

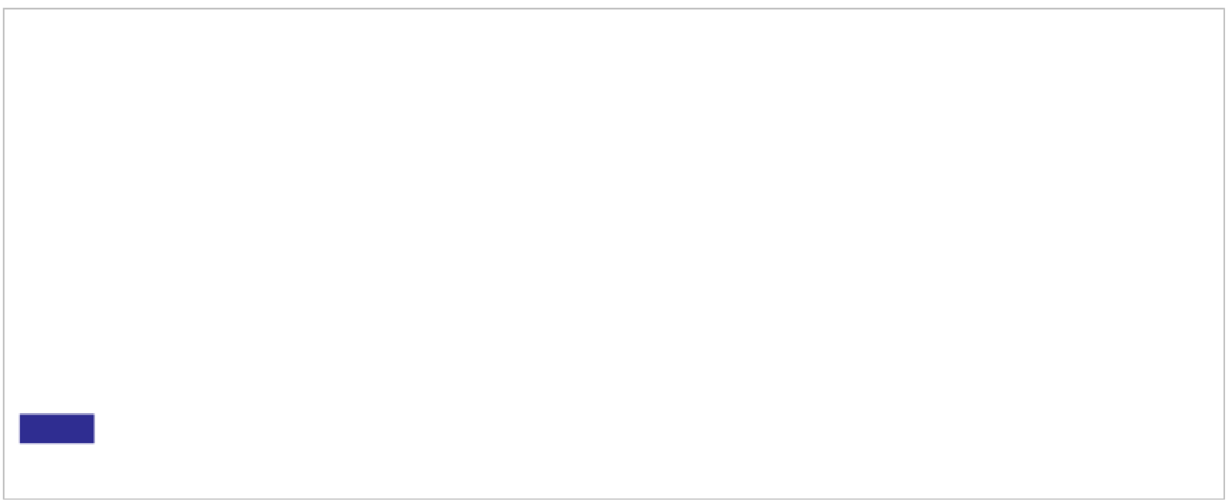


C144-2

PCM

MONITOR SCANTOOL DATA

1. Ignition "OFF"
2. Connect Scantool and Engine "ON"
3. Monitor "ETS Motor" items on Current Data



4. Are those related current data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor’s and/or PCM’s connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection,bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and goto "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

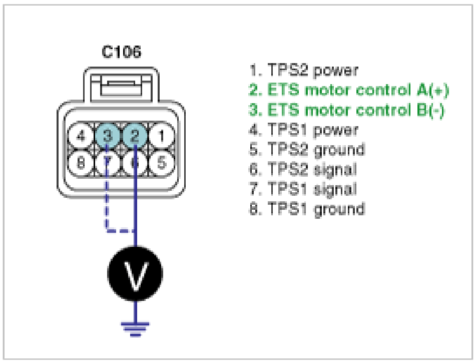
NO

▸ Go to " Control Circuit Inspection " procedure.

CONTROL CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF".
   (2) Disconnect ETS motor & TPS connector.
   (3) IG "ON" and ENG "OFF"
   (4) Measure the voltage between terminal 2,3 of ETS motor & TPS harness connector and chassis ground.

   Specification : Approx. 12V



   (5) Is the measured voltage within specification?

   YES

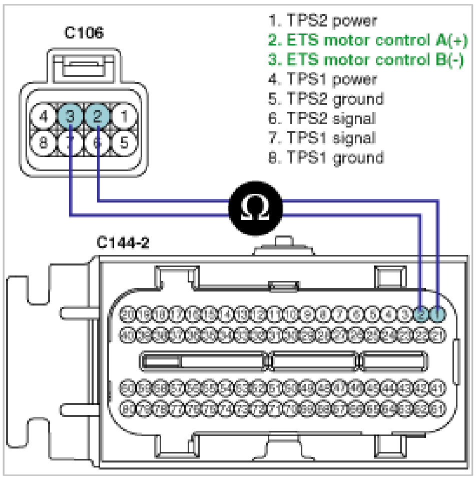
   ▸ Go to "Component inspection" procedure.

   NO

   ▸ Go to "Check open in harness" as follows.

2. Open in control circuit inspection
   (1) IG "OFF"
   (2) Disconnect ETS motor & TPS connector and PCM connector.
   (3) Measure the resistance between terminal 2 of ETS motor & TPS harness connector and terminal 2 of PCM harness connector.
   (4) Measure the resistance between terminal 3 of ETS motor & TPS harness connector and terminal 1 of PCM harness connector.

   Specification : Approx. below 1Ω



(5) Is the measured resistance within specification ?

YES

▸ Go to "Component inspection" procedure.

NO

▸ Repair Open in motor harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check throttle valve for stuck

(1) IG "OFF".

(2) Disconnect the air hose between throttle body and air mass flow sensor.

(3) Check stuck on throttle valve.

(4) Is the throttle valve normal?

YES

▸ Go to check "ETS motor resistance" as follows.

NO

▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

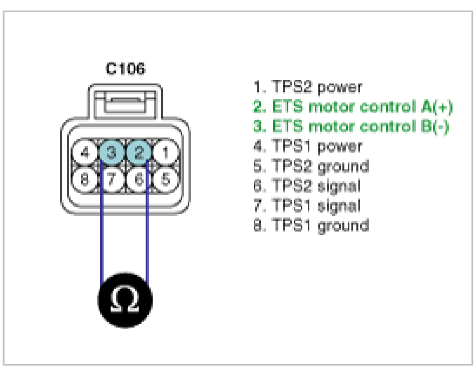
2. Check ETS motor resistance

(1) IG "OFF".

(2) Disconnect ETS motor & TPS connector.

(3) Measure the resistance between terminal 2 and 3 of ETS motor & TPS connector(component side).

Specification : Approx. 1.275 ~ 1.725Ω @ 23°C (73.4°F)



(4) Is the measured resistance within specification?

YES

▸ Go to "ETC motor actuation test" procedure.

NO

▸ Substitute with a known - good ETC motor and check for proper operation. If the problem is corrected, replace ETC motor and go to "Verification of Vehicle Repair" procedure.

※ Procedure of ETS Initialization
1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10 second)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

3. ETC motor actuation test
   (1) IG "OFF".
   (2) Connect ETS motor & TPS connector.
   (3) After IG "ON", execute the "ETC motor actuation test" by Scantool.
   (4) Does the "ETC motor actuation test" execute normally?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good ETC motor and check for proper operation. If the problem is corrected, replace ETC motor and go to "Verification of Vehicle Repair" procedure.
※ Procedure of ETS Initialization
1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10 second)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.
1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0641

GENERAL DESCRIPTION

ETC(Electronic Throttle Control Valve) is the device controlling amount of air to engine acccording to driver's intension. Different from the existing mechanical throttle valve which is composed of accelerator pecal and connecting wire cable, ETC consists of a motor, a throttle body and a throttle position sensor. Receiving input signals from electronic accelerator pedal module, PCM lets ETC motor control throttle valve. With ETC, cruise control system works without any additional device.

DTC DESCRIPTION

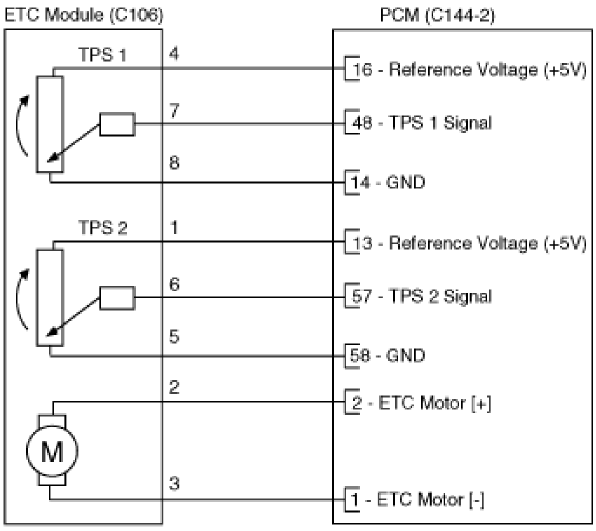
Checking the voltage from sensor power supply every 1.87 sec. under detecting condition, if the value within detecting condition lasts for more than 0.2 sec., PCM sets P0641. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Sensor reference voltage check	• Short in sensor power supply line • Faulty PCM
Enable Conditions	• IG "ON"	
Threshold value	• Sensor supply power < 4.5V or > 5.5V	
Diagnosis Time	• Continuous (More than 0.2 seconds failure for every 1.87 seconds test)	
MIL On Condition	• 2 driving cycle	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



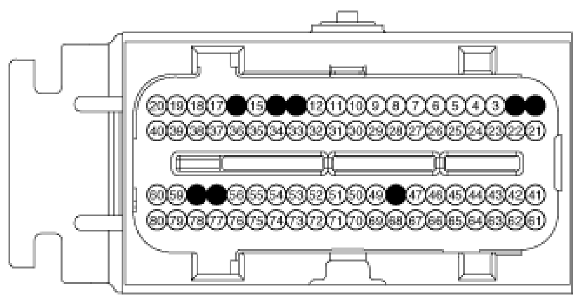
[CONNECTION INFORMATION]

Terminal	Connected to	Funtion
1	PCM C144-2 (13)	TPS 2 Reference Voltage (+5V)
2	PCM C144-2 (2)	ETC Motor [+] Control
3	PCM C144-2 (1)	ETC Motor [-] Control
4	PCM C144-2 (16)	TPS 1 Reference Voltage (+5V)
5	PCM C144-2 (58)	TPS 2 Ground
6	PCM C144-2 (57)	TPS 2 Signal
7	PCM C144-2 (48)	TPS 1 Signal
8	PCM C144-2 (14)	TPS 1 Ground

[HARNESS CONNECTORS]

C106

ETC MODULE



C144-2

PCM

MONITOR SCANTOOL DATA

1. Ignition "OFF".
2. Connect Scantool and Engine "ON".
3. Monitor "TPS1, TPS2" items on Current Data

Fig. 1

4. Are those related current data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor’s and/or PCM’s connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection,bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and goto "Verification of Vehicle Repair" procedure.

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

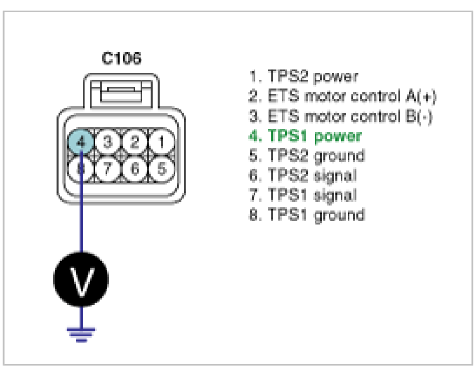
NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF".
   (2) Disconnect TPS connector.
   (3) IG "ON" and ENG "OFF"
   (4) Measure the voltage between terminal 4 of TPS harness connector and chassis ground.

Specification : Approx. 5V



   (5) Is the measured voltage within specification ?

YES

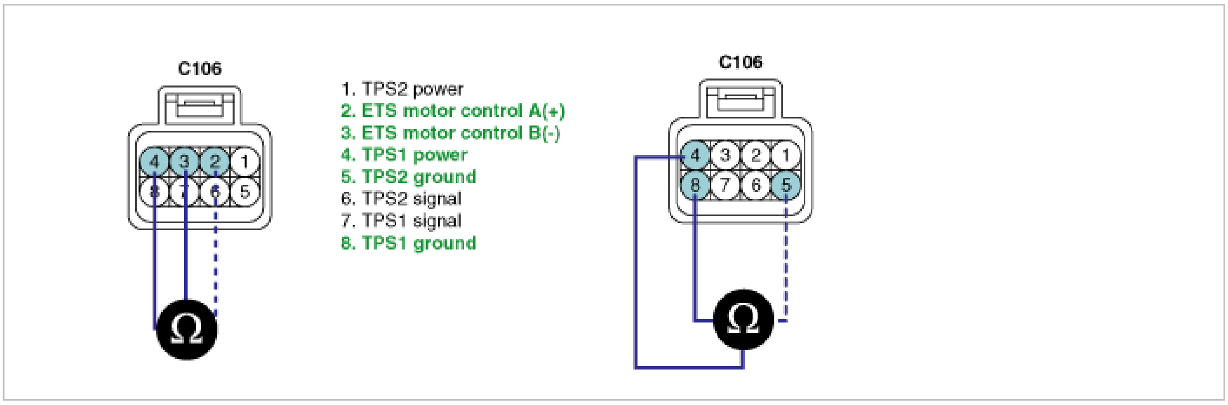
▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Go to "Check short in power harness" as follows.

2. Check short in power harness
   (1) IG "OFF".
   (2) Disconnect TPS connector and PCM connector.
   (3) Measure the resistance between terminal 4 and 2 of TPS harness connector.
   (4) Measure the resistance between terminal 4 and 3 of TPS harness connector.
   (5) Measure the resistance between terminal 4 and 5 of TPS harness connector.
   (6) Measure the resistance between terminal 4 and 8 of TPS harness connector.

Specification : Infinite



   (7) Is the measured resistance within specification ?

YES

▸ Substitute with a known - good PCM and check for proper operation.
▸ If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Repair Short in power circuit and go to "Verification of Vehicle Repair" procedure.
※ Procedure of ETS Initialization
1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10 second)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0646

GENERAL DESCRIPTION

A/C compressor raises pressure to condensen the evaporated refrigerant at evaporator in A/C system more easily. Without A/C signal, A/C compressor does not operate but with ON signal, PCU activate A/C compressor relay. With the relay activation, A/C compressor turns on using the power of the engine.

DTC DESCRIPTION

PCM monitors inputted voltage through A/C compressor relay. Checking voltage every 10 sec. under detecting condition, if the voltage lower than the specified value is detected for more than 5 sec., PCM sets P0646.

DTC DETECTING CONDITION

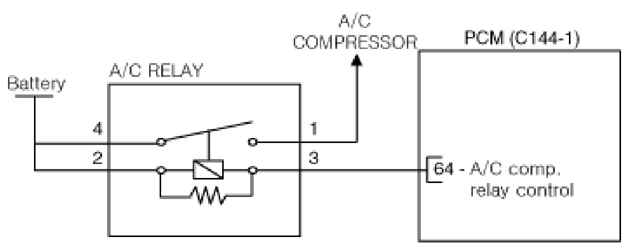
Item	Detecting Condition	Possible cause
DTC Strategy	• Detects circuit short to low voltage	• Poor connection • Open or short to ground in A/C relay circuit • Faulty A/C relay • Faulty PCM
Enable Conditions	• After 0.5 sec under conditions below • No DTC exists • Engine works • 11V ≤ Battery voltage ≤ 16V	
Threshold value	• Open or short to ground	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• DTC only (NO MIL ON)	

SPECIFICATION

Coil Resistance
70Ω ~ 120Ω

SCHEMATIC DIAGRAM

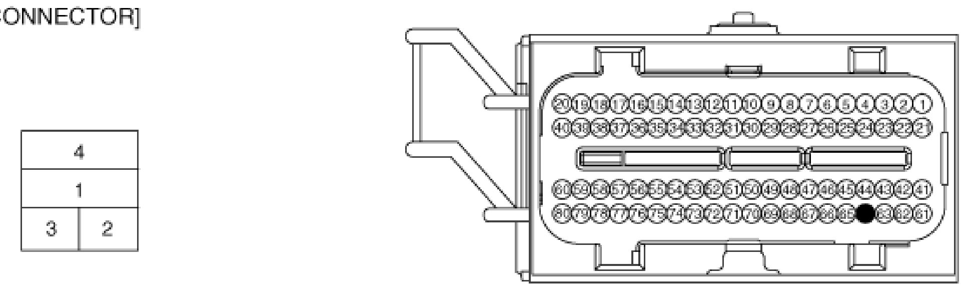
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	A/C COMPRESSOR	COMPRESSOR Supply
2	Battery	Power Supply (B+)
3	PCM C144-1 (64)	A/C comp. relay control
4	Battery	Power Supply (B+)

[HARNESS CONNECTOR]



C144-1
PCM

MONITOR SCANTOOL DATA

1. Ignition "OFF"
2. Connect Scantool and Engine "ON"
3. Monitor items related to "A/C" on Current Data

Fig. 1

Fig. 2

4. Are those related current data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor's and/or PCM's connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection,bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and goto "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. Check voltage

(1) IG "OFF".

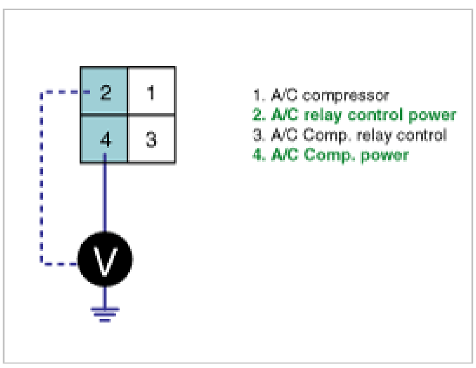
(2) Disconnect A/C relay connector.

(3) IG "ON" and ENG "OFF"

(4) Measure the voltage between terminal 2 of A/C relay harness connector and chassis ground.

(5) Measure the voltage between terminal 4 of A/C relay harness connector and chassis ground.

Specification : B+



(6) Is the measured voltage normal?

YES

▸ Go to "Control circuit inspection" procedure.

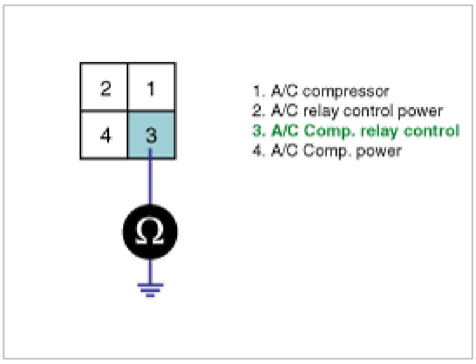
NO

▸ Check the fuse between Battery and A/C relay.
▸ Check Chassis ground 1 and 2 for looseness.
▸ Repair Open or Short to ground in power circuit and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check short in harness
   (1) IG "OFF".
   (2) Disconnect A/C relay and PCM connector.
   (3) Measure the resistance between terminal 3 of A/C relay harness connector and chassis ground.

Specification : Infinite



   (4) Is the measured resistance within specification ?

YES

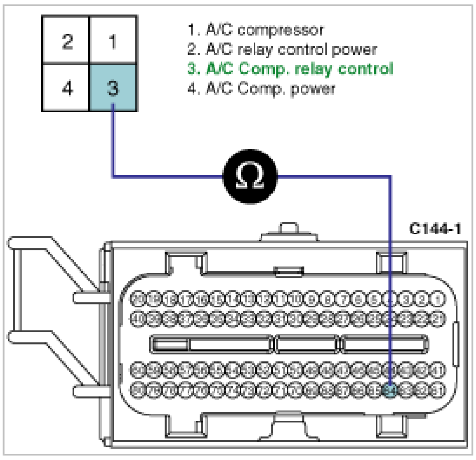
▸ Go to "Check open in harness" as follows.

NO

▸ Repair Short in Coil control harness and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness
   (1) IG "OFF".
   (2) Disconnect A/C relay and PCM connector.
   (3) Measure the resistance between terminal 3 of A/C relay harness connector and terminal 64 of PCM harness connector.

Specification : Approx. below 1Ω



   (4) Is the measured resistance within specification ?

YES

▸ Go to "Component inspection" procedure.

NO

▸ Repair Open in Coil control harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

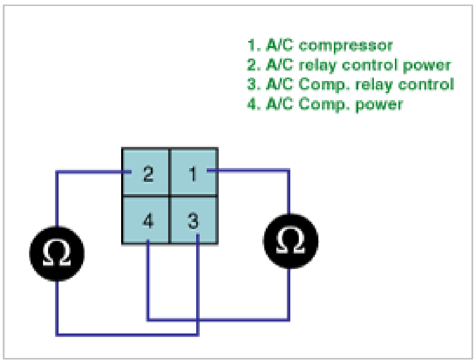
1. Check A/C relay
   (1) IG "OFF".

   (2) Disconnect A/C relay.

   (3) Measure the resistance between terminal 2 and 3 of A/C relay.

   (4) Measure the resistance between terminal 1 and 4 of A/C relay.

Terminal	Power approval
1~4	NO
2~3	YES (약 70Ω ~ 120Ω)



   (5) Is the measured resistance within specification ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good A/C relay and check for proper operation. If the problem is corrected, replace A/C relay and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0647

GENERAL DESCRIPTION

A/C compressor raises pressure to condensen the evaporated refrigerant at evaporator in A/C system more easily. Without A/C signal, A/C compressor does not operate but with ON signal, PCU activate A/C compressor relay. With the relay activation, A/C compressor turns on using the power of the engine.

DTC DESCRIPTION

PCM monitors inputted voltage through A/C compressor relay. Checking voltage every 10 sec. under detecting condition, if the voltage higher than the specified value is detected for more than 5 sec., PCM sets P0647.

DTC DETECTING CONDITION

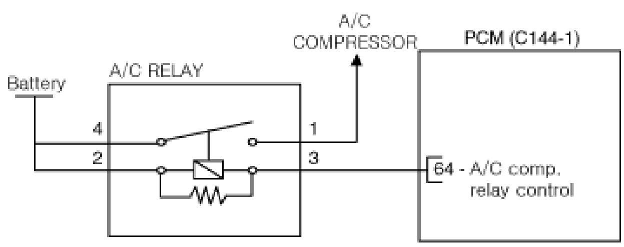
Item	Detecting Condition	Possible cause
DTC Strategy	• Detects circuit short to high voltage	• Poor connection • Short to power in A/C relay circuit • Faulty A/C relay • Faulty PCM
Enable Conditions	• After 0.5 sec under conditions below • No DTC exists • Engine works • 11V ≤ Battery voltage ≤ 16V	
Threshold value	• Short to power	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• DTC only (NO MIL ON)	

SPECIFICATION

Coil Resistance
70Ω ~ 120Ω

SCHEMATIC DIAGRAM

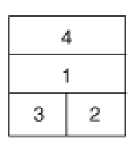
[CIRCUIT DIAGRAM]

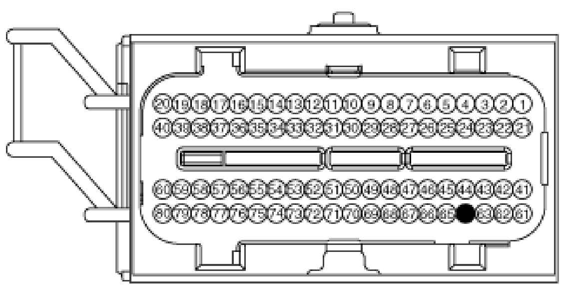


[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	A/C COMPRESSOR	COMPRESSOR Supply
2	Battery	Power Supply (B+)
3	PCM C144-1 (64)	A/C comp. relay control
4	Battery	Power Supply (B+)

[HARNESS CONNECTOR]





C144-1
PCM

MONITOR SCANTOOL DATA

1. Ignition "OFF"
2. Connect Scantool and Engine "ON"
3. Monitor items related to "A/C" on Current Data

Fig. 1

Fig. 2

4. Are those related current data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor’s and/or PCM’s connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection,bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and goto "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. Check voltage

(1) IG "OFF".

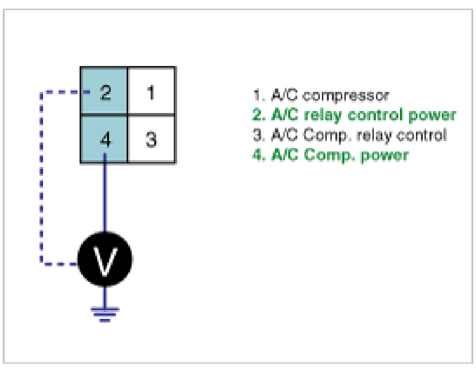
(2) Disconnect A/C relay connector.

(3) IG "ON" and ENG "OFF"

(4) Measure the voltage between terminal 2 of A/C relay harness connector and chassis ground.

(5) Measure the voltage between terminal 4 of A/C relay harness connector and chassis ground.

Specification : B+



(6) Is the measured voltage normal?

YES

▸ Go to "Control circuit inspection" procedure.

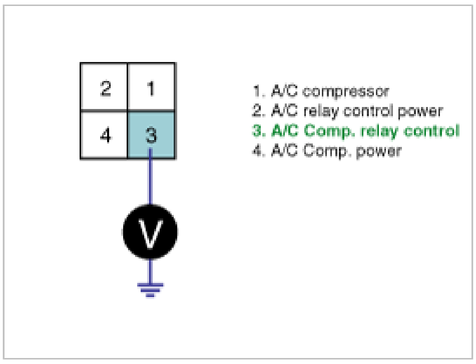
NO

▸ Check the fuse between Battery and A/C relay.
▸ Check Chassis ground 1 and 2 for looseness.
▸ Repair Open or Short to ground in power circuit and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check short in harness
   (1) IG "ON".
   (2) Disconnect A/C relay.
   (3) Measure the resistance between terminal 3 of A/C relay harness connector and chassis ground.

Specification : Approx. 0V



   (4) Is the measured voltage within specification ?

YES

▸ Go to "Component inspection" procedure.

NO

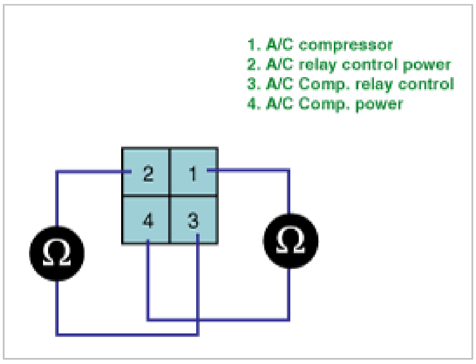
▸ Repair Short in Coil control harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check A/C relay
   (1) IG "OFF".
   (2) Disconnect A/C relay.
   (3) Measure the resistance between terminal 2 and 3 of A/C relay.
   (4) Measure the resistance between terminal 1 and 4 of A/C relay.

SPECIFICATION

Terminal	Power approval
1~4	NO
2~3	YES (약 70Ω ~ 120Ω)



(5) Is the measured resistance within specification ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good A/C relay and check for proper operation. If the problem is corrected, replace A/C relay and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0650

GENERAL DESCRIPTION

As monitoring the errors of several sensors and actuators circuit,if any problem occurs, PCM turns engine check lamp ON at cluster to notify driver occurence of a problem.Generally, engine check lamp turns ON at Ignition ON and turns OFF within couple of seconds after turning engine ON. If engine check lamp turns on during driving, perform diagnosis of engine system and auto-transaxle system.

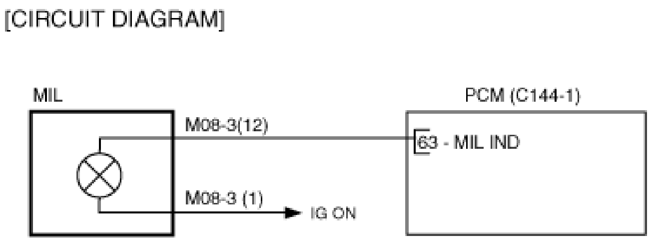
DTC DESCRIPTION

Checking input signal of engine check lamp every 10 sec. under detecting condition, if open, or short to battery or ground is detected for more than 5 sec., PCM sets P0650.

DTC DETECTING CONDITION

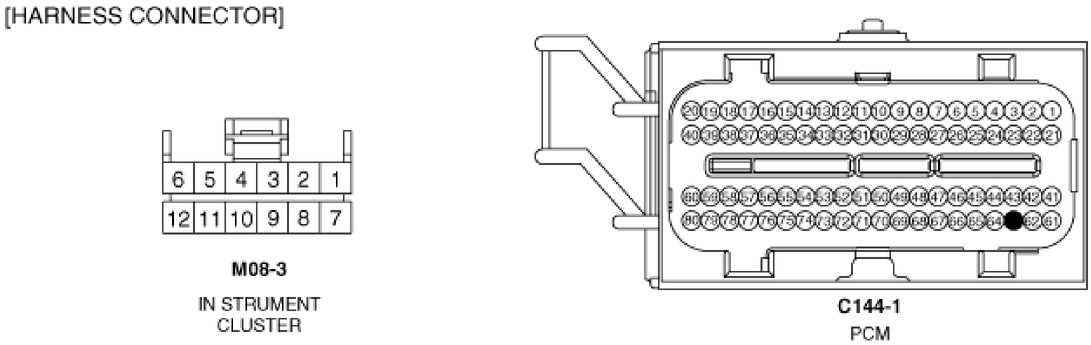
Item	Detecting Condition	Possible cause
DTC Strategy	• Signal low, high	• Poor connection • Open or short in MIL circuit • Faulty MIL • Faulty PCM
Enable Conditions	• After 0.5 sec under conditions below • Engine works • 11V ≤ Battery voltage ≤ 16V	
Threshold value	• Open or short	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• DTC only (NO MIL ON)	

SCHEMATIC DIAGRAM



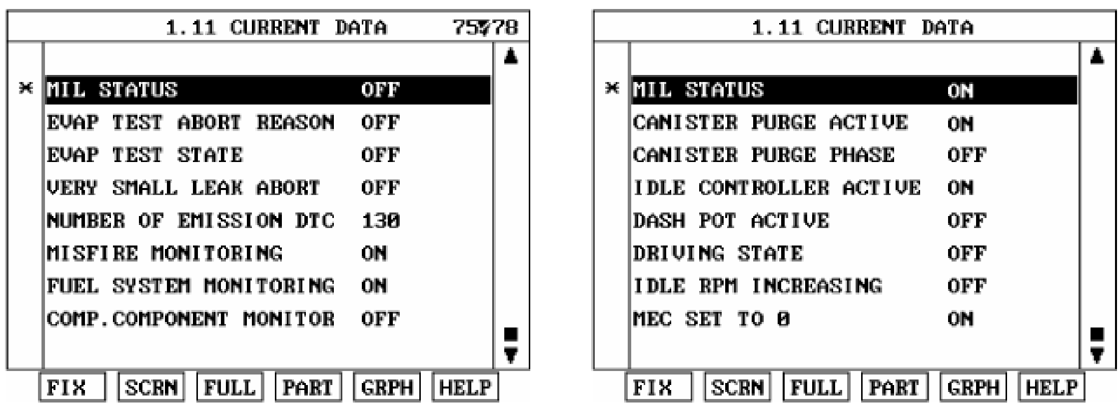
[CONNECTION INFORMATION]

Terminal	Connected to	Function
M08-3 (1)	IG ON	Power Supply (B+)
M08-3 (12)	PCM C144-1 (63)	MIL IND



MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Compare "Current data" on scantool with "Engine Warning Lamp" on cluster.



4. Is the current data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor's and/or PCM's connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection,bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and goto "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

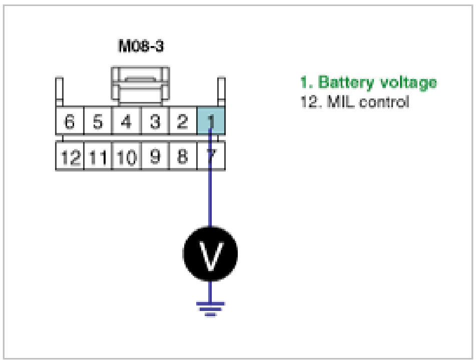
NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. IG "OFF" and disconnect Instrument cluster connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of instrument cluster harness connector and chassis ground.

Specification : Approx. B+



4. Is the measured voltage within specification?

YES

▸ Go to "Control Circuit Inspection" procedure.

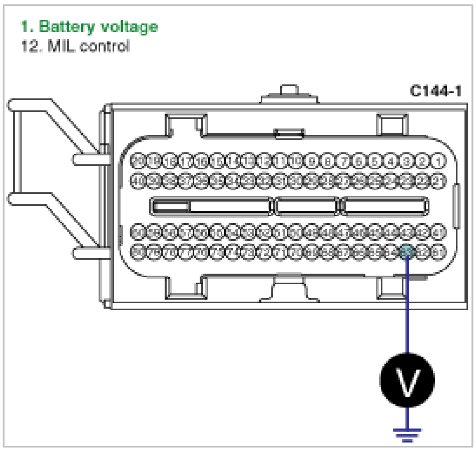
NO

▸ Check fuse between battery and instrument cluster for open or blown-off.
▸ Repair open or short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. IG "OFF" and disconnect PCM connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between 63 of PCM harness connector and chassis ground.

Specification : Approx. B+



4. Is the measured voltage within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Check open in Engine warning lamp's filament.
▸ Repair open or short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check instrument cluster

(1) IG "OFF"

(2) Substitute with a known - good instrument cluster and check for proper operation.

(3) Does it normally operate after replacement?

YES

▶ Replace instrument cluster and go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

Fuel System > Troubleshooting > P0651

GENERAL DESCRIPTION

ETC(Electronic Throttle Control Valve) is the device controlling amount of air to engine acccording to driver's intension. Different from the existing mechanical throttle valve which is composed of accelerator pecal and connecting wire cable, ETC consists of a motor, a throttle body and a throttle position sensor. Receiving input signals from electronic accelerator pedal module, PCM lets ETC motor control throttle valve. With ETC, cruise control system works without any additional device.

DTC DESCRIPTION

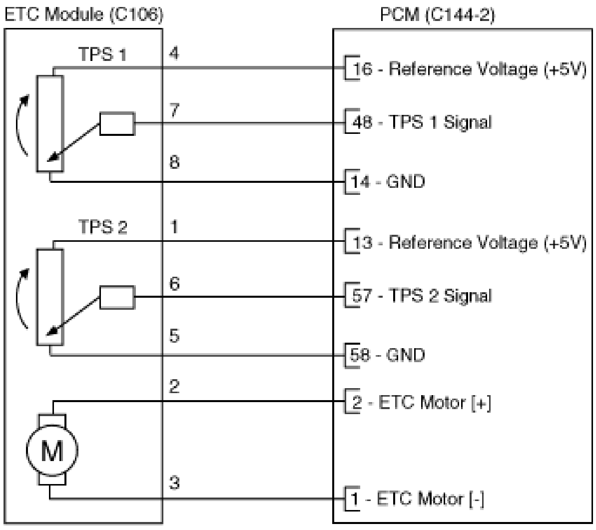
Checking the voltage from sensor power supply every 1.87 sec. under detecting condition, if the value within detecting condition lasts for more than 0.2 sec., PCM sets P0651. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Sensor reference voltage check	• Short in sensor power supply line • Faulty PCM
Enable condition	• Key "ON"	
threshold value	• Sensor supply power < 4.5V or > 5.5V	
diagnosis time	• Continuous (More than 0.2 seconds failure for every 1.87 seconds test)	
MIL ON condition	• 2 driving cycles	

SCHEMATIC DIAGRAM

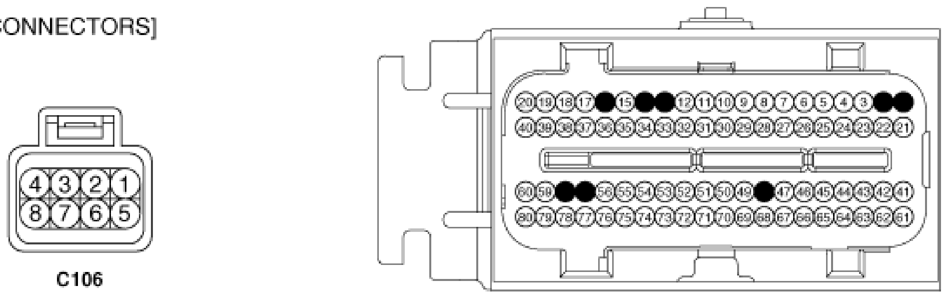
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Funtion
1	PCM C144-2 (13)	TPS 2 Reference Voltage (+5V)
2	PCM C144-2 (2)	ETC Motor [+] Control
3	PCM C144-2 (1)	ETC Motor [-] Control
4	PCM C144-2 (16)	TPS 1 Reference Voltage (+5V)
5	PCM C144-2 (58)	TPS 2 Ground
6	PCM C144-2 (57)	TPS 2 Signal
7	PCM C144-2 (48)	TPS 1 Signal
8	PCM C144-2 (14)	TPS 1 Ground

[HARNESS CONNECTORS]



C106

ETC MODULE

C144-2

PCM

MONITOR SCANTOOL DATA

1. Ignition "OFF"
2. Connect Scantool and Engine "ON"
3. Monitor "TPS1, TPS2" items on Current Data

Fig. 1

4. Are those related current data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor’s and/or PCM’s connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection,bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and goto "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

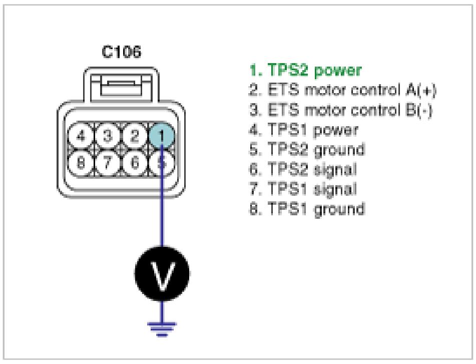
NO

▸ Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF".
   (2) Disconnect TPS connector.
   (3) IG "ON" and ENG "OFF"
   (4) Measure the voltage between terminal 1 of TPS harness connector and chassis ground.

Specification : Approx. 5V



   (5) Is the measured voltage within specification ?

YES

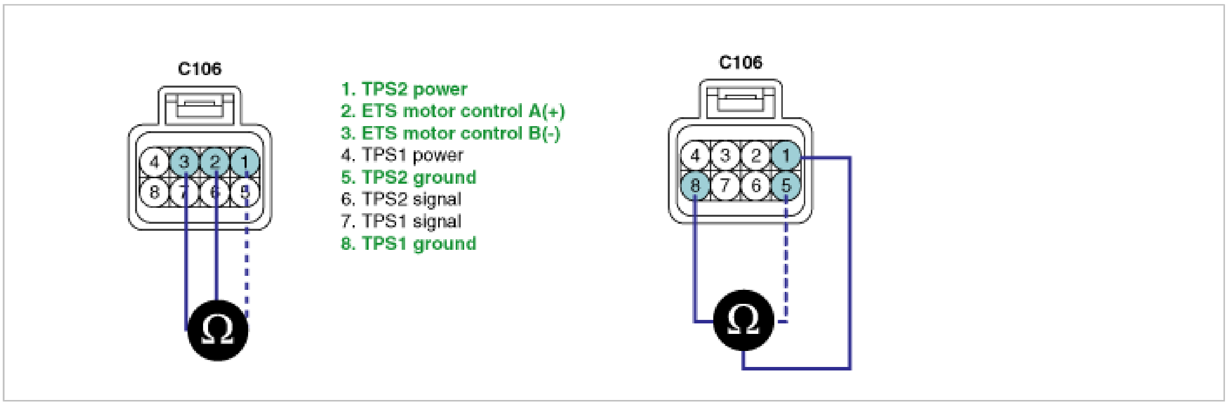
▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Go to "Check short in harness" as follows.

2. Check short in harness
   (1) IG "OFF".
   (2) Disconnect TPS connector and PCM connector.
   (3) Measure the resistance between terminal 1 and 2 of TPS harness connector.
   (4) Measure the resistance between terminal 1 and 3 of TPS harness connector.
   (5) Measure the resistance between terminal 1 and 5 of TPS harness connector.
   (6) Measure the resistance between terminal 1 and 8 of TPS harness connector.

Specification : Infinite



(7) Is the measured resistance within specification ?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Repair Short in power harness and go to "Verification of Vehicle Repair" procedure.

※ Procedure of ETS Initialization

1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10 second)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

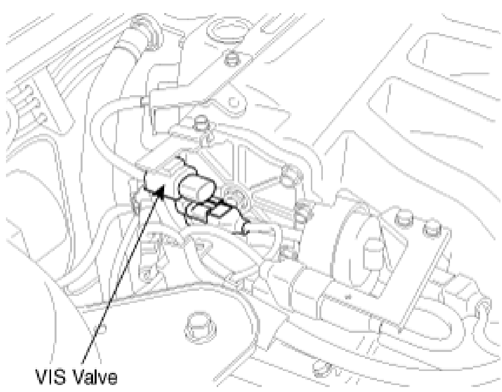
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0660

COMPONENT LOCATION



GENERAL DESCRIPTION

VIS(Variable intake system) is a device which varies the length of intake manifold to genetate maximum power at certain RPM. VIS lengthens intake manifold to improve the torque at low RPM when vehicle speed is low while it shortens intake manifold to raise torque at high RPM when vehicle speed is hign. PCU controlls VIS using RPM signal.

DTC DESCRIPTION

Checking the output voltage from VIS every 10 sec. under detecting condition, if the value within detecting condition lasts for more than 5 sec., PCM sets P0660. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

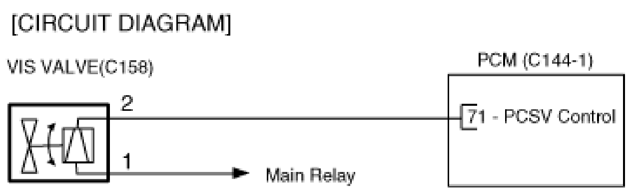
DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal low, high	• Poor connection • Open or short in VIS circuit • Faulty VIS • Faulty PCM
Enable condition	• After 0.5 sec under conditions below • Engine works • 11V ≤ Battery voltage ≤ 16V	
Threshold value	• Open or short	
Diagnosis time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL ON condition	• 2 driving cycles	

SPECIFICATION

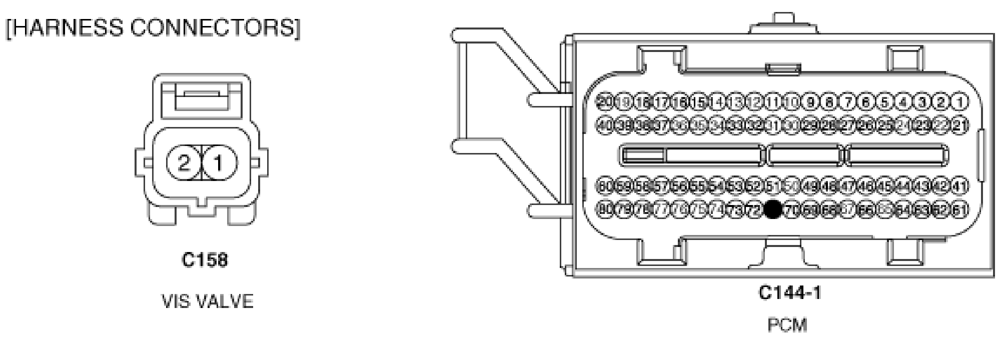
Item	Specification
Coil Resistance (Ω)	21.8 ~ 28.5Ω[22°C (71.6°F)]

SCHEMATIC DIAGRAM



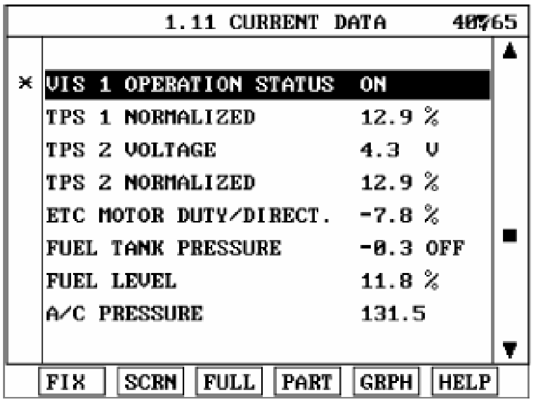
[CONNECTION INFORMATION]

Terminal	Connected to	Funtion
1	Main Relay	Battery voltage (B+)
2	PCM C144-1 (71)	VIS Valve control



MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "VIS 1" item on the service data.



VIS ON at idle

4. Is the related current data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor's and/or PCM's connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection,bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and goto "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

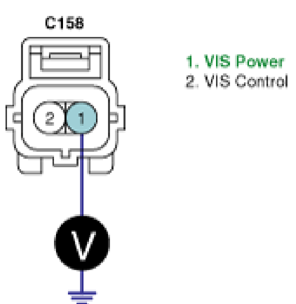
NO

▸ Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION

1. IG "OFF" and disconnect VIS connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of VIS harness connector and chassis ground.

Specification : Approx. B+



4. Is the measured voltage within specification?

YES

▸ Go to "Control Circuit Inspection" procedure.

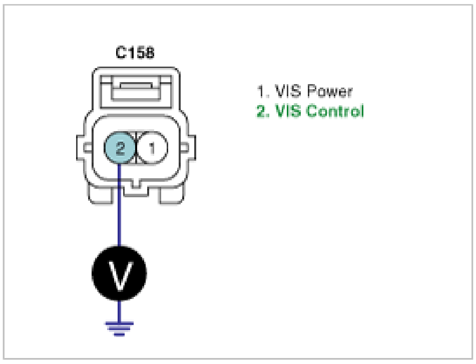
NO

▸ Check fuse connected to power of VIS for open or blown-off.
▸ Repair open or short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF" and disconnect VIS connector.
   (2) IG "ON" and ENG "OFF"
   (3) Measure voltage between terminal 2 of VIS harness connector and chassis ground.

Specification : Approx. 2.5V



   (4) Is the measured voltage within specification?

YES

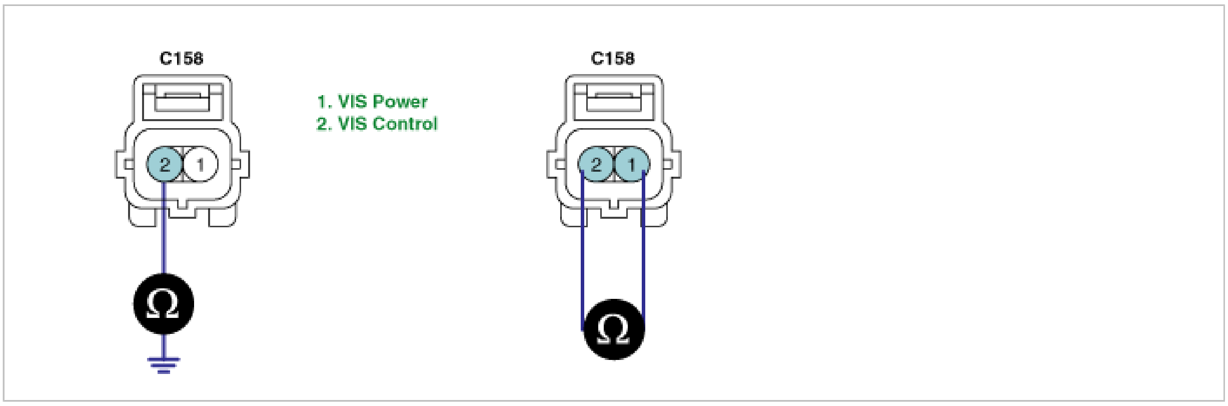
▸ Go to "Component Inspection" procedure.

NO

▸ Go to "Check short in harness" as follows.

2. Check short in harness
   (1) IG "OFF" and disconnect VIS connector and PCM connector.
   (2) Measure resistance between terminal 2 of VIS harness connector and chassis ground.
   (3) Measure resistance between terminals 1 and 2 of VIS harness connector.

Specification : Infinite



   (4) Is the measured resistance within specification?

YES

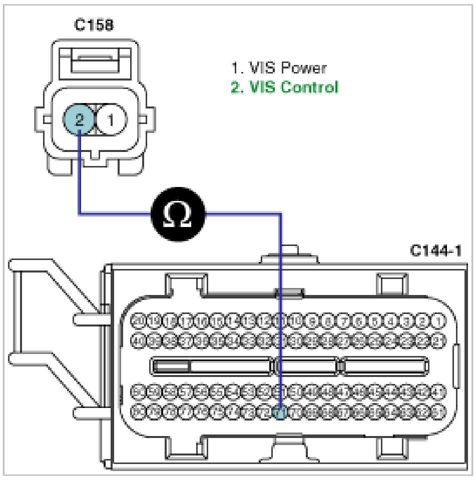
▸ Go to "Check open in harness" as follows.

NO

▸ Repair short in harness, and go to "Verification of Vehicle Repair" procedure.

3. Check open in harness
   (1) IG "OFF" and disconnect VIS connector and PCM connector.
   (2) Measure resistance between terminal 2 of VIS harness connector and terminal 71 of PCM harness connector.

Specification : Below 1Ω



(3) Is the measured resistance within specification?

YES

▸ Go to "Component Inspection" procedure.

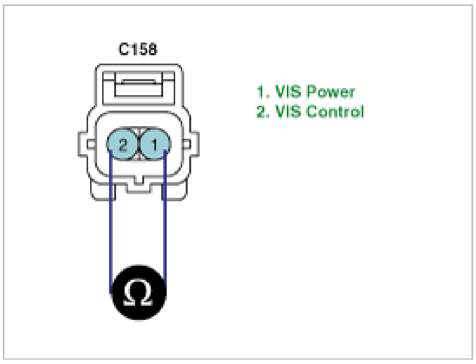
NO

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check VIS
   (1) IG "OFF" and disconnect VIS connector.
   (2) Measure resistance between terminals 1 and 2 of VIS connector.(Component side)

Specification : 21.8 ~ 28.5 Ω [22°C(71.6°F)]



(3) Is the measured resistance within specification?

YES

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good VIS and check for proper operation. If the problem is corrected, replace VIS and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions

4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

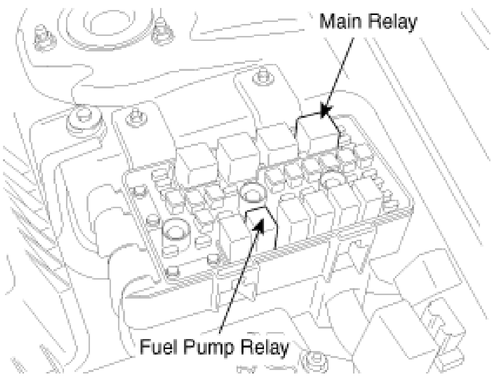
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P0685

COMPONENT LOCATION



GENERAL DESCRIPTION

One terminal of main relay is connected to battery and the other terminal which is ground point is conneted to PCM. PCM monitors the voltages flowing into main relay and going through it.

DTC DESCRIPTION

Checking the contolling state of main relay every 10 sec. under detecting condition, if open or short in the circuit is detected for more than 5 sec., PCM sets P0685.

DTC DETECTING CONDITION

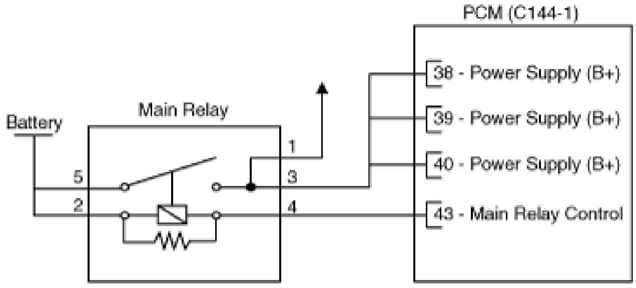
<table>
<tr><th>Item</th><th>Detecting Condition</th><th>Possible cause</th></tr>
<tr><td>DTC Strategy</td><td>• Detects a short to ground, to battery or open circuit on Main Relay output Fault information provided by an output driver chip.</td><td rowspan="5">• Poor Connection
• Open or short in control circuit.
• Main Relay
• PCM</td></tr>
<tr><td>EnableConditions</td><td>• Engine Running
• 11V ≤ Ignition Voltage ≤ 16V
• Enable Time delay ≥ 0.5sec.</td></tr>
<tr><td>Threshold value</td><td>• Open or Short</td></tr>
<tr><td>DiagnosisTime</td><td>• Contineous
(More than 5sec. Failure for every 10 sec. test)</td></tr>
<tr><td>MIL On Condition</td><td>• DTC only (NO MIL ON)</td></tr>
</table>

SPECIFICATION

Coil Resistance
70Ω ~ 120Ω

SCHEMATIC DIAGRAM

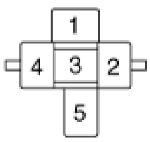
[CIRCUIT DIAGRAM]



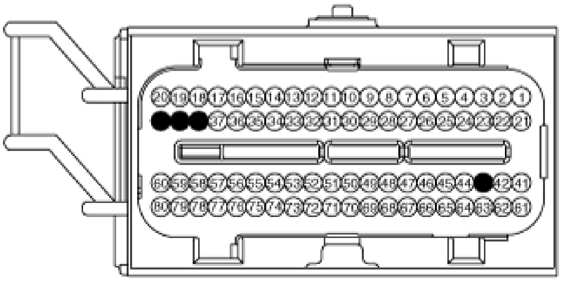
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	-	Power Supply (B+)
2	Battery	Battery Power (B+)
3	PCM C144-1 (38) PCM C144-1 (39) PCM C144-1 (40)	Power Supply (B+)
4	PCM C144-1 (43)	Main Relay Control
5	Battery	Battery Power (B+)

[HARNESS CONNECTOR]



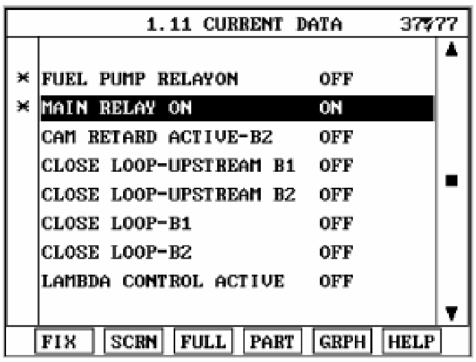
Main Relay



C144-1
PCM

MONITOR SCANTOOL DATA

1. Connect scantool to DLC(Data Link Connector)
2. Warm up the engine to normal operating temperature.
3. Monitor "Main Relay" parameter on scantool.



4. Is the "Main Relay" parameter displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

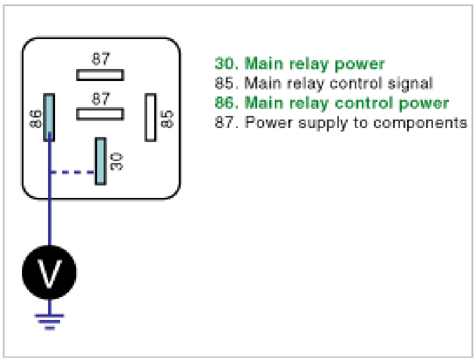
NO

▸ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSEPCTION

1. IG "OFF"
2. Disconnect Main Relay
3. IG "ON" & ENG "OFF".
4. Measure voltage between harness terminal 2 of Main Relay and chassis ground.
5. Measure voltage between harness terminal 5 of Main Relay and chassis ground.

Specification : B+



6. Is the measured voltage within specification ?

YES

▸ Go to "Control Circuit Inspecition" procedure.

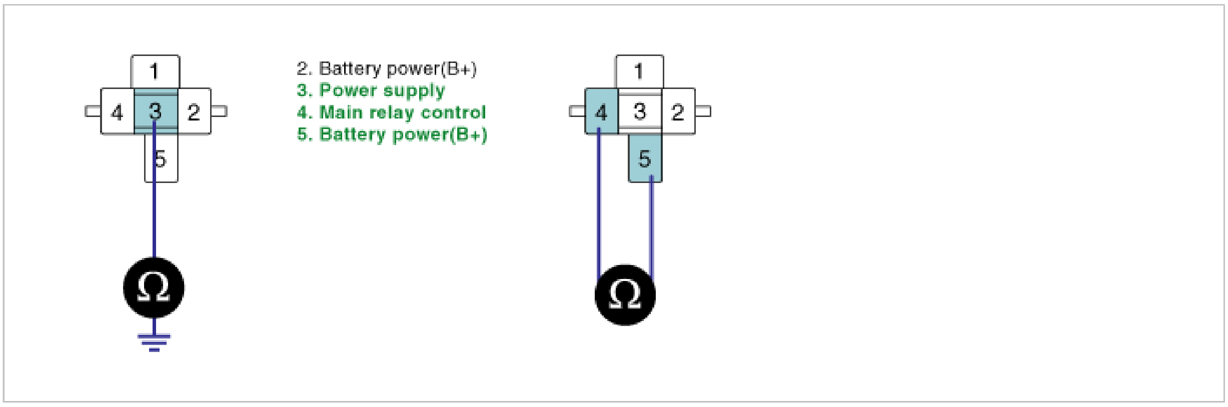
NO

▸ Check fuse between battery and main relay is disconnected.
▸ Repair or replace open or short in harness and then go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check short in coil control
   (1) IG "OFF".
   (2) Disconnect Main Relay and PCM connector.
   (3) Measure resistance between harness terminal 4 and chassis ground.
   (4) Measure resistance between harness terminal 4 and 5 of Main Relay.

   Specification : Infinite



   (5) Is the measured resistance within specification ?

   YES

   ▸ Go to "Check open in coil control" as follows.

   NO

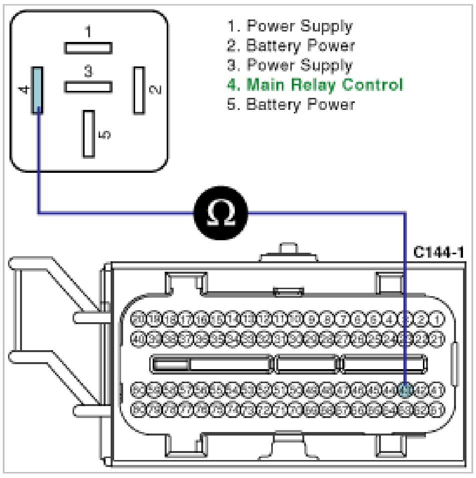
   ▸ Repair or replace as necessary and then go to " Verification of Vehicle Repair" procedure.

2. Check open in coil control
   (1) IG "OFF".

(2) Disconnect Main Relay and PCM connector.

(3) Measure resistance between harness terminal 4 of Main Relay and harness terminal 43/C144-1 of PCM harness connector.

Specification : Approx. below 1Ω



(4) Is the measured resistance within specifications ?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check Main Relay

(1) IG "OFF"

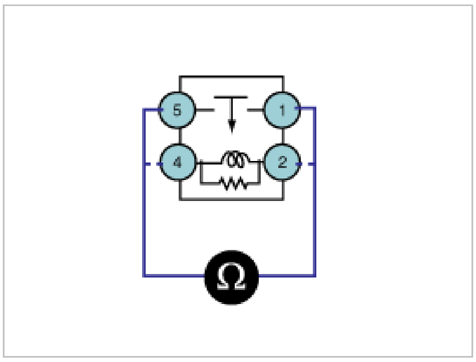
(2) Disconnect Main Relay

(3) Measure resistance between terminal 5 and 3 of Main Relay

(4) Measure resistance between terminal 4 and 2 of Main Relay.

Specification :

Terminal	continuity
3 ~ 5	NO
2 ~ 4	YES (Approx. 70Ω ~ 120Ω)



(5) Is the measured reisistance within specification ?

YES

▸ Substitute with a known - good PCM and check for proper operation.
If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by

PCM.

NO

▸ Substitute with a known - good Main Relay and check for proper operation.
If the problem is corrected, replace Main Relay and go to "Verification of Vehicle Repair"procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

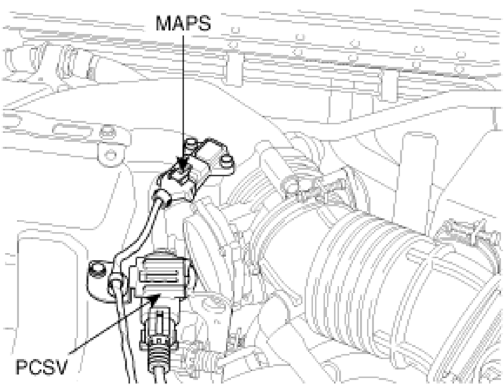
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P1106

COMPONENT LOCATION



GENERAL DESCRIPTION

The amount of intake air flow must be inputted to PCM in order to determine the fuel injection quantity. To measure the pressure inside of intake manifold, MAFS is used at idle and MAPS is required at accelerating. MAPS(Manifold Absolute Pressure) calculates the amount of air indirectly as measuring the pressure inside of intake manifold. This mechanism is alsl called Speed-Density Type.MAPS transfers analog output signal which is proportional to the change of intake manifold pressure, then, with this signal and RPM, PCM calculates the amount of intake air flow. MAPS is mounted on surge tank to measure the pressure inside of intake manifold, and it consists of a piezo electric element and hybrid IC which amplifies output signal from the element. A piezo electric element is a sort of a diaphragm using piezo electric effect. One side of the diaphragm is surrounded with vacuum chamber while intake pressure is applied to the other side. Thus, signals are output by the transformation of diagphragm according to the change of pressure inside of intake manifold.

DTC DESCRIPTION

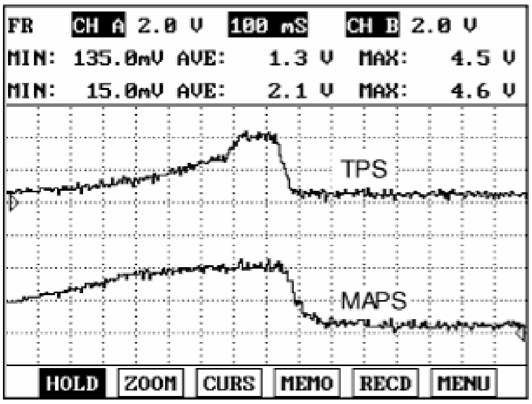
Checking output signals of MAPS every 60 sec. under detecting condition, if an output signal is above 4.5V for more than 2 sec., PCM sets P1106.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible Cause
DTC Strategy		• This code detects a intermittent short to high in either the signal circuit or the MAP sensor	
		• No TPS Active Fault Present	

EnableConditions	Case 1	• No TPS Short Fail Criteria Met • Engine Speed < 2500rpm • Throttle Position ≤ 30%	• Poor connection • Short to batteryin signal circuit • Open in groundcircuit • Faulty MAPS • Faulty PCM
	Case 2	• No TPS Active Fault Present • No TPS Short Fail Criteria Met • Engine Speed > 2500rpm • Throttle Position > 40%	
Threshold value		• MAP signal > 4.5V	
Diagnosis Time		• Continuous (More than 2 sec. failure for every 60 sec. test)	
MIL On Condition		• DTC only (NO MIL ON)	

SIGNAL WAVEFROM AND DATA



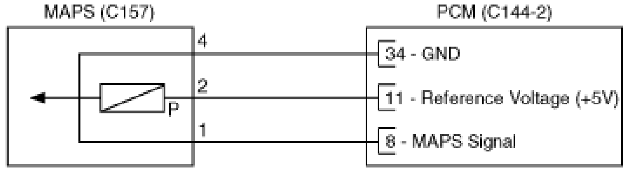
Comparing MAPS and TPS, The signals of MAPS and TPS increasess and decrease simultaneously.

SPECIFICATION

Pressure(kPa)	20	35	60	95	101.32
Voltage(V)	0.789	1.382	2.369	3.75	4
Allowable error(V)	± 0.045				

SCHEMATIC DIAGRAM

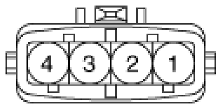
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

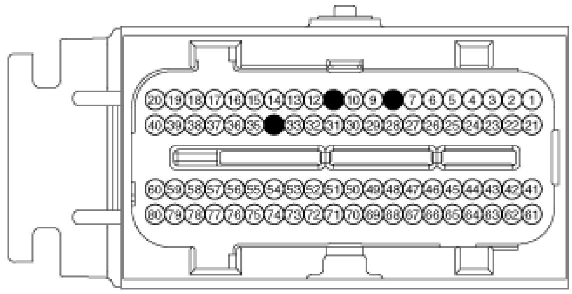
Terminal	Connected to	Funtion
1	PCM C144-2 (8)	MAPS Signal
2	PCM C144-2 (11)	Reference Voltage (+5V)
3	-	-
4	PCM C144-2 (34)	Sensor ground

[HARNESS CONNECTORS]



C157

MAPS

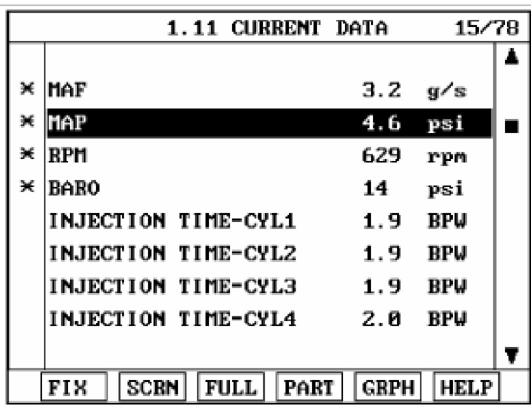


C144-2

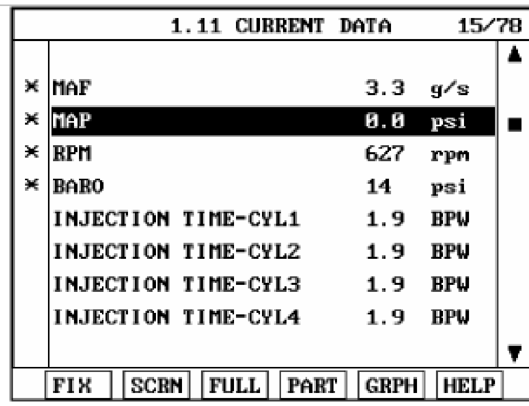
PCM

MONITOR SCANTOOL DATA

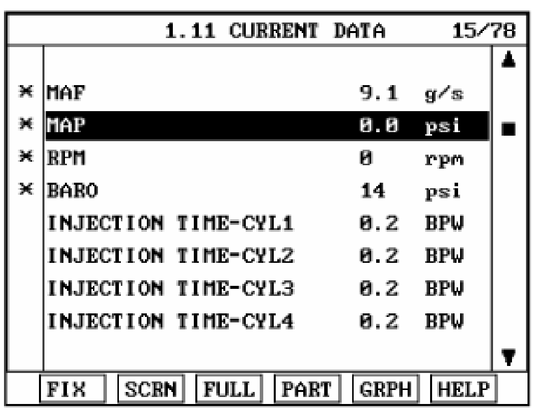
1. Connect scantool to Data Link Connector (DLC)
2. Warm up engine to normal operating temperature
3. Monitor "MAPS" parameter on the scantool.



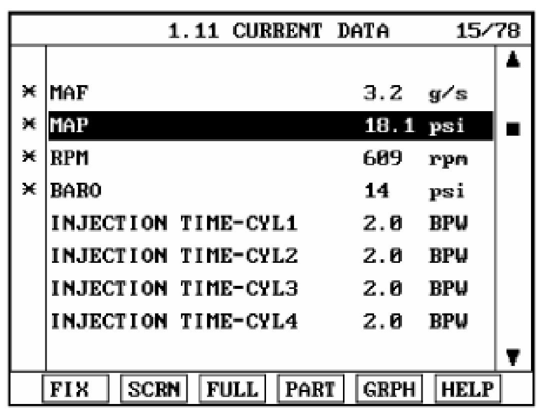
normal at idle



open



short to ground



short to 5V line

4. Is the current data displayed correctly ?

YES

▸Fault is intermittently caused by poor contact in the sensor and/or PCM connector or non cleared PCM memory after repair. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace if necessary and go to "Verification of vehicle Repair" .

NO

▶Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found ?

YES

▶ Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure

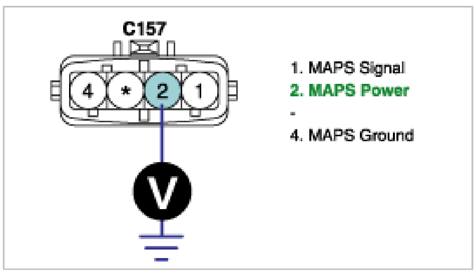
NO

▶ Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION

1. IG "OFF"
2. Disconnect MAPS connector
3. IG "ON"
4. Measure the voltage between terminal 2 of MAPS harness connector and ground.

Specification : Approx. 5V



5. Is the measured voltage within specification ?

YES

▶ Go to "Ground Circuit Inspection" procedure.

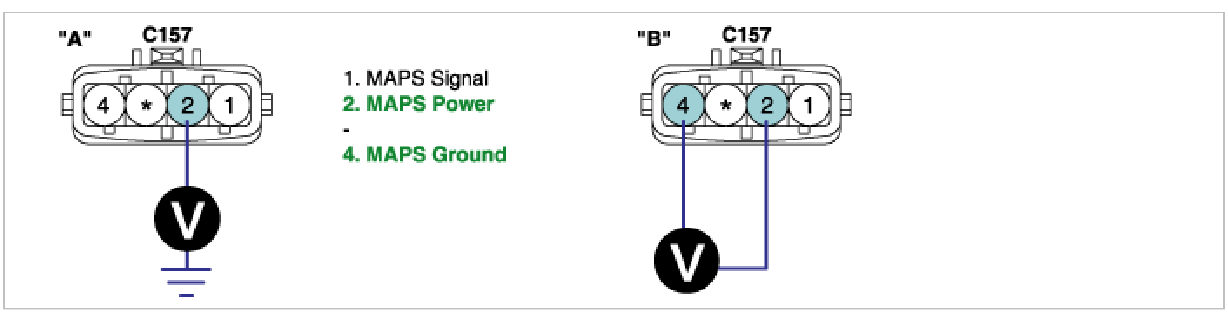
NO

▶ If the voltage is over 5.1V, check short to battery in harness.
▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF".
2. Disconnect MAPS connector.
3. IG "ON" & ENG "OFF"
4. Measure the voltage between terminal 2 of MAPS harness connector and chassis ground.
5. Measure the voltage between terminal 2 and 4 of MAPS harness connector.

Specification : "A" - "B" = : Approx. below 200mV



6. Is the measured voltage within specification ?

YES

▸ Go to "Signal Circuit Inspection" procedure.

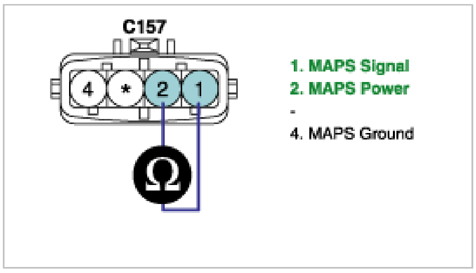
NO

▸ Repair contact reistance or open in harness and then go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. IG "OFF"
2. Disconnect MAPS and PCM connector.
3. Measure resistance between terminal 1 and 2 of MAPS harness connector.

Specification : Infinite



4. Is the measured resistance within specification ?

YES

▸ Go to "Component inspection" procedure.

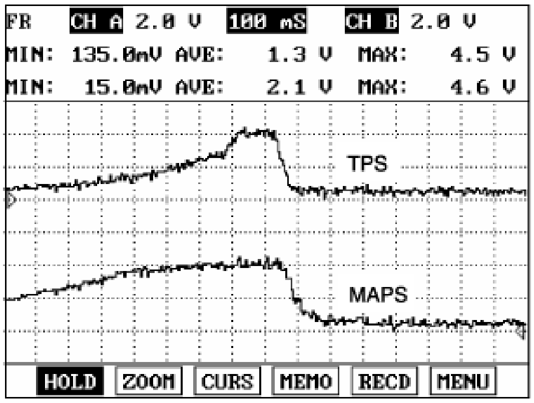
NO

▸ Repair contact reistance or open in harness and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. MAPS performance test
   (1) IG "OFF"
   (2) Connect scantool to Data Link Connector(DLC) and selest "Oscilloscope" then, connect probes to output signal lines of MAPS and TPS.Turn engine "ON" and monitor the waveforms accelerating or decelerating
   (3) Start engine and monitor signal waveform during accelleration and decelleration.
   Specificaton :

Pressure (kPa)	20	35	60	95	101.32
Voltage (V)	0.789	1.382	2.369	3.75	4
Tolerance (V)	± 0.045				



   (4) Is the waveform displayed correctly?(Compare the response time of TPS and MAPS)

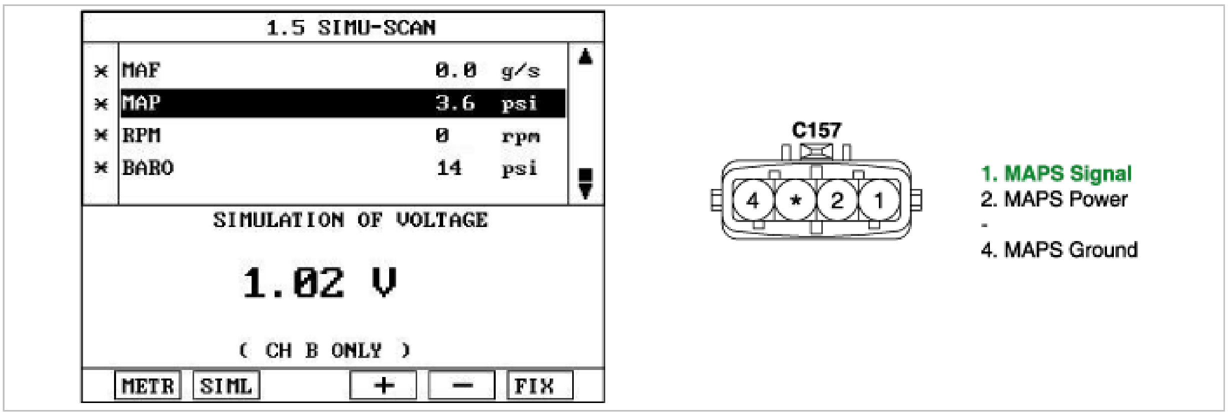
YES

▸ Go to "Check PCM".

NO

▸ After replacing MAPS with new one, if it operates normally, replace MAPS and go to "Verification of Vehicle Repair".

2. Check PCM
   (1) IG "OFF" and disconnect MAPS connector.
   (2) Connect scantool and IG "ON" & ENG "OFF"
   (3) Select simulation function on scantool.
   (4) Simulate voltage at terminal 1 of MAPS harness connector.



   (5) Does the output voltage response to the change of signal by simulation?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

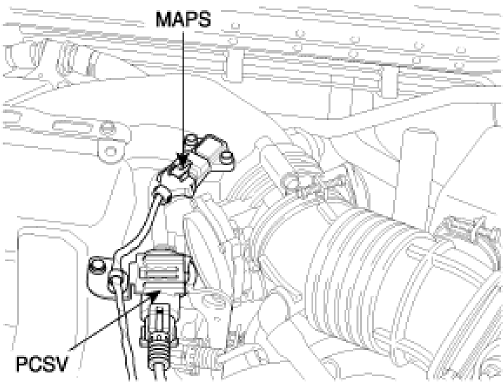
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P1107

COMPONENT LOCATION



GENERAL DESCRIPTION

The amount of intake air flow must be inputted to PCM in order to determine the fuel injection quantity. To measure the pressure inside of intake manifold, MAFS is used at idle and MAPS is required at accelerating. MAPS(Manifold Absolute Pressure) calculates the amount of air indirectly as measuring the pressure inside of intake manifold. This mechanism is alsl called Speed-Density Type.MAPS transfers analog output signal which is proportional to the change of intake manifold pressure, then, with this signal and RPM, PCM calculates the amount of intake air flow. MAPS is mounted on surge tank to measure the pressure inside of intake manifold, and it consists of a piezo electric element and hybrid IC which amplifies output signal from the element. A piezo electric element is a sort of a diaphragm using piezo electric effect. One side of the diaphragm is surrounded with vacuum chamber while intake pressure is applied to the other side. Thus, signals are output by the transformation of diagphragm according to the change of pressure inside of intake manifold.

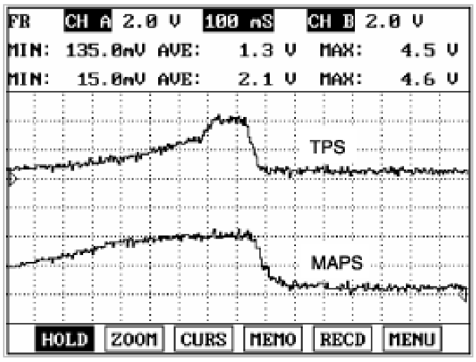
DTC DESCRIPTION

Checking output signals of MAPS every 60 sec. under detecting condition, if an output signal is below 0.25V for more than 2 sec., PCM sets P1107.

DTC DETECTING CONDITION

<table>
<tr><th colspan="2">Item</th><th>Detecting Condition</th><th>Possible Cause</th></tr>
<tr><td colspan="2">DTC Strategy</td><td>• This code detects a intermittent short to low or open in either the signal circuit or the MAP</td><td rowspan="6">• Poor Connection
• Open or Short to ground in Power Circuit
• Open or short to ground in Signal Circuit.
• Faulty MAPS
• Faulty PCM</td></tr>
<tr><td rowspan="2">Enable Conditions</td><td>Case 1</td><td>• No TPS Active Fault Present
• No TPS Short Fail Criteria Met
• Ignition Voltage ≥ 11V
• Engine Speed < 1000rpm
• Throttle Position ≤ 0%</td></tr>
<tr><td>Case 2</td><td>• No TPS Active Fault Present
• Ignition Voltage ≥ 11V
• Engine Speed > 1000rpm
• Throttle Position > 30%</td></tr>
<tr><td colspan="2">Threshold value</td><td>• MAP signal < 0.25V</td></tr>
<tr><td colspan="2">Diagnosis Time</td><td>• Continuous
(More than 2 sec. failure for every 60 sec. test)</td></tr>
<tr><td colspan="2">MIL On Condition</td><td>• DTC only (NO MIL ON)</td></tr>
</table>

SIGNAL WAVEFORM AND DATA

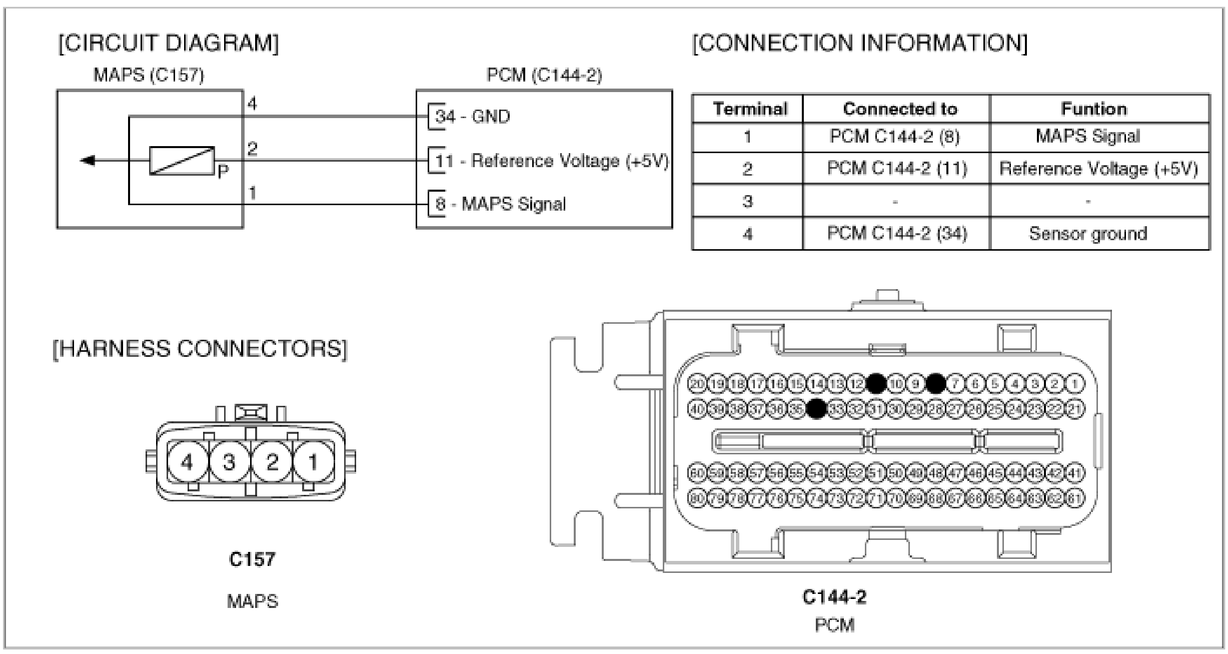


Comparing MAPS and TPS, The signals of MAPS and TPS increasess and decrease simultaneously.

SPECIFICATION

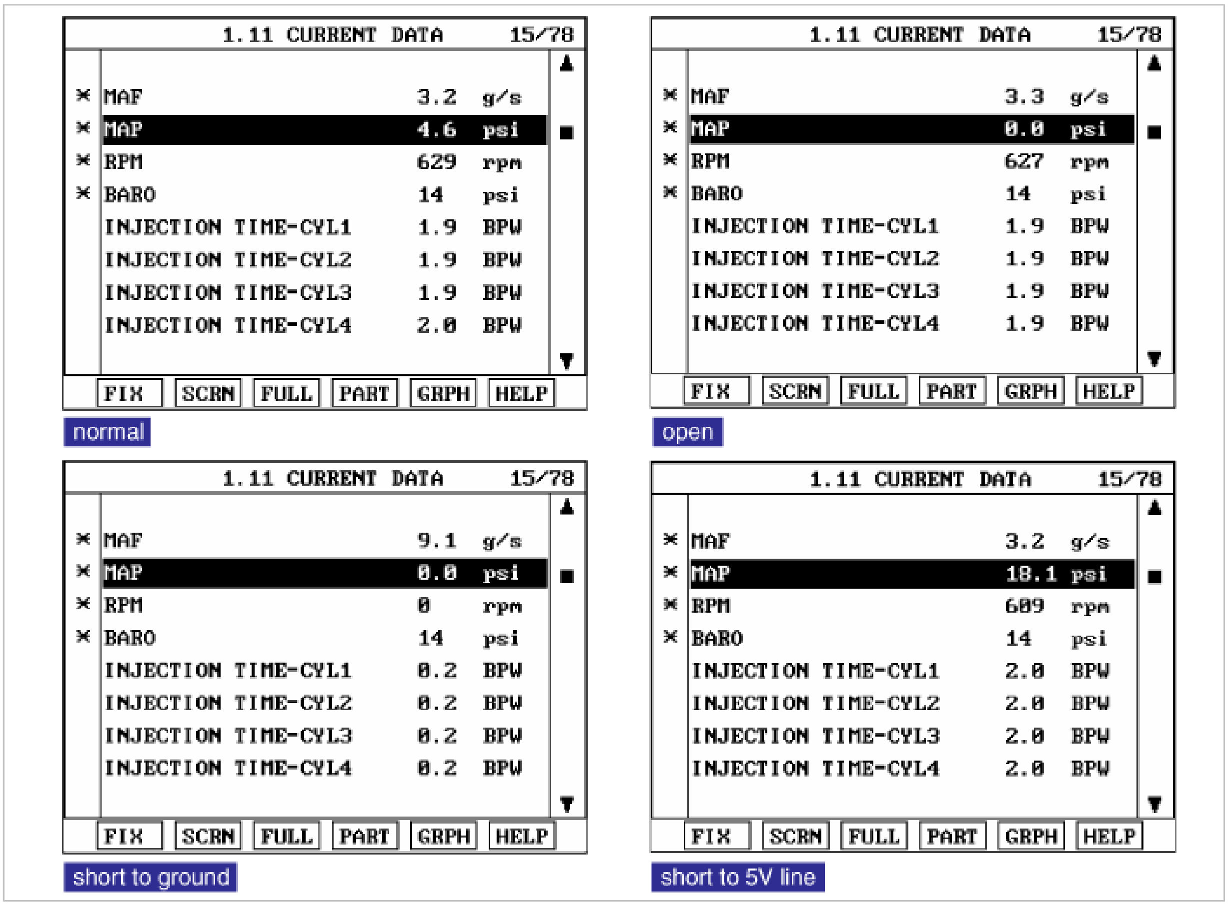
Pressure(kPa)	20	35	60	95	101.32
Voltage(V)	0.789	1.382	2.369	3.75	4
Allowable error(V)	± 0.045				

SCHEMATIC DIAGRAM



MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector (DLC)
2. Warm up engine to normal operating temperature
3. Monitor "MAPS" parameter on the scantool.



4. Is the current data displayed correctly ?

YES

▸ Fault is intermittently caused by poor contact in the sensor and/or PCM connector or non cleared PCM memory after repair. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace if necessary and go to "Verification of vehicle Repair" .

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure

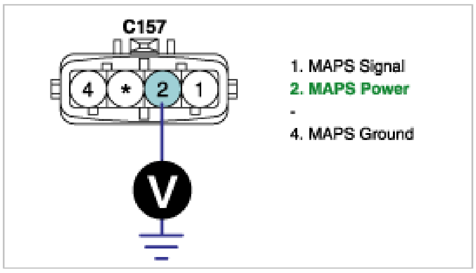
NO

▸ Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION

1. IG "OFF"
2. Disconnect MAPS connector.
3. IG "ON"
4. Measure the voltage between terminal 2 of MAPS harness connector and ground.

Specification : Approx. 5V



5. Is the measured voltage within specification ?

YES

▸ Go to "Signal Circuit Inspection" of MAPS.

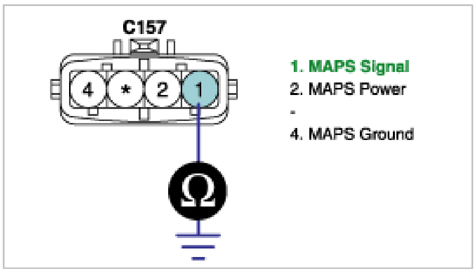
NO

▸ After repairing open or short to ground in harness and go to "Verification of Vehicle Repair"

SIGNAL CIRCUIT INSPECTION

1. Check short to ground in harness
   (1) IG "OFF"
   (2) Disconnect MAPS and PCM connector.
   (3) Measure the resistance between terminal 1 of MAPS harness connector and ground.

   Specification : Infinite



   (4) Is the measured resistance within the specification?

   YES

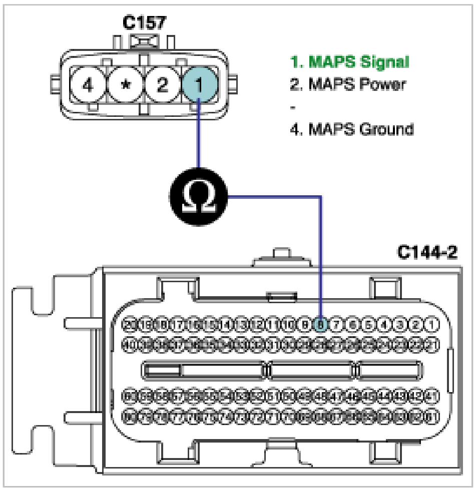
   ▸ Go to "Check open in the harness" of MAPS.

   NO

   ▸ After repairing short to ground in circuits and go to "Verification of Vehicle Repair"

2. Check open in the harness
   (1) IG "OFF"
   (2) Disconnect MAPS and PCM connector.
   (3) Measure the resistance between terminal 1 of MAPS harness connector and terminal 8/C144-2 of PCM harness connector

   Specification : Approx. below 1 Ω



(4) Is the measured resistance within the specification?

YES

▸ Go to "Component Inspection" of MAPS.

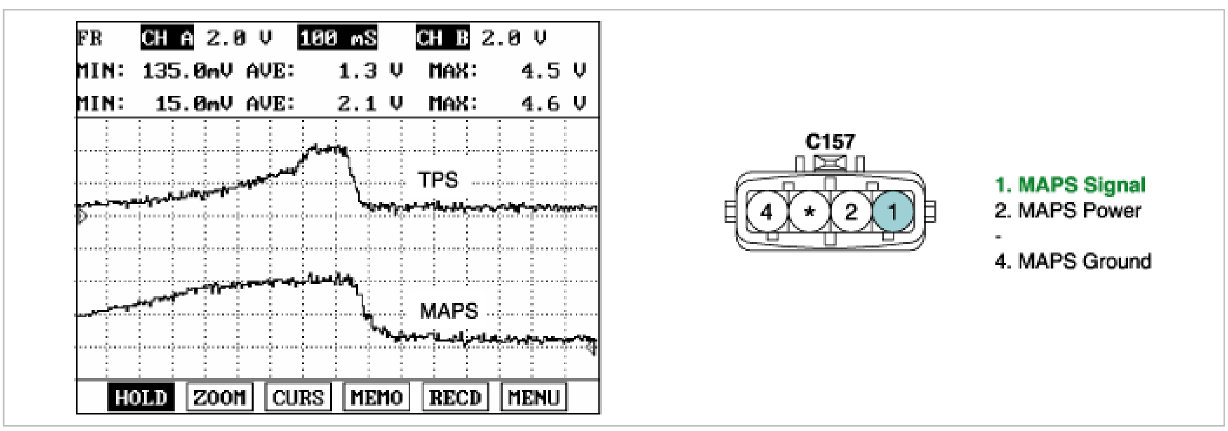
NO

▸ Repair open in the harness and go to "Verification of Vehicle Repair".

COMPONENT INSPECTION

1. MAPS performance test
   (1) IG "OFF"
   (2) Connect scantool to Data Link Connector(DLC) and selest "Oscilloscope" then, connect probes to output signal lines of MAPS and TPS.Turn engine "ON" and monitor the waveforms accelerating or decelerating
   (3) ENG "ON" and monitor signal waveform during accelleration and decelleration.
   Specificaton :

Pressure (kPa)	20	35	60	95	101.32
Voltage (V)	0.789	1.382	2.369	3.75	4
Tolerance (V)	± 0.045				



   (4) Is the waveform displayed correctly?(Compare the response time of TPS and MAPS)

YES

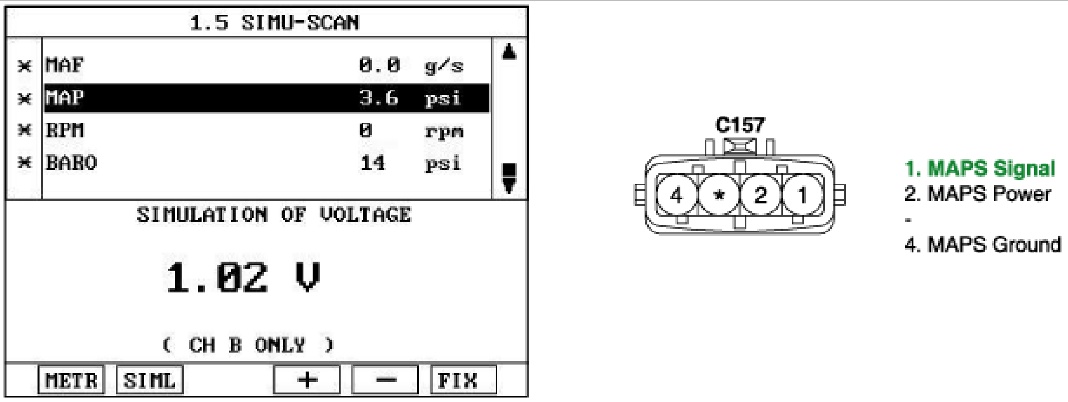
▸ Go to "Check PCM".

NO

▸ After replacing MAPS with new one, if it operates normally, replace MAPS and go to "Verification of Vehicle Repair".

2. Check PCM
   (1) IG "OFF" disconnect MAPS connector
   (2) Connect Scantool and IG "ON" & ENG "OFF"
   (3) Select simulation function on scantool.

(4) Simulate voltage at terminal 1 of MAPS harness connector.



(5) Does the output voltage response to the change of signal by simulation?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

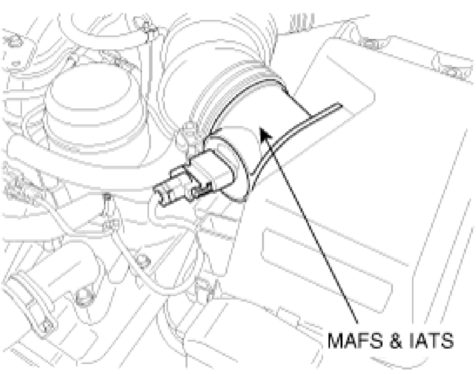
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P1111

COMPONENT LOCATION



GENERAL DESCRIPTION

The Intake Air Temperature (IAT) sensor measures the temperature of engine intake air. The Intake Air Temperature (IAT) sensor is a thermistor (a variable resistor that changes along with outside air temperature) in series with a fixed resistor in the PCM. The PCM applies 5V to the IAT sensor. The PCM monitors the voltage across the IAT sensor and converts it into a temperature reading. When the outside air temperature is cold the IAT sensor resistance is high, and when the outside air temperature is warm the IAT sensor resistance is low. Therefore, when the air temperature is cold the PCM will receive a high voltage input, and when the air temperature is warm the PCM will receive a low voltage input. The signal from IAT sensor is used for injection time correction, ignition timing correction and idle speed correction(Air-density correction).

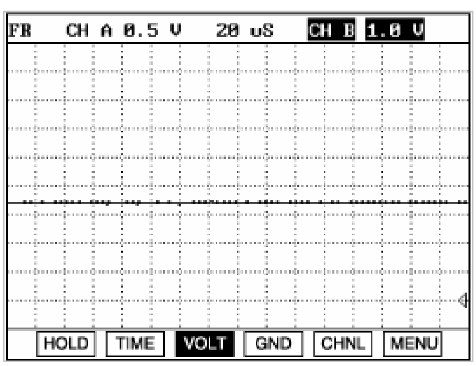
DTC DESCRIPTION

Checking output signals of IATS every 120 sec. under detecting condition, if an ouput signal is over 4.9V for more than 4 sec., PCM sets P1111.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible Cause
DTC Strategy		• This code detects a continuous short to high in either the signal circuit or the sensor	• Poor Connection • Open or short in signal circuit • Open in ground circuit • Faulty IATS • Faulty PCM
Enable Conditions	Case 1	• No VSS Fault Active (No P0501) • No Coolant Short Active Fault Present • No MAF Active Fault Present • Engine Air Flow < 15 g/s • Vehicle Speed < 25kph • Engine Coolant Temperature > 50°C(122 °F) • Engine Running Time > 120 sec.	
	Case 2	• No VSS Fault Active (No P0501) • No Coolant Short Active Fault Present • No MAF Active Fault Present • Engine Air Flow < 15 g/s • Vehicle Speed < 25kph • Ignition off time > 360 min. • Engine Coolant Temperature > -10°C(14 °F) • Engine Running	
Threshold value		• IATS signal > 4.9V	
Diagnosis Time		• Continuous (More than 4 sec. failure for every 120 sec. test)	
MIL On Condition		• DTC only (NO MIL ON)	

SIGNAL WAVEFORM AND DATA



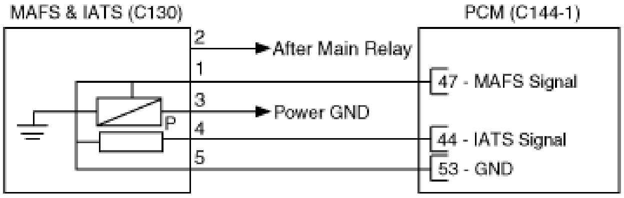
The output signals of IATS & ECTS change smoothly without any rapid changes. Those have almost same characteristic signal during the early period after start. It means that the temperatures of intake air and engine coolant are depended on the temperature of atmosphere. Meanwhile, during the warming up, the output signal of ECTS is going up increasingly. but, the output signal of IATS changes a little bit. even it may not change almost. It means that the heat of engine does not affect on the temperature of intake air.

SPECIFICATION

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	95.95 ~ 105.78	20(68)	3.42 ~ 3.61
-20(-4)	27.4 ~ 29.77	40(104)	1.43 ~ 1.5
0(32)	9.08 ~ 9.72	60(140)	0.66 ~ 0.69
10(50)	5.49 ~ 5.83	80(176)	0.33 ~ 0.34

SCHEMATIC DIAGRAM

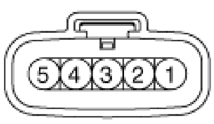
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

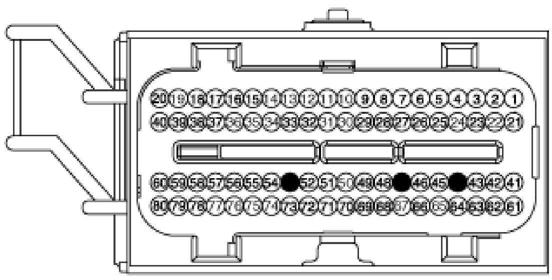
Terminal	Connected to	Funtion
1	PCM C144-1 (47)	MAFS Signal
2	Main Relay	Battery Voltage (B+)
3	Chassis Ground	Ground
4	PCM C144-1 (44)	IATS Signal
5	PCM C144-1 (53)	Sensor Ground

[HARNESS CONNECTORS]



C130

MAFS & IATS



C144-1

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "IATS" item on the service data.

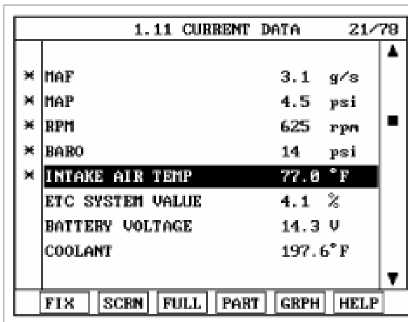


Fig. 1

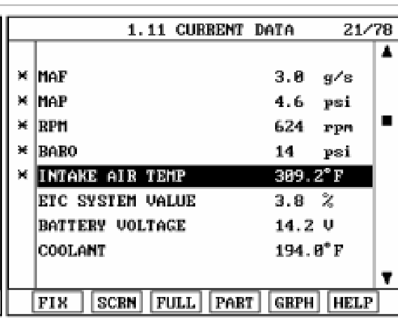


Fig. 2

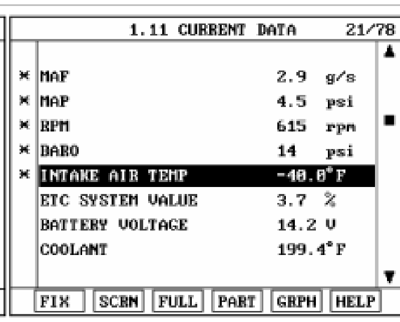


Fig. 3

Fig. 1 : Open at idle
Fig. 2 : Short to ground
Fig. 3 : Short to battery

4. Is the "IATS" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

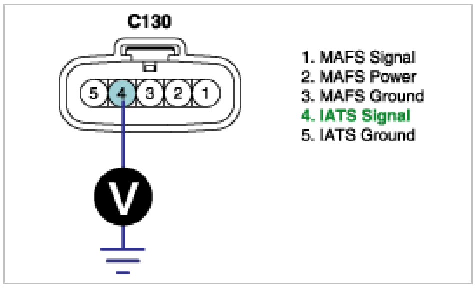
NO

▸ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF" and disconnect IATS connector.
   (2) IG "ON" and ENG "OFF"
   (3) Measure voltage between terminal 4 of IATS harness connector and chassis ground.

Specification : Approx. 5V



   (4) Is the measured voltage within specification ?

YES

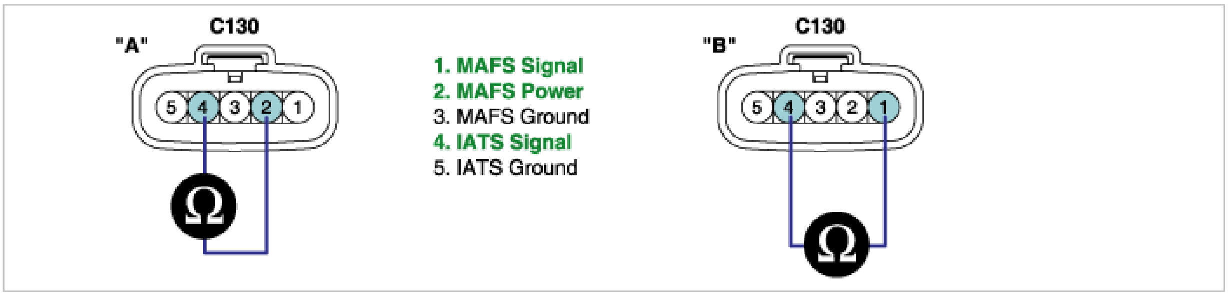
▸ Go to "Ground Circuit Inspection" procedure.

NO

▸ If the voltage is 0V, go to "Check open in harness" as follows. If the voltage is more than 5.1V, go to "Check short to battery in harness" as follows.

2. Check short to battery in harness
   (1) IG "OFF" and disconnect IATS connector and PCM connector.
   (2) Measure resistance between terminals 2 and 4 of IATS harness connector.
   (3) Measure resistance between terminals 1 and 4 of IATS harness connector.

Specification : Infinite



   (4) Is the measured resistance within specification?

YES

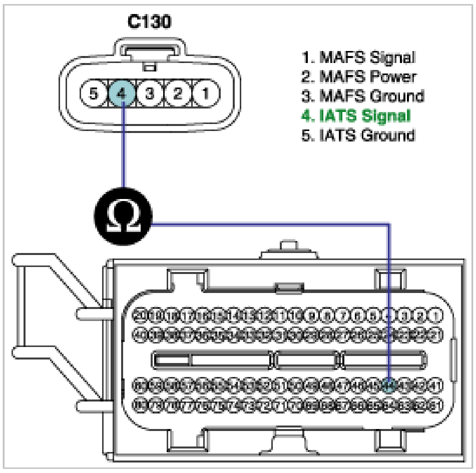
▸ Go to "Component Inspection" procedure.

NO

▸ Repair short to battery in harness and go to "Verification of Vehicle Repair" procedure.

3. Check open in harness
   (1) IG "OFF" and disconnect IATS connector and PCM connctor.
   (2) Measure resistance between terminal 4 of IATS harness connector and 44 of PCM harness connector.

Specification : below 1Ω



   (3) Is the measured resistance within specification?

YES

▸ Go to "Ground Circuit Inspection" procedure.

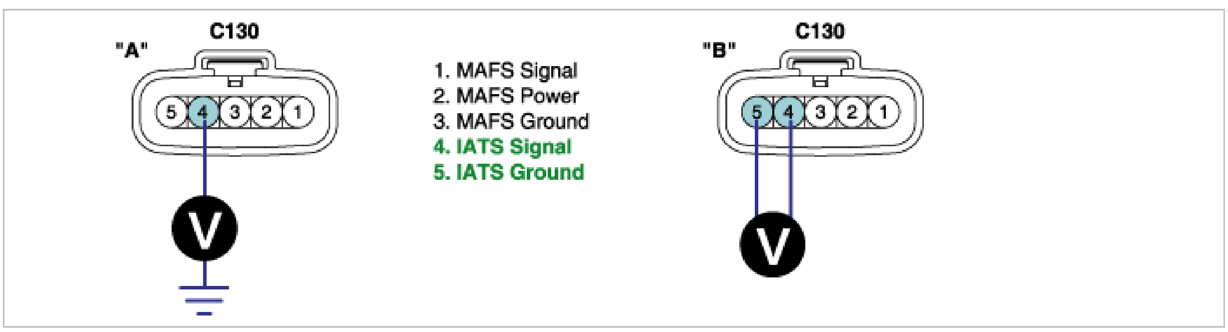
NO

▸ Repair open in harness and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF" and disconnect IATS connector.
2. Measure voltage between terminal 4 of IATS harness connector and chassis ground.
3. Measure voltage between terminals 4 and 5 of IATS harness connector.

Specification : Voltage difference between measurement "A" and "B" is below 200mV.



4. Is the measured voltage within specification ?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair contact resistance or open in harness and go to "Verification of Vehicle Repair" procedure.

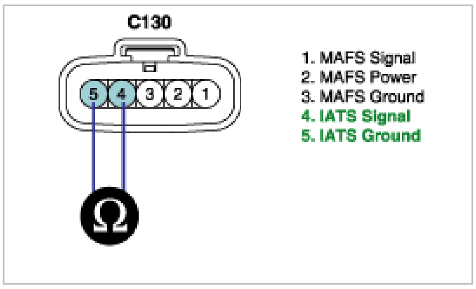
COMPONENT INSPECTION

1. Check IATS
   (1) IG "OFF" and disconnect IATS connector.
   (2) Measure resistance between teminals 4 and 5 of IATS connector.(Component side)

Specificaton :

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)

-40(-40)	95.95 ~ 105.78	20(68)	3.42 ~ 3.61
-20(-4)	27.4 ~ 29.77	40(104)	1.43 ~ 1.5
0(32)	9.08 ~ 9.72	60(140)	0.66 ~ 0.69
10(50)	5.49 ~ 5.83	80(176)	0.33 ~ 0.34



(3) Is the measured resistance within specification ?

YES

▸ Go to "Check PCM" as follows.

NO

▸ Substitute with a known - good IATS and check for proper operation. If the problem is corrected, replace IATS and go to "Verification of Vehicle Repair" procedure.

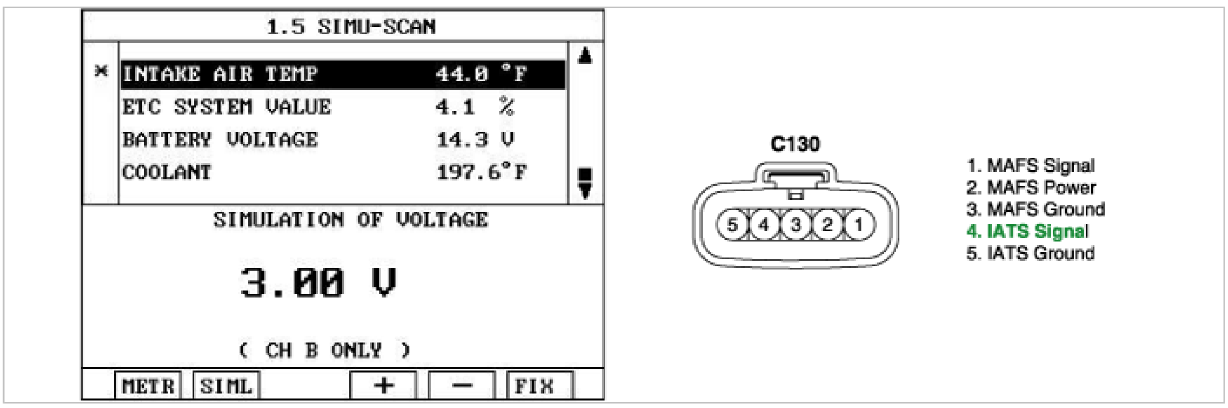
2. Check PCM

(1) IG "OFF" and connect scantool.

(2) Disconnect IATS connector and connect probe to terminal 4 of IATS harness connector.

(3) IG "ON" and ENG "OFF" and simulation Function on scantool.

(4) Simulate voltage at terminal 4 of IATS harness connector.



(5) Does the signal value of IAT sensor change according to simulation voltage ?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs

3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P1112

COMPONENT LOCATION

GENERAL DESCRIPTION

The Intake Air Temperature (IAT) sensor measures the temperature of engine intake air. The Intake Air Temperature (IAT) sensor is a thermistor (a variable resistor that changes along with outside air temperature) in series with a fixed resistor in the PCM. The PCM applies 5V to the IAT sensor. The PCM monitors the voltage across the IAT sensor and converts it into a temperature reading. When the outside air temperature is cold the IAT sensor resistance is high, and when the outside air temperature is warm the IAT sensor resistance is low. Therefore, when the air temperature is cold the PCM will receive a high voltage input, and when the air temperature is warm the PCM will receive a low voltage input. The signal from IAT sensor is used for injection time correction, ignition timing correction and idle speed correction(Air-density correction).

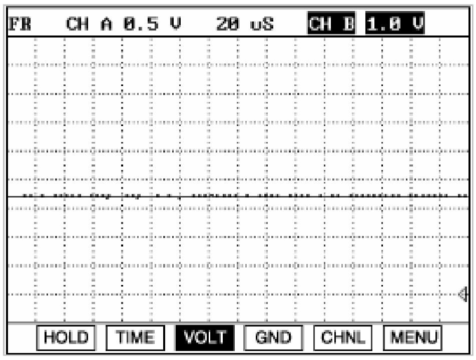
DTC DESCRIPTION

Checking output signals of IATS every 20 sec. under detecting condition, if an ouput signal is below 0.1V for more than 10 sec., PCM sets P1112.

DTC DETECTING CONDITION

<table>
<tr><th colspan="2">Item</th><th>Detecting Condition</th><th>Possible Cause</th></tr>
<tr><td colspan="2">DTC Strategy</td><td>• This code detects a continuous short to ground in either the signal circuit or the sensor</td><td rowspan="6">• Poor Connection
• Short to ground in signal circuit.
• Faulty IATS
• Faulty PCM</td></tr>
<tr><td rowspan="2">Enable Conditions</td><td>Case 1</td><td>• Engine Run State
• No VSS Fault Active
• Vehicle Speed > 50kph(31mph)
• IAT Short Low Enable Criteria Met</td></tr>
<tr><td>Case 2</td><td>• Engine Running Time > 120sec.
• IG "OFF" time > 360min.
• IAT Short Low Enable Criteria Met</td></tr>
<tr><td colspan="2">Threshold value</td><td>• IATS signal < 0.1V</td></tr>
<tr><td colspan="2">Diagnosis Time</td><td>• Continuous
(More than 10 sec. failure for every 20 sec. test)</td></tr>
<tr><td colspan="2">MIL On Condition</td><td>• DTC only</td></tr>
</table>

SIGNAL WAVEFORM AND DATA

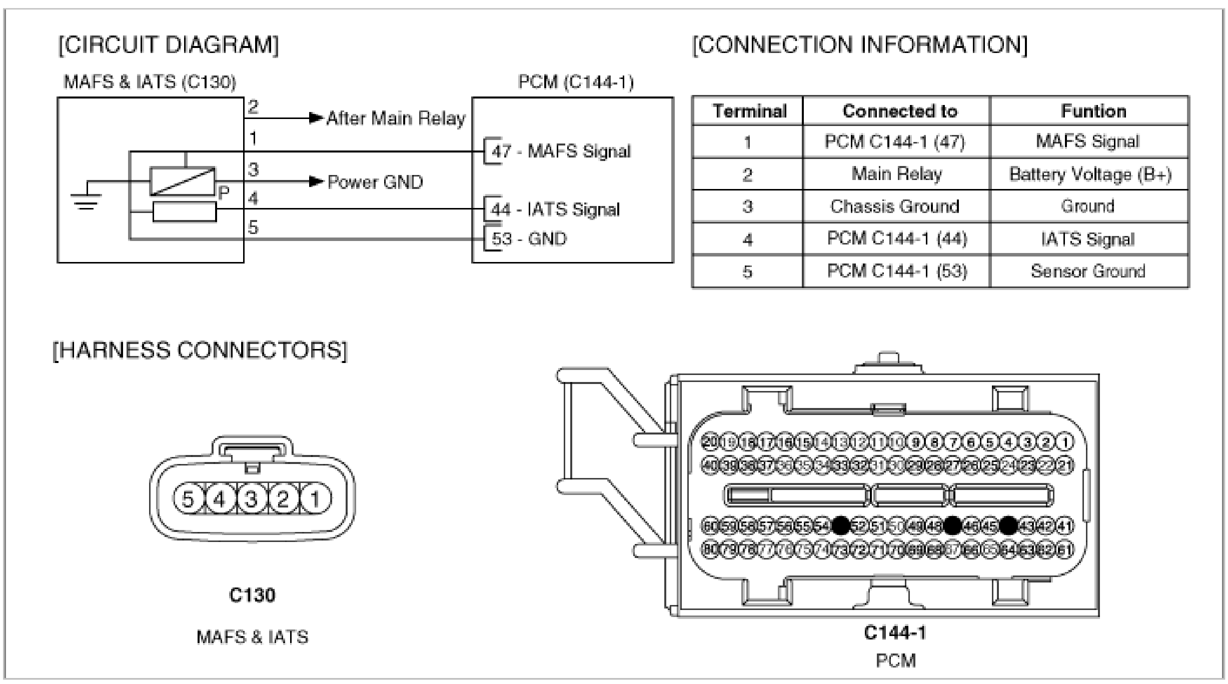


The output signals of IATS & ECTS change smoothly without any rapid changes. Those have almost same characteristic signal during the early period after start. It means that the temperatures of intake air and engine coolant are depended on the temperature of atmosphere. Meanwhile, during the warming up, the output signal of ECTS is going up increasingly. but, the output signal of IATS changes a little bit. even it may not change almost. It means that the heat of engine does not affect on the temperature of intake air.

SPECIFICATION

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	95.95 ~ 105.78	20(68)	3.42 ~ 3.61
-20(-4)	27.4 ~ 29.77	40(104)	1.43 ~ 1.5
0(32)	9.08 ~ 9.72	60(140)	0.66 ~ 0.69
10(50)	5.49 ~ 5.83	80(176)	0.33 ~ 0.34

SCHEMATIC DIAGRAM



MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "IATS" item on the service data.

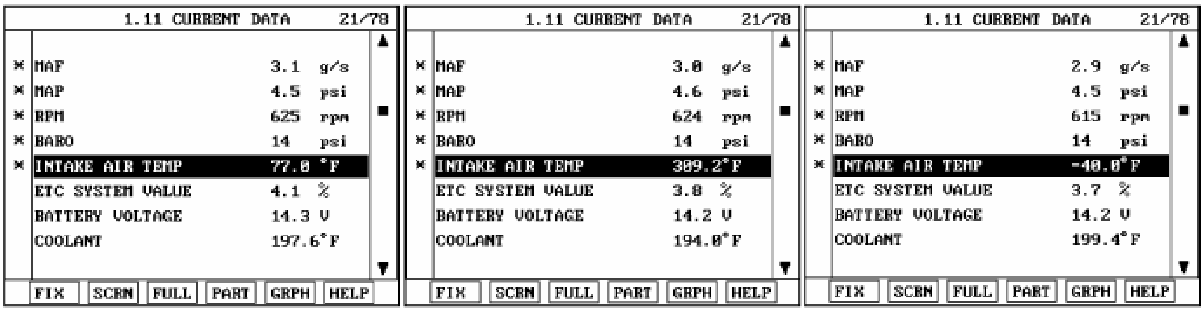


Fig. 1 Fig. 2 Fig. 3

Fig. 1 : Open at idle
Fig. 2 : Short to ground
Fig. 3 : Short to battery

4. Is the "IATS" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to " Signal Circuit Inspection " procedure.

SIGNAL CIRCUIT INSPECTION

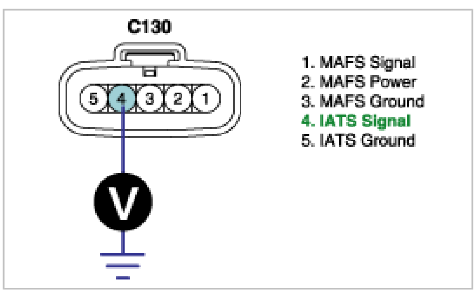
1. Check voltage

(1) IG "OFF" and disconnect IATS connector.

(2) IG "ON" and ENG "OFF"

(3) Measure voltage between terminal 4 of IATS harness connector and chassis ground.

Specification : Approx. 5V



(4) Is the measured voltage within specification ?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Go to " Check short to ground in harness" procedure.

2. Check short to ground in harness

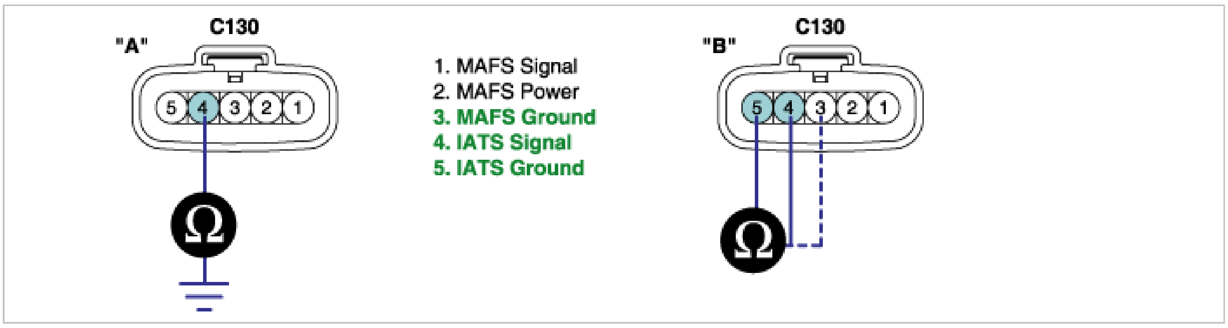
(1) IG "OFF" and disconnect IATS connector and PCM connector.

(2) Measure resistance between terminal 4 of IATS harness connector and chassis ground.

(3) Measure resistance between terminals 4 and 5 of IATS harness connector.

(4) Measure resistance between terminals 4 and 3 of IATS harness connector.

Specification : Infinite



(5) Is the measured resistance within specification?

YES

▸ Go to "Component inspection" procedure.

NO

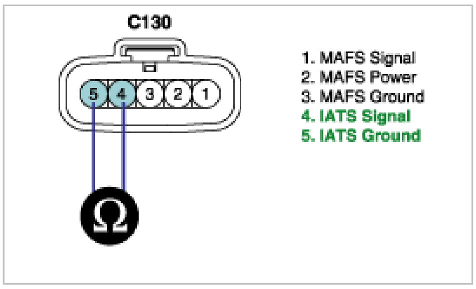
▸ Repair short to ground in harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check IATS
   (1) IG "OFF" and disconnect IATS connector.

   (2) Measure resistance between teminals 4 and 5 of IATS connector.(Component side)
   Specificaton :

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	95.95 ~ 105.78	20(68)	3.42 ~ 3.61
-20(-4)	27.4 ~ 29.77	40(104)	1.43 ~ 1.5
0(32)	9.08 ~ 9.72	60(140)	0.66 ~ 0.69
10(50)	5.49 ~ 5.83	80(176)	0.33 ~ 0.34



   (3) Is the measured resistance within specification ?

YES

▸ Go to "Check PCM" as follows.

NO

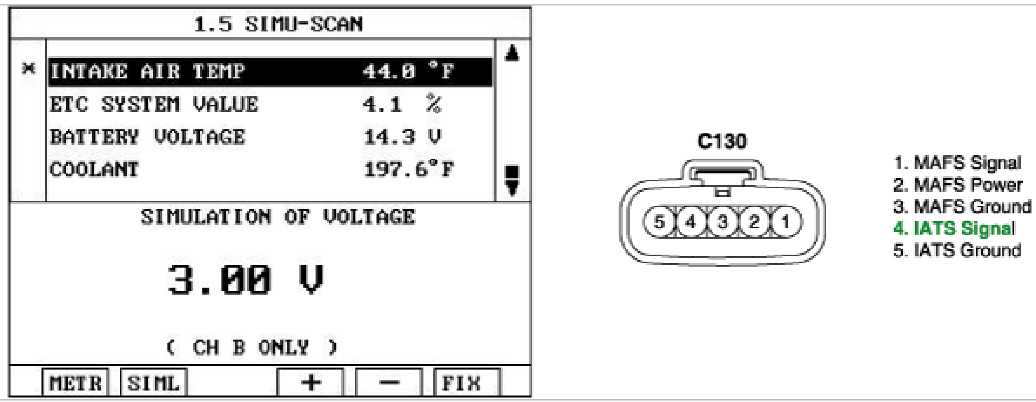
▸ Substitute with a known - good IATS and check for proper operation. If the problem is corrected, replace IATS and go to "Verification of Vehicle Repair" procedure.

2. Check PCM
   (1) IG "OFF" and connect scantool.

   (2) Disconnect IATS connector and connect probe to terminal 4 of IATS harness connector.

   (3) IG "ON" and ENG "OFF" and simulation Function on scantool.

   (4) Simulate voltage at terminal 4 of IATS harness connector.



(5) Does the signal value of IAT sensor change according to simulation voltage ?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

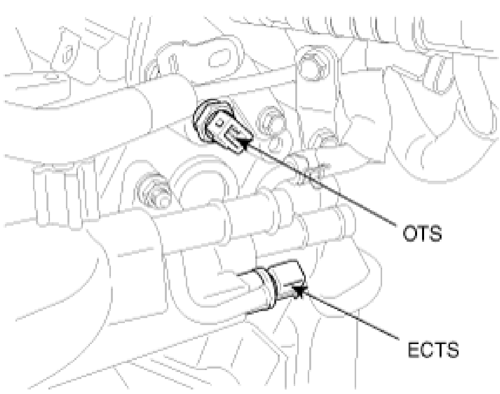
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P1114

COMPONENT LOCATION



GENERAL DESCRIPTION

The Engine Coolant Temperature(ECT) Sensor measures the temperature of engine coolant. The Engine Coolant Temperature (ECT) Sensor is located near the thermostat housing of the cylinder head. ECT Sensor is a thermistor (A Variable Resistor that Changes Along with ECT) in series with a fixed resistor in the Engine Control Module (PCM). The PCM applies 5 volts to the ECT sensor. The PCM monitors the voltage across the ECT sensor and converts it into a temperature reading. When the engine is cold the ECT sensor resistance is high, and when the engine is warm the ECT sensor resistance is low. Therefore, when the engine is cold the PCM will receive a high voltage input, and when the engine is warm the PCM will receive a low voltage input. The signal from ECT sensor is used for Injection, ignition timing, idle speed and cooling fan control.

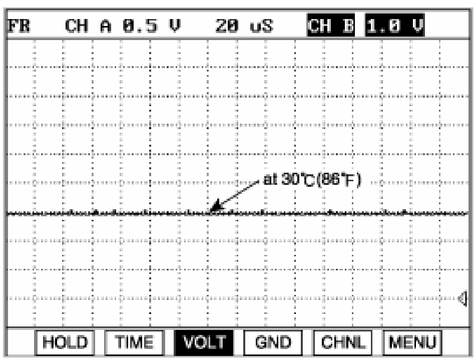
DTC DESCRIPTION

Checking output signals from ECTS every 120 sec. under detecting condition, if an output signal is below 0.1V for more than 4 sec., PCM sets P1114.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible Cause
DTC Strategy		• This code detects a intermittent short to ground in the signal circuit or the sensor	• Poor Connection • Short to ground in signal Circuit • Faulty ECTS • Faulty PCM
Enable Conditions	Case 1	• Engine Running Time > 120sec. • Coolant Short Low Enable Criteria Met	
	Case 2	• Soak Time > 360min. • Engine Running • Coolant Short Low Enable Criteria Met	
Threshold value		• Coolant signal < 0.1V	
Diagnosis Time		• Continuous (More than 4 sec. failure for every 120 sec. test)	
MIL On Condition		• DTC only (NO MIL ON)	

SIGNAL WAVEFORM AND DATA



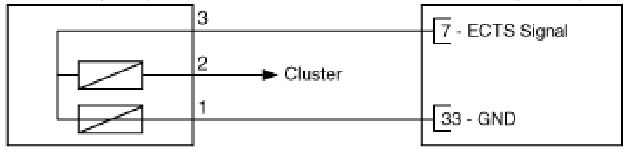
The output signals of IATS & ECTS change smoothly without any rapid changes. Those have almost same characteristic signal during the early period after start. It means that the temperatures of intake air and engine coolant are depended on the temperature of atmosphere. Meanwhile, during the warming up, the output signal of ECTS is going up increasingly. but, the output signal of IATS changes a little bit. even it may not change almost. It means that the heat of engine does not affect on the temperature of intake air.

SPECIFICATION

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59
0(32)	5.79	80(176)	0.32
20(68)	2.31 ~ 2.59		

SCHEMATIC DIAGRAM

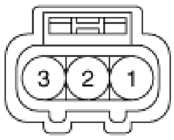
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

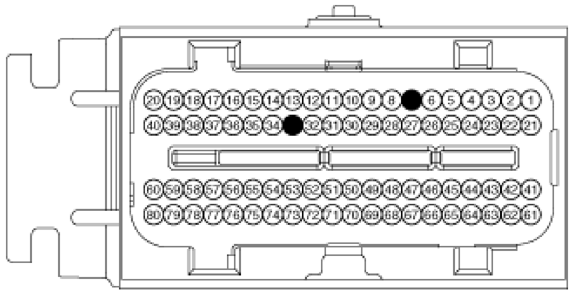
Terminal	Connected to	Funtion
1	PCM C144-2 (33)	Sensor ground
2	Cluster	-
3	PCM C144-2 (7)	ECTS Signal

[HARNESS CONNECTORS]



C101

ECTS



C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "Monitor "ECTS" status on the service data." item on the service data.

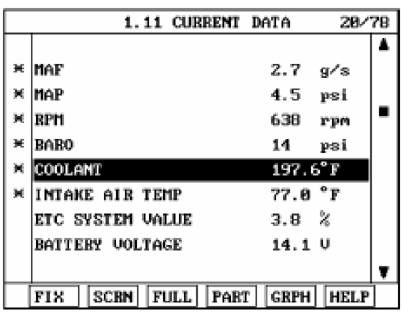


Fig. 1

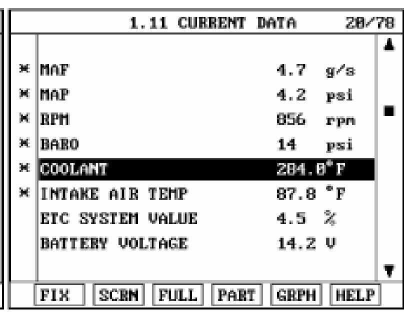


Fig. 2

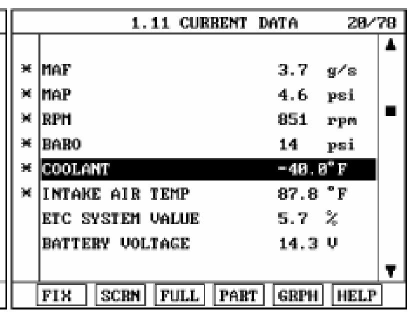


Fig. 3

Fig. 1 : Normal at Idle
Fig. 2 : Short to ground at idle
Fig. 3 : Open or short to battery at idle

4. Is the "ECTS" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

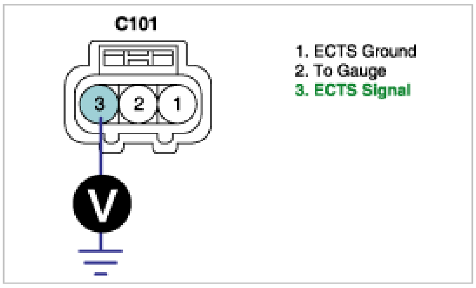
NO

▸ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF" and disconnect ECTS connector.
   (2) IG "ON" and ENG "OFF"
   (3) Measure voltage between terminal 3 of ECTS harness connector and chassis ground.

Specification : Approx. 5V



   (4) Is the measured voltage within specification ?

YES

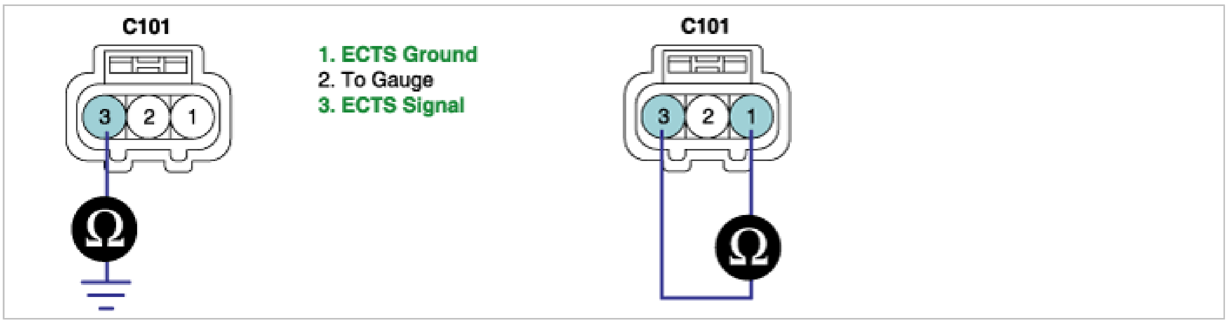
▸ Go to "Component Inspection" procedure.

NO

▸ Go to "Check short to ground in harness" as follows.

2. Check short to ground in harness
   (1) IG "OFF" and disconnect ECTS connector and PCM connector.
   (2) Measure resistance between terminal 3 of ECTS harness connector and chassis ground.
   (3) Measure resistance between terminals 1 and 3 of ECTS harness connector.

Specification : Infinite



   (4) Is the measured resistance within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check ECTS
   (1) IG "OFF" and disconnect ECTS connector.
   (2) Measure resistance between terminals 1 and 3 of ECTS connector.(Component side)

Specificaton :

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59
0(32)	5.79	80(176)	0.32

20(68)	2.31 ~ 2.59		

(3) Is the measured resistance within specification?

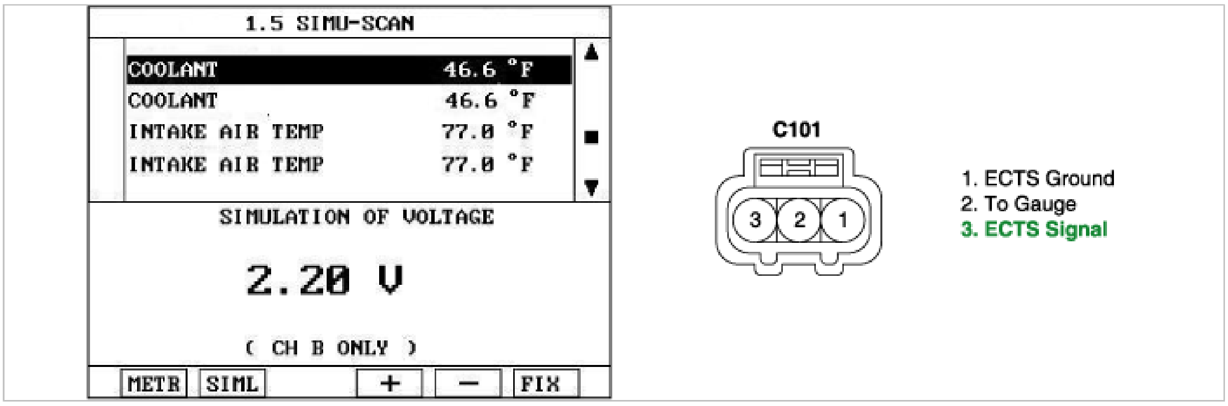
YES

▸ Go to "Check PCM" as follows.

NO

▸ Substitute with a known - good ECTS and check for proper operation. If the problem is corrected, replace ECTS and go to "Verification of Vehicle Repair" procedure.

2. Check PCM
   (1) IG "OFF" and connect scantool.
   (2) Connect probe to terminal 3 of ECTS harness connector.
   (3) IG "ON" and ENG "OFF" and simulation Function on scantool.
   (4) Simulate voltage at terminal 3 of ECTS harness connector.



(5) Does the signal value of ECT sensor change according to simulation voltage ?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

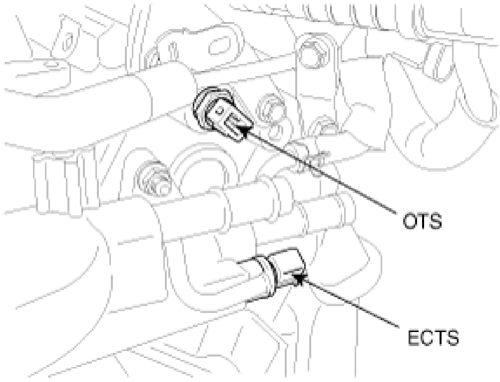
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P1115

COMPONENT LOCATION



GENERAL DESCRIPTION

The Engine Coolant Temperature(ECT) Sensor measures the temperature of engine coolant. The Engine Coolant Temperature (ECT) Sensor is located near the thermostat housing of the cylinder head. ECT Sensor is a thermistor (A Variable Resistor that Changes Along with ECT) in series with a fixed resistor in the Engine Control Module (PCM). The PCM applies 5 volts to the ECT sensor. The PCM monitors the voltage across the ECT sensor and converts it into a temperature reading. When the engine is cold the ECT sensor resistance is high, and when the engine is warm the ECT sensor resistance is low. Therefore, when the engine is cold the PCM will receive a high voltage input, and when the engine is warm the PCM will receive a low voltage input. The signal from ECT sensor is used for Injection, ignition timing, idle speed and cooling fan control.

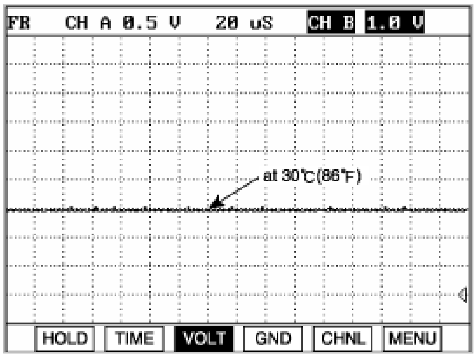
DTC DESCRIPTION

Checking output signals from ECTS every 120 sec. under detecting condition, if an output signal is above 4.9V for more than 4 sec., PCM sets P1115.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible Cause
DTC Strategy		• This code detects a intermittent open or short to battey in the signal circuit or the sensor	• Poor Connection • Open or short to battery in signal Circuit • Open in Ground Circuit. • Faulty ECTS • Faulty PCM
Enable Conditions	Case 1	• Engine Running Time > 120sec. • Coolant Short Low Enable Criteria Met	
	Case 2	• Soak Time > 360min. • Engine Running • Coolant Short Low Enable Criteria Met	
Threshold value		• Coolant signal > 4.9V	
Diagnosis Time		• Continuous (More than 4 sec. failure for every 120 sec. test)	
MIL On Condition		• DTC only (NO MIL ON)	

SIGNAL WAVEFORM AND DATA



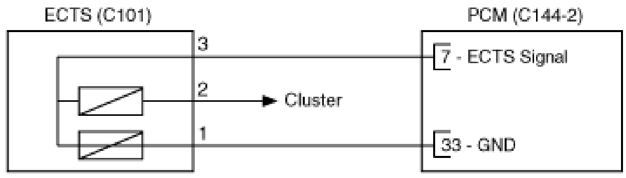
The output signals of IATS & ECTS change smoothly without any rapid changes. Those have almost same characteristic signal during the early period after start. It means that the temperatures of intake air and engine coolant are depended on the temperature of atmosphere. Meanwhile, during the warming up, the output signal of ECTS is going up increasingly. but, the output signal of IATS changes a little bit. even it may not change almost. It means that the heat of engine does not affect on the temperature of intake air.

SPECIFICATION

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59
0(32)	5.79	80(176)	0.32
20(68)	2.31 ~ 2.59		

SCHEMATIC DIAGRAM

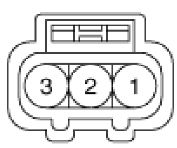
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

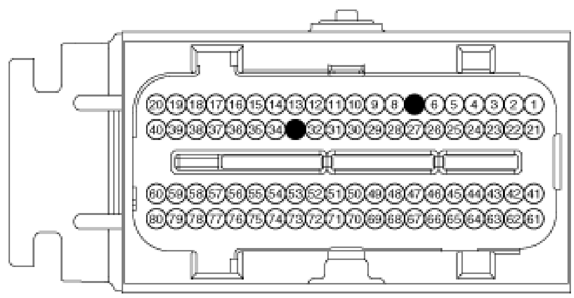
Terminal	Connected to	Funtion
1	PCM C144-2 (33)	Sensor ground
2	Cluster	-
3	PCM C144-2 (7)	ECTS Signal

[HARNESS CONNECTORS]



C101

ECTS



C144-2

PCM

MONITOR SCANTOOL DATA

1. IG "OFF" & connect scantool.
2. ENG "ON" and warm -up the engine to normal operating temperature.
3. Monitor "Monitor "ECTS" status on the service data." item on the service data.

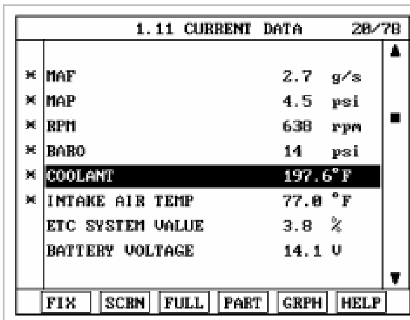


Fig. 1

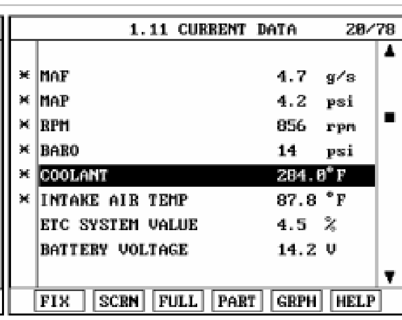


Fig. 2

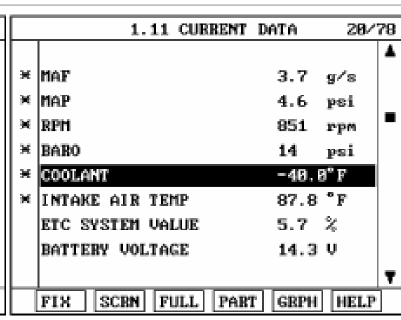


Fig. 3

Fig. 1 : Normal at Idle
Fig. 2 : Short to ground at idle
Fig. 3 : Open or short to battery at idle

4. Is the "ECTS" data displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

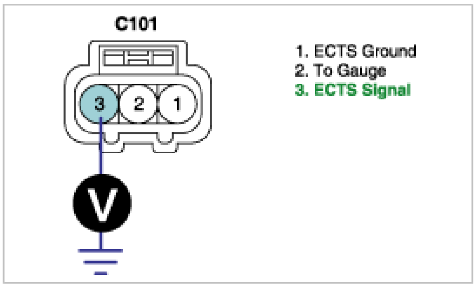
NO

▸ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check voltage
   (1) IG "OFF" and disconnect ECTS connector.
   (2) IG "ON" and ENG "OFF"
   (3) Measure voltage between terminal 3 of ECTS harness connector and chassis ground.

   Specification : Approx. 5V



   (4) Is the measured voltage within specification ?

   YES

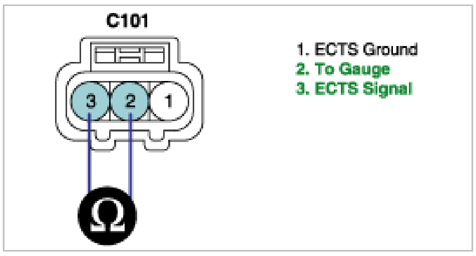
   ▸ Go to "Ground Circuit Inspection" procedure.

   NO

   ▸ If voltage is 0V, go to "Check open in harness" as follows. If it is more than 5.1V, go to "Check short to battery in harness" as follows

2. Check short to battery in harness
   (1) IG "OFF" and disconnect ECTS connector and PCM connector.
   (2) Measure resistance between terminals 2 and 3 of ECTS harness connector.

   Specification : Infinite



   (3) Is the measured resistance within specification?

   YES

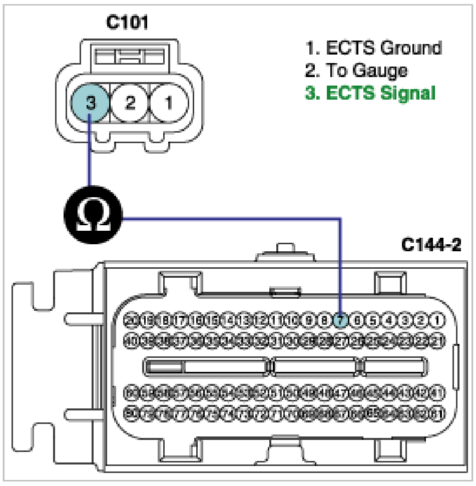
   ▸ Go to "Component Inspection" procedure.

   NO

   ▸ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

3. Check open in harness
   (1) IG "OFF" and disconnect ECTS connector and PCM connector.
   (2) Measure resistance between terminal 3 of ECTS harness connector and terminal 7 of PCM harness connector.

Specification : Below 1Ω



   (3) Is the measured resistance within specification?

YES

▸ Go to "Ground Circuit Inspection" procedure.

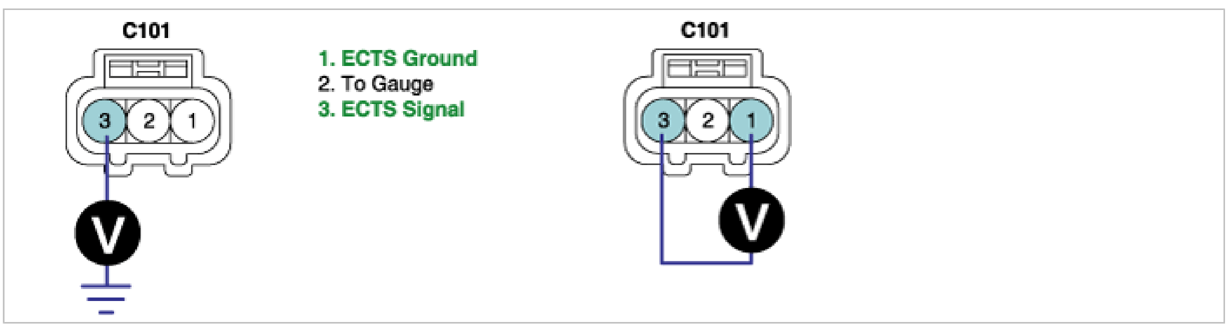
NO

▸ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF" and disconnect ECTS connector.
2. Measure voltage between terminal 3 of ECTS harness connector and chassis ground.
3. Measure voltage between terminals 1 and 3 of ECTS harness connector.

Specification : Voltage difference between measurement "A" and "B" is below 200mV.



4. Is the measured voltage within specification?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair open or contact resistance in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check ECTS
   (1) IG "OFF" and disconnect ECTS connector.
   (2) Measure resistance between terminals 1 and 3 of ECTS connector.(Component side)

Specificaton :

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)

-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59
0(32)	5.79	80(176)	0.32
20(68)	2.31 ~ 2.59		

(3) Is the measured resistance within specification?

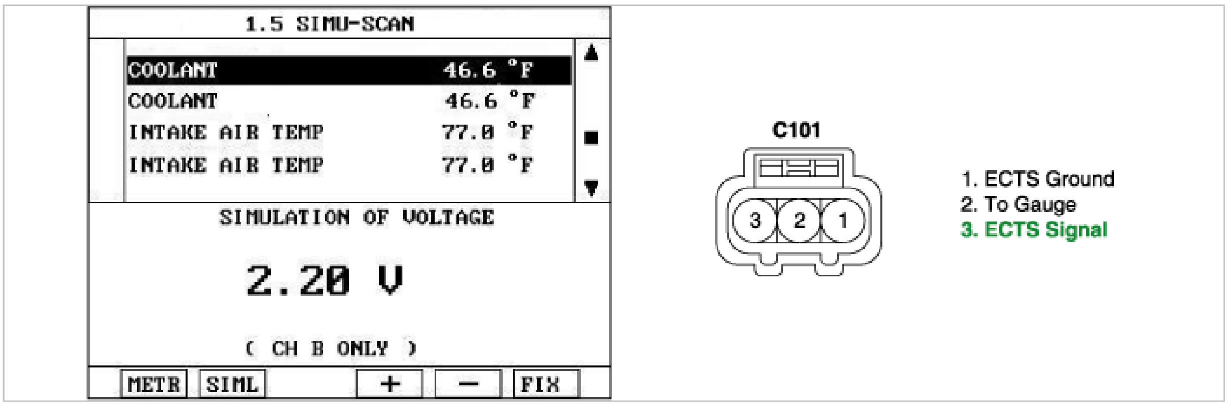
YES

▸ Go to "Check PCM" as follows.

NO

▸ Substitute with a known - good ECTS and check for proper operation. If the problem is corrected, replace ECTS and go to "Verification of Vehicle Repair" procedure.

2. Check PCM
   (1) IG "OFF" and connect scantool.
   (2) Connect probe to terminal 3 of ECTS harness connector.
   (3) IG "ON" and ENG "OFF" and simulation Function on scantool.
   (4) Simulate voltage at terminal 3 of ECTS harness connector.



(5) Does the signal value of ECT sensor change according to simulation voltage ?

YES

▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P1295

COMPONENT LOCATION

GENERAL DESCRIPTION

ETC(Electronic Throttle Control Valve) is the device controlling amount of air to engine acccording to driver's intension. Different from the existing mechanical throttle valve which is composed of accelerator pecal and connecting wire cable, ETC consists of a motor, a throttle body and a throttle position sensor. Receiving input signals from electronic accelerator pedal module, PCM lets ETC motor control throttle valve. With ETC, cruise control system works without any additional device.

DTC DESCRIPTION

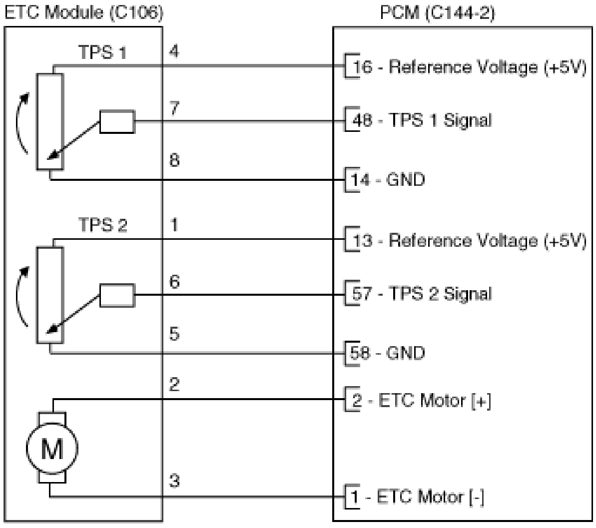
If power management mode is recognized under detecting condition, PCM sets P1295. And MIL(Malfunction Indicatin Lamp) turns on.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• This code detects if the system is in Power Management Mode	• TPS Malfunction • TPS Malfunction + MAFSMalfunction • MAP Malfunction + TPSMalfunction • Faulty PCM
EnableConditions	• Ignition On	
Threshold value	• Power Management Mode is active	
DiagnosisTime	• -	
MIL On Condition	• 1 Driving Cycle	

SCHEMATIC DIAGRAM

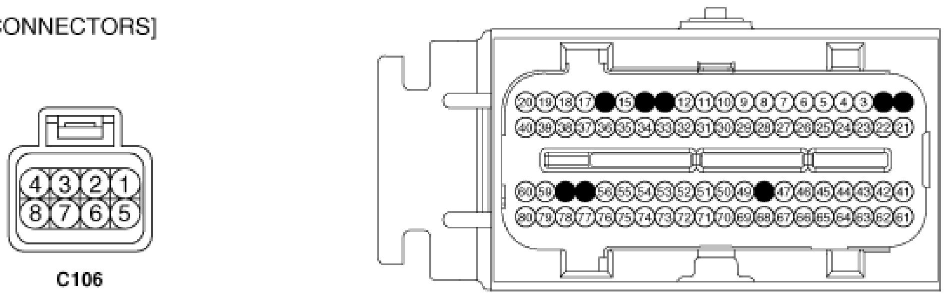
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Funtion
1	PCM C144-2 (13)	TPS 2 Reference Voltage (+5V)
2	PCM C144-2 (2)	ETC Motor [+] Control
3	PCM C144-2 (1)	ETC Motor [-] Control
4	PCM C144-2 (16)	TPS 1 Reference Voltage (+5V)
5	PCM C144-2 (58)	TPS 2 Ground
6	PCM C144-2 (57)	TPS 2 Signal
7	PCM C144-2 (48)	TPS 1 Signal
8	PCM C144-2 (14)	TPS 1 Ground

[HARNESS CONNECTORS]



C106

ETC MODULE

C144-2

PCM

MONITOR SCANTOOL DATA

1. Connect scantool to DLC(Data Link Connector)
2. IG "ON" & Monitor that any different DTC(Diagnostic Trouble Code) is existed.
   (There will be at least one more DTC which causes this DTC P1295 to retrieve)
3. Repair the DTCs cause DTC P1295 first according to the designated trouble shooting guide.
   (After repairing the DTCs cause DTC P1295, don't forget to do "ETC Initialization" as follows.
4. Is the same DTC occurred ?

YES

▸Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Go to "Verification of Vehicle Repair" procedure.
※ Procedure of ETS Initialization
1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10sec.)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs

3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshooooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P1523

COMPONENT LOCATION

GENERAL DESCRIPTION

ETC(Electronic Throttle Control Valve) is the device controlling amount of air to engine acccording to driver's intension. Different from the existing mechanical throttle valve which is composed of accelerator pecal and connecting wire cable, ETC consists of a motor, a throttle body and a throttle position sensor. Receiving input signals from electronic accelerator pedal module, PCM lets ETC motor control throttle valve. With ETC, cruise control system works without any additional device.

DTC DESCRIPTION

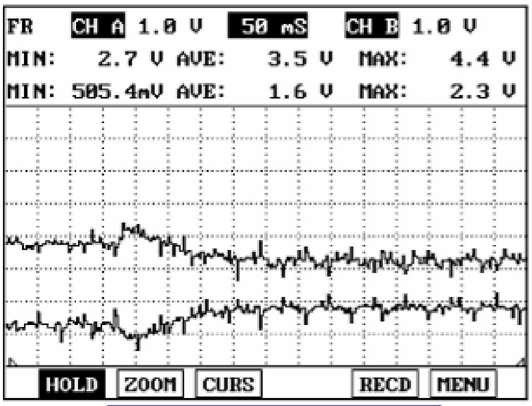
Checking throttle valve return state, under detecting condition, if an output signal is within the threshold value for more than designated time, PCM sets P1523.

DTC DETECTING CONDITION

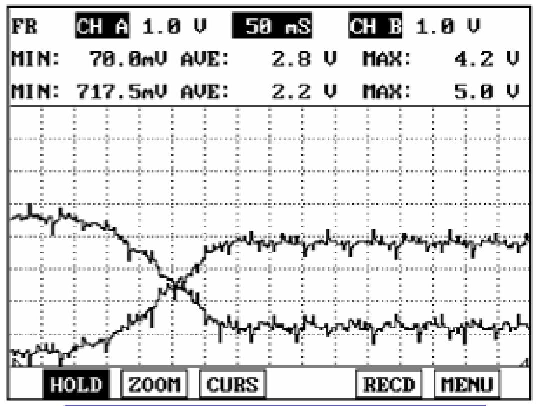
Item	Detecting Condition	Possible cause
DTC Strategy	• This code detects when throttle fails to return to the unpowered default position when power to the ETC motor is turned off. Fault set for failure to return to default position within a time.	• Carbon in throttle • Broken Throttle return spring • throttle sticky • throttle icy • PCM
EnableConditions	• Throttle Actuation Mode Previous NOT Off • Throttle Actuation Mode is Off • ETC Power Control Mode = Normal • TPS 1 & 2 = normal • Sensor Supply voltage = Normal	
Threshold value	• If throttle did not return to default range within cal seconds of turning off, increment fail count. • Normalized value of either TPS within expected default range anytime while enabled. (TPS1 Norm > 0.9V AND TPS1 Norm < 1.85V)OR (TPS2 Norm > 1.85V AND TPS2 Norm < 0.9V)Time depends on engine temperature (Below -20°C(-4 °F): less than 4sec.,Over -20°C(-4 °F) : less than 1sec.)	

DiagnosisTime	• Contineous	
MIL On Condition	• DTC only (NO MIL ON)	

SIGNAL WAVEFROM AND DATA



Stepping on accelleraton pedal.



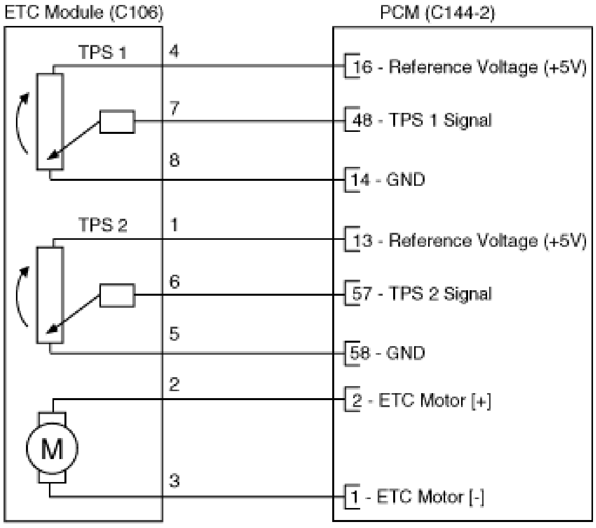
Pulling out accelleration cable with hand.

SPECIFICATION

Throttle opening (°)	Output voltage (V) [Vref = 5.0V]	
	TPS1	**TPS2**
0°	0.0V	5.0V
10°	0.5V	4.5V
20°	0.9V	4.1V
30°	1.4V	3.6V
40°	1.8V	3.2V
50°	2.3V	2.7V
60°	2.7V	2.3V
70°	3.2V	1.8V
80°	3.6V	1.4V
90°	4.1V	0.9V
100°	4.5V	0.5V
110°	5.0V	0.0V

SCHEMATIC DIAGRAM

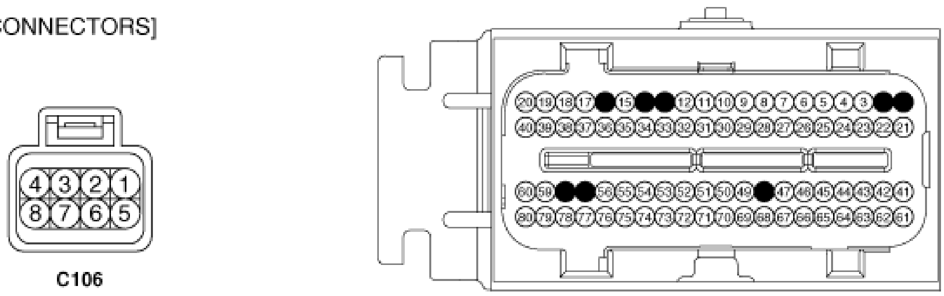
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Funtion
1	PCM C144-2 (13)	TPS 2 Reference Voltage (+5V)
2	PCM C144-2 (2)	ETC Motor [+] Control
3	PCM C144-2 (1)	ETC Motor [-] Control
4	PCM C144-2 (16)	TPS 1 Reference Voltage (+5V)
5	PCM C144-2 (58)	TPS 2 Ground
6	PCM C144-2 (57)	TPS 2 Signal
7	PCM C144-2 (48)	TPS 1 Signal
8	PCM C144-2 (14)	TPS 1 Ground

[HARNESS CONNECTORS]



C106

ETC MODULE

C144-2

PCM

MONITOR SCANTOOL DATA

1. Connect scantool to DLC.(Data Link Connector)
2. IG "ON" & ENG "OFF"
3. Monitor "Throttle Position Sensor" by stepping on and off the accellerator pedal on scantool
4. Are those parameters related to "TPS" operating correctly ?

YES

▸Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, ending, corrosion, contamination, deterioration, or damage. Repair or replace asnecessary and go to "Verification of Vehicle Repair" procedure

NO

▸Go to "System Inspection" procedure.

SYSTEM INSPECTION

1. Visual Inspection
   (1) IG "OFF".
   (2) Check throttle valve after removing air duct.
      A. Carbon deposit.
      B. Throttle icy
      C. Broken return spring.
      D. Throttle sticky
   (3) Is the throttle valve return O.K ?

YES

▸Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Repair or replace as necessary and then, do ETS Initialization" as follows. then, go to "Verification of Vehicle Repair" procedure.

※ Procedure of ETS Initialization

1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10sec.)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P161B

COMPONENT LOCATION

GENERAL DESCRIPTION

Comparing actual torque and desired torque, PCM diagnoses calculated torque state. Actual torque keeps lower than desired torque, PCM checks if actual torque is higher than desired torque. deviding condition into two state, dynamic and steady states, PCM applies different diagnosis logic. Because the responses due to this code is similar to that of MAF control error, checking MAF at first.

DTC DESCRIPTION

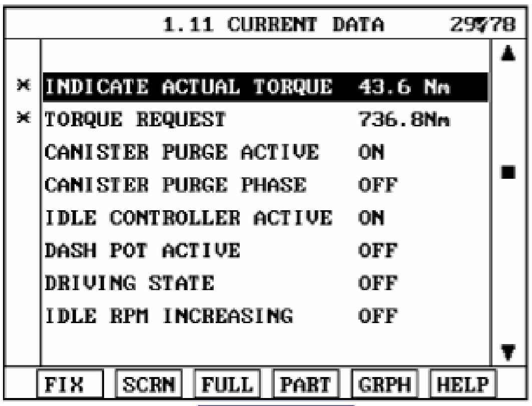
PCM checks if actual torque is higher than desired torque. deviding condition into two state, dynamic and steady states. At diagnosis during steady state, if the difference between actual torque and desired torque is higher than the threshold value, an error is recognized. And at dynamic diagnosis, desired torque of fly wheel and actual dynamic torque is compared. If ETS is on Power Management Mode, total engine torquemodulated by PCM is used instead of total actual engine torque. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till 1 driving cycle.

DTC DETECTING CONDITION

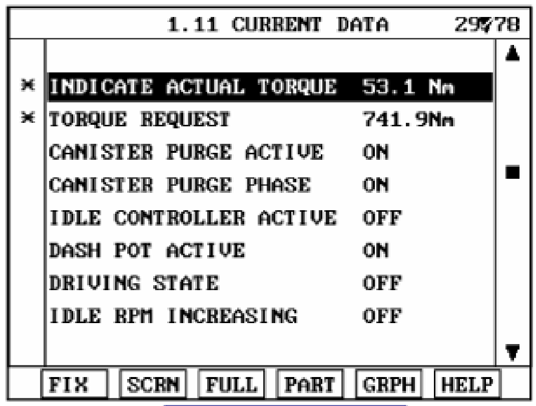
ITEM		Detecting Condition	Possible Cause
DTC Strategy	Case 1	• Determines if Delivered Torque Is Grossly Different fromDesired Torque	• Intake air leakage • Faulty ETS System • Clogged exhaust system • Faulty PCM
	Case 2	• Determines if Delivered Torque is Grossly Different fromDesired Torque	
	Case 3	• Determines if Delivered Torque is Greater than DesiredTorque With Zero Pedal	
Enable Conditions	Case 1	• Engine Running state	
	Case 2	• Engine Running state • Engine Speed > 600rpm • Desired Flywheel Torque Within 20Nm • Steady State Torque Timer > 1sec.	
	Case 3	• Pedal Position < 0.8% • Torque Command Source = Engine off	
Threshold value	Case 1	• When Dynamic torque error (difference between actualand desired torque value) above which the torque toohigh fail criteria is met > 25%While Net Torque ≥ 20NmOR torque throttle load > 1%	
		• Dynamic Torque ErrorThe torque error (differencebetween actual and desired torque value) below whichthe torque too low fail criteria is met < -120%While Desired ETC throttle position < 0%	
	Case 2	• When Steady State Torque Error > 60NmWhile Actual Net Torque ≥ 20NmOR Torque Throttle Load ≥ 2%	
	Case 3	• Maximum limit for the fuel flow rate to pass theredundant torque rationality diagnostic versus enginespeed. > 3g/s	
Diagnosis Time		• Contineous Case1: More than 7.8sec. failure for every 15.6sec.Test Case2: More than 0.03sec. failure for every 0.6sec.Test Case3: More than 7.8sec. failure for every 15.6sec.Test	
MIL On Condition		• 1 Driving Cycle	

MONITOR SCANTOOL DATA

1. Conect scantool to DLC(Data Link Connector)
2. Warm-up the engine to normal operating temperature.
3. Monitor "Actual Torque & Torque Request" parameters on scantool
4. Monitor DTC related to "ETS or CAM" on scantool



Torque at Idle



Torque at accelleration

5. Are there any DTC related to "ETS" or "CAM" on the scantool ?

YES

▸ Repair "ETS" or "CAM" system first, then, go to "Terminal and Connector Inspection" procedure.

NO

▸ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to " System Inspection " procedure.

SYSTEM INSPECTION

1. Check air leakage
   (1) Check contamination or installation of Gasket
   - ▸ Check throttle body gasket
   - ▸ Check gasket between intake manifold and surge tank.
   - ▸ Check contamination or clog by foreign material of gasket between intake manifold and injector.
   - ▸ Check contamination or open stuck resulting from foreign material between surge tank and PCSV.

   (2) Is there any air leakage ?

   YES

   ▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Go to "Check exhaust system for clogging" as follows.

2. Check exhaust system for clogging
   (1) Check exhaust system.
   - ▸ Clogged or broken muffler
   - ▸ Broken catalyst

   (2) Is the exhaust system colgged ?

   YES

   ▸ Go to "Check throttle valve for stuck" as follows.

   NO

   ▸ Repair or repalce as necessary and then, go to "Verification of Vehicle Repair" procedure.

3. Check throttle valve for stuck
   (1) IG "OFF".

   (2) Remove air hose between throttle body and airflow sensor.

(3) Check if throttle valve is sutck by foreign material.

(4) Is the throttle valve normal ?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ After getting rid of foreign material, check that throttle valve is normal and check for proper operation. If the problem is corrected,replace ETC and then go to "Verification of Vehicle Repair" procedure.

※ Procedure of ETS Initialization

1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10sec.)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

COMPONENT INSPECTION

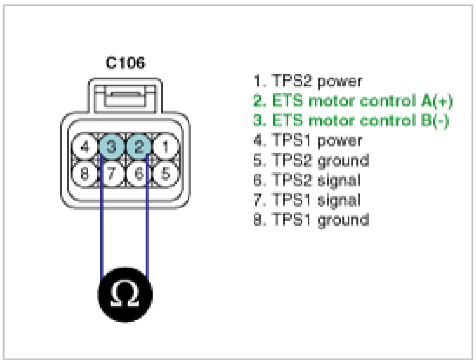
1. Check resistance of ETS Motor

(1) IG "OFF"

(2) Disconnect ETS motor & TPS connector.

(3) Measure resistance between terminal 2 and 3 of ETS motor & TPS connector.(Component Side)

Specification : Approx. 1.275 ~ 1.725Ω@ 23°C(73.4 °F)



(4) Is the measured resistance within specifications ?

YES

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Substitute with a known-good ETC and check for proper operation. If the problem is corrected,replace ETC and then go to "Verification of Vehicle Repair" procedure.

※ Procedure of ETS Initialization

1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10sec.)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions

4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

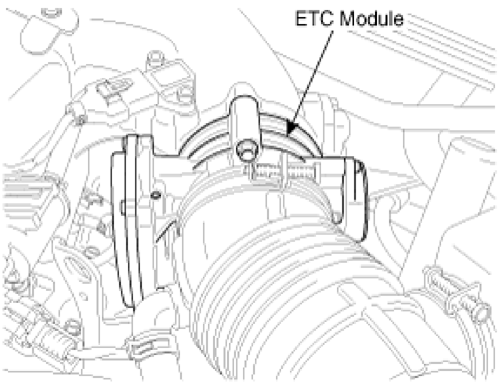
▸ Go to the applicable troubleshooooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P2104

COMPONENT LOCATION



GENERAL DESCRIPTION

ETC(Electronic Throttle Control Valve) is the device controlling amount of air to engine acccording to driver's intension. Different from the existing mechanical throttle valve which is composed of accelerator pecal and connecting wire cable, ETC consists of a motor, a throttle body and a throttle position sensor. Receiving input signals from electronic accelerator pedal module, PCM lets ETC motor control throttle valve. With ETC, cruise control system works without any additional device.

DTC DESCRIPTION

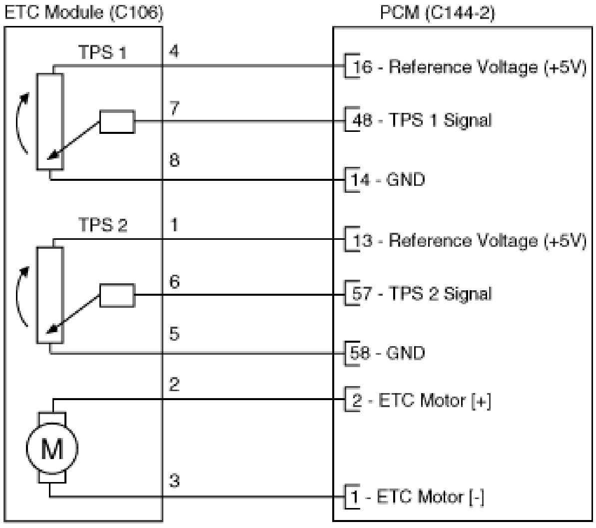
PCM recognizes vehicle state as forced idle under detecting condition, and sets P2104. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till 1 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• This code detects if the system is in Forced Idle Mode	• Faulty APS • Faulty APS+Brake • Faulty APS + Vehicle speed sensor • Faulty APS + Vehicle speed sensor + Brake • Faulty PCM
EnableConditions	• Ignition "ON"	
Threshold value	• Forced Idle Mode is active	
DiagnosisTime	• -	
MIL On Condition	• 1 Driving Cycles	

SCHEMATIC DIAGRAM

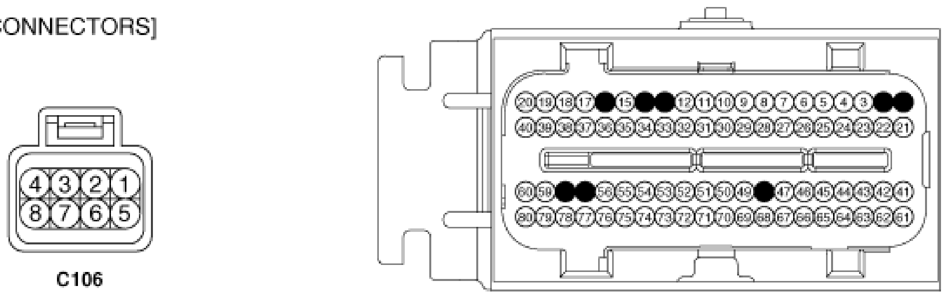
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Funtion
1	PCM C144-2 (13)	TPS 2 Reference Voltage (+5V)
2	PCM C144-2 (2)	ETC Motor [+] Control
3	PCM C144-2 (1)	ETC Motor [-] Control
4	PCM C144-2 (16)	TPS 1 Reference Voltage (+5V)
5	PCM C144-2 (58)	TPS 2 Ground
6	PCM C144-2 (57)	TPS 2 Signal
7	PCM C144-2 (48)	TPS 1 Signal
8	PCM C144-2 (14)	TPS 1 Ground

[HARNESS CONNECTORS]



C106
ETC MODULE

C144-2
PCM

MONITOR SCANTOOL DATA

1. Connect scantool to DLC(Data Link Connector)
2. IG "ON" & Monitor that any different DTC(Diagnostic Trouble Code) is existed.
   (There will be at least one more DTC which causes this DTC P2104 to retrieve)
3. Repair the DTCs cause DTC P2104 first according to the designated trouble shooting guide.
   (After repairing the DTCs cause DTC P2104 , don't forget to do "ETC Initialization" as follows.
4. Is the same DTC occurred ?

YES

▸Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Go to "Verification of Vehicle Repair" procedure.
※ Procedure of ETS Initialization
1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10sec.)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs

3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

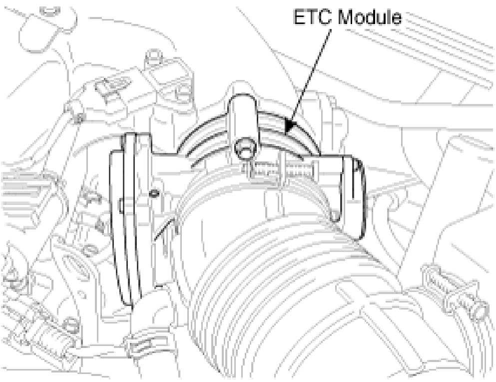
▸ Go to the applicable troubleshooooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P2105

COMPONENT LOCATION



GENERAL DESCRIPTION

ETC(Electronic Throttle Control Valve) is the device controlling amount of air to engine acccording to driver's intension. Different from the existing mechanical throttle valve which is composed of accelerator pecal and connecting wire cable, ETC consists of a motor, a throttle body and a throttle position sensor. Receiving input signals from electronic accelerator pedal module, PCM lets ETC motor control throttle valve. With ETC, cruise control system works without any additional device.

DTC DESCRIPTION

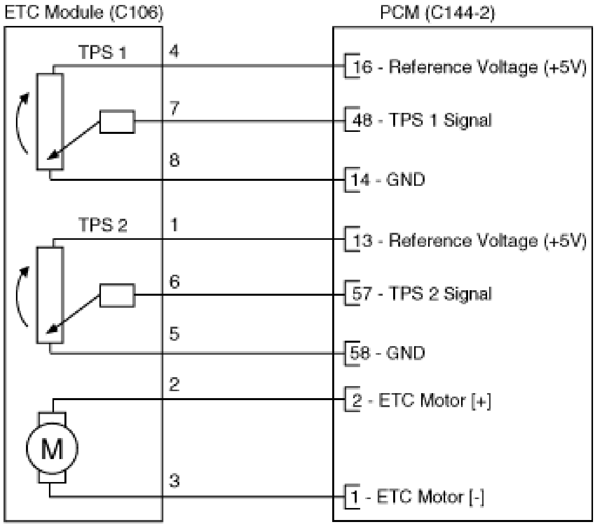
PCM recognizes vehicle state as forced engine stop under detecting condition, and sets P2105. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till 1 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• This code detects if the system is in Forced Engine Shutdown Mode	• Faulty AFS+MAPS+ETS • Faulty PCM
EnableConditions	• Ignition "ON"	
Threshold value	• Forced Engine Shutdown Mode Active	
DiagnosisTime	• -	
MIL On Condition	• 1 Driving Cycles	

SCHEMATIC DIAGRAM

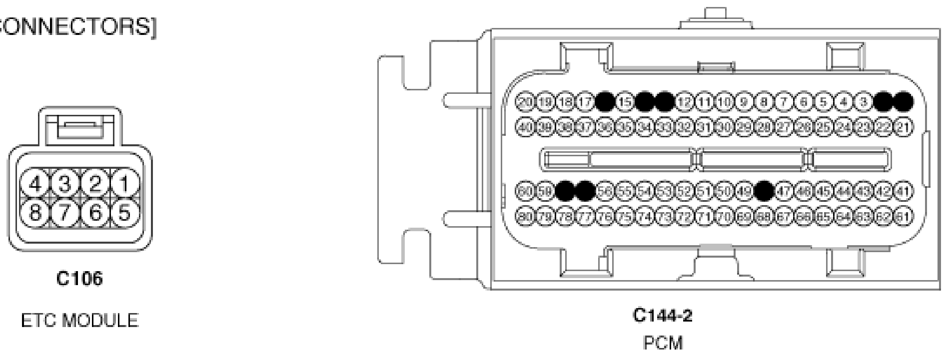
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Funtion
1	PCM C144-2 (13)	TPS 2 Reference Voltage (+5V)
2	PCM C144-2 (2)	ETC Motor [+] Control
3	PCM C144-2 (1)	ETC Motor [-] Control
4	PCM C144-2 (16)	TPS 1 Reference Voltage (+5V)
5	PCM C144-2 (58)	TPS 2 Ground
6	PCM C144-2 (57)	TPS 2 Signal
7	PCM C144-2 (48)	TPS 1 Signal
8	PCM C144-2 (14)	TPS 1 Ground

[HARNESS CONNECTORS]



MONITOR SCANTOOL DATA

1. Connect scantool to DLC(Data Link Connector)
2. IG "ON" & Monitor that any different DTC(Diagnostic Trouble Code) is existed.
   (There will be at least one more DTC which causes this DTC P2105 to retrieve)
3. Repair the DTCs cause DTC P2105 first according to the designated trouble shooting guide.
   (After repairing the DTCs cause DTC P2105 , don't forget to do "ETC Initialization" as follows.
4. Is the same DTC occurred ?

YES

▸Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Go to "Verification of Vehicle Repair" procedure.
※ Procedure of ETS Initialization
1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10sec.)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs

3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

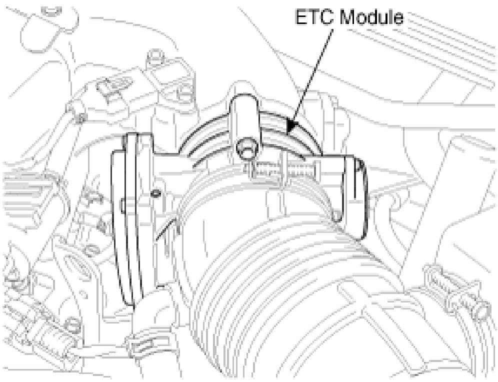
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P2106

COMPONENT LOCATION



GENERAL DESCRIPTION

ETC(Electronic Throttle Control Valve) is the device controlling amount of air to engine acccording to driver's intension. Different from the existing mechanical throttle valve which is composed of accelerator pecal and connecting wire cable, ETC consists of a motor, a throttle body and a throttle position sensor. Receiving input signals from electronic accelerator pedal module, PCM lets ETC motor control throttle valve. With ETC, cruise control system works without any additional device.

DTC DESCRIPTION

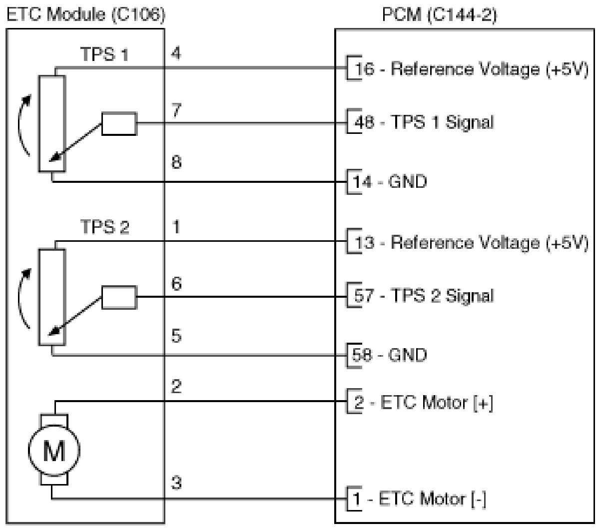
PCM recognizes vehicle state as forced limited power mode under detecting condition, and sets P2106. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till 1 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• This code detects if the system is in Limit Performance Mode	• Faulty APS • Faulty APS+Brake • Faulty APS + Vehicle speed sensor • Faulty APS + Vehicle speed sensor + Brake • Faulty PCM
EnableConditions	• Ignition "ON"	
Threshold value	• Limit Performance Mode is active	
DiagnosisTime	• -	
MIL On Condition	• 1 Driving Cycle	

SCHEMATIC DIAGRAM

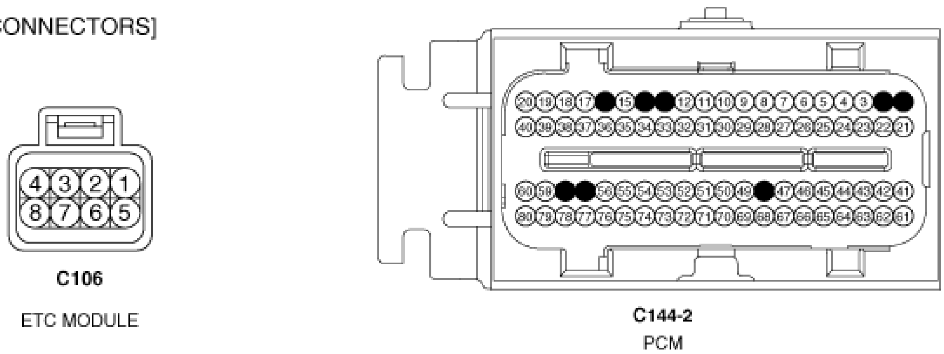
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Funtion
1	PCM C144-2 (13)	TPS 2 Reference Voltage (+5V)
2	PCM C144-2 (2)	ETC Motor [+] Control
3	PCM C144-2 (1)	ETC Motor [-] Control
4	PCM C144-2 (16)	TPS 1 Reference Voltage (+5V)
5	PCM C144-2 (58)	TPS 2 Ground
6	PCM C144-2 (57)	TPS 2 Signal
7	PCM C144-2 (48)	TPS 1 Signal
8	PCM C144-2 (14)	TPS 1 Ground

[HARNESS CONNECTORS]



MONITOR SCANTOOL DATA

1. Connect scantool to DLC(Data Link Connector)
2. IG "ON" & Monitor that any different DTC(Diagnostic Trouble Code) is existed.
   (There will be at least one more DTC which causes this DTC P2106 to retrieve)
3. Repair the DTCs cause DTC P2106 first according to the designated trouble shooting guide.
   (After repairing the DTCs cause DTC P2106 , don't forget to do "ETC Initialization" as follows.
4. Is the same DTC occurred ?

YES

▸Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Go to "Verification of Vehicle Repair" procedure.

※ Procedure of ETS Initialization

1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10sec.)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs

3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

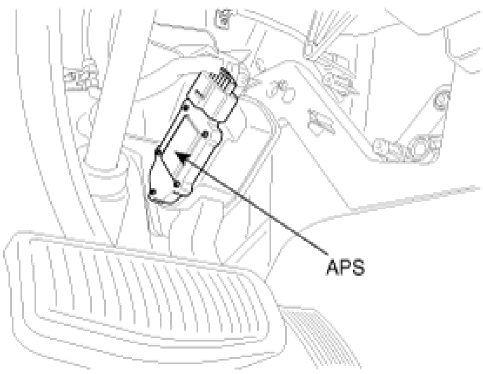
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P2122

COMPONENT LOCATION



GENERAL DESCRIPTION

APS(Acceleration Position Sensor) measures driver's accelerating intension using a potentiometer and APS signal is transmitted to the PCM. The pedal's position is converted as voltages of potentiometer in the APS.The absence of a mechanical link between the accelerator pedal and throttle valve presents a risk of loss of control of the engine in the event of a failure of the component. Therefore, APS has the two potentiometers whose slides are mechanically solid. APS 2 decides whether or not APS 1 & 2 is faulty.

DTC DESCRIPTION

Checking output signals from APS 1 every 78 sec., under detecting condition, if output signals are detected as out of threshold more than the specified number of times., PCM sets P2122. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till 1 driving cycle.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible Cause
DTC Strategy		• This code detects a continuous short to ground or open in either the circuit or the sensor (0-100%)	• Poor connection • Open or short to ground in Power circuit • Open or short to ground in Signal Circuit • Faulty APS • Faulty PCM
EnableConditions		• Ignition "ON" • Fail is NOT reported if: VrefA Fail Count > 0OR A/D converter is not failed.	
Threshold	Case 1	• APS1 < 0.125V	
	Case 2	• VrefA Fail Criteria is met	
Diagnosis Time		• Contineous (More than 4sec. Failure for every 78sec. Test)	
MIL On Condition		• 1 Driving Cycle	

SIGNAL WAVEFROM AND DATA

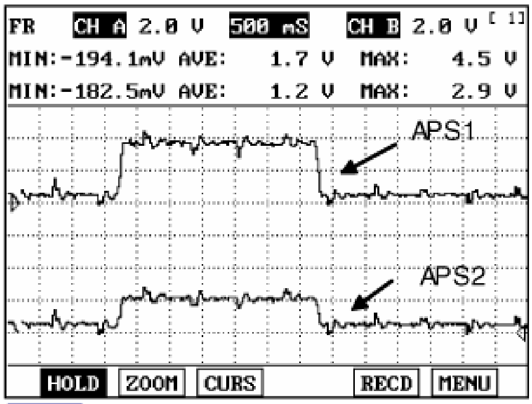


Fig. 1

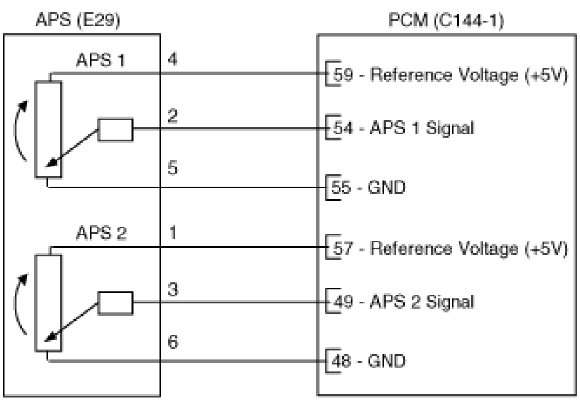
Fig. 1 : This is a signal waveform of APS 1 & 2 which shows that APS 2 increases voltage just half of APS 1 voltage increase when accelleration.

SPECIFICATION

Pedal Position	Output Voltage(V) [Vref = 5.0V]	
	APS1	**APS2**
C.T	0.7 ~ 0.8V	0.275 ~ 0.475V
W.O.T	3.8 ~ 4.4V	1.75 ~ 2.35V

SCHEMATIC DIAGRAM

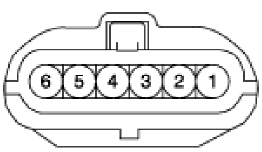
[CIRCUIT DIAGRAM]



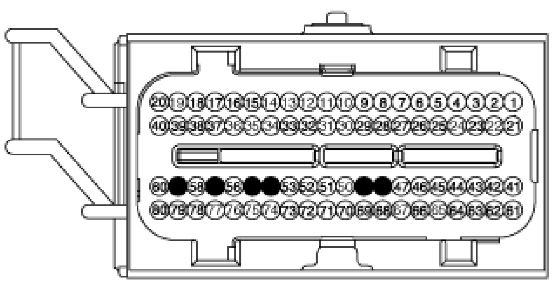
[CONNECTION INFORMATION]

Terminal	Connected to	Funtion
1	PCM C144-1 (57)	APS 2 Reference Voltage (+5V)
2	PCM C144-1 (54)	APS 1 Signal
3	PCM C144-1 (49)	APS 2 Signal
4	PCM C144-1 (59)	APS 1 Reference Voltage (+5V)
5	PCM C144-1 (55)	APS 1 Ground
6	PCM C144-1 (48)	APS 2 Ground

[HARNESS CONNECTORS]



E29
APS

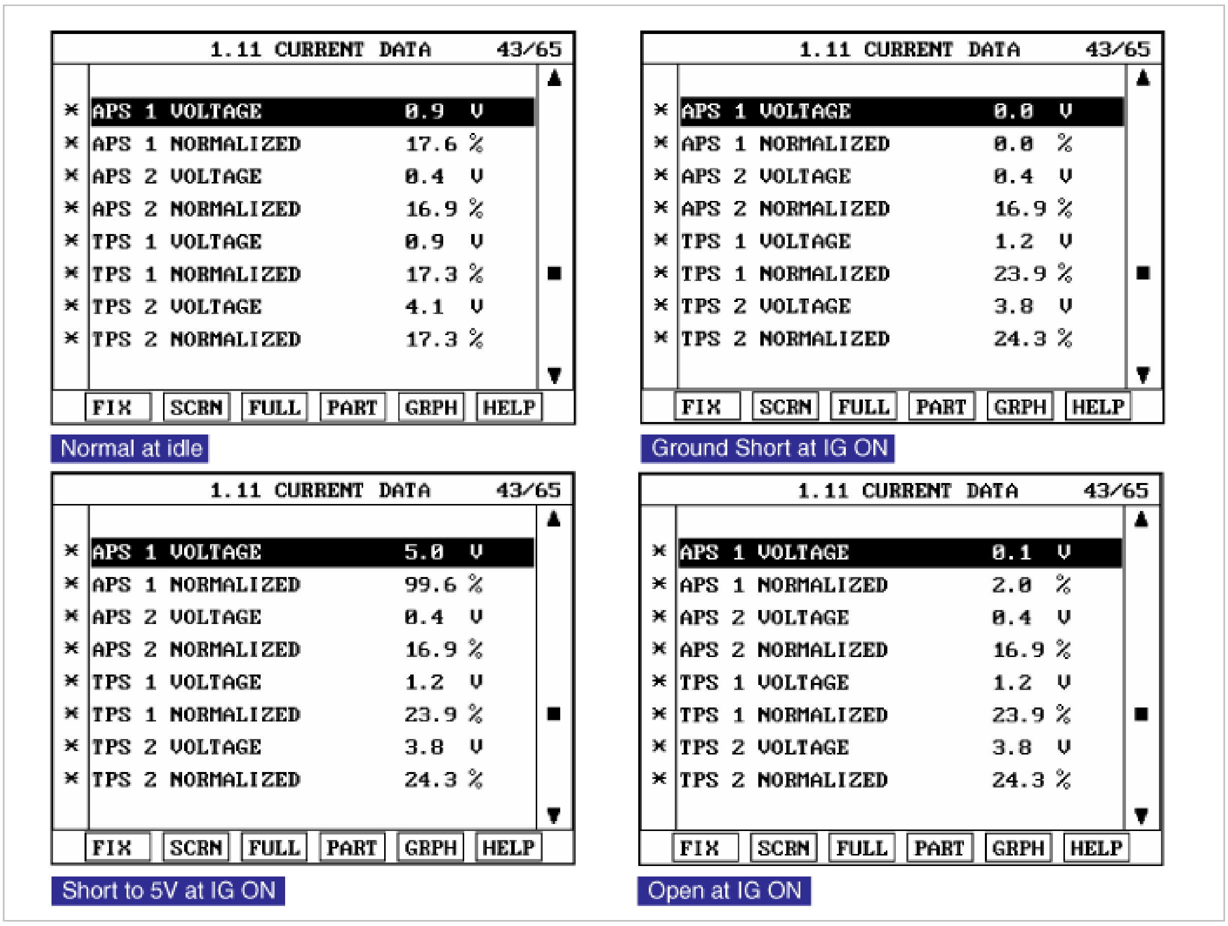


C144-1
PCM

MONITOR SCANTOOL DATA

1. Connect scantool to DLC(Data Link Connector).
2. Warm up the engine to normal operating temperature.
3. Monitor "APS1 & APS2" parameters on the scantool.

Pedal Position	Output Voltage(V) [Vref = 5.0V]	
	APS1	APS2
C.T	0.7 ~ 0.8V	0.275 ~ 0.475V
W.O.T	3.8 ~ 4.4V	1.75 ~ 2.35V



4. Are those "APS1 & APS2" parameters displayed correctly ?

YES

▸Fault is intermittent caused by poor contact in Sensor’s and/or PCM’s connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replaceas necessary and go to "Verification of Vehicle Repair" procedure

NO

▸Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸Repair as necessary and go to "Verification of Vehicle Repair" procedure

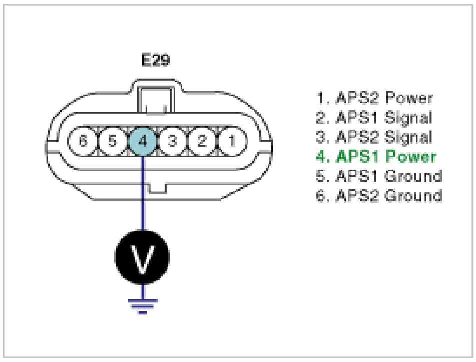
NO

▸Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. IG "OFF" and disconnect APS connector.
2. IG "ON" & ENG "OFF"
3. Measure voltage between harness terminal 4 of APS and chassis ground.

Specification : Approx. 5V



4. Is the measured voltage within specification ?

YES

▸ Go to "Signal Circuit Inspection" procedure.

NO

▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check short to ground in harness
   (1) IG "OFF".

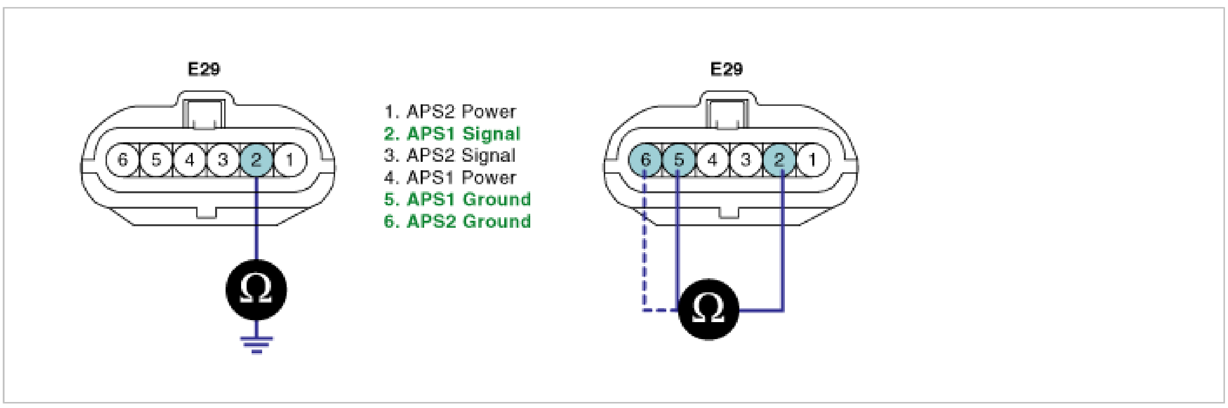
   (2) Disconnect APS & PCM connector.

   (3) Measure resistance between terminal 2 of APS harness connector and chassis ground.

   (4) Measure resistance between terminal 2 and 5 of APS harness connector.

   (5) Measure resistance between terminal 2 and 6 of APS harness connector.

   Specification : Infinite



   (6) Is the measured resistance within specification ?

   YES

   ▸ Go to "Check open in harness" as follows.

   NO

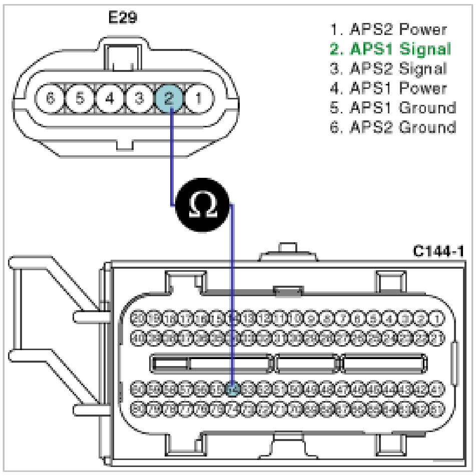
   ▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

2. Check open in harness
   (1) IG "OFF"

   (2) Disconnect "APS" and "PCM" connector.

   (3) Measure resistance between terminal 2 of APS harness connector and terminal 54/C144-1 of PCM harness connector.

   Specification : Approx. below 1Ω



(4) Is the measured resistance within in specification ?

YES

▸ Go to "Component Inspection" procedure.

NO

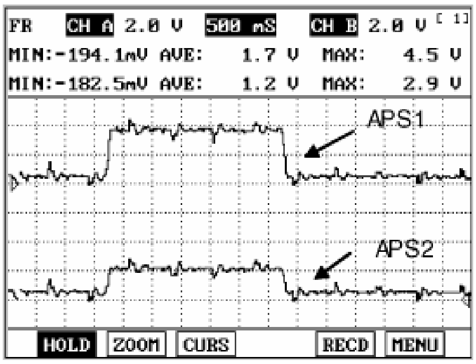
▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check APS
   (1) IG "ON" & ENG "OFF".
   (2) Measure signal waveform of APS by pressing and depressing accellerator pedal.

Specification :

Pedal Position	Output Voltage(V) [Vref = 5.0V]	
	APS1	APS2
C.T	0.7 ~ 0.8V	0.275 ~ 0.475V
W.O.T	3.8 ~ 4.4V	1.75 ~ 2.35V



(3) Is the measured signal waveform O.K ?

YES

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Substitute with a known-good APS and check for proper operation. If the problem is corrected,replace APS and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

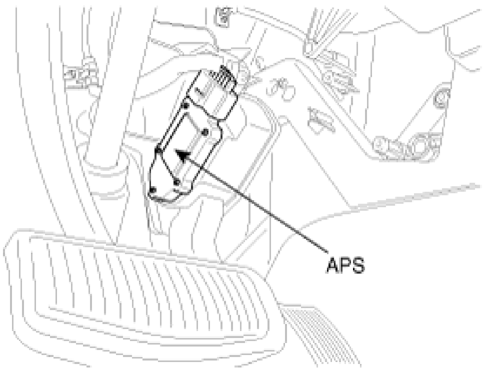
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P2123

COMPONENT LOCATION



GENERAL DESCRIPTION

APS(Acceleration Position Sensor) measures driver's accelerating intension using a potentiometer and APS signal is transmitted to the PCM. The pedal's position is converted as voltages of potentiometer in the APS.The absence of a mechanical link between the accelerator pedal and throttle valve presents a risk of loss of control of the engine in the event of a failure of the component. Therefore, APS has the two potentiometers whose slides are mechanically solid. APS 2 decides whether or not APS 1 & 2 is faulty.

DTC DESCRIPTION

Checking output signals from APS 1 every 78 sec., under detecting condition, if output signals are detected as out of threshold more than the specified number of times., PCM sets P2123. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till 1 driving cycle.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible Cause
DTC Strategy		• This code detects a short to high in either the circuit or the sensor (0-100%)	• Poor connection • Short to battery in signal circuit. • Open in Ground Circuit. • Faulty APS • Faulty PCM
EnableConditions		• Ignition "ON"	
Threshold	Case 1	• APS1 > 4.5V	
	Case 2	• 5.5V < Sensor Power Supply < 4.5V	
Diagnosis Time		• Contineous (More than 4sec. Failure for every 78sec. Test)	
MIL On Condition		• 1 Driving Cycle	

SIGNAL WAVEFROM AND DATA

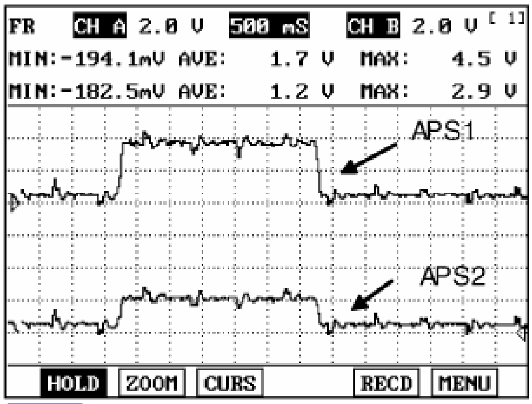


Fig. 1

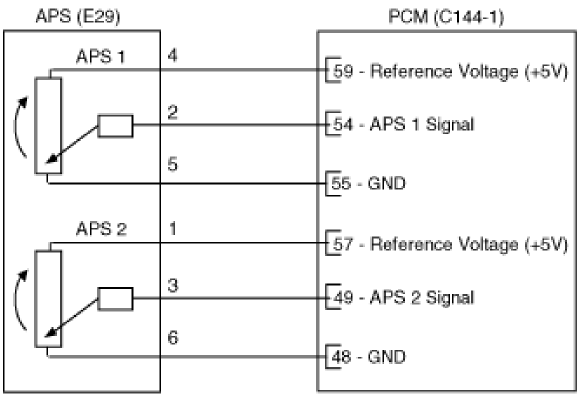
Fig. 1 : This is a signal waveform of APS 1 & 2 which shows that APS 2 increases voltage just half of APS 1 voltage increase when accelleration.

SPECIFICATION

Pedal Position	Output Voltage(V) [Vref = 5.0V]	
	APS1	**APS2**
C.T	0.7 ~ 0.8V	0.275 ~ 0.475V
W.O.T	3.8 ~ 4.4V	1.75 ~ 2.35V

SCHEMATIC DIAGRAM

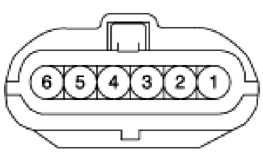
[CIRCUIT DIAGRAM]



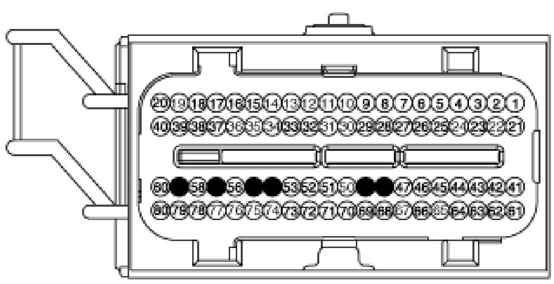
[CONNECTION INFORMATION]

Terminal	Connected to	Funtion
1	PCM C144-1 (57)	APS 2 Reference Voltage (+5V)
2	PCM C144-1 (54)	APS 1 Signal
3	PCM C144-1 (49)	APS 2 Signal
4	PCM C144-1 (59)	APS 1 Reference Voltage (+5V)
5	PCM C144-1 (55)	APS 1 Ground
6	PCM C144-1 (48)	APS 2 Ground

[HARNESS CONNECTORS]



E29
APS



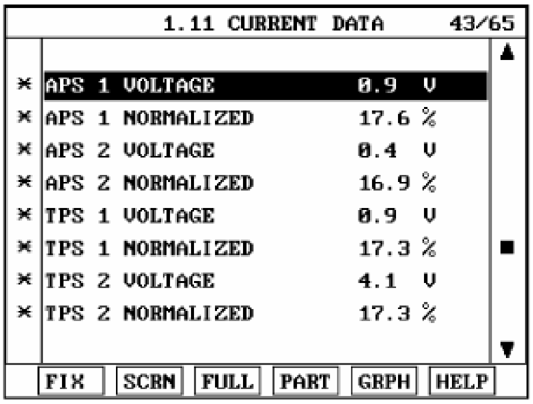
C144-1
PCM

MONITOR SCANTOOL DATA

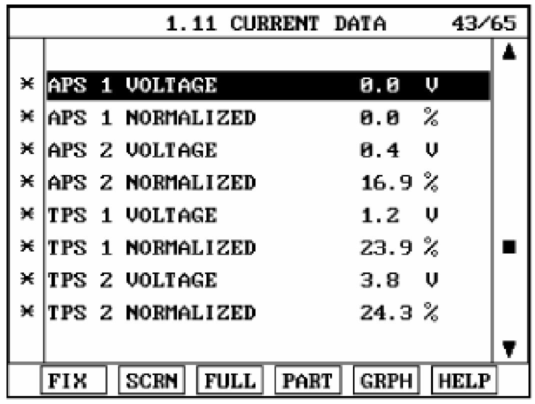
1. Connect scantool to DLC(Data Link Connector).
2. Warm up the engine to normal operating temperature.

3. Monitor "APS1 & APS2" parameters on the scantool.

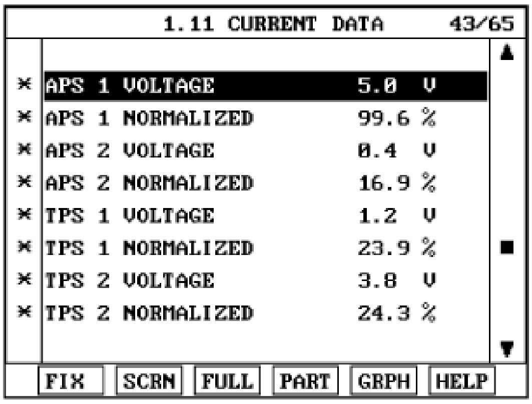
Pedal Position	Output Voltage(V) [Vref = 5.0V]	
	APS1	APS2
C.T	0.7 ~ 0.8V	0.275 ~ 0.475V
W.O.T	3.8 ~ 4.4V	1.75 ~ 2.35V



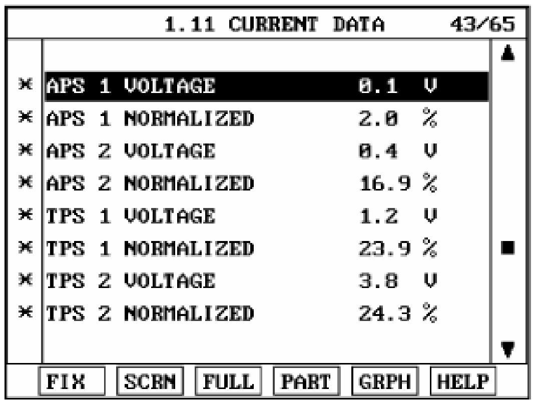
Normal at idle



Ground Short at IG ON



Short to 5V at IG ON



Open at IG ON

4. Are those "APS1 & APS2" parameters displayed correctly ?

YES

▶Fault is intermittent caused by poor contact in Sensor's and/or PCM's connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replaceas necessary and go to "Verification of Vehicle Repair" procedure

NO

▶Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▶ Go to "Signal Circuit Inspection " procedure.

SIGNAL CIRCUIT INSPECTION

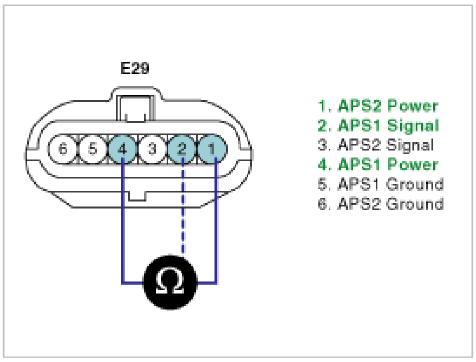
1. Check short to battery in harness
   (1) IG "OFF".

(2) Disconnect APS and PCM connector.

(3) Measure resistance between terminal 1 and 2 of APS harness connector.

(4) Measure resistance between terminal 2 and 4 of APS harness connector.

Specification : Infinite



(5) Is the measured resistance within specification ?

YES

▸ Go to "Ground Circuit Inspection" procedure.

NO

▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. Check open in harness

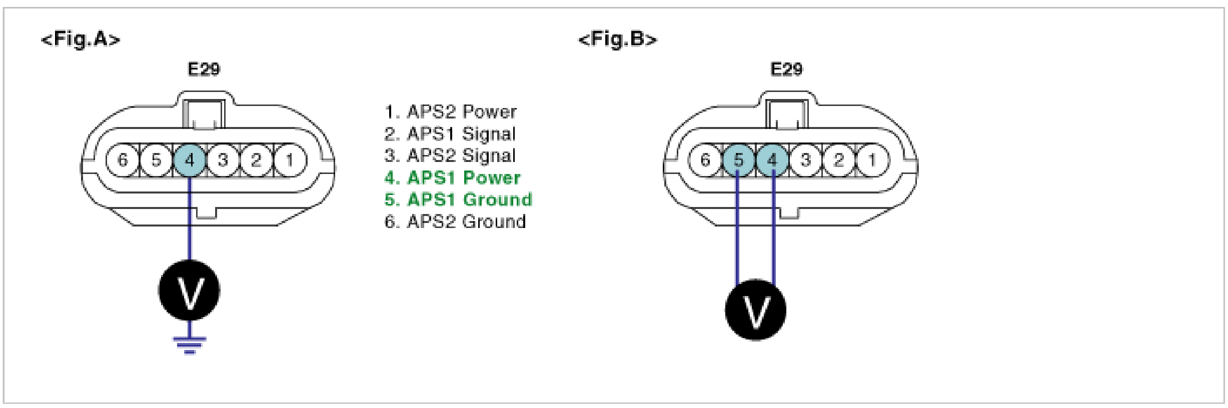
(1) IG "OFF".

(2) Disconnect APS connector.

(3) Measure voltage between terminal 4 of APS harness connector and chassis ground.(Fig. A)

(4) Measure voltage between terminal 4 and 5 of APS harness connector.(Fig. B)

Specification : Fig. "A" - Fig. "B" = approx. below. 200mV.



(5) Is the measured voltage within specification ?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair or replace contact resistance or open in harness and then, go to "Verification of VehicleRepair" procedure.

COMPONENT INSPECTION

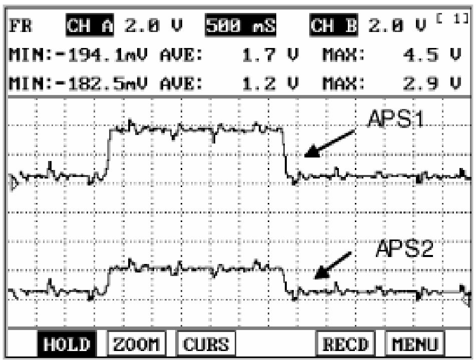
1. Check APS

(1) Ignition "ON" & ENG "OFF".

(2) Measure waveform of APS by pressing and depressing accellerator pedal with scantool.

Specification :

Pedal Position	Output Voltage(V) [Vref = 5.0V]	
	APS1	**APS2**
C.T	0.7 ~ 0.8V	0.275 ~ 0.475V
W.O.T	3.8 ~ 4.4V	1.75 ~ 2.35V



(3) Is the measured signal waveform O.K ?

YES

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Substitute with a known-good APS and check for proper operation. If the problem is corrected,replace APS and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

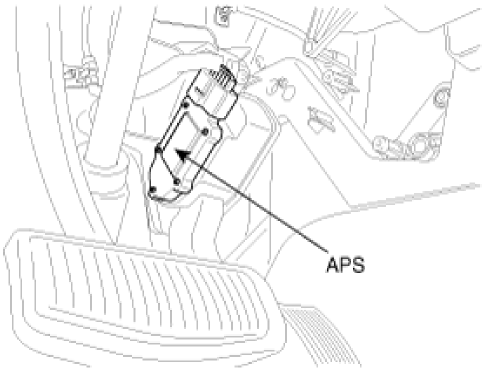
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P2127

COMPONENT LOCATION



GENERAL DESCRIPTION

APS(Acceleration Position Sensor) measures driver's accelerating intension using a potentiometer and APS signal is transmitted to the PCM. The pedal's position is converted as voltages of potentiometer in the APS.The absence of a mechanical link between the accelerator pedal and throttle valve presents a risk of loss of control of the engine in the event of a failure of the component. Therefore, APS has the two potentiometers whose slides are mechanically solid. APS 2 decides whether or not APS 1 & 2 is faulty.

DTC DESCRIPTION

Checking output signals from APS 2 every 78 sec., under detecting condition, if output signals are detected as out of threshold more than the specified number of times., PCM sets P2127. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till 1 driving cycle.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible Cause
DTC Strategy		• This code detects a continuous short to ground or open in either the circuit or the sensor (0-100%)	• Poor connection • Open or short to ground in Power circuit. • Open or short to ground in signal circuit. • Faulty APS • Faulty PCM
EnableConditions		• Ignition "ON"	
Threshold	Case 1	• APS2 < 0.125V	
	Case 2	• 5.5V < Sensor Power Supply < 4.5V	
Diagnosis Time		• Contineous (More than 4sec. Failure for every 78sec. Test)	
MIL On Condition		• 1 Driving Cycle	

SIGNAL WAVEFROM AND DATA

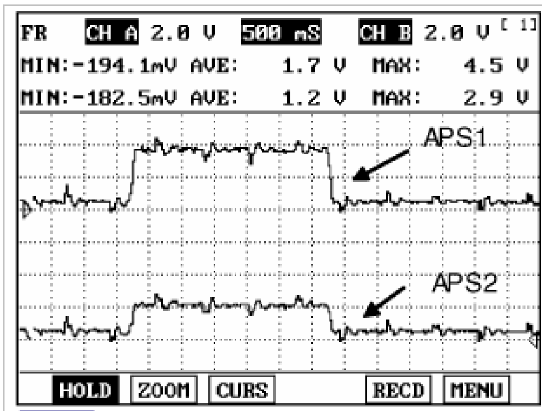


Fig. 1

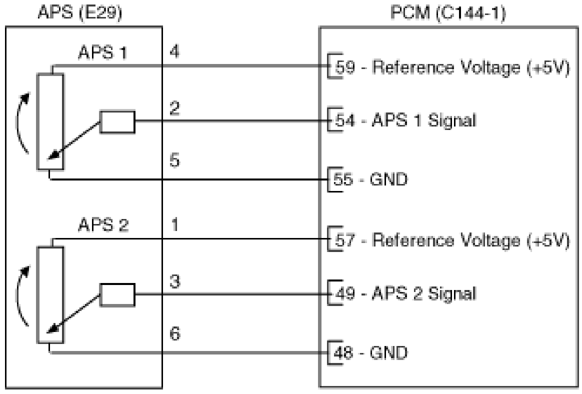
Fig. 1 : This is a signal waveform of APS 1 & 2 which shows that APS 2 increases voltage just half of APS 1 voltage increase when accelleration.

SPECIFICATION

Pedal Position	Output Voltage(V) [Vref = 5.0V]	
	APS1	**APS2**
C.T	0.7 ~ 0.8V	0.275 ~ 0.475V
W.O.T	3.8 ~ 4.4V	1.75 ~ 2.35V

SCHEMATIC DIAGRAM

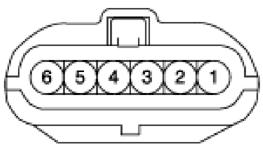
[CIRCUIT DIAGRAM]



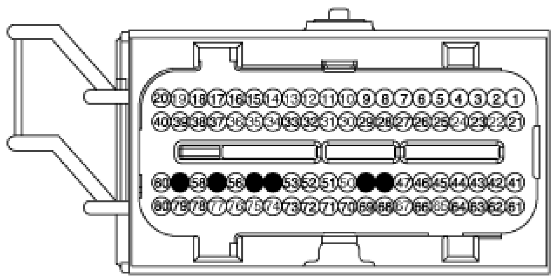
[CONNECTION INFORMATION]

Terminal	Connected to	Funtion
1	PCM C144-1 (57)	APS 2 Reference Voltage (+5V)
2	PCM C144-1 (54)	APS 1 Signal
3	PCM C144-1 (49)	APS 2 Signal
4	PCM C144-1 (59)	APS 1 Reference Voltage (+5V)
5	PCM C144-1 (55)	APS 1 Ground
6	PCM C144-1 (48)	APS 2 Ground

[HARNESS CONNECTORS]



E29
APS

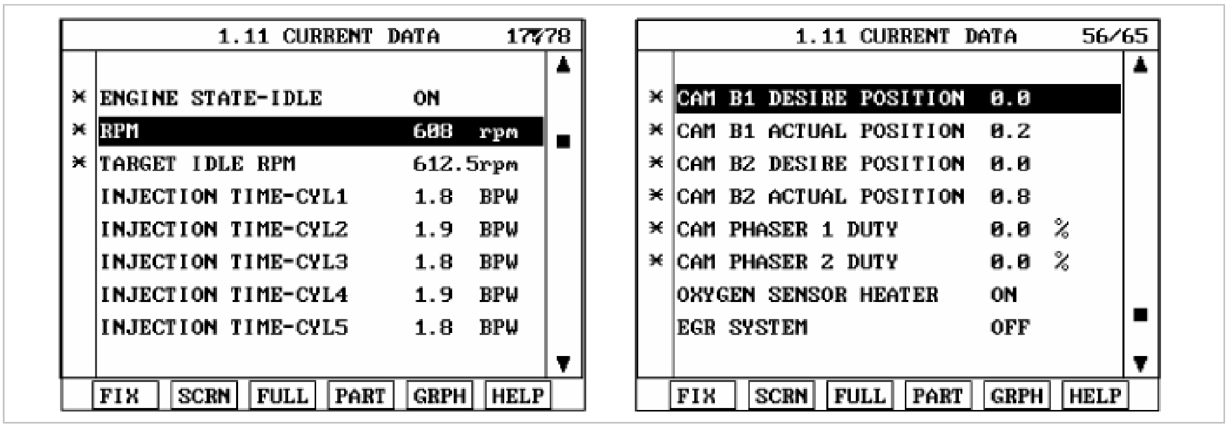


C144-1
PCM

MONITOR SCANTOOL DATA

1. Connect scantool to DLC.(Data Link Connector)
2. Warm up the engine to normal operating temperature.
3. Monitor "APS1 & APS2" parameters on the scantool.

Pedal Position	Output Voltage(V) [Vref = 5.0V]	
	APS1	**APS2**
C.T	0.7 ~ 0.8V	0.275 ~ 0.475V
W.O.T	3.8 ~ 4.4V	1.75 ~ 2.35V



4. Are those "APS1 & APS2" parameters displayed correctly ?

YES

▸Fault is intermittent caused by poor contact in Sensor’s and/or PCM’s connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replaceas necessary and go to "Verification of Vehicle Repair" procedure

NO

▸Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

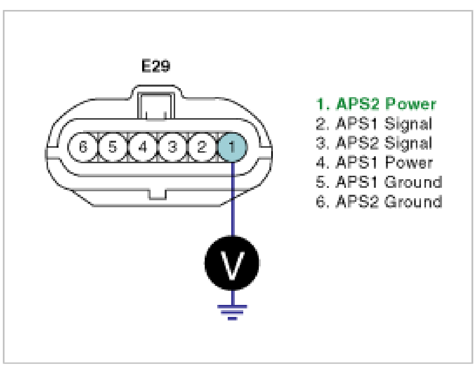
NO

▸ Go to "Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. IG "OFF".
2. Disconnect APS connector.
3. IG "ON" & ENG "OFF".
4. Measure voltage between termial 1 of APS harness connector and chassis ground.

Specification : Approx. 5V



5. Is the measured voltage within specification ?

YES

▸ Go to "Signal Circuit Inspection" procedure.

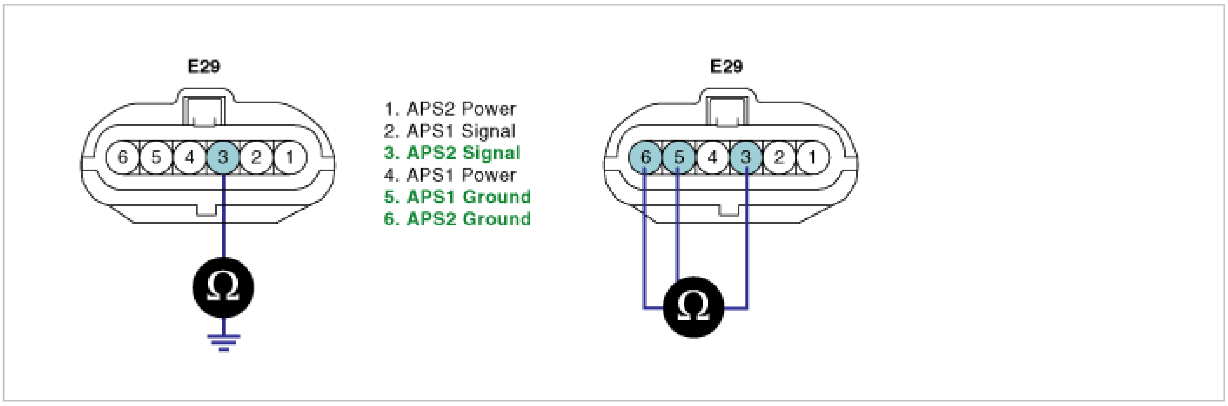
NO

▸ Repair or replace as necessary and then, go to 'Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check short to ground in harness
   (1) IG "OFF".
   (2) Disconnect APS and PCM connector.
   (3) Measure resistance between terminal 3 of APS harness connector and chassis ground.
   (4) Measure resistance between terminal 3 and 5 of APS harness connector.
   (5) Measure resistance between terminal 3 and 6 of APS harness connector.

Specification : Infinite



   (6) Is the measured resistance within specification ?

YES

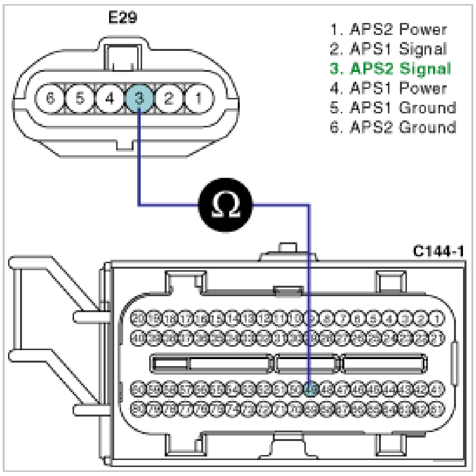
▸ Go to "Check open in harness" as follows.

NO

▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

2. Check open in harness
   (1) IG "OFF".
   (2) Disconnect APS and PCM connector.
   (3) Measure resistance between terminal 3 of APS harness connector and terminal 49/C144-1 of PCM harness connector.

Specification : Approx. below 1Ω



   (4) Is the measured resistance within specification ?

YES

▸ Go to "Component Inspection" procedure.

NO

▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

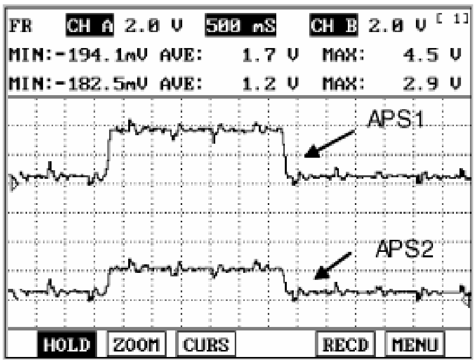
1. Check APS

(1) Ignition "ON" & ENG "OFF".

(2) Measure waveform of APS by pressing and depressing accellerator pedal with scantool.

Specification :

Pedal Position	Output Voltage(V) [Vref = 5.0V]	
	APS1	**APS2**
C.T	0.7 ~ 0.8V	0.275 ~ 0.475V
W.O.T	3.8 ~ 4.4V	1.75 ~ 2.35V



(3) Is the measured signal waveform O.K ?

YES

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Substitute with a known-good APS and check for proper operation. If the problem is corrected,replace APS and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

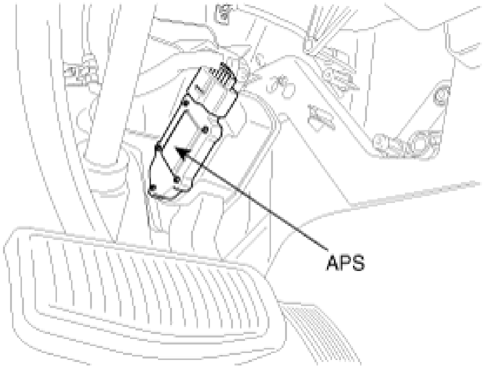
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P2128

COMPONENT LOCATION



GENERAL DESCRIPTION

APS(Acceleration Position Sensor) measures driver's accelerating intension using a potentiometer and APS signal is transmitted to the PCM. The pedal's position is converted as voltages of potentiometer in the APS.The absence of a mechanical link between the accelerator pedal and throttle valve presents a risk of loss of control of the engine in the event of a failure of the component. Therefore, APS has the two potentiometers whose slides are mechanically solid. APS 2 decides whether or not APS 1 & 2 is faulty.

DTC DESCRIPTION

Checking output signals from APS 2 every 78 sec., under detecting condition, if output signals are detected as out of threshold more than the specified number of times., PCM sets P2128. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till 1 driving cycle.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible Cause
DTC Strategy		• This code detects a short to high in either the circuit or the sensor (0-100%)	• Poor connection • Short to battery in Signal Circuit • Open in Ground Circuit • Faulty APS • Faulty PCM
EnableConditions		• Ignition "ON"	
Threshold	Case 1	• APS2 > 3V	
	Case 2	• 4.5V < Sensor Power Supply < 5.5V	
Diagnosis Time		• Contineous (More than 4sec. Failure for every 78sec. Test)	
MIL On Condition		• 1 Driving Cycle	

SIGNAL WAVEFROM AND DATA

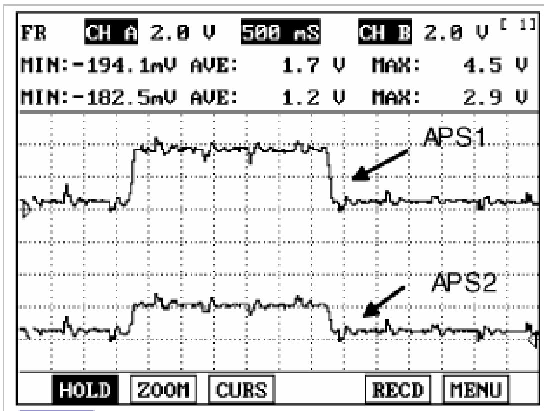


Fig. 1

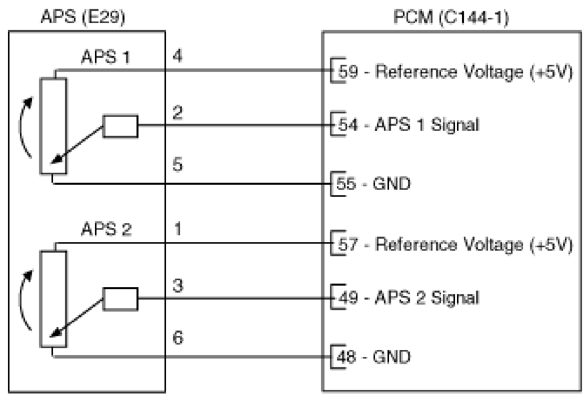
Fig. 1 : This is a signal waveform of APS 1 & 2 which shows that APS 2 increases voltage just half of APS 1 voltage increase when accelleration.

SPECIFICATION

Pedal Position	Output Voltage(V) [Vref = 5.0V]	
	APS1	APS2
C.T	0.7 ~ 0.8V	0.275 ~ 0.475V
W.O.T	3.8 ~ 4.4V	1.75 ~ 2.35V

SCHEMATIC DIAGRAM

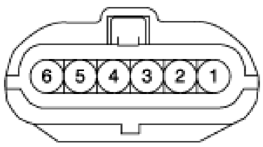
[CIRCUIT DIAGRAM]



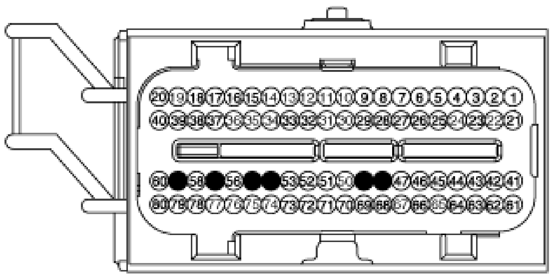
[CONNECTION INFORMATION]

Terminal	Connected to	Funtion
1	PCM C144-1 (57)	APS 2 Reference Voltage (+5V)
2	PCM C144-1 (54)	APS 1 Signal
3	PCM C144-1 (49)	APS 2 Signal
4	PCM C144-1 (59)	APS 1 Reference Voltage (+5V)
5	PCM C144-1 (55)	APS 1 Ground
6	PCM C144-1 (48)	APS 2 Ground

[HARNESS CONNECTORS]



E29
APS

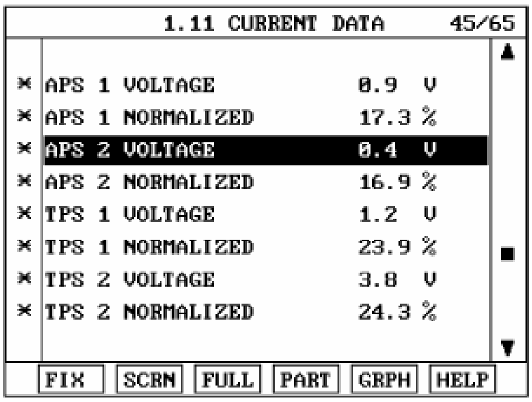


C144-1
PCM

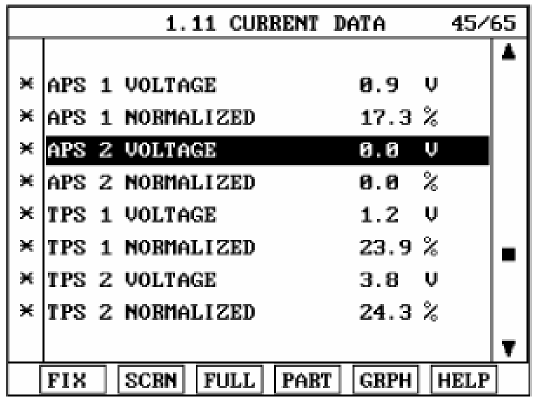
MONITOR SCANTOOL DATA

1. Connect scantool to DLC(Data Link Connector).
2. Warm up the engine to normal operating temperature.
3. Monitor "APS1 & APS2" parameters on the scantool.

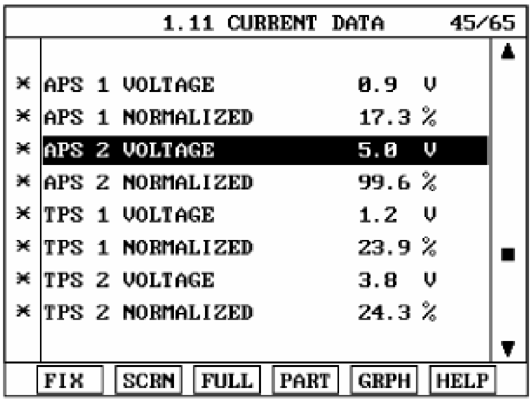
Pedal Position	Output Voltage(V) [Vref = 5.0V]	
	APS1	APS2
C.T	0.7 ~ 0.8V	0.275 ~ 0.475V
W.O.T	3.8 ~ 4.4V	1.75 ~ 2.35V



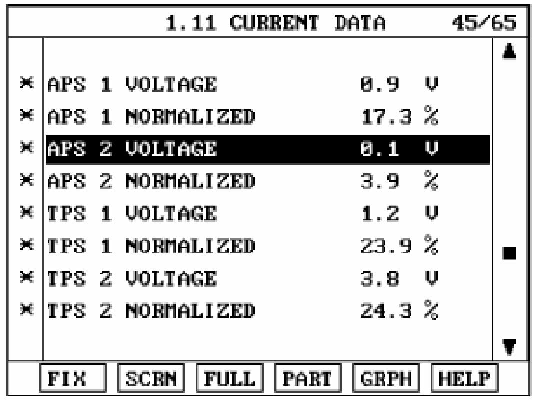
Normal at idle



Ground Short at IG ON



Short to 5V at IG ON



Open at IG ON

4. Are those "APS1 & APS2" parameters displayed correctly ?

YES

▸Fault is intermittent caused by poor contact in Sensor's and/or PCM's connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replaceas necessary and go to "Verification of Vehicle Repair" procedure

NO

▸Go to "Terminal and connector inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

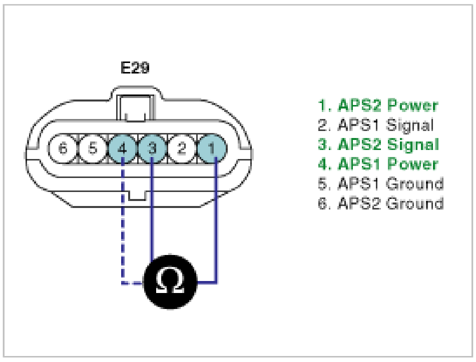
NO

▸ Go to "Signal Circuit Inspection " procedure.

SIGNAL CIRCUIT INSPECTION

1. Check short to battery in harness
   (1) IG "OFF".
   (2) Disconnect APS and PCM connector.
   (3) Measure resistance between terminal 1 and 3 of APS harness connector.
   (4) Measure resistance between terminal 3 and 4 of APS harness connector.

Specification : Infinite



(5) Is the measured reisistance within specification ?

YES

▸ Go to "Ground Circuit Inpsection" procedure.

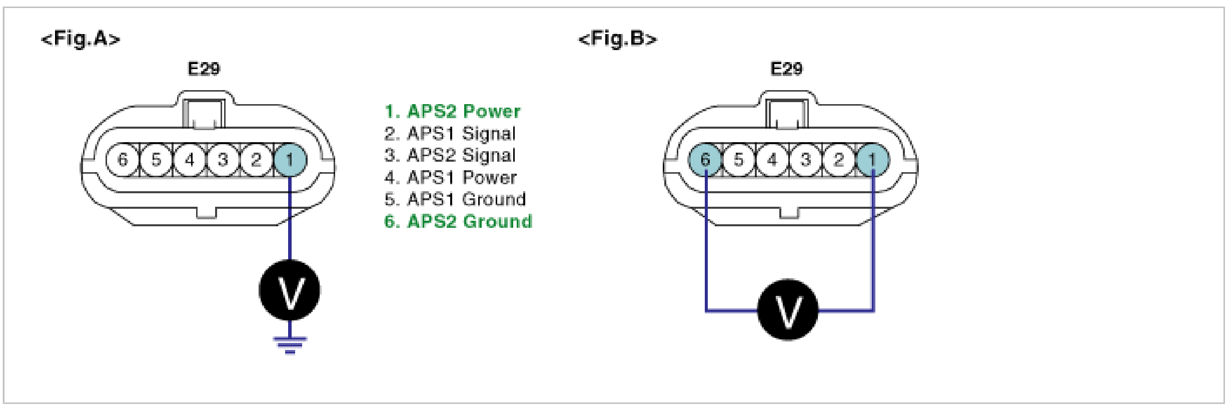
NO

▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. Check open in harness
   (1) IG "OFF"
   (2) Disconnect APS connector.
   (3) Measure voltage between terminal 1 of APS harness connector and chassis ground.(Fig. A)
   (4) Measure voltage between terminal 1 and 6 of APS harness connector.(Fig. B)

Specification : Fig."A" - Fig. "B" = Approx. below 200mV



(5) Is the measured voltage within specification ?

YES

▸ Go to "Component Inspection" procedure.

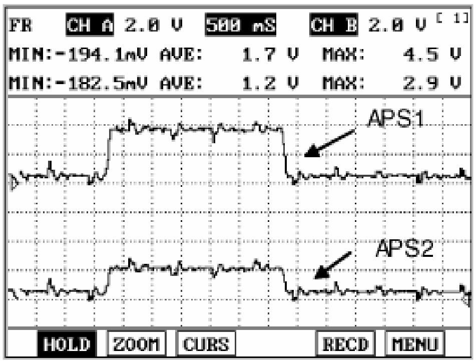
NO

▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check APS
   (1) Ignition "ON" & ENG "OFF".
   (2) Measure waveform of APS by pressing and depressing accellerator pedal with scantool.
   Specification :

Pedal Position	Output Voltage(V) [Vref = 5.0V]	
	APS1	APS2
C.T	0.7 ~ 0.8V	0.275 ~ 0.475V
W.O.T	3.8 ~ 4.4V	1.75 ~ 2.35V



(3) Is the measured signal waveform O.K ?

YES

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Substitute with a known-good APS and check for proper operation. If the problem is corrected,replace APS and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

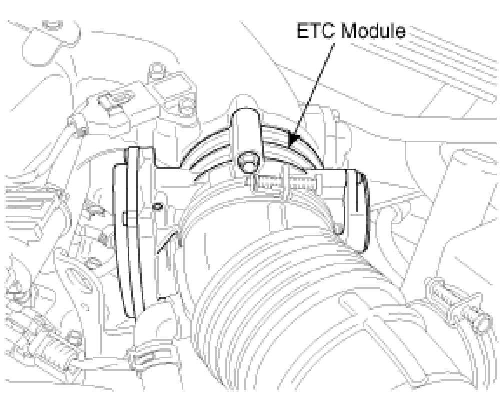
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P2135

COMPONENT LOCATION



GENERAL DESCRIPTION

ETC(Electronic Throttle Control Valve) is the device controlling amount of air to engine acccording to driver's intension. Different from the existing mechanical throttle valve which is composed of accelerator pecal and connecting wire cable, ETC consists of a motor, a throttle body and a throttle position sensor. Receiving input signals from electronic accelerator pedal module, PCM lets ETC motor control throttle valve. With ETC, cruise control system works without any additional device.

DTC DESCRIPTION

Checking output signals from TPS 1 and 2 every 109.2 sec., under detecting condition, if output signals difference between TPS1 and TPS2 are detected more than 3.5% for the specified number of times., PCM sets P2135. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

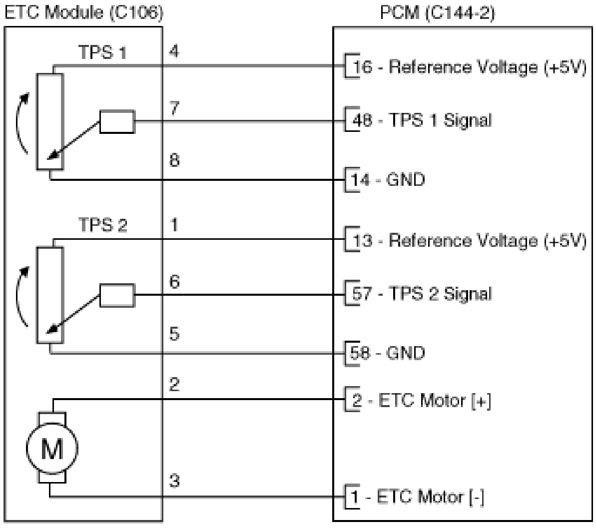
Item	Detecting Condition	Possible Cause
DTC Strategy	• Determines if TPS # 1 disagrees with TPS # 2 (0-100%)	• Poor connection • Open or short in TPS circuit • Faulty TPS • Faulty PCM
Enable condition	• Ignition "ON"	
threshold value	• Difference between average values of TPS1 and TPS2 > 4.5%	
diagnosis time	• Continuous (More than 0.1sec failure for every 10.92sec. Test)	
MIL ON condition	• 2 driving cycles	

SPECIFICATION

Throttle opening (°)	Output voltage(V) [Vref=5.0V]	
	TPS1	TPS2
0°	0.0V	5.0V
10°	0.5V	4.5V
20°	0.9V	4.1V
30°	1.4V	3.6V
40°	1.8V	3.2V
50°	2.3V	2.7V
60°	2.7V	2.3V
70°	3.2V	1.8V
80°	3.6V	1.4V
90°	4.1V	0.9V
100°	4.5V	0.5V
110°	5.0V	0.0V

SCHEMATIC DIAGRAM

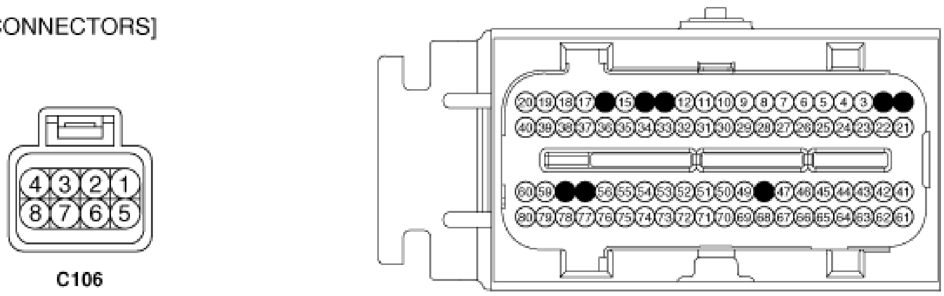
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Funtion
1	PCM C144-2 (13)	TPS 2 Reference Voltage (+5V)
2	PCM C144-2 (2)	ETC Motor [+] Control
3	PCM C144-2 (1)	ETC Motor [-] Control
4	PCM C144-2 (16)	TPS 1 Reference Voltage (+5V)
5	PCM C144-2 (58)	TPS 2 Ground
6	PCM C144-2 (57)	TPS 2 Signal
7	PCM C144-2 (48)	TPS 1 Signal
8	PCM C144-2 (14)	TPS 1 Ground

[HARNESS CONNECTORS]



C106

ETC MODULE

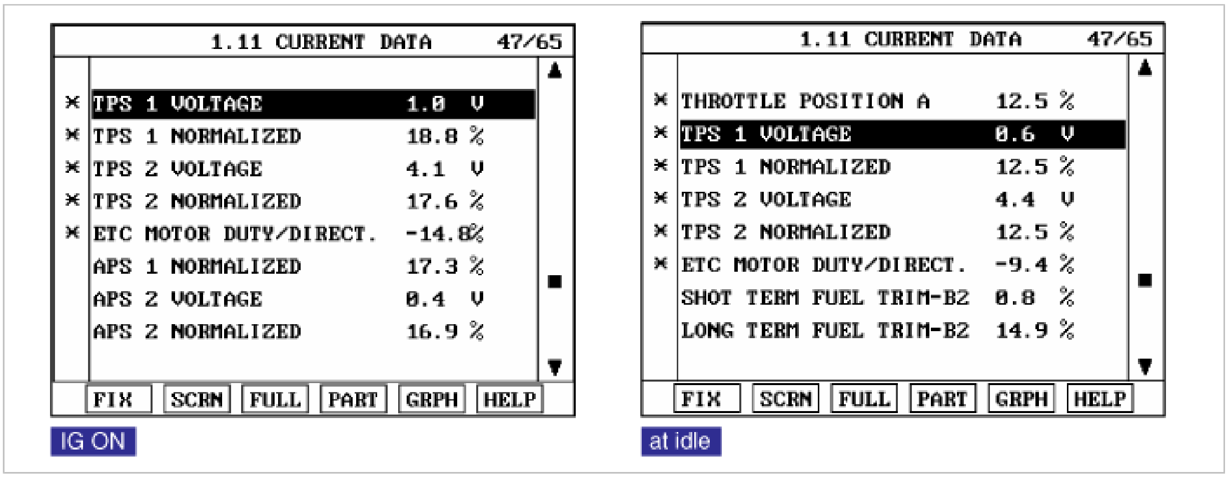
C144-2

PCM

MONITOR SCANTOOL DATA

1. Connect scantool to DLC.(Data Link Connector)
2. IG "ON" & ENG "OFF"
3. Monitor "TPS1 & TPS2" items by pressing and depressing accellerator pedal.
   Specification :

Throttle opening (°)	Output voltage(V) [Vref=5.0V]	
	TPS1	TPS2
0°	0.0V	5.0V
10°	0.5V	4.5V
20°	0.9V	4.1V
30°	1.4V	3.6V
40°	1.8V	3.2V
50°	2.3V	2.7V
60°	2.7V	2.3V
70°	3.2V	1.8V
80°	3.6V	1.4V
90°	4.1V	0.9V
100°	4.5V	0.5V
110°	5.0V	0.0V



4. Are those "TPS1 & TPS2" parameters displayed correctly ?

YES

▸Fault is intermittent caused by poor contact in Sensor's and/or PCM's connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replaceas necessary and go to "Verification of Vehicle Repair" procedure

NO

▸Go to "Terminal and connector inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

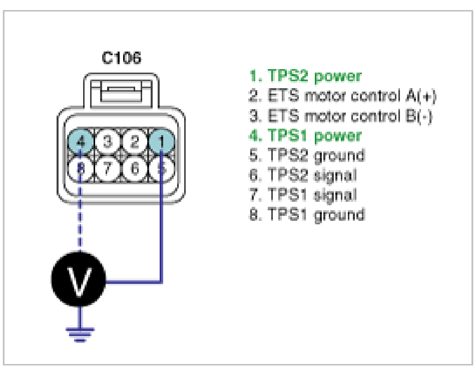
NO

▸ Go to "Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. IG "OFF".
2. Disconnect TPS connector.
3. IG "ON" & ENG "OFF".
4. Measure voltage between terminal 1 of TPS harness connector and chassis ground.
5. Measure voltage between terminal 4 of TPS harness connector and chassis ground.

Specification : Approx. 5V



6. Is the measured voltage within specification ?

YES

▸ Go to "Signal Circuit Inspection" procedure.

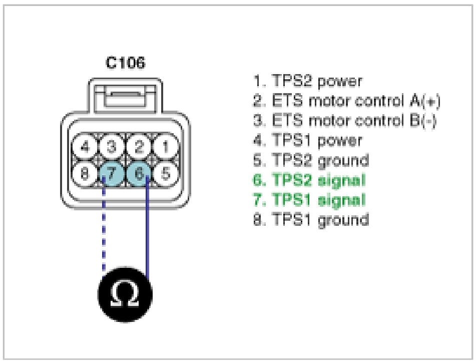
NO

▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. IG "OFF".
2. Disconnect TPS & PCM connector.
3. Measure resistance between terminal 6 and 7 of TPS harness connector.

Specification : Infinite



4. Is the measured resistance within specification ?

YES

▸ Go to "Component Inspection" procedure.

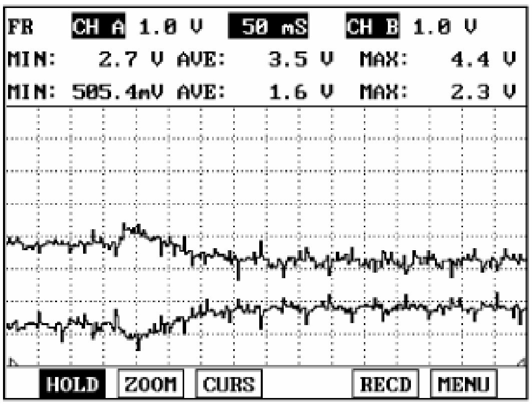
NO

▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

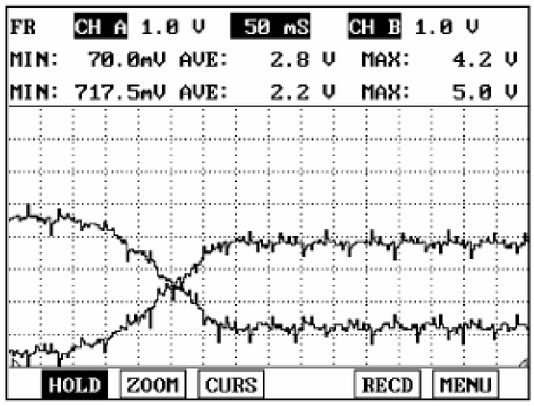
COMPONENT INSPECTION

1. Check TPS
   (1) Ignition "ON" & ENG "OFF".
   (2) Monitor signal waveform of TPS by stepping on and off the accellerator padel on scantool
   Specification :

Throttle opening (°)	Output voltage(V) [Vref=5.0V]	
	TPS1	TPS2
0°	0.0V	5.0V
10°	0.5V	4.5V
20°	0.9V	4.1V
30°	1.4V	3.6V
40°	1.8V	3.2V
50°	2.3V	2.7V
60°	2.7V	2.3V
70°	3.2V	1.8V
80°	3.6V	1.4V
90°	4.1V	0.9V
100°	4.5V	0.5V
110°	5.0V	0.0V



Pressing acclerator pedal at idle



Pulling out accellerator cable with hand at idle

(3) Is the measured signal waveform O.K ?

YES

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Substitute with a known-good TPS and check for proper operation. If the problem is corrected,replace TPS and then go to "Verification of Vehicle Repair" procedure.
(After replacing ETC, do initialization of ETC as follows)

※ Procedure of ETS Initialization

1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10sec.)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

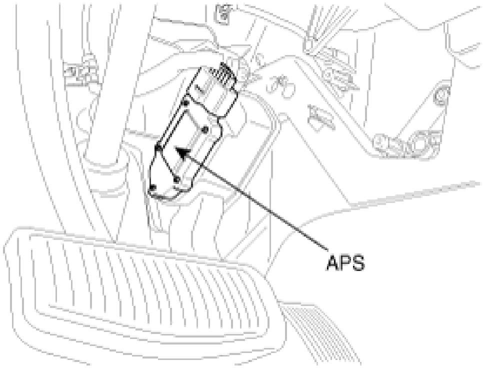
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P2138

COMPONENT LOCATION



GENERAL DESCRIPTION

APS(Acceleration Position Sensor) measures driver's accelerating intension using a potentiometer and APS signal is transmitted to the PCM. The pedal's position is converted as voltages of potentiometer in the APS.The absence of a mechanical link between the accelerator pedal and throttle valve presents a risk of loss of control of the engine in the event of a failure of the component. Therefore, APS has the two potentiometers whose slides are mechanically solid. APS 2 decides whether or not APS 1 & 2 is faulty.

DTC DESCRIPTION

Checking output signals from APS 1 and 2 every 93.6 sec., under detecting condition, if output signals difference between APS 1 and 2 are detected more than 4.5% for the specified number of times., PCM sets P2138. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till 1 driving cycle.

DTC DETECTING CONDITION

Item		Detecting Condition	Possible Cause
DTC Strategy		• This code detects a correlation error between APS 1 and APS 2 (0-100%)	• Poor connection • Open or short in APS Circuit • Faulty APS • Faulty PCM
EnableConditions		• Ignition "ON"	
Threshold	Case 1	• Difference between APS1 and APS2 Normalized values > 4.5%	
	Case 2	• Difference between APS learned minimums > 4.5%	
Diagnosis Time		• Contineous (More than 0.32sec. Failure for every 9.36sec. Test)	
MIL On Condition		• 1 Driving Cycle	

SIGNAL WAVEFROM AND DATA

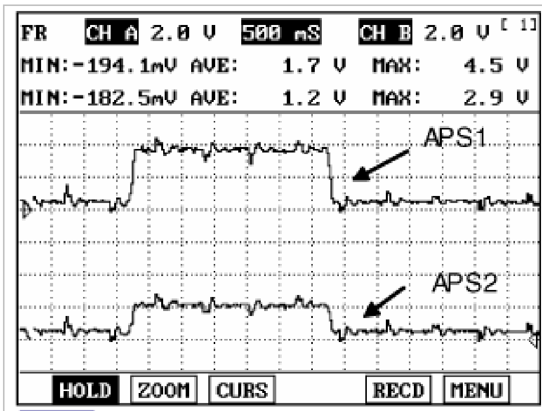


Fig. 1

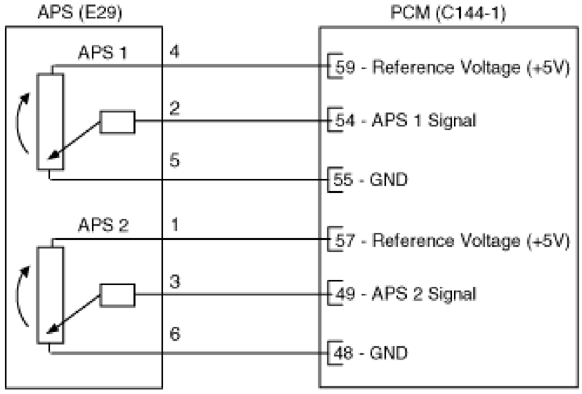
Fig. 1 : This is a signal waveform of APS 1 & 2 which shows that APS 2 increases voltage just half of APS 1 voltage increase when accelleration.

SPECIFICATION

Pedal Position	Output Voltage(V) [Vref = 5.0V]	
	APS1	**APS2**
C.T	0.7 ~ 0.8V	0.275 ~ 0.475V
W.O.T	3.8 ~ 4.4V	1.75 ~ 2.35V

SCHEMATIC DIAGRAM

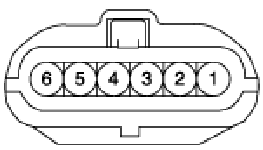
[CIRCUIT DIAGRAM]



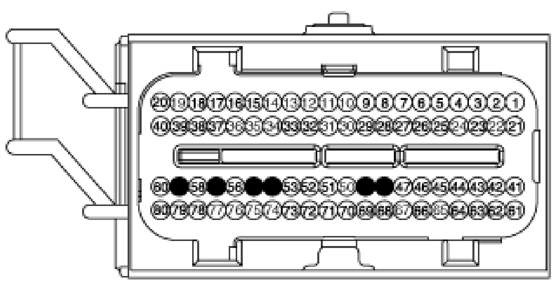
[CONNECTION INFORMATION]

Terminal	Connected to	Funtion
1	PCM C144-1 (57)	APS 2 Reference Voltage (+5V)
2	PCM C144-1 (54)	APS 1 Signal
3	PCM C144-1 (49)	APS 2 Signal
4	PCM C144-1 (59)	APS 1 Reference Voltage (+5V)
5	PCM C144-1 (55)	APS 1 Ground
6	PCM C144-1 (48)	APS 2 Ground

[HARNESS CONNECTORS]



E29
APS

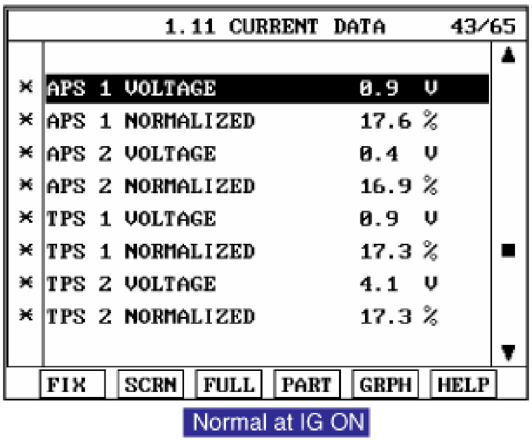


C144-1
PCM

MONITOR SCANTOOL DATA

1. Connect scantool to DLC.(Data Link Connector)
2. Warm up the engine to normal operating temperature.
3. Monitor "APS1 & APS2" parameters on the scantool.

Pedal Position	Output Voltage(V) [Vref = 5.0V]	
	APS1	**APS2**
C.T	0.7 ~ 0.8V	0.275 ~ 0.475V
W.O.T	3.8 ~ 4.4V	1.75 ~ 2.35V



4. Are those "APS1 & APS2" parameters displayed correctly ?

YES

▸Fault is intermittent caused by poor contact in Sensor's and/or PCM's connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replaceas necessary and go to "Verification of Vehicle Repair" procedure

NO

▸Go to "Terminal and connector inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸Repair as necessary and go to "Verification of Vehicle Repair" procedure

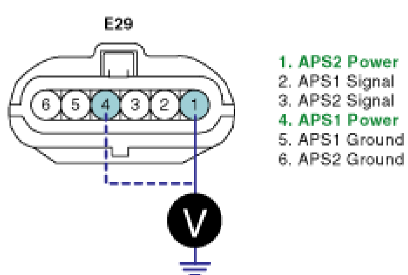
NO

▸Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. IG "OFF"
2. Disconnect APS connector.
3. IG "ON" & ENG "OFF".
4. Measure voltage between terminal 1 of APS harness connector and chassis ground.
5. Measure voltage between terminal 4 of APS harnesss connector and chassis ground.

Specification : Approx. 5V



6. Is the measured voltage within specification ?

YES

▸ Go to "Signal Circuit Inspection" procedure.

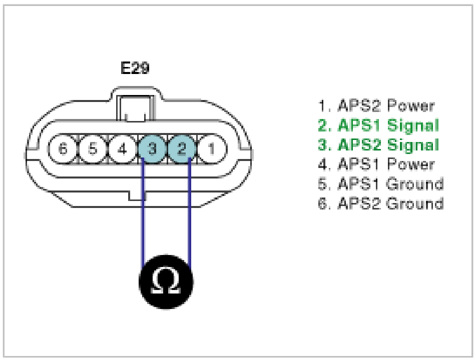
NO

▸ Repair or replace as necessary and then, go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. IG "OFF".
2. Disconnect APS and PCM connector.
3. Measure resistance between terminal 2 and 3 of APS harness connector.

Specification : Infinite



4. Is the measured resistance within specification ?

YES

▸ Go to "Component Inspection" procedure.

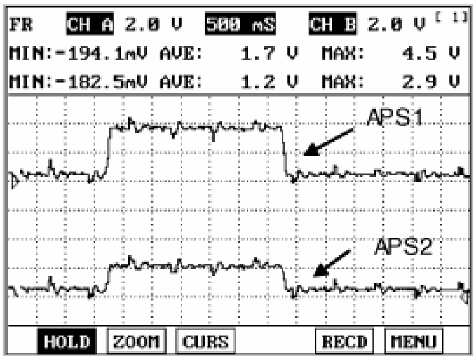
NO

▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check APS
   (1) IG "ON" & ENG "OFF".
   (2) Measure signal waveform of APS 1 and APS 2 by stepping on and off with scantool
   Specification :

Pedal Position	Output Voltage(V) [Vref = 5.0V]	
	APS1	APS2
C.T	0.7 ~ 0.8V	0.275 ~ 0.475V
W.O.T	3.8 ~ 4.4V	1.75 ~ 2.35V



   (3) Is the measured signal waveform O.K ?

YES

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by

PCM.
Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▸ Substitute with a known-good APS and check for proper operation. If the problem is corrected,replace APS and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

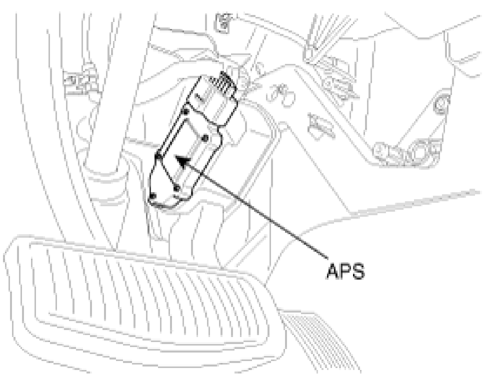
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P2173

COMPONENT LOCATION



GENERAL DESCRIPTION

ETC(Electronic Throttle Control Valve) is the device controlling amount of air to engine acccording to driver's intension. Different from the existing mechanical throttle valve which is composed of accelerator pecal and connecting wire cable, ETC consists of a motor, a throttle body and a throttle position sensor. Receiving input signals from electronic accelerator pedal module, PCM lets ETC motor control throttle valve. With ETC, cruise control system works without any additional device.

DTC DESCRIPTION

Comparing real intake air flow and the intake air flow calculated by ETS every 15.6 sec., under detecting condition, if the difference of air flow more than 200g/s is detected for more than 1.3 sec., PCM sets P2173. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till 1 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• The engine airflow measurements not based on throttle position are compared with throttle position based estimated airflow. If measured airflow is much higher than throttle based estimated airflow, the throttle body may not be throttling the engine.	
	• Engine running	

EnableConditions		• Throttle Actuation Mode is not OFF • MAP Sensor is not failed • MAF Sensor is not failed • IAT sensor is not failed	• Air Leakage between TPS and MAFS • Faulty throttle body • Faulty PCM
Threshold	Case 1	• Speed-Density Airflow - ETC estimated airflow > 9 g/s	
	Case 2	• MAF reading - ETC estimated airflow > 7g/s	
Diagnosis Time		• Contineous (More than 3.9sec. Failure for every 15.6sec. Test)	
MIL On Condition		• 1 Driving Cycle	

SPECIFICATION

MAFS

Air flow (kg/h)	Frequency (Hz)
0 kg/h	720 ~ 880 Hz
12.6 kg/h	2,595 Hz
18.0 kg/h	2,930 Hz
23.4 kg/h	3,208 Hz
32.4 kg/h	3,609 Hz
43.2 kg/h	3,975 Hz
57.6 kg/h	4,361 Hz
72.0 kg/h	4,683 Hz
108.0 kg/h	5,362 Hz
144.0 kg/h	5,885 Hz
198.0 kg/h	6,527 Hz
270.0 kg/h	7,219 Hz
360.0 kg/h	7,945 Hz
486.0 kg/h	8,736 Hz
666.0 kg/h	9,660 Hz
900.0 kg/h	10,613 Hz

TPS

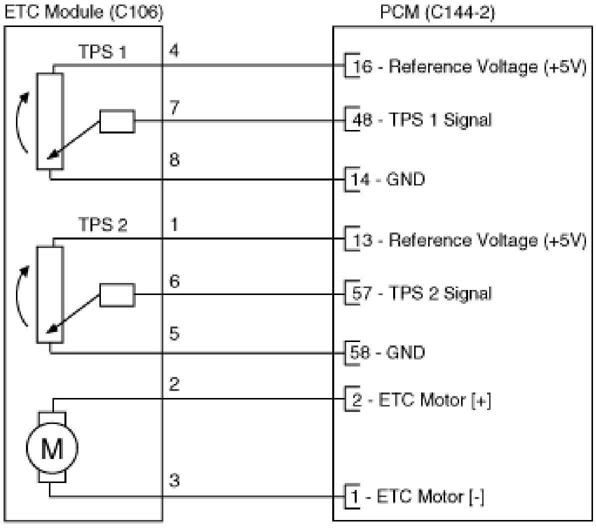
Throttle opening (°)	Output voltage(V) [Vref=5.0V]	
	TPS1	TPS2
0°	0.0V	5.0V
10°	0.5V	4.5V
V20°	0.9V	4.1V
30°	1.4V	3.6V
40°	1.8V	3.2V
50°	2.3V	2.7V
60°	2.7V	2.3V
70°	3.2V	1.8V
80°	3.6V	1.4V
90°	4.1V	0.9V
100°	4.5V	0.5V
110°	5.0V	0.0V

MAPS

Pressure(kPa)(kPa)	Output voltage(V)
20.0kPa	0.79V
35kPa	1.382V
46.66kPa	1.84V
60kPa	2.369V
90kPa	3.75V
101.32kPa	4.00V

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



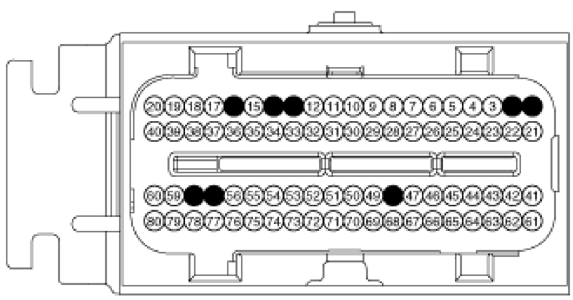
[CONNECTION INFORMATION]

Terminal	Connected to	Funtion
1	PCM C144-2 (13)	TPS 2 Reference Voltage (+5V)
2	PCM C144-2 (2)	ETC Motor [+] Control
3	PCM C144-2 (1)	ETC Motor [-] Control
4	PCM C144-2 (16)	TPS 1 Reference Voltage (+5V)
5	PCM C144-2 (58)	TPS 2 Ground
6	PCM C144-2 (57)	TPS 2 Signal
7	PCM C144-2 (48)	TPS 1 Signal
8	PCM C144-2 (14)	TPS 1 Ground

[HARNESS CONNECTORS]

C106

ETC MODULE

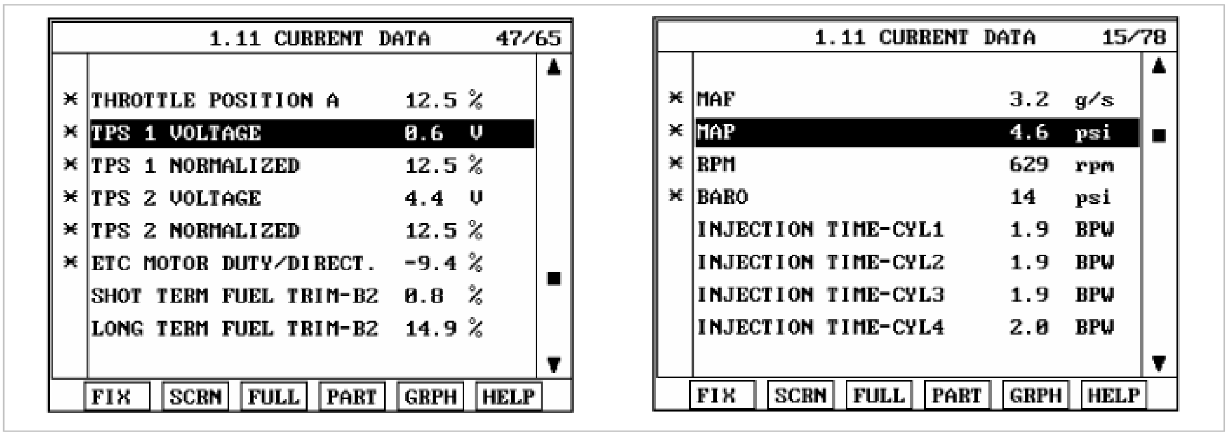


C144-2

PCM

MONITOR SCANTOOL DATA

1. Connect scantool to DLC.(Data Link Connector)
2. Warm up the engine to normal operating temperature.
3. Monitor "TPS1&2, MAPS,MAFS" parameters on scantool



YES

▸Fault is intermittent caused by poor contact in Sensor’s and/or PCM’s connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replaceas necessary and go to "Verification of Vehicle Repair" procedure

NO

▸Go to "System Inspection" procedure.

SYSTEM INSPECTION

1. Visual Inspection
   (1) Check the air hose between MAFS and throttle body is torn or installation.

   (2) Check deforamtion, crack or installation of throttle valve(body)

   (3) Has a problem been found ?

   YES

   ▸ Substitute with a known-good Air hose or throttle body and check for proper operation.
   If the problem is corrected,replace air hose or throttle body and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.
> Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

※ Procedure of ETS Initialization

1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10sec.)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

GENERAL DESCRIPTION

Air-fuel feed back control is the modulation which increases or decreases fuel injection quantity as determining exhaust gas rich or lean with HO2S adjust combustion is done at ideal air-fuel ratioto so as to raise the efficiency of catalytic convertor. Generally, NOx increases at lean combustion while CO, HC increases in rich combustion. Thus, in order to purge all of these gases with catalytic convertor, air-fuel ratio should be nearly at the ideal ratio. However the range in which all gases purified successfully is too narrow, it is impossible to meet ideal range with open loop control, therefore feed back control using HO2S is required. HO2S output signal changes rapidly near ideal air-fuel ratio and this characteristic is used at feed back control. comparing HO2S output signal and reference value, PCM increases fuel injection quantity at lean condition and decreases at rich condition. As deterioration of engine, due to the characteristic changes of many components of intake and fuel line or inevitable tolerance of components at production process, achieving ideal air-fuel ratio is almost impossible with the fixed fuel injection duration. Regarding the change of cross section by clogged injector, feed back correction is performed yet, it cannot cover all the ranges. It means if the correction range is massively seperated from the ideal value or if the mean of feed back control range too inclines to lean or rich condition, feed back correction does not work efficiently. Therefore processing correction value throughout long time statistically during driving, PCM controlls fuel injection duration as fitting the mean to be the ideal air-fuel ratio value. Through adaptive control, accuracy of the control could be improved and the value of adaptive control varies countiuously during driving and is always up-dated.

DTC DESCRIPTION

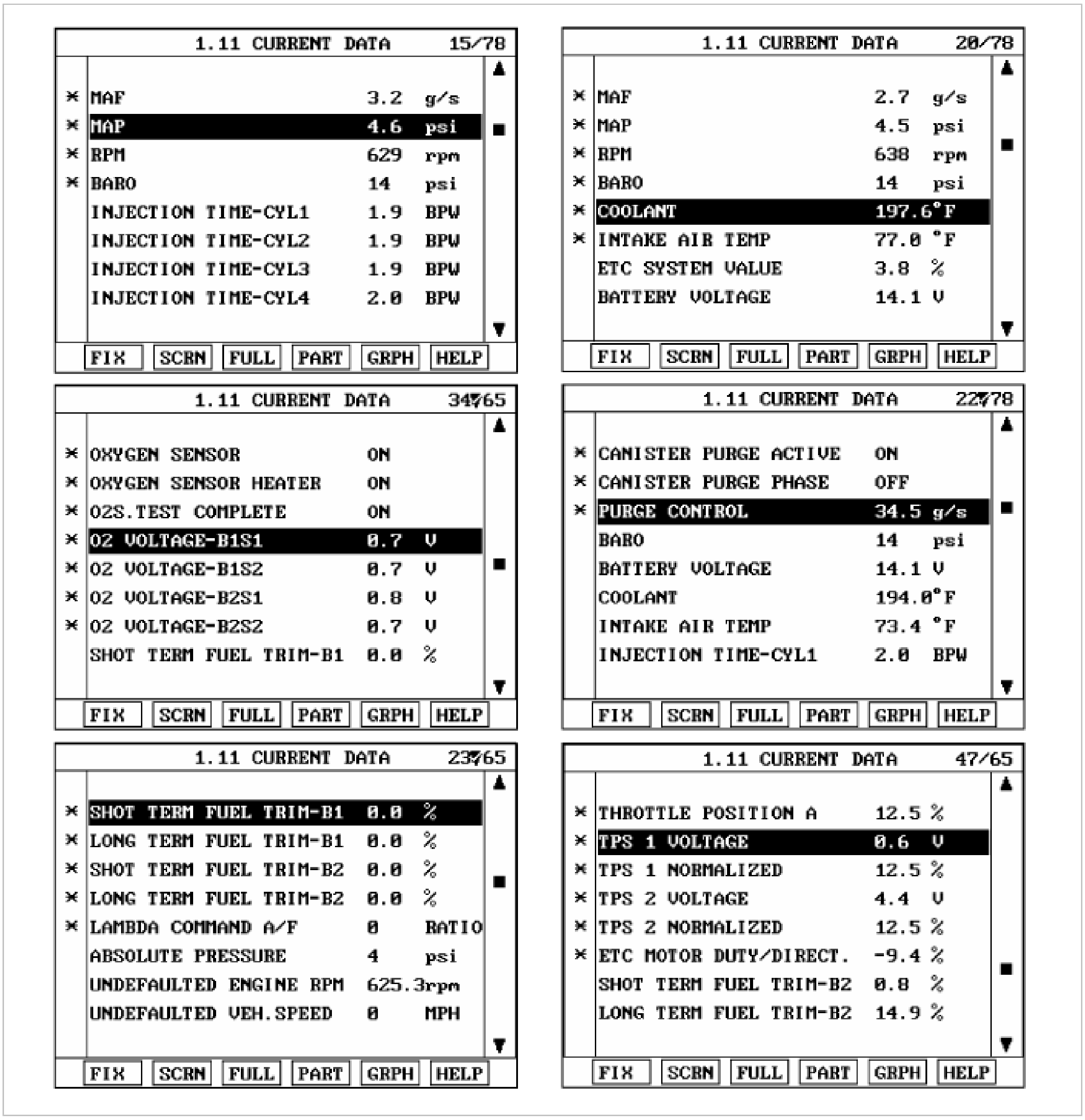
Checking air-fuel ratio correction value every 0.75 sec. at idle, if the value within the detecting condition for more than 0.3 sec., PCM sets P2187. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Fuel Trim Idle Condition Option Limits Exceeded	• Sensors related to Fuel Trim • Intake system • Fuel Pressure • Faulty PCM
EnableConditions	• 550rpm ≤ Engine Speed ≤ 4000rpm • 60°C ≤ Engine coolant temperature ≤ 114.992°C • -10°C ≤ Intake Air Temperature ≤ 60°C • 0° ≤ Throttle Position ≤ 72° • 25kPa ≤ Engine Load ≤ 90kPa • 1.5g/s ≤ Intake Air Flow ≤ 80g/s • Barometric Pressure ≥ 72kPa • Vehicle Speed ≤ 130km/h • System Voltage ≥ 11V • BLM learn Allowed • Closed Loop Active • Other diagnostic fault not active	
Threshold value	• Lean Limit Average > 0.8 (The average of short term fuel trim values) • Lean Limit Average > 1.25 (The average of adaptive index multiplier values)	
DiagnosisTime	• Contineous (More than 0.375sec. Failure for every 0.75sec. Test)	
MIL On Condition	• 2 Driving Cycles	

MONITOR SCANTOOL DATA

1. Connect scantool to DLC(Data Link Connector)
2. Warm up the engine to normal operating temperature.
3. Monitor sensors related to fuel trim(Ex. HO2S,MAFS,MAPS,TPS,MAPS,TPS,ECTS,PCSV,Injectors etc.) with scantool



4. Are those parameters displayed correctly ?

YES

▸Fault is intermittent caused by poor contact in Sensor's and/or PCM's connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replaceas necessary and go to "Verification of Vehicle Repair" procedure

NO

▸Go to "Terminal and connector inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "System Inspection " procedure.

SYSTEM INSPECTION

1. Check Air leakage
   (1) Check gasket is contaminated or misinstalled.
   - Installation or any damage of Throttle body gasket
   - Installation or any damage of the gasket between intake manifold and surge tank.
   - Clogging of intake manifold or injectors resulting from foreign materials.
   - Open stuck of PCSV caused by foreign materials between surge tank and PCSV.

   (2) Has a problem been found ?

   YES
   - Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

   NO
   - Go to "Check Fuel Line Inspection" as follows.

2. Check Fuel Line Inspection
   (1) Check clog, contamination and installation of each hose as follows.
   - Check connection of each fuel line.
   - Check damage, interference and installation of vaccum hose connected to fuel line.
   - Check that fuel pipe in the fuel line is bent and sqeezed.
   - Check any fuel leakage from fuel pipe in the fuel line.

   (2) Has a problem been found ?

   YES
   - Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

   NO
   - Go to "Check fuel pressure" as follows.

3. Check Fuel Pressure
   (1) Refer to "Fuel pressure test" in "Fuel delivery system"

   (2) Is the measured fuel pressure within specification ?

   YES
   - Go to "Component Inspection" procedure.

   YES
   - Repair or replace as necessary and the, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check PCV
   (1) IG "OFF".

   (2) Remove PCV valve and then, check that plunger in the PCV is moving.

   (3) Is the PCV normal ?

   YES
   - Go to "Check PCSV" as follows.

   NO
   - Substitute with a known-good PCV and check for proper operation. If the problem is corrected,replace PCV and then go to "Verification of Vehicle Repair" procedure.

2. Check PCSV
   (1) IG "OFF".

   (2) Remove PCSV and Vaccum Hose

   (3) Check that PCSV is just one way solenoid valve

   (4) Is the PCSV normal ?

   YES
   - Go to "Check injector" as follows.

   NO
   - Substitute with a known-good PCSV and check for proper operation. If the problem is corrected,replace PCSV and then go to "Verification of Vehicle Repair" procedure.

3. Check injector
   (1) IG "OFF"

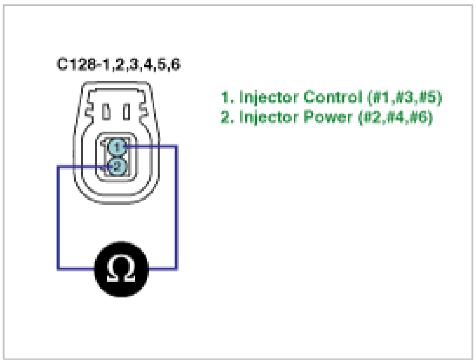
(2) Remove injector.

(3) Check that injector hole is clogged by foreign materials.

(4) Measure resistance between terminal 1 an 2 of injector connector.(Component Side)

Specification :

Temp.	Resistance
20°C (68°F)	11.4 ~ 12.6Ω



(5) Is the measured resistance within specification ?

YES

▸ Go to "Check component related to fuel trim" as follows.

NO

▸ Substitute with a known-good injector and check for proper operation. If the problem is corrected,replace injector and then go to "Verification of Vehicle Repair" procedure.

4. Check component related to fuel trim

(1) Check component related to fuel trim such as HO2S, MAFS,MAPS, TPS, ECTS, PCSV and Injectores) - Refer to each designated trouble shooting guide.

(2) Are those component related to fuel trim O.K ?

YES

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.

NO

▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P2188

GENERAL DESCRIPTION

Air-fuel feed back control is the modulation which increases or decreases fuel injection quantity as determining exhaust gas rich or lean with HO2S adjust combustion is done at ideal air-fuel ratioto so as to raise the efficiency of catalytic convertor. Generally, NOx increases at lean combustion while CO, HC increases in rich combustion. Thus, in order to purge all of these gases with catalytic convertor, air-fuel ratio should be nearly at the ideal ratio. However the range in which all gases purified successfully is too narrow, it is impossible to meet ideal range with open loop control, therefore feed back control using HO2S is required. HO2S output signal changes rapidly near ideal air-fuel ratio and this characteristic is used at feed back control. comparing HO2S output signal and reference value, PCM increases fuel injection quantity at lean condition and decreases at rich condition. As deterioration of engine, due to the characteristic changes of many components of intake and fuel line or inevitable tolerance of components at production process, achieving ideal air-fuel ratio is almost impossible with the fixed fuel injection duration. Regarding the change of cross section by clogged injector, feed back correction is performed yet, it cannot cover all the ranges. It means if the correction range is massively seperated from the ideal value or if the mean of feed back control range too inclines to lean or rich condition, feed back correction does not work efficiently. Therefore processing correction value throughout long time statistically during driving, PCM controlls fuel injection duration as fitting the mean to be the ideal air-fuel ratio value. Through adaptive control, accuracy of the control could be improved and the value of adaptive control varies countiuously during driving and is always up-dated.

DTC DESCRIPTION

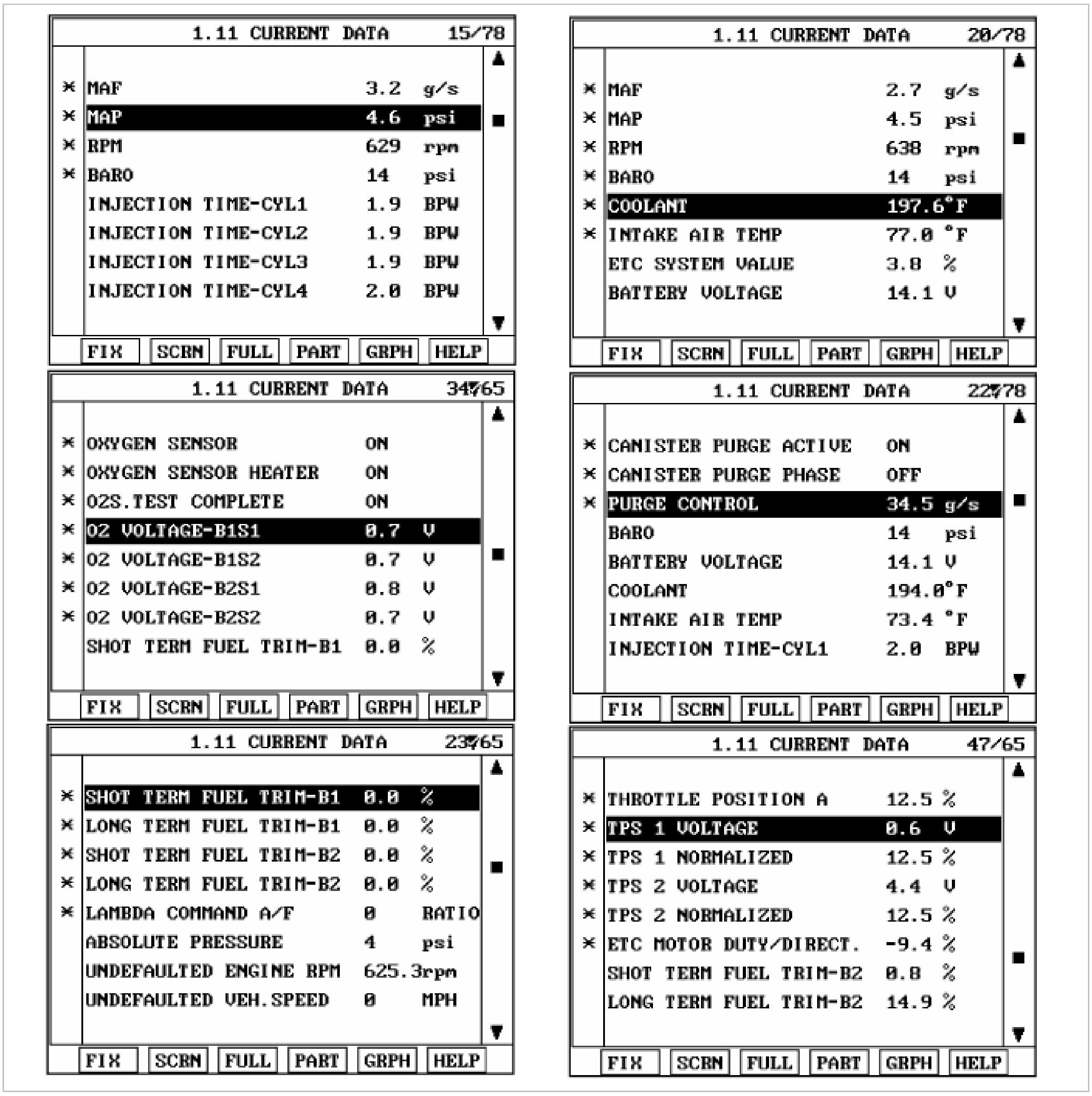
Checking air-fuel ratio correction value every 0.75 sec. at idle, if the value within the detecting condition for more than 0.3 sec., PCM sets P2188. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Fuel Trim Idle Condition Option Limits Exceeded	• Sensors related to Fuel Trim • Intake system • Fuel Pressure • Faulty PCM
EnableConditions	• 550rpm ≤ Engine Speed ≤ 4000rpm • 60°C ≤ Engine coolant temperature ≤ 114.992°C • -10°C ≤ Intake Air Temperature ≤ 60°C • 0° ≤ Throttle Position ≤ 72° • 25kPa ≤ Engine Load ≤ 90kPa • 1.5g/s ≤ Intake Air Flow ≤ 80g/s • Barometric Pressure ≥ 72kPa • Vehicle Speed ≤ 130km/h • System Voltage ≥ 11V • BLM learn Allowed • Closed Loop Active • Other diagnostic fault not active	
Threshold value	• Rich Limit Average < 1.5 (The average of short term fuel trim values) • Rich Limit Average < 0.76 (The average of adaptive index multiplier values)	
DiagnosisTime	• Contineous (More than 0.375sec. Failure for every 0.75sec. Test)	
MIL On Condition	• 2 Driving Cycles	

MONITOR SCANTOOL DATA

1. Connect scantool to DLC(Data Link Connector)
2. Warm up the engine to normal operating temperature.
3. Monitor sensors related to fuel trim(Ex. HO2S,MAFS,MAPS,TPS,MAPS,TPS,ECTS,PCSV,Injectors etc.) with scantool



4. Are those parameters displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor’s and/or PCM’s connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replaceas necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "System Inspection " procedure.

SYSTEM INSPECTION

1. Check air clog.
   (1) Check Contamination ,Gasket installation as follows
      ▸ Damage or installation of throttle body gasket.
      ▸ Check clog of air cleaner
      ▸ Clog or contamination of intake manifold or injectors caused by foreign materials
      ▸ Check vaccum hose connected to surge tank is normal.
   (2) Has a problem been found ?

   YES

   ▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair"procedure.

   NO

   ▸ Go to "Check Fuel Pressure" as follows

2. Check Fuel Pressure.
   (1) Refer to "Fuel pressure test" in "Fuel delivery system"
   (2) Is the measured fuel pressure within specification ?

   YES

   ▸ Go to "Component Inspection"procedure.

   NO

   ▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check PCV
   (1) IG "OFF".
   (2) Remove PCV valve and then, check that plunger in the PCV is moving.
   (3) Is the PCV normal ?

   YES

   ▸ Go to "Check PCSV" as follows.

   NO

   ▸ Substitute with a known-good PCV and check for proper operation. If the problem is corrected,replace PCV and then go to "Verification of Vehicle Repair" procedure.

2. Check PCSV
   (1) IG "OFF".
   (2) Remove PCSV and Vaccum Hose
   (3) Check that PCSV is just one way solenoid valve
   (4) Is the PCSV normal ?

   YES

   ▸ Go to "Check injector" as follows.

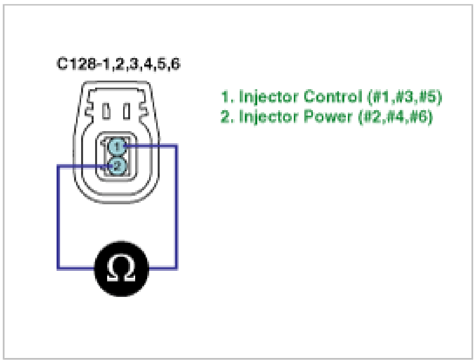
   NO

   ▸ Substitute with a known-good PCSV and check for proper operation. If the problem is corrected,replace PCSV and then go to "Verification of Vehicle Repair" procedure.

3. Check injector
   (1) IG "OFF"
   (2) Remove injector.
   (3) Check that injector hole is clogged by foreign materials.
   (4) Measure resistance between terminal 1 an 2 of injector connector.(Component Side)

   Specification :

Temp.	Resistance
20°C (68°F)	11.4 ~ 12.6Ω



(5) Is the measured resistance within specification ?

YES

▶ Go to "Check component related to fuel trim" as follows.

NO

▶ Substitute with a known-good injector and check for proper operation. If the problem is corrected,replace injector and then go to "Verification of Vehicle Repair" procedure.

4. Check component related to fuel trim
   (1) Check component related to fuel trim such as HO2S, MAFS,MAPS, TPS, ECTS, PCSV and Injectores) - Refer to each designated trouble shooting guide.

   (2) Are those component related to fuel trim O.K ?

YES

▶ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

Fuel System > Troubleshooting > P2189

GENERAL DESCRIPTION

Air-fuel feed back control is the modulation which increases or decreases fuel injection quantity as determining exhaust gas rich or lean with HO2S adjust combustion is done at ideal air-fuel ratioto so as to raise the efficiency of catalytic convertor. Generally, NOx increases at lean combustion while CO, HC increases in rich combustion. Thus, in order to purge all of these gases with catalytic convertor, air-fuel ratio should be nearly at the ideal ratio. However the range in which all gases purified successfully is too narrow, it is impossible to meet ideal range with open loop control, therefore feed back control using HO2S is required. HO2S output signal changes rapidly near ideal air-fuel ratio and this characteristic is used at feed back control. comparing HO2S output signal and reference value, PCM increases fuel injection quantity at lean condition and decreases at rich condition. As deterioration of engine, due to the characteristic changes of many components of intake and fuel line or inevitable tolerance of components at production process, achieving ideal air-fuel ratio is almost impossible with the fixed fuel injection duration. Regarding the change of cross section by clogged injector, feed back correction is performed yet, it cannot cover all the ranges. It means if the correction range is massively seperated from the ideal value or if the mean of feed back control range too inclines to lean or rich condition, feed back correction does not work efficiently. Therefore processing correction value throughout long time statistically during driving, PCM controlls fuel injection duration as fitting the mean to be the ideal air-fuel ratio value. Through adaptive control, accuracy of the control could be improved and the value of adaptive control varies countiuously during driving and is always up-dated.

DTC DESCRIPTION

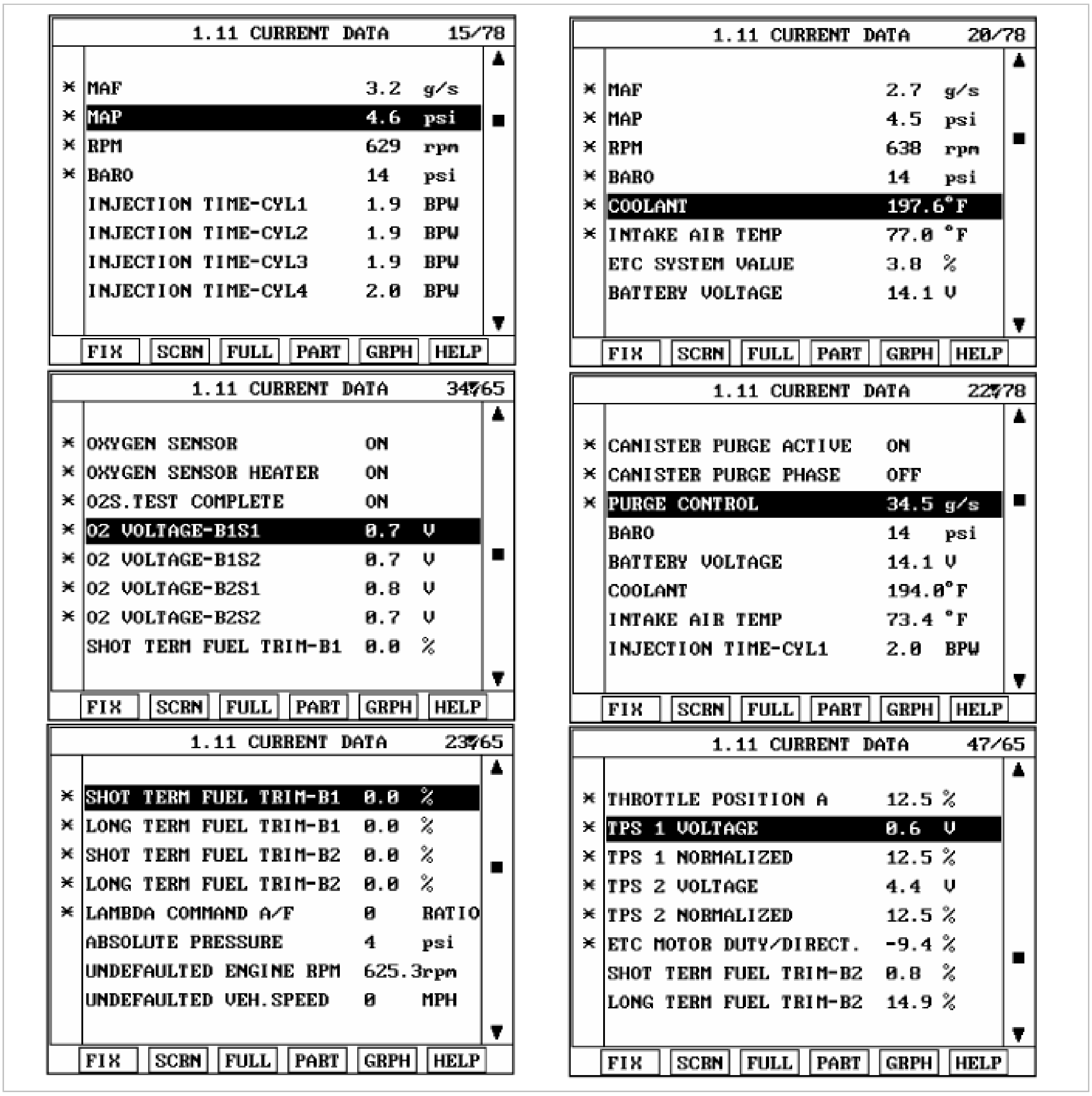
Checking air-fuel ratio correction value every 0.75 sec. at idle, if the value within the detecting condition for more than 0.3 sec., PCM sets P2189. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Fuel Trim Idle Condition Option Limits Exceeded	• Sensors related to Fuel Trim • Intake system • Fuel Pressure • Faulty PCM
EnableConditions	• 550rpm ≤ Engine Speed ≤ 4000rpm • 60°C ≤ Engine coolant temperature ≤ 114.992°C • -10°C ≤ Intake Air Temperature ≤ 60°C • 0° ≤ Throttle Position ≤ 72° • 25kPa ≤ Engine Load ≤ 90kPa • 1.5g/s ≤ Intake Air Flow ≤ 80g/s • Barometric Pressure ≥ 72kPa • Vehicle Speed ≤ 130km/h • System Voltage ≥ 11V • BLM learn Allowed • Closed Loop Active • Other diagnostic fault not active	
Threshold value	• Lean Limit Average > 0.8 (The average of short term fuel trim values) • Lean Limit Average > 1.24 (The average of adaptive index multiplier values)	
DiagnosisTime	• Contineous (More than 0.375sec. Failure for every 0.75sec. Test)	
MIL On Condition	• 2 Driving Cycles	

MONITOR SCANTOOL DATA

1. Connect scantool to DLC(Data Link Connector)
2. Warm up the engine to normal operating temperature.
3. Monitor sensors related to fuel trim(Ex. HO2S,MAFS,MAPS,TPS,MAPS,TPS,ECTS,PCSV,Injectors etc.) with scantool



4. Are those parameters displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor’s and/or PCM’s connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replaceas necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "System Inspection " procedure.

SYSTEM INSPECTION

1. Check Air leakage
   (1) Check gasket is contaminated or misinstalled.
   - Installation or any damage of Throttle body gasket
   - Installation or any damage of the gasket between intake manifold and surge tank.
   - Clogging of intake manifold or injectors resulting from foreign materials.
   - Open stuck of PCSV caused by foreign materials between surge tank and PCSV.

   (2) Has a problem been found ?

   YES

   - Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

   NO

   - Go to "Check Fuel Line Inspection" as follows.

2. Check Fuel Line Inspection
   (1) Check clog, contamination and installation of each hose as follows.
   - Check connection of each fuel line.
   - Check damage, interference and installation of vaccum hose connected to fuel line.
   - Check that fuel pipe in the fuel line is bent and sqeezed.
   - Check any fuel leakage from fuel pipe in the fuel line.

   (2) Has a problem been found ?

   YES

   - Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

   NO

   - Go to "Check fuel pressure" as follows.

3. Check Fuel Pressure
   (1) Refer to "Fuel pressure test" in "Fuel delivery system"

   (2) Is the measured fuel pressure within specification ?

   YES

   - Go to "Component Inspection" procedure.

   NO

   - Repair or replace as necessary and the, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check PCV
   (1) IG "OFF".

   (2) Remove PCV valve and then, check that plunger in the PCV is moving.

   (3) Is the PCV normal ?

   YES

   - Go to "Check PCSV" as follows.

   NO

   - Substitute with a known-good PCV and check for proper operation. If the problem is corrected,replace PCV and then go to "Verification of Vehicle Repair" procedure.

2. Check PCSV
   (1) IG "OFF".

   (2) Remove PCSV and Vaccum Hose

   (3) Check that PCSV is just one way solenoid valve

   (4) Is the PCSV normal ?

   YES

   - Go to "Check injector" as follows.

   NO

   - Substitute with a known-good PCSV and check for proper operation. If the problem is corrected,replace PCSV and then go to "Verification of Vehicle Repair" procedure.

3. Check injector
   (1) IG "OFF"

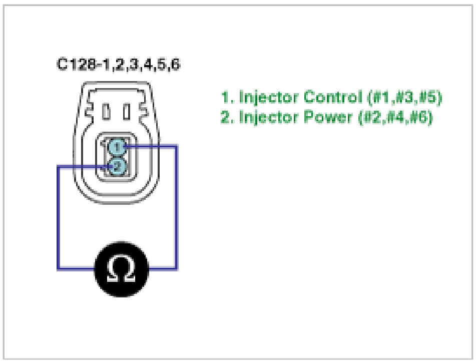
   (2) Remove injector.

(3) Check that injector hole is clogged by foreign materials.

(4) Measure resistance between terminal 1 an 2 of injector connector.(Component Side)

Specification :

Temp.	Resistance
20°C (68°F)	11.4 ~ 12.6Ω



(5) Is the measured resistance within specification ?

YES

▸ Go to "Check component related to fuel trim" as follows.

NO

▸ Substitute with a known-good injector and check for proper operation. If the problem is corrected,replace injector and then go to "Verification of Vehicle Repair" procedure.

4. Check component related to fuel trim
   (1) Check component related to fuel trim such as HO2S, MAFS,MAPS, TPS, ECTS, PCSV and Injectores) - Refer to each designated trouble shooting guide.
   (2) Are those component related to fuel trim O.K ?

YES

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.

NO

▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P2190

GENERAL DESCRIPTION

Air-fuel feed back control is the modulation which increases or decreases fuel injection quantity as determining exhaust gas rich or lean with HO2S adjust combustion is done at ideal air-fuel ratioto so as to raise the efficiency of catalytic convertor. Generally, NOx increases at lean combustion while CO, HC increases in rich combustion. Thus, in order to purge all of these gases with catalytic convertor, air-fuel ratio should be nearly at the ideal ratio. However the range in which all gases purified successfully is too narrow, it is impossible to meet ideal range with open loop control, therefore feed back control using HO2S is required. HO2S output signal changes rapidly near ideal air-fuel ratio and this characteristic is used at feed back control. comparing HO2S output signal and reference value, PCM increases fuel injection quantity at lean condition and decreases at rich condition. As deterioration of engine, due to the characteristic changes of many components of intake and fuel line or inevitable tolerance of components at production process, achieving ideal air-fuel ratio is almost impossible with the fixed fuel injection duration. Regarding the change of cross section by clogged injector, feed back correction is performed yet, it cannot cover all the ranges. It means if the correction range is massively seperated from the ideal value or if the mean of feed back control range too inclines to lean or rich condition, feed back correction does not work efficiently. Therefore processing correction value throughout long time statistically during driving, PCM controlls fuel injection duration as fitting the mean to be the ideal air-fuel ratio value. Through adaptive control, accuracy of the control could be improved and the value of adaptive control varies countiuously during driving and is always up-dated.

DTC DESCRIPTION

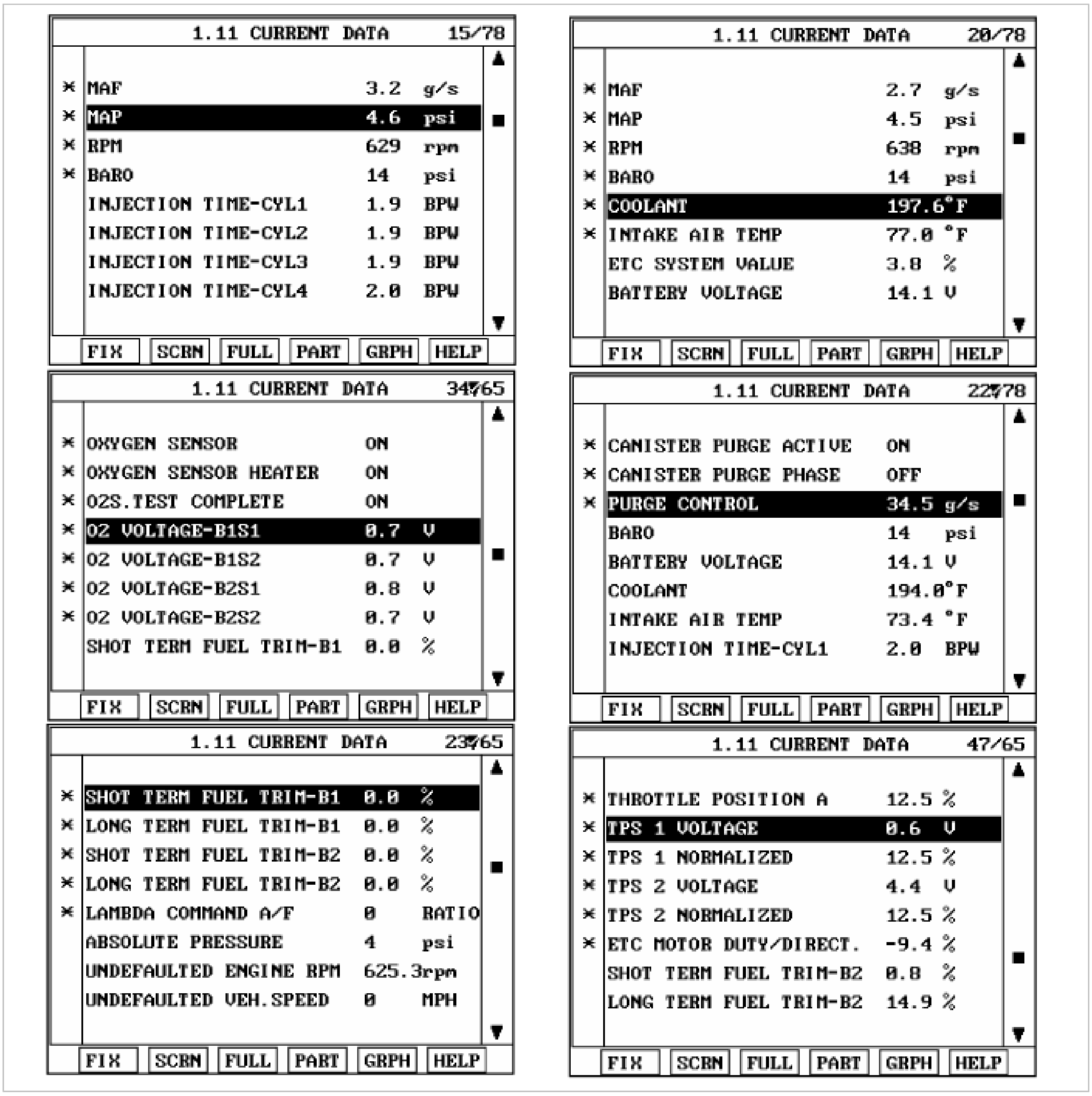
Checking air-fuel ratio correction value every 0.75 sec. at idle, if the value within the detecting condition for more than 0.3 sec., PCM sets P2190. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Fuel Trim Idle Condition Option Limits Exceeded	• Sensors related to Fuel Trim • Intake system • Fuel Pressure • Faulty PCM
EnableConditions	• 550rpm ≤ Engine Speed ≤ 4000rpm • 60°C ≤ Engine coolant temperature ≤ 114.992°C • -10°C ≤ Intake Air Temperature ≤ 60°C • 0° ≤ Throttle Position ≤ 72° • 25kPa ≤ Engine Load ≤ 90kPa • 1.5g/s ≤ Intake Air Flow ≤ 80g/s • Barometric Pressure ≥ 72kPa • Vehicle Speed ≤ 130km/h • System Voltage ≥ 11V • BLM learn Allowed • Closed Loop Active • Other diagnostic fault not active	
Threshold value	• Rich Limit Average < 1.5 (The average of short term fuel trim values) • Rich Limit Average < 0.76 (The average of adaptive index multiplier values)	
DiagnosisTime	• Contineous (More than 0.375sec. Failure for every 0.75sec. Test)	
MIL On Condition	• 2 Driving Cycles	

MONITOR SCANTOOL DATA

1. Connect scantool to DLC(Data Link Connector)
2. Warm up the engine to normal operating temperature.
3. Monitor sensors related to fuel trim(Ex. HO2S,MAFS,MAPS,TPS,MAPS,TPS,ECTS,PCSV,Injectors etc.) with scantool



4. Are those parameters displayed correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor's and/or PCM's connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replaceas necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "System Inspection " procedure.

SYSTEM INSPECTION

1. Check air clog.
   (1) Check Contamination ,Gasket installation as follows
      ▸ Damage or installation of throttle body gasket.
      ▸ Check clog of air cleaner
      ▸ Clog or contamination of intake manifold or injectors caused by foreign materials
      ▸ Check vaccum hose connected to surge tank is normal.

   (2) Has a problem been found ?

      YES

      ▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair"procedure.

      NO

      ▸ Go to "Check Fuel Pressure" as follows

2. Check Fuel Pressure
   (1) Refer to "Fuel pressure test" in "Fuel delivery system"

   (2) Is the measured fuel pressure within specification ?

      YES

      ▸ Go to "Component Inspection" procedure.

      NO

      ▸ Repair or replace as necessary and the, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check PCV
   (1) IG "OFF".

   (2) Remove PCV valve and then, check that plunger in the PCV is moving.

   (3) Is the PCV normal ?

      YES

      ▸ Go to "Check PCSV" as follows.

      NO

      ▸ Substitute with a known-good PCV and check for proper operation. If the problem is corrected,replace PCV and then go to "Verification of Vehicle Repair" procedure.

2. Check PCSV
   (1) IG "OFF".

   (2) Remove PCSV and Vaccum Hose

   (3) Check that PCSV is just one way solenoid valve

   (4) Is the PCSV normal ?

      YES

      ▸ Go to "Check injector" as follows.

      NO

      ▸ Substitute with a known-good PCSV and check for proper operation. If the problem is corrected,replace PCSV and then go to "Verification of Vehicle Repair" procedure.

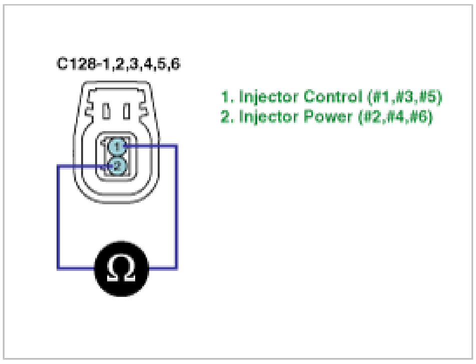
3. Check injector
   (1) IG "OFF"

   (2) Remove injector.

   (3) Check that injector hole is clogged by foreign materials.

   (4) Measure resistance between terminal 1 an 2 of injector connector.(Component Side)
      Specification :

Temp.	Resistance
20°C (68°F)	11.4 ~ 12.6Ω



(5) Is the measured resistance within specification ?

YES

▸ Go to "Check component related to fuel trim" as follows.

NO

▸ Substitute with a known-good injector and check for proper operation. If the problem is corrected,replace injector and then go to "Verification of Vehicle Repair" procedure.

4. Check component related to fuel trim
   (1) Check component related to fuel trim such as HO2S, MAFS,MAPS, TPS, ECTS, PCSV and Injectores) - Refer to each designated trouble shooting guide.

   (2) Are those component related to fuel trim O.K ?

YES

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.

NO

▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P2195

COMPONENT LOCATION

GENERAL DESCRIPTION

In order to control emissions of the CO, HC and NOx components of the exhaust gas, heated oxygen sensor (HO2S), mounted on the front side and rear side of catalytic converter, detects the oxygen content in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation.The HO2S requires a minimum temperature to operate properly and provide a closed loop fuel control system. The HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions.
The oxygen sensor generates a voltage that indicates the difference between the oxygen content of the exhaust stream and the oxygen content of ambient air. When the exhaust stream is “rich,” there is more oxygen in the ambient air than in the exhaust stream, so the voltage will be higher.
This oxygen sensor varieties use a “bias” voltage to achieve better resolution of the exhaust stream signal. Some oxygen sensor varieties use a “pumping circuit” to force ambient air into the sensor to maintain a more pure environment for comparison.In either case, a cold sensor will tend to indicate voltage values near the open circuit value. For the “pumping current” sensors, this open circuit value can be near 3.5 V. Since the Fuel control logic would incorrectly consider this reading to indicate a very rich mixture for an extended time, the fuel control logic can not use the oxygen sensor reading under such conditions.
The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

DTC DESCRIPTION

Checking output signals from HO2S under detecting condition, if an output signal within the detecting condition lasts continuously, PCM sets P2195. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Determines if O2 sensor indicates lean exhaust while in Power Enrichment (PE)	• Poor Connection • Faulty HO2S • Faulty PCM
EnableConditions	• Sensor not in cooled status flag • Not in Transient Conditions status flag • Device control not active • Min airflow present ≥ 2 g/s • Ignition voltage ≥ 10V • Fuel reduction not active • Engine running • Engine running long enough ≥ 60sec. • Power Enrichment conditions present • Engine coolant warm enough ≥ 60°C(140 °F) • Above conditions met long enough ≥ 1.5sec.	
Threshold value	• O2 sensor voltage < 0.35V and Air Fuel Ratio ≤ 13.5	
DiagnosisTime	• Contineous (More than 11.25sec. failure for every 12.5sec. Test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFROM AND DATA

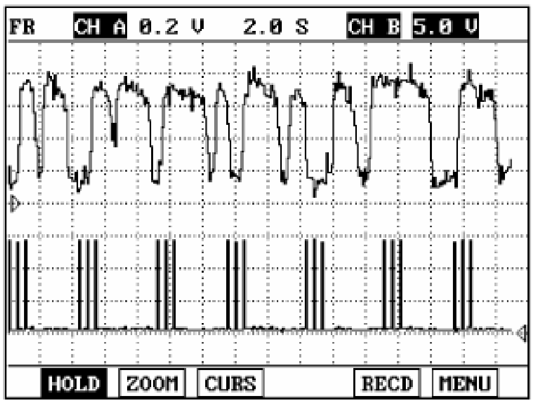


Fig.1:B1S1 & Heater

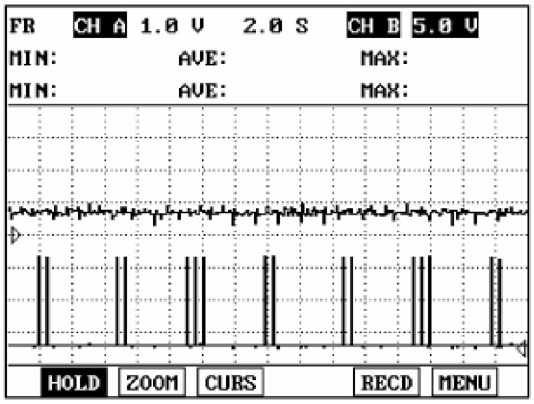


Fig.2:B1S2 & Heater

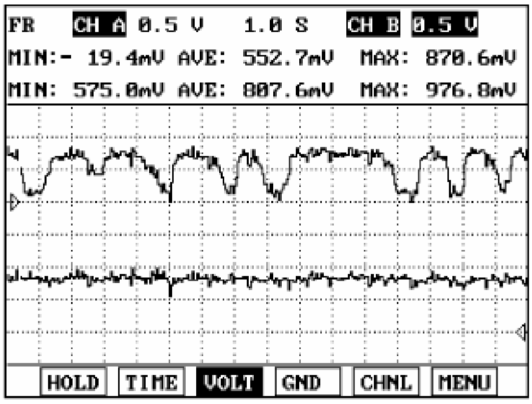


Fig.3:B1S1 & B1S2

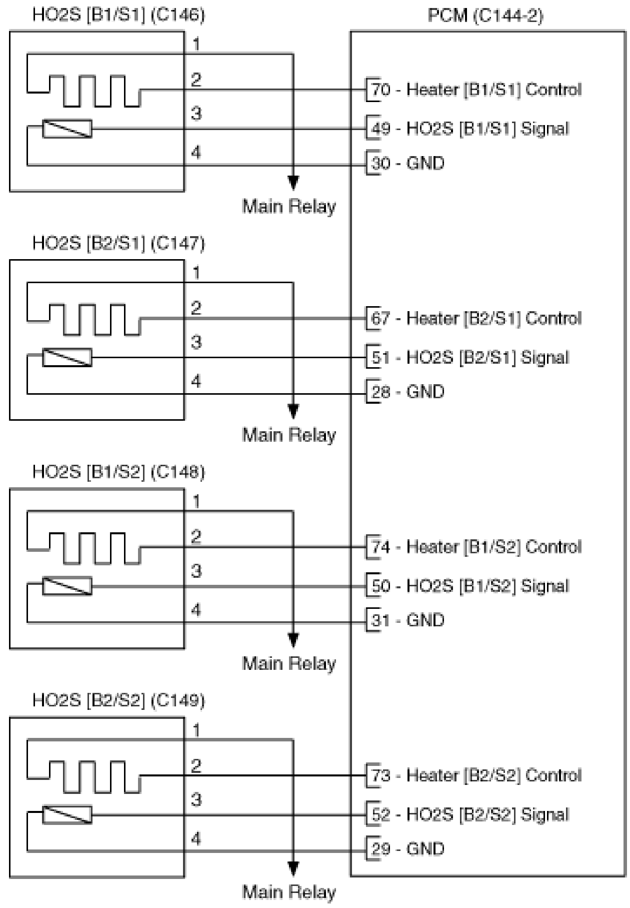
After warming-up, if accelerator pedal is released suddenly around 4000rpm, the HO2S signal reading will be lower than 200mV resulting from Fuel cut-off for the moment. Conversely, if suddenly accelerator pedal is depressed, HO2S signal reading will be around 0.6V ~1.0V. At idle, HO2S signal will switch from lean to rich normally.

SPECIFICATION

A/F Ratio	Output Voltage(V)
Rich	0.75 ~ 1.00V
Lean	0 ~ 0.12V

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

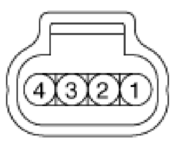
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

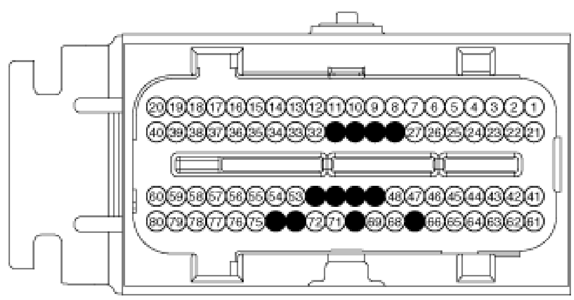
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]

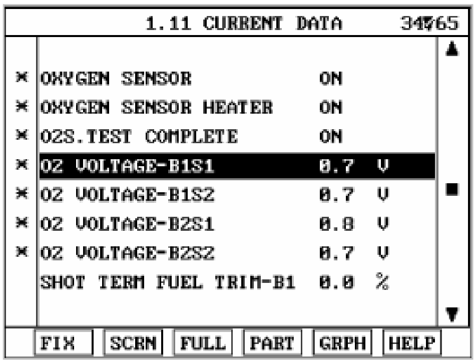


C144-2
PCM

MONITOR SCANTOOL DATA

1. Connect scantool to DLC(Data Link Connector)
2. Warm up the engine to normal operating temperature.
3. Monitor "HO2S(B1S1)" parameter on scantool

Specification : 0.1 ~ 0.9V



4. Does the "HO2S(B1S1)" parameter operates correctly ?

YES

▸Fault is intermittent caused by poor contact in Sensor's and/or PCM's connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replaceas necessary and go to "Verification of Vehicle Repair" procedure

NO

▸Go to "Component Inspection" procedure.

COMPONENT INSPECTION

1. Visual Inspection
   (1) Visually check HO2S as follow.
      A. Contamination, deformation or age of HO2S(B1/S1)

   (2) Is the HO2S(B1/S1) normal ?

   YES

   ▸ Go to "Check performance of HO2S" as follows.

   NO

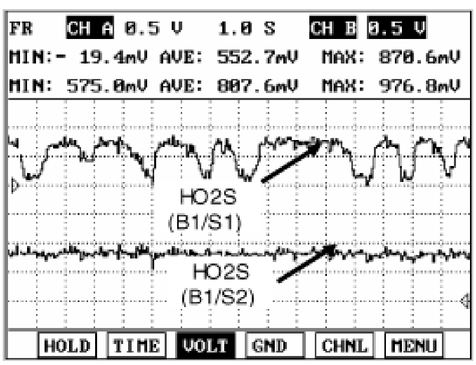
   ▸ Substitute with a known-good HO2S(B1S1) and check for proper operation. If the problem is corrected,replace HO2S (B1S1) and then go to "Verification of Vehicle Repair" procedure.

2. Check performance of HO2S
   (1) Connect scantool to DLC(Data Link Connector)

   (2) Warm up the engine to normal operating temperature.

   (3) Monitor signal waveform of HO2S with scantool.

   Specification : 0.1 ~ 0.9V.



   (4) Is the HO2S(B1S1) working properly ?

   YES

   ▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

   > **NOTE**
   >
   > There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.

   NO

▸ Substitute with a known-good HO2S(B1S1) and check for proper operation. If the problem is corrected,replace HO2S (B1S1) and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P2196

COMPONENT LOCATION

GENERAL DESCRIPTION

In order to control emissions of the CO, HC and NOx components of the exhaust gas, heated oxygen sensor (HO2S), mounted on the front side and rear side of catalytic converter, detects the oxygen content in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation.The HO2S requires a minimum temperature to operate properly and provide a closed loop fuel control system. The HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions.
The oxygen sensor generates a voltage that indicates the difference between the oxygen content of the exhaust stream and the oxygen content of ambient air. When the exhaust stream is “rich,” there is more oxygen in the ambient air than in the exhaust stream, so the voltage will be higher.
This oxygen sensor varieties use a “bias” voltage to achieve better resolution of the exhaust stream signal. Some oxygen sensor varieties use a “pumping circuit” to force ambient air into the sensor to maintain a more pure environment for comparison. In either case, a cold sensor will tend to indicate voltage values near the open circuit value. For the “pumping current” sensors, this open circuit value can be near 3.5 V. Since the Fuel control logic would incorrectly consider this reading to indicate a very rich mixture for an extended time, the fuel control logic can not use the oxygen sensor reading under such conditions.
The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

DTC DESCRIPTION

Checking output signals from HO2S under detecting condition, if an output signal within the detecting condition lasts continuously, PCM sets P2196. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

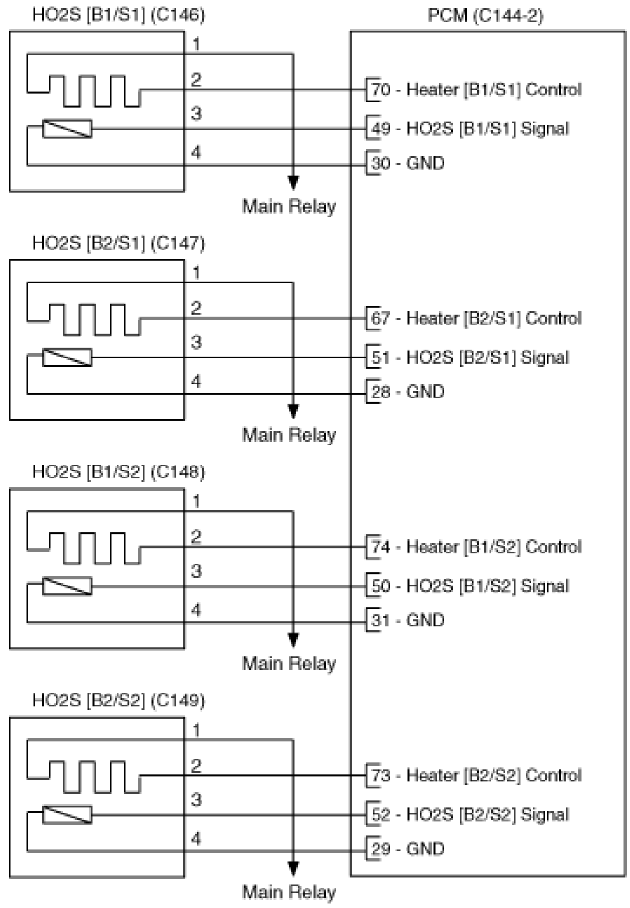
DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause

DTC Strategy	• Determines if O2 sensor indicates rich exhaust while in decel fuel cut-off (DFCO)	• Poor Connection • Faulty HO2S • Faulty PCM
EnableConditions	• Sensor not in cooled status flag • Not in Transient Conditions status flag • Device control not active • Min airflow present ≥ 2 g/s • Ignition voltage ≥ 10V • Fuel reduction not active • Engine running • Engine running long enough ≥ 60sec. • Power Enrichment conditions present • Engine coolant warm enough ≥ 60°C(140 °F) • Above conditions met long enough ≥ 1.5sec.	
Threshold value	• O2 sensor voltage > 0.55V	
DiagnosisTime	• Contineous (More than 11.25sec. failure for every 12.5sec. Test)	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

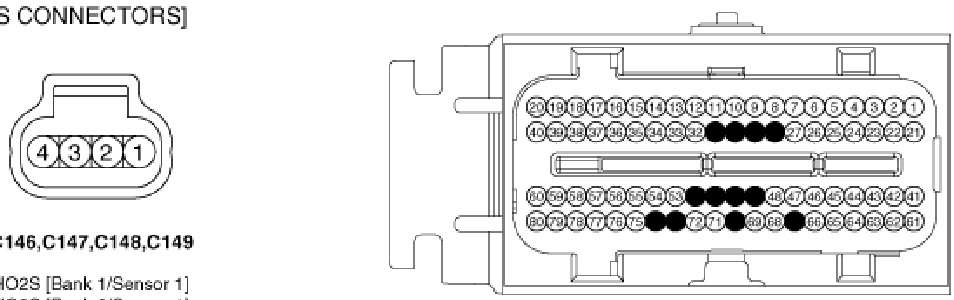
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

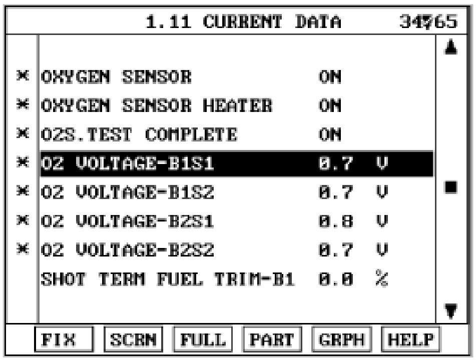
HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]

C144-2
PCM

MONITOR SCANTOOL DATA

1. Connect scantool to DLC(Data Link Connector).
2. Warm up the engine to normal operating temperature.
3. Monitor "HO2S(B1S1)" parameter on scantool

Specification : 0.1 ~ 0.9V



4. Does the "HO2S(B1S1)" parameter operates correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor's and/or PCM's connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replaceas necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸Go to "Component Inspection " procedure.

COMPONENT INSPECTION

1. Visual Inspection
   (1) Visually check HO2S as follow.
      A. Contamination, deformation or age of HO2S(B1/S1)

   (2) Is the HO2S(B1/S1) normal ?

   YES

   ▸ Go to "Check performance of HO2S" as follows.

   NO

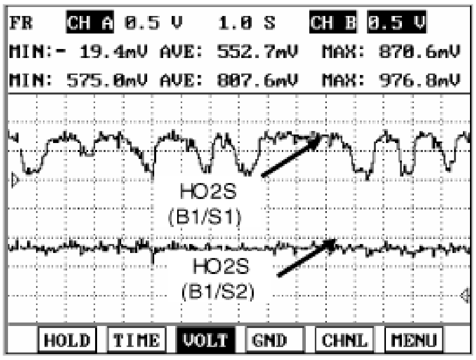
   ▸ Substitute with a known-good HO2S(B1S1) and check for proper operation. If the problem is corrected,replace HO2S (B1S1) and then go to "Verification of Vehicle Repair" procedure.

2. Check performance of HO2S
   (1) Connect scantool to DLC(Data Link Connector)

   (2) Warm up the engine to normal operating temperature.

   (3) Monitor signal waveform of HO2S with scantool.

   Specification : 0.1 ~ 0.9V.



(4) Is the HO2S(B1S1) working properly ?

YES

▶ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.

NO

▶ Substitute with a known-good HO2S(B1S1) and check for proper operation. If the problem is corrected,replace HO2S (B1S1) and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

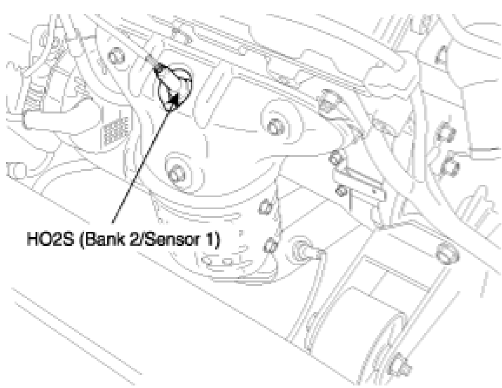
▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

Fuel System > Troubleshooting > P2197

COMPONENT LOCATION



GENERAL DESCRIPTION

In order to control emissions of the CO, HC and NOx components of the exhaust gas, heated oxygen sensor (HO2S), mounted on the front side and rear side of catalytic converter, detects the oxygen content in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper

operation.The HO2S requires a minimum temperature to operate properly and provide a closed loop fuel control system. The HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions.
The oxygen sensor generates a voltage that indicates the difference between the oxygen content of the exhaust stream and the oxygen content of ambient air. When the exhaust stream is “rich,” there is more oxygen in the ambient air than in the exhaust stream, so the voltage will be higher.
This oxygen sensor varieties use a “bias” voltage to achieve better resolution of the exhaust stream signal. Some oxygen sensor varieties use a “pumping circuit” to force ambient air into the sensor to maintain a more pure environment for comparison. In either case, a cold sensor will tend to indicate voltage values near the open circuit value. For the “pumping current” sensors, this open circuit value can be near 3.5 V. Since the Fuel control logic would incorrectly consider this reading to indicate a very rich mixture for an extended time, the fuel control logic can not use the oxygen sensor reading under such conditions.
The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

DTC DESCRIPTION

Checking output signals from HO2S under detecting condition, if an output signal within the detecting condition lasts continuously, PCM sets P2197. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Determines if O2 sensor indicates lean exhaust while in Power Enrichment (PE)	• Poor Connection • Faulty HO2S • Faulty PCM
EnableConditions	• Sensor not in cooled status flag • Not in Transient Conditions status flag • Device control not active • Min airflow present ≥ 2 g/s • Ignition voltage ≥ 10V • Fuel reduction not active • Engine running • Engine running long enough ≥ 60sec. • Power Enrichment conditions present • Engine coolant warm enough ≥ 60°C(140 °F) • Above conditions met long enough ≥ 1.5sec.	
Threshold value	• O2 sensor voltage < 0.48V and, Air Fuel Ratio ≤ 13.5	
DiagnosisTime	• Contineous (More than 11.25sec. failure for every 12.5sec. Test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFROM AND DATA

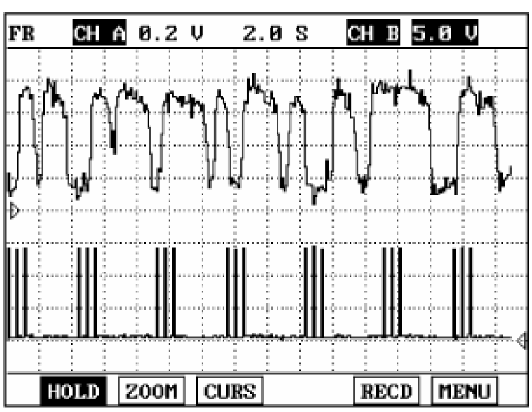


Fig.1: B2S1 & Heater

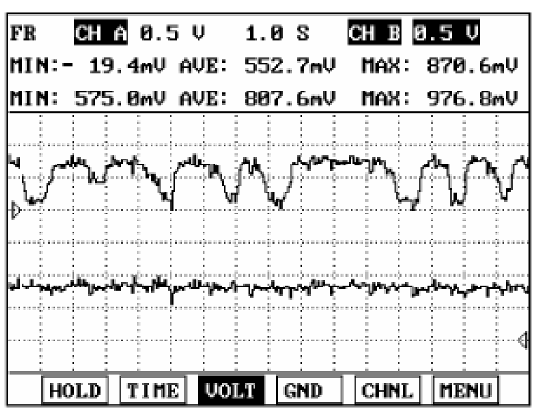


Fig.2: B2S1 & B2S2

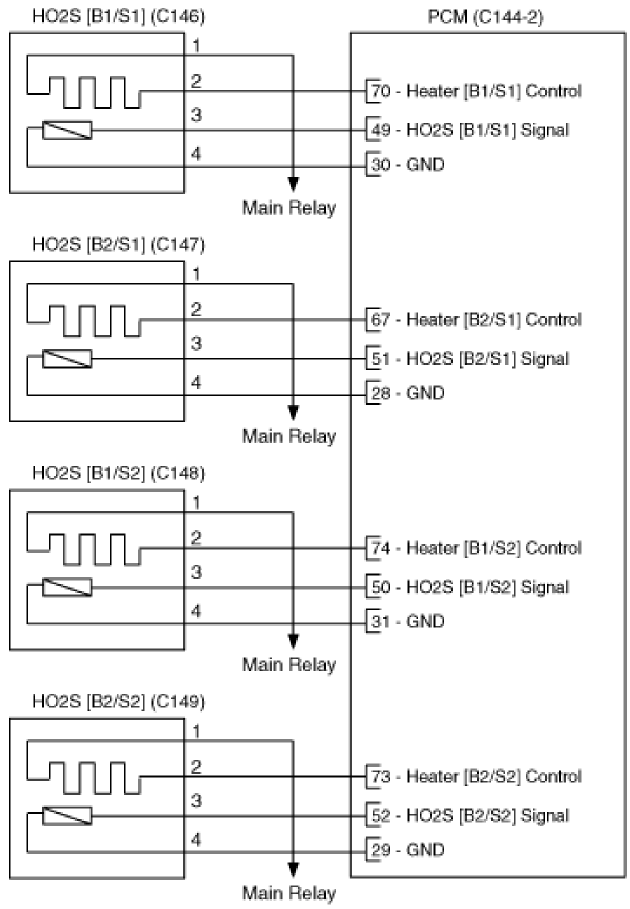
After warming-up, if accelerator pedal is released suddenly around 4000rpm, the HO2S signal reading will be lower than 200mV resulting from Fuel cut-off for the moment. Conversely, if suddenly accelerator pedal is depressed, HO2S signal reading will be around 0.6V ~1.0V. At idle, HO2S signal will switch from lean to rich normally.

SPECIFICATION

A/F Ratio	Output Voltage(V)
Rich	0.75 ~ 1.00V
Lean	0 ~ 0.12V

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

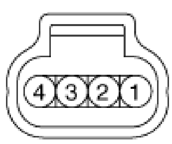
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

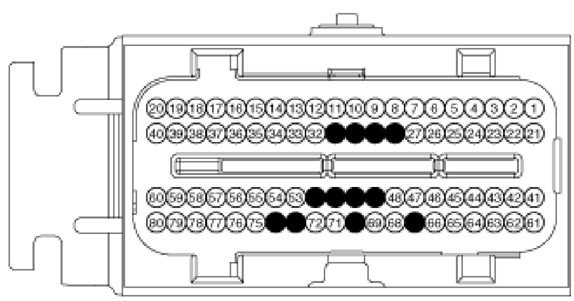
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]

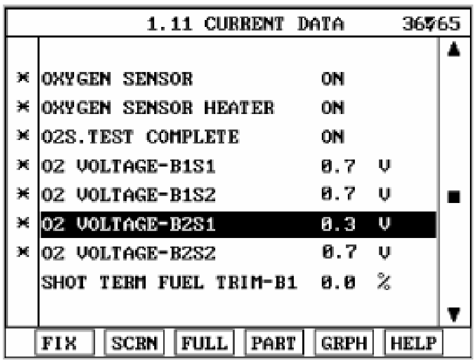


C144-2
PCM

MONITOR SCANTOOL DATA

1. Connect scantool to DLC(Data Link Connector)
2. Warm up the engine to normal operating temperature.
3. Monitor "HO2S(B2S1)" parameter on scantool

Specification : 0.1 ~ 0.9V



4. Does the "HO2S(B2S1)" parameter operates correctly ?

YES

▸Fault is intermittent caused by poor contact in Sensor's and/or PCM's connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replaceas necessary and go to "Verification of Vehicle Repair" procedure

NO

▸Go to "Component Inspection" procedure.

COMPONENT INSPECTION

1. Visual Inspection
   (1) Visually check HO2S as follow.
      A. Contamination, deformation or age of HO2S(B2/S1)

   (2) Is the HO2S(B2/S1) normal ?

   YES

   ▸ Go to "Check performance of HO2S" as follows.

   NO

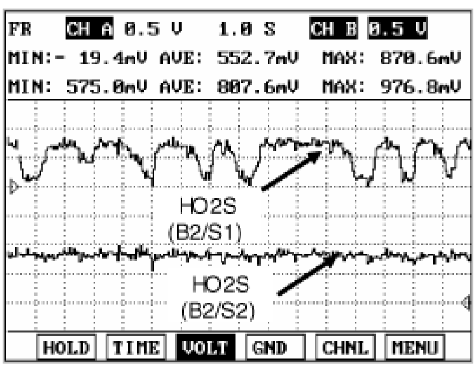
   ▸ Substitute with a known-good HO2S(B2S1) and check for proper operation. If the problem is corrected,replace HO2S (B2S1) and then go to "Verification of Vehicle Repair" procedure.

2. Check performance of HO2S
   (1) Connect scantool to DLC(Data Link Connector)

   (2) Warm up the engine to normal operating temperature.

   (3) Monitor signal waveform of HO2S with scantool.

   Specification : 0.1 ~ 0.9V.



   (4) Is the HO2S(B2S1) working properly ?

   YES

   ▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.

NO

▸ Substitute with a known-good HO2S(B2S1) and check for proper operation. If the problem is corrected,replace HO2S (B2S1) and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

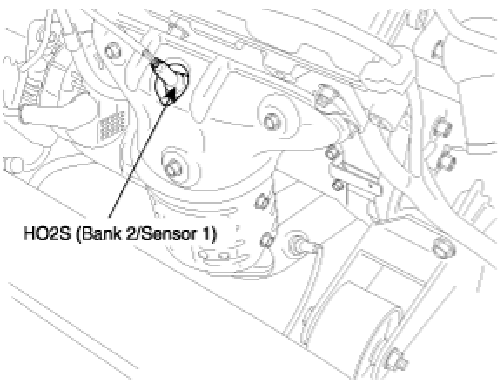
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P2198

COMPONENT LOCATION



GENERAL DESCRIPTION

In order to control emissions of the CO, HC and NOx components of the exhaust gas, heated oxygen sensor (HO2S), mounted on the front side and rear side of catalytic converter, detects the oxygen content in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation.The HO2S requires a minimum temperature to operate properly and provide a closed loop fuel control system. The HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions.
The oxygen sensor generates a voltage that indicates the difference between the oxygen content of the exhaust stream and the oxygen content of ambient air. When the exhaust stream is “rich,” there is more oxygen in the ambient air than in the exhaust stream, so the voltage will be higher.
This oxygen sensor varieties use a “bias” voltage to achieve better resolution of the exhaust stream signal. Some oxygen sensor varieties use a “pumping circuit” to force ambient air into the sensor to maintain a more pure environment for comparison. In either case, a cold sensor will tend to indicate voltage values near the open circuit value. For the “pumping current” sensors, this open circuit value can be near 3.5 V. Since the Fuel control logic would incorrectly consider this reading to indicate a very rich mixture for an extended time, the fuel control logic can not use the oxygen sensor reading under such conditions.
The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

DTC DESCRIPTION

Checking output signals from HO2S under detecting condition, if an output signal within the detecting condition lasts continuously, PCM sets P2198. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

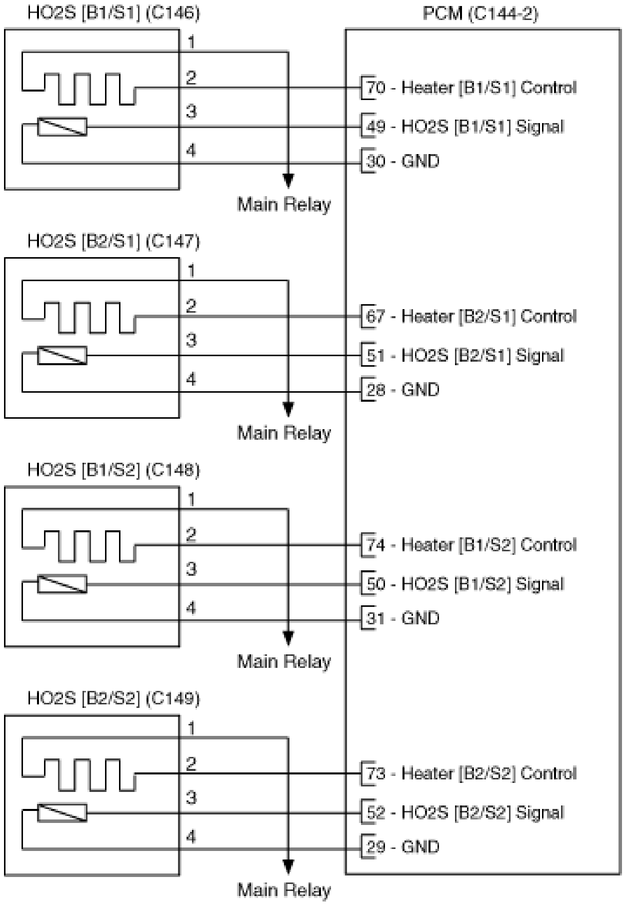
DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause

DTC Strategy	• Determines if O2 sensor indicates rich exhaust while in decel fuel cut-off (DFCO)	• Poor Connection • Faulty HO2S • Faulty PCM
EnableConditions	• Sensor not in cooled status flag • Not in Transient Conditions status flag • Device control not active • Min airflow present ≥ 2 g/s • Ignition voltage ≥ 10V • Fuel reduction not active • Engine running • Engine running long enough ≥ 60sec. • Power Enrichment conditions present • Engine coolant warm enough ≥ 60°C(140 °F) • Above conditions met long enough ≥ 1sec.	
Threshold value	• O2 sensor voltage > 0.4199V	
DiagnosisTime	• Contineous (More than 11.25sec. failure for every 12.5sec. Test)	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

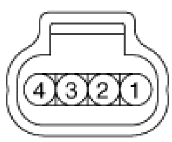
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

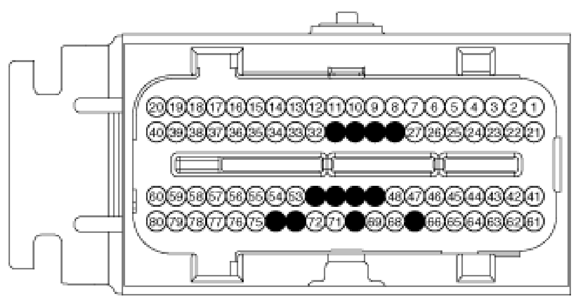
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



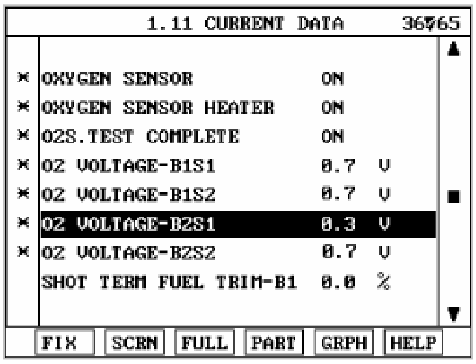
C144-2

PCM

MONITOR SCANTOOL DATA

1. Connect scantool to DLC(Data Link Connector)
2. Warm up the engine to normal operating temperature.
3. Monitor "HO2S(B2S1)" parameter on scantool

Specification : 0.1 ~ 0.9V



4. Does the "HO2S(B2S1)" parameter operates correctly ?

YES

▸Fault is intermittent caused by poor contact in Sensor’s and/or PCM’s connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replaceas necessary and go to "Verification of Vehicle Repair" procedure

NO

▸Go to "Terminal and connector inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸Go to "Component Inspection " procedure.

COMPONENT INSPECTION

1. Visual Inspection
   (1) Visually check HO2S as follow.
      A. Contamination, deformation or age of HO2S(B2/S1)

   (2) Is the HO2S(B2/S1) normal ?

   YES

   ▸ Go to "Check performance of HO2S" as follows.

   NO

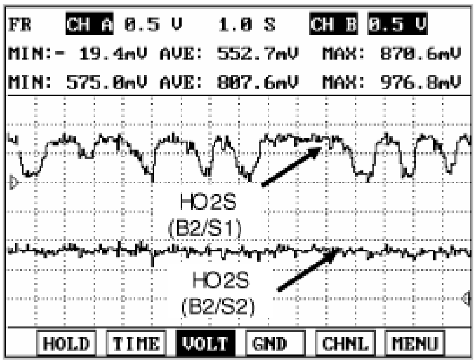
   ▸ Substitute with a known-good HO2S(B2S1) and check for proper operation. If the problem is corrected,replace HO2S (B2S1) and then go to "Verification of Vehicle Repair" procedure.

2. Check performance of HO2S
   (1) Connect scantool to DLC(Data Link Connector)

   (2) Warm up the engine to normal operating temperature.

   (3) Monitor signal waveform of HO2S with scantool.

   Specification : 0.1 ~ 0.9V.



(4) Is the HO2S(B2S1) working properly ?

YES

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.

NO

▸ Substitute with a known-good HO2S(B2S1) and check for proper operation. If the problem is corrected,replace HO2S (B2S1) and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P2270

COMPONENT LOCATION

GENERAL DESCRIPTION

Rear HO2S behind the catalytic conveter checks if purifying process performs well. purifying process is already done, the oxygen

density of exhaust gas through catalytic converter is in the specified value.

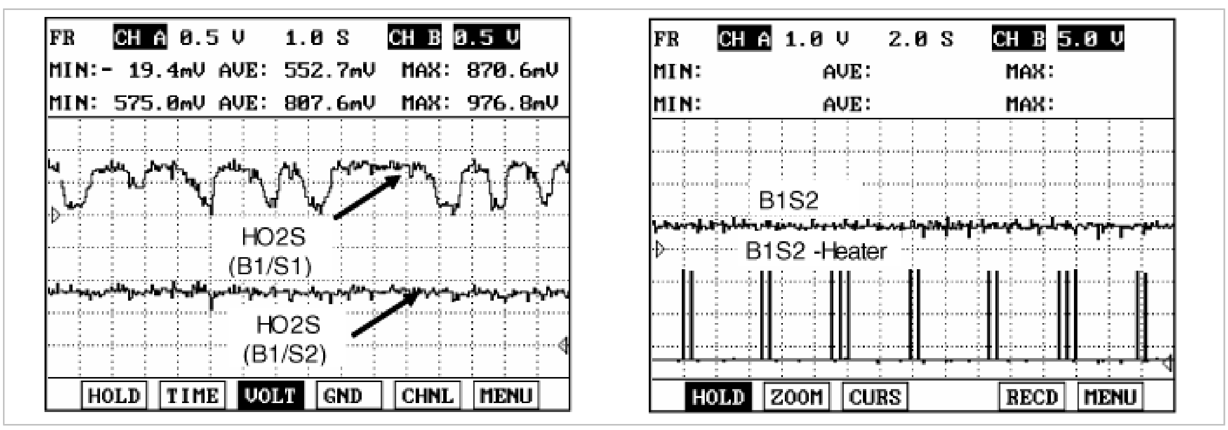
DTC DESCRIPTION

Checking output signals from HO2S under detecting condition, if an output signal within the threshold lasts continuously, PCM sets P2270. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

<table>
<tr><th>Item</th><th>Detecting Condition</th><th>Possible cause</th></tr>
<tr><td>DTC Strategy</td><td>• Determines if O2 sensor indicates lean exhaust while in Power Enrichment (PE)</td><td rowspan="5">• Poor Connection
• Faulty HO2S
• Faulty PCM</td></tr>
<tr><td>EnableConditions</td><td>• Sensor not in cooled status flag
• Not in Transient Conditions status flag
• Device control not active
• Min airflow present ≥ 2 g/s
• Ignition voltage ≥ 10V
• Fuel reduction not active
• Engine running
• Engine running long enough ≥ 60sec.
• Power Enrichment conditions present
• Engine coolant warm enough ≥ 60°C(140 °F)
• Above conditions met long enough ≥ 2.5sec.</td></tr>
<tr><td>Threshold value</td><td>• O2 sensor voltage < 0.48V and, Air Fuel Ratio ≤ 13.5</td></tr>
<tr><td>DiagnosisTime</td><td>• Contineous
(More than 11.25sec. failure for every 12.5sec. Test)</td></tr>
<tr><td>MIL On Condition</td><td>• 2 Driving Cycles</td></tr>
</table>

SIGNAL WAVEFROM AND DATA



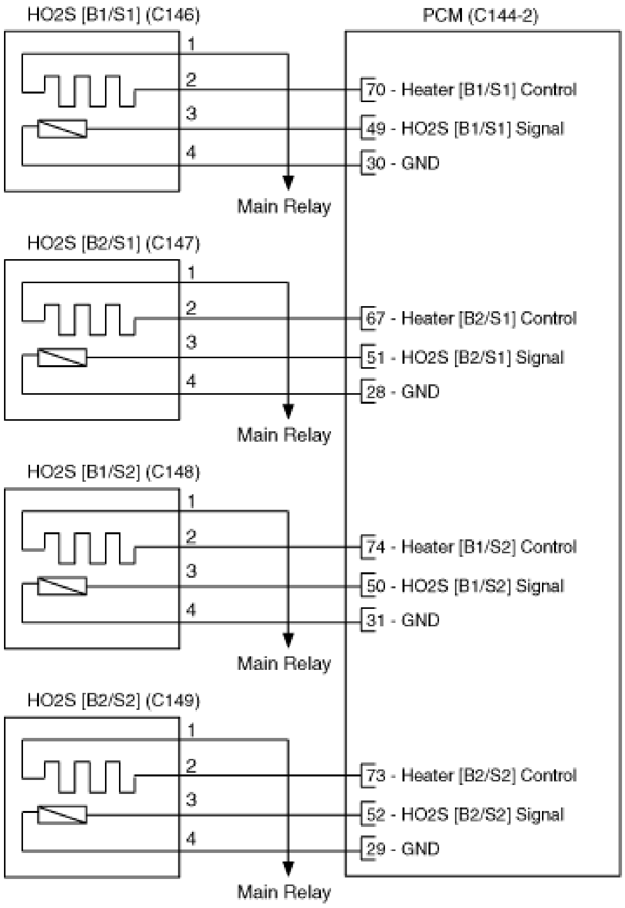
After warming-up, if accelerator pedal is released suddenly around 4000rpm, the HO2S signal reading will be lower than 200mV resulting from Fuel cut-off for the moment. Conversely, if suddenly accelerator pedal is depressed, HO2S signal reading will be around 0.6V ~1.0V. At idle, HO2S signal will switch from lean to rich normally.

SPECIFICATION

A/F Ratio	Output Voltage(V)
Rich	0.75 ~ 1.00V
Lean	0 ~ 0.12V

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

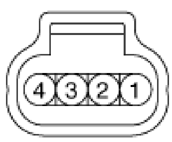
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

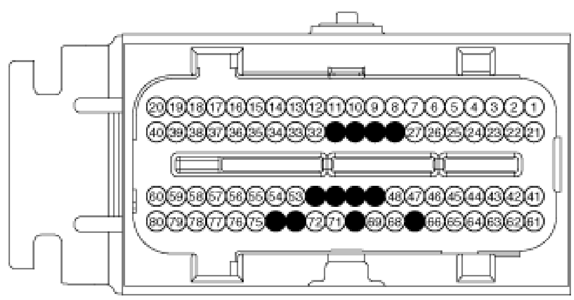
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C144-2
PCM

MONITOR SCANTOOL DATA

1. Connect scantool to DLC(Data Link Connector)
2. Warm up the engine to normal operating temperature.
3. Monitor "HO2S(B1S2)" parameter on scantool

Specification : 0.1 ~ 0.9V

4. Does the "HO2S(B1S2)" parameter operates correctly ?

YES

▸Fault is intermittent caused by poor contact in Sensor’s and/or PCM’s connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replaceas necessary and go to "Verification of Vehicle Repair" procedure

NO

▸Go to "Component Inspection" procedure.

COMPONENT INSPECTION

1. Visual Inspection
   (1) Visually check HO2S as follow.
      A. Contamination, deformation or age of HO2S(B1/S2)

   (2) Is the HO2S(B1/S2) normal ?

   YES

   ▸ Go to "Check performance of HO2S" as follows.

   NO

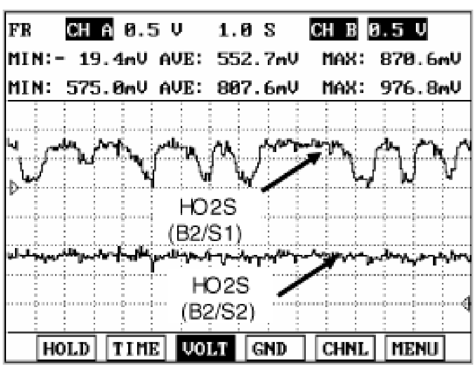
   ▸ Substitute with a known-good HO2S(B1S2) and check for proper operation. If the problem is corrected,replace HO2S (B1S2) and then go to "Verification of Vehicle Repair" procedure.

2. Check performance of HO2S
   (1) Connect scantool to DLC(Data Link Connector)

   (2) Warm up the engine to normal operating temperature.

   (3) Monitor signal waveform of HO2S with scantool.

   Specification : 0.1 ~ 0.9V.



   (4) Is the HO2S(B1S2) working properly ?

   YES

   ▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.

NO

▸ Substitute with a known-good HO2S(B1S2) and check for proper operation. If the problem is corrected,replace HO2S (B1S2) and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P2271

COMPONENT LOCATION

GENERAL DESCRIPTION

Rear HO2S behind the catalytic conveter checks if purifying process performs well. purifying process is already done, the oxygen density of exhaust gas through catalytic converter is in the specified value.

DTC DESCRIPTION

Checking output signals from HO2S under detecting condition, if an output signal within the detecting condition lasts continuously, PCM sets P2271. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

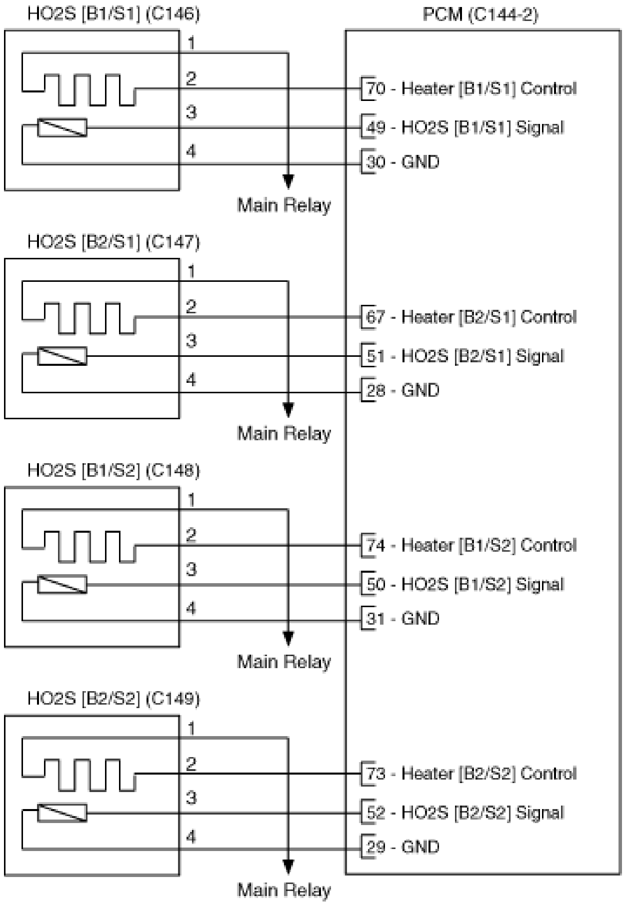
DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Determines if O2 sensor indicates rich exhaust while in decel fuel cut-off (DFCO)	
	• Sensor not in cooled status flag • Not in Transient Conditions status flag • Device control not active • Min airflow present ≥ 2 g/s	

EnableConditions	• Ignition voltage ≥ 10V • Fuel reduction not active • Engine running • Engine running long enough ≥ 60sec. • Power Enrichment conditions present • Engine coolant warm enough ≥ 60°C(140 °F) • Above conditions met long enough ≥ 2sec.	• Poor Connection • Faulty HO2S • Faulty PCM
Threshold value	• O2 sensor voltage > 0.42V	
DiagnosisTime	• Contineous (More than 11.25sec. failure for every 12.5sec. Test)	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

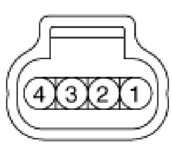
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

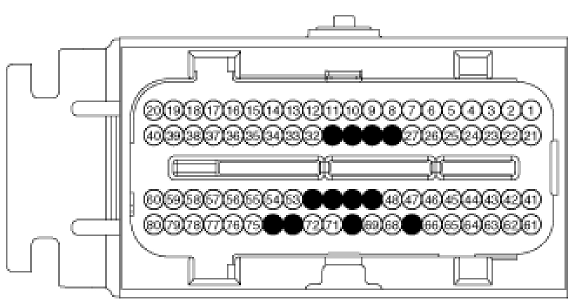
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



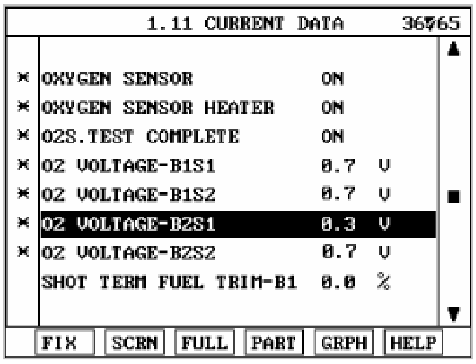
C144-2

PCM

MONITOR SCANTOOL DATA

1. Connect scantool to DLC(Data Link Connector).
2. Warm up the engine to normal operating temperature.
3. Monitor "HO2S(B1S2)" parameter on scantool

Specification : 0.1 ~ 0.9V



4. Does the "HO2S(B1S2)" parameter operates correctly ?

YES

▸Fault is intermittent caused by poor contact in Sensor’s and/or PCM’s connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replaceas necessary and go to "Verification of Vehicle Repair" procedure

NO

▸Go to "Terminal and connector inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸Go to "Component Inspection " procedure.

COMPONENT INSPECTION

1. Visual Inspection
   (1) Visually check HO2S as follow.
      A. Contamination, deformation or age of HO2S(B1/S2)

   (2) Is the HO2S(B1/S2) normal ?

   YES

   ▸ Go to "Check performance of HO2S" as follows.

   NO

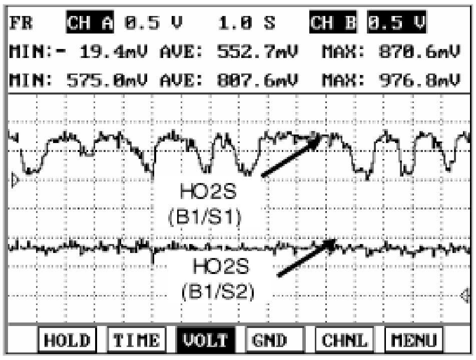
   ▸ Substitute with a known-good HO2S(B1S2) and check for proper operation. If the problem is corrected,replace HO2S (B1S2) and then go to "Verification of Vehicle Repair" procedure.

2. Check performance of HO2S
   (1) Connect scantool to DLC(Data Link Connector)

   (2) Warm up the engine to normal operating temperature.

   (3) Monitor signal waveform of HO2S with scantool.

   Specification : 0.1 ~ 0.9V.



(4) Is the HO2S(B1S2) working properly ?

YES

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.

NO

▸ Substitute with a known-good HO2S(B1S2) and check for proper operation. If the problem is corrected,replace HO2S (B1S2) and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P2272

COMPONENT LOCATION

GENERAL DESCRIPTION

Rear HO2S behind the catalytic conveter checks if purifying process performs well. purifying process is already done, the oxygen

density of exhaust gas through catalytic converter is in the specified value.

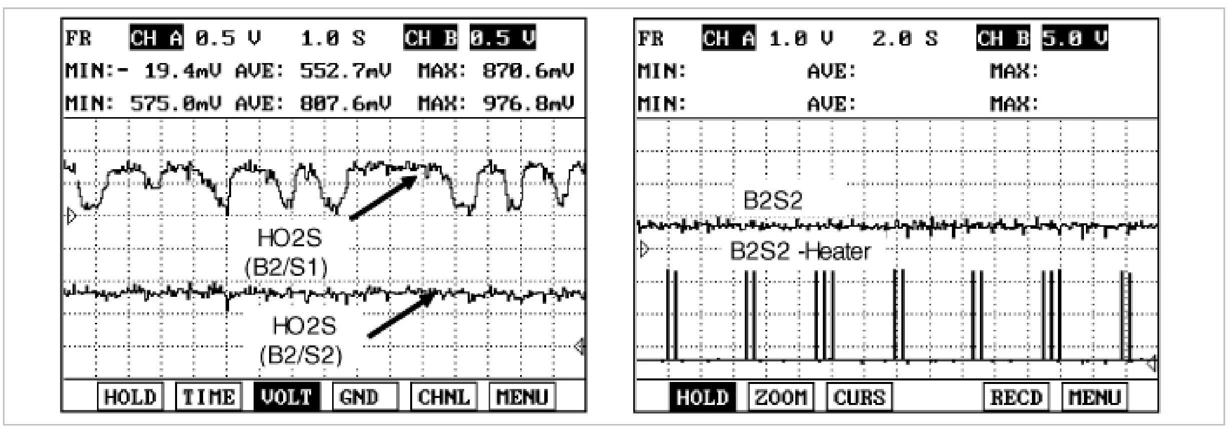
DTC DESCRIPTION

Checking output signals from HO2S under detecting condition, if an output signal within the detecting condition lasts continuously, PCM sets P2272. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Determines if O2 sensor indicates lean exhaust while in Power Enrichment (PE)	• Poor Connection • Faulty HO2S • Faulty PCM
EnableConditions	• Sensor not in cooled status flag • Not in Transient Conditions status flag • Device control not active • Min airflow present ≥ 2 g/s • Ignition voltage ≥ 10V • Fuel reduction not active • Engine running • Engine running long enough ≥ 60sec. • Power Enrichment conditions present • Engine coolant warm enough ≥ 60°C(140 °F) • Above conditions met long enough ≥ 2.5sec.	
Threshold value	• O2 sensor voltage < 0.48V and, Air Fuel Ratio ≤ 13.5	
DiagnosisTime	• Contineous (More than 11.25sec. failure for every 12.5sec. Test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFROM AND DATA



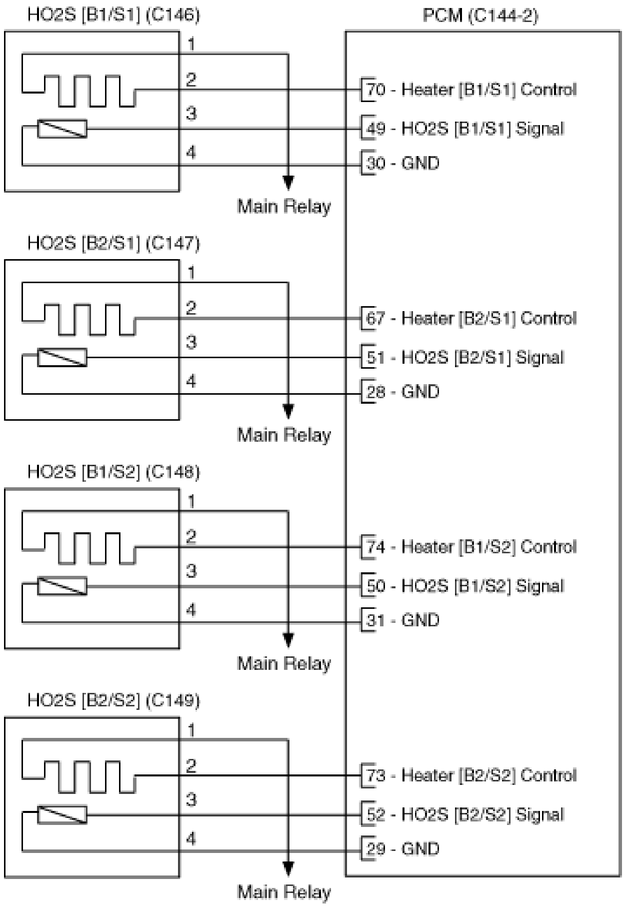
After warming-up, if accelerator pedal is released suddenly around 4000rpm, the HO2S signal reading will be lower than 200mV resulting from Fuel cut-off for the moment. Conversely, if suddenly accelerator pedal is depressed, HO2S signal reading will be around 0.6V ~1.0V. At idle, HO2S signal will switch from lean to rich normally.

SPECIFICATION

A/F Ratio	Output Voltage(V)
Rich	0.75 ~ 1.00V
Lean	0 ~ 0.12V

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

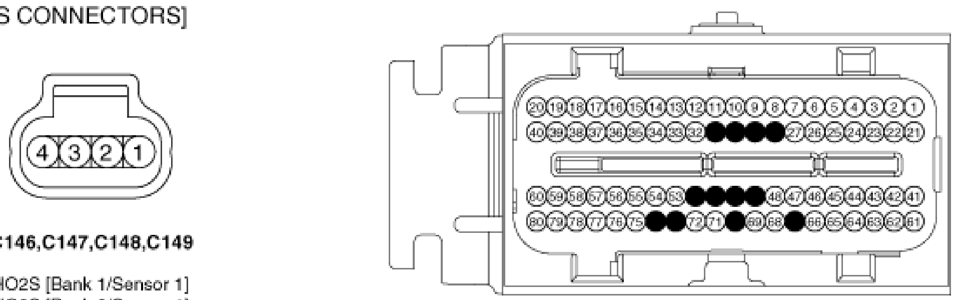
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]

C144-2

PCM

MONITOR SCANTOOL DATA

1. Connect scantool to DLC(Data Link Connector)
2. Warm up the engine to normal operating temperature.
3. Monitor "HO2S(B2S2)" parameter on scantool

Specification : 0.1 ~ 0.9V

4. Does the "HO2S(B2S2)" parameter operates correctly ?

YES

▸Fault is intermittent caused by poor contact in Sensor’s and/or PCM’s connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replaceas necessary and go to "Verification of Vehicle Repair" procedure

NO

▸Go to "Component Inspection" procedure.

COMPONENT INSPECTION

1. Visual Inspection
   (1) Visually check HO2S as follow.
      A. Contamination, deformation or age of HO2S(B2/S2)

   (2) Is the HO2S(B2/S2) normal ?

   YES

   ▸ Go to "Check performance of HO2S" as follows.

   NO

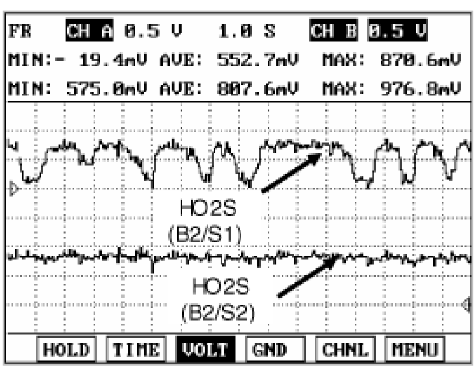
   ▸ Substitute with a known-good HO2S(B2S2) and check for proper operation. If the problem is corrected,replace HO2S (B2S2) and then go to "Verification of Vehicle Repair" procedure.

2. Check performance of HO2S
   (1) Connect scantool to DLC(Data Link Connector)

   (2) Warm up the engine to normal operating temperature.

   (3) Monitor signal waveform of HO2S with scantool.

   Specification : 0.1 ~ 0.9V.



   (4) Is the HO2S(B2S2) working properly ?

   YES

   ▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.

NO

▸ Substitute with a known-good HO2S(B2S2) and check for proper operation. If the problem is corrected,replace HO2S (B2S2) and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P2273

COMPONENT LOCATION

GENERAL DESCRIPTION

Rear HO2S behind the catalytic conveter checks if purifying process performs well. purifying process is already done, the oxygen density of exhaust gas through catalytic converter is in the specified value.

DTC DESCRIPTION

Checking output signals from HO2S under detecting condition, if an output signal within the detecting condition lasts continuously, PCM sets P2273. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

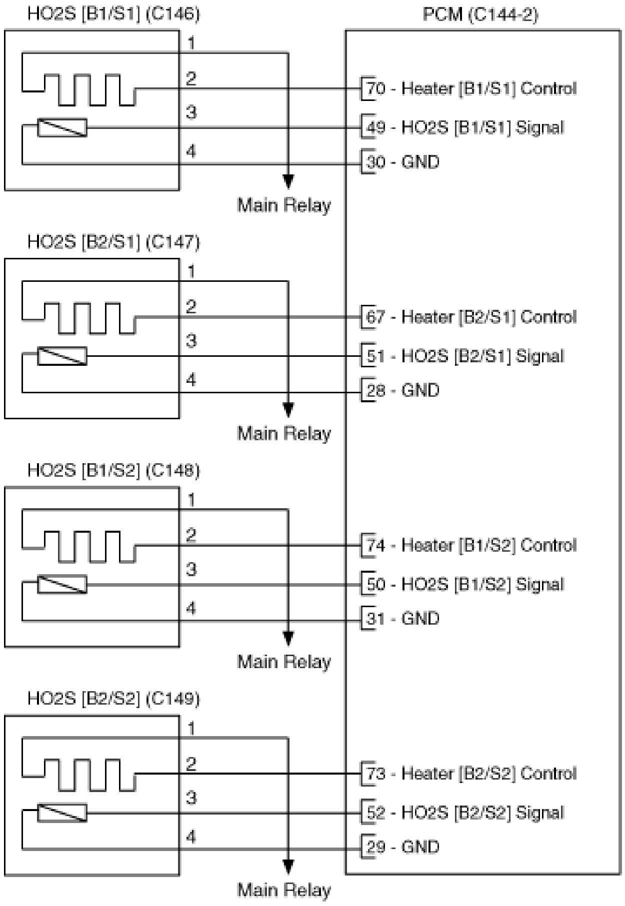
DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Determines if O2 sensor indicates rich exhaust while in decel fuel cut-off (DFCO)	
	• Sensor not in cooled status flag • Not in Transient Conditions status flag • Device control not active • Min airflow present ≥ 2 g/s	

EnableConditions	• Ignition voltage ≥ 10V • Fuel reduction not active • Engine running • Engine running long enough ≥ 60sec. • Power Enrichment conditions present • Engine coolant warm enough ≥ 60°C(140 °F) • Above conditions met long enough ≥ 2sec.	• Poor Connection • Faulty HO2S • Faulty PCM
Threshold value	• O2 sensor voltage > 0.42V	
DiagnosisTime	• Contineous (More than 11.25sec. failure for every 12.5sec. Test)	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

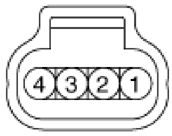
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

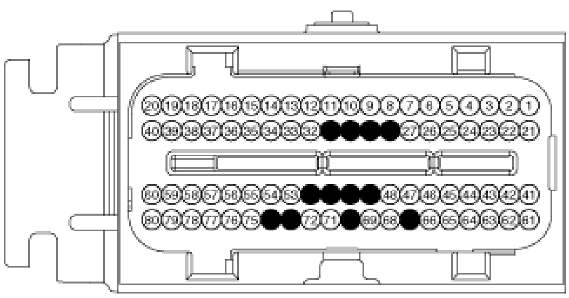
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



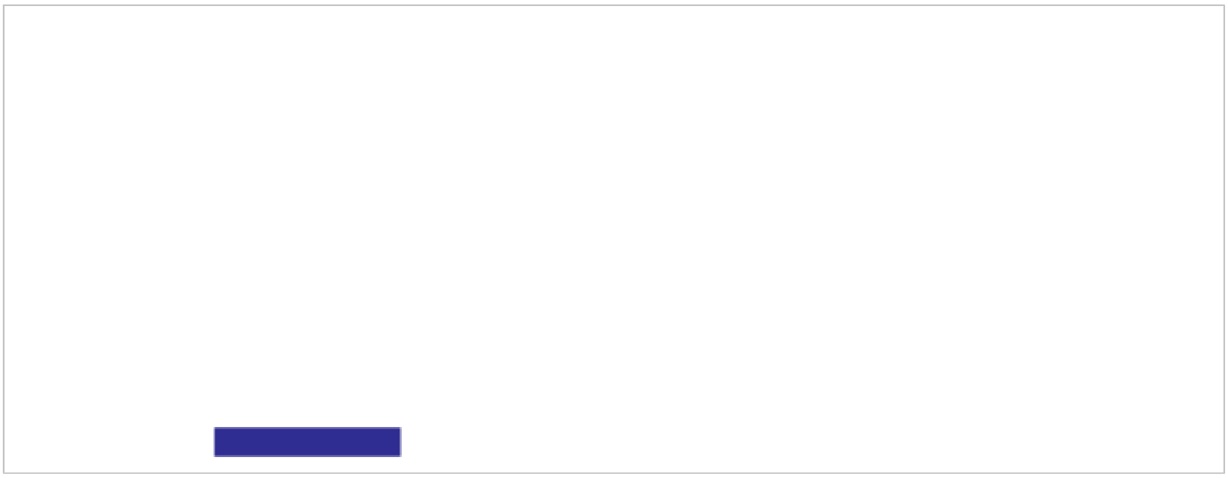
C144-2

PCM

MONITOR SCANTOOL DATA

1. Connect scantool to DLC(Data Link Connector)
2. Warm up the engine to normal operating temperature.
3. Monitor "HO2S(B2S2)" parameter on scantool

Specification : 0.1 ~ 0.9V



4. Does the "HO2S(B2S2)" parameter operates correctly ?

YES

▸ Fault is intermittent caused by poor contact in Sensor’s and/or PCM’s connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replaceas necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and connector inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Component Inspection " procedure.

COMPONENT INSPECTION

1. Visual Inspection
   (1) Visually check HO2S as follow.
      A. Contamination, deformation or age of HO2S(B2/S2)

   (2) Is the HO2S(B2/S2) normal ?

   YES

   ▸ Go to "Check performance of HO2S" as follows.

   NO

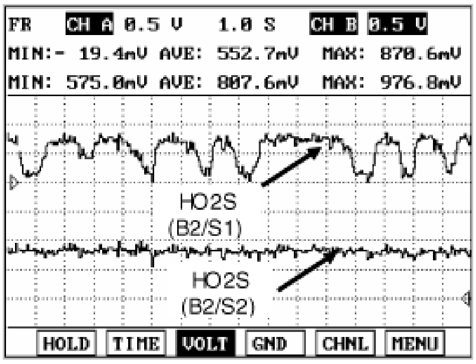
   ▸ Substitute with a known-good HO2S(B2S2) and check for proper operation. If the problem is corrected,replace HO2S (B2S2) and then go to "Verification of Vehicle Repair" procedure.

2. Check performance of HO2S
   (1) Connect scantool to DLC(Data Link Connector)

   (2) Warm up the engine to normal operating temperature.

   (3) Monitor signal waveform of HO2S with scantool.

Specification : 0.1 ~ 0.9V.



(4) Is the HO2S(B2S2) working properly ?

YES

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.

NO

▸ Substitute with a known-good HO2S(B2S2) and check for proper operation. If the problem is corrected,replace HO2S (B2S2) and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P2422

COMPONENT LOCATION

GENERAL DESCRIPTION

The vent valve is a device that is designed to close off the fresh air inlet to the canister. Current vent valve designs are powered closed. An electrically operated vent valve solenoid is requiredfor OBD II compliant evaporative systems. Normally the vent valve is in the open (unpowered)state, but to control the vacuum levels in the fuel tank the EVPD will command the vent valvesolenoid to the closed position. This controlled vacuum level will allow the EVPD to determine the integrity of the evaporative system.
The vent valve orifice is much larger than the purge valve orifice or purge lines so that when thevent valve is open, the purge flow is not restricted. The fresh air inlet in the vent valve solenoid is normally filtered with a serviceable dust filter that helps to prevent contaminants from being drawn into the evaporative system (e.g. water, salt, silica, etc.).

DTC DESCRIPTION

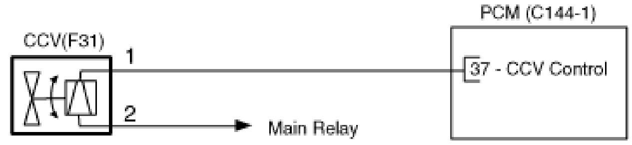
This test will detect blockage by commanding the vent solenoid to its normally open state and commanding the purge system to maintain a calibratable constant amount of purge flow. The fuel tank vacuum is monitored using the fuel tank pressure sensor for a calibration-specified amount of time. Anormally functioning evaporative system will maintain a relatively low vacuum level. Whereas, a failing evaporative system will experience an increasing vacuum level until a “fail” threshold is reached, at which time the test reports a “fail” condition.
Checking output signals from FTPS under detecting condition, if FTPS signal is detected higher than 14in H_2O for more than 5sec. when purging at 0.15 g/s. PCM sets P2422.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Test is failed if tank vacuum exceeds a prescribed threshold for a prescribed time when purging at a prescribed rate.	• Faulty Canister Close Valve • Clogging of canister air filter • Open in ground harness of FTPS • Faulty PCM
EnableConditions	• 10 < Ignition Volt < 15.9907 • Barometric pressure > 72 kPa • Engine off time > 720min or Startup IAT-Startup ECT < 12°C(53.6 °F) • Startup ECT -Startup IAT < 12°C(53.6 °F) • 0°C(32 °F) < Startup ECT < 40°C(104 °F) • 0°C(32 °F) < Startup IAT < 40°C(104 °F) • Start-up IAT-IAT < 1°C(33.8 °F) • Engine Run Time > 1sec • Purge enable time < Threshold • Cold Start Time < 300sec. • 15 % < Fuel Level < 85% • Restricted path test time < 120sec.	
Threshold value	• Tank vacuum ≥ 14 inH_2O • Fail time > 5s • Purge rate 0.15 g/s	
DiagnosisTime	• -	
MIL On Condition	• 1 driving cycle	

SCHEMATIC DIAGRAM

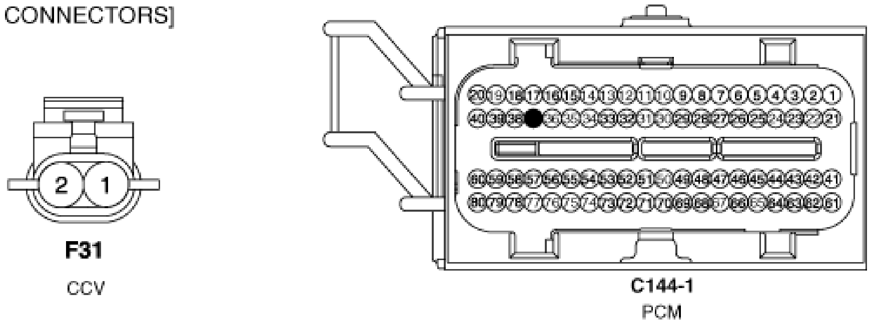
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Funtion
1	PCM C144-1 (37)	CCV Control
2	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTORS]



MONITOR SCANTOOL DATA

1. Warm-up engine to normal operating temperature.

> **NOTE**
>
> Evaporative Emissions Systems (EVAP) Leak Tests can be run by the Scan Tool.The tests are automated and provide either a pass-fail result or directions to check for DTCs.

2. Install scan tool and clear DTC
3. Perform "EVAP. LEAKAGE TEST" mode referring to enable conditions as below
4. Monitoring for (pending) DTC by performing " DIAGNOSTIC TROUBLE CODES"or "MONITORING TEST RESULTS". Is the same DTC set ?

YES

▸ Go to "System Inspection" procedure.

NO

▸ Fault is intermittent caused by poor contact in sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of vehicle Repair" procedure

SYSTEM INSPECTION

1. Check Canister air filter and CCV
   (1) Visually inspect air filter is clogged.
   (2) Visually inspect duck between air filter and CCV is clogged.
   (3) Check that Canister is deformed or clogged by foreign materials.
   (4) Has a problem been found ?

YES

▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

NO

▸ Open in ground harness of FTPS(Fuel tank pressure sensor) can cause this DTC. so check it for open.(Refer to DTC P0454) If the problem is not corrected, substitute with a known-good PCM and check for proper operation.If the problem is corrected, replace PCM and then go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P2610

COMPONENT LOCATION

GENERAL DESCRIPTION

Continuing to calculate data of several sensor despite turning ignition OFF, when ignition turns ON, PCM enables turning ignition ON to be easy using calculated data.

DTC DESCRIPTION

If there is a value difference between desired torque and real torque for more than 20 sec. or if errors exist inside of memory, PCM sets P2610. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

ITEM		Detecting Condition	Possible Cause
DTC Strategy	Case 1	• The LPC SPI Diagnostic allows the Low Power Counter to count down and simulateneously enables a test timer to run for a calibratable length of time and then compares the time elapsed recorded by the LPC (counter delta) against that recorded by the test timer in order to make a PASS/FAIL determination.	• PCM
	Case 2	• The LPC Reset Test checks for abnormal resets of the Low Power Counter	
EnableCondition	Case 1	• Test not complete • Engine running • Enough runtime > 10sec. • Battery voltage > 8V	
	Case 2	• No Memory Failure Occurred	
	Case 1	• The difference between the Counter Delta (test time as recoded by the low power counter) and the calibration the test timer clocks up to should be less than a maximum tolerance > 20sec.	

Threshold	Case 2	• The InItial Register Read flag is set to TRUE only when the Low Power Counter has been reset due to power supply problems or the like. • The Diagnostic logs a failure when it sees this flag set to TRUE, • Provided the engine is not running, • The battery voltage is not too low • The test has not already run this key cycle.	
Diagnosis Time		• -	
MIL On Condition		• 2 Driving Cycle	

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

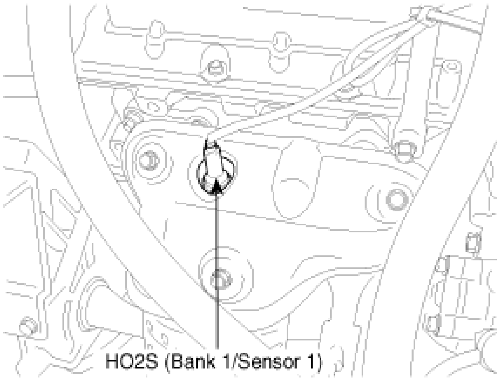
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P2A00

COMPONENT LOCATION



GENERAL DESCRIPTION

In order to control emissions of the CO, HC and NOx components of the exhaust gas, heated oxygen sensor (HO2S), mounted on the front side and rear side of catalytic converter, detects the oxygen content in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation.The HO2S requires a minimum temperature to operate properly and provide a closed loop fuel control system. The HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions.
The oxygen sensor generates a voltage that indicates the difference between the oxygen content of the exhaust stream and the oxygen content of ambient air. When the exhaust stream is “rich,” there is more oxygen in the ambient air than in the exhaust stream, so the voltage will be higher.
Some oxygen sensor varieties use a “bias” voltage to achieve better resolution of the exhaust stream signal. Some oxygen sensor varieties use a “pumping circuit” to force ambient air into the sensor to maintain a more pure environment for comparison. In either case, a cold sensor will tend to indicate voltage values near the open circuit value. For the “pumping current” sensors, this open circuit value can be near 3.5 V. Since the Fuel control logic would incorrectly consider this reading to indicate a very rich mixture for an extended time, the fuel control logic can not use the oxygen sensor reading under such conditions.
. The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

DTC DESCRIPTION

Detect when the oxygen sensor reading has forced closed loop fuel control to stop executing, and Open Loop fuel control is in effect. This action will happen for OSP (flat plate) oxygen sensors that are not yet warmed up when the pumping current is in use. The California Air Resources Board (CARB) will not approve the current strategy without this modification. CARB considers this Open Loop operation to be a “default mode of operation,” and thus CARB expects the Malfunction Indicator Lamp (MIL) to be illuminated.
Checking output signals from B1S1 every 12 sec. under detecting condition, if an output signal is near 3.5V for more than 10 sec., PCM sets P2A00. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till 1 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects Loss of O2 Ready status, which would lead to OpenLoop Fueling operation, a default mode.	• Poor Connection • Faulty HO2S • Faulty PCM
EnableConditions	• Engine Running • Ignition ON • DFCO Not present too long ≤ 15sec. • No Disabling Faults Present • All of the above for minimum time ≥ 20sec.	
Threshold value	• O2 Ready Status lost	
DiagnosisTime	• Contineous (More than 10 second failure for every 12 second test .)	
MIL On Condition	• 1 Driving Cycles	

SIGNAL WAVEFROM AND DATA

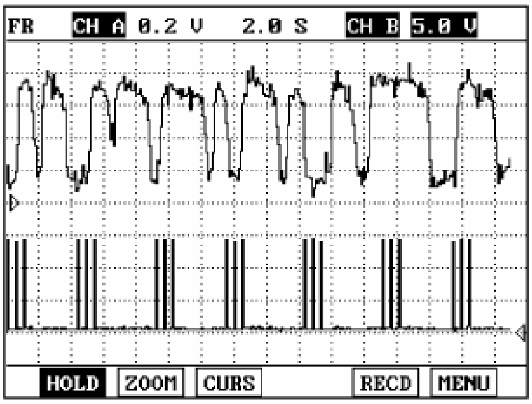


Fig.1 : B1S1 & Heater

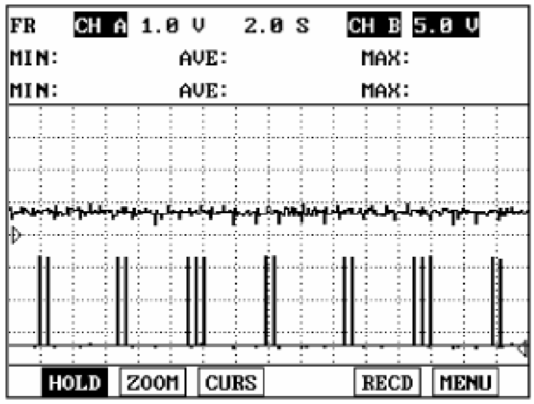


Fig. 2 : B1S2 & Heater

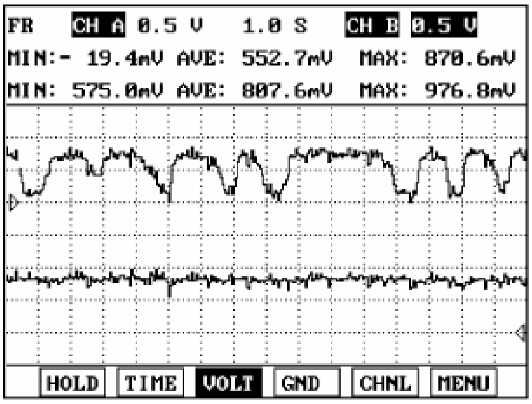


Fig. 3 : B1S1 & B1S2

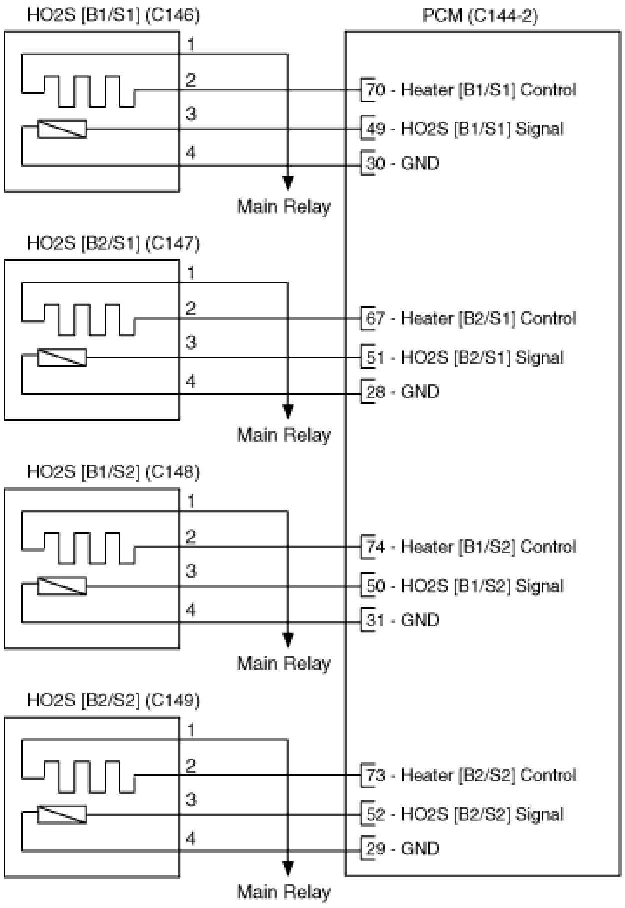
After warming-up, Releasing accellerator pedal suddenly around 4000rpm the HO2S signal reading will be lower than 200mV resulting from Fuel cut-off. Conversely, sudden depressing accellerator pedal HO2S signal reading will be around 0.6V ~1.0V. At idle, HO2S signal will be switching between lean(below 0.48V) to rich(above 0.48V) normally.

SPECIFICATION

HO2S(B1S1)	Warmed up	0 ~ 1V
	Not warmed up	Near 3.5V

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

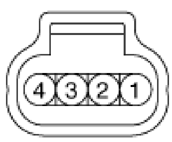
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

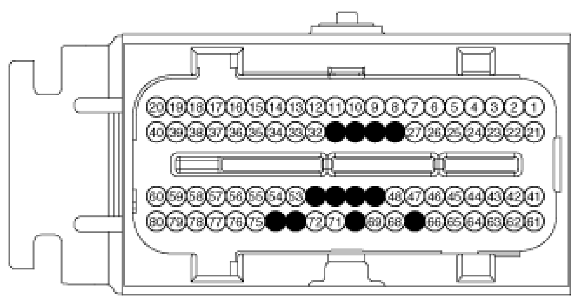
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



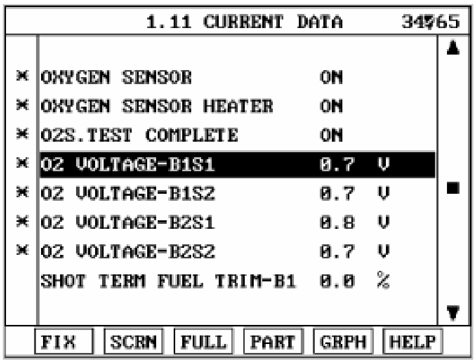
C144-2

PCM

MONITOR SCANTOOL DATA

1. Connect Scantool & Engine "ON"
2. Warm up the engine to normal operating temperature.
3. Monitor HO2S voltage(B1/S1) parameter on scantool

Specification : Voltage will vary from 0.1 to 0.9 V



4. Is the HO2S parameter displayed within specifications ?

YES

▸Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection,bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and goto "Verification of Vehicle Repair" procedure.

NO

▸Go to "Component Inspection" procedure

COMPONENT INSPECTION

1. Visual Inspection of HO2S
   (1) Visually/physically inspect following items:
      A. Inspect the front HO2S for Contaminated, deteriorated or aged Front HO2S
      B. If contamination is evident on the HO2S, replace contaminated sensor
   (2) Is the HO2S visually / physically O.K ?

   YES

   ▸ Go to "Check Performance of H02S" as below

   NO

   ▸ Substitute with a known - good HO2S and check for proper operation. If the problem is corrected, replace HO2S and go to "Verification of Vehicle Repair"

2. Check performance of HO2S
   (1) Connect scantool & Engine "ON"
   (2) Warm-up the engine to normal engine temperature.
   (3) Monitor signal waveform of HO2S with scantool

   Specification : Voltage will vary from 0.1 to 0.9 V

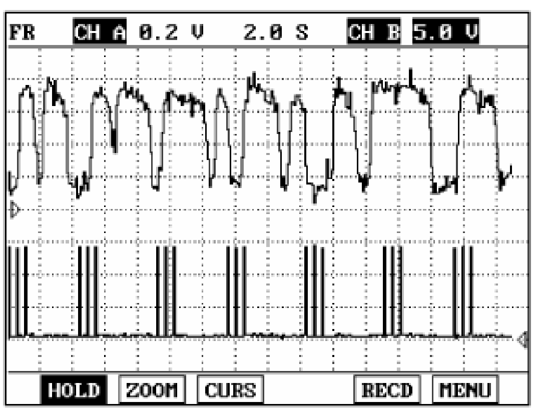


Fig.1: B1S1 & Heater

   (4) Is the sensor signal switching properly ?

   YES

   ▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

   NO

▸ Substitute with a known - good HO2S and check for proper operation. If the problem is corrected, replace HO2S and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

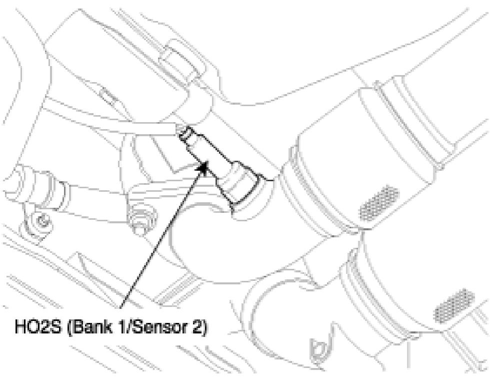
▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > P2A03

COMPONENT LOCATION



GENERAL DESCRIPTION

In order to control emissions of the CO, HC and NOx components of the exhaust gas, heated oxygen sensor (HO2S), mounted on the front side and rear side of catalytic converter, detects the oxygen content in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation.The HO2S requires a minimum temperature to operate properly and provide a closed loop fuel control system. The HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions.
The oxygen sensor generates a voltage that indicates the difference between the oxygen content of the exhaust stream and the oxygen content of ambient air. When the exhaust stream is “rich,” there is more oxygen in the ambient air than in the exhaust stream, so the voltage will be higher.
Some oxygen sensor varieties use a “bias” voltage to achieve better resolution of the exhaust stream signal. Some oxygen sensor varieties use a “pumping circuit” to force ambient air into the sensor to maintain a more pure environment for comparison. In either case, a cold sensor will tend to indicate voltage values near the open circuit value. For the “pumping current” sensors, this open circuit value can be near 3.5 V. Since the Fuel control logic would incorrectly consider this reading to indicate a very rich mixture for an extended time, the fuel control logic can not use the oxygen sensor reading under such conditions.
The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

DTC DESCRIPTION

Detect when the oxygen sensor reading has forced closed loop fuel control to stop executing, and Open Loop fuel control is in effect. This action will happen for OSP (flat plate) oxygen sensors that are not yet warmed up when the pumping current is in use. The California Air Resources Board (CARB) will not approve the current strategy without this modification. CARB considers this

Open Loop operation to be a “default mode of operation,” and thus CARB expects the Malfunction Indicator Lamp (MIL) to be illuminated.
Checking output signals from B1S1 every 12 sec. under detecting condition, if an output signal is near 3.5V for more than 10 sec., PCM sets P2A03. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till 1 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects Loss of O2 Ready status, which would lead to OpenLoop Fueling operation, a default mode.	• Poor Connection • Faulty HO2S • Faulty PCM
EnableConditions	• Engine Running • Ignition ON • DFCO Not present too long ≤ 15sec. • No Disabling Faults Present • All of the above for minimum time ≥ 20sec.	
Threshold value	• O2 Ready Status lost	
DiagnosisTime	• Contineous (More than 10 second failure for every 12 second test .)	
MIL On Condition	• 1 Driving Cycles	

SIGNAL WAVEFROM AND DATA

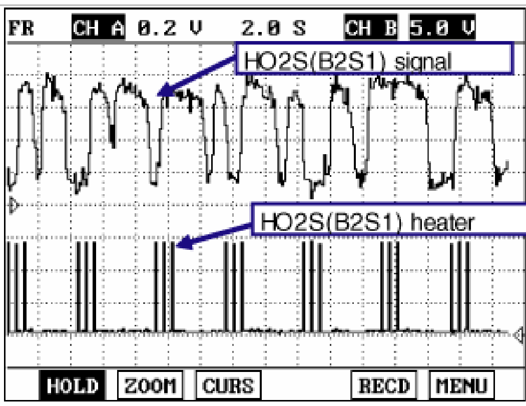


Fig1

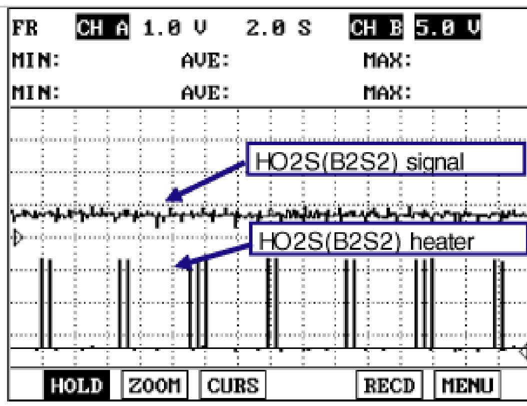


Fig2

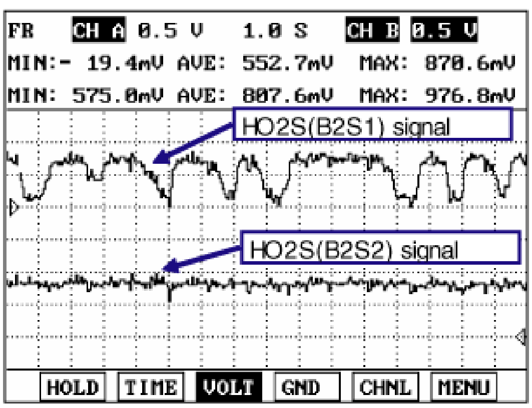


Fig3

Fig1 : HO2S(B1S1) & Heater
Fig2 : HO2S(B2S2) & Heater
Fig3 : HO2S(B2S1) & (B2S2)

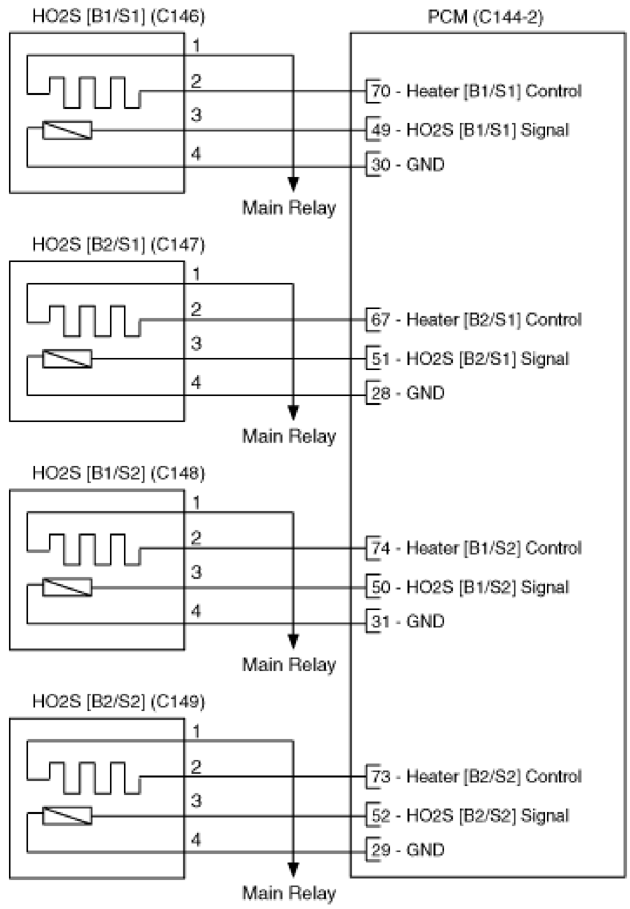
After warming-up, Releasing accellerator pedal suddenly around 4000rpm the HO2S signal reading will be lower than 200mV resulting from Fuel cut-off. Conversely, sudden depressing accellerator pedal HO2S signal reading will be around 0.6V ~1.0V. At idle, HO2S signal will be switching between lean(below 0.48V) to rich(above 0.48V) normally.

SPECIFICATION

HO2S(B2S1)	Warmed up	0 ~ 1V
	Not warmed up	Near 3.5V

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

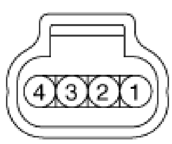
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (70)	Heater [B1/S1] Control
3	PCM C144-2 (49)	HO2S [B1/S1] Signal
4	PCM C144-2 (30)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (67)	Heater [B2/S1] Control
3	PCM C144-2 (51)	HO2S [B2/S1] Signal
4	PCM C144-2 (28)	Sensor ground

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (74)	Heater [B1/S2] Control
3	PCM C144-2 (50)	HO2S [B1/S2] Signal
4	PCM C144-2 (31)	Sensor ground

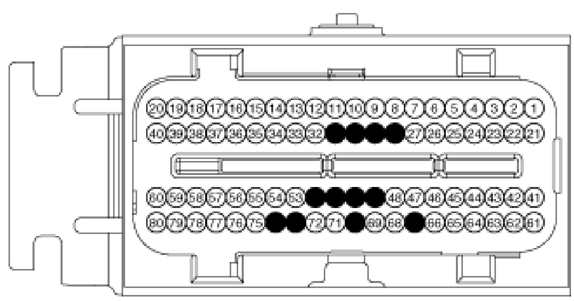
Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	PCM C144-2 (73)	Heater [B2/S2] Control
3	PCM C144-2 (52)	HO2S [B2/S2] Signal
4	PCM C144-2 (29)	Sensor ground

[HARNESS CONNECTORS]



C146,C147,C148,C149

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]
HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]

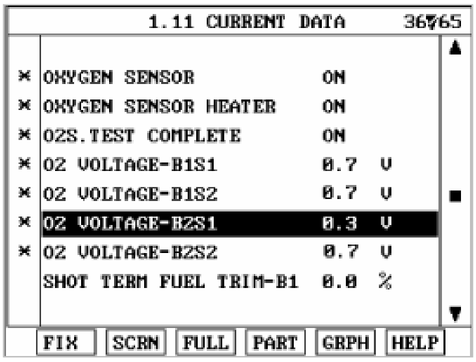


C144-2
PCM

MONITOR SCANTOOL DATA

1. Connect Scantool & "ON"
2. Warm up the engine to normal operating temperature.
3. Monitor HO2S voltage(B2/S1) parameter on scantool

Specification : Voltage will vary from 0.1 to 0.9 V



4. Is the HO2S parameter displayed within specifications ?

YES

▸Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repairedand PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection,bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and goto "Verification of Vehicle Repair" procedure.

NO

▸Go to "Component Inspection" procedure

COMPONENT INSPECTION

1. Visual Inspection of HO2S
   (1) Visually/physically inspect following items:
      A. Inspect the front HO2S for Contaminated, deteriorated or aged Front HO2S
      B. If contamination is evident on the HO2S, replace contaminated sensor

   (2) Is the HO2S visually / physically O.K ?

   YES

   ▸ Go to "Check Performance of H02S" as below

   NO

   ▸ Substitute with a known - good HO2S and check for proper operation. If the problem is corrected, replace HO2S and go to "Verification of Vehicle Repair"

2. Check performance of HO2S
   (1) Connect scantool & Engine "ON"

   (2) Warm-up the engine to normal engine temperature.

   (3) Monitor signal waveform of HO2S with scantool

   Specification : Voltage will vary from 0.1 to 0.9 V

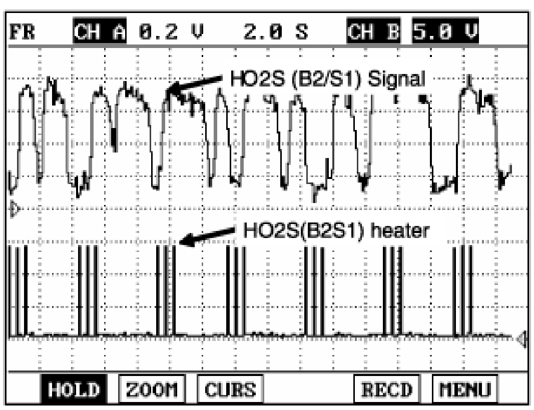


Fig.1 : HO2S(B2S1) & Heater

   (4) Is the sensor signal switching properly ?

   YES

   ▸ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

   NO

▸ Substitute with a known - good HO2S and check for proper operation. If the problem is corrected, replace HO2S and go to "Verification of Vehicle Repair" procedure.

> NOTE
>
> There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▸ Go to the applicable troubleshoooting procedure.

NO

▸ System is performing to specification at this time.

Fuel System > Troubleshooting > U0001

GENERAL DESCRIPTION

As vehicles electronically controlled, various control unit is applied to vehicle and several units are controlled based on the signals from the sensors. Therefore sharing signals of sensors and information is required. To meet this requirement, CAN communication type, which is insensible to external noises and whose communication speed is fast, is applied to power train control.Sharing signals from RPM, APS, gear shifting, torque reduction in ESP, ABS and various modules, adtive control is performed.

DTC DESCRIPTION

Checking CAN communication every 1 sec., under detecting condition, if an output signal within the detecting condition is detected for more than 1.5 sec., PCM sets U0001. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects failures in communication between the PCM and another or allmodules in the vehicle which are on the CAN serial bus.	• CAN Communicatio line • CAN Communication Module
EnableConditions	• Engine Run Time ≥ 2sec. • Ignition Voltage ≥ 11V	
Threshold value	• CAN communicatin error	
DiagnosisTime	• Contineous (More than 1.5sec. Failure for every 1sec. Test)	
MIL On Condition	• 2 Driving Cycles	

SIGNAL WAVEFROM AND DATA

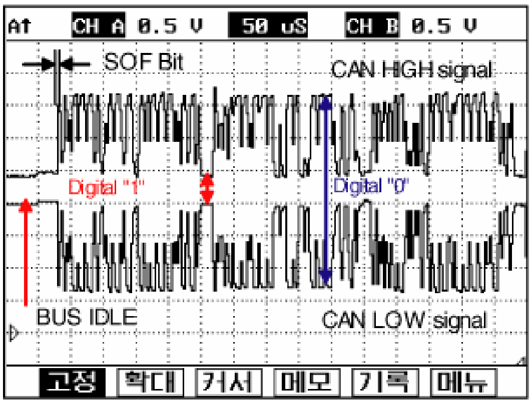


Fig.1

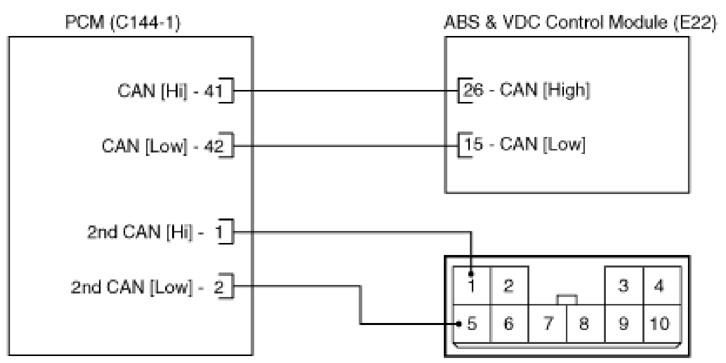
Monitoring CAN HIGH and LOW simultaneously is important in monitoring CAN communication waveform. When CAN HIGH signal rise to 3.5V and LOW signal drops to 1.5V - voltage difference between HIGH and LOW signal is 2V - at BUS IDLE state (DIGITAL "1") whose reference voltage is 2.5V, "0" is recognized. Besides, comparing HIGH and LOW signal if opposite waveform is detected with the reference voltage of 2.5V, Check if current CAM signal is transfers correctly.
Continuous "0"signal above 6BIT means the occurence of error in CAN communication. 1BIT is easily distinguished as calculating the time when "SOF"(START OF FRAME) which notifies the start of frame occurs. Check if "0"signal above 6BIT is detected continuously when monitoring CAN communication waveform.

SPECIFICATION

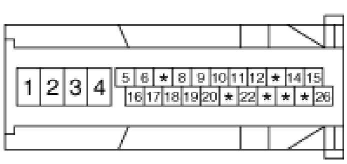
Format	DIGITAL "0"		DIGITAL "1"(BUS IDLE)		CAN Resistance	
	HIGH	LOW	HIGH	LOW	PCM	ESP
CAN 2.0B	3.5V	1.5V	2.5V	2.5V	120Ω (20°C)	120Ω (20°C)

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]

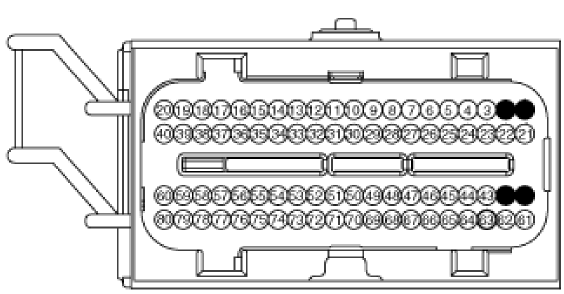


[HARNESS CONNECTOR]



E22

ABS & VDC Control



C144-1

PCM

MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector (DLC).

2. Warm engine up to normal operating temperature.
3. Turn "OFF" electrical devices and A/C.
4. Monitor the data from PCM through CAN communication among ABSCM or ESP data

If CAN is normal, vehicle speed data is showed through CAN communication line from ABS or ESP control module.

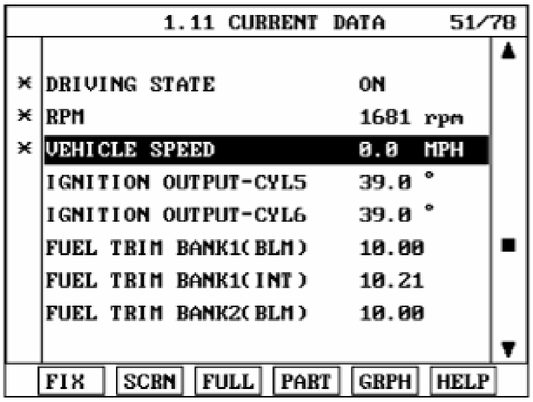


Fig. 1

Fig1 : Vehicle speed data on current data during driving state.

5. Is the data displayed correctly?

YES

▸ Fault is intermittent caused by poor contact in the sensor’s and/or PCM’s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▸ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure

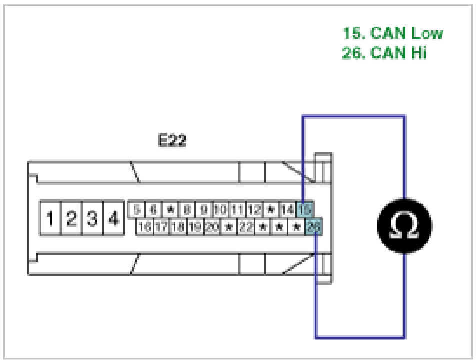
NO

▸ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check CAN communication bus resistance
   (1) Ignition "OFF".
   (2) Check connection state of PCM connector(C144-1) and ESP or ABS connector(E22)
   (3) Measure the resistance between ESP or ABS connector 15 and 26 refering to the checking condition of specification as follows.

Specification : ※ PCM connector, ESP or ABS connector connected : 60Ω ± 5Ω
※ PCM connecotor disconnected, ESP or ABS connector connected : 120Ω ± 10Ω
※ PCM connector connected, ESP or ABS connector disconnected : 120Ω ± 10Ω



(4) Is CAN BUS resistance within the specification?

YES

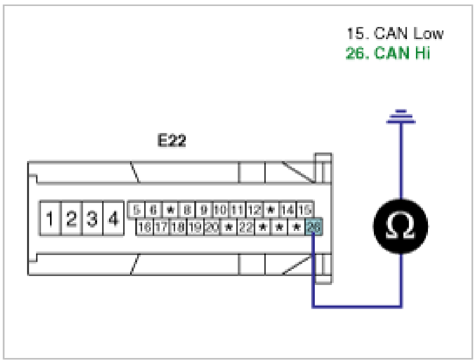
▸ Go to "Check short to ground in CAN BUS" as follows.

NO

▸ When resistance is about 1.0Ω : Go to "3. Check short between CAN communication lines" as follows
▸ When resistance is infinite Ω : Go to "4. Check open in CAN communication line" as follows

2. Check short to ground in CAN communication bus
   (1) Ignition "OFF"
   (2) Disconnect ESP or ABS connector.
   (3) Measure resistance between terminal 26 of ESP or ABS harness connector and chassis ground.

specification : Infinite



(4) Is the measured resistance within the specification?

YES

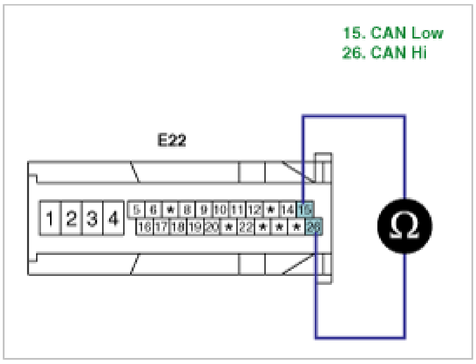
▸ Go to "Component Inspection" procedure

NO

▸ Below 1.0Ω is detected : Repair short to ground in CAN High circuit and go to "Verification of Vehicle Repair" procedure.
▸ Above 120Ω is detected : Repair short to ground in CAN Low circuit and go to "Verification of Vehicle Repair" procedure.

3. Check short between CAN communication lines(LOW and HIGH)
   (1) Ignition "OFF"
   (2) Disconnect PCM connector and ESP or ABS connector.
   (3) Measure resistance between terminal 15 and 26 of ESP or ABS harness connector.

specification : Infinite



(4) Is the measured resistance within the specification?

YES

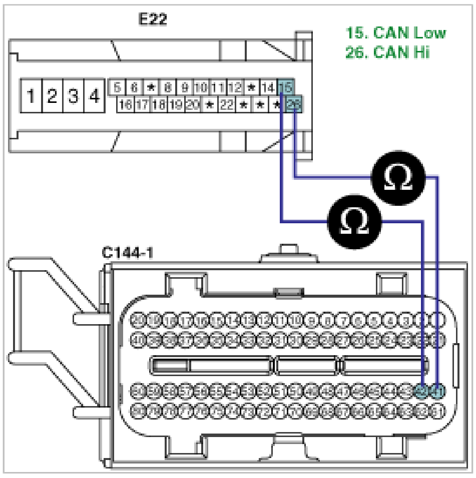
▸ Go to "Component Inspection" procedure.

NO

▸ Below 1.0Ω is detected : Repair short between CAN LOW and HIGH signal line and go to "Verification of Vehicle Repair" procedure.

4. Check open in CAN communication line
   (1) Ignition "OFF".
   (2) Disconnect PCM connector and ESP or ABS connector.
   (3) Measure resistance between terminal 42/C144-1 of PCM harness connector and terminal 15 of ABS or EPS harness connector.(CAN Low)
   (4) Measure resistance between terminal 41/C144-1 of PCM harness connector and terminal 26 of ABS or EPS harness connector (CAN hi)

specification : Below 1.0Ω



(5) Is the measured resistance within the specification?

YES

▸ Go to "Component Inspection" procedure.

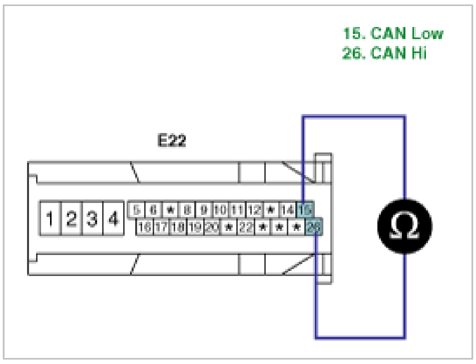
NO

▸ Repair open in harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check the resistance of CAN BUS inside of module
   (1) Ignition "OFF"
   (2) Measure the resistance between ABS or ESP connector 15 and 26 refering to the checking condition of specification as follows.

Specification : ※ PCM connector disconnected, ESP or ABS connector connected. (TEST "A") : 120Ω ± 10Ω
※ PCM connector connected, ESP or ABS connector disconnected (TEST "B") : 120Ω ± 10Ω



(3) Is the measured resistance within the specification?

YES

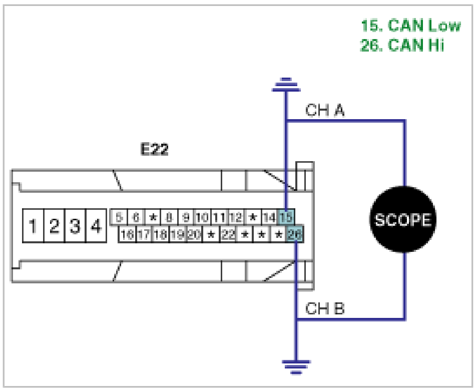
▸ Go to "2. Check CAN communication waveform" as follows

NO

▸ TEST "A" problem : the resistance of CAN BUS inside of ABS or ESP is without specification. Replace ABS or ESP and go to "Verification of Vehicle Repair"
▸ TEST "B" problem : the resistance of CAN BUS inside of PCM is without specification. Replace PCM and go to "Verification of Vehicle Repair"

2. Check CAN communication waveform output
   (1) Ignition "OFF"
   (2) Connect 2 channel scope to ABS or ESP connector terminal 15 and 26.
   (3) Disconnect ABS or ESP connector and check CAN communication waveform after Ignition "ON". (TEST "A")
   (4) Disconnect PCM connector and check CAN communication waveform after Ignition "ON". (TEST "B")

Sspecification : Communication waveform similar to the waveform of "Signal Waveform & Data" is displayed when Ignition "ON"
※ It means communication error of connected module when, being different from reference waveform, 1) CAN HIGH and LOW signals are fixed at 2.5V or 2)HIGH and LOW signals are fixed at 3.5V and 1.5V,respectively



(5) Does correct waveform generate from ECM and TCM?

YES

▸ Go to "Verification of Vehicle Repair"

NO

▸ TEST "A" waveform is abnormal : Repalce PCM due to the communication error with PCM and go to "Verification of Vehicle Repair"
▸ TEST "B" waveform is abnormal : Repalce ABS or ESP due to the communication error with ABS or ESP and go to "Verification of Vehicle Repair"
※ Repeat this process 2~3 times.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.

2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

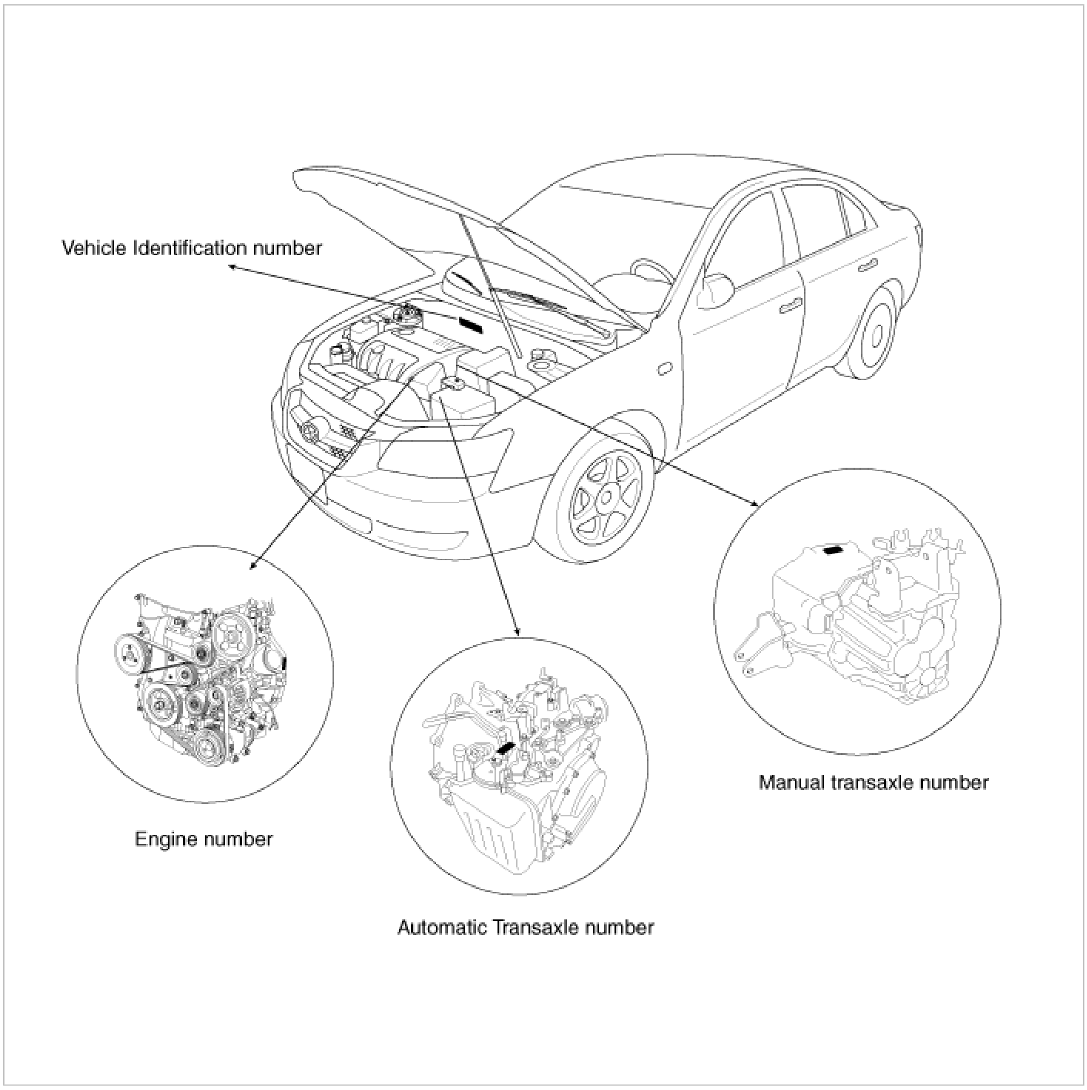
YES

▸ Go to the applicable troubleshoooting procedure.

NO

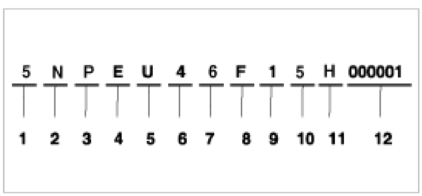
▸ System is performing to specification at this time.

IDENTIFICATION NUMBER LOCATIONS



IDENTIFICATION NUMBER DESCRIPTION

VEHICLE IDENTIFICATION NUMBER



1. Geographic zone
   - K : Korea
2. Manufacturer
   - M : Hyundai motor company
3. Vehicle type
   - 5NP : Passenger cars
   - H : Passenger cars
4. Vehicle line
   - E : SONATA
5. Model & Series
   - S : STANDARD (L)
   - T : DELUXE (GL)
   - U : SUPER DELUXE (GLS)
   - V : GRAND SALON (GDS)

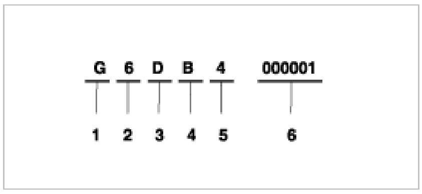
- W : SUPER GRAND SALON (HGS)

6. Body type
   - 4 : Sedan
7. Restraint system
   - 5 : Depowered airbag.
   - 6 : Advanced airbag.
8. Engine type
   - C : Gas 2.4
   - F : Gas 3.3
9. Check digit or others
10. Production year
    - 5 : 2005, 6 : 2006
11. Plant of production
    - H : Alabama in U.S.A
    - A : A-SAN (korea)
12. Vehicle production sequence number
    - 000001 ~ 999999

PAINT CODE

CODE	COLOR
EB	Ebony Black
OT	Special Color
N2	Pure Pearl white
S7	Sleek Silver
B7	Grace Beige
D2	Deep Pearl Blue
W2	Presting Dark R
D3	Aurora Blue
G6	Charming Gray

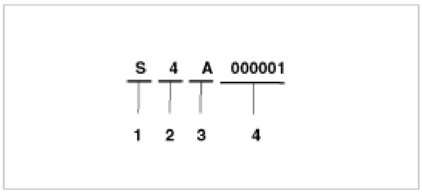
ENGINE IDENTIFICATION NUMBER



1. Engine fuel
   - G : Gasoline
2. Engine range
   - 4 : 4 cycle 4 cylinder
   - 6 : 4 cycle 6 cylinder
3. Engine development order
   - K : Theta engine
   - D : Lamda engine
4. Engine capacity
   - C : 2359 cc (Gasoline)
   - B : 3342 cc (Gasoline)
5. Production year
   - 5 : 2005, 6 : 2006
6. Engine production sequence number
   - 000001 ~ 999999

TRANSMISSION IDENTIFICATION NUMBER

MANUAL

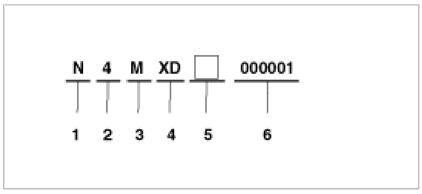


1. Model

- S : M5GF2

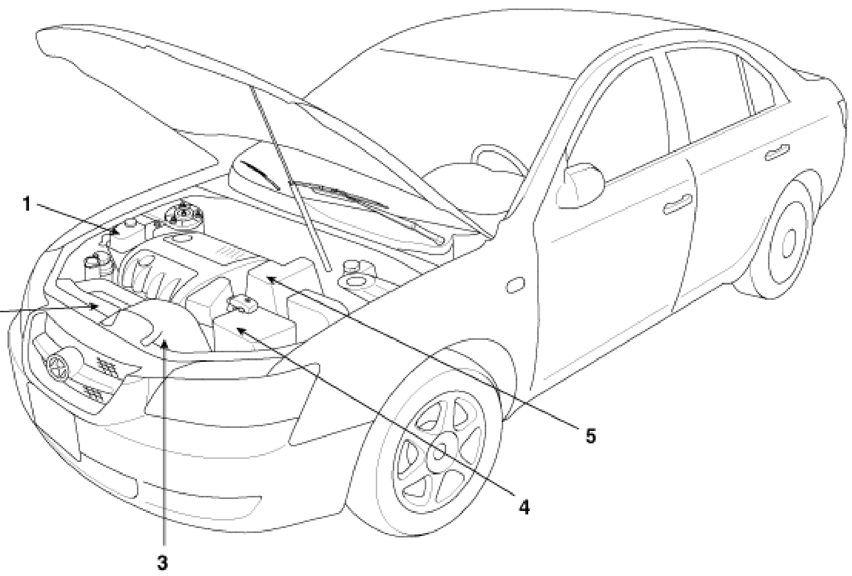
2. Production year
   - 4 : 2004, 5 : 2005, 6 : 2006, 7 : 2007
3. Gear ratio
   - A : 4.680
   - B : 4.333
4. Transaxle production sequence number
   - 000001 ~ 999999

AUTOMATIC



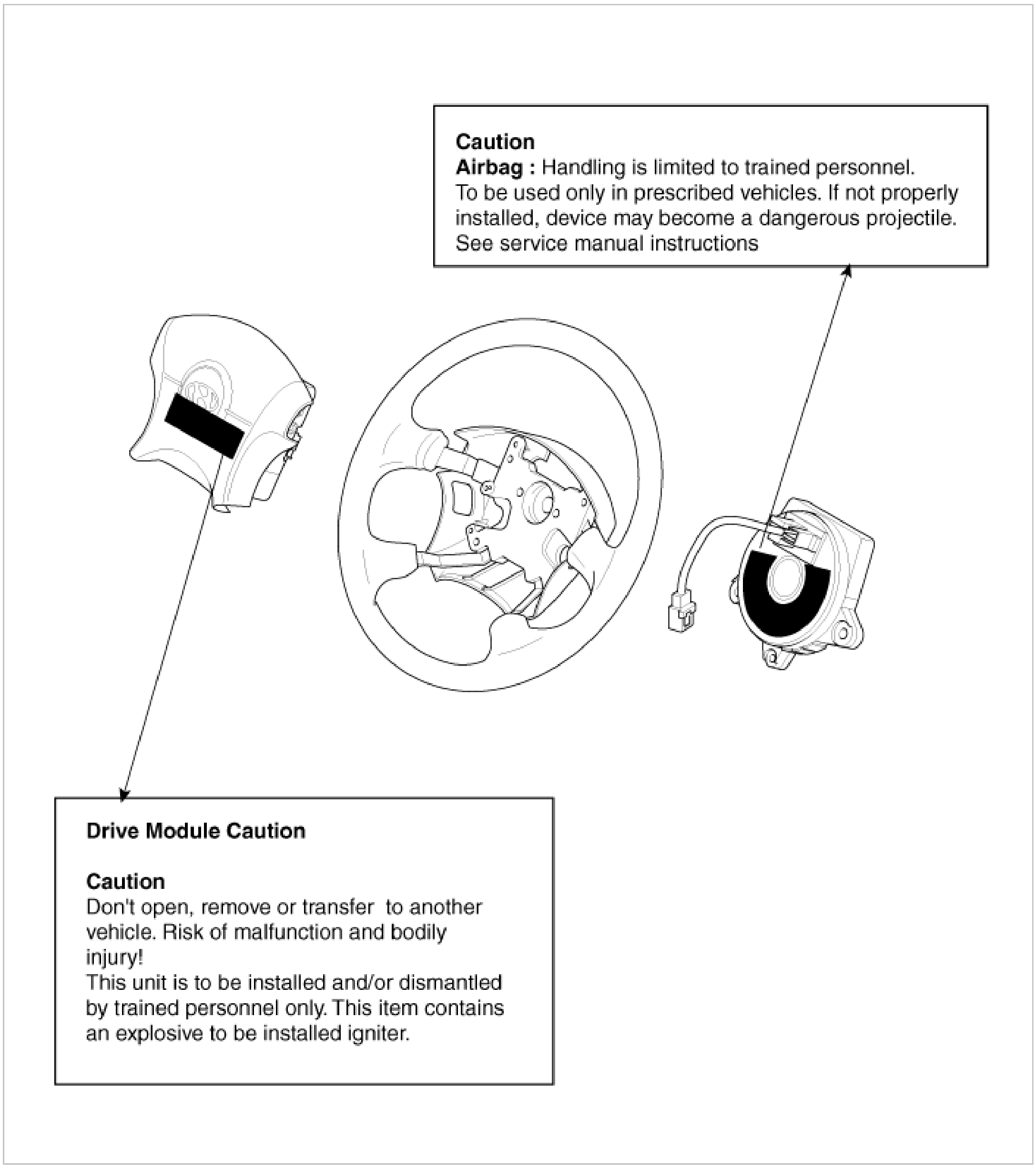
1. Model
   - N : F4A42-2
   - U : A5HF1
2. Production year
   - 4 : 2004, 5 : 2005, 6 : 2006, 7 : 2007
3. Gear ratio
   - M : 3.770
   - K : 3.333
4. Detailed classification
   - XD : 2.4 (Theta engine)
   - GD : 3.3 (Lambda engine)
5. Spare
6. Transaxle production sequence number
   - 000001 ~ 999999

WARNING / CAUTION LABEL LOCATIONS

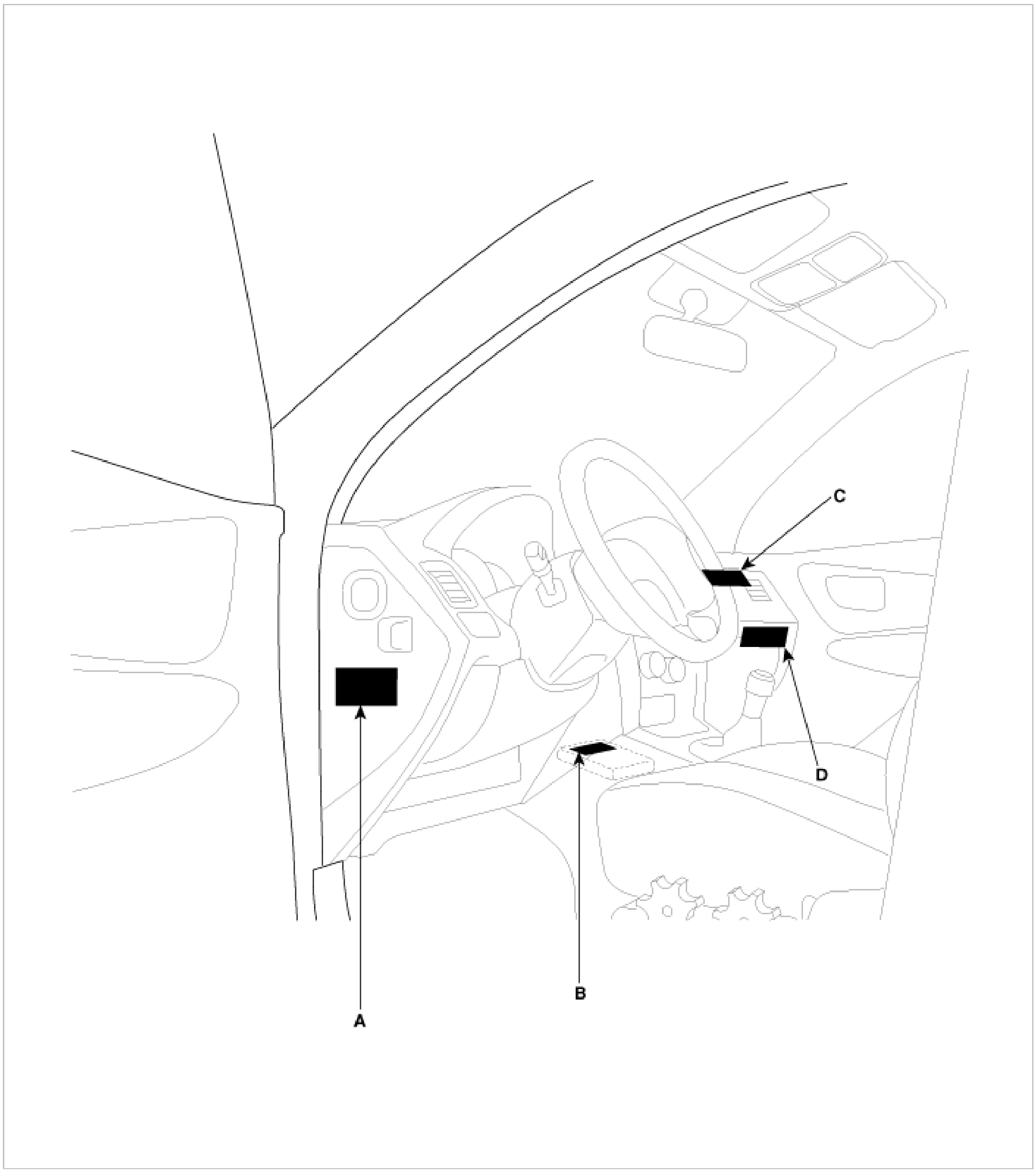


1. COOLANT LEVEL CAUTION
2. FAN CAUTION
3. RADIATOR CAP CAUTION
4. BATTERY CAUTION
5. AIR CLEANER CAUTION

AIR BAG WARNING / CAUTION LABEL



AIR BAG WARING / CAUTION LABEL (CONT'D)



WARNING / CAUTION LABEL (cont'd)

A : WARNING SEE OWNER'S MANUAL. This car is equipped a side airbag for each front seat. • Do not use any accessory seat covers. • Use of other seat covers could reduce the effect of the system. • Do not install any accessories on the side or near the side airbag. • Do not use excessive force on the side of the seal. • For further information, see the owner's manual.

B : CAUTION AIRBAG ESPE UNIT Detach connector before dismounting. Assemble strictly according to manual instructions.

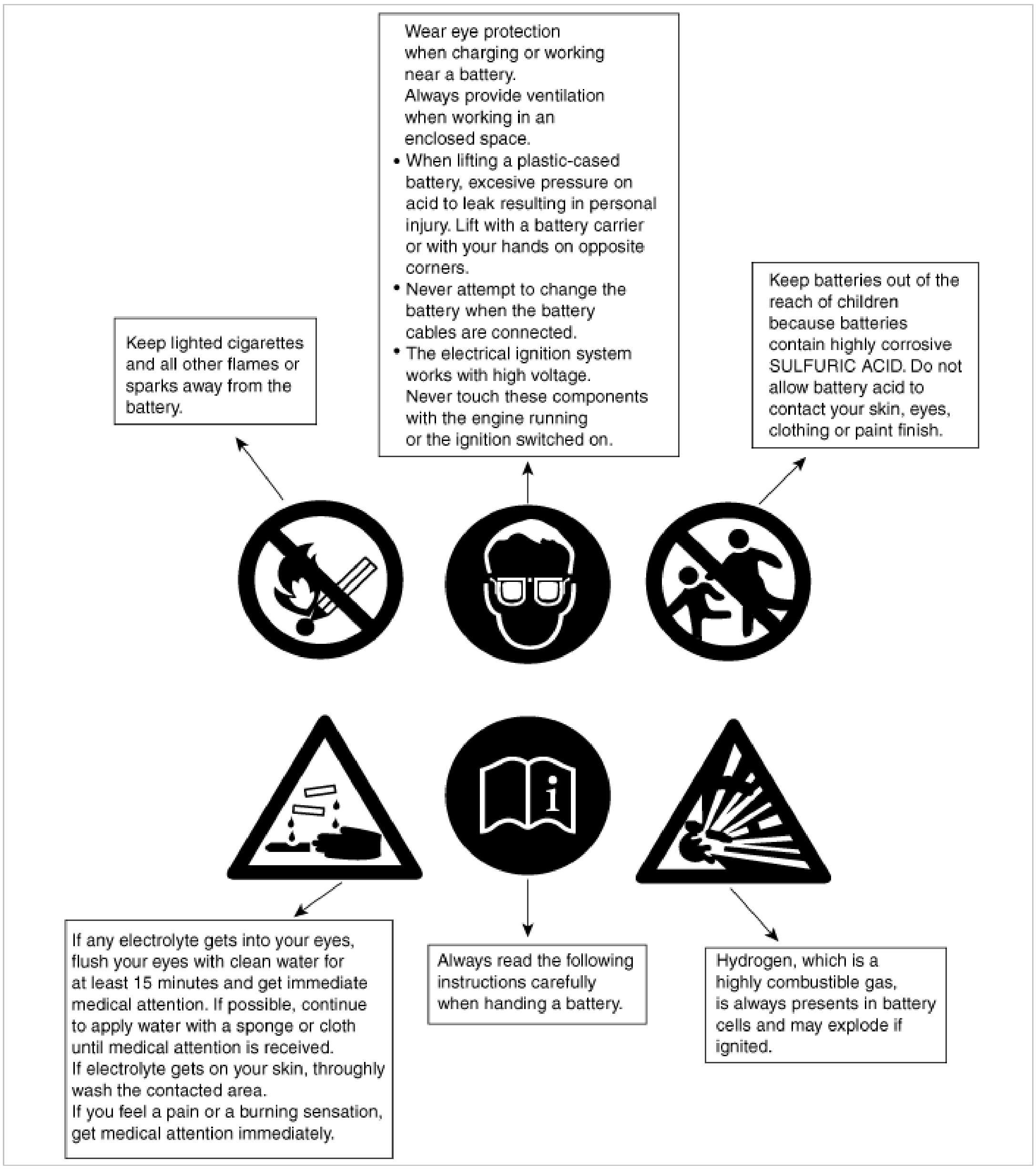
C : PASSENGER MODULE CAUTION CAUTION Don't open, remove or transfer to another vehicle. Risk of malfunction and bodily injury! This unit is to be installed and/or dismantled by trained personnel only. This item contains an explosive igniter.

D : SUPPLEMENTAL RESTRAINT SYSTEM (AIRBAG) INFORMATION • The airbag is a Supplement Restraint System (SRS).

You must always wear seat belts.
- The airbag system condition is normal when the "SRS" lamp in the cluster flashes approximately 6 times after the ignition key is turned on and then goes off.
- If any of the following condition soccur, the system must be serviced.
  - "SRS" lamp does not light up when the key is turned on.
  - "SRS" lamp stays lit or flashes continuously.
  - The airbag has inflated.
- The airbag system must be inspected by an authorized dealer ten years after the vehicle manufacture date shown on the certification label, located on left front door opening area.

WARNING
Failure to the above instructions may result in injury to you or other occupants in the vehicle
- See the "SRS" section in Owner's Manual for more information about airbags.

BATTERY CAUTION LABEL DESCRIPTION



LIFT AND SUPPORT POINTS

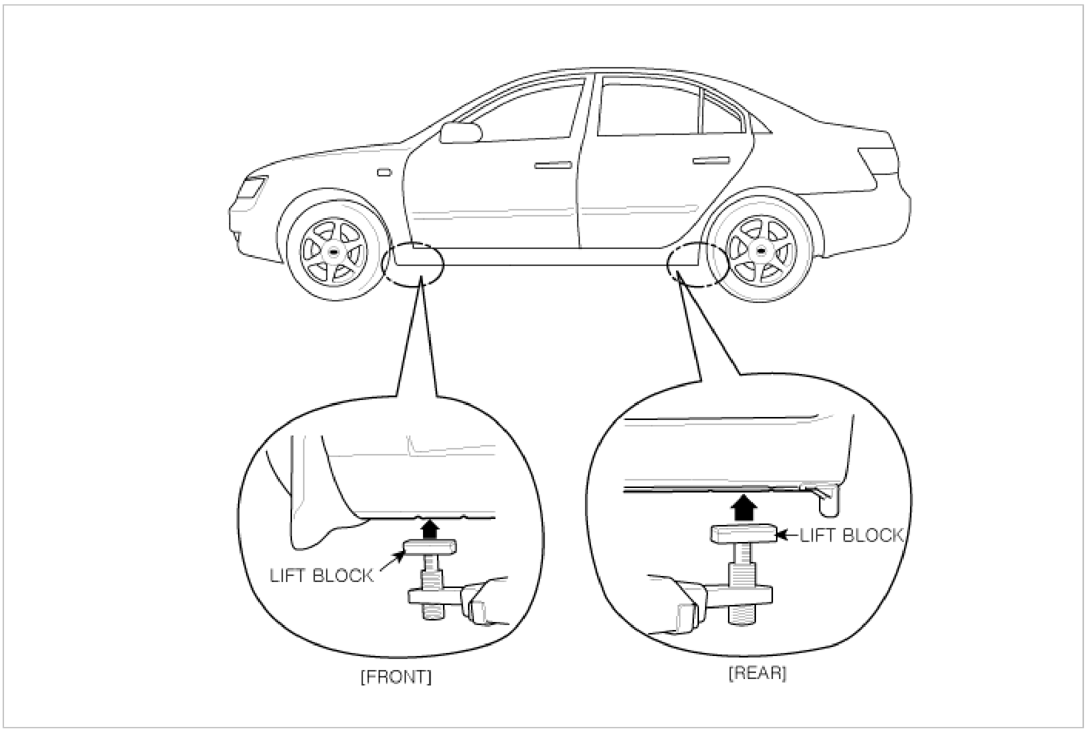
WARNING

When heavy rear components such as suspension, fuel tank, spare tire, tailgate and trunk lid are to be removed, place additional weight in the luggage area before hoisting. When substantial weight is removed from the rear of the vehicle, thecenter of gravity may change and can cause the vehicle to tip forward on the hoist.

NOTE

- Since each tire/wheel assembly weights approximately 30lbs (14kg), placing the front wheels in the luggage area can assist with the weight distribution.
- Use the same support points to support the vehicle on safety stands.

1. Place the lift blocks under the support points as shown in the illustration.
2. Raise the hoist a few inches (centimeters) and rock the vehicle to be sure it is firmly supported.
3. Raise the hoist to full height and inspect the lift points for secure support.



TOWING

If the vehicle needs to be towed, call a professional towing service. Never tow vehicle with just a rope or chain. It is very dangerous.

Emergency Towing

There are three popular methods of towing a vehicle :
If the vehicle cannot be transported by flat-bed, it should be towed with the front wheels off the ground. If due to damage, the vehicle must be tow with the front wheels on the ground, do the following :
Manual Transmission

- Release the parking brake.
- Shift the transmission to neutral

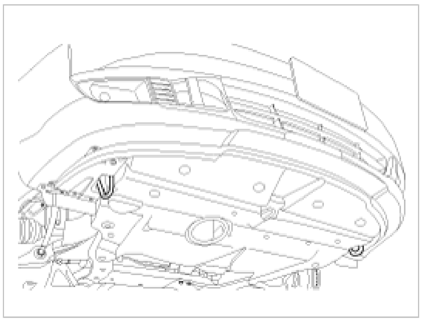
Automatic Transmission

- Release the parking brake.
- Start the engine.
- Shift to [D] position, then [N] position.
- Turn off the engine.

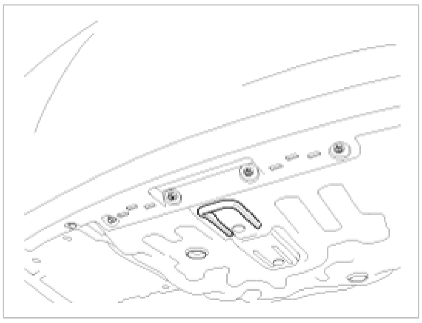
CAUTION

- Improper towing preparation will damage the transmission. Follow the above procedure exactly. If you cannot shift the transmission or start the engine(automatic transmission), your vehicle must be transported on a flatbed.
- It is the best to tow vehicle no farther than 19miles (30km), and keep the speed below 30mph (50km/h).
- Trying to lift or tow your vehicle by the bumpers will cause serious damage. The bumpers are not designed to support the vehicle's weight.

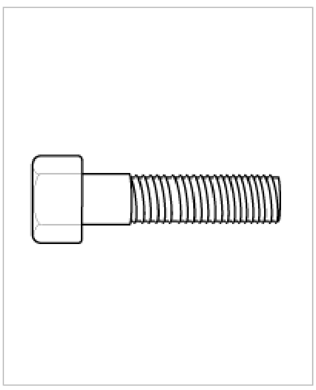
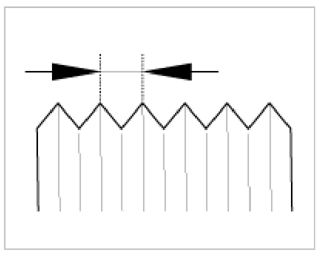
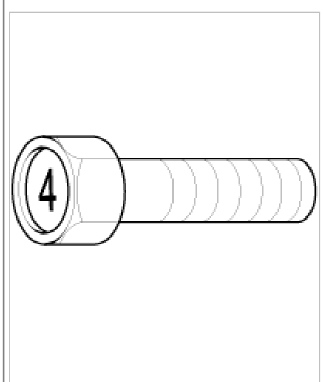
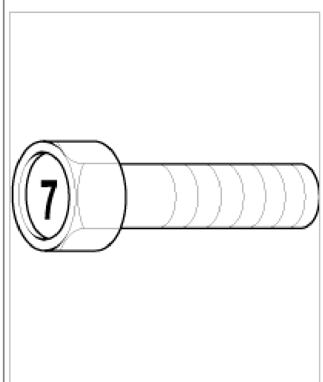
Front :



Rear :



TIGHTENING TORQUE TABLE OF STANDARD PARTS

Bolt nominal diameter (mm)	Pitch (mm)	Torque Nm (kg.cm, lb.ft)	
		Head Mark 4	Head Mark 7
			
M5	0.8	3 ~ 4 (30 ~ 40, 2.2 ~ 2.9)	5 ~ 6 (50 ~ 60, 3.6 ~ 4.3)
M6	1.0	5 ~ 6 (50 ~ 50, 3.6 ~ 4.3)	9 ~ 11 (90 ~ 110, 6.5 ~ 8.0)
M8	1.25	12 ~ 15 (120 ~ 150, 9 ~ 11)	20 ~ 25 (200 ~ 250, 14.5 ~ 18.0)
M10	1.25	25 ~ 30 (250 ~ 300, 18 ~ 22)	30 ~ 50 (300 ~ 500, 22 ~ 36)
M12	1.25	35 ~ 45 (350 ~ 450, 25 ~ 33)	60 ~ 80 (600 ~ 800, 43 ~ 58)
M14	1.5	75 ~ 85 (750 ~ 850, 54 ~ 61)	120 ~ 140 (1,200 ~ 1,400, 85 ~ 100)
M16	1.5	110 ~ 130 (1,100 ~ 1,300, 80 ~ 94)	180 ~ 210 (1,800 ~ 2,100, 130 ~ 150)
M18	1.5	160 ~ 180 (1,600 ~ 1,800, 116 ~ 130)	260 ~ 300 (2,600 ~ 3,000, 190 ~ 215)
M20	1.5	220 ~ 250 (2,200 ~ 2,500, 160 ~ 180)	360 ~ 420 (3,600 ~ 4,200, 260 ~ 300)
M22	1.5	290 ~ 330 (2,900 ~ 3,300, 210 ~ 240)	480 ~ 550 (4,800 ~ 5,500, 350 ~ 400)
M24	1.5	360 ~ 420 (3,600 ~ 4,200, 260 ~ 300)	610 ~ 700 (6,100 ~ 7,000, 440 ~ 505)

NOTE

1. The torques shown in the table are standard values under the following conditions :
    - Nuts and bolts are made of galvanized steel bar.

- Galvanized plain steel washers are inserted.
- All nuts, bolts and plain washers are dry.

2. The torques shown in the table are not applicable :
   - When spring washers, toothed washers and the like are inserted.
   - If plastic parts are fastened.
   - If self-tapping screws or self-locking nuts are used.
   - If threads and surfaces are coated with oil.
3. If you reduce the torques in the table to the percentage indicated below, under the following conditions, if will be the standard value.
   - If spring washers are used : 85%
   - If threads and bearing sufaces are stained with oil : 85%

LUBRICANTS

RECOMMENDED LUBRICANTS

Parts		OIL & GREASE STANDARD	
Engine Oil	Gasoline	API SJ or ABOVE	SAE 5W -20 *1, *2
		*1. SAE 5W-20 engine oil is preferred regardless of regional option and engine variation. *2. If 5W-20 engine oil is not available, secondary recommended engine oil can be used for corresponding temperature range.	
Transaxle	Manual	HYUNDAI GENUINE PART MTF 75W/90 (API GL - 4)	
	Auto	DIAMOND ATF SP-III, SK ATF SP-III	
Power Steering		PSF -4	
Breake Steering		DOT 3, DOT 4 or equivalent	
Coolant		Ethlyene glycol base for aluminium radiator	
Transaxle linkage, parking brake cable mechanism, hood, door latch, seat adjuster, tailgate latch, door hinges, tailgate hinge		Multipurpose grease NIGL grade #2	

WARNING

Always use Genuine Hyundai parts and recommedended fluid.
Using any other type of parts and fluid can cause serious damaged if the vehicle.RECOMMENDED LUBRICANTS

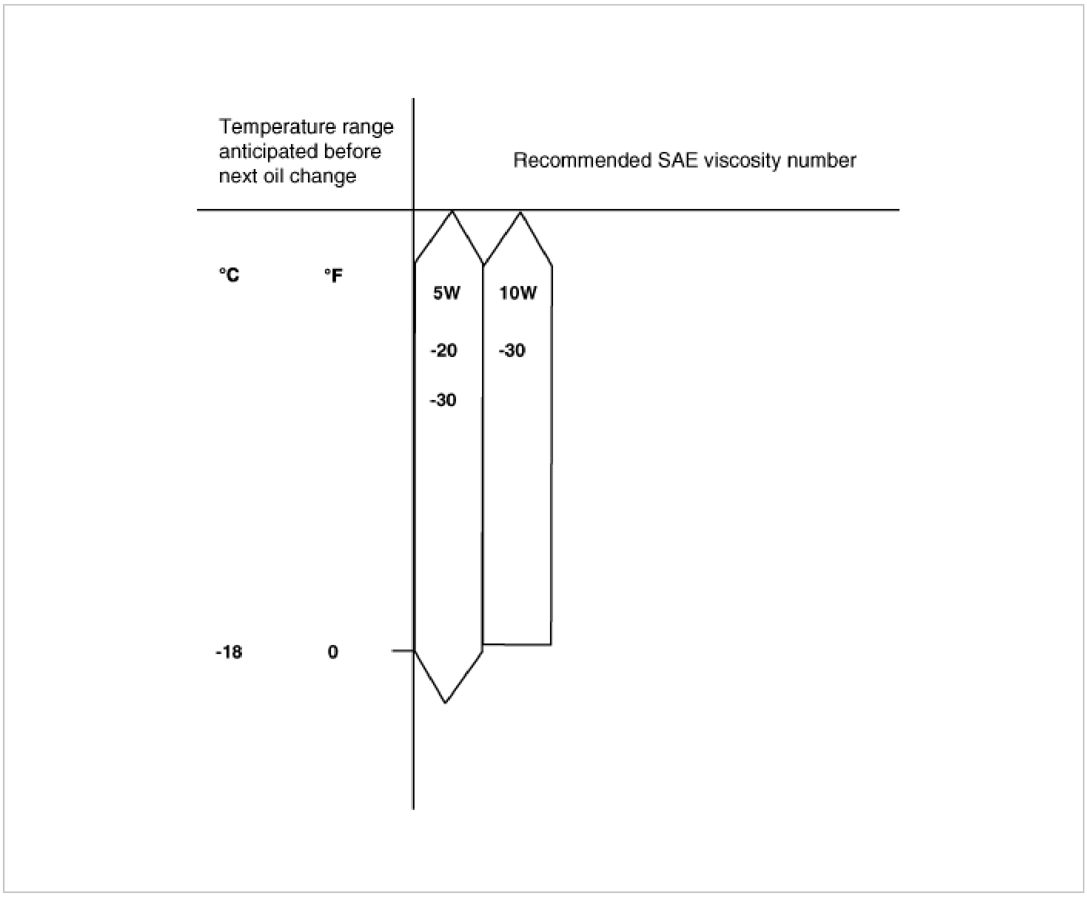
LUBRICANTS CAPACITIES

Description		2.4 (G4KC)	3.3 (G6DB)
Engine oil	Oil pan	3.7 (3.90, 3.26)	5.5 (5.81, 4.84)
	Oil filter	0.3 (0.32, 0.26)	0.4 (0.42, 0.35)
	Drain and refill	4.0 (4.23, 3.52)	5.2 (5.49, 4.58)
	Total	4.0 (4.23, 3.52)	5.9 (6.23, 5.19)
Cooling system		7.8 (8.2, 6.8)	8.9 (9.40, 7.83)
Manual transaxle		2.15 (2.3, 1.86)	-
Automatic transaxle		7.8 (8.2, 6.8)	10.9 (11.51, 9.59)
Power steering		0.9 (0.95, 0.79) ~ 1.0 (1.05, 0.88)	0.9 (0.95, 0.79) ~ 1.0 (1.05, 0.88)

Capacities : [liter (U.S.q-s, Imp.qts)]

SELECTION OF ENGINE OIL : 2.4 Gasoline

Recommended API classification : SJ OR SL ABOVE
Recommended SAE viscosity grades :



NOTE

For best performance and maximum protection of all types of operation, select only those lubricants which :

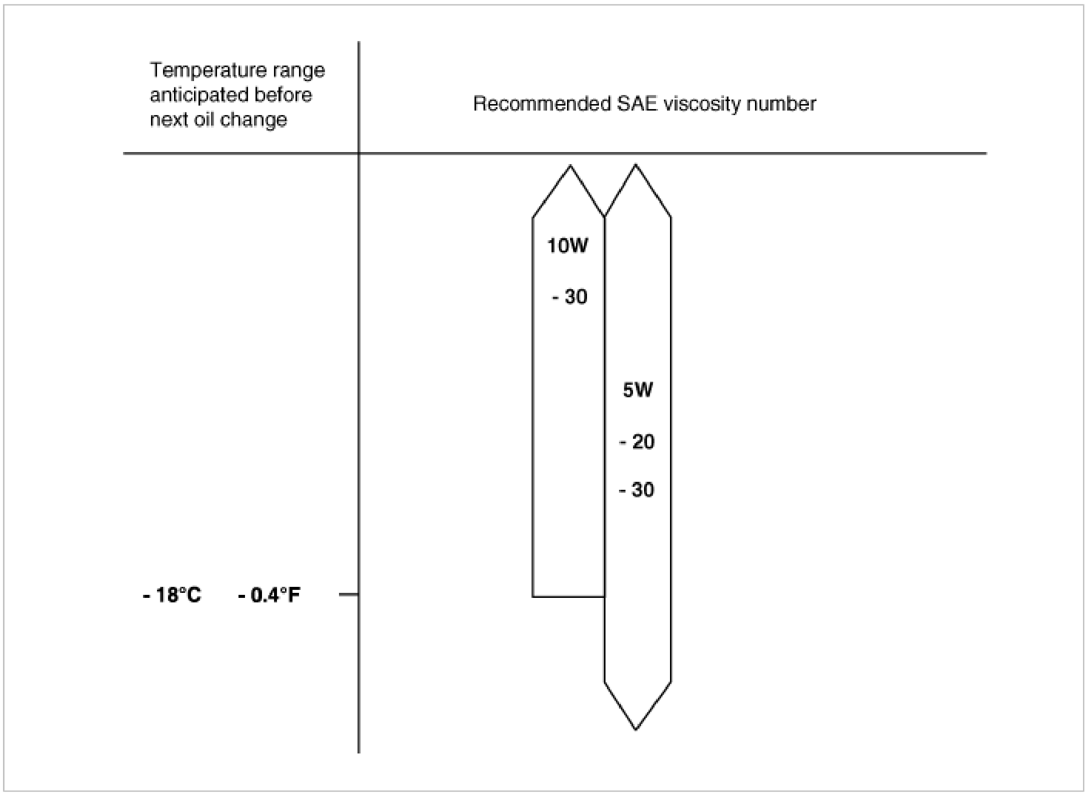
1. Satisfy the requirements of the API classification.
2. Have the proper SAE grade number for expected ambient temperature range.

Lubricants which do not have both an SAE grade number and an API service classification on the container should not be used.

SELECTION OF ENGINE OIL : 3.3 Gasoline

Recommended API classification : SJ OR SL ABOVE

Recommended SAE viscosity grades :



NOTE

For best performance and maximum protection of all types of operation, select only those lubricants which :

1. Satisfy the requirements of the API classification.
2. Have the proper SAE grade number for expected ambient temperature range.

Lubricants which do not have both an SAE grade number and an API service classification on the container should not be used.

GENERAL SERVICE INFORMATION

PROTECTION OF THE VEHICLE

Always be sure to cover fenders, seats, and floor areas before starting work.

CAUTION

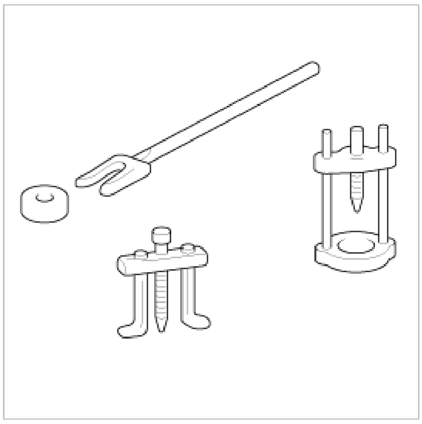
The support rod must be inserted into the hole near the edge of the hood whenever you inspect the engine compartment to prevent the hood from falling and causing possible injury.
Make sure that the support rod has been released prior to closing the hood. Always check to be sure the hood is firmly latched before driving the vehicle.

PREPARATION OF TOOLS AND MESURING EQUIPMENT

Be sure that all necessary tools and measuring equipment are available starting work.

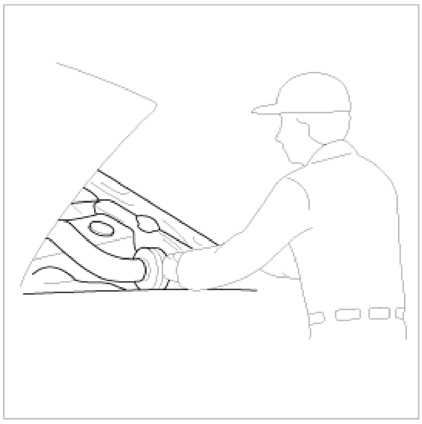
SPECIAL TOOLS

Use special tools when they are required.



REMOVAL OF PARTS

First find the cause of the problem and then determine whether removal or disassembly is required before starting the job.



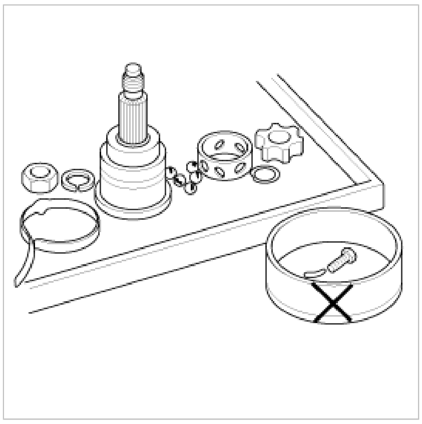
DISASSEMBLY

If the disassembly procedure is complex, requiring many parts to be disassembled, all parts should be disassembled in a way that will not affect their performance or external appearance.

1. **Inspection of parts**
   Each part, when removed, should be carefully inspected for malfunction, deformation, damage, and other problems.

2. **Arrangement of parts**
   All disassembled parts should be carefully arranged for effective reassembly.
   Be sure to separate and correctly identify the parts to be replaced from those that will be used again.

3. **Cleaning parts for reuse**
   All parts to be used again should be carefully and thoroughly cleaned by an appropriate method.

PARTS

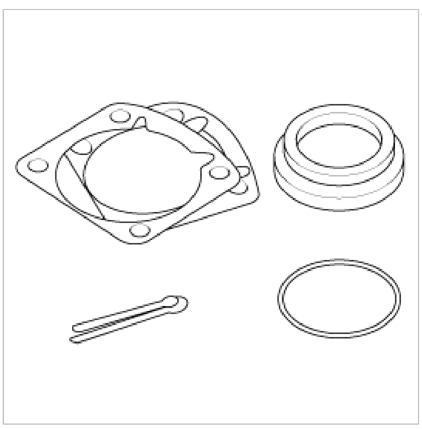
When replacing parts, use HYUNDAI genuine parts.

REPLACEMENT

Standard values, such as torques and certain adjustments, must be strictly observed in the reassembly of all parts.

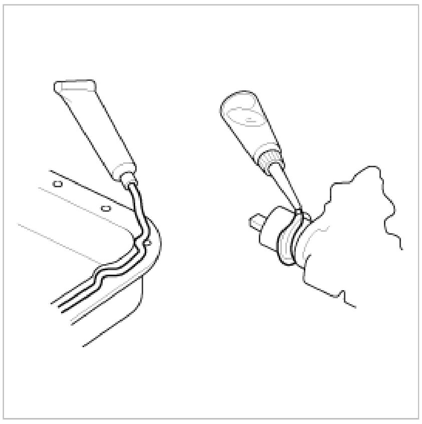
If removed, the following parts should always be replaced with new ones.

1. Oil seals
2. Gaskets
3. O-rings
4. Lock washers
5. Cotter pins (split pins)
6. Plastic nuts



Depending on their location.

7. Sealant should be applied to gaskets.
8. Oil should be applied to the moving components of parts.
9. Specified oil or grease should be applied to the prescribed locations (oil seals, etc) before assembly.

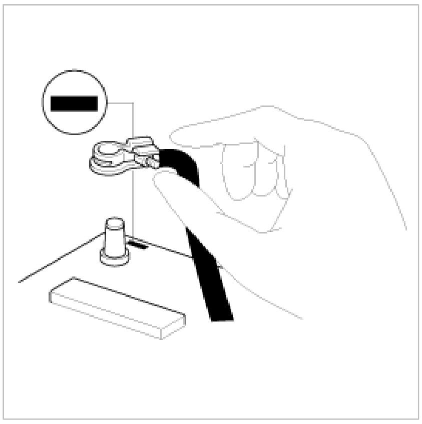


ADJUSTMENT

Use gauges and testers to correclty adjust the parts to standard values.

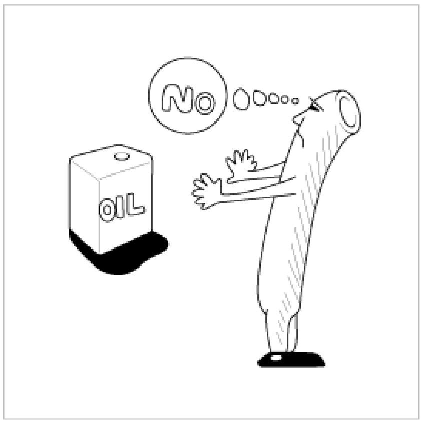
ELECTRICAL SYSTEM

1. Be sure to disconnect the battery cable from the negative (-) terminal of the battery.
2. Never pull on the wires when disconnecting connectors.
3. Locking connectors will click when the connector is secure.
4. Handle sensors and relays carefully. Be careful not to drop them against other parts.



RUBER PARTS AND TUBES

Always prevent gasoline or from touching rubber parts or tubing.

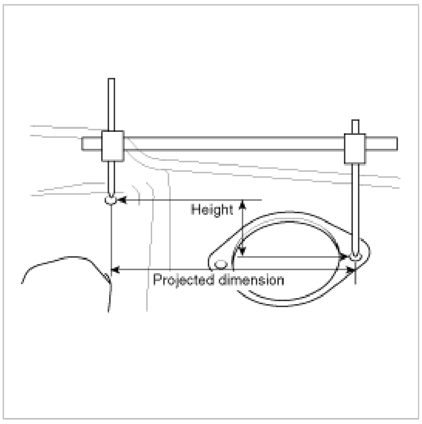


MEASURING BODY DIMENSIONS

1. Basically, all measurements in this manual are taken with a tracking gauge.
2. When a measuring tape is used, check to be sure there is no elongation, twisting or bending.
3. For measuring dimensions, both projected dimensions and actual - measurement dimensions are used in this manual.

DIMENSIONS PROJECTED

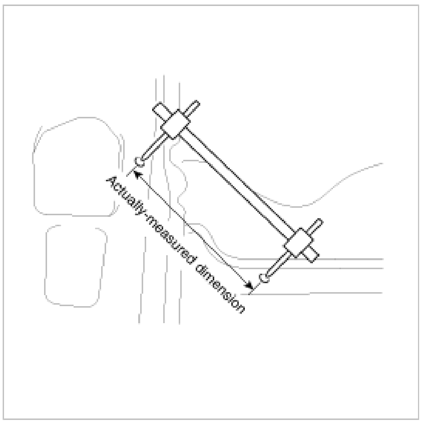
1. These are the dimensions measured when the measurement points are projected from the vehicle's surface, and are the reference dimensions used for used for body alterations.
2. If the length of the tracking gauge probes is adjustable, measure it by lengthening one of two probes as long as the different value in height of the two surfaces.



MEASURING ACTUAL DIMENSIONS

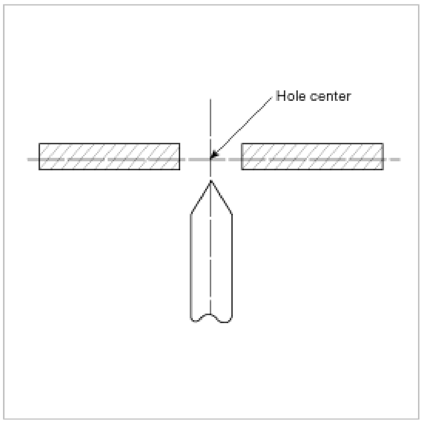
1. These dimensions indicate the actual linear distance between mesaurement points, and are used as the reference dimensions when a tracking gauge is used for measurement.
2. First adjust both probes to the same length (A=A') before measurement.

> NOTE
>
> Check the probes and gauge itself to make sure there is no free play.



MEASUREMENT POINT

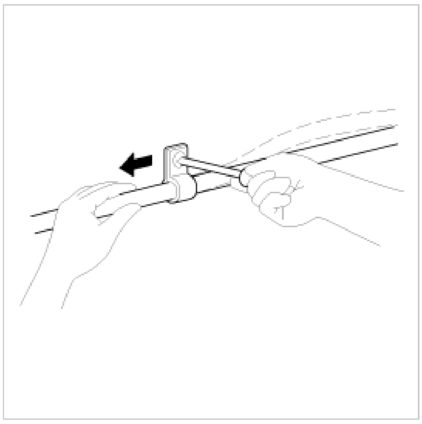
Measurements should be taken at the center of the hole.



CHECKING CABLES AND WIRES

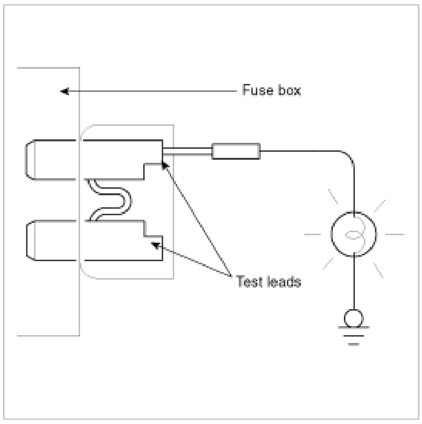
1. Check the terminal for tightness.
2. Check terminals and wires for corrosion from battery electrolyte, etc.
3. Check terminals and wires for open circuits.
4. Check wire insulation and coating for damage, cracks and degrading.
5. Check the conductive parts of terminals for contact with other metallic parts (vehicle body and other parts).
6. Check grounded parts to verify that there is complete continuity between thier attaching bolt(s) and the vehicle's body.
7. Check for incorrect wiring.
8. Check that the wiring is so clamped to prevent contact with sharp corners of the vehicle body, etc. or hot parts (exhaust manifold, etc.)

9. Check that the wiring is clamped firmy to provide enough clearance from the fan pulley, fan belt and other rotating or moving parts.
10. Check that the wiring has a little space so that it can vibrate between fixed and moving parts such as the vehicle body and the engine.



CHECK FUSES

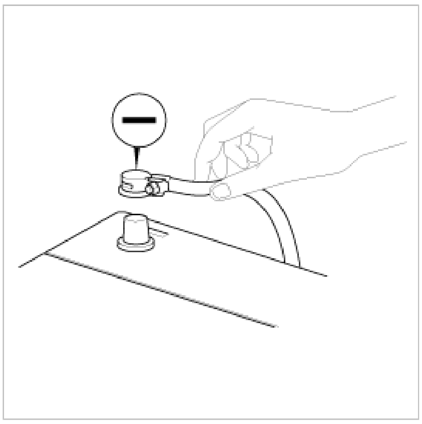
A blade type fuse test taps provided to allow checking the fuse itself without removing if from the fuse box. The fuse is good if the test lamp lights up when one lead is connected to the test taps (one at a time) and the other lead is grounded. (Turn the ignition switch so that the fuse circuit becomes operative)



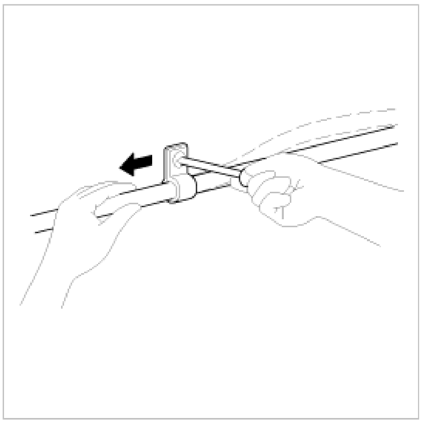
SERVICING THE ELECTRICAL SYSTEM

1. Prior to servicing the electrical system, be sure to turn off the ignition switch and disconnect the battery ground cable.

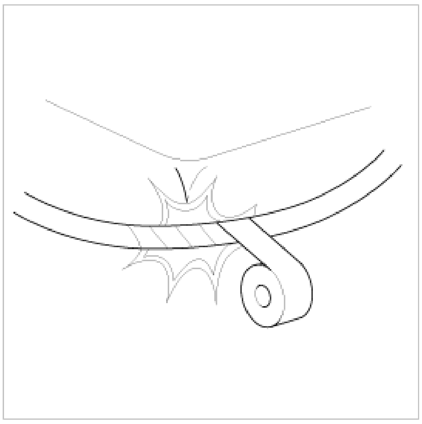
> NOTE
>
> In the course of MFI or ELC system diagnosis, when the battery cable is removed, any diagnostic trouble code retained bythe computer will be cleared. There fore, if necessary, read the diagnostic procedure before removing the battery cable.



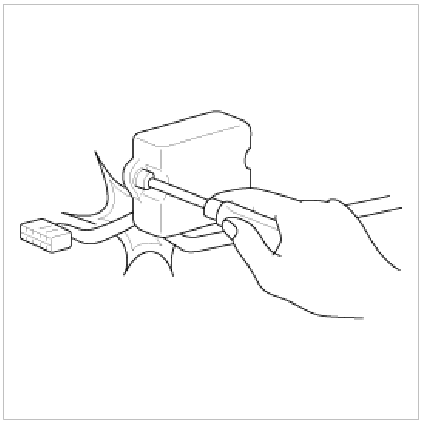
2. Attach the wiring harnesses with clamps so that there is no slack. However, for any harness which passes through the engine or other vibrating parts of the vehicle, allow some slack within a range that does not allow the engine vibrations to cause the harness to come into contact with any of the surrounding parts and then secure the harness by using a clamp.



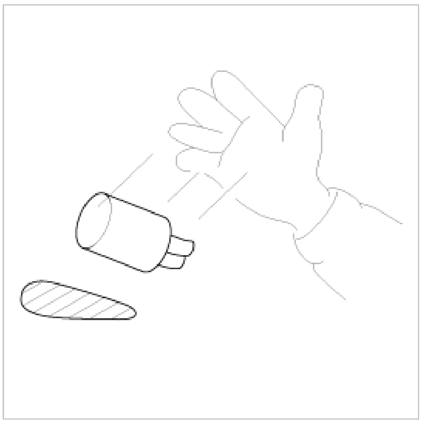
3. If any section of a wiring harness interferes with the edge of a parts, or a corner, wrap the section of the harness with tape or something similar in order to protect it from damage.



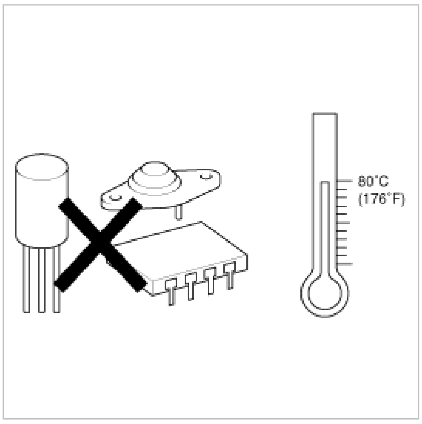
4. When installing any parts, be careful not to pinch or damage any of the wiring harness.



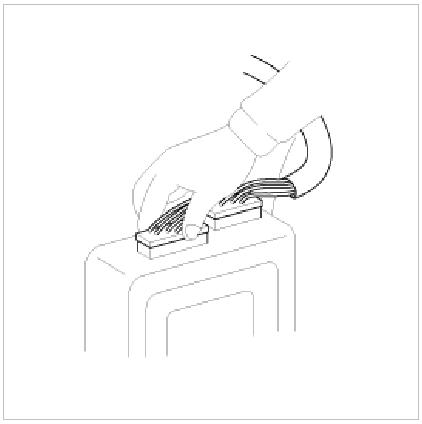
5. Never throw relays, sensors or electrical parts, or expose them to strong shock.



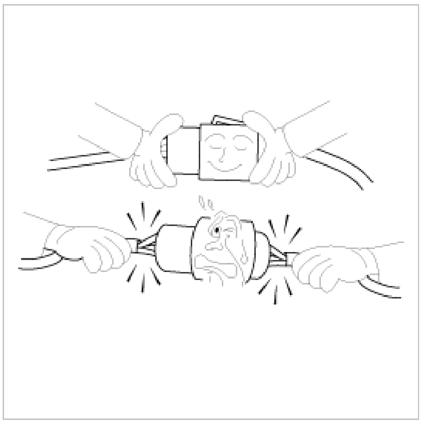
6. The electronic parts used in the computer, relays, etc. are readily damaged by heat. If there is a need for service operations that may cause the temperature to exceed 80°C (176°F), remove the electronic parts before hand.



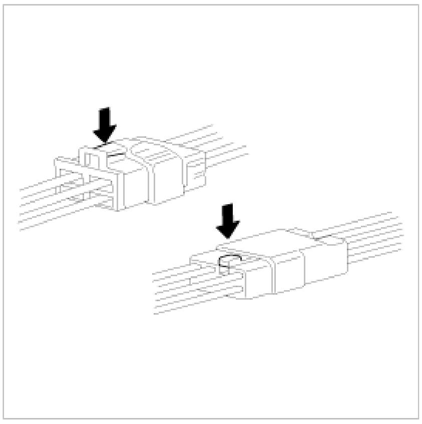
7. Loose connectors cause problems. Make sure that the connectors are always securely fastened.



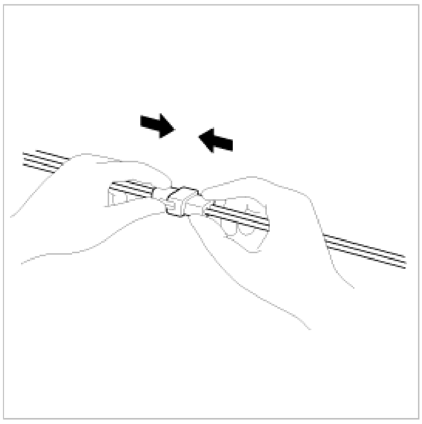
8. When disconnecting a connector, be sure to grip only the connector, not the wires.



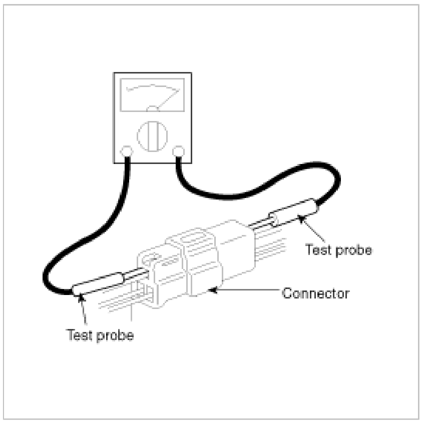
9. Disconnect connectors which have catches by pressing in the direction of the arrows shown the illustration.



10. Connect connectors which have catches by inserting the connectors until they make a clicking sound.



11. When using a circuit tester to check continuity or voltage on connector terminals, insert the test probe into the harness side. If the connector is a sealed connector, insert the test probe through the hole in the rubber cap until it contacts the terminal, being careful not to damage the insulation of the wires.



12. To avoid overloading the wiring, take the electrical current load of the optional equipment into consideration, and determine the appropartate wire size.

Nominal size	SAE gauge No.	Permissible current	
		In engine compartment	Other areas
0.3mm²	AWG 22	-	5A
0.5mm²	AWG 20	7A	13A
0.85mm²	AWG 18	9A	17A
1.25mm²	AWG 16	12A	22A
2.0mm²	AWG 14	16A	30A
3.0mm²	AWG 12	21A	40A
5.0mm²	AWG 10	31A	54A

PRECAUTIONS FOR CATALYTIC CONVERTER

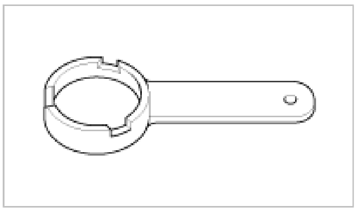
CAUTION

If a large amount of unburned gasoline flow into the converter, it may overheat and create a fire hazard. To prevent this observe the following precautions and explain them to your customer.

1. Use only unleaded gasoline.
2. Do not run the engine while the car is at rest for a long time. Avoid running the engine at fast idle for more than 10minutes and idle speed for more than 20 minutes.
3. Avoid start-jump tests. Do start-jumps only when absolutely necessary. Perform this test as rapidly as possible and, while testing, never race the engine.
4. Do not measure engine compression for an extended time. Engine compression tests must be made as rapidly as possible.
5. Avoid coasting with the ignition turned on and during prolonged braking.
6. Do not dispose of used catalytic converter together with parts contaminated with gasoline or oil.

Heating,Ventilation, Air Conditioning > General Information > Special Service Tools

SPECIAL TOOLS

Tool (Number and name)	Illustration	Use
09977-29000 Disc & hub assembly bolt remover		Removal and installation of the disc & hub assembly bolt

Heating,Ventilation, Air Conditioning > General Information > Troubleshooting

TROUBLESHOOTING

SYMPTOMS TABLE

Before replacing or repairing air conditioning components, first determine if the malfunction is due to the refrigerant charge, air flow or compressor.
Use the table below to help you find the cause of the problem. The numbers indicate the priority of the likely cause of the problem. Check each part in order. If necessary, replace these parts.
After correcting the malfunction, check the complete system to ensure that performance is satisfactory.
STANDARD :

Symptom	Suspect Area	See page
No blower operation	1. Blower fuse	-
	2. Blower relay	HA - 56
	3. Blower motor	HA - 54
	4. Power mosfet / Resistor	HA - 58, 60
	5. Blower speed control switch	HA - 65, 70
	6. Wire harness	-
No air temperature control	1. Engine coolant capacity	-
	2. Heater & A/C controller	HA - 65, 70
No compressor operation	1. Refrigerant capacity	HA - 3
	2. A/C fuse	-
	3. Magnetic clutch	HA - 18
	4. Compressor	HA - 15
	5. APT (A/C pressure transducer)	HA - 23
	6. A/C switch	-
	7. Evaporator temperature sensor	HA - 27
	8. Wire harness	-
No cool air comes out	1. Refrigerant capacity	HA - 3
	2. Refrigerant pressure	-
	3. Drive belt	-
	4. Magnetic clutch	HA - 18
	5. Compressor	HA - 15
	6. APT (A/C pressure transducer)	HA - 23
	7. Evaporator temperature sensor	HA - 27
	8. A/C switch	-

	9. Heater & A/C controller	HA - 65, 70
	10. Wire harness	-
Insufficient cooling	1. Refrigerant capacity	HA - 3
	2. Drive belt	-
	3. Magnetic clutch	HA - 18
	4. Compressor	HA - 15
	5. Condenser	HA - 20
	6. Expansion valve	HA - 45
	7. Evaporator	HA - 44
	8. Refrigerant lines	HA - 25
	9. APT (A/C pressure transducer)	HA - 23
	10. Heater & A/C controller	HA - 65, 70
No engine idle-up when A/C switch ON	1. Engine ECU	-
	2. Wire harness	-
No air inlet control	1. Heater & A/C controller	HA - 65, 70
No mode control	1. Heater & A/C controller	HA - 65, 70
	2. Mode actuator	HA - 49
No cooling fan operation	1. Cooling fan fuse	-
	2. Fan motor	-
	3. Engine ECU	-
	4. Wire harness	-

Heating,Ventilation, Air Conditioning > General Information > Specifications

SPECIFICATION

AIR CONDITIONER

Item		Specification
Compressor	Type	VS 18 (Variable capacity)
	Oil type & Capacity	FD 46 XG(PAG) 150±10cc
	Pulley type	6PK
	Displacement	180cc/rev
Condenser	Heat rejection	14,000 ±5% kcal/hr
APT (A/C pressure transducer)	The method to measure the pressure	Voltage = 0.00878835 * Pressure (psig) + 0.5
Expansion valve	Type	Block
Refrigerant	Type	R-134a
	Capacity [oz.(g)]	19.4 ± 0.88 (550 ± 25)

BLOWER UNIT

Item		Specification
Intake	Operating method	Actuator
Blower	Type	Sirocco
	Speed step	Auto + 8 speed (Automatic), 4 speed (Manual)
	Speed control	Power mosfet (Automatic), Resistor (Manual)
Air filter	Type	Particle filter

HEATER AND EVAPORATOR UNIT

Item		Specification
Heater	Type	Pin & Tube type
	Heating capacity	4,600 - 5% kcal/hr
	Mode operating method	Actuator
	Temperature operating method	Actuator
Evaporator	Temperature control type	Evaporator temperature sensor
	A/C ON/OFF [°C(°F)]	ON : 2.5 ± 0.5(35.8 ± 0.9), OFF: 0.6 ± 0.5(33.0 ± 0.9)

Heating,Ventilation, Air Conditioning > Air conditioning System > General Information

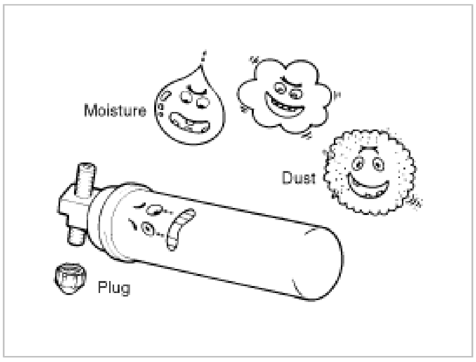
INSTRUCTIONS

WHEN HANDLING REFRIGERANT

1. R-134a liquid refrigerant is highly volatile. A drop on the skin of your hand could result in localized frostbite. When handling the refrigerant, be sure to wear gloves.
2. It is standard practice to wear goggles or glasses to protect your eyes, and gloves to protect your hands. If the refrigerant splashes into your eyes, wash them with clean water immediately.
3. The R-134a container is highly pressurized. Never leave it in a hot place, and check that the storage temperature is below 52°C (126°F)
4. An electronic leak detector should be used to check the system for refrigerant leakage. Bear in mind that the R-134a, upon coming into contact with flame, produces phosgene, a highly toxic gas.
5. Use only recommended the lubricant for R-134a systems. If lubricants other than the recommended one used, system failure may occur.
6. PAG lubricant absorbs moisture from the atmosphere at a rapid rate, therefore the following precautions must be observed:
   A. When removing refrigerant components from a vehicle, cap immediately the components to prevent from the entry of moisture.
   B. When installing refrigerant components to a vehicle, do not remove the cap until just before connecting the components.
   C. Complete the connection of all refrigerant tubes and hoses without delay to prevent the A/C system from taking on moisture.
   D. Use the recommended lubricant from a sealed container only.
7. If an accidental discharge in the system occurs, ventilate the work area before resuming service.

WHEN REPLACING PARTS ON A/C SYSTEM

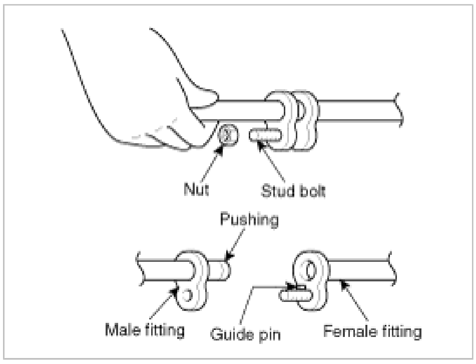
1. Never open or loosen a connection before discharging the system.
2. Seal the open fittings of components with a cap or plug immediately to prevent intrusion of moisture or dust.
3. Do not remove the sealing caps from a replacement component until it is ready to be installed.
4. Before connecting an open fitting, always install a new sealing ring. Coat the fitting and seal with refrigerant oil before making the connection.



WHEN INSTALLING CONNECTING PARTS

FLANGE WITH GUIDE PIN

Check the new O-ring for damage and lubricate it using compressor oil. Tighten the nut to specified torque.



Size	Tightening torque (N.m (kg.m, lb-ft))	
	General bolt, nut	
	4T	7T
M6	5~6 (0.5~0.6, 3.6~4.3)	9~11 (0.9~1.1, 6.5~7.9)
M8	12~14 (1.2~1.4, 8.7~10)	20~26 (2.0~2.6, 14~18)
M10	25~28 (2.5~2.8, 18~20)	45~55 (4.5~5.5, 32~39)
Size	Flange bolt, nut	
	4T	7T
M6	5~7 (0.5~0.7, 3.6~5.0)	8~12 (0.8~1.2, 5.8~8.6)
M8	10~15 (1.0~1.5, 7~10)	19~28 (1.9~2.8, 14~20)
M10	21~31 (2.1~3.1, 15~22)	39~60 (3.9~6.0, 28~43)

NOTE

T means tensile intensity, which is stamped on the head of bolt only numeral.

HANDLING TUBING AND FITTINGS

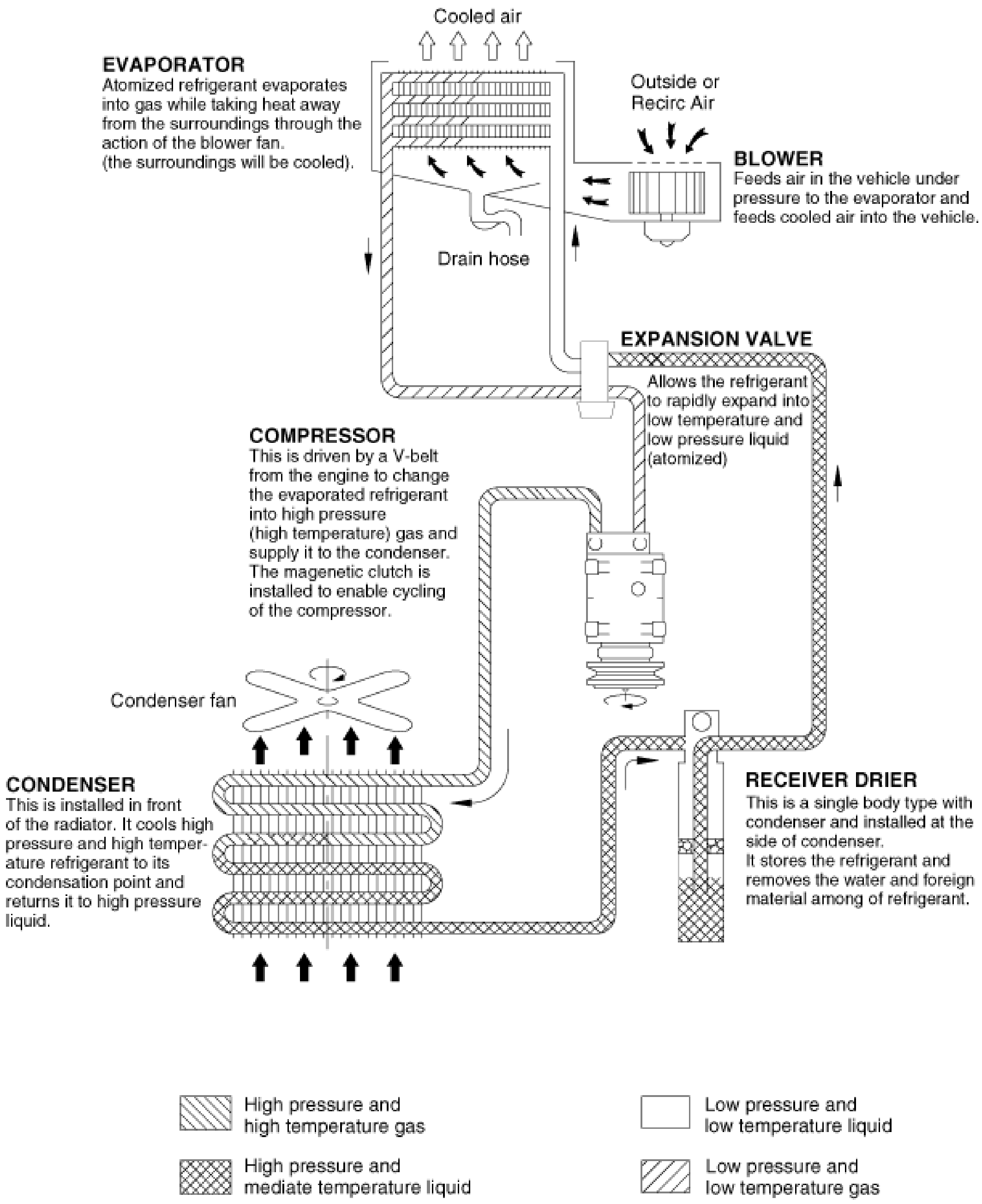
The internal parts of the refrigeration system will remain in a state of chemical stability as long as pure moisture-free refrigerant and refrigerant oil are used. Abnormal amounts of dirt, moisture or air can upset the chemical stability and cause problems or serious damage.

THE FOLLOWING PRECAUTIONS MUST BE OBSERVED

1. When it is necessary to open the refrigeration system, have everything you will need to service the system ready so the system will not be left open any longer than necessary.
2. Cap or plug all lines and fittings as soon as they are opened to prevent the entrance of dirt and moisture.
3. All lines and components in parts stock should be capped or sealed until they are ready to be used.
4. Never attempt to rebind formed lines to fit. Use the correct line for the installation you are servicing.
5. All tools, including the refrigerant dispensing manifold, the gauge set manifold and test hoses, should be kept clean and dry.

Heating,Ventilation, Air Conditioning > Air conditioning System > Description and Operation

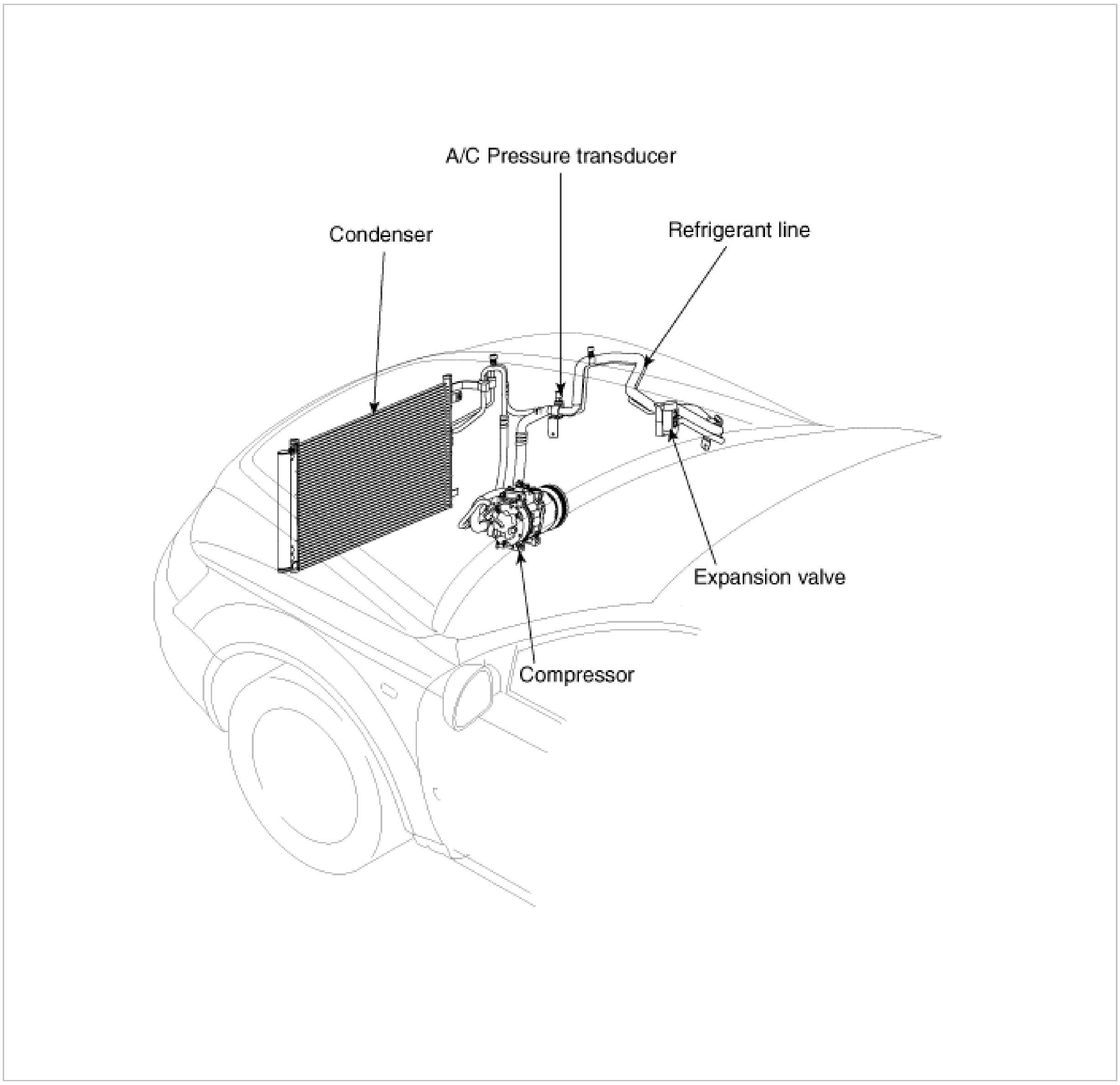
REFRIGERATION CYCLE



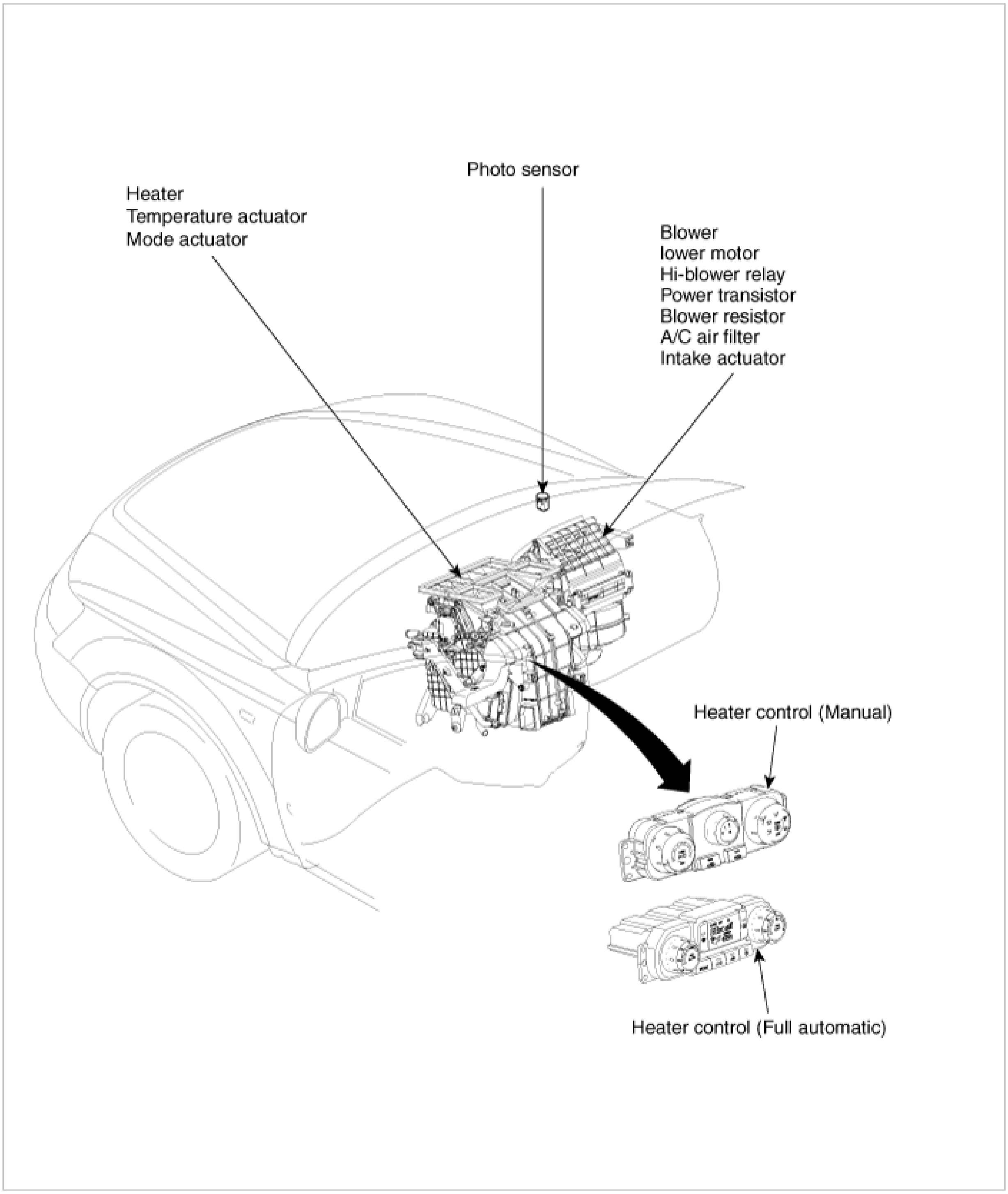
Heating,Ventilation, Air Conditioning > Air conditioning System > Components and Components Location

COMPONENT LOCATION INDEX

ENGINE ROOM


A/C Pressure transducer
Condenser
Refrigerant line
Expansion valve
Compressor

INTERIOR



REFRIGERANT SYSTEM SERVICE BASICS

REFRIGERANT RECOVERY

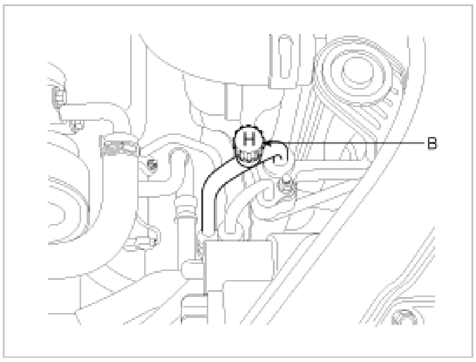
Use only service equipment that is U.L-listed and is certified to meet the requirements of SAE J2210 to remove HFC-134a(R-134a) from the air conditioning system.

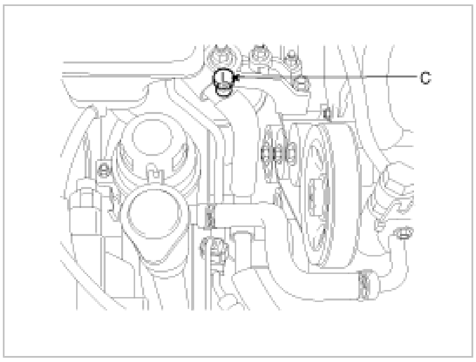
CAUTION

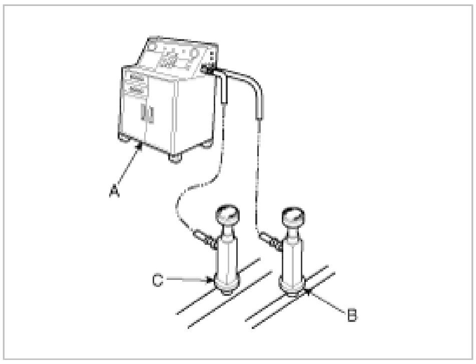
- Air conditioning refrigerant or lubricant vapor can irritate your eyes, nose, or throat.
- Be careful when connecting service equipment.
- Do not breathe refrigerant or vapor.

If accidental system discharge occurs, ventilate work area before resuming service.
Additional health and safety information may be obtained from the refrigerant and lubricant manufacturers.

1. Connect an R-134a refrigerant.
   Recovery/Recycling/Charging System (A) to the high-pressure service port (B) and the low-pressure service port (C) as shown, following the equipment manufacturer's instructions.

2. Measure the amount of refrigerant oil removed from the A/C system after the recovery process is completed. Be sure to install the same amount of new refrigerant oil back into the A/C system before charging.

SYSTEM EVACUATION

Use only service equipment that is U.L-listed and is certified to meet the requirements of SAE J2210 to remove HFC-134a(R-134a) from the air conditioning system.

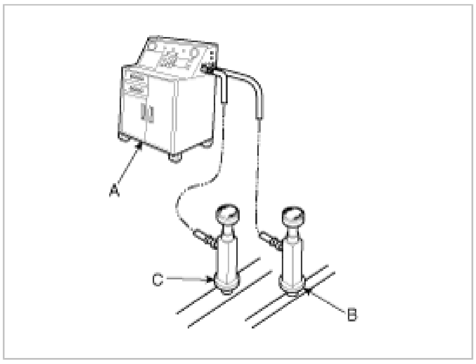
CAUTION

- Air conditioning refrigerant or lubricant vapor can irritate your eyes, nose, or throat.
- Be careful when connecting service equipment.
- Do not breathe refrigerant or vapor.

If accidental system discharge occurs, ventilate work area before resuming service.
Additional health and safety information may be obtained from the refrigerant and lubricant manufacturers.

1. When an A/C System has been opened to the atmosphere, such as during installation or repair, it must be evacuated using an R-134a refrigerant Recovery/Recycling/Charging System. (If the system has been open for several days, the receiver/dryer should be replaced, and the system should be evacuated for several hours.)

2. Connect an R-134a refrigerant.
   Recovery/Recycling/Charging System (A) to the high-pressure service port (B) and the low-pressure service port (C) as shown, following the equipment manufacturer's instructions.



3. If the low-pressure does not reach more than 93.3 kPa (700 mmHg, 27.6 in.Hg) in 10 minutes, there is probably a leak in the system. Partially charge the system, and check for leaks (Refer to Leak Test.).
4. Remove the low pressure valve from the low-pressure service port.

SYSTEM CHARGING

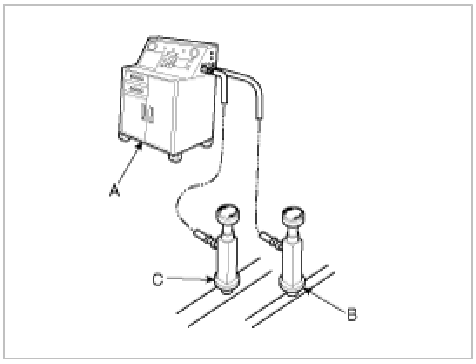
Use only service equipment that is U.L-listed and is certified to meet the requirements of SAE J2210 to remove HFC-134a(R-134a) from the air conditioning system.

CAUTION

- Air conditioning refrigerant or lubricant vapor can irritate your eyes, nose, or throat.
- Be careful when connecting service equipment.
- Do not breathe refrigerant or vapor.

If accidental system discharge occurs, ventilate work area before resuming service.
Additional health and safety information may be obtained from the refrigerant and lubricant manufacturers.

1. Connect an R-134a refrigerant.
   Recovery/Recycling/Charging System (A) to the high-pressure service port (B) as shown, following the equipment manufacturer's instructions.



2. Add the same amount of new refrigerant oil to system that was removed during recovery. Use only specified refrigerant oil. Charge the system with 19.4 ± 0.88 oz. (550 ± 25g) of R-134a refrigerant. Do not overcharge the system the compressor will be damaged.

REFRIGERANT LEAK TEST

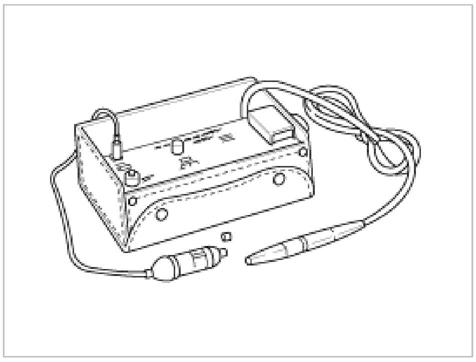
Always conduct a leak test with an electronic leak detector whenever leakage of refrigerant is suspected and when conducting service operations which are accompanied by disassembly or loosening or connection fittings.

NOTE

In order to use the leak detector properly, read the manual supplied by the manufacturer.

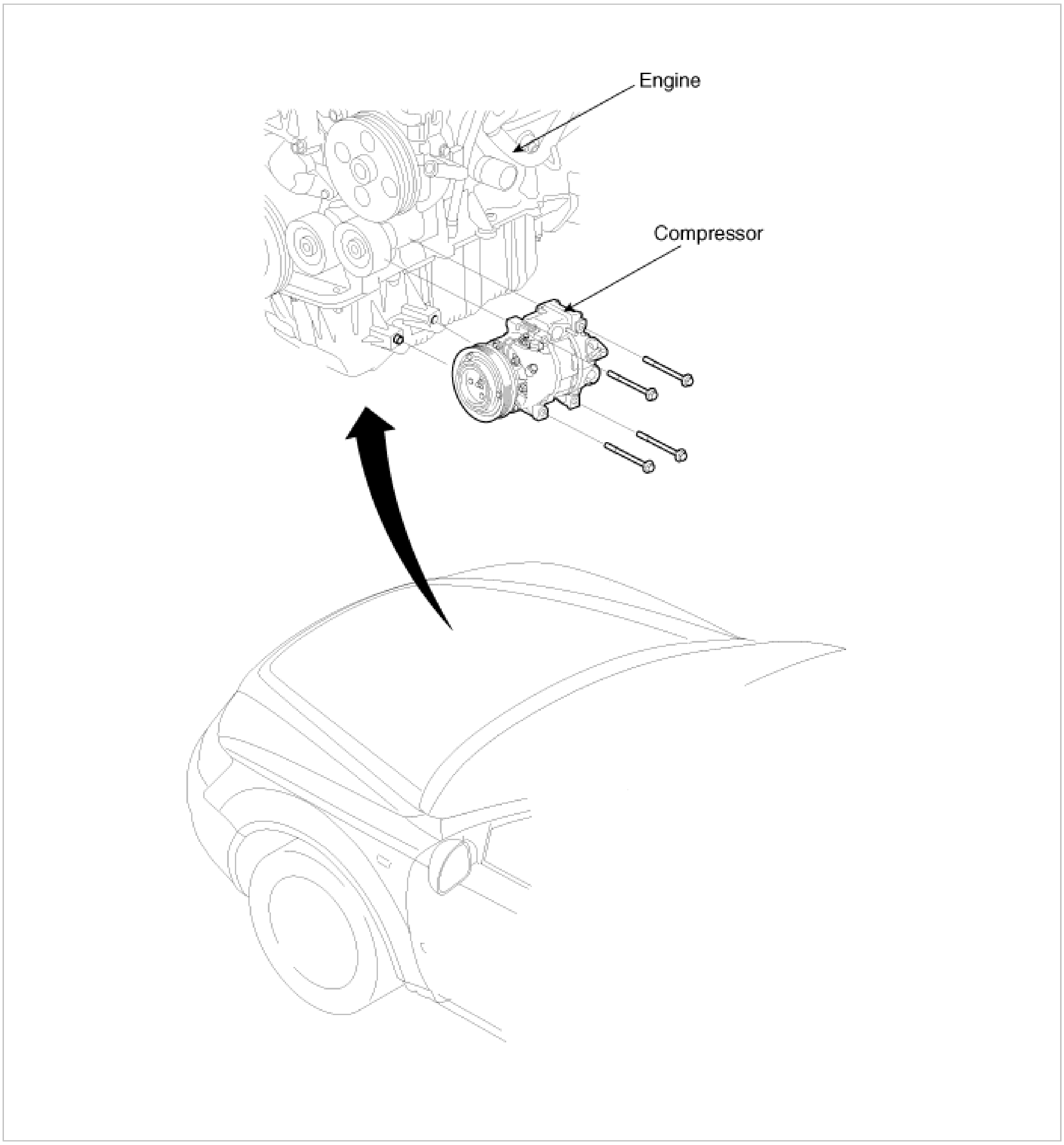
If a gas leak is detected, proceed as follows:

1. Check the torque on the connection fittings and, if too loose, tighten to the proper torque. Check for gas leakage with a leak detector.
2. If leakage continues even after the fitting has been tightened, discharge the refrigerant from the system, disconnect the fittings, and check their seating faces for damage. Always replace, even if the damage is slight.
3. Check the compressor oil and add oil if required.
4. Charge the system and recheck for gas leaks. If no leaks are found, evacuate and charge the system again.

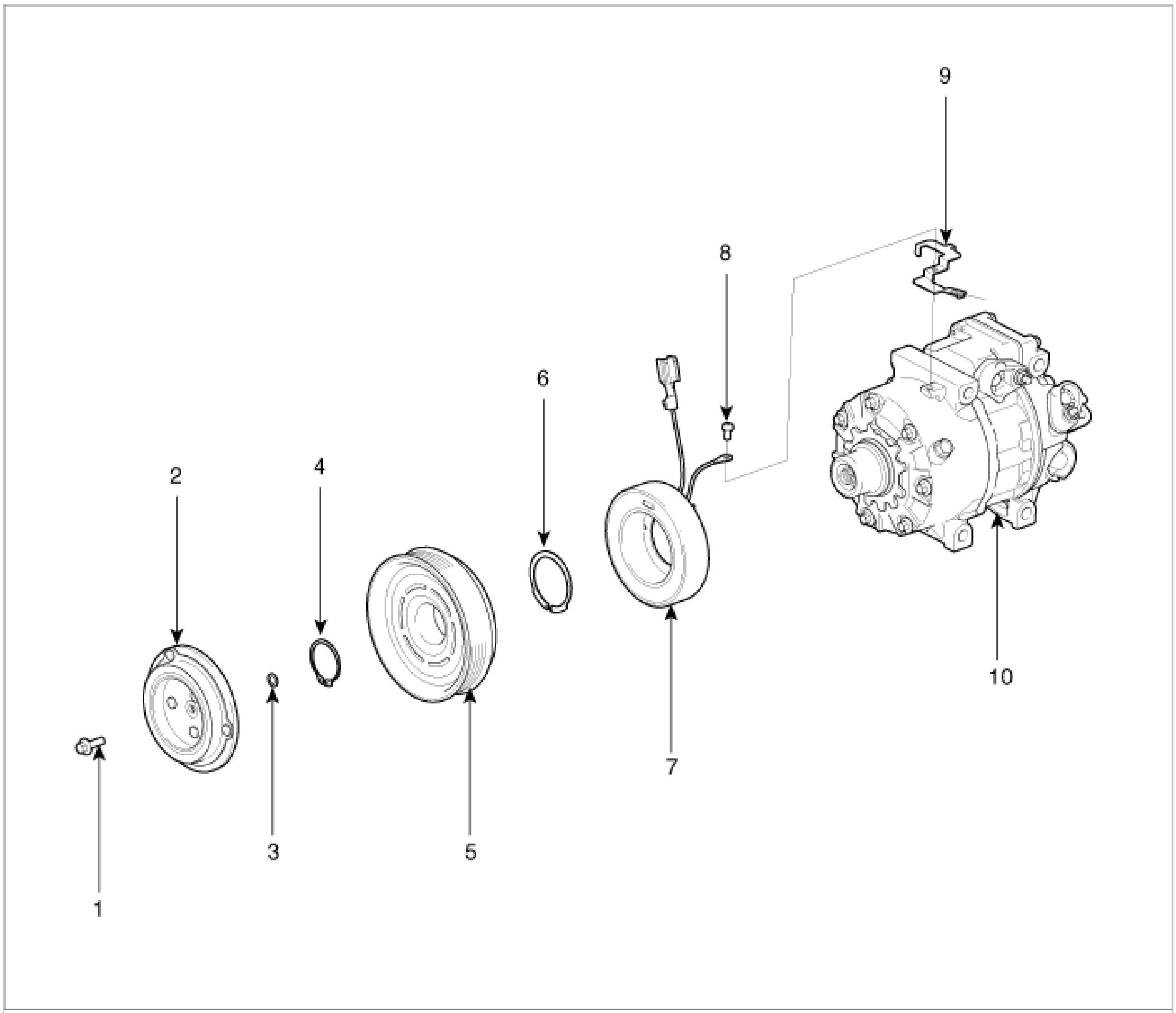


Heating,Ventilation, Air Conditioning > Air conditioning System > Compressor > Components and Components Location

COMPONENT LOCATION



COMPONENTS

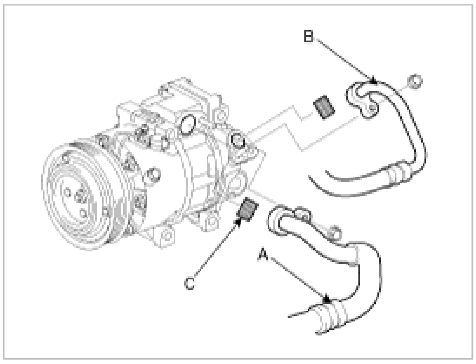


1. Bolt	6. Retainer ring
2. Disc & hub assembly	7. Field coil
3. Shim	8. Screw
4. Retainer ring	9. Connector bracket
5. Pulley	10. Compressor assembly

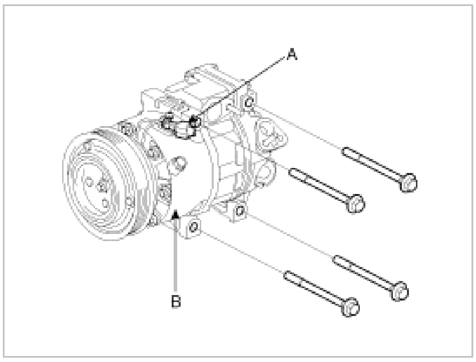
Heating,Ventilation, Air Conditioning > Air conditioning System > Compressor > Repair procedures

REMOVAL

1. If the compressor is marginally operable, run the engine at idle speed, and let the air conditioning work for a few minutes, then shut the engine off.
2. Disconnect the negative cable from the battery.
3. Recover the refrigerant with a recovery/charging station (Refer to page HA-9).
4. Loosen the drive belt (Refer to the EM-Timing).
5. Remove the bolts, then disconnect the suction line (A) and discharge line (B) from the compressor. Plug (C) or cap the lines immediately after disconnecting them to avoid moisture and dust contamination.



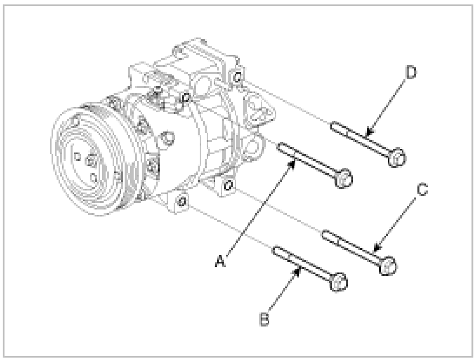
6. Disconnect the compressor clutch connector (A), then remove the mounting bolts and the compressor (B).



INSTALLATION

1. Make sure of the length of compressor mounting bolts, and then tighten it A→B→C→D order.

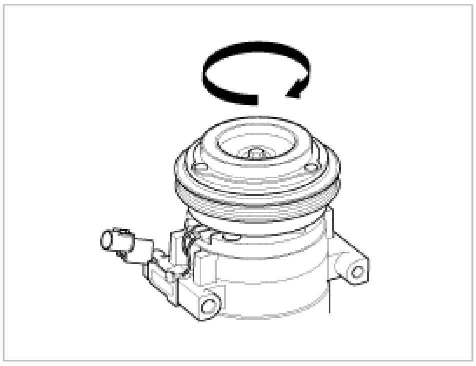
TORQUE : 20~33N.m (2.04 ~ 3.36 kgf.m, 14.7~24.3lb-ft)



2. Install in the reverse order of removal, and note these items.
   A. If you're installing a new compressor, drain all the refrigerant oil from the removed compressor, and measure its volume, Subtract the volume of drained oil from 150cc the result is the amount of oil you should drain from the new compressor (through the suction fitting).
   B. Replace the O-rings with new ones at each fitting, and apply a thin coat of refrigerant oil before installing them. Be sure to use the right O-rings for R-134a to avoid leakage.
   C. To avoid contamination, do not return the oil to the container once dispensed, and never mix it with other refrigerant oils.
   D. Immediately after using the oil, replace the cap on the container and seal it to avoid moisture absorption.
   E. Do not spill the refrigerant oil on the vehicle; it may damage the paint; if the refrigerant oil contacts the paint, wash it off immediately.
   F. Adjust the drive belt (Refer to the EM-Timing) Charge the system and test its performance.

INSPECTION

1. Check the plated parts of the disc & hub assembly for color changes, peeling or other damage. If there is damage, replace the clutch set.
2. Check the pulley bearing play and drag by rotating the pulley by hand. Replace the clutch set with a new one if it is noisy or has excessive play/drag.

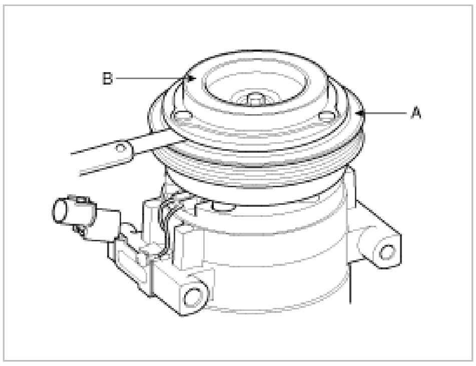


3. Measure the clearance between the pulley (A) and the disc & hub assembly (B) all the way around. If the clearance is not within specified limits, remove the disc & hub assembly (Refer to page HA-17) and add or remove shims as needed to increase or decrease clearance.

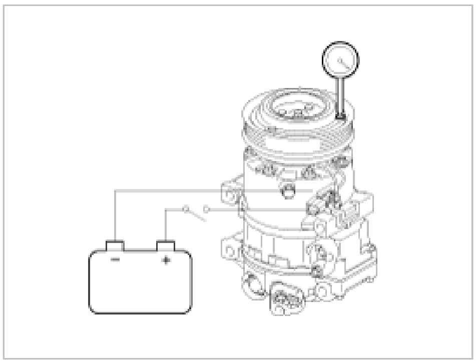
Clearance: 0.5 ± 0.15mm (0.020 ± 0.006 in.)

NOTE

The shims are available in eight thicknesses: 0.7mm, 0.8mm, 0.9mm, 1.0mm, 1.1mm, 1.2mm, 1.3mm and 1.4mm



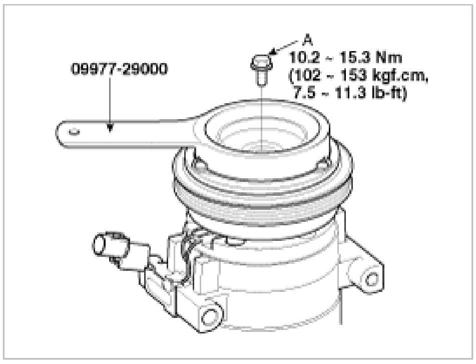
4. Check operation of the magnetic clutch.
Connect the compressor side terminals to the battery (+) terminal and the ground battery (-) terminal to the compressor body.
Check the magnetic clutch operating noise to determine the condition.



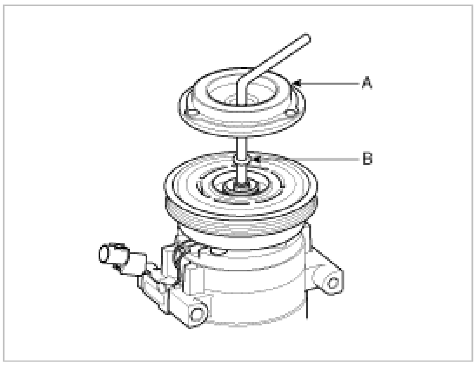
DISASSEMBLY

1. Remove the center bolt (A) while holding the disc & hub assembly with a commercially available disc & hub assembly bolt remover; Special tool number 09977-29000.

TORQUE : 10~15N.m (1.02~1.53 kgf.m, 7.5~11.3 lb-ft)



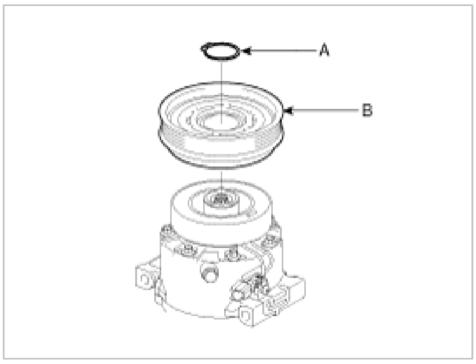
2. Remove the disc & hub assembly (A) and shim (B), taking care not to lose the shims. If the clutch needs adjustment, increase or decrease the number and thickness of shims as necessary, then reinstall the disc & hub assembly, and recheck its clearance (Refer to page HA-18).



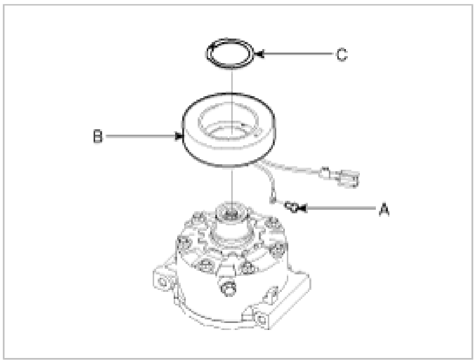
3. If you remove the field coil, remove retainer ring (A) with retainer ring pliers.

NOTE

- Be careful not to damage the pulley (B) and compressor during removal/installation.
- Once retainer ring (A) is removed, replace it with a new one.



4. Remove the screw (A) from the field coil ground terminal and then remove the field coil (B) and retainer ring (C).



5. Reassemble the compressor clutch in the reverse order of disassembly, and note these items :
   A. Clean the pulley and compressor sliding surfaces with non-petroleum solvent.
   B. Install new retainer rings, and make sure they are fully seated in the groove.
   C. Make sure that the pulley turns smoothly after its reassembled.

Heating,Ventilation, Air Conditioning > Air conditioning System > Compressor oil > Repair procedures

OIL SPECIFICATION

- The HFC-134a system requires synthetic (PAG) compressor oil whereas the R-12 system requires mineral compressor oil. The two oils must never be mixed.
- Compressor (PAG) oil varies according to compressor model. Be sure to use oil specified for the model of compressor.

HANDLING OF OIL

- The oil should be free from moisture, dust, metal powder, etc.
- Do not mix with other oil.
- The water content in the oil increases when exposed to the air. After use, seal oil from air immediately. (HFC-134a Compressor Oil absorbs moisture very easily.)
- The compressor oil must be stored in steel containers, not in plastic containers.

COMPRESSOR OIL CHECK

The oil used to lubricate the compressor is circulating with the refrigerant.
Whenever replacing any component of the system or a large amount of gas leakage occurs, add oil to maintain the original amount of oil.

Oil total volume in system: PAG 150cc (5.07 fl.oz)

OIL RETURN OPERATION

There is close affinity between the oil and the refrigerant.
During normal operation, part of the oil recirculates with the refrigerant in the system. When checking the amount of oil in the system, or replacing any component of the system, the compressor must be run in advance for oil return operation. The procedure is as follows:

1. Open all the doors and the engine hood.
2. Start the engine and air conditioning switch to "ON" and set the blower motor control knob at its highest position.
3. Run the compressor for more than 20 minutes between 800 and 1,000 rpm in order to operate the system.
4. Stop the engine.

REPLACEMENT OF COMPONENT PARTS

When replacing the system component parts, supply the following amount of oil to the component parts to be installed.

Component parts to be installed	Amount of Oil
Evaporator	50 cc (1.70 fl.oz)
Condenser	30 cc (1.02 fl.oz)
Receiver/dryer	30 cc (1.02 fl.oz)
Refrigerant line(One piece)	10 cc (0.34 fl.oz)

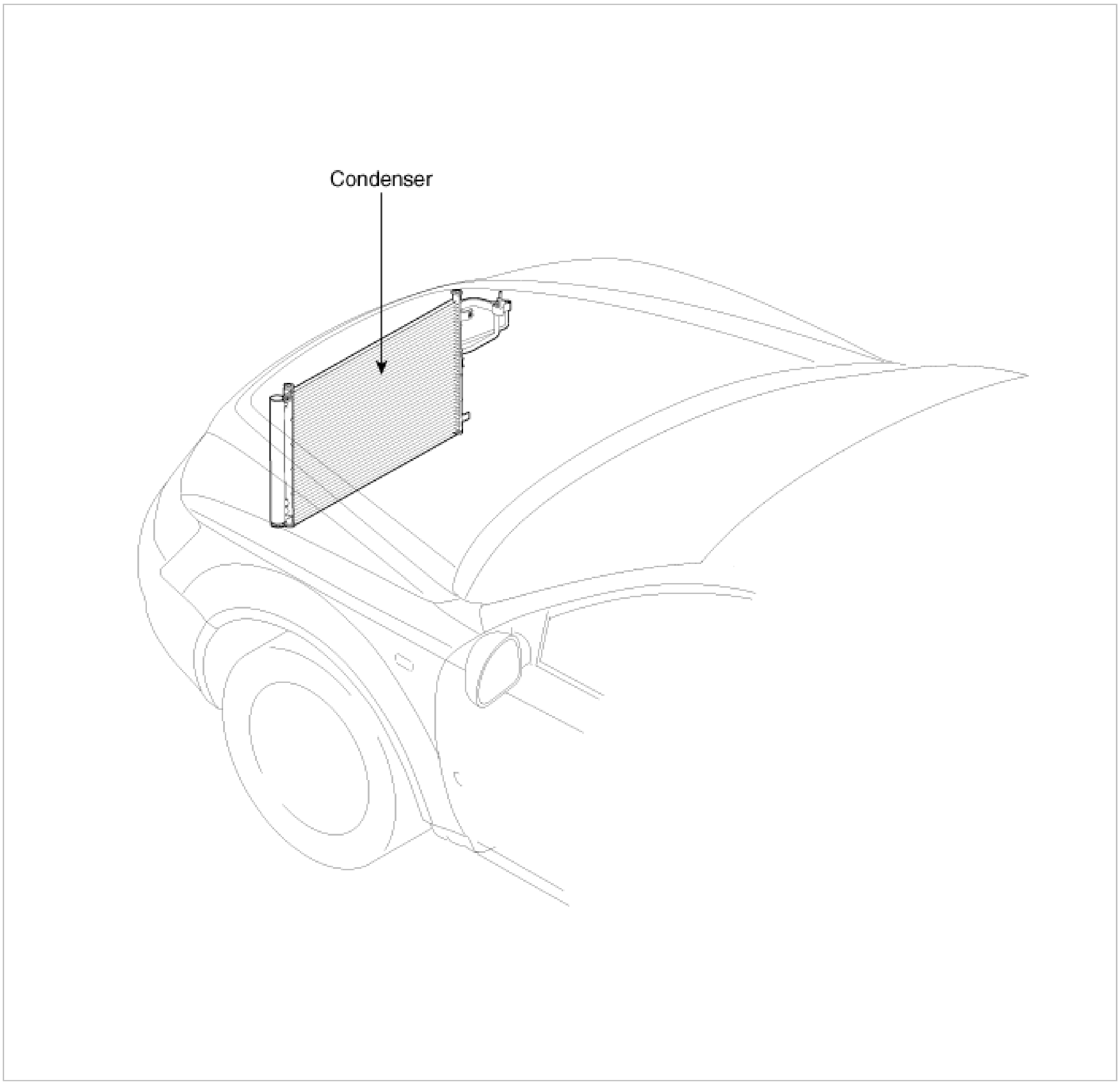
For compressor replacement, subtract the volume of oil drained from the removed compressor from the specified volume, and drain the calculated volume of oil from the new compressor:
The specified volume - volume of removed compressor = volume to drain from the new compressor.

NOTE

Even if no oil is drained from the removed compressor, don't drain more than 50cc from new compressor.

Heating,Ventilation, Air Conditioning > Air conditioning System > Condenser > Components and Components Location

COMPONENT LOCATION



Heating,Ventilation, Air Conditioning > Air conditioning System > Condenser > Repair procedures

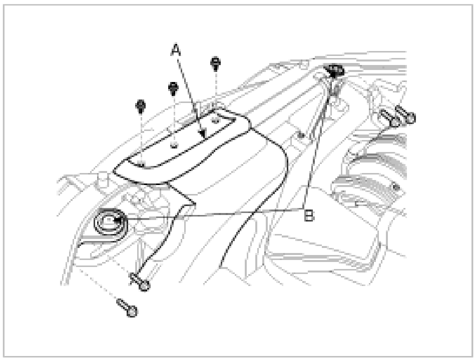
INSPECTION

1. Check the condenser fins for clogging and damage. If clogged, clean them with water, and blow them with compressed air. If bent, gently bend them using a screwdriver or pliers.
2. Check the condenser connections for leakage, and repair or replace it, if required.

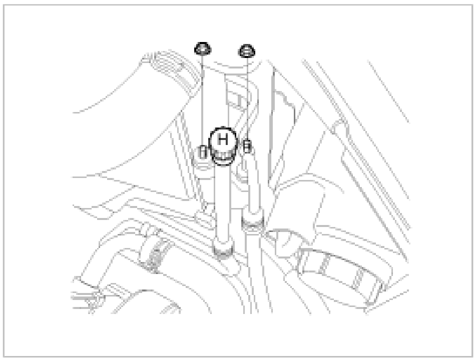
REPLACEMENT

CONDENSER

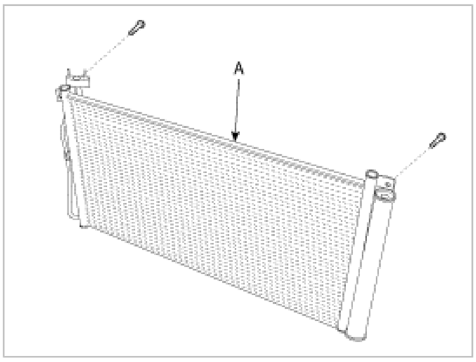
1. Recover the refrigerant with a recovery/ recycling/ charging station (Refer to page HA-9).
2. Disconnect the negative (-) battery terminal.
3. Remove the air duct (A) after loosening 3 fasteners.
4. Remove the radiator bracket (B) after loosening the bolts.



5. Remove the 2 nuts, then disconnect the discharge line and condenser line from the condenser.
   Plug or cap the lines immediately after disconnecting them to avoid moisture and dust contamination.



6. Remove the bolts, then remove the condenser (A) by lifting it up. Be careful not to damage the radiator and condenser fins when removing the condenser.



7. Install in the reverse order of removal, and note these items :
   A. If you're installing a new condenser, add refrigerant oil.
   B. Replace the O-rings with new ones at each fitting, and apply a thin coat of refrigerant oil before installing them. Be sure to use the right O-rings for R-134a to avoid leakage.
   C. Be careful not to damage the radiator and condenser fins when installing the condenser.
   D. Be sure to install the lower mount cushions of condenser securely into the holes.
   E. Charge the system, and test its performance. (Refer to HA-10)

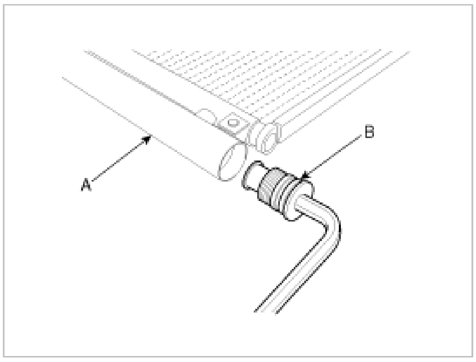
DESICCANT

1. Remove the condenser, and then remove the bottom cap (B) from the receiver/drier tank (A).

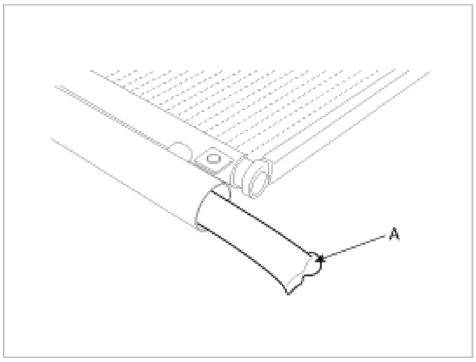
TORQUE : 20~25N.m (2.0~2.5kgf·m, 14.5~18.2lb-ft)

WARNING

Use of impact wrench may cause cracking on the receiver/drier tank connecting pipe to the condenser.



2. Remove the desiccant (A) from the receiver/drier tank using a long nose plier.



Check for crumbled desiccant and clogged bottom cap filter.

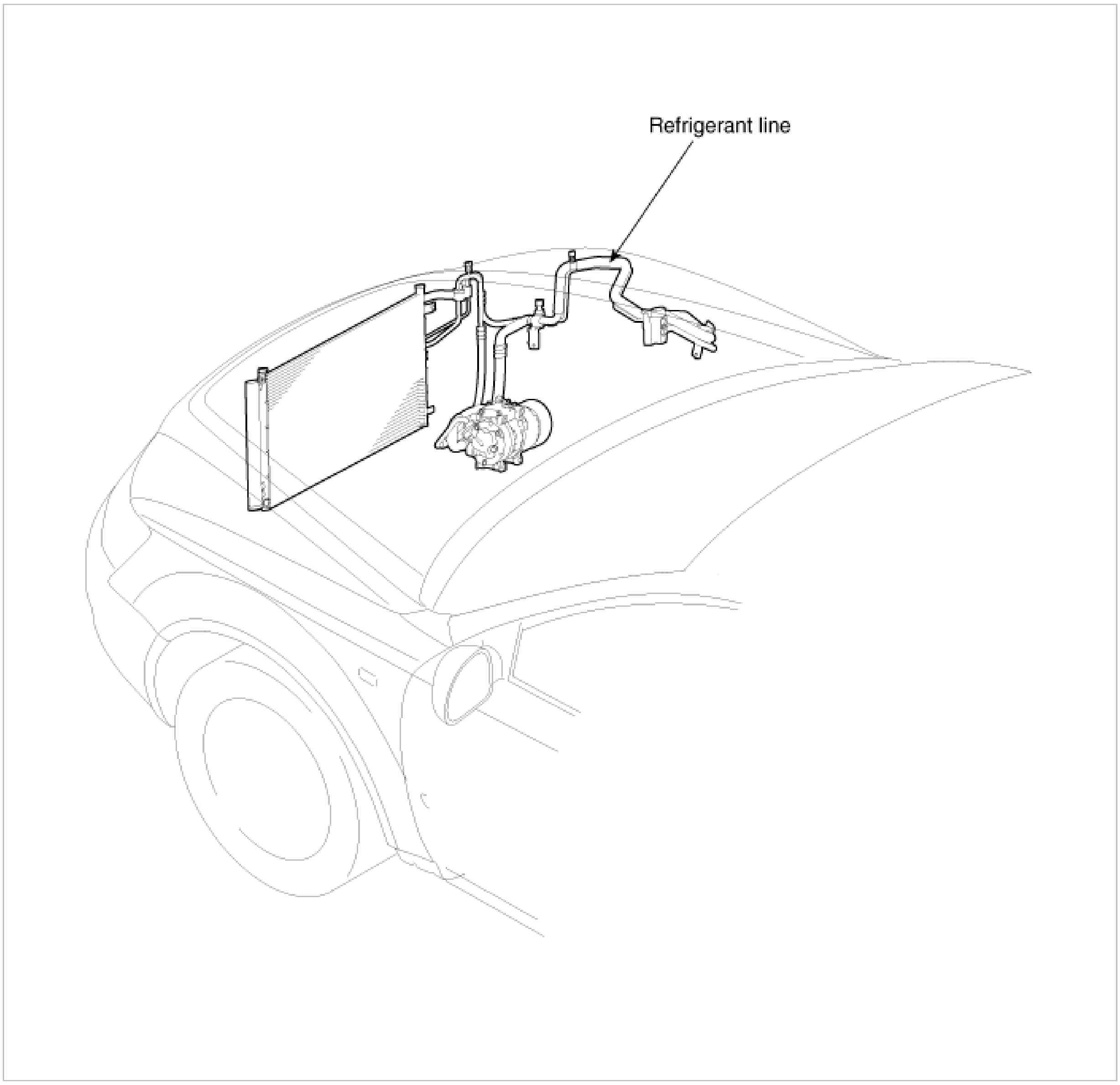
3. Apply air conditioning compressor oil along the O-rings and threads of the new bottom cap.
4. Insert the new desiccant into the receiver drier tank. The desiccant must be sealed in vacuum before it is exposed to air for use.
5. Install the new bottom cap to the receiver drier tank.

NOTE

- Always replace the desiccant and bottom cap at the same time.
- Replace the O-rings with new ones at each fitting, and apply a thin coat of refrigerant oil before installing them. Be sure to use the right O-rings for R-134a to avoid leakage.
- Be careful not to damage the radiator and condenser fins when installing the condenser.
- Be sure to install the lower mount cushions of condenser securely into the holes.
- Charge the system, and test its performance. (Refer to HA-10)

Heating,Ventilation, Air Conditioning > Air conditioning System > Refrigerant line > Components and Components Location

COMPONENT LOCATION



Heating,Ventilation, Air Conditioning > Air conditioning System > Refrigerant line > Repair procedures

REPLACEMENT

1. Discharge refrigerant from refrigeration system (Refer to page HA-9).
2. Replace faulty tube or hose.

> CAUTION
>
> Cap the open fittings immediately to keep moisture or dirt out of the system.

3. Tighten joint of bolt or nut to specified torque.

> CAUTION
>
> Connections should not be torque tighter than the specified torque.

Part tightened	N.m	kgf.m	lb-ft
Condenser x Discharge hose	5 ~ 7	0.5 ~ 0.6	3.7 ~ 5.2
Condenser x Liquid tube			
Compressor x Discharge hose	5 ~ 7	0.5 ~ 0.6	3.7 ~ 5.2
Compressor x Suction hose			

Expansion valve x Evaporator	12 ~ 15	1.2 ~ 1.5	8.7 ~ 10.8

4. Evacuate air in refrigeration system and charge system with refrigerant (Refer to page HA-9).

Specified amount: 550 ± 25g (19.4 ± 0.88 oz.)

5. Inspect for leakage of refrigerant.
   Using a gas leak detector, check for leakage of refrigerant (Refer to page HA-11).
6. Inspect A/C operation.

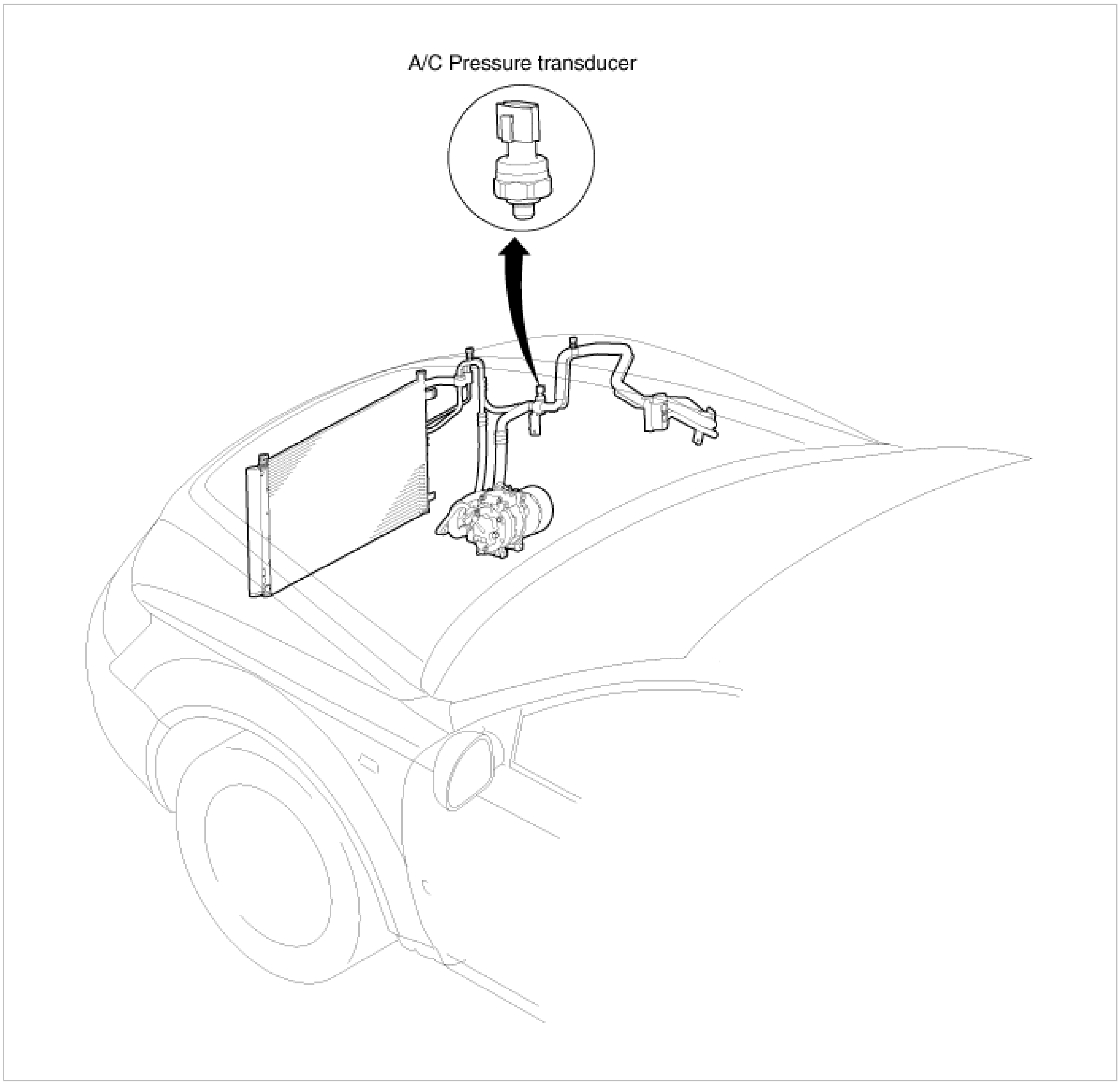
Heating,Ventilation, Air Conditioning > Air conditioning System > A/C pressure transducer > Description and Operation

DESCRIPTION

A/C pressure transducer convert the pressure value of high pressure line into voltage value after measure it. By converted voltage value, engine ECU controls cooling fan by operating it high speed or low speed. Engine ECU stop the operation of compressor when the temperature of refrigerant line is so high or so low irregularly to optimize air conditioning system.

Heating,Ventilation, Air Conditioning > Air conditioning System > A/C pressure transducer > Components and Components Location

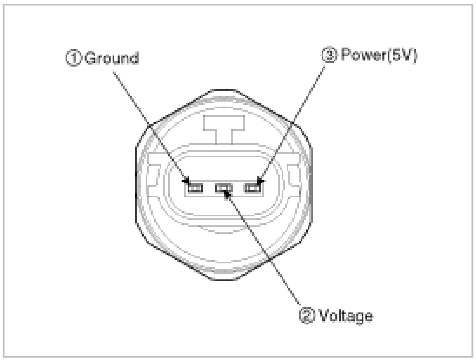
COMPONENT LOCATION



Heating,Ventilation, Air Conditioning > Air conditioning System > A/C pressure transducer > Repair procedures

INSPECTION

1. Measure the pressure of high pressure line by measuring voltage output between NO.1 and NO.2 terminals.



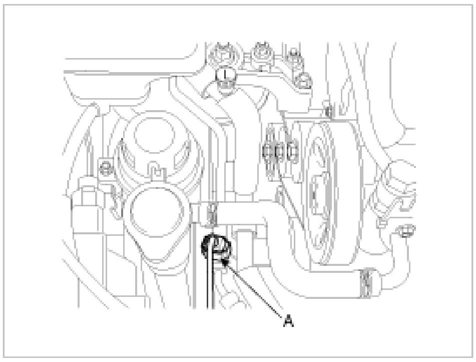
2. Inspection the voltage value whether it is sufficient to be regular value or not.

Voltage = 0.00878835 * Pressure (psig) + 0.5

3. If the measured voltage value is not specification, replace the A/C pressure transducer.

REPLACEMENT

1. Disconnect negative (-) battery terminal.
2. Disconnect A/C pressure transducer connector(A) (3P) from wiring harness.



3. Remove the A/C pressure transducer.

CAUTION

Take care that liquid suction pipe is not bent.

4. Installation is the reverse order of removal.

TORQUE : 10~12 N.m (1.02~1.22 kgf.m, 7.4~8.8 lb-ft)

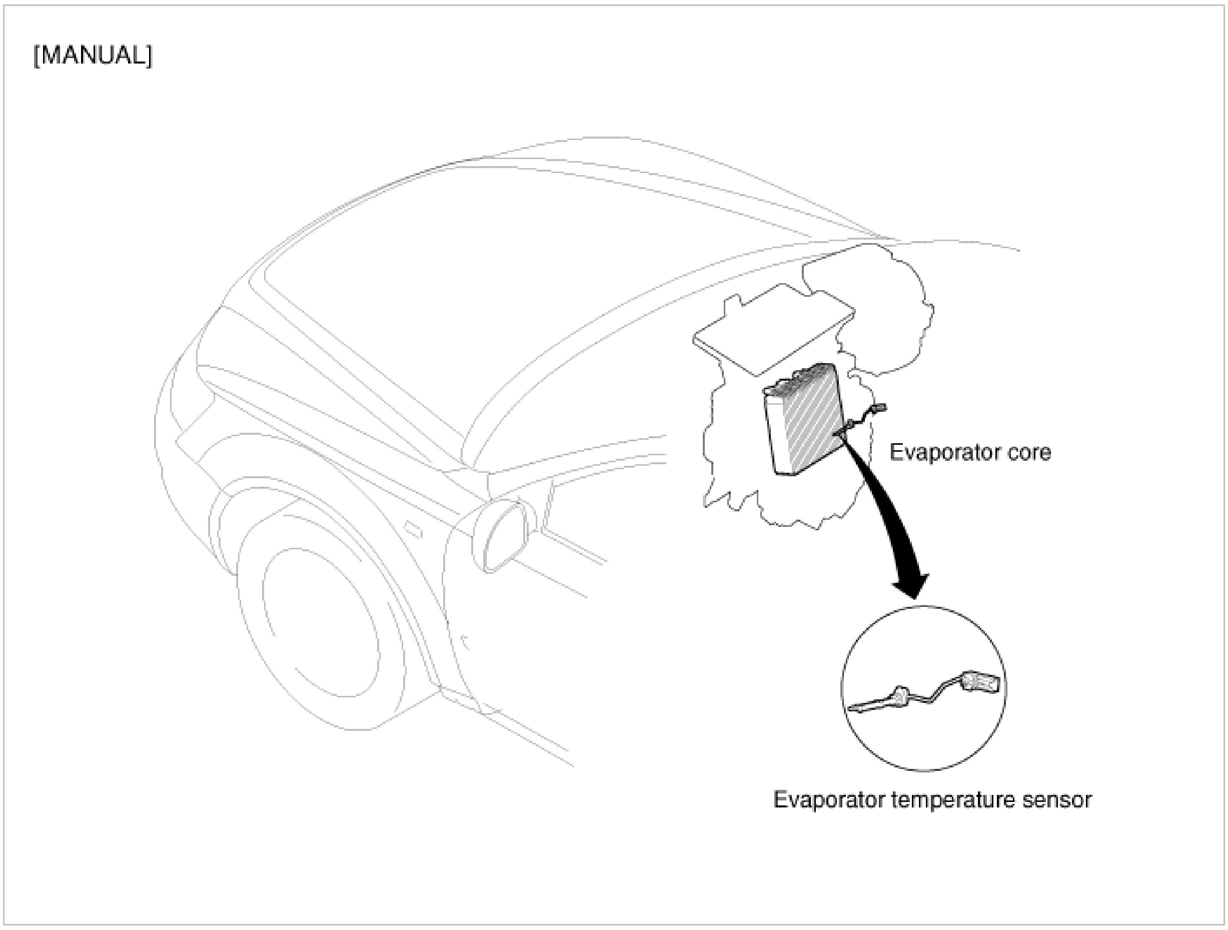
Heating,Ventilation, Air Conditioning > Air conditioning System > Evaporator temperature sensor > Description and Operation

DESCRIPTION

The evaporator temperature sensor will detect the evaporator core temperature and interrupt compressor relay power in order to prevent evaporator freezing by excessive cooling.
It is a negative type thermistor whose resistance is inversely proportional to temperature.

Heating,Ventilation, Air Conditioning > Air conditioning System > Evaporator temperature sensor > Components and Components Location

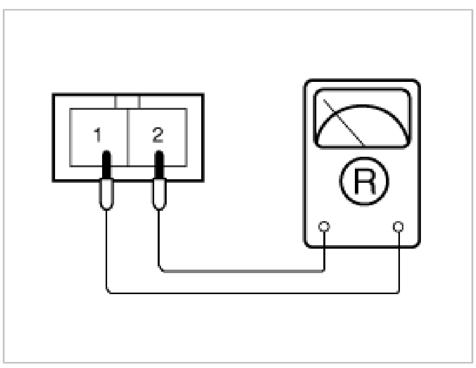
COMPONENT LOCATION



Heating,Ventilation, Air Conditioning > Air conditioning System > Evaporator temperature sensor > Repair procedures

INSPECTION

1. Ignition "ON".
2. Turn on the A/C switch.
3. Disconnect evaporator temperature sensor.
4. Using the multi-tester, Measure resistance between terminal "1" and "2" of evaporator temperature sensor.



Specification

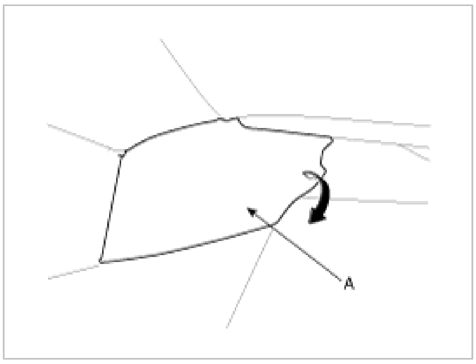
Evaporator core temperature [°C(°F)]	Resistance [KΩ]
-10 (14)	18.31
0 (32)	11.60
10 (50)	7.55
15 (59)	5.04

30 (86)	3.44
40 (104)	2.40

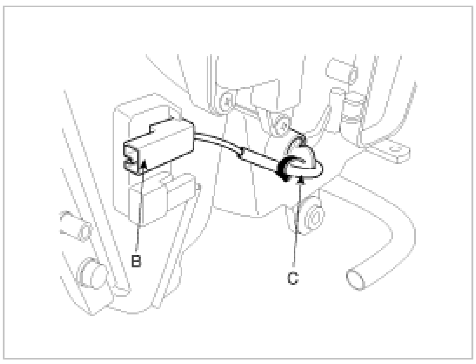
5. If the measured resistance is not specification, substitute with a known-good evaporator temperature sensor and check for proper operation.
6. If the problem is corrected, replace the evaporator temperature sensor.

REPLACEMENT

1. Pull out out the passenger's crash pad center low cover (A).



2. Disconnect the connector pin (B).
3. Remove the evaporator temperature sensor (C) by pulling it after rotating 90° in a counterclockwise direction.

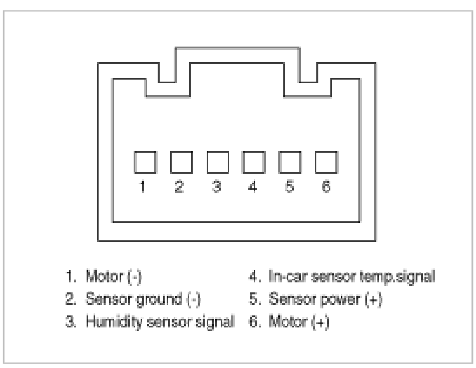


4. Installation is the reverse order of removal.

Heating,Ventilation, Air Conditioning > Air conditioning System > In-car sensor > Description and Operation

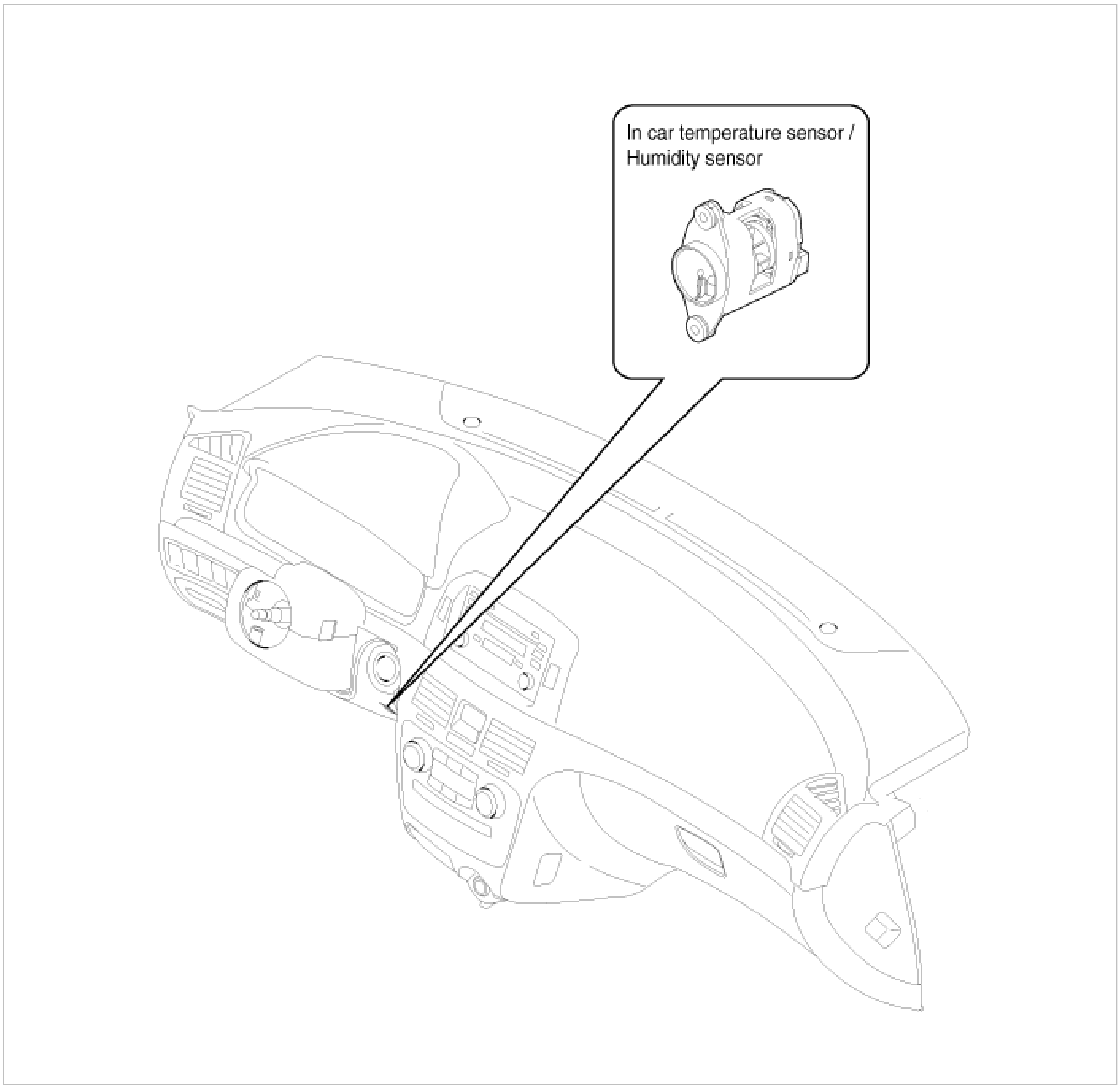
DESCRIPTION

1. In-car air temperature sensor is located at the lower crash pad.
2. The sensor contains a thermistor which measures the temperature of the inside. The signal, decided by the resistance value which changes in accordance with perceived inside temperature, is delivered to heater control unit and according to this signal the control unit regulates incar temperature to intended value.



Heating,Ventilation, Air Conditioning > Air conditioning System > In-car sensor > Components and Components Location

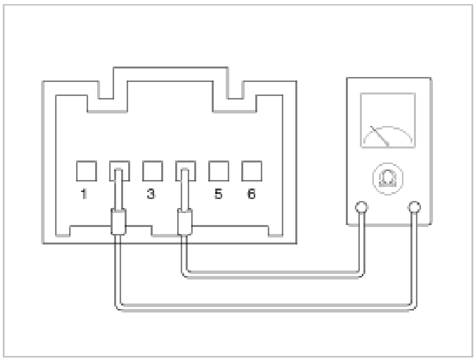
COMPONENT LOCATION



Heating,Ventilation, Air Conditioning > Air conditioning System > In-car sensor > Repair procedures

INSPECTION

1. Ignition "OFF".
2. Disconnect in-car sensor.
3. Using the multi-tester, Measure resistance between terminal "2" and "4" of in-car sensor.

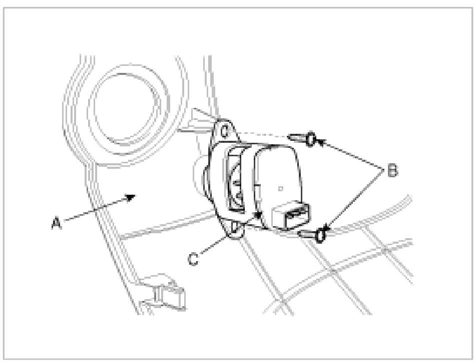


Specification

Temperature [°C(°F)]	Resistance between terminals 2 and 4 (KΩ)
-15 (5)	216.1 ± 3.2%
0 (32)	97.71 ± 2.4%
15 (59)	47.13 ± 1.7%
25 (77)	30.00 ± 1.2%
35 (95)	19.59 ± 1.6%
50 (122)	10.81 ± 2.2%

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the lower crash panel (A) (Refer to the Body group).
3. Disconnect the connector of in-car sensor.
4. Loosen the mounting screws (B) and then remove the in-car sensor (C).



5. Installation is the reverse order of removal.

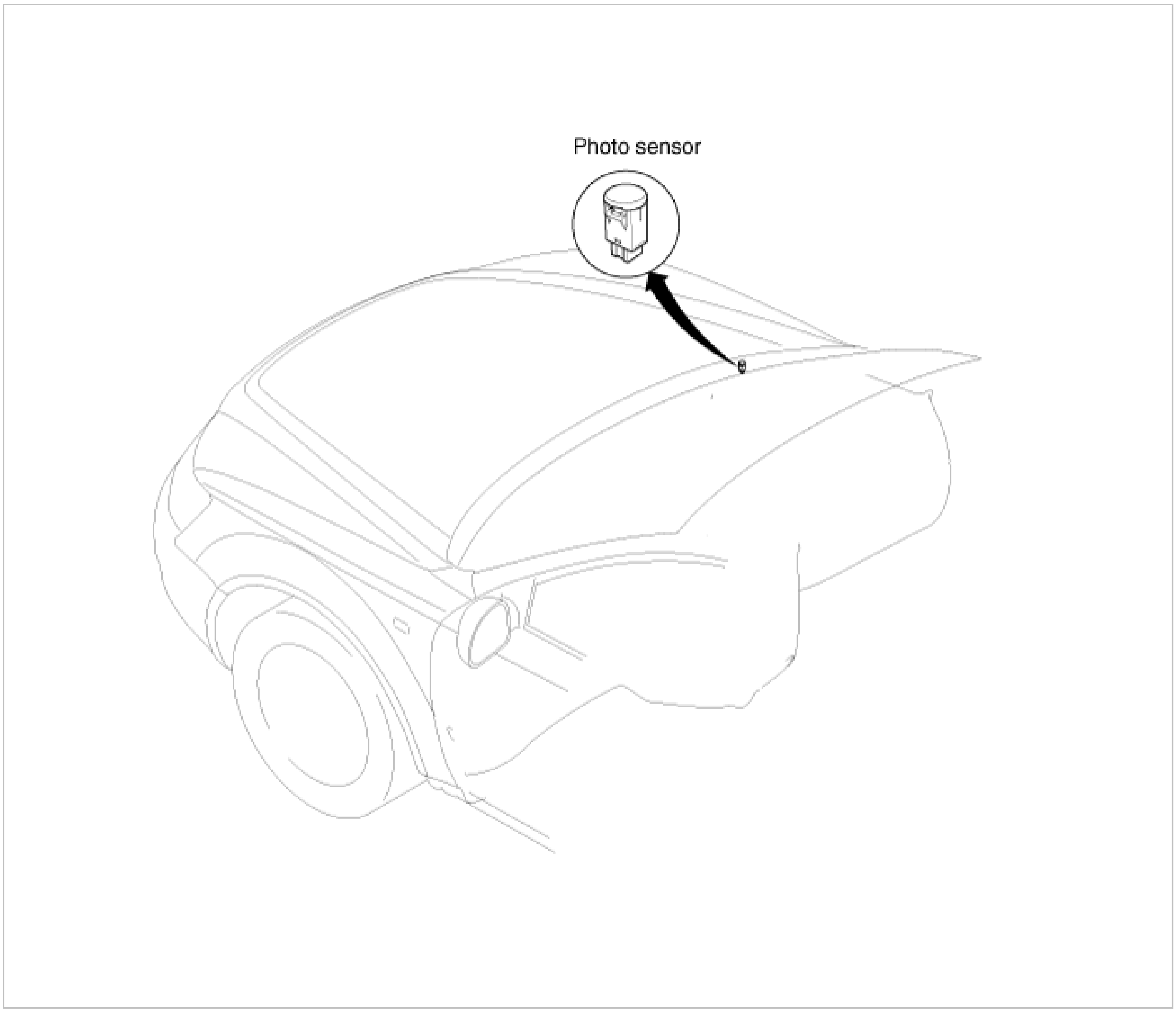
Heating,Ventilation, Air Conditioning > Air conditioning System > Photo sensor > Description and Operation

DESCRIPTION

1. The photo sensor is located at the right part of defrost nozzle.
2. The photo sensor contains a photovoltaic (sensitive to sunlight) diode. The solar radiation received by its light receiving portion, generates an electromotive force in proportion to the amount of radiation received which is transferred to the automatic temperature control module so that the solar radiation compensation will be performed.

Heating,Ventilation, Air Conditioning > Air conditioning System > Photo sensor > Components and Components Location

COMPONENT LOCATION

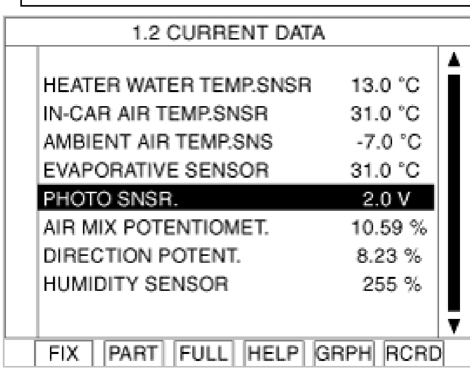


Heating,Ventilation, Air Conditioning > Air conditioning System > Photo sensor > Repair procedures

INSPECTION

1. Ignition "ON".
2. Using the scan tool.
3. Emit intensive light toward photo sensor using sunshine, and check the output absolute voltage change.
4. The absolute voltage will rise with higher intensive light and reduce with lower intensive light.

> **NOTE**
>
> When checking photo sensor, select a place where is exposed to sunshine directly.

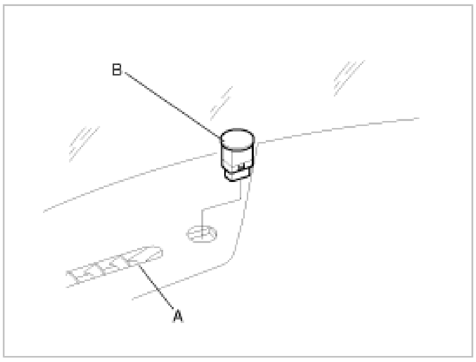


1.2 CURRENT DATA	
HEATER WATER TEMP.SNSR	13.0 °C
IN-CAR AIR TEMP.SNSR	31.0 °C
AMBIENT AIR TEMP.SNS	-7.0 °C
EVAPORATIVE SENSOR	31.0 °C
PHOTO SNSR.	2.0 V
AIR MIX POTENTIOMET.	10.59 %
DIRECTION POTENT.	8.23 %
HUMIDITY SENSOR	255 %

FIX | PART | FULL | HELP | GRPH | RCRD

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Using the (-) driver, Remove the photo sensor (B) from the right part of defrost nozzle (A).
3. Disconnect the connector.

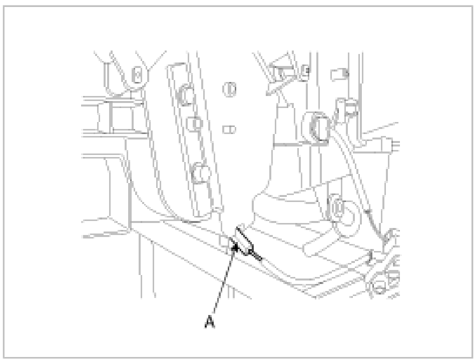


4. Installation is the reverse order of removal.

Heating,Ventilation, Air Conditioning > Air conditioning System > Water temperature sensor > Description and Operation

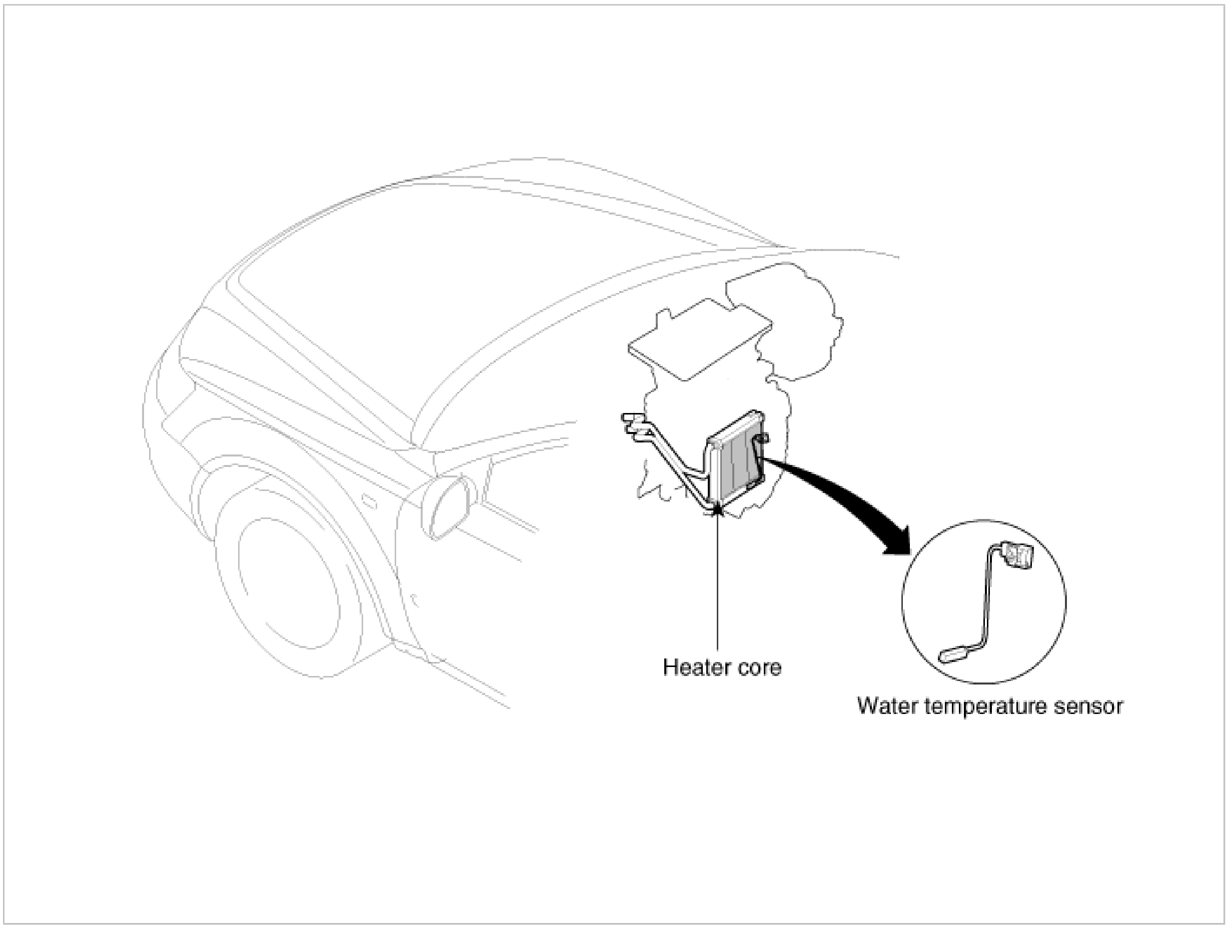
DESCRIPTION

1. Water temperature sensor (A) is located at the heater unit.
2. It detects coolant temperature. Its signal is used for cold engine lockout control. When the driver operates the heater before the engine is warmed up, the signal from sensor causes the heater control unit to reduce blower motor speed until coolant temperature reaches the threshold value.



Heating,Ventilation, Air Conditioning > Air conditioning System > Water temperature sensor > Components and Components Location

COMPONENT LOCATION



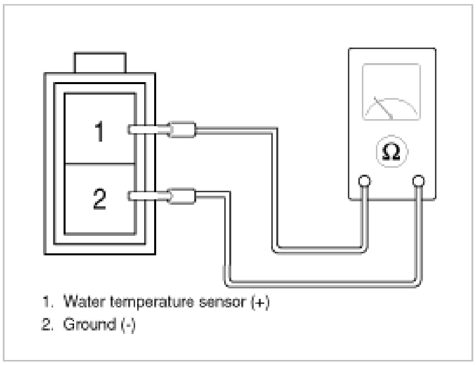
Heating,Ventilation, Air Conditioning > Air conditioning System > Water temperature sensor > Repair procedures

INSPECTION

1. Ignition "OFF".
2. Disconnect water temperature sensor connector.
3. Using the multi-tester, Measure resistance between terminal "1" and "2" of water temperature sensor.
   Specification

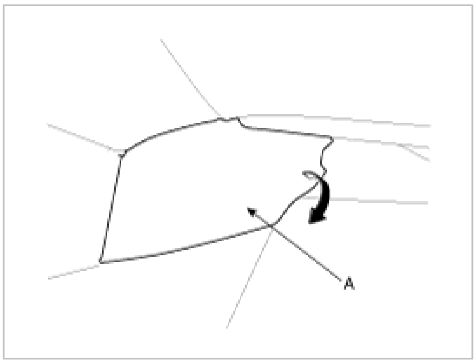
Coolant temperature [°C(°F)]	Resistance between terminals 1and 2 (KΩ)
-10 (14) 0 (32) 20 (68) 40 (104) 60 (140) 80 (176)	55.27 32.61 12.48 5.33 2.50 1.27

4. If the measured resistance is not specification, substitute with a known-good water temperature sensor and check for proper operation.
5. If the problem is corrected, replace the water temperature sensor.

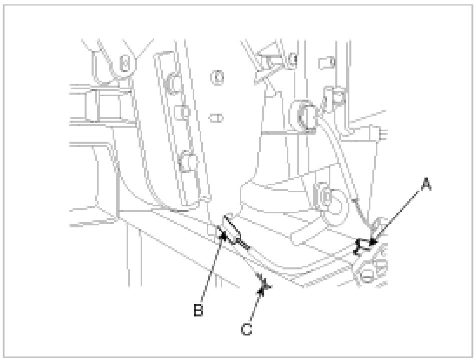


REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Pull out the passenger's crash pad center low cover (A).



3. Remove the under cover after loosening 2 screws.
4. Disconnect the connector (A) of water temperature sensor.
5. Pull the water temperature sensor(B) out at the heater unit with the stopper (C).



6. Install in the reverse order of removal.

> NOTE
>
> Take care that wire of water temperature sensor is not to be damaged.

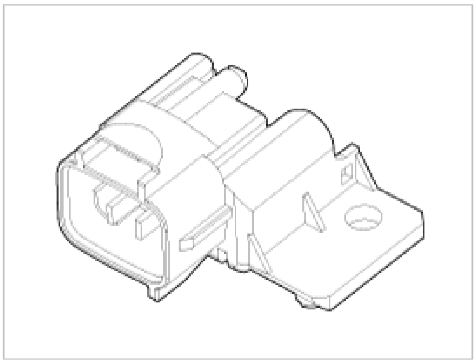
Heating,Ventilation, Air Conditioning > Air conditioning System > Ambient sensor > Description and Operation

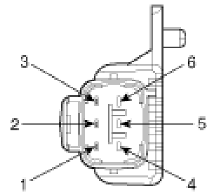
DESCRIPTION

1. The ambient temperature sensor is located at the front of the condenser and detects ambient air temperature. It is a negative type thermistor; resistance will increase with lower temperature, and decrease with higher temperatures.
2. The sensor output will be used for discharge temperature control, temperature regulation door control, blower motor level control, mix mode control and in-car humidity control.

> NOTE

If the ambient temperature is below 2.0°C (35.6°F), the A/C compressor will be stopped.
The compressor will be operated by manual operating.

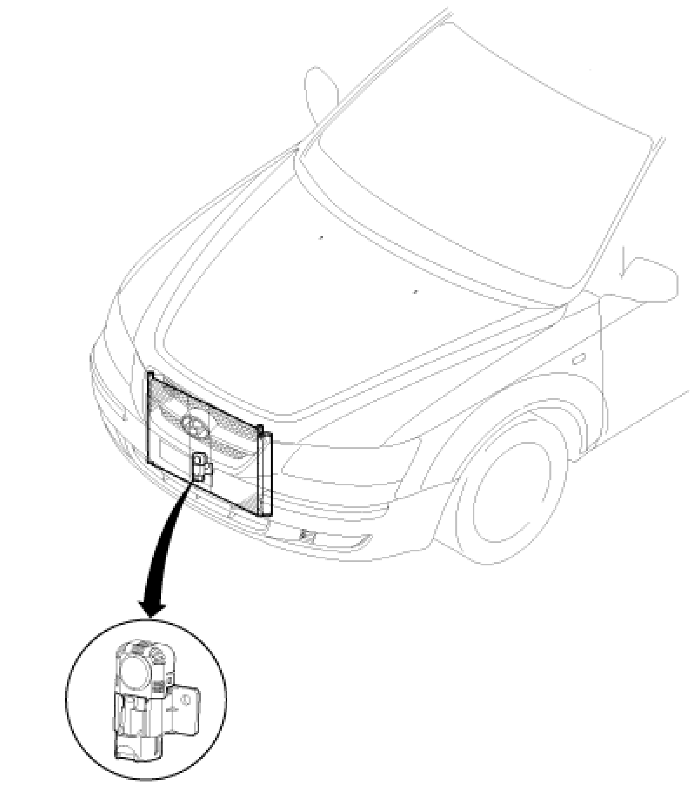




1. Ambient temperature sensor (+)
2. Ambient temperature sensor ground (-)
3. -
4. AQS signal
5. AQS ground (-)
6. IG 2 (+)

Heating,Ventilation, Air Conditioning > Air conditioning System > Ambient sensor > Components and Components Location

COMPONENT LOCATION



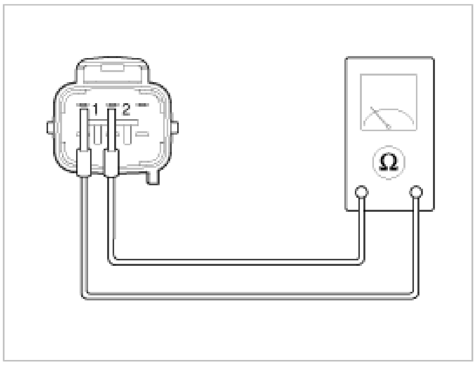
Heating,Ventilation, Air Conditioning > Air conditioning System > Ambient sensor > Repair procedures

INSPECTION

1. Ignition "OFF".
2. Disconnect ambient temperature sensor connector.
3. Check the resistance of ambient temperature sensor between terminals 1 and 2 whether it is changed by changing temperature of the ambient temperature sensor.
   Specification

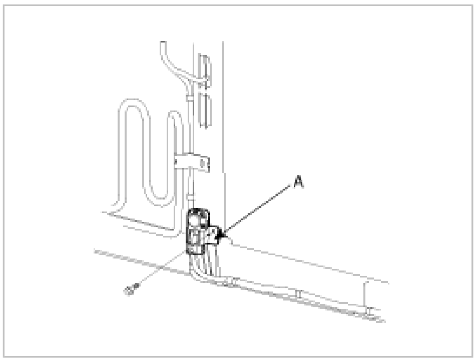
Ambient temperature [°C(°F)]	Resistance between terminals 1 and 2 (KΩ±3%)
-20 (-4) 0 (32) 25 (77) 50 (122) 80 (176)	271.1 95.1 30.0 10.9 3.83

4. If the measured resistance is not specification, substitute with a known-good ambient temperature sensor and check for proper operation.
5. If the problem is corrected, replace the ambient temperature sensor.



REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the front bumper. (Refer to BD group)
3. Remove the ambient temperature sensor(A) after loosening the mounting bolt.



4. Installation is the reverse order of removal.

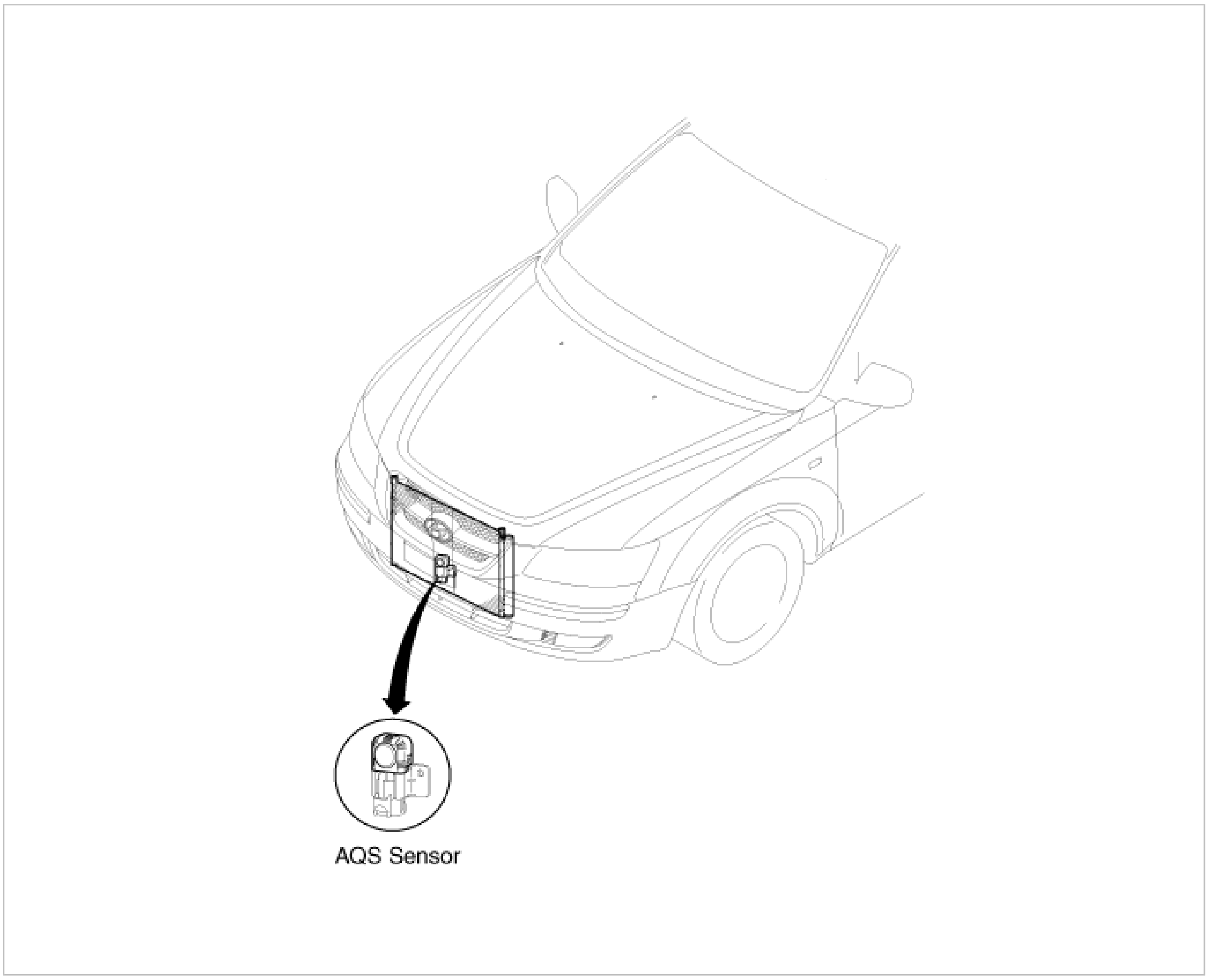
Heating,Ventilation, Air Conditioning > Air conditioning System > A.Q.S (Air Quality Sensor) > Description and Operation

DESCRIPTION

1. A.Q.S is located at center support in front of the engine radiator, and detects hazardous elements in ambient air providing output signal to control.
2. It will detect sulfurous acid gas, carbon dioxide, carbon monoxide, hydrocarbon and allergen.

Heating,Ventilation, Air Conditioning > Air conditioning System > A.Q.S (Air Quality Sensor) > Components and Components Location

COMPONENT LOCATION

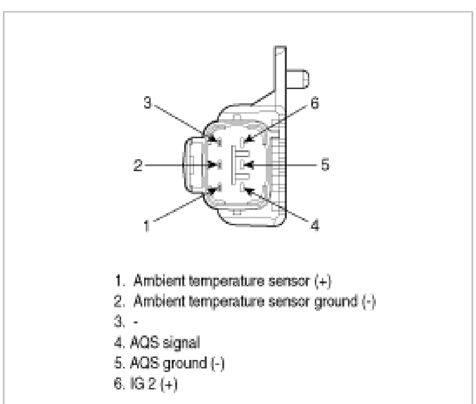


Heating,Ventilation, Air Conditioning > Air conditioning System > A.Q.S (Air Quality Sensor) > Repair procedures

INSPECTION

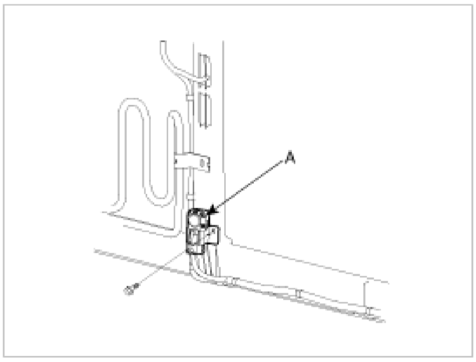
1. Ignition "ON".
2. Using the scan tool.
3. Check the output voltage of AQS between terminals 4 and 5.
   Specification

Condition	Output signal	Intake
Normal condition	4 ~ 5V	Fresh
Hazardous gas detection	0 ~ 1V	Recirculation



REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the front bumper (Refer to the BD group).
3. Remove the AQS sensor (A) after loosening the mounting screws.

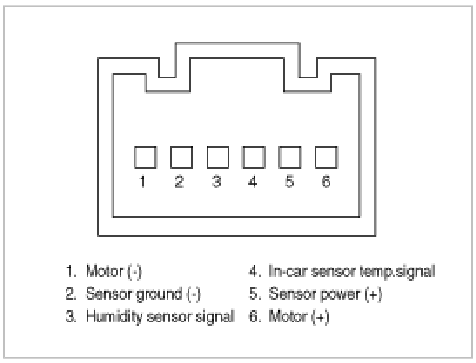


4. Install in the reverse order of removal.

Heating,Ventilation, Air Conditioning > Air conditioning System > Humidity Sensor > Description and Operation

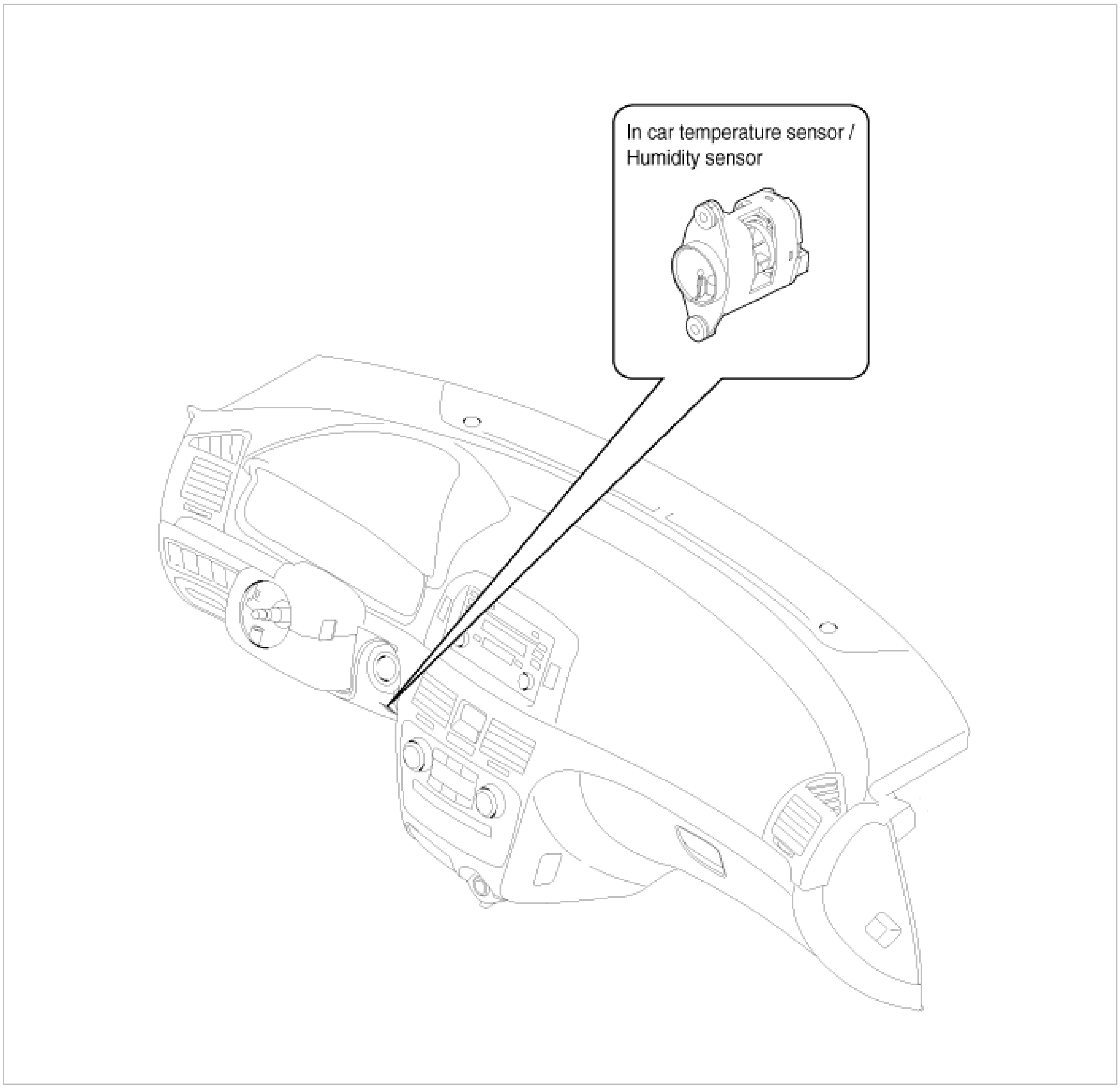
DESCRIPTION

1. Humidity sensor is located at the lower crash pad and detects in-car humidity for in-car humidity control.
2. If ambient air temperature or in-car humidity is outside certain range, it will turn on A/C to control in-car humidity preventing in car fogging.
   Air conditioner operation depends on ambient temperature and humidity.



Heating,Ventilation, Air Conditioning > Air conditioning System > Humidity Sensor > Components and Components Location

COMPONENT LOCATION



Heating,Ventilation, Air Conditioning > Air conditioning System > Humidity Sensor > Repair procedures

INSPECTION

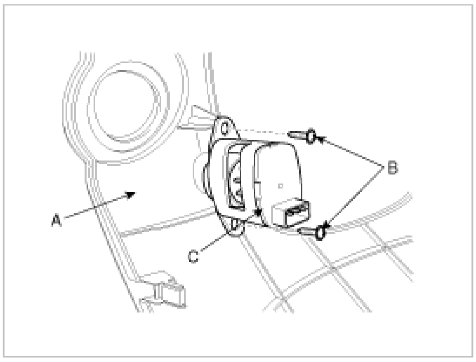
1. Ignition "ON".
2. Using the scan tool.
3. Check the frequency of humidity sensor between terminals 2 and 3.

Humidity (%)	Frequency between terminals 2 and 3(Hz)
0	7351± 10%
10	7224± 10%
20	7100± 5%
30	6976 ± 5%
50	6728 ± 5%
60	6600 ± 5%
70	6468 ± 5%
80	6330 ± 5%
90	6186 ± 10%
100	6033 ± 10%

4. If the measured resistance is not specification, substitute with a known-good humidity sensor and check for proper operation.
5. If the problem is corrected, replace the Humidity sensor.

REPLACEMENT

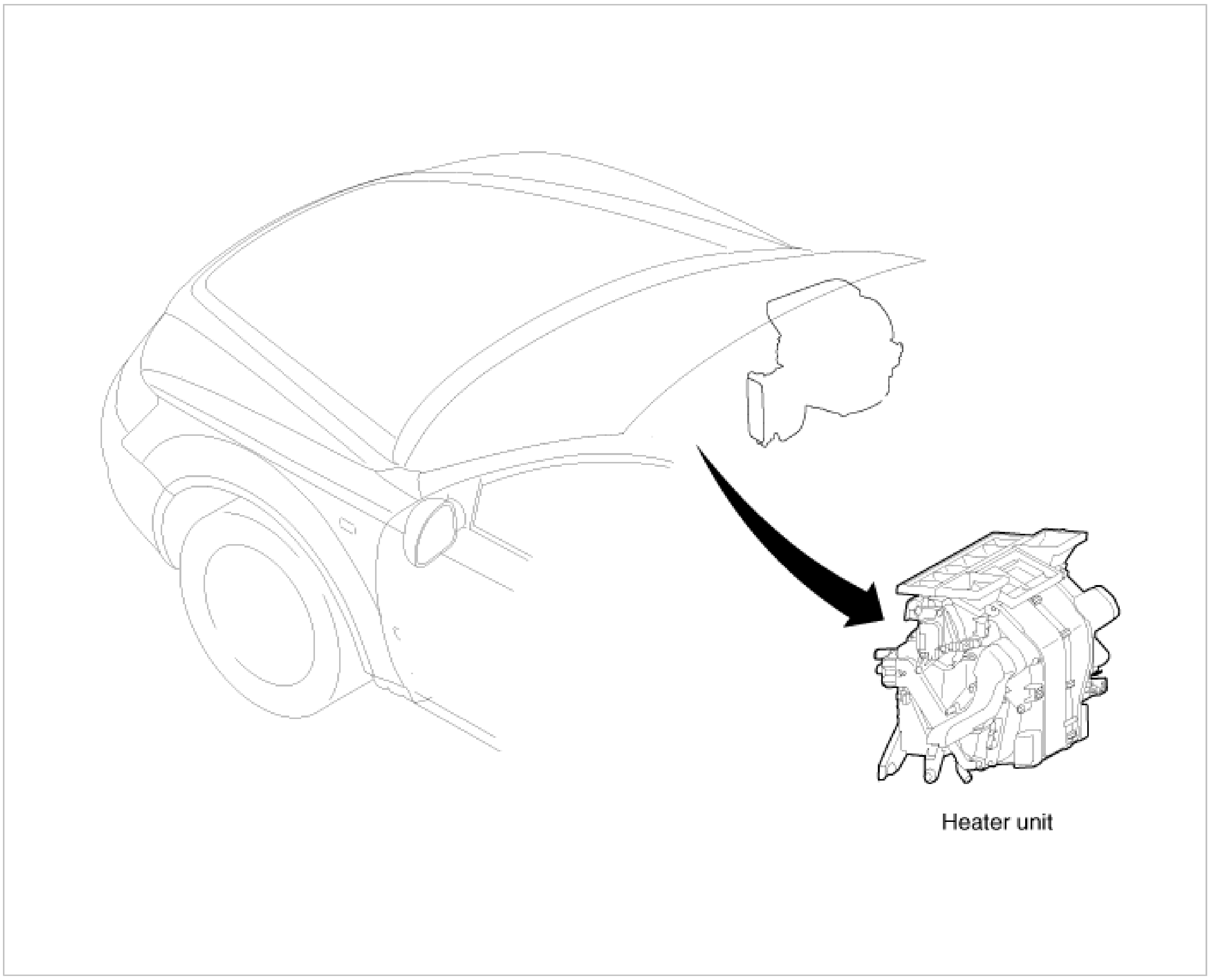
1. Disconnect the negative (-) battery terminal.
2. Remove the lower crash panel (A) (Refer to BD group).
3. Disconnect humidity sensor connector.
4. Loosen the mounting screws (B) and then remove the humidity sensor (C).



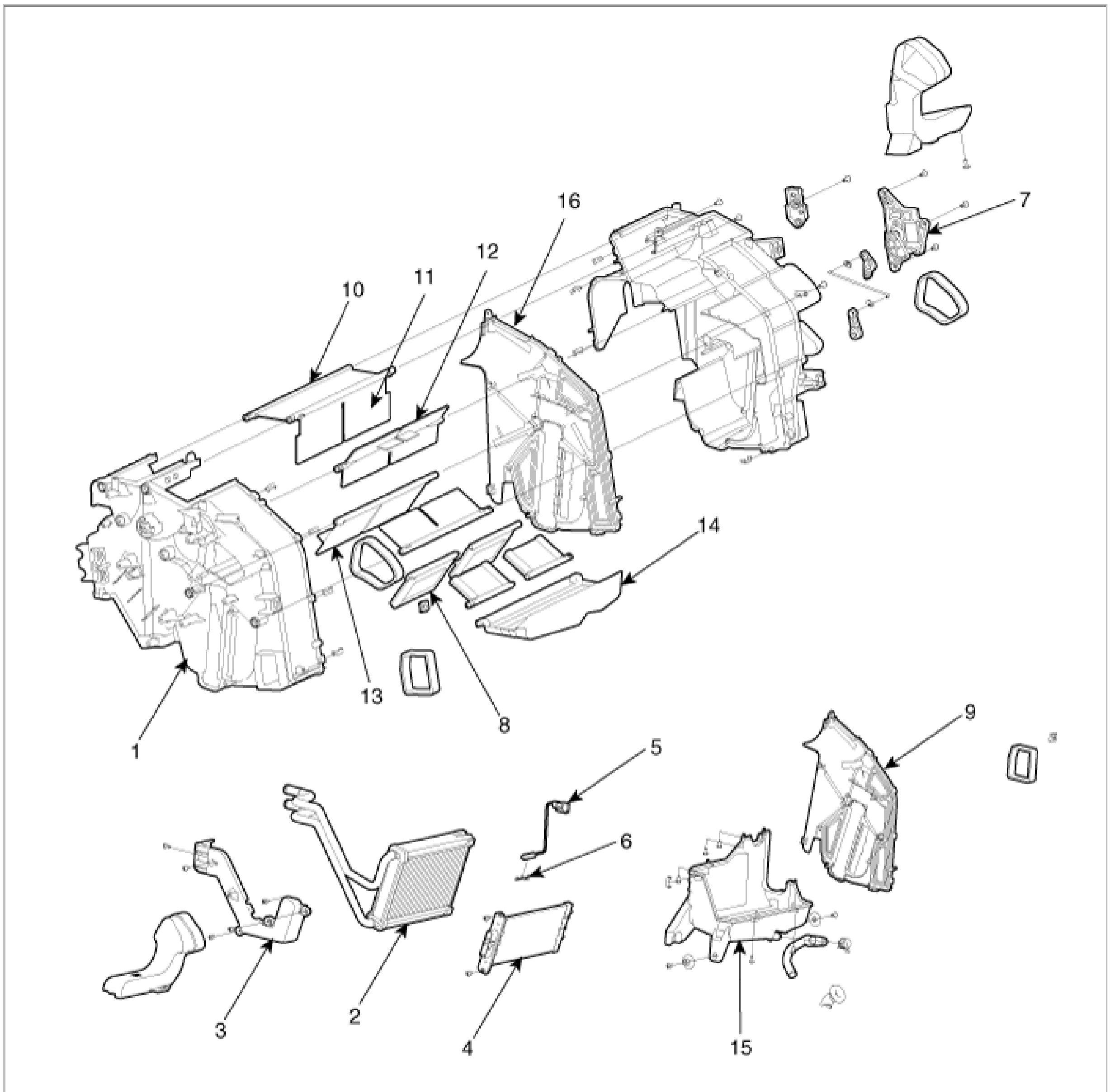
5. Installation is the reverse order of removal.

Heating,Ventilation, Air Conditioning > Heater > Heater Unit > Components and Components Location

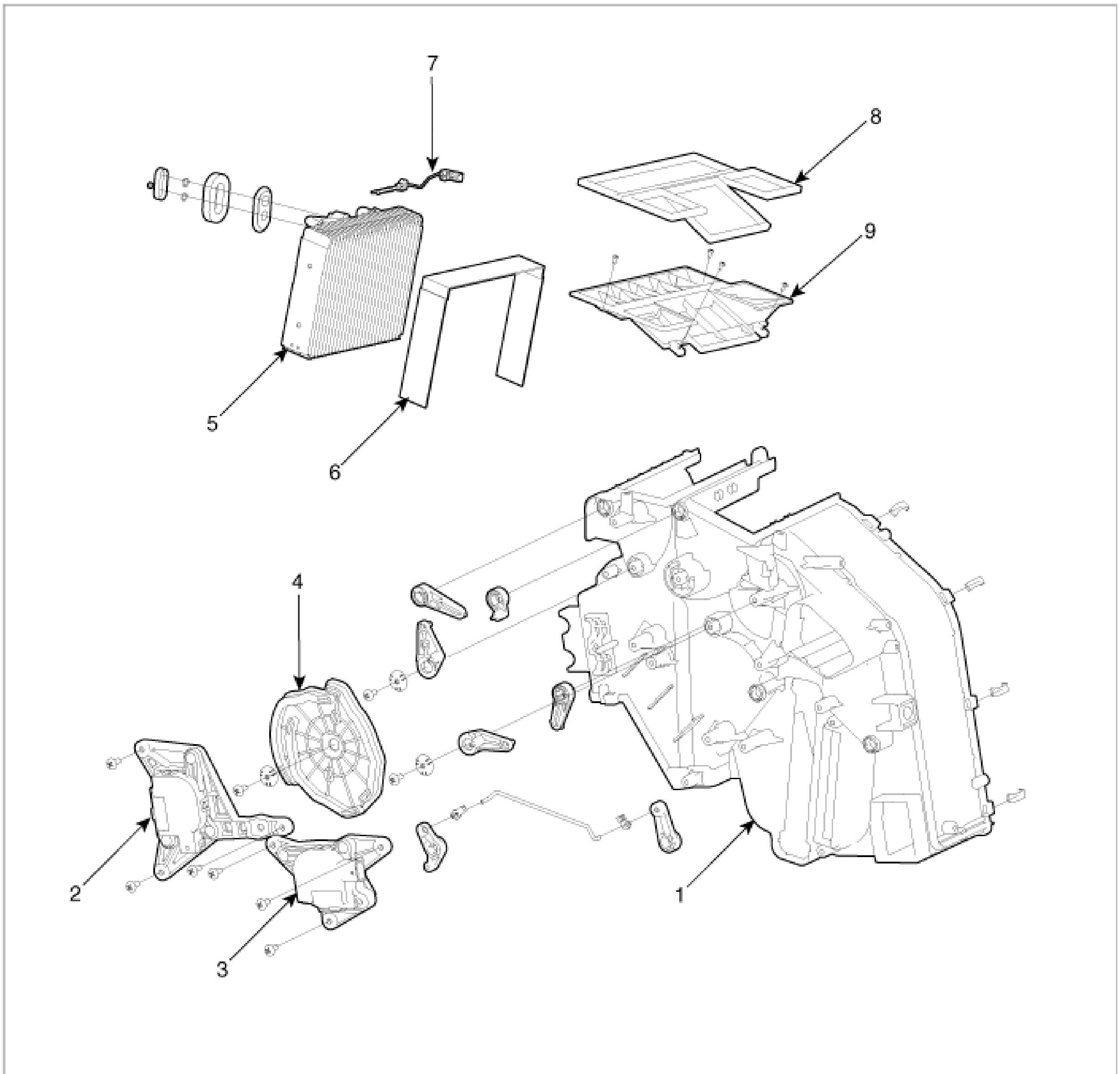
COMPONENT LOCATION



COMPONENTS



1. Heater & Evaporator case
2. Heater core
3. Heater core cover
4. PTC heater (Diesel only)
5. Water temperature sensor
6. Water temperature sensor stopper
7. Temperature control actuator
8. Temperature control door (Dual type)
9. Heater separator (Dual type)
10. Defrost door
11. Vent door
12. Floor door
13. Temperature control door (Single type)
14. Insulation
15. Heater & Evaporator lower case
16. Heater separator (Single type)

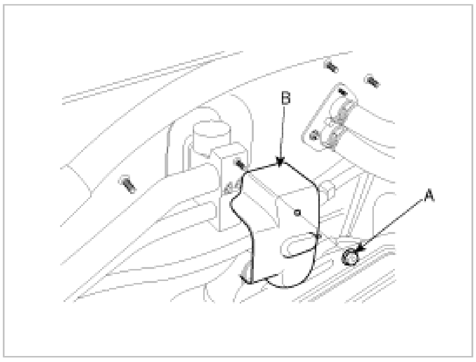


1. Heater & Evaporator case	6. Evaporator case seal
2. Mode control actuator	7. Evaporator temperature sensor
3. Temperature control actuator (Dual type)	8. Upper case seal
4. Mode cam	9. Heater & Evaporator upper case
5. Evaporator core	

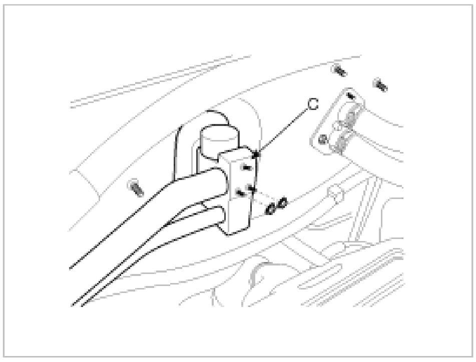
Heating,Ventilation, Air Conditioning > Heater > Heater Unit > Repair procedures

REPLACEMENT

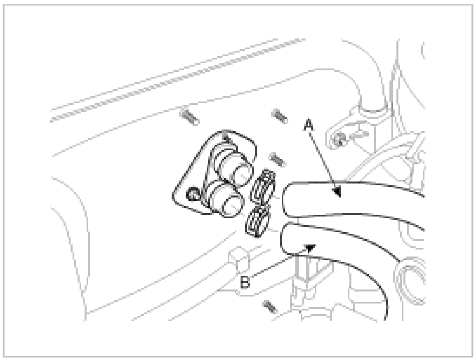
1. Disconnect the negative (-) battery terminal.
2. Recover the refrigerant with a recovery/ recycling/ charging station.
3. When the engine is cool, drain the engine coolant from the radiator.
4. Remove the expansion valve cover after loosening the nut (A).



5. Remove the expansion valve (C) from evaporator core after loosening nuts. Plug or cap the lines immediately after disconnecting them to avoid moisture and dust contamination.



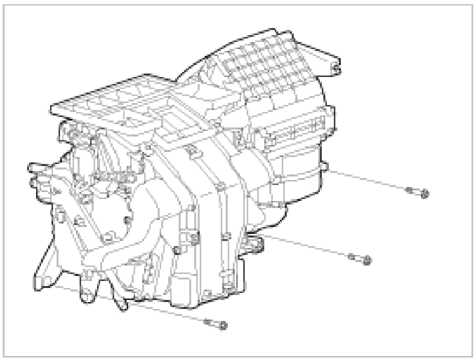
6. Disconnect the inlet (A) and outlet (B) heater hoses from the heater unit.



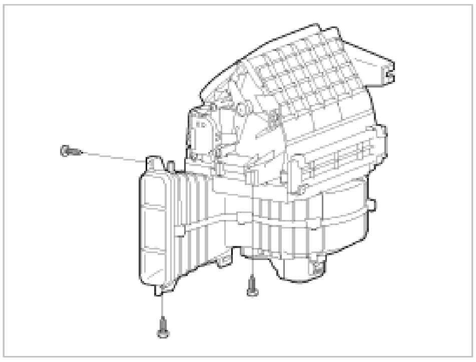
CAUTION

Engine coolant will run out when the hoses are disconnected; drain it into a clean drip pan. Be sure not to let coolant spill on electrical parts or painted surfaces. If any coolant spills, rinse it off immediately.

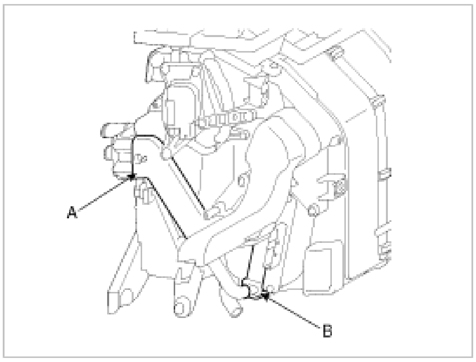
7. Remove the crash pad. (Refer to BD group)
8. Remove the cowl cross member. (Refer to BD group)
9. Disconnect the connectors from the temperature control actuator, the mode control actuator and the evaporator temperature sensor, then remove the mounting nut and the mounting bolts.
10. Remove the heater & evaporator unit after loosening the mounting bolts.



11. Remove the blower unit from heater unit after loosening fixing screws on the connected part.



12. Remove the side bracket (A) and heater core (B).



13. Be careful that inlet and outlet pipes are not to be bent during heater core removal, and pull out the heater core.
14. Install the heater core in the reverse order of removal.
15. Install in the reverse order of removal, and note these items :
    A. If you're installing a new evaporator, add refrigerant oil.
    B. Replace the O-rings with new ones at each fitting, and apply a thin coat of refrigerant oil before installing them. Be sure to use the right O-rings for R-134a to avoid leakage.
    C. Immediately after using the oil, replace the cap on the container, and seal it to avoid moisture absorption.
    D. Do not spill the refrigerant oil on the vehicle ; it may damage the paint ; if the refrigerant oil contacts the paint, wash it off immediately.
    E. Apply sealant to the grommets.
    F. Make sure that there is no air leakage.
    G. Charge the system and test its performance.
    H. Do not interchange the inlet and outlet heater hoses and install the hose clamps securely.
    I. Refill the cooling system with engine coolant.

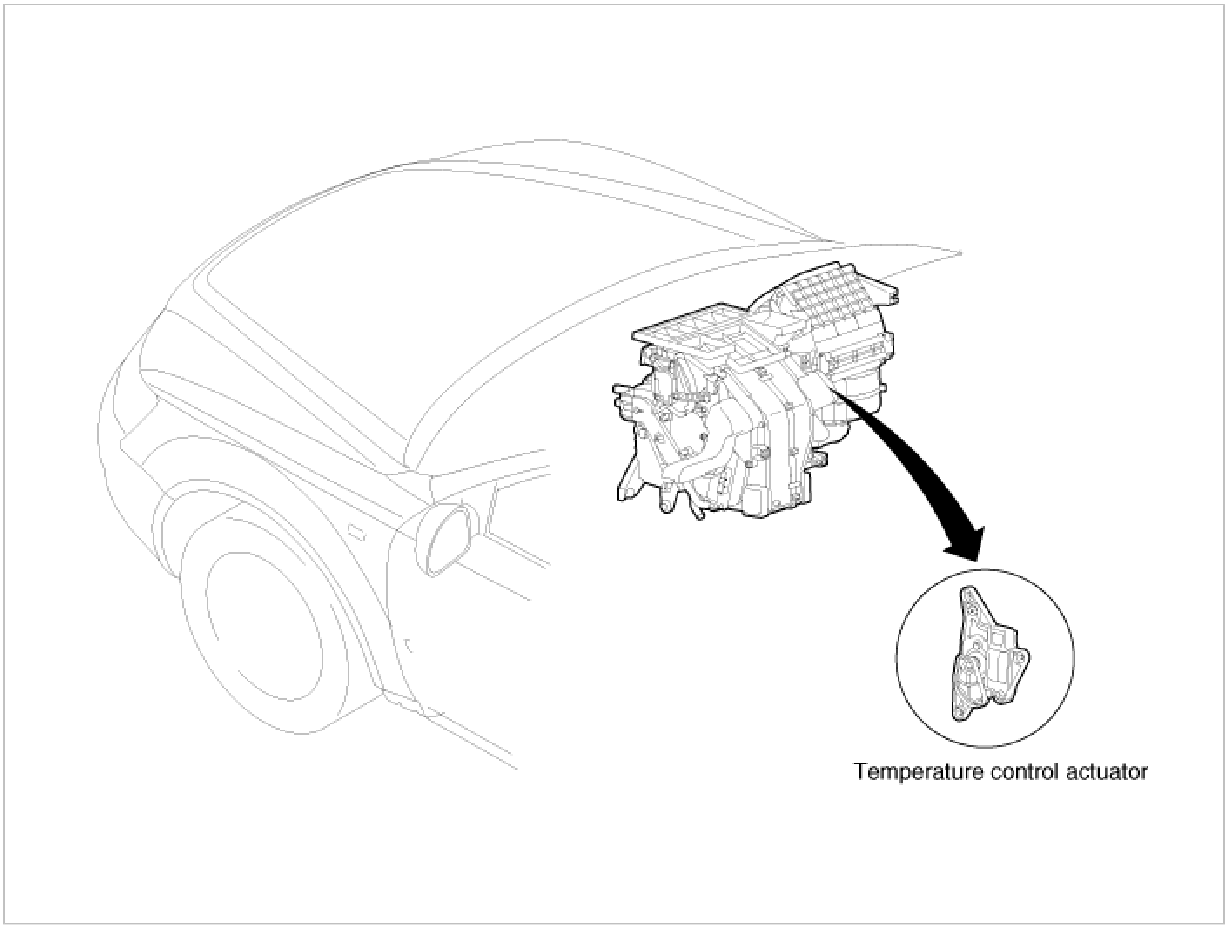
Heating,Ventilation, Air Conditioning > Heater > Temperature Control Actuator > Description and Operation

DESCRIPTION

1. Heater unit includes mode control actuator and temperature control actuator.
2. Temperature control actuator is located at the heater unit. Signal from control unit adjusts position of temperature door by operating temperature switch and then temperature will be regulated by the hot/cold air ratio determined by position of temperature door.

Heating,Ventilation, Air Conditioning > Heater > Temperature Control Actuator > Components and Components Location

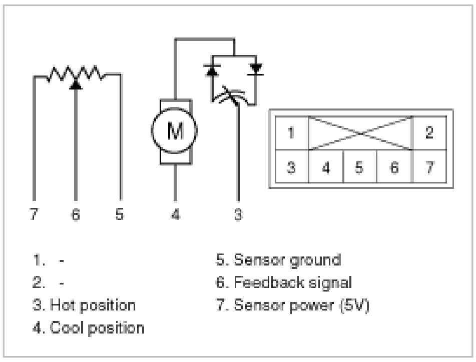
COMPONENT LOCATION



Heating,Ventilation, Air Conditioning > Heater > Temperature Control Actuator > Repair procedures

INSPECTION

1. Ignition "OFF".
2. Disconnect the connector of temperature control actuator.
3. Verify that the temperature control actuator operates to the hot position when connecting 12V to the terminal 3 and grounding terminal 4.
4. Verify that the temperature control actuator operates to the cool position when the connections in are reversed.



5. Check the voltage between terminals 5 and 6.
Specification

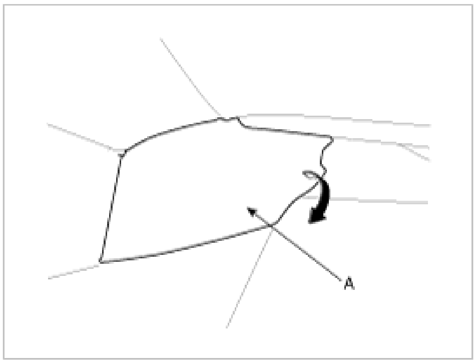
Door position	Voltage (5-6)	Error detecting
Max. cooling	0.3 ± 0.15V	Low voltage : 0.1V or less
Max. heating	4.7 ± 0.15V	High voltage : 4.9V or more

It will feedback current position of actuator to controls.

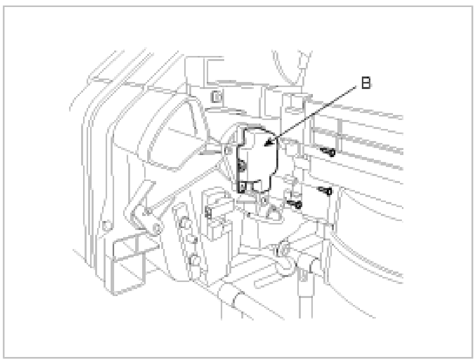
6. If the measured voltage is not within specification, substitute with a known-good temperature control actuator and check for proper operation.
7. If the problem is corrected, replace the temperature control actuator.

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Pull out the passenger’s crash pad center lower cover (A).



3. Disconnect the connector of temperature control actuator after removing the air duct.
4. Loosen the mounting screw and then remove the temperature control actuator (B).



5. Install in the reverse order of removal.

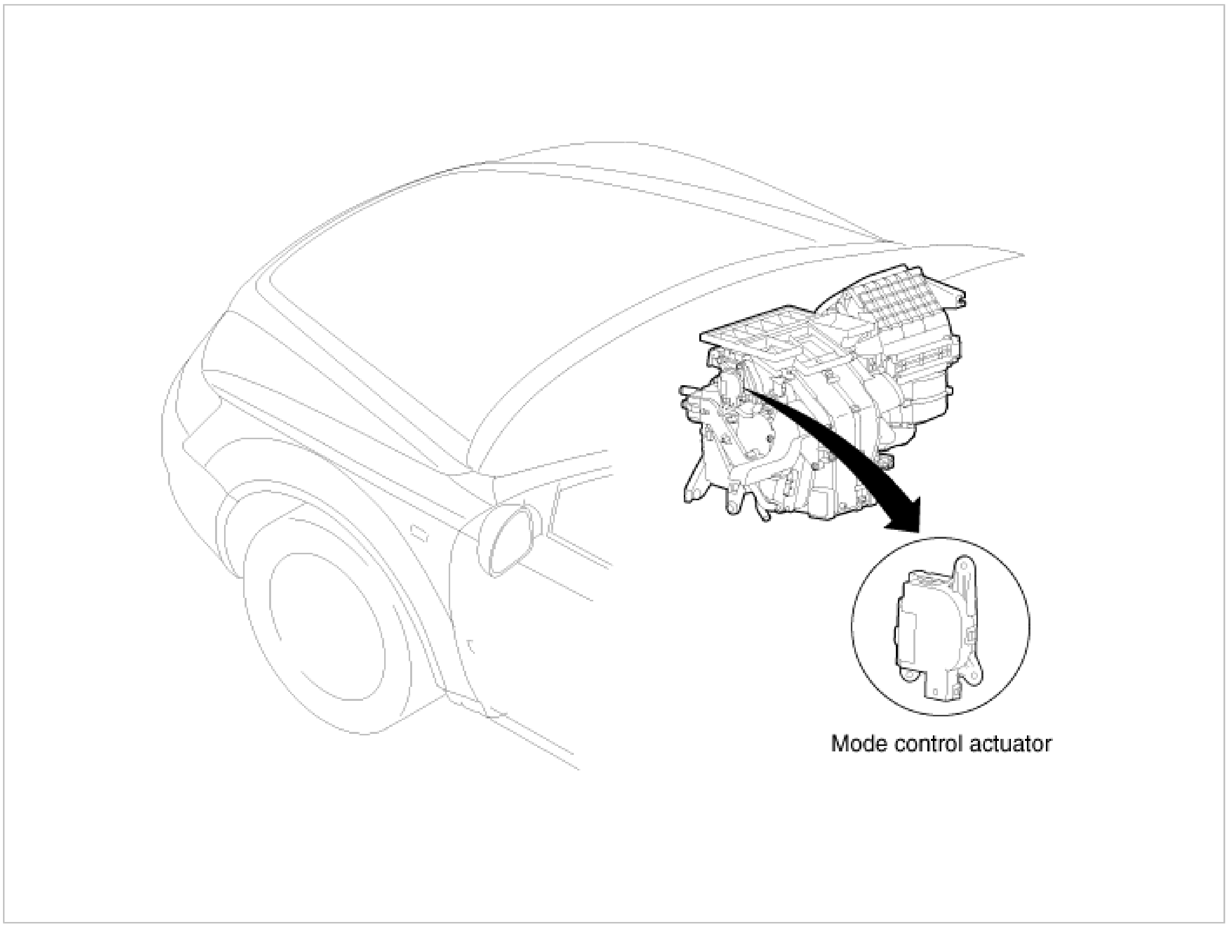
Heating,Ventilation, Air Conditioning > Heater > Mode Control Actuator > Description and Operation

DESCRIPTION

The mode control actuator is located at the heater unit.
It adjusts position of mode door by operating mode control actuator based on signal of A/C control unit. Pressing mode select switch makes the mode control actuator shift in order of vent→ BI/LEVEL → floor → mix.

Heating,Ventilation, Air Conditioning > Heater > Mode Control Actuator > Components and Components Location

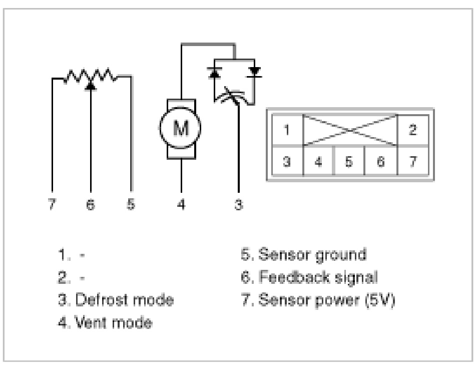
COMPONENT LOCATION



Heating,Ventilation, Air Conditioning > Heater > Mode Control Actuator > Repair procedures

INSPECTION

1. Ignition "OFF”.
2. Disconnect the connector of mode control actuator.
3. Verify that the mode control actuator operates to the defrost position when connecting 12V to the terminal 3 and grounding terminal 4.
4. Verify that the mode control actuator operates to the vent position when connecting in the reverse.



5. Check the voltage between terminals 5 and 6.

Door position	Voltage (5-6)	Error detecting
Vent	0.3 ± 0.15V	Low voltage : 0.1V or less
Defrost	4.7 ± 0.15V	High voltage : 4.9V or more

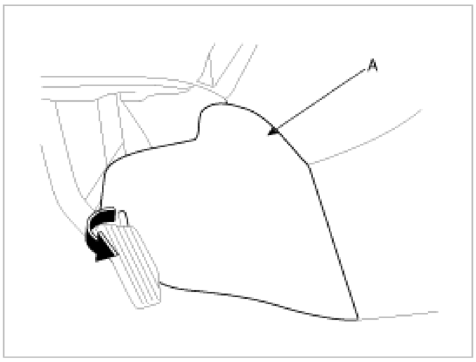
It will feedback current position of actuator to controls.

6. If the measured voltage is not specification, substitute with a known-good mode control actuator and check for proper operation.

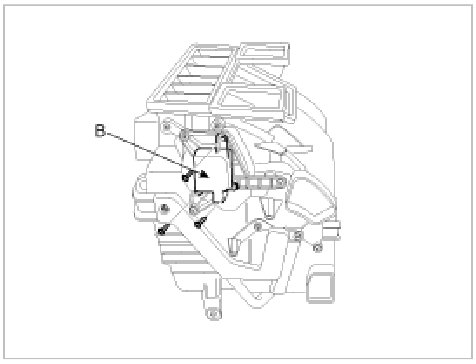
7. If the problem is corrected, replace the mode control actuator.

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Pull out the driver's crush pad center lower cover (A).



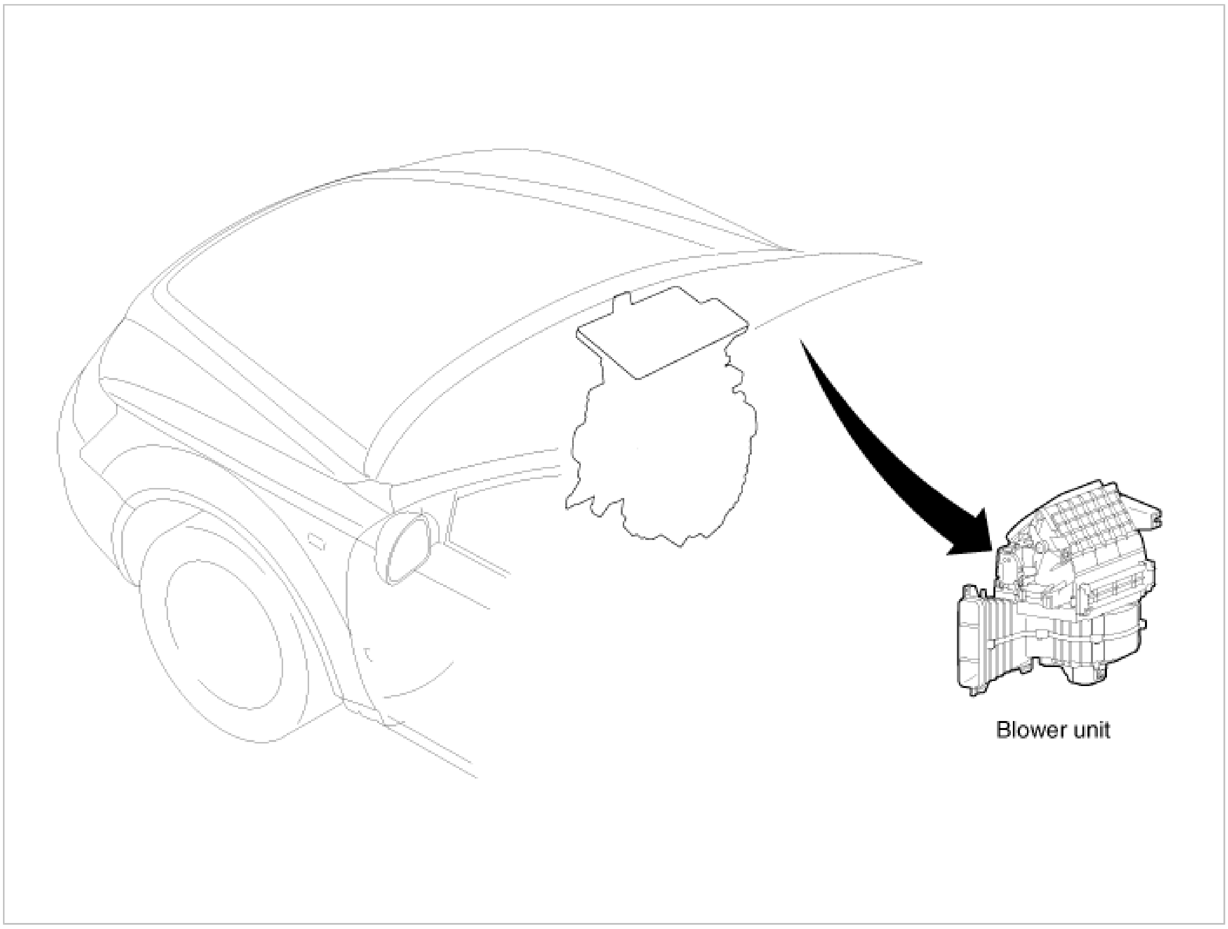
3. Disconnect the connector of mode control actuator after removing the air duct.
4. Loosen the mounting screws and then remove the mode control actuator (B).



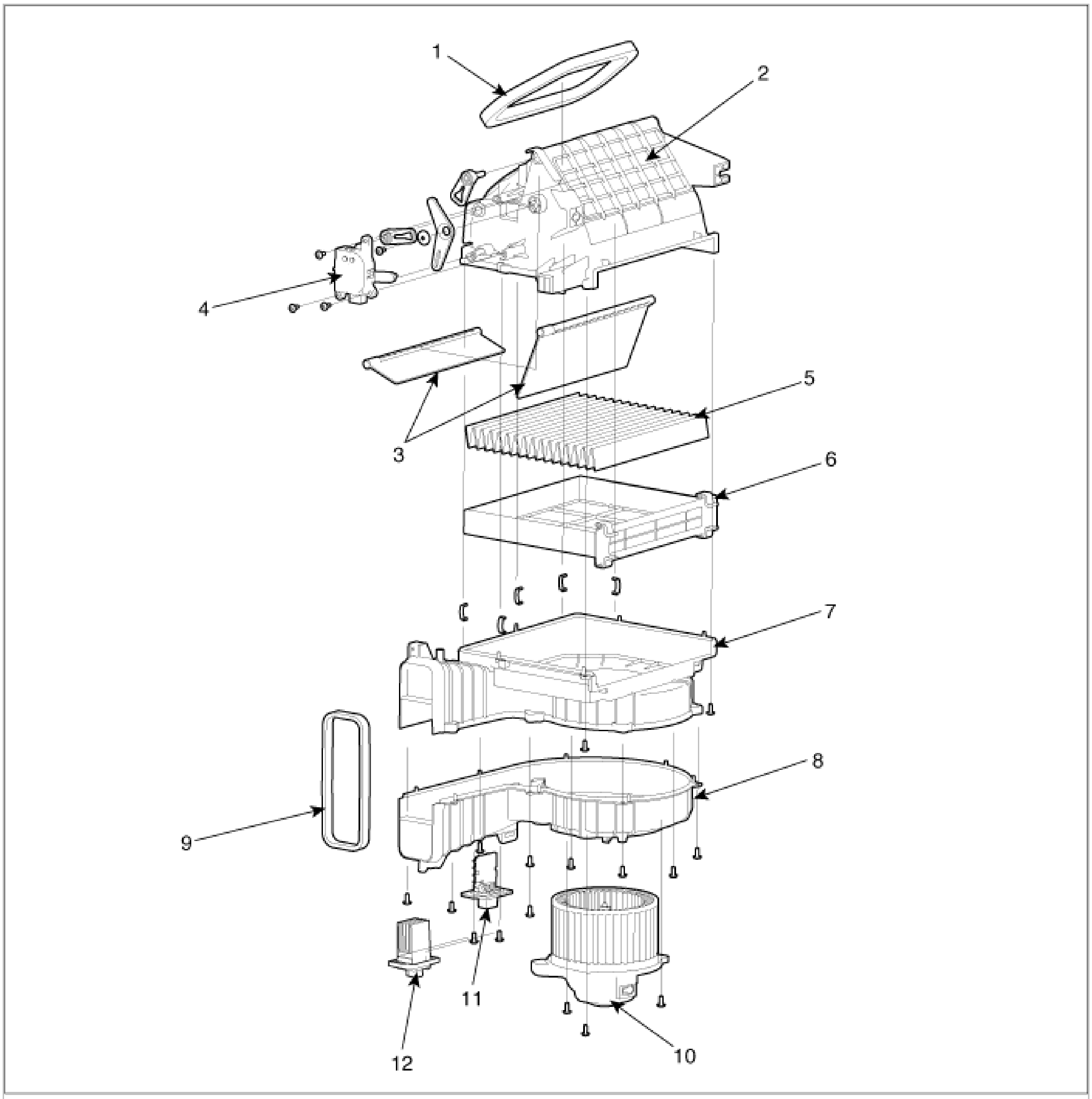
5. Install in the reverse order of removal.

Heating,Ventilation, Air Conditioning > Blower > Blower Unit > Components and Components Location

COMPONENT LOCATION



COMPONENTS

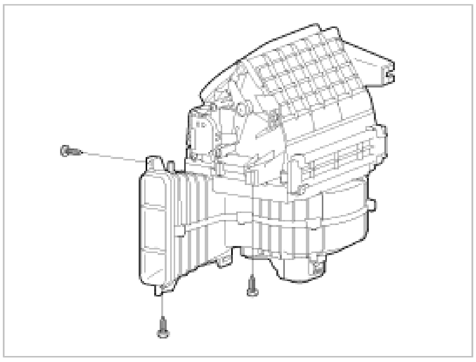


1. Outlet duct seal	7. Blower upper case
2. Inlet duct case	8. Blower lower case
3. Inlet door	9. Blower seal
4. Intake actuator	10. Blower motor
5. Air filter	11. Resistor (MANUAL)
6. Air filter housing	12. Power mosfet (AUTOMATIC)

Heating,Ventilation, Air Conditioning > Blower > Blower Unit > Repair procedures

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the heater & blower unit (Refer to HA-51)
3. Disconnect the connectors from the intake actuator, blower relay, the blower motor, resistor (MANUAL) and power mosfet (AUTOMATIC).
4. Remove the self-tapping screws and the blower unit.

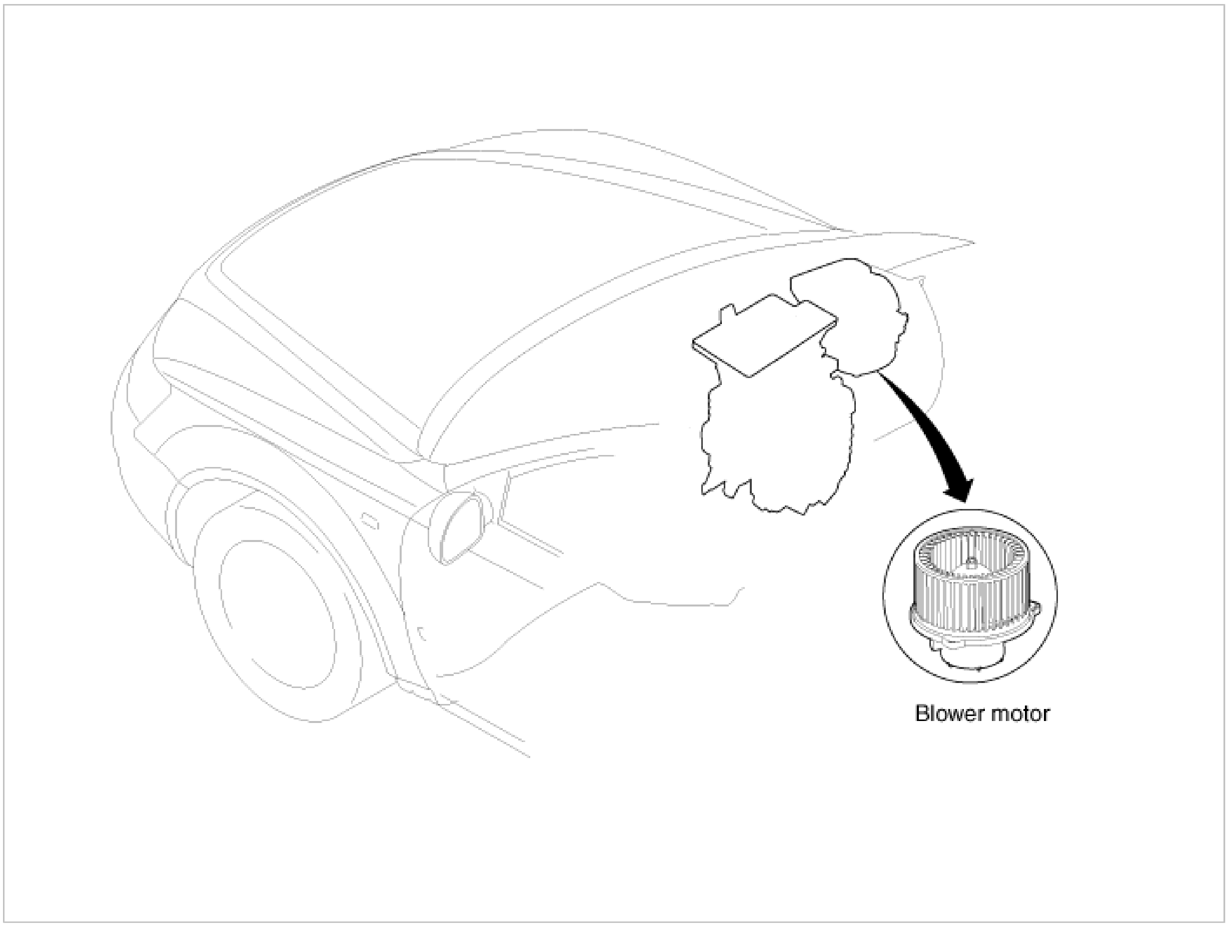


> **NOTE**
>
> Make sure that there is no air leaking out of the blower and duct joints.

5. Install in the reverse order of removal.

Heating,Ventilation, Air Conditioning > Blower > Blower Motor > Components and Components Location

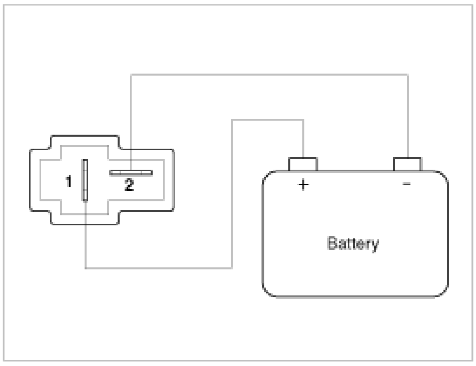
COMPONENT LOCATION



Heating,Ventilation, Air Conditioning > Blower > Blower Motor > Repair procedures

INSPECTION

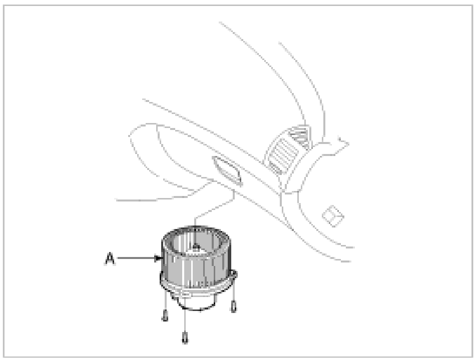
1. Connect the battery voltage and check the blower motor rotation.



2. If the blower motor does not operate properly, substitute with a known-good blower motor and check for proper operation.
3. If the problem is corrected, replace the blower motor.

REPLACEMENT

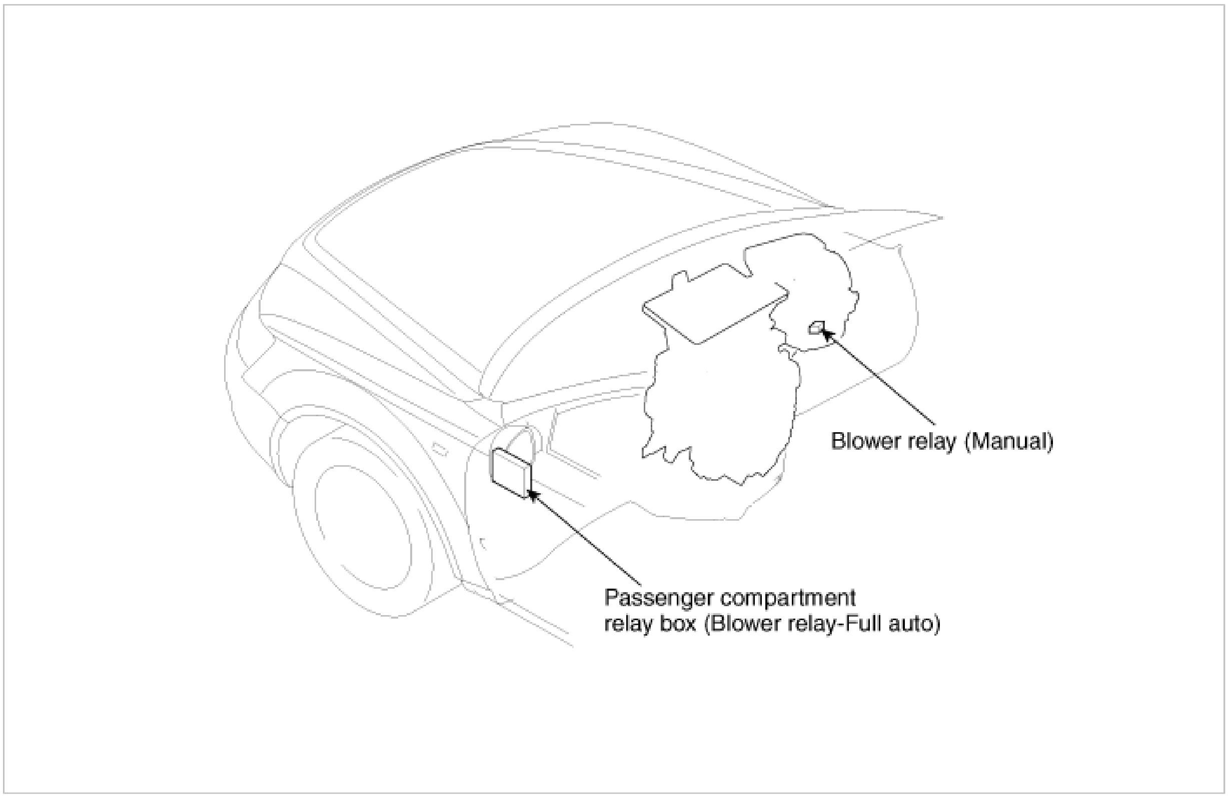
1. Disconnect the negative (-) battery terminal.
2. Remove the under cover after loosening 2 screws.
3. Disconnect the connector of the blower motor.
4. Remove the blower motor (A) after loosening the mounting 3 screws.



5. Installation is the reverse order of removal.

Heating,Ventilation, Air Conditioning > Blower > Blower Relay > Components and Components Location

COMPONENT LOCATION

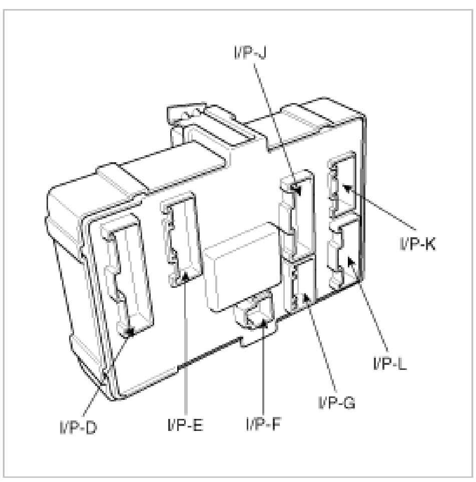


Heating,Ventilation, Air Conditioning > Blower > Blower Relay > Repair procedures

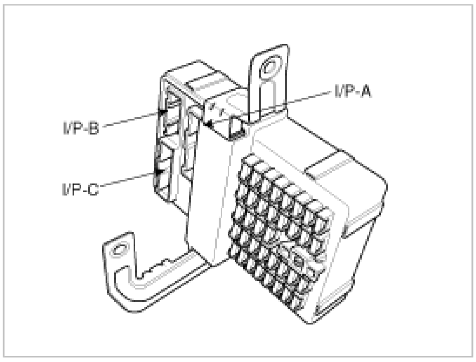
INSPECTION

FULL AUTO TYPE

1. Disconnect the negative (-) battery terminal.
2. Remove the passenger compartment relay box.
   Check for continuity between the terminals.
3. There should be continuity between the No.9 in the I/P-K and No.15 in the I/P-A terminals when power and ground are connected to the No.16 in the I/P-D and No.13 I/P-B terminals in the passenger compartment relay box.
4. There should be no continuity between the No.9 in the I/P-K and No.15 in the I/P-A terminals when power is disconnected.



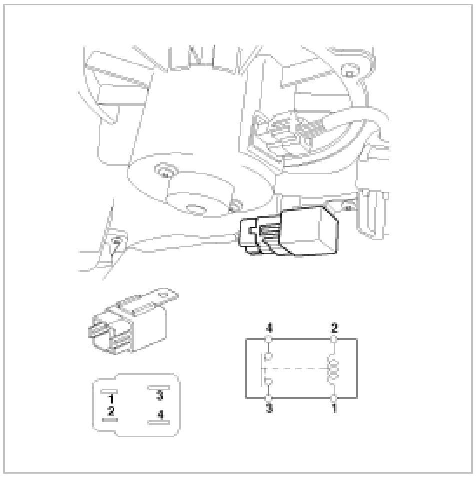
Position \ Terminal	I/P-K (9)	I/P-A (15)	I/P-D (16)	I/P-B (13)
Disconnected			○	○
Connected	○	○	⊖	⊕



5. If the blower motor voltage does not operate properly, substitute with a known-good blower relay and check for proper operation.
6. If the problem is corrected, replace the blower relay.

HI-BLOWER RELAY INSPECTION

1. There should be continuity between the No.3 and No.4 terminals when power and ground are connected to the No.1 and No.2 terminals.
2. There should be no continuity between the No.3 and No.4 terminals when power is disconnected.

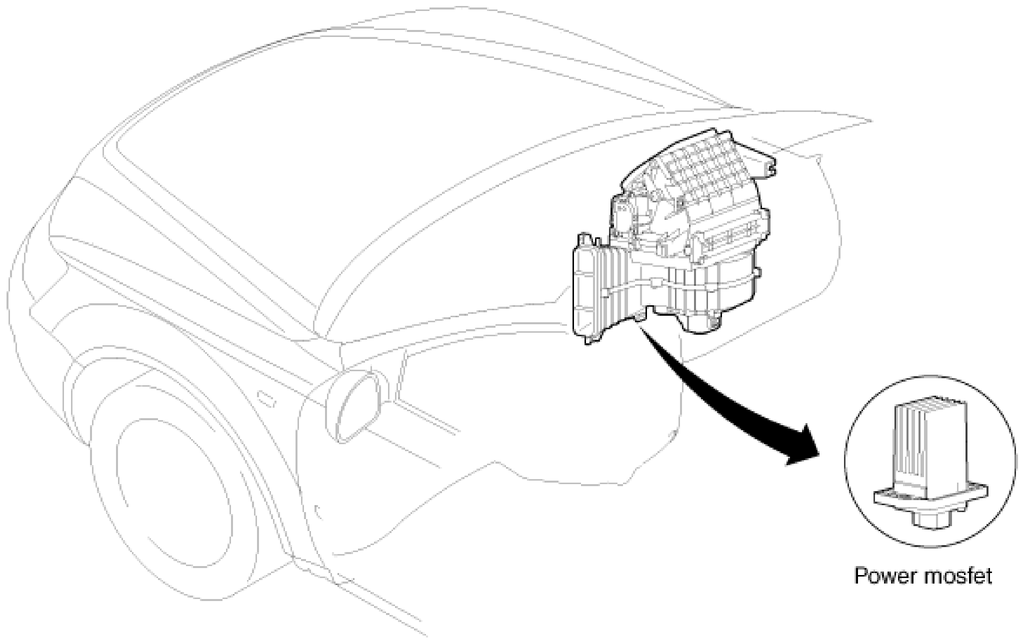


Terminal / Position	3	4	1	2
Disconnected			○	○
Connected	○	○	⊕	⊖

Heating,Ventilation, Air Conditioning > Blower > Power Mosfet > Components and Components Location

COMPONENT LOCATION

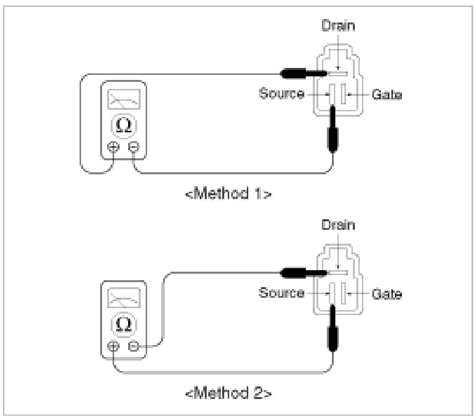
[AUTOMATIC]



Heating,Ventilation, Air Conditioning > Blower > Power Mosfet > Repair procedures

INSPECTION

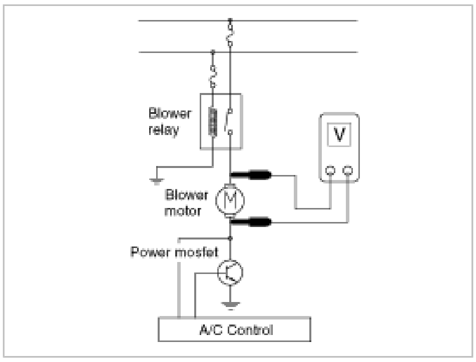
1. Disconnect the negative (-) battery terminal.
2. Remove the power mosfet.Measure resistance between Drain and Source using resistance tester. You can estimate whether power mosfet is failure or not refering to the specification.



FET Fail Check

Resistance (Drain-Source)		Specification	
Measuring method		1	2
Mosfet	Drain	+	-
	Source	-	+
Classification	Normal	∞	About 3 MΩ
	Short	About 0~300Ω	About 0~300Ω
	Open	∞	∞

3. If If the measured resistance is not normal specification, replace the power mosfet.
4. If it is normal, install the power mosfet and ignition "ON".
   Manually operate the control switch and measure the voltage between pin 1 and 2 of blower motor.
5. Select the control switch to raise voltage until high speed.

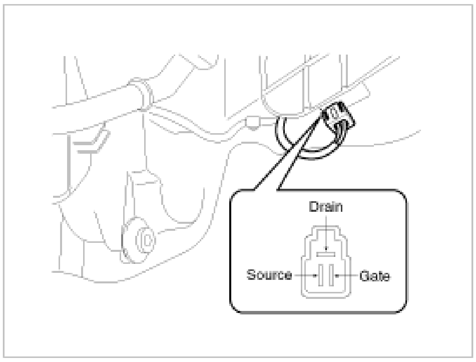


Fan	Motor voltage(V) ± 0.5V
First speed	3.8
Second speed	4.9
Third speed	6.1
Fourth speed	7.2
Fifth speed	8.3
Sixth speed	9.5
Seventh speed	10.6
Eighth speed	Battery (+)

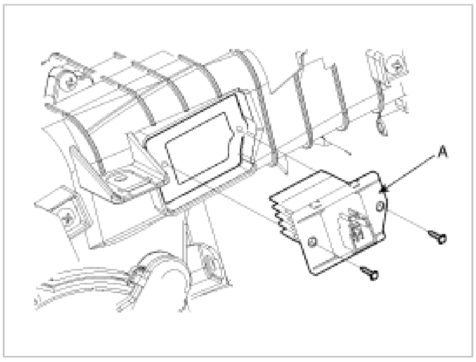
6. If the measured voltage is not within specification, substitute with a known-good power mosfet and check for proper operation.
7. If the problem is corrected, replace the power mosfet.

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Disconnect the connector of the power mosfet at the below blower unit.



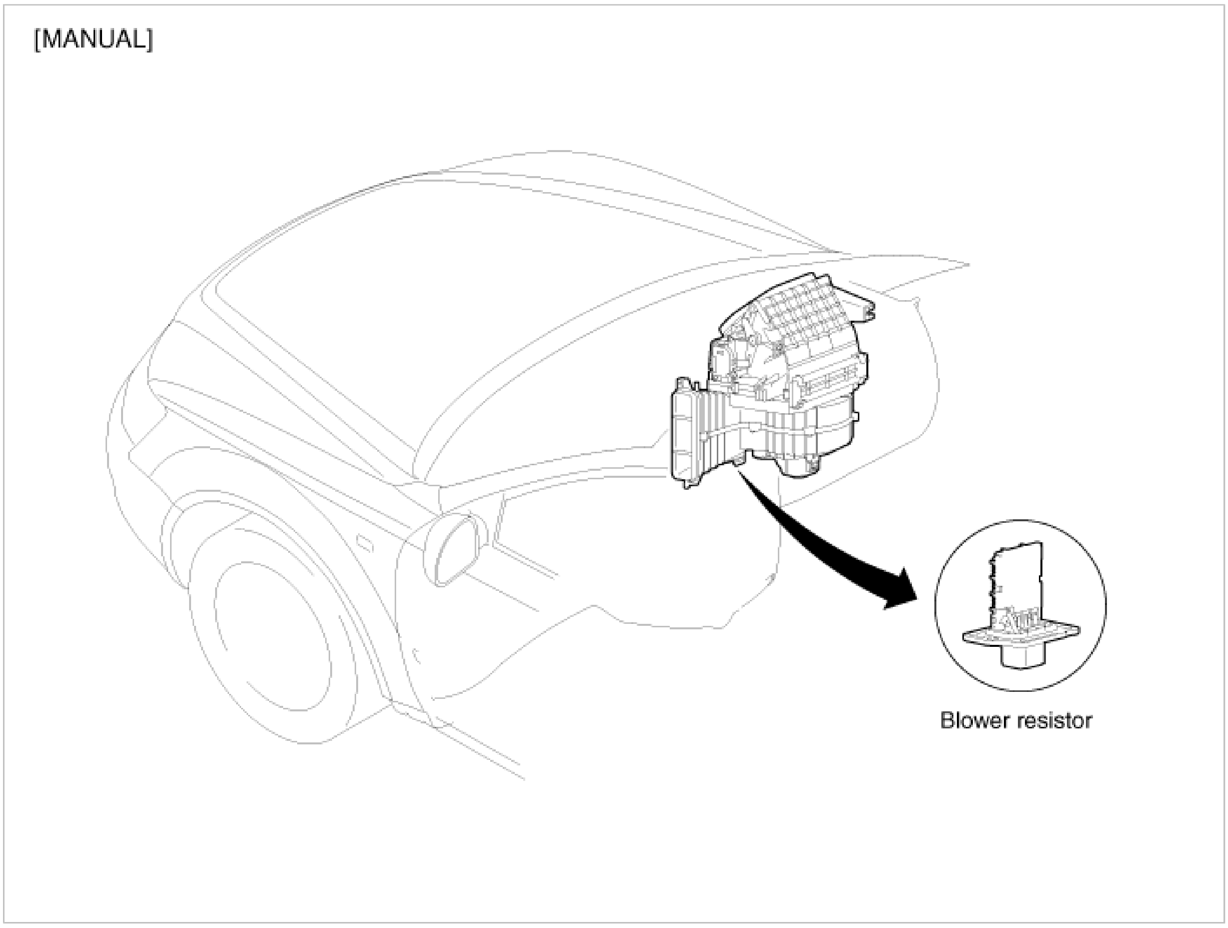
3. Remove the power mosfet (A) after loosening the mounting screws.



4. Install in the reverse order of removal.

Heating,Ventilation, Air Conditioning > Blower > Blower Resistor > Components and Components Location

COMPONENT LOCATION

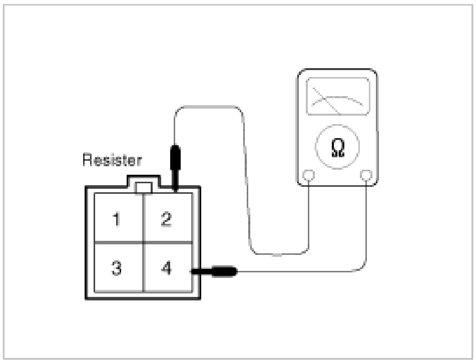


Heating,Ventilation, Air Conditioning > Blower > Blower Resistor > Repair procedures

INSPECTION

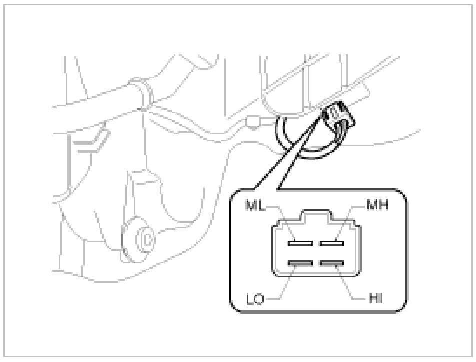
1. Measure terminal-to-terminal resistance of the blower resistor.
2. If measured resistance is not within specification, the blower resistor must be replaced. (After removing the resistor)

Terminal / Speed / Resistance ohmmeter	2	1	4	3	Resistance (Ω)
	MH	ML	HI	LO	
Measurement of resistance between each terminal			O	O	2.9 ± 5%
		O	O		1.5 ± 5%
	O		O		0.5 ± 5%

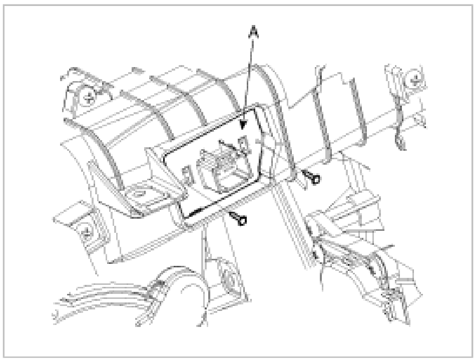


REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Disconnect the connector of the blower resistor at the below blower unit.



3. Remove the blower resistor(A) after loosening the mounting screws.



4. Install in the reverse order of removal.

Heating,Ventilation, Air Conditioning > Blower > A/C Air Filter > Description and Operation

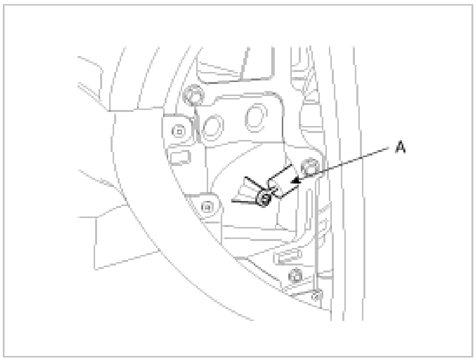
DESCRIPTION

This has particle filter which eliminates foreign materials and odor. The particle filter includes odor filter as well as conventional dust filter to ensure a comfortable interior environment.

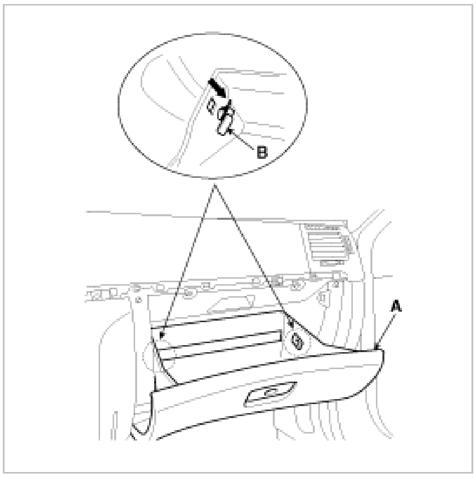
Heating,Ventilation, Air Conditioning > Blower > A/C Air Filter > Repair procedures

REPLACEMENT

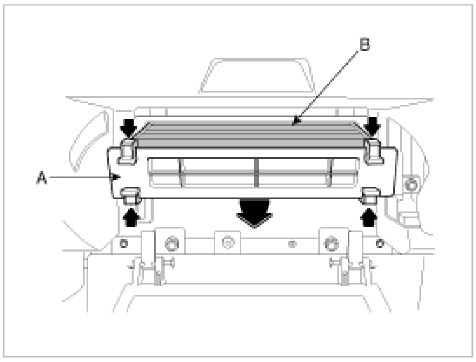
1. Remove the damper (A) from the glove box after removing side cover.



2. Open the glove box (A). Lower the glove box down completely by removing the glove box stopper (B) to the glove box.



3. Remove the filter cover (A) with pushing the knob.
4. Replace the air filter (B), install it after making sure of the direction of air filter.



NOTE

In case of driving in an air-polluted area or rugged terrain, check and replace the air filter as frequently as possible.

Replacement period : 15,000 km (9320 mile)

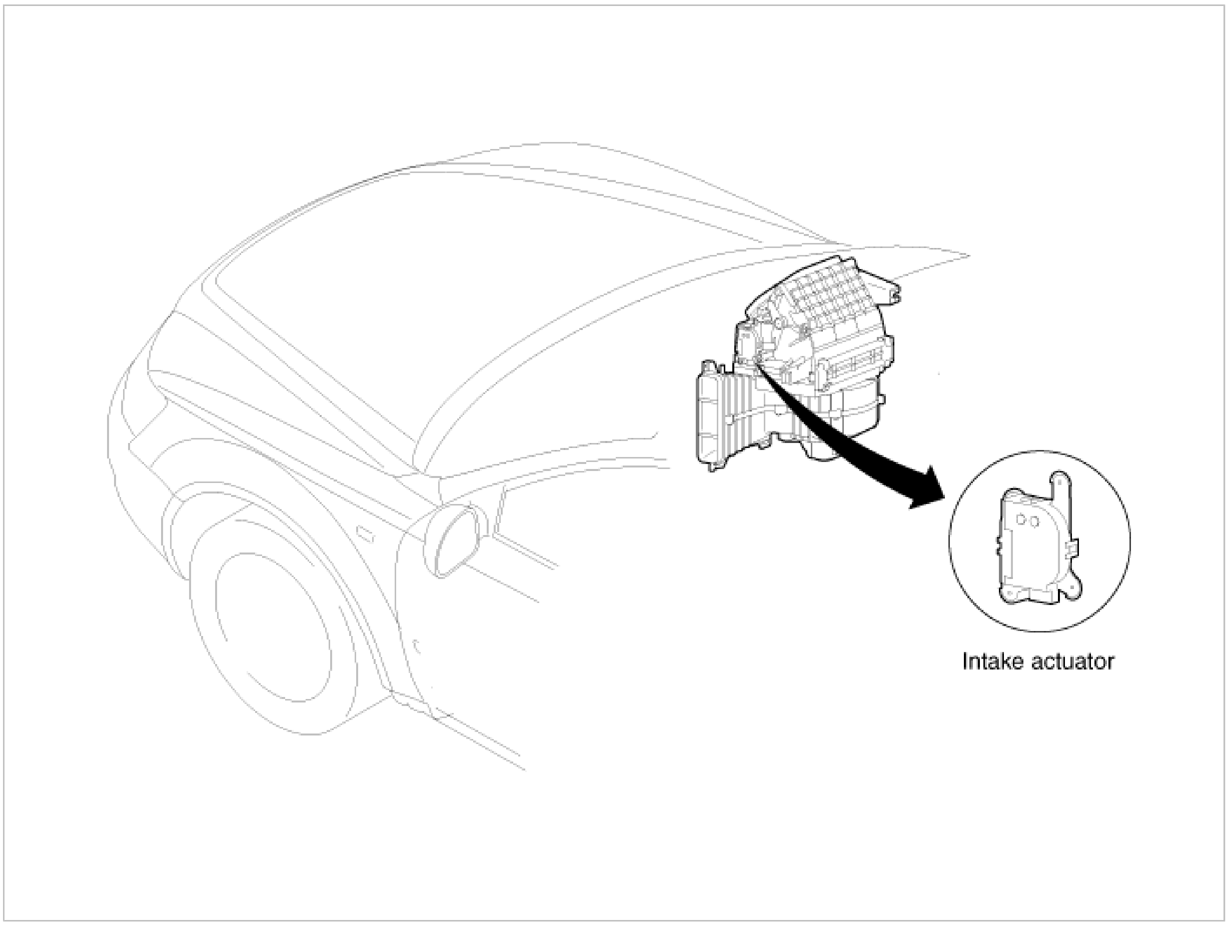
Heating,Ventilation, Air Conditioning > Blower > Intake Actuator > Description and Operation

DESCRIPTION

1. The intake actuator is located at the blower unit.
2. It regulates the intake door by signal from control unit.
3. Pressing the intake selection switch will shift between recirculation and fresh air modes.

Heating,Ventilation, Air Conditioning > Blower > Intake Actuator > Components and Components Location

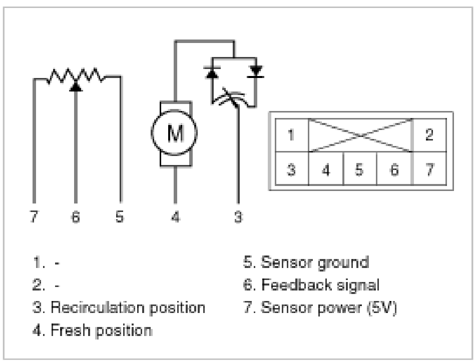
COMPONENT LOCATION



Heating,Ventilation, Air Conditioning > Blower > Intake Actuator > Repair procedures

INSPECTION

1. Ignition "OFF".
2. Disconnect the connector of intake actuator.
3. Verify that the intake actuator actuator operates to the recirculation position when connecting 12V to the terminal 3 and grounding terminal 4.
4. Verify that the intake actuator operates to the fresh position when the connections are reversed.



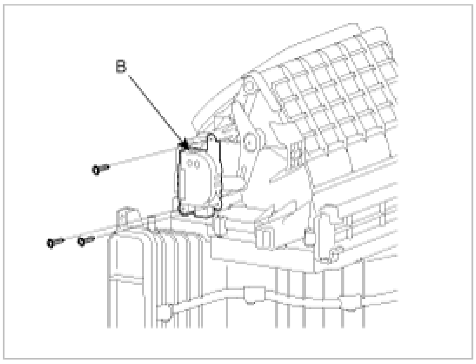
Door position	Voltage (5 - 6)	Error detecting
Recirculation	0.3 ± 0.15V	Low voltage : 0.1V or less
Fresh	4.7 ± 0.15V	High voltage : 4.9V or more

5. If the intake actuator does not operate properly, substitute with a known-good intake actuator and check for proper operation.

6. If the problem is corrected, replace the intake actuator.

REPLACEMENT

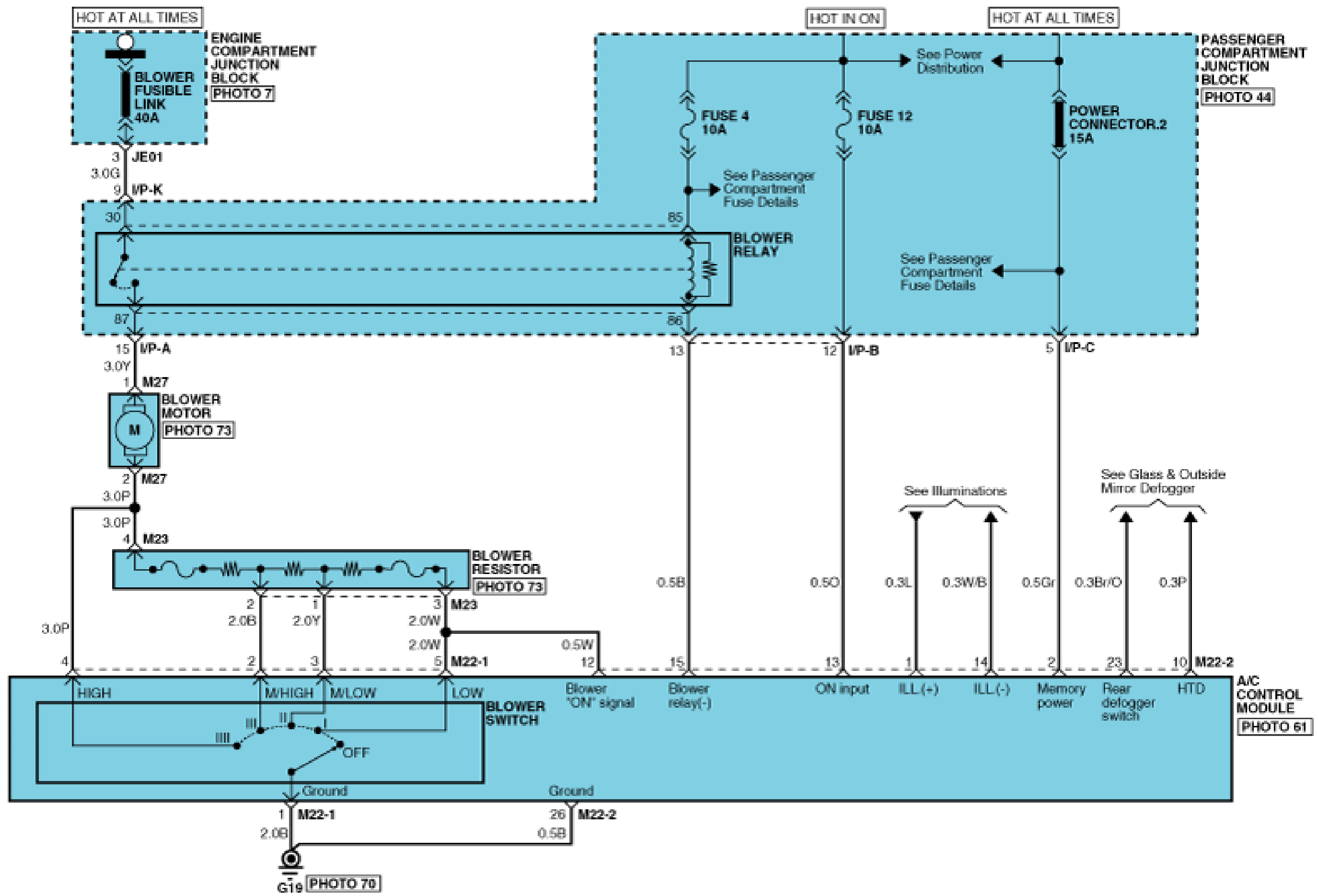
1. Disconnect the negative (-) battery terminal.
2. Remove the glove box (Refer to the BD group).
3. Disconnect the intake actuator connector.
4. Loosen the mounting screw and then remove the intake actuator (B) from the blower unit (A).

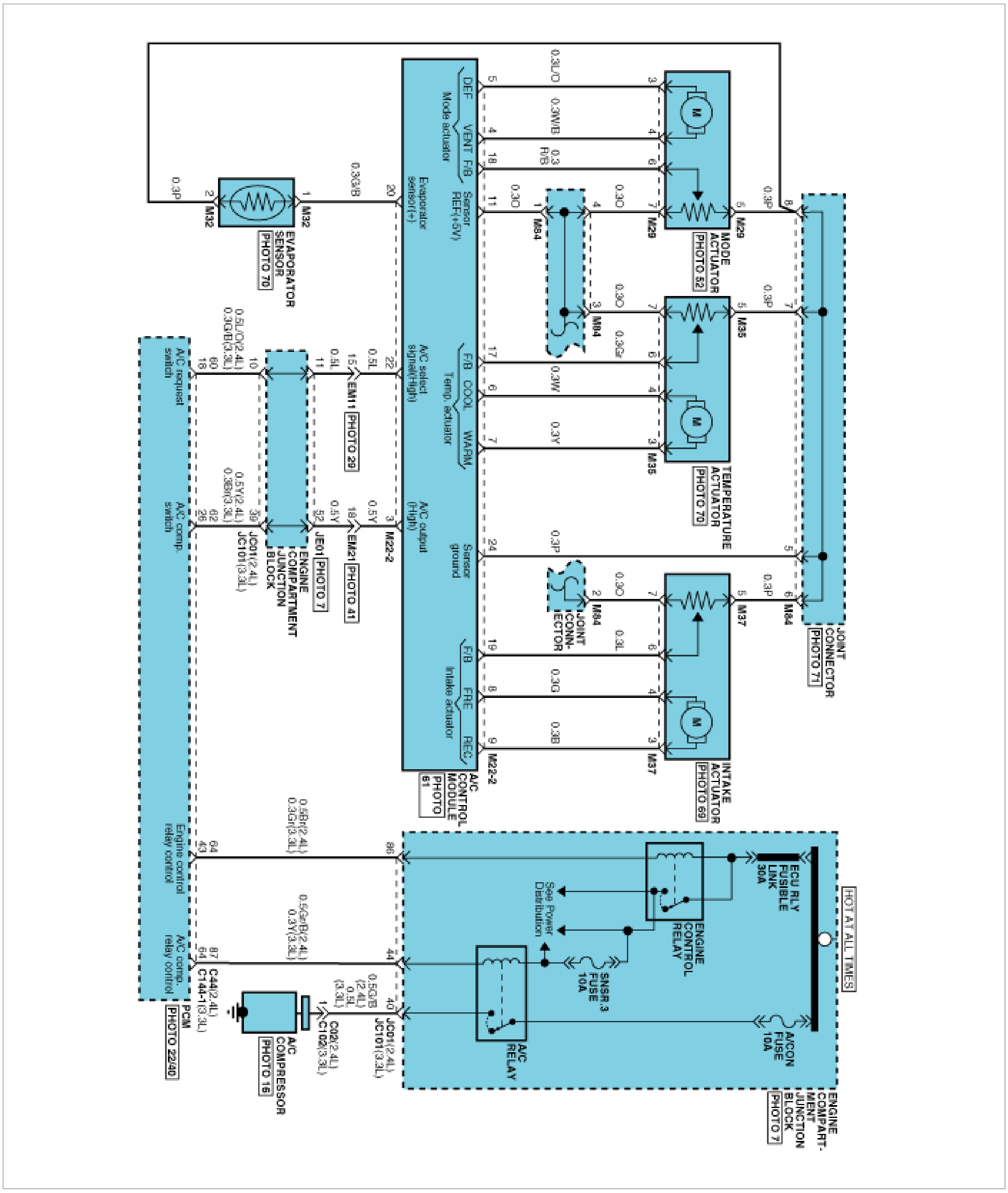


5. Install in the reverse order of removal.

Heating,Ventilation, Air Conditioning > Blower > Control Panel > Schematic Diagrams

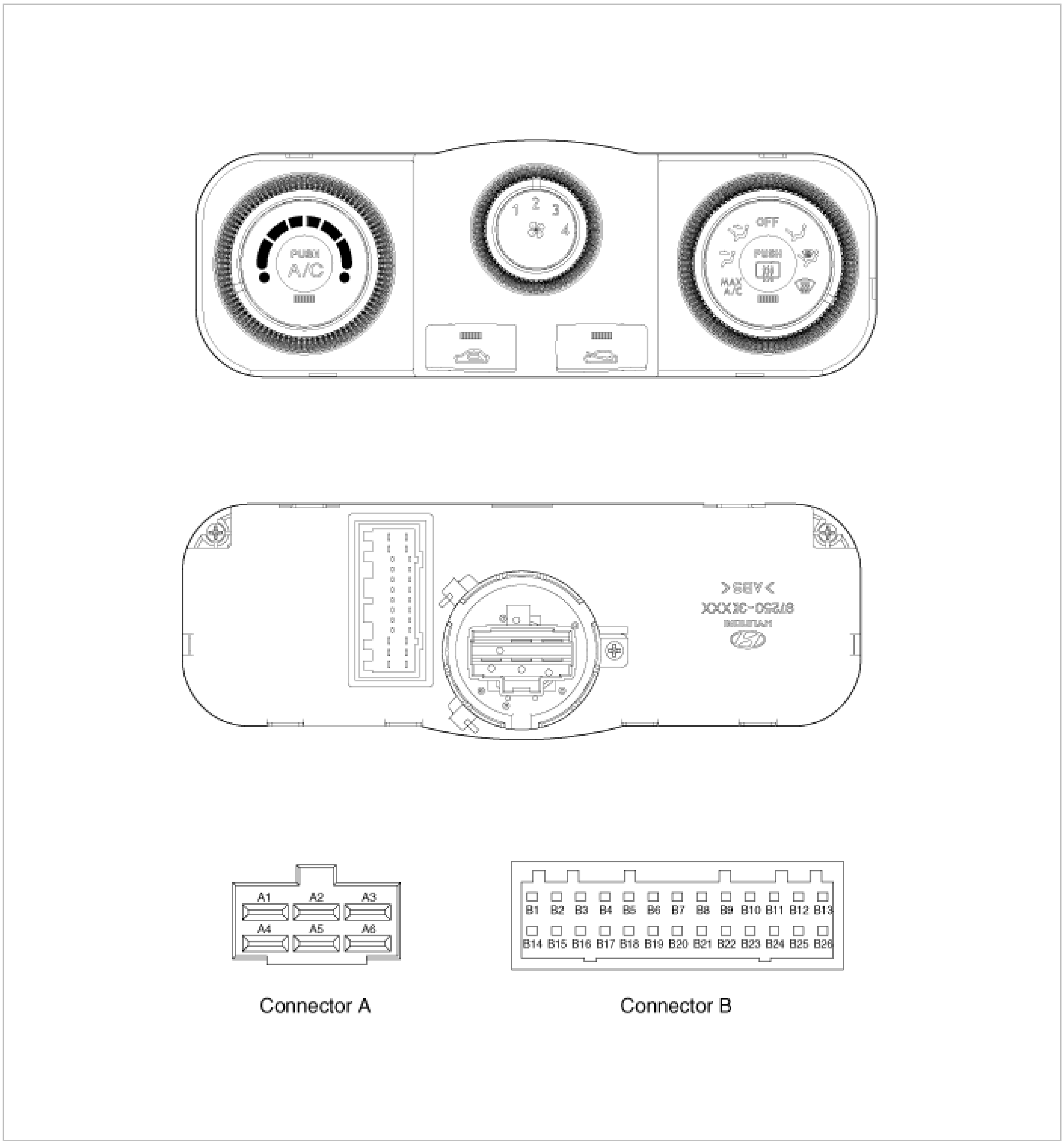
CIRCUIT DIAGRAM


HOT AT ALL TIMES
ENGINE COMPARTMENT JUNCTION BLOCK
PHOTO 7
BLOWER FUSIBLE LINK 40A
JE01
3.0G
I/P-K
30
BLOWER RELAY
87
85
86
I/P-A
3.0Y
M27
BLOWER MOTOR
PHOTO 73
3.0P
M23
BLOWER RESISTOR
PHOTO 73
2.0B
2.0Y
2.0W
0.5W
M22-1
HOT IN ON
HOT AT ALL TIMES
PASSENGER COMPARTMENT JUNCTION BLOCK
PHOTO 44
See Power Distribution
FUSE 4 10A
FUSE 12 10A
POWER CONNECTOR.2 15A
See Passenger Compartment Fuse Details
See Passenger Compartment Fuse Details
I/P-B
I/P-C
0.5B
0.5O
0.3L
0.3W/B
0.5Gr
0.3Br/O
0.3P
See Illuminations
See Glass & Outside Mirror Defogger
M22-2
HIGH
M/HIGH
M/LOW
LOW
BLOWER SWITCH
OFF
Ground
Blower "ON" signal
Blower relay(-)
ON input
ILL.(+)
ILL.(-)
Memory power
Rear defogger switch
HTD
A/C CONTROL MODULE
PHOTO 61
2.0B
0.5B
G19
PHOTO 70



Heating,Ventilation, Air Conditioning > Blower > Control Panel > Components and Components Location

COMPONENTS



CONNECTOR PIN FUNCTION

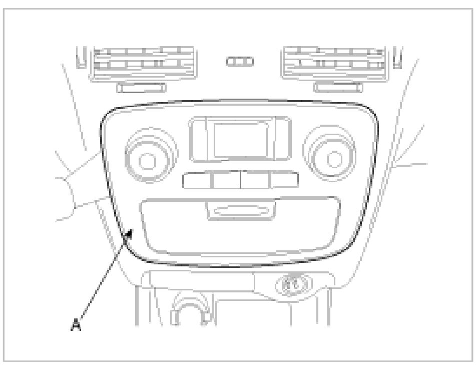
CONNECTOR	PIN	FUNCTION
Connector (A)	1	Ground
	2	Middle high
	3	Middle low
	4	High
	5	Low
	6	-
	1	Tail lamp (+)
	2	Battery
	3	A/C output
	4	Mode vent
	5	Mode defrost
	6	Temp actuator cool
	7	Temp actuator warm

Connector (B)	8	Intake (Fresh)
	9	Intake (Recirculation)
	10	Rear defogger indicator
	11	Sensor power (+5V)
	12	Blower ON signal
	13	IG2
	14	Tail lamp (-) : Rheostat
	15	Blower relay (-)
	16	-
	17	Temp actuator feedback signal
	18	Mode actuator feedback signal
	19	Intake actuator feedback signal
	20	Evaporator temperature sensor
	21	-
	22	A/C select signal
	23	Rear defogger switch
	24	Sensor ground
	25	-
	26	Ground

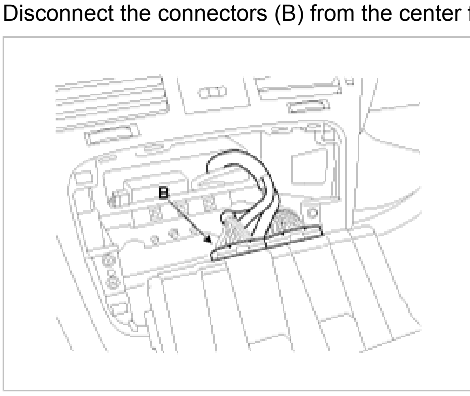
Heating,Ventilation, Air Conditioning > Blower > Control Panel > Repair procedures

REPLACEMENT

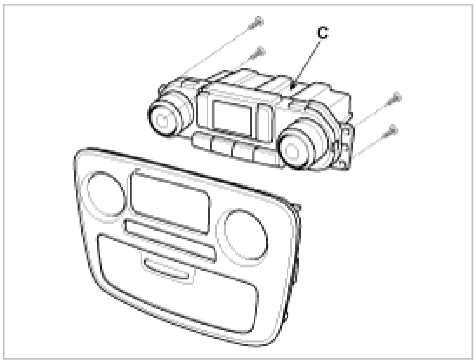
1. Disconnect the negative (-) battery terminal.
2. Remove the center facia panel (A) after pulling it by using a regular screwdriver (-).



3. Disconnect the connectors (B) from the center facia.



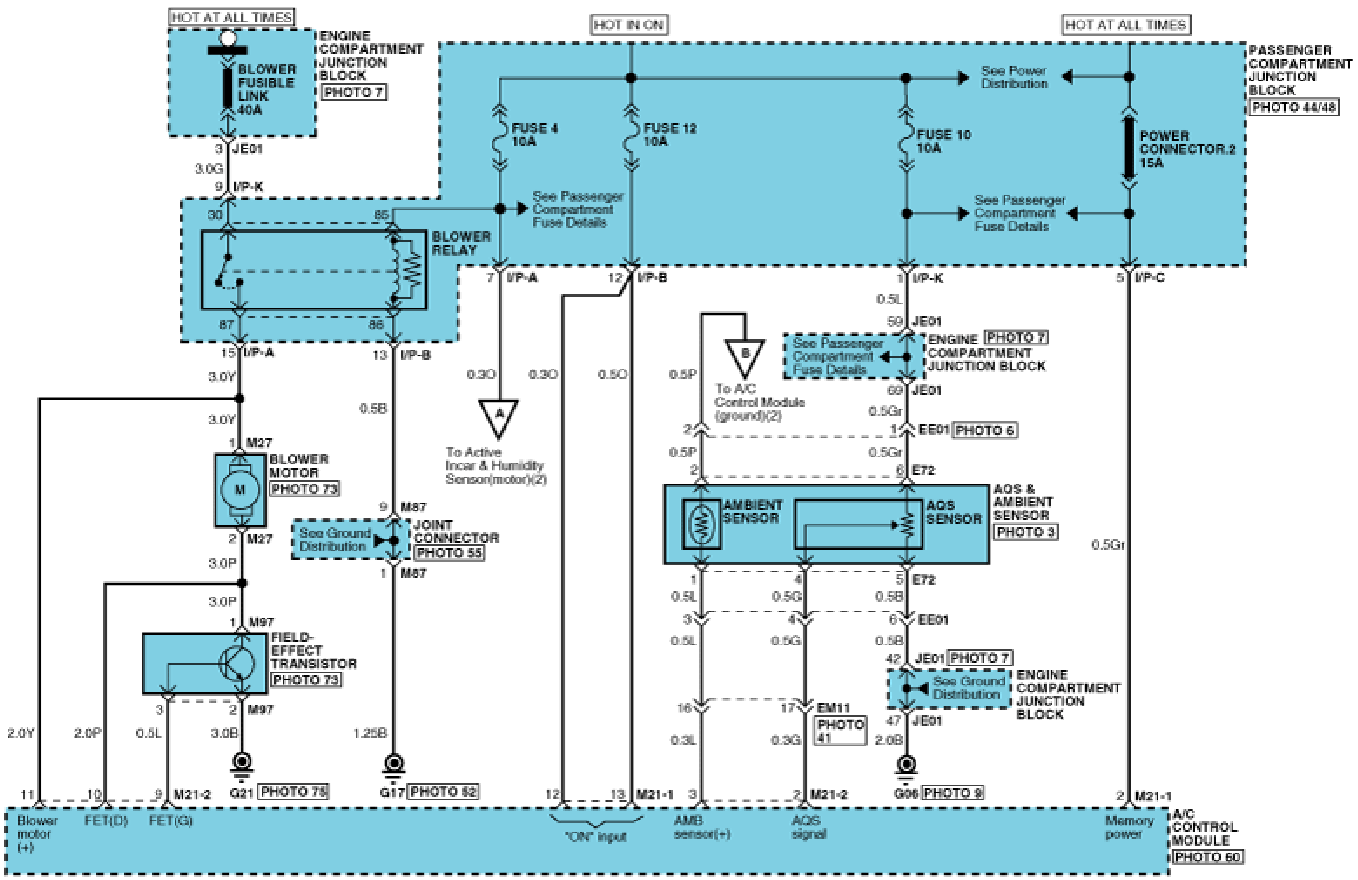
4. Remove the heater & A/C controller (C).

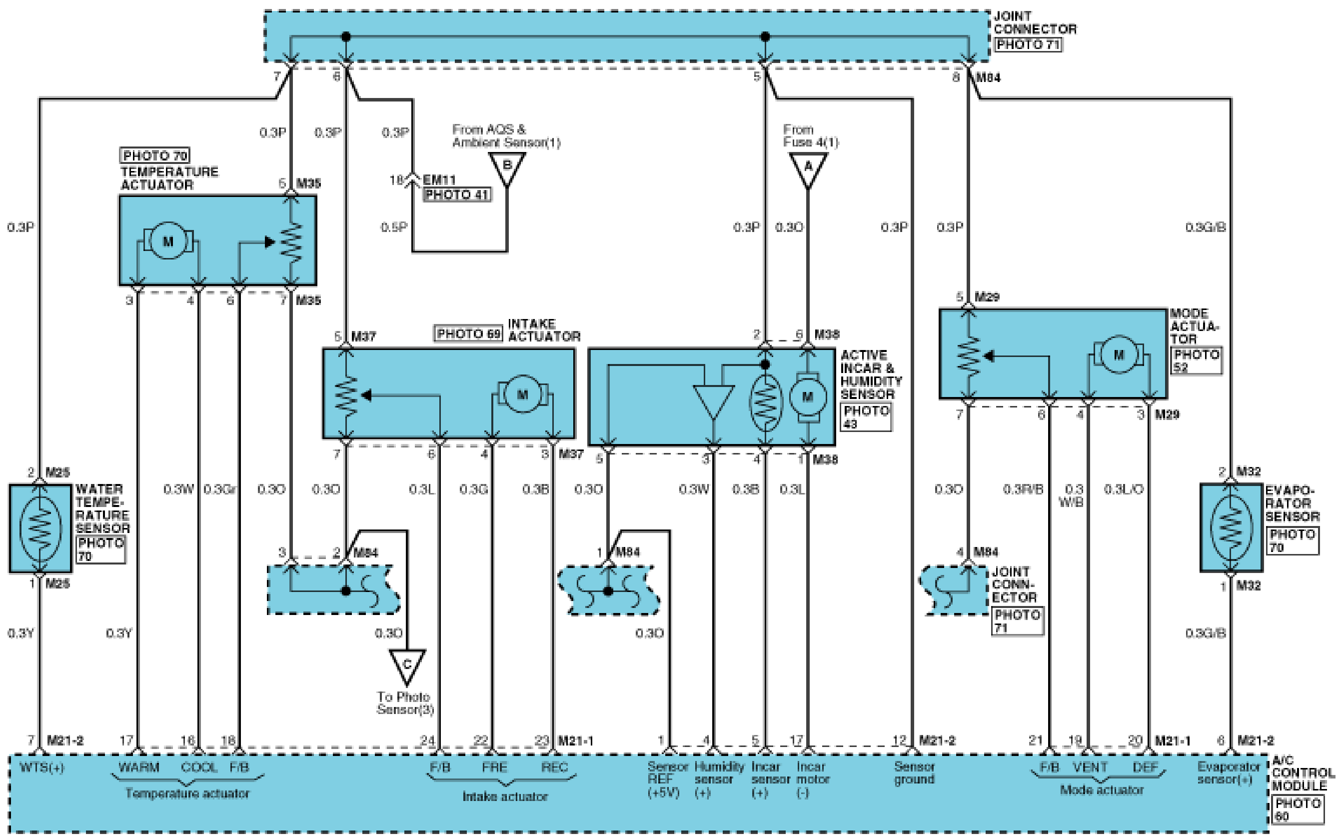


5. Install in the reverse order of removal.

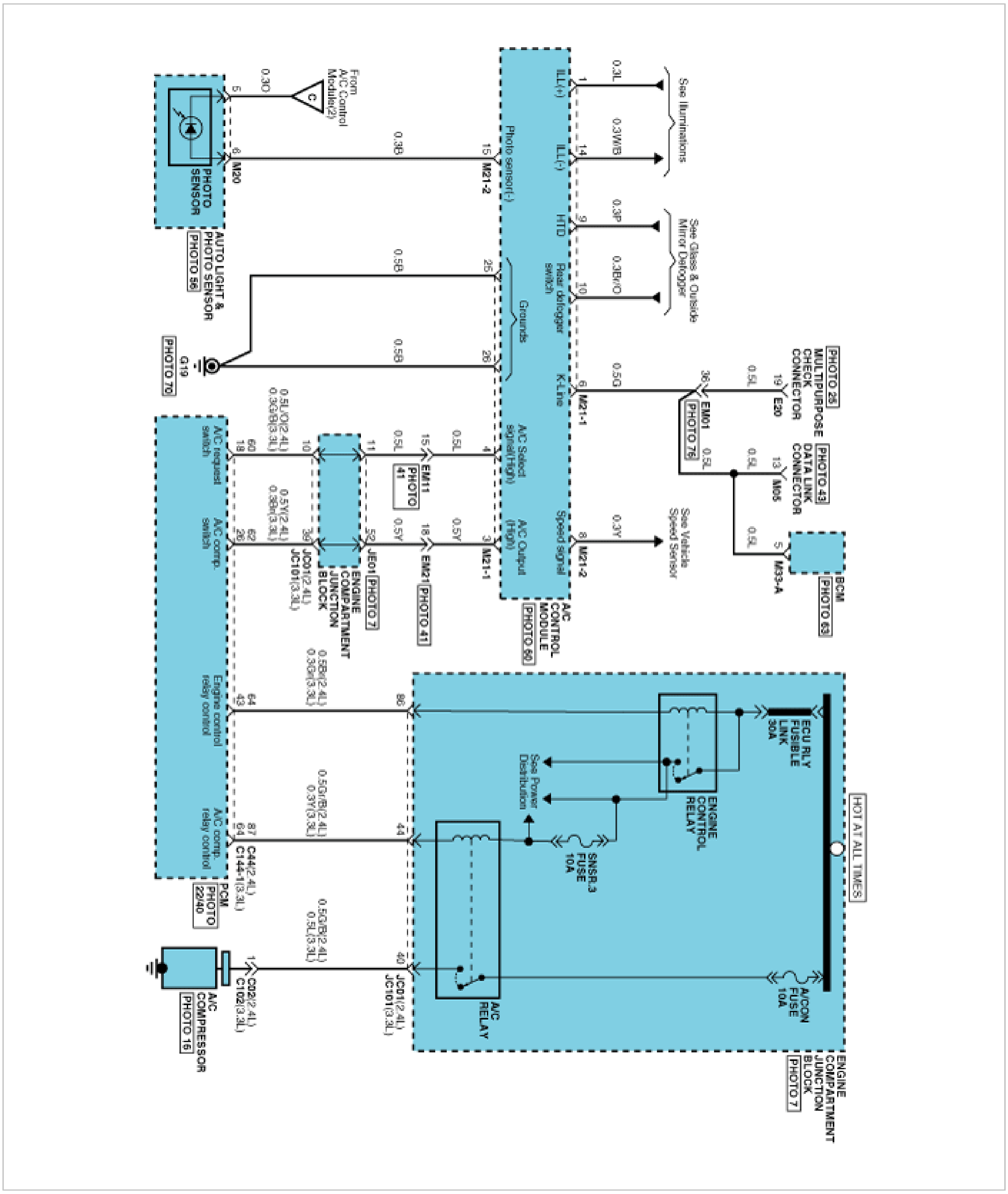
Heating,Ventilation, Air Conditioning > Controller > Manual Controller > Schematic Diagrams

CIRCUIT DIAGRAM

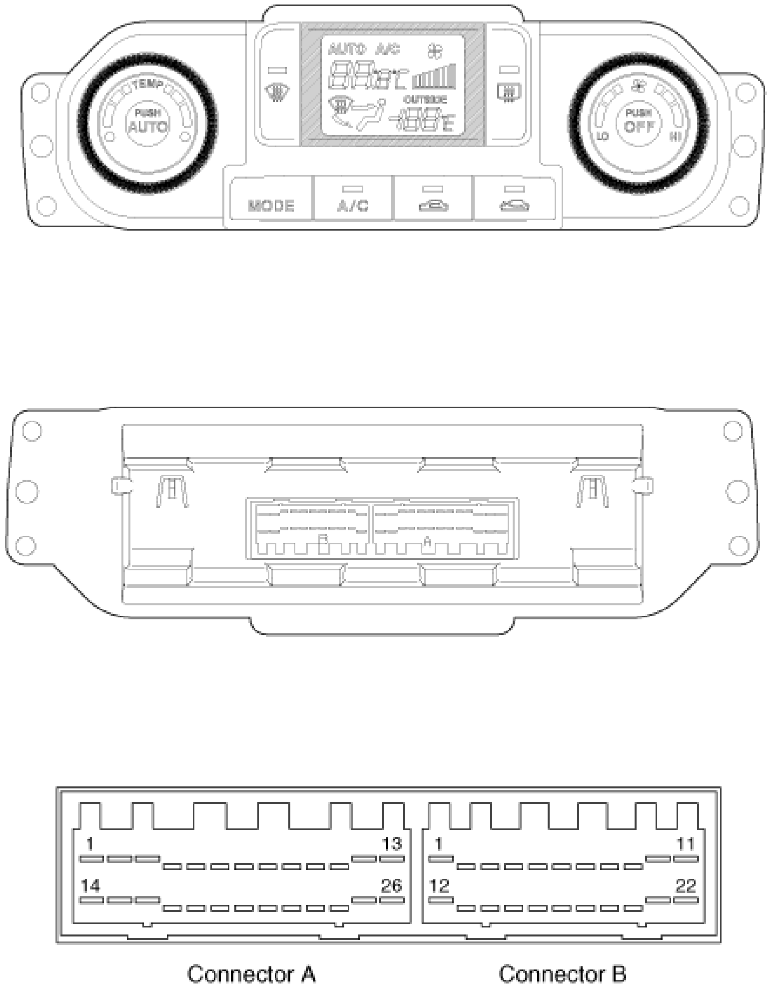

HOT AT ALL TIMES
ENGINE COMPARTMENT JUNCTION BLOCK
PHOTO 7
BLOWER FUSIBLE LINK 40A
HOT IN ON
HOT AT ALL TIMES
PASSENGER COMPARTMENT JUNCTION BLOCK
PHOTO 44/48
FUSE 4 10A
FUSE 12 10A
FUSE 10 10A
See Power Distribution
POWER CONNECTOR.2 15A
See Passenger Compartment Fuse Details
BLOWER RELAY
To Active Incar & Humidity Sensor(motor)(2)
To A/C Control Module (ground)(2)
BLOWER MOTOR
PHOTO 73
See Ground Distribution
JOINT CONNECTOR
PHOTO 55
FIELD-EFFECT TRANSISTOR
PHOTO 73
AMBIENT SENSOR
AQS SENSOR
AQS & AMBIENT SENSOR
PHOTO 3
PHOTO 6
PHOTO 41
PHOTO 75
PHOTO 82
PHOTO 9
Blower motor (+)
FET(D)
FET(G)
"ON" input
AMB sensor(+)
AQS signal
Memory power
A/C CONTROL MODULE
PHOTO 60



JOINT CONNECTOR
PHOTO 71
M84
0.3P
From AQS & Ambient Sensor(1)
EM11
PHOTO 41
0.5P
PHOTO 70
TEMPERATURE ACTUATOR
M35
From Fuse 4(1)
0.3O
MODE ACTUATOR
PHOTO 52
M29
PHOTO 69
INTAKE ACTUATOR
M37
ACTIVE INCAR & HUMIDITY SENSOR
PHOTO 43
M38
0.3G/B
WATER TEMPERATURE SENSOR
PHOTO 70
M25
0.3W
0.3Gr
0.3L
0.3G
0.3B
0.3R/B
0.3 W/B
0.3L/O
EVAPORATOR SENSOR
PHOTO 70
M32
JOINT CONNECTOR
PHOTO 71
0.3Y
To Photo Sensor(3)
M21-2
M21-1
WTS(+)
WARM
COOL
F/B
Temperature actuator
F/B
FRE
REC
Intake actuator
Sensor REF (+5V)
Humidity sensor (+)
Incar sensor (+)
Incar motor (-)
Sensor ground
F/B
VENT
DEF
Mode actuator
Evaporator sensor(+)
A/C CONTROL MODULE
PHOTO 60


HOT AT ALL TIMES
ENGINE COMPARTMENT JUNCTION BLOCK
PHOTO 7
ECU RLY FUSIBLE LINK 30A
ENGINE CONTROL RELAY
SNSR.3 FUSE 10A
A/CON FUSE 10A
A/C RELAY
See Power Distribution
A/C COMPRESSOR
PHOTO 16
PCM
PHOTO 22/40
A/C CONTROL MODULE
PHOTO 60
AUTO LIGHT & PHOTO SENSOR
PHOTO 56
PHOTO SENSOR
G19
PHOTO 70
MULTIPURPOSE CHECK CONNECTOR
PHOTO 25
DATA LINK CONNECTOR
PHOTO 43
BCM
PHOTO 63
See Illuminations
See Glass & Outside Mirror Defogger
See Vehicle Speed Sensor
ILL(+)
ILL(-)
HTD
Rear defogger switch
K-Line
Speed signal
Photo sensor(-)
Grounds
A/C Select signal(High)
A/C Output (High)
A/C request switch
A/C comp. switch
Engine control relay control
A/C comp. relay control

COMPONENTS



CONNECTOR PIN FUNCTION

CONNECTOR	PIN	FUNCTION	CONNECTOR	PIN	FUNCTION
	1	Tail lamp (+)		1	Sensor power (5V)
	2	Battery (+)		2	-
	3	A/C output		3	Ambient sensor (+)
	4	A/C select signal		4	Humidity sensor (+)
	5	-		5	In car sensor (+)
	6	Diagnostic tool		6	Evaporator temperature sensor (+)
	7	-		7	Water temperature sensor
	8	-		8	Speed sensor
	9	Rear defogger indicator		9	Power mosfet (G)
	10	Rear defogger switch		10	Power mosfet (D)
	11	-		11	Blower motor (+)
	12	IG2		12	Sensor ground

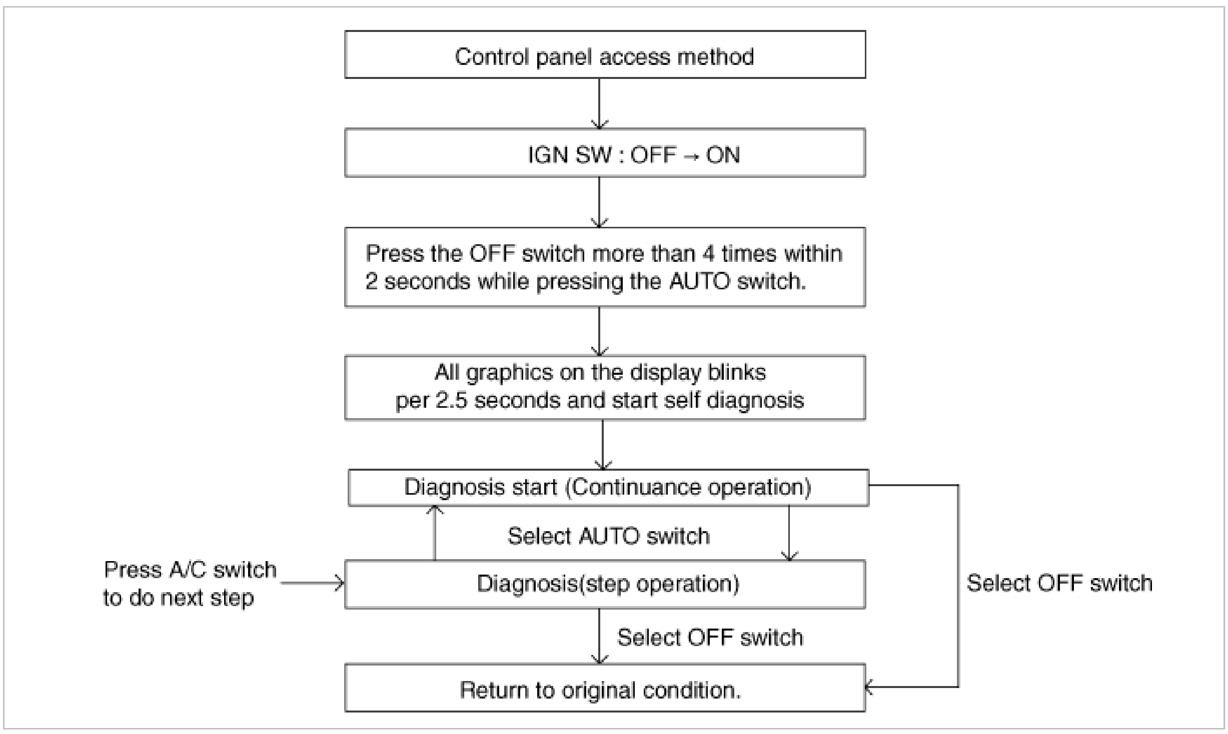
CONNECTOR (A)	13	IG2	CONNECTOR (B)	13	-
	14	Rheostat		14	-
	15	-		15	Photo sensor (+)
	16	Temp actuator cool		16	-
	17	Temp actuator warm		17	In car motor
	18	Temp actuator feedback signal		18	-
	19	Mode vent		19	Blower ON signal
	20	Mode defrost		20	
	21	Mode actuator feedback signal		21	
	22	Intake fresh		22	
	23	Intake recirculation			
	24	Intake feedback signal			
	25	Ground			
	26	Ground			

Heating,Ventilation, Air Conditioning > Controller > Manual Controller > Repair procedures

SELF-DIAGNOSIS

Self-diagnosis process

The F.A.T.C. module self test feature will detect electrical malfunction and provide error codes for system components with suspected failures.



NOTE

Turn off the A/C system during the DTC check.

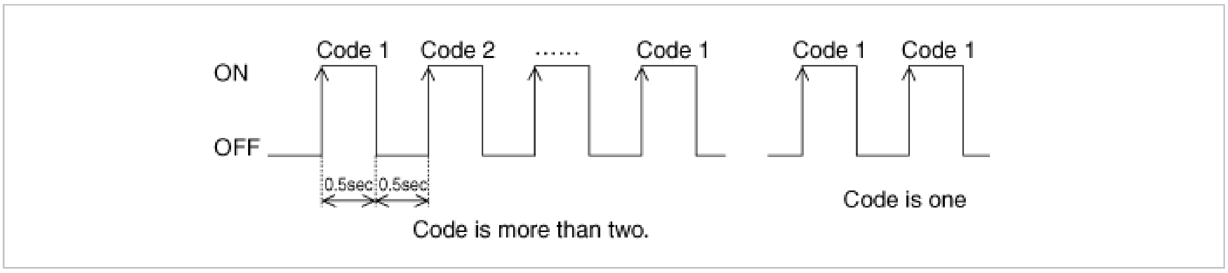
HOW TO READ SELF-DIAGNOSTIC CODE

1. After the display panel flickers three times every 0.5 second, the corresponding fault code flickers on the setup temperature display panel every 0.5 second and will show two figures.
2. Fault code

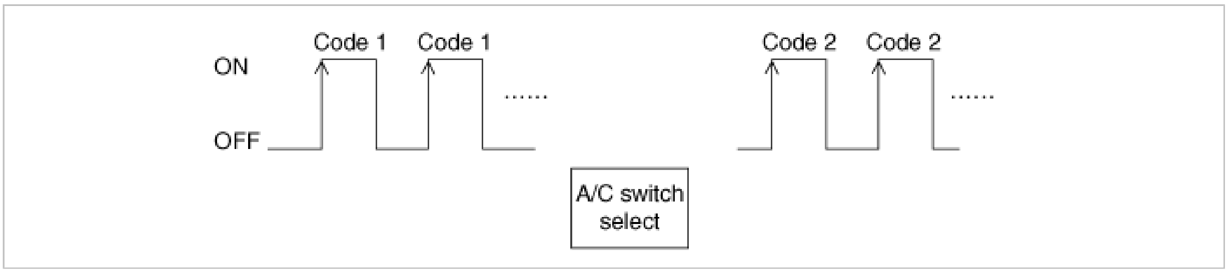
Fault code		

Control unit	Scan tool (DTC)	Fail description
00	-	Normal
11	B1234	In-car temperature sensor open (High)
12	B1233	In-car temperature sensor short (Low)
13	B1238	Ambient temperature sensor open (High)
14	B1237	Ambient temperature sensor short (Low)
15	B1202	Water temperature sensor open (High)
16	B1203	Water temperature sensor short (Low)
17	B1242	Evaporator temperature sensor open (High)
18	B1241	Evaporator temperature sensor short (Low)
19	B1245	Air mix potentiometer open (Low) - Driver
19	B1246	Air mix potentiometer short (High) - Driver
20	B2406	Air mix motor failure (Driver)
21	B1249	Direction potentiometer open (Low) - Driver
21	B1250	Direction potentiometer short (High) - Driver
22	B2409	Direction control motor failure (Driver)
23	B1200	Humidity sensor open (High)
24	B1201	Humidity sensor short (Low)
25	B1208	Intake potentiometer open (Low)
25	B1209	Intake potentiometer short (High)
26	B2408	Intake motor failure
27	B1257	AQS sensor open (High)
28	B1258	AQS sensor short (Low)
29	B1259	AQS sensor failure

3. Fault code display
   (1) Continuance operation



   (2) Step operation



4. If a fault code is displayed during the DTC check, Inspect a malfunction cause by referring to the DTC code.
5. Fail safe
   (1) In-car temperature sensor: Control with the value of 25°C(77°F)
   (2) Ambient temperature sensor: Control with the value of 20°C(67°F)
   (3) Evaporator temperature sensor: Control with the value of -2°C(28.4°F)

(4) Humidity sensor: Control with the value of 10%

(5) Temperature sensor : Control with the value of -2°C (28.4°F)

(6) Temperature control actuator (Air mix potentiometer):
If temperature setting 17°C-24.5°C, fix at maximum cooling position.
If temperature setting 25°C-32°C, fix at maximum heating position.

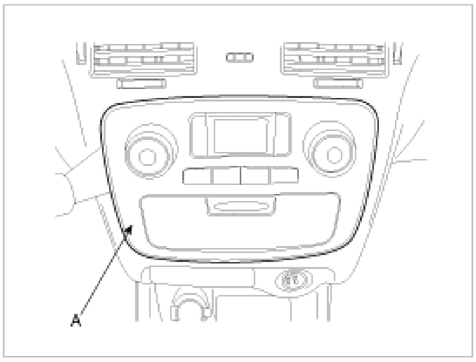
(7) Mode control actuator (Direction potentiometer):
Fix vent position, while selecting vent mode.
Fix defrost position, while selecting all except vent mode.

(8) Intake control actuator :
Fix fresh position, while selecting fresh mode.
Fix recirculation position, while selecting recirculation mode.

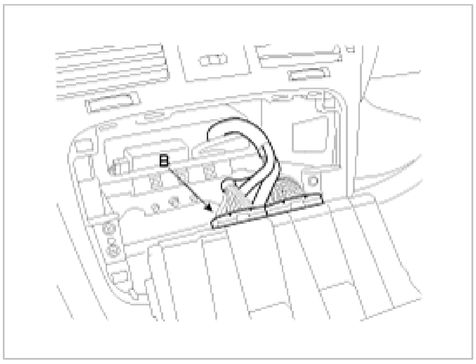
(9) AQS sensor : AQS operation OFF.
A. Intake position : The position before selecting AQS switch.

REPLACEMENT

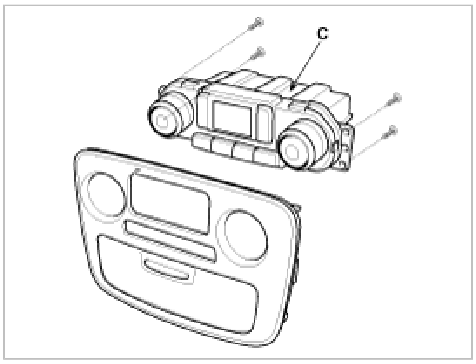
1. Disconnect the negative (-) battery terminal.
2. Remove the center facia panel (A) after pulling it by using a regular screw driver (-).



3. Disconnect the connectors (B) from the center facia.



4. Remove the heater & A/C controller (C).



5. Install in the reverse order of removal.

Heating,Ventilation, Air Conditioning > Controller > B1200 Humidity Sensor Open(High)

Component Location

General Description

Humidity sensor located at heater control unit detects in-car humidity for in-car humidity control. If ambient air temperature or in-car humidity is outside a specified range, A/C will be activated to control in-car humidity to prevent fogging of the windows.

DTC Description

The ECM sets DTC B1200 if there is an open circuit in humidity sensor signal harness or the measured frequency value of sensor is more than the threshold value(about 7,100Hz)

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	● Frequency check	● Open Circuit in signal harness ● Fault Humidity Sensor ● Faulty A/C control unit
Threshold value	● > 7,100Hz	
Detecting time	● 10msec	
FAIL SAFE	● Control with the vlaue of 10%	

Schematic Diagram

Signal Waveform

※ Frequency value of humidity sensor as a function of humidity.

Relative humidity(%)	Frequency(Hz)	Relative humidity(%)	Frequency(Hz)
20	7100	60	6600
30	6976	70	6468
40	6853	80	6330
50	6728	90	6186

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "Humidity Sensor" Parameter on the Scantool. While drying the humidity sensor with the implement such as hair drier
4. Are the DTC B1200 present and is parameter of "Humidity Sensor" fixed ?
   ※Parameter of "Humidity Sensor" will be fixed at 10%, if there is any fault in Humidity Sensor

   YES

   1) Go to "Inspection & Repair" procedure

   NO

   1) Fault is intermittent caused by poor contact in the sensor's and/or A/C control unit's connector or was repaired and A/C control unit memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by

interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

1) Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

1) Go to "Signal Circuit Inspection" procedure

Signal Circuit Inspection

Check for open in harness

1. Ignition "OFF"
2. Disconnect Humidity Sensor.
3. Measure resistance between terminal "3" of Humidity Sensor and terminal "4" of A/C Control Unit
   A. Specification :Approx. 0 Ω
4. Is the measured resistance within specifications?

YES

1) Go to "Ground Circuit Inspection " procedure.

NO

1) Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Ground Circuit inspection

Check for open in ground harness

1. Ignition "OFF"
2. Disconnect Humidity Sensor.
3. Measure resistance between terminal "2" of Humidity Sensor and terminal "12" of A/C Control Unit
   A. Specification :Approx. 0 Ω
4. Is the measured resistance within specifications?

YES

1) Go to "Component Inspection " procedure.

NO

1) Check for open in ground harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Component Inspection

Check Humidity Sensor

1. Engine "ON"
2. Connect Humidity Sensor.
3. Measure Frequency between terminal "3" and "2" of Humidity sensor while increasing humidity.
   A. Specification : Refer the specifications in fig5)
4. Is the measured frequency within specifications in fig5)? (tolerance limits ±5%)

YES

1) Go to "Check A/C Control Unit" procedure

NO

1) Substitute with a known-good Humidity sensor and check for proper operation.

If the problem is corrected, replace Humidity sensor and then go to "Verification of Vehicle Repair" procedure.

Check A/C Control Unit

1. Engine "ON"
2. Disconnect Humidity Sensor.
3. Measure voltage value between terminal "4" of A/C control unit and chassis ground.
   A. Specification : 5V
4. Is the measured voltage within specifications?

   YES

   1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

   NO

   1) Substitute with a known-good A/C Control Unit and check for proper operation.
   If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

   YES

   1) Go to the applicable troubleshooting procedure

   NO

   1) System is performing to specification at this time.

Heating,Ventilation, Air Conditioning > Controller > B1201 Humidity Sensor Short(Low)

Component Location

General Description

Humidity sensor located at heater control unit detects in-car humidity for in-car humidity control. If ambient air temperature or in-car humidity is outside a specified range, A/C will be activated to control in-car humidity to prevent fogging of the windows.

DTC Description

The ECM sets DTC B1201 if there is a short circuit in humidity sensor signal harness or the measured frequency value of the sensor is less than the threshold value(about 6,186Hz)

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	● Frequency check	● Open Circuit in power harness ● Short Circuit in signal harness ● Faulty Humidity Sensor ● Faulty A/C control unit
Threshold value	● < 6,186Hz	
Detecting time	● 10msec	
FAIL SAFE	● Control with the vlaue of 10%	

Schematic Diagram

Signal Waveform

※ Frequency value of humidity sensor as a function of humidity.

Humidity(%)	Frequency(Hz)	Humidity(%)	Frequency(Hz)
20	7100	60	6600
30	6976	70	6468
40	6853	80	6330
50	6728	90	6186

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "Humidity Sensor" Parameter on the Scantool. While drying the humidity sensor with the implement such as hair drier
4. Are the DTC B1201 present and is parameter of "Humidity Sensor" fixed ?
   ※Parameter of "Humidity Sensor" will be fixed at 10%, if there is any fault in Humidity Sensor

   YES

   1) Go to "Inspection & Repair" procedure

   NO

   1) Fault is intermittent caused by poor contact in the sensor’s and/or A/C control unit’s connector or was repaired and A/C control unit memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   1) Repair as necessary and go to "Verification of Vehicle Repair" procedure

   NO

   1) Go to "Signal Circuit Inspection" procedure

Signal Circuit Inspection

Check for short to ground in harness

1. Ignition "OFF"
2. Disconnect Humidity Sensor.
3. Measure resistance between terminal "3" of Humidity sensor and chassis ground.
   A. Specification :Approx. ∞ Ω
4. Is the measured resistance within specifications?

   YES

   1) Go to "Power Circuit Inspection " procedure.

   NO

   1) Check for short to ground in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Power Supply Circuit Inspection

Check for open in power harness

1. Ignition "ON"
2. Disconnect Humidity Sensor.

3. Measure voltage value between terminal "5" of Humidity Sensor and chassis ground
   A. Specification :5V

4. Is the measured voltage value within specifications?

   YES

   1) Go to "Component Inspection " procedure.

   NO

   1) Check for open in power harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Component Inspection

Check Humidity Sensor

1. Engine "ON"
2. Connect Humidity Sensor.
3. Measure Frequency between terminal "3" and "2" of Humidity sensor while increasing humidity.
   A. Specification : Refer the specifications in fig3)

4. Is the measured frequency within specifications in fig5)? (tolerance limits ±5%)

   YES

   1) Go to "Check A/C Control Unit" procedure

   NO

   1) Substitute with a known-good Humidity sensor and check for proper operation.
   If the problem is corrected, replace Humidity sensor and then go to "Verification of Vehicle Repair" procedure.

Check A/C Control Unit

1. Engine "ON"
2. Disconnect Humidity Sensor.
3. Measure voltage value between terminal "4" of A/C control unit and chassis ground.
   A. Specification : 5V

4. Is the measured voltage within specifications?

   YES

   1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

   NO

   1) Substitute with a known-good A/C Control Unit and check for proper operation.
   If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

   YES

   1) Go to the applicable troubleshooting procedure

   NO

   1) System is performing to specification at this time.

Heating,Ventilation, Air Conditioning > Controller > B1202 Water Temperature Sensor Open (High)

Component Location

General Description

A water temp sensor located at heater unit detects coolant temperature. Its signal is used for cold engine lockout control.When the driver operates the heater before the engine is warmed up, the signal from sensor causes the heater control unit to reduce blower motor speed until coolant temperature reaches the threshold value.

DTC Description

The ECM sets DTC B1202 if there is an open circuit in water temp sensor signal harness or the measured resistance value of the sensor is more than the threshold value(about 176.3kΩ)

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	● Resistance check	● Open Circuit in harness ● Fault water temp. Sensor ● Fault A/C Control Unit
Threshold value	● > 176.3kΩ	
Detecting time	● 0.3sec	
FAIL SAFE	● Control with the value of 28.4°F	

Schematic Diagram

Signal Waveform

※ Resistance value of water temp sensor as a function of temperature.

Temperature(°F)	Resistance(kΩ)	Temperature(°F)	Resistance(kΩ)
-22	176.3	77	10
5	73.6	95	6.5
32	32.9	140	2.5
59	15.8	176	1.2

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "WATER TEMP SENSOR" Parameter on the Scantool.
4. Are the DTC B1202 present and is parameter of "WATER TEMP SENSOR" fixed?
   ※ Parameter of "WATER TEMP SENSOR" will be fixed at 28.4°F, if there is any fault in WATER TEMP SENSOR

   YES

   1) Go to "Inspection & Repair" procedure

   NO

   1) Fault is intermittent caused by poor contact in the sensor's and/or A/C control unit's connector or was repaired and A/C control unit memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by

interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

1) Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

1) Go to "Signal Circuit Inspection" procedure

Signal Circuit Inspection

Check for open in harness

1. Ignition "OFF"
2. Disconnect water temp. sensor.
3. Measure resistance between terminal "1" of water temp. sensor and terminal "7" of A/C Control Unit
   A. Specification :Approx. 0 Ω
4. Is the measured resistance within specifications?

YES

1) Go to "Ground Circuit Inspection " procedure.

NO

1) Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Ground Circuit inspection

Check for open in ground harness

1. Ignition "OFF"
2. Disconnect water temp. sensor.
3. Measure resistance between terminal "2" of water temp. sensor and chasis ground
   A. Specification :Approx. 0 Ω
4. Is the measured resistance within specifications?

YES

1) Go to "Component Inspection " procedure.

NO

1) Check for open in ground harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Component Inspection

Check WATER TEMP Sensor

1. Ignition "OFF"
2. Disconnect water temp. sensor.
3. Measure resistance between terminal "1" and "2" of water temp. sensor.
   A. Specification : Refer the specifications in fig3)
4. Is the measured resistance within specifications in fig3)? (tolerance limits ±3%)

YES

1) Go to "Check A/C Control Unit" procedure

NO

1) Substitute with a known-good water temp. sensor and check for proper operation. If the problem is corrected, replace water temp. sensor and then go to "Verification of Vehicle Repair" procedure.

Check A/C Control Unit

1. Engine "ON"
2. Disconnect water temp. sensor.
3. Measure Voltage between terminal "7" of A/C Control Unit and chasis ground
   A. Specification : Approx. 5V
4. Is the measured voltage within specifications?
   - YES
     1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
   - NO
     1) Substitute with a known-good A/C Control Unit and check for proper operation.
     If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?
   - YES
     1) Go to the applicable troubleshooting procedure
   - NO
     1) System is performing to specification at this time.

Heating,Ventilation, Air Conditioning > Controller > B1203 Water Temperature Sensor Short (Low)

Component Location

General Description

A water temp sensor located at heater unit detects coolant temperature. Its signal is used for cold engine lockout control. When the driver operates the heater before the engine is warmed up, the signal from sensor causes the heater control unit to reduce blower motor speed until coolant temperature reaches the threshold value.

DTC Description

The ECM sets DTC B1203 if there is a short circuit in water temp sensor signal harness or the measured resistance value of the sensor is less than the threshold value(about 1.2kΩ)

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	● Resistance check	● Short circuit in harness ● Fault water temp. Sensor ● Fault A/C Control Unit
Threshold value	● <1.2kΩ	
Detecting time	● 0.3sec	
FAIL SAFE	● Control with the value of 28.4°F	

Schematic Diagram

Signal Waveform

※ Resistance value of water temp sensor as a function of temperature.

Temperature(°F)	Resistance(kΩ)	Temperature(°F)	Resistance(kΩ)
-22	176.3	77	10
5	73.6	95	6.5
32	32.9	140	2.5
59	15.8	176	1.2

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "WATER TEMP SENSOR" Parameter on the Scantool.
4. Are the DTC B1203 present and is parameter of "WATER TEMP.SENSOR" fixed ?
   ※ Parameter of "WATER TEMP SENSOR" will be fixed at 28.4°F, if there is any fault in WATER TEMP SENSOR

   YES

   1) Go to "Inspection & Repair" procedure

   NO

   1) Fault is intermittent caused by poor contact in the sensor'ss and/or A/C control unit'ss connector or was repaired and A/C control unit memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   1) Repair as necessary and go to "Verification of Vehicle Repair" procedure

   NO

   1) Go to "Signal Circuit Inspection" procedure

Signal Circuit Inspection

Check for short to ground in harness

1. Ignition "OFF"
2. Disconnect water temp. sensor.
3. Measure resistance between terminal "1" of water temp. sensor and chassis ground.
   A. Specification :Approx. ∞ Ω
4. Is the measured resistance within specifications?

   YES

   1) Go to "Component Inspection" procedure.

   NO

   1) Check for short to ground in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Component Inspection

Check WATER TEMP Sensor

1. Ignition "OFF"
2. Disconnect water temp. sensor.
3. Measure resistance between terminal "1" and "2" of water temp. sensor.

A. Specification : Refer the specifications in fig3)

4. Is the measured resistance within specifications in fig3)? (tolerance limits ±3%)

YES

1) Go to "Check A/C Control Unit" procedure

NO

1) Substitute with a known-good water temp. sensor and check for proper operation. If the problem is corrected, replace water temp. sensor and then go to "Verification of Vehicle Repair" procedure.

Check A/C Control Unit

1. Engine "ON"
2. Disconnect water temp. sensor.
3. Measure Voltage between terminal "7" of A/C Control Unit and chasis ground
   A. Specification : Approx. 5V
4. Is the measured voltage within specifications?

YES

1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

1) Substitute with a known-good A/C Control Unit and check for proper operation. If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

YES

1) Go to the applicable troubleshooting procedure

NO

1) System is performing to specification at this time.

Heating,Ventilation, Air Conditioning > Controller > B1233 In-car Temperature Sensor Short (Low)

Component Location

General Description

The incar temperature sensor is located at heater control unit. It contains a thermistor which measures the temperature of the inside. The signal,decided by the resistance value which changes in accordance with perceived inside temperature, is delivered to heater control unit and according to this signal, the control unit regulates incar temperature to intended value

DTC Description

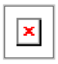
The ECM sets DTC B1233 if there is a short circuit in incar temp sensor signal harness or the measured resistance value of the sensor is less than the threshold value(about 7.46kΩ)

DTC Detecting Condition

Item	Detecting Condition	Possible Cause

DTC Strategy	● Resistance check	● Short circuit in harness ● Fault incar temp.sensor ● Fault A/C Control Unit
Threshold value	● <7.46kΩ	
Detecting time	● 0.3sec	
FAIL SAFE	● Control with the value of 77°F	

Schematic Diagram



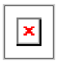
Signal Waveform

※ Resistance value of water temp sensor as a function of temperature.

Temperature(°F)	Resistance(kΩ)	Temperature(°F)	Resistance(kΩ)
-22	509.57	77	30
5	216.07	95	15.59
32	97.71	122	10.81
59	47.13	140	7.46

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "INCAR TEMP.SENSOR" Parameter on the Scantool.



4. Are the DTC B1233 present and is parameter of "INCAR TEMP.SENSOR" fixed ?
   ※ Parameter of "INCAR TEMP.SENSOR" will be fixed at 77°F, if there is any fault in INCAR SENSOR

   YES

   1) Go to "Inspection & Repair" procedure

   NO

   1) Fault is intermittent caused by poor contact in the sensor’s and/or A/C control unit’s connector or was repaired and A/C control unit memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   1) Repair as necessary and go to "Verification of Vehicle Repair" procedure

   NO

   1) Go to "Signal Circuit Inspection" procedure

Signal Circuit Inspection

Check for short to ground in harness

1. Ignition "OFF"
2. Disconnect incar sensor.
3. Measure resistance between terminal "4" of incar sensor and chassis ground
   A. Specification :Approx. ∞ Ω

4. Is the measured resistance within specifications?

YES

1) Go to "Component Inspection" procedure.

NO

1) Check for short to ground in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Component Inspection

Check Incar Temp. sensor

1. Ignition "OFF"
2. Disconnect incar sensor.
3. Measure resistance between terminal "4" and "2" of incar sensor
   A. Specification : Refer the specifications in fig3)
4. Is the measured resistance within specifications in fig3)? (tolerance limits ±3%)

YES

1) Go to "Check A/C Control Unit" procedure

NO

1) Substitute with a known-good incar sensor and check for proper operation. If the problem is corrected, replace incar sensor and then go to "Verification of Vehicle Repair" procedure.

Check A/C Control Unit

1. Engine : "ON"
2. Disconnect incar sensor.
3. Measure Voltage between terminal "5" of A/C Control Unit and chassis ground
   A. Specification :Approx. 5V
4. Is the measured voltage within specifications?

YES

1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

1) Substitute with a known-good A/C Control Unit and check for proper operation. If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

YES

1) Go to the applicable troubleshooting procedure

NO

1) System is performing to specification at this time.

Heating,Ventilation, Air Conditioning > Controller > B1234 In-car Temperature Sensor Open (High)

Component Location

General Description

The incar temperature sensor is located at heater control unit. It contains a thermistor which measures the temperature of the inside. The signal,decided by the resistance value which changes in accordance with perceived inside temperature, is delivered to heater control unit and according to this signal, the control unit regulates incar temperature to intended value

DTC Description

The ECM sets DTC B1234 if there is an open circuit in incar temp sensor signal harness or the measured resistance value of the sensor is more than the threshold value(about 509.57kΩ)

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	● Resistance check	● Open Circuit in harness ● Fault incar temp.sensor ● Fault A/C Control Unit
Threshold value	● > 509.57kΩ	
Detecting time	● 0.3sec	
FAIL SAFE	● Control with the value of 25°C	

Schematic Diagram

Signal Waveform

※ Resistance value of water temp sensor as a function of temperature.

Temperature(°F)	Resistance(kΩ)	Temperature(°F)	Resistance(kΩ)
-22	509.57	77	30
5	216.07	95	15.59
32	97.71	122	10.81
59	47.13	140	7.46

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "INCAR TEMP.SENSOR" Parameter on the Scantool.
4. Are the DTC B1234 present and is parameter of "INCAR TEMP.SENSOR" fixed ?
   ※ Parameter of "INCAR TEMP.SENSOR" will be fixed at 77°F, if there is any fault in INCAR SENSOR

   YES

   1) Go to "Inspection & Repair" procedure

   NO

   1) Fault is intermittent caused by poor contact in the sensor's and/or A/C control unit's connector or was repaired and A/C control unit memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

1) Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

1) Go to "Signal Circuit Inspection" procedure

Signal Circuit Inspection

Check for open in harness

1. Ignition "OFF"
2. Disconnect incar temp.sensor.
3. Measure resistance between terminal "4" of incar temp.sensor and terminal "5" of A/C Control Unit
   A. Specification :Approx. 0 Ω
4. Is the measured resistance within specifications?

YES

1) Go to "Ground Circuit Inspection " procedure.

NO

1) Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Ground Circuit inspection

Check for open in ground harness

1. Ignition "OFF"
2. Disconnect incar temp.sensor.
3. Measure resistance between terminal "2" of incar temp.sensor and terminal "12" of A/C Control Unit
   A. Specification :Approx. 0 Ω
4. Is the measured resistance within specifications?

YES

1) Go to "Component Inspection " procedure.

NO

1) Check for open in ground harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Component Inspection

Check Incar Temp. sensor

1. Ignition "OFF"
2. Disconnect incar sensor.
3. Measure resistance between terminal "4" and "2" of incar sensornsor
   A. Specification : Refer the specifications in fig3)
4. Is the measured resistance within specifications in fig3)? (tolerance limits ±3%)

YES

1) Go to "Check A/C Control Unit" procedure

NO

1) Substitute with a known-good incar sensor and check for proper operation. If the problem is corrected, replace incar sensor and then go to "Verification of Vehicle Repair" procedure.

Check A/C Control Unit

1. Engine : "ON"

2. Disconnect incar sensor.
3. Measure Voltage between terminal "5" of A/C Control Unit and chassis ground
   A. Specification :Approx. 5V

4. Is the measured voltage within specifications?

   YES

   1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

   NO

   1) Substitute with a known-good A/C Control Unit and check for proper operation. If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

   YES

   1) Go to the applicable troubleshooting procedure

   NO

   1) System is performing to specification at this time.

Heating,Ventilation, Air Conditioning > Controller > B1237 Ambient Temperature Sensor Short (Low)

Component Location

General Description

The ambient temperature sensor located at the center stay of the condensor detects ambient air temperature. It is a negative type thermistor whose resistance is inversely proportional to temperature. Its output is used for sensor fail-safe, temperature regulation door lock, blower motor level control, mix mode control and in-car humidity control

DTC Description

The ECM sets DTC B1237 if there is a short circuit in ambient temp sensor signal harness or the measured resistance value of the sensor is less than the threshold value(about 7.48kΩ)

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Resistance check	• Short circuit in harness • Faulty ambient temp.sensor • Faulty A/C Control Unit
Threshold Value	• <7.48kΩ	
Detecting Time	• 0.3sec	
Fail Safe	• Control with the value of 68°F	

Specification

※ Resistance value of ambient temp.sensor as a function of temperature.

Temperature(°F)	Resistance(kΩ)	Temperature(°F)	Resistance(kΩ)
-22	527.99	77	30
5	218.21	95	19.6

32	97.83	122	10.82
59	47.12	140	7.48

Schematic Diagram

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "AMBIENT TEMP.SENSOR" Parameter on the Scantool..
   ※ Parameter of "AMBIENT TEMP.SENSOR" will be fixed at 68°F, if there is any fault in AMBIENT TEMP.SENSOR.
4. Are the DTC B1237 present and is parameter of "AMBIENT TEMP.SENSOR" fixed ?
   YES
   1) Go to "Inspection & Repair" procedure
   NO
   1) Fault is intermittent caused by poor contact in the sensor's and/or A/C control unit's connector or was repaired and A/C control unit memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?
   YES
   1) Repair as necessary and go to "Verification of Vehicle Repair" procedure
   NO
   1) Go to "Signal Circuit Inspection" procedure

Signal Circuit Inspection

Check for short to ground in harness

1. Ignition "OFF"
2. Disconnect ambient sensor.
3. Measure resistance between terminal "1" of ambient sensor and chassis ground
   A. Specification :Approx. ∞ Ω
4. Is the measured resistance within specifications??
   YES
   1) Go to "Component Inspection" procedure.
   NO
   1) Check for short to ground in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Component Inspection

Check Ambient sensor

1. Ignition "OFF"
2. Disconnect ambient sensor.

3. Measure resistance between terminal "1" and "2" of ambient sensor
   A. Specification : Refer the specifications in fig3)

4. Is the measured resistance within specifications in fig3)? (tolerance limits ±3%)
   YES
   1) Go to "Check A/C Control Unit" procedure
   NO
   1) Substitute with a known-good incar sensor and check for proper operation. If the problem is corrected, replace incar sensor and then go to "Verification of Vehicle Repair" procedure.

Check A/C Control Unit

1. Engine : "ON"
2. Disconnect ambient sensor.
3. Measure voltage between terminal "3" of A/C Control Unit and chassis ground
   A. Specification :Approx. 5V

4. Is the measured voltage within specifications?
   YES
   1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
   NO
   1) Substitute with a known-good A/C Control Unit and check for proper operation. If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?
   YES
   1) Go to the applicable troubleshooting procedure
   NO
   1) System is performing to specification at this time.

Heating,Ventilation, Air Conditioning > Controller > B1238 Ambient Temperature Sensor Open (High)

Component Location

General Description

The ambient temperature sensor located at the center stay of the condensor detects ambient air temperature. It is a negative type thermistor whose resistance is inversely proportional to temperature. Its output is used for sensor fail-safe, temperature regulation door lock, blower motor level control, mix mode control and in-car humidity control

DTC Description

The ECM sets DTC B1238 if there is an open circuit in ambient temp sensor signal harness or the measured resistance value of the sensor is more than the threshold value(about 527kΩ)

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	● Resistance check	● Short circuit in harness ● Faulty ambient temp.sensor ● Faulty A/C Control Unit
Threshold Value	● > 527kΩ	
Detecting Time	● 0.3sec	
Fail Safe	● Control with the value of 68°F	

Specification

※ Resistance value of ambient temp.sensor as a function of temperature.

Temperature(°F)	Resistance(kΩ)	Temperature(°F)	Resistance(kΩ)
-22	527.99	77	30
5	218.21	95	19.6
32	97.83	122	10.82
59	47.12	140	7.48

Schematic Diagram

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "AMBIENT TEMP.SENSOR" Parameter on the Scantool..
   ※ Parameter of "AMBIENT TEMP.SENSOR" will be fixed at 68°F, if there is any fault in AMBIENT TEMP.SENSOR.
4. Are the DTC B1238 present and is parameter of "AMBIENT TEMP.SENSOR" fixed ?
   YES
   1) Go to "Inspection & Repair" procedure
   NO
   1) Fault is intermittent caused by poor contact in the sensor's and/or A/C control unit's connector or was repaired and A/C control unit memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?
   YES
   1) Repair as necessary and go to "Verification of Vehicle Repair" procedure
   NO
   1) Go to "Signal Circuit Inspection" procedure

Signal Circuit Inspection

Check for open in harness

1. Ignition "OFF"
2. Disconnect ambient temp.sensor.
3. Measure resistance between terminal "1" of ambient temp.sensor and terminal "3" of A/C Control Unit

A. Specification :Approx. ∞ Ω

4. Is the measured resistance within specifications?
   - YES
     1) Go to "Ground Circuit Inspection " procedure.
   - NO
     1) Check for short to ground in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Ground Circuit inspection

Check for open in ground harness

1. Ignition "OFF"
2. Disconnect ambient temp.sensor.
3. Measure resistance between terminal "2" of ambient temp.sensor and chassis ground.
   A. Specification :Approx. 0 Ω
4. Is the measured resistance within specifications?
   - YES
     1) Go to "Component Inspection " procedure.
   - NO
     1) Check for open in ground harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Component Inspection

Check Ambient sensor

1. Ignition "OFF"
2. Disconnect ambient sensor.
3. Measure resistance between terminal "1" and "2" of ambient sensor
   A. Specification : Refer the specifications in fig3)
4. Is the measured resistance within specifications in fig3)? (tolerance limits ±3%)
   - YES
     1) Go to "Check A/C Control Unit" procedure
   - NO
     1) Substitute with a known-good ambient sensor and check for proper operation. If the problem is corrected, replace ambient sensor and then go to "Verification of Vehicle Repair" procedure.

Check A/C Control Unit

1. Engine : "ON"
2. Disconnect ambient sensor.
3. Measure voltage between terminal "3" of A/C Control Unit and chassis ground
   A. Specification :Approx. 5V
4. Is the measured voltage within specifications?
   - YES
     1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
   - NO
     1) Substitute with a known-good A/C Control Unit and check for proper operation. If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

   YES

   1) Go to the applicable troubleshooting procedure

   NO

   1) System is performing to specification at this time.

Heating,Ventilation, Air Conditioning > Controller > B1241 Evaporator Sensor Short(Low)

Component Location

General Description

The Evaporator sensor located on heater unit detects the core temperature and interrupts compressor relay power, in order to prevent evaporator freezing by excessive cooling. It is a negative type thermistor whose resistance is inversely proportional to temperature

DTC Description

The ECM sets DTC B1241 if there is a short circuit in evaporator sensor signal harness or the measured resistance value of the sensor is less than the threshold value(about 0.9kΩ)

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	● Resistance check	● Short circuit in harness. ● Fault Evaporator sensor ● Fault A/C Control Unit
Threshold value	● < 0.9kΩ	
Detecting time	● 0.3sec	
FAIL SAFE	● Control with the value of 28.4°F	

Schematic Diagram

Signal Waveform

※ Resistance value of evaporator sensor as a function of temperature.

Temperature(°F)	Resistance(kΩ)	Temperature(°F)	Resistance(kΩ)
14	13.6	59	3.9
32	8	86	2
41	6.2	104	1.3
50	4.9	122	0.9

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "EVAPORATIVE SENSOR" Parameter on the Scantool.

4. Are the DTC B1241 present and is parameter of "EVAPORATIVE SENSOR" fixed ?
   ※ Parameter of "EVAPORATIVE SENSOR" will be fixed at 28.4°F, if there is any fault in EVAPORATIVE SENSOR.
   - YES
     1) Go to "Inspection & Repair" procedure
   - NO
     1) Fault is intermittent caused by poor contact in the sensor's and/or A/C control unit's connector or was repaired and A/C control unit memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?
   - YES
     1) Repair as necessary and go to "Verification of Vehicle Repair" procedure
   - NO
     1) Go to "Signal Circuit Inspection" procedure

Signal Circuit Inspection

Check for short to ground in harness

1. Ignition "OFF"
2. Disconnect evaporator sensor.
3. Measure resistance between terminal "1" of evaporator sensor and chassis ground
   A. Specification :Approx. ∞ Ω
4. Is the measured resistance within specifications?
   - YES
     1) Go to "Component Inspection" procedure.
   - NO
     1) Check for short to ground in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Component Inspection

Check evaporator sensor

1. Ignition "OFF"
2. Disconnect evaporator sensor.
3. Measure resistance between terminal "1" and "2" of evaporator sensor
   A. Specification : Refer the specifications in fig3)
4. Is the measured resistance within specifications in fig3)? (tolerance limits ±3%)
   - YES
     1) Go to "Check A/C Control Unit" procedure
   - NO
     1) Substitute with a known-good evaporator sensor and check for proper operation. If the problem is corrected, replace evaporator sensor and then go to "Verification of Vehicle Repair" procedure.

Check A/C Control Unit

1. Engine "ON"
2. Disconnect evaporator sensor.
3. Measure voltage between terminal "6" of A/C Control Unit and chassis ground
   A. Specification :Approx. 5V
4. Is the measured voltage within specifications?
   YES
   1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

   NO
   1) Substitute with a known-good A/C Control Unit and check for proper operation. If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?
   YES
   1) Go to the applicable troubleshooting procedure

   NO
   1) System is performing to specification at this time.

Heating,Ventilation, Air Conditioning > Controller > B1242 Evaporator Sensor Open(HIGH)

Component Location

General Description

The Evaporator sensor located on heater unit detects the core temperature and interrupts compressor relay power, in order to prevent evaporator freezing by excessive cooling. It is a negative type thermistor whose resistance is inversely proportional to temperature

DTC Description

The ECM sets DTC B1242 if there is an open circuit in evaporator sensor signal harness or the measured resistance value of the sensor is more than the threshold value(about 13.6kΩ)

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	● Resistance check	● Open Circuit in harness ● Fault Evaporator sensor ● Fault A/C Control Unit
Threshold value	● > 13.6kΩ	
Detecting time	● 0.3sec	
FAIL SAFE	● Control with the value of 28.4°F	

Schematic Diagram

Signal Waveform

※ Resistance value of evaporator sensor as a function of temperature.

Temperature(°F)	Resistance(kΩ)	Temperature(°F)	Resistance(kΩ)
14	13.6	59	3.9
32	8	86	2
41	6.2	104	1.3
50	4.9	122	0.9

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "EVAPORATIVE SENSOR" Parameter on the Scantool.
4. Are the DTC B1242 present and is parameter of "EVAPORATIVE SENSOR" fixed ?
   ※ Parameter of "EVAPORATIVE SENSOR" will be fixed at 28.4°F, if there is any fault in EVAPORATIVE SENSOR.
   YES
   1) Go to "Inspection & Repair" procedure
   NO
   1) Fault is intermittent caused by poor contact in the sensor's and/or A/C control unit's connector or was repaired and A/C control unit memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?
   YES
   1) Repair as necessary and go to "Verification of Vehicle Repair" procedure
   NO
   1) Go to "Signal Circuit Inspection" procedure

Signal Circuit Inspection

Check for open in harness

1. Ignition "OFF"
2. Disconnect evaporator sensor.
3. Measure resistance between terminal "1" of evaporator sensor and terminal "6" of A/C Control Unit
   A. Specification :Approx. 0 Ω
4. Is the measured resistance within specifications?
   YES
   1) Go to "Ground Circuit Inspection " procedure.
   NO
   1) Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Ground Circuit inspection

Check for open in ground harness

1. Ignition "OFF"
2. Disconnect evaporator sensor.
3. Measure resistance between terminal "2" of evaporator sensor and chassis ground.

A. Specification :Approx. 0 Ω

4. Is the measured resistance within specifications?

YES

1) Go to "Component Inspection " procedure.

NO

1) Check for open in ground harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Component Inspection

Check evaporator sensor

1. Ignition "OFF"
2. Disconnect evaporator sensor.
3. Measure resistance between terminal "1" and "2" of evaporator sensor

A. Specification : Refer the specifications in fig3)

4. Is the measured resistance within specifications in fig3)? (tolerance limits ±3%)

YES

1) Go to "Check A/C Control Unit" procedure

NO

1) Substitute with a known-good evaporator sensor and check for proper operation. If the problem is corrected, replace evaporator sensor and then go to "Verification of Vehicle Repair" procedure.

Check A/C Control Unit

1. Engine "ON"
2. Disconnect evaporator sensor.
3. Measure voltage between terminal "6" of A/C Control Unit and chassis ground

A. Specification :Approx. 5V

4. Is the measured voltage within specifications?

YES

1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

1) Substitute with a known-good A/C Control Unit and check for proper operation. If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

YES

1) Go to the applicable troubleshooting procedure

NO

1) System is performing to specification at this time.

Heating,Ventilation, Air Conditioning > Controller > B1245 Air Mix Potentiometer Open(Low) - Driver

Component Location

General Description

Temperature control actuator located at heater unit regulates the temperature by the procedure as follows. Signal from control unit adjusts position of temp door by operating temp motor and then temperature will be regulated by the hot/cold air ratio decided by position of temp door

DTC Description

The ECM sets DTC B1245 if there is an open circuit or poor connection of connected part in the air mix potentiometer.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
Monitor Strategy	● Voltage check	● Poor connection of connected part ● Open circuit in harness ● Short circuit in harness ● Faulty DR Air Mix potentiometer
Threshold value	●<0.1V	
Detecting time	● 0.3sec	
FAIL SAFE	● setting temperature : 62 - 76°F fix at max. cooling position ● setting temperature : 77 - 90°F fix at max. heating position	

Specification

※ Voltage value of Air Mix potentiometer as a function of setting temperature

Schematic Diagram

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "DR AIR MIX potentiometer" Parameter on the Scantool. While operating temp switch
4. Are the DTC B1245 present and is parameter of "DR AIR MIX Potentiometor" fixed ?
   ※ Parameter of "DR AIR MIX potentiometer" will be fixed at 100%(or any value above 90%), or 0% (or any value below 10%), if there is any fault in DR AIR MIX potentiometer.

   YES

   1) Go to "Inspection & Repair" procedure

   NO

   1) Fault is intermittent caused by poor contact in the sensor's and/or A/C control unit's connector or was repaired and A/C control unit memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

1) Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

1) Go to "Signal Circuit Inspection" procedure

Signal Circuit Inspection

Check for open in harness

1. Ignition "OFF"
2. Disconnect DR Air Mix potentiometer
3. Measure resistance between terminal "6" of DR Air Mix potentiometer and terminal "18" of A/C control unit.
   A. Specification :Approx. 0 Ω
4. Is the measured resistance within specifications?

YES

1) Go to "Check for short to ground in harness" procedure.

NO

1) Check for open in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Check for short to ground in harness

1. Ignition "OFF"
2. Disconnect DR Air Mix Actuator
3. Measure resistance between terminal "6" of DR Air Mix potentiometer and chassis ground
   A. Specification :Approx. ∞ Ω
4. Is the measured resistance within specifications?

YES

1) Go to "Power Circuit Inspection" procedure

NO

1) Check for short to ground in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Power Supply Circuit Inspection

Check for short or open in harness

1. Ignition "ON"
2. Connect DR Air Mix Potentiometer.
3. Measure voltage between terminal "7" of DR Air Mix potentiometer and chassis ground
   A. Specification :Approx.5V
4. Is the measured voltage within specifications?

YES

1) Go to "Component Inspection " procedure.

NO

1) Check for short or open in power harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Component Inspection

Check actuator motor

1. Ignition "OFF"
2. Disconnect DR Air Mix Potentiometer.
3. Connect (+) terminal of battery to terminal 3 of Air Mix potentiometer and (-) terminal to terminal 4
4. Verify that the temperature actuator operates to the hot position
5. Verify that the temperature actuator operates to the cool position with reverse connecting.((+) to 4 and (-) to 3)

6. Dose the actuator work properly?
   YES
   1) Go to "Check potentiometer" procedure.
   NO
   1) Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace actuator and then go to "Verification of Vehicle Repair" procedure.

Check potentiometer

1. Ignition "ON"
2. Connect DR Air Mix potentiometer
3. Measure voltage between terminal "5" and "6" of DR AIR MIX potentiometer while operating the temp switch.
   A. Specification : Refer the specifications in fig3)

Door position	Voltage (5-6)	Threshold value
MAX. Cooling	0.3±0.15V	Low voltage : 0.08V or less
MAX. Heating	4.7±0.15V	High voltage : 4.9V or more

4. Is the measured voltage within specifications in fig3)?
   YES
   1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
   NO
   1) Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace actuator and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?
   YES
   1) Go to the applicable troubleshooting procedure
   NO
   1) System is performing to specification at this time.

Heating,Ventilation, Air Conditioning > Controller > B1246 Air Mix Potentiometer Short(High) - Driver

Component Location

General Description

Temperature control actuator located at heater unit regulates the temperature by the procedure as follows. Signal from control unit adjusts position of temp door by operating temp motor. then temperature will be regulated by the hot/cold air ratio decided by position of temp door

DTC Description

The ECM sets DTC B1246 if there is a short to power harness in the air mix potentiometer.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
Monitor Strategy	● Voltage check	● Open circuit in harness ● Short circuit in harness ● Faulty DR Air Mix potentiometer
Threshold value	●>4.9V	
Detecting time	● 0.3sec	
FAIL SAFE	● setting temperature : 62 - 76°F fix at max. cooling position ● setting temperature : 77 - 90°F fix at max. heating position	

Specification

※ Voltage value of Air Mix potentiometer as a function of setting temperature

Schematic Diagram

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "DR AIR MIX potentiometer" Parameter on the Scantool. While operating temp switch
4. Are the DTC B1246 present and is parameter of "DR AIR MIX Potentiometor" fixed ?
   ※ Parameter of "DR AIR MIX potentiometer" will be fixed at 100%(or any value above 90%), or 0% (or any value below 10%), if there is any fault in DR AIR MIX potentiometer.

   YES

   1) Go to "Inspection & Repair" procedure

   NO

   1) Fault is intermittent caused by poor contact in the sensor's and/or A/C control unit's connector or was repaired and A/C control unit memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   1) Repair as necessary and go to "Verification of Vehicle Repair" procedure

   NO

   1) Go to "Signal Circuit Inspection" procedure

Signal Circuit Inspection

Check for short in harness

1. Ignition "OFF"
2. Disconnect DR Air mix potentiometer
3. Measure resistance between terminal "6" and "7" of DR Air mix potentiometer
   A. Specification :Approx. ∞ Ω

4. Is the measured resistance within specifications?

YES

1) Go to "Ground Circuit Inspection" procedure

NO

1) Check for short to power harness in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Ground Circuit inspection

Check for open in ground harness

1. Ignition "OFF"
2. Disconnect DR Air mix potentiometer.
3. Measure resistance between terminal "5" of DR Air mix potentiometer and chassis ground.
   A. Specification :Approx. 0 Ω
4. Is the measured resistance within specifications?

YES

1) Go to "Component Inspection " procedure.

NO

1) Check for open in ground harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Component Inspection

Check actuator motor

1. Ignition "OFF"
2. Disconnect DR Air mix potentiometer.
3. Connect (+) terminal of battery to terminal 3 of Air mix potentiometer and (-) terminal to terminal 4
4. Verify that the temperature actuator operates to the hot position
5. Verify that the temperature actuator operates to the cool position with reverse connecting.((+) to 4 and (-) to 3)
6. Dose the actuator work properly?

YES

1) Go to "Check potentiometer" procedure.

NO

1) Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace actuator and then go to "Verification of Vehicle Repair" procedure.

Check potentiometer

1. Ignition "ON"
2. Connect DR Air mix potentiometer
3. Measure voltage between terminal "5" and "6" of DR Air mix potentiometer while operating the temp switch.
   A. Specification : Refer the specifications in fig3)

Door position	Voltasge (5-6)	Threshold value
MAX. Cooling	0.3±0.15V	voltage value > 0.08V
MAX. Heating	4.7±0.15V	voltage value > 4.9V

4. Is the measured voltage within specifications in fig3)?

YES

1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

1) Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace actuator and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

YES

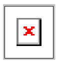
1) Go to the applicable troubleshooting procedure

NO

1) System is performing to specification at this time.

Heating,Ventilation, Air Conditioning > Controller > B1249 Direction Potentiometer Open(Low) - Driver

Component Location



General Description

The mode control actuator mounted on heater unit adjusts position of mode door by operating Direction Motor based on signal of A/C control unit. Pressing mode select switch makes the mode control actuator shift in order of vent→ B/L → floor → mix.

DTC Description

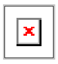
The ECM sets DTC B1249 if there is an open circuit or poor connection of connected part in the Direction potentiometer.

DTC Detecting Condition

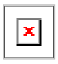
Item	Detecting Condition	Possible Cause
DTC Strategy	● Voltage check	● Poor connection of connected part ● Open circuit in harness ● Short circuit in harness ● Faulty DR Direction potentiometer
Threshold value	● <0.1V	
Detecting time	● 0.3sec	
FAIL SAFE	● Fix vent position ● Fix in defrost mode	

Specification

※ Voltage value of Direction potentiometer as a function of position of mode switch



Schematic Diagram



Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "DR DIRECTION POTENTIO" parameter on the scantool. While operating mode switch

4. Are the DTC B1249 present and is parameter of "DR DIRECTION POTENTIO" fixed ?
※ Parameter of "DR DIRECTION POTENTIO" will be fixed at 100%(or any value above 90%), or 0% (or any value below 10%), if there is any fault in DR direction potentiometer
   - YES
     1) Go to "Inspection & Repair" procedure
   - NO
     1) Fault is intermittent caused by poor contact in the sensor's and/or A/C control unit's connector or was repaired and A/C control unit memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?
   - YES
     1) Repair as necessary and go to "Verification of Vehicle Repair" procedure
   - NO
     1) Go to "Signal Circuit Inspection" procedure

Signal Circuit Inspection

Check for open in harness

1. Ignition "OFF"
2. Disconnect DR Direction Actuator
3. Measure resistance between terminal "6 of DR Direction Potentiometer and terminal "21" of A/C control unit.
   A. Specification :Approx. 0 Ω
4. Is the measured resistance within specifications?
   - YES
     1) Go to "Check for short to ground in harness" procedure.
   - NO
     1) Check for open in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Check for short to ground in harness

1. Ignition "OFF"
2. Disconnect DR Direction Actuator
3. Measure resistance between terminal "6" of DR Direction Potentiometer and chasis ground
   A. Specification :Approx. ∞ Ω
4. Is the measured resistance within specifications?
   - YES
     1) Go to "Power Circuit Inspection" procedure
   - NO
     1) Check for short to ground in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Power Supply Circuit Inspection

1. Ignition "ON"
2. Connect DR Direction Potentiometer.
3. Measure voltage between terminal "7" of DR Direction Potentiometer and chasis ground
   A. Specification :Approx.5V

4. Is the measured voltage within specifications?

YES

1) Go to "Component Inspection" procedure.

NO

1) Check for short or open in power harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Component Inspection

Check actuator motor

1. Ignition "OFF"
2. Disconnect DR Direction Potentiometer.
3. Connect (+) terminal of battery to terminal 3 of DR Direction potentiometer and (-) terminal to terminal 4
4. Verify that the mode actuator operates to the hot position
5. Verify that the mode actuator operates to the cool position with reverse connecting.((+) to 4 and (-) to 3)
6. Dose the actuator work properly?

YES

1) Go to "Check potentiometer" procedure.

NO

1) Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace actuator and then go to "Verification of Vehicle Repair" procedure.

Check potentiometer

1. Ignition "ON"
2. Connect DR Direction Potentiometer.
3. Measure voltage between terminal "5" and "6" of DR Direction Potentiometer while operating mode switch
   A. Specification : Refer the specifications in fig3)

<table>
<tr><td>Door position</td><td>Voltasge (5-6)</td><td>Error detecting</td></tr>
<tr><td>VENT</td><td>0.3±0.15V</td><td rowspan="6">Undervoltage : 0.08V or less
Overvoltage : 4.92V or more</td></tr>
<tr><td>BI-LEVEL(1)</td><td>1.35±0.4V</td></tr>
<tr><td>BI-LEVEL(2)</td><td>2.25±0.4V</td></tr>
<tr><td>FLOOR</td><td>3.0±0.4V</td></tr>
<tr><td>MIX</td><td>3.6±0.4V</td></tr>
<tr><td>DEF</td><td>4.7±0.15V</td></tr>
</table>

4. Is the measured voltage within specifications in fig3)?

YES

1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

1) Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace actuator and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC

2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

YES

1) Go to the applicable troubleshooting procedure

NO

1) System is performing to specification at this time.

Heating,Ventilation, Air Conditioning > Controller > B1250 Direction Potentiometer Short(High) - Driver

Component Location

General Description

The mode control actuator mounted on heater unit adjusts position of mode door by operating Direction Motor based on signal of A/C control unit. Pressing mode select switch makes the mode control actuator shift in order of vent→ B/L → floor → mix.

DTC Description

The ECM sets DTC B1250 if there is a short to power harness in the Direction potentiometer.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
Monitor Strategy	● Voltage check	● Open circuit in harness ● Short circuit in harness ● Faulty DR Direction potentiometer
Threshold value	● >4.9V	
Detecting time	● 0.3sec	
FAIL SAFE	● Fix vent position	

Specification

※ Voltage value of Direction potentiometer as a function of position of mode switch

Schematic Diagram

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "DR DIRECTION POTENTIO" parameter on the scantool. While operating mode switch
4. Are the DTC B1250 present and is parameter of "DR DIRECTION POTENTIO" fixed ?
※Parameter of "DR DIRECTION POTENTIO" will be fixed at 100%(or any value above 90%), or 0% (or any value below 10%), if there is any fault in DR direction Potentiometer

YES

1) Go to "Inspection & Repair" procedure

NO

1) Fault is intermittent caused by poor contact in the sensor’s and/or A/C control unit’s connector or was repaired and A/C control unit memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   1) Repair as necessary and go to "Verification of Vehicle Repair" procedure

   NO

   1) Go to "Signal Circuit Inspection" procedure

Signal Circuit Inspection

Check for short in harness

1. Ignition "OFF"
2. Disconnect DR Direction potentiometer
3. Measure resistance between terminal "6" and "7" of DR Direction potentiometer
   A. Specification :Approx. ∞ Ω
4. Is the measured resistance within specifications?

   YES

   1) Go to "Ground Circuit Inspection " procedure

   NO

   1) Check for short to power harness in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Ground Circuit inspection

Check for open in ground harness

1. Ignition "OFF"
2. Disconnect DR Direction Actuator.
3. Measure resistance between terminal "5" of DR Direction Actuator and chassis ground.
   A. Specification :Approx. 0 Ω
4. Is the measured resistance within specifications?

   YES

   1) Go to "Component Inspection " procedure.

   NO

   1) Check for open in ground harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Component Inspection

Check actuator motor

1. Ignition "OFF"
2. Disconnect DR Direction Potentiometor.
3. Connect (+) terminal of battery to terminal 3 of DR Direction potentiometer and (-) terminal to terminal 4
4. Verify that the mode actuator operates to the hot position
5. Verify that the mode actuator operates to the cool position with reverse connecting.((+) to 4 and (-) to 3)
6. Dose the actuator work properly?

   YES

   1) Go to "Check potentiometer" procedure.

   NO

1) Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace actuator and then go to "Verification of Vehicle Repair" procedure.

Check potentiometer

1. Ignition "ON"
2. Connect DR Direction Potentiometer.
3. Measure voltage between terminal "5" and "6" of DR Direction potentiometer while operating mode switch .
   A. Specification : Refer the specifications in fig3)

Door position	Voltasge (5-6)	Error detecting
VENT	0.3±0.15V	Undervoltage : 0.08V or less Overvoltage : 4.92V or more
BI-LEVEL(1)	1.35±0.4V	
BI-LEVEL(2)	2.25±0.4V	
FLOOR	3.0±0.4V	
MIX	3.6±0.4V	
DEF	4.7±0.15V	

4. Is the measured voltage within specifications in fig3)?

YES

1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

1) Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace actuator and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

YES

1) Go to the applicable troubleshooting procedure

NO

1) System is performing to specification at this time.

Heating,Ventilation, Air Conditioning > Controller > B2406 Air Mix Motor(Driver)

Component Location

General Description

Temperature control actuator located at heater unit regulates the temperature by the procedure as follows. Signal from control unit adjusts position of temp door by operating temp motor. then temperature will be regulated by the hot/cold air ratio decided by position of temp door

DTC Description

The ECM sets DTC B2406 if the air mix actuator dosen‘t move to intended position within 40sec (The ECM attempts to move the temp door for a 2 second duration at a frequency of 3 times every 20 seconds before storing a DTC.)

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	● Voltage check	● Poor connection of connected part ● Open circuit in harness ● Short circuit in harness ● Faulty DR Air Mix potentiometer ● Faulty A/C Control Unit
Threshold value	●< 0.1V	
Detecting time	● 0.3sec	
FAIL SAFE		

Specification

※ Voltage value of Air Mix potentiometer as a function of setting temperature

Schematic Diagram

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "DR AIR MIX Potentiometer" Parameter on the Scantool. While operating temp switch
4. Are the DTC B2406 present and is parameter of "DR AIR MIX Potentiometer" fixed?
   ※ There is any fault in DR AIR MIX Motor. If the parameter of "DRIVER AIR MIX DOOR" is 30% or less when the actuator operates to the hot position, or If the parameter is 60% and more when the actuator operates to the cold position

   YES

   1) Go to "Inspection & Repair" procedure

   NO

   1) Fault is intermittent caused by poor contact in the sensor’s and/or A/C control unit’s connector or was repaired and A/C control unit memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   1) Repair as necessary and go to "Verification of Vehicle Repair" procedure

   NO

   1) Go to "Signal Circuit Inspection" procedure

Signal Circuit Inspection

Check for open in harness

1. Ignition "OFF"
2. Disconnect DR Air Mix Actuator
3. Measure resistance between terminal "3,4" of DR Air Mix Motor and terminal "16,17" of A/C control unit.
   A. Specification :Approx. 0 Ω
4. Is the measured resistance within specifications?

YES

1) Go to "Check for short to ground in harness" procedure.

NO

1) Check for open in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Check for short to ground in harness

1. Ignition "OFF"
2. Disconnect DR Air Mix Actuator
3. Measure resistance between terminal "3,4" of DR Air Mix Motor and chasis ground
   A. Specification :Approx. ∞ Ω
4. Is the measured resistance within specifications?

YES

1) Go to "Visual/Physical Inspection " procedure

NO

1) Check for short to ground in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Visual / Physical Inspection

Check actuator

※Check if DR Air Mix Actuator works properly through ACTUATION TEST.

1. Ignition : ON
2. Connect Scantool and select " ACTUATION TEST" mode and press [F1]
3. Dose DR Air Mix Actuator work properly?

YES

1) Go to "Component Inspection" procedure

NO

1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Component Inspection

Check actuator motor

1. Ignition "OFF"
2. Disconnect DR Air Mix Potentiometer.
3. Connect (+) terminal of battery to terminal 3 of DR Air Mix Actuator and (-) terminal to terminal 4
4. Verify that the mode actuator operates to the hot position
5. Verify that the mode actuator operates to the cool position with reverse connecting.((+) to 4 and (-) to 3)
6. Dose the actuator work properly?

YES

1) Go to "Check potentiometer" procedure.

NO

1) Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace actuator and then go to "Verification of Vehicle Repair" procedure.

Check potentiometer

1. Ignition "ON"
2. Connect DR Air Mix Actuator
3. Measure voltage between terminal "5" and "6" of DR AIR MIX potentiometer while operating the temp switch.
   A. Specification : Refer the specifications in fig5)

Door position	Voltage (5-6)	Threshold value
MAX. Cooling	0.3±0.15V	Voltage value > 0.08V
MAX. Heating	4.7±0.15V	Voltage value > 4.9V

4. Is the measured voltage within specifications in fig3)?

YES

1) Go to "Check A/C Control Unit" procedure

NO

1) Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace actuator and then go to "Verification of Vehicle Repair" procedure.

Check A/C Control Unit

1. Engine "ON"
2. Connect A/C Control Unit.
3. Measure voltage between terminal "16" and "17" of A/C Control Unit while operating the temp switch.
   A. Specification :Approx. 12V
4. Is the measured voltage within specifications?

YES

1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

1) Substitute with a known-good A/C Control Unit and check for proper operation. If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

YES

1) Go to the applicable troubleshooting procedure

NO

1) System is performing to specification at this time.

Heating,Ventilation, Air Conditioning > Controller > B2409 Direction Control Motor(Driver)

Component Location

General Description

The mode control actuator mounted on heater unit adjusts position of mode door by generating Direction Motor in accordance with signal of A/C control unit. Pressing mode select switch makes the mode control actuator shift in order of vent→ B/L → floor → mix.

DTC Description

The ECM sets DTC B2409 if the direction motor dosen’t move to intended position within 40sec(The ECM attempts to move the temp door for a 2 second duration at a frequency of 3 times every 20 seconds before storing a DTC.)

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	● Voltage check	● Poor connection of connected part ● Open circuit in harness ● Short circuit in harness ● Faulty DR Direction potentiometer ● Faulty A/C Control Unit
Threshold value	● < 0.1V	
Detecting time	● 0.3sec	
FAIL SAFE		

Specification

※ Voltage value of Direction potentiometer as a function of position of mode switch

Schematic Diagram

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "DR AIR MIX Potentiometer" Parameter on the Scantool. While operating mode switch
4. Are the DTC B2409 present and is parameter of "DR DIRECTION POTENTIO" fixed?
   ※ There is any fault in DR Direction Motor. If the parameter of "DR DIRECTION POTENTIO" is 10% or less on "VENT" mode, or If the parameter is 90% or more on "DEF" mode.

   YES

   1) Go to "Inspection & Repair" procedure

   NO

   1) Fault is intermittent caused by poor contact in the sensor's and/or A/C control unit's connector or was repaired and A/C control unit memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   1) Repair as necessary and go to "Verification of Vehicle Repair" procedure

   NO

   1) Go to "Signal Circuit Inspection" procedure

Signal Circuit Inspection

Check for open in harness

1. Ignition "OFF"
2. Disconnect DR Direction Actuator.
3. Measure resistance between terminal "3,4" of DR Direction Motor and terminal "19,20" of A/C control unit.
   A. Specification :Approx. 0 Ω
4. Is the measured resistance within specifications?

YES

1) Go to "Check for short to ground in harness" procedure.

NO

1) Check for open in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Check for short to ground in harness

1. Ignition "OFF"
2. Disconnect DR Direction Actuator.
3. Measure resistance between terminal "3,4" of DR Direction Motor and chasis ground
   A. Specification :Approx. ∞ Ω
4. Is the measured resistance within specifications?

YES

1) Go to "Visual/Physical Inspection " procedure

NO

1) Check for short to ground in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Visual / Physical Inspection

Check actuator

※ Check if DR Direction Actuator works properly through ACTUATION TEST.

1. Ignition : ON
2. Connect Scantool and select " ACTUATION TEST" mode and press [F1]
3. Dose DR Direction Actuator work properly?

YES

1) Go to "Component Inspection" procedure

NO

1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Component Inspection

Check actuator motor

1. Ignition "OFF"
2. Disconnect DR Direction Potentiometer.
3. Connect (+) terminal of battery to terminal 3 of DR Direction potentiometer and (-) terminal to terminal 4
4. Verify that the mode actuator operates to the hot position
5. Verify that the mode actuator operates to the cool position with reverse connecting.((+) to 4 and (-) to 3)
6. Dose the actuator work properly?

YES

1) Go to "Check potentiometer" procedure.

NO

1) Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace actuator and then go to "Verification of Vehicle Repair" procedure.

Check potentiometer

1. Ignition "ON"
2. Connect DR Direction Potentiometer.
3. Measure voltage between terminal "5" and "6" of DR Direction Potentiometor while operating the mode switch.
   A. Specification : Refer the specifications in fig5)

Door position	Voltasge (5-6)	Error detecting
VENT	0.3±0.15V	Undervoltage : 0.08V or less Overvoltage : 4.92V or more
BI-LEVEL(1)	1.35±0.4V	
BI-LEVEL(2)	2.25±0.4V	
FLOOR	3.0±0.4V	
MIX	3.6±0.4V	
DEF	4.7±0.15V	

4. Is the measured voltage within specifications in fig3)?

YES

1) Go to "Check A/C Control Unit" procedure

NO

1) Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace actuator and then go to "Verification of Vehicle Repair" procedure.

Check A/C Control Unit

1. Engine "ON"
2. Connect A/C Control Unit.
3. Measure voltage between terminal "19" and "20" of A/C Control Unit while operating the mode switch.
   A. Specification :Approx. 12V
4. Is the measured voltage within specifications?

YES

1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

1) Substitute with a known-good A/C Control Unit and check for proper operation. If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

YES

1) Go to the applicable troubleshooting procedure

NO

1) System is performing to specification at this time.

Heating,Ventilation, Air Conditioning > Controller > B1208 Intake Potentiometer Open (Low)

Component Location

General Description

Intake door located at heater unit controls the inlet of car. When driver operates the intake switch, ECU receives mode signal from intake switch and operates intake door actuator to turn intake door to intended position. (with FRE mode signal, intake door is closed and with REC mode signal, intake door is opened)

DTC Description

The ECM sets DTC B1208 if there is an open circuit or poor connection in the Intake potentiometer

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	● Voltage check	● Poor connection of connected part ● Open circuit in harness ● Short circuit in harness ● Faulty Intake potentiometer
Threshold value	● < 0.1V	
Detecting time	● 0.3sec	
FAIL SAFE	● Fix at FRE	

Specification

※ Voltage value of Intake potentiometer as a function of position of Intake door

Door position	Voltage	Threshold value
FRE	0.3±0.15V	Voltage value > 0.08V
REC	4.7±0.15V	Voltage value > 4.9V

Schematic Diagram

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the " Intake potentiometer" Parameter on the Scantool. While operating intake switch
4. Are the DTC B1208 present and is parameter of "Intake potentiometer" fixed?
   ※ Parameter of "Intake potentiometer" will be fixed at 100%(or any value above 90%), or 0% (or any value below 10%), if there is any fault in Intake potentiometer

   YES

   1) Go to "Inspection & Repair" procedure

   NO

   1) Fault is intermittent caused by poor contact in the sensor's and/or A/C control unit's connector or was repaired and A/C control unit memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   1) Repair as necessary and go to "Verification of Vehicle Repair" procedure

   NO

   1) Go to "W/Harness Inspection" procedure

Signal Circuit Inspection

Check for open in harness

1. Ignition "OFF"
2. Disconnect Intake potentiometer
3. Measure resistance between terminal "6" of Intake potentiometer and terminal "24" of A/C control unit.
   A. Specification :Approx. 0 Ω
4. Is the measured resistance within specifications?

YES

1) Go to "Check for short to ground in harness" procedure.

NO

1) Check for open in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Check for short to ground in harness

1. Ignition "OFF"
2. Disconnect Intake potentiometer
3. Measure resistance between terminal "6" of Intake potentiometer and chassis ground
   A. Specification :Approx. ∞ Ω
4. Is the measured resistance within specifications?

YES

1) Go to "Power Circuit Inspection" procedure

NO

1) Check for short to ground in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Power Supply Circuit Inspection

Check for short or open in harness

1. Ignition "ON"
2. Connect Intake potentiometer
3. Measure voltage between terminal "7" of Intake potentiometer and chassis ground.
   A. Specification :Approx.5V
4. Is the measured voltage within specifications?

YES

1) Go to "Component Inspection " procedure.

NO

1) Check for short or open in power harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Component Inspection

Check actuator motor

1. Ignition "OFF"
2. Disconnect Intake potentiometer.
3. Connect (+) terminal of battery to terminal 3 of Intake potentiometer and (-) terminal to terminal 4
4. Verify that the mode actuator operates to the hot position
5. Verify that the mode actuator operates to the cool position with reverse connecting.((+) to 4 and (-) to 3)
6. Dose the actuator work properly?

YES

1) Go to "Check potentiometer" procedure.

NO

1) Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace actuator and

then go to "Verification of Vehicle Repair" procedure.

Check potentiometer

1. Ignition "ON"
2. Connect Intake potentiometer.
3. Measure voltage between terminal "5" and "6" of Intake potentiometer while operating Intake switch
   A. Specification : Refer the specifications in fig3)
4. Is the measured voltage within specifications in fig3)?

   YES

   1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

   NO

   1) Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace actuator and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

   YES

   1) Go to the applicable troubleshooting procedure

   NO

   1) System is performing to specification at this time.

Heating,Ventilation, Air Conditioning > Controller > B1209 Intake Potentiometer Short (High)

Component Location

General Description

Intake door located at heater unit controls the inlet of car. When driver operates the intake switch, ECU receives mode signal from intake switch and operates intake door actuator to turn intake door to intended position. (with FRE mode signal, intake door is closed and with REC mode signal, intake door is opened)

DTC Description

The ECM sets DTC B1209 if there is a short to power in the Intake potentiometer.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Voltage check	• Open circuit in harness • Short circuit in harness • Faulty Intake potentiometer
Threshold value	• < 4.9V	
Detecting time	• 0.3sec	
FAIL SAFE	• Fix at FRE	

Specification

※ Voltage value of Intake potentiometer as a function of position of Intake door

Door position	Voltage	Threshold value
FRE	0.3±0.15V	Voltage value > 0.08V
REC	4.7±0.15V	Voltage value > 4.9V

Schematic Diagram

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the " Intake potentiometer" Parameter on the Scantool. While operating intake switch
4. Are the DTC B1209 present and is parameter of "Intake potentiometer" fixed?
   ※ Parameter of "Intake potentiometer" will be fixed at 100%(or any value above 90%), or 0% (or any value below 10%), if there is any fault in Intake potentiometer

   YES

   1) Go to "Inspection & Repair" procedure

   NO

   1) Fault is intermittent caused by poor contact in the sensor's and/or A/C control unit's connector or was repaired and A/C control unit memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   1) Repair as necessary and go to "Verification of Vehicle Repair" procedure

   NO

   1) Go to "W/Harness Inspection" procedure

Signal Circuit Inspection

Check for short in harness

1. Ignition "OFF"
2. Disconnect Intake potentiometer
3. Measure resistance between terminal "6" and "7" of Intake potentiometer.
   A. Specification :Approx. ∞ Ω
4. Is the measured resistance within specifications?

   YES

   1) Go to "Ground Circuit Inspection " procedure

   NO

   1) Check for short to power harness in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Ground Circuit inspection

Check for open in ground harness

1. Ignition "OFF"
2. Disconnect Intake potentiometer
3. Measure resistance between terminal "5" of Intake potentiometer and chassis ground.
   A. Specification :Approx. 0 Ω
4. Is the measured resistance within specifications?

YES

1) Go to "Component Inspection " procedure.

NO

1) Check for open in ground harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Component Inspection

Check actuator motor

1. Ignition "OFF"
2. Disconnect Intake potentiometer.
3. Connect (+) terminal of battery to terminal 3 of Intake potentiometer and (-) terminal to terminal 4
4. Verify that the mode actuator operates to the hot position
5. Verify that the mode actuator operates to the cool position with reverse connecting.((+) to 4 and (-) to 3)
6. Dose the actuator work properly?

YES

1) Go to "Check potentiometer" procedure.

NO

1) Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace actuator and then go to "Verification of Vehicle Repair" procedure.

Check potentiometer

1. Ignition "ON"
2. Connect Intake potentiometer.
3. Measure voltage between terminal "5" and "6" of Intake potentiometer while operating Intake switch
   A. Specification : Refer the specifications in fig3)
4. Is the measured voltage within specifications in fig3)?

YES

1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

1) Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace actuator and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

YES

1) Go to the applicable troubleshooting procedure

NO

1) System is performing to specification at this time.

Heating,Ventilation, Air Conditioning > Controller > B2408 Intake Motor

Component Location

General Description

Intake door located at heater unit controls the inlet of car. When driver operates the intake switch, ECU receives mode signal from intake switch and operates intake door actuator to turn intake door to intended position. (with FRE mode signal, intake door is closed and with REC mode signal, intake door is opened)

DTC Description

The ECM sets DTC B2408 if the intake motor dosen't move to intended position within 40sec(The ECM attempts to move the intake door for a 2 second duration at a frequency of 3 times every 20 seconds before storing a DTC.)

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	● Voltage check	● Poor connection of connected part ● Open circuit in harness ● Short circuit in harness ● Faulty Intake potentiometer
Threshold value	●< 0.1V	
Detecting time	● 0.3sec	
FAIL SAFE		

Specification

※ Voltage value of Intake potentiometer as a function of position of Intake door

Door position	Voltage	Threshold value
FRE	0.3±0.15V	Voltage value > 0.08V
REC	4.7±0.15V	Voltage value > 4.9V

Schematic Diagram

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the " Intake potentiometer" Parameter on the Scantool. While operating Intake switch
4. Are the DTC B2408 present and is parameter of "Intake potentiometer" fixed?
   ※ There is any fault in Intake potentiometer. If the parameter of "Intake potentiometer" is 30% or less when the actuator operates to the FRE position, or If the parameter is 60% and more when the actuator operates to the REC position

   YES

   1) Go to "Inspection & Repair" procedure

   NO

   1) Fault is intermittent caused by poor contact in the sensor's and/or A/C control unit's connector or was repaired and A/C control unit memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

1) Repair as necessary and go to "Verification of Vehicle Repair" procedure

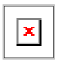
NO

1) Go to "Signal Circuit Inspection" procedure

Signal Circuit Inspection

Check for open in harness

1. Ignition "OFF"
2. Disconnect Intake potentiometer
3. Measure resistance between terminal "3,4" of Intake potentiometer and terminal "22,23" of A/C control unit.
   A. Specification :Approx. 0 Ω



4. Is the measured resistance within specifications?

YES

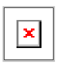
1) Go to "Check for short to ground in harness" procedure.

NO

1) Check for open in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Check for short to ground in harness

1. Ignition "OFF"
2. Disconnect Intake potentiometer
3. Measure resistance between terminal "3,4" of Intake potentiometer and chassis ground
   A. Specification :Approx. ∞ Ω



4. Is the measured resistance within specifications?

YES

1) Go to "Visual/Physical Inspection " procedure

NO

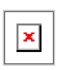
1) Check for short to ground in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Visual / Physical Inspection

Check actuator

※ Check if Intake potentiometer works properly through ACTUATION TEST.

1. Ignition : ON
2. Connect Scantool and select " ACTUATION TEST" mode and press [F1]



3. Dose Intake potentiometer work properly?

YES

1) Go to "Component Inspection" procedure

NO

1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Component Inspection

Check actuator motor

1. Ignition "OFF"
2. Disconnect Intake potentiometer
3. Connect (+) terminal of battery to terminal 3 of Intake potentiometer and (-) terminal to terminal 4
4. Verify that the mode actuator operates to the hot position
5. Verify that the mode actuator operates to the cool position with reverse connecting.((+) to 4 and (-) to 3)
6. Dose the actuator work properly?
   - YES
     1) Go to "Check potentiometer" procedure.
   - NO
     1) Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace actuator and then go to "Verification of Vehicle Repair" procedure.

Check potentiometer

1. Ignition "ON"
2. Connect Intake potentiometer.
3. Measure voltage between terminal "5" and "6" of Intake potentiometer while operating Intake switch
   A. Specification : Refer the specifications in fig3)
4. Is the measured voltage within specifications in fig3)?
   - YES
     1) Go to "Check A/C Control Unit" procedure
   - NO
     1) Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace actuator and then go to "Verification of Vehicle Repair" procedure.

Check A/C Control Unit

1. Engine "ON"
2. Connect A/C Control Unit.
3. Measure voltage between terminal "22" and "23" of A/C Control Unit while operating the Intake switch.
   A. Specification :Approx. 12V
4. Is the measured voltage within specifications?
   - YES
     1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
   - NO
     1) Substitute with a known-good A/C Control Unit and check for proper operation. If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?
   - YES
     1) Go to the applicable troubleshooting procedure
   - NO
     1) System is performing to specification at this time.

Component Location

General Description

AQS(Air Quality System) keeps air inside in the most suitable state for driver. In polluted area AQS detects hazardous gas and intercepts inflow automatically, Inversely, In fresh area it allows the inflow of air to prevent the shortage of air and the accumulation of carbon dioxide. AQS sensor is located at front side of condensor and once hazardous gas is detected, it delivers the voltage signal to ECU for closing intake door.

DTC Description

The ECM sets DTC B1257 if there is an open circuit in AQS sensor signal harness or the measured voltage value of the sensor is more than the threshold value

DTC Detecting Condition

<table>
<tr><td>Item</td><td>Detecting Condition</td><td>Possible Cause</td></tr>
<tr><td>DTC Strategy</td><td>● Voltage check</td><td rowspan="4">● Open circuit in power harness
● Open circuit in ground harness
● Faulty AQS sensor
● Poor connection of connected part</td></tr>
<tr><td>Threshold value</td><td>● < 4.9V</td></tr>
<tr><td>Detecting time</td><td>● 1sec</td></tr>
<tr><td>FAIL SAFE</td><td>● AQS function OFF
● Intake door : return to previous state</td></tr>
</table>

Specification

※ Voltage value of AQS sensor as a function of position of operating condition.

Operating condition	Voltage	Note
Right after IGN "ON"	2.5V ± 0.3V	Preheating(35 ± 2sec)
Normal	4.3V ± 0.3V	Intake door : REC
Gas detected	0.9V ± 0.3V	Intake door : FRE

Schematic Diagram

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the " AQS sensor " Parameter on the Scantool. While making hazardous gas such as tobacco fumes around the AQS sensor
4. Are the DTC B1257 present and is parameter of " AQS sensor " fixed?
   ※ Parameter of " AQS sensor" will be fixed even though hazardous gas is around AQS sensor, if there is any fault in AQS sensor

   YES

   1) Go to "Inspection & Repair" procedure

   NO

   1) Fault is intermittent caused by poor contact in the sensor's and/or A/C control unit's connector or was repaired and A/C control unit memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?
   - YES
     1) Repair as necessary and go to "Verification of Vehicle Repair" procedure
   - NO
     1) Go to "Signal Circuit Inspection" procedure

Signal Circuit Inspection

Check for open in harness

1. Ignition "OFF"
2. Disconnect AQS sensor
3. Measure resistance between terminal "4" of AQS sensor and terminal "2" of A/C Control Unit
   A. Specification :Approx. 0 Ω
4. Is the measured resistance within specifications?
   - YES
     1) Go to "Ground Circuit Inspection " procedure.
   - NO
     1) Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Ground Circuit inspection

Check for open in ground harness

1. Ignition "OFF"
2. Disconnect AQS sensor
3. Measure resistance between terminal "5" of AQS sensor and chassis ground.
   A. Specification :Approx. 0 Ω
4. Is the measured resistance within specifications?
   - YES
     1) Go to "Component Inspection " procedure.
   - NO
     1) Check for open in ground harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Component Inspection

Check Ambient sensor

1. Engine "ON"
2. Connect AQS sensor
3. Measure voltage value between terminal "4" and "5" of AQS sensor
   A. Specification : Refer the specifications in fig3)
4. Is the measured voltage within specifications in fig3)?
   - YES
     1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

1) Substitute with a AQS sensor and check for proper operation. If the problem is corrected, replace AQS sensor and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

YES

1) Go to the applicable troubleshooting procedure

NO

1) System is performing to specification at this time.

Heating,Ventilation, Air Conditioning > Controller > B1258 AQS Sensor Short(Low)

Component Location

General Description

AQS(Air Quality System) keeps air inside in the most suitable state for driver. In polluted area AQS detects hazardous gas and intercepts inflow automatically, Inversely, In fresh area it allows the inflow of air to prevent the shortage of air and the accumulation of carbon dioxide. AQS sensor is located at front side of condensor and once hazardous gas is detected, it delivers the voltage signal to ECU for closing intake door.

DTC Description

The ECM sets DTC B1258 if there is a short circuit in AQS sensor signal harness or the measured voltage value of the sensor is less than the threshold value

DTC Detecting Condition

<table>
<tr><td>Item</td><td>Detecting Condition</td><td>Possible Cause</td></tr>
<tr><td>DTC Strategy</td><td>● Voltage check</td><td rowspan="4">● Short circuit in harness
● Faulty AQS sensor
● Faulty A/C Control Unit</td></tr>
<tr><td>Threshold value</td><td>● > 0.1V</td></tr>
<tr><td>Detecting time</td><td>● 1sec</td></tr>
<tr><td>FAIL SAFE</td><td>● AQS function OFF
● Intake door : return to previous state</td></tr>
</table>

Specification

※ Voltage value of AQS sensor as a function of position of operating condition.

Operating condition	Voltage	Note
Right after IGN "ON"	2.5V ± 0.3V	Preheating(35 ± 2sec)
Normal	4.3V ± 0.3V	Intake door : REC
Gas detected	0.9V ± 0.3V	Intake door : FRE

Schematic Diagram

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the " AQS sensor " Parameter on the Scantool. While making hazardous gas such as tobacco fumes around the AQS sensor
4. Are the DTC B1258 present and is parameter of " AQS sensor " fixed?
   ※ Parameter of " AQS sensor" will be fixed even though hazardous gas is around AQS sensor, if there is any fault in AQS sensor

   YES

   1) Go to "Inspection & Repair" procedure

   NO

   1) Fault is intermittent caused by poor contact in the sensor's and/or A/C control unit's connector or was repaired and A/C control unit memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   1) Repair as necessary and go to "Verification of Vehicle Repair" procedure

   NO

   1) Go to "Signal Circuit Inspection" procedure

Signal Circuit Inspection

Check for short to ground in harness

1. Ignition "OFF"
2. Disconnect AQS sensor
3. Measure resistance between terminal "1" of AQS sensor and chassis ground
   A. Specification :Approx. ∞ Ω
4. Is the measured resistance within specifications?

   YES

   1) Go to "Component Inspection" procedure.

   NO

   1) Check for short to ground in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Component Inspection

Check Ambient sensor

1. Engine "ON"
2. Connect AQS sensor
3. Measure voltage value between terminal "4" and "5" of AQS sensor
   A. Specification : Refer the specifications in fig3)
4. Is the measured voltage within specifications in fig3)?

   YES

   1) Go to "Check A/C Control Unit" procedure.

NO

1) Substitute with a AQS sensor and check for proper operation. If the problem is corrected, replace AQS sensor and then go to "Verification of Vehicle Repair" procedure.

Check A/C Control Unit

1. Engine : "ON"
2. Disconnect AQS sensor.
3. Measure voltage between terminal "2" of A/C Control Unit and chassis ground
   A. Specification :Approx. 5V
4. Is the measured voltage within specifications?

YES

1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

1) Substitute with a known-good A/C Control Unit and check for proper operation.
If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

YES

1) Go to the applicable troubleshooting procedure

NO

1) System is performing to specification at this time.

Heating,Ventilation, Air Conditioning > Controller > B1259 AQS Sensor Fault

Component Location

General Description

AQS(Air Quality System) keeps air inside in the most suitable state for driver. In polluted area AQS detects hazardous gas and intercepts inflow automatically, Inversely, In fresh area it allows the inflow of air to prevent the shortage of air and the accumulation of carbon dioxide. AQS sensor is located at front side of condensor and once hazardous gas is detected, it delivers the voltage signal to ECU for closing intake door.

DTC Description

The ECM sets DTC B1259 if preheating time of AQS sensor is over 40sec or signal from AQS sensor is not within specifications

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	● Voltage/time check	● Poor connection of connected part ● Faulty AQS sensor
Threshold value	● Voltage : Preheating - 2.5V±0.3V Normal - 4.3V±0.3V Gas detected - 0.9V±0.3V	
Detecting time	-	
FAIL SAFE	● AQS function OFF ● Intake door : return to previous state	

Specification

※ Voltage value of AQS sensor as a function of position of operating condition.

Operating condition	Voltage	Note
Right after IGN "ON"	2.5V ± 0.3V	Preheating(35 ± 2sec)
Normal	4.3V ± 0.3V	Intake door : REC
Gas detected	0.9V ± 0.3V	Intake door : FRE

Schematic Diagram

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the " AQS sensor " Parameter on the Scantool. While making hazardous gas such as tobacco fumes around the AQS sensor
4. Are the DTC B1259 present and is parameter of " AQS sensor " fixed?
   ※ Parameter of " AQS sensor" will be fixed even though hazardous gas is around AQS sensor, if there is any fault in AQS sensor

   YES

   1) Go to "Inspection & Repair" procedure

   NO

   1) Fault is intermittent caused by poor contact in the sensor's and/or A/C control unit's connector or was repaired and A/C control unit memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   1) Repair as necessary and go to "Verification of Vehicle Repair" procedure

   NO

   1) Go to "Signal Circuit Inspection" procedure

Signal Circuit Inspection

Check for short to ground in harness

1. Ignition "ON"
2. Disconnect AQS sensor
3. Measure voltage value between terminal "6" of AQS sensor and chassis groundit
   A. Specification : 12V
4. Is the measured resistance within specifications?

   YES

   1) Go to "Component Inspection" procedure.

   NO

1) Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Component Inspection

Check Ambient sensor

1. Engine "ON"
2. Connect AQS sensor
3. Measure voltage value between terminal "4" and "5" of AQS sensor
   A. Specification : Refer the specifications in fig3)
4. Is the measured voltage within specifications in fig3)?

YES

1) Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

1) Substitute with a AQS sensor and check for proper operation. If the problem is corrected, replace AQS sensor and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

YES

1) Go to the applicable troubleshooting procedure

NO

1) System is performing to specification at this time.

Precautions

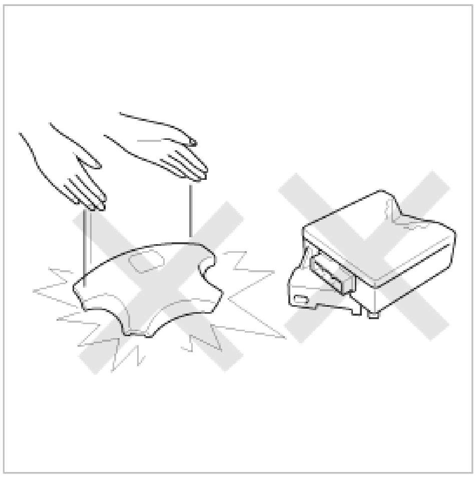
General Precautions

Please read the following precautions carefully before performing the airbag system service. Observe the instructions described in this manual, or the airbags could accidentally deploy and cause damage or injury.

- Except when performing electrical inspections, always turn the ignition switch OFF and disconnect the negative cable from the battery, and wait at least three minutes before beginning work.

> NOTE
>
> The contents in the SRSCM memory are not erased even if the ignition switch is turned OFF or the battery cables are disconnected from the battery.

- Use the replacement parts which are manufactured to the same standards as the original parts and quality.
  Do not install used SRS parts from another vehicle.
  Use only new parts when making SRS repairs.
- Carefully inspect any SRS part before you install it.
  Do not install any part that shows signs of having been dropped or improperly handled, such as dents, cracks or deformation.

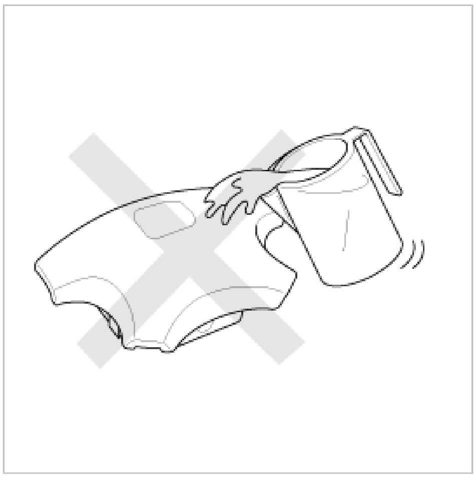


- Before removing any of the SRS parts (including the disconnection of the connectors), always disconnect the SRS connector.

Airbag Handling and Storage

Do not disassemble the airbags; They have no serviceable parts. Once an airbag has been deployed, it cannot be repaired or reused.
For temporary storage of the air bag during service, please observe the following precautions.

- Store the removed airbag with the pad surface up.
- Keep free from any oil, grease, detergent, or water to prevent damage to the airbag assembly.



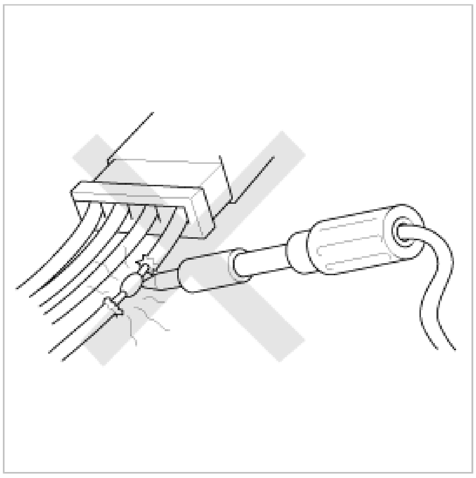
- Store the removed airbag on secure, flat surface away from high heat source (exceeding 200 °F / 93 °C).
- Never perform electrical inspections to the airbags, such as measuring resistance.
- Do not position yourself in front of the airbag assembly during removal, inspection, or replacement.

- Refer to the scrapping procedures for disposal of the damaged airbag.
- Be careful not to bump or impact the SRSCM or the side impact sensors whenever the ignition switch is ON, wait at least three minutes after the ignition switch is turned OFF before begin work.
- During installation or replacement, be careful not to bump (by impact wrench, hammer, etc.) the area around the SRSCM and the side impact sensor. The airbags could accidentally deploy and cause damage or injury.
- After a collision in which the airbags were deployed, replace the front airbags and the SRSCM. After a collision in which the side airbag was deployed, replace the side airbag, the front impact sensor and side impact sensor on the side where the side airbag deployed and the SRSCM. After a collision in which the airbags or the side air bags did not deploy, inspect for any damage or any deformation on the SRSCM and the side impact sensors. If there is any damage, replace the SRSCM, the front impact sensor and/or the side impact sensors.
- Do not disassemble the SRSCM, the front impact sensor or the side impact sensors
- Turn the ignition switch OFF, disconnect the battery negative cable and wait at least three minutes before beginning installation or replacement of the SRSCM.
- Be sure the SRSCM, the front impact sensor and side impact sensors are installed securely with the mounting bolts.
- Do not spill water or oil on the SRSCM,or the front impact sensor or the side impact sensors and keep them away from dust.
- Store the SRSCM, the front impact sensor and the side impact sensors in a cool (less than 104°F/40°C) and dry (less than 80% relative humidity, no moisture) area.

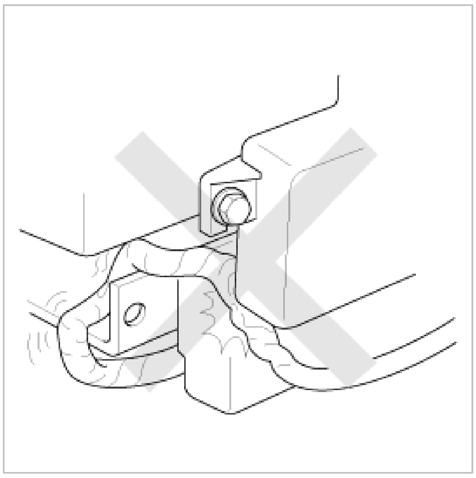
Wiring Precautions

SRS wiring can be identified by special yellow outer covering (except the SRS circuits under the front seats).
Observe the instructions described in this section.

- Never attempt to modify, splice, or repair SRS wiring.
  If there is an open or damage in SRS wiring, replace the harness.



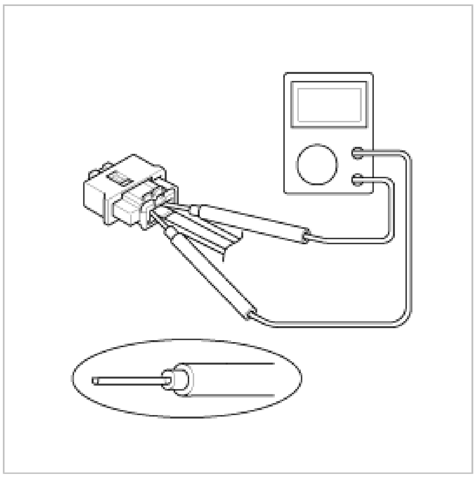
- Be sure to install the harness wires so that they are not pinched, or interfere with other parts.



- Make sure all SRS ground locations are clean, and grounds are securely fastened for optimum metal-to-metal contact. Poor grounding can cause intermittent problems that are difficult to diagnose.

Precautions for Electrical Inspections

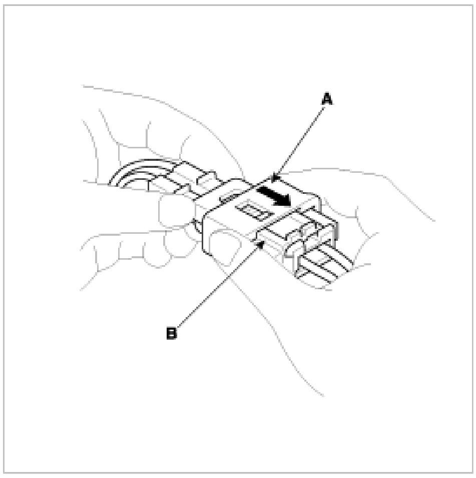
- When using electrical test equipment, insert the probe of the tester into the wire side of the connector.
  Do not insert the probe of the tester into the terminal side of the connector, and do not tamper with the connector.



• Use a u-shaped probe. Do not insert the probe forcibly.
• Use specificed service connectors for troubleshooting.
  Using improper tools could cause an error in inspection due to poor metal contact.

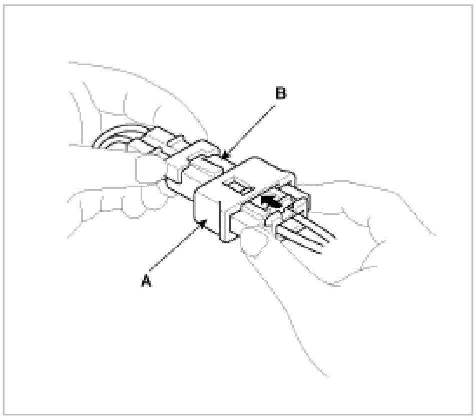
Spring-loaded Lock Connector

Airbag Connector(I)

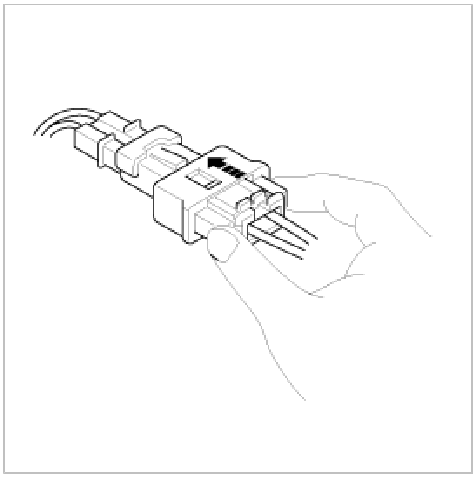


Connecting

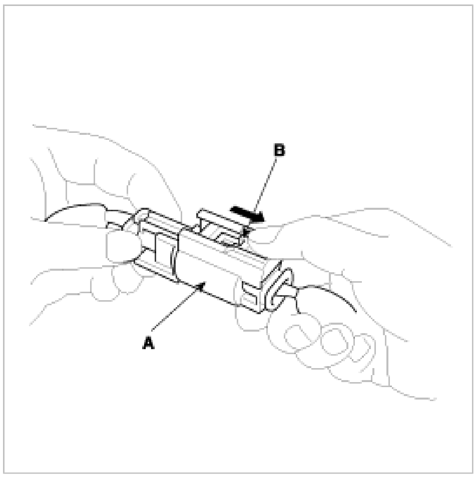
1. To reconnect, hold the pawl-side connector half, and press on the back of the sleeve-side connector half in the direction shown. As the two connectpr halves are pressed together, the sleeve (A) is pushed back by the pawl (B). Do not touch the sleeve.



2. When the connector halves are completely connected, the pawl is released, and the spring-loaded sleeve locks the connector.

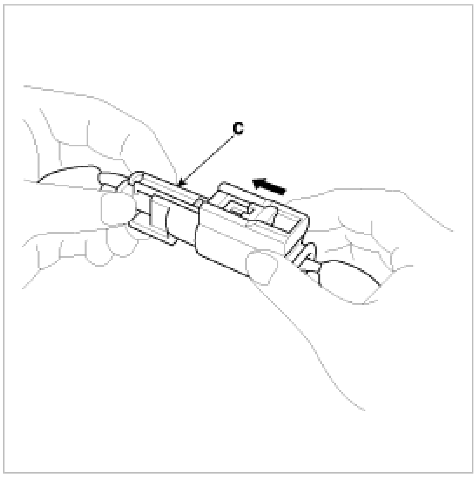


Airbag Connector(II)



Connecting

Hold both connector halves and press firmly until the projection (C) of the sleeve-side connector clicks to lock.



COMPONENT REPLACEMENT AFTER DEPLOYMENT

NOTE

Before doing any SRS repairs, use the Hi-Scan Pro to check for DTCs. Refer to the Diagnostic Trouble Code list for repairing of the related DTCs.

When the front airbag(s) deployed after a collision, replace the following items.

- SRSCM
- Deployed airbag(s)
- Seat belt pretensioner(s)
- Seat belt buckle pretensioner(s)

- Front impact sensors
- SRS wiring harnesses
- Clock spring (when Driver Airbag deployed)

hen the seat belt pretensioner(s) deployed after a collision, replace the following items.

- Seat belt pretensioner(s)
- Seat belt buckle pretensioner(s)
- SRSCM (if B1658 detected)
- Front impact sensors
- SRS wiring harnesses

hen the side/curtain airbag(s) deployed after a collision, replace the following items.

- SRSCM
- Deployed airbag(s)
- Side impact sensor(s) for the deployed side(s)
- SRS wiring harnesses

After the vehicle is completely repaired, confirm the SRS airbag system is OK.

- Turn the ignition switch ON, the SRS indicator should come on for about 6 seconds and then go off.

Restraint > General Information > General Information

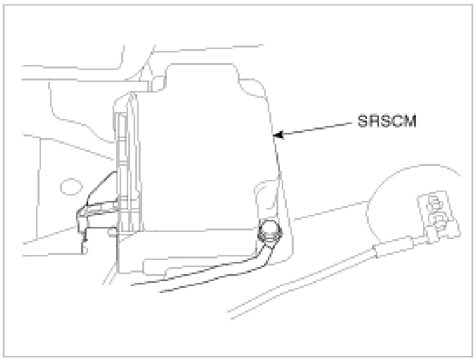
General

The supplemental restraint system (SRS) is designed to supplement the seat belt to help reduce the risk of severe injury to the driver and passenger by activating and deploying the driver, passenger, side airbag and belt pre-tensioner in certain frontal or side collisions. The SRS (Airbag) consists of : a driver side airbag module located in the center of the steering wheel, which contains the folded cushion and an inflator unit ; a passenger side airbag module located in the passenger side crash pad contains the folded cushion assembled with inflator unit ; side airbag modules located in the driver and passenger seat contains the folded cushion and an inflator unit ; curtain airbag modules located inside the headliner which contains folded cushions and inflator units. The Passenger Occupant classification System (OCS) utilizes a sensor mat placed between the passenger seat cover and cushion pad to measure the occupant's loading force on the vehicle seat. Seat Track Position Sensor (STPS) is located in the driver and passenger seat it, interfaces with the SRS Control module (SRSCM) and will help determine whether to suppress either stage of the multi-stage airbag system. SRSCM is located under the center console. The impact sensing function of the SRSCM is carried out by electronic accelerometer that continuously measures the vehicle's acceleration and delivers a corresponding signal through amplifying and filtering circuitry to the microprocessor.

SRSCM (SRS Control Module)

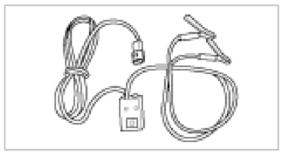
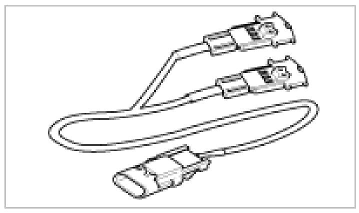
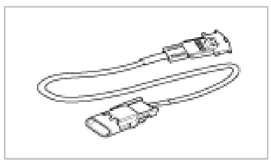
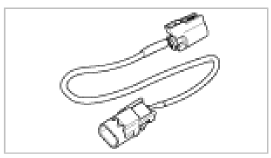
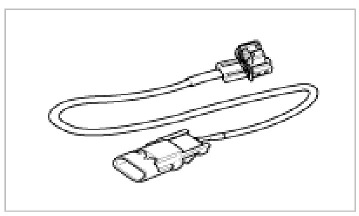
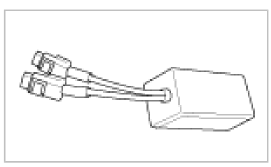
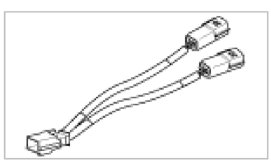
The SRS airbag system consists of electrical and electronic components. Be cautious of the airbag parts. The SRSCM will detect front impact with an inside sensor, side impact with a side impact sensor, airbag deployment request signal, and determine airbag module deployment.

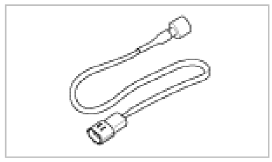
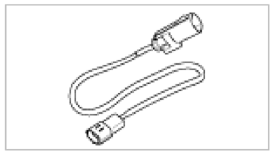
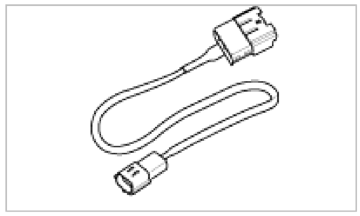
1. DC/DC converter: DC/DC converter in power supply unit includes up/down transformer converter, and provides ignition voltage for 2 front airbag ignition circuits and inside operation voltage. If inside operation voltage is below critical value setting, it will perform re-setting.
2. Safety sensor: The safety sensor is located in the airbag ignition circuit. The safety sensor will operate airbag circuit at any deployment condition and release airbag circuit safely at normal driving condition. The safety sensor is a double contact electro-mechanical switch that will close detecting deceleration above certain criteria.
3. Back up power supply: SRSCM has a separate back up power supply, it will supply deployment energy instantly in low voltage condition or upon power failure by front crash.
4. Self diagnosis: SRSCM will constantly monitor current SRS operation status and detect system failure when the vehicle power supply is on, system failure may be checked with trouble codes using the scan tool. (Hi-Scan)
5. Airbag warning lamp : Upon detecting error, the SRSCM will transmit a signal to the airbag warning lamp located in the cluster. The lamp will indicate SRS error. When the ignition key is on, the SRS lamp will be turned on for about 6 seconds, then will be turned off for a self check. If it remains on, the error is indicated.
6. Trouble code registration: Upon error occurrence in the system, the SRSCM will store a DTC corresponding to the error. DTC can be cleared only by Hi-Scan.
7. Self diagnostic connector: Data stored in SRSCM memory will be output to the Hi-Scan or other external output devices through the data link connector located below the driver side crash pad.
8. Once the airbag is deployed, the SRSCM should not be used again and replaced.
9. SRSCM will determine whether a passenger has put on a seat belt using built-in switch signal in the seat belt buckle, and deploy the front passenger seat airbag accordingly.
10. Side airbag deployment will be determined by SRSCM that will detect satellite sensor impact signal upon side crash, irrespective to seat belt condition.



Restraint > General Information > Special Service Tools

SPECIAL SERVICE TOOLS

Tool(Number and Name)	Illustration	Use
Deployment tool 0957A-34100A		Airbag deployment tool
Deployment adapter 0957A-38510		Use with deployment tool. (DAB,PAB)
Deployment adapter 0957A-38500		Use with deployment tool. (CAB,BPT,)
Deployment adapter 0957A-3F100		Use with deployment tool. (SAB)
Deployment adapter 0957A-2E210		Use with deployment tool. (BUPT)
Dummy load 0957A-38200		Simulator to check the resistance of each wiring harness
Dummy adapter 0957A-2D100		Use with dummy load (SAB)
Dummy adapter 0957A-1C000		Use with dummy load (DAB,CAB,BPT)

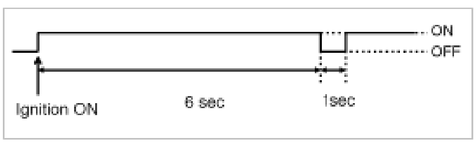
		
Dummy adapter 0957A-3F000		Use with dummy load (SAB)
Dummy adapter 0957A-2E200		Use with dummy load (BUPT)

DAB : Driver Airbag
PAB : Passenger Airbag
SAB : Side Airbag
CAB : Curtain Airbag
BPT : Belt Pretensioner
BUPT: Buckle Pretensioner

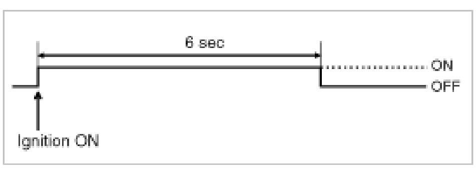
Restraint > General Information > Description and Operation

Warning Lamp Activation

1. Active fault or more than 10 faults are memorized
   A. warning lamp turns on continuously for 6 seconds after IG ON.
   B. warning lamp turns off for 1 second.
   C. warning lamp turns on continuously.



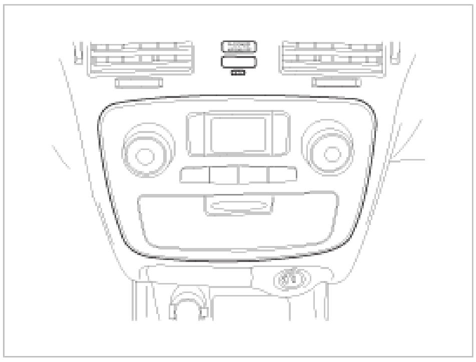
2. No current fault or Less than 10 faults are memorized
   A. warning lamp turns on continuously for 6 seconds after IG ON.
   B. warning lamp turns off continuously.



3. Failure recognition time table

	Active fault	Historical fault
internal fault	2sec.	4sec.
external fault	2sec.	4sec.
battery voltage high/low	10sec.	10sec.

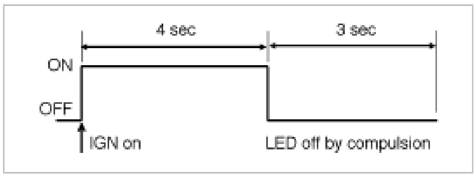
TELLTALE LAMP ACTIVATION



The Telltale Lamp indicates the Passenger Airbag(PAB) enable and disablestatus based on occupant status of passenger seat. If the passenger seat isempty or occupied with a child (or child seat), the Passenger Airbag is disabledand the Telltale Lamp is turned ON to inform the driver that the PAB is disabled.As soon as operating voltage is applied to the SRSCM ignition input, the SRSCMactivates the telltale lamp for 4 seconds. OCS will send an indeterminatestatus to the SRSCM as a default setting for the passenger airbag deployment duringthe prove out period. After a crash, if OCS gets reset and sends the indeterminate status,the telltale lamp will be ON as long as the occupant status is in the indeterminatestatus. Occupant status information and telltale ststus are as below table.

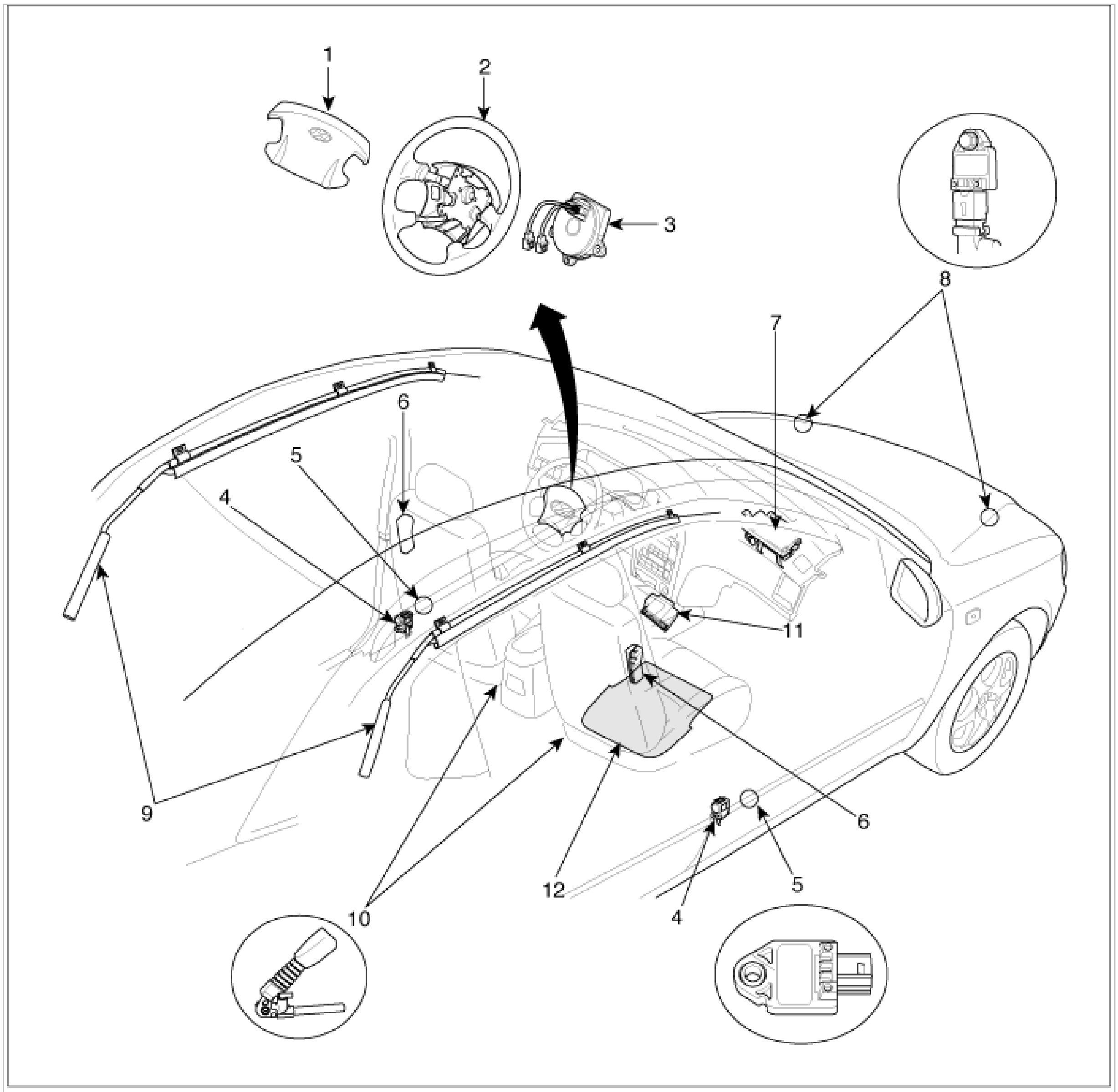
OCS statusresponse message	Tell-tale Lamp	Passenger Airbag	Belt pretensioner (Passenger)	Buckle pretensioner (Passenger)	Side airbag (Passenger)
Initial 4 seconds	ON→OFF	Default	Default	Default	Default
Class 0 = Empty	ON	Disabled	Disabled	Disabled	Disable
Class 1 = Child	ON	Disabled	Disabled	Disabled	Enable
Class 2 = Adult	OFF	Enable	Enable	Enable	Enable
Defect	Default	Default	Default	Default	Default

After turning the ignition on, the telltale lamp will turn on for 4 seconds and turn off for 3 seconds during the initialization phase and be turned off for 3 seconds until a message is received from OCS system.



Restraint > General Information > Components and Components Location

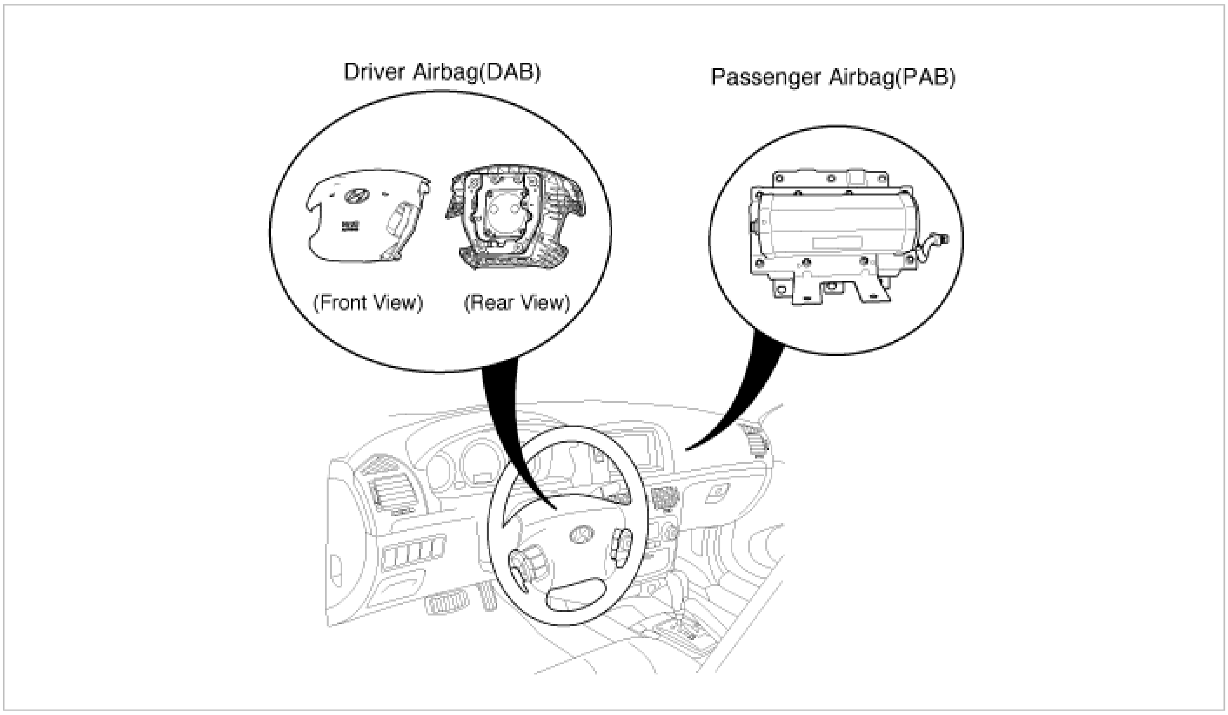
components



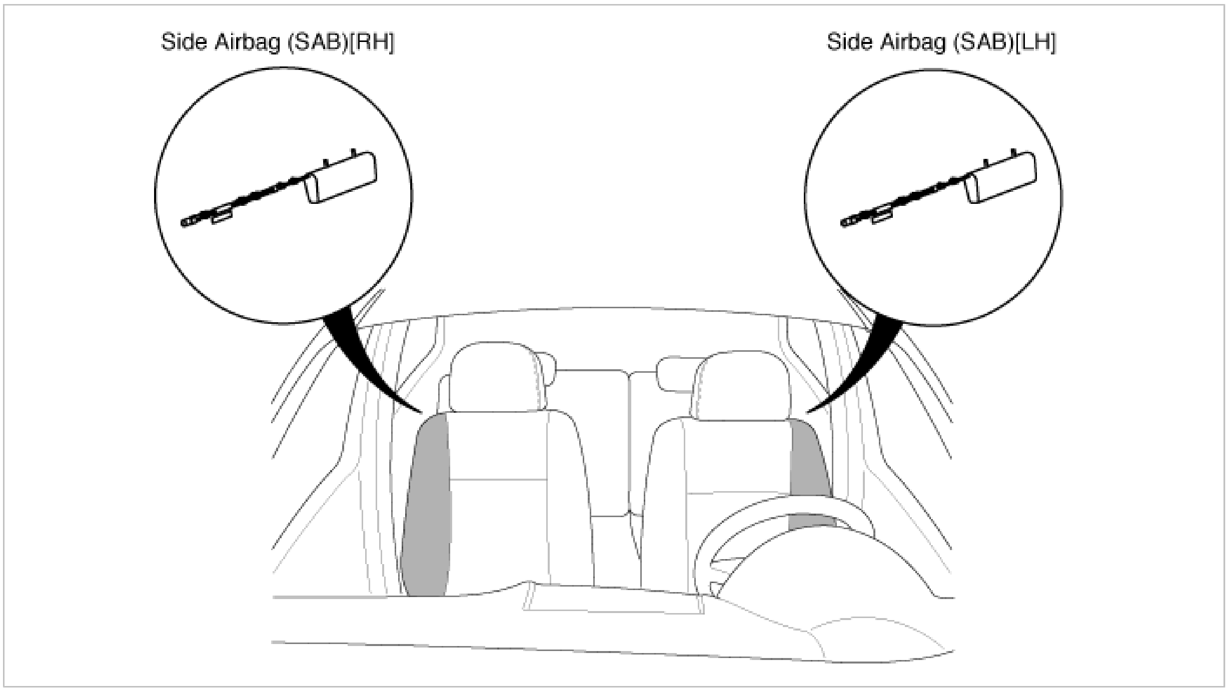
1. Driver Airbag (DAB)
2. Steering Wheel
3. Clock Spring
4. Seat Belt Pretensioner (BPT)
5. Side Impact Sensor (SIS)
6. Side Airbag (SAB)
7. Passenger Airbag (PAB)
8. Front Impact Sensor (FIS)
9. Curtain Airbag (CAB)
10. Buckle Pretensioner (BUPT)
11. Airbag Control Module (SRSCM)
12. Occupant Classification Sensor (OCS)

components location

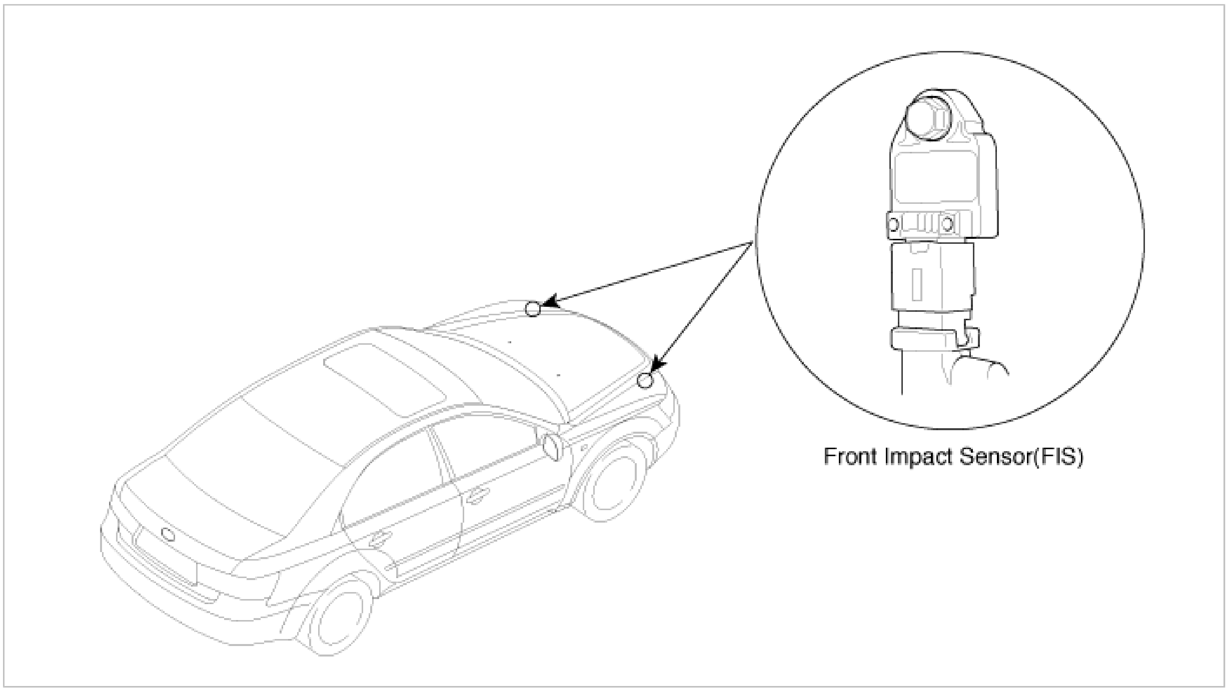
driver airbag(DAB)/passenger airbag(PAB)



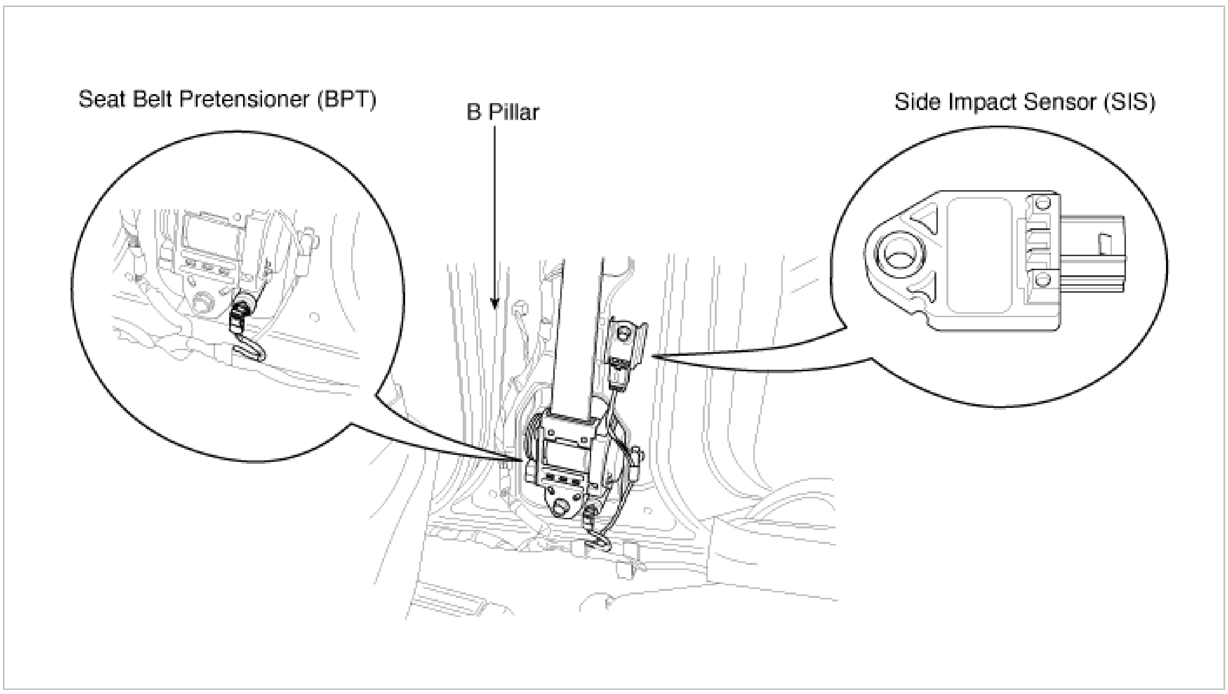
side airbag (SAB)



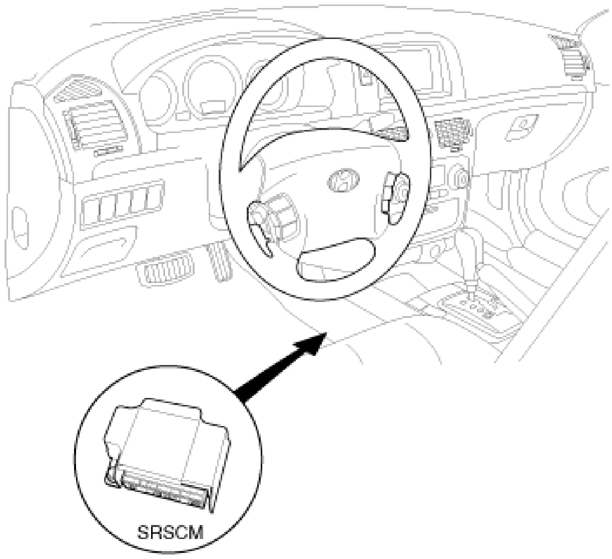
front impact sensor(fis)



seat belt pretensioner(bpt) / side impact sensor(sis)



srscm



Restraint > General Information > Specifications

SPECIFICATION

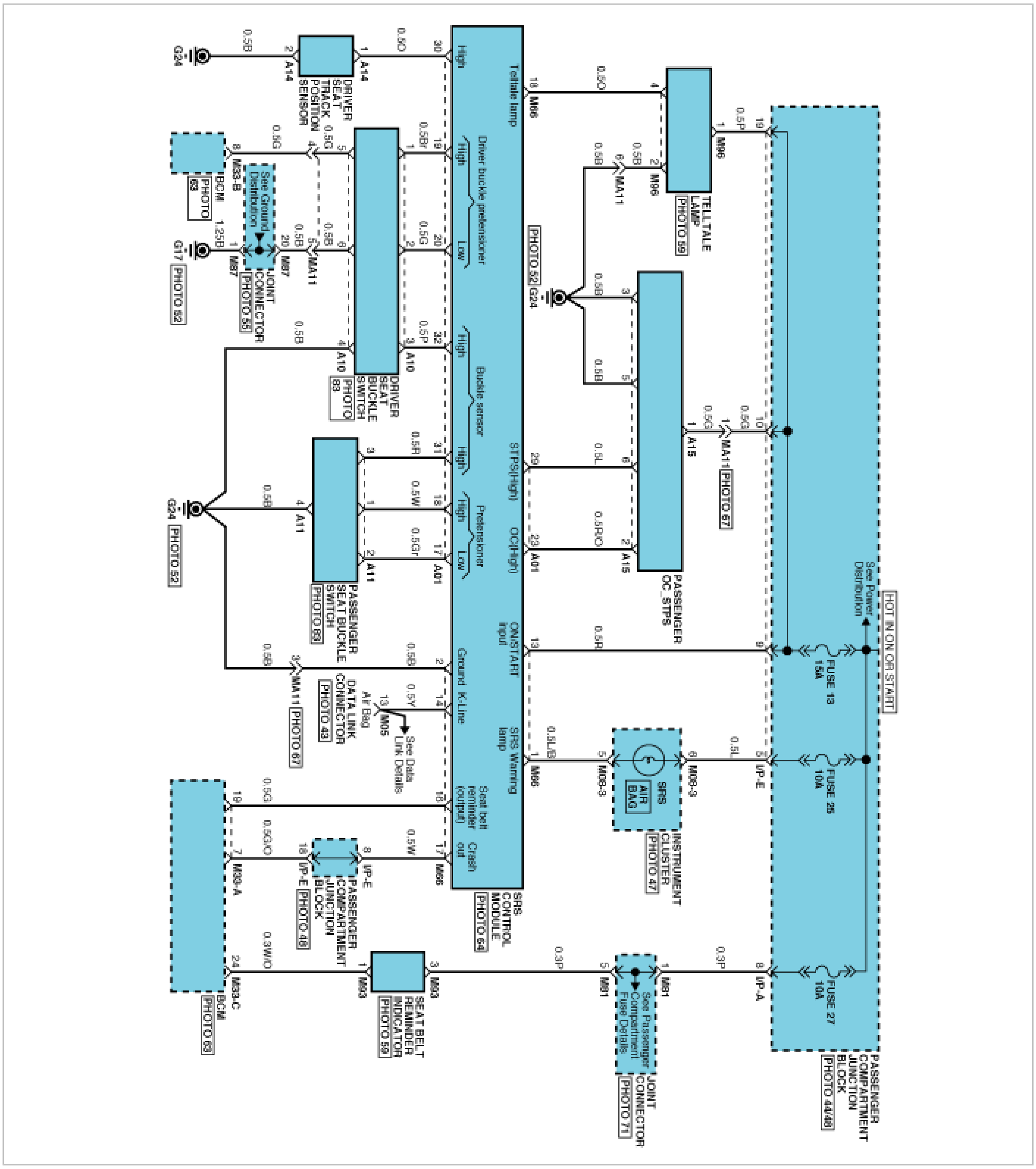
Item Spec	ification	
Driver Airbag (DAB)	Resistance(Ω)	1.925~3.074 Ω
Passenger Airbag(PAB)	Resistance(Ω)	1.878~2.442 Ω
Driver Side Airbag(DSAB)	Resistance(Ω)	1.804~2.568 Ω
Passenger Side Airbag(PSAB)	Resistance(Ω)	1.812~2.576 Ω
Driver Curtain Airbag(DCAB)	Resistance(Ω)	1.940~2.704 Ω
Passenger Curtain Airbag(PCAB)	Resistance(Ω)	1.948~2.712 Ω
Seat Belt Pretensioner (BPT)	Resistance(Ω)	1.943~2.806 Ω
Buckle Pretensioner (BUPT)	Resistance(Ω)	1.905~2.769 Ω

TIGHTENING TORQUES

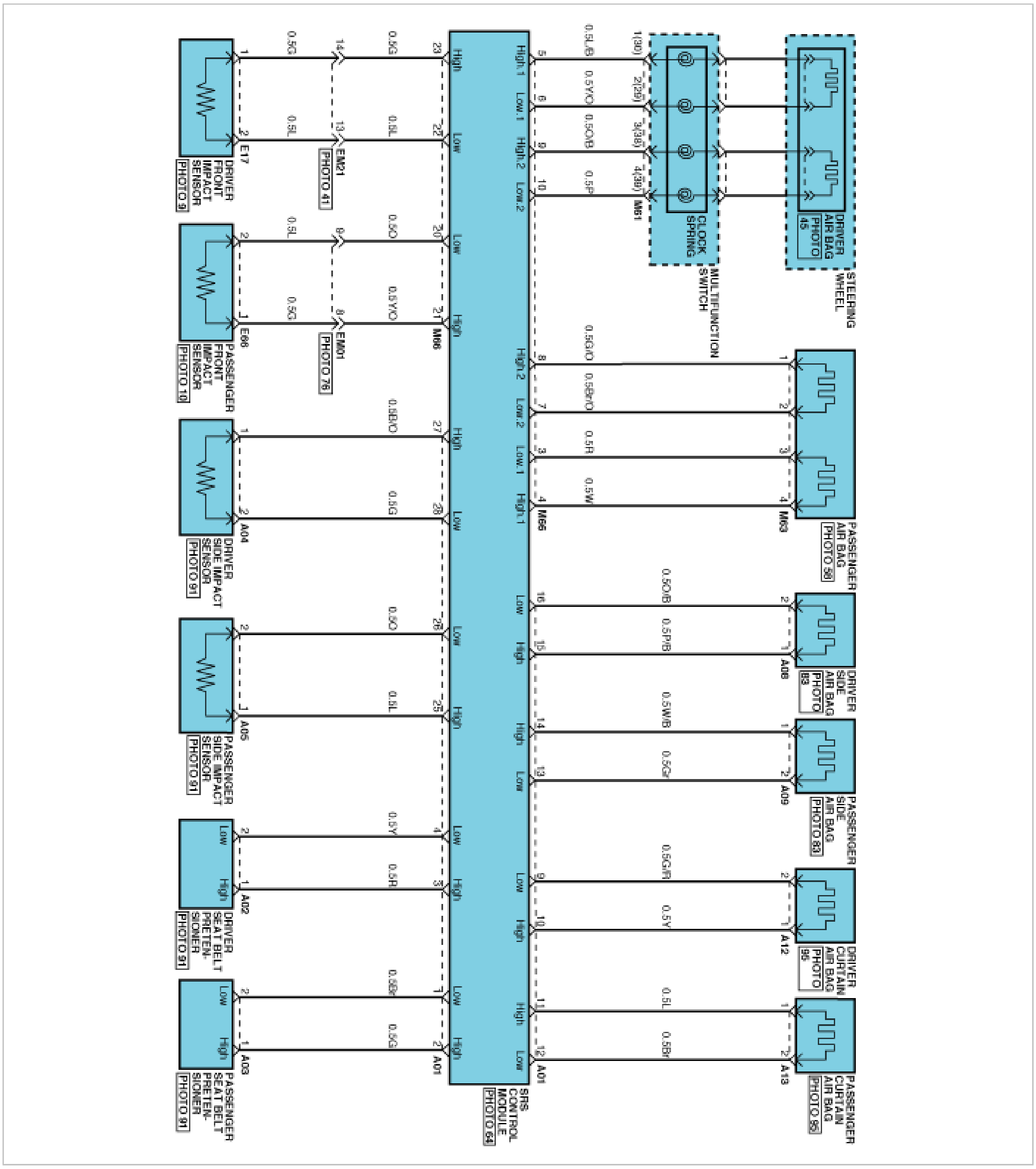
Item kgf	·m	Nm	lb-ft
Driver Airbag (DAB)	0.8 ~ 1.1	7.84 ~ 10.79	5.79 ~ 7.96
M12 Hex lock nut(PAB)	2.7 ~ 3.3	26.48 ~ 32.36	19.53 ~ 23.87
M6 Hex flange nut(PAB)	0.5 ~ 0.7	4.9 ~ 6.86	3.62 ~ 5.06
Curtain Airbag(CAB)	1.1 ~ 1.5	10.79 ~ 14.71	7.96 ~ 10.85
Seat Belt Lower Anchor Bolt (BPT)	4 ~ 5.5	39.23 ~ 53.94	28.93 ~ 39.78
SRSCM Mounting Bolt	0.97 ~ 1.39	9.5 ~ 13.6	7.0 ~ 10.03
Front Impact Sensor (FIS) Mounting Bolt	0.97 ~ 1.39	9.5 ~ 13.6	7.0 ~ 10.03
Side Impact Sensor (SIS) Mounting Bolt	0.97 ~ 1.39	9.5 ~ 13.6	7.0 ~ 10.03

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Schematic Diagrams

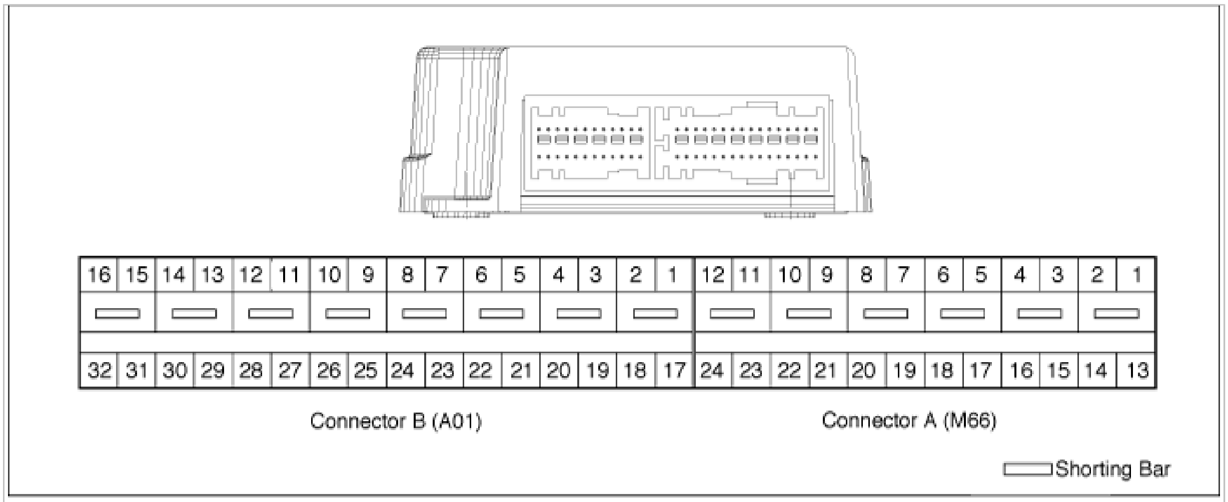
circuit diagram(1)



circuit diagram(2)



SRSCM CONNECTOR PIN LAYOUT(wiring harness side)



ACU PIN #	Connector A (M66)	ACU PIN #	Connector B (A01)
1	Airbag warning lamp	1	Passenger frontal pretensioner - low
2	GND	2	Passenger frontal pretensioner - high
3	Passenger 1st stage-low	3	Driver frontal pretensioner - high
4	Passenger 1st stage-high	4	Driver frontal pretensioner - low
5	Driver 1st stage-high	5	
6	Driver 1st stage-low	6	
7	Passenger 2nd stage-low	7	
8	Passenger 2nd stage-high	8	
9	Driver 2nd stage-high	9	Driver curtain airbag - low
10	Driver 2nd stage-low	10	Driver curtain airbag - high
11		11	Passenger curtain airbag - high
12		12	Passenger curtain airbag - low
13	Ignition	13	Passenger side airbag - low
14	ISO9141 (K-Line)	14	Passenger side airbag - high
15		15	Driver side airbag - high
16	Seat belt reminder	16	Driver side airbag - low
17	Crash out	17	Passenger buckle-pretensioner - low
18	Tell-tale lamp	18	Passenger buckle-pretensioner - high
19		19	Driver buckle-pretensioner - high
20	FIS passenger low	20	Driver buckle-pretensioner - low
21	FIS passenger high	21	
22	FIS driver low	22	
23	FIS driver high	23	OC
24		24	
		25	SIS Passenger high
		26	SIS Passenger low
		27	SIS Driver high
		28	SIS Driver low
		29	Passenger seat track position sensor
		30	Driver seat track position sensor
		31	Passenger buckle sensor
		32	Driver buckle sensor

* : Shorting Bar Switch

DIAGNOSTIC TROUBLE CODE (DTC) TABLE

Code F	ault description	Page
B1101	Ignition voltage high	
B1102	Ignition voltage low	
B1328	FIS Driver defect	
B1329	FIS Driver communication error	
B1333	FIS Passenger defect	
B1334	FIS Passenger communication error	
B1346	Driver airbag resistance too high	
B1347	Driver airbag resistance too low	
B1348	Driver airbag resistance circuit short to ground	

B1349	Driver airbag resistance circuit short to battery	
B1352	Passenger airbag resistance too high	
B1353	Passenger airbag resistance too low	
B1354	Passenger airbag resistance circuit short to ground	
B1355	Passenger airbag resistance circuit short to battery	
B1361	Pretensioner front-Driver resistance too high	
B1362	Pretensioner front-Driver resistance too low	
B1363	Pretensioner front-Driver resistance circuit short to ground	
B1364	Pretensioner front-Driver resistance circuit short to battery	
B1367	Pretensioner front-Passenger resistance too high	
B1368	Pretensioner front-Passenger resistance too low	
B1369	Pretensioner front-Passenger resistance circuit short to ground	
B1370	Pretensioner front-Passenger resistance circuit short to battery	
B1378	Side airbag front-Driver resistance too high	
B1379	Side airbag front-Driver resistance too low	
B1380	Side airbag front-Driver resistance circuit short to ground	
B1381	Side airbag front-Driver resistance circuit short to battery	
B1382	Side airbag front-Passenger resistance too high	
B1383	Side airbag front-Passenger resistance too low	
B1384	Side airbag front-Passenger resistance circuit short to ground	
B1385	Side airbag front-Passenger resistance circuit short to battery	
B1387	Driver side seat track position sensor short to ground	
B1388	Driver side seat track position sensor open to battery	
B1389	Driver side seat track position sensor defect	
B1390	Passenger side seat track position sensor short to ground	
B1391	Passenger side seat track position sensor open to battery	
B1392	Passenger side seat track position sensor defect	
B1395	Squib Interconnection Fault	
B1400	SIS front-Driver defect	
B1403	SIS front-Passenger defect	
B1409	SIS front-Driver communication error	
B1410	SIS front-Passenger communication error	
B1448	Passenger side occupant classification sensor defect	
B1449	Passenger side occupant classification system communication error	
B1450	Passenger side occupant classification system Wrong ID	
B1473	Inflatable Curtain-Driver resistance too high	
B1474	Inflatable Curtain-Driver resistance too low	
B1475	Inflatable Curtain-Driver resistance circuit short to ground	
B1476	Inflatable Curtain-Driver resistance circuit short to battery	
B1477	Inflatable Curtain-Pass resistance too high	
B1478	Inflatable Curtain-Pass resistance too low	
B1479	Inflatable Curtain-Pass resistance circuit short to ground	
B1480	Inflatable Curtain-Pass resistance circuit short to battery	
B1481	2nd Stage Driver airbag resistance too high	
B1482	2nd Stage Driver airbag resistance too low	
B1483	2nd Stage Driver airbag resistance circuit short to ground	

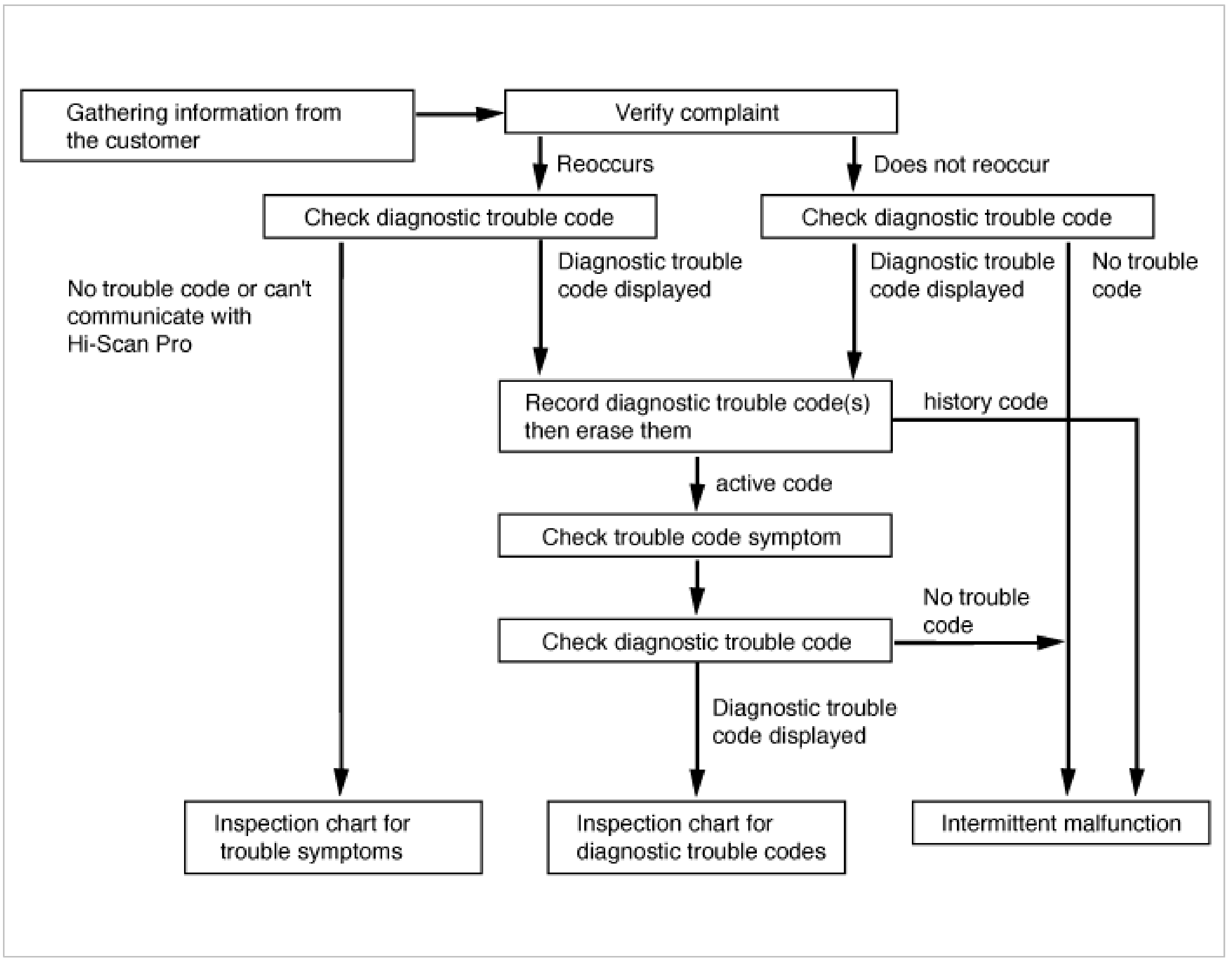
B1484	2nd Stage Driver airbag resistance circuit short to battery	
B1485	2nd Stage Passenger airbag resistance too high	
B1486	2nd Stage Passenger airbag resistance too low	
B1487	2nd Stage Passenger airbag resistance circuit leakag to ground	
B1488	2nd Stage Passenger airbag resistance circuit leakag to battery	
B1511	Driver seat buckle switch open or short to battery	
B1512	Driver seat buckle switch short or short to ground	
B1513	Passenger seat buckle switch open or short to battery	
B1514	Passenger seat buckle switch short or short to ground	
B1515	Driver seat buckle switch defect	
B1516	Passenger seat buckle switch defect	
B1517	Driver seat buckle switch instability	
B1518	Passenger seat buckle switch instability	
B1620	Internal fault- Replace the ACU	
B1650	Crash recorded in 1st Stage only	
B1651	Crash recorded Side Airbag front-Driver	
B1652	Crash recorded Side Airbag front-Passenger	
B1655	Crash recorded - Pass side with PAB inhibited (no deployment)	
B1657	Crash recorded - Belt pretensioner only	
B1658	Maximum belt pretensioner crash detection reached	
B1659	Rear impact detected	
B1670	Crash recorded in full stage	
B1701	Buckle Pretensioner front-Driver resistance too high	
B1702	Buckle Pretensioner front-Driver resistance too low	
B1703	Buckle Pretensioner front-Driver resistance circuit short to Ground	
B1704	Buckle Pretensioner front-Driver resistance circuit short to Battery	
B1706	Buckle Pretensioner front-Passenger resistance too high	
B1707	Buckle Pretensioner front-Passenger resistance too low	
B1708	Buckle Pretensioner front-Passenger resistance circuit short to Ground	
B1709	Buckle Pretensioner front-Passenger resistance circuit short to Battery	
B2500	SRS Warning lamp Failure	
B2502	Passenger airbag tell tale lamp fail	

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting

Hi-Scan check

1. Turn the ignition switch off.
2. Connect the Hi-Scan Pro connector to the datalink connector located under the crash pad.
3. Connect the Hi-Scan Pro power cable.
4. Turn the ignition switch on and power on the Hi-Scan Pro.
5. Read DTCs.
6. Find and repair the trouble, and clear the DTCs using Hi-Scan Pro.
7. Disconnect the Hi-Scan Pro.

DIAGNOSTIC TROUBLESHOOTING FLOW

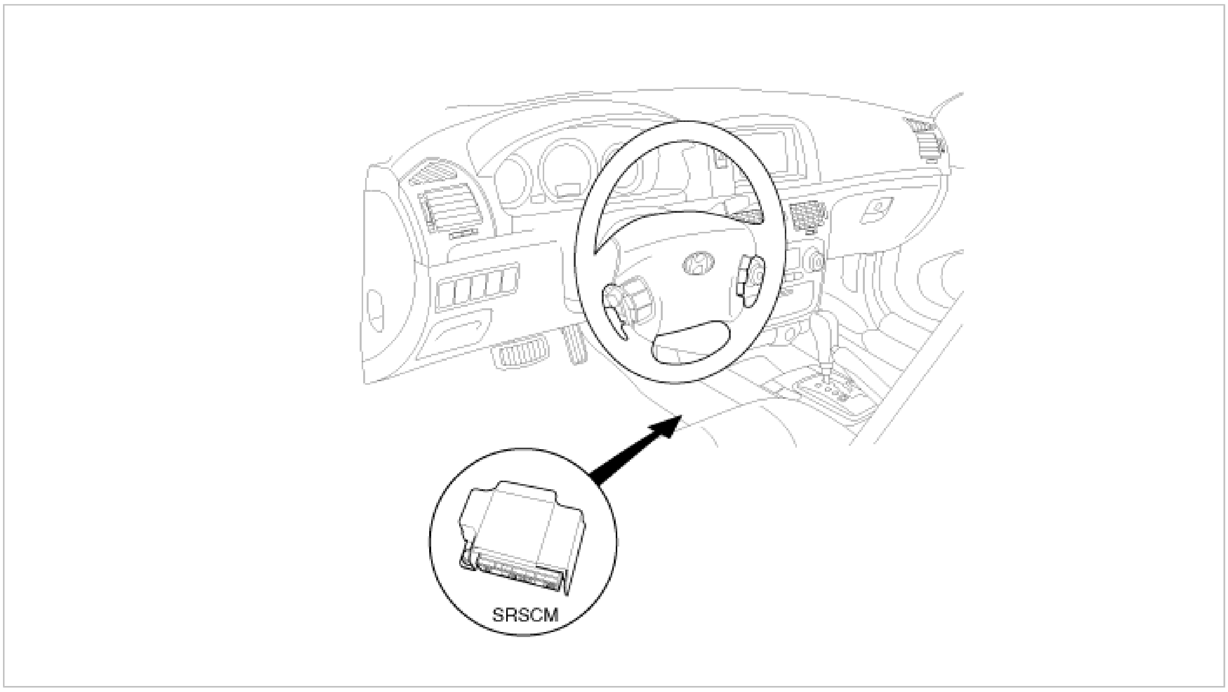


Restraint > Supplemental Restraint System Control Module (SRnodeM) > SRS Control Module (SRnodeM) > Description and Operation

DESCRIPTION

Restraint > Supplemental Restraint System Control Module (SRnodeM) > SRS Control Module (SRnodeM) > Components and Components Location

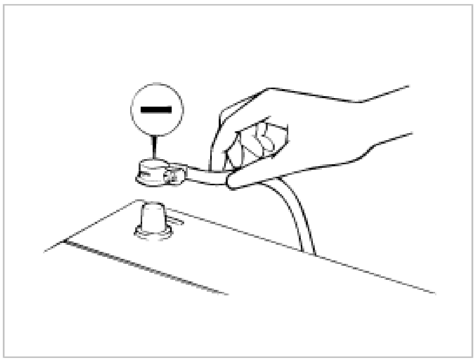
components



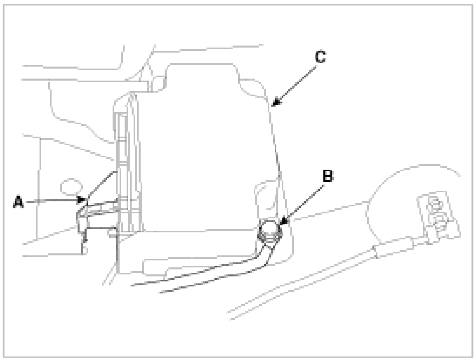
Restraint > Supplemental Restraint System Control Module (SRnodeM) > SRS Control Module (SRnodeM) > Repair procedures

REMOVAL

1. Disconnect the negative(-) cable from battery and wait for at least 3 minutes.



2. Remove ignition key from the vehicle.
3. Remove the center console.(Refer to "BD" group in this Workshop Manual).
4. Pull back the lever, then disconnect the SRSCM harness connector(A). Loosen the bolt(B), then remove the SRSCM(C).



SRSCM mounting bolt :
0.97~1.39 kgf.m(9.5 ~ 13.6 Nm ,7.0 ~ 10.03 lb-ft)

5. Installation is the reverse of removal.

NOTE

- Turn the ignition switch ON; the SRS indicator light should turn on for about six seconds and then go off.
- Always use new bolts when intalling the SRSCM.

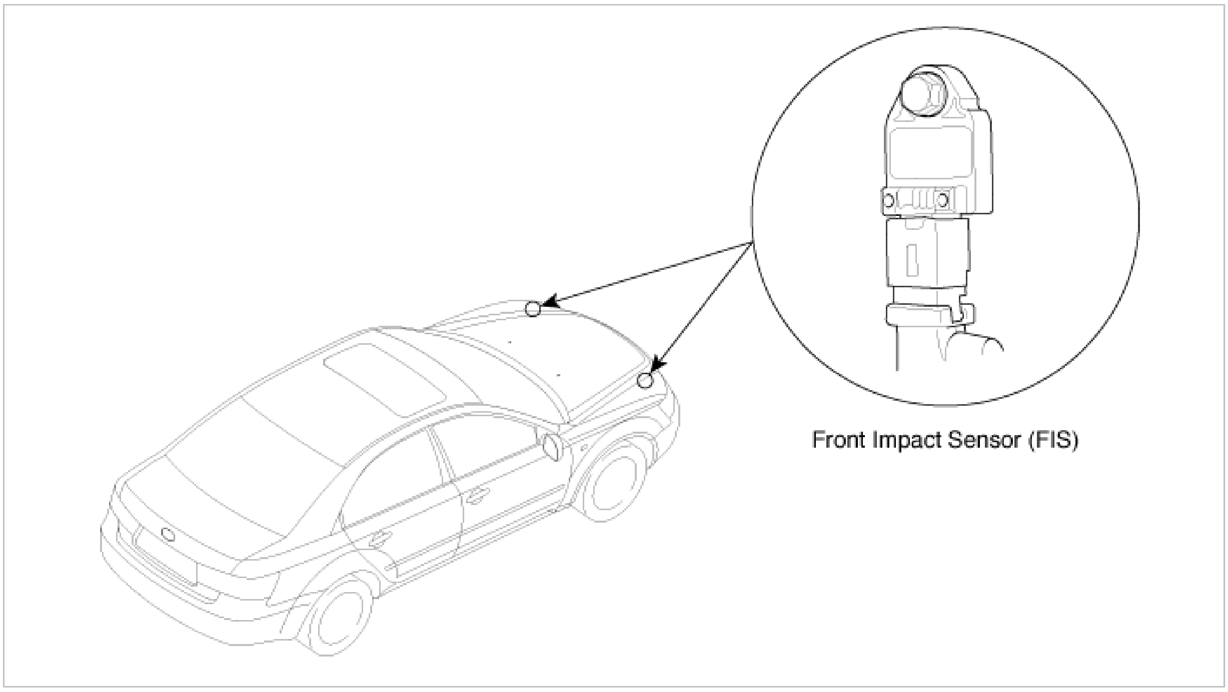
Restraint > Supplemental Restraint System Control Module (SRnodeM) > Front Impact Sensor (FIS) > Description and Operation

DESCRIPTION

The front impact sensors (FIS) are installed inside the member inner. They are remote sensors that detect acceleration due to collision at their mounting locations. The primary purpose of the Front Impact Sensor (FIS) is to provide an indication of a collition. the Front Impact Sensor(FIS) sends acceleration data to the SRSCM.

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Front Impact Sensor (FIS) > Components and Components Location

components



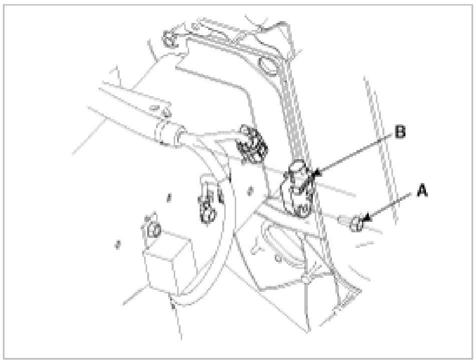
Restraint > Supplemental Restraint System Control Module (SRnodeM) > Front Impact Sensor (FIS) > Repair procedures

removal

CAUTION

- Removal of the airbag must be performed according to the precautions/ procedures described previously.
- Before disconnecting the front impact sensor connector, disconnect the front airbag connector(s).
- Do not turn the ignition switch ON and do not connect the battery cable while replacing the front impact sensor.

1. Disconnect the negative battery cable, and wait at least three minutes before beginning work.
2. Remove the bolt(A) then remove the front impact sensor(B).



3. Installation is the reverse of removal.

NOTE

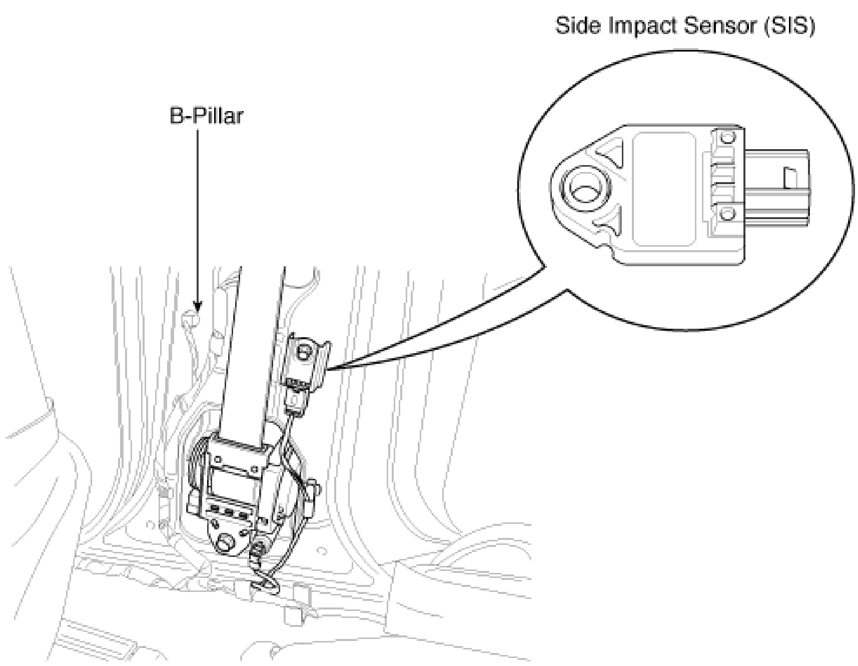
After installing the front impact sensor, confirm proper system operation: Turn the ignition switch ON: the SRS indicator light should turn on for about six seconds and then go off.

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Side Impact Sensor (SIS) > Description and Operation

DESCRIPTION

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Side Impact Sensor (SIS) > Components and Components Location

components



Restraint > Supplemental Restraint System Control Module (SRnodeM) > Side Impact Sensor (SIS) > Repair procedures

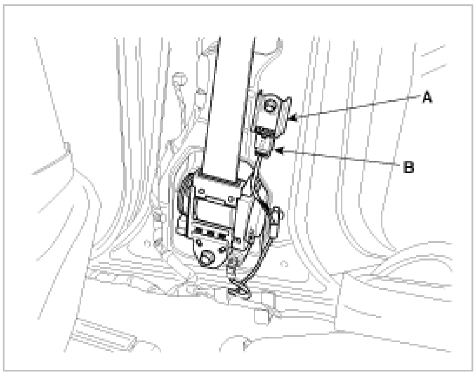
removal

CAUTION

- Removal of the airbag must be performed according to the precautions/procedures described previously.

• Before disconnecting the side impact sensor connector(s), disconnect the side airbag connector(s).
• Do not turn the ignition switch ON and do not connect the battery cable while replacing the side impact sensor.

1. Disconnect the negative battery cable, and wait at least three minutes before beginning work.
2. Remove the front door scuff trim (Refer to BD group - interior).
3. Remove the center pillar trim (Refer to BD group - interior).
4. Remove the bolt(A) then remove the side impact sensor (B).



Installation

CAUTION

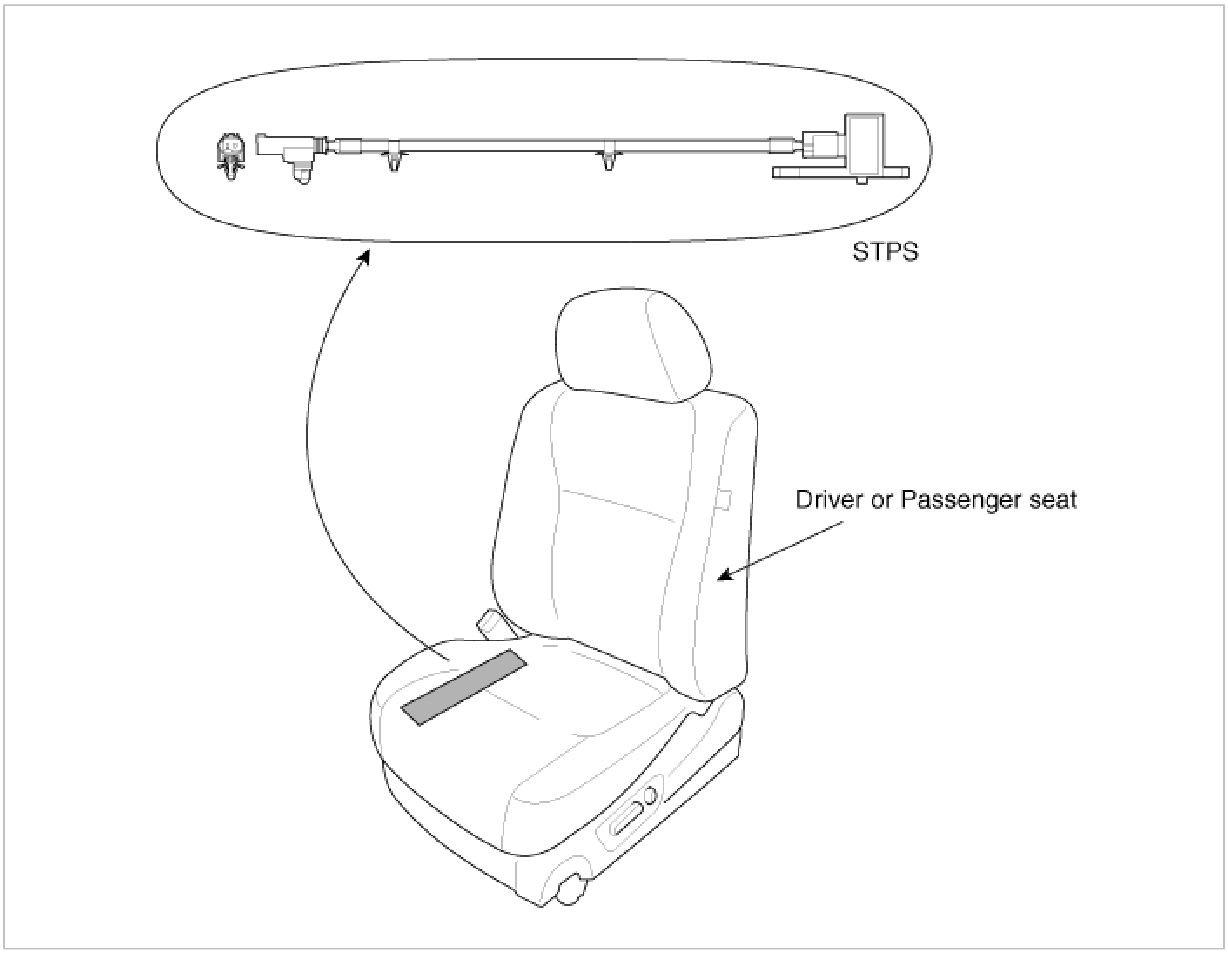
• Be sure to install the harness wires so that they are not pinched or interfere with other parts.
• Do not turn the ignition switch ON and do not connect the battery cable while replacing the side impact sensor.

1. Install the new side impact sensor with the bolt then connect the SRS harness connector to the side impact sensor.
2. Reinstall the belt pretensioner.
3. Reconnect the negative battery cable.
4. After installing the side impact sensor, confirm proper system operation: Turn the ignition switch ON: the SRS indicator light should turn on about six seconds and then go off.

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Seat Track Position Sensor (STPS) > Description and Operation

DESCRIPTION

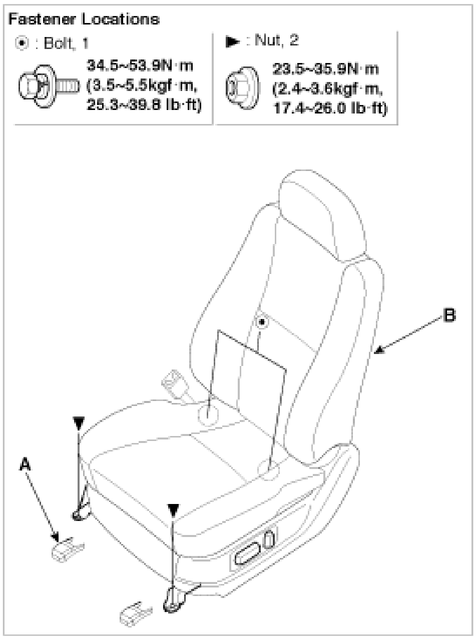
COMPONENTS



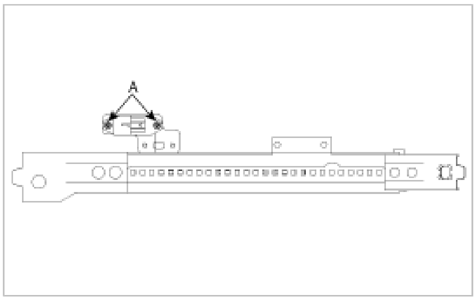
Restraint > Supplemental Restraint System Control Module (SRnodeM) > Seat Track Position Sensor (STPS) > Repair procedures

REPLACEMENT

1. Remove the seat assembly mounting cover (A).
2. After loosening the seat assembly mounting bolt and nut, remove the seat assembly (B).



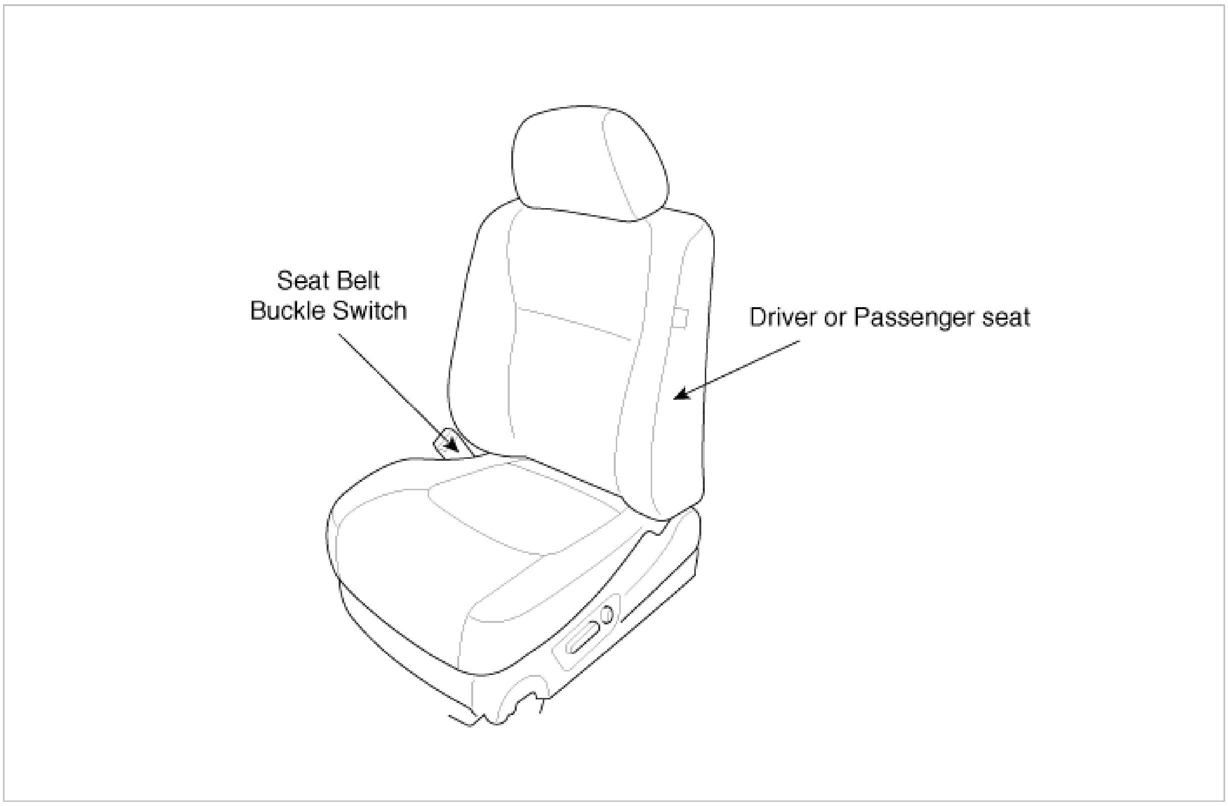
3. Disconnect the STPS connector and remove the mounting bolts(A).



Restraint > Supplemental Restraint System Control Module (SRnodeM) > Seat Belt Buckle Switch (BS) > Description and Operation

DESCRIPTION

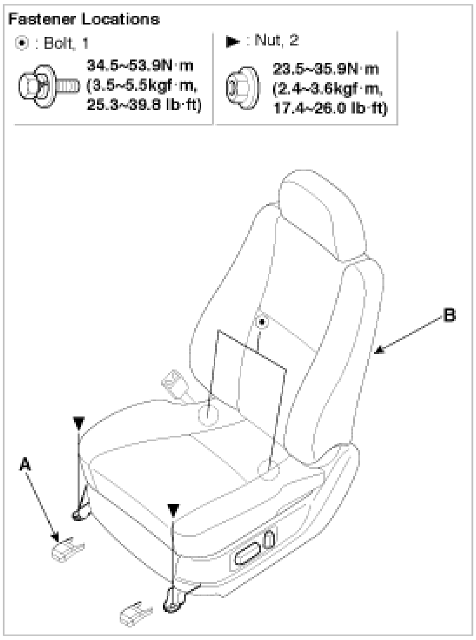
COMPONENTS



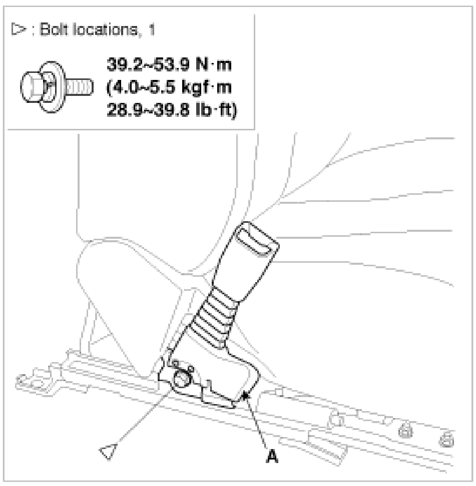
Restraint > Supplemental Restraint System Control Module (SRnodeM) > Seat Belt Buckle Switch (BS) > Repair procedures

REPLACEMENT

1. Remove the seat assembly mounting cover (A).
2. After loosening the seat assembly mounting bolt and nut, remove the seat assembly (B).



3. Remove the wire harness of buckle from seat.
4. Remove the seat belt buckle (A).



5. Installation is the reverse of removal.

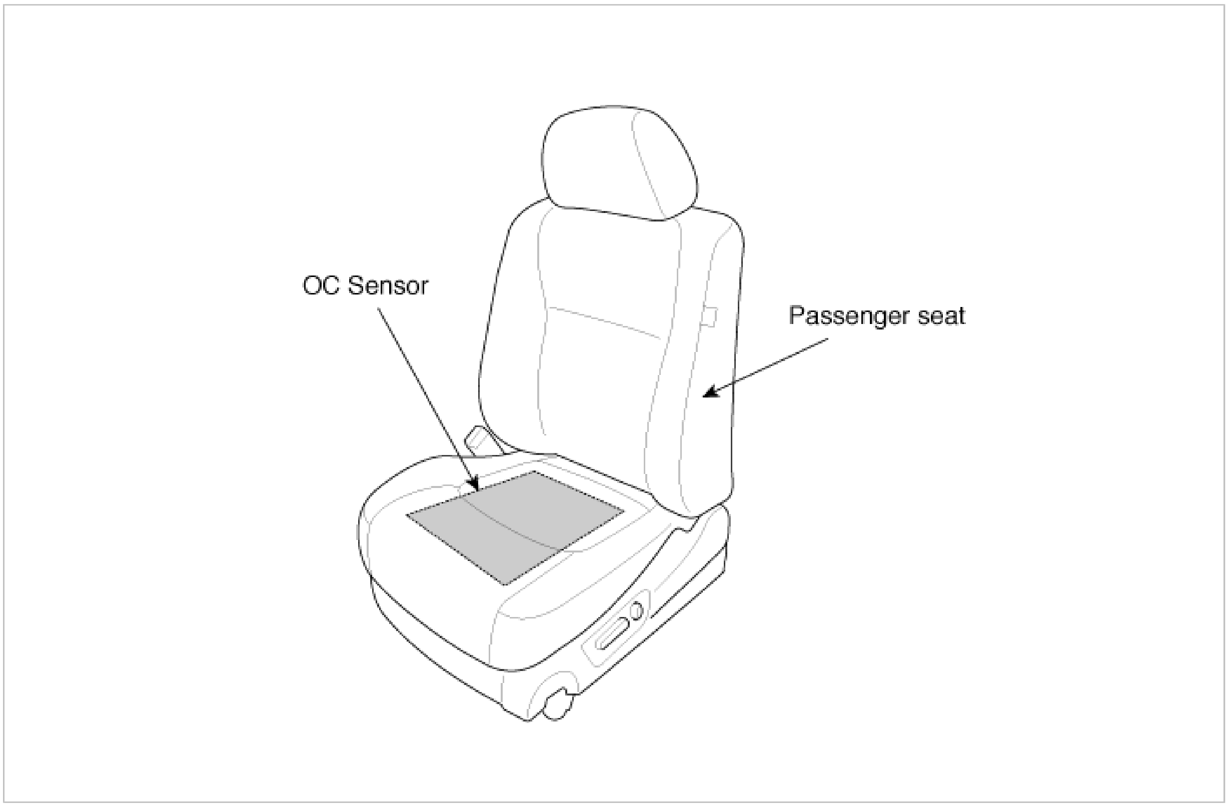
Restraint > Supplemental Restraint System Control Module (SRnodeM) > Occupant Classification Sensor (OCS) > Description and Operation

DESCRIPTION

The system is intended to classify the occupancy status of the front passenger seat in a motor vehicle based on the measured force on the bottom seat cushion.
The system also communicates to the SRSCM whether to allow or inhibit the deployment of the passenger airbags and/or pretensioner based upon this status.
The System also measures dynamic responses of the occupant. This information is used to idenitify when a child seat is cinched down tightly with the seat belt, and to also determine if the seat is unoccupied.
However, the dynamic measurements are not intended, nor capable of monitoring the seating position of the occupant, nor can they determine the proximity of the occupant to the inflator modules.
The system should not be confused with an occupant position recognition system, or any other occupant proximity sensor.

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Occupant Classification Sensor (OCS) > Components and Components Location

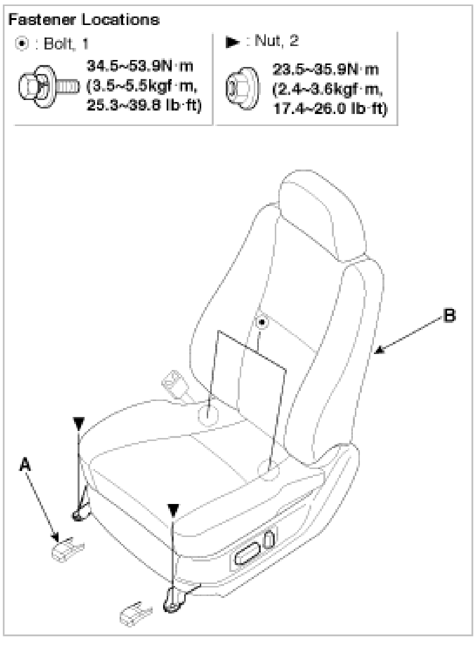
COMPONENTS



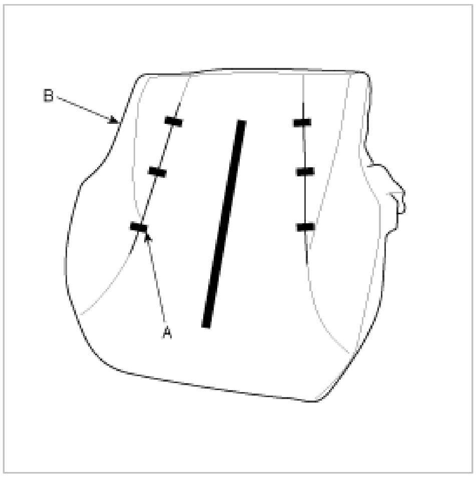
Restraint > Supplemental Restraint System Control Module (SRnodeM) > Occupant Classification Sensor (OCS) > Repair procedures

REPLACEMENT

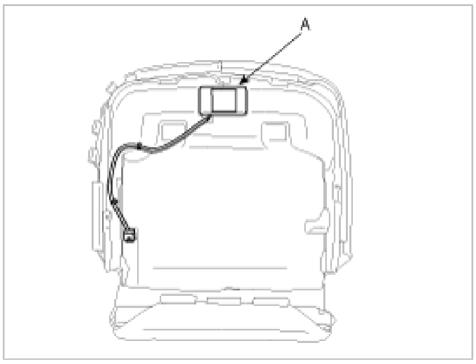
1. Remove the passenger seat assembly mounting cover (A).
2. After loosening the passenger seat assembly mounting bolt and nut, remove the seat assembly (B).



3. Remove the seat cushion. (Refer to BD-Seat)
4. After removing the hogring clip(A) on the front of seat cushion and remove the seat cushion cover(B).



5. Remove the OCS module(A).



Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1101

DTC Description

The SRSCM sets above DTC(s) if it detects that the battery voltage of restraints system is too high or too low. When the voltage returns to normal, the SRS warning light automatically goes off and a malfunction is no longer indicated.

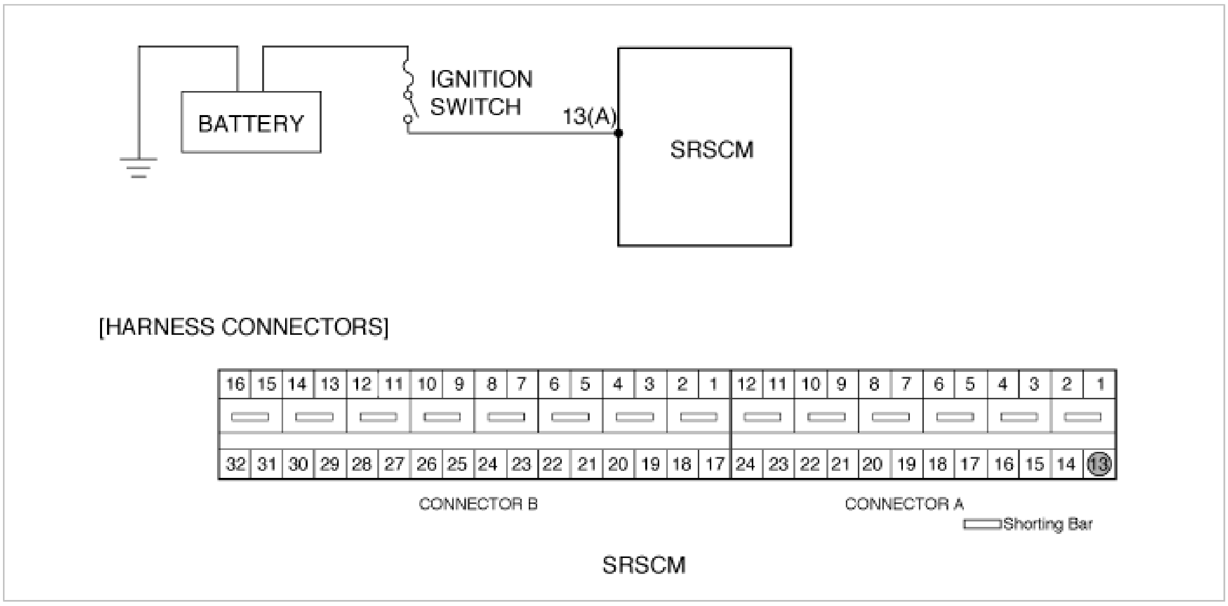
DTC Detecting Condition

DTC Condition		Probable cause
B1101	Battery Voltage > 16.0 V for 10 seconds after IG ON	• Battery • Alternator • Wiring Harness • SRSCM
B1102	Battery Voltage < 9.0 V for 10 seconds after IG ON	

Specification

Voltage : 9.0 ≤ V ≤ 16.0 V

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> CAUTION
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

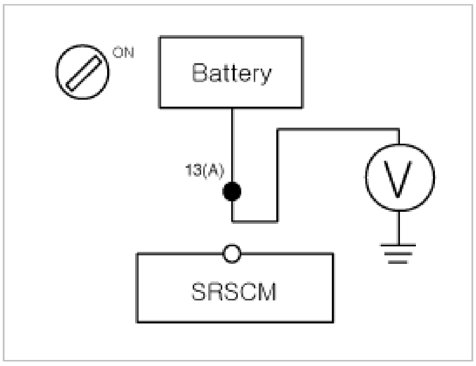
YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SOURCE VOLTAGE
   (1) Turn the ignition switch to ON.
   (2) Measure voltage between the terminal 13(A) of SRSCM harness connector and chassis ground.

specification(voltage) : 9.0 ≤ V ≤ 16.0 V



Is the measured voltage within specification?

NO

▸ Check the battery.

YES

▸ Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

3. CHECK THE BATTERY
   (1) Check the battery.
   - Refer to "EE" group in this SERVICE MANUAL.

   Is the battery normal?

YES

▸ Check the alternator.

NO

▸ Repair or replace the battery(Refer to "EE" group in this SERVICE MANUAL).

4. CHECK ALTERNATOR
   (1) Check the altenator.
   - Refer to "EE" group in this SERVICE MANUAL.

   Is the alternator normal?

YES

▸ Check wiring harness.

NO

▸ Repair or replace the alternator(Refer to "EE" group in this SERVICE MANUAL).

5. CHECK WIRING HARNESS
   (1) Check the wiring harness between the battery and SRSCM.
   Check the wiring harness between the battery and chassis ground.
   Is the wiring harness normal?

YES

▸ Check the DTC again.

NO

▸ Repair or Replace the wiring harness.

6. CHECK THE DTC AGAIN
   (1) Turn the ignition switch to LOCK and wait for at least 30 seconds.

> **CAUTION**
>
> Check again that the battery negative (-) terminal is disconnected from the battery.

   (2) Install the DAB module and connect the DAB connector.

   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (4) Connect the SRSCM connector.

   (5) Connect the negative (-) terminal to the battery.

   (6) Connect a Hi-Scan(Pro) to the data link connector.

   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC?

YES

▸ Perform the troubleshooting procedures associated with those codes.

NO

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1102

DTC Description

The SRSCM sets above DTC(s) if it detects that the battery voltage of restraints system is too high or too low. When the voltage returns to normal, the SRS warning light automatically goes off and a malfunction is no longer indicated.

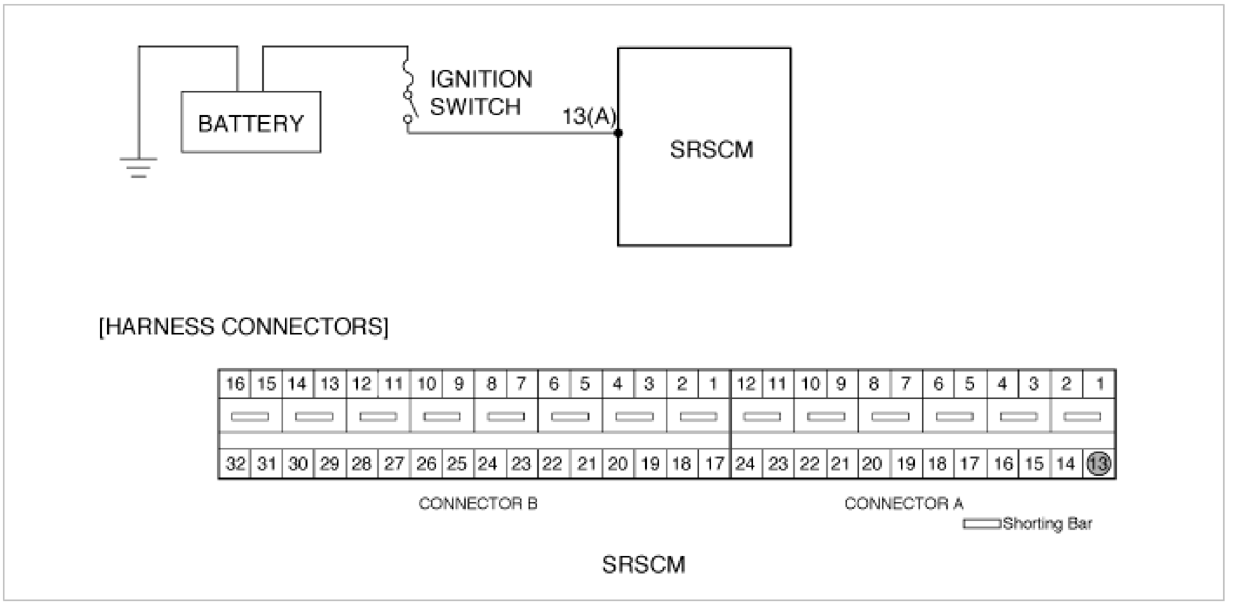
DTC Detecting Condition

DTC	Condition	Probable cause
B1101	Battery Voltage > 16.0 V for 10 seconds after IG ON	• Battery • Alternator • Wiring Harness • SRSCM
B1102	Battery Voltage < 9.0 V for 10 seconds after IG ON	

Specification

Voltage : 9.0 ≤ V ≤ 16.0 V

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

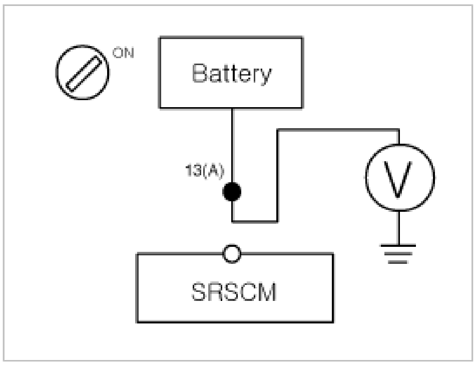
▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK SOURCE VOLTAGE
   (1) Turn the ignition switch to ON.
   (2) Measure voltage between the terminal 13(A) of SRSCM harness connector and chassis ground.

specification(voltage) : 9.0 ≤ V ≤ 16.0 V



Is the measured voltage within specification?

NO

▸ Check the battery.

YES

▸ Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

3. CHECK THE BATTERY
   (1) Check the battery.
   - Refer to "EE" group in this SERVICE MANUAL.

   Is the battery normal?

YES

▸ Check the alternator.

NO

▸ Repair or replace the battery(Refer to "EE" group in this SERVICE MANUAL).

4. CHECK ALTERNATOR
   (1) Check the altenator.
   - Refer to "EE" group in this SERVICE MANUAL.

   Is the alternator normal?

YES

▸ Check wiring harness.

NO

▸ Repair or replace the alternator(Refer to "EE" group in this SERVICE MANUAL).

5. CHECK WIRING HARNESS
   (1) Check the wiring harness between the battery and SRSCM.
   Check the wiring harness between the battery and chassis ground.
   Is the wiring harness normal?

YES

▸ Check the DTC again.

NO

▸ Repair or Replace the wiring harness.

6. CHECK THE DTC AGAIN
   (1) Turn the ignition switch to LOCK and wait for at least 30 seconds.

   > CAUTION
   >
   > Check again that the battery negative (-) terminal is disconnected from the battery.

   (2) Install the DAB module and connect the DAB connector.

   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (4) Connect the SRSCM connector.

   (5) Connect the negative (-) terminal to the battery.

   (6) Connect a Hi-Scan(Pro) to the data link connector.

   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC?

YES

▸ Perform the troubleshooting procedures associated with those codes.

NO

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1328

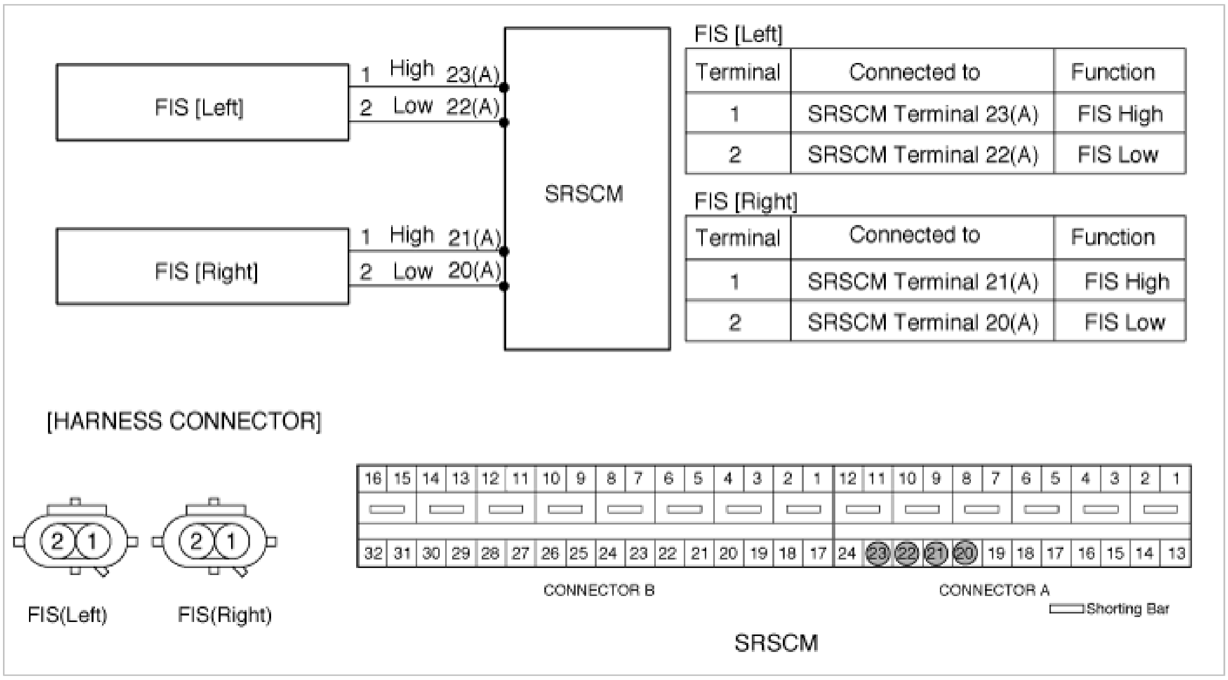
DTC Description

The detecting system for front crash consists of the SRSCM and two Front Impact Sensors (FIS). The SRSCM sets above DTC(s) if it detects that any FIS is defective or there is communication error between any FIS and the SRSCM.

DTC Detecting Condition

DTC	Condition	Probable cause
B1328 B1329 B1333 B1334	• Open between FIS and SRSCM • Front Impact Sensor(FIS) Malfunction • SRSCM Malfunction	• Wiring Harness • Front Impact Sensor(FIS) squib • SRSCM

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

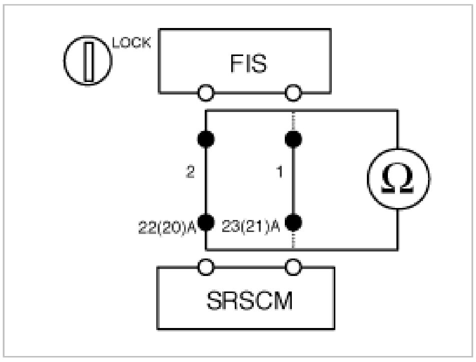
▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK FIS CIRCUIT
   (1) Disconnect the battery, wait 3 minutes.
   (2) Disconnect the FIS and SRSCM.
   (3) Measure the resistance between terminal 1 of the FIS harness connector and terminal A 23(21) of SRSCM harness connector.
   (4) Measure the resistance between terminal 2 of the FIS harness connector and terminal A 22(20) of SRSCM harness connector.

   specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

▸Check Front Impact Sensor.

NO

▸ Repair or replace the wiring harness between the FIS and the SRSCM.

3. CHECK FRONT IMPACT SENSOR
   (1) Replace the front impact sensor(FIS) with a new one.
   - Refer to "Front Impact Sensor(FIS)" section in this SERVICE MANUAL.

   (2) Install the DAB module and connect the DAB connector.

   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (4) Connect the SRSCM connector.

   (5) Connect the negative (-) terminal to the battery.

   (6) Connect a Hi-Scan(Pro) to the data link connector.

   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to FIS?

   YES

   ▸ Go to next step.

   NO

   ▸ Replace the Front Impact Sensor(FIS).

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.

   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (3) Connect the SRSCM connector.

   (4) Connect the negative (-) terminal to the battery.

   (5) Connect a Hi-Scan(Pro) to the data link connector.

   (6) Turn the ignition switch to ON .

   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

   (9) Turn the ignition switch to ON and wait for at least 30 seconds.

   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1329

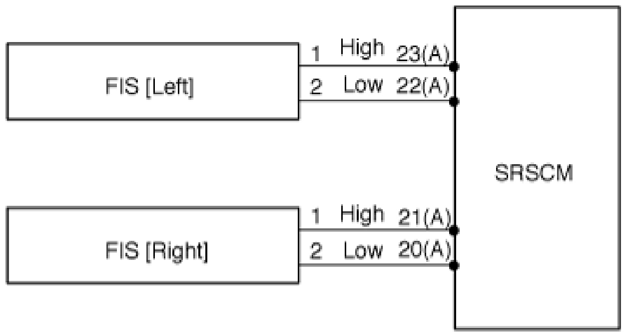
DTC Description

The detecting system for front crash consists of the SRSCM and two Front Impact Sensors (FIS). The SRSCM sets above DTC(s) if it detects that any FIS is defective or there is communication error between any FIS and the SRSCM.

DTC Detecting Condition

DTC	Condition	Probable cause
B1328 B1329 B1333 B1334	• Open between FIS and SRSCM • Front Impact Sensor(FIS) Malfunction • SRSCM Malfunction	• Wiring Harness • Front Impact Sensor(FIS) squib • SRSCM

Schematic Diagram



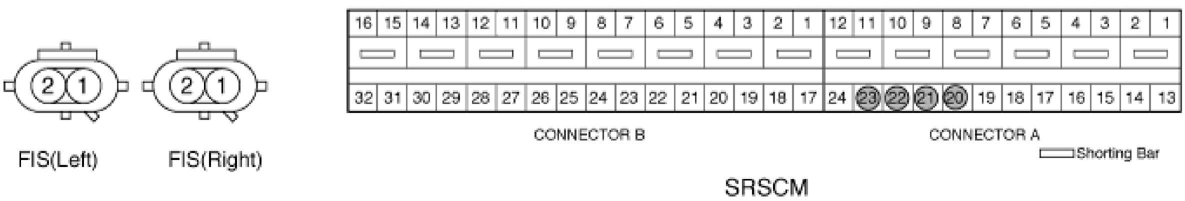
FIS [Left]

Terminal	Connected to	Function
1	SRSCM Terminal 23(A)	FIS High
2	SRSCM Terminal 22(A)	FIS Low

FIS [Right]

Terminal	Connected to	Function
1	SRSCM Terminal 21(A)	FIS High
2	SRSCM Terminal 20(A)	FIS Low

[HARNESS CONNECTOR]



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

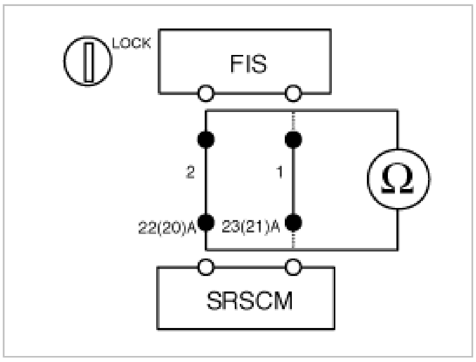
Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK FIS CIRCUIT
   (1) Disconnect the battery, wait 3 minutes.
   (2) Disconnect the FIS and SRSCM.

(3) Measure the resistance between terminal 1 of the FIS harness connector and terminal A 23(21) of SRSCM harness connector.

(4) Measure the resistance between terminal 2 of the FIS harness connector and terminal A 22(20) of SRSCM harness connector.

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

▸Check Front Impact Sensor.

NO

▸ Repair or replace the wiring harness between the FIS and the SRSCM.

3. CHECK FRONT IMPACT SENSOR
   (1) Replace the front impact sensor(FIS) with a new one.
   - Refer to "Front Impact Sensor(FIS)" section in this SERVICE MANUAL.

   (2) Install the DAB module and connect the DAB connector.

   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (4) Connect the SRSCM connector.

   (5) Connect the negative (-) terminal to the battery.

   (6) Connect a Hi-Scan(Pro) to the data link connector.

   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to FIS?

   YES

   ▸ Go to next step.

   NO

   ▸ Replace the Front Impact Sensor(FIS).

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.

   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (3) Connect the SRSCM connector.

   (4) Connect the negative (-) terminal to the battery.

   (5) Connect a Hi-Scan(Pro) to the data link connector.

   (6) Turn the ignition switch to ON .

   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

   (9) Turn the ignition switch to ON and wait for at least 30 seconds.

   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

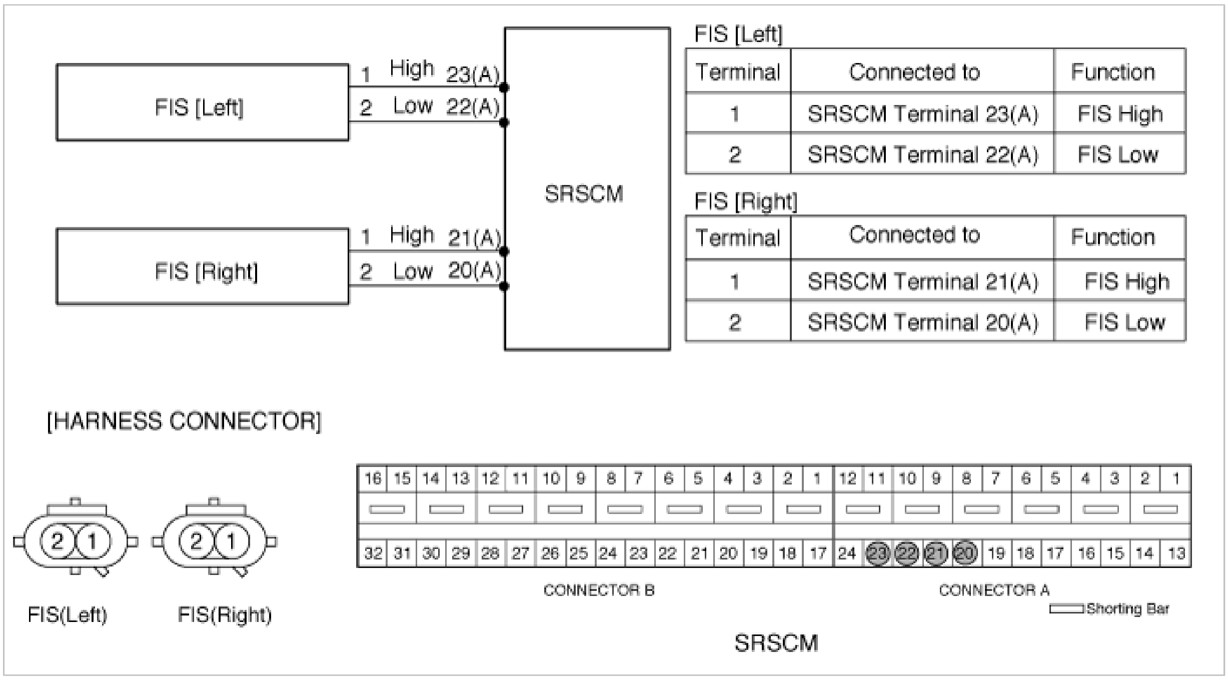
DTC Description

The detecting system for front crash consists of the SRSCM and two Front Impact Sensors (FIS). The SRSCM sets above DTC(s) if it detects that any FIS is defective or there is communication error between any FIS and the SRSCM.

DTC Detecting Condition

DTC	Condition	Probable cause
B1328 B1329 B1333 B1334	• Open between FIS and SRSCM • Front Impact Sensor(FIS) Malfunction • SRSCM Malfunction	• Wiring Harness • Front Impact Sensor(FIS) squib • SRSCM

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.

(3) Remove the DAB module and disconnect the DAB connector.

(4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

2. CHECK FIS CIRCUIT

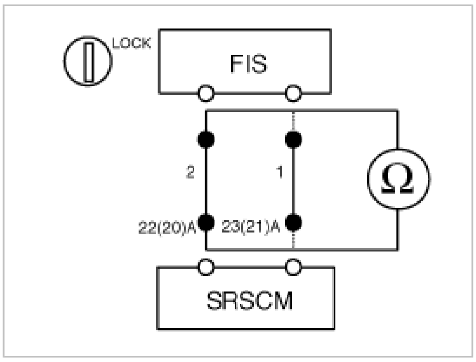
(1) Disconnect the battery, wait 3 minutes.

(2) Disconnect the FIS and SRSCM.

(3) Measure the resistance between terminal 1 of the FIS harness connector and terminal A 23(21) of SRSCM harness connector.

(4) Measure the resistance between terminal 2 of the FIS harness connector and terminal A 22(20) of SRSCM harness connector.

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

▸Check Front Impact Sensor.

NO

▸ Repair or replace the wiring harness between the FIS and the SRSCM.

3. CHECK FRONT IMPACT SENSOR

(1) Replace the front impact sensor(FIS) with a new one.

- Refer to "Front Impact Sensor(FIS)" section in this SERVICE MANUAL.

(2) Install the DAB module and connect the DAB connector.

(3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal to the battery.

(6) Connect a Hi-Scan(Pro) to the data link connector.

(7) Turn the ignition switch to ON and check the vehicle again.
Does Hi-Scan (Pro) indicate any DTC related to FIS?

YES

▸ Go to next step.

NO

▸ Replace the Front Impact Sensor(FIS).

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON .

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1334

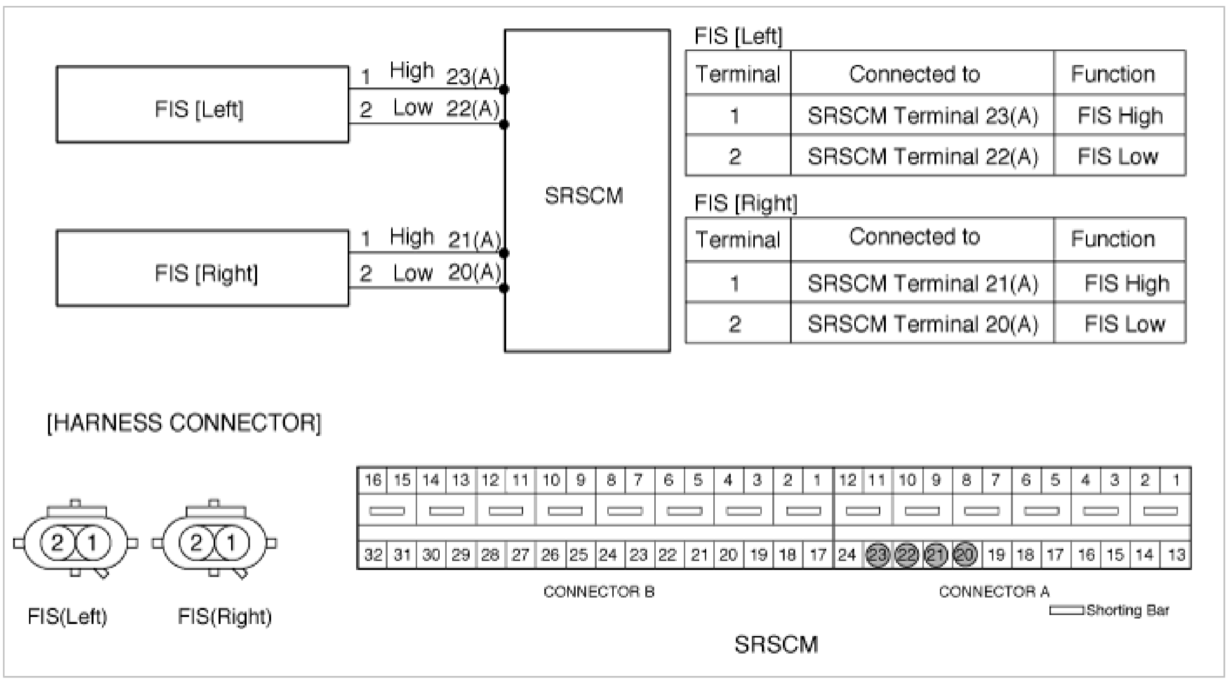
DTC Description

The detecting system for front crash consists of the SRSCM and two Front Impact Sensors (FIS). The SRSCM sets above DTC(s) if it detects that any FIS is defective or there is communication error between any FIS and the SRSCM.

DTC Detecting Condition

DTC	Condition	Probable cause
B1328 B1329 B1333 B1334	• Open between FIS and SRSCM • Front Impact Sensor(FIS) Malfunction • SRSCM Malfunction	• Wiring Harness • Front Impact Sensor(FIS) squib • SRSCM

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

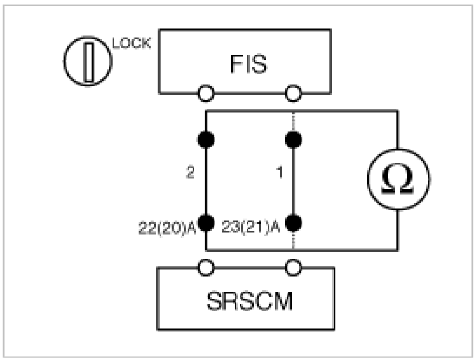
YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK FIS CIRCUIT
   (1) Disconnect the battery, wait 3 minutes.
   (2) Disconnect the FIS and SRSCM.
   (3) Measure the resistance between terminal 1 of the FIS harness connector and terminal A 23(21) of SRSCM harness connector.
   (4) Measure the resistance between terminal 2 of the FIS harness connector and terminal A 22(20) of SRSCM harness connector.

   specification(resistance) : below 1 Ω

   Is the measured resistance within specification?

   YES

   ▸Check Front Impact Sensor.

   NO

   ▸ Repair or replace the wiring harness between the FIS and the SRSCM.
3. CHECK FRONT IMPACT SENSOR
   (1) Replace the front impact sensor(FIS) with a new one.
   ● Refer to "Front Impact Sensor(FIS)" section in this SERVICE MANUAL.
   (2) Install the DAB module and connect the DAB connector.
   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (4) Connect the SRSCM connector.
   (5) Connect the negative (-) terminal to the battery.
   (6) Connect a Hi-Scan(Pro) to the data link connector.
   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to FIS?

   YES

   ▸ Go to next step.

   NO

   ▸ Replace the Front Impact Sensor(FIS).
4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON .

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1346

DTC Description

The Driver Airbag circuit consists of the SRSCM, Clockspring and the Driver Airbag (DAB) which has two squib circuits. The SRSCM sets above DTC(s) if it detects that the resistance of DAB squib is too high or low.

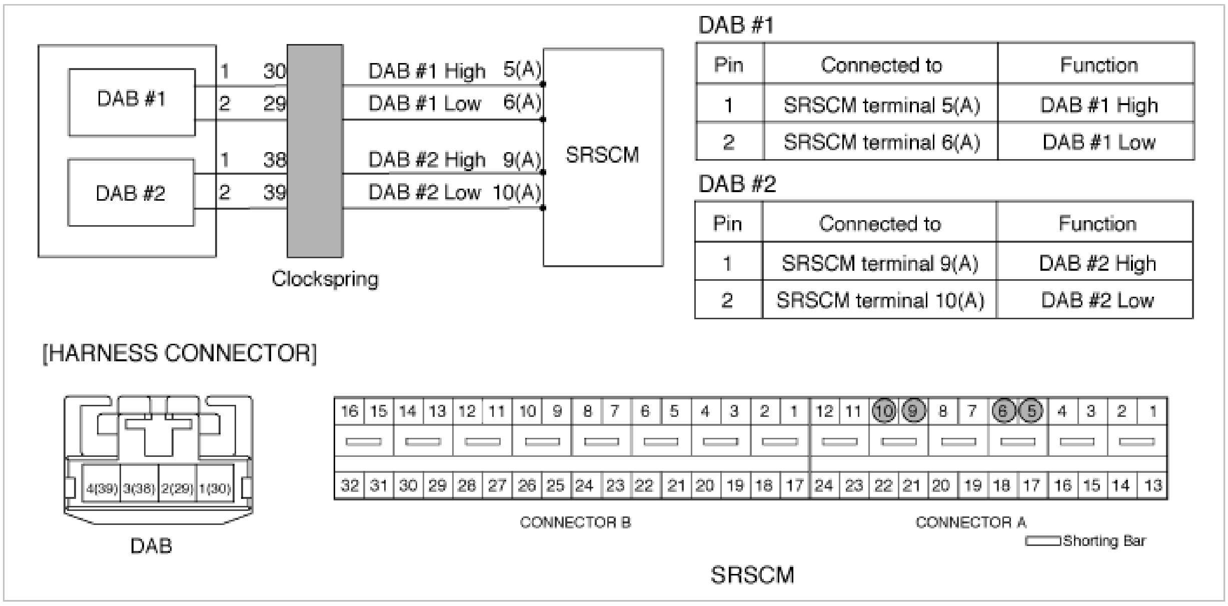
DTC Detecting Condition

DTC	Condition	Probable cause
B1346 B1347	• Too high or low resistance between DAB high(+) and DAB low (-) • Driver Airbag (DAB) Malfunction • Clockspring Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Driver Airbag (DAB) squib • Clockspring • SRSCM • Partially connected connector

Specification

DAB resistance : $1.9 \le R \le 3.0\ \Omega$

Schematic Diagram



DAB #1

Pin	Connected to	Function
1	SRSCM terminal 5(A)	DAB #1 High
2	SRSCM terminal 6(A)	DAB #1 Low

DAB #2

Pin	Connected to	Function
1	SRSCM terminal 9(A)	DAB #2 High
2	SRSCM terminal 10(A)	DAB #2 Low

Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

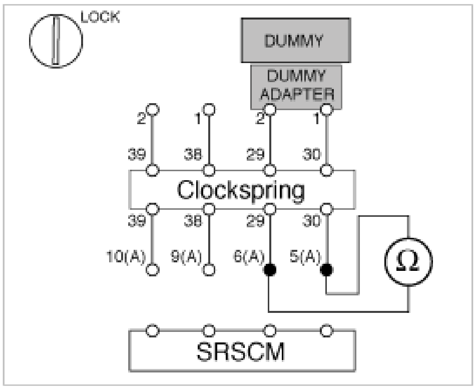
1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB,SAB,CAB,BPT,BUPT,FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK DAB RESISTANCE

> **CAUTION**
>
> Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

(1) Connect the Dummy and the Dummy Adapter on DAB harness connector.
●Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

(2) Measure resistance between the terminal 5 and 6 of SRSCM harness connector(A).

DAB resistance : $1.9 \le R \le 3.0\ \Omega$



(3) Is the measured resistance within specification?

NO

▸ Check open circuit.

YES

▸ Replace the Driver Airbag(DAB) module.

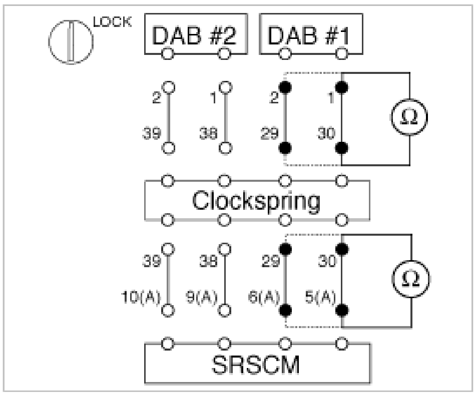
3. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 1 of DAB stage #1 harness connector and the terminal 30 of clockspring harness connector.

   (2) Measure resistance between the terminal 2 of DAB stage #1 harness connector and the terminal 29 of clockspring harness connector.

   (3) Measure resistance between the terminal 30 of clockspring harness connector and the terminal 5 of SRSCM harness connector(A).

   (4) Measure resistance between the terminal 29 of clockspring harness connector and the terminal 6 of SRSCM harness connector(A).

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

▸ Check short circuit.

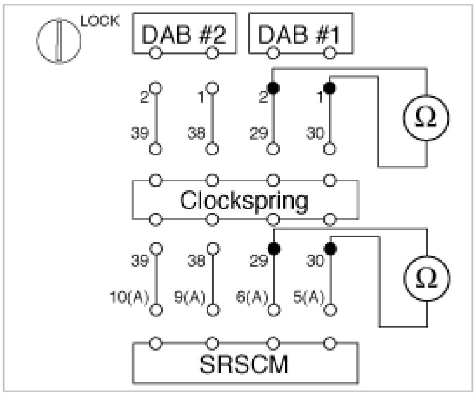
NO

▸ Repair or replace the wiring harness between the DAB and the clockspring or between the clockspring and the SRSCM.

4. CHECK SHORT CIRCUIT
   (1) Measure resistance between the terminal 1 and 2 of DAB stage #1 harness connector.

   (2) Measure resistance between the terminal 29 and 30 of clockspring harness connector.

specification(resistance) : ∞ Ω



Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair or replace the wiring harness between the DAB and the clockspring or between the clockspring and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON .
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1347

DTC Description

The Driver Airbag circuit consists of the SRSCM, Clockspring and the Driver Airbag (DAB) which has two squib circuits. The SRSCM sets above DTC(s) if it detects that the resistance of DAB squib is too high or low.

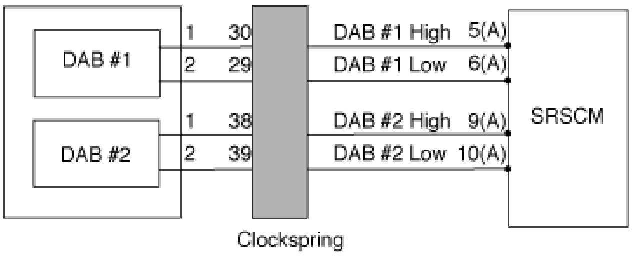
DTC Detecting Condition

DTC	Condition	Probable cause
B1346 B1347	• Too high or low resistance between DAB high(+) and DAB low (-) • Driver Airbag (DAB) Malfunction • Clockspring Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Driver Airbag (DAB) squib • Clockspring • SRSCM • Partially connected connector

Specification

DAB resistance : 1.9 ≤ R ≤ 3.0 Ω

Schematic Diagram



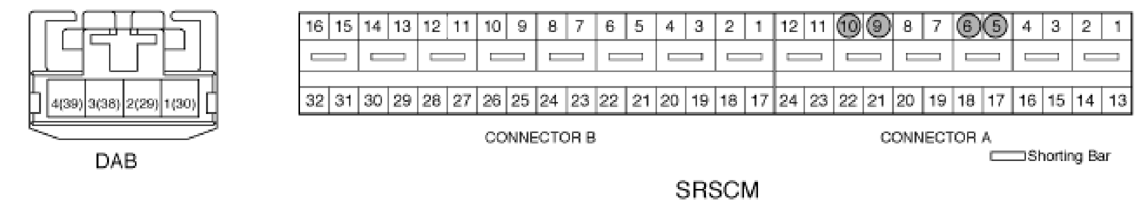
DAB #1

Pin	Connected to	Function
1	SRSCM terminal 5(A)	DAB #1 High
2	SRSCM terminal 6(A)	DAB #1 Low

DAB #2

Pin	Connected to	Function
1	SRSCM terminal 9(A)	DAB #2 High
2	SRSCM terminal 10(A)	DAB #2 Low

[HARNESS CONNECTOR]



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

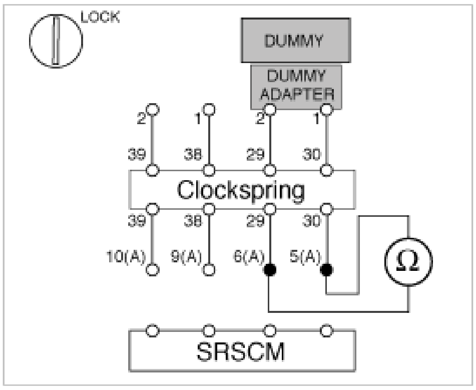
Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB,SAB,CAB,BPT,BUPT,FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK DAB RESISTANCE

> **CAUTION**
>
> Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

(1) Connect the Dummy and the Dummy Adapter on DAB harness connector.
●Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.
(2) Measure resistance between the terminal 5 and 6 of SRSCM harness connector(A).

DAB resistance : 1.9 ≤ R ≤ 3.0 Ω



(3) Is the measured resistance within specification?

NO

▸ Check open circuit.

YES

▸ Replace the Driver Airbag(DAB) module.

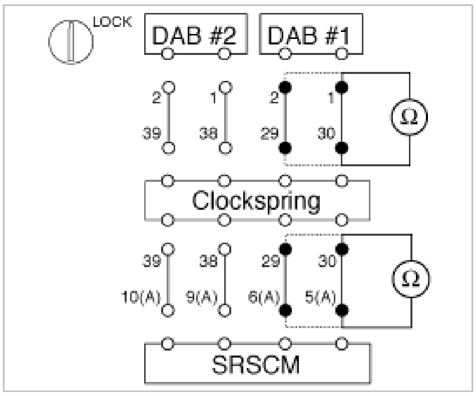
3. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 1 of DAB stage #1 harness connector and the terminal 30 of clockspring harness connector.

   (2) Measure resistance between the terminal 2 of DAB stage #1 harness connector and the terminal 29 of clockspring harness connector.

   (3) Measure resistance between the terminal 30 of clockspring harness connector and the terminal 5 of SRSCM harness connector(A).

   (4) Measure resistance between the terminal 29 of clockspring harness connector and the terminal 6 of SRSCM harness connector(A).

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

▸ Check short circuit.

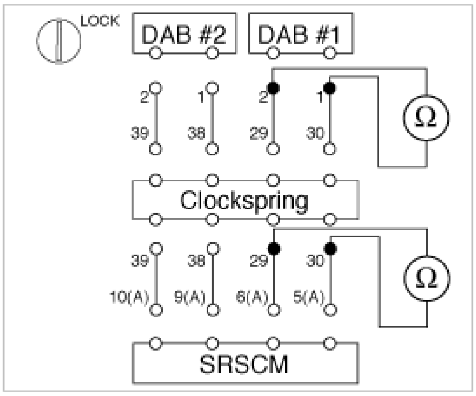
NO

▸ Repair or replace the wiring harness between the DAB and the clockspring or between the clockspring and the SRSCM.

4. CHECK SHORT CIRCUIT
   (1) Measure resistance between the terminal 1 and 2 of DAB stage #1 harness connector.

   (2) Measure resistance between the terminal 29 and 30 of clockspring harness connector.

specification(resistance) : ∞ Ω



Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair or replace the wiring harness between the DAB and the clockspring or between the clockspring and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON .
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1348

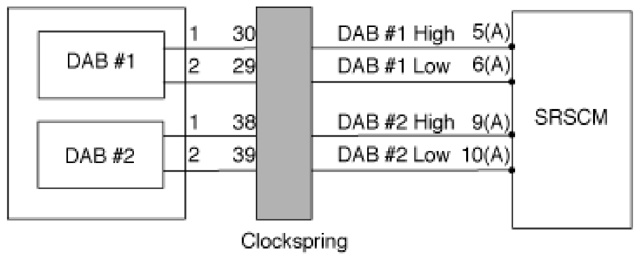
DTC Description

The Driver Airbag circuit consists of the SRSCM, Clockspring and the Driver Airbag (DAB) which has two squib circuits. The SRSCM sets above DTC(s) if it detects short to ground on the DAB circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1348 B1483	• Short to ground between DAB and clockspring • Short to ground between clockspring and SRSCM • Driver Airbag (DAB) Malfunction • Clockspring Malfunction • SRSCM Malfunction	• Short to ground circuit on wiring harness • Driver Airbag (DAB) squib • Clockspring • SRSCM

Schematic Diagram

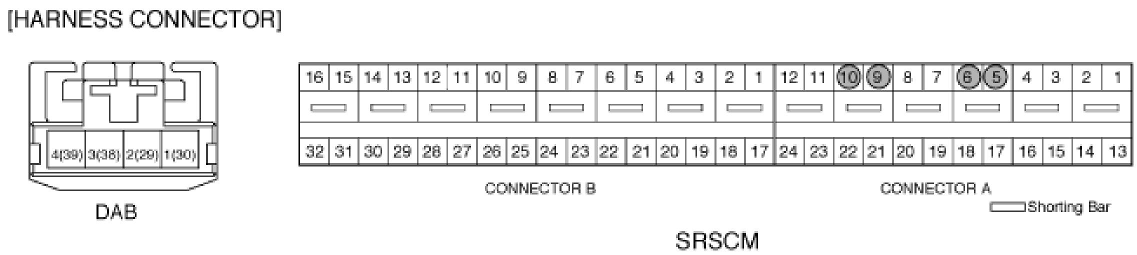


DAB #1

Pin	Connected to	Function
1	SRSCM terminal 5(A)	DAB #1 High
2	SRSCM terminal 6(A)	DAB #1 Low

DAB #2

Pin	Connected to	Function
1	SRSCM terminal 9(A)	DAB #2 High
2	SRSCM terminal 10(A)	DAB #2 Low



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

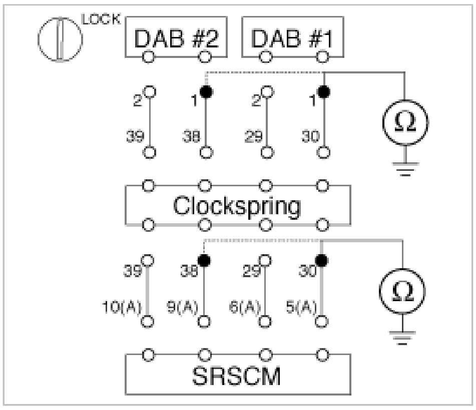
YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SHORT TO GROUND
   (1) Measure resistance between the terminal 1 of DAB stage #1 harness connector and chassis ground.(DAB stage #1)
   (2) Measure resistance between the terminal 1 of DAB stage #2 harness connector and chassis ground.(DAB stage #2)
   (3) Measure resistance between the terminal 30 of clockspring harness connector and chassis ground.(DAB stage #1)
   (4) Measure resistance between the terminal 38 of clockspring harness connector and chassis ground.(DAB stage #2)

specification(resistance) : infinite



(5) Is the measured resistance within specification?

YES

▸Check the DAB Module.

NO

▸ Repair or replace the wiring harness between the DAB and the clockspring or between the clockspring and the SRSCM.

3. CHECK THE DAB MODULE
   (1) Replace the Driver Airbag(DAB) with a new one.
   - Refer to "Driver Airbag(DAB)" section in this SERVICE MANUAL.

   (2) Install the DAB module and connect the DAB connector.

   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (4) Connect the SRSCM connector.

   (5) Connect the negative (-) terminal to the battery.

   (6) Connect a Hi-Scan(Pro) to the data link connector.

   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to DAB?

YES

▸Check the clockspring.

NO

▸Replace the Driver Airbag(DAB).

4. CHECK THE CLOCKSPRING
   (1) Check the clockspring.
   Is the clockspring normal?

YES

▸ Go to next step.

NO

▸ Replace the clockspring.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.

   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (3) Connect the SRSCM connector.

   (4) Connect the negative (-) terminal to the battery.

   (5) Connect a Hi-Scan(Pro) to the data link connector.

   (6) Turn the ignition switch to ON

   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

   (9) Turn the ignition switch to ON and wait for at least 30 seconds.

   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1349

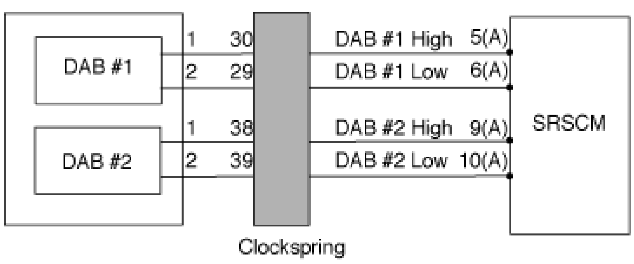
DTC Description

The Driver Airbag circuit consists of the SRSCM, Clockspring and the Driver Airbag (DAB) which has two squib circuits. The SRSCM sets above DTC(s) if it detects short to battery line on the DAB circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1349 B1484	• Short to battery line between DAB and clockspring • Short to battery line between clockspring and SRSCM • Driver Airbag (DAB) Malfunction • Clockspring Malfunction • SRSCM Malfunction	• Short to battery line on wiring harness • Driver Airbag (DAB) squib • Clockspring • SRSCM

Schematic Diagram



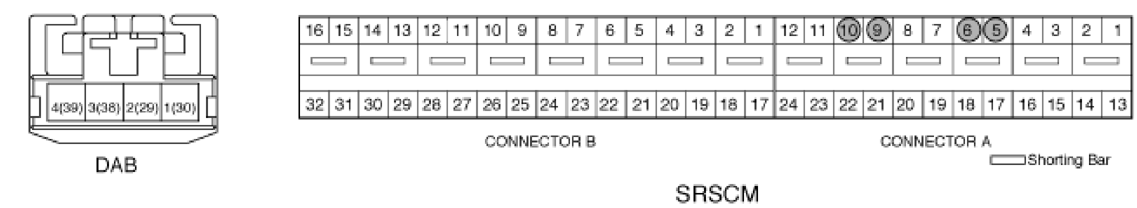
DAB #1

Pin	Connected to	Function
1	SRSCM terminal 5(A)	DAB #1 High
2	SRSCM terminal 6(A)	DAB #1 Low

DAB #2

Pin	Connected to	Function
1	SRSCM terminal 9(A)	DAB #2 High
2	SRSCM terminal 10(A)	DAB #2 Low

[HARNESS CONNECTOR]



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

CAUTION

Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.

(3) Remove the DAB module and disconnect the DAB connector.

(4) Disconnect the connectors of the PAB,SAB,CAB,BPT,BUPT,FIS and SIS.

(5) Disconnect the SRSCM connector.

2. CHECK SHORT TO BATTERY LINE

(1) Connect the negative (-) terminal to the battery.

(2) Turn the ignition switch to ON.

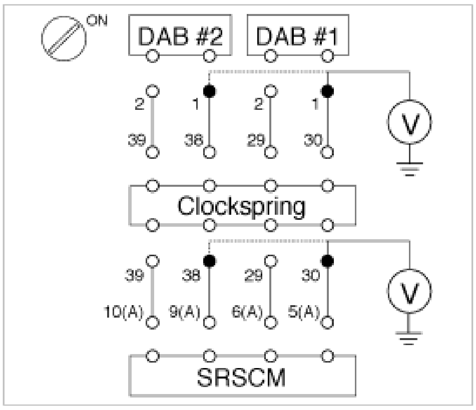
(3) Measure voltage between the terminal 1 of DAB stage #1 harness connector and chassis ground(-).(DAB stage #1)

(4) Measure voltage between the terminal 1 of DAB stage #2 harness connector and chassis ground(-).(DAB stage #2)

(5) Measure voltage between the terminal 30 of clockspring harness connector and chassis ground(-).(DAB stage #1)

(6) Measure voltage between the terminal 38 of clockspring harness connector and chassis ground(-).(DAB stage #2)

specification(voltage) : Approximately 0 V



Is the measured voltage within specification?

YES

▸Check the DAB module.

NO

▸ Repair or replace the wiring harness between the DAB and the clockspring or between the clockspring and the SRSCM.

3. CHECK THE DAB MODULE

(1) Replace the Driver Airbag(DAB) with a new one.

● "Refer to "Driver Airbag(DAB)" section in this SERVICE MANUAL.

(2) Install the DAB module and connect the DAB connector.

(3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal to the battery.

(6) Connect a Hi-Scan(Pro) to the data link connector.

(7) Turn the ignition switch to ON and check the vehicle again.

Does Hi-Scan (Pro) indicate any DTC related to DAB?

YES

▸Check the clockspring.

NO

▸Replace the Driver Airbag(DAB).

4. CHECK THE CLOCKSPRING

(1) Check the clockspring.

Is the clockspring normal?

YES

▸ Go to next step.

NO

▸ Replace the clockspring.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON.
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1352

DTC Description

The Passenger Airbag circuit consists of the SRSCM and the Passenger Airbag (PAB) which has two squib circuits. The SRSCM sets above DTC(s) if it detects that the resistance of PAB squib is too high or low.

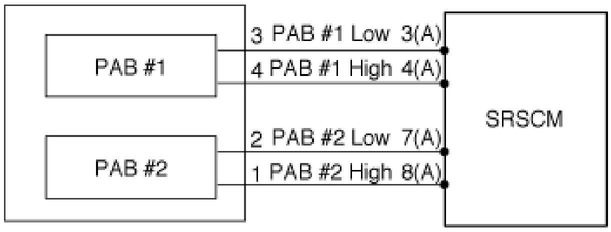
DTC Detecting Condition

DTC	Condition	Probable cause
B1352 B1353	• Too high or low resistance between PAB high(+) and PAB low (-) • Passenger Airbag (PAB) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Passenger Airbag (PAB) squib • SRSCM • Partially connected connector

Specification

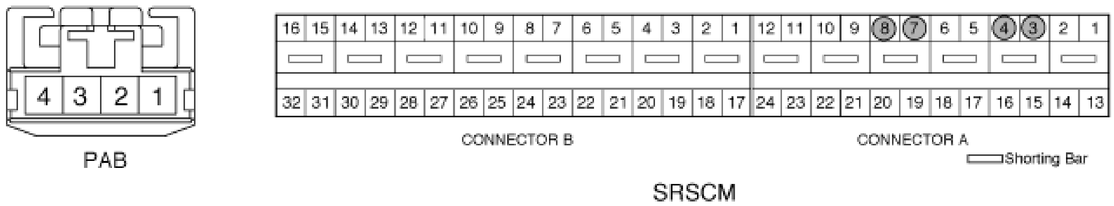
PAB resistance : $1.8 \le R \le 2.4\ \Omega$

Schematic Diagram



Pin	Connected to	Function
1	SRSCM terminal 8(A)	PAB #2 High
2	SRSCM terminal 7(A)	PAB #2 Low
3	SRSCM terminal 3(A)	PAB #1 Low
4	SRSCM terminal 4(A)	PAB #1 High

[HARNESS CONNECTOR]



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> CAUTION
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

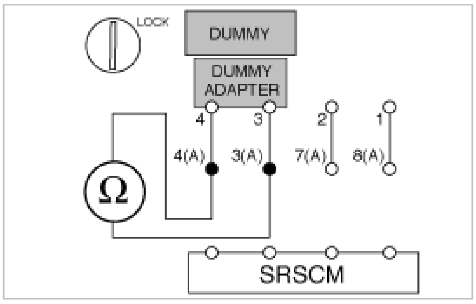
2. CHECK PAB RESISTANCE

> CAUTION
>
> Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

   (1) Connect the Dummy and the Dummy Adapter on PAB harness connector.
   - Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

   (2) Measure resistance between the terminal 4 and 3 of SRSCM harness connector(A).

PAB resistance : $1.8 \le R \le 2.4\ \Omega$



(3) Is the measured resistance within specification?

YES

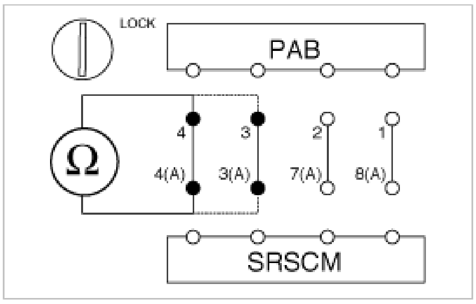
▸ Replace the Passenger Airbag(PAB) module.

NO

▸ Check open circuit.

3. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 4 of PAB harness connector and the terminal 4 of SRSCM harness connector(A).
   (2) Measure resistance between the terminal 3 of PAB harness connector and the terminal 3 of SRSCM harness connector(A).

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

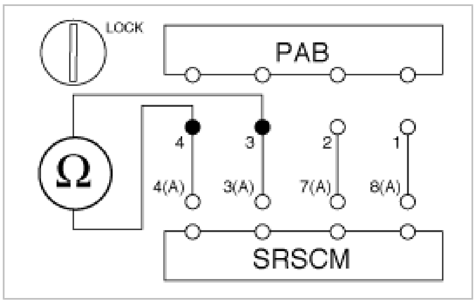
▸Check short circuit.

NO

▸Repair or replace the wiring harness between the PAB and the SRSCM.

4. CHECK SHORT CIRCUIT
   (1) Measure resistance between the terminal 4 and 3 of PAB harness connector.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair or replace the wiring harness between the PAB and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON.

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▶ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▶Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1353

DTC Description

The Passenger Airbag circuit consists of the SRSCM and the Passenger Airbag (PAB) which has two squib circuits. The SRSCM sets above DTC(s) if it detects that the resistance of PAB squib is too high or low.

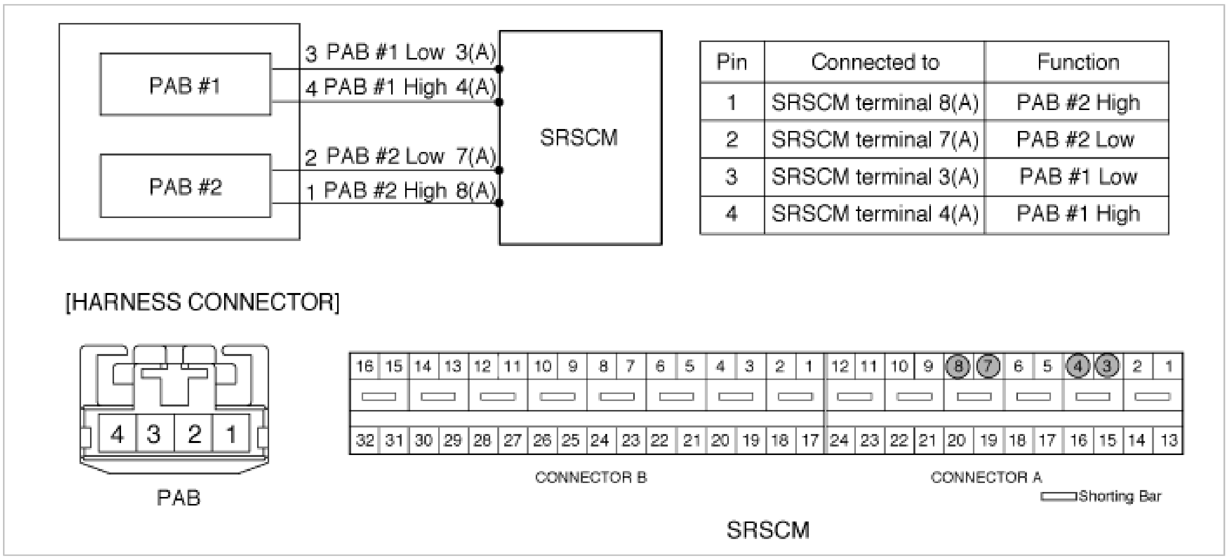
DTC Detecting Condition

DTC	Condition	Probable cause
B1352 B1353	• Too high or low resistance between PAB high(+) and PAB low (-) • Passenger Airbag (PAB) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Passenger Airbag (PAB) squib • SRSCM • Partially connected connector

Specification

PAB resistance : $1.8 \leq R \leq 2.4\ \Omega$

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

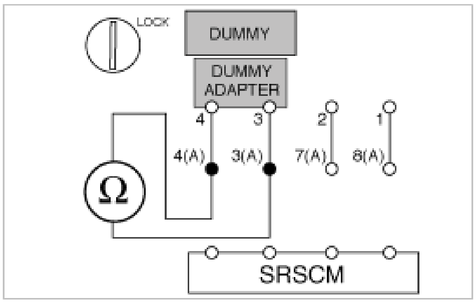
1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK PAB RESISTANCE

> **CAUTION**
>
> Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

   (1) Connect the Dummy and the Dummy Adapter on PAB harness connector.
   - Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

   (2) Measure resistance between the terminal 4 and 3 of SRSCM harness connector(A).

PAB resistance : $1.8 \le R \le 2.4\ \Omega$



(3) Is the measured resistance within specification?

YES

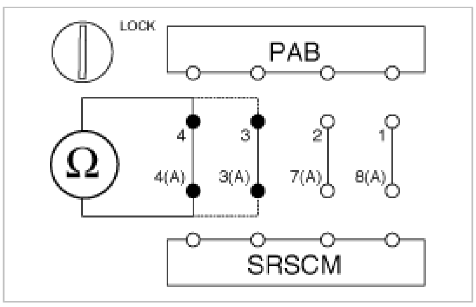
▸ Replace the Passenger Airbag(PAB) module.

NO

▸ Check open circuit.

3. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 4 of PAB harness connector and the terminal 4 of SRSCM harness connector(A).
   (2) Measure resistance between the terminal 3 of PAB harness connector and the terminal 3 of SRSCM harness connector(A).

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

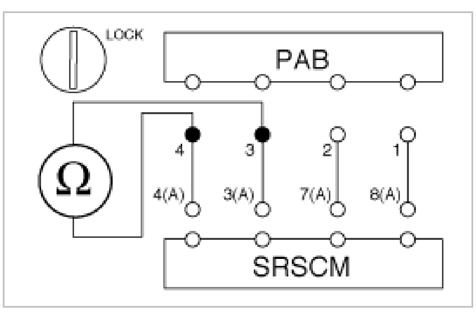
▸Check short circuit.

NO

▸Repair or replace the wiring harness between the PAB and the SRSCM.

4. CHECK SHORT CIRCUIT
   (1) Measure resistance between the terminal 4 and 3 of PAB harness connector.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair or replace the wiring harness between the PAB and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON.

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1354

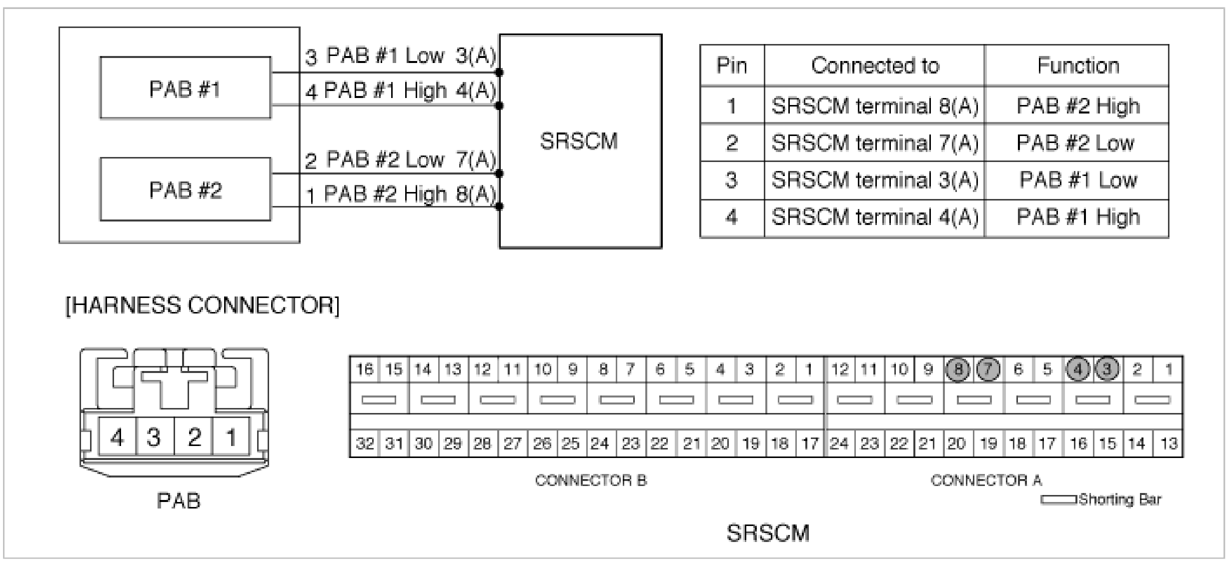
DTC Description

The Passenger Airbag circuit consists of the SRSCM and the Passenger Airbag (PAB) which has two squib circuits. The SRSCM sets above DTC(s) if it detects short to ground on the PAB circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1354 B1487	• Short to ground between PAB module and SRSCM • Passenger Airbag (PAB) Malfunction • SRSCM Malfunction	• Short to ground on wiring harness • Passenger Airbag (PAB) squib • SRSCM

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

CAUTION

Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

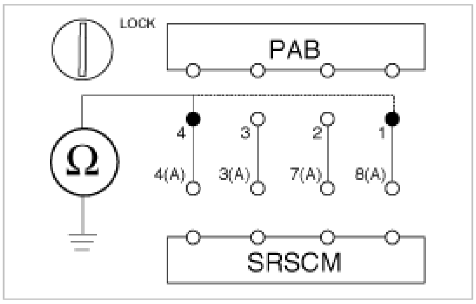
▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK SHORT TO GROUND
   (1) Measure resistance between the terminal 4 of PAB harness connector and chassis ground.(PAB stage #1)
   (2) Measure resistance between the terminal 1 of PAB harness connector and chassis ground.(PAB stage #2)

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸ Check the PAB Module.

NO

▸ Repair or replace the wiring harness between the PAB and the SRSCM.

3. CHECK THE PAB MODULE
   (1) Replace the Passenger Airbag (PAB) with a new one.
   - Refer to "Passenger Airbag (PAB)" section in this SERVICE MANUAL.
   (2) Install the DAB module and connect the DAB connector.
   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (4) Connect the SRSCM connector.
   (5) Connect the negative (-) terminal to the battery.
   (6) Connect a Hi-Scan(Pro) to the data link connector.
   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to PAB?

YES

▸ Go to next step.

NO

▸Replace PAB module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON .

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1355

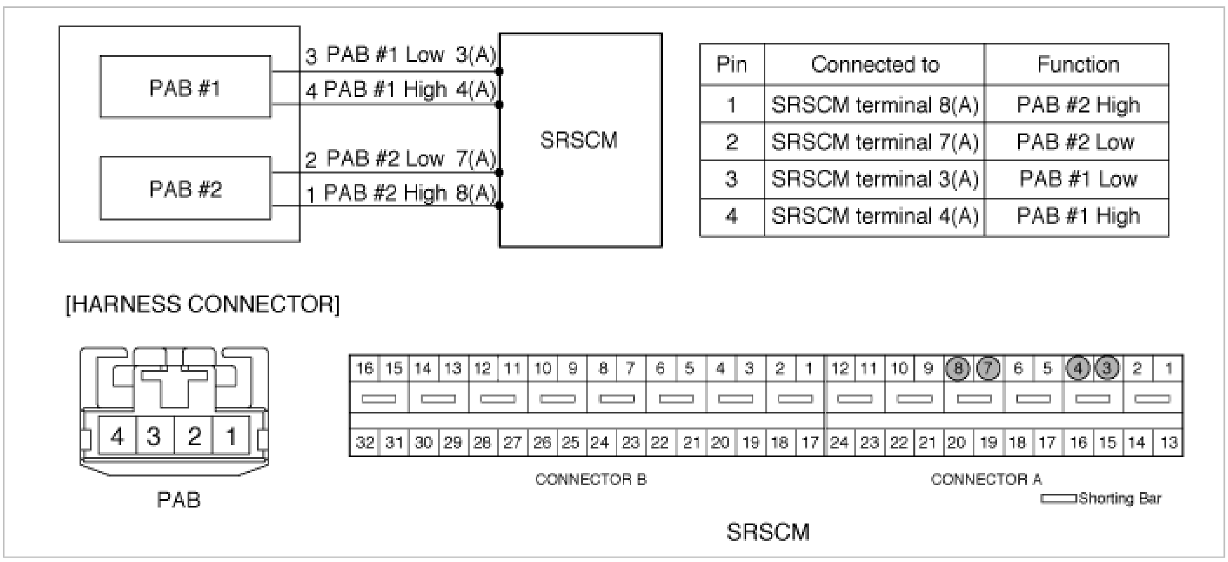
DTC Description

The Passenger Airbag circuit consists of the SRSCM and the Passenger Airbag (PAB) which has two squib circuits.The SRSCM sets above DTC(s) if it detects short to battery line on the PAB circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1355 B1488	• Short to battery line between PAB and SRSCM • Passenger Airbag (PAB) Malfunction • SRSCM Malfunction	• Short to battery line circuit on wiring harness • Passenger Airbag (PAB) squib • SRSCM

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

CAUTION

Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

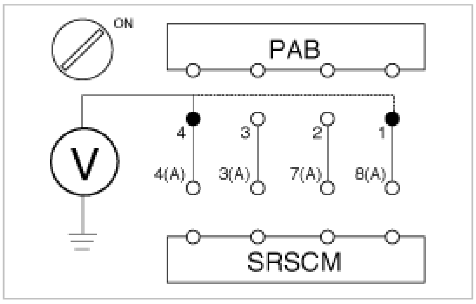
▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK SHORT TO BATTERY LINE
   (1) Connect the negative (-) terminal to the battery.
   (2) Turn the ignition switch to ON.
   (3) Measure voltage between the terminal 4 of PAB harness connector and chassis ground(-).(PAB stage #1)
   (4) Measure voltage between the terminal 1 of PAB harness connector and chassis ground(-).(PAB stage #2)

specification(voltage) : Approximately 0 V



Is the measured voltage within specification?

YES

▸ Check the PAB Module.

NO

▸ Repair the short to battery line circuit on wiring harness between the PAB and the SRSCM.

3. CHECK THE PAB MODULE
   (1) Replace the Passenger Airbag(PAB) with a new one.
   - Refer to "Passenger Airbag(PAB)" section in this SERVICE MANUAL.
   (2) Install the DAB module and connect the DAB connector.
   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (4) Connect the SRSCM connector.
   (5) Connect the negative (-) terminal to the battery.
   (6) Connect a Hi-Scan(Pro) to the data link connector.
   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to PAB?

YES

▸ Go to next step.

NO

▸Replace PAB module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON.

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1361

DTC Description

The Seat Belt Pretensioner circuit consists of the SRSCM and two Seat Belt Pretensioner (BPT).
The SRSCM sets above DTC(s) if it detects that the resistance of BPT squib is too high or low.

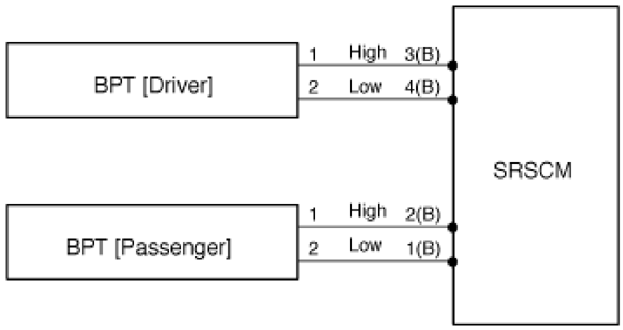
DTC Detecting Condition

DTC	Condition	Probable cause
B1361 B1362 B1367 B1368	• Too high or low resistance between BPT high(+) and BPT low (-) • Seat Belt Pretensioner (BPT) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Seat Belt Pretensioner (BPT) squib • SRSCM

Specification

BPT resistance : $1.9 \le R \le 2.8\ \Omega$

Schematic Diagram



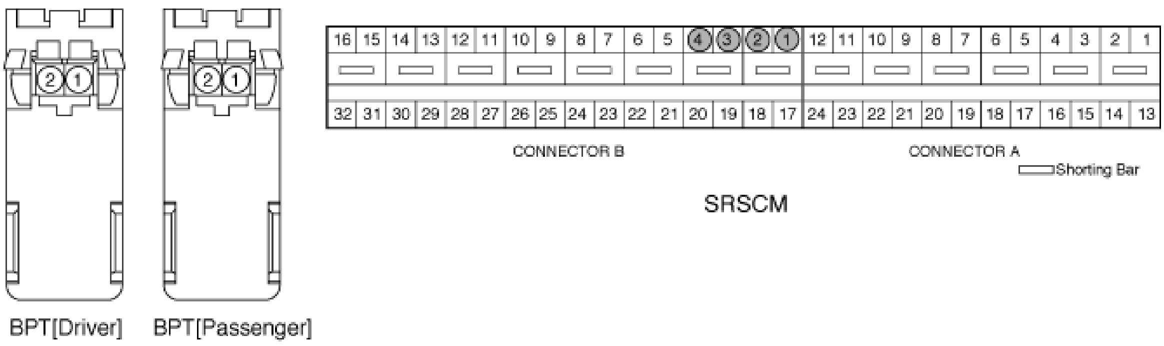
BPT [Driver]

Terminal	Connected to	Function
1	SRSCM Terminal 3(B)	BPT High
2	SRSCM Terminal 4(B)	BPT Low

BPT [Passenger]

Terminal	Connected to	Function
1	SRSCM Terminal 2(B)	BPT High
2	SRSCM Terminal 1(B)	BPT Low

[HARNESS CONNECTOR]



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

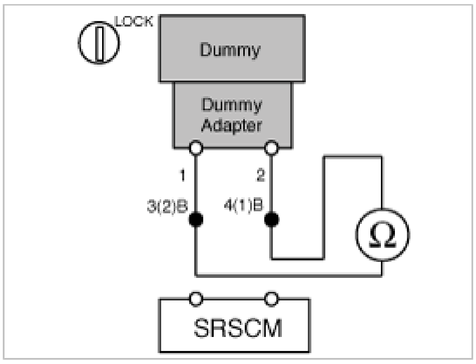
1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK BPT RESISTANCE

> **CAUTION**
>
> Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

   (1) Connect the Dummy and the Dummy Adapter on BPT harness connector.
   - Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

   (2) Measure resistance between the terminal 3(2) and 4(1) of SRSCM harness connector(B).

BPT resistance : 1.9 ≤ R ≤ 2.8 Ω



Is the measured resistance within specification?

YES

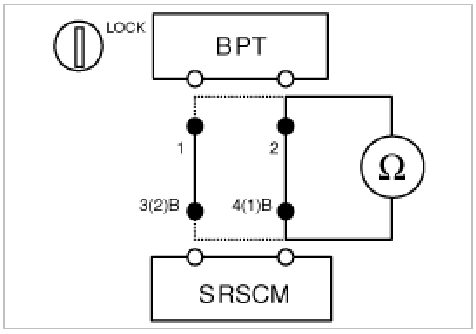
▶ Replace the Seat Belt Pretensioner(BPT) module.

NO

▶Check open circuit.

3. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 1 of BPT harness connector and the terminal 3(2) of SRSCM harness connector (B).
   (2) Measure resistance between the terminal 2 of BPT harness connector and the terminal 4(1) of SRSCM harness connector (B).

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

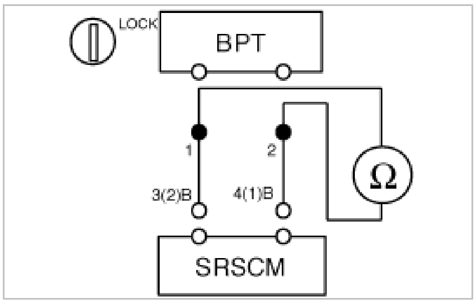
▶ Check short circuit.

NO

▶ Repair or replace the wiring harness between the BPT and the SRSCM.

4. CHECK SHORT CIRCUIT
   (1) Measure resistance between the terminal 1 and 2 of BPT harness connector.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▶ Go to next step.

NO

▸ Repair or replace the wiring harness between the BPT and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON.
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1362

DTC Description

The Seat Belt Pretensioner circuit consists of the SRSCM and two Seat Belt Pretensioner (BPT).
The SRSCM sets above DTC(s) if it detects that the resistance of BPT squib is too high or low.

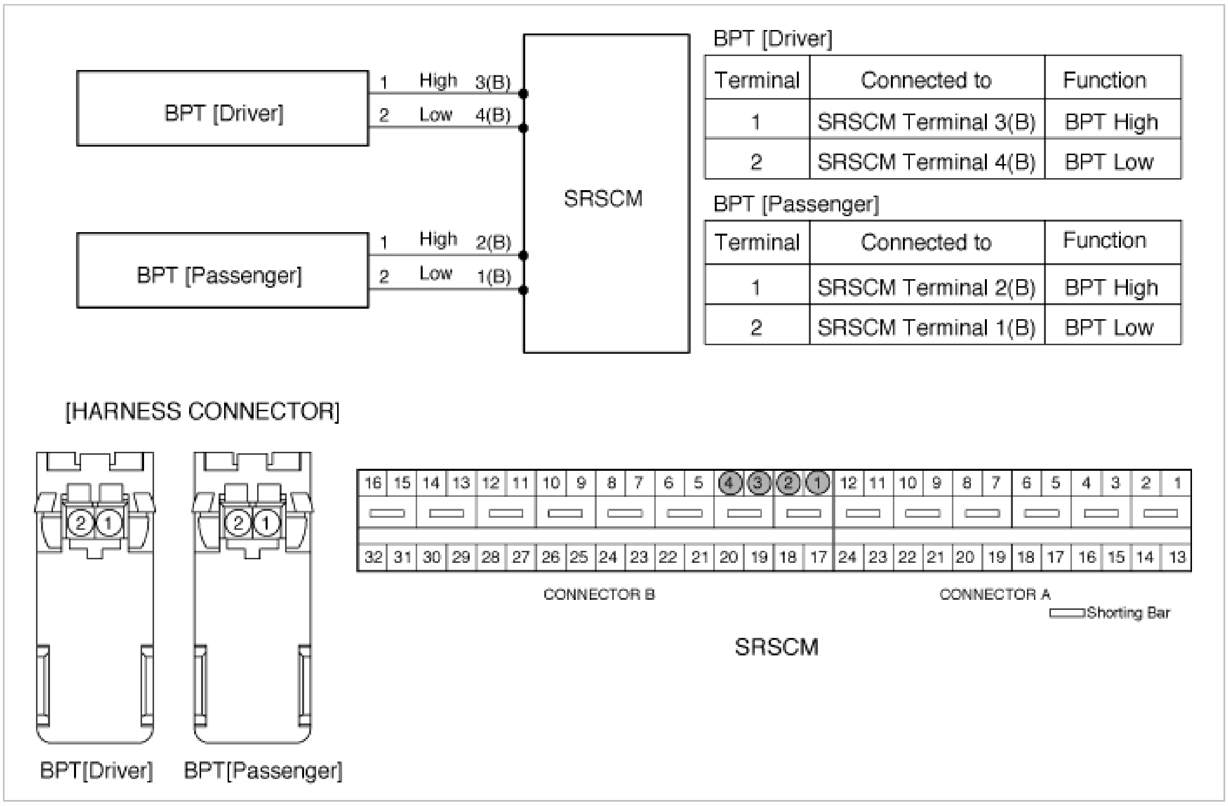
DTC Detecting Condition

DTC	Condition	Probable cause
B1361 B1362 B1367 B1368	• Too high or low resistance between BPT high(+) and BPT low (-) • Seat Belt Pretensioner (BPT) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Seat Belt Pretensioner (BPT) squib • SRSCM

Specification

BPT resistance : 1.9 ≤ R ≤2.8 Ω

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

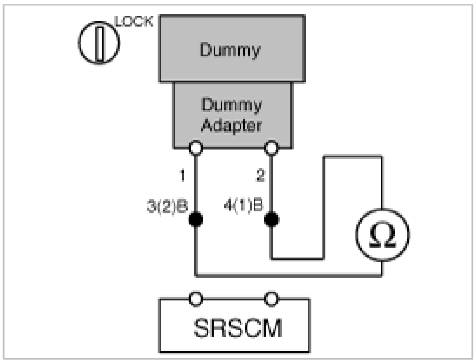
1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK BPT RESISTANCE

> **CAUTION**
>
> Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

   (1) Connect the Dummy and the Dummy Adapter on BPT harness connector.
   - Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

   (2) Measure resistance between the terminal 3(2) and 4(1) of SRSCM harness connector(B).

BPT resistance : $1.9 \le R \le 2.8\ \Omega$



Is the measured resistance within specification?

YES

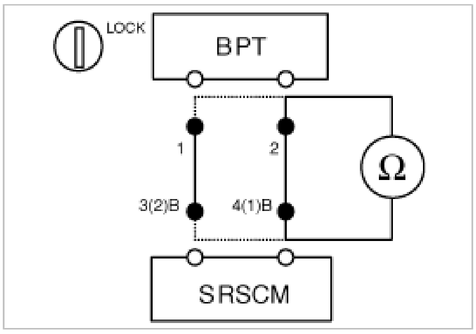
▶ Replace the Seat Belt Pretensioner(BPT) module.

NO

▶Check open circuit.

3. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 1 of BPT harness connector and the terminal 3(2) of SRSCM harness connector (B).
   (2) Measure resistance between the terminal 2 of BPT harness connector and the terminal 4(1) of SRSCM harness connector (B).

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

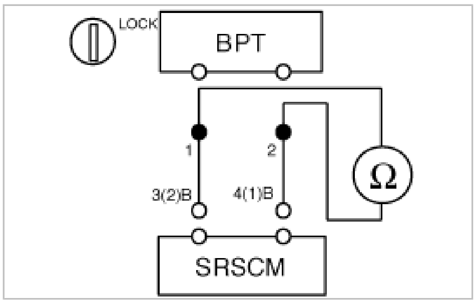
▶ Check short circuit.

NO

▶ Repair or replace the wiring harness between the BPT and the SRSCM.

4. CHECK SHORT CIRCUIT
   (1) Measure resistance between the terminal 1 and 2 of BPT harness connector.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▶ Go to next step.

NO

▸ Repair or replace the wiring harness between the BPT and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON.
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1363

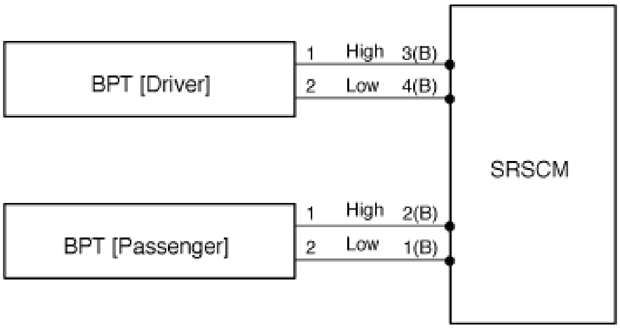
DTC Description

The Seat Belt Pretensioner consists of the SRSCM and two Seat Belt Pretensioner (BPT).The SRSCM sets above DTC(s) if it detects short to ground on the BPT circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1363 B1369	• Short to ground between BPT and SRSCM • Seat Belt Pretensioner (BPT) Malfunction • SRSCM Malfunction	• Short to ground circuit on wiring harness • Seat Belt Pretensioner (BPT) squib • SRSCM

Schematic Diagram

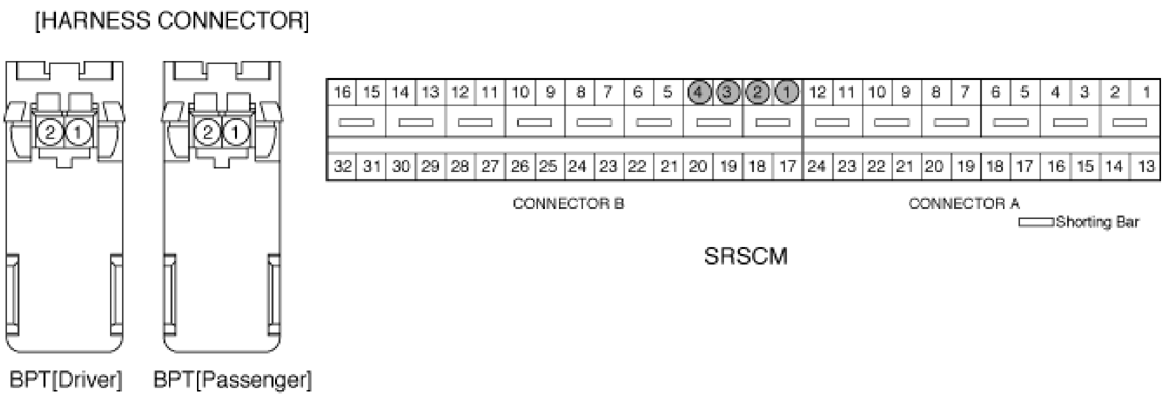


BPT [Driver]

Terminal	Connected to	Function
1	SRSCM Terminal 3(B)	BPT High
2	SRSCM Terminal 4(B)	BPT Low

BPT [Passenger]

Terminal	Connected to	Function
1	SRSCM Terminal 2(B)	BPT High
2	SRSCM Terminal 1(B)	BPT Low



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

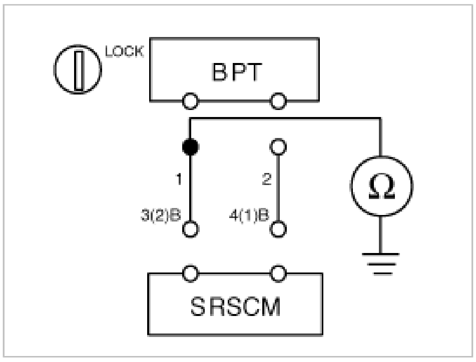
YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SHORT TO GROUND
   (1) Measure resistance between the terminal 1 of BPT harness connector and chassis ground.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸Check the BPT Module.

NO

▸ Repair or replace the wiring harness between the BPT and the SRSCM.

3. CHECK THE BPT MODULE
   (1) Replace the Belt Pretensioner (BPT) with a new one.
   - Refer to "Belt Pretensioner (BPT)" section in this SERVICE MANUAL.

   (2) Install the DAB module and connect the DAB connector.

   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (4) Connect the SRSCM connector.

   (5) Connect the negative (-) terminal to the battery.

   (6) Connect a Hi-Scan(Pro) to the data link connector.

   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to Belt Pretensioner (BPT)?

   YES

   ▸Go to next step.

   NO

   ▸Replace BPT module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.

   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (3) Connect the SRSCM connector.

   (4) Connect the negative (-) terminal to the battery.

   (5) Connect a Hi-Scan(Pro) to the data link connector.

   (6) Turn the ignition switch to ON.

   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

   (9) Turn the ignition switch to ON and wait for at least 30 seconds.

   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1364

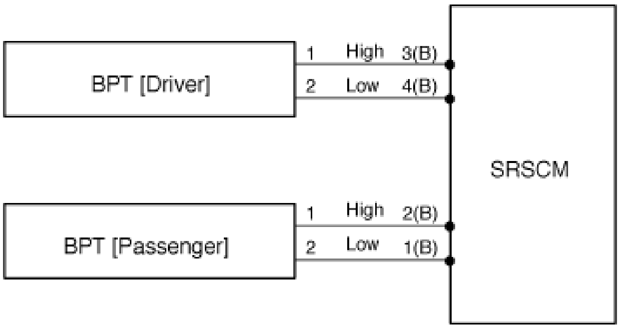
DTC Description

The Seat Belt Pretensioner consists of the SRSCM and two Seat Belt Pretensioner (BPT). The SRSCM sets above DTC(s) if it detects short to battery line on the BPT circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1364 B1370	• Short to battery line between BPT and SRSCM • Seat Belt Pretensioner (BPT) Malfunction • SRSCM Malfunction	• Short to battery line circuit on wiring harness • Seat Belt Pretensioner (BPT) squib • SRSCM

Schematic Diagram



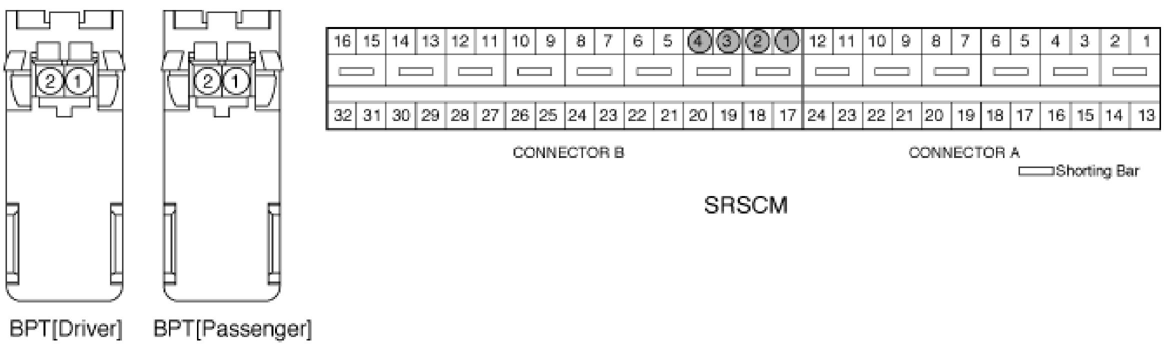
BPT [Driver]

Terminal	Connected to	Function
1	SRSCM Terminal 3(B)	BPT High
2	SRSCM Terminal 4(B)	BPT Low

BPT [Passenger]

Terminal	Connected to	Function
1	SRSCM Terminal 2(B)	BPT High
2	SRSCM Terminal 1(B)	BPT Low

[HARNESS CONNECTOR]



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

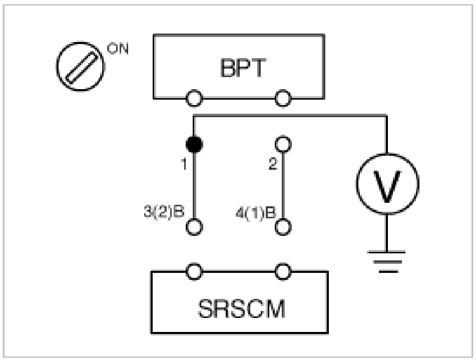
Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

2. CHECK SHORT TO BATTERY LINE
   (1) Connect the negative (-) terminal to the battery.
   (2) Turn the ignition switch to ON.
   (3) Measure voltage between the terminal 1 of BPT harness connector and chassis ground(-).

   specification(voltage) : Approximately 0 V



Is the measured voltage within specification?

YES

▶Check the BPT Module.

NO

▶Repair the short to battery line circuit on wiring harness between the BPT and the SRSCM.

3. CHECK THE BPT MODULE
   (1) Replace the Belt Pretensioner (BPT) with a new one.
   - Refer to "Belt Pretensioner (BPT)" section in this SERVICE MANUAL.
   (2) Install the DAB module and connect the DAB connector.
   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (4) Connect the SRSCM connector.
   (5) Connect the negative (-) terminal to the battery.
   (6) Connect a Hi-Scan(Pro) to the data link connector.
   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to Belt Pretensioner (BPT)?

YES

▶ Go to next step.

NO

▶Replace BPT module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON .
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

YES

▶ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1367

DTC Description

The Seat Belt Pretensioner circuit consists of the SRSCM and two Seat Belt Pretensioner (BPT).
The SRSCM sets above DTC(s) if it detects that the resistance of BPT squib is too high or low.

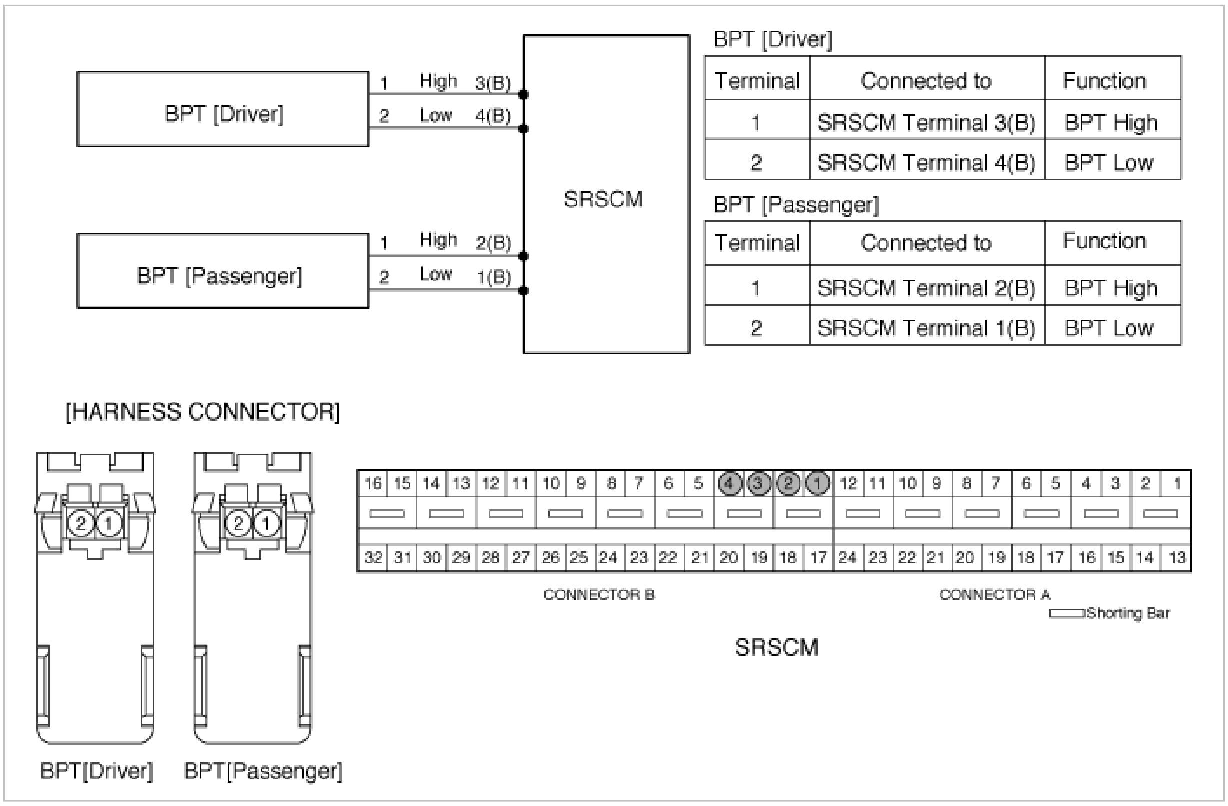
DTC Detecting Condition

DTC	Condition	Probable cause
B1361 B1362 B1367 B1368	• Too high or low resistance between BPT high(+) and BPT low (-) • Seat Belt Pretensioner (BPT) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Seat Belt Pretensioner (BPT) squib • SRSCM

Specification

BPT resistance : 1.9 ≤ R ≤2.8 Ω

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

CAUTION

Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK BPT RESISTANCE

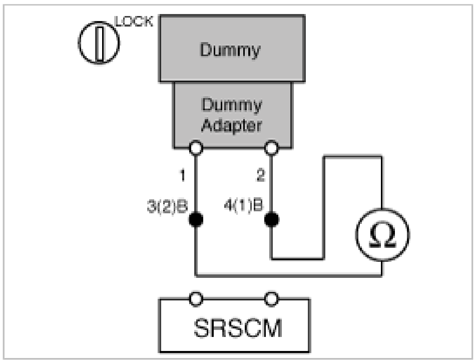
CAUTION

Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

   (1) Connect the Dummy and the Dummy Adapter on BPT harness connector.
   - Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

   (2) Measure resistance between the terminal 3(2) and 4(1) of SRSCM harness connector(B).

BPT resistance : $1.9 \leq R \leq 2.8\ \Omega$



Is the measured resistance within specification?

YES

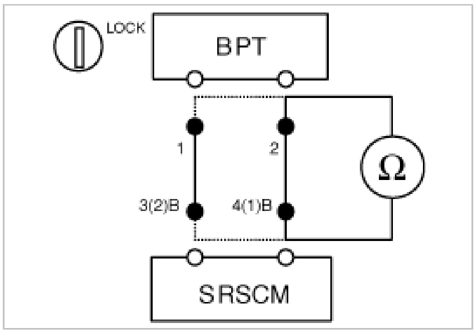
▸ Replace the Seat Belt Pretensioner(BPT) module.

NO

▸Check open circuit.

3. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 1 of BPT harness connector and the terminal 3(2) of SRSCM harness connector (B).
   (2) Measure resistance between the terminal 2 of BPT harness connector and the terminal 4(1) of SRSCM harness connector (B).

specification(resistance) : below $1\ \Omega$



Is the measured resistance within specification?

YES

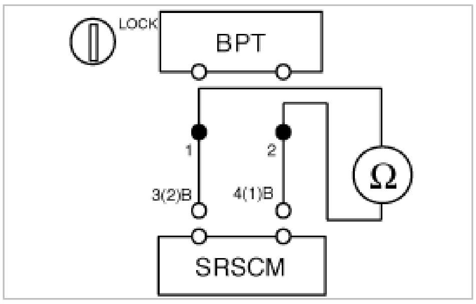
▸ Check short circuit.

NO

▸ Repair or replace the wiring harness between the BPT and the SRSCM.

4. CHECK SHORT CIRCUIT
   (1) Measure resistance between the terminal 1 and 2 of BPT harness connector.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair or replace the wiring harness between the BPT and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON.
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1368

DTC Description

The Seat Belt Pretensioner circuit consists of the SRSCM and two Seat Belt Pretensioner (BPT).
The SRSCM sets above DTC(s) if it detects that the resistance of BPT squib is too high or low.

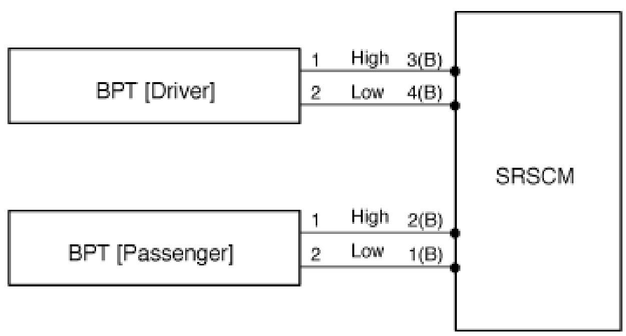
DTC Detecting Condition

DTC	Condition	Probable cause
B1361 B1362 B1367 B1368	• Too high or low resistance between BPT high(+) and BPT low (-) • Seat Belt Pretensioner (BPT) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Seat Belt Pretensioner (BPT) squib • SRSCM

Specification

BPT resistance : 1.9 ≤ R ≤2.8 Ω

Schematic Diagram

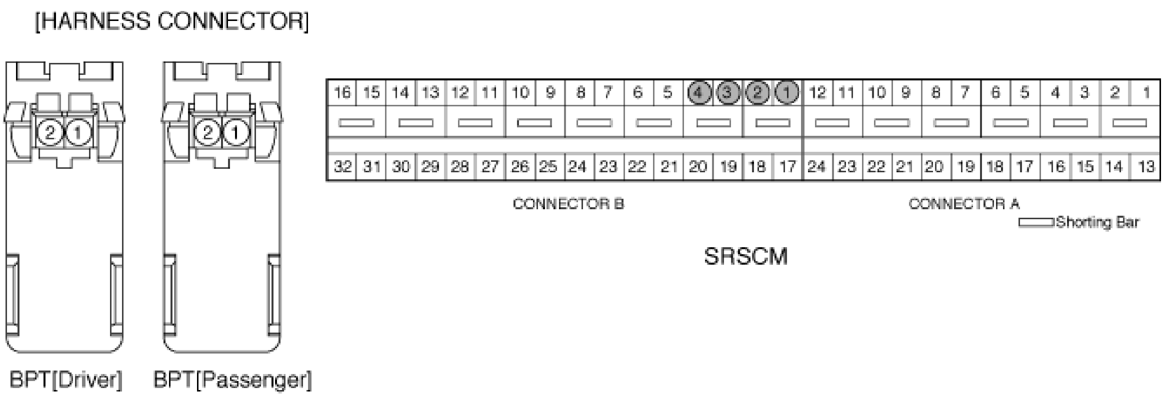


BPT [Driver]

Terminal	Connected to	Function
1	SRSCM Terminal 3(B)	BPT High
2	SRSCM Terminal 4(B)	BPT Low

BPT [Passenger]

Terminal	Connected to	Function
1	SRSCM Terminal 2(B)	BPT High
2	SRSCM Terminal 1(B)	BPT Low



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.

   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.

   (3) Remove the DAB module and disconnect the DAB connector.

   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (5) Disconnect the SRSCM connector.

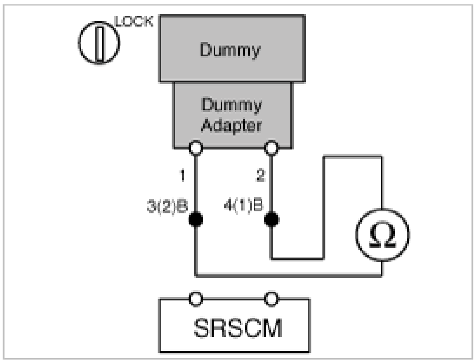
2. CHECK BPT RESISTANCE

> **CAUTION**
>
> Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

   (1) Connect the Dummy and the Dummy Adapter on BPT harness connector.
   - Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

   (2) Measure resistance between the terminal 3(2) and 4(1) of SRSCM harness connector(B).

BPT resistance : 1.9 ≤ R ≤ 2.8 Ω



Is the measured resistance within specification?

YES

▸ Replace the Seat Belt Pretensioner(BPT) module.

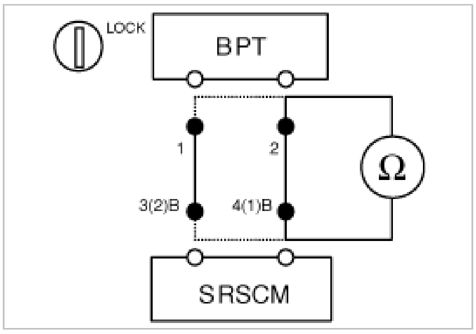
NO

▸Check open circuit.

3. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 1 of BPT harness connector and the terminal 3(2) of SRSCM harness connector (B).

   (2) Measure resistance between the terminal 2 of BPT harness connector and the terminal 4(1) of SRSCM harness connector (B).

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

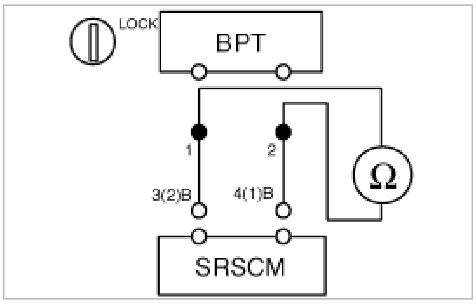
▸ Check short circuit.

NO

▶ Repair or replace the wiring harness between the BPT and the SRSCM.

4. CHECK SHORT CIRCUIT
   (1) Measure resistance between the terminal 1 and 2 of BPT harness connector.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▶ Go to next step.

NO

▶ Repair or replace the wiring harness between the BPT and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON.
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

YES

▶ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▶Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1369

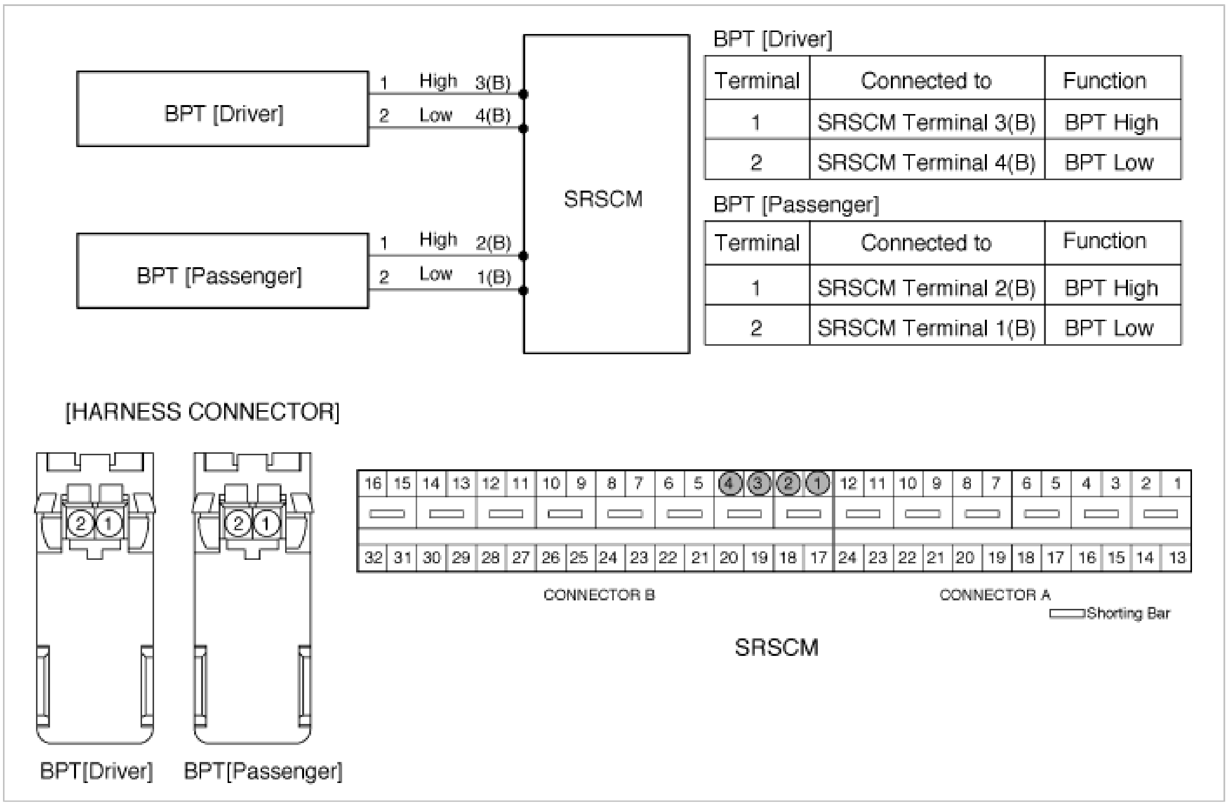
DTC Description

The Seat Belt Pretensioner consists of the SRSCM and two Seat Belt Pretensioner (BPT).The SRSCM sets above DTC(s) if it detects short to ground on the BPT circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1363 B1369	• Short to ground between BPT and SRSCM • Seat Belt Pretensioner (BPT) Malfunction • SRSCM Malfunction	• Short to ground circuit on wiring harness • Seat Belt Pretensioner (BPT) squib • SRSCM

Schematic Diagram



BPT [Driver]

Terminal	Connected to	Function
1	SRSCM Terminal 3(B)	BPT High
2	SRSCM Terminal 4(B)	BPT Low

BPT [Passenger]

Terminal	Connected to	Function
1	SRSCM Terminal 2(B)	BPT High
2	SRSCM Terminal 1(B)	BPT Low

Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

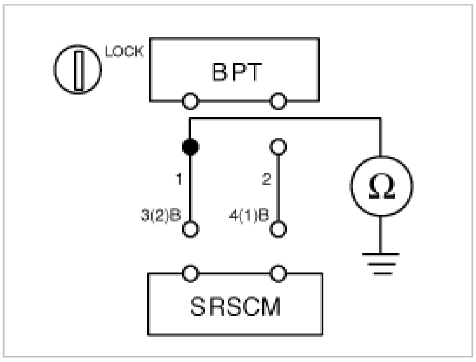
▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK SHORT TO GROUND
   (1) Measure resistance between the terminal 1 of BPT harness connector and chassis ground.

   specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸Check the BPT Module.

NO

▸ Repair or replace the wiring harness between the BPT and the SRSCM.

3. CHECK THE BPT MODULE
   (1) Replace the Belt Pretensioner (BPT) with a new one.
   - Refer to "Belt Pretensioner (BPT)" section in this SERVICE MANUAL.

   (2) Install the DAB module and connect the DAB connector.

   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (4) Connect the SRSCM connector.

   (5) Connect the negative (-) terminal to the battery.

   (6) Connect a Hi-Scan(Pro) to the data link connector.

   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to Belt Pretensioner (BPT)?

   YES

   ▸Go to next step.

   NO

   ▸Replace BPT module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.

   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (3) Connect the SRSCM connector.

   (4) Connect the negative (-) terminal to the battery.

   (5) Connect a Hi-Scan(Pro) to the data link connector.

   (6) Turn the ignition switch to ON.

   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

   (9) Turn the ignition switch to ON and wait for at least 30 seconds.

   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1370

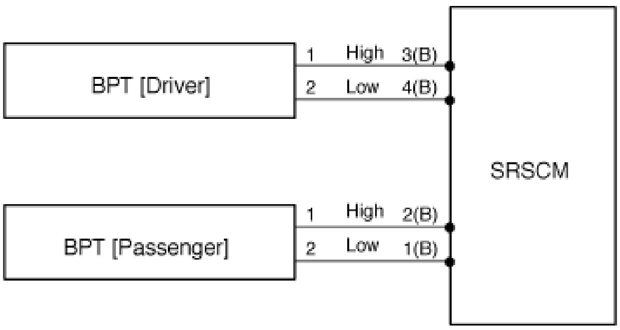
DTC Description

The Seat Belt Pretensioner consists of the SRSCM and two Seat Belt Pretensioner (BPT). The SRSCM sets above DTC(s) if it detects short to battery line on the BPT circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1364 B1370	• Short to battery line between BPT and SRSCM • Seat Belt Pretensioner (BPT) Malfunction • SRSCM Malfunction	• Short to battery line circuit on wiring harness • Seat Belt Pretensioner (BPT) squib • SRSCM

Schematic Diagram



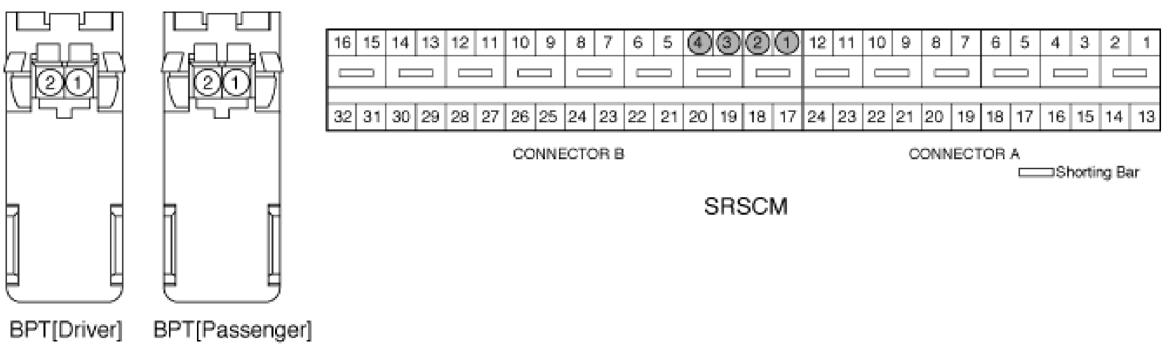
BPT [Driver]

Terminal	Connected to	Function
1	SRSCM Terminal 3(B)	BPT High
2	SRSCM Terminal 4(B)	BPT Low

BPT [Passenger]

Terminal	Connected to	Function
1	SRSCM Terminal 2(B)	BPT High
2	SRSCM Terminal 1(B)	BPT Low

[HARNESS CONNECTOR]



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

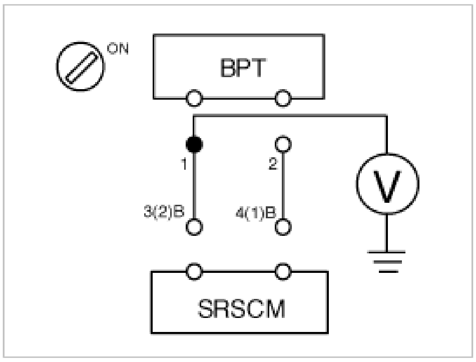
(5) Disconnect the SRSCM connector.

2. CHECK SHORT TO BATTERY LINE
   (1) Connect the negative (-) terminal to the battery.

   (2) Turn the ignition switch to ON.

   (3) Measure voltage between the terminal 1 of BPT harness connector and chassis ground(-).

   specification(voltage) : Approximately 0 V



Is the measured voltage within specification?

YES

▸Check the BPT Module.

NO

▸Repair the short to battery line circuit on wiring harness between the BPT and the SRSCM.

3. CHECK THE BPT MODULE
   (1) Replace the Belt Pretensioner (BPT) with a new one.
   - Refer to "Belt Pretensioner (BPT)" section in this SERVICE MANUAL.

   (2) Install the DAB module and connect the DAB connector.

   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (4) Connect the SRSCM connector.

   (5) Connect the negative (-) terminal to the battery.

   (6) Connect a Hi-Scan(Pro) to the data link connector.

   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to Belt Pretensioner (BPT)?

YES

▸ Go to next step.

NO

▸Replace BPT module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.

   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (3) Connect the SRSCM connector.

   (4) Connect the negative (-) terminal to the battery.

   (5) Connect a Hi-Scan(Pro) to the data link connector.

   (6) Turn the ignition switch to ON .

   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

   (9) Turn the ignition switch to ON and wait for at least 30 seconds.

   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1378

DTC Description

The Side Airbag circuit consists of the SRSCM and two Side Airbag (SAB). The SRSCM sets above DTC(s) if it detects that the resistance of SAB squib is too high or low.

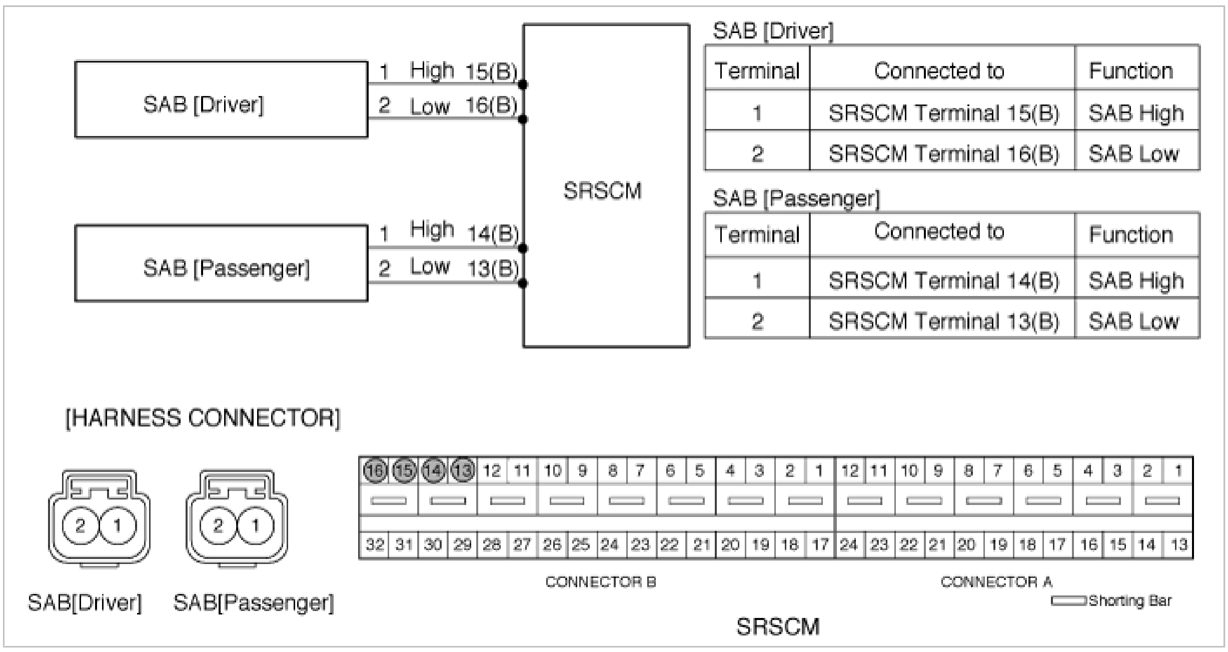
DTC Detecting Condition

DTC	Condition	Probable cause
B1378 B1379 B1382 B1383	• Too high or low resistance between SAB high(+) and SAB low (-) • Side Airbag (SAB) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Side Airbag (SAB) squib • SRSCM

Specification

SAB resistance : 1.8 ≤ R ≤ 2.6 Ω

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

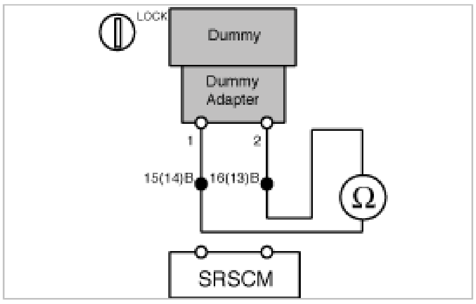
1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SAB RESISTANCE

CAUTION
Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

   (1) Connect the Dummy and the Dummy Adapter on SAB harness connector.
   - Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

   (2) Measure resistance between the terminal 15(14) and 16(13) of SRSCM harness connector(B).

SAB resistance : $1.8 \leq R \leq 2.6\ \Omega$



Is the measured resistance within specification?

YES

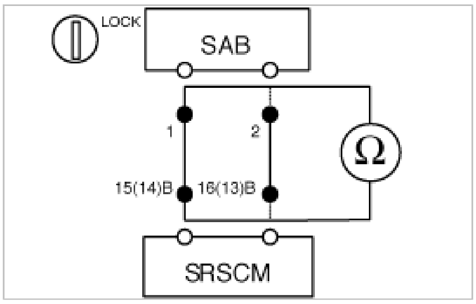
▸Replace the Side Airbag(SAB) module.

NO

▸Check open circuit.

3. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 1 of SAB harness connector and the terminal 15(14) of SRSCM harness connector(B).
   (2) Measure resistance between the terminal 2 of SAB harness connector and the terminal 16(13) of SRSCM harness connector(B).

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

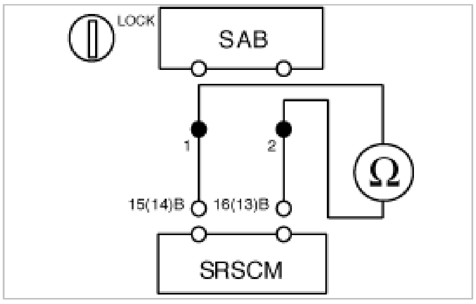
▸Check short circuit.

NO

▸Repair or replace the wiring harness between the SAB nd the SRSCM.

4. CHECK SHORT CIRCUIT
   (1) Measure resistance between the terminal 1 and 2 of SAB harness connector.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair or replace the wiring harness between the SAB and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON.
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1379

DTC Description

The Side Airbag circuit consists of the SRSCM and two Side Airbag (SAB). The SRSCM sets above DTC(s) if it detects that the resistance of SAB squib is too high or low.

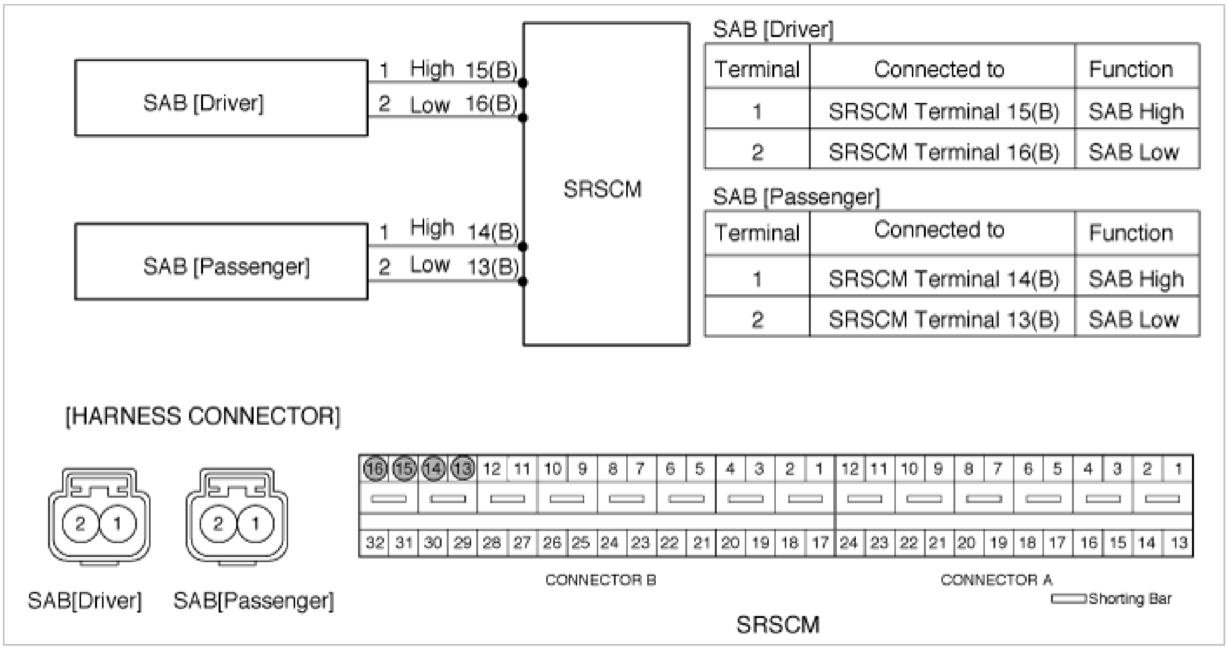
DTC Detecting Condition

DTC	Condition	Probable cause
B1378 B1379 B1382 B1383	• Too high or low resistance between SAB high(+) and SAB low (-) • Side Airbag (SAB) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Side Airbag (SAB) squib • SRSCM

Specification

SAB resistance : $1.8 \le R \le 2.6\ \Omega$

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

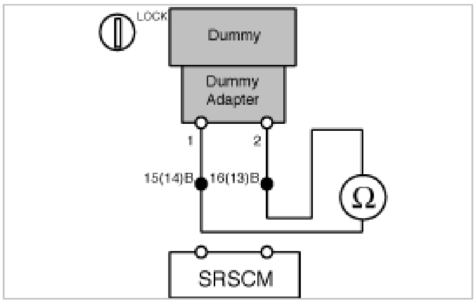
1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SAB RESISTANCE

> **CAUTION**
>
> Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

(1) Connect the Dummy and the Dummy Adapter on SAB harness connector.
- Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

(2) Measure resistance between the terminal 15(14) and 16(13) of SRSCM harness connector(B).

SAB resistance : 1.8 ≤ R ≤ 2.6 Ω



Is the measured resistance within specification?

YES

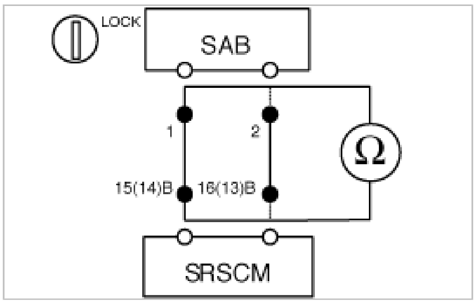
▸Replace the Side Airbag(SAB) module.

NO

▸Check open circuit.

3. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 1 of SAB harness connector and the terminal 15(14) of SRSCM harness connector(B).
   (2) Measure resistance between the terminal 2 of SAB harness connector and the terminal 16(13) of SRSCM harness connector(B).

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

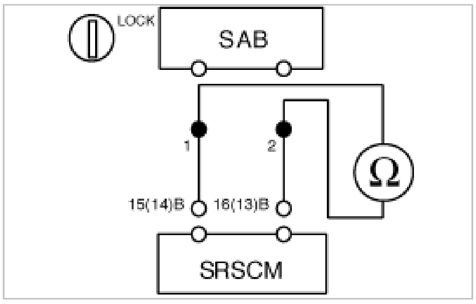
▸Check short circuit.

NO

▸Repair or replace the wiring harness between the SAB nd the SRSCM.

4. CHECK SHORT CIRCUIT
   (1) Measure resistance between the terminal 1 and 2 of SAB harness connector.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair or replace the wiring harness between the SAB and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON.

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1380

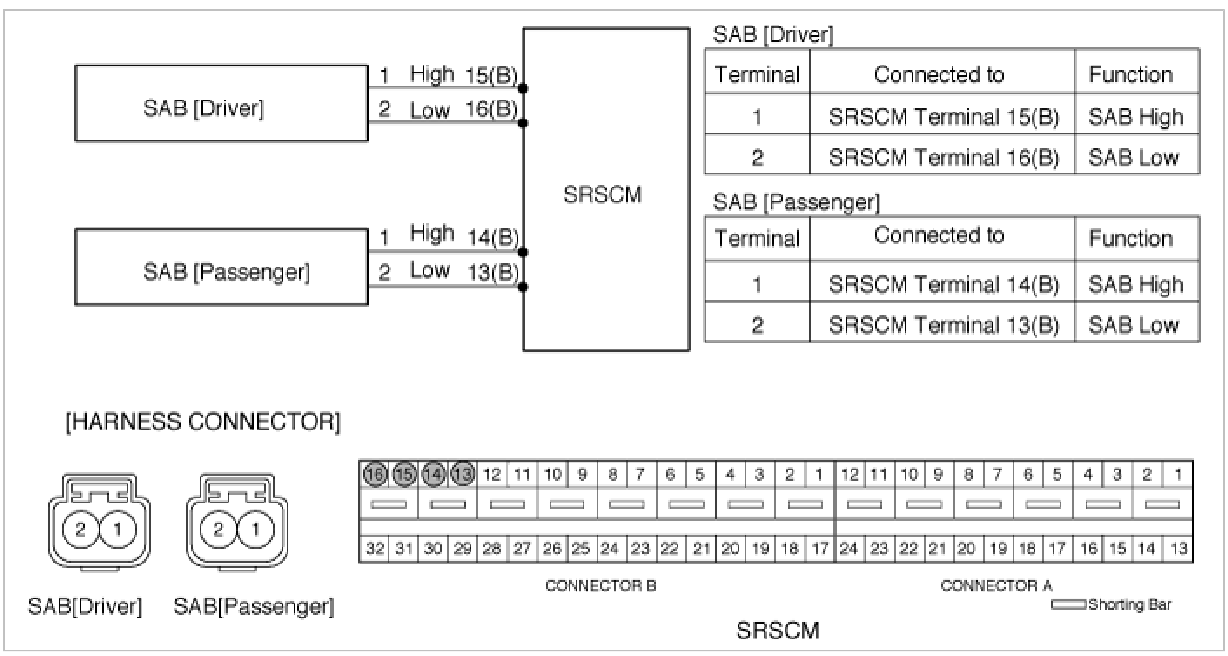
DTC Description

The Side Airbag circuit consists of the SRSCM and two Side Airbag (SAB). The SRSCM sets above DTC(s) if it detects short to ground on the SAB circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1380 B1384	• Short to ground between SAB and SRSCM • Side Airbag (SAB) Malfunction • SRSCM Malfunction	• Short to ground circuit on wiring harness • Side Airbag (SAB) squib • SRSCM

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.

2. Inspect terminals for damage and corrosion.

CAUTION

Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

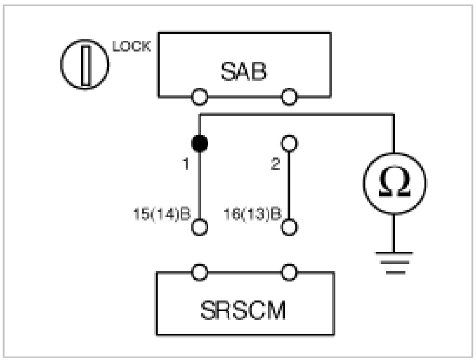
▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK SHORT TO GROUND
   (1) Measure resistance between the terminal 1 of SAB harness connector and chassis ground.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸ Check the SAB Module.

NO

▸ Repair or replace the wiring harness between the SAB and the SRSCM.

3. CHECK THE SAB MODULE
   (1) Replace the Side Airbag(SAB) with a new one.
   - Refer to "Side Airbag(SAB)" section in this SERVICE MANUAL.

   (2) Install the DAB module and connect the DAB connector.
   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (4) Connect the SRSCM connector.
   (5) Connect the negative (-) terminal to the battery.
   (6) Connect a Hi-Scan(Pro) to the data link connector.
   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to Side Airbag(SAB)?

YES

▸Go to next step.

NO

▸Replace SAB module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON.

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1381

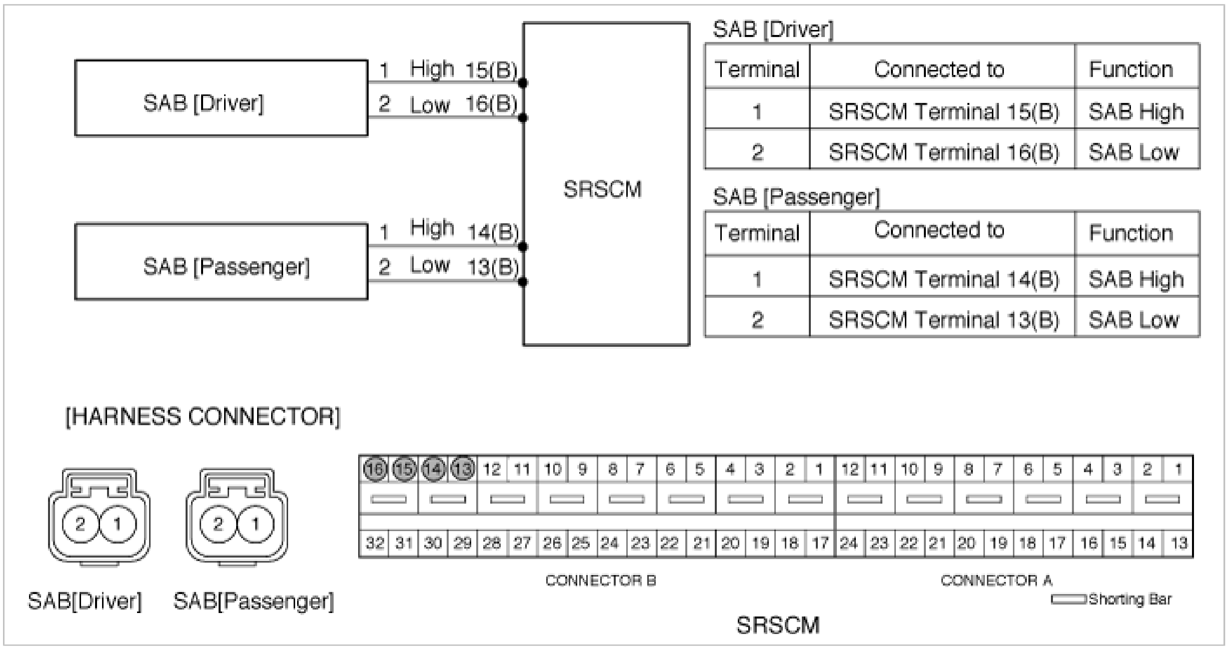
DTC Description

The Side Airbag circuit consists of the SRSCM and two Side Airbag (SAB).The SRSCM sets above DTC(s) if it detects short to battery line on the SAB circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1381 B1385	• Short to battery line between SAB and SRSCM • Side Airbag (SAB) Malfunction • SRSCM Malfunction	• Short to battery line circuit on wiring harness • Side Airbag (SAB) squib • SRSCM

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

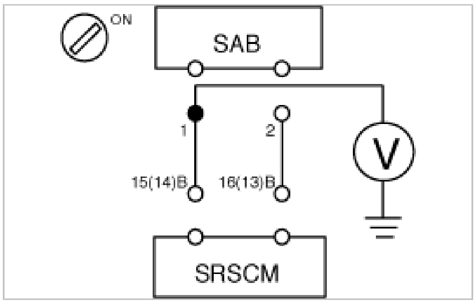
▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK SHORT TO BATTERY LINE
   (1) Connect the negative (-) terminal to the battery.
   (2) Turn the ignition switch to ON.
   (3) Measure voltage between the terminal 1 of SAB harness connector and chassis ground(-).

specification(voltage) : Approximately 0 V



Is the measured voltage within specification?

YES

▸ Check the SAB Module.

NO

▸ Repair the short to battery line circuit on wiring harness between the SAB and the SRSCM.

3. CHECK THE SAB MODULE
   (1) Replace the Side Airbag(SAB) with a new one.
   - Refer to "Side Airbag(SAB)" section in this SERVICE MANUAL.

   (2) Install the DAB module and connect the DAB connector.
   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (4) Connect the SRSCM connector.
   (5) Connect the negative (-) terminal to the battery.
   (6) Connect a Hi-Scan(Pro) to the data link connector.
   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to Side Airbag(SAB)?

YES

▸ Go to next step.

NO

▸Replace SAB module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON.
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

YES

▶ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▶Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1382

DTC Description

The Side Airbag circuit consists of the SRSCM and two Side Airbag (SAB). The SRSCM sets above DTC(s) if it detects that the resistance of SAB squib is too high or low.

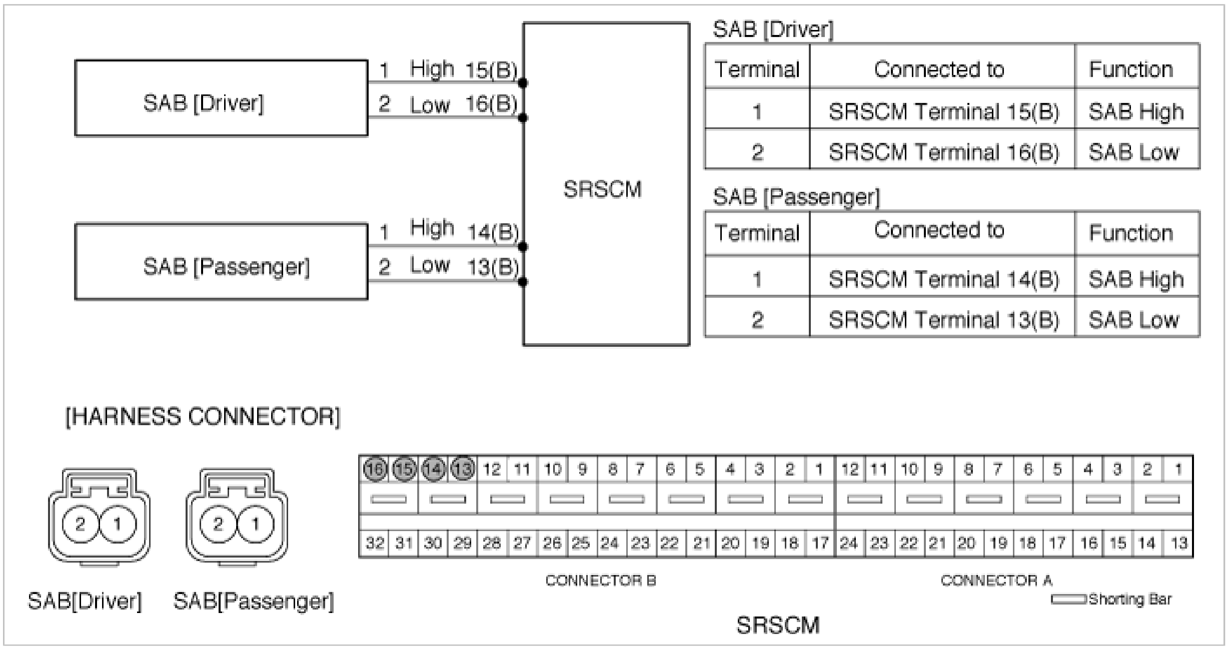
DTC Detecting Condition

DTC	Condition	Probable cause
B1378 B1379 B1382 B1383	• Too high or low resistance between SAB high(+) and SAB low (-) • Side Airbag (SAB) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Side Airbag (SAB) squib • SRSCM

Specification

SAB resistance : 1.8 ≤ R ≤ 2.6 Ω

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

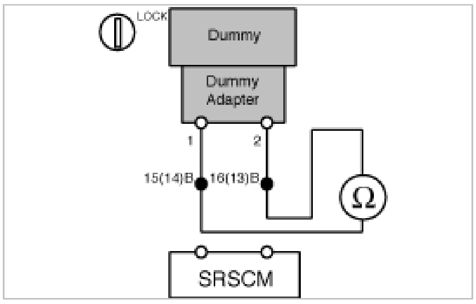
1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SAB RESISTANCE

> **CAUTION**
>
> Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

   (1) Connect the Dummy and the Dummy Adapter on SAB harness connector.
   - Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

   (2) Measure resistance between the terminal 15(14) and 16(13) of SRSCM harness connector(B).

SAB resistance : $1.8 \le R \le 2.6\ \Omega$



Is the measured resistance within specification?

YES

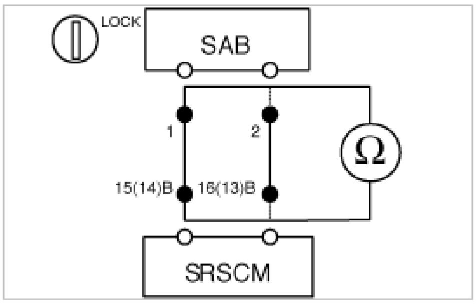
▸Replace the Side Airbag(SAB) module.

NO

▸Check open circuit.

3. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 1 of SAB harness connector and the terminal 15(14) of SRSCM harness connector(B).
   (2) Measure resistance between the terminal 2 of SAB harness connector and the terminal 16(13) of SRSCM harness connector(B).

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

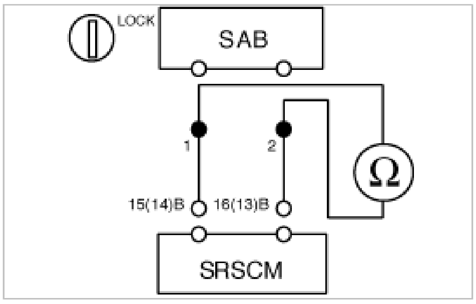
▸Check short circuit.

NO

▸Repair or replace the wiring harness between the SAB nd the SRSCM.

4. CHECK SHORT CIRCUIT
   (1) Measure resistance between the terminal 1 and 2 of SAB harness connector.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair or replace the wiring harness between the SAB and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON.

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▶ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▶Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1383

DTC Description

The Side Airbag circuit consists of the SRSCM and two Side Airbag (SAB). The SRSCM sets above DTC(s) if it detects that the resistance of SAB squib is too high or low.

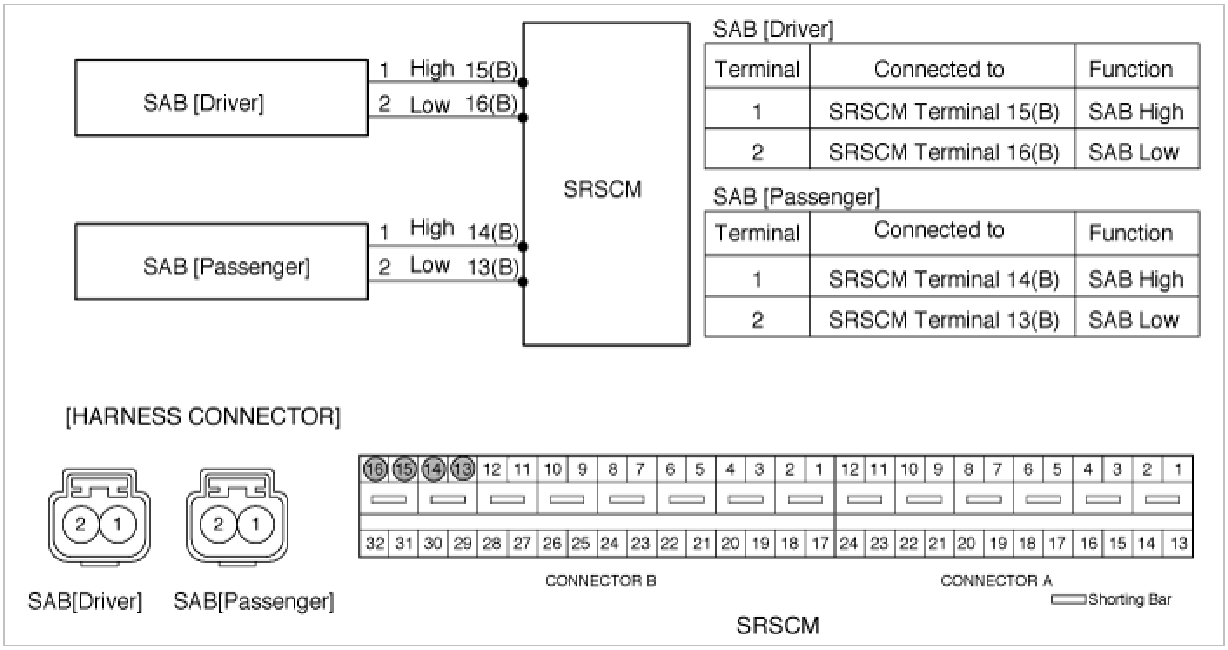
DTC Detecting Condition

DTC	Condition	Probable cause
B1378 B1379 B1382 B1383	• Too high or low resistance between SAB high(+) and SAB low (-) • Side Airbag (SAB) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Side Airbag (SAB) squib • SRSCM

Specification

SAB resistance : $1.8 \leq R \leq 2.6\ \Omega$

Schematic Diagram



SAB [Driver]

Terminal	Connected to	Function
1	SRSCM Terminal 15(B)	SAB High
2	SRSCM Terminal 16(B)	SAB Low

SAB [Passenger]

Terminal	Connected to	Function
1	SRSCM Terminal 14(B)	SAB High
2	SRSCM Terminal 13(B)	SAB Low

Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

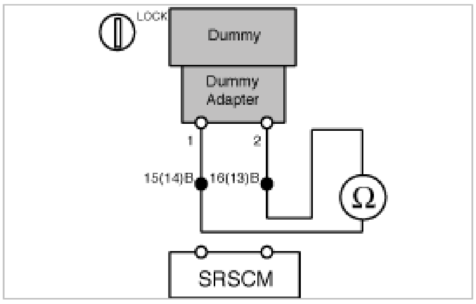
1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SAB RESISTANCE

> **CAUTION**
>
> Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

(1) Connect the Dummy and the Dummy Adapter on SAB harness connector.
- Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

(2) Measure resistance between the terminal 15(14) and 16(13) of SRSCM harness connector(B).

SAB resistance : $1.8 \le R \le 2.6\ \Omega$



Is the measured resistance within specification?

YES

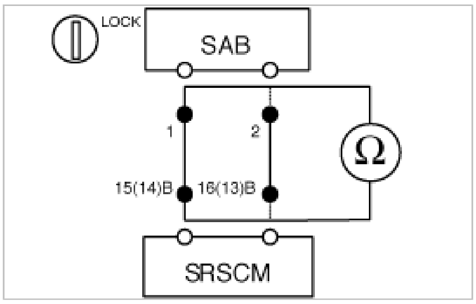
▸Replace the Side Airbag(SAB) module.

NO

▸Check open circuit.

3. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 1 of SAB harness connector and the terminal 15(14) of SRSCM harness connector(B).
   (2) Measure resistance between the terminal 2 of SAB harness connector and the terminal 16(13) of SRSCM harness connector(B).

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

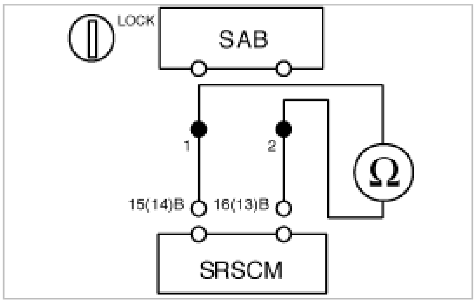
▸Check short circuit.

NO

▸Repair or replace the wiring harness between the SAB nd the SRSCM.

4. CHECK SHORT CIRCUIT
   (1) Measure resistance between the terminal 1 and 2 of SAB harness connector.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair or replace the wiring harness between the SAB and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON.

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1384

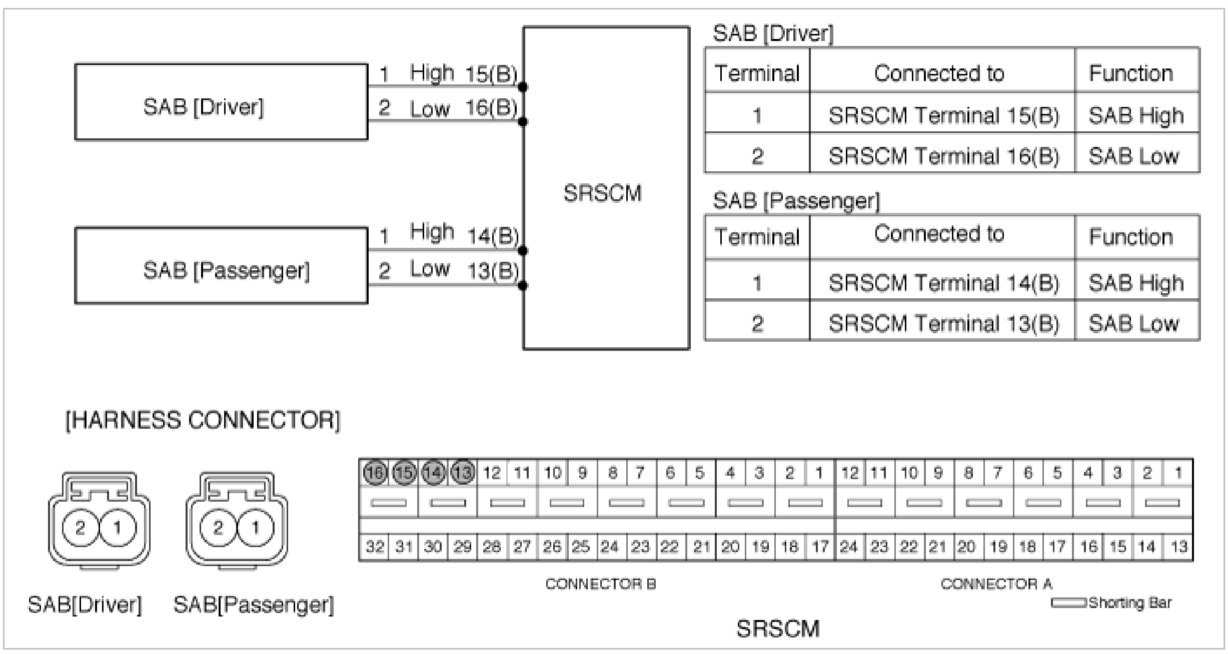
DTC Description

The Side Airbag circuit consists of the SRSCM and two Side Airbag (SAB). The SRSCM sets above DTC(s) if it detects short to ground on the SAB circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1380 B1384	• Short to ground between SAB and SRSCM • Side Airbag (SAB) Malfunction • SRSCM Malfunction	• Short to ground circuit on wiring harness • Side Airbag (SAB) squib • SRSCM

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.

2. Inspect terminals for damage and corrosion.

> CAUTION
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

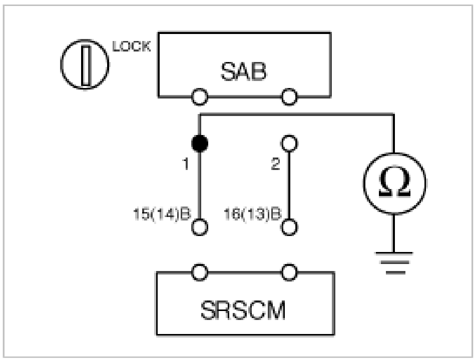
▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK SHORT TO GROUND
   (1) Measure resistance between the terminal 1 of SAB harness connector and chassis ground.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸ Check the SAB Module.

NO

▸ Repair or replace the wiring harness between the SAB and the SRSCM.

3. CHECK THE SAB MODULE
   (1) Replace the Side Airbag(SAB) with a new one.
   - Refer to "Side Airbag(SAB)" section in this SERVICE MANUAL.

   (2) Install the DAB module and connect the DAB connector.
   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (4) Connect the SRSCM connector.
   (5) Connect the negative (-) terminal to the battery.
   (6) Connect a Hi-Scan(Pro) to the data link connector.
   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to Side Airbag(SAB)?

YES

▸Go to next step.

NO

▸Replace SAB module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON.

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▶ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▶Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1385

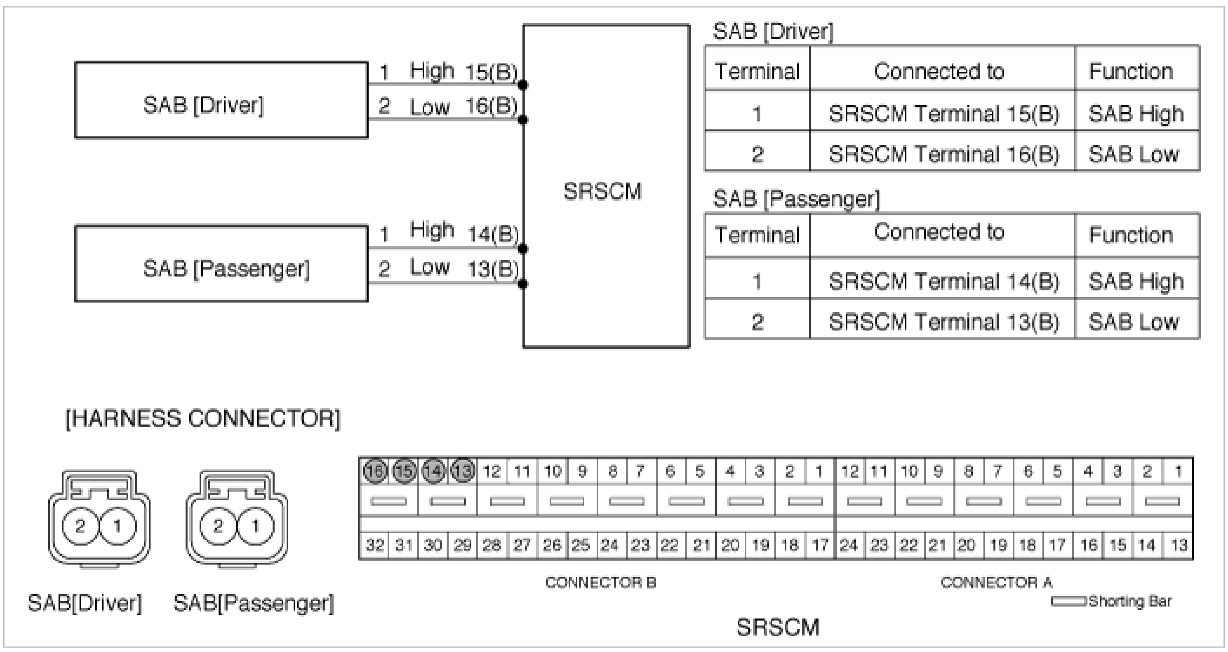
DTC Description

The Side Airbag circuit consists of the SRSCM and two Side Airbag (SAB).The SRSCM sets above DTC(s) if it detects short to battery line on the SAB circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1381 B1385	• Short to battery line between SAB and SRSCM • Side Airbag (SAB) Malfunction • SRSCM Malfunction	• Short to battery line circuit on wiring harness • Side Airbag (SAB) squib • SRSCM

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

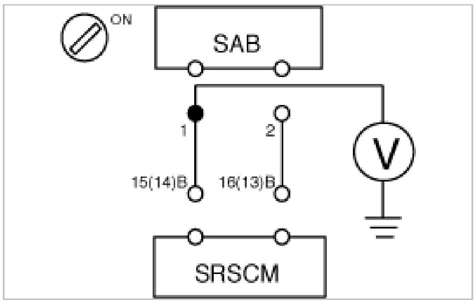
YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SHORT TO BATTERY LINE
   (1) Connect the negative (-) terminal to the battery.
   (2) Turn the ignition switch to ON.
   (3) Measure voltage between the terminal 1 of SAB harness connector and chassis ground(-).

specification(voltage) : Approximately 0 V



Is the measured voltage within specification?

YES

▸ Check the SAB Module.

NO

▸ Repair the short to battery line circuit on wiring harness between the SAB and the SRSCM.

3. CHECK THE SAB MODULE
   (1) Replace the Side Airbag(SAB) with a new one.
   - Refer to "Side Airbag(SAB)" section in this SERVICE MANUAL.
   (2) Install the DAB module and connect the DAB connector.
   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (4) Connect the SRSCM connector.
   (5) Connect the negative (-) terminal to the battery.
   (6) Connect a Hi-Scan(Pro) to the data link connector.
   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to Side Airbag(SAB)?

YES

▸ Go to next step.

NO

▸Replace SAB module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON.

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▶ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▶Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1387

DTC Description

The Seat Track Position Sensor (STPS) circuit consists of the SRSCM and two STPS. The SRSCM sets above DTC(s) if it detects open or short to ground on the STPS circuit. The "Seat Forward" status currently represents a seat position in which the deployment of the second stage airbag is prohibited.

DTC Detecting Condition

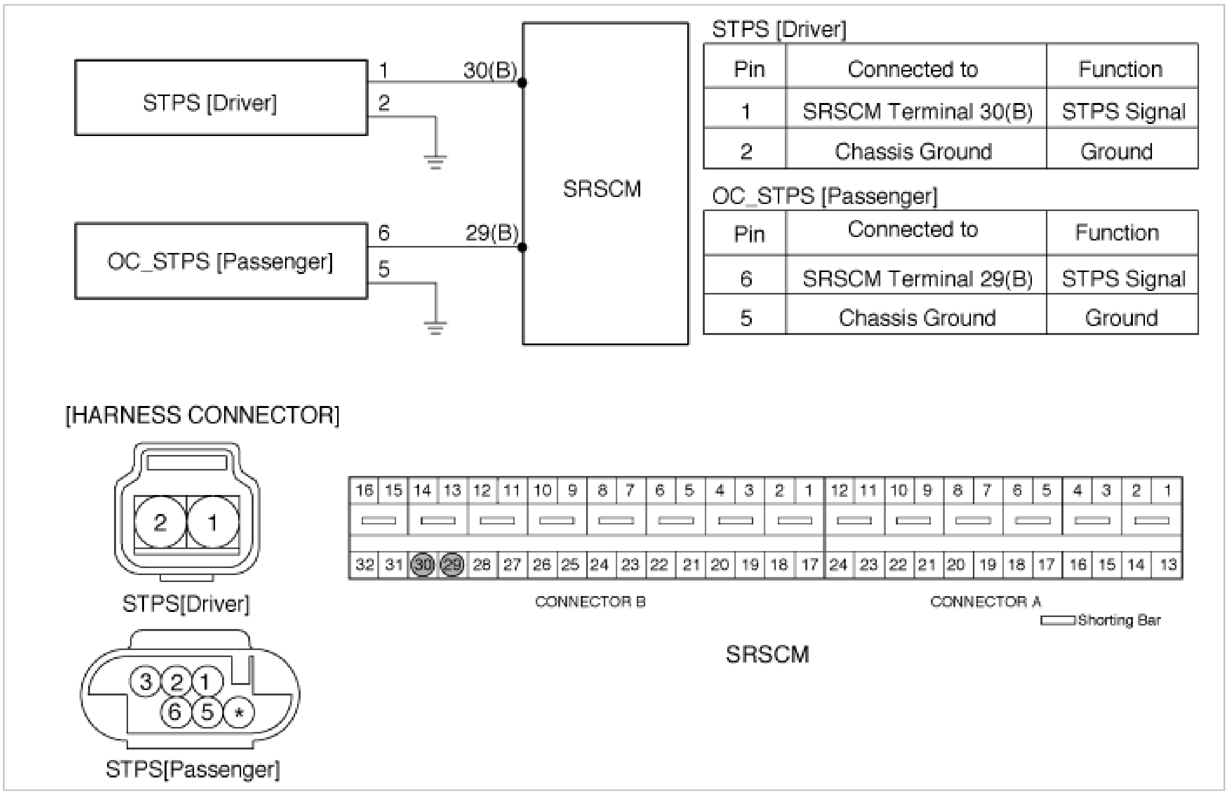
DTC	Condition	Probable cause
B1387 B1390	• Short between STPS and SRSCM • Short to ground between STPS and SRSCM • STPS Malfunction • SRSCM Malfunction	• Short or short to ground circuit on wiring harness • STPS • SRSCM

Specification

[Seat position diagnostic current limits]

Open/Short to Battery	Grey Zone	Forward	Grey Zone	Defect	Grey Zone	Rearward	Grey Zone	Short/Short to ground
< 3.98 mA	3.98 - 4.79 mA	4.79 - 7.16 mA	7.16 - 8.62 mA	8.62 - 9.94 mA	9.94 - 11.97 mA	11.97 - 17.29 mA	17.29 - 20.83 mA	> 20.83 mA

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

CAUTION
Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

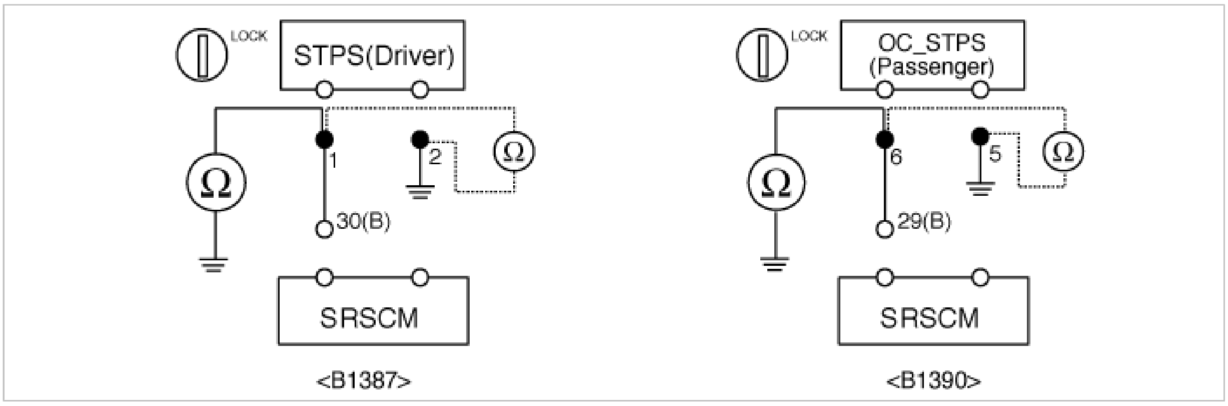
YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SHORT OR SHORT TO GROUND
   (1) Disconnect the STPS connector.
   (2) Measure resistance between the terminal 1(6) of STPS harness connector and chassis ground.
   (3) Measure resistance between the terminal 1(6) and 2(3) of STPS harness connector.

specification(resistance) : infinite



(4) Is the measured resistance within specification?

YES

▸ Check the STPS.

NO

▸ Repair or replace the wiring harness between the STPS and the SRSCM.

3. CHECK THE SEAT TRACK POSITION SENSOR (STPS)
   (1) Measure current between the terminal 1(6) of STPS and 30(29) of SRSCM(B).

Specification(current) : 12 ~ 17 mA (Reward status), 5 ~ 7 mA (Forward status)

(2) Is the measured current within specification?

YES

▸ Goto next stop.

NO

▸ Replace the STPS.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON .
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1388

DTC Description

The Seat Track Position Sensor (STPS) circuit consists of the SRSCM and two STPS. The SRSCM sets above DTC(s) if it detects short or short to battery line on the STPS circuit. The "Seat Forward" status currently represents a seat position in which the deployment of the second stage airbag is prohibited.

DTC Detecting Condition

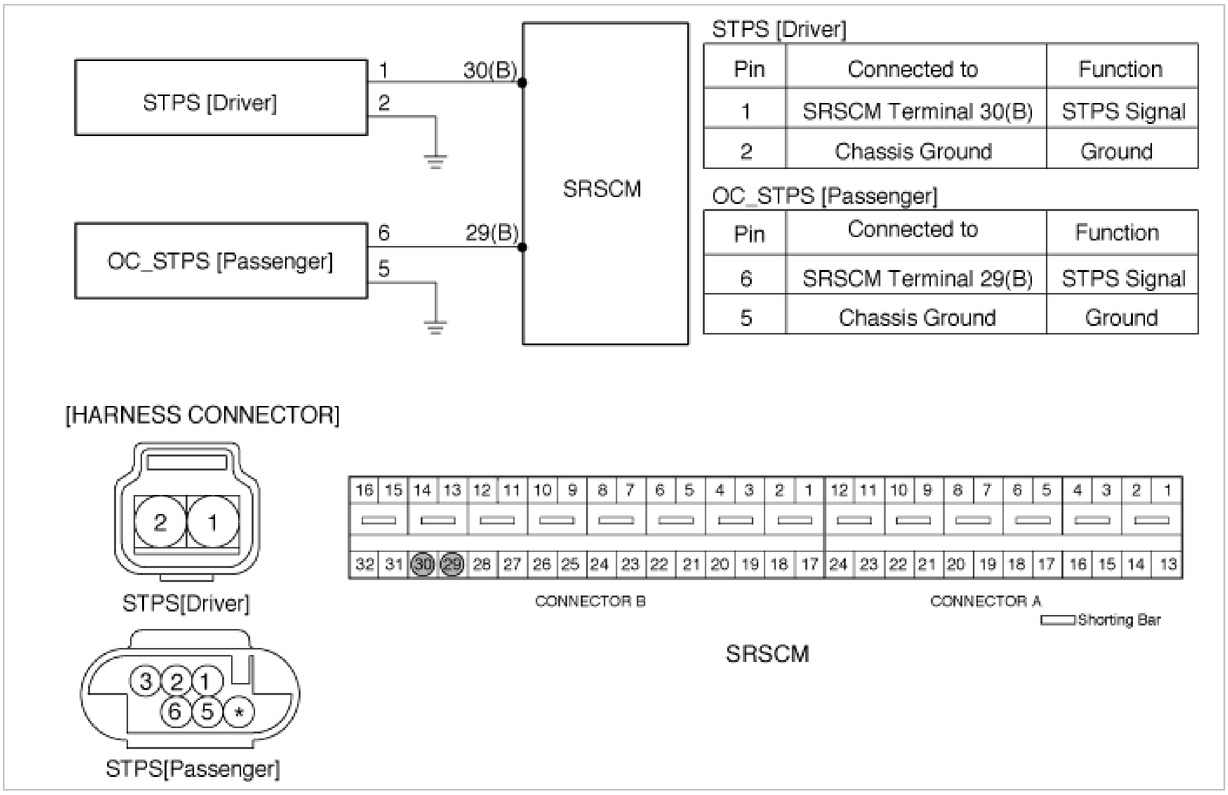
DTC	Condition	Probable cause
B1388 B1391	• Open between STPS and SRSCM • Short to battery line between STPS and SRSCM • STPS Malfunction • SRSCM Malfunction	• Open or short to battery line circuit on wiring harness • STPS • SRSCM

Specification

[Seat position diagnostic current limits]

Open/Short to Battery	Grey Zone	Forward	Grey Zone	Defect	Grey Zone	Rearward	Grey Zone	Short/Short to ground
< 3.98 mA	3.98 - 4.79 mA	4.79 - 7.16 mA	7.16 - 8.62 mA	8.62 - 9.94 mA	9.94 - 11.97 mA	11.97 - 17.29 mA	17.29 - 20.83 mA	> 20.83 mA

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> CAUTION
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

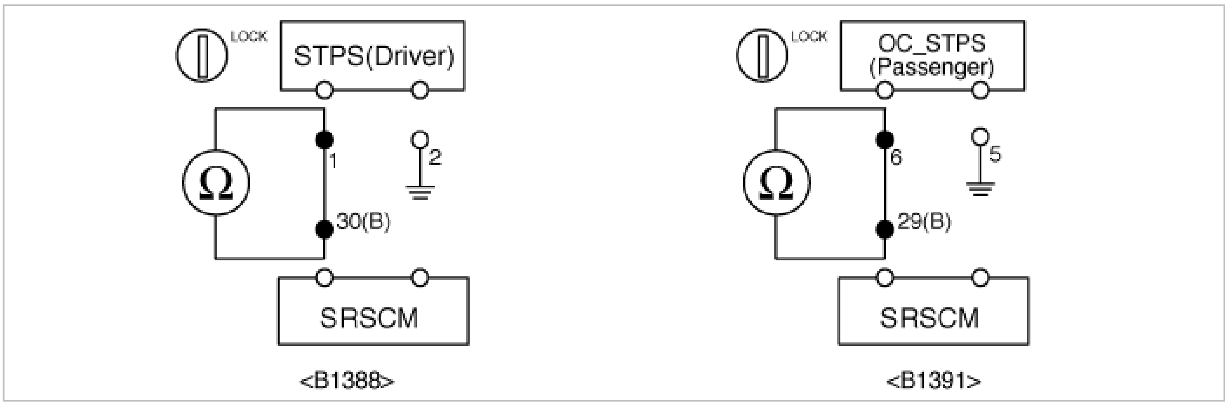
▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK OPEN CIRCUIT
   (1) Disconnect the STPS connector.
   (2) Measure resistance between the terminal 1 of STPS harness connector and the terminal 30 of SRSCM harness connector (B).<B1388>
   (3) Measure resistance between the terminal 6 of STPS harness connector and the terminal 29 of SRSCM harness connector (B).<B1391>

specification(resistance) : below 1 Ω



   (4) Is the measured resistance within specification?

YES

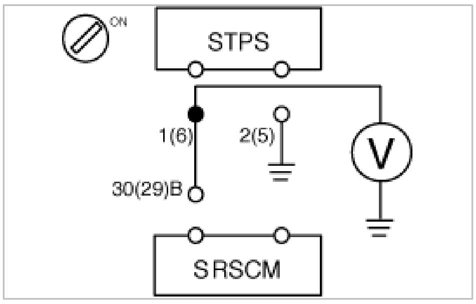
▸ Check short to ground.

NO

▸ Repair the open circuit on wiring harness between the STPS and the SRSCM.

3. CHECK SHORT TO BATTERY LINE
   (1) Connect the negative (-) terminal to the battery.
   (2) Turn the ignition switch to ON.
   (3) Measure voltage between the terminal 1(6) of STPS harness connector and chassis ground(-).

specification(voltage) : Approximately 0 V



   (4) Is the measured voltage within specification?

YES

▸ Check the STPS.

NO

▸ Repair the short to battery line circuit on wiring harness between the STPS and the SRSCM.

4. CHECK THE SEAT TRACK POSITION SENSOR (STPS)
   (1) Measure current between the terminal 1(6) of STPS and 30(29) of SRSCM(B).

   Specification(current) : 12 ~ 17 mA (Reward status), 5 ~ 7 mA (Forward status)

   (2) Is the measured current within specification?

   YES

   ▸ Goto next stop.

   NO

   ▸ Replace the STPS.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON .
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1389

DTC Description

The Seat Track Position Sensor (STPS) circuit consists of the SRSCM and two STPS. The SRSCM sets above DTC(s) if it detects the STPS fault. The "Seat Forward" status currently represents a seat position in which the deployment of the second stage airbag is prohibited.

DTC Detecting Condition

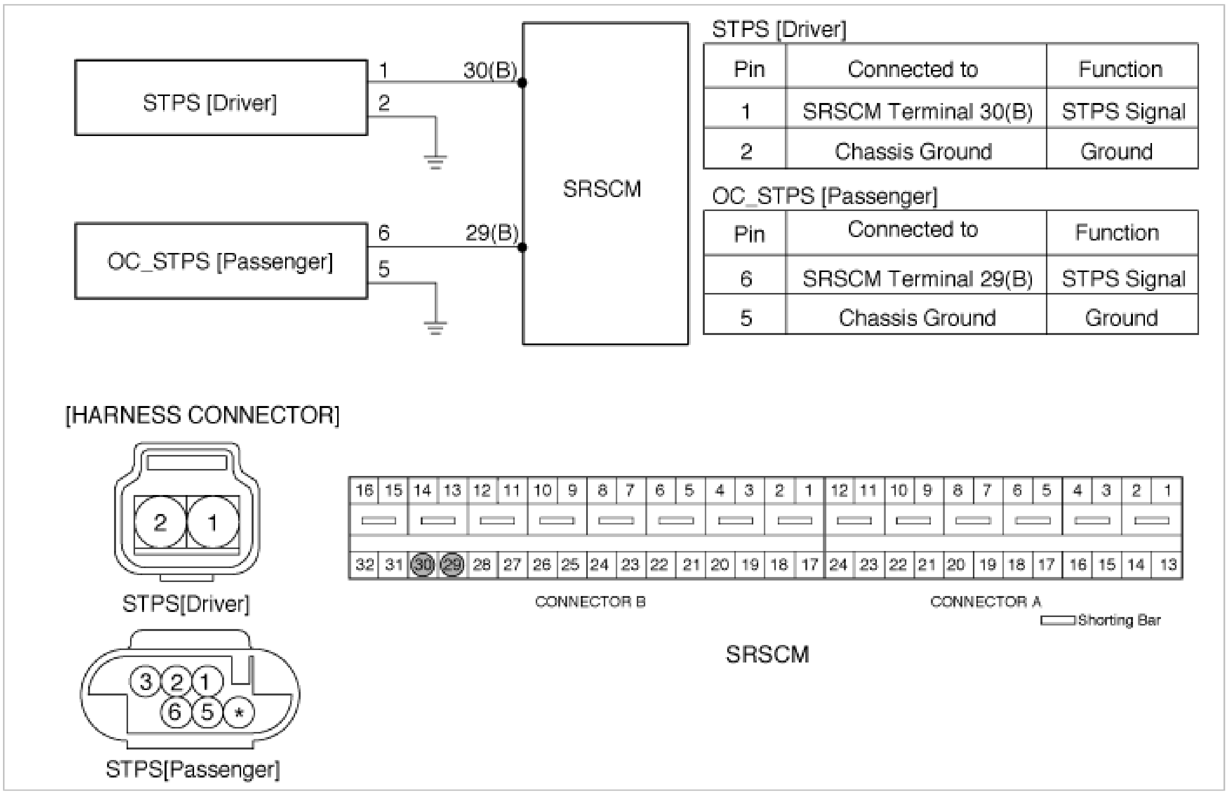
DTC	Condition	Probable cause
B1389 B1392	• STPS Malfunction • SRSCM Malfunction	• STPS • SRSCM

Specification

[Seat position diagnostic current limits]

Open/Short to Battery	Grey Zone	Forward	Grey Zone	Defect	Grey Zone	Rearward	Grey Zone	Short/Short to ground
< 3.98 mA	3.98 - 4.79 mA	4.79 - 7.16 mA	7.16 - 8.62 mA	8.62 - 9.94 mA	9.94 - 11.97 mA	11.97 - 17.29 mA	17.29 - 20.83 mA	> 20.83 mA

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK THE SEAT TRACK POSITION SENSOR (STPS)
   (1) Measure current between the terminal 1(6) of STPS and 30(29) of SRSCM(B).

   Specification(current) : 12 ~ 17 mA (Reward status), 5 ~ 7 mA (Forward status)

   (2) Is the measured current within specification?

   YES

   ▸ Goto next stop.

   NO

   ▸ Replace the STPS.

3. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON .

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1390

DTC Description

The Seat Track Position Sensor (STPS) circuit consists of the SRSCM and two STPS. The SRSCM sets above DTC(s) if it detects open or short to ground on the STPS circuit. The "Seat Forward" status currently represents a seat position in which the deployment of the second stage airbag is prohibited.

DTC Detecting Condition

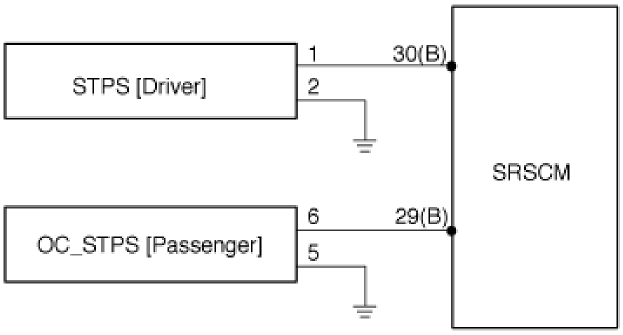
DTC	Condition	Probable cause
B1387 B1390	• Short between STPS and SRSCM • Short to ground between STPS and SRSCM • STPS Malfunction • SRSCM Malfunction	• Short or short to ground circuit on wiring harness • STPS • SRSCM

Specification

[Seat position diagnostic current limits]

Open/Short to Battery	Grey Zone	Forward	Grey Zone	Defect	Grey Zone	Rearward	Grey Zone	Short/Short to ground
< 3.98 mA	3.98 - 4.79 mA	4.79 - 7.16 mA	7.16 - 8.62 mA	8.62 - 9.94 mA	9.94 - 11.97 mA	11.97 - 17.29 mA	17.29 - 20.83 mA	> 20.83 mA

Schematic Diagram



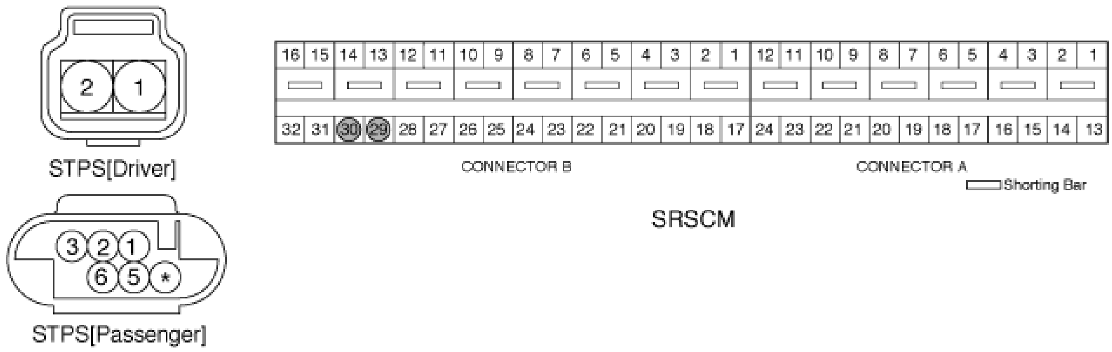
STPS [Driver]

Pin	Connected to	Function
1	SRSCM Terminal 30(B)	STPS Signal
2	Chassis Ground	Ground

OC_STPS [Passenger]

Pin	Connected to	Function
6	SRSCM Terminal 29(B)	STPS Signal
5	Chassis Ground	Ground

[HARNESS CONNECTOR]



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

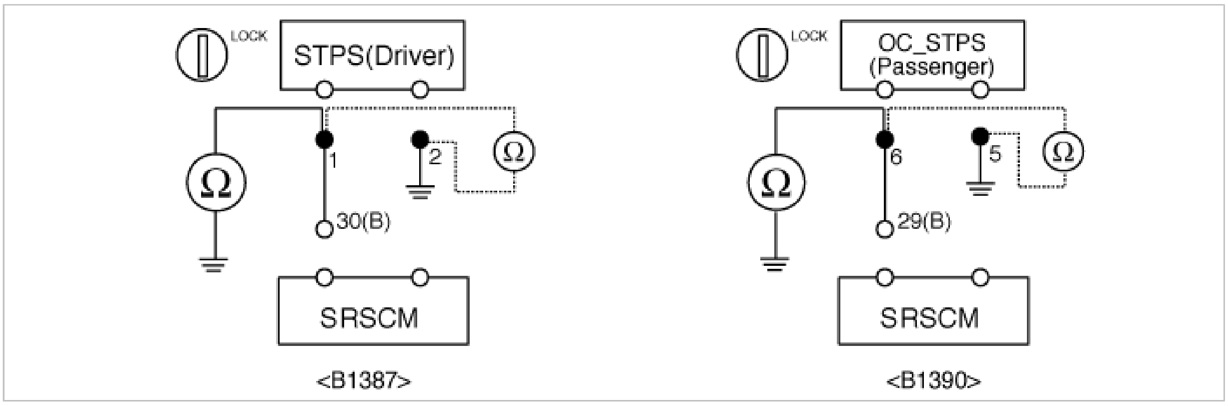
YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SHORT OR SHORT TO GROUND
   (1) Disconnect the STPS connector.
   (2) Measure resistance between the terminal 1(6) of STPS harness connector and chassis ground.
   (3) Measure resistance between the terminal 1(6) and 2(3) of STPS harness connector.

specification(resistance) : infinite



(4) Is the measured resistance within specification?

YES

▸ Check the STPS.

NO

▸ Repair or replace the wiring harness between the STPS and the SRSCM.

3. CHECK THE SEAT TRACK POSITION SENSOR (STPS)

(1) Measure current between the terminal 1(6) of STPS and 30(29) of SRSCM(B).

Specification(current) : 12 ~ 17 mA (Reward status), 5 ~ 7 mA (Forward status)

(2) Is the measured current within specification?

YES

▸ Goto next stop.

NO

▸ Replace the STPS.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON .

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1391

DTC Description

The Seat Track Position Sensor (STPS) circuit consists of the SRSCM and two STPS. The SRSCM sets above DTC(s) if it detects short or short to battery line on the STPS circuit. The "Seat Forward" status currently represents a seat position in which the deployment of the second stage airbag is prohibited.

DTC Detecting Condition

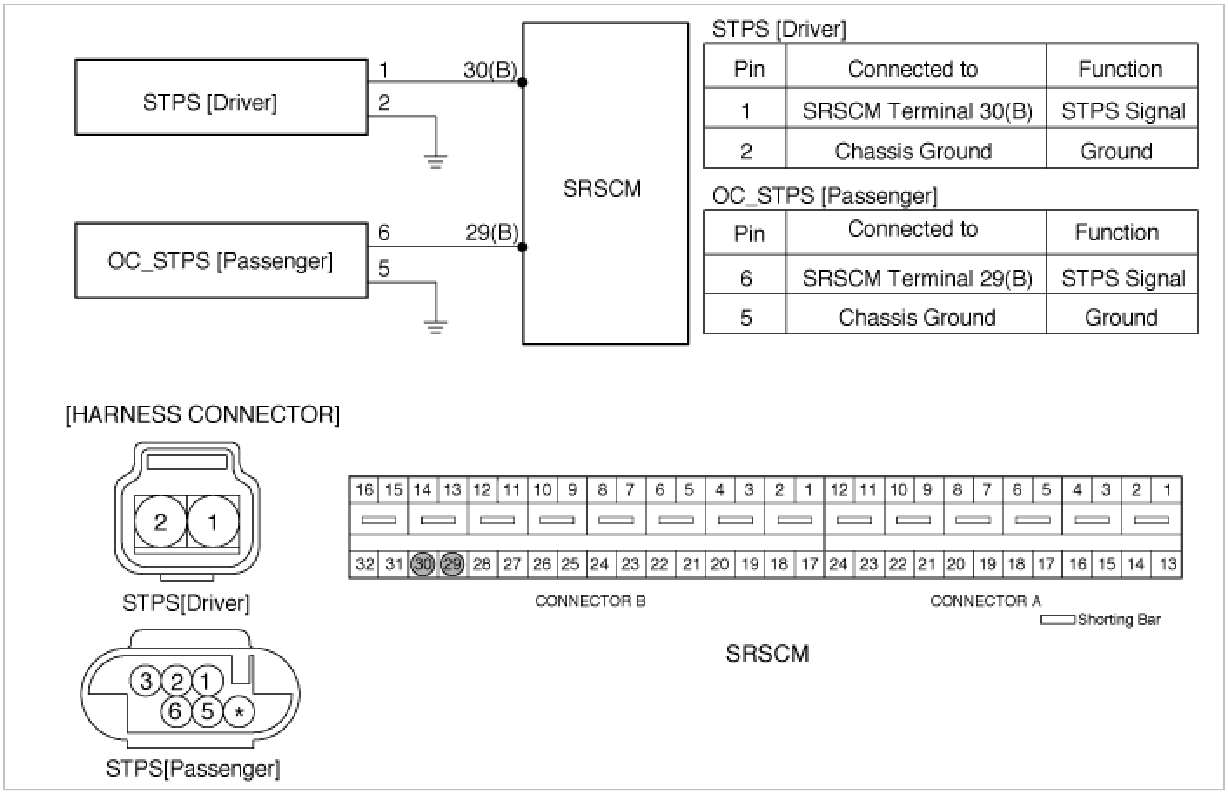
DTC	Condition	Probable cause
B1388 B1391	• Open between STPS and SRSCM • Short to battery line between STPS and SRSCM • STPS Malfunction • SRSCM Malfunction	• Open or short to battery line circuit on wiring harness • STPS • SRSCM

Specification

[Seat position diagnostic current limits]

Open/Short to Battery	Grey Zone	Forward	Grey Zone	Defect	Grey Zone	Rearward	Grey Zone	Short/Short to ground
< 3.98 mA	3.98 - 4.79 mA	4.79 - 7.16 mA	7.16 - 8.62 mA	8.62 - 9.94 mA	9.94 - 11.97 mA	11.97 - 17.29 mA	17.29 - 20.83 mA	> 20.83 mA

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> CAUTION
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

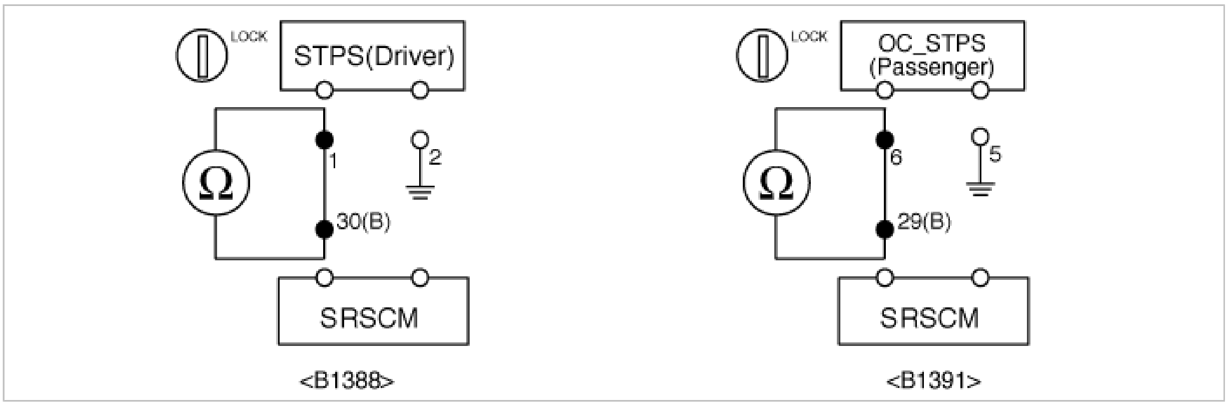
▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK OPEN CIRCUIT
   (1) Disconnect the STPS connector.
   (2) Measure resistance between the terminal 1 of STPS harness connector and the terminal 30 of SRSCM harness connector (B).<B1388>
   (3) Measure resistance between the terminal 6 of STPS harness connector and the terminal 29 of SRSCM harness connector (B).<B1391>

specification(resistance) : below 1 Ω



   (4) Is the measured resistance within specification?

YES

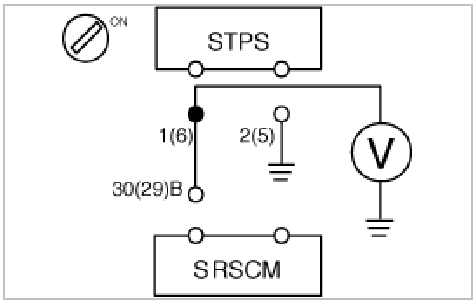
▸ Check short to ground.

NO

▸ Repair the open circuit on wiring harness between the STPS and the SRSCM.

3. CHECK SHORT TO BATTERY LINE
   (1) Connect the negative (-) terminal to the battery.
   (2) Turn the ignition switch to ON.
   (3) Measure voltage between the terminal 1(6) of STPS harness connector and chassis ground(-).

specification(voltage) : Approximately 0 V



   (4) Is the measured voltage within specification?

YES

▸ Check the STPS.

NO

▸ Repair the short to battery line circuit on wiring harness between the STPS and the SRSCM.

4. CHECK THE SEAT TRACK POSITION SENSOR (STPS)

(1) Measure current between the terminal 1(6) of STPS and 30(29) of SRSCM(B).

Specification(current) : 12 ~ 17 mA (Reward status), 5 ~ 7 mA (Forward status)

(2) Is the measured current within specification?

YES

▸ Goto next stop.

NO

▸ Replace the STPS.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON .

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1392

DTC Description

The Seat Track Position Sensor (STPS) circuit consists of the SRSCM and two STPS. The SRSCM sets above DTC(s) if it detects the STPS fault. The "Seat Forward" status currently represents a seat position in which the deployment of the second stage airbag is prohibited.

DTC Detecting Condition

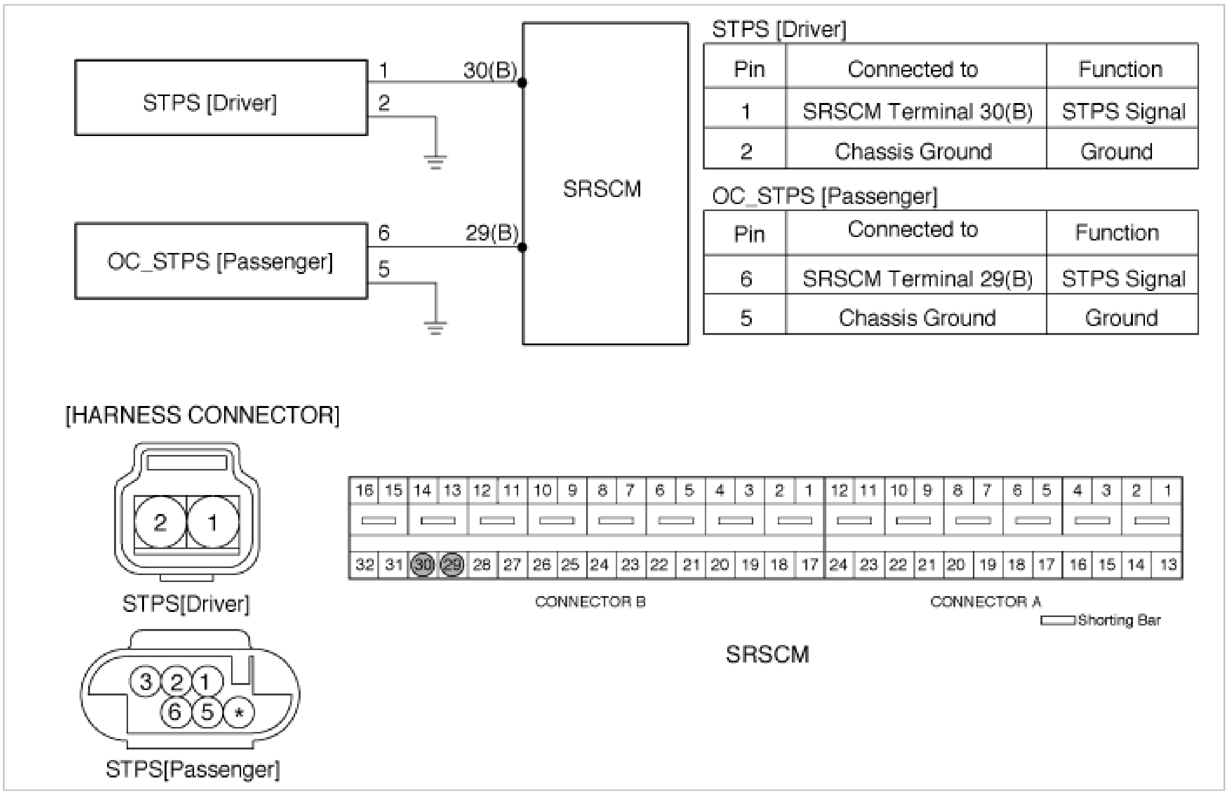
DTC	Condition	Probable cause
B1389 B1392	• STPS Malfunction • SRSCM Malfunction	• STPS • SRSCM

Specification

[Seat position diagnostic current limits]

Open/Short to Battery	Grey Zone	Forward	Grey Zone	Defect	Grey Zone	Rearward	Grey Zone	Short/Short to ground
< 3.98 mA	3.98 - 4.79 mA	4.79 - 7.16 mA	7.16 - 8.62 mA	8.62 - 9.94 mA	9.94 - 11.97 mA	11.97 - 17.29 mA	17.29 - 20.83 mA	> 20.83 mA

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK THE SEAT TRACK POSITION SENSOR (STPS)
   (1) Measure current between the terminal 1(6) of STPS and 30(29) of SRSCM(B).

   Specification(current) : 12 ~ 17 mA (Reward status), 5 ~ 7 mA (Forward status)

   (2) Is the measured current within specification?

   YES

   ▸ Goto next stop.

   NO

   ▸ Replace the STPS.

3. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON .
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1395

DTC Description

DTC code is detected when short is broken out between airbag module and the other module. And warning lamp operates after DTC is detected.

Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

   NO

   ▸ Go to next step.

   YES

   ▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. CHECK CIRCUIT
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
   (6) Measure resistance between airbag module wiring harness and the other wiring harness.(ex. DAB vs PAB, DAB vs SAB, DAB vs CAB, DAB vs BPT, DAB vs BUPT etc.)

   specification(resistance) : infinite

   Is the measured resistance within specification?

   YES

   ▸ Replace SRSCM, then go to " CLEAR THE DTC AND CHECK THE VEHICLE AGAIN ".

   NO

▸ Repair or replace the wiring harness, then go to " CLEAR THE DTC AND CHECK THE VEHICLE AGAIN ".

2. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON.
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1400

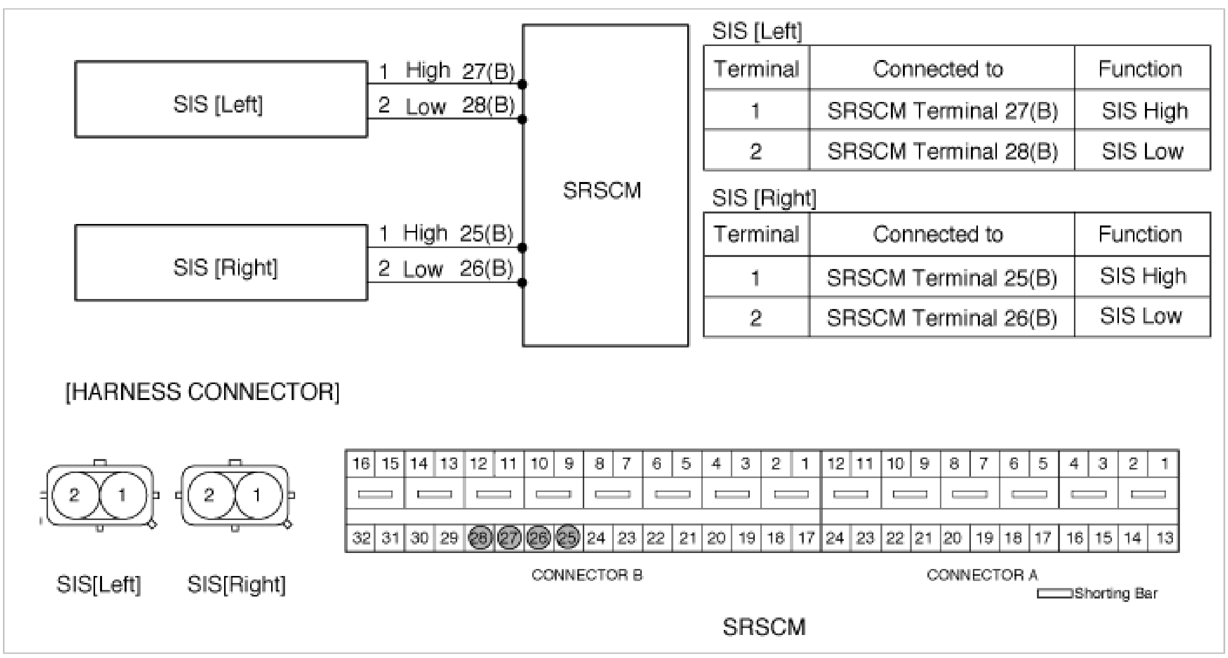
DTC Description

The detecting system for side crash consists of the SRSCM and two Side Impact Sensors (SIS).The SRSCM sets above DTC(s) if it detects that any SIS is defective or there is communication error between any front SIS and the SRSCM.

DTC Detecting Condition

DTC	Condition	Probable cause
B1400 B1403 B1409 B1410	• Open between SIS and SRSCM • Side Impact Sensor (SIS) Malfunction • SRSCM Malfunction	• Wiring Harness • Side Impact Sensor (SIS) squib • SRSCM

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

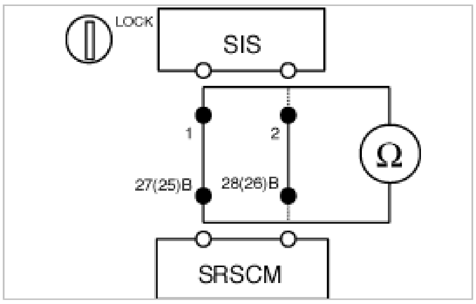
▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK SIS CIRCUIT
   (1) Measure resistance between the terminal 1 of SIS harness connector and the terminal 27(25) of SRSCM harness connector(B).
   (2) Measure resistance between the terminal 2 of SIS harness connector and the terminal 28(26) of SRSCM harness connector(B).

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

▸Check Side Impact Sensor.

NO

▸ Repair or replace the wiring harness between the SIS and the SRSCM.

3. CHECK THE SIDE IMPACT SENSOR
   (1) Replace the Side Impact Sensor(SIS) with a new one.
   - Refer to "Side Impact Sensor(SIS)" section in this SERVICE MANUAL.
   (2) Install the DAB module and connect the DAB connector.
   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (4) Connect the SRSCM connector.
   (5) Connect the negative (-) terminal to the battery.
   (6) Connect a Hi-Scan(Pro) to the data link connector.
   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to Side Impact Sensor(SIS)?

YES

▸ Go to next step.

NO

▸ Replace SIS.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON .
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1403

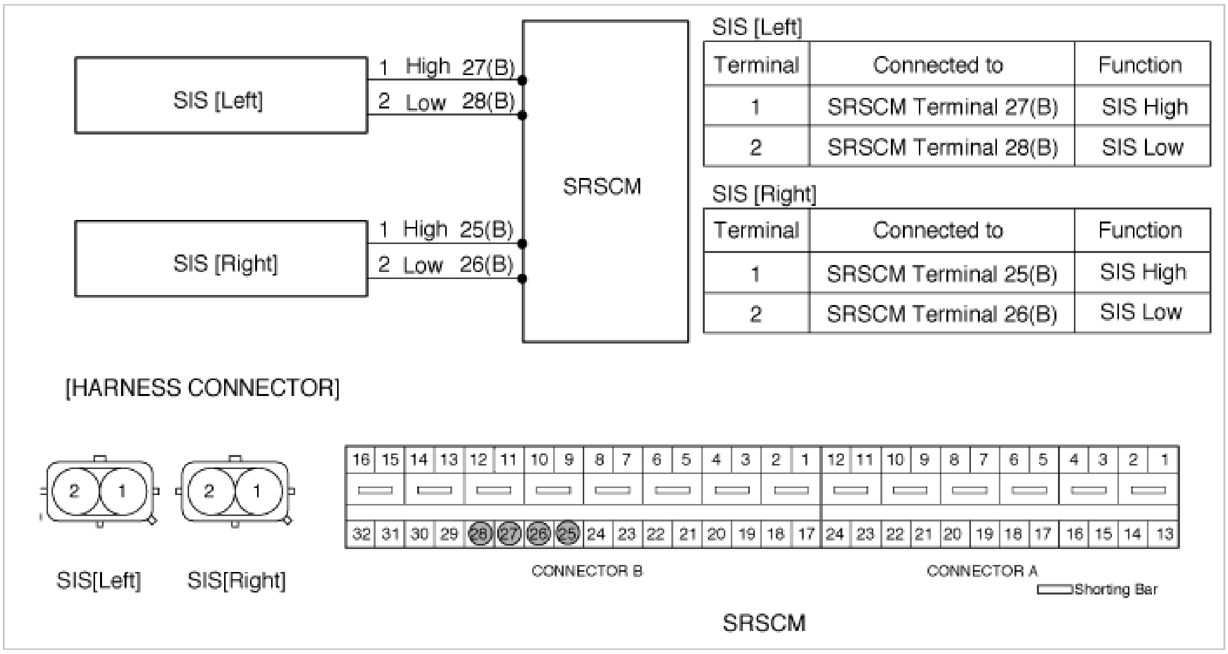
DTC Description

The detecting system for side crash consists of the SRSCM and two Side Impact Sensors (SIS).The SRSCM sets above DTC(s) if it detects that any SIS is defective or there is communication error between any front SIS and the SRSCM.

DTC Detecting Condition

DTC	Condition	Probable cause
B1400 B1403 B1409 B1410	• Open between SIS and SRSCM • Side Impact Sensor (SIS) Malfunction • SRSCM Malfunction	• Wiring Harness • Side Impact Sensor (SIS) squib • SRSCM

Schematic Diagram



SIS [Left]

Terminal	Connected to	Function
1	SRSCM Terminal 27(B)	SIS High
2	SRSCM Terminal 28(B)	SIS Low

SIS [Right]

Terminal	Connected to	Function
1	SRSCM Terminal 25(B)	SIS High
2	SRSCM Terminal 26(B)	SIS Low

Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

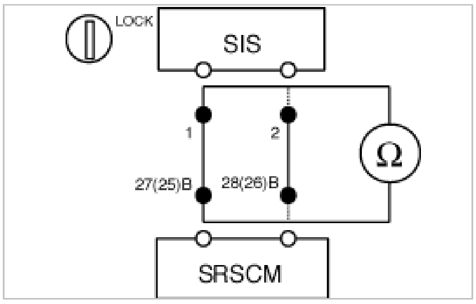
YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SIS CIRCUIT
   (1) Measure resistance between the terminal 1 of SIS harness connector and the terminal 27(25) of SRSCM harness connector(B).
   (2) Measure resistance between the terminal 2 of SIS harness connector and the terminal 28(26) of SRSCM harness connector(B).

   specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

▸Check Side Impact Sensor.

NO

▸ Repair or replace the wiring harness between the SIS and the SRSCM.

3. CHECK THE SIDE IMPACT SENSOR
   (1) Replace the Side Impact Sensor(SIS) with a new one.
   - Refer to "Side Impact Sensor(SIS)" section in this SERVICE MANUAL.

   (2) Install the DAB module and connect the DAB connector.

   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (4) Connect the SRSCM connector.

   (5) Connect the negative (-) terminal to the battery.

   (6) Connect a Hi-Scan(Pro) to the data link connector.

   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to Side Impact Sensor(SIS)?

   YES

   ▸ Go to next step.

   NO

   ▸ Replace SIS.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.

   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (3) Connect the SRSCM connector.

   (4) Connect the negative (-) terminal to the battery.

   (5) Connect a Hi-Scan(Pro) to the data link connector.

   (6) Turn the ignition switch to ON .

   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

   (9) Turn the ignition switch to ON and wait for at least 30 seconds.

   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1409

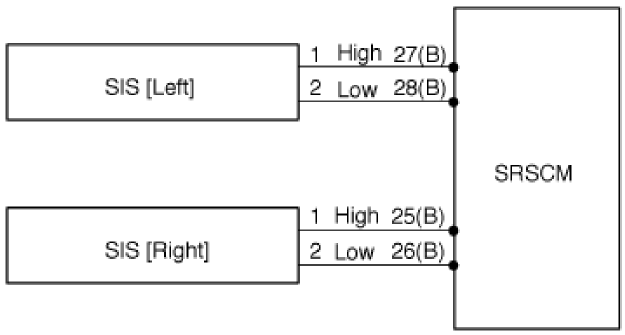
DTC Description

The detecting system for side crash consists of the SRSCM and two Side Impact Sensors (SIS).The SRSCM sets above DTC(s) if it detects that any SIS is defective or there is communication error between any front SIS and the SRSCM.

DTC Detecting Condition

DTC	Condition	Probable cause
B1400 B1403 B1409 B1410	• Open between SIS and SRSCM • Side Impact Sensor (SIS) Malfunction • SRSCM Malfunction	• Wiring Harness • Side Impact Sensor (SIS) squib • SRSCM

Schematic Diagram

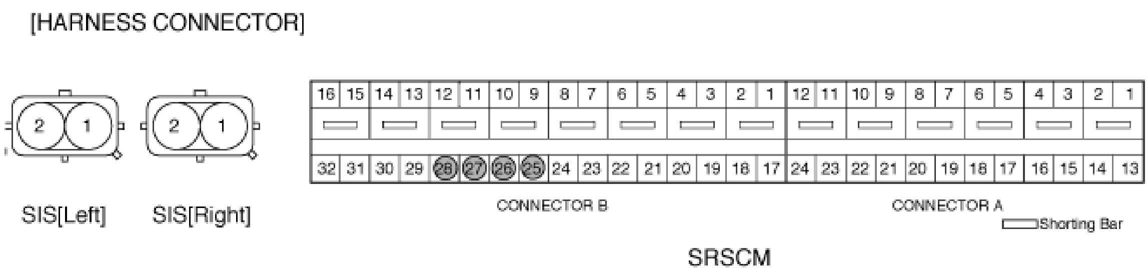


SIS [Left]

Terminal	Connected to	Function
1	SRSCM Terminal 27(B)	SIS High
2	SRSCM Terminal 28(B)	SIS Low

SIS [Right]

Terminal	Connected to	Function
1	SRSCM Terminal 25(B)	SIS High
2	SRSCM Terminal 26(B)	SIS Low



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

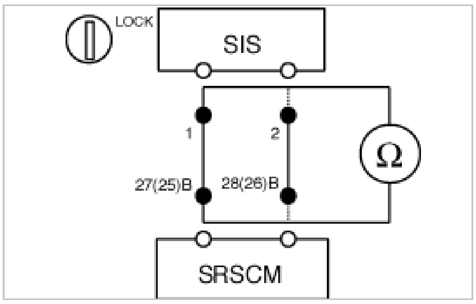
▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SIS CIRCUIT
   (1) Measure resistance between the terminal 1 of SIS harness connector and the terminal 27(25) of SRSCM harness connector(B).
   (2) Measure resistance between the terminal 2 of SIS harness connector and the terminal 28(26) of SRSCM harness

connector(B).

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

▸Check Side Impact Sensor.

NO

▸ Repair or replace the wiring harness between the SIS and the SRSCM.

3. CHECK THE SIDE IMPACT SENSOR
   (1) Replace the Side Impact Sensor(SIS) with a new one.
      ● Refer to "Side Impact Sensor(SIS)" section in this SERVICE MANUAL.
   (2) Install the DAB module and connect the DAB connector.
   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (4) Connect the SRSCM connector.
   (5) Connect the negative (-) terminal to the battery.
   (6) Connect a Hi-Scan(Pro) to the data link connector.
   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to Side Impact Sensor(SIS)?

YES

▸ Go to next step.

NO

▸ Replace SIS.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON .
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1410

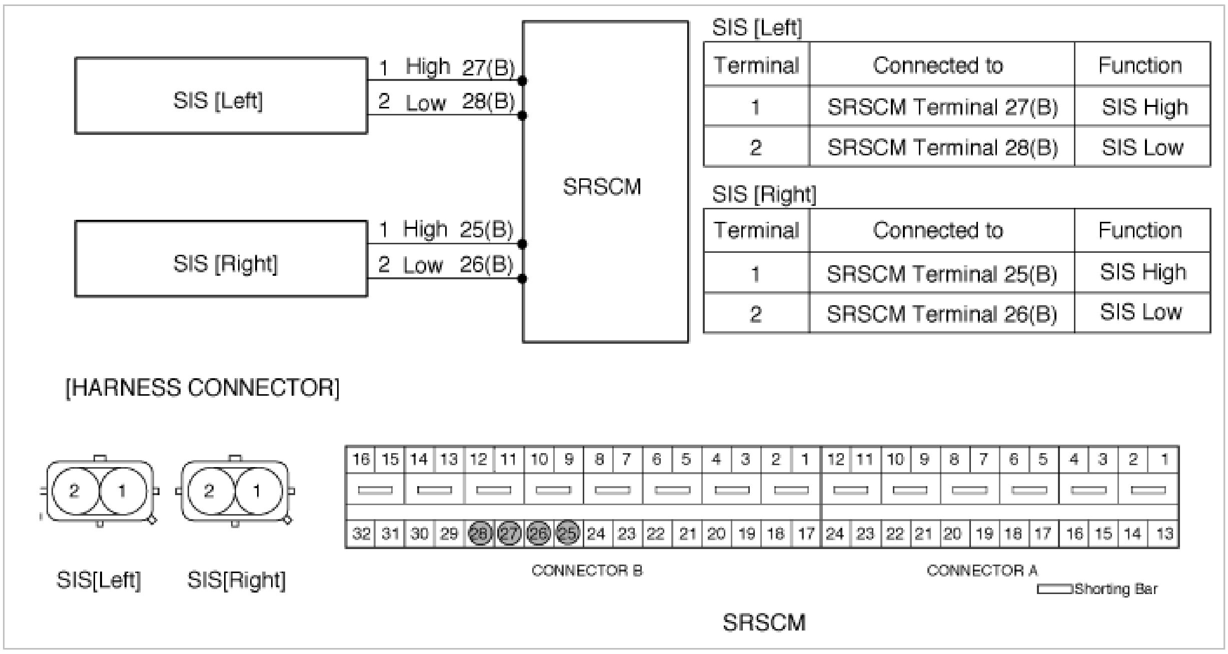
DTC Description

The detecting system for side crash consists of the SRSCM and two Side Impact Sensors (SIS).The SRSCM sets above DTC(s) if it detects that any SIS is defective or there is communication error between any front SIS and the SRSCM.

DTC Detecting Condition

DTC	Condition	Probable cause
B1400 B1403 B1409 B1410	• Open between SIS and SRSCM • Side Impact Sensor (SIS) Malfunction • SRSCM Malfunction	• Wiring Harness • Side Impact Sensor (SIS) squib • SRSCM

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

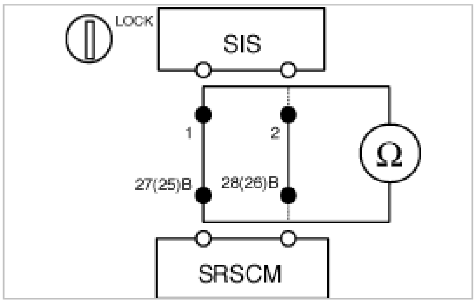
Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SIS CIRCUIT
   (1) Measure resistance between the terminal 1 of SIS harness connector and the terminal 27(25) of SRSCM harness

connector(B).

(2) Measure resistance between the terminal 2 of SIS harness connector and the terminal 28(26) of SRSCM harness connector(B).

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

▸Check Side Impact Sensor.

NO

▸ Repair or replace the wiring harness between the SIS and the SRSCM.

3. CHECK THE SIDE IMPACT SENSOR
   (1) Replace the Side Impact Sensor(SIS) with a new one.
   - Refer to "Side Impact Sensor(SIS)" section in this SERVICE MANUAL.

   (2) Install the DAB module and connect the DAB connector.

   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (4) Connect the SRSCM connector.

   (5) Connect the negative (-) terminal to the battery.

   (6) Connect a Hi-Scan(Pro) to the data link connector.

   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to Side Impact Sensor(SIS)?

YES

▸ Go to next step.

NO

▸ Replace SIS.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.

   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (3) Connect the SRSCM connector.

   (4) Connect the negative (-) terminal to the battery.

   (5) Connect a Hi-Scan(Pro) to the data link connector.

   (6) Turn the ignition switch to ON .

   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

   (9) Turn the ignition switch to ON and wait for at least 30 seconds.

   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting >

B1448

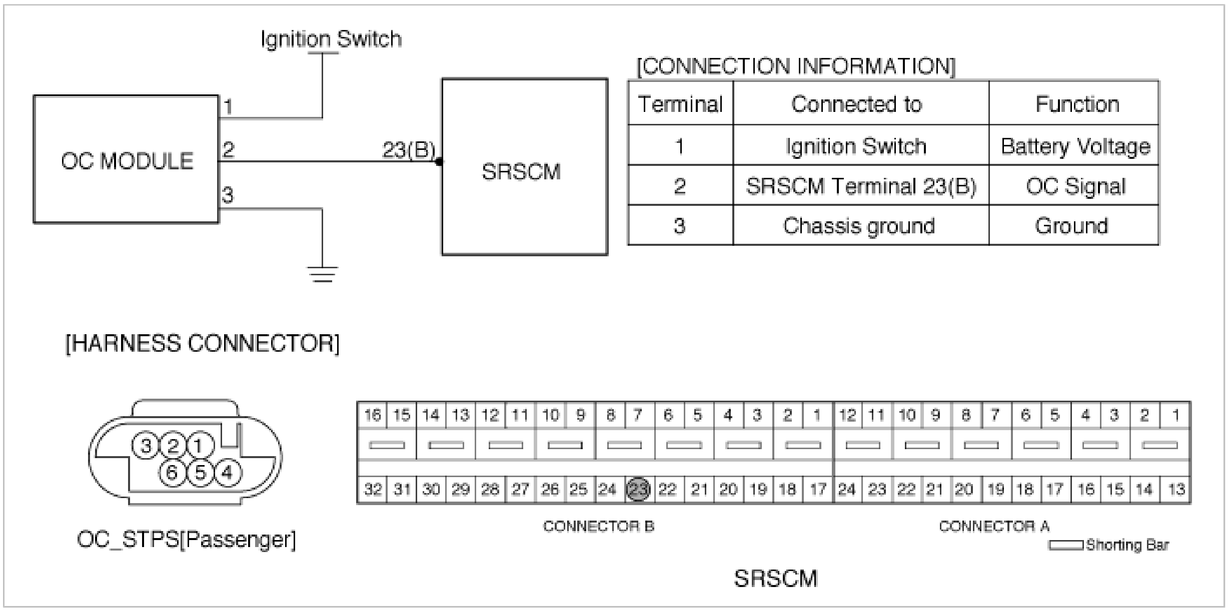
DTC Description

The passenger occupant classification system consists of the SRSCM and the OC module. The above DTC is recorded when a defect or communication error of the OC module is detected in the OC module circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1448 B1449 B1450	• OC module Malfunction • SRSCM Malfunction	• Wiring Harness • OC module • SRSCM

Schematic Diagram



Terminal	Connected to	Function
1	Ignition Switch	Battery Voltage
2	SRSCM Terminal 23(B)	OC Signal
3	Chassis ground	Ground

Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

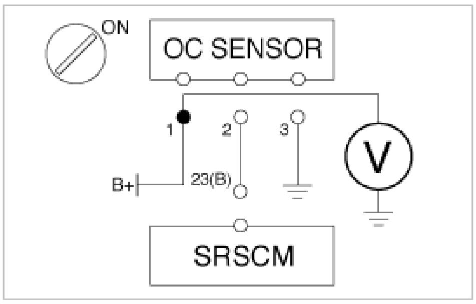
1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK POWER TO OC SENSOR

(1) Connect the negative (-) terminal to the battery.

(2) Turn the ignition switch to ON.

(3) Measure voltage between the terminal 1 of OC Sensor harness connector and chassis ground.

specification(voltage) : Battery voltage



(4) Is the measured voltage within specification?

YES

▸ Check short to battery line.

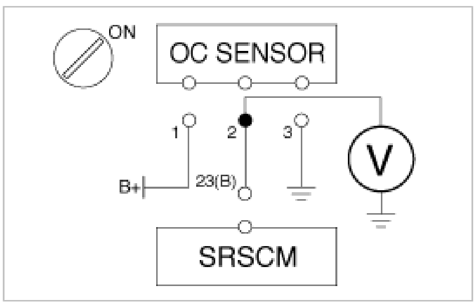
NO

▸ Repair or replace the wiring harness between the OC Sensor and ignition switch.

3. CHECK SHORT TO BATTERY LINE

(1) Measure voltage between the terminal 2 of OC Sensor harness connector and chassis ground.

specification(voltage) : Approximately 0 V



(2) Is the measured voltage within specification?

YES

▸ Check short to ground.

NO

▸ Repair the short to battery line circuit on wiring harness between the OC Sensor and the SRSCM.

4. CHECK SHORT TO GROUND

(1) Disconnect the negative(-) terminal from the battery.

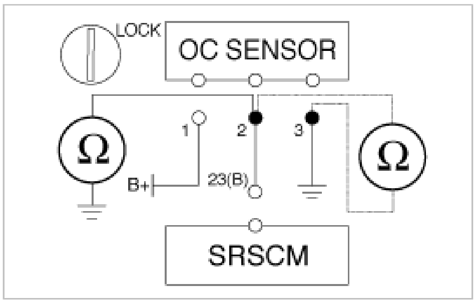
(2) Turn the ignition switch to LOCK.

(3) Disconnect the negative (-) terminal from the battery.

(4) Measure resistance between the terminal 2 of OC Sensor harness connector and chassis ground.

(5) Measure resistance between the terminal the terminal 2 and 3 of OC Sensor harness connector

Specification(resistance) : Infinite



(6) Is the measured resistance within specification?

YES

▸ Check OC Sensor Circuit.

NO

▸ Repair or replace the wiring harness between the OC Sensor and the SRSCM.

5. CHECK OC SENSOR CIRCUIT
   (1) Measure resistance between the terminal 2 of OC Sensor harness connector and the terminal 23 of the SRSCM harness connector(B).

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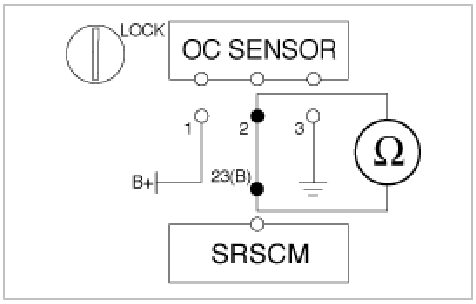
specification(resistance) : below 1 Ω



(2) Is the measured resistance within specification?

YES

▸ Check OC Sensor.

NO

▸ Repair or replace the wiring harness between the OC Sensor and the SRSCM.

6. CHECK OC SENSOR
   (1) Replace the OC Sensor with a new one.
   - Refer to "OC SENSOR" section in this SERVICE MANUAL.

   (2) Install the DAB module and connect the DAB connector.

   (3) Connect the connectors of the PAB, SAB, CAB, BPT, FIS and SIS.

   (4) Connect the SRSCM connector.

   (5) Connect the negative (-) terminal to the battery.

   (6) Connect the a Hi-Scan(Pro) the the data link connector.

   (7) Turn the ignition switch to ON and check the vehicle again.

   (8) Does Hi-Scan(Pro) indicate any DTC related to OC Sensor?

YES

▸ Go to next step.

NO

▸ Replace the OC Sensor.

7. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.

   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (3) Connect the SRSCM connector.

   (4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON .

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1449

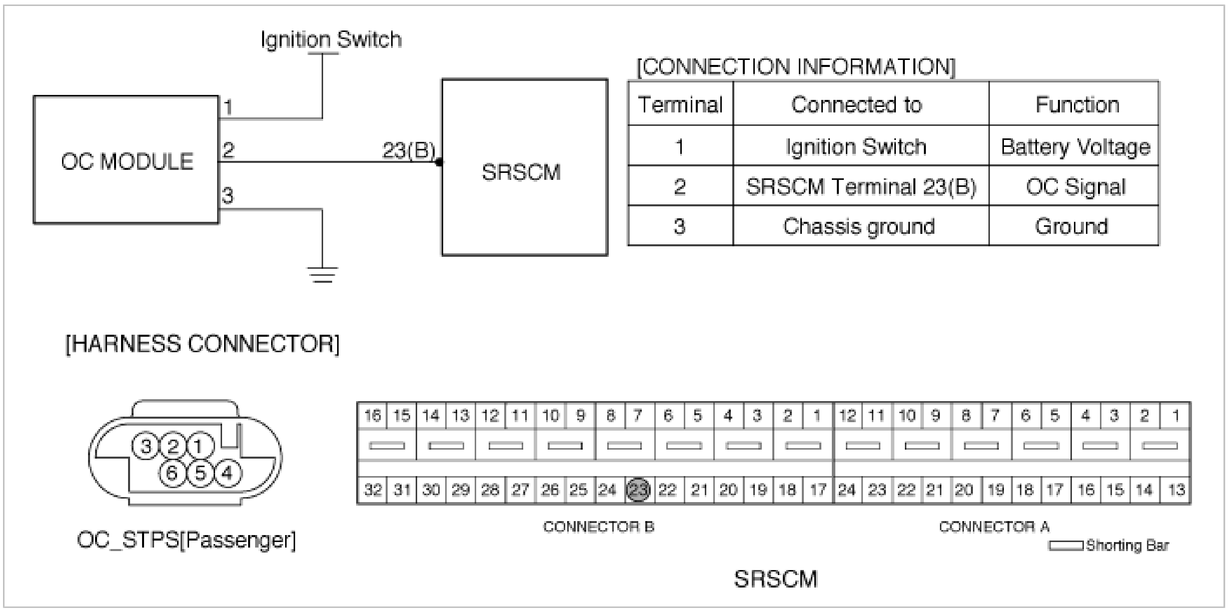
DTC Description

The passenger occupant classification system consists of the SRSCM and the OC module. The above DTC is recorded when a defect or communication error of the OC module is detected in the OC module circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1448 B1449 B1450	• OC module Malfunction • SRSCM Malfunction	• Wiring Harness • OC module • SRSCM

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

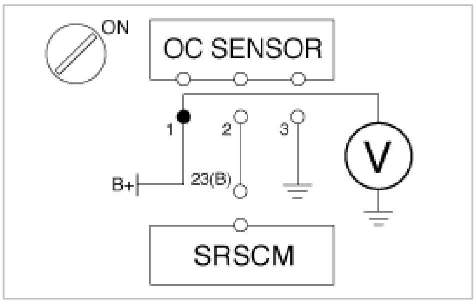
YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK POWER TO OC SENSOR
   (1) Connect the negative (-) terminal to the battery.
   (2) Turn the ignition switch to ON.
   (3) Measure voltage between the terminal 1 of OC Sensor harness connector and chassis ground.

specification(voltage) : Battery voltage



   (4) Is the measured voltage within specification?

YES

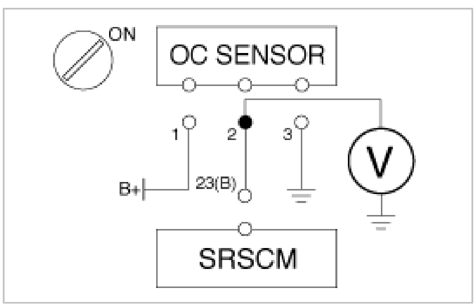
▸ Check short to battery line.

NO

▸ Repair or replace the wiring harness between the OC Sensor and ignition switch.

3. CHECK SHORT TO BATTERY LINE
   (1) Measure voltage between the terminal 2 of OC Sensor harness connector and chassis ground.

specification(voltage) : Approximately 0 V



   (2) Is the measured voltage within specification?

YES

▸ Check short to ground.

NO

▸ Repair the short to battery line circuit on wiring harness between the OC Sensor and the SRSCM.

4. CHECK SHORT TO GROUND

(1) Disconnect the negative(-) terminal from the battery.

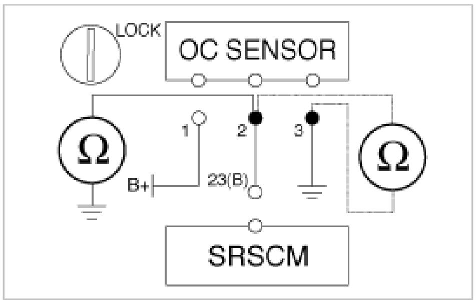
(2) Turn the ignition switch to LOCK.

(3) Disconnect the negative (-) terminal from the battery.

(4) Measure resistance between the terminal 2 of OC Sensor harness connector and chassis ground.

(5) Measure resistance between the terminal the terminal 2 and 3 of OC Sensor harness connector

Specification(resistance) : Infinite



(6) Is the measured resistance within specification?

YES

▸ Check OC Sensor Circuit.

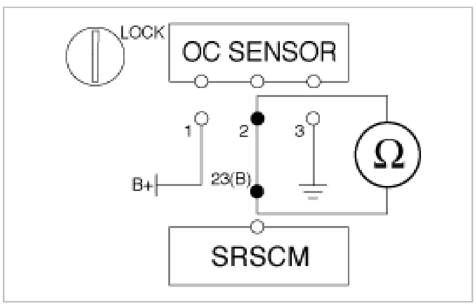
NO

▸ Repair or replace the wiring harness between the OC Sensor and the SRSCM.

5. CHECK OC SENSOR CIRCUIT

(1) Measure resistance between the terminal 2 of OC Sensor harness connector and the terminal 23 of the SRSCM harness connector(B).

specification(resistance) : below 1 Ω



(2) Is the measured resistance within specification?

YES

▸ Check OC Sensor.

NO

▸ Repair or replace the wiring harness between the OC Sensor and the SRSCM.

6. CHECK OC SENSOR

(1) Replace the OC Sensor with a new one.

- Refer to "OC SENSOR" section in this SERVICE MANUAL.

(2) Install the DAB module and connect the DAB connector.

(3) Connect the connectors of the PAB, SAB, CAB, BPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal to the battery.

(6) Connect the a Hi-Scan(Pro) the the data link connector.

(7) Turn the ignition switch to ON and check the vehicle again.

(8) Does Hi-Scan(Pro) indicate any DTC related to OC Sensor?

YES

▸ Go to next step.

NO

▸ Replace the OC Sensor.

7. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON .
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1450

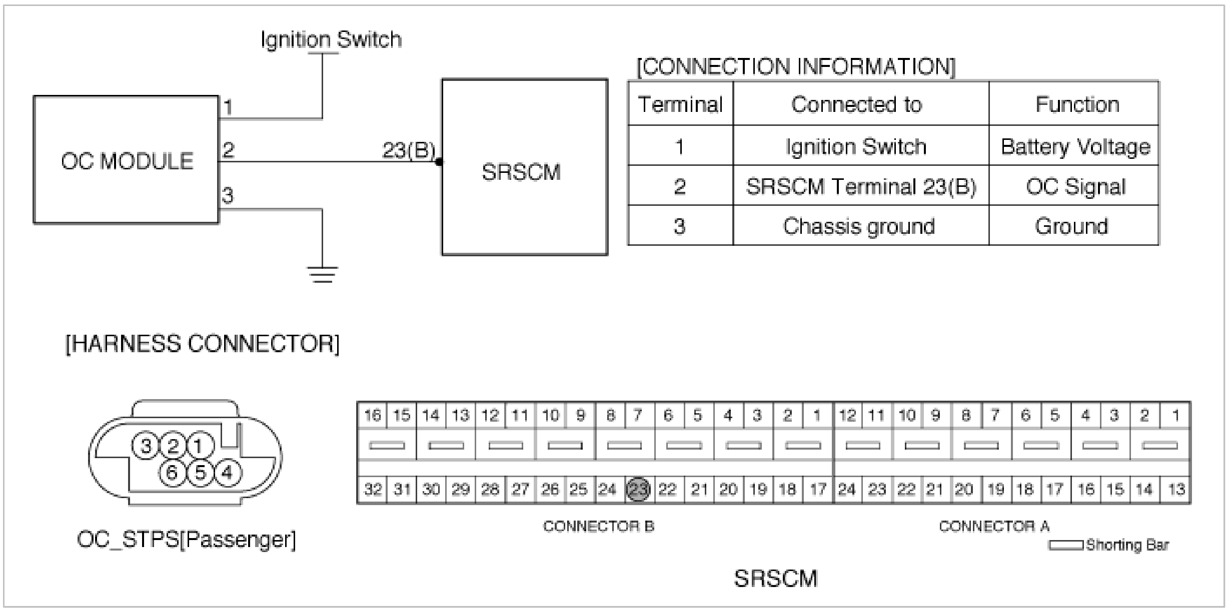
DTC Description

The passenger occupant classification system consists of the SRSCM and the OC module. The above DTC is recorded when a defect or communication error of the OC module is detected in the OC module circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1448 B1449 B1450	• OC module Malfunction • SRSCM Malfunction	• Wiring Harness • OC module • SRSCM

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

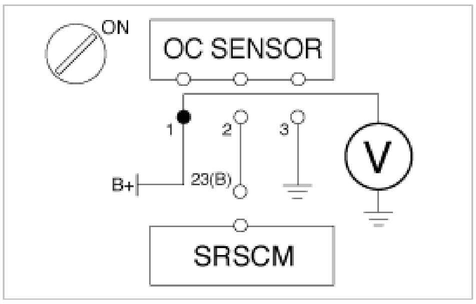
▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK POWER TO OC SENSOR
   (1) Connect the negative (-) terminal to the battery.
   (2) Turn the ignition switch to ON.
   (3) Measure voltage between the terminal 1 of OC Sensor harness connector and chassis ground.

specification(voltage) : Battery voltage



   (4) Is the measured voltage within specification?

YES

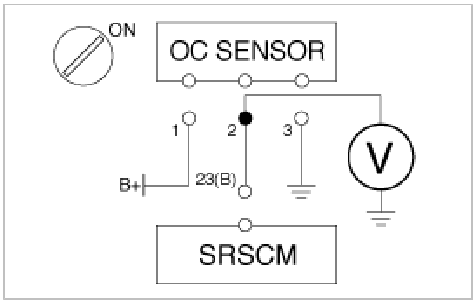
▸ Check short to battery line.

NO

▸ Repair or replace the wiring harness between the OC Sensor and ignition switch.

3. CHECK SHORT TO BATTERY LINE
   (1) Measure voltage between the terminal 2 of OC Sensor harness connector and chassis ground.

specification(voltage) : Approximately 0 V



(2) Is the measured voltage within specification?

YES

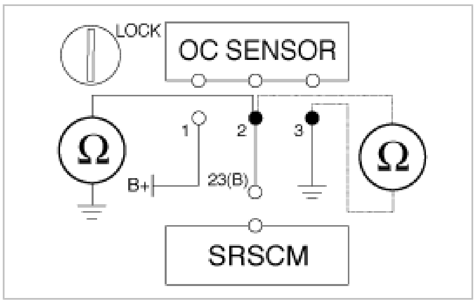
▸ Check short to ground.

NO

▸ Repair the short to battery line circuit on wiring harness between the OC Sensor and the SRSCM.

4. CHECK SHORT TO GROUND
   (1) Disconnect the negative(-) terminal from the battery.
   (2) Turn the ignition switch to LOCK.
   (3) Disconnect the negative (-) terminal from the battery.
   (4) Measure resistance between the terminal 2 of OC Sensor harness connector and chassis ground.
   (5) Measure resistance between the terminal the terminal 2 and 3 of OC Sensor harness connector

Specification(resistance) : Infinite



(6) Is the measured resistance within specification?

YES

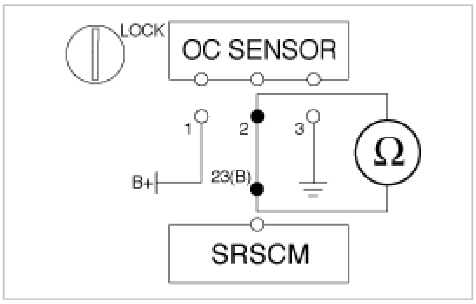
▸ Check OC Sensor Circuit.

NO

▸ Repair or replace the wiring harness between the OC Sensor and the SRSCM.

5. CHECK OC SENSOR CIRCUIT
   (1) Measure resistance between the terminal 2 of OC Sensor harness connector and the terminal 23 of the SRSCM harness connector(B).

specification(resistance) : below 1 Ω



(2) Is the measured resistance within specification?

YES

▸ Check OC Sensor.

NO

▸ Repair or replace the wiring harness between the OC Sensor and the SRSCM.

6. CHECK OC SENSOR
   (1) Replace the OC Sensor with a new one.
      ● Refer to "OC SENSOR" section in this SERVICE MANUAL.
   (2) Install the DAB module and connect the DAB connector.
   (3) Connect the connectors of the PAB, SAB, CAB, BPT, FIS and SIS.
   (4) Connect the SRSCM connector.
   (5) Connect the negative (-) terminal to the battery.
   (6) Connect the a Hi-Scan(Pro) the the data link connector.
   (7) Turn the ignition switch to ON and check the vehicle again.
   (8) Does Hi-Scan(Pro) indicate any DTC related to OC Sensor?

   YES

   ▸ Go to next step.

   NO

   ▸ Replace the OC Sensor.

7. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON .
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1473

DTC Description

The CAB squib circuit consists of the SRSCM and CAB.It causes the SRS to deploy when the SRS deployment conditions are satisfied.The above DTC is recorded when the CAB resistance too high or low is detected in the CAB squib circuit.

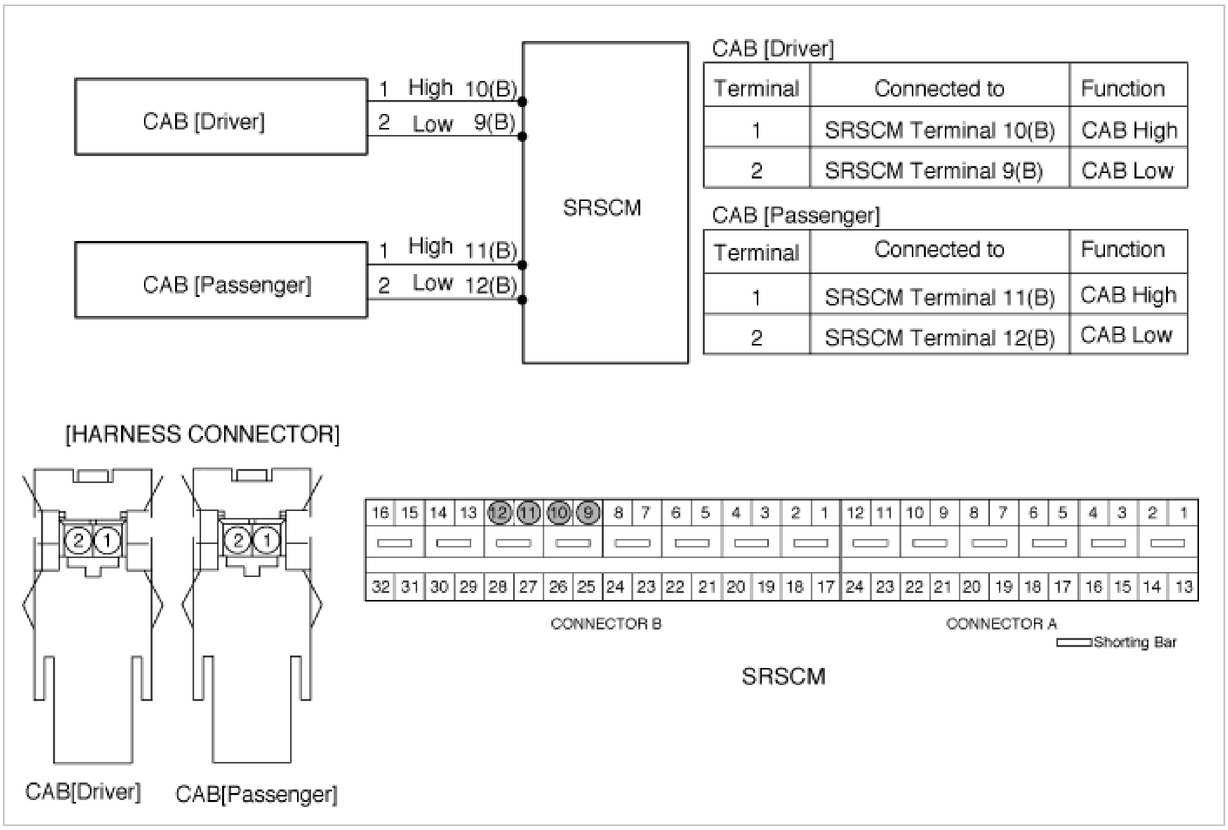
DTC Detecting Condition

DTC	Condition	Probable cause
B1473 B1474 B1477 B1478	• Too high or low resistance between CAB high(+) and CAB low (-) • Curtain Airbag (CAB) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Cirtain Airbag (CAB) squib • SRSCM • Partially connected connector

Specification

CAB resistance : 1.9 ≤ R ≤ 2.7 Ω

Schematic Diagram



CAB [Driver]

Terminal	Connected to	Function
1	SRSCM Terminal 10(B)	CAB High
2	SRSCM Terminal 9(B)	CAB Low

CAB [Passenger]

Terminal	Connected to	Function
1	SRSCM Terminal 11(B)	CAB High
2	SRSCM Terminal 12(B)	CAB Low

Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> CAUTION
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

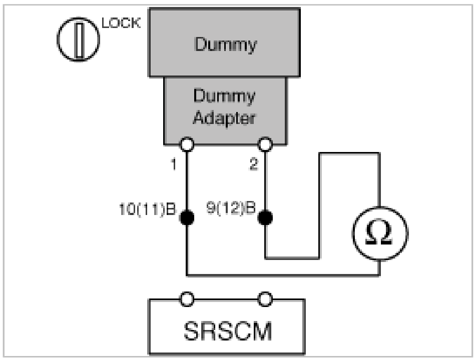
1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK CAB RESISTANCE

> CAUTION
>
> Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

(1) Connect the Dummy and the Dummy Adapter on CAB harness connector.
- Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

(2) Measure resistance between the terminal 10(11) and 9(12) of SRSCM harness connector(B).

CAB resistance : $1.9 \leq R \leq 2.7\ \Omega$



Is the measured resistance within specification?

YES

▸Replace the Curtain Airbag(CAB) module.

NO

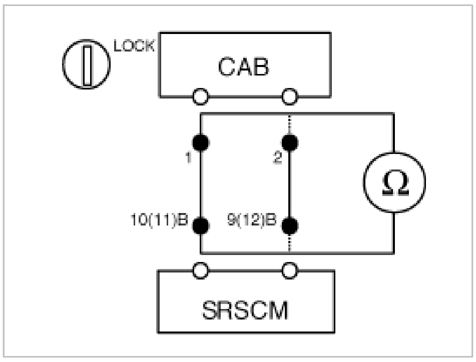
▸Check open circuit.

3. CHECK OPEN CIRCUIT

(1) Measure resistance between the terminal 1 of CAB harness connector and the terminal 10(11) of SRSCM harness connector(B).

(2) Measure resistance between the terminal 2 of CAB harness connector and the terminal 9(12) of SRSCM harness connector(B).

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

▸Check short circuit.

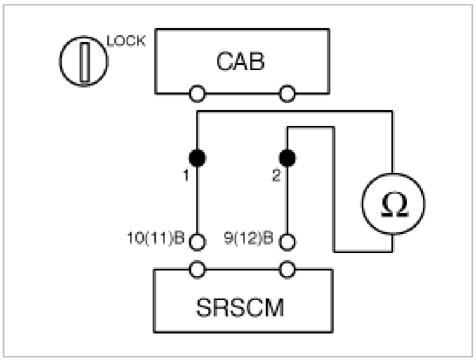
NO

▸Repair or replace the wiring harness between the CAB and the SRSCM.

4. CHECK SHORT CIRCUIT

(1) Measure resistance between the terminal 1 and 2 of CAB harness connector.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair or replace the wiring harness between the CAB and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON.
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1474

DTC Description

The CAB squib circuit consists of the SRSCM and CAB.It causes the SRS to deploy when the SRS deployment conditions are satisfied.The above DTC is recorded when the CAB resistance too high or low is detected in the CAB squib circuit.

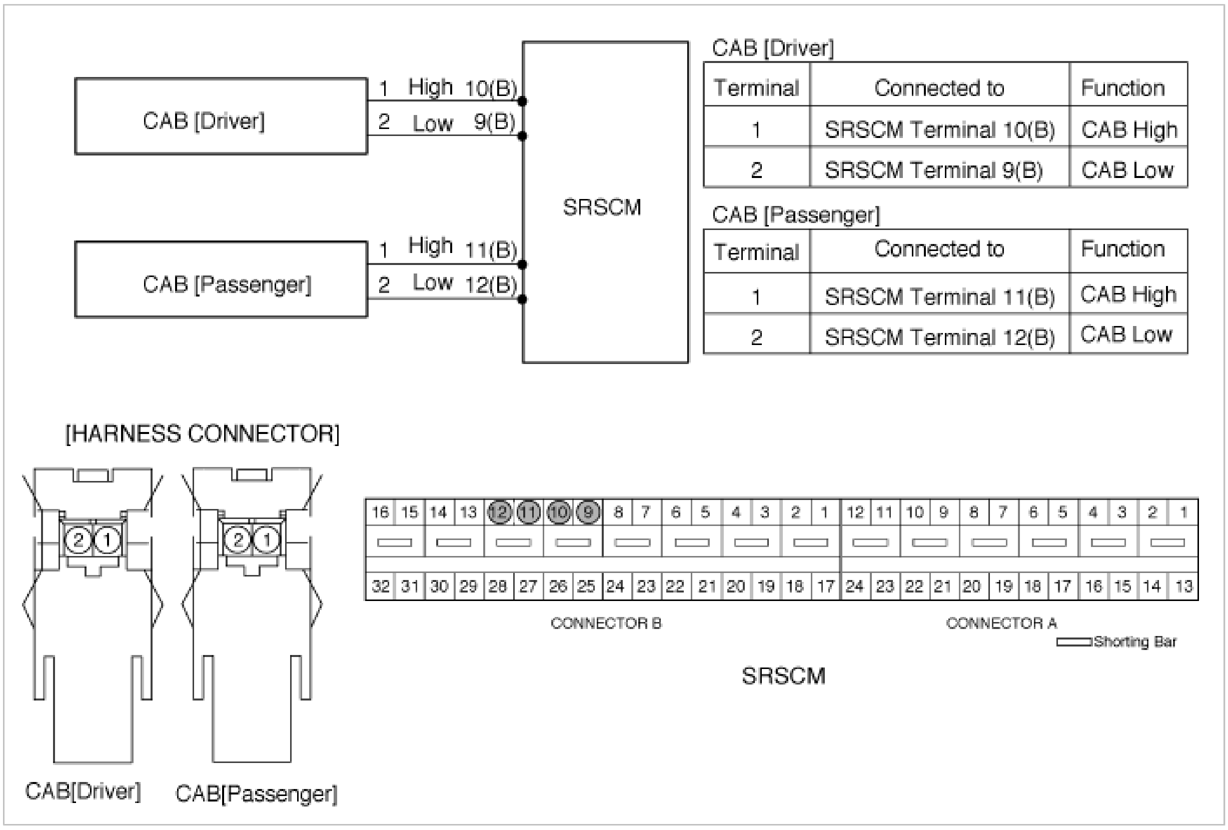
DTC Detecting Condition

DTC	Condition	Probable cause
B1473 B1474 B1477 B1478	• Too high or low resistance between CAB high(+) and CAB low (-) • Curtain Airbag (CAB) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Cirtain Airbag (CAB) squib • SRSCM • Partially connected connector

Specification

CAB resistance : $1.9 \le R \le 2.7\ \Omega$

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▶ Go to next step.

YES

▶ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

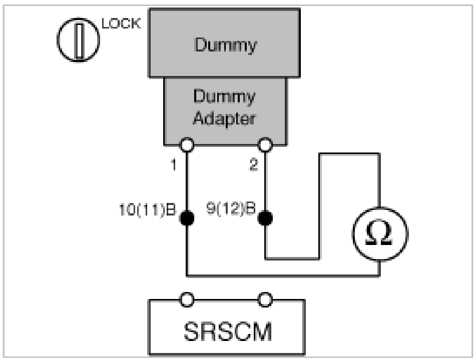
2. CHECK CAB RESISTANCE

> **CAUTION**
>
> Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

(1) Connect the Dummy and the Dummy Adapter on CAB harness connector.
- Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

(2) Measure resistance between the terminal 10(11) and 9(12) of SRSCM harness connector(B).

CAB resistance : 1.9 ≤ R ≤ 2.7 Ω



Is the measured resistance within specification?

YES

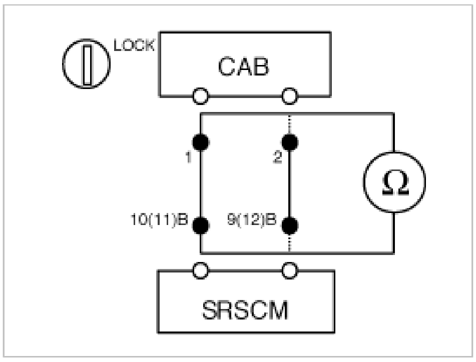
▸Replace the Curtain Airbag(CAB) module.

NO

▸Check open circuit.

3. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 1 of CAB harness connector and the terminal 10(11) of SRSCM harness connector(B).
   (2) Measure resistance between the terminal 2 of CAB harness connector and the terminal 9(12) of SRSCM harness connector(B).

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

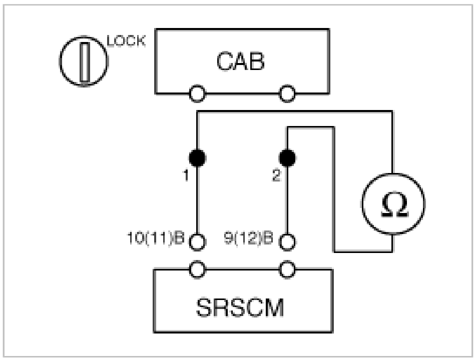
▸Check short circuit.

NO

▸Repair or replace the wiring harness between the CAB and the SRSCM.

4. CHECK SHORT CIRCUIT
   (1) Measure resistance between the terminal 1 and 2 of CAB harness connector.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair or replace the wiring harness between the CAB and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON.
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1475

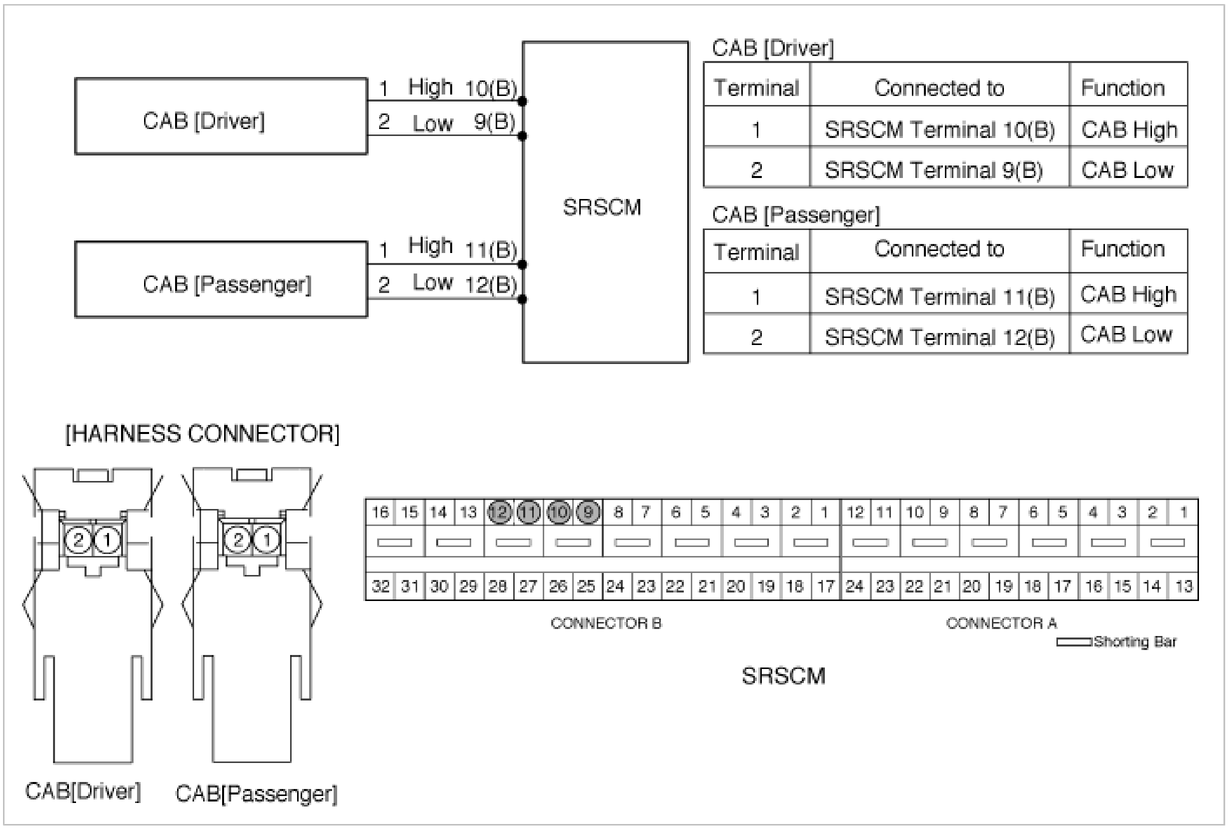
DTC Description

The CAB squib circuit consists of the SRSCM and CAB.It causes the SRS to deploy when the SRS deployment conditions are satisfied.The above DTC is recorded when short to ground is detected in the CAB squib circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1475 B1479	• Short to ground between CAB and SRSCM • Curtain Airbag (CAB) Malfunction • SRSCM Malfunction	• Short to ground circuit on wiring harness • Curtain Airbag (CAB) squib • SRSCM

Schematic Diagram



CAB [Driver]

Terminal	Connected to	Function
1	SRSCM Terminal 10(B)	CAB High
2	SRSCM Terminal 9(B)	CAB Low

CAB [Passenger]

Terminal	Connected to	Function
1	SRSCM Terminal 11(B)	CAB High
2	SRSCM Terminal 12(B)	CAB Low

Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

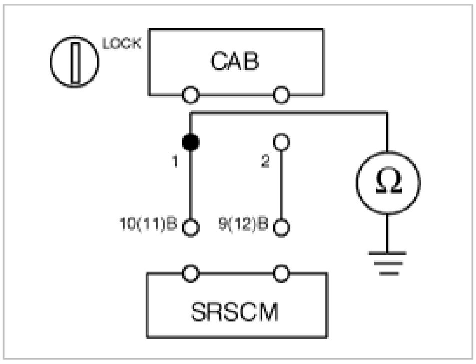
YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SHORT TO GROUND
   (1) Measure resistance between the terminal 1 of CAB harness connector and chassis ground.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸ Check the CAB Module.

NO

▸ Repair or replace the wiring harness between the CAB and the SRSCM.

3. CHECK THE CAB MODULE
   (1) Replace the Curtain Airbag(CAB) with a new one.
   - Refer to "Curtain Airbag(CAB)" section in this SERVICE MANUAL.

   (2) Install the DAB module and connect the DAB connector.

   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (4) Connect the SRSCM connector.

   (5) Connect the negative (-) terminal to the battery.

   (6) Connect a Hi-Scan(Pro) to the data link connector.

   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to Curtain Airbag(CAB)?

   YES

   ▸ Go to next step.

   NO

   ▸ Replace CAB module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.

   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (3) Connect the SRSCM connector.

   (4) Connect the negative (-) terminal to the battery.

   (5) Connect a Hi-Scan(Pro) to the data link connector.

   (6) Turn the ignition switch to ON .

   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

   (9) Turn the ignition switch to LOCK and wait for at least 30 seconds.

   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1476

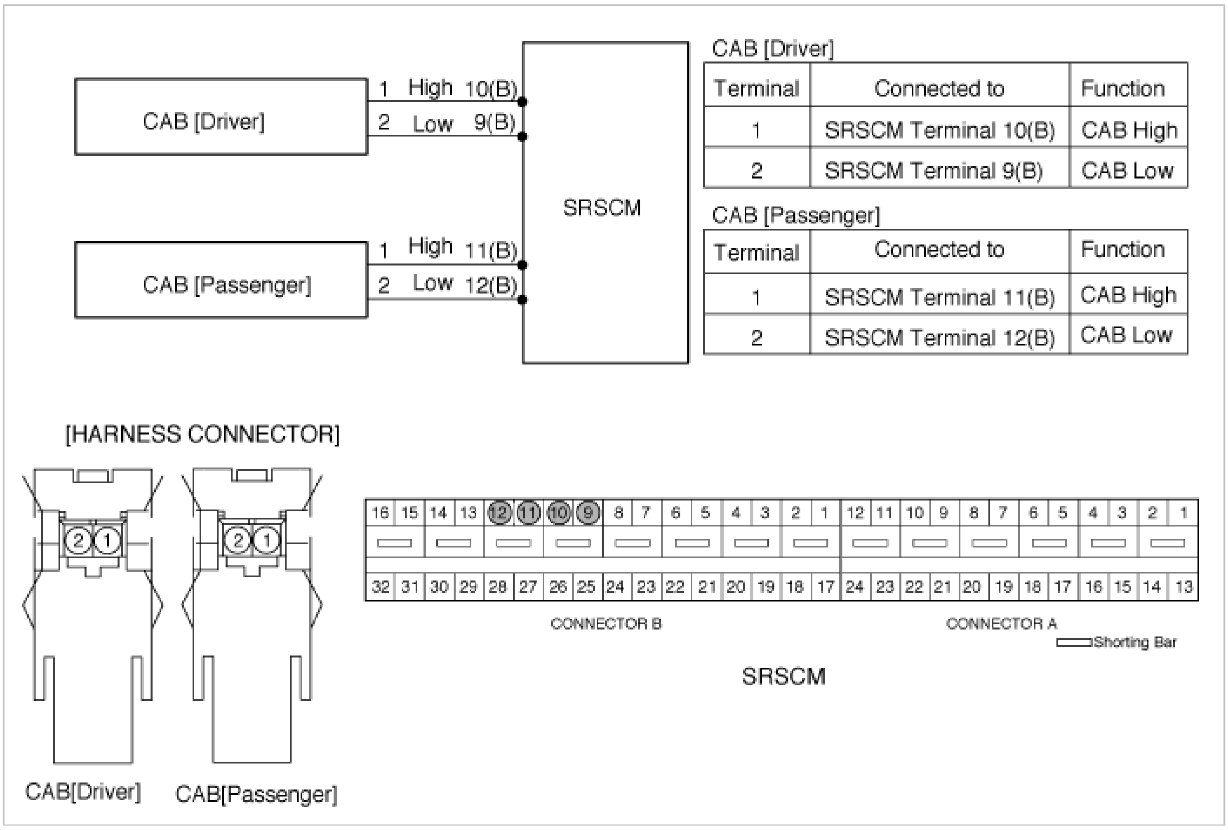
DTC Description

The CAB squib circuit consists of the SRSCM and CAB.It causes the SRS to deploy when the SRS deployment conditions are satisfied.The above DTC is recorded when short to battery is detected in the CAB squib circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1476 B1480	• Short to battery between CAB and SRSCM • Curtain Airbag (CAB) Malfunction • SRSCM Malfunction	• Short to battery line circuit on wiring harness • Curtain Airbag (CAB) squib • SRSCM

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

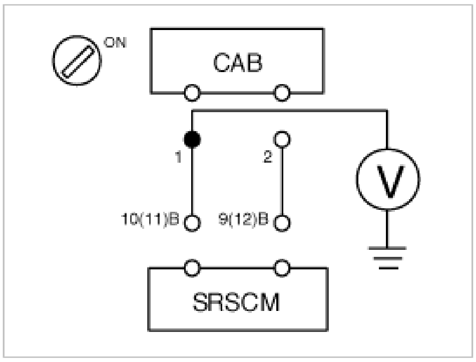
Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

2. CHECK SHORT TO BATTERY LINE
   (1) Connect the negative (-) terminal to the battery.
   (2) Turn the ignition switch to ON.
   (3) Measure voltage between the terminal 1 of CAB harness connector and chassis ground(-).

specification(voltage) : Approximately 0 V



Is the measured voltage within specification?

YES

▸ Check the CAB Module.

NO

▸ Repair the short to battery line circuit on wiring harness between the CAB and the SRSCM.

3. CHECK THE CAB MODULE
   (1) Replace the Curtain Airbag(CAB) with a new one.
   - Refer to "Curtain Airbag(CAB)" section in this SERVICE MANUAL.
   (2) Install the DAB module and connect the DAB connector.
   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (4) Connect the SRSCM connector.
   (5) Connect the negative (-) terminal to the battery.
   (6) Connect a Hi-Scan(Pro) to the data link connector.
   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to Curtain Airbag(CAB)?

YES

▸ Go to next step.

NO

▸ Replace CAB module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON .
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1477

DTC Description

The CAB squib circuit consists of the SRSCM and CAB.It causes the SRS to deploy when the SRS deployment conditions are satisfied.The above DTC is recorded when the CAB resistance too high or low is detected in the CAB squib circuit.

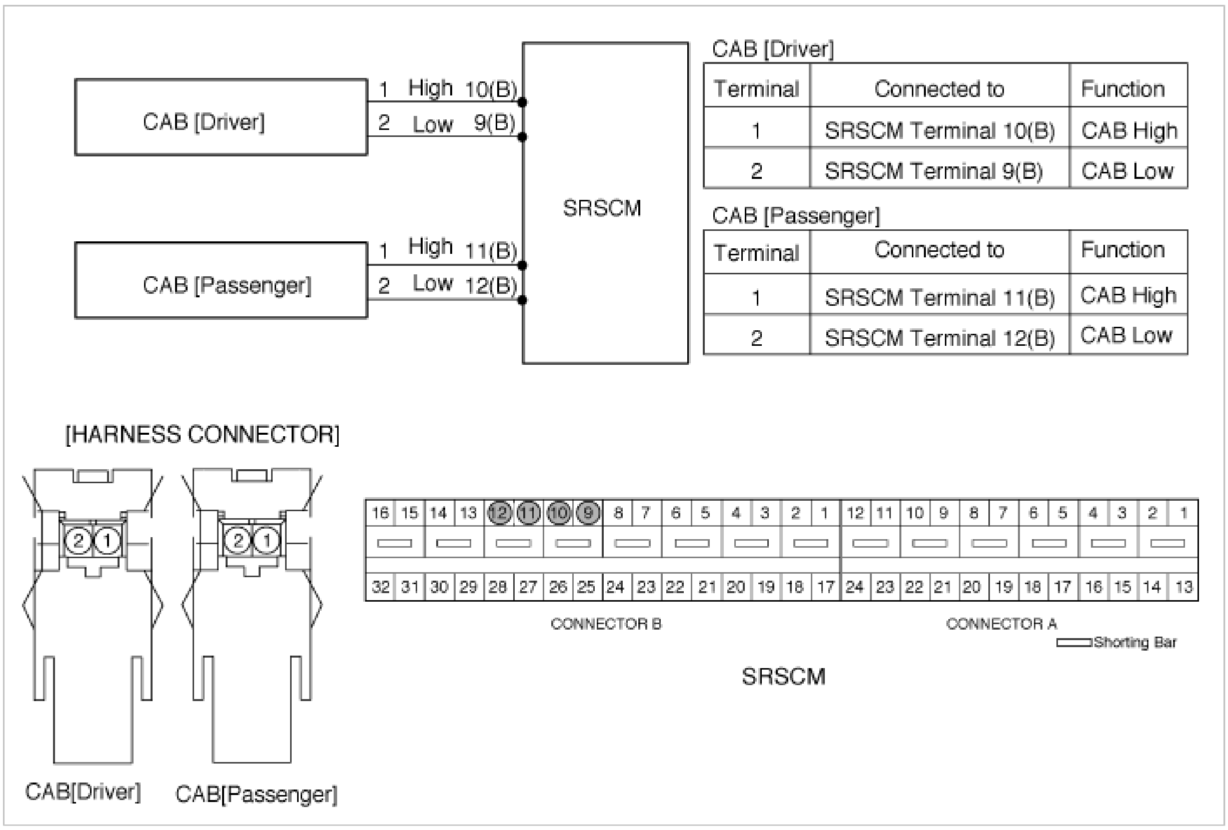
DTC Detecting Condition

DTC	Condition	Probable cause
B1473 B1474 B1477 B1478	• Too high or low resistance between CAB high(+) and CAB low (-) • Curtain Airbag (CAB) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Cirtain Airbag (CAB) squib • SRSCM • Partially connected connector

Specification

CAB resistance : 1.9 ≤ R ≤ 2.7 Ω

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

CAUTION

Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK CAB RESISTANCE

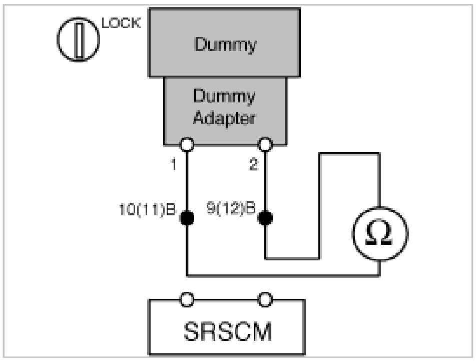
CAUTION

Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

   (1) Connect the Dummy and the Dummy Adapter on CAB harness connector.
   - Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

   (2) Measure resistance between the terminal 10(11) and 9(12) of SRSCM harness connector(B).

CAB resistance : $1.9 \le R \le 2.7\ \Omega$



Is the measured resistance within specification?

YES

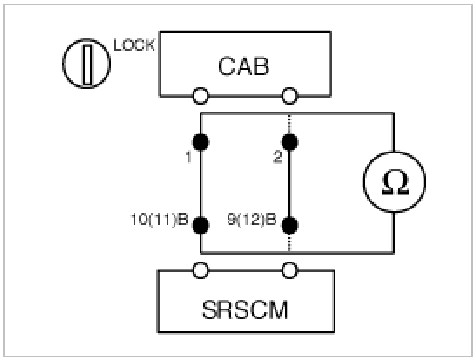
▸Replace the Curtain Airbag(CAB) module.

NO

▸Check open circuit.

3. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 1 of CAB harness connector and the terminal 10(11) of SRSCM harness connector(B).
   (2) Measure resistance between the terminal 2 of CAB harness connector and the terminal 9(12) of SRSCM harness connector(B).

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

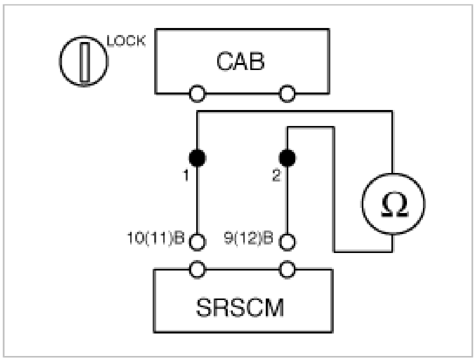
▸Check short circuit.

NO

▸Repair or replace the wiring harness between the CAB and the SRSCM.

4. CHECK SHORT CIRCUIT
   (1) Measure resistance between the terminal 1 and 2 of CAB harness connector.

   specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair or replace the wiring harness between the CAB and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON.
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

DTC Description

The CAB squib circuit consists of the SRSCM and CAB.It causes the SRS to deploy when the SRS deployment conditions are satisfied.The above DTC is recorded when the CAB resistance too high or low is detected in the CAB squib circuit.

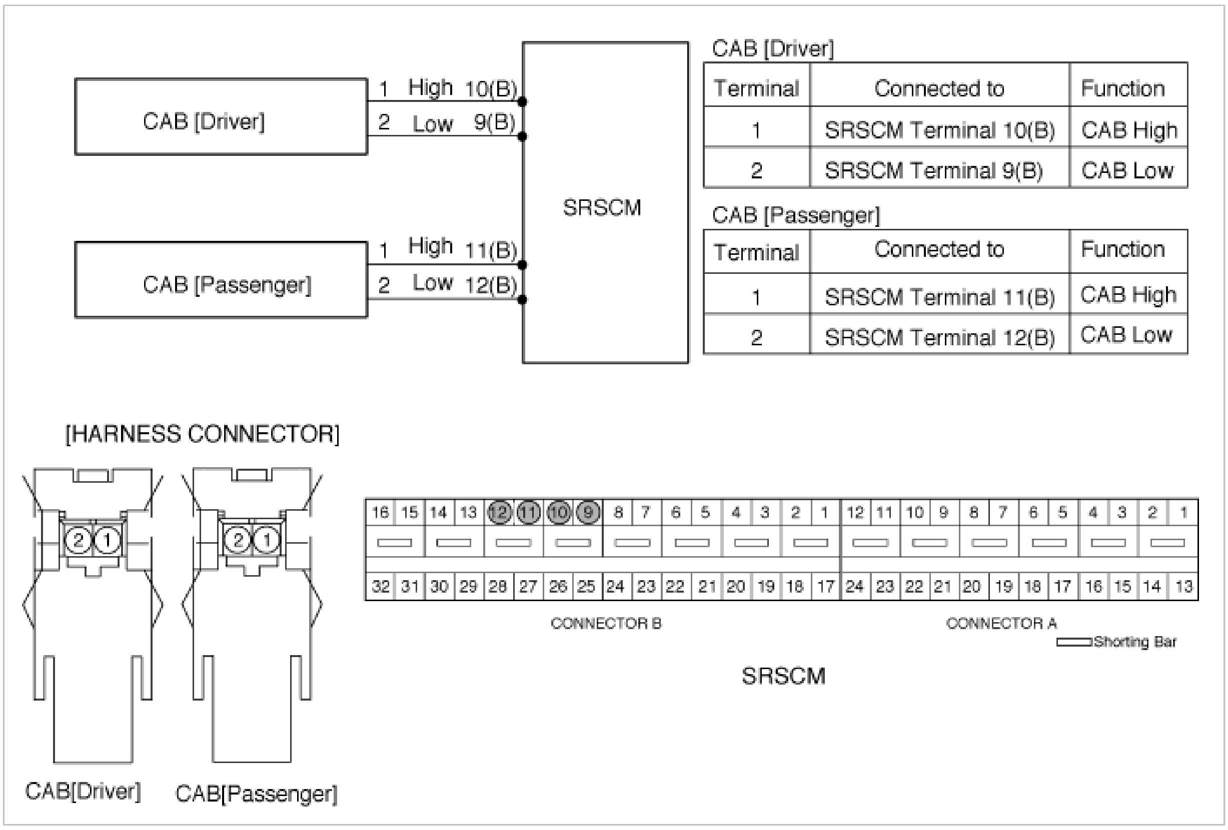
DTC Detecting Condition

DTC	Condition	Probable cause
B1473 B1474 B1477 B1478	• Too high or low resistance between CAB high(+) and CAB low (-) • Curtain Airbag (CAB) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Cirtain Airbag (CAB) squib • SRSCM • Partially connected connector

Specification

CAB resistance : 1.9 ≤ R ≤ 2.7 Ω

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> CAUTION
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

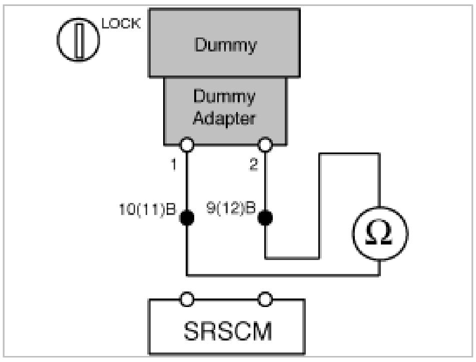
Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK CAB RESISTANCE

> **CAUTION**
>
> Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

   (1) Connect the Dummy and the Dummy Adapter on CAB harness connector.
   ● Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.
   (2) Measure resistance between the terminal 10(11) and 9(12) of SRSCM harness connector(B).

CAB resistance : 1.9 ≤ R ≤ 2.7 Ω



Is the measured resistance within specification?

YES

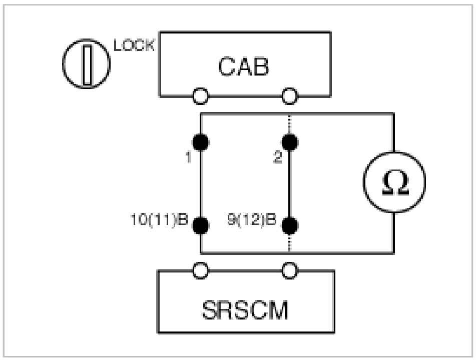
▸Replace the Curtain Airbag(CAB) module.

NO

▸Check open circuit.

3. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 1 of CAB harness connector and the terminal 10(11) of SRSCM harness connector(B).
   (2) Measure resistance between the terminal 2 of CAB harness connector and the terminal 9(12) of SRSCM harness connector(B).

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

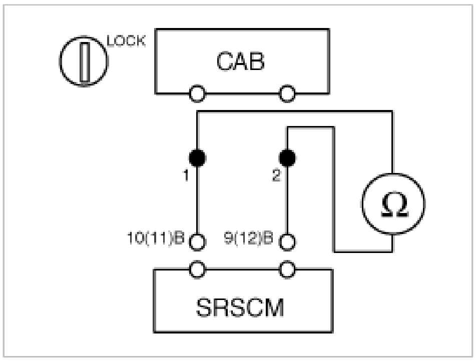
▸Check short circuit.

NO

▸Repair or replace the wiring harness between the CAB and the SRSCM.

4. CHECK SHORT CIRCUIT
   (1) Measure resistance between the terminal 1 and 2 of CAB harness connector.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair or replace the wiring harness between the CAB and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON.
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1479

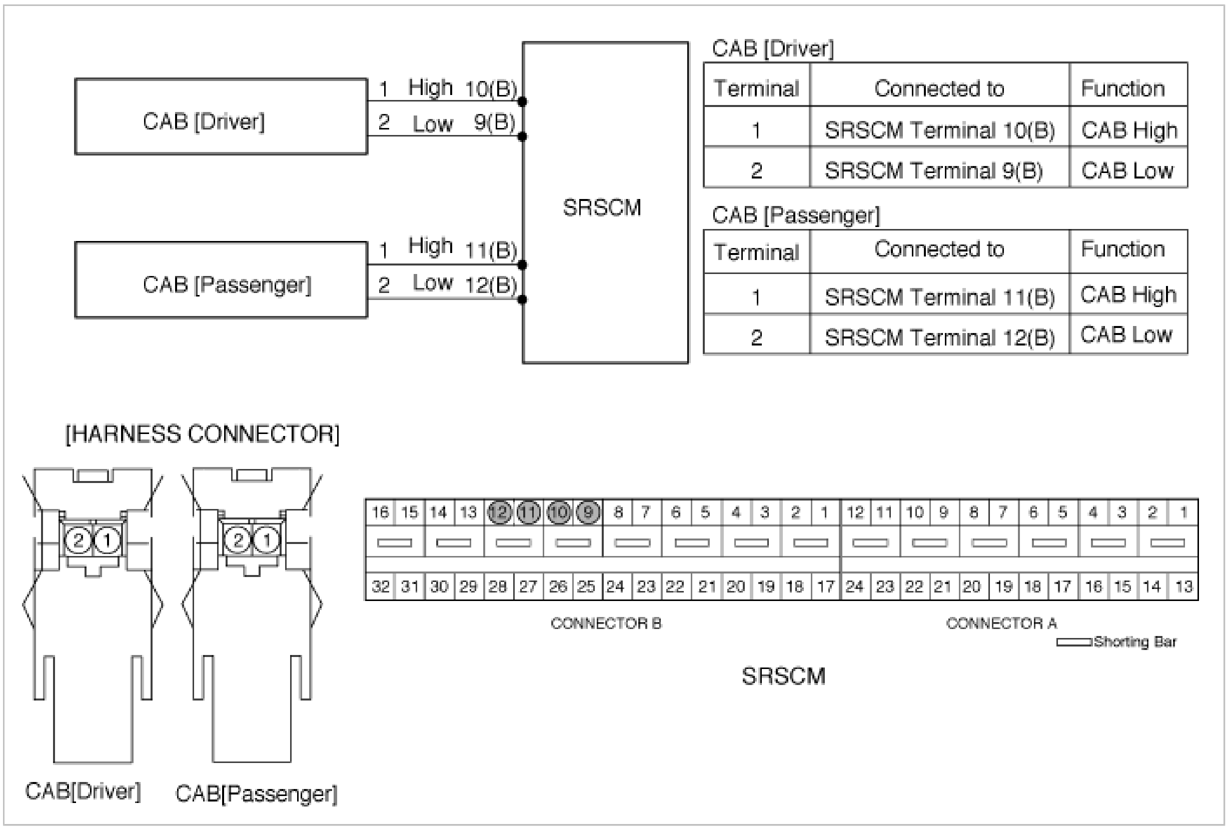
DTC Description

The CAB squib circuit consists of the SRSCM and CAB.It causes the SRS to deploy when the SRS deployment conditions are satisfied.The above DTC is recorded when short to ground is detected in the CAB squib circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1475 B1479	• Short to ground between CAB and SRSCM • Curtain Airbag (CAB) Malfunction • SRSCM Malfunction	• Short to ground circuit on wiring harness • Curtain Airbag (CAB) squib • SRSCM

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

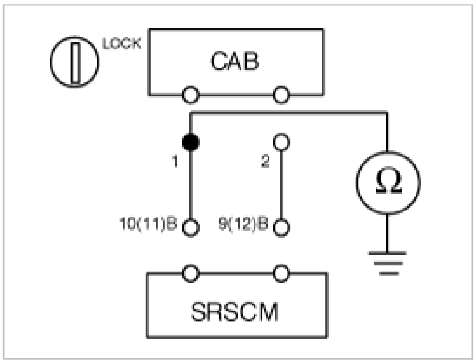
▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK SHORT TO GROUND
   (1) Measure resistance between the terminal 1 of CAB harness connector and chassis ground.

   specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸ Check the CAB Module.

NO

▸ Repair or replace the wiring harness between the CAB and the SRSCM.

3. CHECK THE CAB MODULE
   (1) Replace the Curtain Airbag(CAB) with a new one.
      ● Refer to "Curtain Airbag(CAB)" section in this SERVICE MANUAL.
   (2) Install the DAB module and connect the DAB connector.
   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (4) Connect the SRSCM connector.
   (5) Connect the negative (-) terminal to the battery.
   (6) Connect a Hi-Scan(Pro) to the data link connector.
   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to Curtain Airbag(CAB)?

YES

▸ Go to next step.

NO

▸ Replace CAB module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON .
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1480

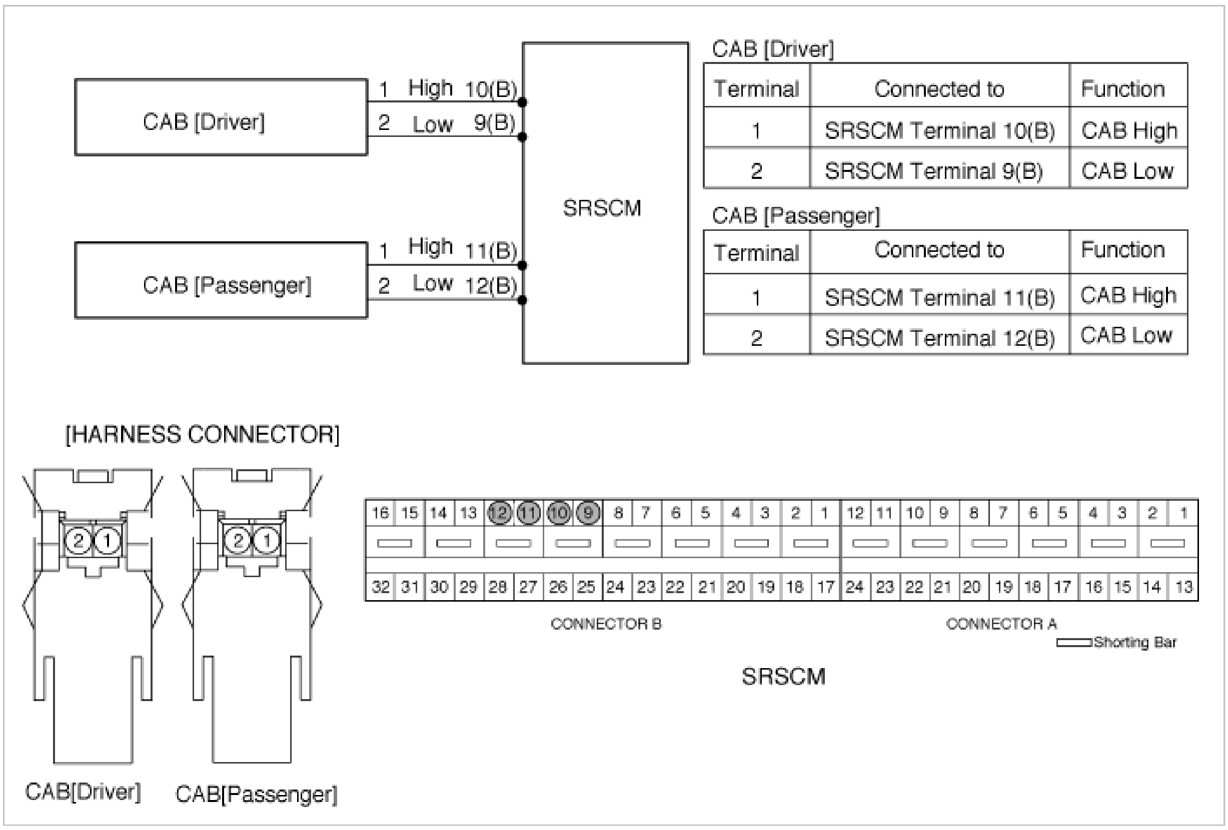
DTC Description

The CAB squib circuit consists of the SRSCM and CAB.It causes the SRS to deploy when the SRS deployment conditions are satisfied.The above DTC is recorded when short to battery is detected in the CAB squib circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1476 B1480	• Short to battery between CAB and SRSCM • Curtain Airbag (CAB) Malfunction • SRSCM Malfunction	• Short to battery line circuit on wiring harness • Curtain Airbag (CAB) squib • SRSCM

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

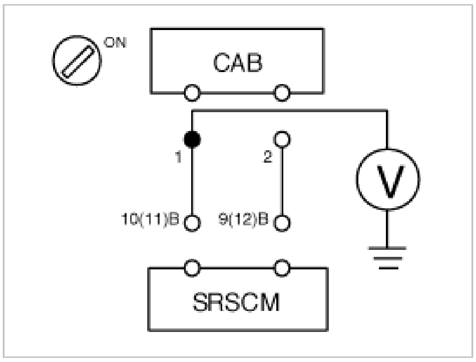
YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SHORT TO BATTERY LINE
   (1) Connect the negative (-) terminal to the battery.
   (2) Turn the ignition switch to ON.
   (3) Measure voltage between the terminal 1 of CAB harness connector and chassis ground(-).

specification(voltage) : Approximately 0 V



Is the measured voltage within specification?

YES

▸ Check the CAB Module.

NO

▸ Repair the short to battery line circuit on wiring harness between the CAB and the SRSCM.

3. CHECK THE CAB MODULE
   (1) Replace the Curtain Airbag(CAB) with a new one.
   - Refer to "Curtain Airbag(CAB)" section in this SERVICE MANUAL.

   (2) Install the DAB module and connect the DAB connector.
   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (4) Connect the SRSCM connector.
   (5) Connect the negative (-) terminal to the battery.
   (6) Connect a Hi-Scan(Pro) to the data link connector.
   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to Curtain Airbag(CAB)?

YES

▸ Go to next step.

NO

▸ Replace CAB module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON .

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1481

DTC Description

The Driver Airbag circuit consists of the SRSCM, Clockspring and the Driver Airbag (DAB) which has two squib circuits. The SRSCM sets above DTC(s) if it detects that the resistance of DAB squib is too high or low.

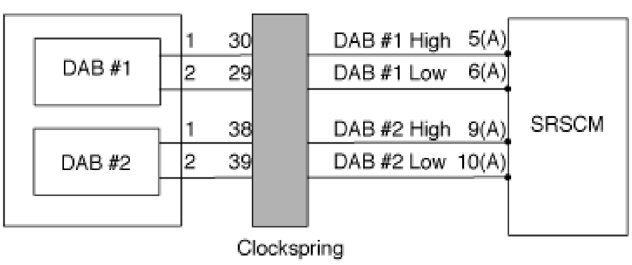
DTC Detecting Condition

DTC	Condition	Probable cause
B1481 B1482	• Too high or low resistance between DAB high(+) and DAB low (-) • Driver Airbag (DAB) Malfunction • Clockspring Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Driver Airbag (DAB) squib • Clockspring • SRSCM

Specification

DAB resistance : 1.9 ≤ R ≤ 3.0 Ω

Schematic Diagram



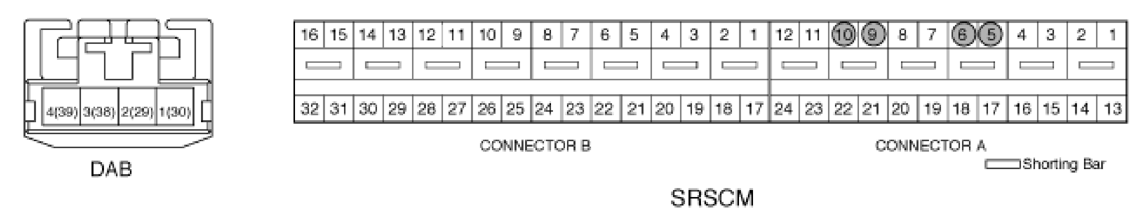
DAB #1

Pin	Connected to	Function
1	SRSCM terminal 5(A)	DAB #1 High
2	SRSCM terminal 6(A)	DAB #1 Low

DAB #2

Pin	Connected to	Function
1	SRSCM terminal 9(A)	DAB #2 High
2	SRSCM terminal 10(A)	DAB #2 Low

[HARNESS CONNECTOR]



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> CAUTION
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

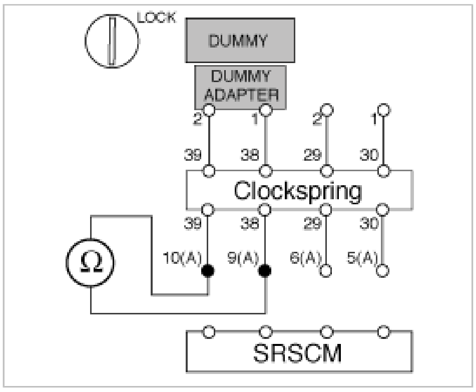
1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK DAB RESISTANCE

> CAUTION
>
> Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

   (1) Connect the Dummy and the Dummy Adapter on DAB harness connector.
   ●Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.
   (2) Measure resistance between the terminal 9(A) and 10(A) of SRSCM harness connector.

DAB resistance : 1.9 ≤ R ≤ 3.0 Ω



   (3) Is the measured resistance within specification?

NO

▸ Check open circuit.

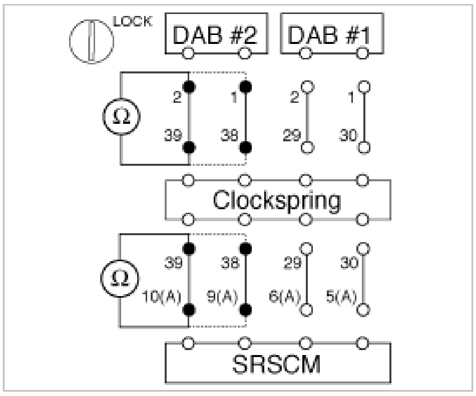
YES

▸ Replace the Driver Airbag(DAB) module.

3. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 1 of DAB stage #2 harness connector and the terminal 30 of Clockspring harness connector.
   (2) Measure resistance between the terminal 2 of DAB stage #2 harness connector and the terminal 29 of Clockspring harness connector.
   (3) Measure resistance between the terminal 38 of Clockspring harness connector and the terminal 9 of SRSCM harness connector(A).

(4) Measure resistance between the terminal 39 of Clockspring harness connector and the terminal 10 of SRSCM harness connector(A).

specification(resistance) : below 1 Ω



(5) Is the measured resistance within specification?

YES

▸ Check short circuit.

NO

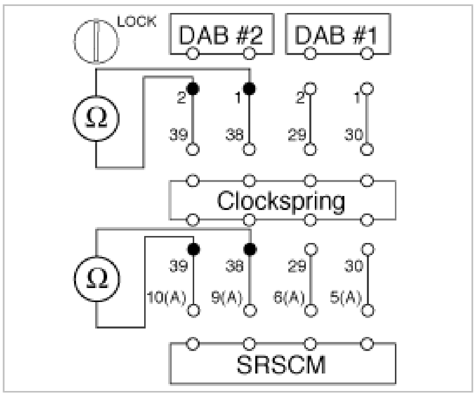
▸ Repair or replace the wiring harness between the DAB and the clockspring or between the clockspring and the SRSCM.

4. CHECK SHORT CIRCUIT

(1) Measure resistance between the terminal 1 and 2 of DAB stage #2 harness connector.

(2) Measure resistance between the terminal 38 and 39 of Clockspring harness connector.

specification(resistance) : ∞ Ω



(3) Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair or replace the wiring harness between the DAB and the clockspring or between the clockspring and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON .

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1482

DTC Description

The Driver Airbag circuit consists of the SRSCM, Clockspring and the Driver Airbag (DAB) which has two squib circuits. The SRSCM sets above DTC(s) if it detects that the resistance of DAB squib is too high or low.

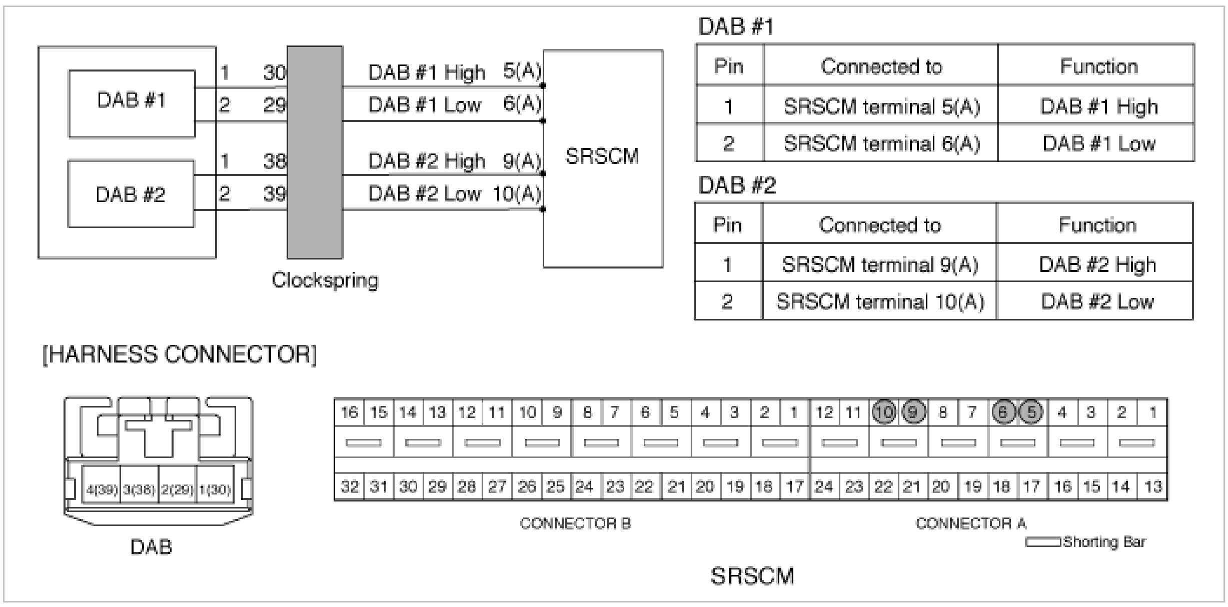
DTC Detecting Condition

DTC	Condition	Probable cause
B1481 B1482	• Too high or low resistance between DAB high(+) and DAB low (-) • Driver Airbag (DAB) Malfunction • Clockspring Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Driver Airbag (DAB) squib • Clockspring • SRSCM

Specification

DAB resistance : 1.9 ≤ R ≤ 3.0 Ω

Schematic Diagram



DAB #1

Pin	Connected to	Function
1	SRSCM terminal 5(A)	DAB #1 High
2	SRSCM terminal 6(A)	DAB #1 Low

DAB #2

Pin	Connected to	Function
1	SRSCM terminal 9(A)	DAB #2 High
2	SRSCM terminal 10(A)	DAB #2 Low

Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

CAUTION

Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

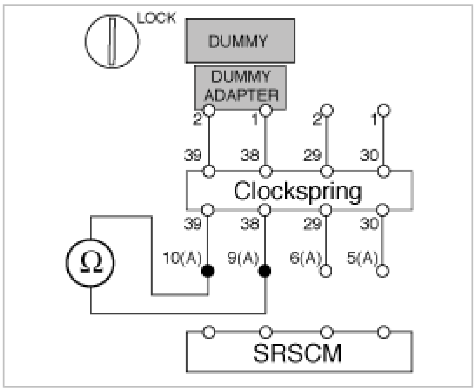
1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK DAB RESISTANCE

> **CAUTION**
>
> Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

   (1) Connect the Dummy and the Dummy Adapter on DAB harness connector.
   ●Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.
   (2) Measure resistance between the terminal 9(A) and 10(A) of SRSCM harness connector.

DAB resistance : 1.9 ≤ R ≤ 3.0 Ω



   (3) Is the measured resistance within specification?

NO

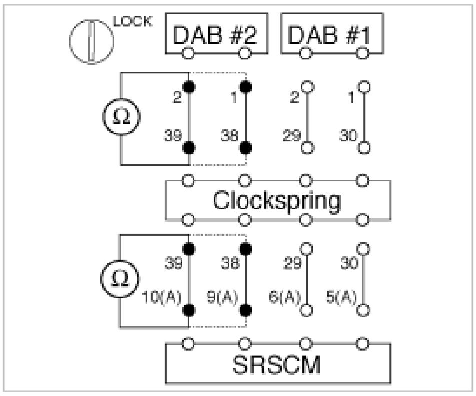
▸ Check open circuit.

YES

▸ Replace the Driver Airbag(DAB) module.

3. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 1 of DAB stage #2 harness connector and the terminal 30 of Clockspring harness connector.
   (2) Measure resistance between the terminal 2 of DAB stage #2 harness connector and the terminal 29 of Clockspring harness connector.
   (3) Measure resistance between the terminal 38 of Clockspring harness connector and the terminal 9 of SRSCM harness connector(A).
   (4) Measure resistance between the terminal 39 of Clockspring harness connector and the terminal 10 of SRSCM harness connector(A).

specification(resistance) : below 1 Ω



(5) Is the measured resistance within specification?

YES

▸ Check short circuit.

NO

▸ Repair or replace the wiring harness between the DAB and the clockspring or between the clockspring and the SRSCM.

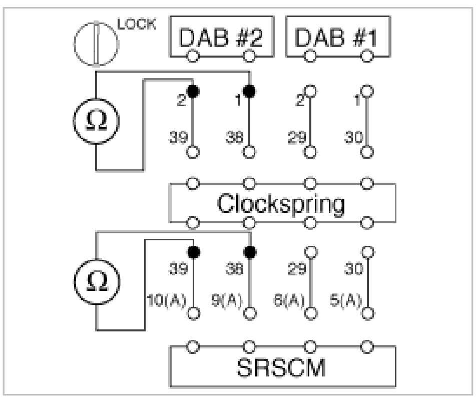
4. CHECK SHORT CIRCUIT

(1) Measure resistance between the terminal 1 and 2 of DAB stage #2 harness connector.

(2) Measure resistance between the terminal 38 and 39 of Clockspring harness connector.

---

specification(resistance) : ∞ Ω



(3) Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair or replace the wiring harness between the DAB and the clockspring or between the clockspring and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON .

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▶Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1483

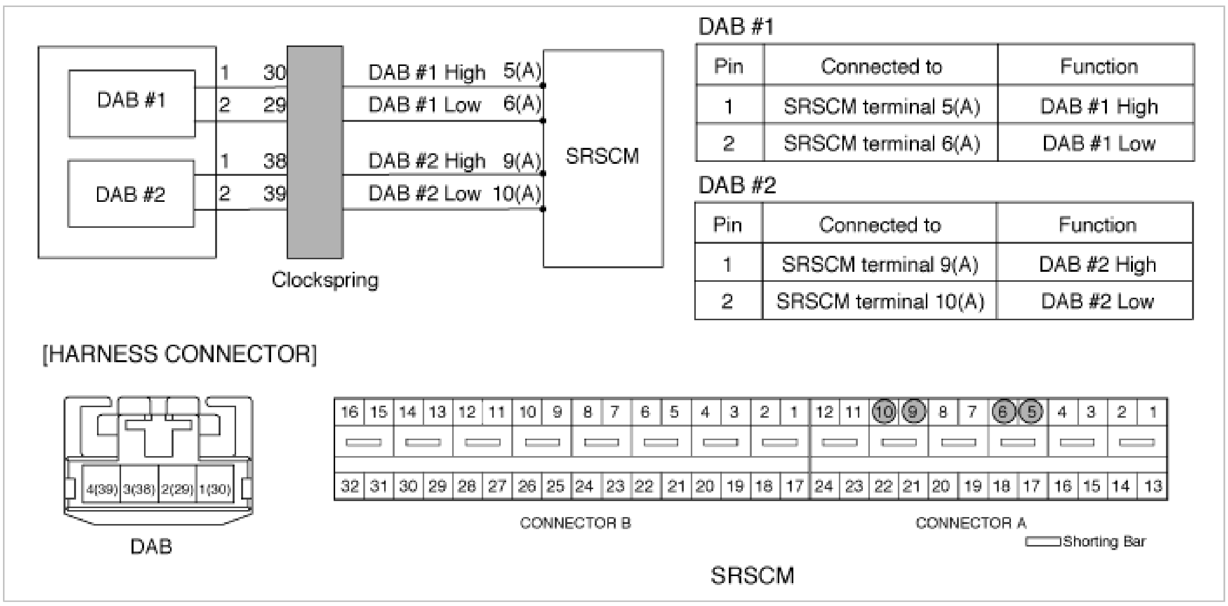
DTC Description

The Driver Airbag circuit consists of the SRSCM, Clockspring and the Driver Airbag (DAB) which has two squib circuits. The SRSCM sets above DTC(s) if it detects short to ground on the DAB circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1348 B1483	• Short to ground between DAB and clockspring • Short to ground between clockspring and SRSCM • Driver Airbag (DAB) Malfunction • Clockspring Malfunction • SRSCM Malfunction	• Short to ground circuit on wiring harness • Driver Airbag (DAB) squib • Clockspring • SRSCM

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▶ Go to next step.

YES

▶ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.

(3) Remove the DAB module and disconnect the DAB connector.

(4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

2. CHECK SHORT TO GROUND

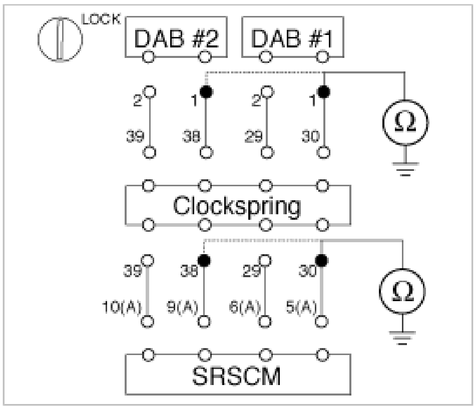
(1) Measure resistance between the terminal 1 of DAB stage #1 harness connector and chassis ground.(DAB stage #1)

(2) Measure resistance between the terminal 1 of DAB stage #2 harness connector and chassis ground.(DAB stage #2)

(3) Measure resistance between the terminal 30 of clockspring harness connector and chassis ground.(DAB stage #1)

(4) Measure resistance between the terminal 38 of clockspring harness connector and chassis ground.(DAB stage #2)

specification(resistance) : infinite



(5) Is the measured resistance within specification?

YES

▸Check the DAB Module.

NO

▸ Repair or replace the wiring harness between the DAB and the clockspring or between the clockspring and the SRSCM.

3. CHECK THE DAB MODULE

(1) Replace the Driver Airbag(DAB) with a new one.

● Refer to "Driver Airbag(DAB)" section in this SERVICE MANUAL.

(2) Install the DAB module and connect the DAB connector.

(3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal to the battery.

(6) Connect a Hi-Scan(Pro) to the data link connector.

(7) Turn the ignition switch to ON and check the vehicle again.
Does Hi-Scan (Pro) indicate any DTC related to DAB?

YES

▸Check the clockspring.

NO

▸Replace the Driver Airbag(DAB).

4. CHECK THE CLOCKSPRING

(1) Check the clockspring.
Is the clockspring normal?

YES

▸ Go to next step.

NO

▸ Replace the clockspring.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1484

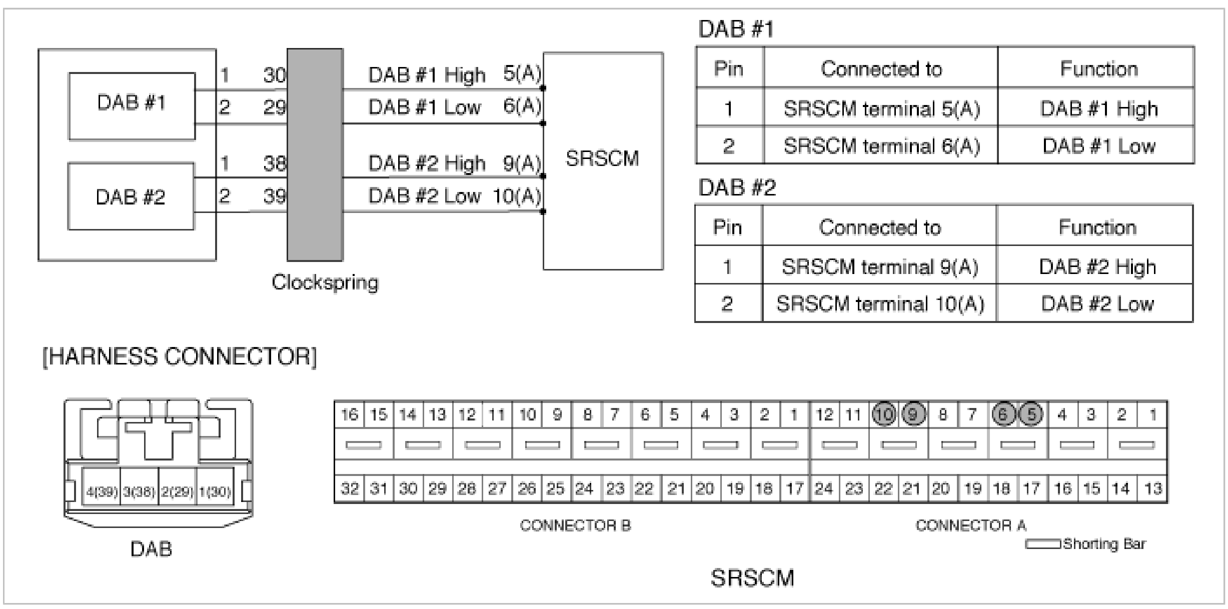
DTC Description

The Driver Airbag circuit consists of the SRSCM, Clockspring and the Driver Airbag (DAB) which has two squib circuits. The SRSCM sets above DTC(s) if it detects short to battery line on the DAB circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1349 B1484	• Short to battery line between DAB and clockspring • Short to battery line between clockspring and SRSCM • Driver Airbag (DAB) Malfunction • Clockspring Malfunction • SRSCM Malfunction	• Short to battery line on wiring harness • Driver Airbag (DAB) squib • Clockspring • SRSCM

Schematic Diagram



DAB #1

Pin	Connected to	Function
1	SRSCM terminal 5(A)	DAB #1 High
2	SRSCM terminal 6(A)	DAB #1 Low

DAB #2

Pin	Connected to	Function
1	SRSCM terminal 9(A)	DAB #2 High
2	SRSCM terminal 10(A)	DAB #2 Low

Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.

2. Inspect terminals for damage and corrosion.

CAUTION

Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

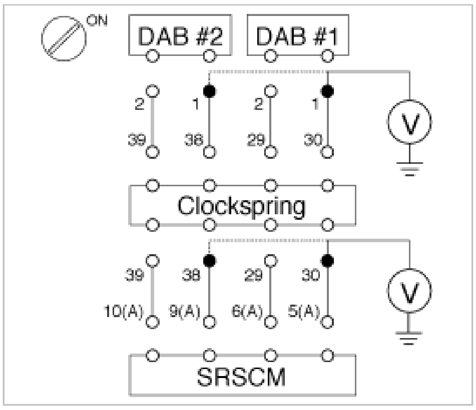
YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB,SAB,CAB,BPT,BUPT,FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SHORT TO BATTERY LINE
   (1) Connect the negative (-) terminal to the battery.
   (2) Turn the ignition switch to ON.
   (3) Measure voltage between the terminal 1 of DAB stage #1 harness connector and chassis ground(-).(DAB stage #1)
   (4) Measure voltage between the terminal 1 of DAB stage #2 harness connector and chassis ground(-).(DAB stage #2)
   (5) Measure voltage between the terminal 30 of clockspring harness connector and chassis ground(-).(DAB stage #1)
   (6) Measure voltage between the terminal 38 of clockspring harness connector and chassis ground(-).(DAB stage #2)

specification(voltage) : Approximately 0 V



Is the measured voltage within specification?

YES

▸Check the DAB module.

NO

▸ Repair or replace the wiring harness between the DAB and the clockspring or between the clockspring and the SRSCM.

3. CHECK THE DAB MODULE
   (1) Replace the Driver Airbag(DAB) with a new one.
   - "Refer to "Driver Airbag(DAB)" section in this SERVICE MANUAL.

   (2) Install the DAB module and connect the DAB connector.
   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (4) Connect the SRSCM connector.
   (5) Connect the negative (-) terminal to the battery.
   (6) Connect a Hi-Scan(Pro) to the data link connector.

(7) Turn the ignition switch to ON and check the vehicle again.
Does Hi-Scan (Pro) indicate any DTC related to DAB?

YES

▸Check the clockspring.

NO

▸Replace the Driver Airbag(DAB).

4. CHECK THE CLOCKSPRING

(1) Check the clockspring.
Is the clockspring normal?

YES

▸ Go to next step.

NO

▸ Replace the clockspring.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON.

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1485

DTC Description

The Passenger Airbag circuit consists of the SRSCM and the Passenger Airbag (PAB) which has two squib circuits. The SRSCM sets above DTC(s) if it detects that the resistance of PAB squib is too high or low.

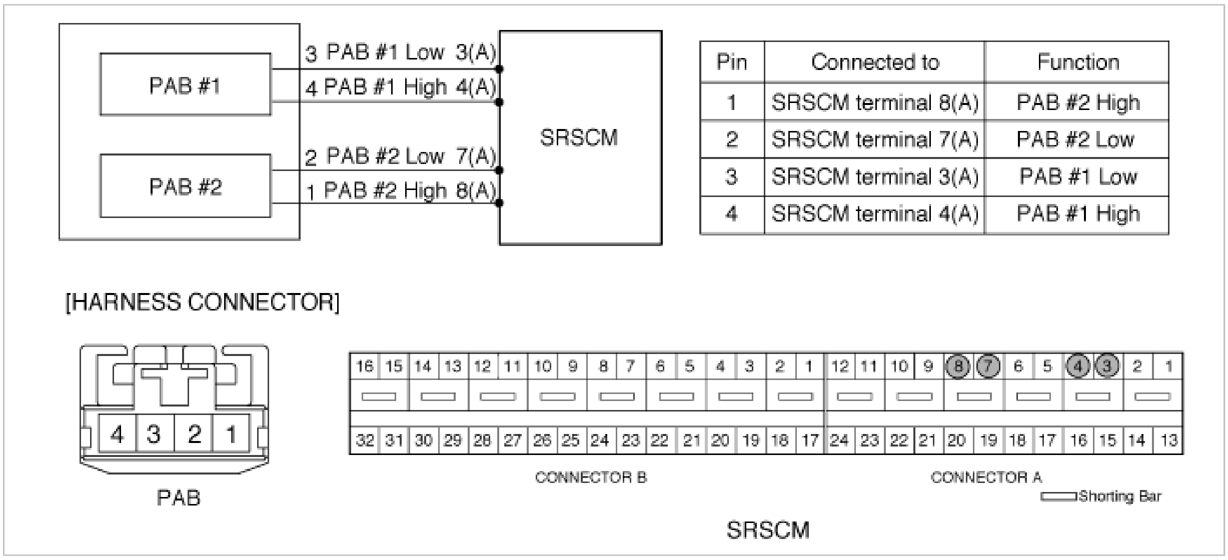
DTC Detecting Condition

DTC	Condition	Probable cause
B1485 B1486	• Too high or low resistance between PAB high(+) and PAB low (-) • Passenger Airbag (PAB) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Passenger Airbag (PAB) squib • SRSCM

Specification

PAB resistance : 1.8 ≤ R ≤ 2.4 Ω

Schematic Diagram



Pin	Connected to	Function
1	SRSCM terminal 8(A)	PAB #2 High
2	SRSCM terminal 7(A)	PAB #2 Low
3	SRSCM terminal 3(A)	PAB #1 Low
4	SRSCM terminal 4(A)	PAB #1 High

Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

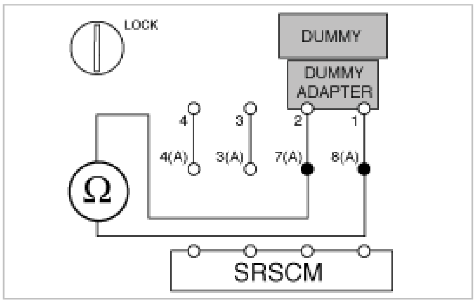
1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK PAB RESISTANCE

> **CAUTION**
> Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

   (1) Connect the Dummy and the Dummy Adapter on PAB harness connector.
   - Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

   (2) Measure resistance between the terminal 6 and 7 of SRSCM harness connector.

PAB resistance : $1.8 \leq R \leq 2.4\ \Omega$



(3) Is the measured resistance within specification?

YES

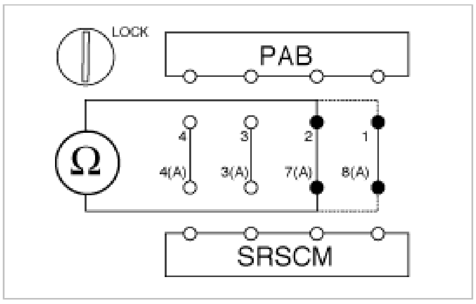
▸ Replace the Passenger Airbag(PAB) module.

NO

▸ Check open circuit.

3. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 1 of PAB harness connector and the terminal 8(A) of SRSCM harness connector.
   (2) Measure resistance between the terminal 2 of PAB harness connector and the terminal 7(A) of SRSCM harness connector.

specification(resistance) : below 1 Ω



(3) Is the measured resistance within specification?

YES

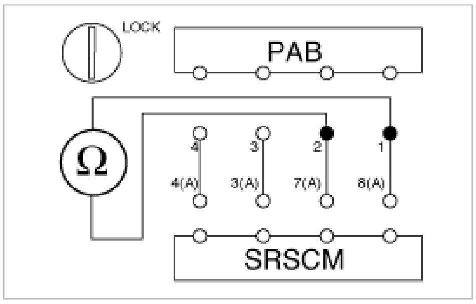
▸Check short circuit.

NO

▸Repair or replace the wiring harness between the PAB and the SRSCM.

4. CHECK SHORT CIRCUIT
   (1) Measure resistance between the terminal 1 and 2 of PAB harness connector.

specification(resistance) : infinite



(2) Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair or replace the wiring harness between the PAB and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON.

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1486

DTC Description

The Passenger Airbag circuit consists of the SRSCM and the Passenger Airbag (PAB) which has two squib circuits. The SRSCM sets above DTC(s) if it detects that the resistance of PAB squib is too high or low.

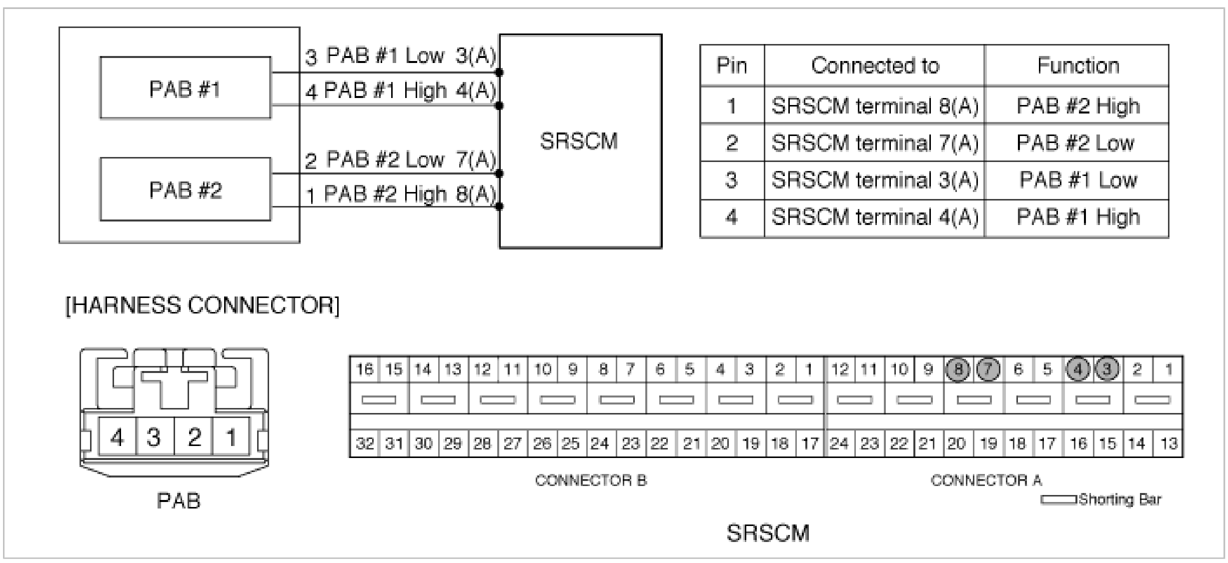
DTC Detecting Condition

DTC	Condition	Probable cause
B1485 B1486	• Too high or low resistance between PAB high(+) and PAB low (-) • Passenger Airbag (PAB) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Passenger Airbag (PAB) squib • SRSCM

Specification

PAB resistance : 1.8 ≤ R ≤ 2.4 Ω

Schematic Diagram



Pin	Connected to	Function
1	SRSCM terminal 8(A)	PAB #2 High
2	SRSCM terminal 7(A)	PAB #2 Low
3	SRSCM terminal 3(A)	PAB #1 Low
4	SRSCM terminal 4(A)	PAB #1 High

Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> CAUTION
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

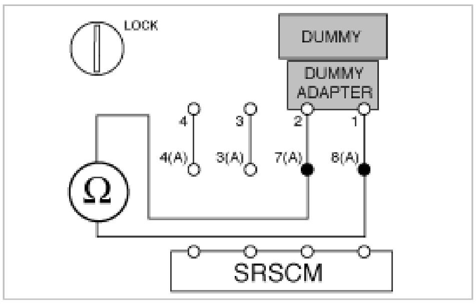
1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK PAB RESISTANCE

> CAUTION
>
> Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

   (1) Connect the Dummy and the Dummy Adapter on PAB harness connector.
   ● Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.
   (2) Measure resistance between the terminal 6 and 7 of SRSCM harness connector.

PAB resistance : $1.8 \leq R \leq 2.4\ \Omega$



   (3) Is the measured resistance within specification?

YES

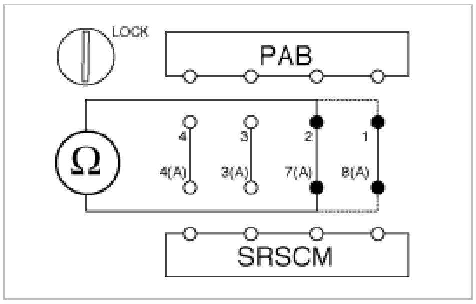
▸ Replace the Passenger Airbag(PAB) module.

NO

▸ Check open circuit.

3. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 1 of PAB harness connector and the terminal 8(A) of SRSCM harness connector.
   (2) Measure resistance between the terminal 2 of PAB harness connector and the terminal 7(A) of SRSCM harness connector.

specification(resistance) : below 1 Ω



(3) Is the measured resistance within specification?

YES

▸Check short circuit.

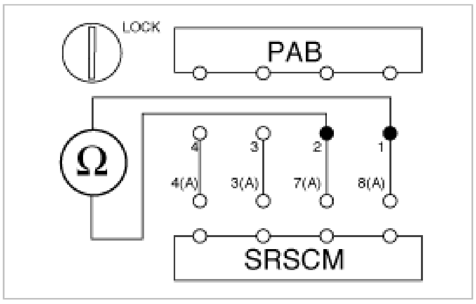
NO

▸Repair or replace the wiring harness between the PAB and the SRSCM.

4. CHECK SHORT CIRCUIT

(1) Measure resistance between the terminal 1 and 2 of PAB harness connector.

specification(resistance) : infinite



(2) Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair or replace the wiring harness between the PAB and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON.

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1487

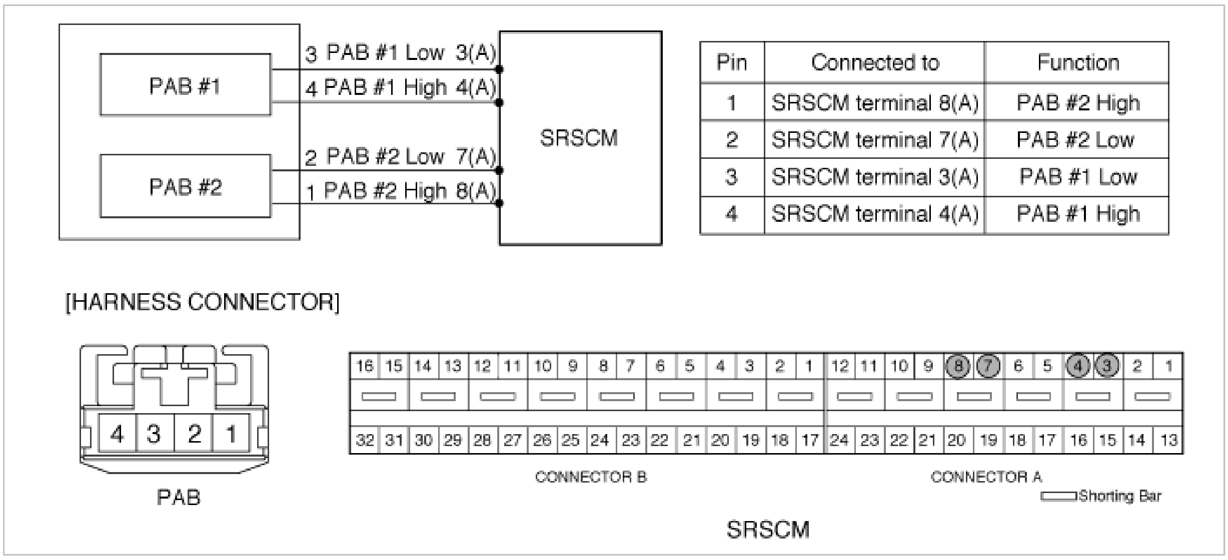
DTC Description

The Passenger Airbag circuit consists of the SRSCM and the Passenger Airbag (PAB) which has two squib circuits. The SRSCM sets above DTC(s) if it detects short to ground on the PAB circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1354 B1487	• Short to ground between PAB module and SRSCM • Passenger Airbag (PAB) Malfunction • SRSCM Malfunction	• Short to ground on wiring harness • Passenger Airbag (PAB) squib • SRSCM

Schematic Diagram



Pin	Connected to	Function
1	SRSCM terminal 8(A)	PAB #2 High
2	SRSCM terminal 7(A)	PAB #2 Low
3	SRSCM terminal 3(A)	PAB #1 Low
4	SRSCM terminal 4(A)	PAB #1 High

Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

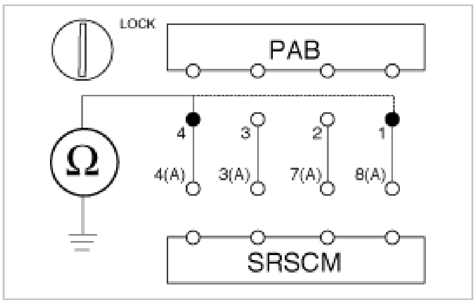
▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SHORT TO GROUND
   (1) Measure resistance between the terminal 4 of PAB harness connector and chassis ground.(PAB stage #1)

(2) Measure resistance between the terminal 1 of PAB harness connector and chassis ground.(PAB stage #2)

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸ Check the PAB Module.

NO

▸ Repair or replace the wiring harness between the PAB and the SRSCM.

3. CHECK THE PAB MODULE
   (1) Replace the Passenger Airbag (PAB) with a new one.
   - Refer to "Passenger Airbag (PAB)" section in this SERVICE MANUAL.

   (2) Install the DAB module and connect the DAB connector.

   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (4) Connect the SRSCM connector.

   (5) Connect the negative (-) terminal to the battery.

   (6) Connect a Hi-Scan(Pro) to the data link connector.

   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to PAB?

YES

▸ Go to next step.

NO

▸Replace PAB module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.

   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (3) Connect the SRSCM connector.

   (4) Connect the negative (-) terminal to the battery.

   (5) Connect a Hi-Scan(Pro) to the data link connector.

   (6) Turn the ignition switch to ON .

   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

   (9) Turn the ignition switch to ON and wait for at least 30 seconds.

   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1488

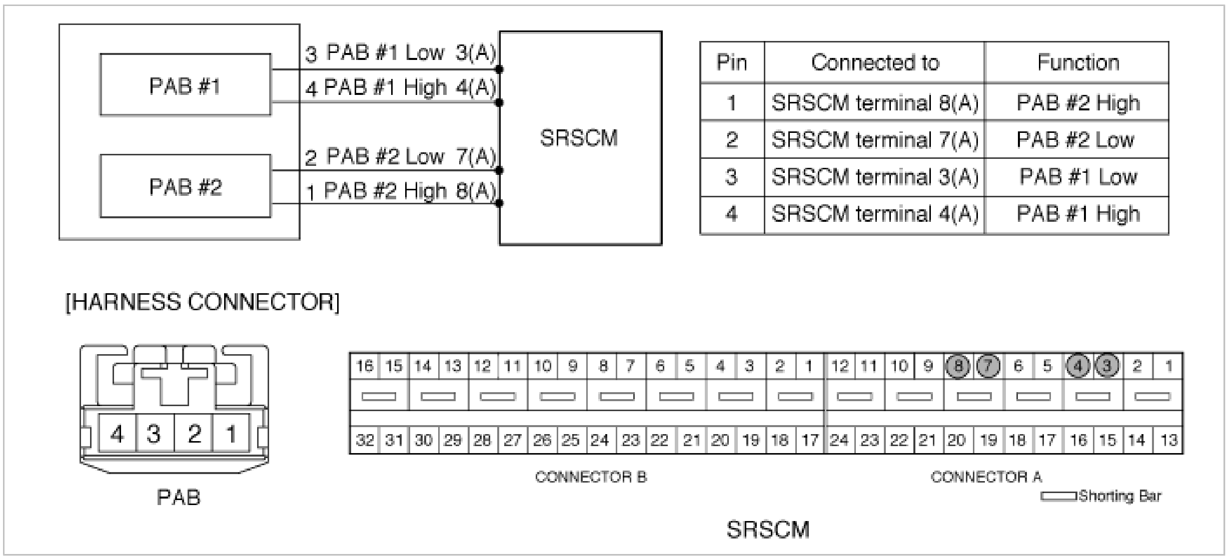
DTC Description

The Passenger Airbag circuit consists of the SRSCM and the Passenger Airbag (PAB) which has two squib circuits.The SRSCM sets above DTC(s) if it detects short to battery line on the PAB circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1355 B1488	• Short to battery line between PAB and SRSCM • Passenger Airbag (PAB) Malfunction • SRSCM Malfunction	• Short to battery line circuit on wiring harness • Passenger Airbag (PAB) squib • SRSCM

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

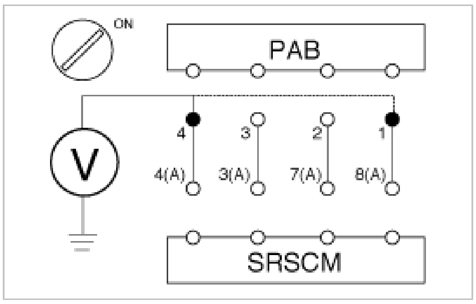
Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SHORT TO BATTERY LINE
   (1) Connect the negative (-) terminal to the battery.
   (2) Turn the ignition switch to ON.

(3) Measure voltage between the terminal 4 of PAB harness connector and chassis ground(-).(PAB stage #1)

(4) Measure voltage between the terminal 1 of PAB harness connector and chassis ground(-).(PAB stage #2)

specification(voltage) : Approximately 0 V



Is the measured voltage within specification?

YES

▸ Check the PAB Module.

NO

▸ Repair the short to battery line circuit on wiring harness between the PAB and the SRSCM.

3. CHECK THE PAB MODULE
   (1) Replace the Passenger Airbag(PAB) with a new one.
   - Refer to "Passenger Airbag(PAB)" section in this SERVICE MANUAL.

   (2) Install the DAB module and connect the DAB connector.

   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (4) Connect the SRSCM connector.

   (5) Connect the negative (-) terminal to the battery.

   (6) Connect a Hi-Scan(Pro) to the data link connector.

   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to PAB?

   YES

   ▸ Go to next step.

   NO

   ▸Replace PAB module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.

   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (3) Connect the SRSCM connector.

   (4) Connect the negative (-) terminal to the battery.

   (5) Connect a Hi-Scan(Pro) to the data link connector.

   (6) Turn the ignition switch to ON.

   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

   (9) Turn the ignition switch to ON and wait for at least 30 seconds.

   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1511

DTC Description

The Seat Belt Buckle Switch (BS) circuit consists of the SRSCM and two BS. The SRSCM sets above DTC(s) if it detects open or short to battery line on the BS circuit. This system decides whether the driver or passenger seat belt is locked or not.

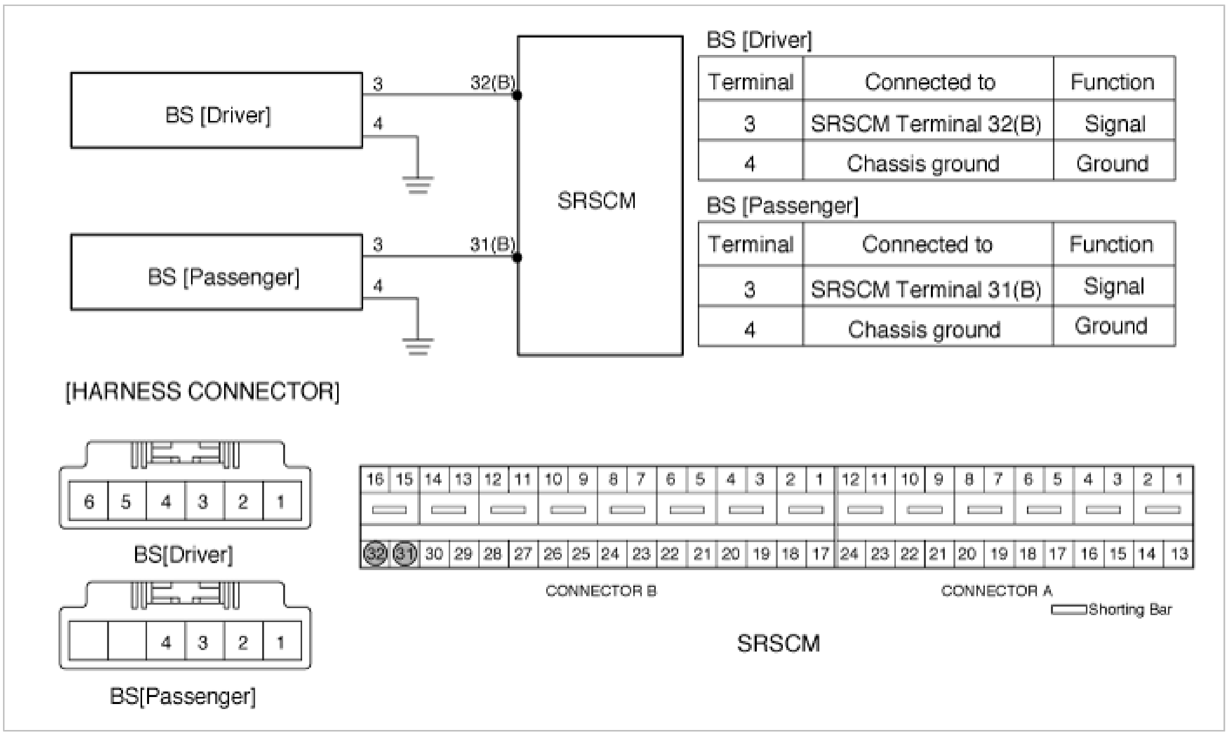
DTC Detecting Condition

DTC	Condition	Probable cause
B1511 B1513	• Open between BS and SRSCM (Current I < 2.98 mA). • Short to battery line between BS and SRSCM (Current I < 2.98 mA) • Seat Belt Buckle Switch (BS) Malfunction • SRSCM Malfunction	• Open or short to battery line circuit on wiring harness • Seat Belt Buckle Switch (BS) • SRSCM

Specification

Open/Short to Battery	Grey Zone	Unbuckled	Grey Zone	Defect	Grey Zone	Buckled	Grey Zone	Short/Shortto ground
< 2.98 mA	2.98 - 3.6 mA	3.6 - 7.4 mA	7.4 - 8.9 mA	8.9 - 9.7 mA	9.7 - 11.7 mA	11.7 - 18.3 mA	18.3 - 22.0 mA	> 22.0 mA

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> CAUTION
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

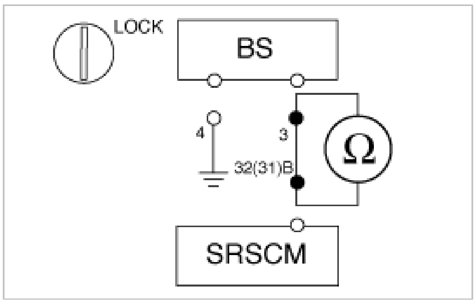
YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK OPEN CIRCUIT
   (1) Disconnect the BS connector.
   (2) Measure resistance between the terminal 3 of BS harness connector and the terminal 32(31) of SRSCM harness connector (B).

   specification(Resistance) : below 1 Ω



   (3) Is the measured resistance within specification?

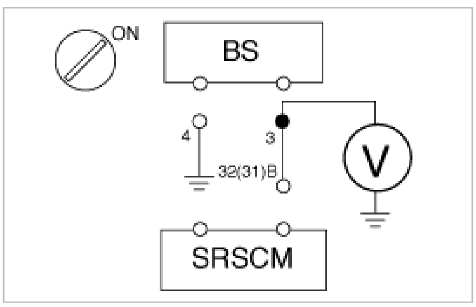
   YES

   ▸ Go to next step.

   NO

   ▸ Repair or replace the wiring harness between the BS and the SRSCM.
3. CHECK SHORT TO BATTERY LINE
   (1) Connect the negative (-) terminal to the battery.
   (2) Turn the ignition switch to ON.
   (3) Measure voltage between the terminal 3 of BS harness connector and chassis ground(-).

   specification(voltage) : Approximately 0 V



   (4) Is the measured voltage within specification?

   YES

   ▸ Check the Seat belt buckle switch(BS).

   NO

   ▸ Repair the short to battery line circuit on wiring harness between the BS and the SRSCM.
4. CHECK THE SEAT BELT BUCKLE SWITCH (BS)
   (1) Measure current between the terminal 3 of BS and 32(31) of SRSCM harness connector(B).

specification(current) : 12 ~ 18 mA (Buckled status) , 4 ~ 7 mA (Unbuckled status)

(2) Is the wiring harness normal?

YES

▸ Go to next stop.

NO

▸ Replace the BS.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON .
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1512

DTC Description

The Seat Belt Buckle Switch (BS) circuit consists of the SRSCM and two BS. The SRSCM sets above DTC(s) if it detects short or short to ground on the BS circuit. This system decides whether the driver or passenger seat belt is locked or not.

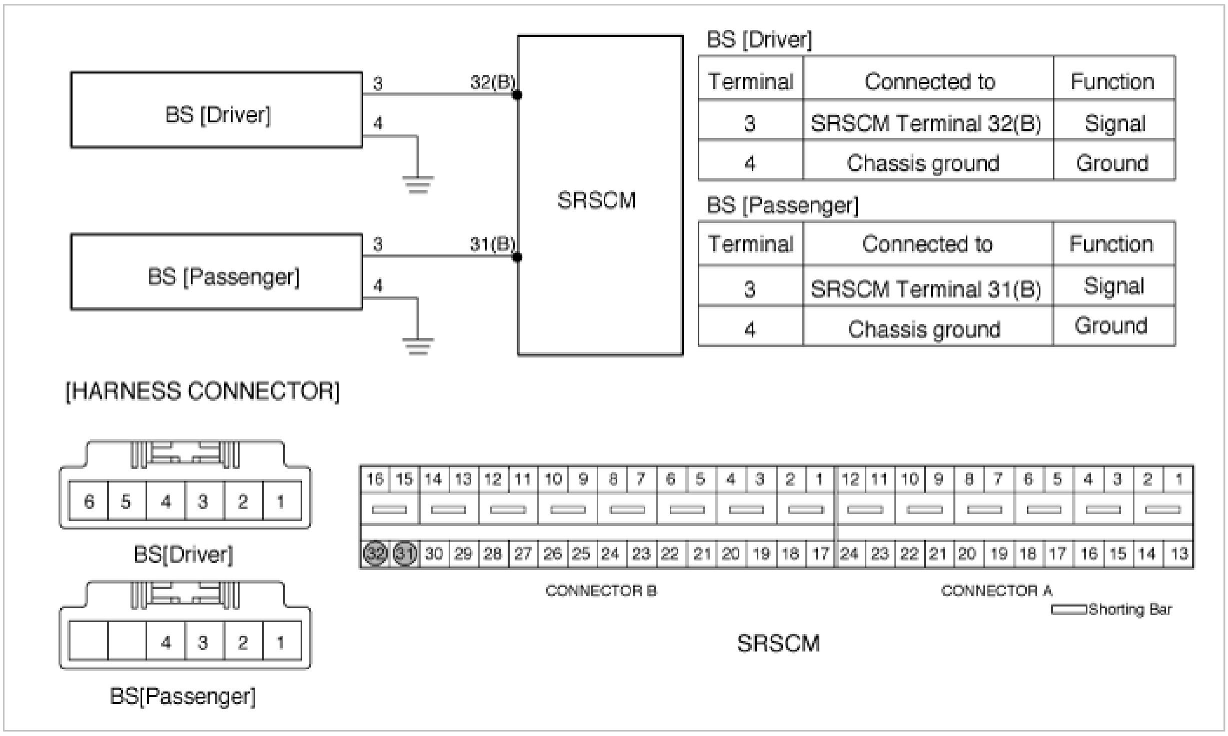
DTC Detecting Condition

DTC	Condition	Probable cause
B1512 B1514	• Short or Short to ground between BS and SRSCM (Current I < 22.0 mA) • Seat Belt Buckle Switch (BS) Malfunction • SRSCM Malfunction	• short or short to ground circuit on wiring harness • Seat Belt Buckle Switch (BS) • SRSCM

Specification

Open/Short to Battery	Grey Zone	Unbuckled	Grey Zone	Defect	Grey Zone	Buckled	Grey Zone	Short/Shortto ground
< 2.98 mA	2.98 - 3.6 mA	3.6 - 7.4 mA	7.4 - 8.9 mA	8.9 - 9.7 mA	9.7 - 11.7 mA	11.7 - 18.3 mA	18.3 - 22.0 mA	> 22.0 mA

Schematic Diagram



BS [Driver]

Terminal	Connected to	Function
3	SRSCM Terminal 32(B)	Signal
4	Chassis ground	Ground

BS [Passenger]

Terminal	Connected to	Function
3	SRSCM Terminal 31(B)	Signal
4	Chassis ground	Ground

Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

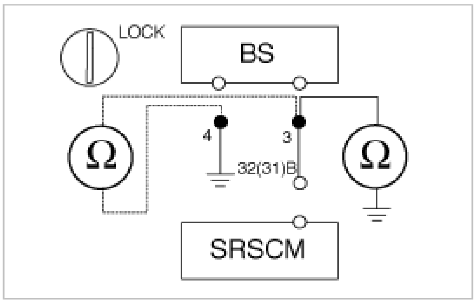
YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SHORT OR SHORT TO GROUND
   (1) Disconnect the BS connector.
   (2) Measure resistance between the terminal 3 of BS harness connector and chassis ground.
   (3) Measure resistance between the terminal 3 and 4 of BS harness connector.

   specification(Resistance) : Infinite



(4) Is the measured resistance within specification?

YES

(5) ▸ Go to next step.

NO

▸ Repair the short or short to ground circuit on wiring harness between the BS and the SRSCM.

3. CHECK THE SEAT BELT BUCKLE SWITCH (BS)

(1) Measure current between the terminal 3 of BS and 32(31) of SRSCM harness connector(B).

specification(current) : 12 ~ 18 mA (Buckled status) , 4 ~ 7 mA (Unbuckled status)

(2) Is the wiring harness normal?

YES

▸ Go to next stop.

NO

▸ Replace the BS.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON .

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1513

DTC Description

The Seat Belt Buckle Switch (BS) circuit consists of the SRSCM and two BS. The SRSCM sets above DTC(s) if it detects open or short to battery line on the BS circuit. This system decides whether the driver or passenger seat belt is locked or not.

DTC Detecting Condition

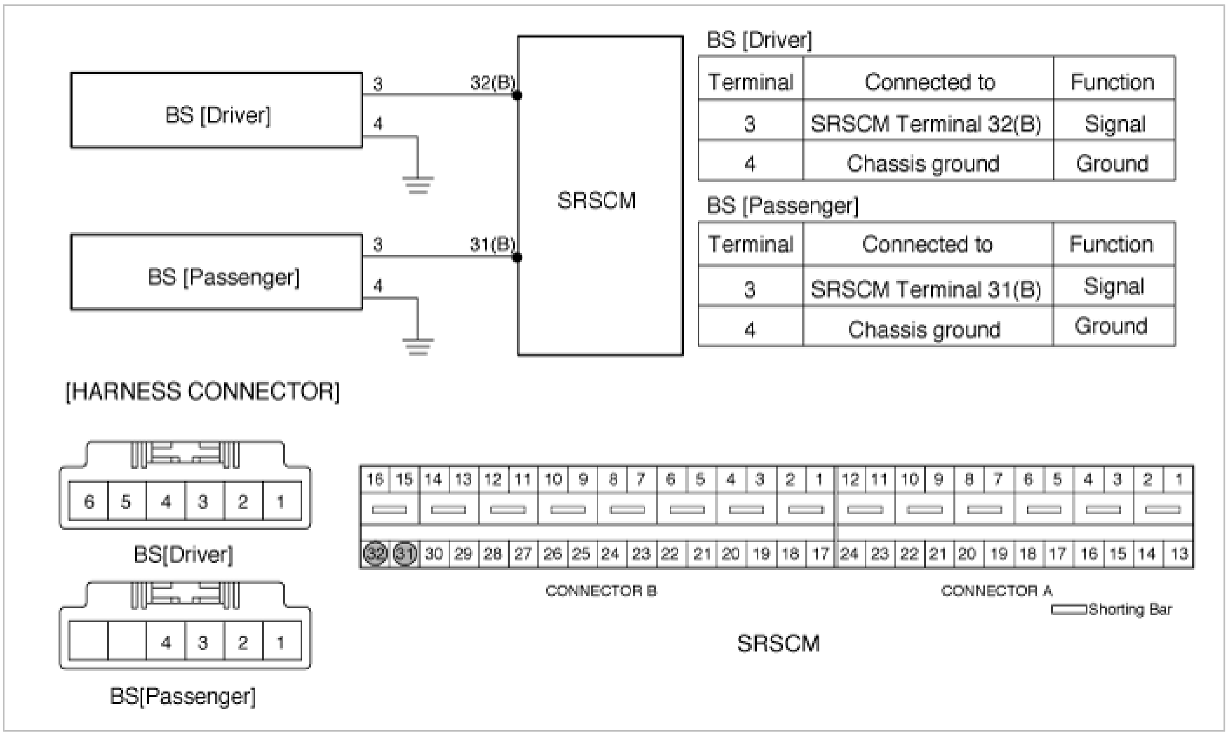
DTC	Condition	Probable cause
	• Open between BS and SRSCM (Current I < 2.98 mA).	• Open or short to battery line circuit on wiring

B1511 B1513	• Short to battery line between BS and SRSCM (Current I < 2.98 mA) • Seat Belt Buckle Switch (BS) Malfunction • SRSCM Malfunction	harness • Seat Belt Buckle Switch (BS) • SRSCM

Specification

Open/Short to Battery	Grey Zone	Unbuckled	Grey Zone	Defect	Grey Zone	Buckled	Grey Zone	Short/Shortto ground
< 2.98 mA	2.98 - 3.6 mA	3.6 - 7.4 mA	7.4 - 8.9 mA	8.9 - 9.7 mA	9.7 - 11.7 mA	11.7 - 18.3 mA	18.3 - 22.0 mA	> 22.0 mA

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.

(3) Remove the DAB module and disconnect the DAB connector.

(4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

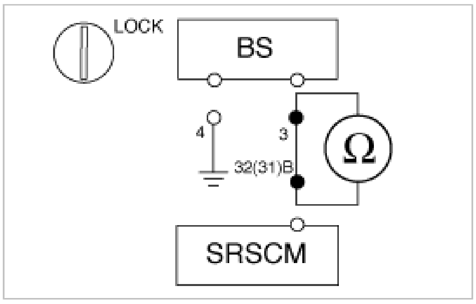
(5) Disconnect the SRSCM connector.

2. CHECK OPEN CIRCUIT

(1) Disconnect the BS connector.

(2) Measure resistance between the terminal 3 of BS harness connector and the terminal 32(31) of SRSCM harness connector (B).

specification(Resistance) : below 1 Ω



(3) Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair or replace the wiring harness between the BS and the SRSCM.

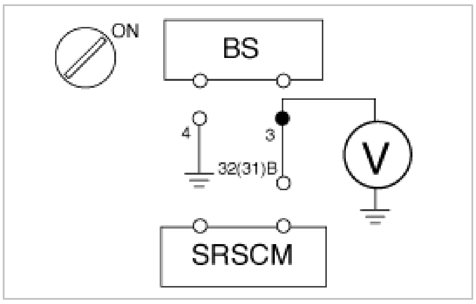
3. CHECK SHORT TO BATTERY LINE

(1) Connect the negative (-) terminal to the battery.

(2) Turn the ignition switch to ON.

(3) Measure voltage between the terminal 3 of BS harness connector and chassis ground(-).

specification(voltage) : Approximately 0 V



(4) Is the measured voltage within specification?

YES

▸ Check the Seat belt buckle switch(BS).

NO

▸ Repair the short to battery line circuit on wiring harness between the BS and the SRSCM.

4. CHECK THE SEAT BELT BUCKLE SWITCH (BS)

(1) Measure current between the terminal 3 of BS and 32(31) of SRSCM harness connector(B).

specification(current) : 12 ~ 18 mA (Buckled status) , 4 ~ 7 mA (Unbuckled status)

(2) Is the wiring harness normal?

YES

▸ Go to next stop.

NO

▸ Replace the BS.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
(1) Install the DAB module and connect the DAB connector.
(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
(3) Connect the SRSCM connector.
(4) Connect the negative (-) terminal to the battery.
(5) Connect a Hi-Scan(Pro) to the data link connector.
(6) Turn the ignition switch to ON .
(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
(9) Turn the ignition switch to ON and wait for at least 30 seconds.
(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1514

DTC Description

The Seat Belt Buckle Switch (BS) circuit consists of the SRSCM and two BS. The SRSCM sets above DTC(s) if it detects short or short to ground on the BS circuit. This system decides whether the driver or passenger seat belt is locked or not.

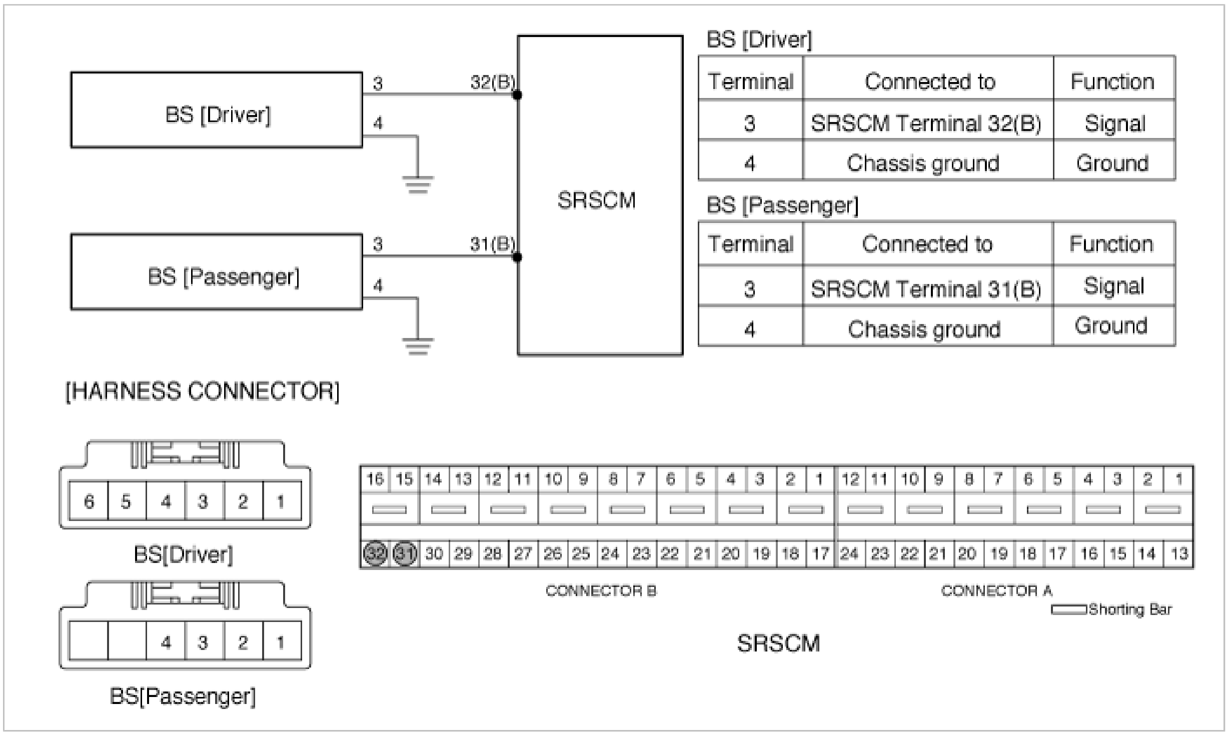
DTC Detecting Condition

DTC	Condition	Probable cause
B1512 B1514	• Short or Short to ground between BS and SRSCM (Current I < 22.0 mA) • Seat Belt Buckle Switch (BS) Malfunction • SRSCM Malfunction	• short or short to ground circuit on wiring harness • Seat Belt Buckle Switch (BS) • SRSCM

Specification

Open/Short to Battery	Grey Zone	Unbuckled	Grey Zone	Defect	Grey Zone	Buckled	Grey Zone	Short/Shortto ground
< 2.98 mA	2.98 - 3.6 mA	3.6 - 7.4 mA	7.4 - 8.9 mA	8.9 - 9.7 mA	9.7 - 11.7 mA	11.7 - 18.3 mA	18.3 - 22.0 mA	> 22.0 mA

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

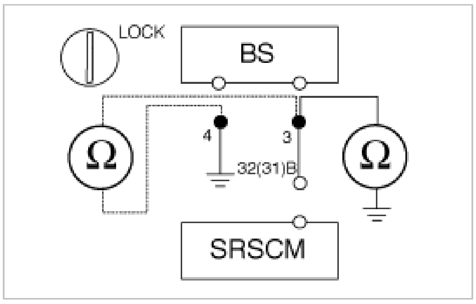
YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SHORT OR SHORT TO GROUND
   (1) Disconnect the BS connector.
   (2) Measure resistance between the terminal 3 of BS harness connector and chassis ground.
   (3) Measure resistance between the terminal 3 and 4 of BS harness connector.

specification(Resistance) : Infinite



(4) Is the measured resistance within specification?

YES

(5) ▸ Go to next step.

NO

▸ Repair the short or short to ground circuit on wiring harness between the BS and the SRSCM.

3. CHECK THE SEAT BELT BUCKLE SWITCH (BS)
   (1) Measure current between the terminal 3 of BS and 32(31) of SRSCM harness connector(B).

   specification(current) : 12 ~ 18 mA (Buckled status) , 4 ~ 7 mA (Unbuckled status)

   (2) Is the wiring harness normal?

   YES

   ▸ Go to next stop.

   NO

   ▸ Replace the BS.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON .
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1515

DTC Description

The Seat Belt Buckle Switch (BS) circuit consists of the SRSCM and two BS. The SRSCM sets above DTC(s) if it detects the BS faults. This system decides whether the driver or passenger seat belt is locked or not.

DTC Detecting Condition

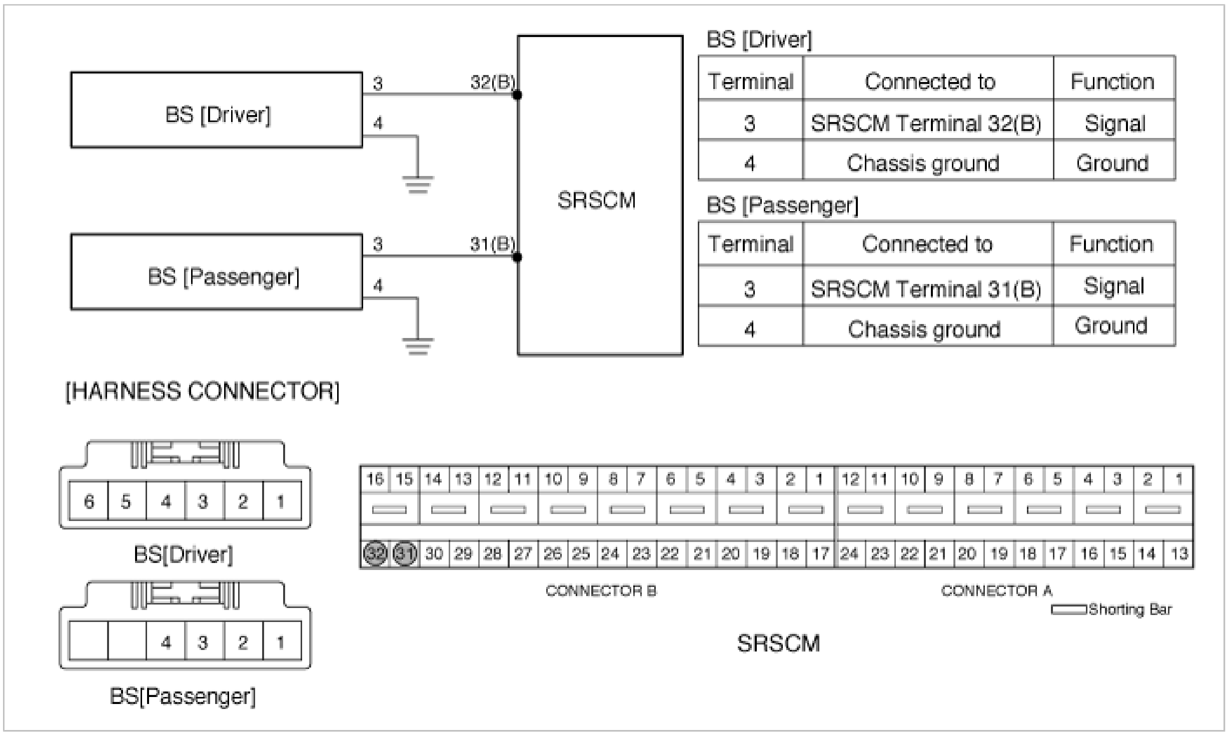
DTC	Condition	Probable cause
B1515 B1516	• Seat Belt Buckle Switch (BS) Malfunction	• Seat Belt Buckle Switch (BS)

B1517 B1518	• SRSCM Malfunction	• SRSCM

Specification

Open/Short to Battery	Grey Zone	Unbuckled	Grey Zone	Defect	Grey Zone	Buckled	Grey Zone	Short/Shortto ground
< 2.98 mA	2.98 - 3.6 mA	3.6 - 7.4 mA	7.4 - 8.9 mA	8.9 - 9.7 mA	9.7 - 11.7 mA	11.7 - 18.3 mA	18.3 - 22.0 mA	> 22.0 mA

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

2. CHECK THE SEAT BELT BUCKLE SWITCH (BS)
   (1) Measure current between the terminal 3 of BS and 32(31) of SRSCM harness connector(B).

   specification(current) : 12 ~ 18 mA (Buckled status) , 4 ~ 7 mA (Unbuckled status)

   (2) Is the wiring harness normal?

   YES

   ▸ Go to next stop.

   NO

   ▸ Replace the BS.

3. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON .
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1516

DTC Description

The Seat Belt Buckle Switch (BS) circuit consists of the SRSCM and two BS. The SRSCM sets above DTC(s) if it detects the BS faults. This system decides whether the driver or passenger seat belt is locked or not.

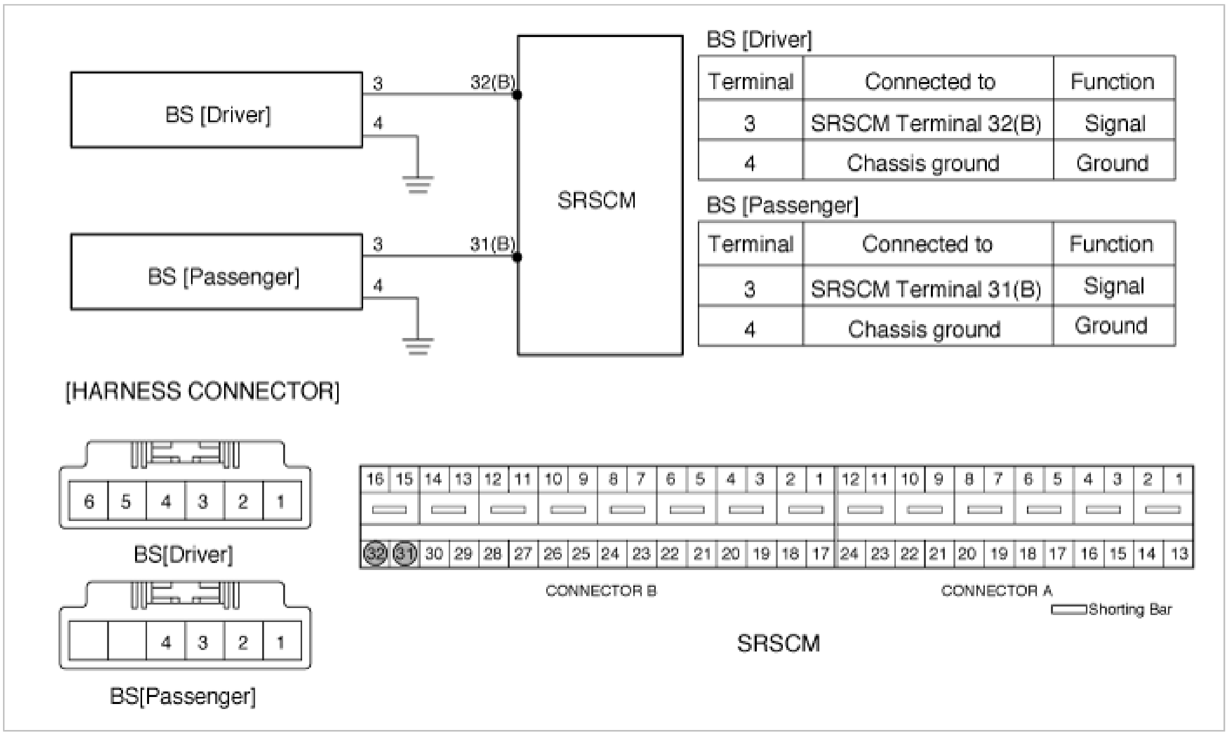
DTC Detecting Condition

DTC	Condition	Probable cause
B1515 B1516 B1517 B1518	• Seat Belt Buckle Switch (BS) Malfunction • SRSCM Malfunction	• Seat Belt Buckle Switch (BS) • SRSCM

Specification

Open/Short to Battery	Grey Zone	Unbuckled	Grey Zone	Defect	Grey Zone	Buckled	Grey Zone	Short/Shortto ground
< 2.98 mA	2.98 - 3.6 mA	3.6 - 7.4 mA	7.4 - 8.9 mA	8.9 - 9.7 mA	9.7 - 11.7 mA	11.7 - 18.3 mA	18.3 - 22.0 mA	> 22.0 mA

Schematic Diagram



BS [Driver]

Terminal	Connected to	Function
3	SRSCM Terminal 32(B)	Signal
4	Chassis ground	Ground

BS [Passenger]

Terminal	Connected to	Function
3	SRSCM Terminal 31(B)	Signal
4	Chassis ground	Ground

Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK THE SEAT BELT BUCKLE SWITCH (BS)
   (1) Measure current between the terminal 3 of BS and 32(31) of SRSCM harness connector(B).

   specification(current) : 12 ~ 18 mA (Buckled status) , 4 ~ 7 mA (Unbuckled status)

   (2) Is the wiring harness normal?

   YES

   ▸ Go to next stop.

   NO

   ▸ Replace the BS.
3. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON .

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1517

DTC Description

The Seat Belt Buckle Switch (BS) circuit consists of the SRSCM and two BS. The SRSCM sets above DTC(s) if it detects the BS faults. This system decides whether the driver or passenger seat belt is locked or not.

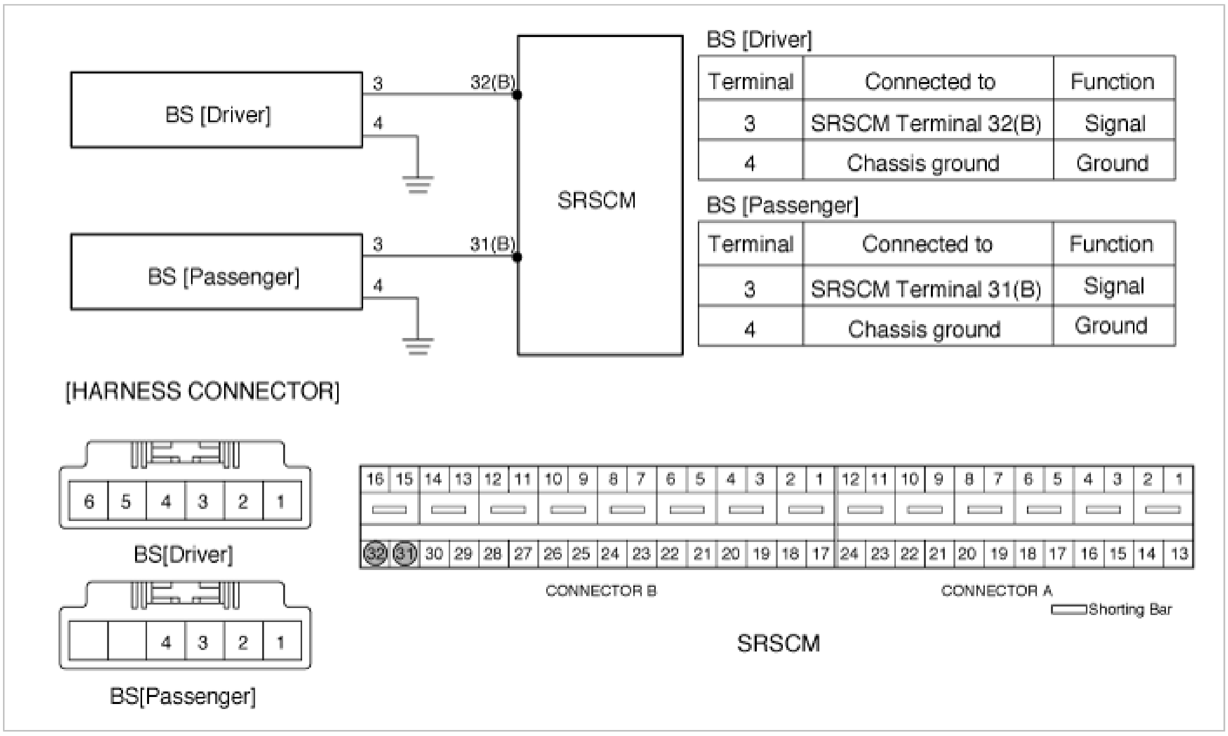
DTC Detecting Condition

DTC	Condition	Probable cause
B1515 B1516 B1517 B1518	• Seat Belt Buckle Switch (BS) Malfunction • SRSCM Malfunction	• Seat Belt Buckle Switch (BS) • SRSCM

Specification

Open/Short to Battery	Grey Zone	Unbuckled	Grey Zone	Defect	Grey Zone	Buckled	Grey Zone	Short/Shortto ground
< 2.98 mA	2.98 - 3.6 mA	3.6 - 7.4 mA	7.4 - 8.9 mA	8.9 - 9.7 mA	9.7 - 11.7 mA	11.7 - 18.3 mA	18.3 - 22.0 mA	> 22.0 mA

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▶ Go to next step.

YES

▶ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK THE SEAT BELT BUCKLE SWITCH (BS)
   (1) Measure current between the terminal 3 of BS and 32(31) of SRSCM harness connector(B).

   specification(current) : 12 ~ 18 mA (Buckled status) , 4 ~ 7 mA (Unbuckled status)

   (2) Is the wiring harness normal?

   YES

   ▶ Go to next stop.

   NO

   ▶ Replace the BS.

3. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON .

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1518

DTC Description

The Seat Belt Buckle Switch (BS) circuit consists of the SRSCM and two BS. The SRSCM sets above DTC(s) if it detects the BS faults. This system decides whether the driver or passenger seat belt is locked or not.

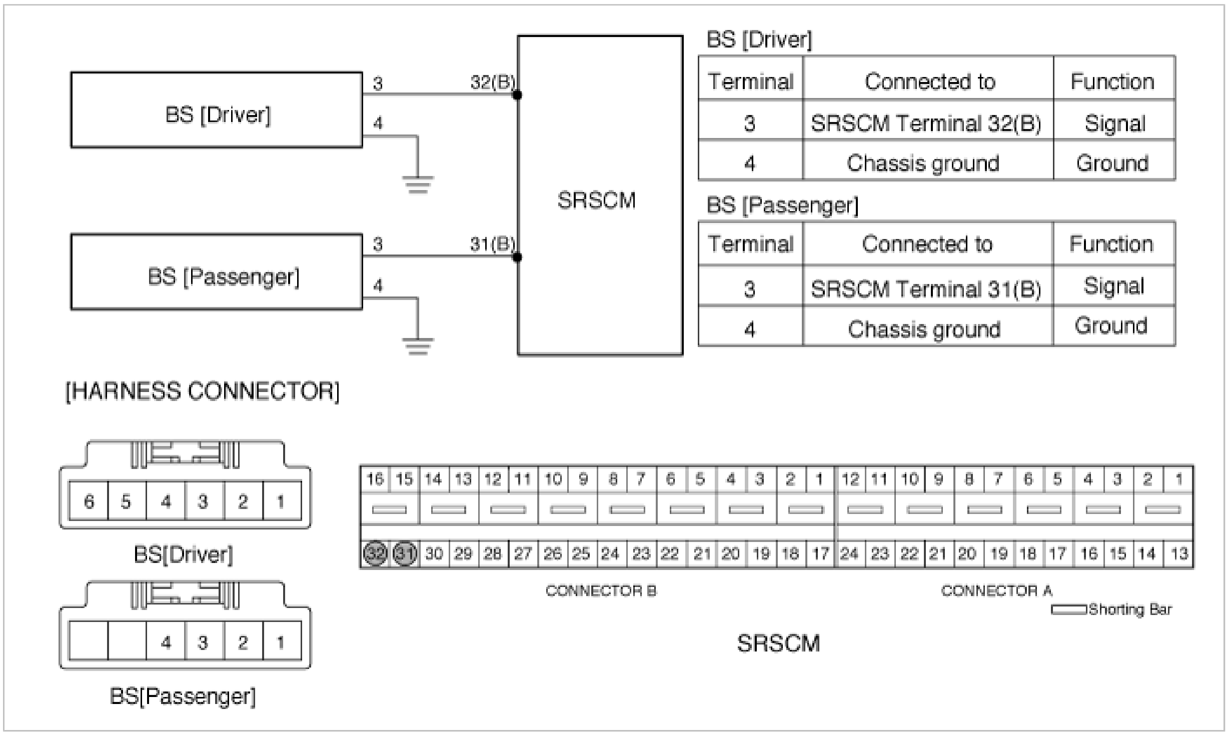
DTC Detecting Condition

DTC	Condition	Probable cause
B1515 B1516 B1517 B1518	• Seat Belt Buckle Switch (BS) Malfunction • SRSCM Malfunction	• Seat Belt Buckle Switch (BS) • SRSCM

Specification

Open/Short to Battery	Grey Zone	Unbuckled	Grey Zone	Defect	Grey Zone	Buckled	Grey Zone	Short/Shortto ground
< 2.98 mA	2.98 - 3.6 mA	3.6 - 7.4 mA	7.4 - 8.9 mA	8.9 - 9.7 mA	9.7 - 11.7 mA	11.7 - 18.3 mA	18.3 - 22.0 mA	> 22.0 mA

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK THE SEAT BELT BUCKLE SWITCH (BS)
   (1) Measure current between the terminal 3 of BS and 32(31) of SRSCM harness connector(B).

   specification(current) : 12 ~ 18 mA (Buckled status) , 4 ~ 7 mA (Unbuckled status)

   (2) Is the wiring harness normal?

   YES

   ▸ Go to next stop.

   NO

   ▸ Replace the BS.

3. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON .

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1620

General Description

SRSCM (Supplement Restraint System Control Module) decides to deploy the airbag module by sensing the frontal impact sensed by the sensor built in to the SRSCM.

1. DC/DC convertor : The DC/DC convertors of the power supply includes a step up and a step down converter, which provides the firing voltage for four firing circuits and the internal operating voltage. If the internal operatingvoltage falls below a defined threshold, a reset is executed.
2. Arming sensor/safing sensor : The arming/safing sensor built in to the airbag firing circuit has the function of arming the airbag circuit under all required deployment conditions and maintaining the airbag firing circuits unarmed under normal driving conditions. The safing sensor is a dual-contact electromechanical switch which closes if it experiences a deceleration exceedinga specified threshold
3. Back-up power : The SRSCM reserves an energy supply to provide deployment energy for a short second when the vehicle voltage is low or if lost in avehicle frontal crash.
4. Malfunction detection : The SRSCM continuously monitors the current SRS operation status while the ignition key is turned on and detects possible malfunction of the system. The malfunction can be displayed in the form of a diagnostic trouble code using Hi-Scan.
5. MIL (Malfunction Indication Lamp) notification : If any fault is detected, the SRSCM sends a signal to the indicator lamp on the cluster to warn thevehicle driver.The MIL indicator is the key item in notifying the driver of SRS faults. Verify lamp and SRSCM operation by flashing 6 times when the ignition switches first turned on.
6. Malfunction recording : Once a fault occurs in the system, the SRSCM records the fault in the memory in the form of DTC and the DTC can only beerased only by Hi-Scan.
7. Data link connector : Data stored in he SRSCM memory is read by Hi-Scan through the data link connector.
8. After firing the airbags once, the SRSCM cannot be used again and must be replaced.
9. Crash output : The crash output is used to control an external device which will unlock the doors in case of a crash event. The crash output is specified as follows : 0-200 μA in OFF mode and 200mA in ON mode. In case of the unlock command the switch is closed for 200 mS.

DTC Description

The SRSCM shall also cyclically monitor the following :

1. Functional readliness of the firing circuit activation transistors.
2. Adequacy of deployment energy reserves.
3. Safing sensor integtity : detection of faulty closure.
4. Plausibility of accelerometer signal.
5. Operation of SRSCM components.

DTC Detecting Condition

DTC	Condition	Probable cause
B1620	• Internal faults : accelerometer sensor fault, FLIC fault, energy back up capacitor fault, watch dog	• SRSCM

Verification of vehicle repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scan tool, clear the DTCs.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

▸ Go to the applicable troubleshooting procedure.

NO

▸ System is performing to specification at this time.

Inspection Procedure

1. Ignition "OFF" , connect scantool.
2. Ignition "ON" & engine "OFF", select "Diagnistic Trouble Codes(DTCs)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTCs.
5. Is DTC present problem?

YES

▸ Substitute with a known-good SRSCM and check for proper operation.If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Do not change the SRSCM, the SRSCM is OK at this moment.Fault is intermittent it has been repaired and SRSCM memory is not cleared yet. Thoroughly check SRSCM for looseness, bending, corrosion, contamination, deterioration, and/or damage.Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1650

General Description

SRSCM (Supplement Restraint System Control Module) decides to deploy the airbag module by sensing the frontal impact sensed by the sensor built in to the SRSCM.

1. DC/DC convertor : The DC/DC convertors of the power supply includes a step up and a step down converter, which provides the firing voltage for four firing circuits and the internal operating voltage. If the internal operatingvoltage falls below a defined threshold, a reset is executed.
2. Arming sensor/safing sensor : The arming/safing sensor built in to the airbag firing circuit has the function of arming the airbag circuit under all required deployment conditions and maintaining the airbag firing circuits unarmed under normal driving conditions. The safing sensor is a dual-contact electromechanical switch which closes if it experiences a deceleration exceedinga specified threshold
3. Back-up power : The SRSCM reserves an energy supply to provide deployment energy for a short second when the vehicle voltage is low or if lost in avehicle frontal crash.
4. Malfunction detection : The SRSCM continuously monitors the current SRS operation status while the ignition key is turned on and detects possible malfunction of the system. The malfunction can be displayed in the form of a diagnostic trouble code using Hi-Scan.
5. MIL (Malfunction Indication Lamp) notification : If any fault is detected, the SRSCM sends a signal to the indicator lamp on the cluster to warn thevehicle driver.The MIL indicator is the key item in notifying the driver of SRS faults. Verify lamp and SRSCM operation by flashing 6 times when the ignition switches first turned on.
6. Malfunction recording : Once a fault occurs in the system, the SRSCM records the fault in the memory in the form of DTC and the DTC can only beerased only by Hi-Scan.
7. Data link connector : Data stored in he SRSCM memory is read by Hi-Scan through the data link connector.

8. After firing the airbags once, the SRSCM cannot be used again and must be replaced.
9. Crash output : The crash output is used to control an external device which will unlock the doors in case of a crash event. The crash output is specified as follows : 0-200 μA in OFF mode and 200mA in ON mode. In case of the unlock commandthe switch is closed for 200 mS.

DTC Description

The frontal Crash recorded in the SRS Control module.

DTC Detecting Condition

DTC	Condition	Probable cause
B1650 B1657 B1658 B1670	• Crash recorded in the SRSCM	• SRSCM

Verification of vehicle repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scan tool, clear the DTCs.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

▸ Go to the applicable troubleshooting procedure.

NO

▸ System is performing to specification at this time.

Inspection Procedure

1. Ignition "OFF", connect scantool.
2. Ignition "ON" & engine "OFF", select "Diagnistic Trouble Codes(DTCs)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTCs.
5. Is DTC present problem?

YES

▸ The front crash is recorded. Replace SRS Control Module assy.(Except for B1657) Be able to reuse SRSCM 5 times, when B1657 is only monitored. And then goto next step.

NO

▸ System is OK at this moment.

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1651

General Description

SRSCM (Supplement Restraint System Control Module) decides to deploy the airbag module by sensing the frontal impact sensed by the sensor built in to the SRSCM.

1. DC/DC convertor : The DC/DC convertors of the power supply includes a step up and a step down converter, which provides the firing voltage for four firing circuits and the internal operating voltage. If the internal operatingvoltage falls below a defined threshold, a reset is executed.
2. Arming sensor/safing sensor : The arming/safing sensor built in to the airbag firing circuit has the function of arming the airbag circuit under all required deployment conditions and maintaining the airbag firing circuits unarmed under normal driving conditions. The safing sensor is a dual-contact electromechanical switch which closes if it experiences a deceleration exceedinga specified threshold
3. Back-up power : The SRSCM reserves an energy supply to provide deployment energy for a short second when the vehicle voltage is low or if lost in avehicle frontal crash.

4. Malfunction detection : The SRSCM continuously monitors the current SRS operation status while the ignition key is turned on and detects possible malfunction of the system. The malfunction can be displayed in the form of a diagnostic trouble code using Hi-Scan.
5. MIL (Malfunction Indication Lamp) notification : If any fault is detected, the SRSCM sends a signal to the indicator lamp on the cluster to warn thevehicle driver.The MIL indicator is the key item in notifying the driver of SRS faults. Verify lamp and SRSCM operation by flashing 6 times when the ignition switches first turned on.
6. Malfunction recording : Once a fault occurs in the system, the SRSCM records the fault in the memory in the form of DTC and the DTC can only beerased only by Hi-Scan.
7. Data link connector : Data stored in he SRSCM memory is read by Hi-Scan through the data link connector.
8. After firing the airbags once, the SRSCM cannot be used again and must be replaced.
9. Crash output : The crash output is used to control an external device which will unlock the doors in case of a crash event. The crash output is specified as follows : 0-200 μA in OFF mode and 200mA in ON mode. In case of the unlock commandthe switch is closed for 200 mS.

DTC Description

The frontal Crash recorded in the SRS Control module.

DTC Detecting Condition

DTC	Condition	Probable cause
B1651 B1652	• Crash recorded in the SRSCM(side)	• SRSCM

Verification of vehicle repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scan tool, clear the DTCs.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

Inspection Procedure

1. Ignition "OFF", connect scantool.
2. Ignition "ON" & engine "OFF", select "Diagnistic Trouble Codes(DTCs)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTCs.
5. Is DTC present problem?

YES

▶ The side crash is recorded. Replace SRS Control Module assy. And then goto next step.

NO

▶ System is OK at this moment.

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1652

General Description

SRSCM (Supplement Restraint System Control Module) decides to deploy the airbag module by sensing the frontal impact sensed by the sensor built in to the SRSCM.

1. DC/DC convertor : The DC/DC convertors of the power supply includes a step up and a step down converter, which provides the firing voltage for four firing circuits and the internal operating voltage. If the internal operatingvoltage falls below a defined

threshold, a reset is executed.

2. Arming sensor/safing sensor : The arming/safing sensor built in to the airbag firing circuit has the function of arming the airbag circuit under all required deployment conditions and maintaining the airbag firing circuits unarmed under normal driving conditions. The safing sensor is a dual-contact electromechanical switch which closes if it experiences a deceleration exceedinga specified threshold
3. Back-up power : The SRSCM reserves an energy supply to provide deployment energy for a short second when the vehicle voltage is low or if lost in avehicle frontal crash.
4. Malfunction detection : The SRSCM continuously monitors the current SRS operation status while the ignition key is turned on and detects possible malfunction of the system. The malfunction can be displayed in the form of a diagnostic trouble code using Hi-Scan.
5. MIL (Malfunction Indication Lamp) notification : If any fault is detected, the SRSCM sends a signal to the indicator lamp on the cluster to warn thevehicle driver.The MIL indicator is the key item in notifying the driver of SRS faults. Verify lamp and SRSCM operation by flashing 6 times when the ignition switches first turned on.
6. Malfunction recording : Once a fault occurs in the system, the SRSCM records the fault in the memory in the form of DTC and the DTC can only beerased only by Hi-Scan.
7. Data link connector : Data stored in he SRSCM memory is read by Hi-Scan through the data link connector.
8. After firing the airbags once, the SRSCM cannot be used again and must be replaced.
9. Crash output : The crash output is used to control an external device which will unlock the doors in case of a crash event. The crash output is specified as follows : 0-200 μA in OFF mode and 200mA in ON mode. In case of the unlock commandthe switch is closed for 200 mS.

DTC Description

The frontal Crash recorded in the SRS Control module.

DTC Detecting Condition

DTC	Condition	Probable cause
B1651 B1652	• Crash recorded in the SRSCM(side)	• SRSCM

Verification of vehicle repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scan tool, clear the DTCs.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

▸ Go to the applicable troubleshooting procedure.

NO

▸ System is performing to specification at this time.

Inspection Procedure

1. Ignition "OFF", connect scantool.
2. Ignition "ON" & engine "OFF", select "Diagnistic Trouble Codes(DTCs)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTCs.
5. Is DTC present problem?

YES

▸ The side crash is recorded. Replace SRS Control Module assy. And then goto next step.

NO

▸ System is OK at this moment.

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting >

B1655

General Description

SRSCM (Supplement Restraint System Control Module) decides to deploy the airbag module by sensing the frontal impact sensed by the sensor built in to the SRSCM.

1. DC/DC convertor : The DC/DC convertors of the power supply includes a step up and a step down converter, which provides the firing voltage for four firing circuits and the internal operating voltage. If the internal operatingvoltage falls below a defined threshold, a reset is executed.
2. Arming sensor/safing sensor : The arming/safing sensor built in to the airbag firing circuit has the function of arming the airbag circuit under all required deployment conditions and maintaining the airbag firing circuits unarmed under normal driving conditions. The safing sensor is a dual-contact electromechanical switch which closes if it experiences a deceleration exceedinga specified threshold
3. Back-up power : The SRSCM reserves an energy supply to provide deployment energy for a short second when the vehicle voltage is low or if lost in avehicle frontal crash.
4. Malfunction detection : The SRSCM continuously monitors the current SRS operation status while the ignition key is turned on and detects possible malfunction of the system. The malfunction can be displayed in the form of a diagnostic trouble code using Hi-Scan.
5. MIL (Malfunction Indication Lamp) notification : If any fault is detected, the SRSCM sends a signal to the indicator lamp on the cluster to warn thevehicle driver.The MIL indicator is the key item in notifying the driver of SRS faults. Verify lamp and SRSCM operation by flashing 6 times when the ignition switches first turned on.
6. Malfunction recording : Once a fault occurs in the system, the SRSCM records the fault in the memory in the form of DTC and the DTC can only beerased only by Hi-Scan.
7. Data link connector : Data stored in he SRSCM memory is read by Hi-Scan through the data link connector.
8. After firing the airbags once, the SRSCM cannot be used again and must be replaced.
9. Crash output : The crash output is used to control an external device which will unlock the doors in case of a crash event. The crash output is specified as follows : 0-200 μA in OFF mode and 200mA in ON mode. In case of the unlock commandthe switch is closed for 200 mS.

DTC Description

The frontal Crash recorded in the SRS Control module.

DTC Detecting Condition

DTC	Condition	Probable cause
B1650 B1657 B1658 B1670	• Crash recorded in the SRSCM	• SRSCM

Verification of vehicle repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scan tool, clear the DTCs.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

   YES

   ▸ Go to the applicable troubleshooting procedure.

   NO

   ▸ System is performing to specification at this time.

Inspection Procedure

1. Ignition "OFF", connect scantool.
2. Ignition "ON" & engine "OFF", select "Diagnistic Trouble Codes(DTCs)" mode.
3. Monitor diagnostic trouble code and present of trouble code.

4. Using a scan tool, clear the DTCs.
5. Is DTC present problem?

YES

▸ The crash is recorded.(Pass. side) Replace SRS Control Module assy. And then goto next step.

NO

▸ System is OK at this moment.

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1657

General Description

SRSCM (Supplement Restraint System Control Module) decides to deploy the airbag module by sensing the frontal impact sensed by the sensor built in to the SRSCM.

1. DC/DC convertor : The DC/DC convertors of the power supply includes a step up and a step down converter, which provides the firing voltage for four firing circuits and the internal operating voltage. If the internal operatingvoltage falls below a defined threshold, a reset is executed.
2. Arming sensor/safing sensor : The arming/safing sensor built in to the airbag firing circuit has the function of arming the airbag circuit under all required deployment conditions and maintaining the airbag firing circuits unarmed under normal driving conditions. The safing sensor is a dual-contact electromechanical switch which closes if it experiences a deceleration exceedinga specified threshold
3. Back-up power : The SRSCM reserves an energy supply to provide deployment energy for a short second when the vehicle voltage is low or if lost in avehicle frontal crash.
4. Malfunction detection : The SRSCM continuously monitors the current SRS operation status while the ignition key is turned on and detects possible malfunction of the system. The malfunction can be displayed in the form of a diagnostic trouble code using Hi-Scan.
5. MIL (Malfunction Indication Lamp) notification : If any fault is detected, the SRSCM sends a signal to the indicator lamp on the cluster to warn thevehicle driver.The MIL indicator is the key item in notifying the driver of SRS faults. Verify lamp and SRSCM operation by flashing 6 times when the ignition switches first turned on.
6. Malfunction recording : Once a fault occurs in the system, the SRSCM records the fault in the memory in the form of DTC and the DTC can only beerased only by Hi-Scan.
7. Data link connector : Data stored in he SRSCM memory is read by Hi-Scan through the data link connector.
8. After firing the airbags once, the SRSCM cannot be used again and must be replaced.
9. Crash output : The crash output is used to control an external device which will unlock the doors in case of a crash event. The crash output is specified as follows : 0-200 μA in OFF mode and 200mA in ON mode. In case of the unlock commandthe switch is closed for 200 mS.

DTC Description

The frontal Crash recorded in the SRS Control module.

DTC Detecting Condition

DTC	Condition	Probable cause
B1650 B1657 B1658 B1670	• Crash recorded in the SRSCM	• SRSCM

Verification of vehicle repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scan tool, clear the DTCs.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

▸ Go to the applicable troubleshooting procedure.

NO

▸ System is performing to specification at this time.

Inspection Procedure

1. Ignition "OFF", connect scantool.
2. Ignition "ON" & engine "OFF", select "Diagnistic Trouble Codes(DTCs)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTCs.
5. Is DTC present problem?

YES

▸ The front crash is recorded. Replace SRS Control Module assy.(Except for B1657) Be able to reuse SRSCM 5 times, when B1657 is only monitored. And then goto next step.

NO

▸ System is OK at this moment.

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1658

General Description

SRSCM (Supplement Restraint System Control Module) decides to deploy the airbag module by sensing the frontal impact sensed by the sensor built in to the SRSCM.

1. DC/DC convertor : The DC/DC convertors of the power supply includes a step up and a step down converter, which provides the firing voltage for four firing circuits and the internal operating voltage. If the internal operatingvoltage falls below a defined threshold, a reset is executed.
2. Arming sensor/safing sensor : The arming/safing sensor built in to the airbag firing circuit has the function of arming the airbag circuit under all required deployment conditions and maintaining the airbag firing circuits unarmed under normal driving conditions. The safing sensor is a dual-contact electromechanical switch which closes if it experiences a deceleration exceedinga specified threshold
3. Back-up power : The SRSCM reserves an energy supply to provide deployment energy for a short second when the vehicle voltage is low or if lost in avehicle frontal crash.
4. Malfunction detection : The SRSCM continuously monitors the current SRS operation status while the ignition key is turned on and detects possible malfunction of the system. The malfunction can be displayed in the form of a diagnostic trouble code using Hi-Scan.
5. MIL (Malfunction Indication Lamp) notification : If any fault is detected, the SRSCM sends a signal to the indicator lamp on the cluster to warn thevehicle driver.The MIL indicator is the key item in notifying the driver of SRS faults. Verify lamp and SRSCM operation by flashing 6 times when the ignition switches first turned on.
6. Malfunction recording : Once a fault occurs in the system, the SRSCM records the fault in the memory in the form of DTC and the DTC can only beerased only by Hi-Scan.
7. Data link connector : Data stored in he SRSCM memory is read by Hi-Scan through the data link connector.
8. After firing the airbags once, the SRSCM cannot be used again and must be replaced.
9. Crash output : The crash output is used to control an external device which will unlock the doors in case of a crash event. The crash output is specified as follows : 0-200 μA in OFF mode and 200mA in ON mode. In case of the unlock commandthe switch is closed for 200 mS.

DTC Description

The frontal Crash recorded in the SRS Control module.

DTC Detecting Condition

DTC	Condition	Probable cause
B1650 B1657 B1658 B1670	• Crash recorded in the SRSCM	• SRSCM

Verification of vehicle repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scan tool, clear the DTCs.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

▸ Go to the applicable troubleshooting procedure.

NO

▸ System is performing to specification at this time.

Inspection Procedure

1. Ignition "OFF", connect scantool.
2. Ignition "ON" & engine "OFF", select "Diagnistic Trouble Codes(DTCs)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTCs.
5. Is DTC present problem?

YES

▸ The front crash is recorded. Replace SRS Control Module assy.(Except for B1657) Be able to reuse SRSCM 5 times, when B1657 is only monitored. And then goto next step.

NO

▸ System is OK at this moment.

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1659

General Description

DTC is detected when a rear Crash is recorded in the SRS Control module .Although it is detected , any airbag doesn't inflate. And DTC code is only eliminated by using HI-scan.

Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> CAUTION
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK, remove battery(-) cable. wait for 1 min.
   (2) Connect battery(-) cable ,connect Hi-scan. Turn on the ignition , wait for 30 sec.
   (3) IGN ON, Engine off. select "Diagnostic Trouble Codes(DTCs)" mode.
   (4) Monitor diagnostic trouble code and present of trouble code.
   (5) Using a scan tool, clear the DTCs.
   Is a DTC monitored?

   YES

▸ If a DTC can,t be eliminated, replace the SRSCM. Then go to next step.

NO

▸ System is OK at this moment.

2. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON .
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1670

General Description

SRSCM (Supplement Restraint System Control Module) decides to deploy the airbag module by sensing the frontal impact sensed by the sensor built in to the SRSCM.

1. DC/DC convertor : The DC/DC convertors of the power supply includes a step up and a step down converter, which provides the firing voltage for four firing circuits and the internal operating voltage. If the internal operatingvoltage falls below a defined threshold, a reset is executed.
2. Arming sensor/safing sensor : The arming/safing sensor built in to the airbag firing circuit has the function of arming the airbag circuit under all required deployment conditions and maintaining the airbag firing circuits unarmed under normal driving conditions. The safing sensor is a dual-contact electromechanical switch which closes if it experiences a deceleration exceedinga specified threshold
3. Back-up power : The SRSCM reserves an energy supply to provide deployment energy for a short second when the vehicle voltage is low or if lost in avehicle frontal crash.
4. Malfunction detection : The SRSCM continuously monitors the current SRS operation status while the ignition key is turned on and detects possible malfunction of the system. The malfunction can be displayed in the form of a diagnostic trouble code using Hi-Scan.
5. MIL (Malfunction Indication Lamp) notification : If any fault is detected, the SRSCM sends a signal to the indicator lamp on the cluster to warn thevehicle driver.The MIL indicator is the key item in notifying the driver of SRS faults. Verify lamp and SRSCM operation by flashing 6 times when the ignition switches first turned on.
6. Malfunction recording : Once a fault occurs in the system, the SRSCM records the fault in the memory in the form of DTC and the DTC can only beerased only by Hi-Scan.
7. Data link connector : Data stored in he SRSCM memory is read by Hi-Scan through the data link connector.
8. After firing the airbags once, the SRSCM cannot be used again and must be replaced.
9. Crash output : The crash output is used to control an external device which will unlock the doors in case of a crash event. The crash output is specified as follows : 0-200 μA in OFF mode and 200mA in ON mode. In case of the unlock commandthe switch is closed for 200 mS.

DTC Description

The frontal Crash recorded in the SRS Control module.

DTC Detecting Condition

DTC	Condition	Probable cause
B1650 B1657 B1658 B1670	• Crash recorded in the SRSCM	• SRSCM

Verification of vehicle repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scan tool, clear the DTCs.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

▸ Go to the applicable troubleshooting procedure.

NO

▸ System is performing to specification at this time.

Inspection Procedure

1. Ignition "OFF", connect scantool.
2. Ignition "ON" & engine "OFF", select "Diagnistic Trouble Codes(DTCs)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTCs.
5. Is DTC present problem?

YES

▸ The front crash is recorded. Replace SRS Control Module assy.(Except for B1657) Be able to reuse SRSCM 5 times, when B1657 is only monitored. And then goto next step.

NO

▸ System is OK at this moment.

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1701

DTC Description

The Buckle Pretensioner circuit consists of the SRSCM and two Buckle Pretensioner (BUPT). The SRSCM sets above DTC(s) if it detects that the resistance of BUPT squib is too high or low.

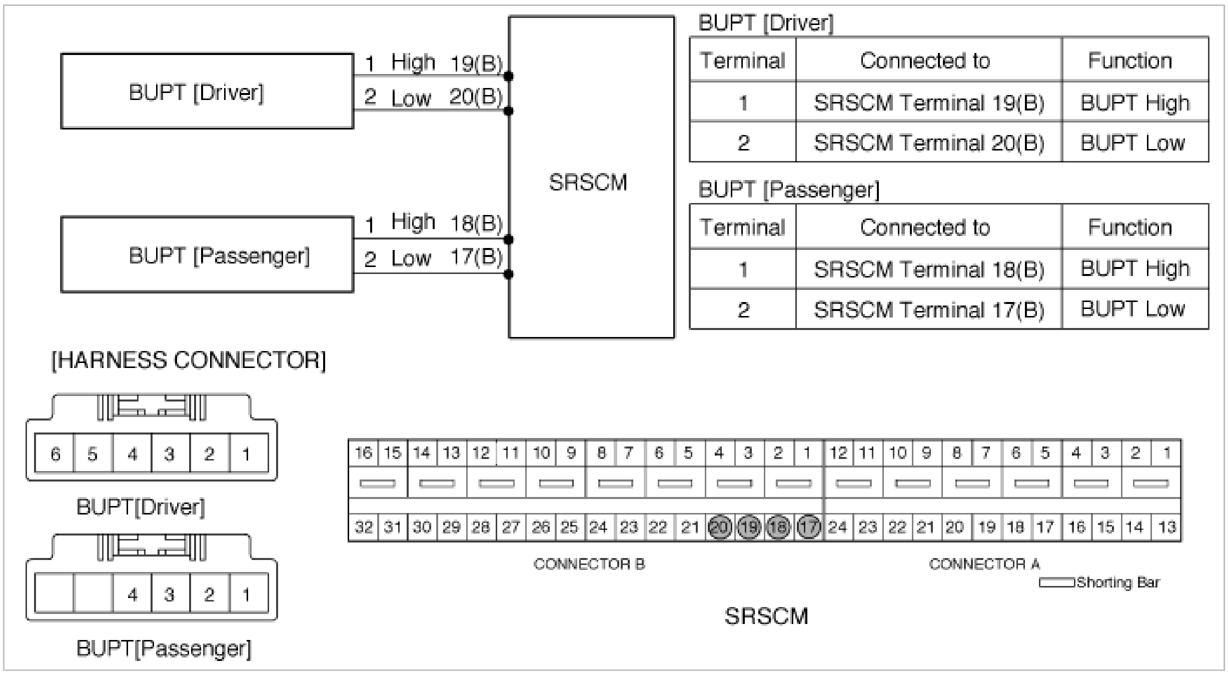
DTC Detecting Condition

DTC	Condition	Probable cause
B1701 B1702 B1706 B1707	• Too high or low resistance between BUPT high(+) and BUPT low (-) • Seat Buckle Pretensioner (BUPT) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Seat Buckle Pretensioner (BUPT) squib • SRSCM • Partially connected connector

Specification

BUPT resistance : $1.9 \leq R \leq 2.7\ \Omega$

Schematic Diagram



BUPT [Driver]

Terminal	Connected to	Function
1	SRSCM Terminal 19(B)	BUPT High
2	SRSCM Terminal 20(B)	BUPT Low

BUPT [Passenger]

Terminal	Connected to	Function
1	SRSCM Terminal 18(B)	BUPT High
2	SRSCM Terminal 17(B)	BUPT Low

Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

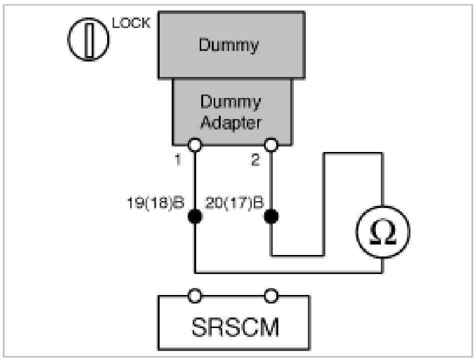
1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK BUPT RESISTANCE

> **CAUTION**
>
> Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

(1) Connect the Dummy and the Dummy Adapter on BUPT harness connector.
- Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

(2) Measure resistance between the terminal 19(18) and 20(17) of SRSCM harness connector(B).

BUPT resistance : 1.9 ≤ R ≤ 2.7 Ω



Is the measured resistance within specification?

YES

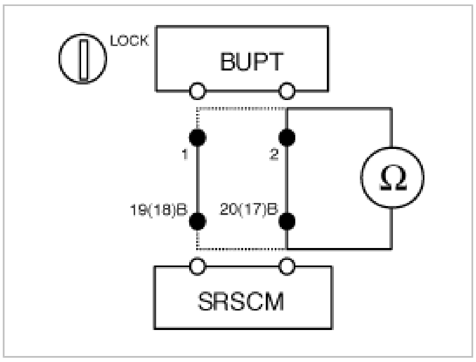
▸ Replace the Buckle Pretensioner(BUPT) module.

NO

▸ Check open circuit.

3. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 1 of BUPT harness connector and the terminal 19(18) of SRSCM harness connector(B).
   (2) Measure resistance between the terminal 2 of BUPT harness connector and the terminal 20(17) of SRSCM harness connector(B).

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

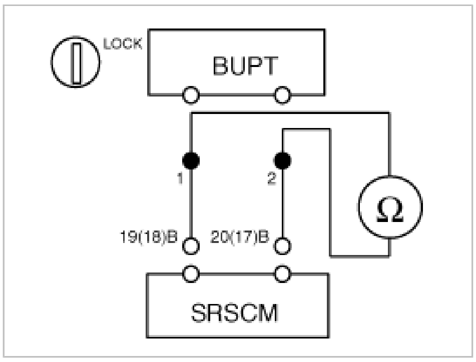
▸ Check short circuit.

NO

▸ Repair or replace the wiring harness between the BUPT and the SRSCM.

4. CHECK SHORT CIRCUIT
   (1) Measure resistance between the terminal 1 and 2 of BUPT harness connector.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair or replace the wiring harness between the BUPT and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON .
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehiclenormally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1702

DTC Description

The Buckle Pretensioner circuit consists of the SRSCM and two Buckle Pretensioner (BUPT). The SRSCM sets above DTC(s) if it detects that the resistance of BUPT squib is too high or low.

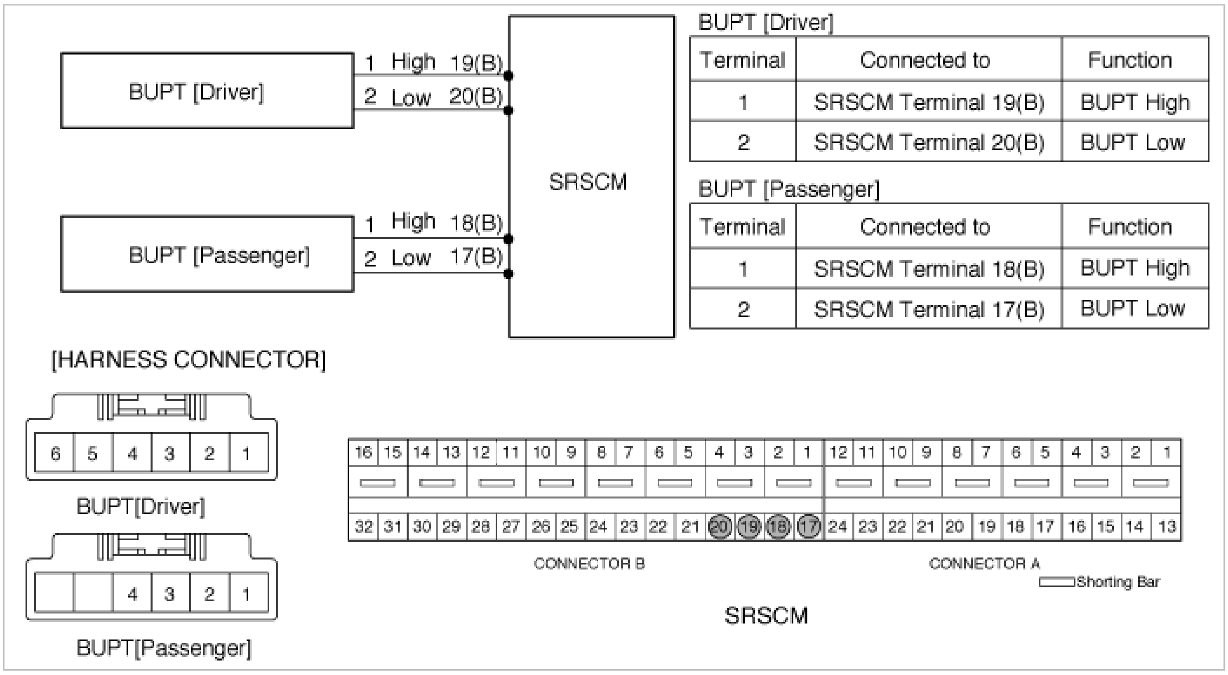
DTC Detecting Condition

DTC	Condition	Probable cause
B1701 B1702 B1706 B1707	• Too high or low resistance between BUPT high(+) and BUPT low (-) • Seat Buckle Pretensioner (BUPT) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Seat Buckle Pretensioner (BUPT) squib • SRSCM • Partially connected connector

Specification

BUPT resistance : 1.9 ≤ R ≤ 2.7 Ω

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

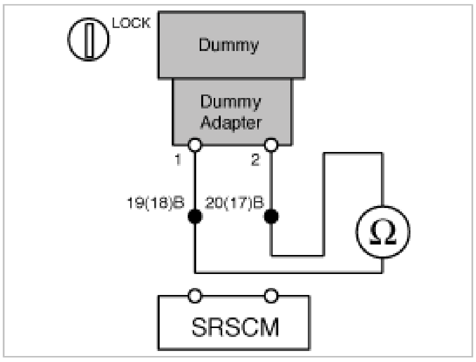
1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK BUPT RESISTANCE

> **CAUTION**
>
> Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

   (1) Connect the Dummy and the Dummy Adapter on BUPT harness connector.
   - Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

   (2) Measure resistance between the terminal 19(18) and 20(17) of SRSCM harness connector(B).

BUPT resistance : $1.9 \le R \le 2.7\ \Omega$



Is the measured resistance within specification?

YES

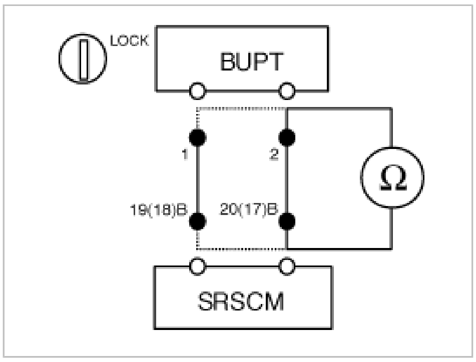
▸ Replace the Buckle Pretensioner(BUPT) module.

NO

▸ Check open circuit.

3. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 1 of BUPT harness connector and the terminal 19(18) of SRSCM harness connector(B).
   (2) Measure resistance between the terminal 2 of BUPT harness connector and the terminal 20(17) of SRSCM harness connector(B).

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

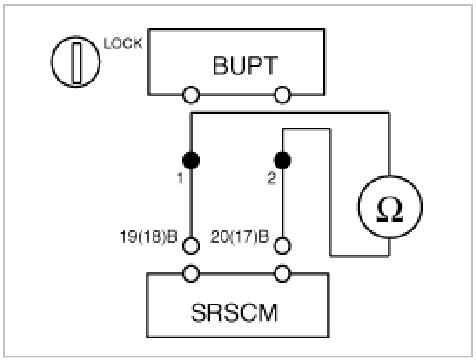
▸ Check short circuit.

NO

▸ Repair or replace the wiring harness between the BUPT and the SRSCM.

4. CHECK SHORT CIRCUIT
   (1) Measure resistance between the terminal 1 and 2 of BUPT harness connector.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair or replace the wiring harness between the BUPT and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON .
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehiclenormally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1703

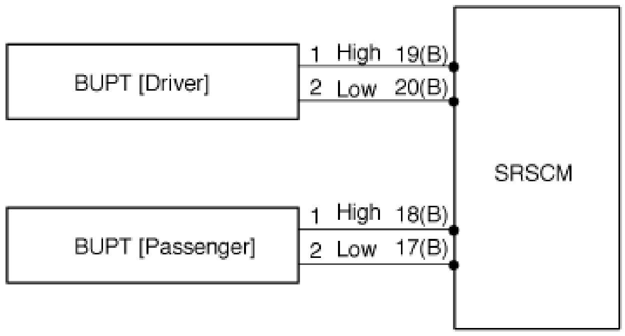
DTC Description

The Buckle Pretensioner circuit consists of the SRSCM and two Buckle Pretensioner (BUPT). The SRSCM sets above DTC(s) if it detects short to ground on the BUPT circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1703 B1708	• Short to ground between BUPT and SRSCM • Seat Buckle Pretensioner (BUPT) Malfunction • SRSCM Malfunction	• Short to ground circuit on wiring harness • Seat Buckle Pretensioner (BUPT) squib • SRSCM

Schematic Diagram

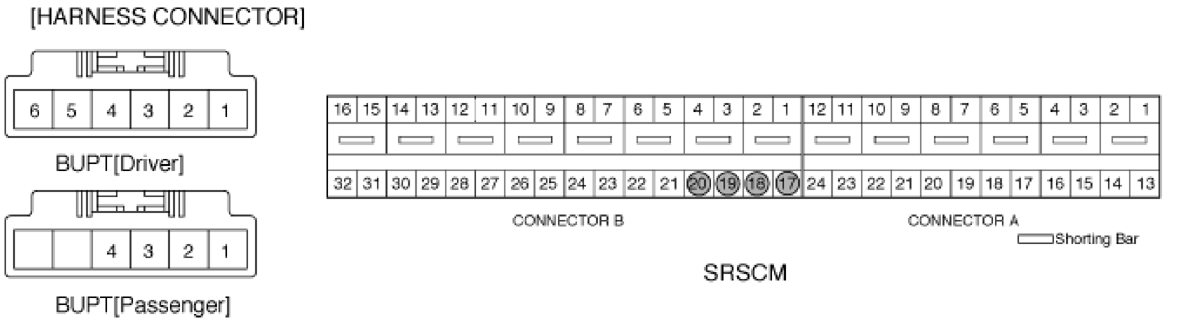


BUPT [Driver]

Terminal	Connected to	Function
1	SRSCM Terminal 19(B)	BUPT High
2	SRSCM Terminal 20(B)	BUPT Low

BUPT [Passenger]

Terminal	Connected to	Function
1	SRSCM Terminal 18(B)	BUPT High
2	SRSCM Terminal 17(B)	BUPT Low



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> CAUTION
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

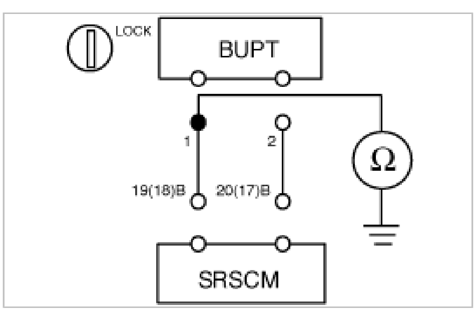
YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SHORT TO GROUND
   (1) Measure resistance between the terminal 1 of BUPT harness connector and chassis ground.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸ Check the BUPT Module.

NO

▸ Repair or replace the wiring harness between the BUPT and the SRSCM.

3. CHECK THE BUPT MODULE
   (1) Replace the Buckle Pretensioner(BUPT) with a new one.
   - Refer to "Buckle Pretensioner(BUPT)" section in this SERVICE MANUAL.

   (2) Install the DAB module and connect the DAB connector.

   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (4) Connect the SRSCM connector.

   (5) Connect the negative (-) terminal to the battery.

   (6) Connect a Hi-Scan(Pro) to the data link connector.

   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to Buckle Pretensioner(BUPT)?

   YES

   ▸ Go to next step.

   NO

   ▸ Replace BUPT module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.

   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (3) Connect the SRSCM connector.

   (4) Connect the negative (-) terminal to the battery.

   (5) Connect a Hi-Scan(Pro) to the data link connector.

   (6) Turn the ignition switch to ON .

   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

   (9) Turn the ignition switch to ON and wait for at least 30 seconds.

   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehiclenormally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1704

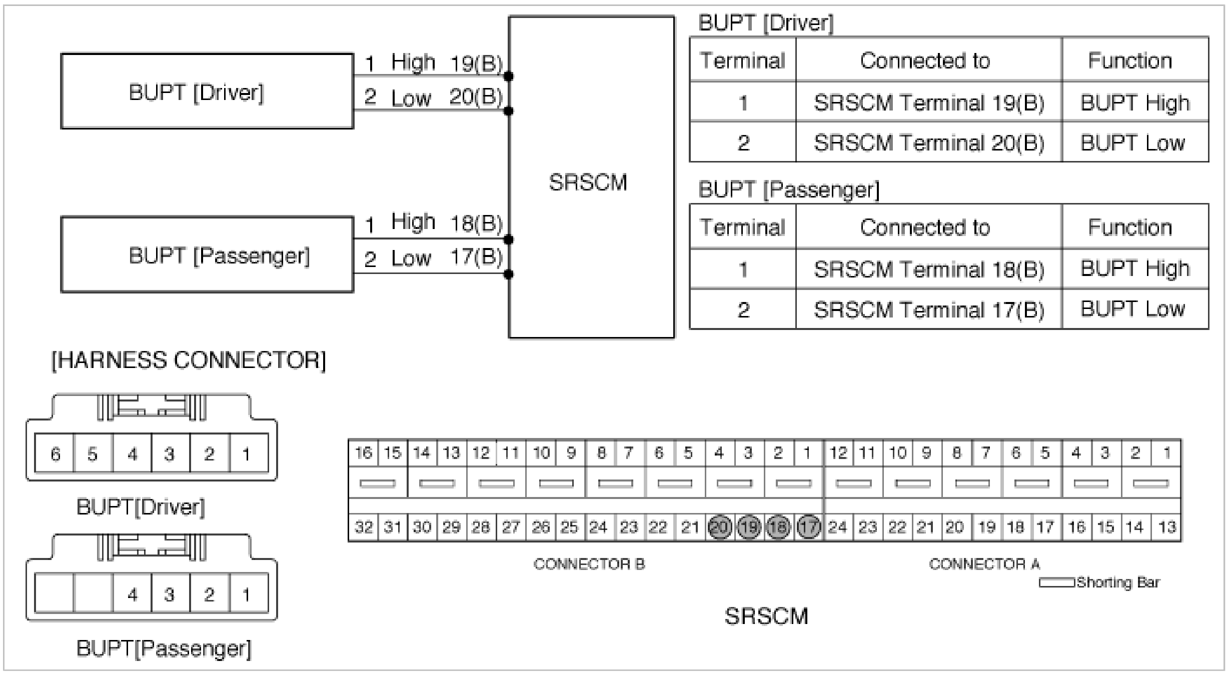
DTC Description

The Buckle Pretensioner circuit consists of the SRSCM and two Buckle Pretensioner (BUPT). The SRSCM sets above DTC(s) if it detects short to battery on the BUPT circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1704 B1709	• Short to battery between BUPT and SRSCM • Seat Buckle Pretensioner (BUPT) Malfunction • SRSCM Malfunction	• Short to battery line circuit on wiring harness • Buckle Pretensioner (BUPT) squib • SRSCM

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

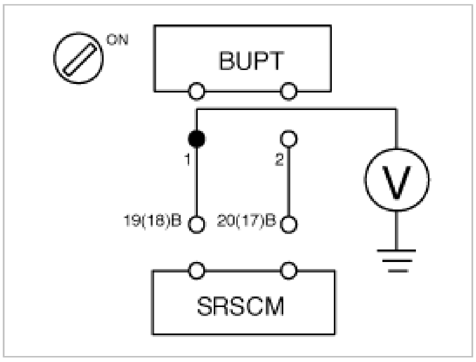
YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SHORT TO BATTERY LINE
   (1) Connect the negative (-) terminal to the battery.
   (2) Turn the ignition switch to ON.
   (3) Measure voltage between the terminal 1 of BUPT harness connector and chassis ground(-).

specification(voltage) : Approximately 0 V



Is the measured voltage within specification?

YES

▸ Check the BUPT Module.

NO

▸ Repair the short to battery line circuit on wiring harness between the BUPT and the SRSCM.

3. CHECK THE BUPT MODULE
   (1) Replace the Buckle Pretensioner(BUPT) with a new one.
   - Refer to "Buckle Pretensioner(BUPT)" section in this SERVICE MANUAL.

   (2) Install the DAB module and connect the DAB connector.

   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (4) Connect the SRSCM connector.

   (5) Connect the negative (-) terminal to the battery.

   (6) Connect a Hi-Scan(Pro) to the data link connector.

   (7) Connect a Hi-Scan(Pro) to the data link connector.
   Does Hi-Scan (Pro) indicate any DTC related to Buckle Pretensioner(BUPT)?

   YES

   ▸ Go to next step.

   NO

   ▸ Replace BUPT module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.

   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (3) Connect the SRSCM connector.

   (4) Connect the negative (-) terminal to the battery.

   (5) Connect a Hi-Scan(Pro) to the data link connector.

   (6) Turn the ignition switch to ON.

   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

   (9) Turn the ignition switch to ON and wait for at least 30 seconds.

   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸ Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehiclenormally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1706

DTC Description

The Buckle Pretensioner circuit consists of the SRSCM and two Buckle Pretensioner (BUPT). The SRSCM sets above DTC(s) if it detects that the resistance of BUPT squib is too high or low.

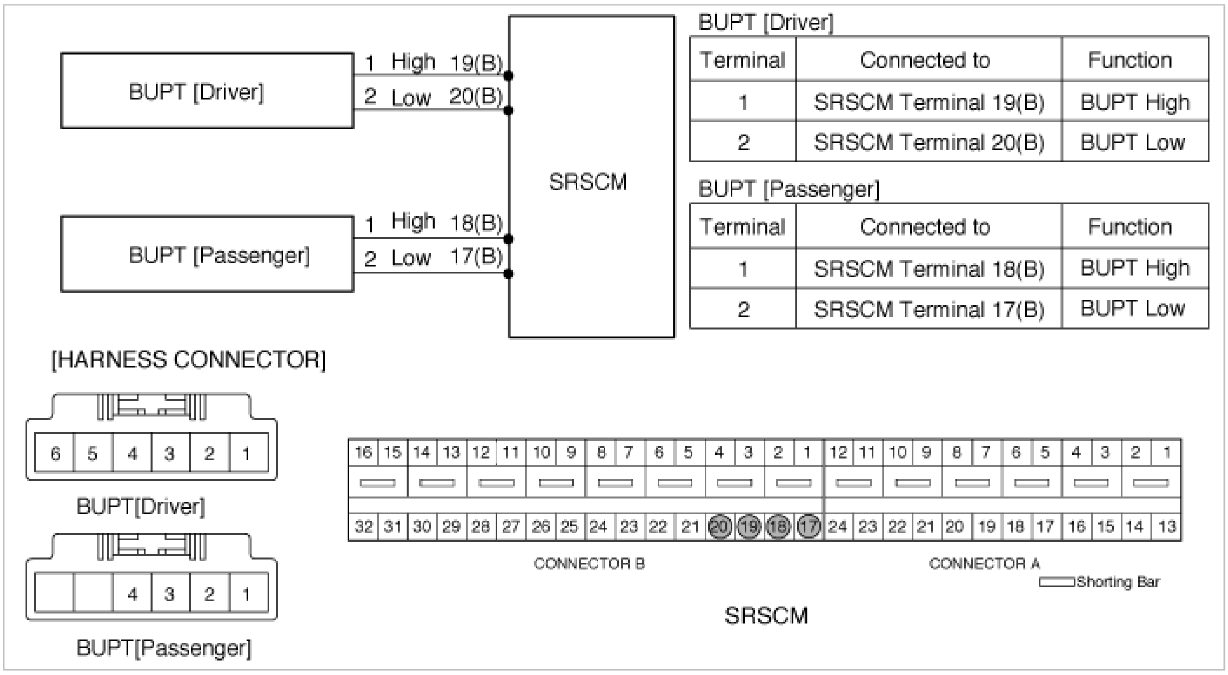
DTC Detecting Condition

DTC	Condition	Probable cause
B1701 B1702 B1706 B1707	• Too high or low resistance between BUPT high(+) and BUPT low (-) • Seat Buckle Pretensioner (BUPT) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Seat Buckle Pretensioner (BUPT) squib • SRSCM • Partially connected connector

Specification

BUPT resistance : 1.9 ≤ R ≤ 2.7 Ω

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> CAUTION
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.

(3) Remove the DAB module and disconnect the DAB connector.

(4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

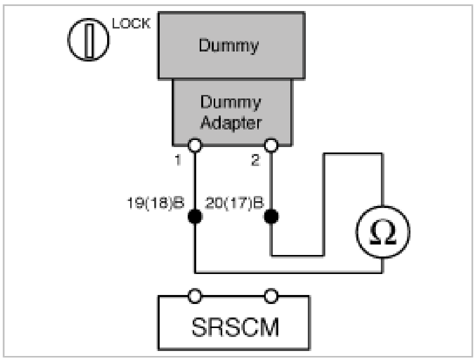
2. CHECK BUPT RESISTANCE

CAUTION
Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

(1) Connect the Dummy and the Dummy Adapter on BUPT harness connector.
- Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

(2) Measure resistance between the terminal 19(18) and 20(17) of SRSCM harness connector(B).

BUPT resistance : 1.9 ≤ R ≤ 2.7 Ω



Is the measured resistance within specification?

YES

▸ Replace the Buckle Pretensioner(BUPT) module.

NO

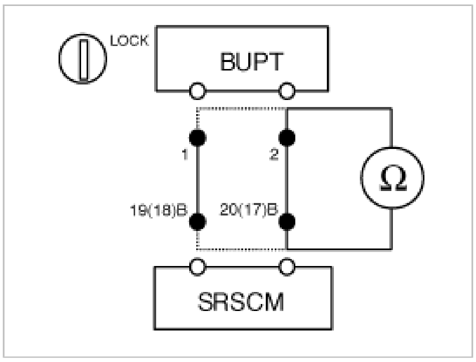
▸ Check open circuit.

3. CHECK OPEN CIRCUIT

(1) Measure resistance between the terminal 1 of BUPT harness connector and the terminal 19(18) of SRSCM harness connector(B).

(2) Measure resistance between the terminal 2 of BUPT harness connector and the terminal 20(17) of SRSCM harness connector(B).

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

▸ Check short circuit.

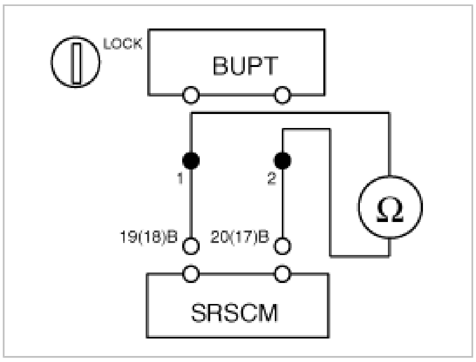
NO

▸ Repair or replace the wiring harness between the BUPT and the SRSCM.

4. CHECK SHORT CIRCUIT

(1) Measure resistance between the terminal 1 and 2 of BUPT harness connector.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair or replace the wiring harness between the BUPT and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON .
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehiclenormally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1707

DTC Description

The Buckle Pretensioner circuit consists of the SRSCM and two Buckle Pretensioner (BUPT). The SRSCM sets above DTC(s) if it detects that the resistance of BUPT squib is too high or low.

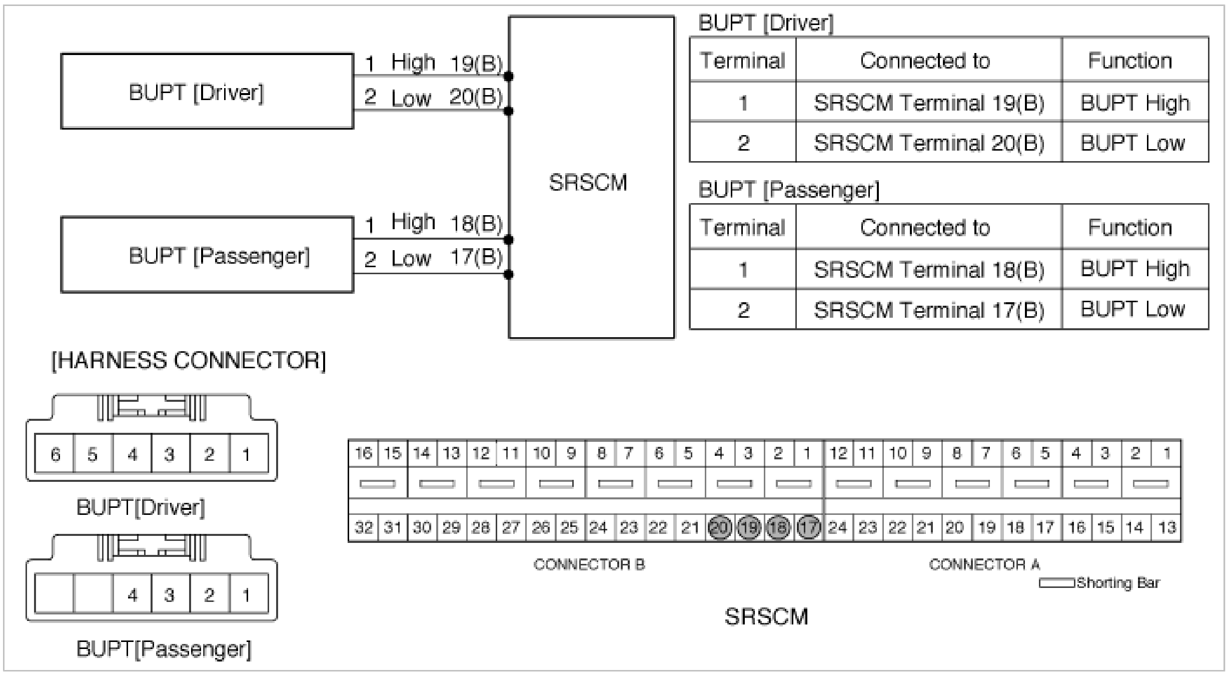
DTC Detecting Condition

DTC	Condition	Probable cause
B1701 B1702 B1706 B1707	• Too high or low resistance between BUPT high(+) and BUPT low (-) • Seat Buckle Pretensioner (BUPT) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Seat Buckle Pretensioner (BUPT) squib • SRSCM • Partially connected connector

Specification

BUPT resistance : 1.9 ≤ R ≤ 2.7 Ω

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

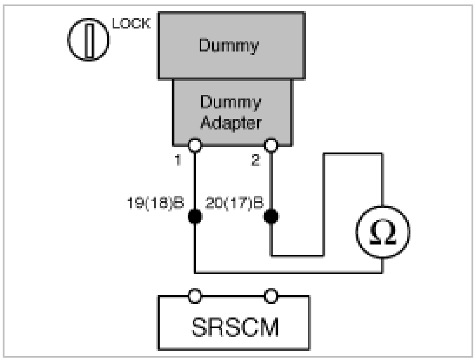
1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK BUPT RESISTANCE

> **CAUTION**
>
> Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

(1) Connect the Dummy and the Dummy Adapter on BUPT harness connector.
- Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

(2) Measure resistance between the terminal 19(18) and 20(17) of SRSCM harness connector(B).

BUPT resistance : 1.9 ≤ R ≤ 2.7 Ω



Is the measured resistance within specification?

YES

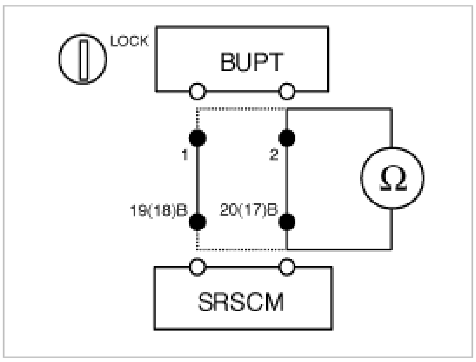
▸ Replace the Buckle Pretensioner(BUPT) module.

NO

▸ Check open circuit.

3. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 1 of BUPT harness connector and the terminal 19(18) of SRSCM harness connector(B).
   (2) Measure resistance between the terminal 2 of BUPT harness connector and the terminal 20(17) of SRSCM harness connector(B).

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

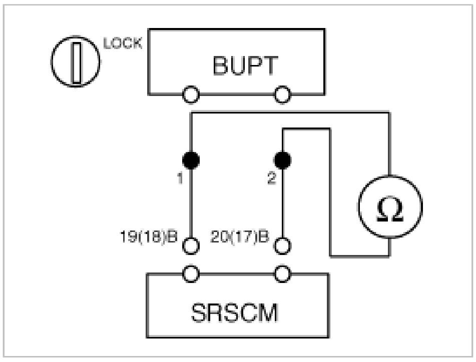
▸ Check short circuit.

NO

▸ Repair or replace the wiring harness between the BUPT and the SRSCM.

4. CHECK SHORT CIRCUIT
   (1) Measure resistance between the terminal 1 and 2 of BUPT harness connector.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair or replace the wiring harness between the BUPT and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON .
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (9) Turn the ignition switch to ON and wait for at least 30 seconds.
   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehiclenormally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1708

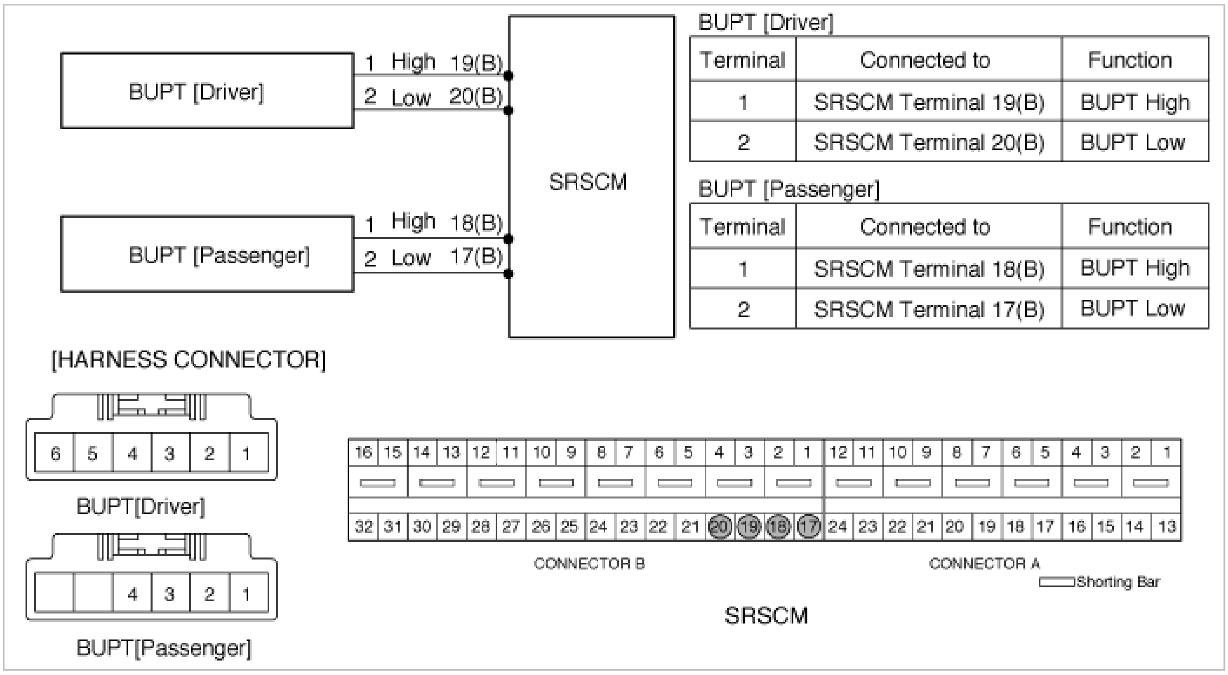
DTC Description

The Buckle Pretensioner circuit consists of the SRSCM and two Buckle Pretensioner (BUPT). The SRSCM sets above DTC(s) if it detects short to ground on the BUPT circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1703 B1708	• Short to ground between BUPT and SRSCM • Seat Buckle Pretensioner (BUPT) Malfunction • SRSCM Malfunction	• Short to ground circuit on wiring harness • Seat Buckle Pretensioner (BUPT) squib • SRSCM

Schematic Diagram



BUPT [Driver]

Terminal	Connected to	Function
1	SRSCM Terminal 19(B)	BUPT High
2	SRSCM Terminal 20(B)	BUPT Low

BUPT [Passenger]

Terminal	Connected to	Function
1	SRSCM Terminal 18(B)	BUPT High
2	SRSCM Terminal 17(B)	BUPT Low

Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

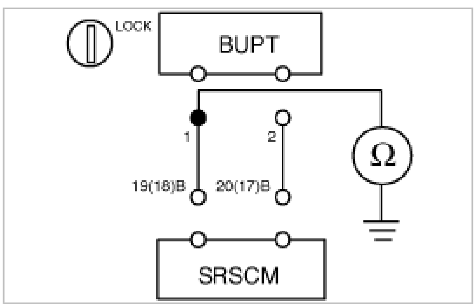
YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SHORT TO GROUND
   (1) Measure resistance between the terminal 1 of BUPT harness connector and chassis ground.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

▸ Check the BUPT Module.

NO

▸ Repair or replace the wiring harness between the BUPT and the SRSCM.

3. CHECK THE BUPT MODULE
   (1) Replace the Buckle Pretensioner(BUPT) with a new one.
   - Refer to "Buckle Pretensioner(BUPT)" section in this SERVICE MANUAL.

   (2) Install the DAB module and connect the DAB connector.

   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (4) Connect the SRSCM connector.

   (5) Connect the negative (-) terminal to the battery.

   (6) Connect a Hi-Scan(Pro) to the data link connector.

   (7) Turn the ignition switch to ON and check the vehicle again.
   Does Hi-Scan (Pro) indicate any DTC related to Buckle Pretensioner(BUPT)?

   YES

   ▸ Go to next step.

   NO

   ▸ Replace BUPT module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.

   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (3) Connect the SRSCM connector.

   (4) Connect the negative (-) terminal to the battery.

   (5) Connect a Hi-Scan(Pro) to the data link connector.

   (6) Turn the ignition switch to ON .

   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

   (9) Turn the ignition switch to ON and wait for at least 30 seconds.

   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehiclenormally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B1709

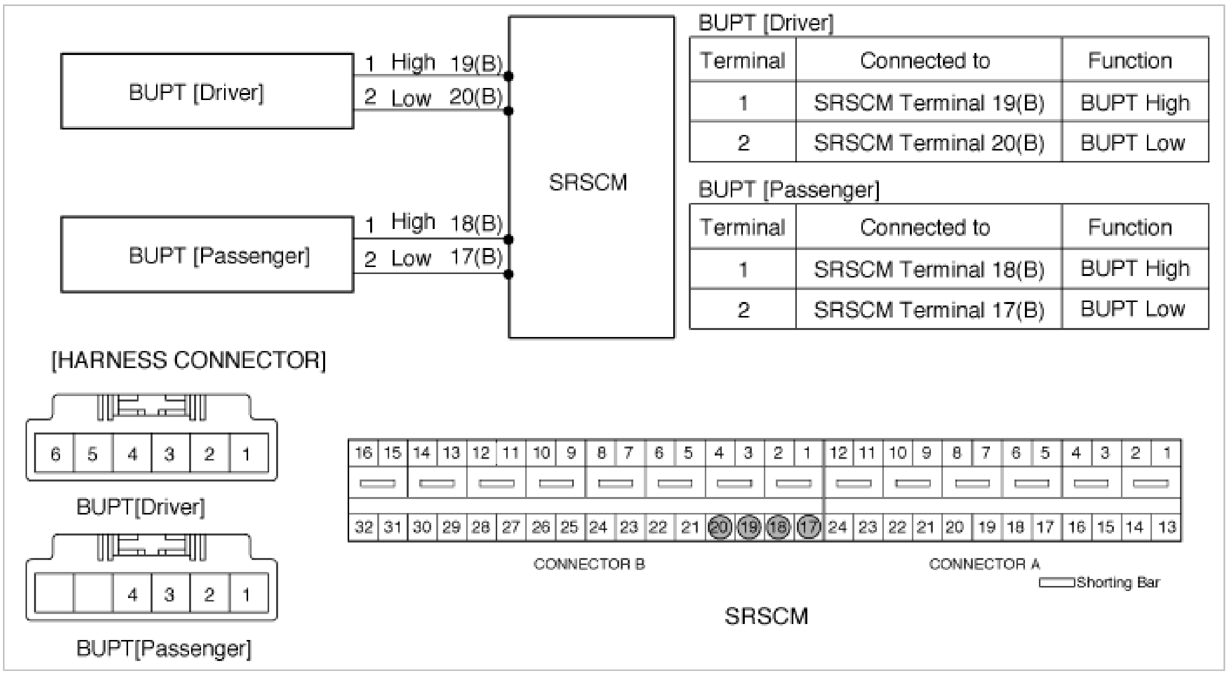
DTC Description

The Buckle Pretensioner circuit consists of the SRSCM and two Buckle Pretensioner (BUPT). The SRSCM sets above DTC(s) if it detects short to battery on the BUPT circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1704 B1709	• Short to battery between BUPT and SRSCM • Seat Buckle Pretensioner (BUPT) Malfunction • SRSCM Malfunction	• Short to battery line circuit on wiring harness • Buckle Pretensioner (BUPT) squib • SRSCM

Schematic Diagram



BUPT [Driver]

Terminal	Connected to	Function
1	SRSCM Terminal 19(B)	BUPT High
2	SRSCM Terminal 20(B)	BUPT Low

BUPT [Passenger]

Terminal	Connected to	Function
1	SRSCM Terminal 18(B)	BUPT High
2	SRSCM Terminal 17(B)	BUPT Low

Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

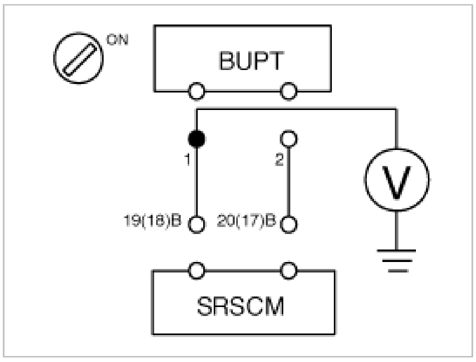
▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK SHORT TO BATTERY LINE
   (1) Connect the negative (-) terminal to the battery.
   (2) Turn the ignition switch to ON.
   (3) Measure voltage between the terminal 1 of BUPT harness connector and chassis ground(-).

specification(voltage) : Approximately 0 V



Is the measured voltage within specification?

YES

▶ Check the BUPT Module.

NO

▶ Repair the short to battery line circuit on wiring harness between the BUPT and the SRSCM.

3. CHECK THE BUPT MODULE
   (1) Replace the Buckle Pretensioner(BUPT) with a new one.
   - Refer to "Buckle Pretensioner(BUPT)" section in this SERVICE MANUAL.

   (2) Install the DAB module and connect the DAB connector.

   (3) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (4) Connect the SRSCM connector.

   (5) Connect the negative (-) terminal to the battery.

   (6) Connect a Hi-Scan(Pro) to the data link connector.

   (7) Connect a Hi-Scan(Pro) to the data link connector.
   Does Hi-Scan (Pro) indicate any DTC related to Buckle Pretensioner(BUPT)?

   YES

   ▶ Go to next step.

   NO

   ▶ Replace BUPT module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.

   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

   (3) Connect the SRSCM connector.

   (4) Connect the negative (-) terminal to the battery.

   (5) Connect a Hi-Scan(Pro) to the data link connector.

   (6) Turn the ignition switch to ON.

   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

   (8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

   (9) Turn the ignition switch to ON and wait for at least 30 seconds.

   (10) Check the vehicle again with the Hi-Scan(Pro).
   Does the above DTC(s) go off?

   YES

   ▶ Problem is intermittent or was repaired and SRSCM memory was not cleared.

   NO

   ▶ Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehiclenormally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B2500

DTC Description

The SRS warning lamp is located in the cluster. When the airbag system is normal, the SRS SRI flashes for approx. 6 seconds after the ignition switch is turned " ON ", and then turns off automatically.If there is a malfunction in the airbag system, the SRS

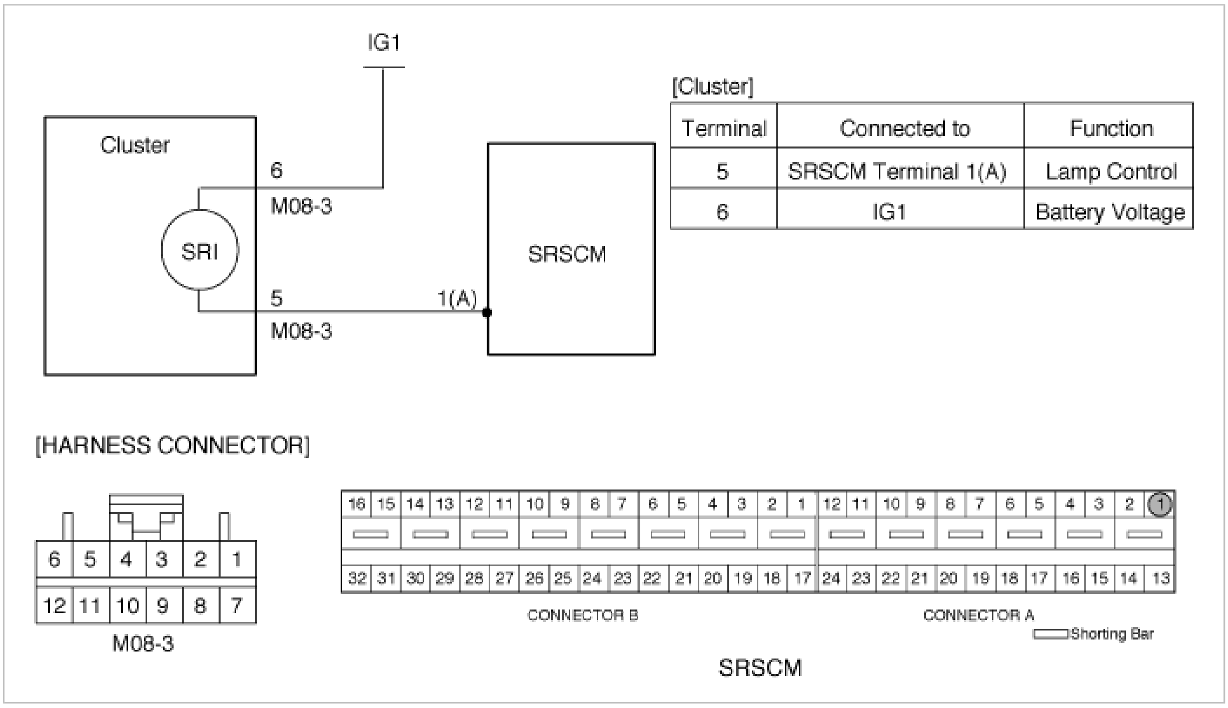
SRI lights up to inform the driver of the abnormality.The SRSCM shall measure the voltage at the SRS SRI output pin, both when the lamp is on and when the lamp is off, to detect whether the commanded state matches the actual state.

> NOTE
>
> The SRI will be continuously illuminated if the SRSCM is loose or disconnects.

DTC Detecting Condition

DTC	Condition	Probable cause
B2500	• Airbag fuse • Warning Lamp Bulb • Open between warning lamp and SRSCM • Short to ground or battery line between the warning lamp and SRSCM • SRSCM Malfunction	• Fuse • Warning lamp bulb • Wiring Harness • SRSCM

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> CAUTION
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.

(3) Remove the DAB module and disconnect the DAB connector.

(4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

2. CHECK THE FUSE

(1) Remove the airbag fuse and the airbag warning lamp fuse from junction block.

(2) Inspect the fuses.

Are the fuses normal?

YES

▸ Check the warning lamp bulb.

NO

▸ Repair or replace the fuses.

3. CHECK THE WARNING LAMP BULB

(1) Remove the bulb from the instrument cluster.

(2) Inspect the bulb.

Is the bulb normal?

YES

▸Check source voltage.

NO

▸ Repair or replace the bulb.

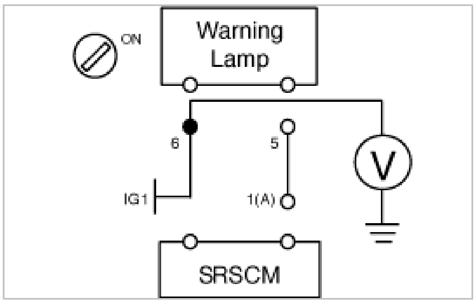
4. CHECK SOURCE VOLTAGE

(1) Connect the negative (-) terminal to the battery.

(2) Turn the ignition switch to ON.

(3) Measure voltage between the terminal 6 of the instrument Cluster harness connector and chassis ground(-).

specification(voltage) : 9 ~ 16 V



Is the measured voltage within specification?

YES

▸Check short to battery line.

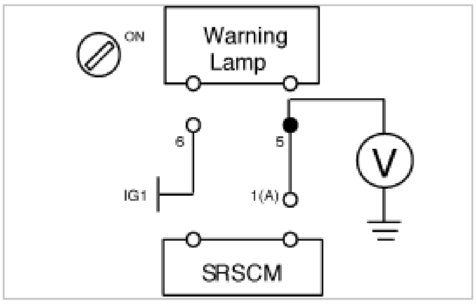
NO

▸Repair or replace the wiring harness between ignition switch and the Warning Lamp.

5. CHECK SHORT TO BATTERY LINE

(1) Measure voltage between the terminal 5 of the instrument Cluster harness connector and chassis ground(-).

specification(voltage) : Approximately 0 V



Is the measured voltage within specification?

YES

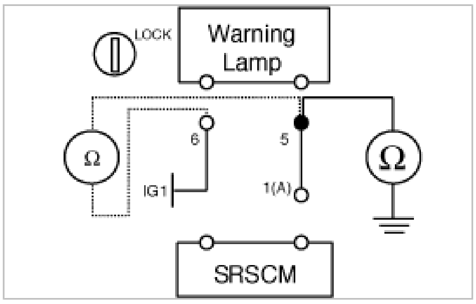
▸ Check short or short to ground.

NO

▸ Repair the short to battery line circuit on wiring harness between the SRSCM and the Warning Lamp.

6. CHECK SHORT OR SHORT TO GROUND
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative(-) terminal from the battery.
   (3) Measure resistance between the terminal 5 of the instrument cluster harness connector and chassis ground.
   (4) Measure resistance between the terminal 5 and 6 of the Instrument Cluster harness connector.

specification(resistance) : infinite



Is the measured resistance within specification?

YES

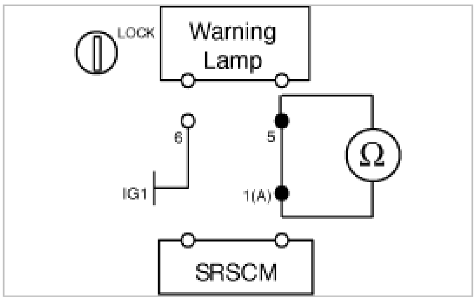
▸Check open circuit.

NO

▸ Repair the short or short to ground circuit on wiring harness between the SRSCM and the Warning Lamp.

7. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 5 of the Instrument Cluster connector and the terminal 1 of SRSCM harness connector(A).

specification(resistance) : below 1 Ω



Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair the open circuit on wiring harness between the SRSCM and the Warning Lamp.

8. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal to the battery.
   (5) Connect a Hi-Scan(Pro) to the data link connector.
   (6) Turn the ignition switch to ON.
   (7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting > B2502

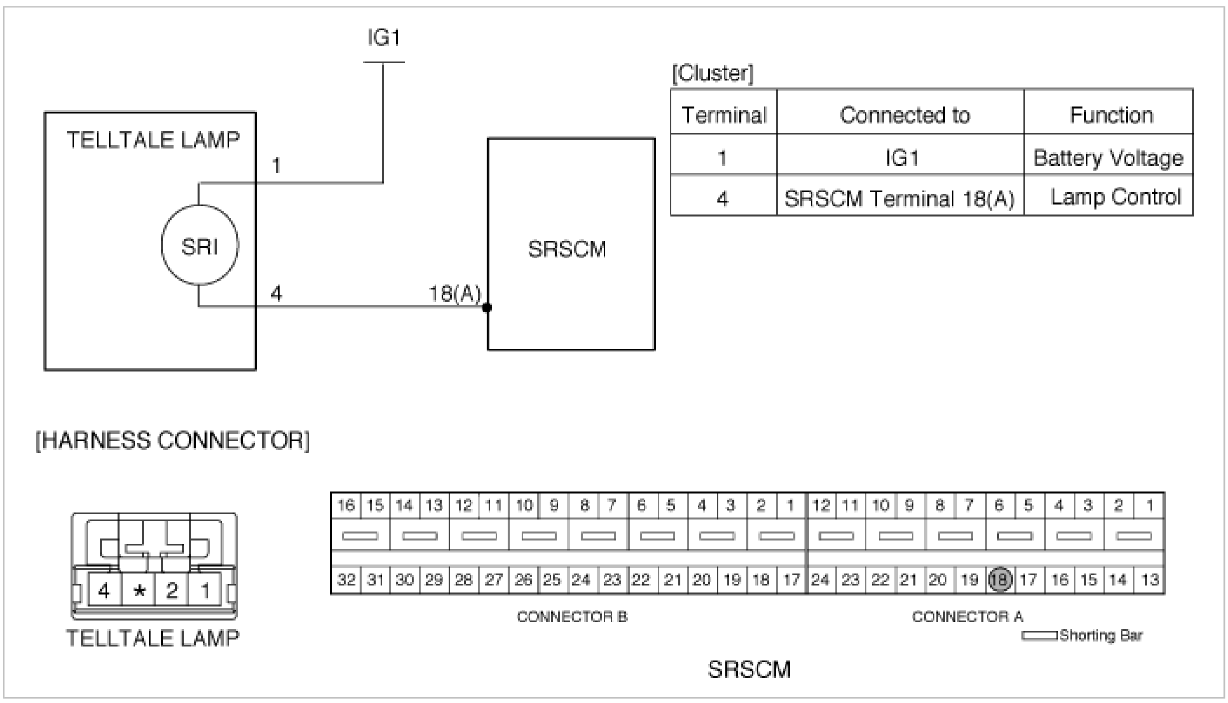
DTC Description

The Telltale Lamp circuit consisits of the Telltale Lamp and the SRSCM. SRSCM set the above DTC that the Telltale Lamp failure is detected.

DTC Detecting Condition

DTC	Condition	Probable cause
B2502	• Airbag fuse • Telltale Lamp Bulb • Open between Telltale Lamp and SRSCM • Short to ground or battery line between the Telltale Lamp and SRSCM • SRSCM Malfunction	• Fuse • Telltale Lamp Bulb • Wiring Harness • SRSCM

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

CAUTION

Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▸ Go to next step.

YES

▸ After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK THE FUSE
   (1) Remove the airbag fuse and the airbag telltale lamp fuse from junction block.
   (2) Inspect the fuses. Are the fuses normal?

   YES

   ▸ Check the telltale lamp bulb.

   NO

   ▸ Repair or replace the fuses.

3. CHECK THE TELLTALE LAMP BULB
   (1) Remove the bulb from the instrument cluster.
   (2) Inspect the bulb. Is the bulb normal?

   YES

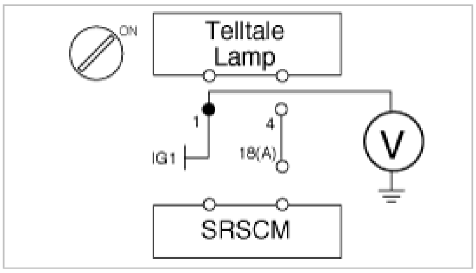
   ▸Check source voltage.

   NO

   ▸ Repair or replace the bulb.

4. CHECK SOURCE VOLTAGE
   (1) Connect the negative (-) terminal to the battery.
   (2) Turn the ignition switch to ON.
   (3) Measure voltage between the terminal 1 of the Telltale Lamp harness connector and chassis ground(-).

   specification(voltage) : 9 ~ 16 V

   (4) Is the measured voltage within specification?

   YES

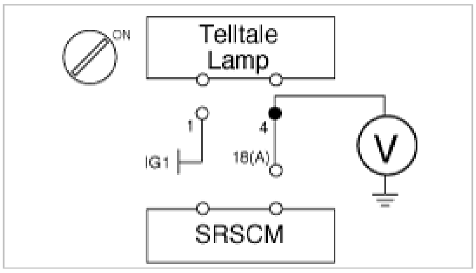
   ▸Check short to battery line.

   NO

   ▸Repair or replace the wiring harness between ignition switch and the Telltale Lamp.

5. CHECK SHORT TO BATTERY LINE
   (1) Measure voltage between the terminal 4 of the Telltale Lamp harness connector and chassis ground(-).

   specification(voltage) : Approximately 0 V



(2) Is the measured voltage within specification?

YES

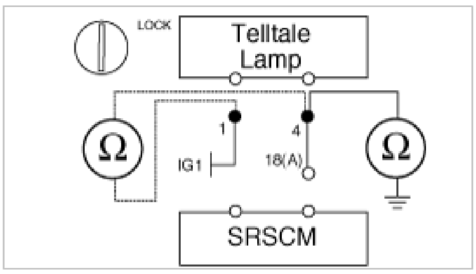
▸ Check short or short to ground.

NO

▸ Repair the short to battery line circuit on wiring harness between the SRSCM and the Telltale Lamp.

6. CHECK SHORT OR SHORT TO GROUND
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative(-) terminal from the battery.
   (3) Measure resistance between the terminal 4 of the Telltale Lamp harness connector and chassis ground.
   (4) Measure resistance between the terminal 1 and 4 of the Telltale Lamp harness connector.

specification(resistance) : infinite



(5) Is the measured resistance within specification?

YES

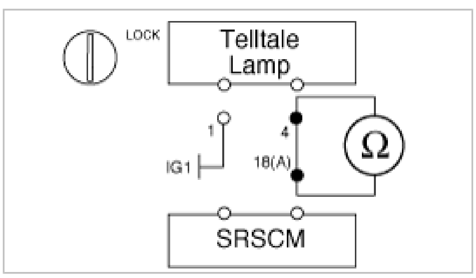
▸Check open circuit.

NO

▸ Repair the short or short to ground circuit on wiring harness between the SRSCM and the Telltale Lamp.

7. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 4 of the Telltale Lamp harness connector and the terminal 18(A) of SRSCM harness connector.

specification(resistance) : below 1 Ω



(2) Is the measured resistance within specification?

YES

▸ Go to next step.

NO

▸ Repair the open circuit on wiring harness between the SRSCM and the Telltale Lamp.

8. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal to the battery.

(5) Connect a Hi-Scan(Pro) to the data link connector.

(6) Turn the ignition switch to ON.

(7) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).

(8) Turn the ignition switch to LOCK and wait for at least 30 seconds.

(9) Turn the ignition switch to ON and wait for at least 30 seconds.

(10) Check the vehicle again with the Hi-Scan(Pro).
Does the above DTC(s) go off?

YES

▸ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

▸Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Airbag Module > Description and Operation

AIRBAG DISPOSAL

Special Tool Required

Before scrapping any airbags or side airbags (including those in a whole vehicle to be scrapped), the airbags or side airbags must be deployed. If the vehicle is still within the warranty period, before deploying the airbags or side airbags, the Technical Manager must give approval and/or special instruction. Only after the airbags or side airbags have been deployed (as the result of vehicle collision, for example), can they be scrapped.
If the airbags or side airbags appear intact (not deployed), treat them with extreme caution. Follow this procedure.

Deploying Airbags In the vehicle

If a SRS equipped vehicle is to be entirely scrapped, its airbags or side airbags should be deployed while still in the vehicle. The airbags or side airbags should not be considered as salvageable parts and should never be installed in another vehicle.

1. Turn the ignition switch OFF, and disconnect the battery negative cable and wait at least three minutes.
2. Confirm that each airbag or side airbag are securely mounted.
3. Confirm that the special tool is functioning properly by following the check procedure.
   Driver's Airbag :
4. Remove the driver's airbag , then disconnect #1,#2 driver's airbag connector.
   Then install the SST(0957A-38510).
   Passenger's Airbag :
5. Remove the passenger's airbag, then disconnect passenger's airbag connector.
   Then install the SST(0957A-38510).
   Side Airbag :
6. Remove the side airbag, then disconnect side airbag connector.
   Then install the SST(0957A-3F100).
   Curtain Airbag :
7. Remove the curtain airbag, then disconnect curtain airbag connector.
   Then instal the SST(0957A-38500).
   Belt pretensioner :
8. Remove the belt pretensioner, then disconnect belt pretensioner connector.
   Then instal the SST(0957A-38500).
   Buckle pretensioner :
9. Remove the buckle pretensioner, then disconnect buckle pretensioner connector.
   Then install the SST(0957A-2E210).
10. Place the deployment tool at least thirty feet (10 meters) away from the airbag.
11. Connect a 12 volt battery to the tool.
12. Push the tool's deployment switch. The airbag should deploy. Repeat for 2nd circuit if deploying DAB or PAB. (deployment is both highly audible and visible: a loud noise and rapid inflation of the bag, followed by slow deflection)
13. Dispose of the complete airbag. No part of it can be reused. Place it in a sturdy plastic bag and seal it securely.

Deploying the Airbag Out of the vehicle

If an intact airbag has been removed from a scrapped vehicle, or has been found defective or damage during transit, storage or service, it should be deployed as follows :

1. Confirm that the special tool is functioning properly by following the check procedure on this page.
2. Position the airbag face up, outdoors on flat ground at least thirty feet (10meters) from any obstacles or people.

Disposal of Damaged Airbag

1. If installed in a vehicle, follow the removal procedure of driver's airbag, front passenger's and side airbag.
2. In all cases, make a short circuit by twisting together the two airbag inflator wires.
3. Package the airbag in exactly the same packing that the new replacement part come in.

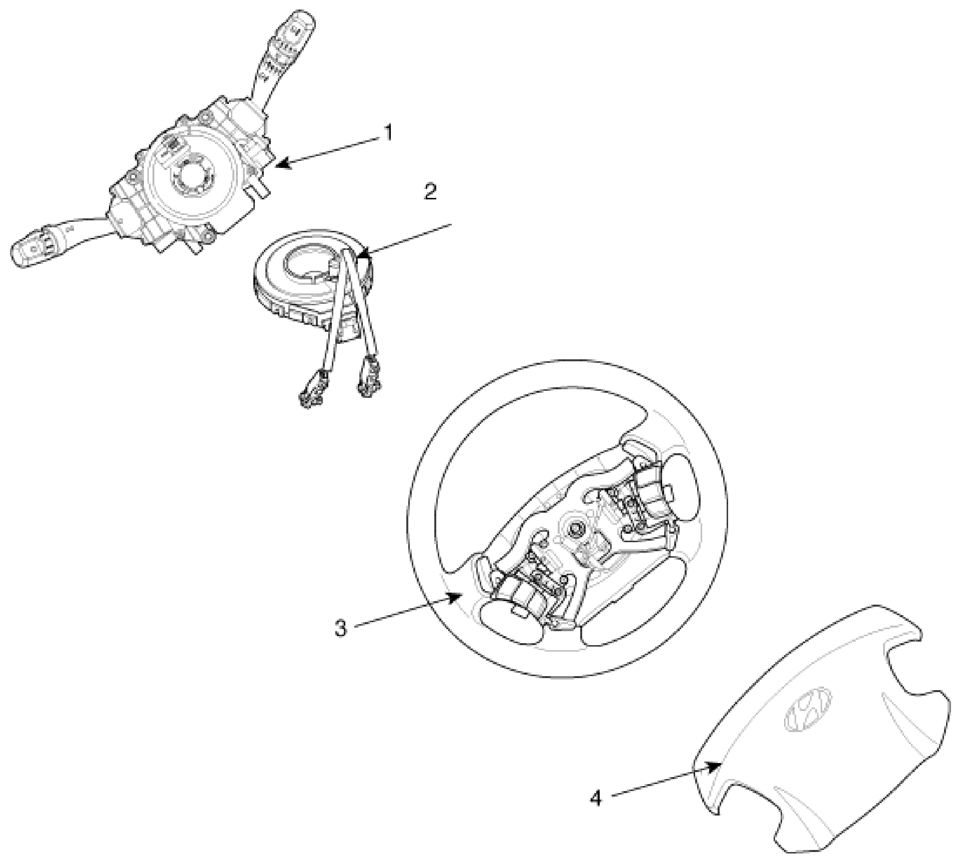
Restraint > Airbag Module > Driver Airbag (DAB) Module and Clock Spring > Description and Operation

DESCRIPTION

Driver Airbag (DAB) is installed in steering wheel and electrically connected to SRSCM via clockspring. It protects the driver from danger by deploying a bag when frontal crash occurs. The SRSCM determines deployment of Driver Airbag (DAB) by using the Front Impact Sensor (FIS) signal. The driver airbag is a two stage device. If the crash algorithm determines that only the first stage is to be activated, the second stage will be automatically disposed of after a programmable time has elapsed since the first stage deployment. The ACU shall be capable to deploy all firing loops for at least 150ms after IGN has been disconnected.

Restraint > Airbag Module > Driver Airbag (DAB) Module and Clock Spring > Components and Components Location

components



1. Multi-Function Switch
2. Clock Spring
3. Steering Wheel
4. Driver Airbag (DAB)

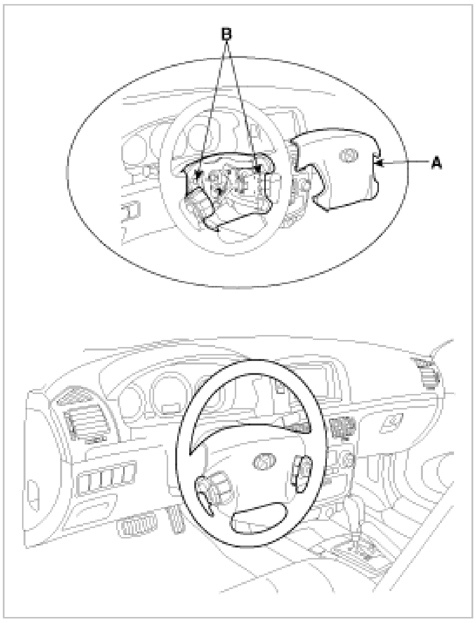
Restraint > Airbag Module > Driver Airbag (DAB) Module and Clock Spring > Repair procedures

REMOVAL

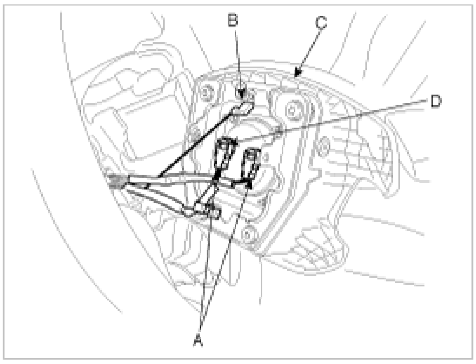
DAB REMOVAL

1. Disconnect the battery negative cable and wait at least three minutes before beginning work.
2. After removing the cover (A), loosen the two Torx bolt (B).

> NOTE
>
> • Use the magnetic tool, because the bolts(B) are not seperated completely.



3. Disconnect the connectors(A) after lifting up the pin(D) and the horn connector(B). Remove the driver's airbag(C) from the steering wheel.

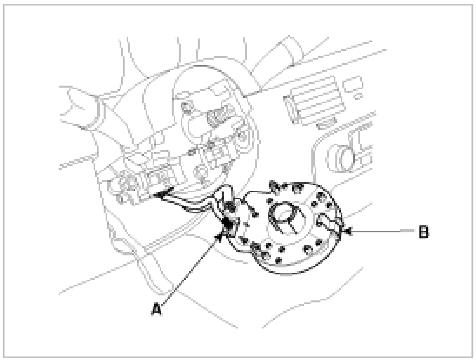


CAUTION

The removed airbag module should be stored in a clean and dry place with the pad cover face up.

CLOCK SPRING REMOVAL

1. Disconnect the negative battery cable, and wait at least 3 minutes before beginning work.
2. Remove the DAB.
3. Remove the steering wheel (Refer to ST- Steering wheel group).
4. Remove the steering column shroud.(Refer to ST-steering column and shaft)
5. Remove clock spring connector(A), then remove clock spring(B).



6. Verify front wheelS are pointed straight ahead.
7. Turn clockspring clockwise until it stopS. (softly, do not force)
   Turn it counter clockwise 3 truns until front wheel is pointed forward.
8. Install on to steering column.

9. Installation is the reverse of removal.

NOTE

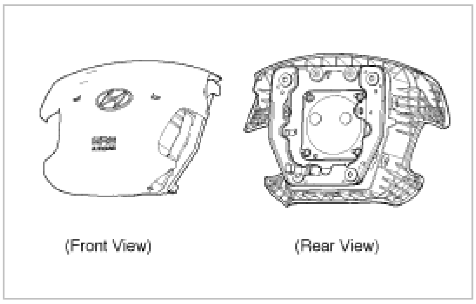
After installing the clock spring, confirm proper system operation; Turn the ignition switch ON: the SRS indicator light should turn on for about 6 seconds and then go off.

INSPECTION

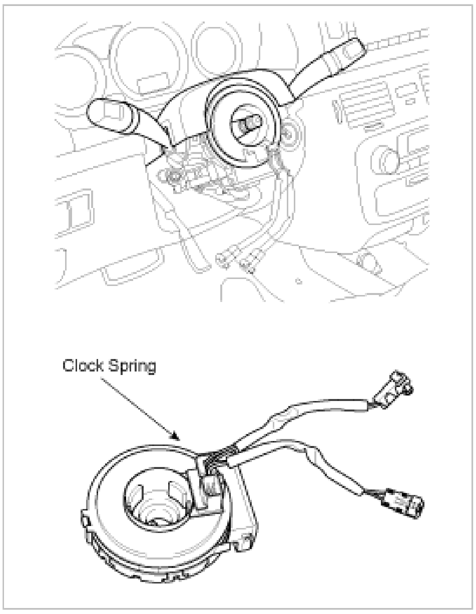
CAUTION

Never attempt to measure the circuit resistance of the airbag module (squib) even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental airbag deployment will result in serious personal injury.

1. Check pad cover for dents, cracks or deformities.
2. Check the airbag module for denting, cracking or deformation.
3. Check hooks and connectors for damage, terminals for deformities, and harness for binds.
4. Check airbag inflator case for dents, cracks or deformities.



5. Install the airbag module to the steering wheel to check for fit or alignment of the wheel.
   A. If, as a result of the following checks, even one abnormal point is discovered, replace the clock spring with a new one.
   B. Check connectors and protective tube for damage, and terminals for deformities.



Restraint > Airbag Module > Passenger Airbag (PAB) Module > Description and Operation

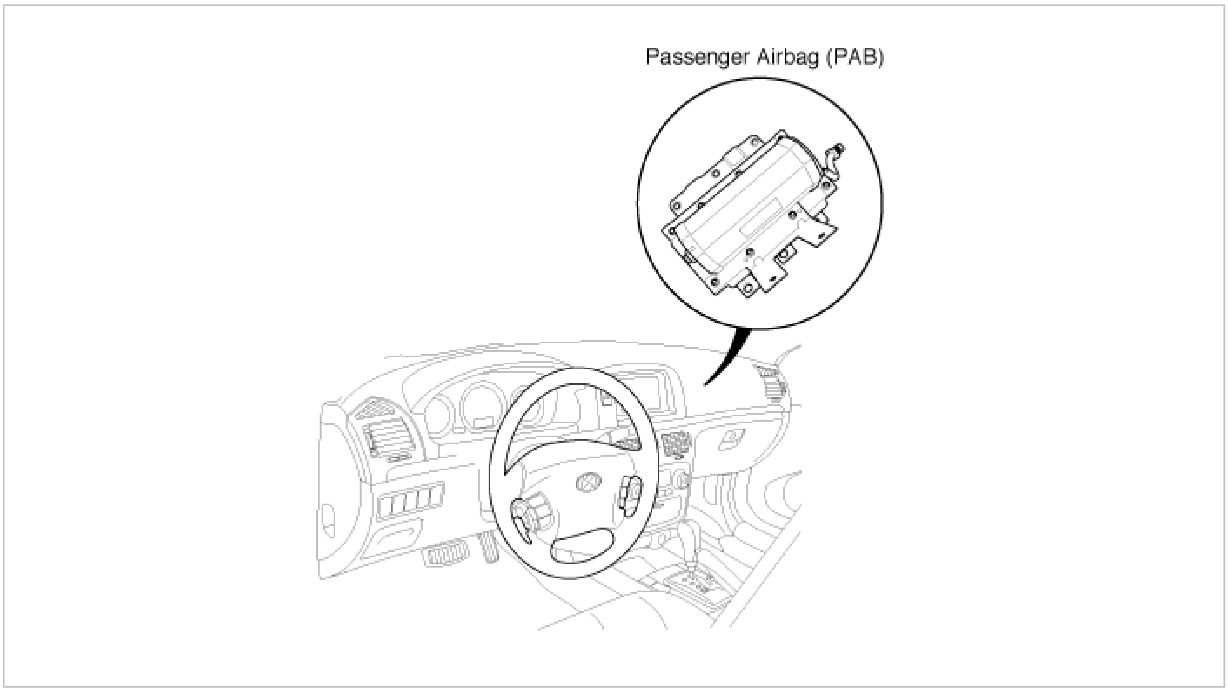
DESCRIPTION

The passenger Airbag (PAB) is installed inside the dash and protects the front passenger in the event of a frontal crash. The SRSCM determines if and when to deploy the PAB from the front impact sensor (FIS) signal. The PAB is a two-stage device; if the SRSCM determines that only the first stage should activate, the second stage will dispose after first-stage deployment. In case of loss of vehicle power, the driver firing loops have a 150 ms battery backup.

Restraint > Airbag Module > Passenger Airbag (PAB) Module > Components and Components

Location

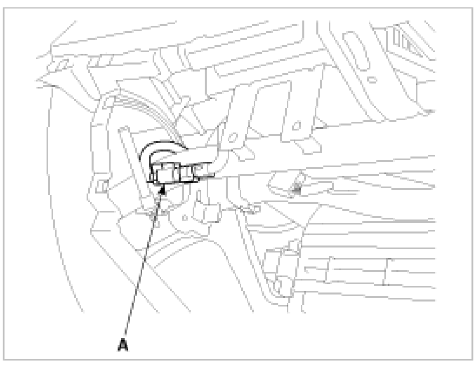
components



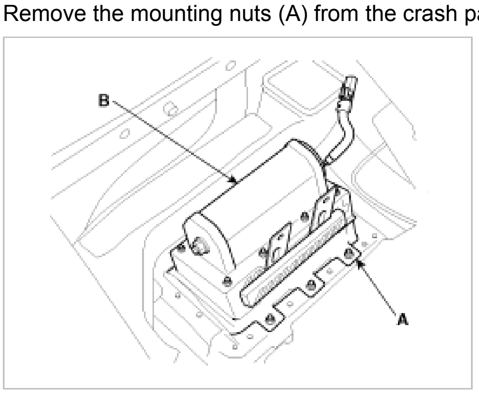
Restraint > Airbag Module > Passenger Airbag (PAB) Module > Repair procedures

REMOVAL

1. Disconnect the battery negative cable and wait at least three minutes before beginning work.
2. Remove the glove box (Refer to group - glove box) , then disconnect the connector(A).



3. Remove the crash pad. (Refer to BD group - crash pad)
4. Remove the mounting nuts (A) from the crash pad. Then remove the passenger's airbag (B).



5. Installation is the reverse of removal.

NOTE

After installing the clock spring, confirm proper system operation; Turn the ignition switch ON: the SRS indicator light should turn on for about 6 seconds and then go off.

Restraint > Airbag Module > Side Airbag (SAB) Module > Description and Operation

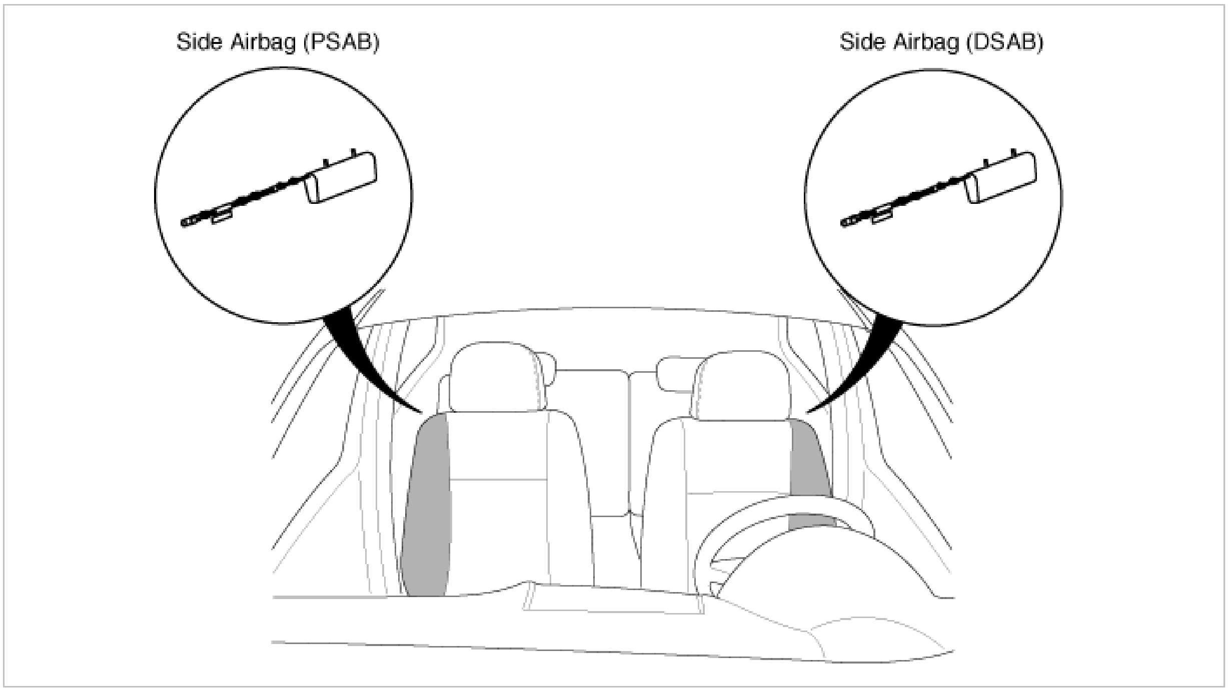
DESCRIPTION

CAUTION

Never attempt to measure the circuit resistance of the airbag module (squib) even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental airbag deployment may result in serious personal injury.

Restraint > Airbag Module > Side Airbag (SAB) Module > Components and Components Location

components



Restraint > Airbag Module > Side Airbag (SAB) Module > Repair procedures

REMOVAL

1. Disconnect the battery negative cable and wait at least 3 minutes before beginning work.
2. Remove the front seat assembly(Refer to BD-Front Seat)
3. Remove the seat-back assembly.(Refer to BD-Front Seat)
4. Installation is the reverse of removal.

NOTE

After installing the side airbag, confirm proper system operation: Turn the ignition switch ON; the SRS indicator light should turn on about six seconds and then go off.

Restraint > Airbag Module > Curtain Airbag (CAB) Module > Description and Operation

DESCRIPTION

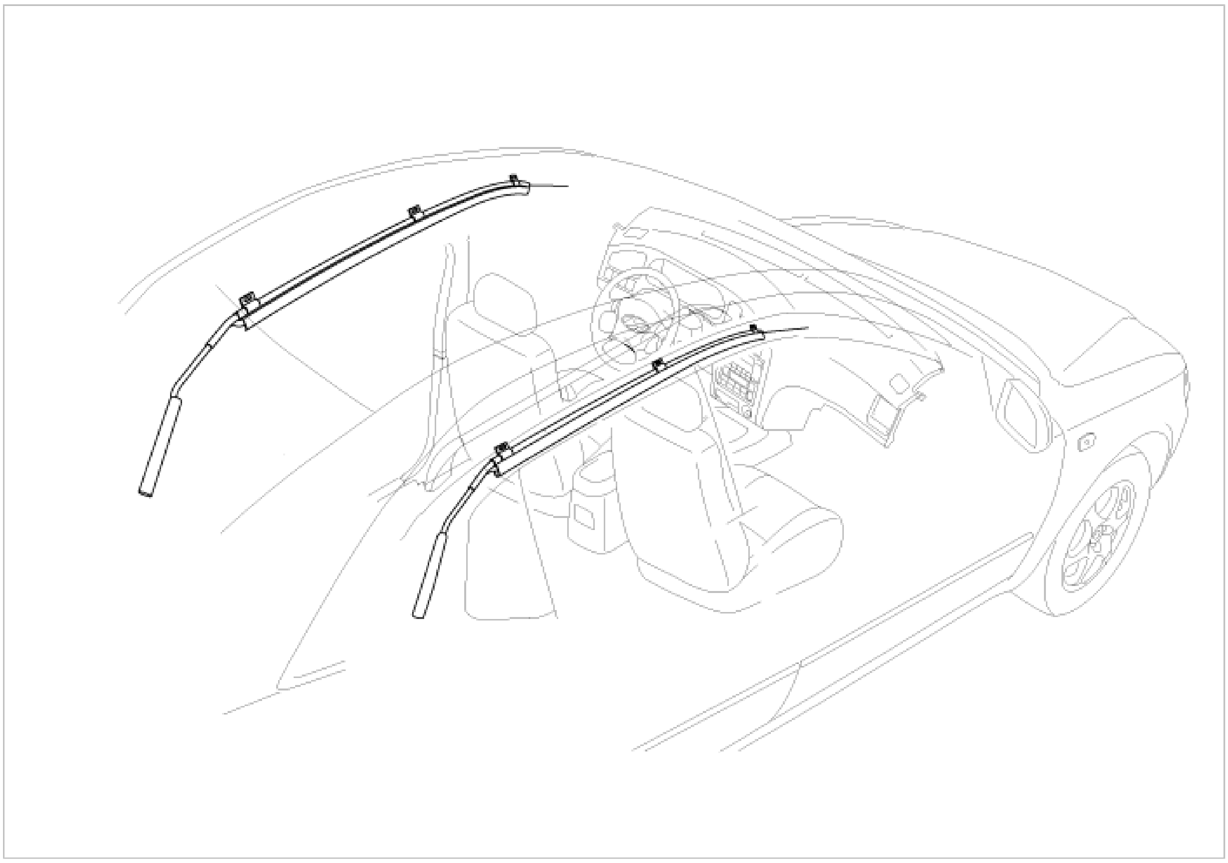
Curtain airbags are installed inside the headliner (LH and RH) and protect the driver and passanger from danger when side crash occurs. The SRSCM determines deployment of curtain airbag by using side impact sensor (SIS) signal.

CAUTION

Never attempt to measure the circuit resistance of the airbag module even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental airbag deployment will result in serious personal injury.

Restraint > Airbag Module > Curtain Airbag (CAB) Module > Components and Components Location

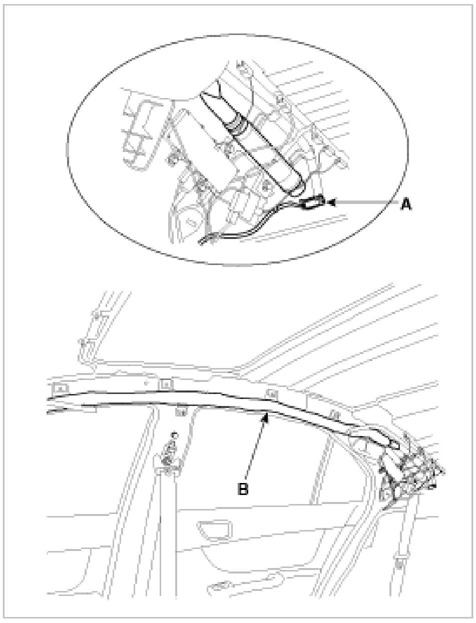
components



Restraint > Airbag Module > Curtain Airbag (CAB) Module > Repair procedures

removal

1. Disconnect the battery negative cable and wait at least 3 minutes before beginning work.
2. Remove the following parts (Refer to BD- group).
   A. Front and rear seat
   B. Interior trim
   C. Trunk trim
   D. Headlining
3. Disconnect the connector (A).
4. After loosening the mounting bolts, remove the curtain airbag (B).



5. Installation is the reverse of removal

> **NOTE**
>
> After installing the curtain airbag, confirm proper system operation: Turn the ignition switch ON; the SRS indicator light should turn on about seconds and then go off.

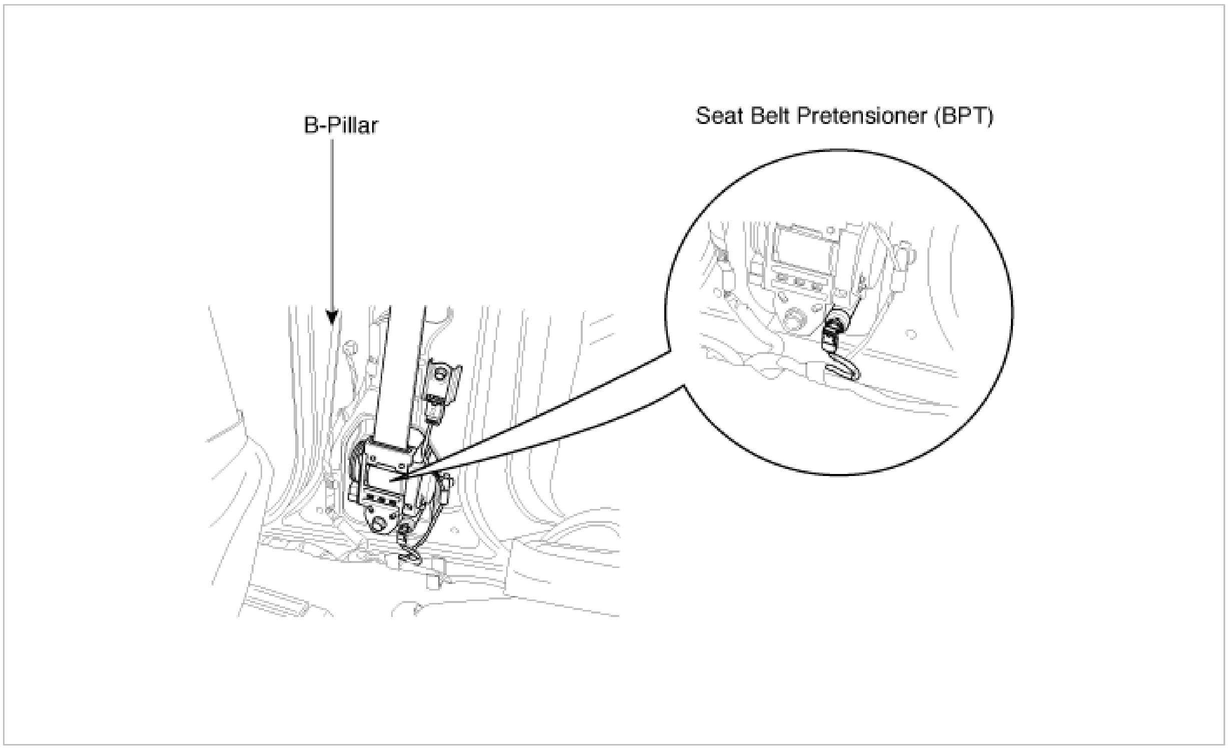
Restraint > Seat Belt Pretensioner > Seat Belt Retractor Pretensioner (BPT) > Description and Operation

DESCRIPTION

> **CAUTION**
>
> - Never attempt to measure the circuit resistance of the Seat Belt Pretensioner (BPT) even if you are using the specified tester. If the circuit resistance is measured with a tester, the pretensioner will be ignited accidentally. This will result in serious personal injury.
> - Both the seat belt and the seat belt buckle must be replaced if they worn during an accident, even if the pretensioners did not deploy.

Restraint > Seat Belt Pretensioner > Seat Belt Retractor Pretensioner (BPT) > Components and Components Location

components

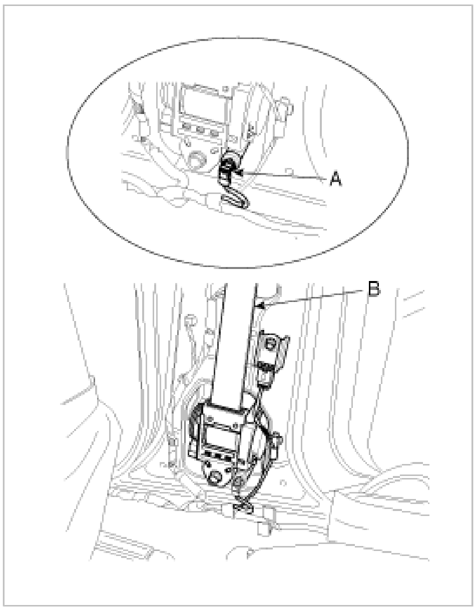


Restraint > Seat Belt Pretensioner > Seat Belt Retractor Pretensioner (BPT) > Repair procedures

removal

SEAT BELT PRETENSIONER

1. Disconnect the battery negative cable, and wait at least three minutes before beginning work.
2. Remove the front seat assembly (Refer to BD group - seat)
3. Remove the front door scuff trim (Refer to BD group - interior)
4. Remove the center pillar trim (Refer to BD group - interior)
5. Remove the lower anchor bolt (Refer to BD group - belt)
6. Remove the upper anchor bolt (Refer to BD group - belt)
7. Disconnect the connector (A).
8. Lossen the mounting bolt.
   Remove the pretensioner (B).

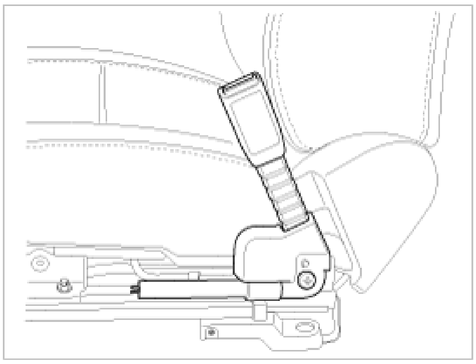
9. Installation is the reverse of removal.

NOTE

After installing the belt pretensioner, confirm proper system operation: Turn the ignition switch ON: the SRS indicator light should turn on about six seconds and then go off.

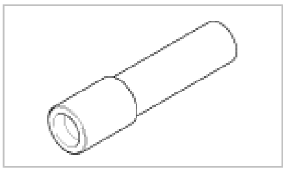
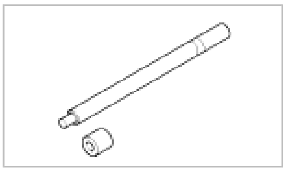
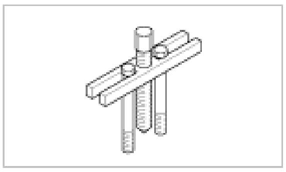
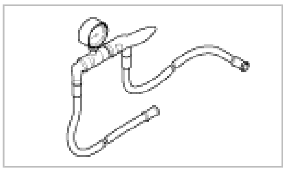
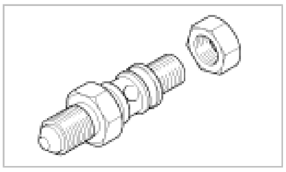
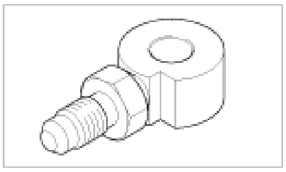
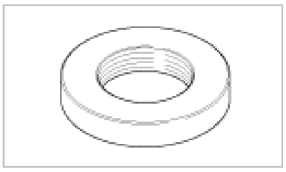
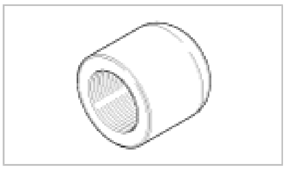
SEAT BELT BUCKLE PRETENSIONER

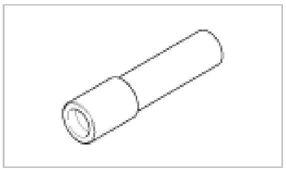
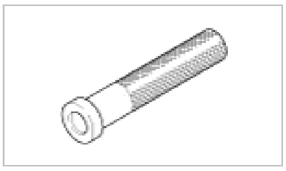
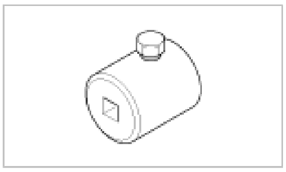
1. Disconnect the (-) battery cable and wait at least three minutes before beginning work.
2. Remove the front seat assembly(Refer to BD group - seat)
3. Remove the buckle pretensioner bolt.



4. Remove the seat belt buckle pretensioner.
5. Installation is the reverse of removal.

SPECIAL TOOLS

Tool (Number and Name)	Illustration	Use
09222-32100 Valve stem oil seal installer		Installation of the oil pump oil seal
09555-21000 Bar		Removal and installation of the oil seal (Use with 09573-33100, 09573-33000,09573-21000)
09561-11001 Steering wheel puller		Removal of steering wheel
09568-4A000 Tie rod end puller		Separation of the tie rod end bail joint
09572-21000 Oil pressure gauge		Measurement of the oil pressure (Use with 09572-22100, 09572-21200)
09572-21200 Oil pressure gauge adapter		Measurement of the oil pressure (Use with 09572-21000, 09572-22100)
09572-22100 Oil pressure gauge adapter		Measurement of the oil pressure (Use with 09572-21000, 09572-21200)
09573-33000 Oil seal installer		Installation of the back up washer and oil seal (Use with 09753-21000,09573-33100, 09555-21000)
09573-33100 Oil seal guide		Removal and installation of the oil seal (Use with 09573-21000, 09573-33000,09555-21000)
09573-21000		Installing the oil seal of the rack housing

Oil seal installer gauge		
09434-14200 Counter shaft bearing installer		Installing the gear box oil seal
09565-11100 Preload socket		Measuring the pinion shaft preload

Steering System > General Information > Troubleshooting

TROUBLESHOOTING

Symptom Pro	bable cause	Remedy
Excessive play in steering	Loose yoke plug	Retighten
	Loose steering gear mounting bolts	Retighten
	Loose or worn tie rod end	Retighten or replace as necessary
Steering wheel operation is not smooth (Insufficient power assist)	V-belt slippage	Readjust
	Damaged V-belt	Replace
	Low fluid level	Replenish
	Air in the fluid	Bleed air
	Twisted or damaged hoses	Correct the routing or replace
	Insufficient oil pump pressure	Repair or replace the oil pump
	Sticky flow control valve	Replace
	Excessive internal oil pump leakage	Replace the damaged parts
	Excessive oil leaks from rack and pinion in gear box	Replace the damaged parts
	Distorted or damaged gear box or valve body seals	Replace
Steering wheel does not return properly	Excessive turning resistance of tierod end	Replace
	Yoke plug excessively tight	Adjust
	Tie rod and/or ball joint cannot turn smoothly	Replace
	Loose mounting of gear box mounting bracket Worn steering shaft joint and/or	Retighten
	Worn steering shaft joint and/or body grommet	Correct or replace
	Distorted rack	Replace
	Damaged pinion bearing	Replace
	Twisted or damaged hoses	Reposition or replace
	Damaged oil pressure control valve	Replace

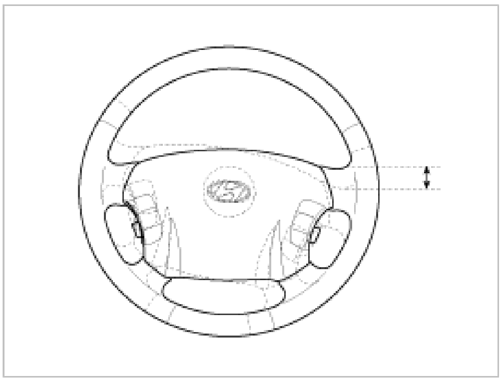
	Damaged oil pump input shaft bearing	Replace
Noise	Hissing Noise in Steering Gear There is some noise with all power steering systems. One of the most common is a hissing sound when the steering wheel is turned and the car is not moving. This noise will be most evident when turning the wheel while the brakes are being applied. There is no relationship between this noise and steering performance. Do not replace the valve unless the "hissing" noise becomes extreme. A replaced valve will also make a slight noise, and is not always a solution for the condition.	
Rattling or chucking noise in the rack and pinion	Interference with hoses from vehicle body	Reposition
	Loose gear box bracket	Retighten
	Loose tie rod end and/or ball joint	Retighten
	Worn tie rod and/or ball joint	Replace
Noise in the oil pump	Low fluid level	Replenish
	Air in the fluid	Bleed air
	Loose pump mounting bolts	Retighten

SERVICE ADJUSTMENT PROCEDURE

CHECKING STEERING WHEEL FREE PLAY

1. Start the engine and with the steering wheel in the straight ahead position.
2. Measure the play while turning the steering wheel to the left and right.

Standard value :
Steering wheel free play : 30 mm (1.1 in)



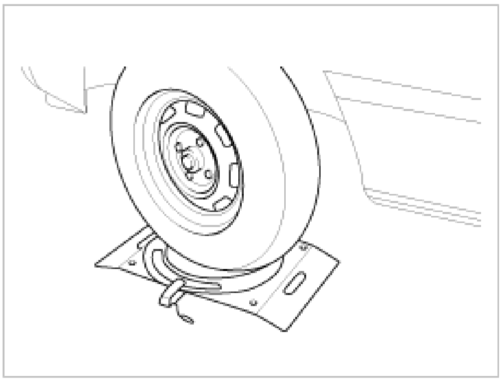
3. If the play exceeds the standard value, inspect the connection between the steering shaft and tie rod ends.

CHECKING STEERING ANGLE

1. Place the front wheel on a turning radius gauge and measure the steering angle.

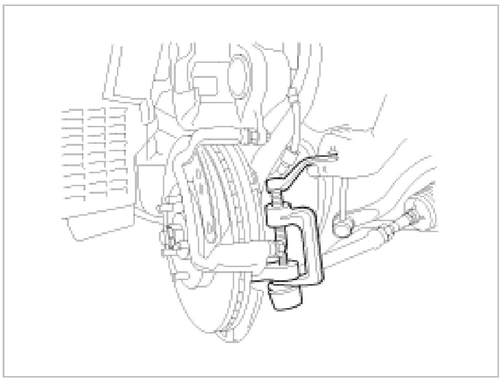
Standard value :	
Wheel angle	
Inside wheel	39.17°±2°
Outside wheel	31.56°

2. If the measured value is not within the standard value, adjust the toe and inspect again.



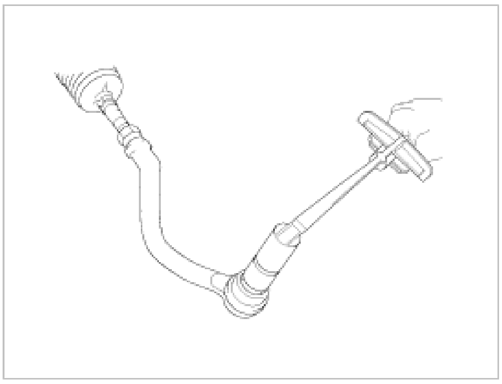
CHECKING THE TIE ROD END BALL JOINT STARTING TORQUE

1. Disconnect tie rod and knuckle with the special tool(09568-4A000).



2. Shake the ball joint stud several times to check for looseness.

Tie rod end ball joint starting torque :
30 kg·cm or less



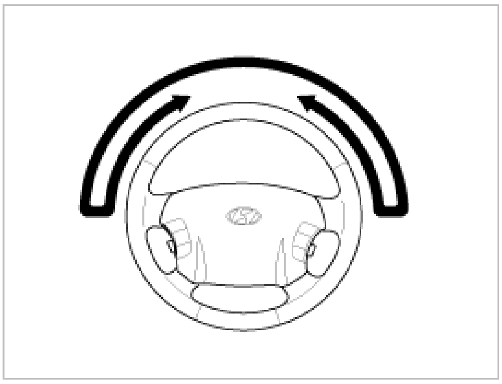
3. If the starting torque exceeds the upper limit of the standard value, replace the tie rod end.
4. Even if the starting torque is below the lower limit of the standard value, check the play of the ball joint and replace if necessary.

CHECKING STEERING WHEEL RETURN

1. The force required to turn the steering wheel and the wheel return should be the same for both moderate and sharp turns.
2. When the steering wheel is turned 90° and held for a couple of seconds while the vehicle is being driven at 20-30 kph (12-19 mph), the steering wheel should return at least 20° from its central position when it is released.

NOTE

If the steering wheel is turned very quickly, steering may be momentarily difficult. This is not a malfunction because the oil pump output will be somewhat decreased.



CHECKING POWER STEERING BELT TENSION

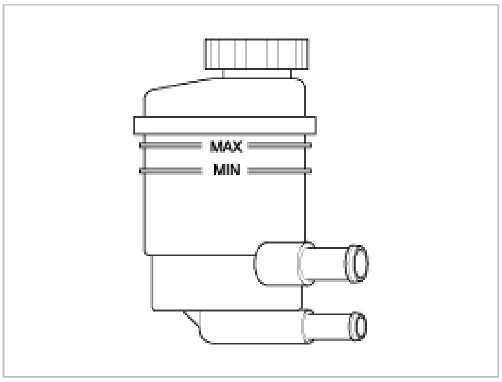
Refer to EM group(Timing system).

CHECKING POWER STEERING FLUID LEVEL

1. Position the vehicle on a level surface.
2. Start the engine. With the vehicle kept stationary, turn the steering wheel several times continuously to raise the fluid temperature to 50-60°C (122-140°F).
3. With the engine at idle, turn the steering wheel fully clockwise and counter-clockwise several times.
4. Make sure that there is no foaming or cloudiness in the reservoir fluid.
5. Stop the engine and check for any difference in fluid level between a stationary and a running engine.

NOTE

1. If the fluid level varies 5 mm (0.2 in) or more, bleed the system again.
2. If the fluid level suddenly rises after stopping the engine, further bleeding is required.
3. Incomplete bleeding will produce a chattering sound in the pump and noise in the flow control valve, and lead to decreased durability of the pump.



REPLACING POWER STEERING FLUID

1. Jack up the front wheels and support them with jackstands.
2. Disconnect the return hose from the oil reservoir and plug the oil reservoir.
3. Connect a vinyl hose to the disconnected return hose, and drain the oil into a container.
4. Disconnect the high-tension cable at the ignition coil side. While operating the starter motor intermittently, turn the steering wheel all the way to the left and then to the right several times to drain the fluid.
5. Connect the return hoses, then fill the oil reservoir with the specified fluid.
6. Start the engine. Check for oil leakage.
7. Stop the engine.
8. Bleed the system.

Power steering fluid type : PSF-4
Total quantity : Approx 1.0 liter

AIR BLEEDING

1. Disconnect the high tension cable, and while operating the starting motor intermittently (for 15-20 seconds), turn the steering wheel all the way to the left and then to the right five or six times.

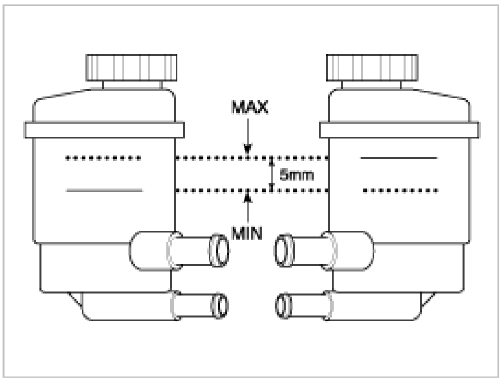
> **NOTE**
>
> 1. During air bleeding, replenish the fluid supply so that the level never falls below the lower position of the filter.
> 2. If air bleeding is done while the vehicle is idling, the air will be broken up and absorbed into the fluid. Be sure to do the bleeding only while cranking.

2. Connect the high tension cable, and start the engine(idling).
3. Turn the steering wheel to the left and the right until there are no air bubbles in the oil reservoir.

> **CAUTION**
>
> Do not hold the steering wheel turned all the way to either side for more than ten seconds.

4. Confirm that the fluid is not milky, and that the level is up to the position specified on the level gauge.
5. Confirm that there is little change in the surface o the fluid when the steering wheel is turned left and right.

> **CAUTION**
>
> 1. If the surface of the fluid changes considerably, air bleeding should be done again.
> 2. If the fluid level rises suddenly when the engine is stopped, it indicates that there is still air in the system.
> 3. If there is air in the system, a jingling noise may be heard from the pump and the control valve may also produce unusual noises.
>   Air in the system will shorten the life of the pump and other parts.

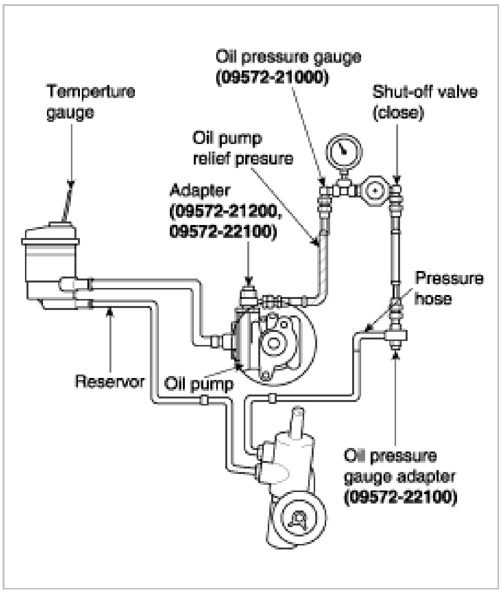


OIL PUMP PRESSURE TEST (OIL PUMP RELIEF PRESSURE)

1. Disconnect the pressure hose from the oil pump. Connect the special tool between the oil pump and pressure hose as illustrated.
2. Bleed the air, and then start the engine and turn the steering wheel several times so that the fluid temperature rises to approximately 50°C (122°F).
3. Set the engine speed to 1,000 rpm.
4. Close the shut-off valve of the special tool and measure the fluid pressure to confirm the it is within the range.

standard vaule :
Relief pressure: 90 +3/-2 kgf/cm^2

> **CAUTION**
>
> Don’t keep the shut-off valve on the pressure gauge closed for longer than 10 seconds.



5. Remove the special tools, and tighten the pressure hose to the specified torque.

Tightening torque :
55-65 Nm (5.5-6.5 kgf·m)

6. Bleed the system.

Steering System > General Information > Specifications

SPECIFICATIONS

Item			Specifications
Column and shaft	Shaft and joint type		Collapsible, crossjoint with tilt column
	Steering gear type		Rack and pinion
	Rack stroke mm		150
	Tilt stroke	Non electrical	±7°
Oil pump	Type		Vane type
	Displacement		10.5 cc/rev
	Relief pressure		90 +3/-2 kgf/cm²
Steering angle	Inner		39.17°±2°
	Outer		31.56°
	TIE ROD END BALL JOINTSTARTING TORQUE		30kg·cm or less

TIGHTENING TORQUE

Items		Nm	kgf·m	lb-ft
Steering column and shaft	Steering column to column member mounting (upper)	13 ~ 18	1.3 ~ 1.8	9.4 ~ 13
	Steering column shroud	4 ~ 6	0.4 ~ 0.6	2.8 ~ 4.3
	Steering column to column member mounting (lower)	13 ~ 18	1.3 ~ 1.8	9.4 ~ 13

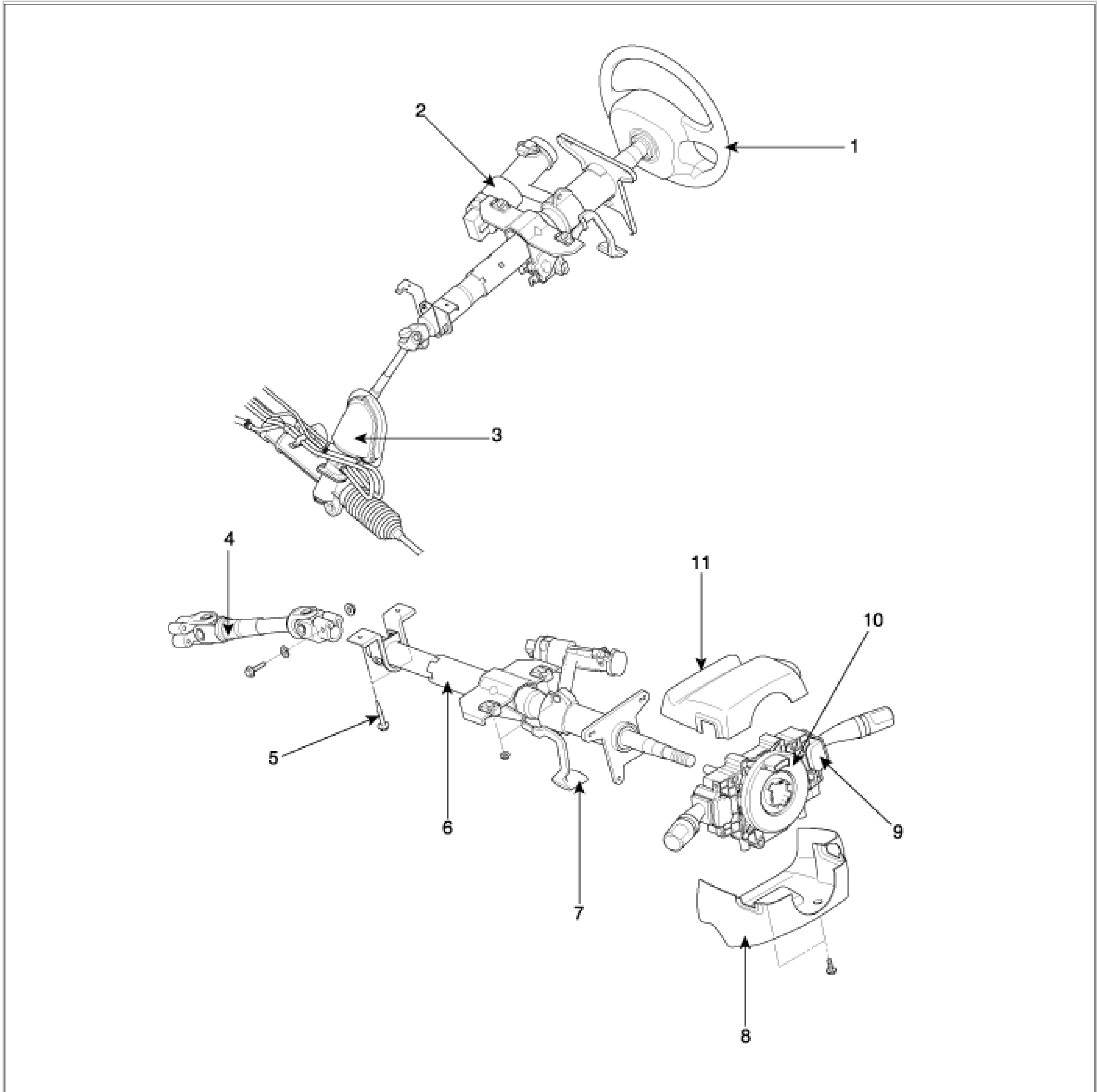
	Steering wheel lock nut	40 ~ 50	4 ~ 5	28.9 ~ 36.1
	Joint assembly	18 ~ 25	1.8 ~ 2.5	13 ~ 18
Steering gear box	Pressure hose to gear box	12 ~ 18	1.2 ~ 1.8	8.6 ~ 13
	Return tube to gear box	12 ~ 18	1.2 ~ 1.8	8.6 ~ 13
	Tie rod end lock nut	50 ~ 55	5 ~ 5.5	36.1 ~ 39.7
	Pinion and valve assembly to self locking nut	20 ~ 30	2 ~ 3	14.4 ~ 21.6
	lock nut	50 ~ 70	5 ~ 7	36.1 ~ 50.6
	Tie rod end self locking nut	24 ~ 34	2.4 ~ 3.4	17.3 ~ 24.5
	Mounting bracket to crossmember	60 ~ 80	6 ~ 8	43.3 ~ 57.8
Oil pump	Pressure hose to oil pump	55 ~ 65	5.5 ~ 6.5	39.7 ~ 47
	Oil pump mounting bolt(2.4)	17 ~ 26	1.7 ~ 2.6	12.2 ~ 18.8
	Oil pump mounting bolt(3.3)	35 ~ 50	3.5 ~ 5	25.3 ~ 36.1
	Pump cover to pump body	18 ~ 22	1.8 ~ 2.2	13 ~ 15.9
	Suction connector to oil pump body	6 ~ 10	0.6 ~ 1	4.3 ~ 7.2
	Flow control valve connector to pump body	65 ~ 75	6.5 ~ 7.5	47 ~ 54.2
Steering hoses and oil reservoir	Oil reservoir bracket mounting bolt	4 ~ 6	0.4 ~ 0.6	2.8 ~ 4.3
	Cooler tube clamp mounting bolt	4 ~ 6	0.4 ~ 0.6	2.8 ~ 4.3
	Tube clip and tube bracket	4 ~ 6	0.4 ~ 0.6	2.8 ~ 4.3
	Pressure hose bracket mounting bolt	4 ~ 6	0.4 ~ 0.6	2.8 ~ 4.3
	Hose clamp	4 ~ 6	0.4 ~ 0.6	2.8 ~ 4.3

LUBRICANTS

Items	Specified lubricant	Quantity
Steering column bearing	Multipurpose grease SAE J310a, NLGI No.2	As required
Steering gear box rack, pinion gear part	Multipurpose grease SAE J310a, NLGI No.2	As required
Bellows	Silicone grease	As required
Oil pump	Power steering fluid (PSF-4)	As required
Power steering fluid	Power steering fluid (PSF-4)	0.9(0.79 pts.) ~ 1.0 lit (0.88 qts.)

Steering System > Steering Column & Shaft > Steering Column/Shaft > Components and Components Location

COMPONENTS

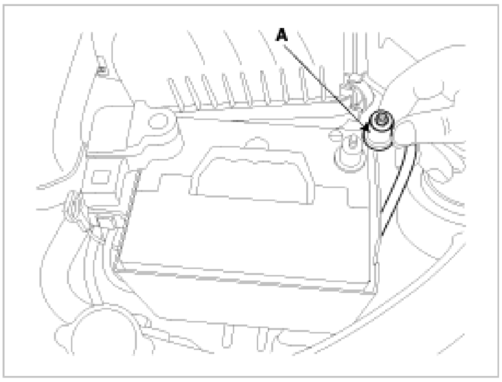


1. Steering wheel
2. Key lock assembly
3. Dust cover assembly
4. Universal joint assembly
5. Steering column shaft mounting bolt
6. Steering colum shaft assembly
7. Tilt lever
8. Steering column lower shroud
9. Multifunction switch
10. Clock spring
11. Steering column upper shroud

Steering System > Steering Column & Shaft > Steering Column/Shaft > Repair procedures

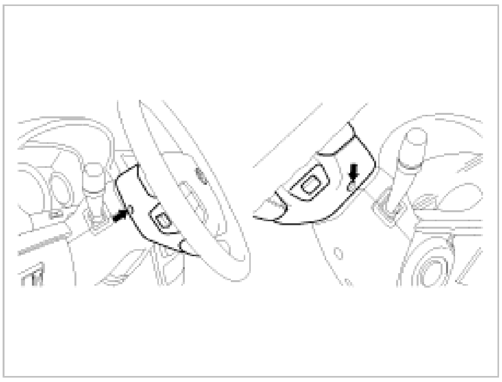
REMOVAL

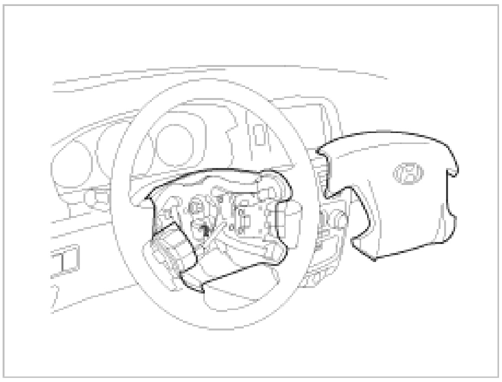
1. Disconnect the negative (-) terminal(A) from the battery.



2. Loosen the tapping screws and lift up the horn pad and remove it.
3. Remove the lock nut and the washer.

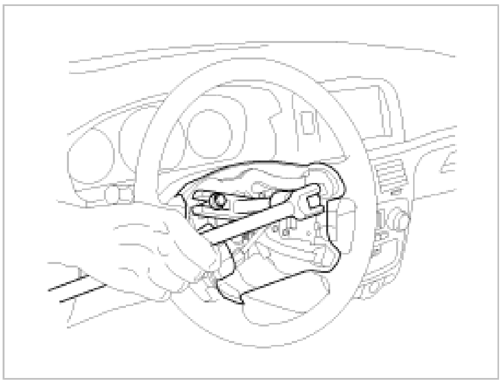
> **CAUTION**
>
> Before doing these procedures, see the SRS section (RT Group. Only for vehicles equipped with SRS).





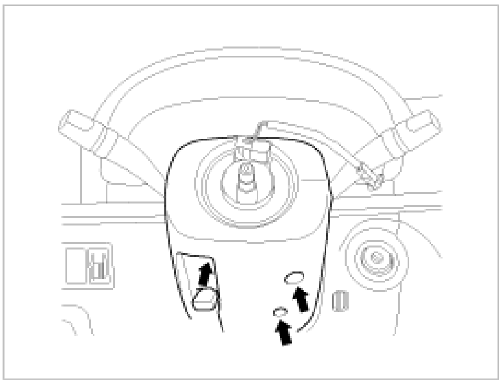
4. Remove the steering wheel with (09561-11001).

> **CAUTION**
>
> Do not hammer on the steering wheel to remove it doing so may damage the collapsible mechanism.

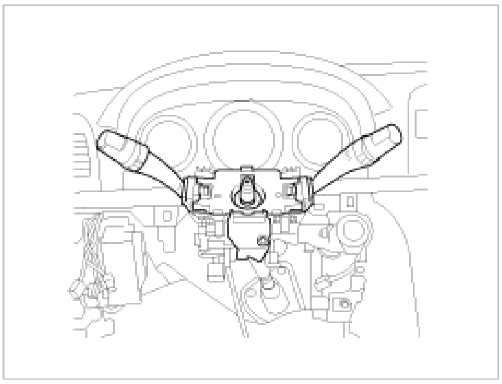


5. Remove the steering column lower and upper shrouds.

6. Remove the lower cover.



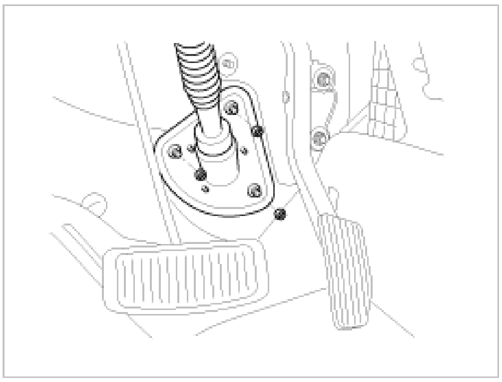
7. Disconnect the connectors and remove the multifunction switch.



8. Remove the bolts securing the coupling and universal joint. Pull out the universal joint from the gear box.

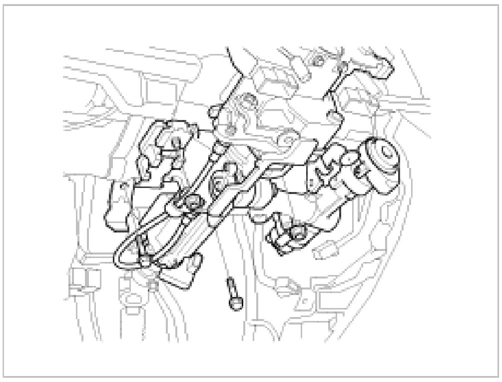
> **CAUTION**
>
> Keep the neutral-range to prevent the damage of the clock spring inner cable when you handlethe steering wheel.

9. Remove the dust cover mounting bolts.



10. Remove the steering column mounting bolts (4bolts).

11. Remove the steering column and shaft with the universal joint and cover.



INSTALLATION

1. Before installation, apply multipurpose grease to the groove inside the bearing and contracting surfaces of the boot and cover assembly.
2. Connect the steering lower shaft and joint assembly.

> NOTE
>
> When installing, mount the U-joint to the gear box first, then to the steering column shaft.

3. Install the dust cover to the column shaft assembly.
4. Install the steering column assembly to the column member assembly.
5. Install the multifunction switch and connect the connectors.

> CAUTION
>
> When installing the clock spring, refer the RT group to prevent the damage of clock spring inner cable.

6. Install the lower cover and steering column upper and lower shroud.
7. Install the steering wheel.

> NOTE
>
> When installing, do not use a hammer because the collapsible column shaft could be damaged.

INSPECTION

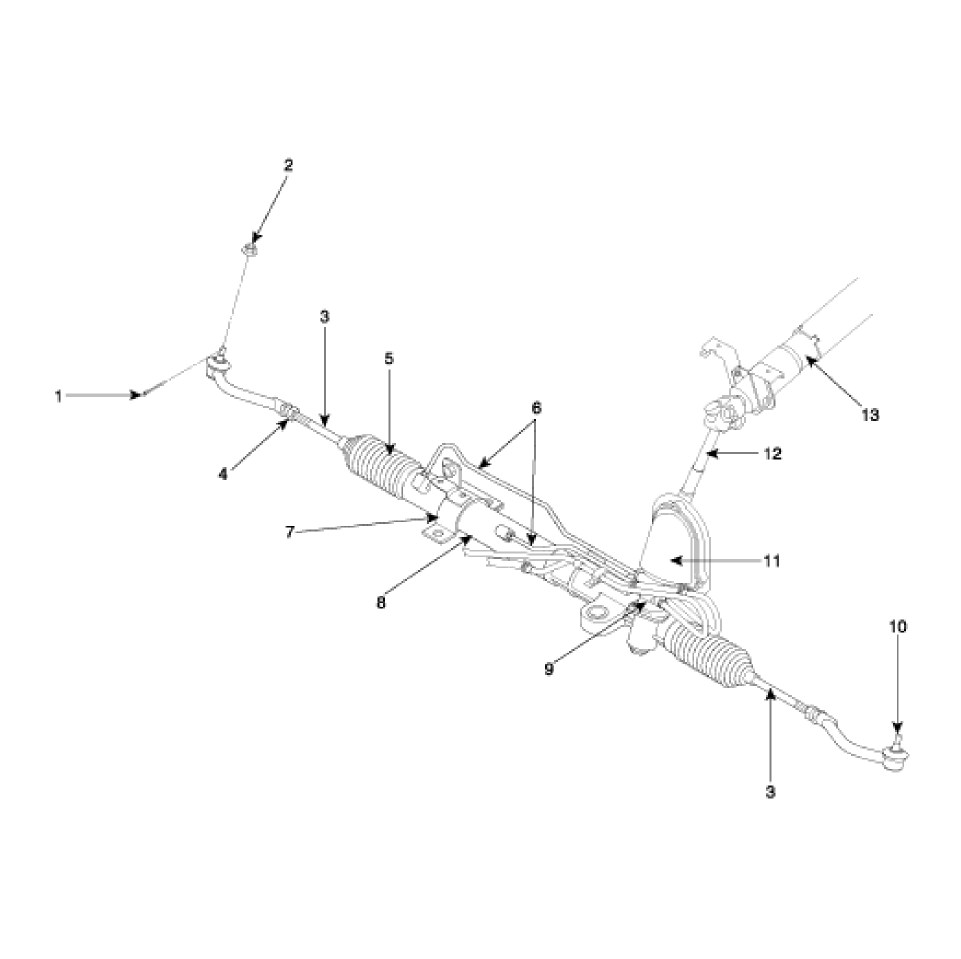
1. Check the steering shaft for damage, play and round movement.
2. Check the upper and lower bearing for wear or damage.
3. Check the joints for excessive play, damage or rough movement
4. Check the tilt bracket for cracks or damage.
5. Check the cover or boot for damage.
6. Check that the steering lock mechanism operates properly. If necessary, replace.

REASSEMBLY

1. Reassembly is reverse of the removal.
2. Make parallel the steering shaft's groove to the hook of the steering lock, when installing the steering lock assembly.

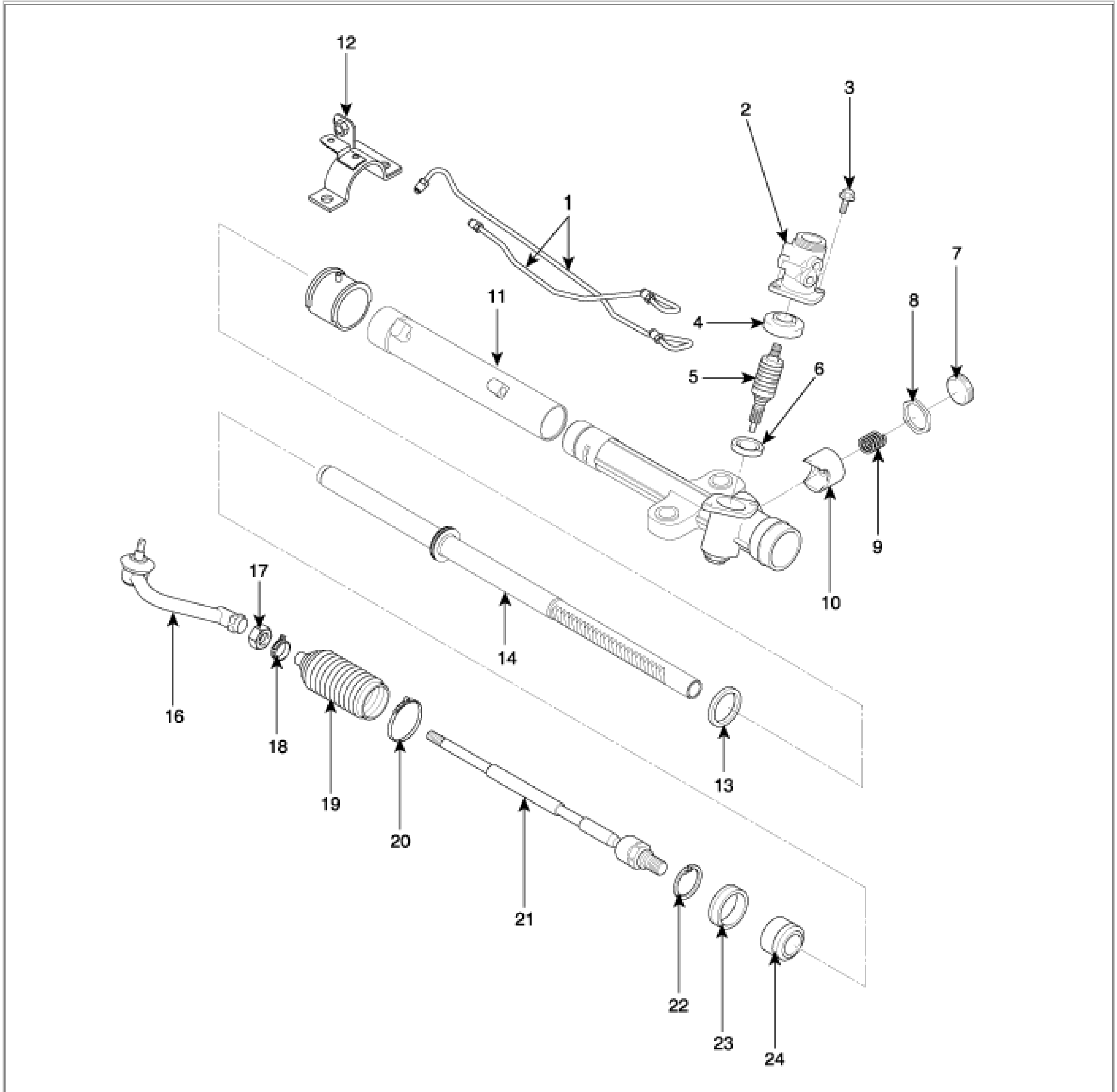
Steering System > Hydraulic Power Steering System > Power Steering Gear Box > Components and Components Location

COMPONENTS



1. Split pin
2. Slotted nut
3. Tie rod assembly
4. Lock nut
5. Bellows
6. Feed tube
7. Power steering gear box mounting clamp
8. Rack housing
9. Valve body assembly
10. Tie rod end assembly
11. Dust cover
12. Joint assembly
13. Steering column assembly

DISSASSEMBLY AND ASSEMBLY



1. Feed tube	9. Rack support spring	17. Bellows clip
2. Valve body housing	10. Rack support yoke	18. Bellows
3. Bolt	11. Rack housing	19. Bellows band
4. Oil seal	12. Power steering gear box mounting clamp	20. Tie rod
5. Pinion valve assembly	13. Oil seal	21. Circlip
6. Oil seal	14. Rack	22. Oil seal
7. Yoke plug	15. Tie rod end	23. Rack stopper
8. Lock nut	16. Lock nut	

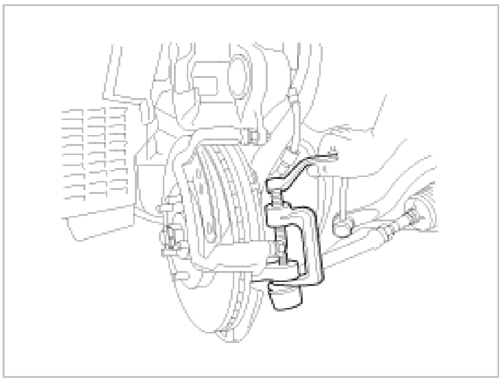
Steering System > Hydraulic Power Steering System > Power Steering Gear Box > Repair procedures

REMOVAL

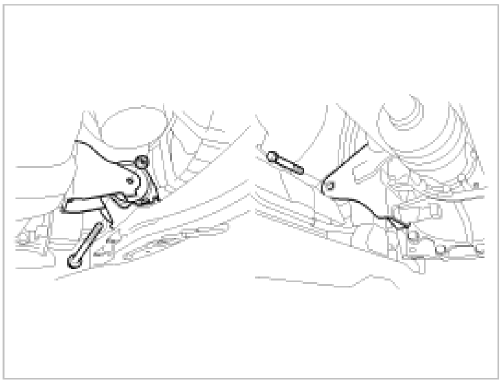
1. Drain the power steering fluid.
2. Remove the joint assembly connecting bolt.

> CAUTION
>
> Keep the neutral-range to prevent the damage of the clock spring inner cable when you handlethe steering wheel.

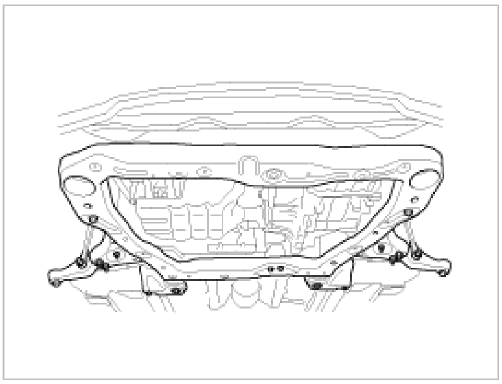
3. Using the special tool (09568-4A000), disconnect the tie rod end from the knuckle arm.



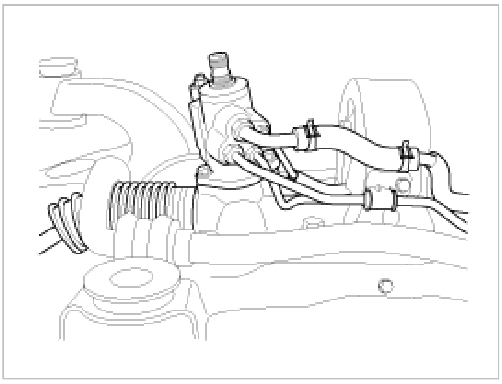
4. Remove the front fork and the knuckle ball joint from the front lower arm.
5. Remove the connecting bolts of front and rear roll stopper.



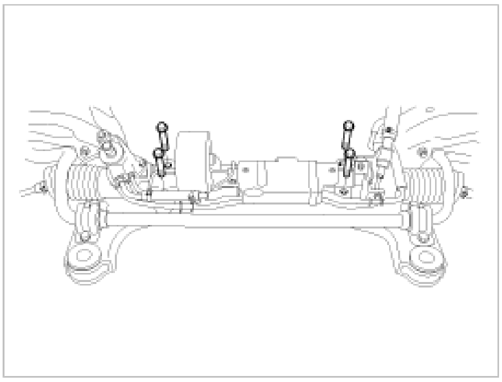
6. Remove the mounting bolts(10EA) of cross member complete assembly.



7. Disconnect the pressure hose and the return tube.

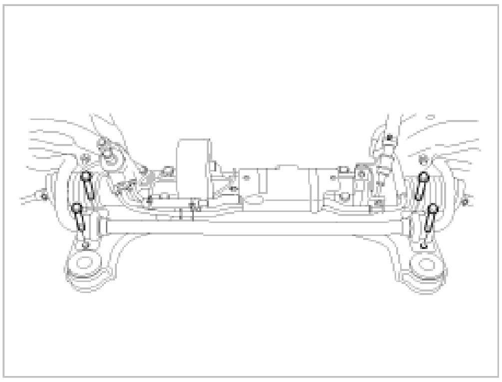


8. Remove the steering gear box mounting bolts and remove the steering gear box assembly and the mounting rubber.



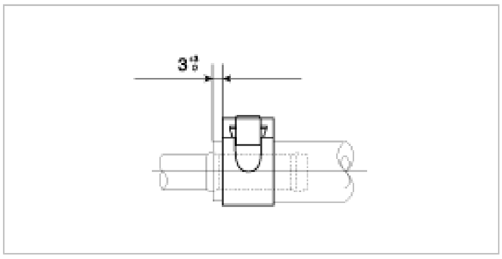
> **CAUTION**
>
> When removing the gear box, pull it out carefully and slowly to avoid damaging the boots.

9. Remove the stabilizer bar.



INSTALLATION

> **NOTE**
>
> Be sure to connect between a tube and a hose as shown in the illustration.



1. Installation is reverse of removal.

Tightening torque :

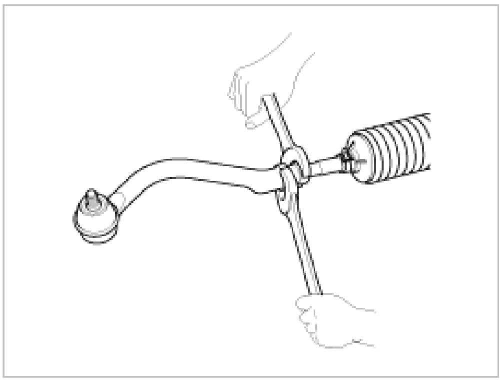
Items	Nm(kgf·m, lb-ft)

Pressure hose to gear box	12~18(1.2~1.8, 8.6~13)
Return tube to gear box	12~18(1.2~1.8, 8.6~13)
Tie rod end lock nut	50~55(5~5.5, 36.1~39.7)
Pinion and valve assembly to self locking nut	20~30(2~3, 14.4~21.6)
lock nut	50~70(5~7, 36.1~50.6)
Tie rod end self locking nut	24~34(2.4~3.4, 17.3~24.5)
Mounting bracket to crossmember	60~80(6~8, 43.3~57.8)

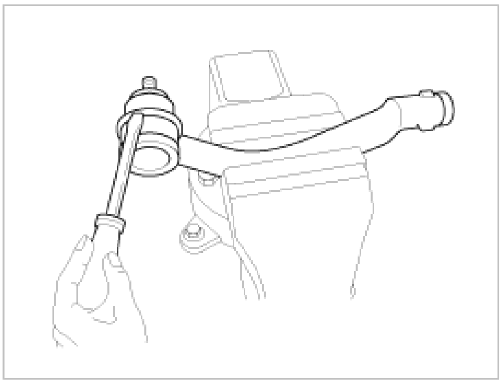
2. After installation, bleed the air in the power steering system(See page ST-11).

DISASSEMBLY

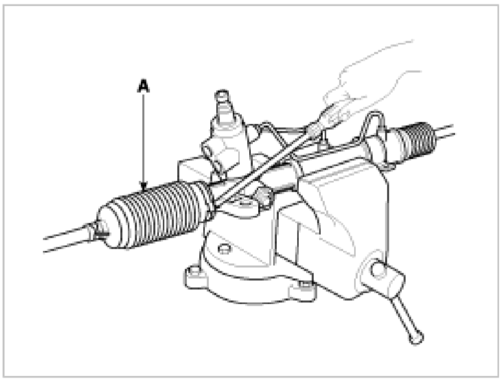
1. Remove the tie rod end from the tie rod.



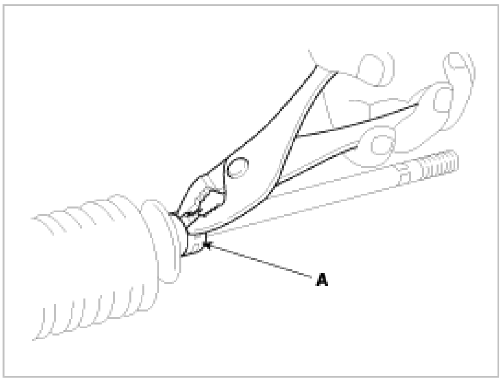
2. Remove the dust cover from the ball joint.



3. Remove the bellows band(A).



4. Remove the bellows clip(A).

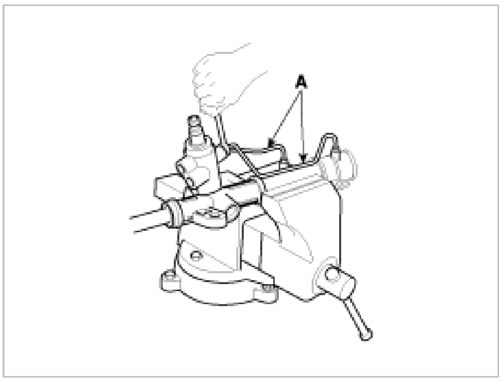


5. Pull the bellows out toward the tie rod.

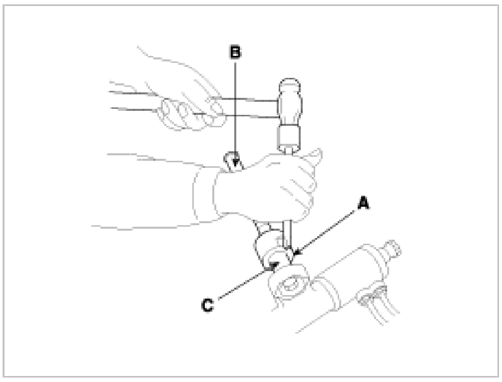
NOTE

Check for rust on the rack when the bellows are replaced.

6. Remove the feed tube(A) from the rack housing.



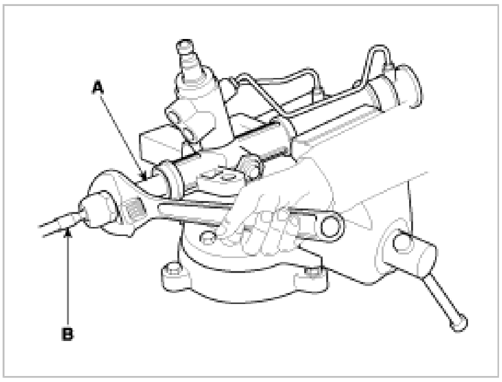
7. While moving the rack slowly, drain the fluid from the rack housing.
8. Unstake the tab washer(A) which fixes the tie rod(B) and rack(C) with a chisel.



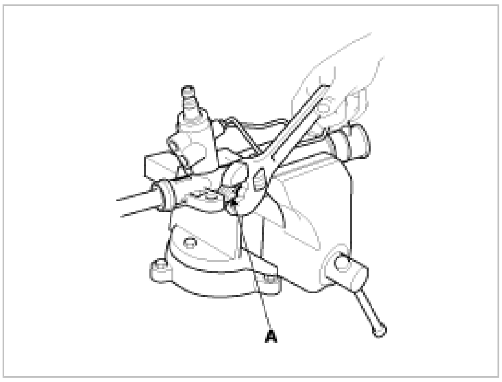
9. Remove the tie rod(B) from the rack(A).

CAUTION

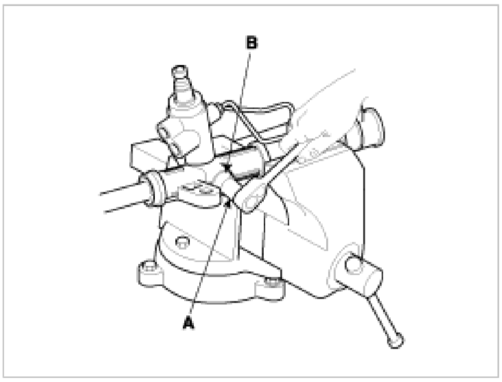
Remove the tie rod(B) from the rack(A), taking care not to twist the rack.



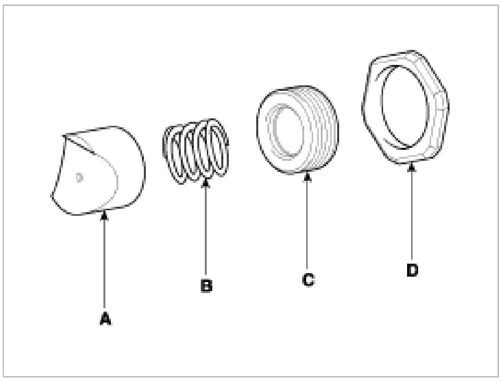
10. Remove the yoke plug locking nut(A).



11. Remove the yoke plug(B) with a 14mm socket(A).

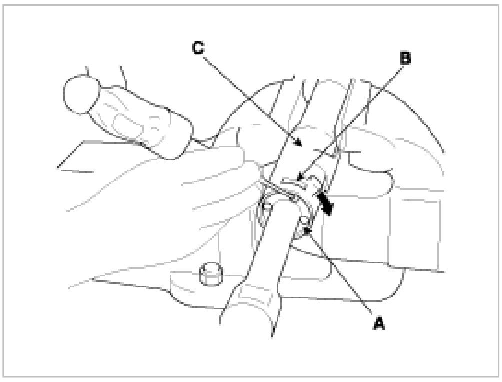


12. Remove the lock nut(D), yoke plug(C), rack support spring(B) and rack support yoke(A) from the gear box.

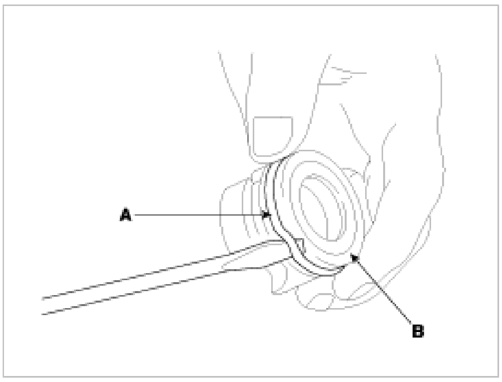


13. When the end of the circlip comes out of the notched hole of the housing rack cylinder, turn the rack stopper counterclockwise and remove the circlip.

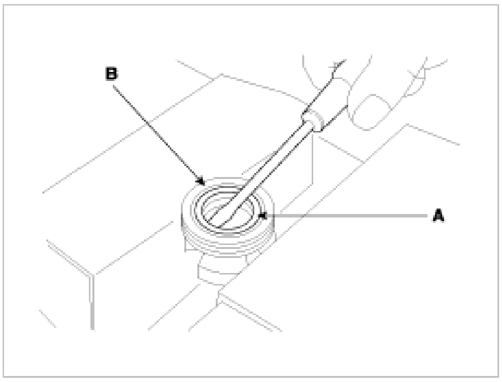
> **CAUTION**
>
> Be careful not to damage the rack.



14. Remove the rack bushing and rack from the rack housing.
15. Remove the O-ring(A) from the rack bushing(B).



16. Remove the oil seal(B) from the rack bushing(A).

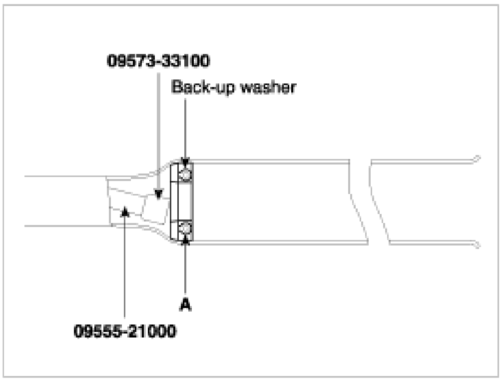


17. Remove the valve body from the valve body housing with a soft hammer.
18. Using the special tool, remove the oil seal and ball bearing from the valve body housing.
19. Remove the oil seal and O-ring from the rack housing.

> **CAUTION**
>
> Be careful not to damage the pinion valve cylinder inside of the rack housing.

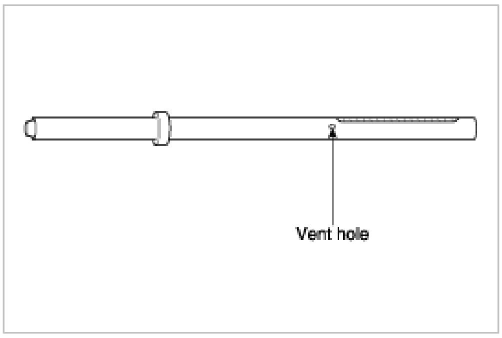
20. Using the special tool(09573-21200, 09555-33100), remove the oil seal(A) from the rack housing.

> **CAUTION**
>
> Be careful not to damage the rack cylinder inside of the rack housing.

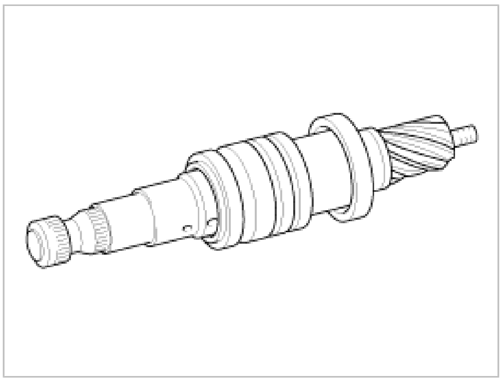


INSPECTION

1. Rack
   (1) Check for rack tooth face damage or wear.
   (2) Check for oil seal contact surface damage.
   (3) Check for rack bending or twisting.
   (4) Check for oil seal ring damage or wear.
   (5) Check for oil seal damage or wear.



2. Pinion valve
   (1) Check for pinion gear tooth face damage or wear.
   (2) Check for oil seal contact surface damage.
   (3) Check for seal ring damage or wear.
   (4) Check for oil seal damage or wear.



3. Bearing
   (1) Check for seizure or abnormal noise during a bearing rotation.
   (2) Check for excessive play.
   (3) Check for missing needle bearing rollers.
4. Others
   (1) Check for damage of the rack housing cylinder bore.

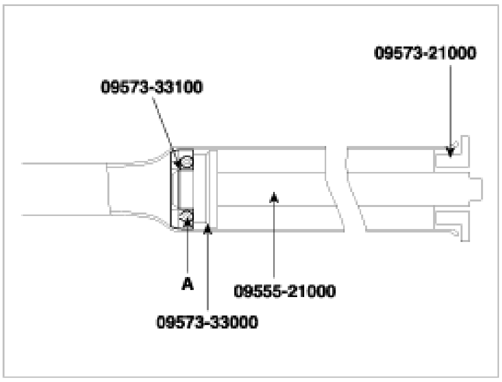
(2) Check for boot damage, cracking or aging.

REASSEMBLY

1. Apply the specified fluid to the entire surface of the rack oil seal.

Recommended fluid : PSF-4

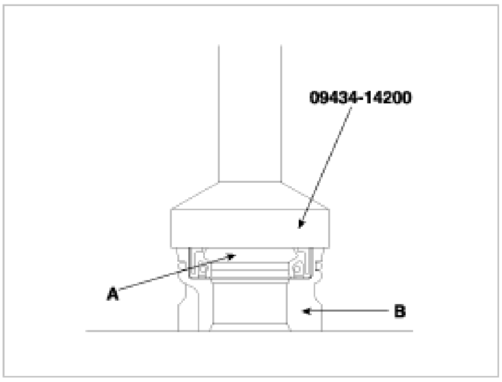
2. Install the backup washer and oil seal(A) to the specified position in the rack housing.



3. Apply the specified fluid to the entire surface of the rack bushing oil seal.

Recommended fluid : PSF-4

4. Install the oil seal(A) in the rack bushing(B).

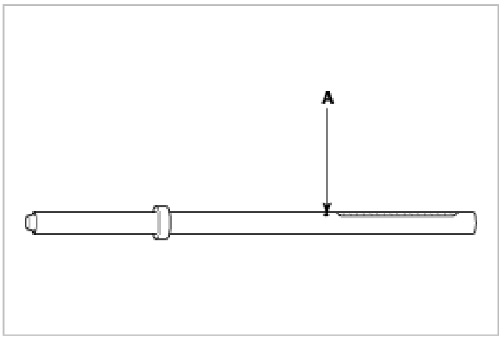


5. Apply the specified fluid to the entire surface of the O-ring and install it in the rack bushing.
6. Apply the specified grease to the rack teeth.

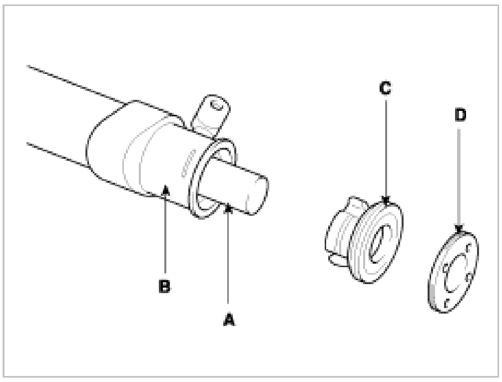
Recommended grease
Multipurpose grease SAE J310a NLGI No.2

NOTE

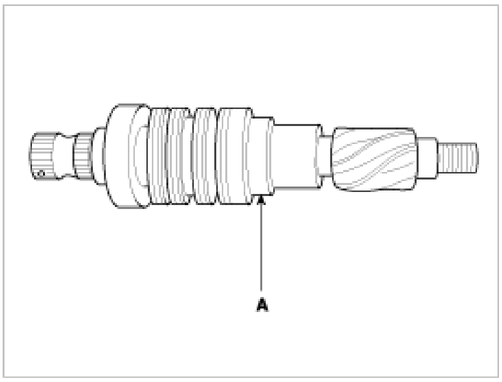
Do not plug the vent hole(A) in the rack with grease.



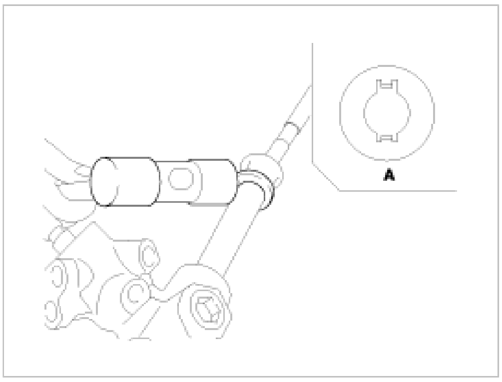
7. Insert the rack(A) into the rack housing(B) and install the rack bushing(C).



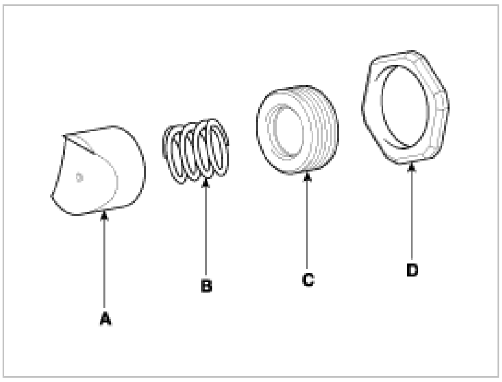
8. Using a special tool, install the oil seal and the ball bearing in the valve body housing.
9. After applying the specified fluid and grease to the pinion valve assembly(A), install it in the rack housing assembly.



10. Install the tie rod and punch on a point over the tie rod with a chisel.



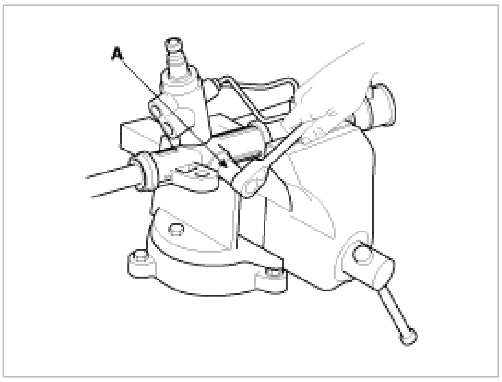
11. Install the rack support yoke(A), rack support spring(B), yoke plug(C) and lock nut(D) in the order shown in the illustration. Apply semi-drying sealant to the threaded section of the yoke plug before installation.



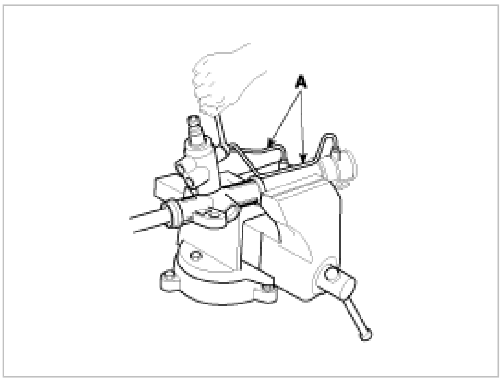
12. With the rack placed in the center position, attach the yoke plug to the rack housing. Tighten the yoke plug to 12 Nm (120 kg·cm, 8.9 lb·ft), with a 14mm socket(A). Loosen the yoke plug approximately from 30° to 60° and tighten the yoke nut to the specified torque.

Tightening torque

50 ~ 70 N·m (5 ~ 7 kgf·m, 37 ~ 52 lb-ft)

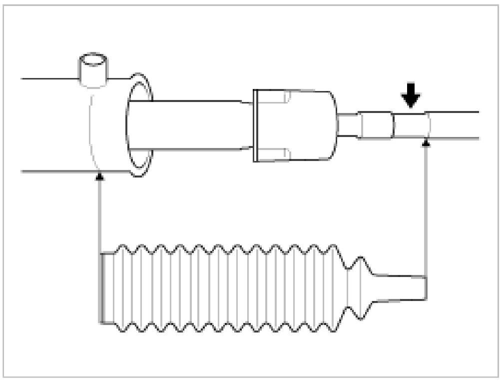


13. Tighten the feed tube(A) to the specified torque and install the mounting rubber using adhesive.



14. Apply the specified grease to the bellows mounting position (fitting groove) of the tie rod.

Recommended grease : Silicone grease

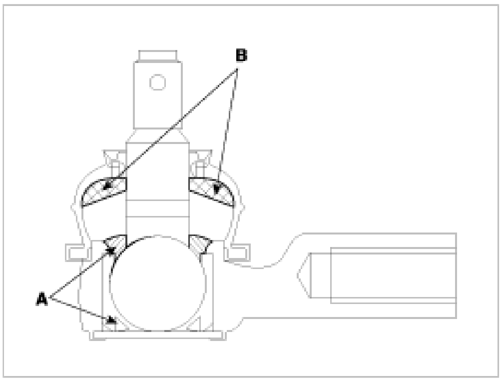


15. Install the new attaching band to the bellows.

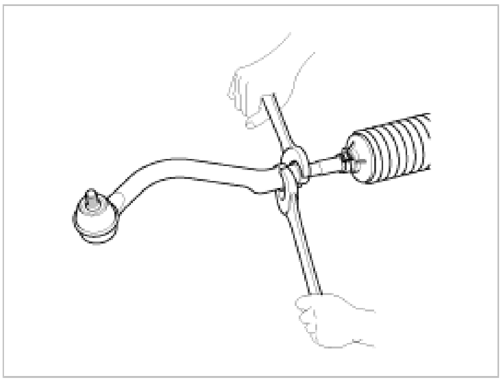
> **NOTE**
>
> When the bellows are installed, a new band must be used.

16. Install the bellows in position, taking care not to twist it.
17. Fill the dust cover inner side and lip with the specified grease, and fix the dust cover in position with the clip ring attached in the groove of the tie rod end.

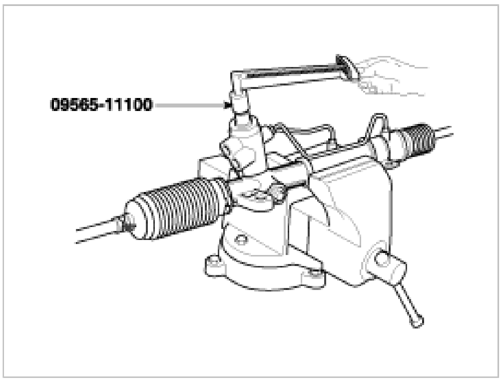
Recommended grease
A : POLY LUB GLY 801K or equivalent
B : SHOWA SUNLIGHT MB2 or equivalent
Dust cover inner side and lip : THREE BOND



18. Install the tie rod to the tie rod end.

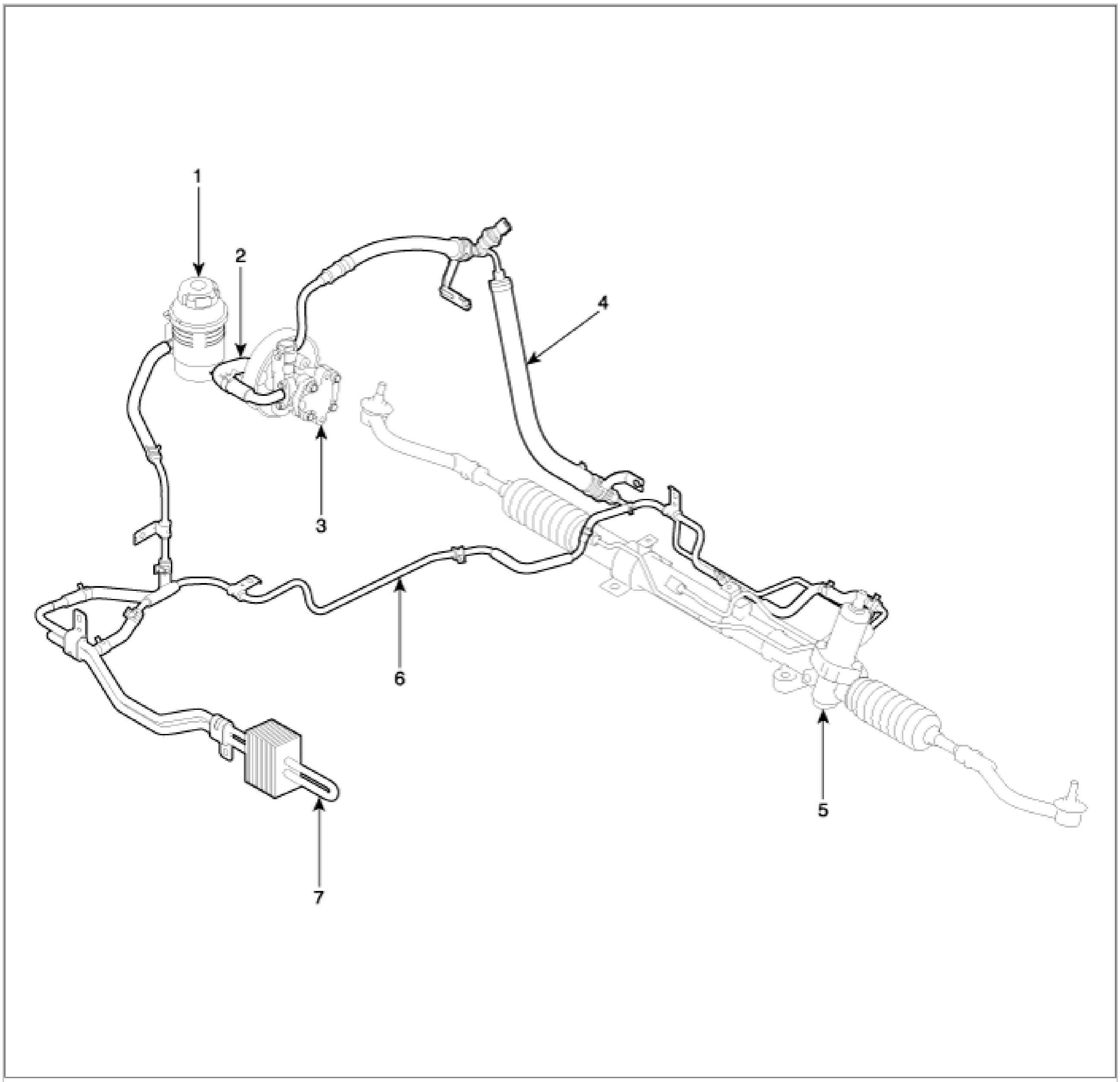


19. Check for total pinion preload.



Steering System > Hydraulic Power Steering System > Power Steering Hoses > Components and Components Location

COMPONENTS

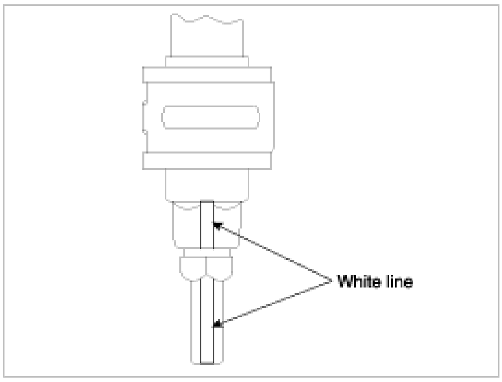


1. Power steering oil reservoir
2. Suction hose
3. Oil pump
4. Pressure hose
5. Power steering gear box
6. Return tube
7. Cooler tube

Steering System > Hydraulic Power Steering System > Power Steering Hoses > Repair procedures

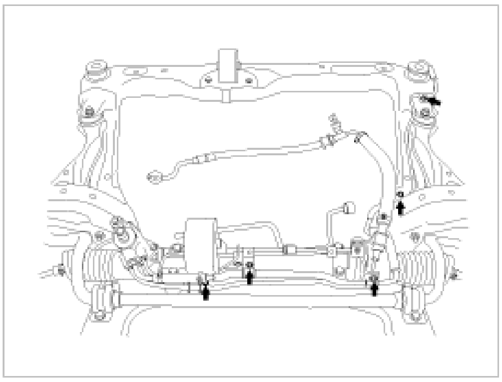
REMOVAL

While installing the tube and hose assembly, be sure to align white marks on each fitting.

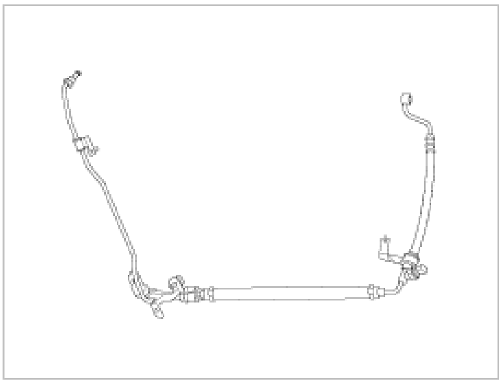


PRESSURE HOSE, TUBE AND RETURN TUBE, HOSE

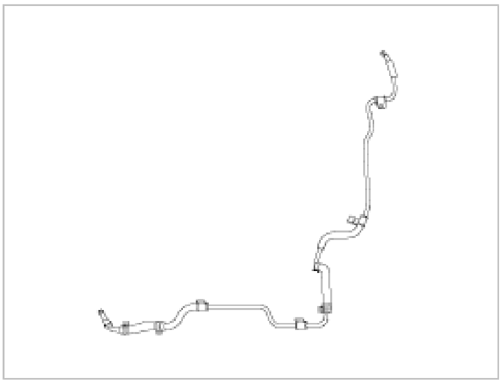
1. Remove the mounting clamps from the pressure tube and the return tube.



2. Remove the pitting of both the pressure tube and the return tube from the gear box.
3. Remove the pressure hose and tube.



4. Remove the return tube and hose.



INSTALLATION

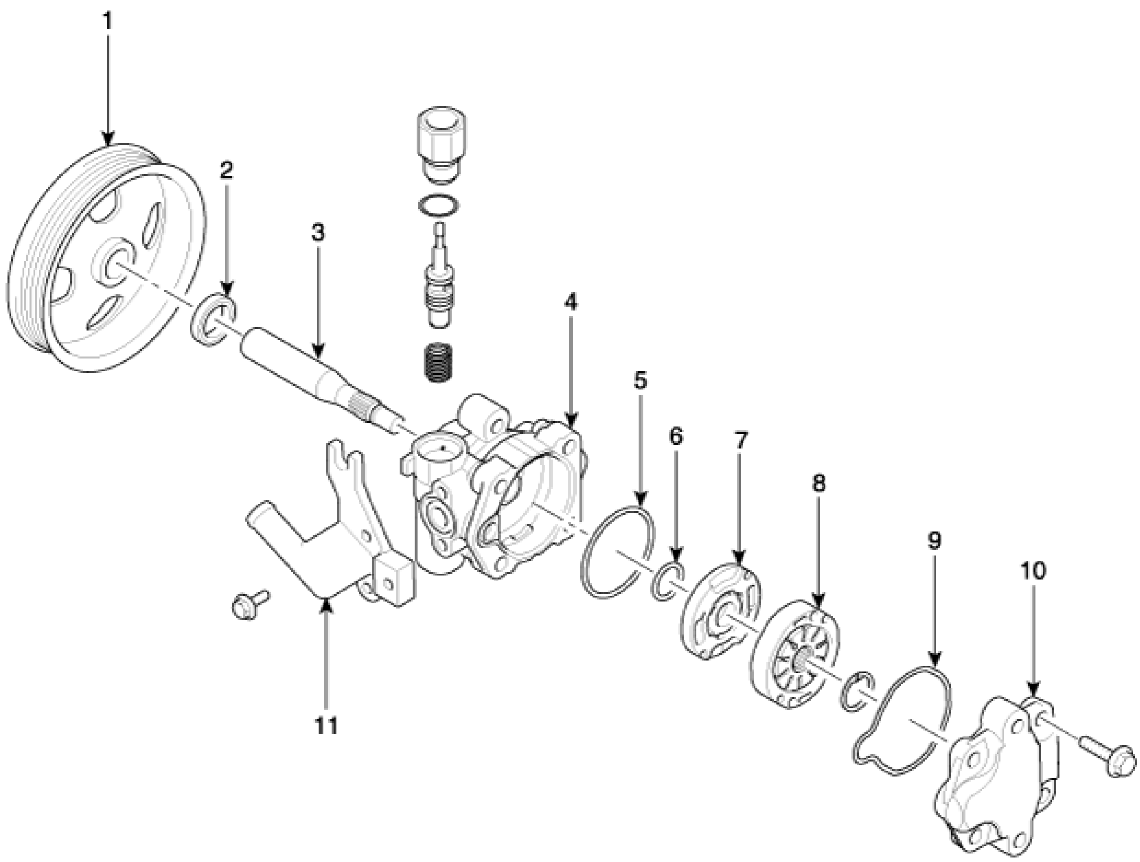
Installation is the reverse of removal.

NOTE

- Install the return tube and hoses so that they are not twisted and it does not come in contact with any other parts.
- After installation, air bleed the system.

Steering System > Hydraulic Power Steering System > Power Steering Oil Pump > Components and Components Location

COMPONENTS

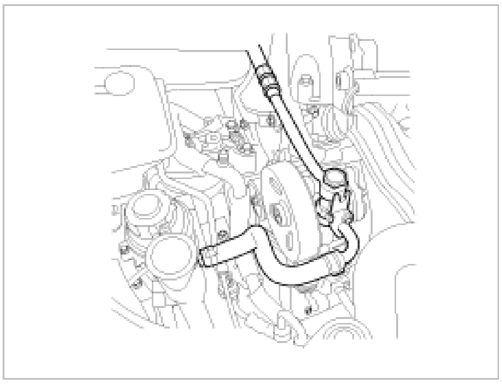


1. Pulley	5. O-ring (Outer)	9. Gasket
2. Dust spacer	6. O-ring (Inner)	10. Oil pump cover assembly
3. Pulley shaft	7. Front side plate	11. Suction pipe
4. Front housing	8. Cam ring	

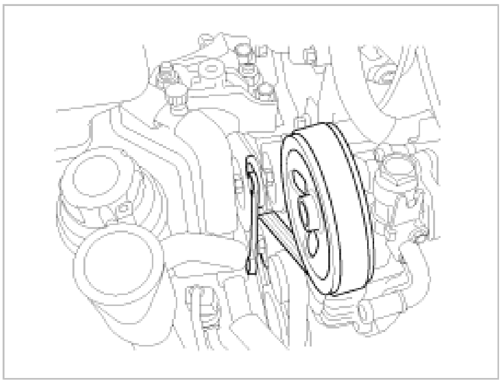
Steering System > Hydraulic Power Steering System > Power Steering Oil Pump > Repair procedures

REMOVAL

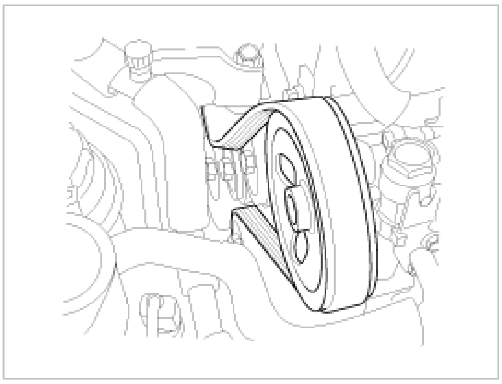
1. Remove the pressure hose from the oil pump and the suction hose from the suction pipe, then drain the powersteering oil.



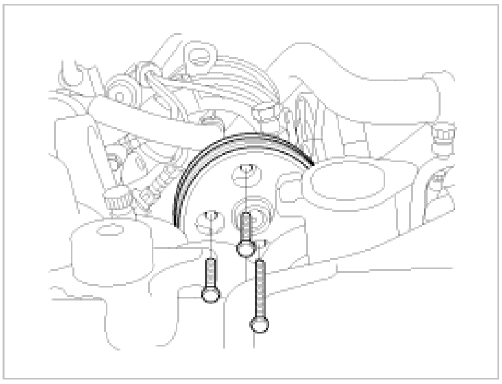
2. Release the tension of the powersteering V-type belt by lifting the auto-tensioner pulley.



3. Remove the V-type belt from the pulley of the powersteering oil pump.

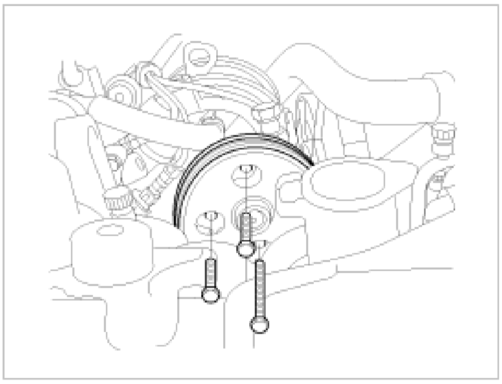


4. Remove the powersteering oil pump assembly by removing the three bolts as shown below.



INSTALLATION

1. Install the oil pump to the oil pump bracket.

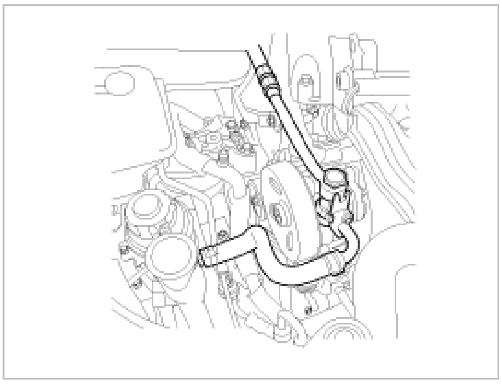


2. Install the "V"-type belt by pulling the auto tensioner.
3. Install the suction hose.

> **CAUTION**
>
> Install the pressure hose to the oil pump.

4. Install the pressure hose to the oil pump.

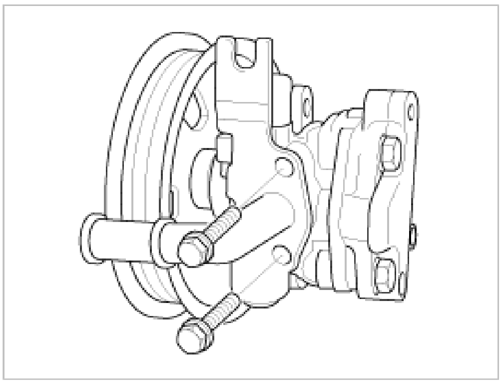
> **NOTE**
>
> Install the pressure hose being careful so that it does not twist and come in contact with other components.



5. Add power steering fluid (PSF-4).
6. Air bleed the system.
7. Check the oil pump pressure.

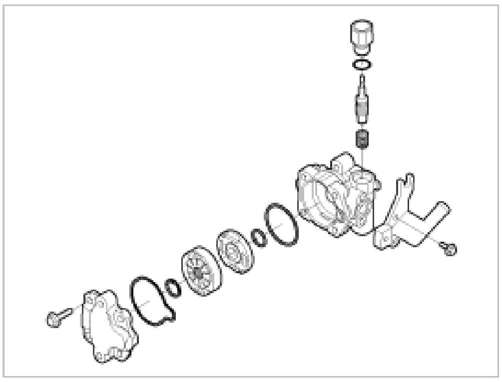
DISASSEMBLY

1. Remove the bolts from the oil pump body, and then remove the suction pipe and O-ring.

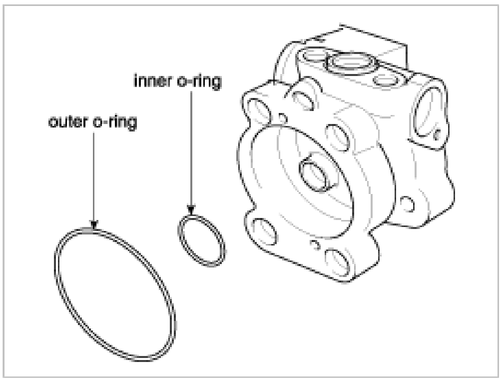


2. Loosen the four bolts and remove the oil pump cover assembly.
3. Remove the cam ring.
4. Remove the rotor and vanes.

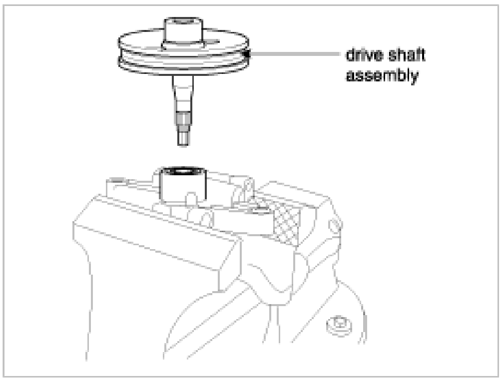
5. Remove the oil pump side plate.



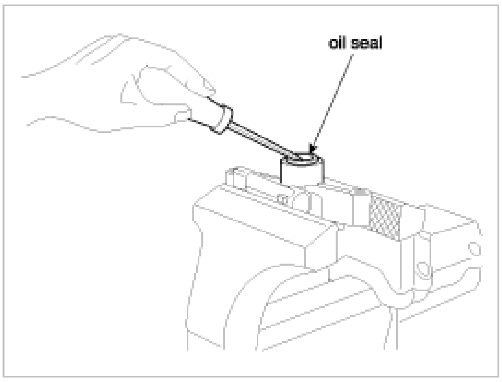
6. Remove the inner and outer O-ring.
7. Remove the inner O-ring and outer O-ring.



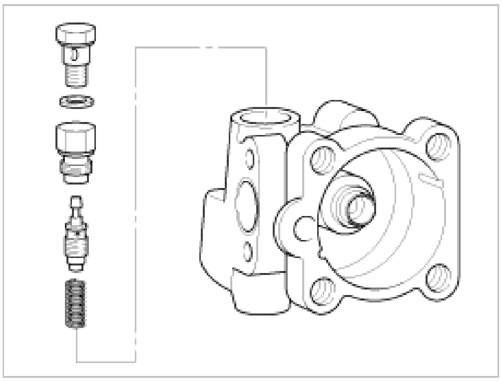
8. Remove the snap ring and take out the pulley and the drive shaft assembly.



9. Remove the oil seal from the oil pump body.



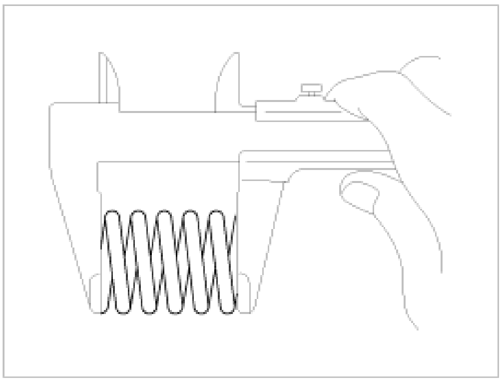
10. Remove the connector from the oil pump body, and take out the flow control valve and the flow control spring.



INSPECTION

1. Check the free length of the flow control spring.

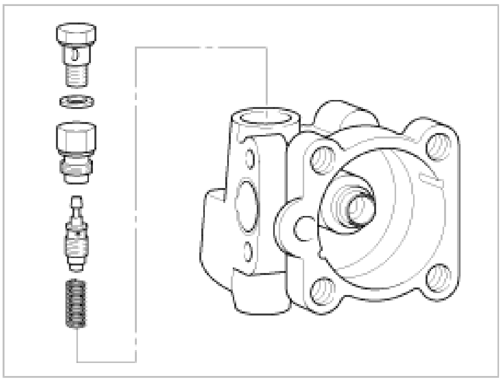
Free length of the flow control spring : 36.5mm



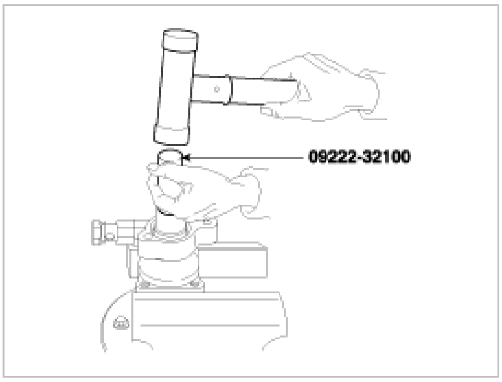
2. Check that the flow control valve is not bent.
3. Check the shaft for wear and damage.
4. Check the V-belt for wear and deterioration.
5. Check the grooves of the rotor and vanes for stratified abrasion.
6. Check the contact surface of the cam ring and vanes for stratified abrasion.
7. Check vanes for damage.
8. Check that there is no striped wear in the side plate or contacting part between the shaft and the pump cover surface.

REASSEMBLY

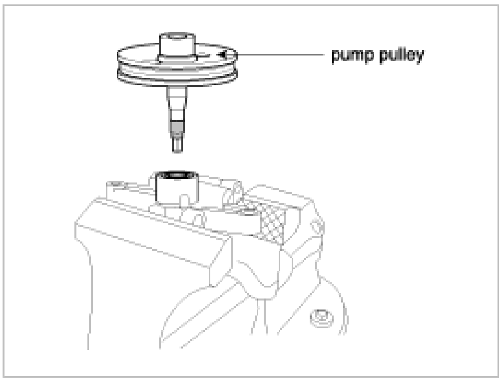
1. Install the flow control spring, the flow control valve and the connector in to the pump body.



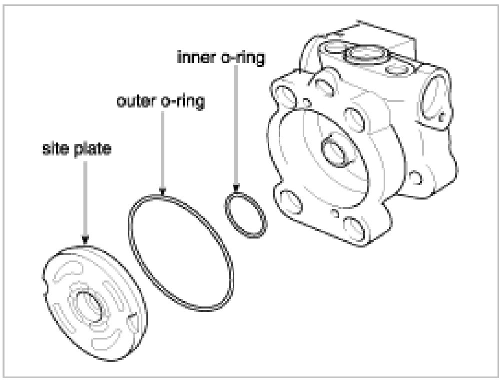
2. Install the oil seal in the pump body by using the special tool(09222-32100).



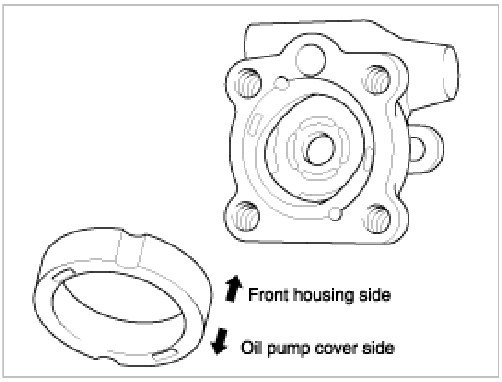
3. Install the pump pulley.



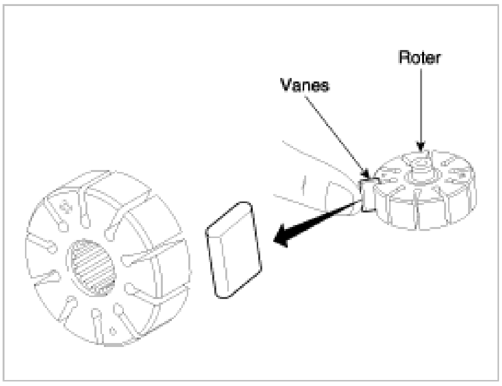
4. Assemble the inner O-ring and the outer O-ring and install the site plate.



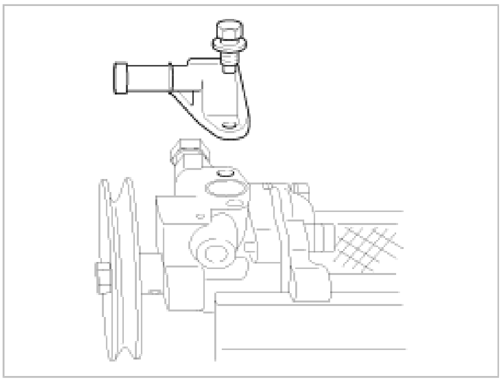
5. After inserting the lock pin into the groove of the front housing, install the camring attending to the direction.



6. Install the rotor.
7. Install the vanes.



8. Install the gasket and oil pump cover assembly.
9. Install the suction pipe and O-ring.



Specifications

Front Suspension System

Items			Specification
Type			Double Wishbone
Shock Absorber	Type		Gas
	Stroke mm(in)		96(3.78)
	Expansion mm(in)		424.0±3(16.69±0.118)
	Compression mm(in)		328.0 +3/-∞ (12.91+0.118/-∞)
	Damping force (0.3 m/s)	Expansion N(kgf)	2.4ℓ : 1060±160(106±16) 3.3ℓ : 1640±220(164±22)
		Compression N(kgf)	2.4ℓ : 440±90(44±9) 3.3ℓ : 690±130(69±13)
	I.D color		2.4ℓ : Gray, 3.3ℓ : Purple
Spring	2.4GSL	Free height mm(in)	380.1(14.96)
		I.D color	Pink - Yellow
	3.3GSL	Free height mm(in)	390.5(15.37)
		I.D color	Pink - Orange

Rear Suspension System

Items			Specification
Type			Multi Link
Shock Absorber	Type		Gas
	Stroke mm(in)		160.5(6.32)
	Expansion mm(in)		584.6±3(23.016±0.118)
	Compression mm(in)		424.1 +3/-∞ (16.697+0.118/-∞)
	Damping force (0.3 m/s)	Expansion N(kgf)	2.4ℓ : 680±110(68±11) 3.3ℓ : 840±130(84±13)
		Compression N(kgf)	2.4ℓ : 290±70(29±7) 3.3ℓ : 240±60(24±6)
	I.D color		2.4ℓ : Gray, 3.3ℓ : Purple
Spring	2.4GSL/3.3GSL	Free height mm(in)	355.4(13.20)
		I.D color	Green - Yellow

Wheels And Tires

Items		Specification
Tire Size		215/60 R16
		225/50 R17
Wheel Size	Steel	6.5J×16, OFFSET=46
	Aluminium	6.5J×16, OFFSET=46
		6.5J×17, OFFSET=46
Tire Pressure kPa(kg/cm²,psi)	All	210(2.1, 30)

Wheel Alignment

Items		Front	Rear
Camber		0° ± 0.5°	-0.5° ± 0.5°
Caster		4.8°± 4.75°	-
Toe-in	Total	0° ± 0.2°	0.2° ± 0.2°
	Individual	0° ± 0.1°	0.1° ± 0.1°
King pin angle		9.45°	-
Tread mm(in)		1565(61.61)	1550(61.02)

TIGHTENING TORQUE

FRONT SUSPENSION

Items	Nm	kgf·m	lb-ft
Front strut assembly mounting nut	45 ~ 60	4.5 ~ 6.0	32.5 ~ 43.4
Front strut assembly self-locking nut	20 ~ 25	2.0 ~ 2.5	14.5 ~ 18.1
Front shock absorber to fork nut	60 ~ 80	6 ~ 8	43.4 ~ 57.8
Front lower arm ball joint self-locking nut	75 ~ 90	7.5 ~ 9.0	54.2 ~ 65.1
Front lower arm ball joint mounting bolt	100 ~ 120	10 ~ 12	72.3 ~ 86.8
Front upper arm ball joint self-locking nut	35 ~ 45	3.5 ~ 4.5	25.3 ~ 32.5
Front upper arm mounting bolt	55 ~ 65	5.5 ~ 6.5	39.8 ~ 47.0
Front lower arm bushing(A) mounting bolt	140 ~ 160	14 ~ 16	101.2 ~ 115.7
Front lower arm bushing(G) mounting bolt	140 ~ 160	14 ~ 16	101.2 ~ 115.7
Front lower arm connector nut (to fork)	140 ~ 160	14 ~ 16	101.2 ~ 115.7
Front stabilizer link self-locking nut	100 ~ 120	10~12	72.3 ~ 86.8
Front stabilizer bar bracket mounting bolt(to Subframe)	45 ~ 55	4.5~ 5.5	32.5 ~ 39.8
Wheel nut	90 ~ 110	9 ~ 11	65.1 ~ 79.5

REAR SUSPENSION

Items	Nm	kgf·m	lb-ft
Rear strut assembly self-locking nut	20 ~ 25	2.0 ~ 2.5	14.5 ~ 18.1
Rear strut assembly bracket mounting bolt	50 ~ 65	5.0~ 6.5	36.2 ~ 47.0
Rear shock absorber nut (to rear axle assembly)	140 ~ 160	14 ~ 16	101.2 ~ 115.7
Rear upper arm ball joint nut (to rear axle assembly)	80 ~ 90	8 ~ 9	57.8 ~ 65.1
Rear upper arm self-locking nut (to cross member)	100 ~ 120	10 ~ 12	72.3 ~ 86.8
Rear lower arm mounting bolt (to rear axle assembly)	140 ~ 160	14 ~ 16	101.2 ~ 115.7
Rear lower arm mounting nut (to cross member)	110 ~ 120	11 ~ 12	79.5 ~ 86.8
Assist arm mounting bolt (to rear axle assembly)	140 ~ 160	14 ~ 16	101.2 ~ 115.7
Assist arm mounting nut (to cross member)	110 ~ 120	11 ~ 12	79.5 ~ 86.8
Trailing arm mounting nut (to body)	140 ~ 160	14 ~ 16	101.2 ~ 115.7
Trailing arm self-locking nut (to rear axle assembly)	140 ~ 160	14 ~ 16	101.2 ~ 115.7
Cross member mounting bolt	140~ 160	14 ~ 16	101.2 ~ 115.7
Rear stabilizer bar bracket mounting bolt	45 ~ 55	4.5 ~ 5.5	32.5 ~ 39.8
Rear stabilizer link self-locking nut	35 ~ 45	3.5 ~ 4.5	25.3 ~ 32.5

CAUTION

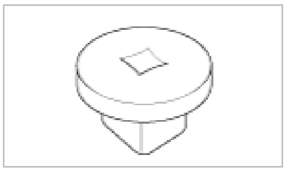
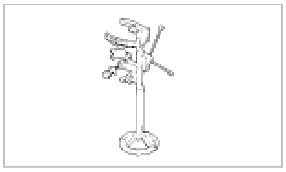
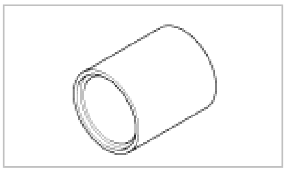
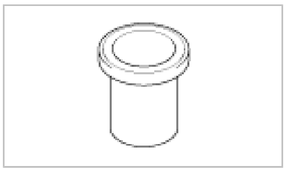
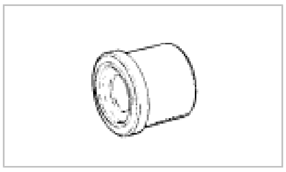
Replace the self-locking nuts with new ones after removal.

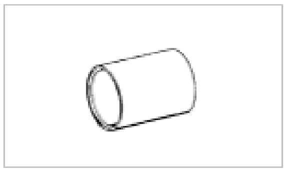
LUBRICANTS

Items	The recommended	Quantity
Front upper arm ball joint	LUBCHEM SB 6042M	As required
Front lower arm ball joint	LUBCHEM SB 6042M	As required
Rear upper arm ball joint	LUBCHEM SB 6042M	As required
Stabilizer link ball joint (Front and Rear)	BJM-2	1.2 ~ 1.7 g

Suspension System > General Information > Special Service Tools

SPECIAL SERVICE TOOLS

Tool (Number and Name)	Illustration	Use
09568-4A000 Ball joint remover		Removal of Ball joint (Front upper arm/lower arm, & Rear upper arm)
09532-11600 Preload socket		Measurement of the front lower arm ball joint starting torque. (Use with torque wrench)
09546-26000 Strut spring compressor		Compression of the coil spring
09214-32000 Mount bushing remover and installer		Removal & installation of lower arm bushing(G) (Use with 09216-21100)
09216-21100 Mount bushing remover and installer		Removal & installation of lower arm bushing(G) (Use with 09216-32000)
09216-21600 Mount bushing remover and installer arbor		Removal and installation of trailing arm bushing (Use with 09552-38100)
09552-38100 Rear trailing arm bushing remover and installer		Removal and installation of the rear trailing arm bushing (Use with 09216-21600)

Suspension System > General Information > Troubleshooting

TROUBLESHOOTING

Vehicle inspection

WHEEL/TIRE/CHECK :

Balance Check **Yes / No**

Maximum Runout Allowed :

Wheel : Radial ________ Lateral ________

Tire : Radial ________ Lateral ________

Measured Runout :

Tire/Wheel Radial : LF ________ LR ________ RF ________ RR ________

Lateral : LF ________ LR ________ RF ________ RR ________

Wheel Only Radial : LF ________ LR ________ RF ________ RR ________

Lateral : LF ________ LR ________ RF ________ RR ________

SUSPENSION INSPECTION :

Can Cause Shimmy ☐ Clunk ☐ Squeak ☐ Harshness ☐

Suspension Bushing : Loose ☐ Worn ☐ Missing ☐ OK ☐

Front stabilizer ☐ Rear stabilizer (sway bar) ☐ Rear trailing arm ☐

Front lower arm ☐ Rear suspension front ☐ Rear suspension rear arm ☐

Other ________________________________

Suspension/Components : Loose Worm Missing OK

Ball Joint ☐ Shock absorbers F/R ☐ Springs F/R ☐ The rod ends/sleeve ☐

SYMPTOM CHART

Symptom	Suspect Area	Remedy (See page)
Squeak or grunt-noise from the front suspension, occurs more in cold ambient temperatures-more noticeable over rough roads or when turning	Front stabilizer bar	Under these conditions, the noise is acceptable.
Clunk-noise from the front suspension, occurs in and out of turns	Loose front struts or shocks	Inspect for loose nuts or bolts. Tighten to specifications. See page SS-26.
Clunk-noise from the rear suspension, occurs when shifting from reverse to drive	Loose rear suspension components	Inspect for loose or damaged rear suspension components. Repair or install new components as necessary. See page SS-41.
Click or pop-noise from the front suspension-more noticeable over rough roads or over bumps	Worn or damaged ball joints	Install new lower arm as necessary. See page SS-34.

Click or pop-noise occurs when vehicle is turning	Worn or damaged ball joints	Install new lower arm as necessary. See page SS-34.
Click or snap-occurs when accelerating around a corner	Damaged or worn Birfield joint	Repair or install a new Birfied joint as necessary. See DS group - driveshaft.
Front suspension noise-a squeak, creak or rattle noise-occurs mostly over bumps or rough roads	Steering components Loose or bent front struts or shock absorbers Damaged spring or spring mounts Damaged or worn arm bushings Worn or damaged stabilizer bar bushing or links	Go to detailed test A. See page SS-11.
Groaning or grinding-noise from the front strut, occurs when driving on bumpy roads or turning the vehicle	Uneven seating surface between the insulator and panel by the burrs around the strut insulator mounting bolts and the insulator boltes mounting holes	Repair or install a new parts as necessary. See page SS-29.
Rear suspension noise - a squeak, creak or rattle noise - occurs mostly over bumps or rough roads	Loose or bent rear shock absorbers Damaged spring or spring mounts Damaged or worn control arm bushings	Go to detailed test B. See page SS-12.
Shudder-occurs during acceleration from a slow speed or stop	Rear axle assembly mispositioned Damaged or worn front suspension components	Check the axle mounts and Rear suspension the rear suspension for damage or wear. Repair as necessary. Check for a loose stabilizer bar, damaged or loose strut/strut bushings or loose or worn ball joints. Inspect the steering linkage for wear or damage. Repair or Install new components as necessary.
Shimmy-most noticeable on coast/deceleration-also hard steering condition	Excessive positive caster	Check the caster alignment angle. Correct as necessary. See page SS-57.
Tire noise-hum/moan at constant speeds	Abnormal wear patterns	Spin the tire and Check for tire wear. Install a new tire as necessary. Inspect for damaged/worn suspension components. Carry out wheel alignment. See page SS-56, SS-61.
Tire noise-noise tone lowers as the vehicle speed is lowered	Out-of-balance tire	Balance the tire and road test. Install a new tire as necessary. See page SS-61.
Tire noise - ticking noise, change with speed	Nail puncture or stone in tire tread	Inspect the tire. Repair as necessary. See page SS-61.
Wheel and tire-vibration and noise concern is directly related to vehicle speed and is not affected by acceleration, coasting or decelerating	Damaged or worn tire	Go to detailed test C. See page SS-13.
Tire wobble or shudder - occurs at lower speeds	Damaged wheel bearings	Spin the tire and check for abnormal wheel bearing play or roughness. Adjust or Install new wheel bearings as necessary. See DS group - front/rear axle.
	Damaged wheel	Inspect the wheel for damage. Install a new wheel as necessary. See page SS-61.
	Damaged or worn suspension components	Inspect the suspension components for wear or damage. Repair as necessary.

		See page SS-43.
	Loosen wheel nuts	Check the wheel nuts. Tighten to specification. See page SS-61.
	Damaged or uneven tire wear	Spin the tire and Check for abnormal tire wear or damage. Install a new tire as necessary. See page SS-60.
Tire shimmy or shake - occurs at lower speeds	Wheel/tire out of balance	See page SS-56.
	Uneven tire wear	Check for abnormal tire wear. Install a new tire as necessary. See page SS-60.
	Excessive radial runout of wheel or tire	Carry out a radial runout test of the wheel and tire. Install a new tire as necessary. See page SS-61.
	Worn or damaged wheel studs or elongate stud holes	Inspect the wheel studs and wheels. Install new components as necessary. See page SS-61.
	Excessive lateral runout of the wheel or tire	Carry out a lateral runout test of the wheel and tire. Check the wheel, tire and hub. Repair or Install new components as necessary. See page SS-61.
	Foreign materal between the brake disc and hub.	Clean the mounting surfaces of the brake disc and hub. See DS group - front/rear axle.
High speed shake or shimmy-occurs at high speeds	Excessive wheel hub runout Damaged or worn tires Damaged or worn wheel bearings Worn or damaged suspension or steering linkage Brake disc or drum imbalance	Go to detailed test D. See page SS-16.
Drift left or right	Tires Steering linkage Alignment Base brake system	Go to detailed test E. See page SS-18.
Steering wheel	Alignment Steering linkage Front lower arm ball joint	Go to detailed test F. See page SS-19.
Tracks incorrectly	Rear suspension Caster	Go to detailed test G. See page SS-20.
Rough ride	Front strut and spring assembly Rear shock absor and spring assembly	Go to detailed test H. See page SS-21.
Excessive noise	Front or rear stabilizer bar components Springs Suspension components Shock absorbers	Go to detailed test I. See page SS-21.
Incorrect tire wear	Tire or unbalanced wheels Tire inflation Strut Alignment	Go to detailed test J. See page SS-22.
Vibration	Wheel/tire Front wheel drivshaft(s)	Go to detailed test K. See page SS-23.

	Steering system Strut and spring assembly Spring and strut mounting Front lower arm ball joint Front lower arm mounting bolt bushing Stabilizer bar bushings Wheel hubs and bearing Rear suspension arms and bushings	
Vehicle leans	Tire/wheel Vehicle load Suspension components Incorrect ride height	Inflate tires to specification. See page SS-60. Redistribute the load as necessary. Visually inspect the suspention system. Correct the ride height as necessary.
Poor returnability	High knuckle rotating torque Alignment	Go to detailed test E. See page SS-18.

DETAILED TEST A : FRONT SUSPENSION NOISE

CONDITIONS	DETAILS/RESULTS/ACTIONS
ROAD TEST THE VEHICLE	
	1. Test drive the vehicle. 2. During the road test, drive the vehicle over a rough road. Determine from which area/component the noise is originating. ● Is there a squeak, creak or rattle noise ? → **YES** Go to → **NO** The suspension system is OK. Conduct a diagnosis on other suspect systems.
INSPECT THE STEERING SYSTEM	
	1. Check the steering system for wear or damage. Carry out a steering linkage test. Inspect the tire wear pattern. See page SS-25. ● Are the steering components worn or damaged ? → **YES** Repair the steering system. Install new components as necessary. Test the system for normal operation. → **NO** Go to
FRONT SHOCK ABSORBER/STRUT CHECK	
	1. Check the front shock absorbers/strut mounts for loose bolts or nuts. 2. Check the front shock absorbers/struts for damage. Carry out a shock absorber check. ● Are the front shock absorbers/struts loose or damaged ? → **YES** Tighten to specifications if loose. Install new front shock absorbers/struts if damaged. Test the system for normal operation. → **NO** Go to
CHECK THE FRONT SPRINGS	
	Check the front spring and front spring mounts/brackets for wear or damage ● Are the front springs or spring mounts/brackets worn or damaged ? → **YES** Repair or Install new components as necessary. Test the system for normal

	operation. → **NO** Go to**A5.**
CHECK THE STABILIZER BAR	
	1. Check the stabilizer bar bushing and links for damage or wear. 2. Check the stabilizer bar for damage. 3. Check for loose or damaged stabilizer brackets. ● Are the stabilizer bar/track bar components loose, worn or damaged ? → **YES** Repair or Install new components as necessary. Test the system for normal operation. → **NO** Suspension system is OK. Conduct diagnosis on other suspect systems.

DETAILED TEST B : REAR SUSPENSION NOISE

CONDITIONS	DETAILS/RESULTS/ACTIONS
ROAD TEST THE VEHICLE	
	1. Test drive the vehicle. 2. During the road test, drive the vehicle over a rough road. Determine from which area/component the noise is originating. ● Is there a squeak, creak or rattle noise ? → **YES** Go to → **NO** The suspension system is OK. Conduct a diagnosis on other suspect systems.
REAR SHOCK ABSORBER/STRUT CHECK	
	1. Raise and support the vehicle. See GI group - lift support point. 2. Check the rear shock absorber/strut mounts for loose bolts or nuts. 3. Check the rear shock absorbers/strut for damage. Carry out a shock absorber check. ● Are the rear shock absorbers/struts loose or damaged ? → **YES** Tighten to specifications if loose. Install new rear shock absorbers/struts if damaged. Test the system for normal operation. → **NO** Go to
CHECK THE REAR SPRINGS	
	Check the rear springs and rear spring mounts/brackets for wear or damage. ● Are the rear springs or spring mounts/brackets worn or damaged ? → **YES** Repair or Install new components as necessary. Test the system for normal operation. → **NO** Go to**B4.**
CHECK THE TRAILING ARMS	
	1. Inspect the trailing arm bushings for wear or damage. Check for loose trailing arm bolts. 2. Inspect for twisted or bent trailing arms. ● Are the trailing arms loose, damaged or worn ?

	→ **YES** Repair or Install new components as necessary. Test the system for normal operation. → **NO** Suspension system is OK. Conduct diagnosis on other suspect systems.

DETAILED TEST C : WHEEL AND TIRE

CONDITIONS	DETAILS/RESULTS/ACTIONS
ROAD TEST THE VEHICLE	
	NOTE Wheel or tire vibrations felt in the steering wheel are most likely related to the front wheel or tire. Vibration felt through the seat are most likely related to the rear wheel or tire. This may not always be true, but it can help to isolate the problem to the front or rear of the vehicle. Test drive the vehicle at different speed ranges. During the road test, if the vibration can be eliminated by placing the vehicle in neutral or is affected by the speed of the engine, the cause is not the wheels or tires. ● Is there a vibration and noise ? → **YES** Go to**C2.** → **NO** The wheel and tires are OK. Conduct a diagnosis on other suspect systems.
CHECK THE FRONT WHEEL BEARINGS	
	Check the front wheel bearings. Refer to Wheel Bearing Check (See DS group - front axle). ● Are the wheel bearings OK ? → **YES** Go to**C3.** → **NO** Inspect the wheel bearings. Adjust or Repair as necessary. Test the system for normal operation.
INSPECT THE TIRES	
	1. Check the tires for missing weights. 2. Check the wheels for damage. 3. Inspect the tire wear pattern. See page SS-25. ● Do the tires have an abnormal wear pattern ? → **YES** Correct the condition that caused the abnormal wear. Install new tire(s). Test the system for normal operation. → **NO** Go to
TIRE ROTATION DIAGNOSIS	
	1. Spin the tires slowly and watch for signs of lateral runout. 2. Spin the tires slowly and watch for signs of radial runout.. ● Are there signs of visual runout ? → **YES** Go to

	→ **NO** Check the wheel and tire balance. Correct as necessary. Test the system for normal operation.
RADIAL RUNOUT CHECK ON THE TIRE	
	Measure the radial runout of the wheel and tire assembly. A typical specification for total radial runout is 1.15mm (0.059 inch). ● Is the radial runout within specifications ? → **YES** Go to**C8.** → **NO** Go to**C6.**
RADIAL RUNOUT CHECK ON THE WHEEL	
	Measure the radial runout of the wheel. A typical specification for total radial runout is 1.14mm (0.045 inch.). ● Is the radial runout within specifications ? → **YES** Install a new tire. Test the system for normal operation. → **NO** Go to**C7.**
CHECK THE HUB/BRAKE DISC OR DRUM PILOT RUNOUT OR BOLT CIRCLE RUNOUT	
	Measure the pilot or bolt circle runout. A typical specification for radial runout is : ● pilot runout - less than 0.15mm (0.006 inch.) ● bolt circle runout - less than 0.38 mm (0.015 inch.) ● Is the radial runout within specification ? → **YES** Install a new wheel. Test the system for normal operation. → **NO** Repair or Install new components as necessary. See page SS-28 for the front suspension or SS-43 for the rear suspension.
LATERAL RUNOUT CHECK ON THE TIRE	
	Measure the lateral runout of the wheel and tire assembly. A typical specification for total lateral runout is 2.5mm (0.098 inch). ● Is the lateral runout within specifications ? → **YES** Wheel and tires are OK. Conduct diagnosis on other suspect systems. → **NO** Go to**C9.**
LATERAL RUNOUT CHECK ON THE WHEEL	
	Measure the lateral runout of the wheel. A typical specification for total radial runout is 1.2mm (0.047 inch.) ● Is the lateral runout within specifications ? → **YES**

	Install a new tire. Test the system for normal operation. → **NO** Go to**C10.**
CHECK THE FLANGE FACE LATERAL RUNOUT	
	Measure the flange face lateral runout. A typical specification for lateral runout is : ● hub/brake disc - less than 0.13mm (0.005 inch) ● Is the lateral runout within specifications ? → **YES** Install a new wheel. Test the system for normal operation. → **NO** Repair or Install new components as necessary. See page SS-27 for the front suspension or SS-44 for the rear suspension.

DETAILED TEST D :

CONDITIONS	DETAILS/RESULTS/ACTIONS
CHECK FOR FRONT WHEEL BEARING ROUGHNESS	
	1. Raise and support the front end of the vehicle so that the front wheel and tire assemblies can spin. See GI group - lift support point. 2. Spin the front tires by hand. ● Do the wheel bearings feel rough ? → **YES** Inspect the wheel bearings. Repair as necessary. Test the system for normal operation. → **NO** Go to
CHECK THE END PLAY OF THE FRONT WHEEL BEARINGS	
	Check the end play of the front wheel bearings. ● Is the end play OK ? → **YES** Go to**D3.** → **NO** Adjust or Repair as necessary. Test the system for normal operation.
MEASURE THE LATERAL RUNOUT AND THE RADIAL RUNOUT OF THE FRONT WHEELS ON THE VEHICLE	
	Measure the lateral runout and the radial runout of the front wheels on the vehicle. Go to detailed test C. ● Are the measurements within specifications ? → **YES** Go to**D4.** → **NO** Install new wheels as necessary and Balance the assembly. Test the system for normal operation.
MEASURE THE LATERAL RUNOUT OF THE FRONT TIRES ON THE VEHICLE	
	Measure the lateral runout of the front tires on the vehicle. Go to detailed test

	C. ● Is the runout within specifications ? → **YES** Go to**D5.** → **NO** Install new tires as necessary and Balance the assembly. Test the system for normal operation.
MEASURE THE RADIAL RUNOUT OF THE FRONT TIRES ON THE VEHICLE	
	Measure the radial runout of the front tires on the vehicle. Go to detailed test C. ● Is the runout within specifications ? → **YES** Balance the front wheel and tire assemblies. If any tire cannot be balanced, Install a new tire. Test the system for normal operation. → **NO** Go to**D6.**
MATCH MOUNT THE TIRE AND WHEEL ASSEMBLY	
	Mark the high runout location on the tire and also on the wheel. Break the assembly down and rotate the tire 180 degrees (halfway around) on the wheel. Inflate the tire and measure the radial runout. ● Is the runout within specifications ? → **YES** Balance the assembly. Test the system for normal operation. → **NO** If the high spot is not within 101.6mm (4 inches) of the first high spot on the tire, Go to**D7.**
MEASURE THE WHEEL FLANGE RUNOUT	
	Dismount the tire and mount the wheel on a wheel balancer. Measure the runout on both wheel flanges. Go to detailed test C ● Is the runout within specifications ? → **YES** Locate and Mark the low spot on the wheel. Install the tire, matching the high spot on the tire with the low spot on the wheel. Balance the assembly. Test the system for normal operation. If the condition persists, Go to**D8.** → **NO** Install a new wheel. Check the runout on the new wheel. If the new wheel is within limits, locate and Mark the low spot. Install the tire, matching the high spot on the tire with the low spot on the wheel. Balance the assembly. Test the system for normal operation. If the condition persists, Go to**D8.**
CHECK FOR VIBRATION FROM THE FRONT OF THE VEHICLE	
	Spin the front wheel and tire assemblies with a wheel balancer while the vehicle is raised on a hoist. Feel for vibration in the front fender or while seated in the vehicle. ● Is the vibration persent ?

	→ **YES** Substitute known good wheel and tire assemblies as necessary. Test the system for normal operation. → **NO** Check the driveline components. Test the system for normal operation.

DETAILED TEST E : DRIFT LEFT OR RIGHT

CONDITIONS	DETAILS/RESULTS/ACTIONS
CHECK THE TIRES	
	Inspect the tires for excessive wear or damage. ● Are the tires excessively worn or damaged ? → **YES** Install new tires. → **NO** Go to**E2.**
CHECK THE STEERING LINKAGE	
	1. Raise and support the vehicle. 2. Check the steering components for indications of excessive wear or damage. See ST group - specification. ● Is there an indication of excessive wear or damage ? → **YES** Repair or Install new components as necessary. → **NO** Go to
CHECK THE VEHICLE ALIGNMENT	
	1. Place the vehicle on an alignment rack. Check the vehicle alignmnt. ● Is the alignment within specification ? → **YES** Go to → **NO** Adjust the alignment as necessary. See page SS-56 (wheel alignment).
BRAKE DRAG DIAGNOSIS	
	Apply the brakes while driving. ● Does drift or pull occur when the brakes are applied ? → **YES** See BR group - specification. → **NO** If the steering wheel is in the center, the vehicle is OK. If the steering wheel is off-center, Go to Detailed Test**F.**

DETAILED TEST F : STEERING WHEEL OFF-CENTER

CONDITIONS	DETAILS/RESULTS/ACTIONS
CHECK THE CLEAR VISION	
	Place the vehicle on an alignment rack.

	● Is the clear vision within specification ? → **YES** Go to**F2.** → **NO** Adjust the clear vision to specification.
INSPECT THE STEERING COMPONENTS	
	1. Raise and support the vehicle. 2. Inspect the steering components for excessive wear or damage. See ST group - specification. ● Are the steering components excessively worn or damaged ? → **YES** Repair or Install new components as necessary. → **NO** If it tracks corectly, vehicle is OK. If it tracks incorrectly, Go to Detailed Test

DETAILED TEST G : TRACKS INCORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
CHECK THE CASTER	
	Place the vehicle on an alignment rack. ● Is the caster within specification ? → **YES** Go to**G2.** →**NO** Replace bent or damaged parts.
CHECK THE REAR SUSPENSION	
	1. Measure the vehicle wheel base for LH and RH. 2. Compare the measurements. ● Are the measurements the same ? → **YES** If the ride is smooth, vehicle is OK. If the ride is rough, Go to Detailed Test → **NO** Inspect the rear suspension components for wear or damage. Repair or Install new components as necessary. See page SS-41 (rear suspension).

DETAILED TEST H : ROUGH RIDE

CONDITIONS	DETAILS/RESULTS/ACTIONS
CHECK THE FRONT SHOCK ABSORBER	
	1. Raise support the vehicle. 2. Inspect the front shock absorber for oil leaks or damage. ● Are the tires excessively worn or damaged ? → **YES** Install new front shock absorbers. See page SS-29 (front strut assembly). → **NO** Go to
CHECK THE REAR SHOCK ABSORBERS	

	Inspect the rear shock absorbers for oil leaks or damage. ● Are the rear shock absorbers leaking ? → **YES** Install new rear shock absorbers. See page SS-43 (rear strut assembly). → **NO** The vehicle is OK. Go to**TROUBLESHOOTING.**

DETAILED TEST I : EXCESSIVE NOISE

CONDITIONS	DETAILS/RESULTS/ACTIONS
INSPECT THE SUSPENSION	
	1. Raise and support the vehicle. 2. Inspect the shock absorber mounting bolts. ● Are the mounting bolts loose or broken ? → **YES** Tighten or Install new shock absorber mounting bolts. See page SS-29 and SS-43 (front/rear suspension) → **NO** Go to
INSPECT THE SPRING AND TORSION BARS	
	Inspect the springs and stabilizer bars for damage. ● Are the spring or stabilizer bars damaged ? → **YES** Install new spring and/or stabilizer bars. See page SS-48 and SS-55 (front/rear stabilizer bars). → **NO** Go to**I3.**
INSPECT THE FRONT SUSPENSION	
	Inspect the front suspension components for excessive wear or damage. ● Are the front suspension components worn or damaged ? → **YES** Install new front suspension components. See page SS-26 (front suspension). → **NO** The vehicle is OK. Go to**TROUBLESHOOTING.**

DETAILED TEST J : INCORRECT TIRE WEAR

CONDITIONS	DETAILS/RESULTS/ACTIONS
INSPECT THE TIRES	
	1. Raise and support the vehicle. 2. Inspect the tires for uneven wear on the inner or outer shoulder. ● Is there uneven tire wear ? → **YES** Align the vehicle. Install new tires if badly worn. → **NO** Go to

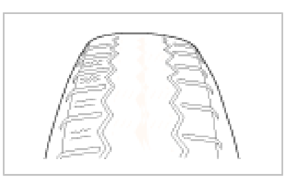
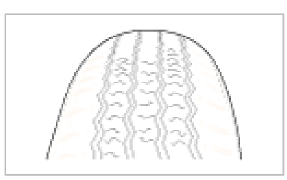
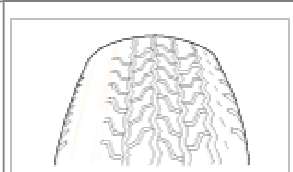
UNEVEN TIRE WEAR	
	Inspect the tires for a feathering pattern. ● Do the tires have a feathering pattern ? → **YES** Align the vehicle. Install new tires if badly worn. → **NO** Go to**J3.**
CHECK FOR CUPPED TIRE	
	Inspect the tires for cupping or dishing. ● Are the tires cupped or dished ? → **YES** Balance and Rotate the tires. → **NO** The vehicle is OK. Go to**TROUBLESHOOTING.**

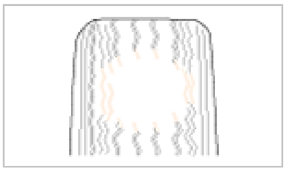
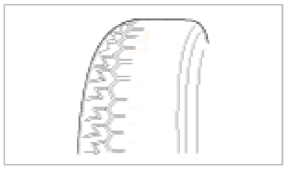
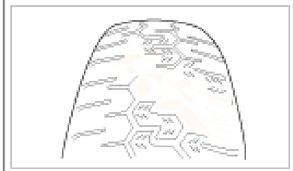
DETAILED TEST K : VIBRATION

CONDITIONS	DETAILS/RESULTS/ACTIONS
ROAD TEST	
	Accelerate the vehicle to the speed at which the customer indicated the vibration occured. ● Is the vibration present ? → **YES** Go to**K2.** → **NO** The vehicle is OK. Go to**TROUBLESHOOTING.**
INSPECT THE TIRES	
	1. Raise and support the vehicle with a frame contact hoist. 2. Inspect the tires for extreme wear or damage, cupping, or flat spots. ● Are the tires OK ? → **YES** Go to → **NO** Check the suspension components for misalignment, abnormal wear, or damage that may have contributed to the tire wear. Correct the suspension concerns and Install new tires.
INSPECT THE WHEEL BEARINGS	
	Spin the tires by hand to check for wheel bearing rougness. ● Is the front wheel bearing OK ? → **YES** Go to**K4.** → **NO** Install new front wheel bearings as necessary. See Ds group - front axle.
TIRE/WHEEL BALANCE	

	Check the tire/wheel balance. ● Are the tires balanced ? → **YES** Go to**K5.** → **NO** Balance the tires and wheels as necessary.
MEASURE THE RUNOUTS	
	For each wheel position measure, locate and mark the following items. See page SS-61 (wheel/tire). - High point of the tire/wheel assembly total radial runout - High point of the wheel radial runout - High point of the wheel lateral runout ● Are the runouts as specified ? → **YES** Go to**K7.** → **NO** Go to**K6.**
SUBSTITUTE THE WHEELS AND TIRE	
	1. Substitute a known good set of wheels and tires. 2. Carry out a road test. 3. If the vehicle still exhibits a shake or vibration, note the vehicle speed and/or engine rpm which it occurs. ● Is the vibration felt ? → **YES** Engine/transmission imbalance. See the specification of TR group, EM group, FL group and EC group. → **NO** Install the original tire/wheel assemblies one by one, Road testing at each step until the damaged tire(s)/wheel(s) as necessary. Test the system for normal operation.

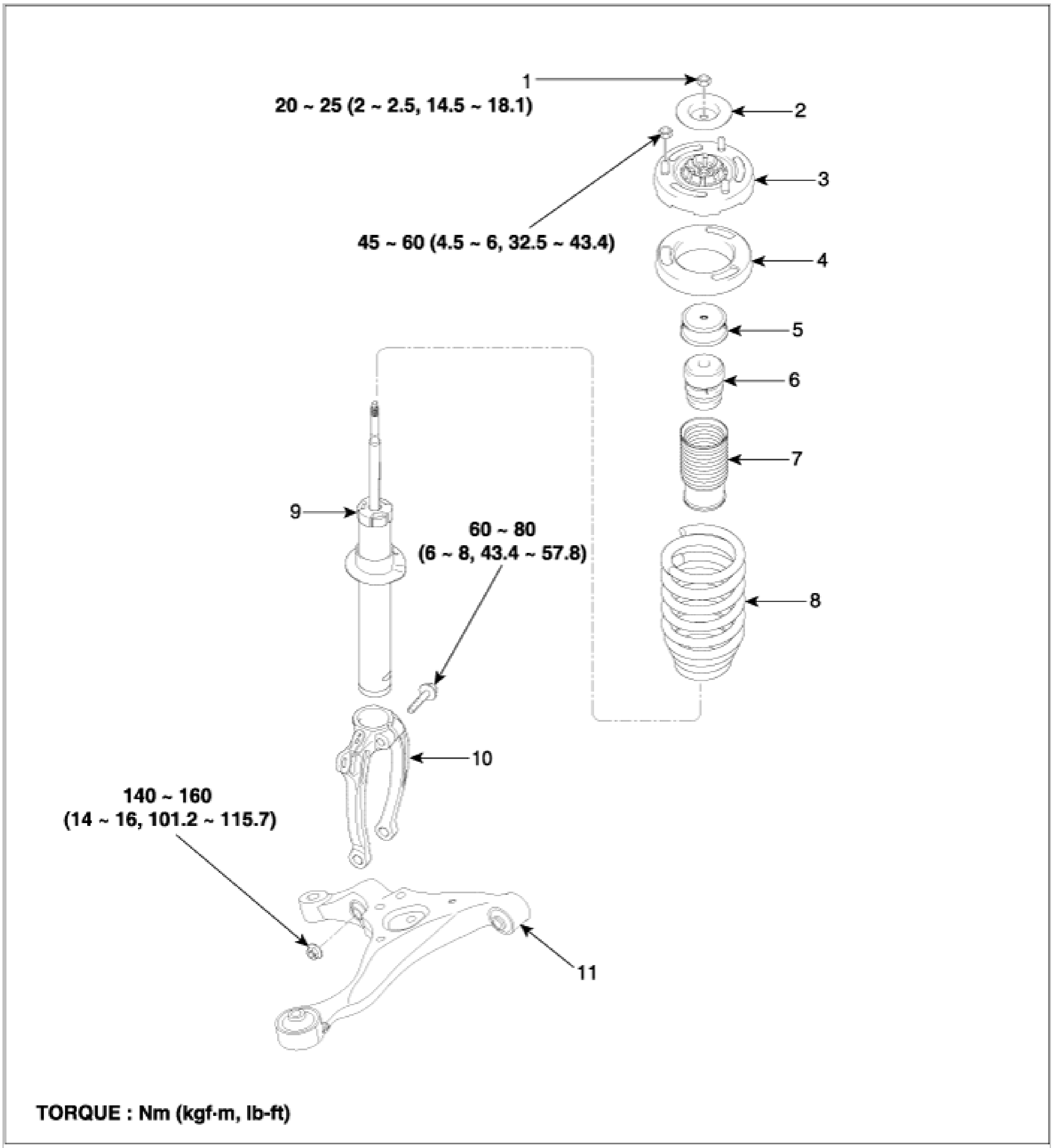
Wheel /tire noise, vibration and harshness concerns are directly related to vehicle speed and are not generally affected by acceleration, coasting or decelerating. Also, out-of-balance wheel and tires can vibrate at more than one speed. A vibration that is affected by the engine rpm, or is eliminated by placing the transmission in Neutral is not related to the tire and wheel. As a general rule, tire and wheel vibrations felt in the steering wheel are related to the front tire and wheel assemblies. Vibrations felt in the seat or floor are related to the rear tire and wheel assemblies. This can initially isolate a concern to the front or rear.
Careful attention must be paid to the tire and wheels. There are several symptoms that can be caused by damaged or worn tire and wheels. Carry out a careful visual inspection of the tires and wheel assemblies. Spin the tires slowly and watch for signs of lateral or radial runout. Refer to the tire wear chart to determine the tire wear conditions and actions

WHEEL AND TIRE DIAGNOSIS		
Rapid wear at the center	Rapid wear at both shoulders	Wear at one shoulder
		
• Center-tread down to fabric due to excessive over inflated tires • Lack of rotation	• Under-inflated tires • Worn suspension components • Excessive cornering speeds	• Toe adjustment out of specification • Camber out of specification • Damaged strut

• Excessive toe on drive wheels • Heavy acceleration on drive	• Lack of rotation	• Damaged lower arm
Partial wear	Feathered edge	Wear pattern
		
• Caused by irregular burrs on brake drums	• Toe adjustment out of specification • Damaged or worn tie rods • Damaged knuckle	• Excessive toe on non-drive wheels • Lack of rotation

Suspension System > Front Suspension System > Front Strut Assembly > Components and Components Location

COMPONENTS



1. Self-locking nut	4. Upper pad	7. Dust cover	10. Fork
2. Plate	5. Cup assembly	8. Spring	11. Front lower arm
3. Bracket	6. Urethane bumper	9. Shock absober	

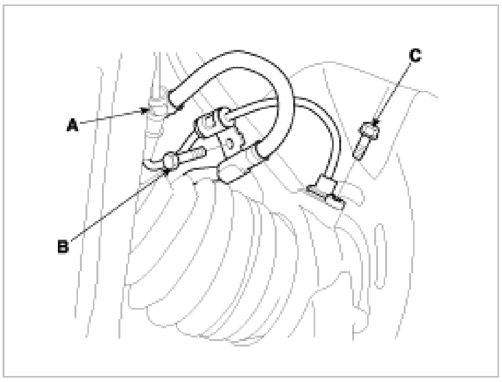
Suspension System > Front Suspension System > Front Strut Assembly > Repair procedures

REMOVAL

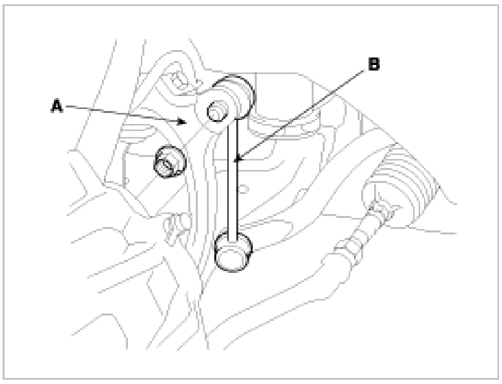
1. Loosen the wheel nuts slightly.
   Raise the front of the vehicle, and make sure it is securely supported.
2. Remove the front wheel and tire from front hub.

> **CAUTION**
>
> Be careful not to damage the hub bolts when removing the front wheel and tire.

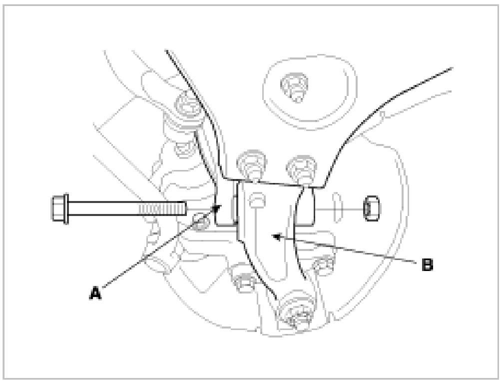
3. Remove the brake hose bracket(A) and speed sensor cable mounting bolt(B) from the front axle assembly.



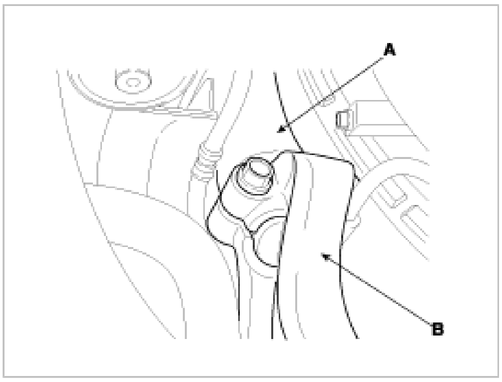
4. Remove the speed sensor bolt(C).
5. Remove the front stabilizer link(B) from the fork(A).



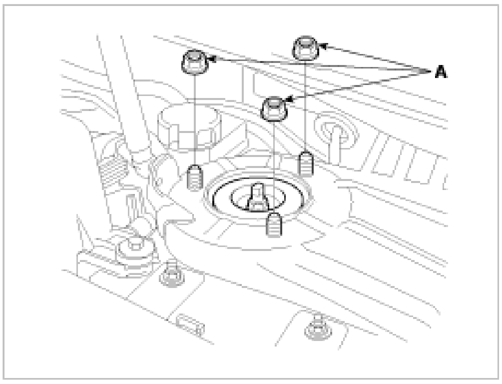
6. Remove the fork(A) from the front lower arm connector(B).



7. Remove the front strut assembly(A) from the fork(B).



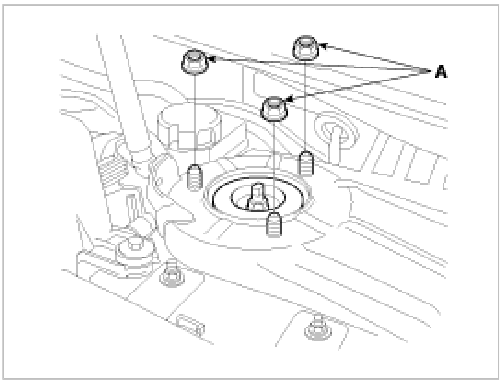
8. Remove the strut upper mounting nuts(A).



INSTALLATION

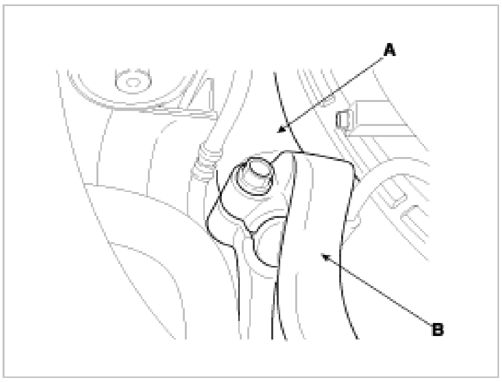
1. Install the strut assembly(B) and then install the strut lower mounting bolts(A).

Tightening torque Nm (kgf·m, lb-ft) :
45 ~ 60 (4.5 ~ 6.0, 32.5 ~ 43.4)



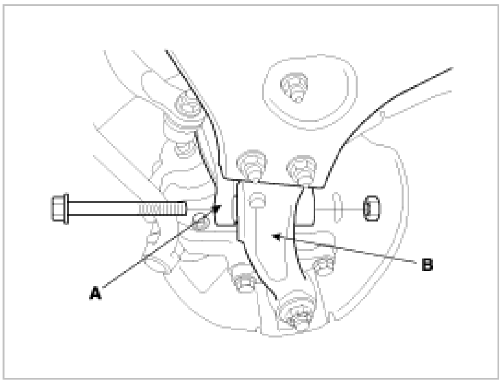
2. Install the fork(B) to the strut assembly(A) with the I.D. mark facing outward.

Tightening torque Nm (kgf·m, lb-ft) :
60 ~ 80 (6.0 ~ 8.0, 43.4 ~ 57.8)



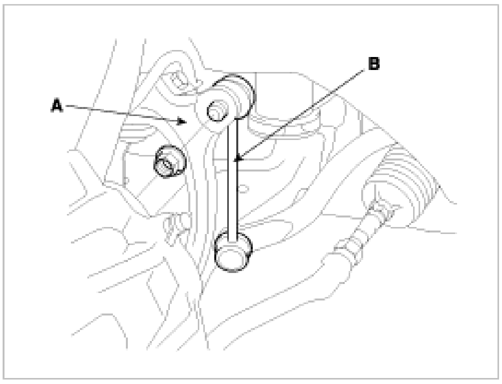
3. Install the fork(A) to the front lower arm connector(B).

Tightening torque Nm (kgf·m, lb-ft) :
140 ~ 160 (14~16, 101.2~115.7)

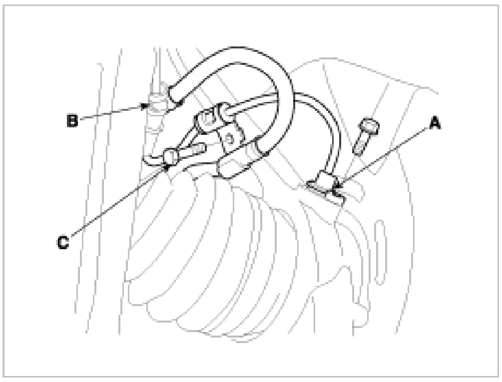


4. Install the front stabilizer link(B) to the fork(A).

Tightening torque Nm (kgf·m, lb-ft) :
100 ~ 120 (10 ~ 12, 72.3 ~ 86.8)



5. Install the speed sensor bolt(A).



6. Install the brake hose bracket(B) to the fork and speed sensor cable mounting bolt(C) to the axle assembly.
7. Install the wheel and the tire to the front hub.

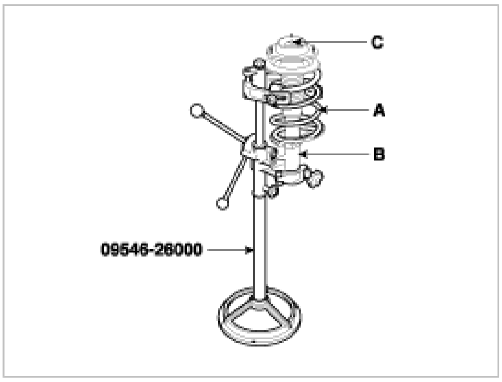
Tightening torque Nm (kgf·m, lb-ft) :
90 ~ 110 (9 ~ 11, 65.1 ~ 79.5)

CAUTION

Be careful not to damage the hub bolts when installing the front wheel and tire.

DISASSEMBLY

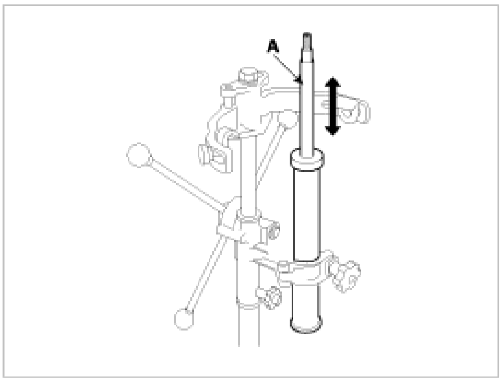
1. Using the special tool (09546-26000), compress the coil spring(A).



2. Remove the self-locking nut(C) from the strut assembly(B).
3. Remove the insulator, spring seat, coil spring and dust cover from the strut assembly.

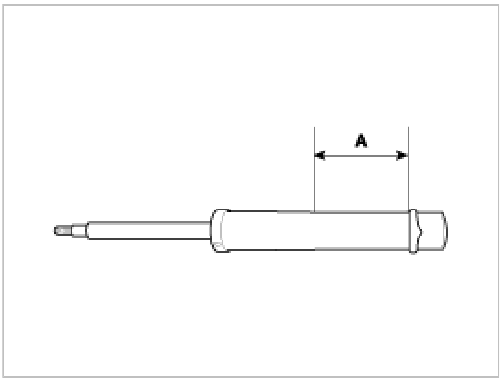
INSPECTION

1. Check the strut insulator for wear or damage.
2. Check rubber parts for damage or deterioration.
3. Compress and extend the piston rod(A) and check that there is no abnormal resistance or unusual sound during operation.



DISPOSAL

1. Fully extend the piston rod.
2. Drill a hole on the A section to remove gas from the cylinder.



> **CAUTION**
>
> The gas coming out is harmless, but be careful of chips that may fly when drilling.

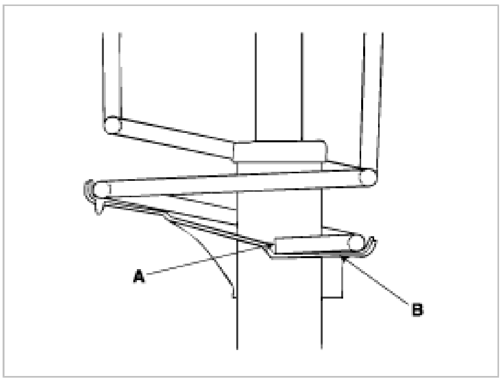
REASSEMBLY

1. Compress coil spring using special tool (09546- 26000).
   Install compressed coil spring onto shock absorber.

NOTE

1) There are two clolor marks on the coil spring. One corresponds to model option (see page SS-2), and the other corresponds to load classification. Ensure that the correct parts are being installed.
2) Install the coil spring with the identification mark directed toward the knuckle.

2. After fully extending the piston rod, install the spring upper seat and insulator assembly.
3. After seating the upper and lower ends of the coil spring(A) in the upper and lower spring seat grooves(B) correctly, tighten new self-locking nut temporarily.



4. Remove the special tool(09546-26000).
5. Tighten the self-locking nut to the specified torque.

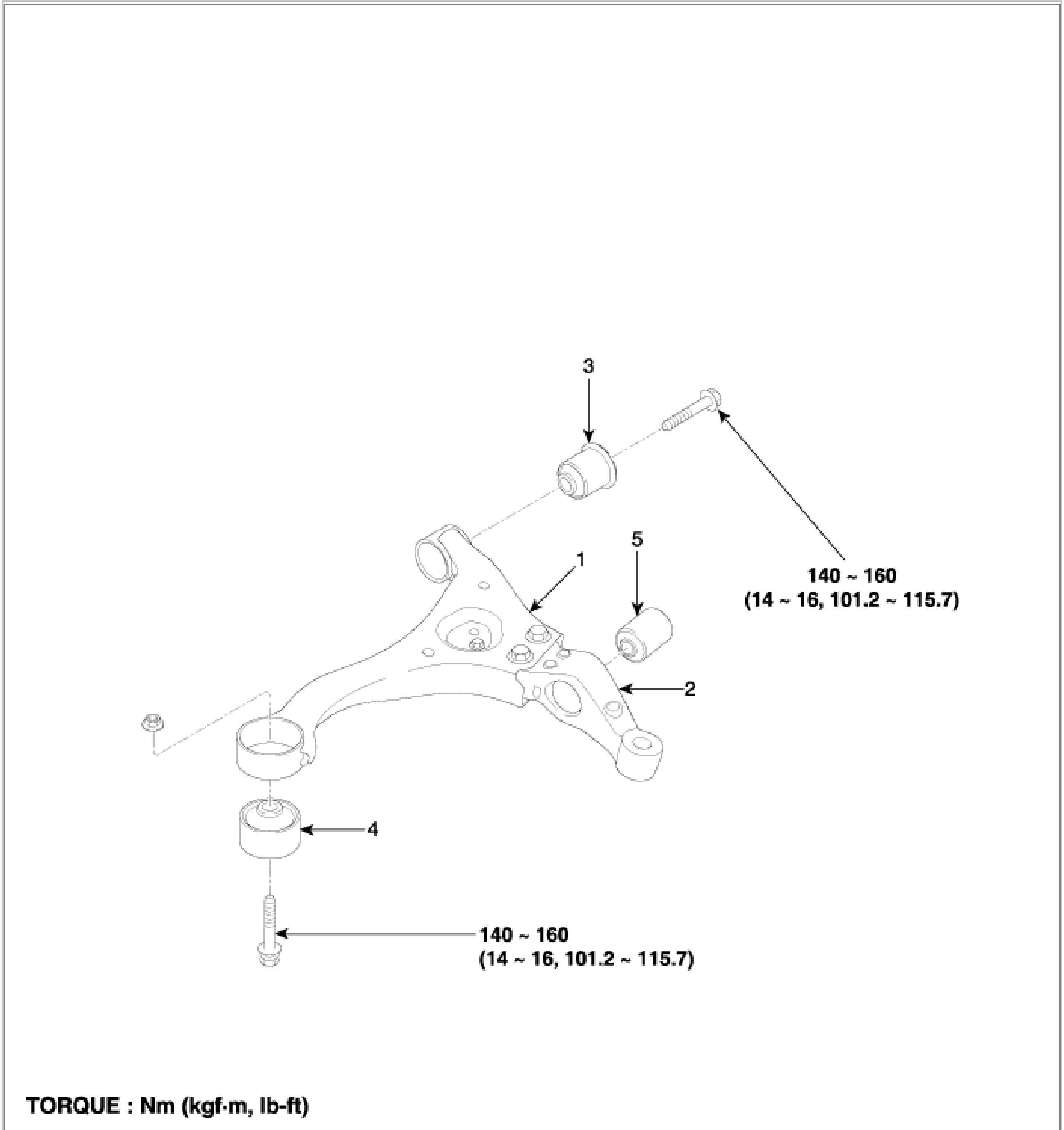
Tightening torque Nm (kgf·m, lb-ft) :
20 ~ 25 (2.0 ~ 2.5, 14.5 ~ 18.1)

CAUTION

Do not reuse the self-locking nut.

Suspension System > Front Suspension System > Front Lower Arm > Components and Components Location

COMPONENTS



1. Front lower arm
2. Connector
3. Bushing (A)
4. Bushing (G)
5. Bushing

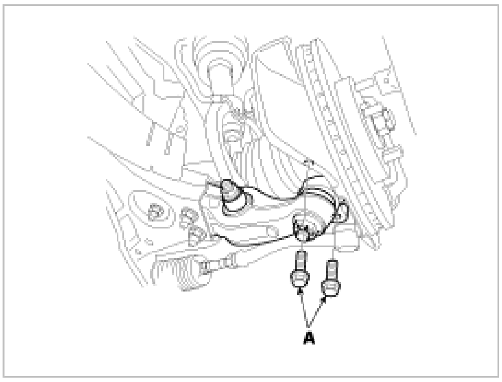
Suspension System > Front Suspension System > Front Lower Arm > Repair procedures

REMOVAL

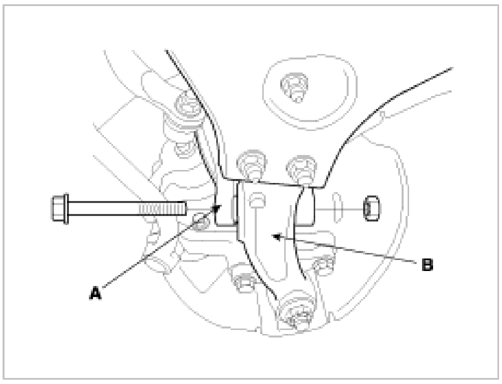
1. Loosen the wheel nuts slightly.
   Raise the front of the vehicle, and make sure it is securely supported.
2. Remove the front wheel and tire from front hub.

> CAUTION
>
> Be careful not to damage the hub bolts when removing the front wheel and tire.

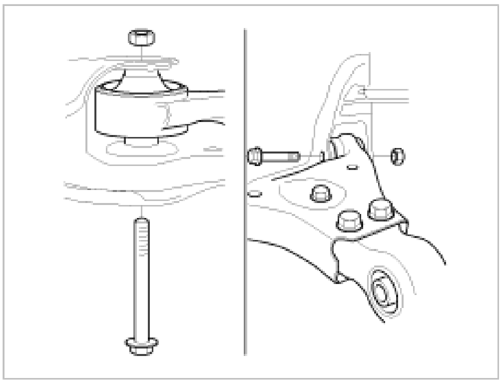
3. Remove the lower arm ball joint mounting bolts(A).



4. Remove the front lower arm connector(B) from the fork(A).

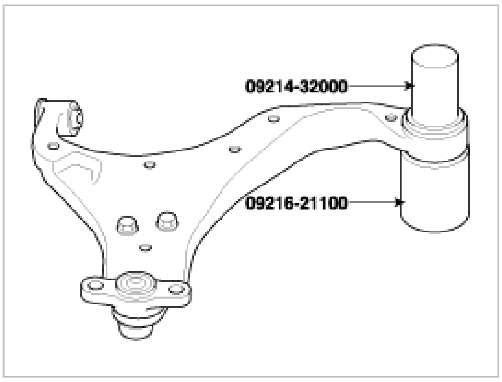


5. Remove the lower arm mounting bolts.

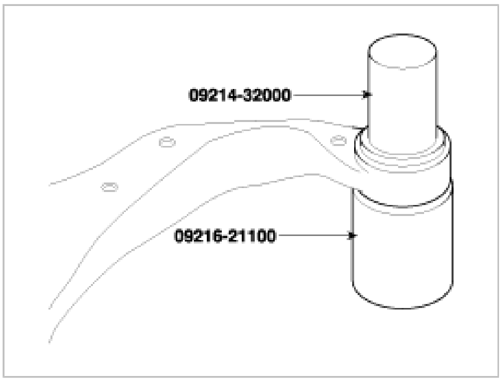


REPLACEMENT

1. Using the special tools(09214-32000 & 09216- 211000), remove the bushing from the lower arm.



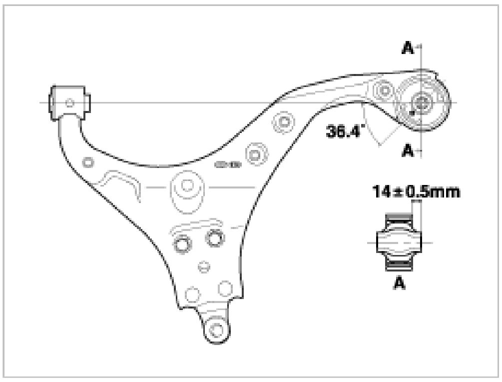
2. Apply soap solution to the following parts.
   A. Outer surface of the bushing.
   B. Inner surface of the lower bushing mounting part.
3. Using the special tools(09214-32000 & 09216-21100), install the busing on the lower arm.



CAUTION

Insert bushing in the direction shown in the illustration.

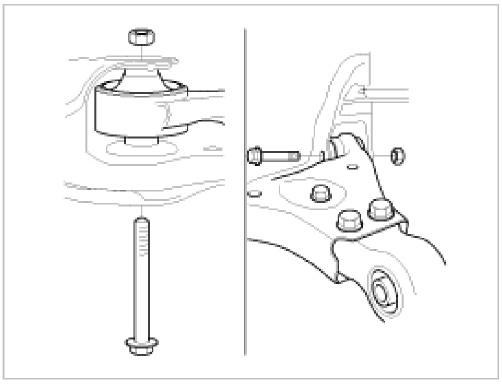
Separation force is over 800 Nm (800Kgf, 1763 lbf)



INSTALLATION

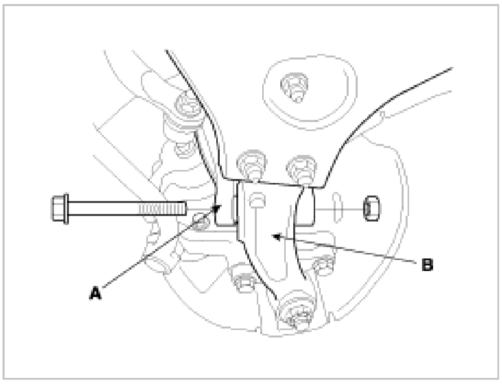
1. Install the lower arm mounting bolts.

Tightening torque Nm (kgf·m, lb-ft) :
Bushing(A) ; 140 ~ 160 (14 ~ 16, 101.2 ~ 115.7)
Bushing(G) ; 140 ~ 160 (14 ~ 16, 101.2 ~ 115.7)



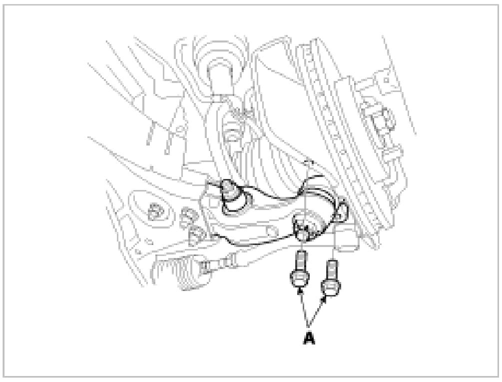
2. Install the lower arm connector(B) to the fork(A).

Tightening torque Nm (kgf·m, lb-ft) :
140~160 (14~16, 101.2~115.7)



3. Install the lower arm ball joint mounting bolts(A).

Tightening torque Nm (kgf·m, lb-ft) :
100 ~ 120 (10 ~ 12, 72.3 ~ 86.8)



4. Install the wheel and the tire to the front hub.

Tightening torque Nm (kgf·m, lb-ft) :
90 ~ 110 (9 ~ 11, 65.1 ~ 79.5)

CAUTION

Be careful not to damage the hub bolts when installing the front wheel and tire.

INSPECTION

1. Check the bushing for wear and deterioration.
2. Check the lower arm for bending or breakage.
3. Check the ball joint dust cover for cracks.
4. Check all bolts.
5. Check the lower arm ball joint for rotating torque.
   (1) If a crack is noted in the dust cover, replace the ball joint assembly.
   (2) Shake the ball joint stud several times.
   (3) Measure the ball joint rotating torque.

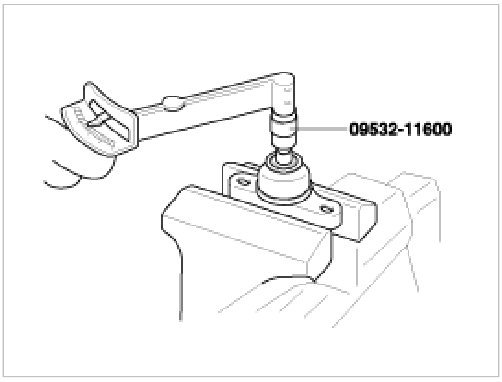
Standard value :
0.4 ~ 2 Nm (4 ~ 20 kgf·cm, 0.29 ~ 1.45 lb-ft)

NOTE

Measure torque using the special tool(09532-11600) and torque wrench at the range of 0.5 - 2 rpm after moving the ball joint stud at degree 3° several times at room temperature.

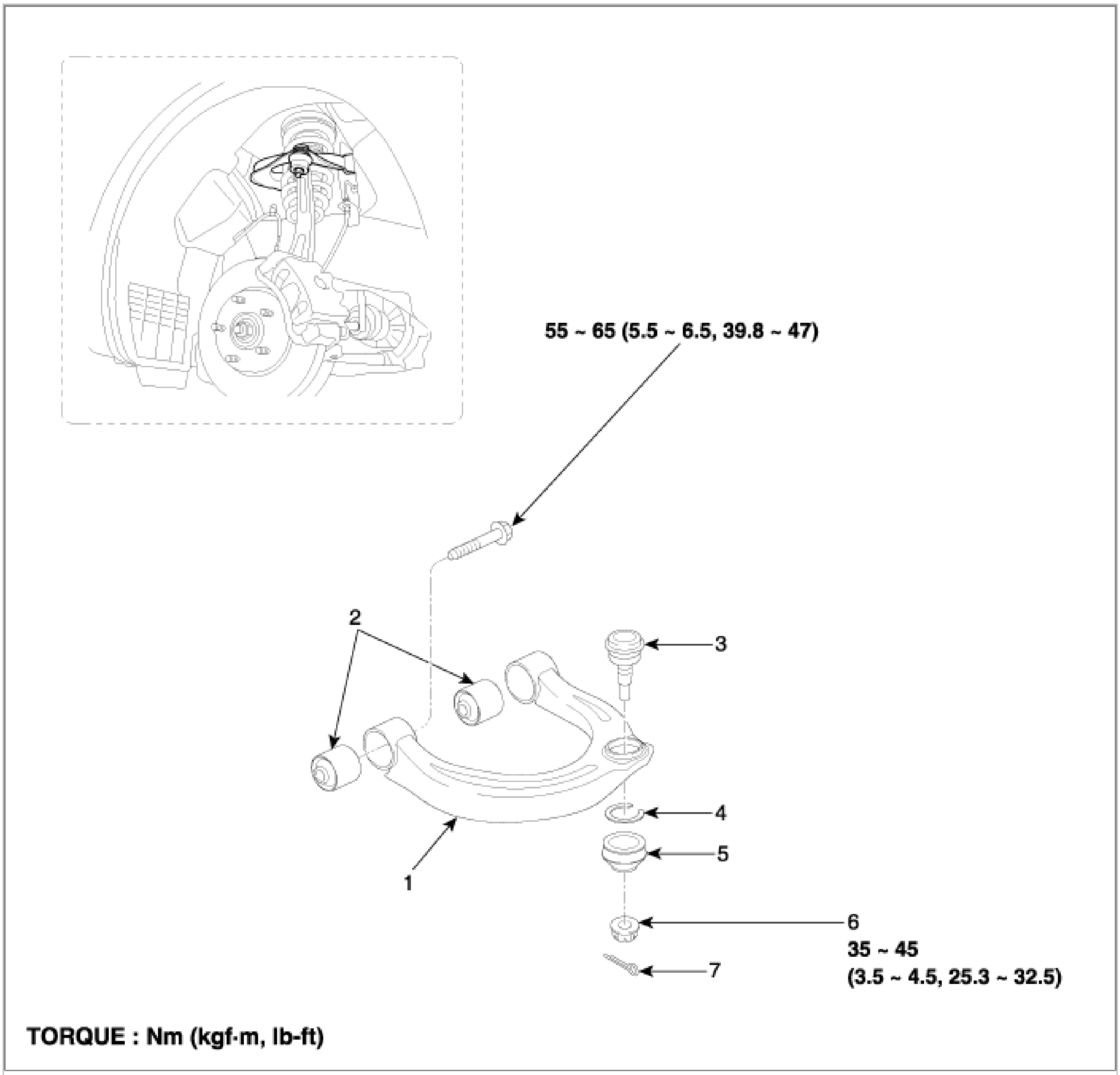
(4) If the rotating torque is below the lower limit of standard value, replace the ball joint assembly.

(5) Even if the rotating toque is below the lower limit of the standard value, the ball joint may be reused unless it has drag and excessive play.



Suspension System > Front Suspension System > Front Upper Arm > Components and Components Location

COMPONENTS



1. Front upper arm
2. Bushing
3. Ball joint
4. Snap ring
5. Boot
6. Self-locking nut
7. Split pin

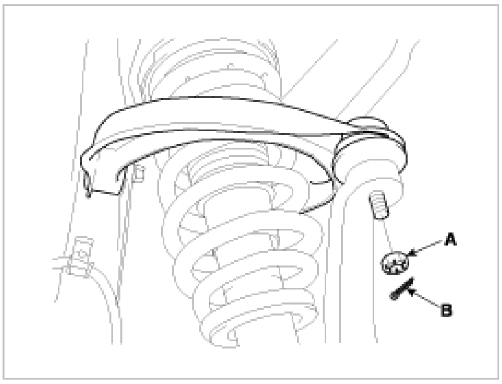
Suspension System > Front Suspension System > Front Upper Arm > Repair procedures

REMOVAL

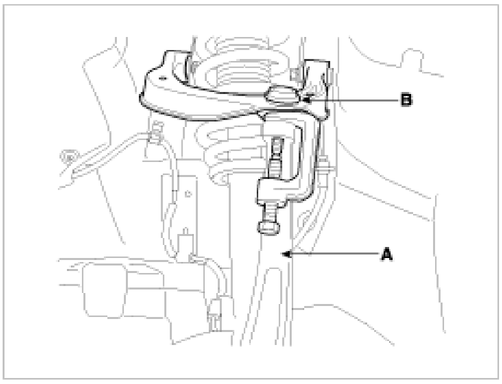
1. Loosen the wheel nuts slightly.
   Raise the front of the vehicle, and make sure it is securely supported.
2. Remove the front wheel and tire from front hub.

> **CAUTION**
>
> Be careful not to damage the hub bolts when removing the front wheel and tire.

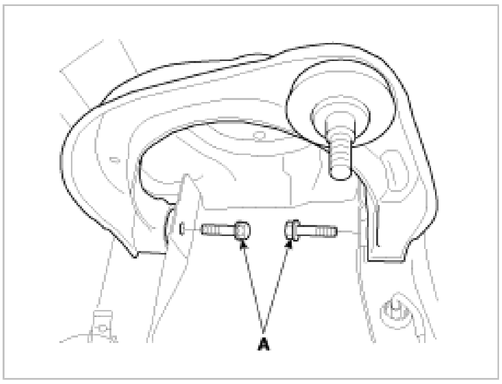
3. Remove the upper arm ball joint self-locking nut(A) and the split pin(B).



4. Using the special tools(09568-4A000), disconnect the upper arm ball joint from the knuckle.



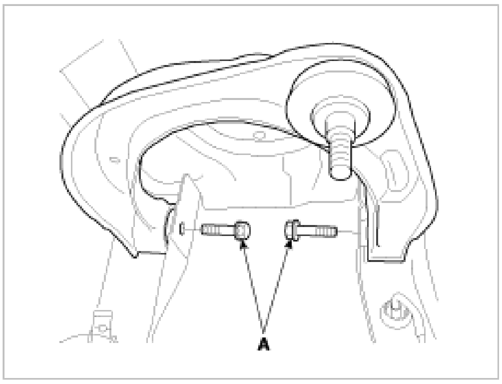
5. Remove the front strut assembly (Refer to SS-10).
6. Remove the two upper arm mounting bolts(A) from the body.



INSTALLATION

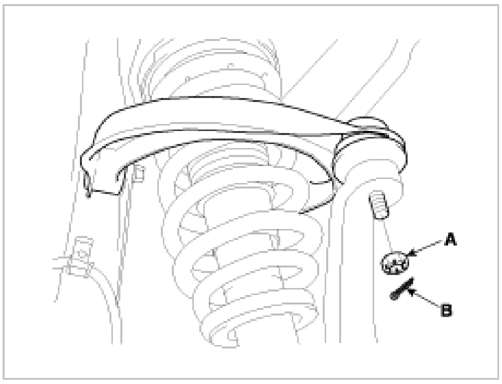
1. Install the two upper arm mounting bolts(A) to the body.

Tightening torque Nm (kgf·m, lb-ft) :
55 ~ 65 (5.5 ~ 6.5, 39.8 ~ 47.0)



2. Install the front strut assembly (Refer to SS-12).
3. Install the upper arm ball joint self-locking nut(A) and the split pin(B).

Tightening torque Nm (kgf·m, lb-ft) :
35 ~ 45 (3.5 ~ 4.5, 25.3 ~ 32.5)



4. Install the wheel and the tire to the front hub.

Tightening torque Nm (kgf·m, lb-ft) :
90 ~ 110 (9 ~ 11, 65.1 ~ 79.5)

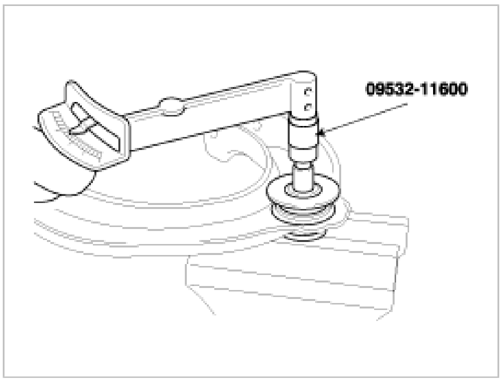
CAUTION

Be careful not to damage the hub bolts when installing the front wheel and tire.

INSPECTION

1. Check the bushing for wear and deterioration.
2. Check the upper arm for bending or breakage.
3. Check the ball joint for rotating torque.
   (1) If there is a crack in the dust cover, replace it and add grease.
   (2) Shake the stabilizer link ball joint stud several times.
   (3) Mount the self-locking nut on the ball joint, and then measure the ball joint rotating torque.

Standard value :
0.5 ~ 1.5 Nm (5 ~ 15 kgf·cm, 0.36 ~ 1.09 lb-ft)

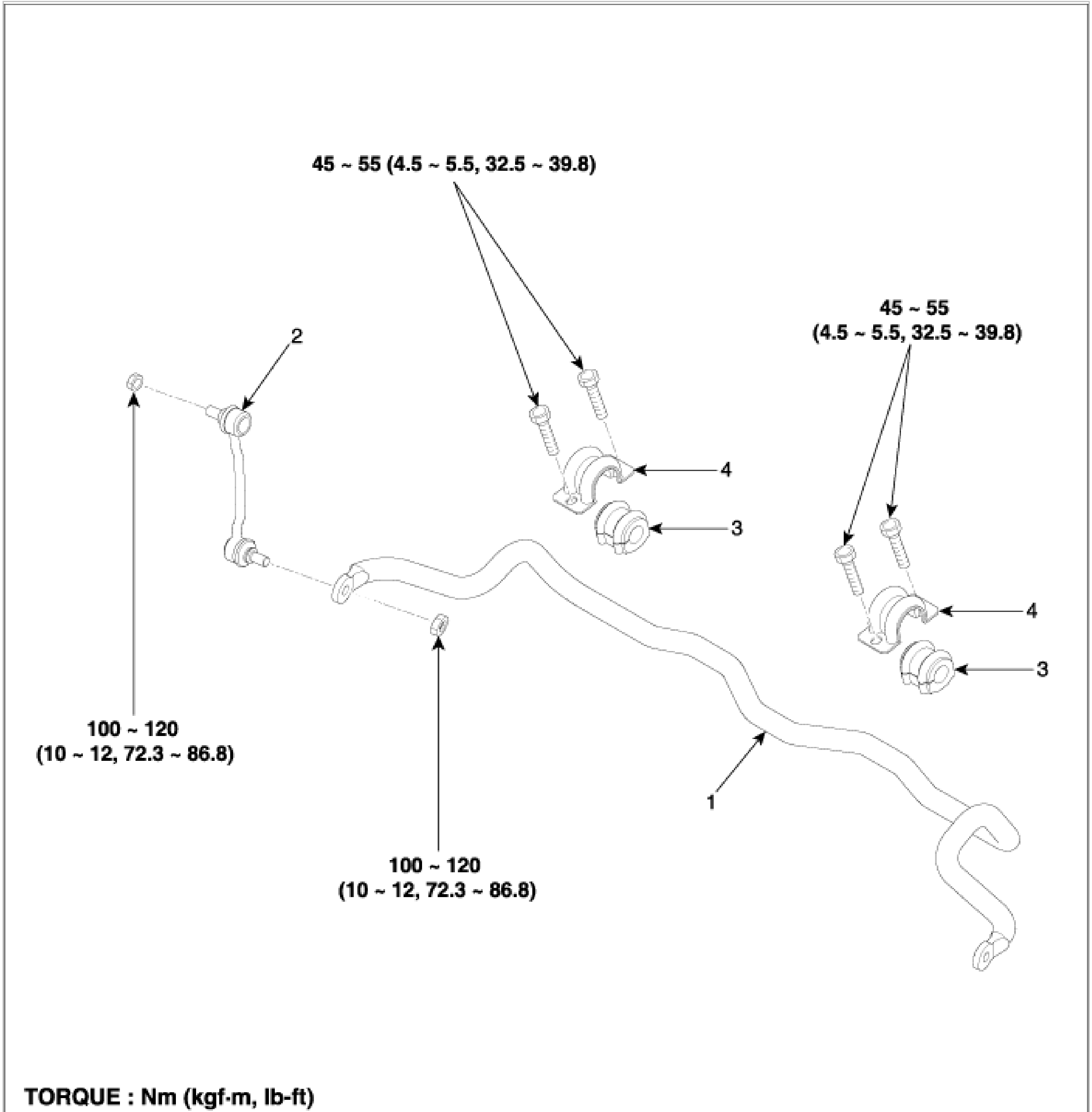


   (4) If the rotating torque exceeds the upper limit of standard value, replace the upper arm assembly.
   (5) Even if the rotating toque is below the lower limit of the standard value, the ball joint may be reused unless it has drag and excessive play.

Suspension System > Front Suspension System > Front Stabilizer Bar > Components and

Components Location

COMPONENTS



1. Front stabilizer bar
2. Stabilizer link
3. Bushing
4. Bracket

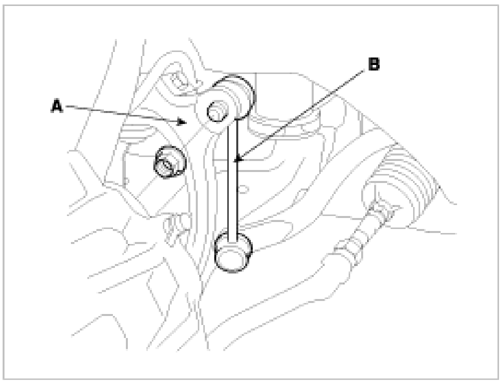
Suspension System > Front Suspension System > Front Stabilizer Bar > Repair procedures

REMOVAL

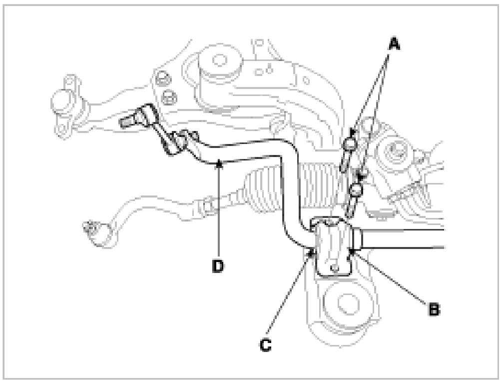
1. Loosen the wheel nuts slightly.
   Raise the front of the vehicle, and make sure it is securely supported.
2. Remove the front wheel and tire from front hub.

> **CAUTION**
>
> Be careful not to damage the hub bolts when removing the front wheel and tire.

3. Remove the stabilizer link(B) from the fork(A).



4. Remove the two mounting bolts of the rear side of the subframe, supporting the subframe with a jack.
5. Remove the rear mounting bolts(A) of subframe.

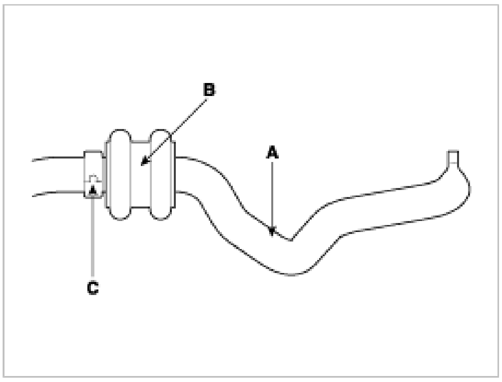


6. Remove the stabilizer bracket(B) and bushing(C).
7. Remove the stabilizer bar(D).

> CAUTION
>
> Be careful not to damage the pressure tube.

INSTALLATION

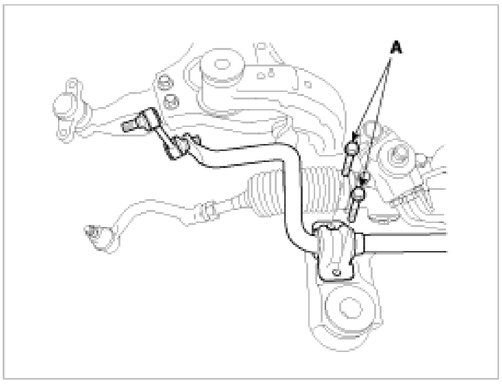
1. Install the bushing(B) on the stabilizer bar(A).



> NOTE
>
> Bring clamp(C) of stabilizer bar(A) into contact with bushing(B).

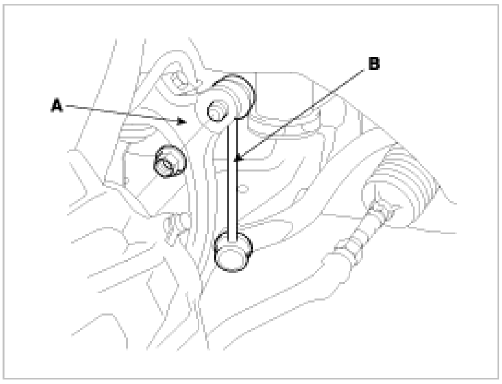
2. Install the bracket on the bushing(B).
3. After tightening the bolts of the bushing bracket temporarily, install the bushing bracket on the opposite side.
4. Install the rear stabilizer bark bracket mounting bolts(A) to the subframe.

Tightening torque Nm (kgf·m, lb-ft) :
45 ~ 55 (4.5 ~ 5.5, 32.5 ~ 39.8)



5. Install the stabilizer link(B) to the fork(A).

Tightening torque Nm (kgf·m, lb-ft) :
100 ~ 120 (10 ~ 12, 72.3 ~ 86.8)



6. Install the wheel and the tire to the front hub.

Tightening torque Nm (kgf·m, lb-ft) :
90 ~ 110 (9 ~ 11, 65.1 ~ 79.5)

CAUTION

Be careful not to damage the hub bolts when installing the front wheel and tire.

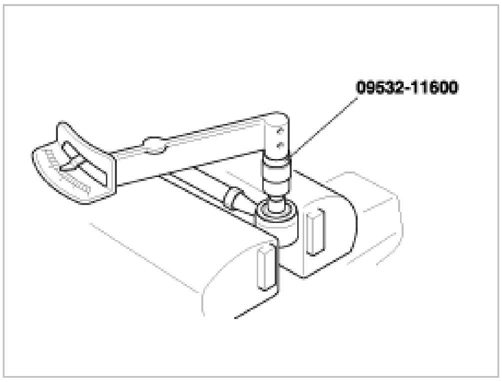
INSPECTION

1. Check the bushing for wear and deterioration.
2. Check the stabilizer bar for bending or breakage.
3. Check the ball joint for rotating torque.
   (1) If there is a crack in the dust cover, replace it and add grease.
   (2) Shake the stabilizer link ball joint stud several times.
   (3) Mount the self-locking nut on the ball joint, and then measure the ball joint rotating torque.

Standard value :
0.7 ~ 2 Nm (7 ~ 20 kgf·cm, 0.51 ~ 1.45 lb-ft)

NOTE

Measure torque using the special tool(09532-11600) and torque wrench at the range of 0.5 - 2 rpm after moving the ball joint stud at degree 3° several times at room temperature.

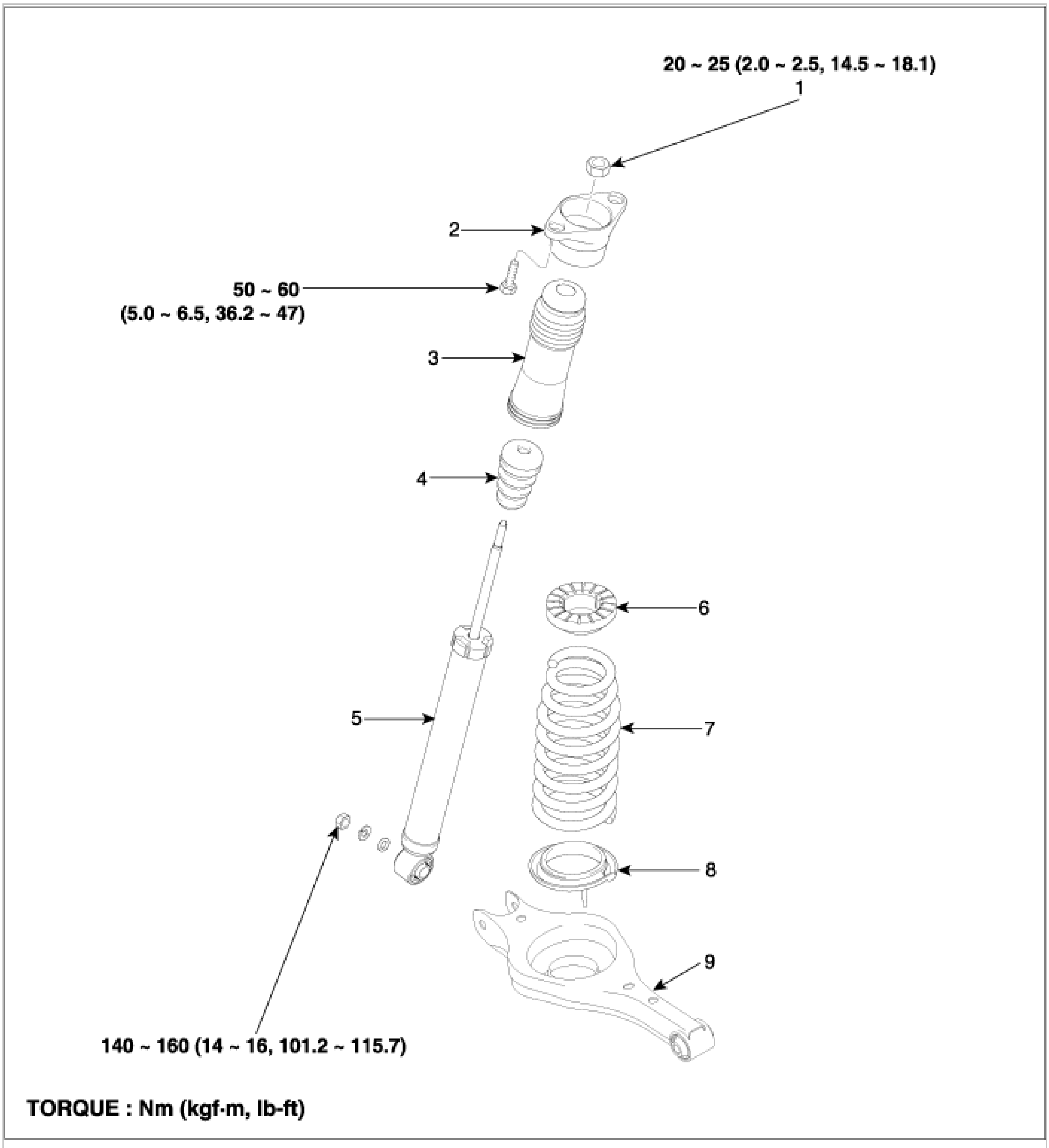


(4) If the rotating torque exceeds the upper limit of standard value, replace the upper arm assembly.

(5) Even if the rotating toque is below the lower limit of the standard value, the ball joint may be reused unless it has drag and excessive play.

Suspension System > Rear Suspension System > Rear Strut Assembly > Components and Components Location

COMPONENTS



1. Self-locking nut	4. Urethane bumper	7. Spring
2. Bracket	5. Shock absorber	8. Lower pad
3. Dust cover	6. Upper pad	9. Rear lower arm

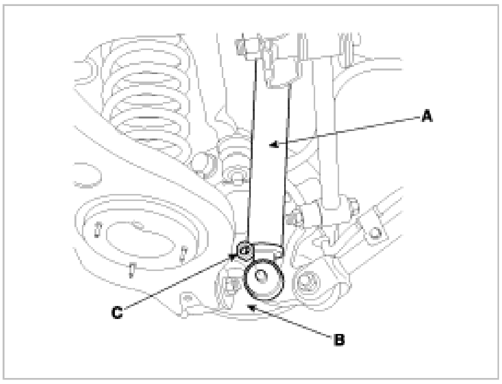
Suspension System > Rear Suspension System > Rear Strut Assembly > Repair procedures

REMOVAL

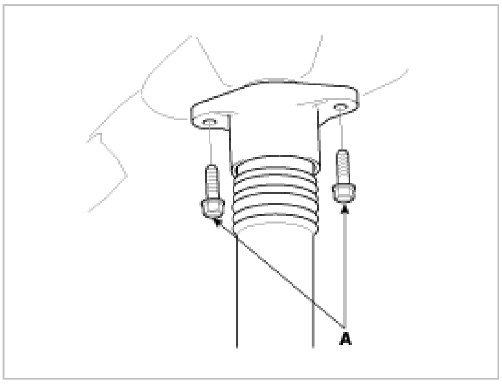
1. Loosen the wheel nuts slightly.
   Raise the rear of the vehicle, and make sure it is securely supported.
2. Remove the rear wheel and tire from rear hub.

> **CAUTION**
>
> Be careful not to damage the hub bolts when removing the rear wheel and tire.

3. Remove the rear shock absorber assembly bolts(C) from the rear axle assembly(B), then remove the shock absorber assembly(A).



4. Remove the two rear shock absorber assembly mounting bolts(A).

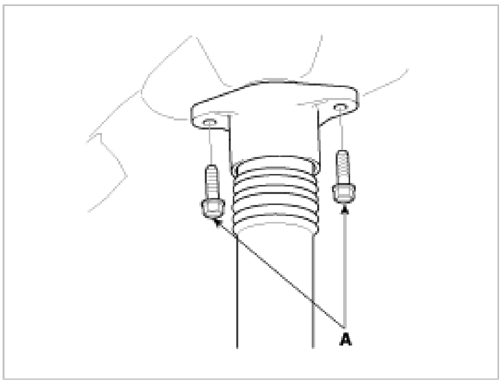


5. Disassembly the rubber bumper and the dust cover from the rear shock absorber.

INSTALLATION

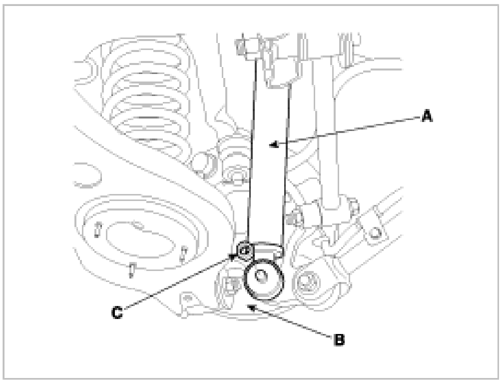
1. Assembly the rubber bumper and the dust cover to the rear shock absorber, after pulling the rod of the rear shock absorber completely.
2. Install the two rear shock absorber mounting bolts(A).

Tightening torque Nm (kgf·m, lb-ft) :
50 ~ 65 (5.0 ~ 6.5, 36.2 ~ 47.0)



3. Install the shock absorber assembly(A) to the rear axle assembly(B) with the specified torque.

Tightening torque Nm (kgf·m, lb-ft) :
140 ~ 160 (14~16, 101.2~115.7)



4. Install the wheel and the tire to the rear hub.

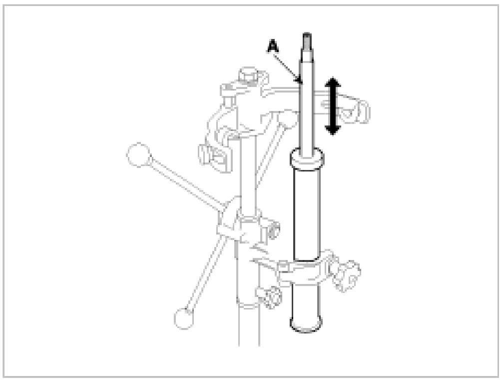
Tightening torque Nm (kgf·m, lb-ft) :
90 ~ 110 (9 ~ 11, 65.1 ~ 79.5)

CAUTION

Be careful not to damage the hub bolts when installing the rear wheel and tire.

INSPECTION

1. Check the rubber parts for damage or deterioration.
2. Check the shock absorber for abnormal resistance or unusual sounds.

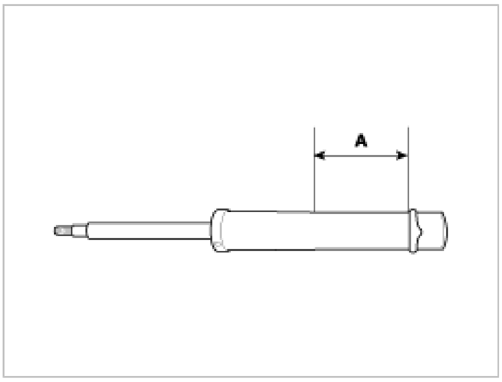


DISPOSAL

1. Fully extend the shock absorber rod.
2. Drill a hole to remove gas from the cylinder.

CAUTION

The gas coming out is harmless, but be careful of chips that may fly up when drilling. Be sure to use face shield and safety goggles.



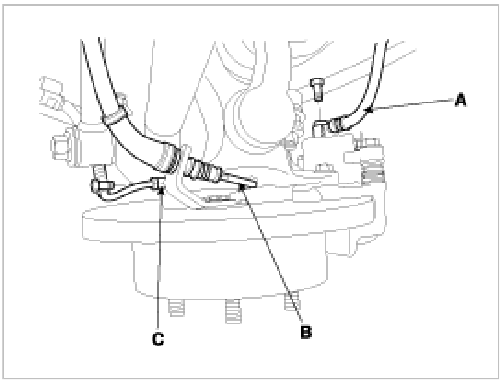
Suspension System > Rear Suspension System > Rear Upper Arm > Repair procedures

REMOVAL

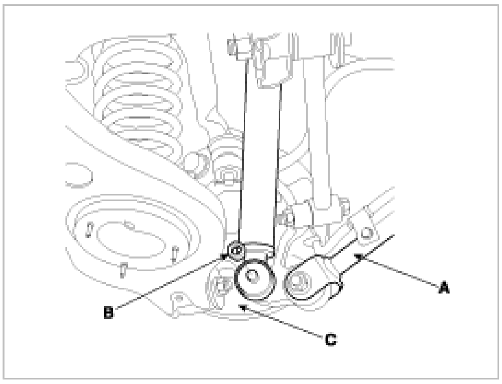
1. Loosen the wheel nuts slightly.
   Raise the rear of the vehicle, and make sure it is securely supported.
2. Remove the rear wheel and tire from rear hub.

> CAUTION
>
> Be careful not to damage the hub bolts when removing the rear wheel and tire.

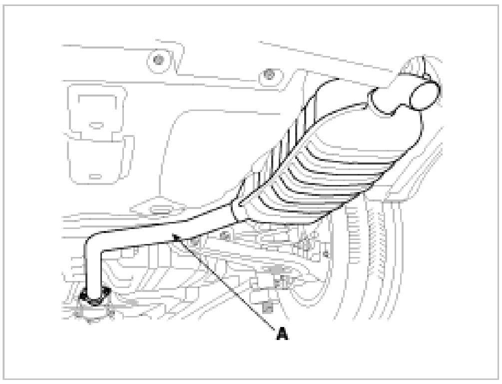
3. Remove the brake hose(A), the parking brake cable(B), and the wheel speed sensor(C).



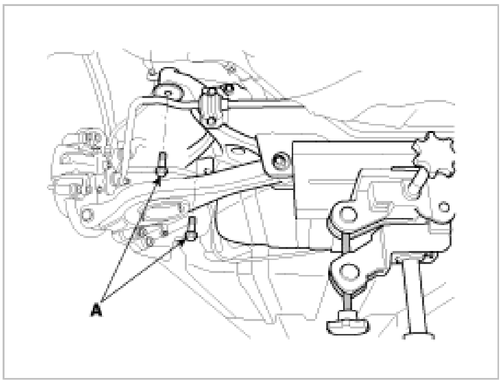
4. Remove the trailing arm(A) and the shock absorber(B) from the rear axle assembly(C), supporting with a jack.



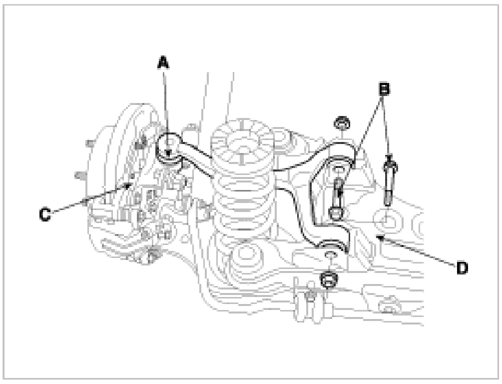
5. Remove the muffler(A).



6. Remove the four rear cross member mounting bolts(A), while supporting with a jack.



7. Remove the split pin and the upper arm ball joint self-locking nut(A).

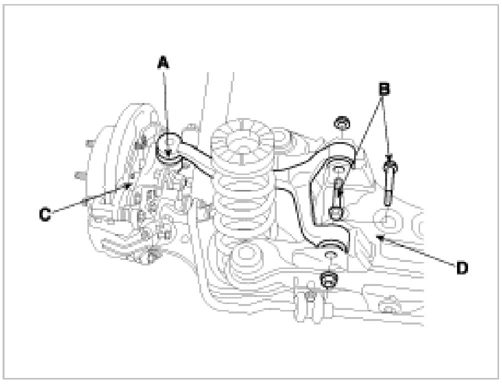


8. Remove the upper arm ball joint from the rear axle assembly(C) with special tool (09568-4A000).
9. Remove the two upper arm mounting bolts(B) from the cross member(D).

INSTALLATION

1. Install the upper arm to the cross member(D) with two mounting bolts(B).

Tightening torque Nm (kgf·m, lb-ft) :
100 ~ 120 (10 ~ 12, 72.3 ~ 86.8)

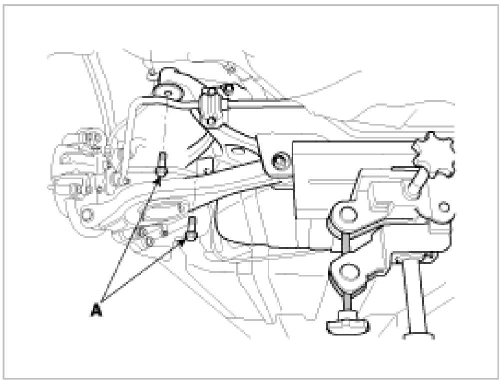


2. Install the upper arm ball joint self-locking nut(A) to the rear axle assembly(C) with a specified torque, and then install the split pin.

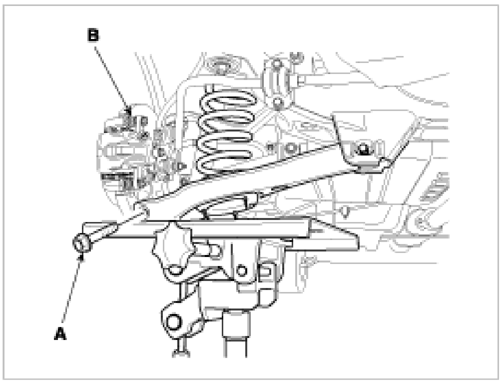
Tightening torque Nm (kgf·m, lb-ft) :
80 ~ 90 (8 ~ 9, 57.8 ~ 65.1)

3. Install the cross member(A).

Tightening torque Nm (kgf·m, lb-ft) :
140 ~ 160 (14~16, 101.2~115.7)

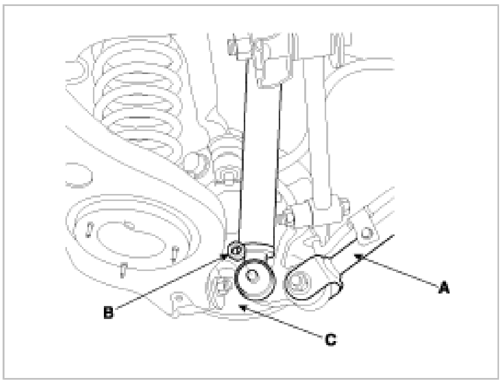


4. Install the spring, the lower seat, and the upper pad.
5. Install the lower arm bolt(A) to the axle assembly(B), while supporting with a jack.

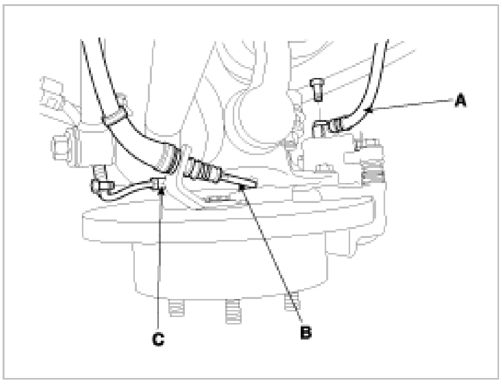


6. Install the trailing arm(A) and the shock absorber(B) to the rear axle assembly(C).

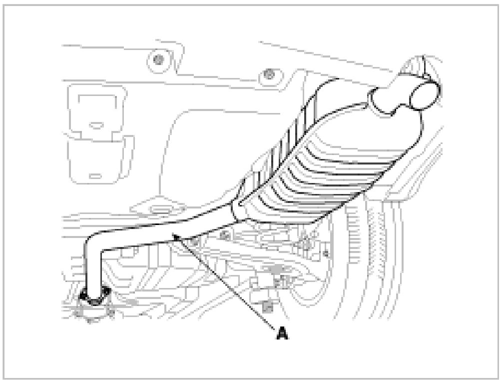
Tightening torque Nm (kgf·m, lb-ft) :
140 ~ 160 (14~16, 101.2~115.7)



7. Install the brake hose(A), the parking brake cable(B), and the wheel speed sensor(C).



8. Install the muffler(A).



9. Install the wheel and the tire to the rear hub.

Tightening torque Nm (kgf·m, lb-ft) :
90 ~ 110 (9 ~ 11, 65.1 ~ 79.5)

CAUTION

Be careful not to damage the hub bolts when installing the rear wheel and tire.

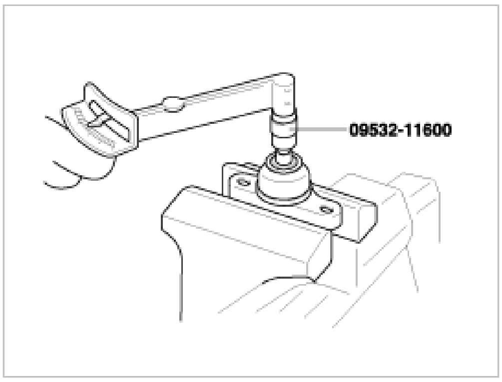
INSPECTION

1. Check the bushing for wear and deterioration.
2. Check the upper arm for bending or breakage.
3. Check the ball joint for rotating torque.
   (1) If there is a crack in the dust cover, replace it and add grease.
   (2) Shake the stabilizer link ball joint stud several times.
   (3) Mount the self-locking nut on the ball joint, and then measure the ball joint rotating torque.

   Specified torque :
   1 ~ 5 Nm (10 ~ 50 kgf·cm, 0.73 ~ 3.64 lb-ft)

   NOTE

   Measure torque using the special tool(09532-11600) and torque wrench at the range of 0.5 - 2 rpm after moving the ball joint stud at degree 3° several times at room temperature.



   (4) If the rotating torque exceeds the upper limit of standard value, replace the upper arm assembly.
   (5) Even if the rotating toque is below the lower limit of the standard value, the ball joint may be reused unless it has drag and excessive play.

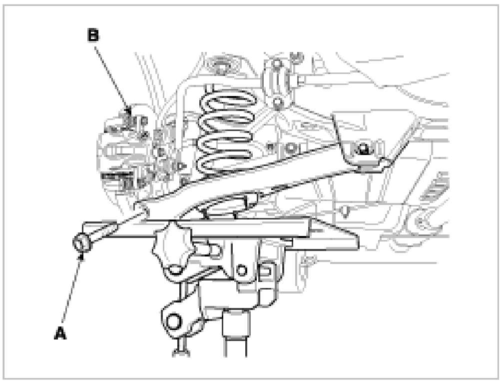
Suspension System > Rear Suspension System > Rear Lower Arm > Repair procedures

REMOVAL

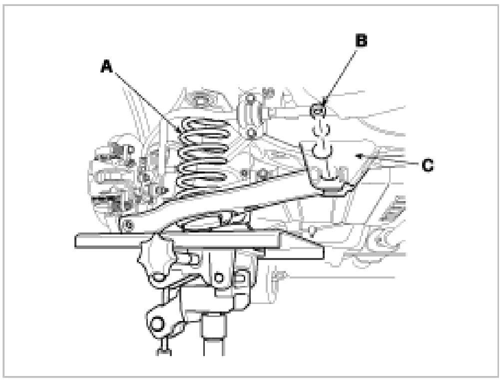
1. Loosen the wheel nuts slightly.
   Raise the rear of the vehicle, and make sure it is securely supported.
2. Remove the rear wheel and tire from rear hub.

> CAUTION
>
> Be careful not to damage the hub bolts when removing the rear wheel and tire.

3. Remove the lower arm bolt(A) from the rear axle assembly(B), while supporting with a jack as shown below.



4. Remove the spring(A), the lower seat, and the upper pad.

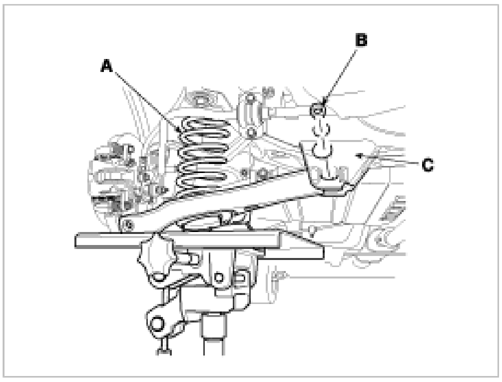


5. Remove the lower arm mounting bolts(B) from the cross member(C).

INSTALLATION

1. Install the lower arm mounting bolts(B) to the cross member(C) with a specified torque.

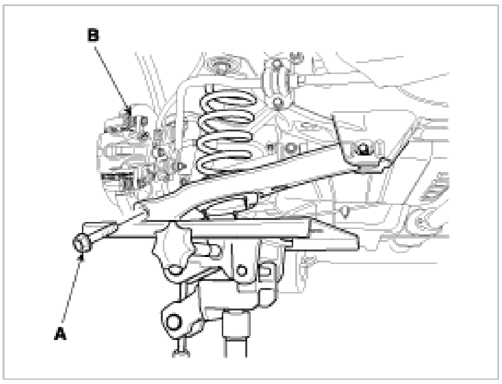
Tightening torque Nm (kgf·m, lb-ft) :
110 ~ 120 (11 ~ 12, 79.5 ~ 86.8)



2. Install the spring(A), the lower seat, and the upper pad.
3. Install the lower arm bolt(A) from the rear axle assembly(B) with a specified torque, while supporting with a jack as shown below.

Tightening torque Nm (kgf·m, lb-ft) :

140~160 (14 ~ 16, 101.2~115.7)



4. Install the wheel and the tire to the rear hub.

Tightening torque Nm (kgf·m, lb-ft) :
90 ~ 110 (9 ~ 11, 65.1 ~ 79.5)

CAUTION

Be careful not to damage the hub bolts when installing the rear wheel and tire.

INSPECTION

Rear lower arm

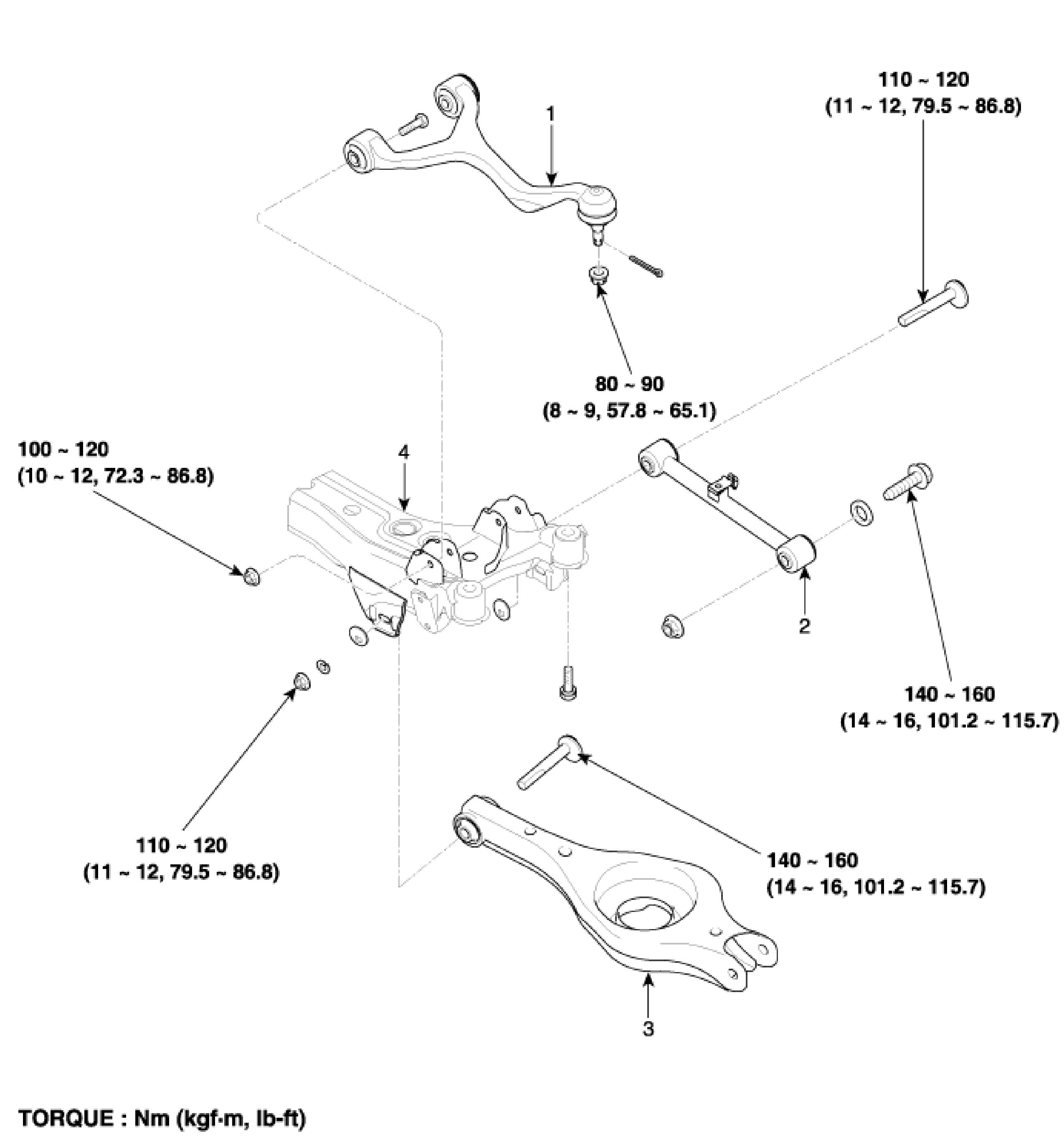
1. Check the bushing for wear and deterioration.
2. Check the center arm for bending or breakage.
3. Check the bolts for damage.

Spring

1. Check the spring for distortion, aging or damage.
2. Check the spring upper pad for aging or damage.

Suspension System > Rear Suspension System > Upper Arm, Lower Arm And Assist Link > Components and Components Location

COMPONENTS



1. Rear upper arm	3. Rear lower arm
2. Assist arm	4. Cross member

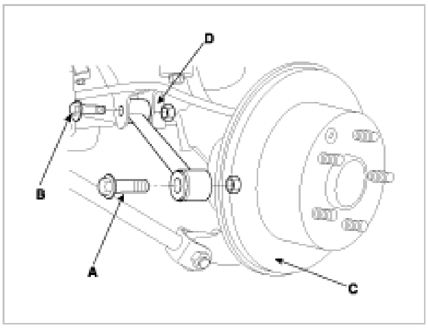
Suspension System > Rear Suspension System > Rear Assist Arm > Repair procedures

REMOVAL

1. Loosen the wheel nuts slightly.
   Raise the rear of the vehicle, and make sure it is securely supported.
2. Remove the rear wheel and tire from rear hub.

> CAUTION
>
> Be careful not to damage the hub bolts when removing the rear wheel and tire.

3. Remove the assist arm mounting bolt(A) from the rear axle assembly(C).

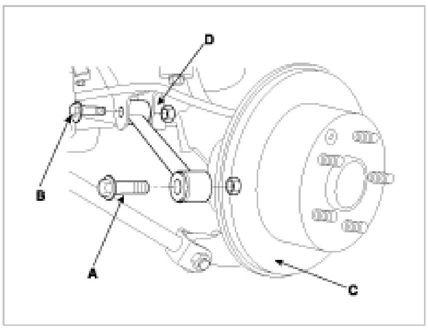


4. Remove the assist arm mounting bolt(B) from the cross member(D).

INSTALLATION

1. Install the assist arm mounting bolt(B) to the cross member(D).

Tightening torque Nm (kgf·m, lb-ft) :
110 ~ 120 (11 ~ 12, 79.5 ~ 86.8)



2. Install the assist arm mounting bolt(A) from the rear axle assembly(C).

Tightening torque Nm (kgf·m, lb-ft) :
140~160 (14~16, 101.2~115.7)

3. Install the wheel and the tire to the rear hub.

Tightening torque Nm (kgf·m, lb-ft) :
90 ~ 110 (9 ~ 11, 65.1 ~ 79.5)

CAUTION

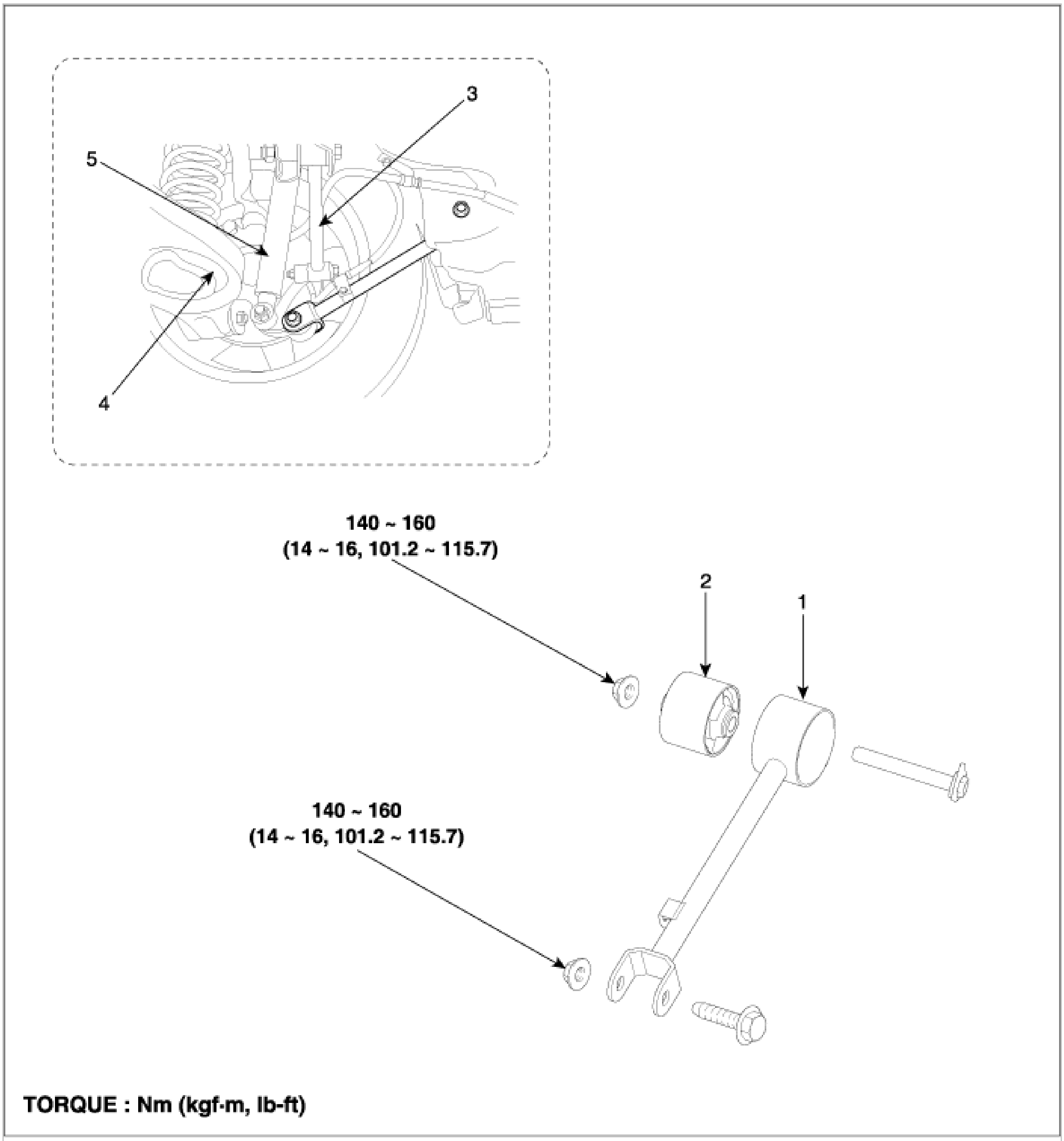
Be careful not to damage the hub bolts when installing the rear wheel and tire.

INSPECTION

1. Check the bushing for wear and deterioration.
2. Check the assist arm for bending or breakage.
3. Check all the bolts for damage.

Suspension System > Rear Suspension System > Trailing Arm > Components and Components Location

COMPONENTS

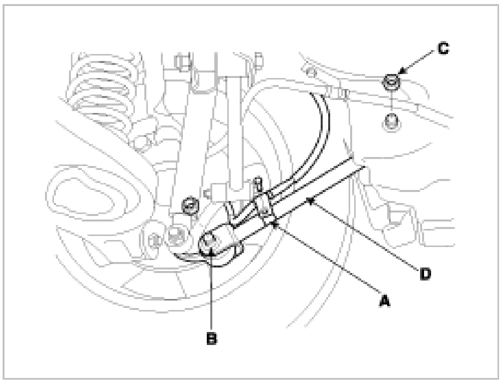


1. Trailing arm
2. Bushing
3. Assist arm
4. Rear lower arm
5. Rear strut assembly

Suspension System > Rear Suspension System > Trailing Arm > Repair procedures

REMOVAL

1. Remove the wheel speed sensor bracket(A).

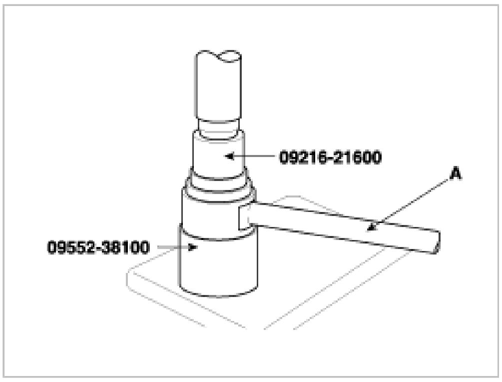


2. Remove the trailing arm mounting nut(B) from the rear axle assembly.
3. Remove the trailing arm mounting nut(C) from the body.
4. Remove the trailing arm(D).

REPLACEMENT

TRAILING ARM BUSHING

1. Using the special tools(09216-21600, 09552-38100), press-fit the bushing.



2. Remove the bushing from the trailing arm(A).
3. Using the special tool(09552-38000), replace the bushing.

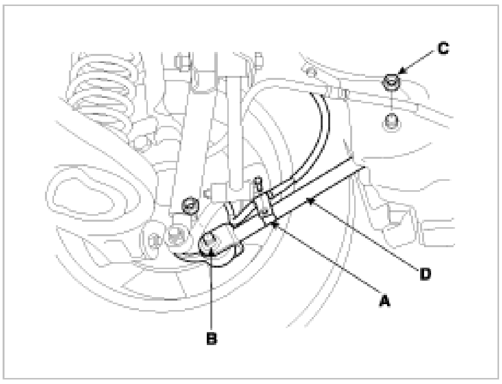
over 100 kN (1000 kgf, 2204 lb)

NOTE

Be sure to press the bushing with the jut of the bushing aligned to the longitude of the trailing arm.

INSTALLATION

1. Place the trailing arm(D) as shown below.



2. Install the trailing arm nuts.

NOTE

Fully tighten the trailing arm mounting nuts with the vehicle on the ground in unloaded condition.

A. Install the trailing arm mounting nut(B).

Tightening torque Nm (kgf·m, lb-ft) :
140~160 (14~16, 101.2~115.7)

B. Install the trailing arm bracket mounting nut(C).

Tightening torque Nm (kgf·m, lb-ft) :
140~160 (14~16, 101.2~115.7)

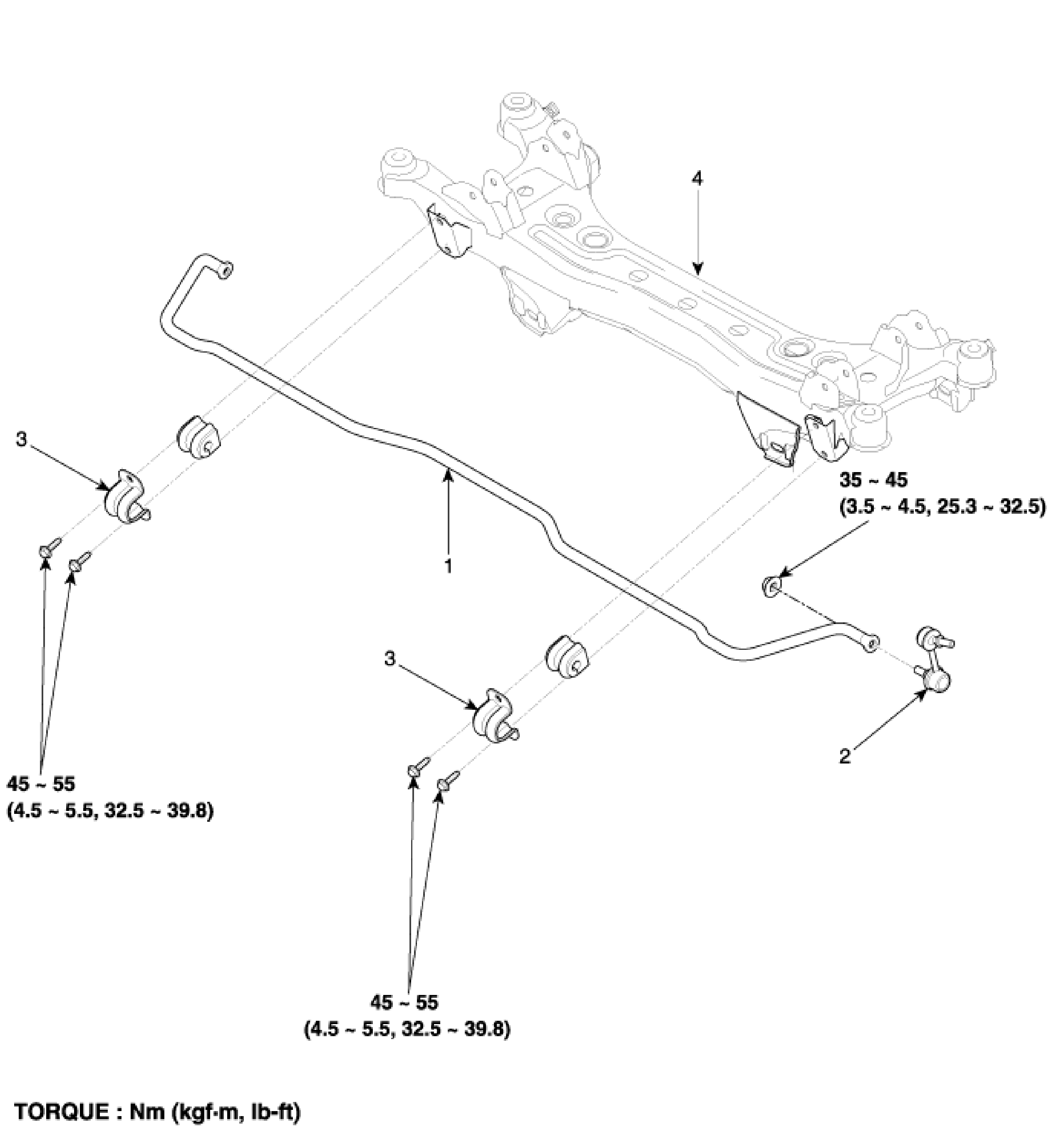
3. Install the wheel speed sensor bracket(A).

INSPECTION

1. Check the bushing for wear and deterioration.
2. Check the trailing arm for bending or breakage.
3. Check all the bolts for damage.

Suspension System > Rear Suspension System > Rear Stabilizer Bar > Components and Components Location

COMPONENTS



1. Rear stabilizer bar	3. Bracket
2. Stabilizer link	4. Cross member

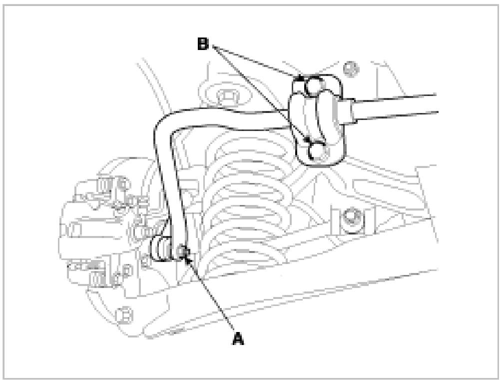
Suspension System > Rear Suspension System > Rear Stabilizer Bar > Repair procedures

REMOVAL

1. Loosen the wheel nuts slightly.
   Raise the rear of the vehicle, and make sure it is securely supported.
2. Remove the rear wheel and tire from rear hub.

> **CAUTION**
>
> Be careful not to damage the hub bolts when removing the rear wheel and tire.

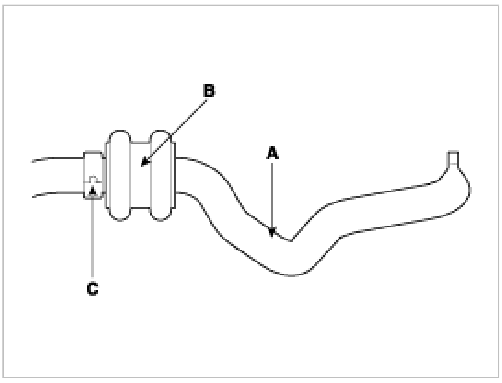
3. Remove the left/right nuts(A) of the rear stabilizer links.
4. Remove the left/right mounting nuts(B) of the rear stabilizer bar brackets.



5. Remove the rear stabilizer bar(C).

INSTALLATION

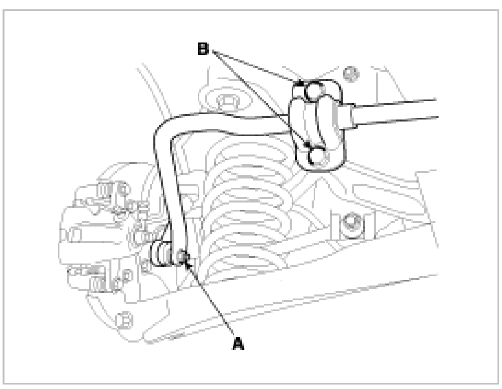
1. Install the bushing(B) on the stabilizer bar(A).



> **NOTE**
>
> Bring clamp(C) of stabilizer bar(A) into contact with bushing(B).

2. One side bracket should be temporarily tightened, and then install the bushing on the opposite side.
3. Install the stabilizer bracket bolt(B).

Tightening torque Nm (kgf·m, lb-ft) :
45 ~ 55 (4.5 ~ 5.5, 32.5 ~ 39.8)



4. Install the stabilizer link mounting nut(A).

Tightening torque Nm (kgf·m, lb-ft) :
35 ~ 45 (3.5 ~ 4.5, 25.3 ~ 32.5)

5. Repeat step 3 and 4 for the other side.
6. Install the wheel and the tire to the rear hub.

Tightening torque Nm (kgf·m, lb-ft) :
90 ~ 110 (9 ~ 11, 65.1 ~ 79.5)

CAUTION

Be careful not to damage the hub bolts when installing the rear wheel and tire.

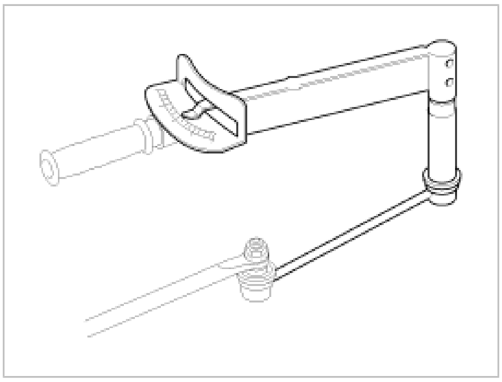
INSPECTION

1. Check the bushing for wear and deterioration.
2. Check the stabilizer bar for bending or breakage.
3. Check the ball joint for rotating torque.
   (1) If there is a crack in the dust cover, replace it and add grease.
   (2) Shake the stabilizer link ball joint stud several times.
   (3) Mount the self-locking nut on the ball joint, and then measure the ball joint rotating torque.

Specified torque :
0.7 ~ 2 Nm (7 ~ 20 kgf·m, 0.51 ~ 1.45 lb-ft)

NOTE

Measure torque using the special tool(09532-11600) and torque wrench at the range of 0.5 - 2 rpm after moving the ball joint stud at degree 3° several times at room temperature.



   (4) If the rotating torque exceeds the upper limit of standard value, replace the upper arm assembly.
   (5) Even if the rotating toque is below the lower limit of the standard value, the ball joint may be reused unless it has drag and excessive play.

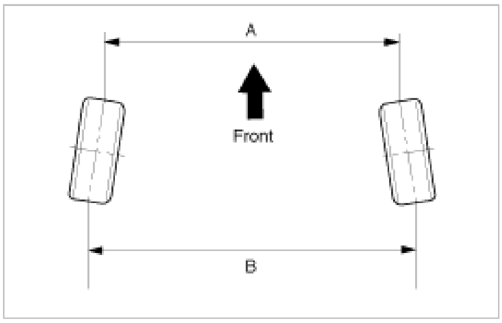
Suspension System > Tires/Wheels > Tire > Repair procedures

Wheel Alignment

When using commercially available computerized four wheel alignment equipment (caster, camber, toe) to inspect the front wheel alignment, always position the car on a level surface with the front wheels facing straight ahead.
Prior to inspection, make sure that the front suspension and steering system are in normal operating condition and that the wheels and tires face straight ahead and the tires are inflated to the specified pressure.

Toe

Toe is a measurement of how much the front of the wheels are turned in or out from the straight-ahead position.



Item	Description
A - B < 0	Positive (+) toe (toe in)
A - B > 0	Negative (-) toe (toe out)

When the wheels are turned in toward the front of the vehicle, toe is positive (+) (toe in). When the wheels are turned out toward the front of the vehicle, toe is negative(-) (toe out). Toe is measured in degrees, from side to side, and totaled.

[Front]

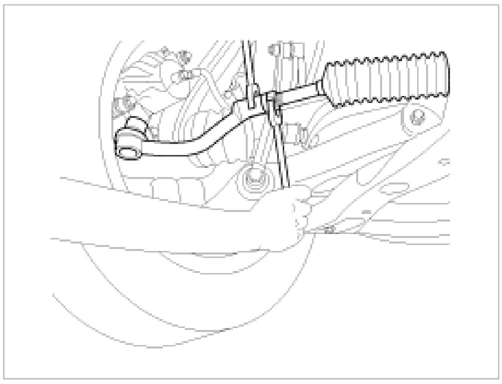
Toe-in(B-A or angle a+b) is adjusted by turning the tie rod turnbuckles. Toe-in on the left front wheel can be reduced by turning the tie rod toward the rear of the car. Toe- in change is adjusted by turning the tie rods for the right and left heels simultaneously at the same amount as follows.

Standard value :
Toe-in
Total : 0°±0.2°
Individual : 0°±0.1°

NOTE

- Toe-in adjustment should be made by turning the right and left tie rods at the same amount.
- When adjusting toe-in, loosen the outer bellows clip to prevent twisting the bellows.
- After the adjustment, tighten the tie rod end lock nuts firmly and reinstall the bellows clip.
- Adjust each toe-in to be the range of ±1°.

Tie rod(A) Specified torque :
50~55N.m (5~5.5kgf.m, 36.2~39.8lb-ft)



[Rear]

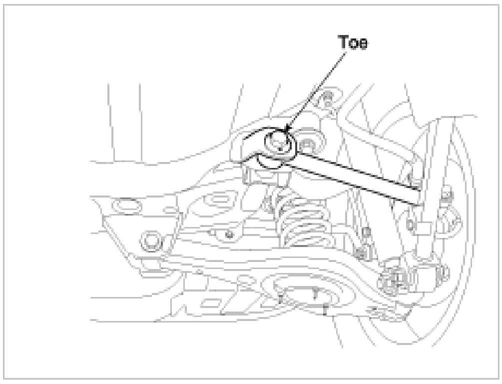
Standard value :
Toe-in
Total : 0.2°±0.2°
Individual : 0.1°±0.1°

Adjust the toe-in by turning the cambolt of the assist arm.

Left cambolt : Clockwise → toe-in
Right cambolt : Clockwise → toe-out
The variation of toe by a rotation of the cambolt :
About 0.4°

CAUTION

- Each toe should be within 0.1° ± 0.1° .
  If the difference between right and left is not within +0.2° , repeat adjustment.
- After adjusting the cambolt, tighten the nut to the specified torque.

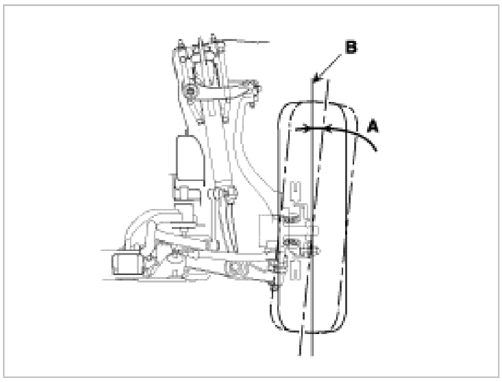


Specified torque
110 ~ 120N.m (11 ~ 12kgf.m, 79.5 ~ 86.8lb-ft)

Camber

[Front]

Camber is the inward or outward tilting of the wheels at the top.



Item	Description
A	Positive camber angle
B	True vertical

When the wheel tilts out at the top, then the camber is positive(+).
When the wheel tilts in at the top, then the camber is negative(-).

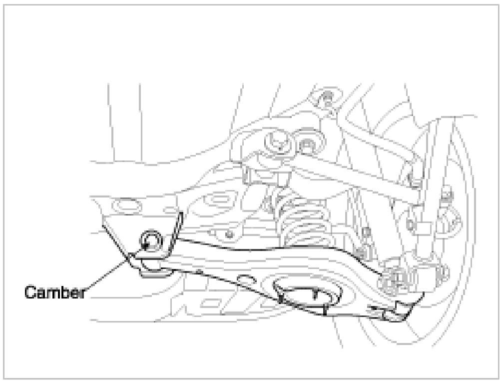
Standard value : -0°±0.5°
Difference between right and left angle is within 0.5°

NOTE

Camber is pre-set at the factory and doesn't need to be adjusted. If the camber is not within the standard value, replace the bent or damaged parts.

[Rear]

Standard value : -0.5°±0.5°
Difference between right and left angle is within 0.5°



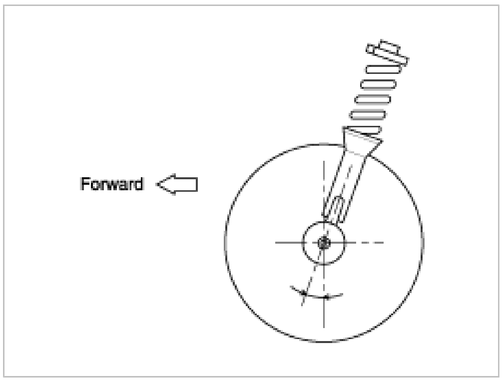
Adjust the camber by turning the cambolt of the rear lower arm.

Left cambolt : Clockwise → camber(+)
Right cambolt : Clockwise →camber(-)
The variation of camber by a rotation of the cambolt :
About 0.2°

Caster

Caster is the tilting of the strut axis either forward or backward from vertical. A backward tilt is positive (+) and a forward tilt is negative (-).
Caster is pre-set at the factory and doesn't need to be adjusted. If the caster is not within the standard value, replace the bent or damaged parts.

Caster : 4.8°±0.75°



NOTE

- The worn loose or damaged parts of the front suspension assembly must be replaced prior to measuring front wheel alignment.
- Camber and caster are pre-set to the specified value at the factory and don't need to be adjusted.
- If the camber and caster are not within specifications, replace bent or damaged parts.
- The difference of left and right wheels about the camber and the caster must be within the range of 0° ± 0.5°.

TIRE WEAR

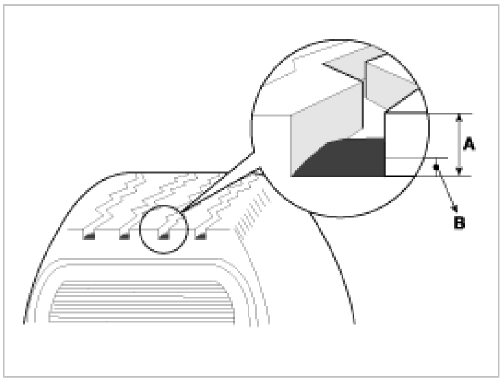
1. Measure the tread depth of the tires.

   Tread depth [limit] : 1.6 mm (0.063 in)

2. If the remaining tread(A) depth is less than the limit, replace the tire.

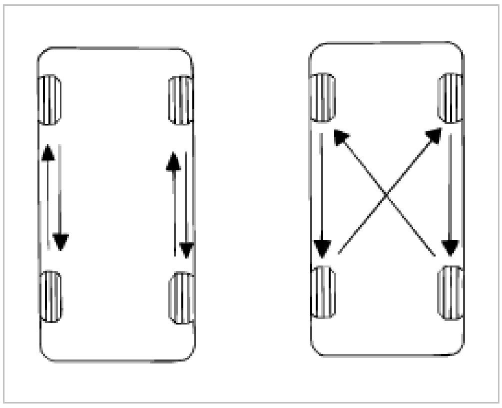
NOTE

When the tread depth of the tires is less than 1.6 mm (0.063 in), the wear indicators(B) will appear.



TIRE ROTATION

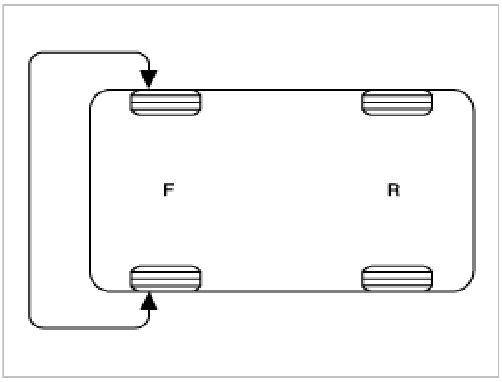
Rotate the tires in the pattern illustrated.



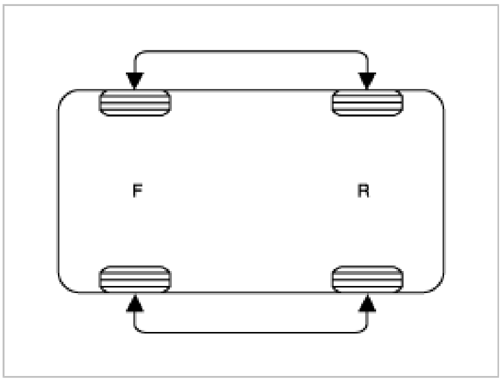
CHECKING FOR PULL AND WANDER

If the steering pulls to one side, rotate the tires according to the following wheel rotation procedure.

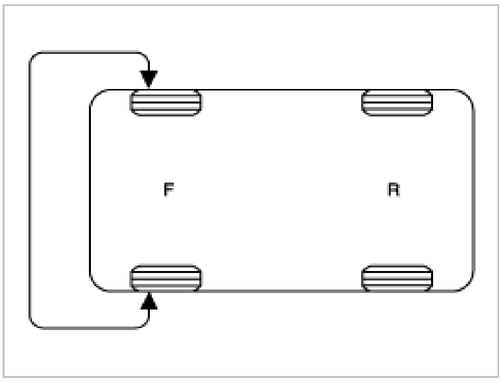
1. Rotate the front right and front left tires, and perform a road test in order to confirm vehicle stability.



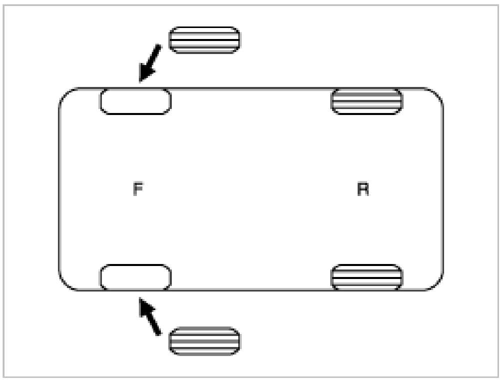
2. If the steering pulls to the opposite side, rotate the front and rear tires, and perform a road test again.



3. If the steering continues to pull to one side, rotate the front right and left tires again, and perform a road test.



4. If the steering continues to pull to the opposite side, replace the front wheels with new ones.

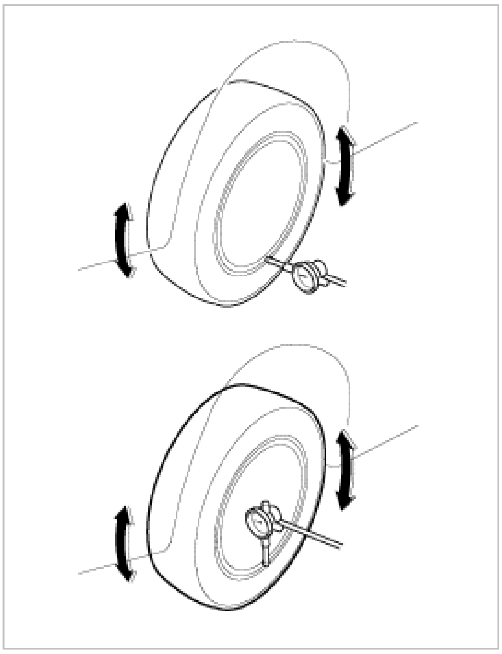


Suspension System > Tires/Wheels > Wheel > Repair procedures

WHEEL RUNOUT

1. Jack up the vehicle and support it with jack stands.
2. Measure the wheel runout with a dial indicator as illustrated.
3. Replace the wheel if the wheel runout exceeds the limit.

Limit		Radial	Axial
Runout mm(in)	Steel	0.9	1.4
	Aluminium	0.3	0.3



WHEEL NUT TIGHTENING

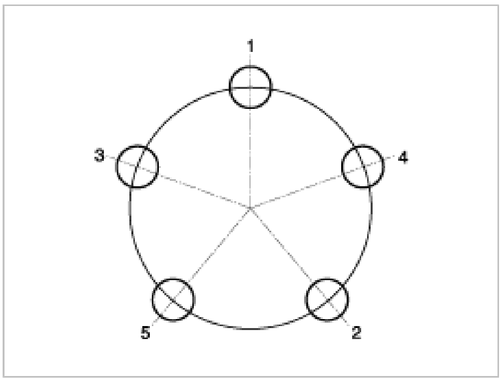
1. Tightening torque.

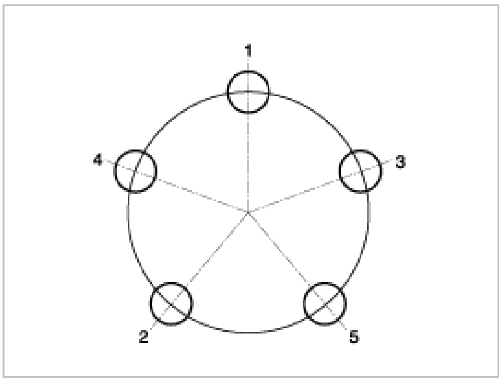
Tightening torque Nm (kgf·m, lb-ft) :
90 ~ 110 (9 ~ 11, 65.1 ~ 79.5)

CAUTION

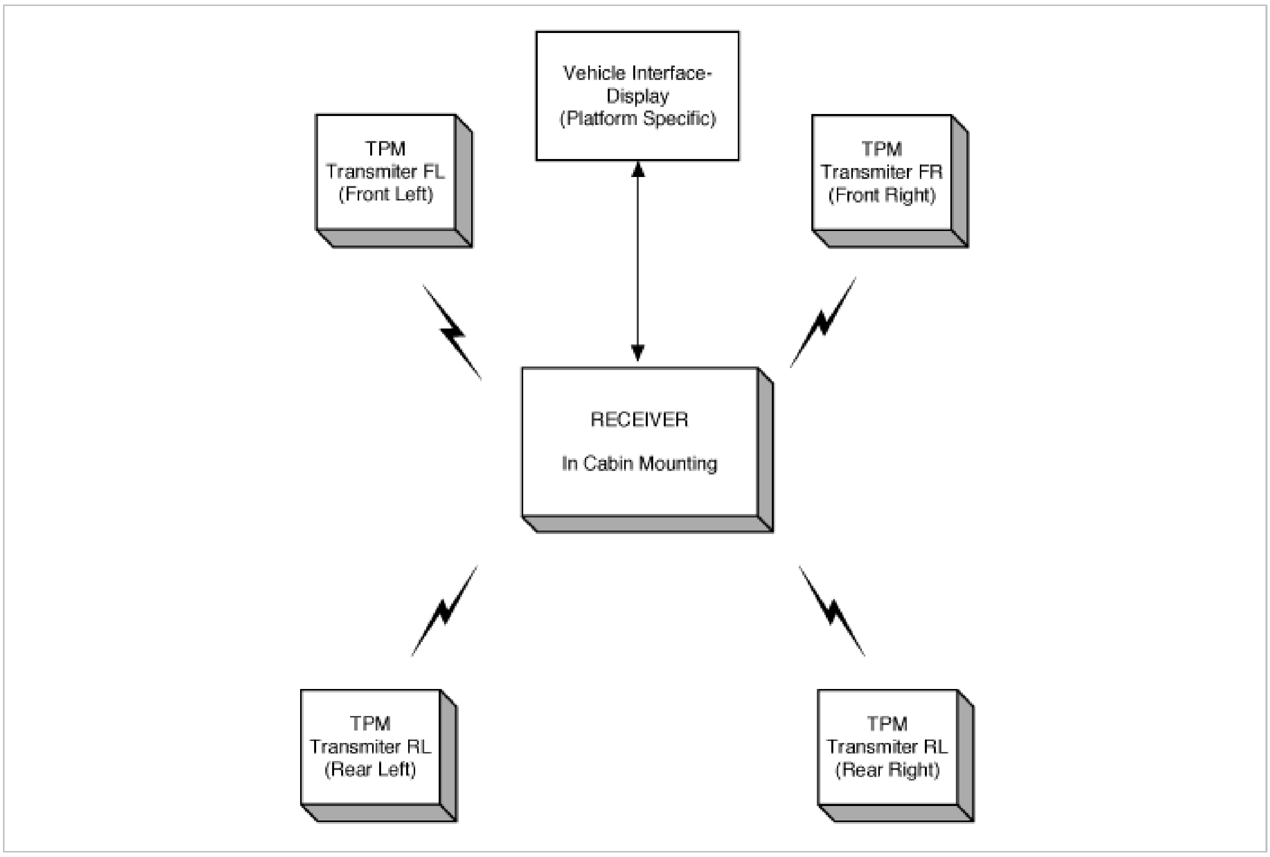
When using an impact gun, final tightening torque should be checked using a torque wrench.

2. Tightening order.
   Check the torque again after tightening the wheel nuts diagonally.

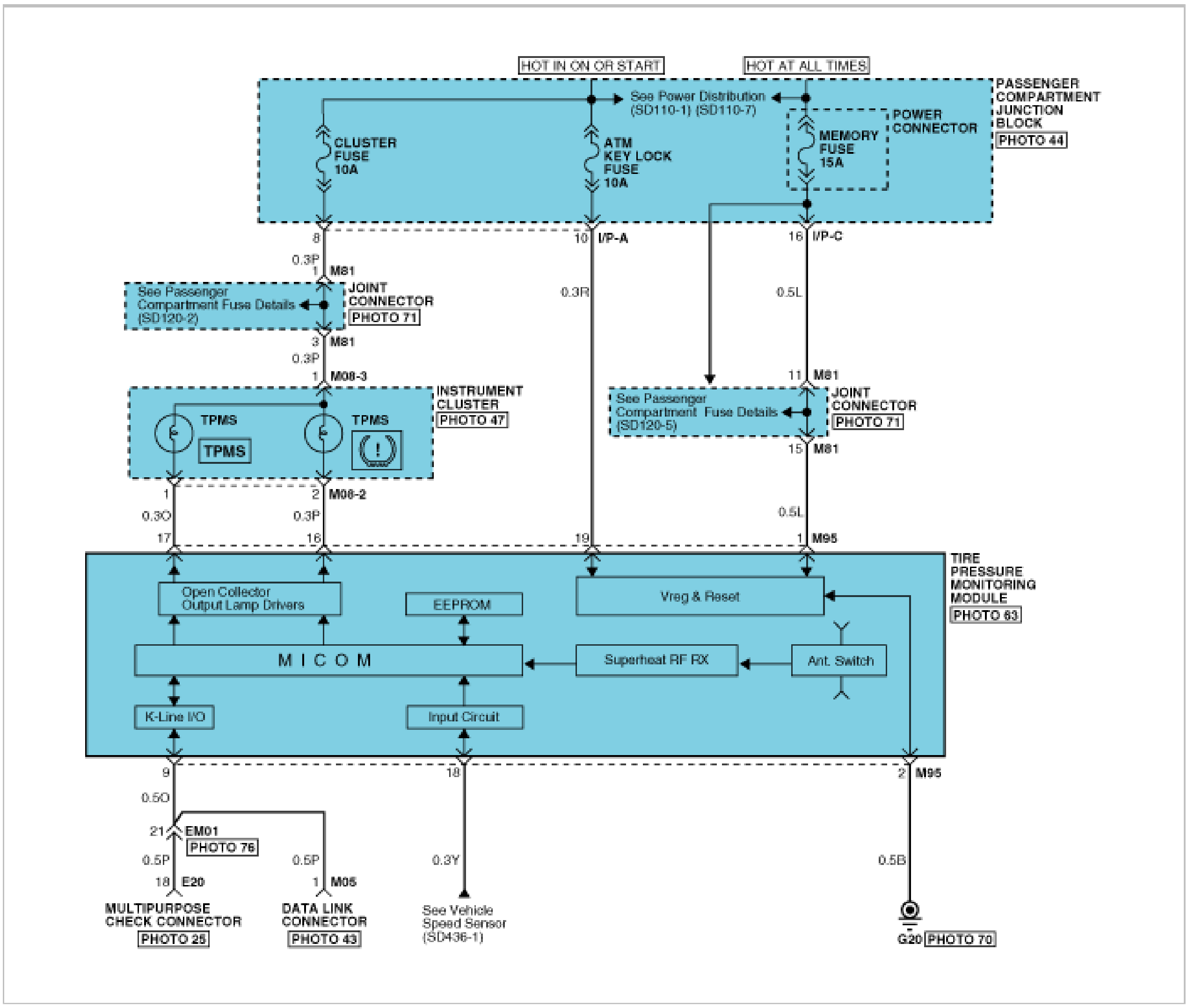




SCHEMATIC DIAGRAM



circuit diagram



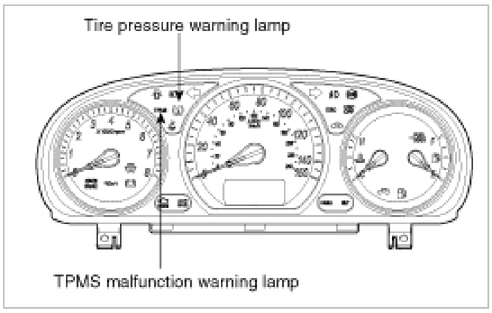
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

NO	PIN-OUT ASSIGNMENT	NO	PIN-OUT ASSIGNMENT
1	Battery	11	-
2	Ground(TPMS receiver)	12	-
3	-	13	-
4	-	14	-
5	-	15	-
6	-	16	TREAD lamp
7	-	17	Diagnostic lamp (TPMS)
8	-	18	Speed signal
9	K-LINE	19	Ignition 1(+)
10	-	20	-

Suspension System > Tire Pressure Monitoring System > Description and Operation

DESCRIPTION

WARNING LAMPS



TREAD Lamp

- Tire Under Inflation / Leak Warning.

1. Turn on condition
   A. When tire pressure is below allowed threshold
   B. When rapid leak is detected by the sensor.
   C. Indicates that tire needs to be re-inflated to placard pressure / repaired.
2. Turn off condition
   A. Under-inflation ; When tire pressure is above (warning threshold + hysteresis).
   B. Rapid Leak ; When tire pressure is above (leak warning threshold).

DTC Warning

TPMS

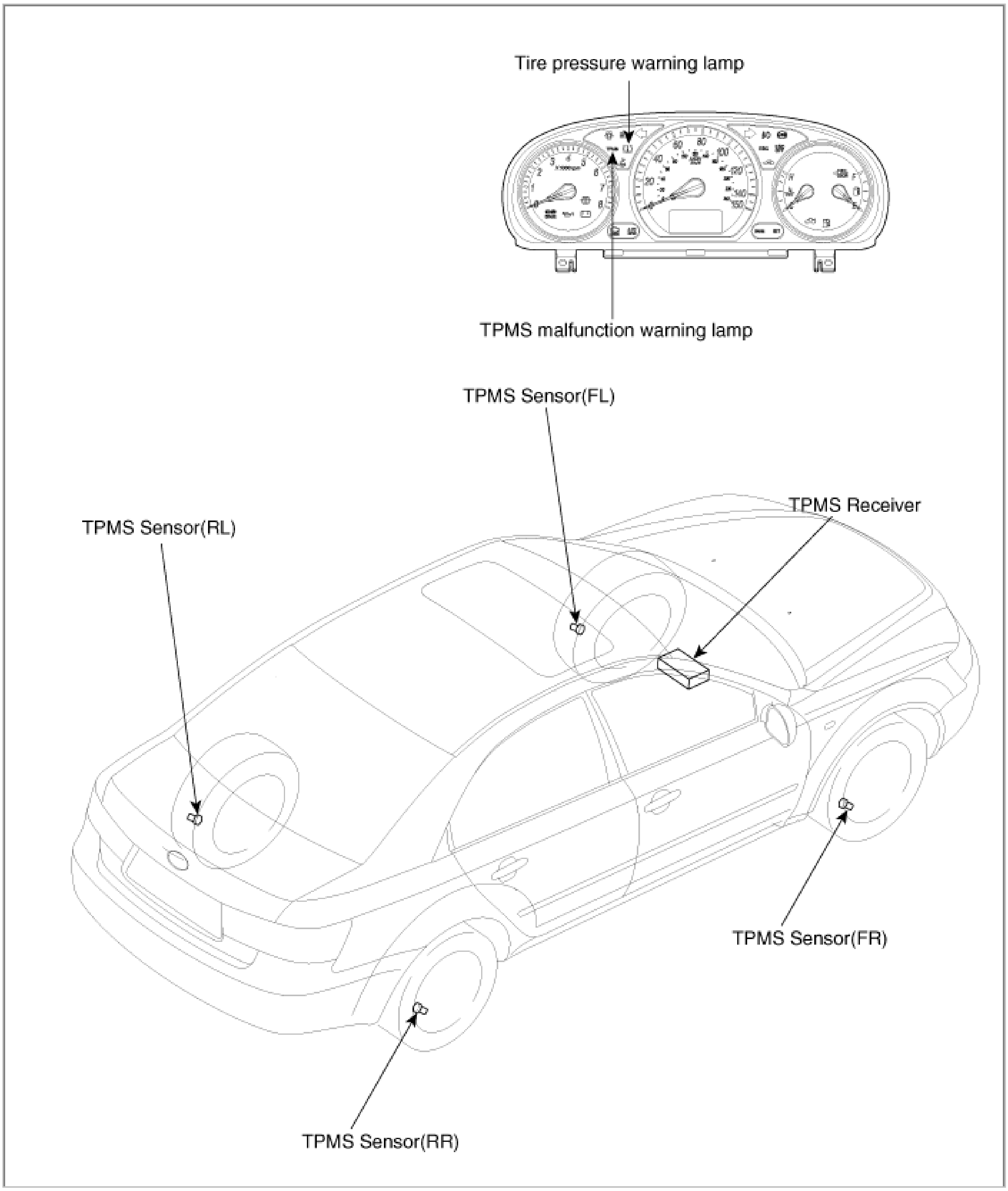
1. Turn on condition
   A. When the system detects a fault that is external to the receiver/ sensor.
   B. When the system detects a receiver fault.
   C. When the system detects a sensor fault.
2. Turn off condition
   A. If the fault is considered as 'critical', then the lamp is held on throughout the current Ignition cycle (even if the DTC has been demoted). This is because it is important to bring the problem to the drivers attention. On the following Ignition cycle, the demotion conditions will be re-checked. If the demotion conditions occur, the lamp will be turned off. It will be held on until DTC demotion checking is completed.
   B. 'Non critical' faults are those that can occur temporarily e.g. vehicle battery under voltage. The lamp is therefore turned off when the DTC demotion condition occurs.

SYSTEM FAULT

1. General Function
   A. The system monitors a number of inputs across time in order to determine that a fault exists.
   B. Faults are prioritized according to which has the most likely cause.
   C. Maximum fault store is equal to 15.
   D. Certain faults are not covered through DTC. The main ones are:
      1) Speed input. This is important since it is required for Auto-Learn & DTC. Requires diagnostic check of speed while driving vehicle to diagnose.
      2) Sensor thermal shutdown (over 257°F/125°C).
      3) Control module Micro-controller lock up ; requires observation of lamps at Ignition ON to diagnose.
      4) Ignition Line stuck ; requires observation of lamps at Ignition ON to diagnose.

Suspension System > Tire Pressure Monitoring System > Components and Components Location

components



Suspension System > Tire Pressure Monitoring System > Troubleshooting

TROUBLESHOOTING

- the lamp check should occur and then all lamps / LED's should turn off.
- **If the lamp test does not occur:**
  - Check connectors and fuse/harnessing - open / short circuits.
  - Check DTC's.
  - If diagnostics cannot be entered, replace the receiver with a known good one (follow configuration & learning procedure).

TREAD warnings

- **Information to ascertain (TREAD Lamp):**

- Was puncture repair fluid used (it should not be)?
  - This can cause the sensor pressure port to block and incorrect warning to occur.
- What temperature were tires last inflated at?
  At what temperature did warnings occur?
  - Pressure change is approx. 1.5psi / 10°C increase.
- Have the tires been checked / inflated since the lamp first came on?

- **If the TREAD Lamp is on:**
  - Check for short circuits.
  - Enter Diagnostics and read TREAD Warnings Local Identifier Data.
  - Check to see if warning type is under inflation or leak.
  - If the warning is for under inflation, then:
    a. Re-inflate the wheel with the matching sensor ID to it's desired Placard pressure.
    b. Check to make sure that the TREAD lamp turns off (this may take up to 4 minutes if the tire is not rapidly re-inflated).
  - If the warning is for a leak, then:
    a. Fix any puncture and re-inflate the tire to the desired Placard pressure.
    b. Wait up to 4 minutes and make sure that the TREAD lamp turns off and the lamp does not turn on again.
    c. If lamp comes on again:
    d. Re-check pressure for signs of a puncture and Re-Check TREAD Warnings Local Identifier Data.
- **If the Placard pressure is OK and the TREAD lamp still does not turn off:**
  - Turn wheel a quarter turn and again wait 4 minutes (the sensor may be in an RF null).
  - If the lamp still does not turn off:
    check for loose receiver wiring and replace the receiver with a known good one if necessary (follow configuration & learning procedure).
    - If the problem still exists, replace sensor.
    - Ensure that all tires are inflated to their correct Placard pressures.
    - Clear TREAD warnings.
    - Test drive the vehicle and ensure that the TREAD lamp does not come back on.

DTC's

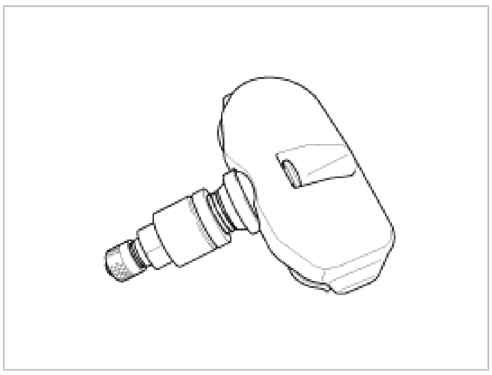
- Information to ascertain (DTC Lamp):
  - At what temperature did the DTC occur? Under certain conditions (approx.-40°C/F), a RF channel missing / hardware failure DTC may occur. This is due to the battery behavior.
- DTC's should be retrieved by using Hi-Scan diagnostic tool.
- The fault should then be diagnosed and rectified.
- DTC's should then be cleared.

DTC	Warning Type	Trouble Description	Diagnostic Lamp
C1121	Battery Level	Sensor 1 Battery Low.	Permanent during detection.
C1122		Sensor 2 Battery Low.	
C1123		Sensor 3 Battery Low.	
C1124		Sensor 4 Battery Low.	
C1126		Vehicle / TPMS receiver Battery Low.	
C1127		Vehicle / TPMS receiver Battery High.	
C1300	LF / RF External Interference	LF/RF Interference Failure.	Permanent during detection.
C1306	RF Internal Interference	Internal vehicle RF source e.g. scanner.	Permanent
C1312	Individual RF channel failure.	Sensor 1 / Front Left RF Failure.	Permanent
C1313		Sensor 2 / Front Right RF Failure.	
C1314		Sensor 3 / Rear Left RF Failure.	
C1315		Sensor 4 / Rear Right RF Failure.	
C1322	Sensor over Temperature	Sensor 1 / Front Left Sensor over 230°F(110°C).	Permanent
C1323		Sensor 2 / Front Right Sensor over	

		230°F(110°C).	
C1324		Sensor 3 / Rear Left Sensor over 230°F(110°C).	
C1325		Sensor 4 / Rear Right Sensor over 230°F(110°C).	
C1332	Sensor Failure	Sensor 1 / Front Left Sensor Fault.	Permanent
C1333		Sensor 2 / Front Right Sensor Fault.	
C1334		Sensor 3 / Rear Left Sensor Fault.	
C1335		Sensor 4 / Rear Right Sensor Fault.	
C1660	System Hardware	TPMS receiver RF circuit.	Permanent
C1661	EEPROM Failure	TPMS receiver EEPROM Failure.	Permanent
C1668	Micro controller error	Repeated Watchdog Reset / Internal failure detection.	Permanent
C2510	Lamp Short Circuit	TREAD lamp short circuit to 12 V.	Permanent
C2511		Diagnostic lamp short circuit to 12 V.	Permanent

Suspension System > Tire Pressure Monitoring System > TPMS Sensor > Description and Operation

DESCRIPTION



1. MODE
   (1) Configuration State
      A. All sensors should be in the Low Line (Base) state.
      B. In Low Line (Base) configuration, sensor transmissions occur every 3 minutes 20 seconds (nominal) and pressure is measured every 20 seconds.

   (2) Normal Fixed Base State
      A. Sensor transmissions continue at the Low Line (Base) configuration defined rates until the state is either changed by LF command or by the sensor detecting a condition that requires a temporary change to another state.
      B. The LF command to this state must contain the sensors ID.

   (3) Storage Base State:
      A. This state is a Low current consumption state.
      B. Sensors are in this state when they first arrive at the dealership (either on the vehicle or as replacement spares).
      C. In this state, the sensor does not measure pressure / temperature / battery level.
      D. The sensor will not transmit in this state unless requested to do so by the initiate command.

   (4) Alert State:
      A. The sensor automatically enters this state if the measured temperature exceeds 230 °F(110 °C) and over temperature shutdown is likely.
      B. In this state, pressure is measured every 4 seconds and RF data transmitted every 4 seconds.
      C. The state lasts for 1 minute if it is pressure triggered.
      D. After state is alse entered when a 3 psi change in pressure from the last RF transmission occurs.

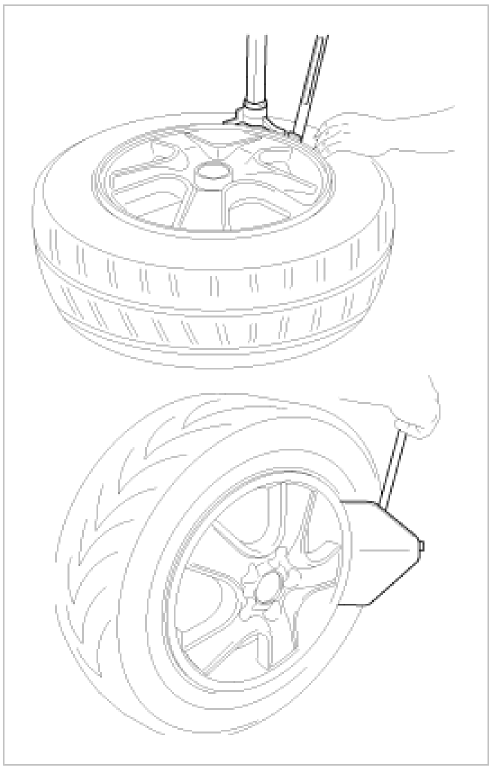
REMOVAL

Tire Removal

1. Deflate tire & remove balance weights.

CAUTION

- The tire bead should be broken approx. 90° from the valve side of the wheel. The bead breaker should not be set too deep.
- Avoid tire/tool contact with the valve on dismount.
- Dismount should end near the valve.

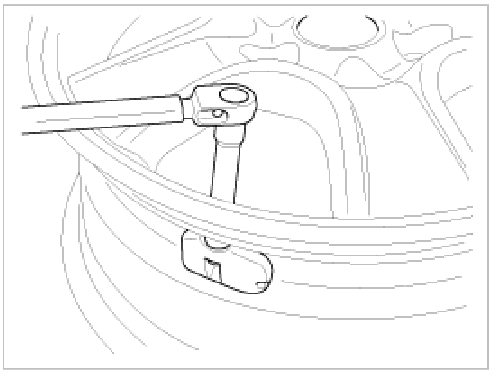


Sensor Removal

CAUTION

Handle the sensor with care.

1. Remove the valve nut.



CAUTION

The valve nut should not be re-used.

2. Discard the valve assembly.

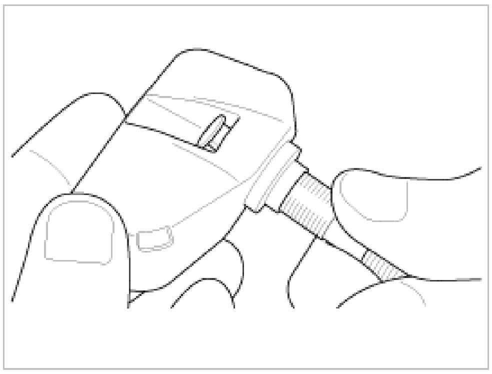
INSTALLATION

Sensor Fit

CAUTION

- Handle the sensor with care.
- Avoid lubricant contact if possible.

1. Assemble valve to sensor and turn valve 3 times with the square part of the screw in the slot.



CAUTION

- The fit should not be tight i.e. it should still be possible to easily adjust valve angle.
- Ensure that the wheel to be fitted is designed for sensor mount. There should normally be a mark to indicate this.
- Ensure that the valve hole and mating face of the wheel are clean.

2. Mount assembly to wheel.

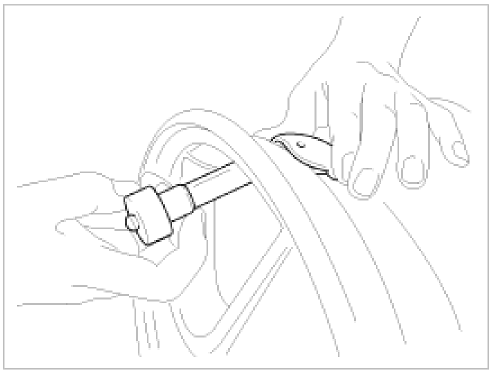
CAUTION

Ensure sensor feet are against the wheel throughout the remainder of the assembly process.

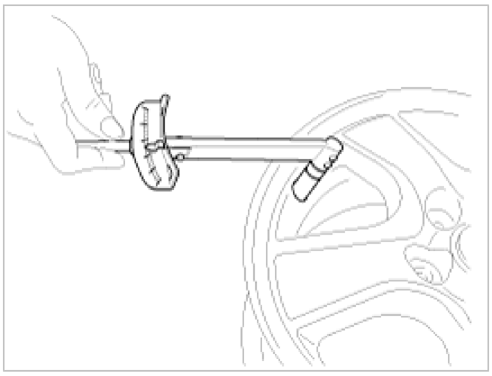
3. Tighten washer and nut by hand until the valve thread meets the nut built-in calibrated stop.

CAUTION

Ensure that the grommet remains in contact with the wheel.



4. Using a torque wrench, tighten the nut to 2.95±0.37 lb-ft (4.0±0.5 Nm) It is normal to feel a break as the 1.7 lb-ft (2.3Nm) calibrated stop in the nut snaps and the torque falls.



CAUTION

- Increase torque smoothly in order to achieve a clean break of the stop.
- Do not exceed allowed torque.
- Do not use electric or pneumatic tools.

Tire Fit

CAUTION

Only use wheels designed to accommodate the TPMS sensor.

1. Lubricate the tire bead not the rim. Excessive lubrication should not be applied.
2. Start tire mounting approx. 5.9 in(15 cm) from valve.
3. Move the mounting tool away from the valve.

   CAUTION

   Avoid tire / tool contact with the valve.

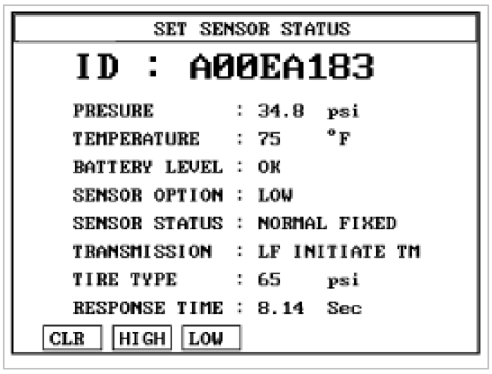
4. Finish with mounting tool near to valve.
5. Carry out inflation / pressure correction and then fit valve cap.

Sensor Initiating Procedure

NOTE

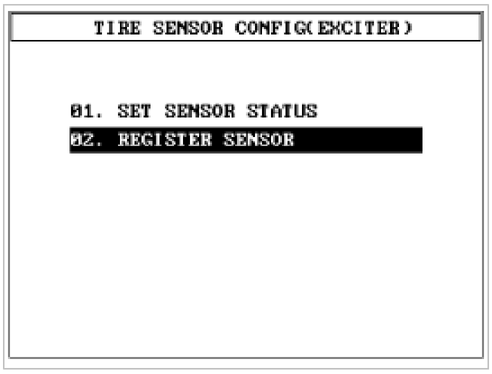
The sensor's default state will be Storage Auto (High Line).

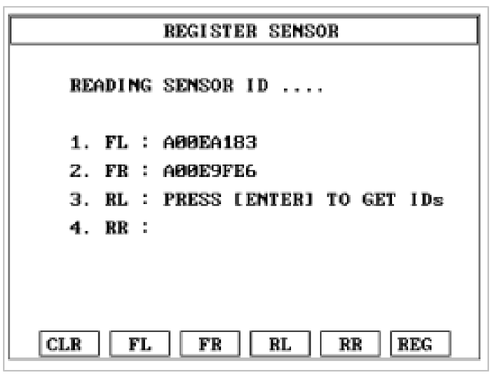
1. Change the sensor mode to Normal Fixed Base(Low Line) with the 'TPMS exciter'.



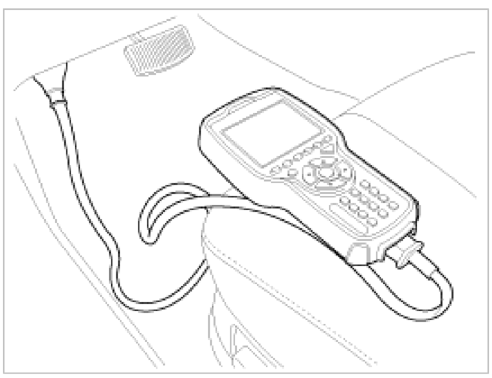
2. Read the four sensor's ids starting with sensor 1 (1 normally front left, 2 front right, 3 rear left, 4 rear right).

> **NOTE**
>
> Note that sensors which were already configured as Base (Low Line) will take longer to read.

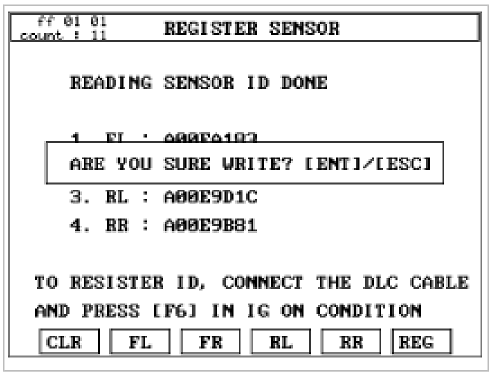


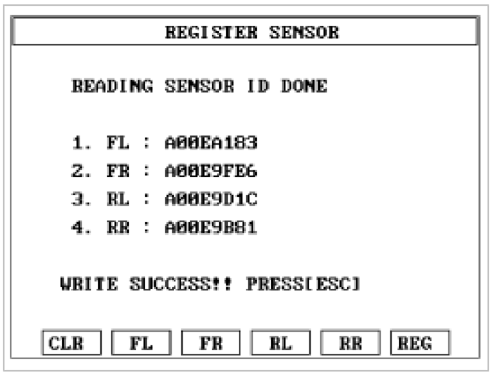


3. Connect 'TPMS exciter' to the diagnostic connector.



4. Register the four sensor's ids to the receiver.

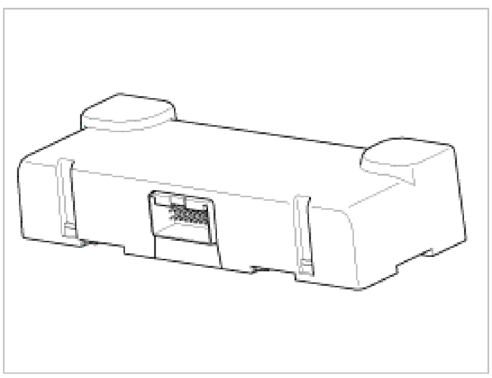




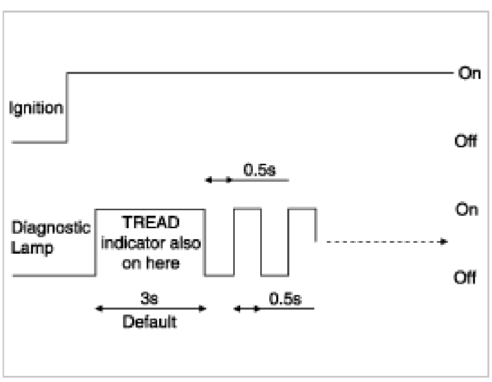
5. Cycle Ignition, wait 4 minutes and check that Normal Receiver State is now indicated (see SS-).

Suspension System > Tire Pressure Monitoring System > TPMS Receiver > Description and Operation

DESCRIPTION



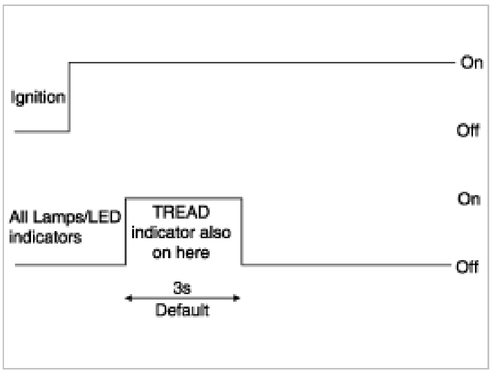
1. **Mode**
   (1) Virgin State
      A. The receiver as a sole part is shipped in this state. Replacement parts should therefore arrive in this state.
      B. In this state, there is no sensor monitoring and no DTC monitoring.
      C. The state indicates that platform specific parameters must be written to the receiver and that sensors are un-learned.



(2) Normal State

A. In order for tire inflation state and DTC monitoring to occur, the receiver must be in this state.

B. In this state, automatic sensor learning is enabled.



2. **Overview**
   A. Receives RF data from sensor.
   B. Uses sensor data to decide whether to turn on TREAD Lamp.
   C. Uses sensor information, distance traveled, background noise levels, Auto-learn status, short circuit output status, vehicle battery level, internal receiver states to determine if there is a system or a vehicle fault.

OPERATION

1. General Function
   A. Auto-learn takes place only once per Ignition cycle.
   B. On successful completion, 4 road wheel sensor ID's are latched into memory for monitoring.
   C. Until Auto-learn completes, previously learned sensors are monitored for under inflation / leak warnings.
2. General Conditions to Learn New Sensors:
   A. Receiver must determine that it is confident that sensor is not temporary:
      1) Uses vehicle speed.
      2) Uses confidence reduction of previously learned sensors.
   B. Typical time at driving over 12.4 mph(20 kph) to learn a new sensor is up to 20 minutes.
3. General Conditions to Un-Learn a sensor that is removed:
   A. It takes less than 20 minutes at 12.4~18.6 mph(20~30kph).
   B. Confidence reduction is dependent on vehicle speed greater than or equal to 12.4 mph(12 kph).

Suspension System > Tire Pressure Monitoring System > TPMS Receiver > Repair procedures

REPLACEMENT

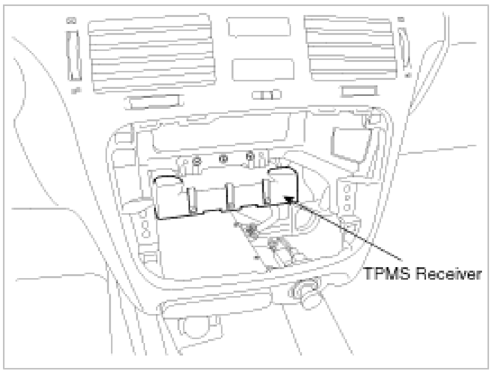
NOTE

When the receiver first arrives for replacement:
1) It will be in Virgin State.
2) It will not be configured for any specific platform.
3) It will not have any sensor ID's memorized.

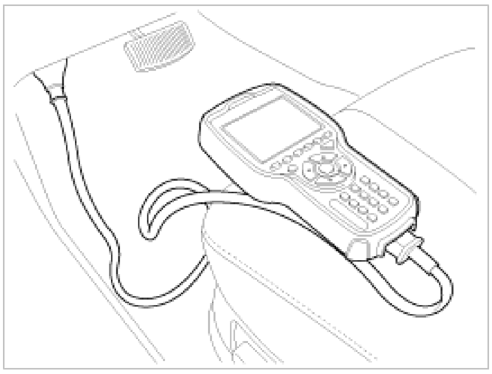
CAUTION

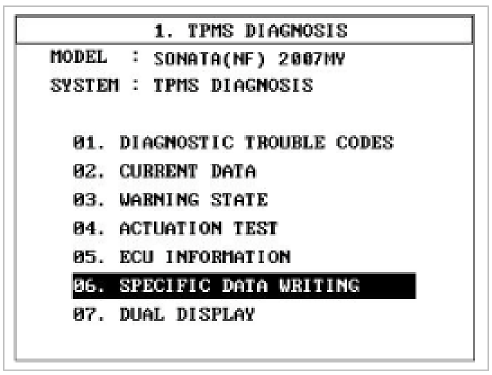
It is important to make sure that the correct receiver is used to replace the faulty part i.e. it must be Low Line (PN 95800-2E500) and not High Line (PN 95800-26000) in order to have the correct inflation warning thresholds set.

1. Disconnect vehicle battery.
2. Remove faulty part and fit bracket assembly to new part.

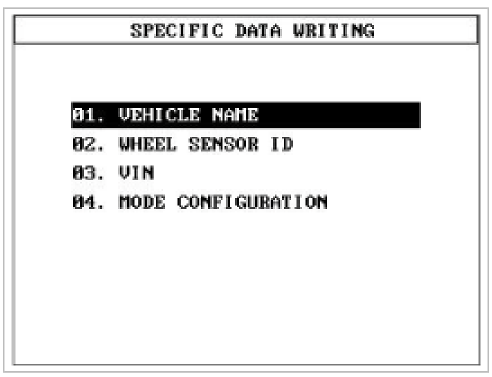


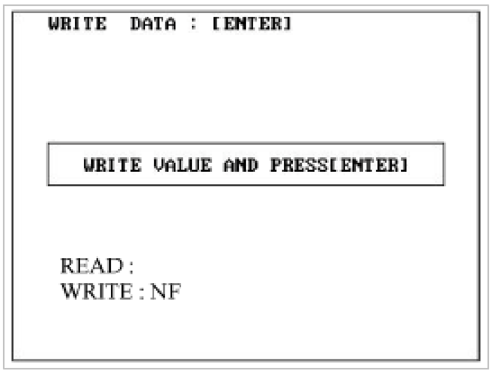
3. Secure new part to vehicle and fit connector.
4. Re-connect battery and turn Ignition on.
5. Check that DTC flash rate matches Virgin State indication (see SS-).
6. Connect 'TPMS exciter' to the diagnostic connector.



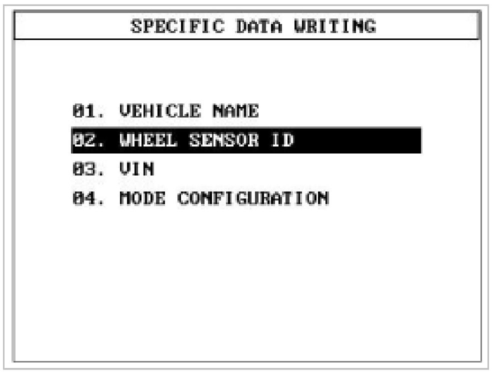


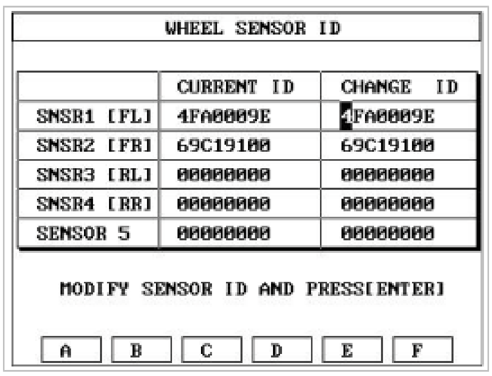
7. Write vehicle name to receiver. receiver will now automatically update monitoring parameters.



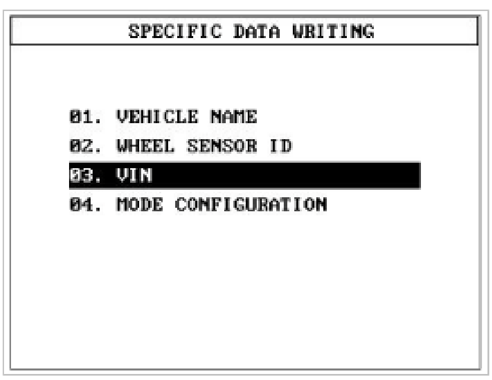


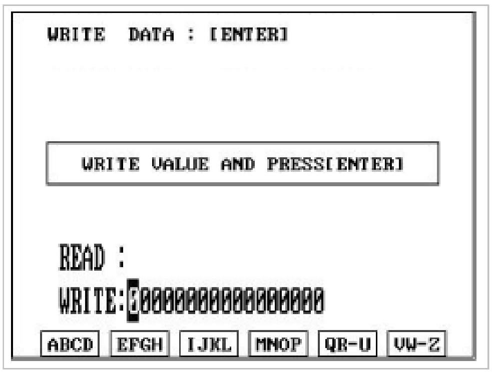
8. Read sensor's ids with the 'TPMS exciter'.
   (Refer to 'SENSOR INITIATING PROCEDURE')
9. Register sensor's ids to receiver.



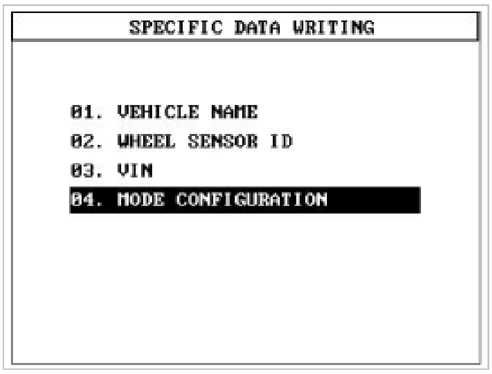


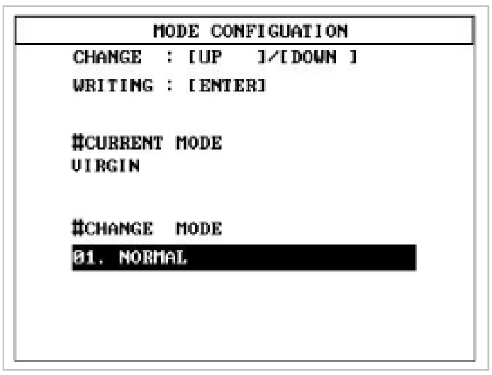
10. Register VIN number of the vehicle.(17 digits)





11. Change receiver state from Virgin to Normal.

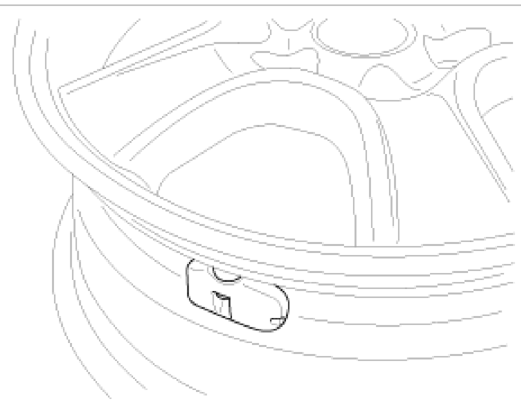




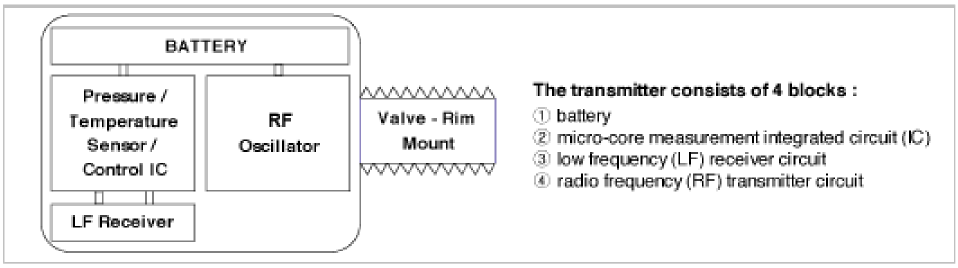
12. Disconnect diagnostic link.
13. Turn ignition off for approximately 10 seconds then turn it back on and check that Normal State is now indicated (see SS-).

Suspension System > Troubleshooting > C1121

Component Location



General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere due to transmission. Wheel sensors shall support usage on steel or aluminum rims.
Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 248 °F(40 to 120 °C). Transmitter shall enter thermal shutdown once the measured temperature is greater than or equal to 257 °F(125 °C). The accuracy of the sensor is 23 to 44.6 °F(-5 to 7 °C)at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 212 °F(100 °C). The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit..

【Tire Pressure Monitoring】

When 4 sensors have been learned as road wheels, it shall not be possible to learn new road wheel sensors on the same Ignition cycle. In normal mode low line, tire pressure and temperature shall be transmitted every 3 minutes 20 s nominally independent of vehicle operation. Monitoring shall be every 20 s. If sensor detects rapid deflation, then RF messages will be transmitted every 4 s for 1 minute duration. Communication from wheel sensors shall be via RF at a frequency of 315 MHz, 5 kBaud. Tire pressure measurement tolerance shall be ±7 kPa from 32 to 122 °F(0 to 50 °C) and ±17.5 kPa from -40 to 248 °F (-40 to 120°C) with a range of 100 to 450 kPa. Tire temperature measurement tolerance shall be ±37.4 °F(±3 °C) from -4 to 158 °F(-20 to 70 °C) and to ±41 °F(±5 °C) from -40 to 248 °F(40 to 120 °C)..

DTC Description

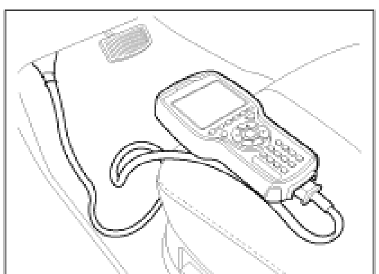
This DTC indicates that the sensor battery voltage level is Low. The most likely cause is battery passing it's expected life / excessively Low temperatures / sensor failure.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Sensor battery check	• Sensor temperature low • Sensor battery low • Faulty TPMS sensor
Enable conditions	• Latest Lowest sensor Temp. > -4 °F(-20 °C) • Distance travelled during 12 min. > 4 km	
Threshold value	• Sensor voltage <2.2 V	
Diagnosis time	• 12 ~13 minutes	

Monitor Scantool Data

1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



Connect the DLC for 'TPMS exciter'

3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mod of "CURRENT DATA" function.
5. Monitor the parameter of SENSOR 1 on the 'TPMS exciter' or scantool after 13 minutes.

Specification : 'Sensor Temp.' is more than -68 °F(-20 °C)and 'Sensor battery value' is 'Normal'.

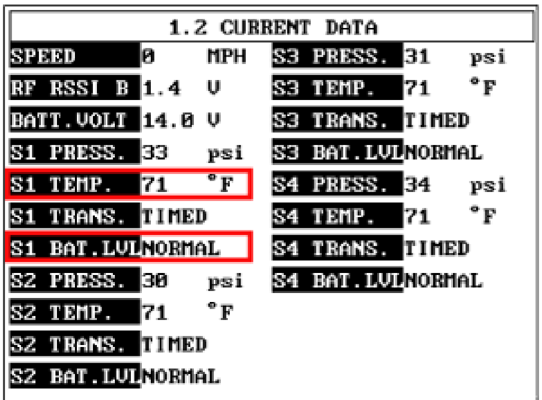


Fig 1 Sensor current data (normal)

6. Is parameter within specifications?

YES

▸ Fault is intermittent. It has been repaired and TPMS receiver module memory is not cleared yet.
▸ Go to "Verification of vehicle Repair" procedure.

NO

▸ Go to "Component Inspection" procedure.

Component Inspection

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
3. Execute "SET SENSOR STATUS" of each wheel.

Specification : 'Sensor battery value' is 'Normal' and 'Sensor Temp.' is more than -68 °F(-20 °C).

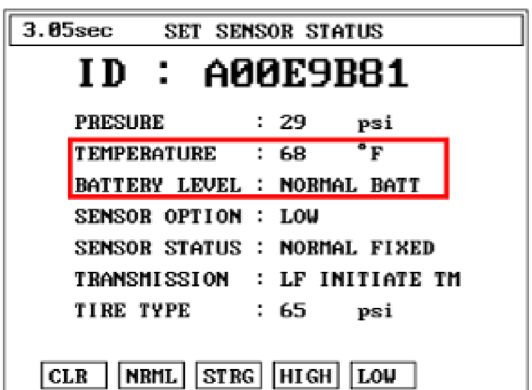


Fig 1 Sensor status (normal)


Executing "SET SENSOR STATUS"

4. Is any sensor data outside specification?

YES

▸ The sensor which displays data above the specification is SENSOR 1.
▸ Check wheel / tire where abnormal sensor data was detected. Check for tire / wheel damage and overheated brake condition.
▸ Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure.
▸ If it is OK, go to "Check wheel / tire" as follows.

NO

▸ Check for sensor if unable to retrieve data with 'TPMS exciter'.
▸ Replace TPMS sensor if necessary and register sensor ID with 'TPMS exciter'.
▸ Go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

▸ Go to the applicable troubleshooting procedure.

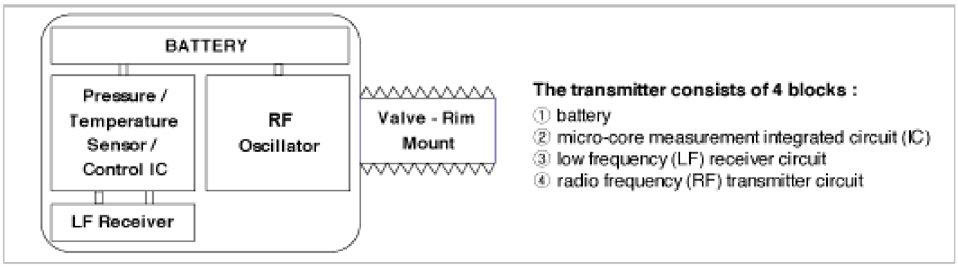
NO

▸ System performing to specification at this time.

Suspension System > Troubleshooting > C1122

Component Location

General Description



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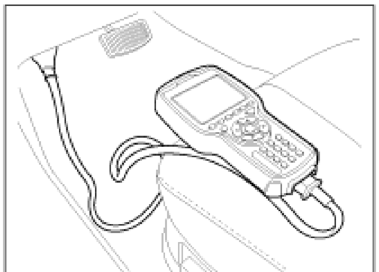

Connect the DLC for 'TPMS exciter'

3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mod of "CURRENT DATA" function.
5. Monitor the parameter of SENSOR 1 on the 'TPMS exciter' or scantool after 13 minutes.

Specification : 'Sensor Temp.' is more than -68 °F(-20 °C)and 'Sensor battery value' is 'Normal'.

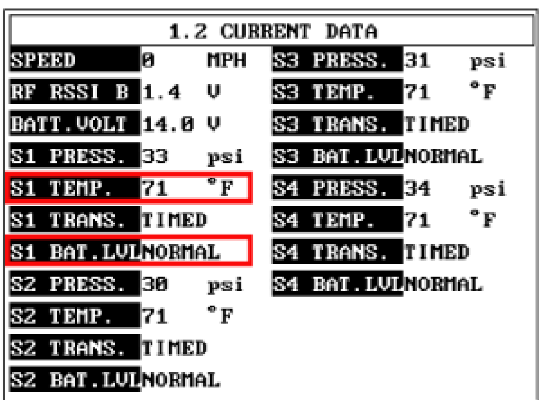

Fig 1 Sensor current data (normal)

6. Is parameter within specifications?

YES

▸ Fault is intermittent. It has been repaired and TPMS receiver module memory is not cleared yet.

▸ Go to "Verification of vehicle Repair" procedure.

NO

▸ Go to "Component Inspection" procedure.

Component Inspection

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
3. Execute "SET SENSOR STATUS" of each wheel.

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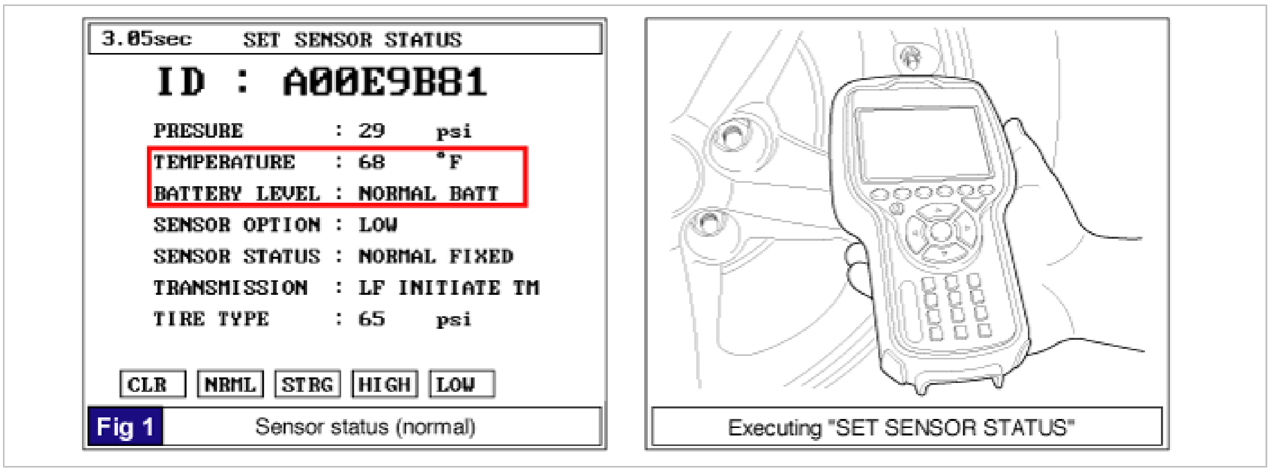


Fig 1 Sensor status (normal)

Executing "SET SENSOR STATUS"

4. Is any sensor data outside specification?

YES

▸ The sensor which displays data above the specification is SENSOR 1.
▸ Check wheel / tire where abnormal sensor data was detected. Check for tire / wheel damage and overheated brake condition.
▸ Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure.
▸ If it is OK, go to "Check wheel / tire" as follows.

NO

▸ Check for sensor if unable to retrieve data with 'TPMS exciter'.
▸ Replace TPMS sensor if necessary and register sensor ID with 'TPMS exciter'.
▸ Go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

▸ Go to the applicable troubleshooting procedure.

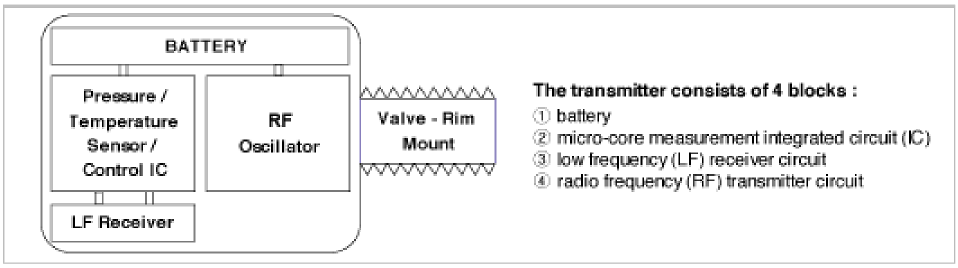
NO

▸ System performing to specification at this time.

Suspension System > Troubleshooting > C1123

Component Location

General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere due to transmission. Wheel sensors shall support usage on steel or aluminum rims.
Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 248 °F(40 to 120 °C). Transmitter shall enter thermal shutdown once the measured temperature is greater than or equal to 257 °F(125 °C). The accuracy of the sensor is 23 to 44.6 °F(-5 to 7 °C)at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 212 °F(100 °C). The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit..

【Tire Pressure Monitoring】

When 4 sensors have been learned as road wheels, it shall not be possible to learn new road wheel sensors on the same Ignition cycle. In normal mode low line, tire pressure and temperature shall be transmitted every 3 minutes 20 s nominally independent of vehicle operation. Monitoring shall be every 20 s. If sensor detects rapid deflation, then RF messages will be transmitted every 4 s for 1 minute duration. Communication from wheel sensors shall be via RF at a frequency of 315 MHz, 5 kBaud. Tire pressure measurement tolerance shall be ±7 kPa from 32 to 122 °F(0 to 50 °C) and ±17.5 kPa from -40 to 248 °F (-40 to 120°C) with a range of 100 to 450 kPa. Tire temperature measurement tolerance shall be ±37.4 °F(±3 °C) from -4 to 158 °F(-20 to 70 °C) and to ±41 °F(±5 °C) from -40 to 248 °F(40 to 120 °C)..

DTC Description

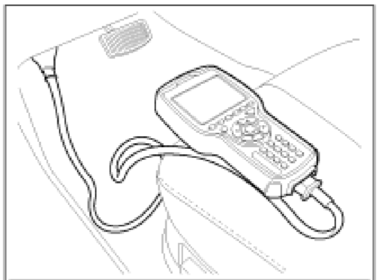
This DTC indicates that the sensor battery voltage level is Low. The most likely cause is battery passing it's expected life / excessively Low temperatures / sensor failure.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Sensor battery check	• Sensor temperature low • Sensor battery low • Faulty TPMS sensor
Enable conditions	• Latest Lowest sensor Temp. > -4 °F(-20 °C) • Distance travelled during 12 min. > 4 km	
Threshold value	• Sensor voltage <2.2 V	
Diagnosis time	• 12 ~13 minutes	

Monitor Scantool Data

1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



Connect the DLC for 'TPMS exciter'

3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mod of "CURRENT DATA" function.
5. Monitor the parameter of SENSOR 1 on the 'TPMS exciter' or scantool after 13 minutes.

Specification : 'Sensor Temp.' is more than -68 °F(-20 °C)and 'Sensor battery value' is 'Normal'.

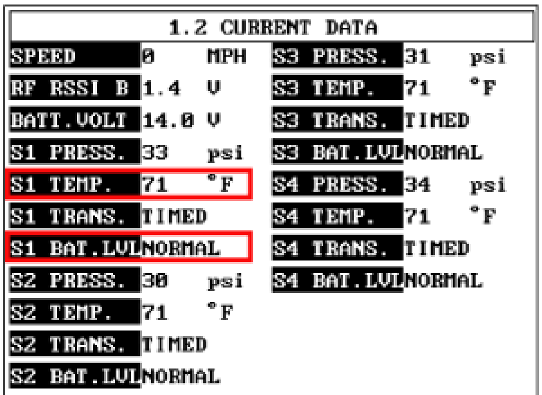


Fig 1 Sensor current data (normal)

6. Is parameter within specifications?

YES

▸ Fault is intermittent. It has been repaired and TPMS receiver module memory is not cleared yet.
▸ Go to "Verification of vehicle Repair" procedure.

NO

▸ Go to "Component Inspection" procedure.

Component Inspection

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
3. Execute "SET SENSOR STATUS" of each wheel.

Specification : 'Sensor battery value' is 'Normal' and 'Sensor Temp.' is more than -68 °F(-20 °C).

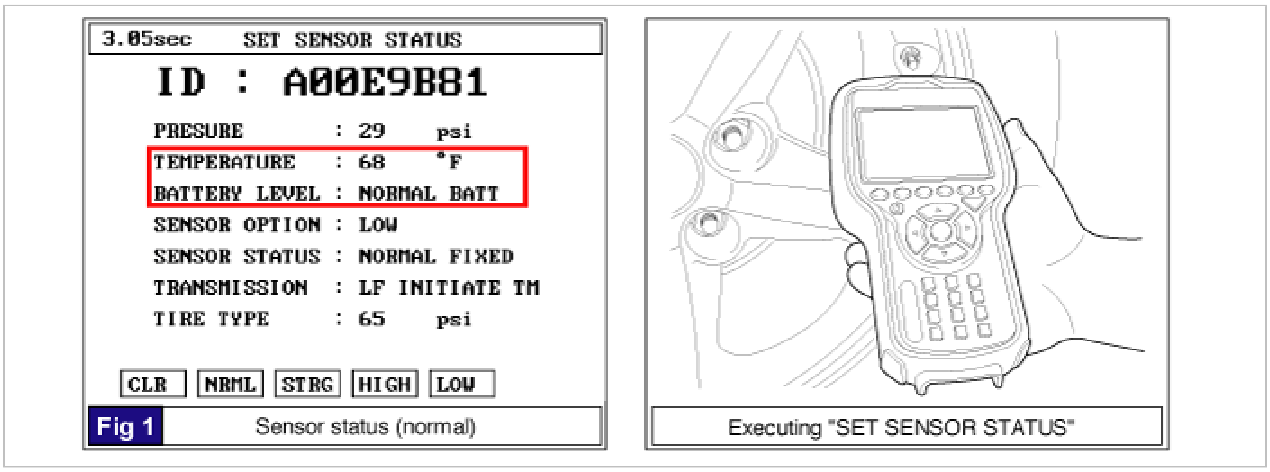


Fig 1 Sensor status (normal)

Executing "SET SENSOR STATUS"

4. Is any sensor data outside specification?

YES

▸ The sensor which displays data above the specification is SENSOR 1.
▸ Check wheel / tire where abnormal sensor data was detected. Check for tire / wheel damage and overheated brake condition.
▸ Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure.
▸ If it is OK, go to "Check wheel / tire" as follows.

NO

▸ Check for sensor if unable to retrieve data with 'TPMS exciter'.
▸ Replace TPMS sensor if necessary and register sensor ID with 'TPMS exciter'.
▸ Go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

▸ Go to the applicable troubleshooting procedure.

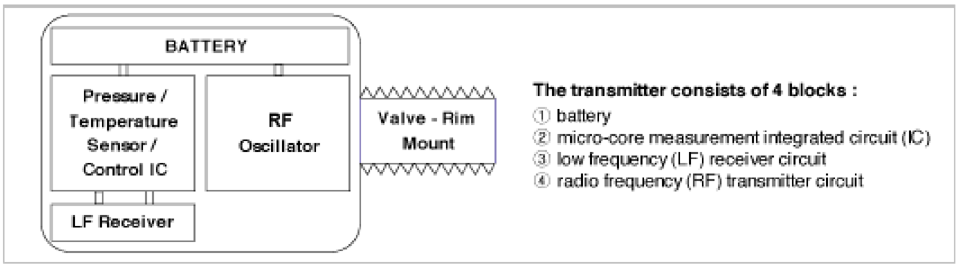
NO

▸ System performing to specification at this time.

Suspension System > Troubleshooting > C1124

Component Location

General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere due to transmission. Wheel sensors shall support usage on steel or aluminum rims.
Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 248 °F(40 to 120 °C). Transmitter shall enter thermal shutdown once the measured temperature is greater than or equal to 257 °F(125 °C). The accuracy of the sensor is 23 to 44.6 °F(-5 to 7 °C)at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 212 °F(100 °C). The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit..

【Tire Pressure Monitoring】

When 4 sensors have been learned as road wheels, it shall not be possible to learn new road wheel sensors on the same Ignition cycle. In normal mode low line, tire pressure and temperature shall be transmitted every 3 minutes 20 s nominally independent of vehicle operation. Monitoring shall be every 20 s. If sensor detects rapid deflation, then RF messages will be transmitted every 4 s for 1 minute duration. Communication from wheel sensors shall be via RF at a frequency of 315 MHz, 5 kBaud. Tire pressure measurement tolerance shall be ±7 kPa from 32 to 122 °F(0 to 50 °C) and ±17.5 kPa from -40 to 248 °F (-40 to 120°C) with a range of 100 to 450 kPa. Tire temperature measurement tolerance shall be ±37.4 °F(±3 °C) from -4 to 158 °F(-20 to 70 °C) and to ±41 °F(±5 °C) from -40 to 248 °F(40 to 120 °C)..

DTC Description

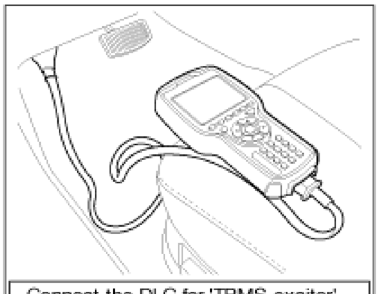
This DTC indicates that the sensor battery voltage level is Low. The most likely cause is battery passing it's expected life / excessively Low temperatures / sensor failure.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Sensor battery check	• Sensor temperature low • Sensor battery low • Faulty TPMS sensor
Enable conditions	• Latest Lowest sensor Temp. > -4 °F(-20 °C) • Distance travelled during 12 min. > 4 km	
Threshold value	• Sensor voltage <2.2 V	
Diagnosis time	• 12 ~13 minutes	

Monitor Scantool Data

1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



Connect the DLC for 'TPMS exciter'

3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mod of "CURRENT DATA" function.
5. Monitor the parameter of SENSOR 1 on the 'TPMS exciter' or scantool after 13 minutes.

Specification : 'Sensor Temp.' is more than -68 °F(-20 °C)and 'Sensor battery value' is 'Normal'.

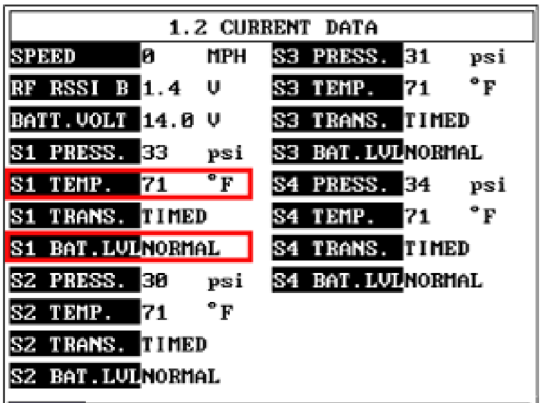


Fig 1 Sensor current data (normal)

6. Is parameter within specifications?

YES

▸ Fault is intermittent. It has been repaired and TPMS receiver module memory is not cleared yet.
▸ Go to "Verification of vehicle Repair" procedure.

NO

▸ Go to "Component Inspection" procedure.

Component Inspection

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
3. Execute "SET SENSOR STATUS" of each wheel.

Specification : 'Sensor battery value' is 'Normal' and 'Sensor Temp.' is more than -68 °F(-20 °C).

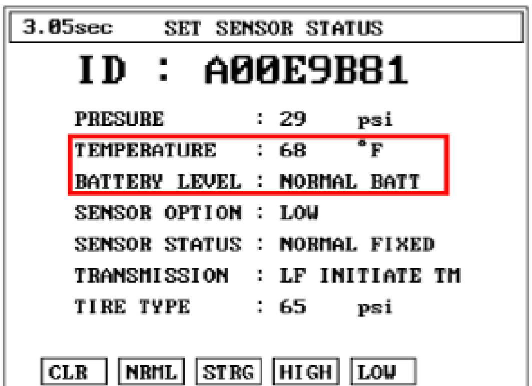


Fig 1 Sensor status (normal)


Executing "SET SENSOR STATUS"

4. Is any sensor data outside specification?

YES

▸ The sensor which displays data above the specification is SENSOR 1.
▸ Check wheel / tire where abnormal sensor data was detected. Check for tire / wheel damage and overheated brake condition.
▸ Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure.
▸ If it is OK, go to "Check wheel / tire" as follows.

NO

▸ Check for sensor if unable to retrieve data with 'TPMS exciter'.
▸ Replace TPMS sensor if necessary and register sensor ID with 'TPMS exciter'.
▸ Go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

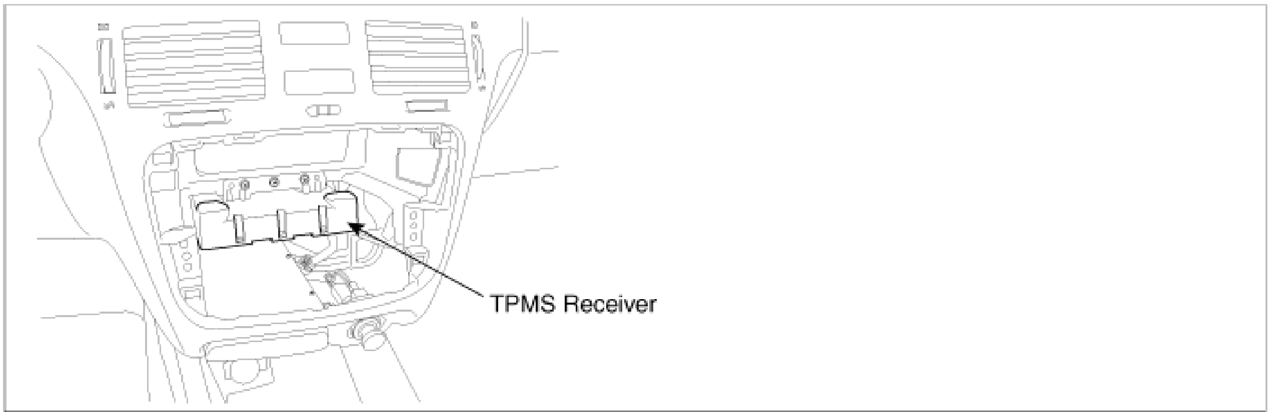
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Suspension System > Troubleshooting > C1126

Component Location



General Description

TPM Receiver is integrated with the TPM module installed at the bottom of the console. The operating battery of TPM module is supplied from the vehicle battery. Data such as Tire pressure, Tire Temperature, TPM sensor battery status and TPM sensor valve ID from TPM sensors are transmitted to TPM receiver in the form of RF signal. TPM module accomplishes Tire Monitoring and Warning Logic with received data.

DTC Description

This indicates that the receiver battery level is Low. The most likely cause is battery / harness / receiver input / A-D failure.

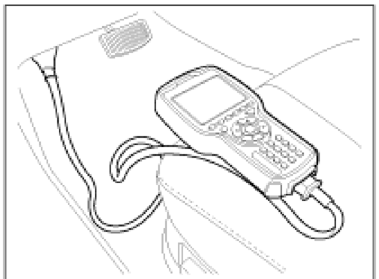
DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Battery level check	• Faulty charging system • Vehicle battery low • Faulty TPMS Receiver
Enable conditions	• Battery voltage level low	
Threshold value	• Battery voltage < 9V	
Diagnosis time	• 2 sec.	

Monitor Scantool Data

1. Start engine and turn headight and rear defroster.

2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



Connect the DLC for 'TPMS exciter'

3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mode of "CURRENT DATA" function.
5. Maintaining ENG. RPM at 2,500RPM(idle) over 2 minutes.
6. Monitor the parameter of BATT. VOLT on the 'TPMS exciter' or scantool

Specification : 'BATT. VOLT' is more than 10 V

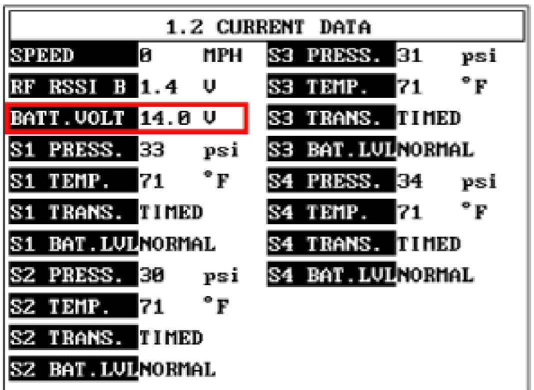


Fig 1 Sensor current data (normal)

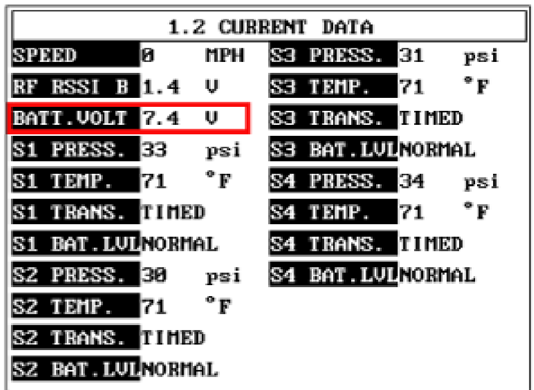


Fig 2 BATT. VOLT low

7. Is parameter normal?

YES

- Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.
- Go to "Verification of vehicle Repair" procedure.

NO

- Go to "Inspection/Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminal condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/or damage.
3. Has a problem been found?

YES

- Repair if necessary and then go to "Verification of Vehicle Repair" procedure.

NO

- Go to "Charging System Inspection" procedure.

Charging System Inspection

1. Engine "ON".
2. headight and rear defroster "ON".

3. Measure voltage between terminal (+) and (-) of battery maintaining ENG. RPM at 2,500 RPM(idle) over 2 minutes.

Specification : more than 10 V

4. Is the measured voltage within specifications?

YES

▸ Substitute with a known-good TPM receiver and check for proper operation.
▸ If the problem is corrected, replace TPM receiver and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Check for fault in charging system and check for tension of generator drive belt, ENG.idle rpm or open/short in harness from battery to generator.
▸ Repair if necessary and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

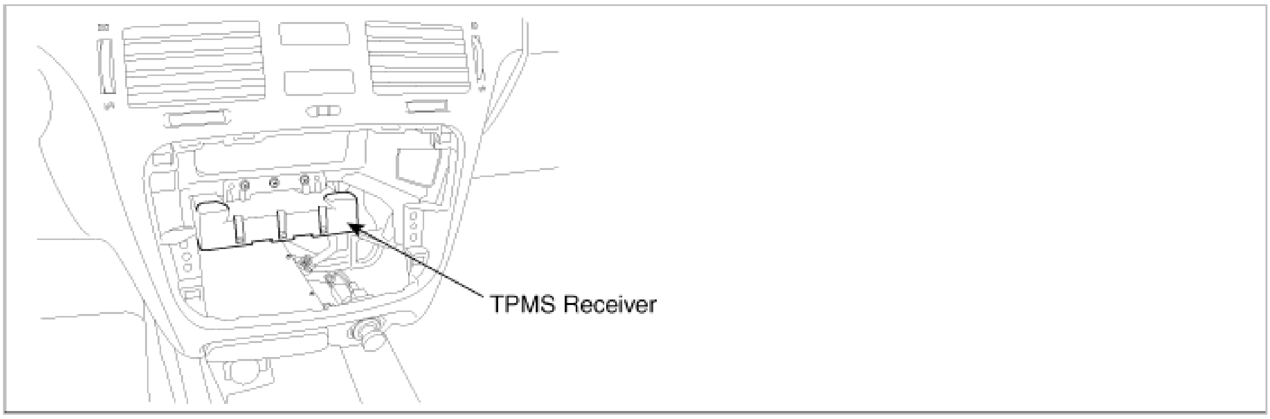
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Suspension System > Troubleshooting > C1127

Component Location



General Description

TPM Receiver is integrated with the TPM module installed at the bottom of the steering column. The operating battery of TPM module is supplied from the vehicle battery. Data such as Tire pressure, Tire Temperature, TPM sensor battery status and TPM sensor valve ID from TPM sensors are transmitted to TPM receiver in the form of RF signal. TPM module accomplishes Tire Monitoring and Warning Logic with received data.

DTC Description

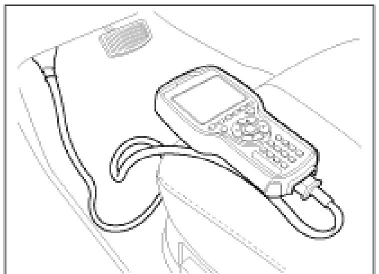
This indicates that the receiver battery level is High. The most likely cause is receiver input / A-D failure.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Battery level check	• Faulty charging system • Vehicle battery high • Faulty TPMS Receiver
Enable conditions	• Battery voltage level high	
Threshold value	• Battery voltage > 17.5 V	
Diagnosis time	• 2 sec.	

Monitor Scantool Data

1. Start engine and turn headight and heatwire on.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



Connect the DLC for 'TPMS exciter'

3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mode of "CURRENT DATA" function.
5. Maintaining ENG. RPM at 2,500RPM(idle) over 2 minutes.
6. Monitor the parameter of BATT. VOLT on the 'TPMS exciter' or scantool.

Specification : 'BATT. VOLT' is less than 16.5 V

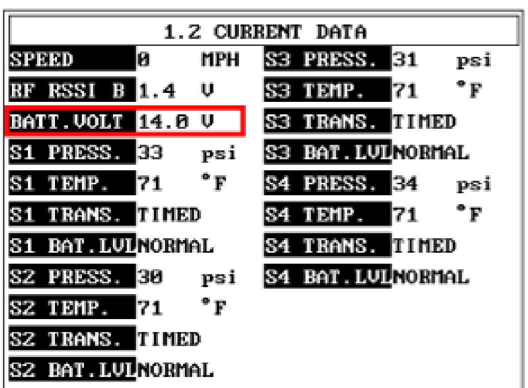


Fig 1 Sensor current data (normal)

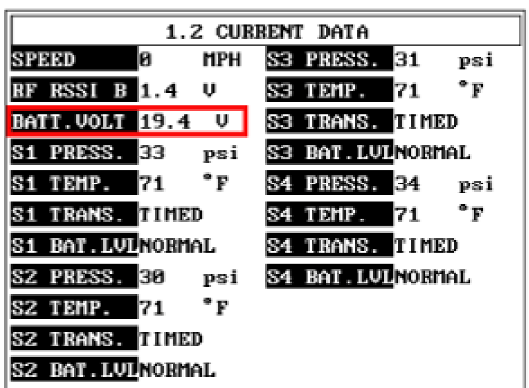


Fig 2 BATT. VOLT high

7. Is parameter normal?

YES

▸ Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.
▸ Go to "Verification of vehicle Repair" procedure.

NO

▸ Go to "Inspection/Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminal condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/or damage.
3. Has a problem been found?

YES

▸ Repair if necessary and then go to "Verification of Vehicle Repair" procedure.

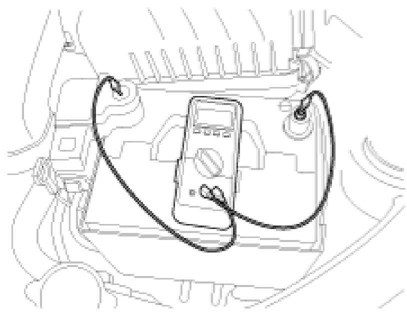
NO

▸ Go to "Charging System Inspection" procedure.

Charging System Inspection

1. Engine "ON".
2. headight and rear defroster "ON".
3. Measure voltage between terminal (+) and (-) of battery maintaining ENG. RPM at 2,500 RPM(idle) over 2 minutes.

Specification : less than 16.5 V



4. Is the measured voltage within specifications?

YES

▸ Substitute with a known-good TPM receiver and check for proper operation.
▸ If the problem is corrected, replace TPM receiver and then go to "Verification of Vehicle Repair" procedure.

NO

▸ Check for fault in charging system and thoroughly check all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/or damage.
Repair or replace if necessary and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

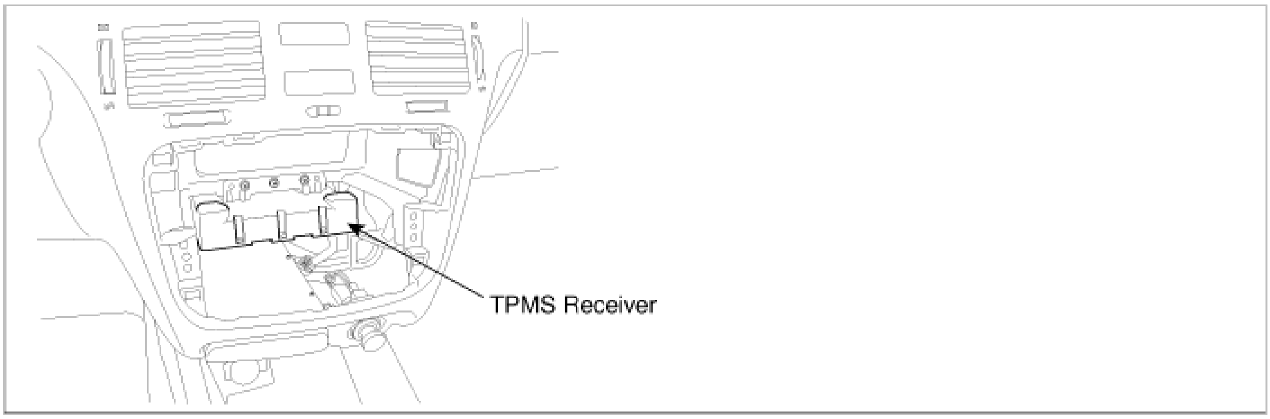
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Suspension System > Troubleshooting > C1300

Component Location



General Description

TPM Receiver is integrated with the TPM module installed at the bottom of the steering column. The operating battery of TPM module is supplied from the vehicle battery. Data such as Tire pressure, Tire Temperature, TPM sensor battery status and TPM sensor valve ID from TPM sensors are transmitted to TPM receiver in the form of RF signal. TPM module accomplishes Tire Monitoring and Warning Logic with received data.

DTC Description

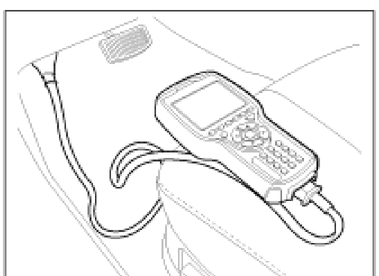
This DTC indicates that system is not functioning due to High interference levels from external sources.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• LF/RF check	• LF/RF Interference from external sources(unless C1306 also exists as historic. If this is the case then interference source is likely to be internal to the vehicle)
Enable conditions	• System not functioning due to High RF interference levels	
Threshold value	• No valid RF data for 8 min from any sensor • Distance travelled during 8 minutes ≤ 1.68 mile(2.7 km)	
Diagnosis time	• 8 - 9 minutes	

Monitor Scantool Data

1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



Connect the DLC for 'TPMS exciter'

3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mode of "CURRENT DATA" function.
5. Monitor the parameter of RF RSSI background on the 'TPMS exciter' or scantool after 9 minutes.

Specification : "RSSI background" is less than 1.9 V

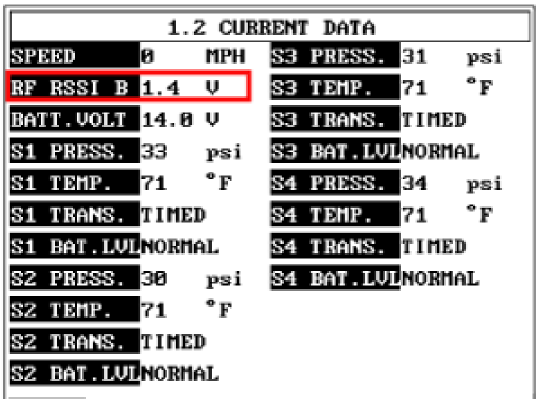


Fig 1 Sensor current data (normal)

6. Is parameter within specifications?

YES

- Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.
- Go to "Verification of vehicle Repair" procedure.

NO

- Substitute with a known-good TPM receiver module and check for proper operation.
- If the problem is corrected, replace TPM receiver module and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

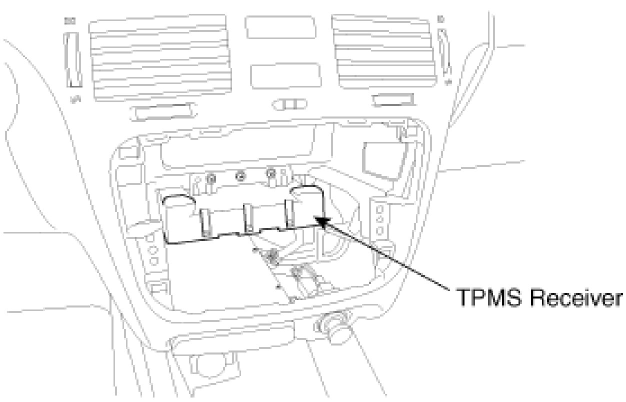
- Go to the applicable troubleshooting procedure.

NO

- System performing to specification at this time.

Suspension System > Troubleshooting > C1306

Component Location



General Description

TPM Receiver is integrated with the TPM module installed at the bottom of the steering column. The operating battery of TPM module is supplied from the vehicle battery. Data such as Tire pressure, Tire Temperature, TPM sensor battery status and TPM sensor valve ID from TPM sensors are transmitted to TPM receiver in the form of RF signal. TPM module accomplishes Tire Monitoring and Warning Logic with received data.

DTC Description

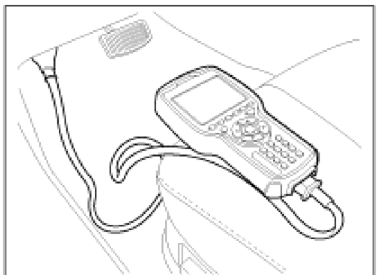
This DTC indicates that system is not functioning due to High interference levels, which are most likely being generated in the vehicle.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• LF/RF check	• Internal vehicle noise source
Enable conditions	• System not functioning due to High RF interference (Internal) levels	
Threshold value	• No valid RF data for 8 min from any sensor • Distance travelled during 8 minutes > 1.68 mile(2.7 km)	
Diagnosis time	• 8 - 9 minutes	

Monitor Scantool Data

1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



Connect the DLC for 'TPMS exciter'

3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mode of "CURRENT DATA" function.
5. Monitor the parameter of RF RSSI background on the 'TPMS exciter' or scantool after 9 minutes..

Specification : "RSSI background" is less than 1.9V

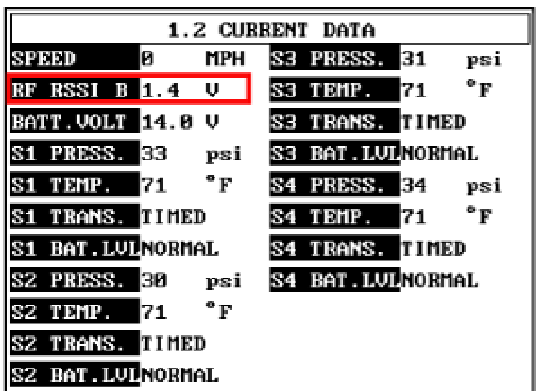


Fig 1 Sensor current data (normal)

6. Is parameter within specifications?

YES

▸ Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.
▸ Go to "Verification of vehicle Repair" procedure.

NO

▸ Substitute with a known-good TPM receiver module and check for proper operation.
▸ If the problem is corrected, replace TPM receiver module and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

▸ Go to the applicable troubleshooting procedure.

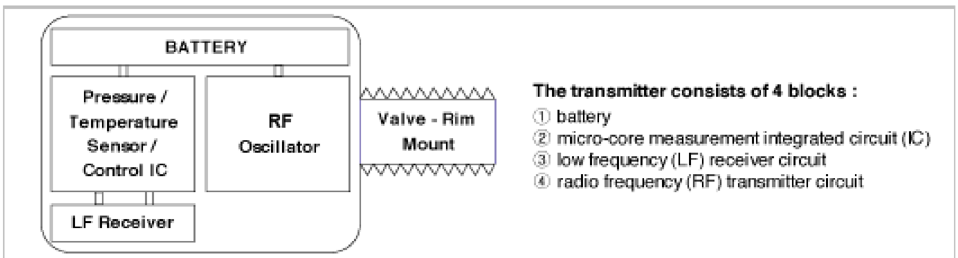
NO

▸ System performing to specification at this time.

Suspension System > Troubleshooting > C1312

Component Location

General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere such as due to the simultaneous transmission. Wheel sensors shall support usage on steel or aluminum rims.
Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 120 °C. Transmitter shall enter thermal shutdown once the measured temperature is greater than or equal to 125 °C. The accuracy of the sensor is ± 5°C at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 100 °C. The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit.

【Tire Pressure Monitoring】

When 4 sensors have been learned as road wheels, it shall not be possible to learn new road wheel sensors on the same Ignition cycle. In normal mode low line, tire pressure and temperature shall be transmitted every 3 minutes 20 s nominally independent of vehicle operation. Monitoring shall be every 20 s. If sensor detects rapid deflation, then RF messages will be transmitted every 4 s for 1 minute duration. Communication from wheel sensors shall be via RF at a frequency of 315 MHz, 5 kBaud. Tire pressure measurement tolerance shall be ±7 kPa from 0 to 50 °C and ±17.5 kPa from -40 to 120°C with a range of 100 to 450 kPa. Tire temperature measurement tolerance shall be ±3 °C from -20 to 70 °C and to ±5 °C from -40 to 120 °C.

DTC Description

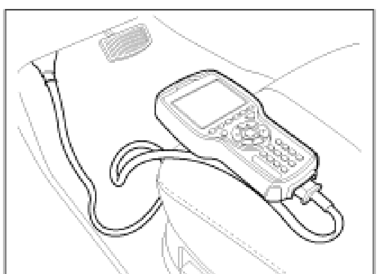
This DTC indicates that the sensor has either failed to learn OR has successfully learned and the receiver did not receive messages from the learned sensor for 12 minutes.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• RF message from sensor1 check	• Incorrectly configured TPMS sensor e.g.Low Line vehicle with High Line sensors. • Low Line vehicle sensors in storage state. • Wrong receiver type fitted e.g. Low Line receiver to a High Line vehicle. • Shielding in vehicle. • Un-approved wheels/tires i.e. a vehicle set up that has not been approved for good RF performance. • Incorrectly fitted sensor / receiver. • Faulty TPMS sensor
Enable conditions	• 2.48 mile < Distance travelled during 12 min. < 24.85 mile	
Threshold value	• Failure to Learn Sensors1 Correctly. • No RF message received from sensor1 over 12 min.	
Diagnosis time	• 12 ~ 20 minutes.	

Monitor Scantool Data

1. Connect "TPMS exciter' or scantool to Data Link Connector(DLC).



Connect the DLC for 'TPMS exciter'

2. Select "TPMS DIAGNOSIS" mode.
3. Select the "FULL" mode of "CURRENT DATA" function.
4. Monitor the parameter of SENSOR 1 on the 'TPMS exciter' or scantool after 20 minutes.

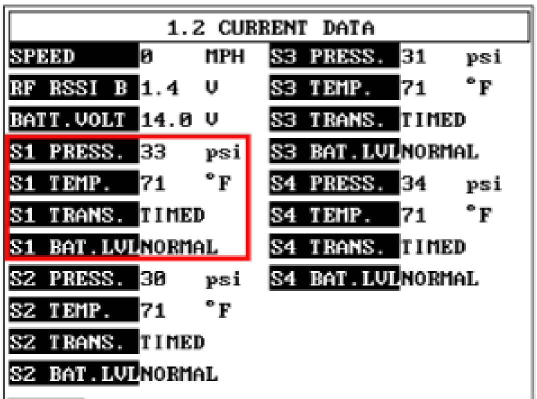


Fig 1 Sensor current data (normal)

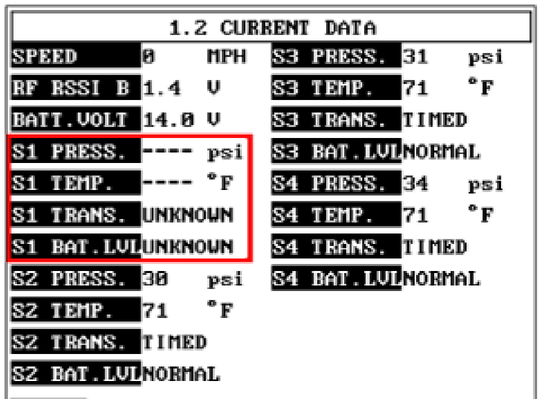


Fig 2 Sensor current data (failure)

5. Is parameter normal?

YES

- Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.
- Go to "Verification of vehicle Repair" procedure.

NO

- Go to "Component Inspection" procedure.

Component Inspection

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
3. Execute "SET SENSOR STATUS" of each wheel.

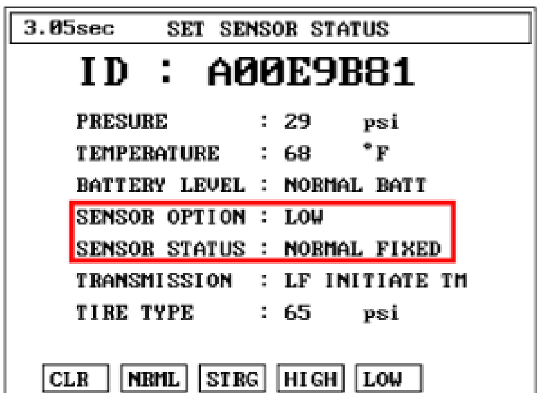


Fig 1 Sensor status (normal)


Executing "SET SENSOR STATUS"

4. Is data unable to be retrieved for any sensor?

YES

- Replace affected TPM sensor and register sensor ID with 'TPMS exciter'.
- Go to "Verification of Vehicle Repair" procedure.

NO

- Substitute with a known-good TPM receiver module and check for proper operation.
- If the problem is corrected, replace TPM receiver module and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

▸ Go to the applicable troubleshooting procedure.

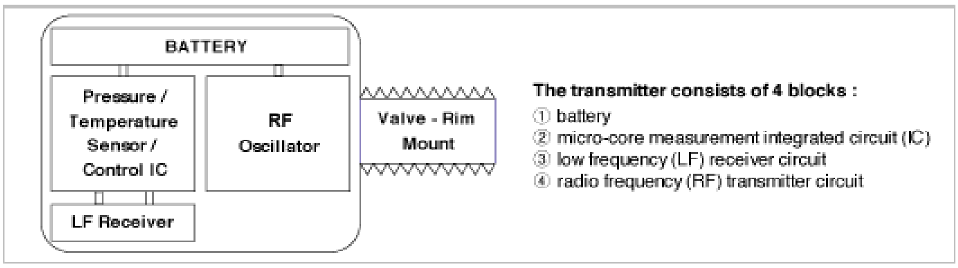
NO

▸ System performing to specification at this time.

Suspension System > Troubleshooting > C1313

Component Location

General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere such as due to the simultaneous transmission. Wheel sensors shall support usage on steel or aluminum rims.
Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 120 °C. Transmitter shall enter thermal shutdown once the measured temperature is greater than or equal to 125 °C. The accuracy of the sensor is ± 5°C at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 100 °C. The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit.

【Tire Pressure Monitoring】

When 4 sensors have been learned as road wheels, it shall not be possible to learn new road wheel sensors on the same Ignition cycle. In normal mode low line, tire pressure and temperature shall be transmitted every 3 minutes 20 s nominally independent of vehicle operation. Monitoring shall be every 20 s. If sensor detects rapid deflation, then RF messages will be transmitted every 4 s for 1 minute duration. Communication from wheel sensors shall be via RF at a frequency of 315 MHz, 5 kBaud. Tire pressure measurement tolerance shall be ±7 kPa from 0 to 50 °C and ±17.5 kPa from -40 to 120°C with a range of 100 to 450 kPa. Tire temperature measurement tolerance shall be ±3 °C from -20 to 70 °C and to ±5 °C from -40 to 120 °C.

DTC Description

This DTC indicates that the sensor has either failed to learn OR has successfully learned and the receiver did not receive messages from the learned sensor for 12 minutes.

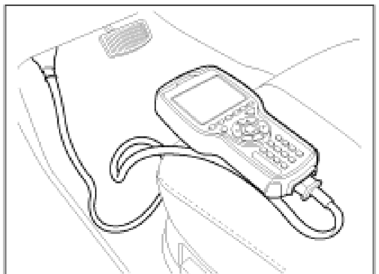
DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• RF message from sensor1 check	• Incorrectly configured TPMS sensor e.g.Low

Enable conditions	• 2.48 mile < Distance travelled during 12 min. < 24.85 mile	Line vehicle with High Line sensors. • Low Line vehicle sensors in storage state. • Wrong receiver type fitted e.g. Low Line receiver to a High Line vehicle. • Shielding in vehicle. • Un-approved wheels/tires i.e. a vehicle set up that has not been approved for good RF performance. • Incorrectly fitted sensor / receiver. • Faulty TPMS sensor
Threshold value	• Failure to Learn Sensors1 Correctly. • No RF message received from sensor1 over 12 min.	
Diagnosis time	• 12 ~ 20 minutes.	

Monitor Scantool Data

1. Connect "TPMS exciter' or scantool to Data Link Connector(DLC).



Connect the DLC for 'TPMS exciter'

2. Select "TPMS DIAGNOSIS" mode.
3. Select the "FULL" mode of "CURRENT DATA" function.
4. Monitor the parameter of SENSOR 1 on the 'TPMS exciter' or scantool after 20 minutes.

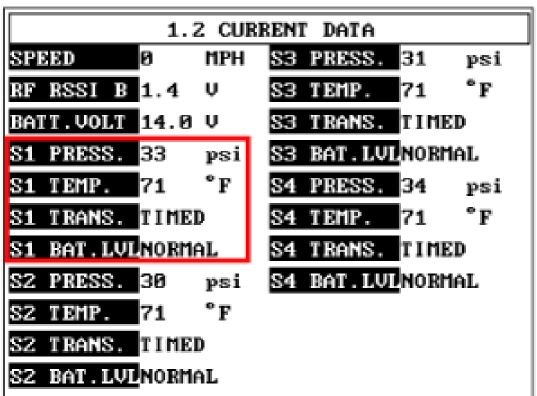


Fig 1 Sensor current data (normal)

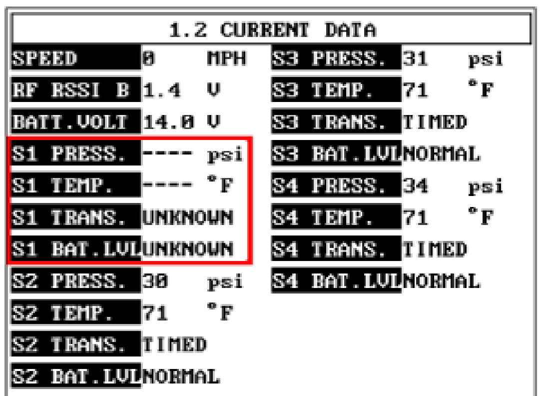


Fig 2 Sensor current data (failure)

5. Is parameter normal?

YES

▸ Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.

▸ Go to "Verification of vehicle Repair" procedure.

NO

▸ Go to "Component Inspection" procedure.

Component Inspection

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
3. Execute "SET SENSOR STATUS" of each wheel.

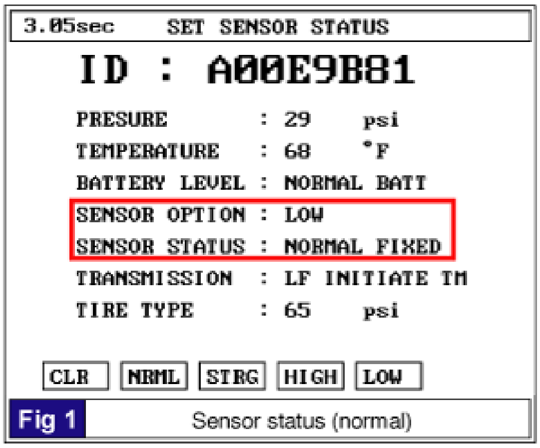
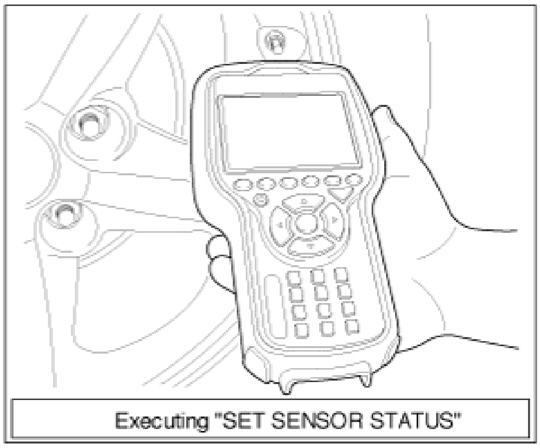


Fig 1 Sensor status (normal)


Executing "SET SENSOR STATUS"

4. Is data unable to be retrieved for any sensor?

YES

▸ Replace affected TPM sensor and register sensor ID with 'TPMS exciter'.
▸ Go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known-good TPM receiver module and check for proper operation.
▸ If the problem is corrected, replace TPM receiver module and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

▸ Go to the applicable troubleshooting procedure.

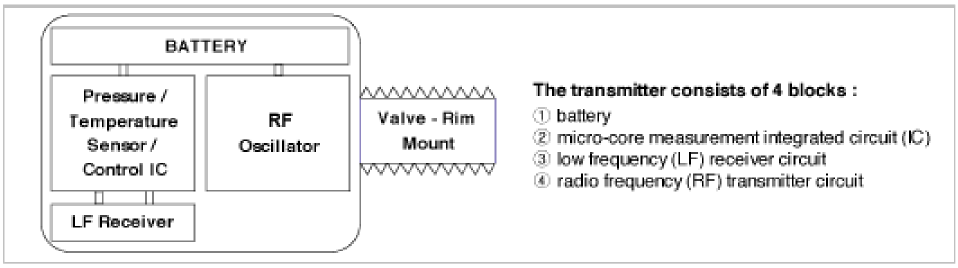
NO

▸ System performing to specification at this time.

Suspension System > Troubleshooting > C1314

Component Location

General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere such as due to the simultaneous transmission. Wheel sensors shall support usage on steel or aluminum rims.

Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 120 °C. Transmitter shall enter thermal shutdown once the measured temperature is greater than or equal to 125 °C. The accuracy of the sensor is ± 5°C at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 100 °C. The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit.

【Tire Pressure Monitoring】

When 4 sensors have been learned as road wheels, it shall not be possible to learn new road wheel sensors on the same Ignition cycle. In normal mode low line, tire pressure and temperature shall be transmitted every 3 minutes 20 s nominally independent of vehicle operation. Monitoring shall be every 20 s. If sensor detects rapid deflation, then RF messages will be transmitted every 4 s for 1 minute duration. Communication from wheel sensors shall be via RF at a frequency of 315 MHz, 5 kBaud. Tire pressure measurement tolerance shall be ±7 kPa from 0 to 50 °C and ±17.5 kPa from -40 to 120°C with a range of 100 to 450 kPa. Tire temperature measurement tolerance shall be ±3 °C from -20 to 70 °C and to ±5 °C from -40 to 120 °C.

DTC Description

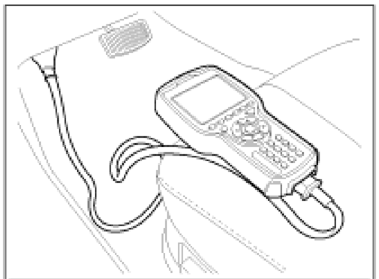
This DTC indicates that the sensor has either failed to learn OR has successfully learned and the receiver did not receive messages from the learned sensor for 12 minutes.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• RF message from sensor1 check	• Incorrectly configured TPMS sensor e.g.Low Line vehicle with High Line sensors. • Low Line vehicle sensors in storage state. • Wrong receiver type fitted e.g. Low Line receiver to a High Line vehicle. • Shielding in vehicle. • Un-approved wheels/tires i.e. a vehicle set up that has not been approved for good RF performance. • Incorrectly fitted sensor / receiver. • Faulty TPMS sensor
Enable conditions	• 2.48 mile < Distance travelled during 12 min. < 24.85 mile	
Threshold value	• Failure to Learn Sensors1 Correctly. • No RF message received from sensor1 over 12 min.	
Diagnosis time	• 12 ~ 20 minutes.	

Monitor Scantool Data

1. Connect "TPMS exciter' or scantool to Data Link Connector(DLC).



Connect the DLC for 'TPMS exciter'

2. Select "TPMS DIAGNOSIS" mode.
3. Select the "FULL" mode of "CURRENT DATA" function.
4. Monitor the parameter of SENSOR 1 on the 'TPMS exciter' or scantool after 20 minutes.

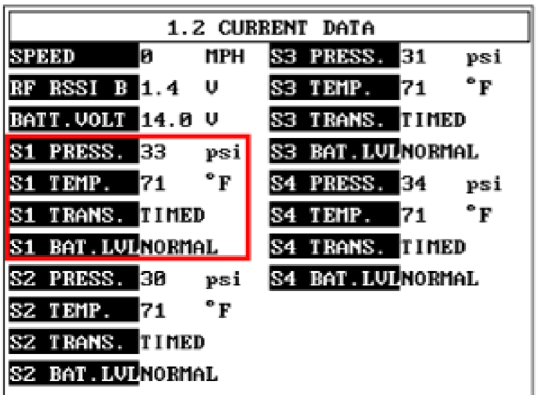


Fig 1 Sensor current data (normal)

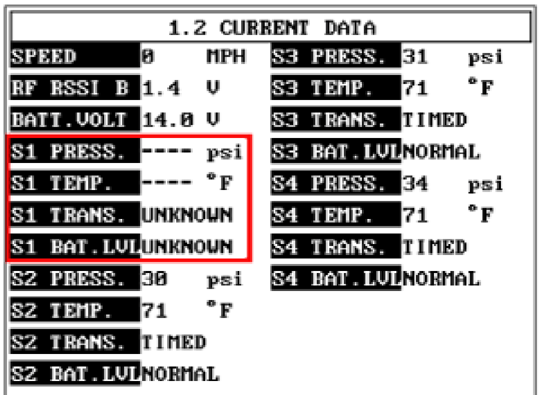


Fig 2 Sensor current data (failure)

5. Is parameter normal?

YES

▸ Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.
▸ Go to "Verification of vehicle Repair" procedure.

NO

▸ Go to "Component Inspection" procedure.

Component Inspection

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
3. Execute "SET SENSOR STATUS" of each wheel.

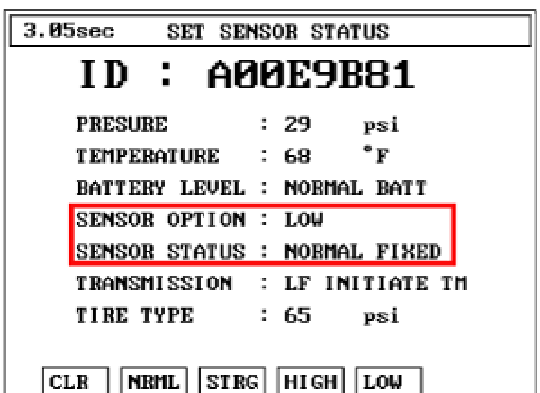


Fig 1 Sensor status (normal)

Executing "SET SENSOR STATUS"

4. Is data unable to be retrieved for any sensor?

YES

▸ Replace affected TPM sensor and register sensor ID with 'TPMS exciter'.
▸ Go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known-good TPM receiver module and check for proper operation.
▸ If the problem is corrected, replace TPM receiver module and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

▸ Go to the applicable troubleshooting procedure.

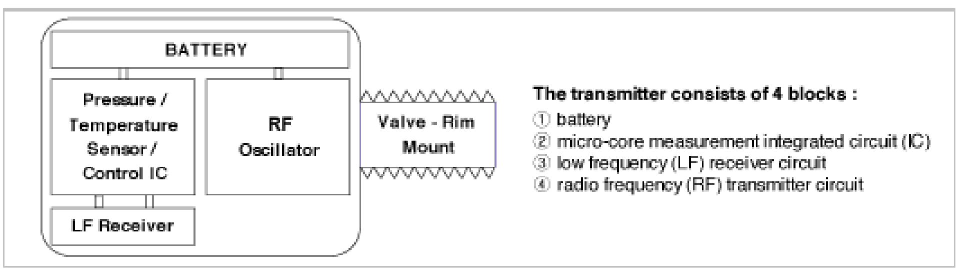
NO

▸ System performing to specification at this time.

Suspension System > Troubleshooting > C1315

Component Location

General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere such as due to the simultaneous transmission. Wheel sensors shall support usage on steel or aluminum rims.
Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 120 °C. Transmitter shall enter thermal shutdown once the measured temperature is greater than or equal to 125 °C. The accuracy of the sensor is ± 5°C at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 100 °C. The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit.

【Tire Pressure Monitoring】

When 4 sensors have been learned as road wheels, it shall not be possible to learn new road wheel sensors on the same

Ignition cycle. In normal mode low line, tire pressure and temperature shall be transmitted every 3 minutes 20 s nominally independent of vehicle operation. Monitoring shall be every 20 s. If sensor detects rapid deflation, then RF messages will be transmitted every 4 s for 1 minute duration. Communication from wheel sensors shall be via RF at a frequency of 315 MHz, 5 kBaud. Tire pressure measurement tolerance shall be ±7 kPa from 0 to 50 °C and ±17.5 kPa from -40 to 120°C with a range of 100 to 450 kPa. Tire temperature measurement tolerance shall be ±3 °C from -20 to 70 °C and to ±5 °C from -40 to 120 °C.

DTC Description

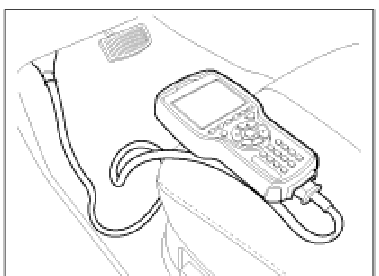
This DTC indicates that the sensor has either failed to learn OR has successfully learned and the receiver did not receive messages from the learned sensor for 12 minutes.

DTC Detecting Condition

<table>
<tr><th>Item</th><th>Detecting Condition</th><th>Possible cause</th></tr>
<tr><td>DTC strategy</td><td>• RF message from sensor1 check</td><td rowspan="4">• Incorrectly configured TPMS sensor e.g.Low Line vehicle with High Line sensors.
• Low Line vehicle sensors in storage state.
• Wrong receiver type fitted e.g. Low Line receiver to a High Line vehicle.
• Shielding in vehicle.
• Un-approved wheels/tires i.e. a vehicle set up that has not been approved for good RF performance.
• Incorrectly fitted sensor / receiver.
• Faulty TPMS sensor</td></tr>
<tr><td>Enable conditions</td><td>• 2.48 mile < Distance travelled during 12 min. < 24.85 mile</td></tr>
<tr><td>Threshold value</td><td>• Failure to Learn Sensors1 Correctly.
• No RF message received from sensor1 over 12 min.</td></tr>
<tr><td>Diagnosis time</td><td>• 12 ~ 20 minutes.</td></tr>
</table>

Monitor Scantool Data

1. Connect "TPMS exciter' or scantool to Data Link Connector(DLC).



Connect the DLC for 'TPMS exciter'

2. Select "TPMS DIAGNOSIS" mode.
3. Select the "FULL" mode of "CURRENT DATA" function.
4. Monitor the parameter of SENSOR 1 on the 'TPMS exciter' or scantool after 20 minutes.

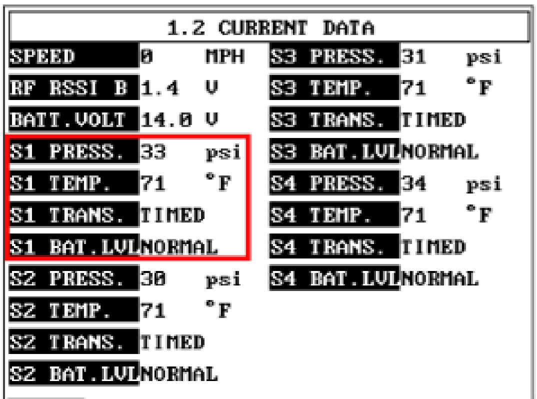


Fig 1 Sensor current data (normal)

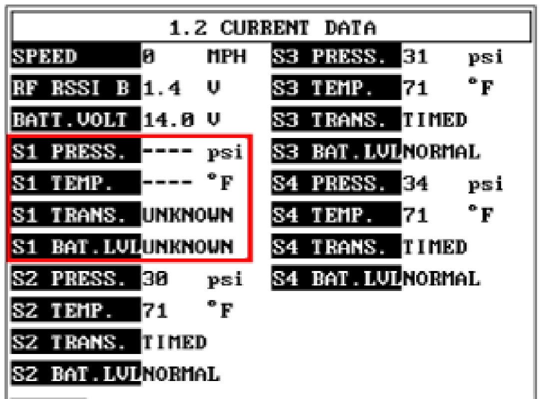


Fig 2 Sensor current data (failure)

5. Is parameter normal?

YES

▸ Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.
▸ Go to "Verification of vehicle Repair" procedure.

NO

▸ Go to "Component Inspection" procedure.

Component Inspection

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
3. Execute "SET SENSOR STATUS" of each wheel.

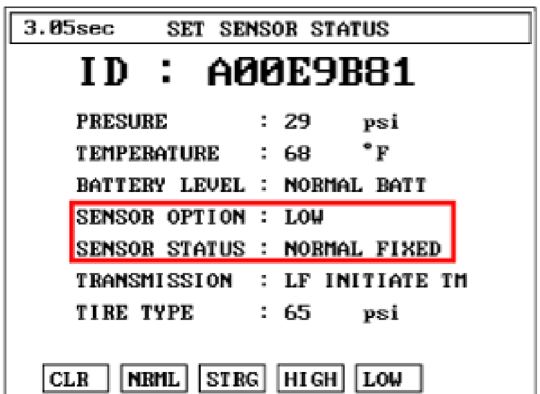


Fig 1 Sensor status (normal)


Executing "SET SENSOR STATUS"

4. Is data unable to be retrieved for any sensor?

YES

▸ Replace affected TPM sensor and register sensor ID with 'TPMS exciter'.
▸ Go to "Verification of Vehicle Repair" procedure.

NO

▸ Substitute with a known-good TPM receiver module and check for proper operation.
▸ If the problem is corrected, replace TPM receiver module and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

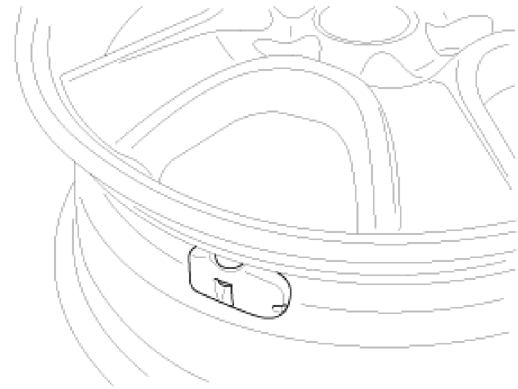
▸ Go to the applicable troubleshooting procedure.

NO

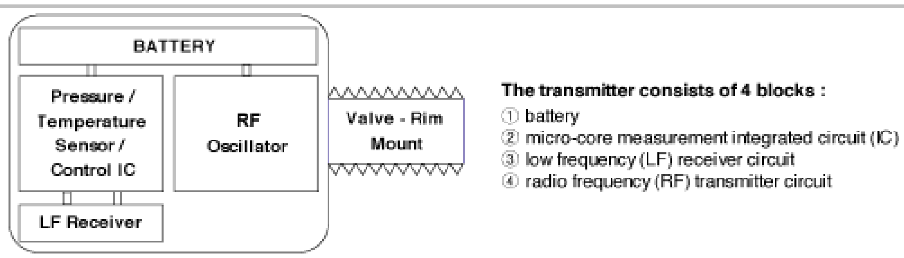
▸ System performing to specification at this time.

Suspension System > Troubleshooting > C1322

Component Location



General Description



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【Tire Pressure Monitoring】

When 4 sensors have been learned as road wheels, it shall not be possible to learn new road wheel sensors on the same Ignition cycle. In normal mode low line, tire pressure and temperature shall be transmitted every 3 minutes 20 s nominally independent of vehicle operation. Monitoring shall be every 20 s. If sensor detects rapid deflation, then RF messages will be transmitted every 4 s for 1 minute duration. Communication from wheel sensors shall be via RF at a frequency of 315 MHz, 5 kBaud. Tire pressure measurement tolerance shall be ±7 kPa from 0 to 50 °C and ±17.5 kPa from -40 to 120°C with a range of 100 to 450 kPa. Tire temperature measurement tolerance shall be ±3 °C from -20 to 70 °C and to ±5 °C from -40 to 120 °C.

DTC Description

This DTC indicates that the sensor has seen a temperature in excess of 110°C. At 125°C, the sensor will shut down and the warning is therefore so that the driver knows that there is a problem with the vehicle that may affect tire performance.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Temperature of sensor check	• Damaged tire

Enable conditions	• 2 consecutive Alert State temperature > 230°F(110°C)	• Excessive braking • Driving while the parking brake is on.
Threshold value	• Sensor temperature > 230°F(110°C)	
Diagnosis time	• < 10 sec.	

Monitor Scantool Data

1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).
3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mode of "CURRENT DATA" function.
5. Monitor the parameter of SENSOR 1 temperature on the 'TPMS exciter' or scantool after 4 minutes.

Specification : Less than 230 °F(110 °C)

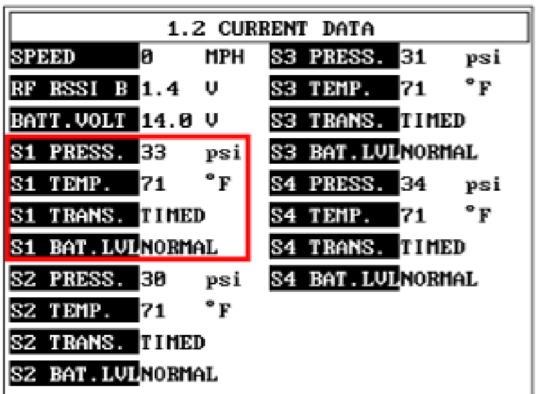
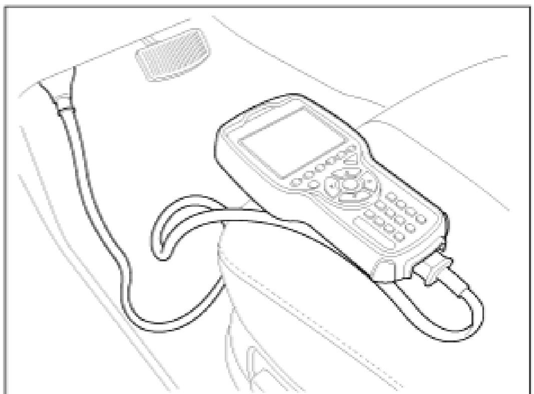


Fig 1 Sensor current data (normal)



Connect the DLC for 'TPMS exciter'

6. Is parameter within specifications?

YES

▸ Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.
▸ Go to "Verification of vehicle Repair" procedure.

NO

▸ Go to "Component Inspection" procedure.

Component Inspection

【Check TPM SENSOR 1】

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
   Execute "SET SENSOR STATUS" of each wheel.
3. Monitor the parameter of each sensor temperature on the 'TPMS exciter'.

Specification : Less than 230 °F(110 °C)

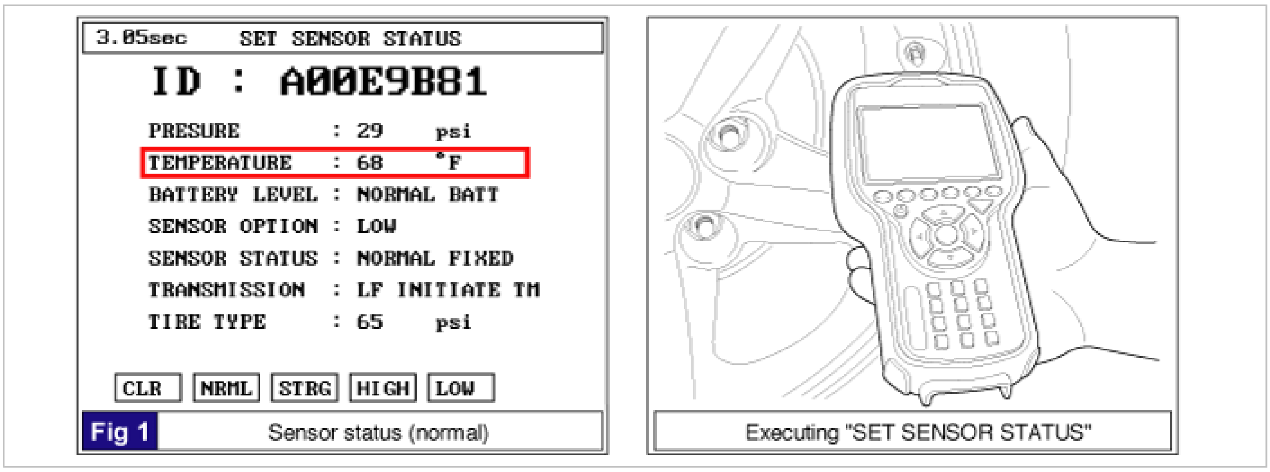


Fig 1 Sensor status (normal)

Executing "SET SENSOR STATUS"

4. Is any sensor data outside specification?

YES

▸ The sensor which displays data above the specification is SENSOR 1.
▸ Check wheel / tire of SENSOR 1 if Damaged tire, Excessive braking, Driving while the parking brake is on is detected.
▸ Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure.
▸ If it is OK, go to "Check wheel / tire" as fellows.

NO

▸ Substitute with a known-good TPMS receiver module and check proper operation.
▸ If the problem is corrected, replace TPMS receiver module and go to "Verification of Vehicle Repair" procedure.

【Check wheel / tire】

1. Cool the heat of the SENSOR 1 wheel / tire.
2. IG OFF & IG ON.
3. Monitor the parameter of sensor 1 temperature on the 'TPMS exciter' or scantool after 4 minutes.

Specification : Less than 230 °F(110 °C)

YES

▸ Fault can be because of temporary overheating.
▸ Go to "Verification of vehicle Repair" procedure.

NO

▸ Replace TPMS sensor and register sensor ID with 'TPMS exciter'.
▸ Go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

▸ Go to the applicable troubleshooting procedure.

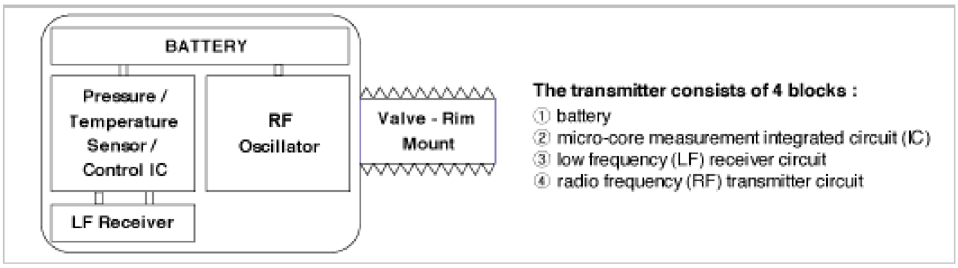
NO

▸ System performing to specification at this time.

Suspension System > Troubleshooting > C1323

Component Location

General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere such as due to the simultaneous transmission. Wheel sensors shall support usage on steel or aluminum rims.
Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 120 °C. Transmitter shall enter thermal shutdown once the measured temperature is greater than or equal to 125 °C. The accuracy of the sensor is ± 5°C at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 100 °C. The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit.
【Tire Pressure Monitoring】
When 4 sensors have been learned as road wheels, it shall not be possible to learn new road wheel sensors on the same Ignition cycle. In normal mode low line, tire pressure and temperature shall be transmitted every 3 minutes 20 s nominally independent of vehicle operation. Monitoring shall be every 20 s. If sensor detects rapid deflation, then RF messages will be transmitted every 4 s for 1 minute duration. Communication from wheel sensors shall be via RF at a frequency of 315 MHz, 5 kBaud. Tire pressure measurement tolerance shall be ±7 kPa from 0 to 50 °C and ±17.5 kPa from -40 to 120°C with a range of 100 to 450 kPa. Tire temperature measurement tolerance shall be ±3 °C from -20 to 70 °C and to ±5 °C from -40 to 120 °C.

DTC Description

This DTC indicates that the sensor has seen a temperature in excess of 110°C. At 125°C, the sensor will shut down and the warning is therefore so that the driver knows that there is a problem with the vehicle that may affect tire performance.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Temperature of sensor check	• Damaged tire • Excessive braking • Driving while the parking brake is on.
Enable conditions	• 2 consecutive Alert State temperature > 230°F(110°C)	
Threshold value	• Sensor temperature > 230°F(110°C)	
Diagnosis time	• < 10 sec.	

Monitor Scantool Data

1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).
3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mode of "CURRENT DATA" function.
5. Monitor the parameter of SENSOR 1 temperature on the 'TPMS exciter' or scantool after 4 minutes.

Specification : Less than 230 °F(110 °C)

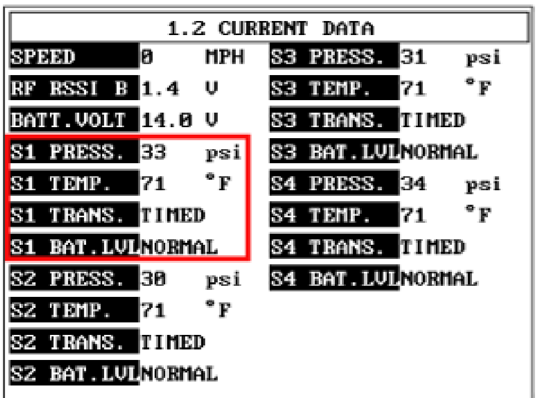
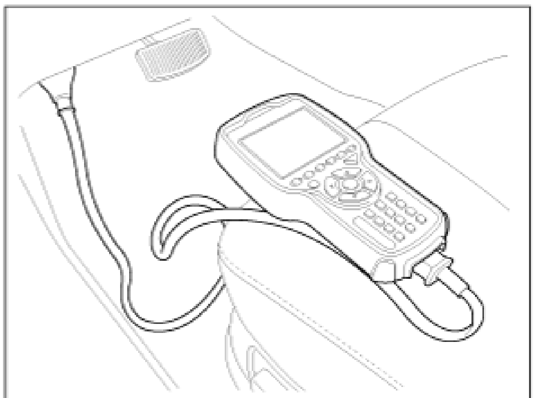


Fig 1 Sensor current data (normal)



Connect the DLC for 'TPMS exciter'

6. Is parameter within specifications?

YES

▸ Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.
▸ Go to "Verification of vehicle Repair" procedure.

NO

▸ Go to "Component Inspection" procedure.

Component Inspection

【Check TPM SENSOR 1】

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
   Execute "SET SENSOR STATUS" of each wheel.
3. Monitor the parameter of each sensor temperature on the 'TPMS exciter'.

Specification : Less than 230 °F(110 °C)

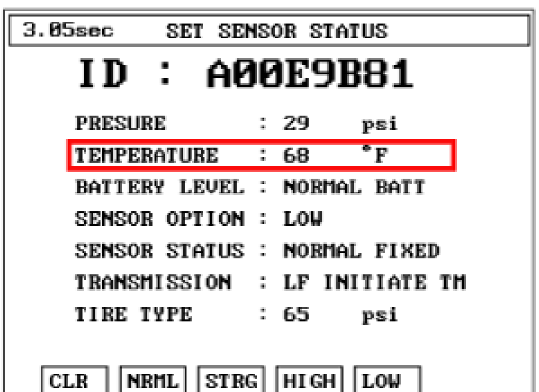


Fig 1 Sensor status (normal)

Executing "SET SENSOR STATUS"

4. Is any sensor data outside specification?

YES

▸ The sensor which displays data above the specification is SENSOR 1.

▸ Check wheel / tire of SENSOR 1 if Damaged tire, Excessive braking, Driving while the parking brake is on is detected.
▸ Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure.
▸ If it is OK, go to "Check wheel / tire" as fellows.

NO

▸ Substitute with a known-good TPMS receiver module and check proper operation.
▸ If the problem is corrected, replace TPMS receiver module and go to "Verification of Vehicle Repair" procedure.

【Check wheel / tire】

1. Cool the heat of the SENSOR 1 wheel / tire.
2. IG OFF & IG ON.
3. Monitor the parameter of sensor 1 temperature on the 'TPMS exciter' or scantool after 4 minutes.

Specification : Less than 230 °F(110 °C)

YES

▸ Fault can be because of temporary overheating.
▸ Go to "Verification of vehicle Repair" procedure.

NO

▸ Replace TPMS sensor and register sensor ID with 'TPMS exciter'.
▸ Go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

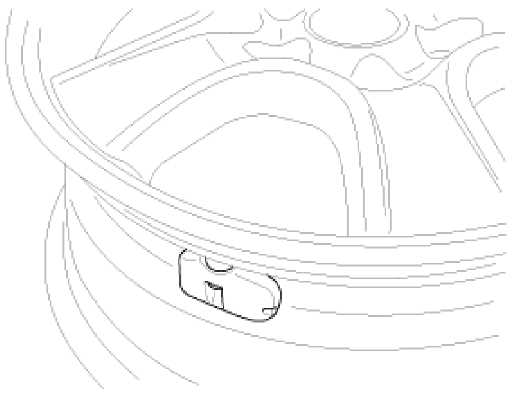
▸ Go to the applicable troubleshooting procedure.

NO

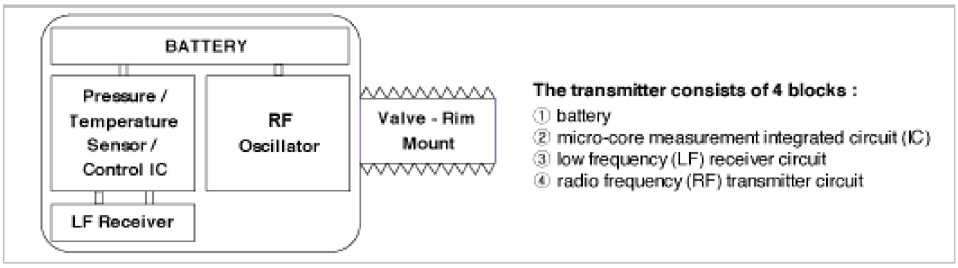
▸ System performing to specification at this time.

Suspension System > Troubleshooting > C1324

Component Location



General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere such as due to the simultaneous transmission. Wheel sensors shall support usage on steel or aluminum rims.

Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 120 °C. Transmitter shall enter thermal shutdown once the measured temperature is greater than or equal to 125 °C. The accuracy of the sensor is ± 5°C at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 100 °C. The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit.

【Tire Pressure Monitoring】

When 4 sensors have been learned as road wheels, it shall not be possible to learn new road wheel sensors on the same Ignition cycle. In normal mode low line, tire pressure and temperature shall be transmitted every 3 minutes 20 s nominally independent of vehicle operation. Monitoring shall be every 20 s. If sensor detects rapid deflation, then RF messages will be transmitted every 4 s for 1 minute duration. Communication from wheel sensors shall be via RF at a frequency of 315 MHz, 5 kBaud. Tire pressure measurement tolerance shall be ±7 kPa from 0 to 50 °C and ±17.5 kPa from -40 to 120°C with a range of 100 to 450 kPa. Tire temperature measurement tolerance shall be ±3 °C from -20 to 70 °C and to ±5 °C from -40 to 120 °C.

DTC Description

This DTC indicates that the sensor has seen a temperature in excess of 110°C. At 125°C, the sensor will shut down and the warning is therefore so that the driver knows that there is a problem with the vehicle that may affect tire performance.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Temperature of sensor check	• Damaged tire • Excessive braking • Driving while the parking brake is on.
Enable conditions	• 2 consecutive Alert State temperature > 230°F(110°C)	
Threshold value	• Sensor temperature > 230°F(110°C)	
Diagnosis time	• < 10 sec.	

Monitor Scantool Data

1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).
3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mode of "CURRENT DATA" function.
5. Monitor the parameter of SENSOR 1 temperature on the 'TPMS exciter' or scantool after 4 minutes.

Specification : Less than 230 °F(110 °C)

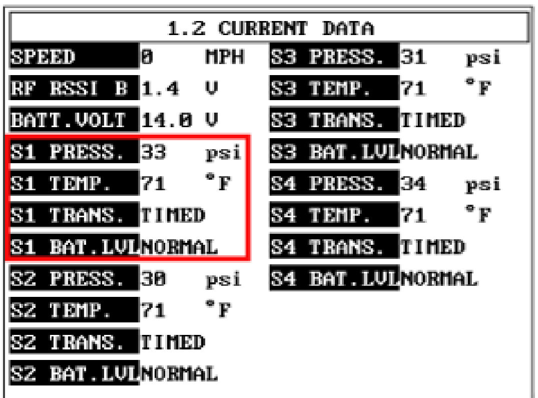
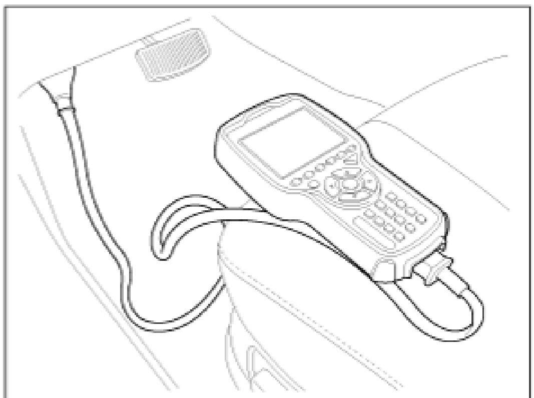


Fig 1 Sensor current data (normal)


Connect the DLC for 'TPMS exciter'

6. Is parameter within specifications?

YES

▸ Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.
▸ Go to "Verification of vehicle Repair" procedure.

NO

▸ Go to "Component Inspection" procedure.

Component Inspection

【Check TPM SENSOR 1】

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
   Execute "SET SENSOR STATUS" of each wheel.
3. Monitor the parameter of each sensor temperature on the 'TPMS exciter'.

Specification : Less than 230 °F(110 °C)

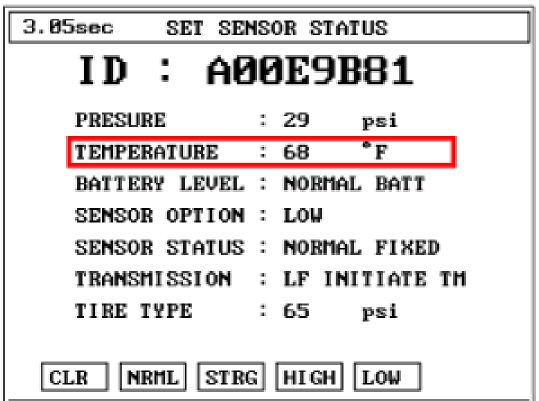


Fig 1 Sensor status (normal)


Executing "SET SENSOR STATUS"

4. Is any sensor data outside specification?

YES

▸ The sensor which displays data above the specification is SENSOR 1.
▸ Check wheel / tire of SENSOR 1 if Damaged tire, Excessive braking, Driving while the parking brake is on is detected.
▸ Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure.
▸ If it is OK, go to "Check wheel / tire" as fellows.

NO

▸ Substitute with a known-good TPMS receiver module and check proper operation.
▸ If the problem is corrected, replace TPMS receiver module and go to "Verification of Vehicle Repair" procedure.

【Check wheel / tire】

1. Cool the heat of the SENSOR 1 wheel / tire.

2. IG OFF & IG ON.
3. Monitor the parameter of sensor 1 temperature on the 'TPMS exciter' or scantool after 4 minutes.

Specification : Less than 230 °F(110 °C)

YES

▸ Fault can be because of temporary overheating.
▸ Go to "Verification of vehicle Repair" procedure.

NO

▸ Replace TPMS sensor and register sensor ID with 'TPMS exciter'.
▸ Go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

▸ Go to the applicable troubleshooting procedure.

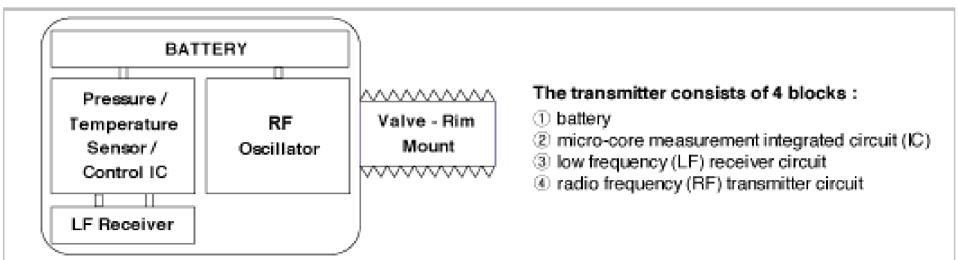
NO

▸ System performing to specification at this time.

Suspension System > Troubleshooting > C1325

Component Location

General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere such as due to the simultaneous transmission. Wheel sensors shall support usage on steel or aluminum rims.
Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 120 °C. Transmitter shall enter thermal shutdown once the

measured temperature is greater than or equal to 125 °C. The accuracy of the sensor is ± 5°C at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 100 °C. The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit.

【Tire Pressure Monitoring】

When 4 sensors have been learned as road wheels, it shall not be possible to learn new road wheel sensors on the same Ignition cycle. In normal mode low line, tire pressure and temperature shall be transmitted every 3 minutes 20 s nominally independent of vehicle operation. Monitoring shall be every 20 s. If sensor detects rapid deflation, then RF messages will be transmitted every 4 s for 1 minute duration. Communication from wheel sensors shall be via RF at a frequency of 315 MHz, 5 kBaud. Tire pressure measurement tolerance shall be ±7 kPa from 0 to 50 °C and ±17.5 kPa from -40 to 120°C with a range of 100 to 450 kPa. Tire temperature measurement tolerance shall be ±3 °C from -20 to 70 °C and to ±5 °C from -40 to 120 °C.

DTC Description

This DTC indicates that the sensor has seen a temperature in excess of 110°C. At 125°C, the sensor will shut down and the warning is therefore so that the driver knows that there is a problem with the vehicle that may affect tire performance.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Temperature of sensor check	• Damaged tire • Excessive braking • Driving while the parking brake is on.
Enable conditions	• 2 consecutive Alert State temperature > 230°F(110°C)	
Threshold value	• Sensor temperature > 230°F(110°C)	
Diagnosis time	• < 10 sec.	

Monitor Scantool Data

1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).
3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mode of "CURRENT DATA" function.
5. Monitor the parameter of SENSOR 1 temperature on the 'TPMS exciter' or scantool after 4 minutes.

Specification : Less than 230 °F(110 °C)

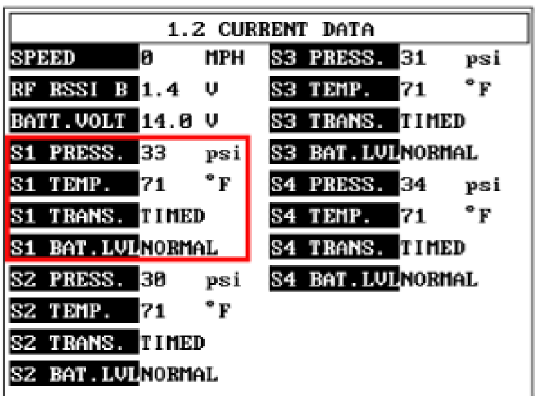
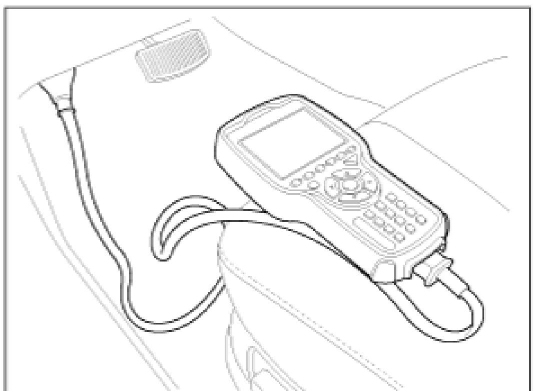


Fig 1 Sensor current data (normal)


Connect the DLC for 'TPMS exciter'

6. Is parameter within specifications?

YES

▸ Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.
▸ Go to "Verification of vehicle Repair" procedure.

NO

▸ Go to "Component Inspection" procedure.

Component Inspection

【Check TPM SENSOR 1】

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
   Execute "SET SENSOR STATUS" of each wheel.
3. Monitor the parameter of each sensor temperature on the 'TPMS exciter'.

Specification : Less than 230 °F(110 °C)

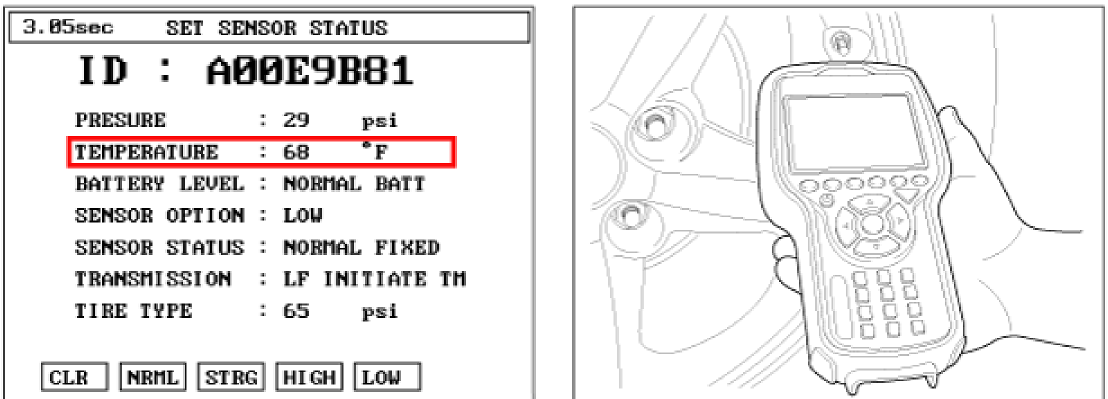


Fig 1 Sensor status (normal)

Executing "SET SENSOR STATUS"

4. Is any sensor data outside specification?

YES

- The sensor which displays data above the specification is SENSOR 1.
- Check wheel / tire of SENSOR 1 if Damaged tire, Excessive braking, Driving while the parking brake is on is detected.
- Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure.
- If it is OK, go to "Check wheel / tire" as fellows.

NO

- Substitute with a known-good TPMS receiver module and check proper operation.
- If the problem is corrected, replace TPMS receiver module and go to "Verification of Vehicle Repair" procedure.

【Check wheel / tire】

1. Cool the heat of the SENSOR 1 wheel / tire.
2. IG OFF & IG ON.
3. Monitor the parameter of sensor 1 temperature on the 'TPMS exciter' or scantool after 4 minutes.

Specification : Less than 230 °F(110 °C)

YES

- Fault can be because of temporary overheating.
- Go to "Verification of vehicle Repair" procedure.

NO

- Replace TPMS sensor and register sensor ID with 'TPMS exciter'.
- Go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

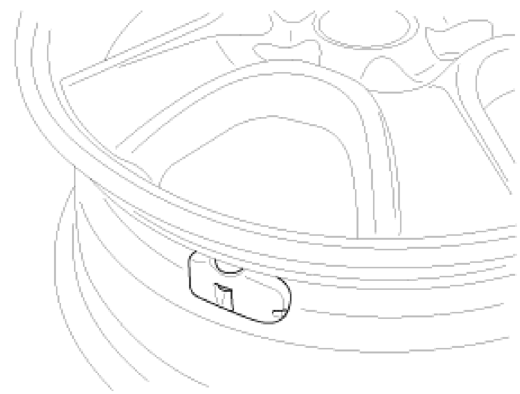
▸ Go to the applicable troubleshooting procedure.

NO

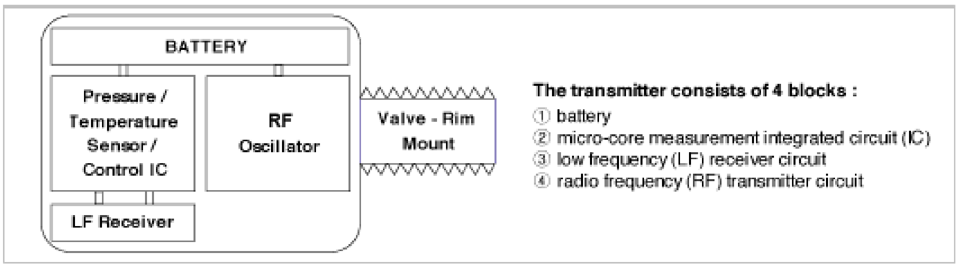
▸ System performing to specification at this time.

Suspension System > Troubleshooting > C1332

Component Location



General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere such as due to the simultaneous transmission. Wheel sensors shall support usage on steel or aluminum rims.
Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 120 °C. Transmitter shall enter thermal shutdown once the measured temperature is greater than or equal to 125 °C. The accuracy of the sensor is ± 5°C at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 100 °C. The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit.

【Tire Pressure Monitoring】

When 4 sensors have been learned as road wheels, it shall not be possible to learn new road wheel sensors on the same Ignition cycle. In normal mode low line, tire pressure and temperature shall be transmitted every 3 minutes 20 s nominally independent of vehicle operation. Monitoring shall be every 20 s. If sensor detects rapid deflation, then RF messages will be transmitted every 4 s for 1 minute duration. Communication from wheel sensors shall be via RF at a frequency of 315 MHz, 5 kBaud. Tire pressure measurement tolerance shall be ±7 kPa from 0 to 50 °C and ±17.5 kPa from -40 to 120°C with a range of 100 to 450 kPa. Tire temperature measurement tolerance shall be ±3 °C from -20 to 70 °C and to ±5 °C from -40 to 120 °C.

DTC Description

This DTC indicates that the sensor has detected that it has an internal fault. The most likely cause is sensor failure.

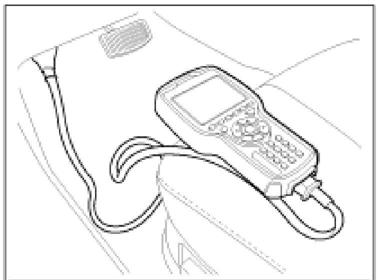
DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Sensor check	• Damage to sensor
Enable	• An internal fault in the TPMS sensor	

conditions		• Faulty TPMS sensor
Threshold value	• TPMS sensor fault	
Diagnosis time	• < 9 minutes	

Monitor Scantool Data

1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



Connect the DLC for 'TPMS exciter'

3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mode of "CURRENT DATA" function.
5. Monitor each sensor's temperature parameter on the 'TPMS exciter' or scantool after 9 minutes.

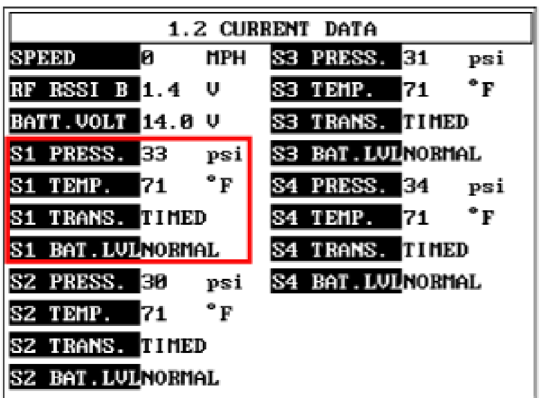


Fig 1 Sensor current data (normal)

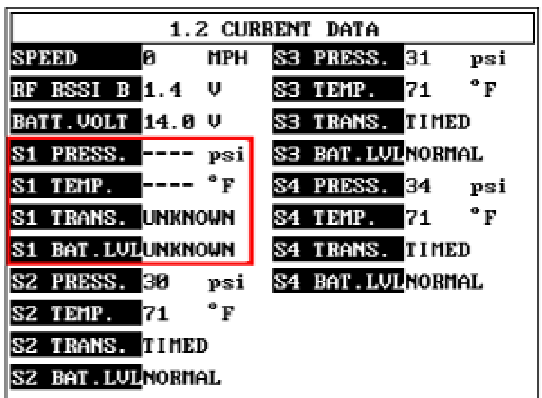


Fig 2 Sensor current data (failure)

6. Is parameter normal?

YES

▸ Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.
▸ Go to "Verification of vehicle Repair" procedure.

NO

▸ Go to "Component Inspection" procedure.

Component Inspection

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
3. Execute "SET SENSOR STATUS" of each wheel.

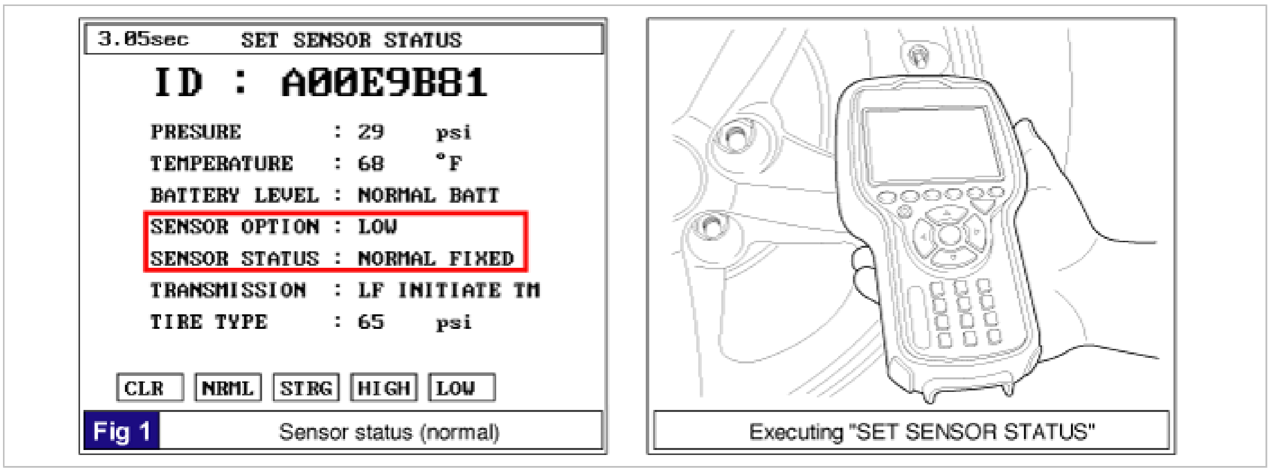


Fig 1 Sensor status (normal)

Executing "SET SENSOR STATUS"

4. Is data unable to be retrieved for any sensor?

YES

- Check for damaged of TPMS sensor on affected wheel.
- Replace TPMS sensor if necessary and register sensor ID with 'TPMS exciter'.
- Go to "Verification of Vehicle Repair" procedure.

NO

- Substitute with a known-good TPM receiver module and check for proper operation.
- If the problem is corrected, replace TPM receiver module and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

- Go to the applicable troubleshooting procedure.

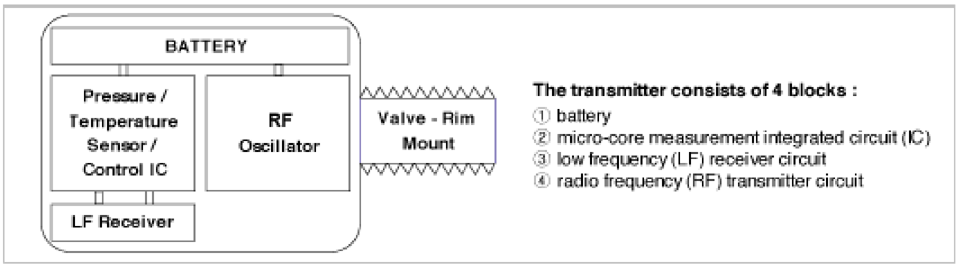
NO

- System performing to specification at this time.

Suspension System > Troubleshooting > C1333

Component Location

General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere such as due to the simultaneous transmission. Wheel sensors shall support usage on steel or aluminum rims.

Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 120 °C. Transmitter shall enter thermal shutdown once the measured temperature is greater than or equal to 125 °C. The accuracy of the sensor is ± 5°C at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 100 °C. The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit.

【Tire Pressure Monitoring】

When 4 sensors have been learned as road wheels, it shall not be possible to learn new road wheel sensors on the same Ignition cycle. In normal mode low line, tire pressure and temperature shall be transmitted every 3 minutes 20 s nominally independent of vehicle operation. Monitoring shall be every 20 s. If sensor detects rapid deflation, then RF messages will be transmitted every 4 s for 1 minute duration. Communication from wheel sensors shall be via RF at a frequency of 315 MHz, 5 kBaud. Tire pressure measurement tolerance shall be ±7 kPa from 0 to 50 °C and ±17.5 kPa from -40 to 120°C with a range of 100 to 450 kPa. Tire temperature measurement tolerance shall be ±3 °C from -20 to 70 °C and to ±5 °C from -40 to 120 °C.

DTC Description

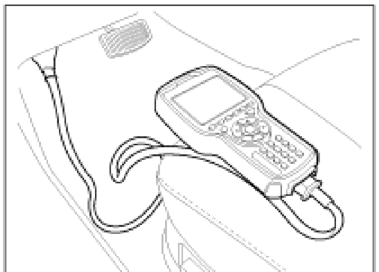
This DTC indicates that the sensor has detected that it has an internal fault. The most likely cause is sensor failure.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Sensor check	• Damage to sensor • Faulty TPMS sensor
Enable conditions	• An internal fault in the TPMS sensor	
Threshold value	• TPMS sensor fault	
Diagnosis time	• < 9 minutes	

Monitor Scantool Data

1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



Connect the DLC for 'TPMS exciter'

3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mode of "CURRENT DATA" function.

5. Monitor each sensor's temperature parameter on the 'TPMS exciter' or scantool after 9 minutes.

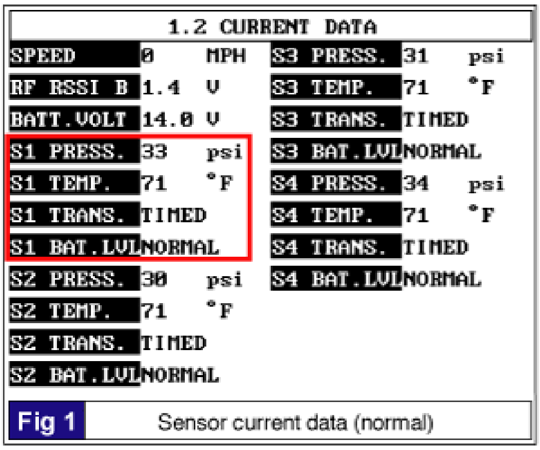


Fig 1 Sensor current data (normal)

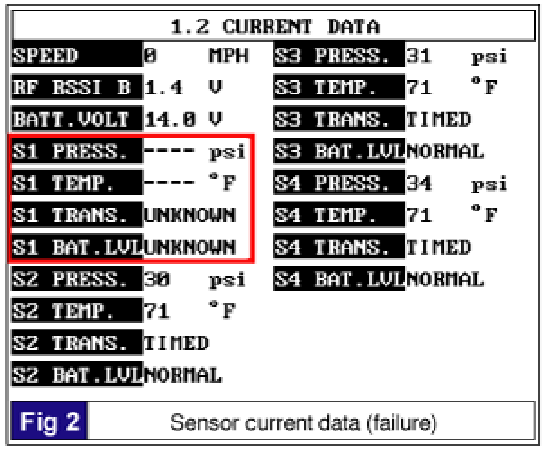


Fig 2 Sensor current data (failure)

6. Is parameter normal?

YES

- Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.
- Go to "Verification of vehicle Repair" procedure.

NO

- Go to "Component Inspection" procedure.

Component Inspection

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
3. Execute "SET SENSOR STATUS" of each wheel.

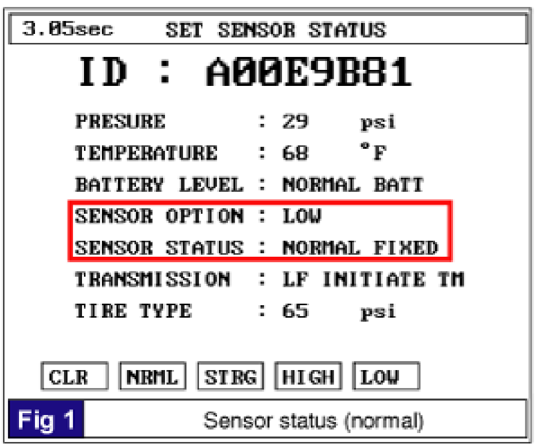
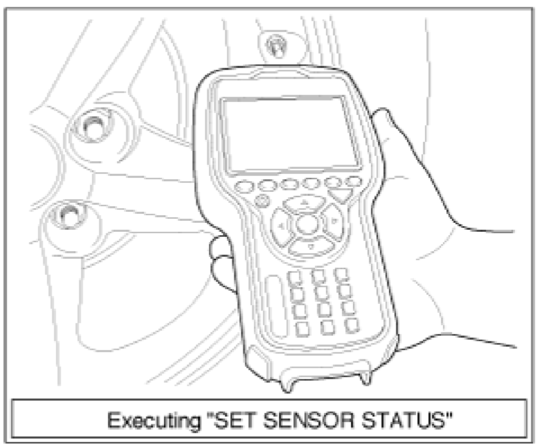


Fig 1 Sensor status (normal)


Executing "SET SENSOR STATUS"

4. Is data unable to be retrieved for any sensor?

YES

- Check for damaged of TPMS sensor on affected wheel.
- Replace TPMS sensor if necessary and register sensor ID with 'TPMS exciter'.
- Go to "Verification of Vehicle Repair" procedure.

NO

- Substitute with a known-good TPM receiver module and check for proper operation.
- If the problem is corrected, replace TPM receiver module and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.

4. Are any DTCs present ?

YES

▸ Go to the applicable troubleshooting procedure.

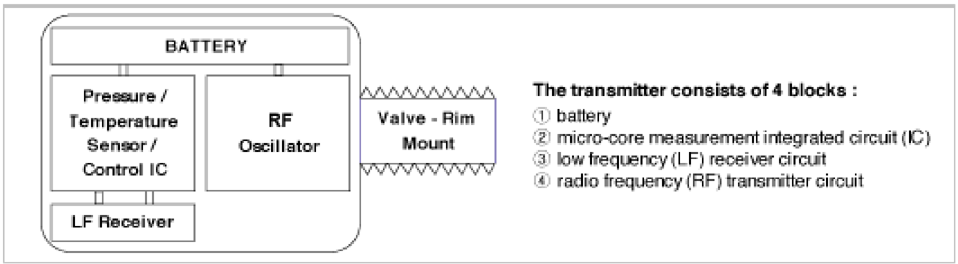
NO

▸ System performing to specification at this time.

Suspension System > Troubleshooting > C1334

Component Location

General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere such as due to the simultaneous transmission. Wheel sensors shall support usage on steel or aluminum rims.
Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 120 °C. Transmitter shall enter thermal shutdown once the measured temperature is greater than or equal to 125 °C. The accuracy of the sensor is ± 5°C at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 100 °C. The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit.

【Tire Pressure Monitoring】

When 4 sensors have been learned as road wheels, it shall not be possible to learn new road wheel sensors on the same Ignition cycle. In normal mode low line, tire pressure and temperature shall be transmitted every 3 minutes 20 s nominally independent of vehicle operation. Monitoring shall be every 20 s. If sensor detects rapid deflation, then RF messages will be transmitted every 4 s for 1 minute duration. Communication from wheel sensors shall be via RF at a frequency of 315 MHz, 5 kBaud. Tire pressure measurement tolerance shall be ±7 kPa from 0 to 50 °C and ±17.5 kPa from -40 to 120°C with a range of 100 to 450 kPa. Tire temperature measurement tolerance shall be ±3 °C from -20 to 70 °C and to ±5 °C from -40 to 120 °C.

DTC Description

This DTC indicates that the sensor has detected that it has an internal fault. The most likely cause is sensor failure.

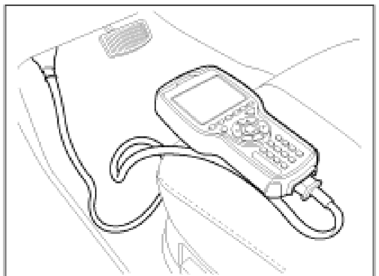
DTC Detecting Condition

Item	Detecting Condition	Possible cause

DTC strategy	• Sensor check	• Damage to sensor • Faulty TPMS sensor
Enable conditions	• An internal fault in the TPMS sensor	
Threshold value	• TPMS sensor fault	
Diagnosis time	• < 9 minutes	

Monitor Scantool Data

1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



Connect the DLC for 'TPMS exciter'

3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mode of "CURRENT DATA" function.
5. Monitor each sensor's temperature parameter on the 'TPMS exciter' or scantool after 9 minutes.

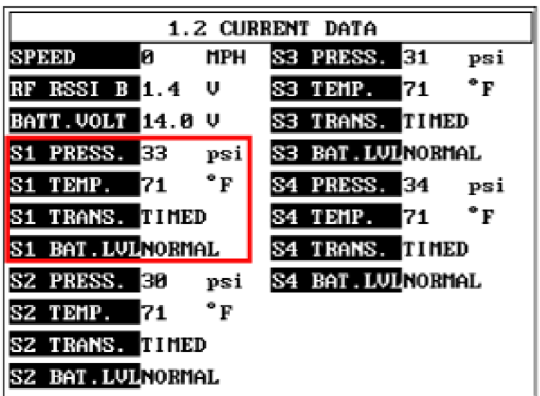


Fig 1 Sensor current data (normal)

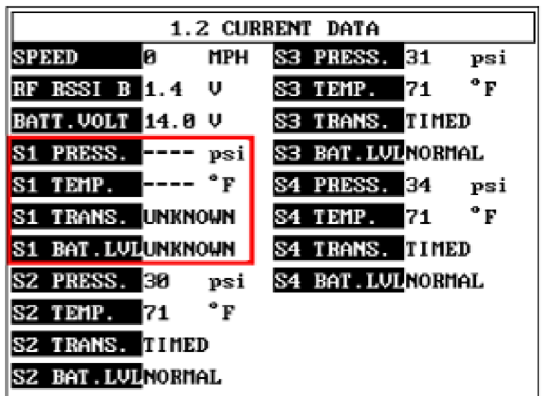


Fig 2 Sensor current data (failure)

6. Is parameter normal?

YES

▸ Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.
▸ Go to "Verification of vehicle Repair" procedure.

NO

▸ Go to "Component Inspection" procedure.

Component Inspection

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
3. Execute "SET SENSOR STATUS" of each wheel.

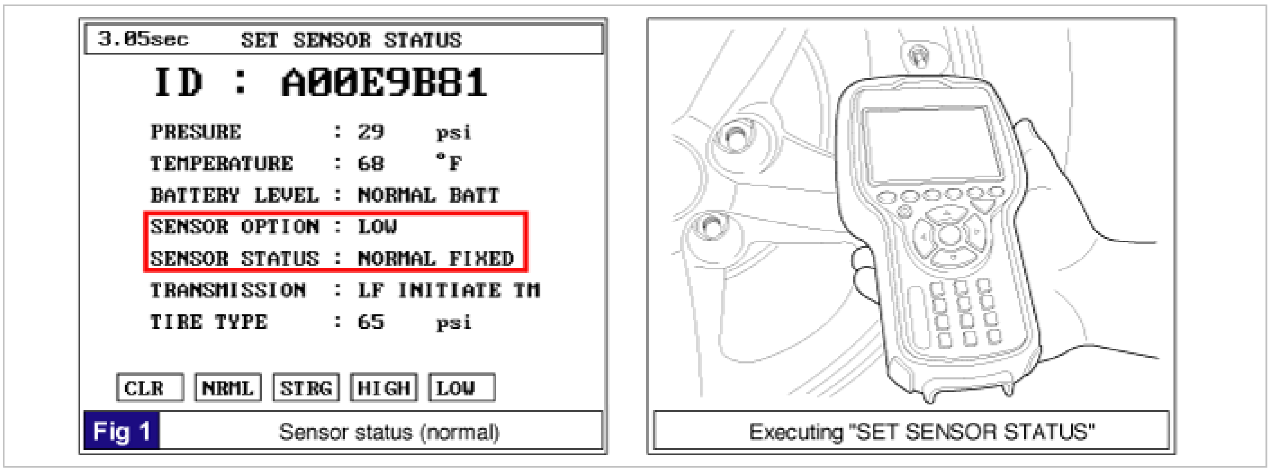


Fig 1 Sensor status (normal)

Executing "SET SENSOR STATUS"

4. Is data unable to be retrieved for any sensor?

YES

- Check for damaged of TPMS sensor on affected wheel.
- Replace TPMS sensor if necessary and register sensor ID with 'TPMS exciter'.
- Go to "Verification of Vehicle Repair" procedure.

NO

- Substitute with a known-good TPM receiver module and check for proper operation.
- If the problem is corrected, replace TPM receiver module and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

- Go to the applicable troubleshooting procedure.

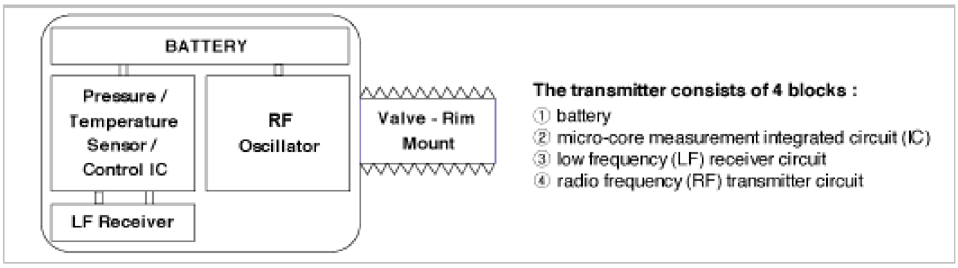
NO

- System performing to specification at this time.

Suspension System > Troubleshooting > C1335

Component Location

General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere such as due to the simultaneous transmission. Wheel sensors shall support usage on steel or aluminum rims.
Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 120 °C. Transmitter shall enter thermal shutdown once the measured temperature is greater than or equal to 125 °C. The accuracy of the sensor is ± 5°C at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 100 °C. The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit.

【Tire Pressure Monitoring】

When 4 sensors have been learned as road wheels, it shall not be possible to learn new road wheel sensors on the same Ignition cycle. In normal mode low line, tire pressure and temperature shall be transmitted every 3 minutes 20 s nominally independent of vehicle operation. Monitoring shall be every 20 s. If sensor detects rapid deflation, then RF messages will be transmitted every 4 s for 1 minute duration. Communication from wheel sensors shall be via RF at a frequency of 315 MHz, 5 kBaud. Tire pressure measurement tolerance shall be ±7 kPa from 0 to 50 °C and ±17.5 kPa from -40 to 120°C with a range of 100 to 450 kPa. Tire temperature measurement tolerance shall be ±3 °C from -20 to 70 °C and to ±5 °C from -40 to 120 °C.

DTC Description

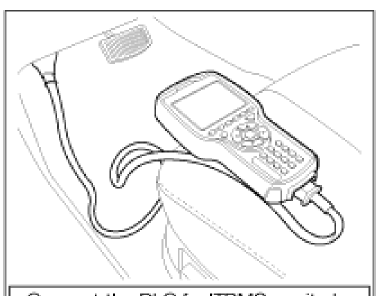
This DTC indicates that the sensor has detected that it has an internal fault. The most likely cause is sensor failure.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Sensor check	• Damage to sensor • Faulty TPMS sensor
Enable conditions	• An internal fault in the TPMS sensor	
Threshold value	• TPMS sensor fault	
Diagnosis time	• < 9 minutes	

Monitor Scantool Data

1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).


Connect the DLC for 'TPMS exciter'

3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mode of "CURRENT DATA" function.

5. Monitor each sensor's temperature parameter on the 'TPMS exciter' or scantool after 9 minutes.

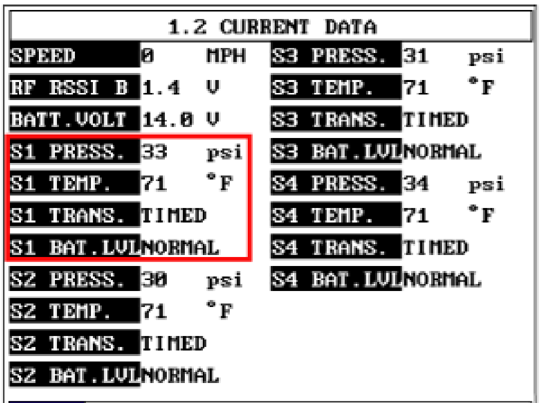


Fig 1 Sensor current data (normal)

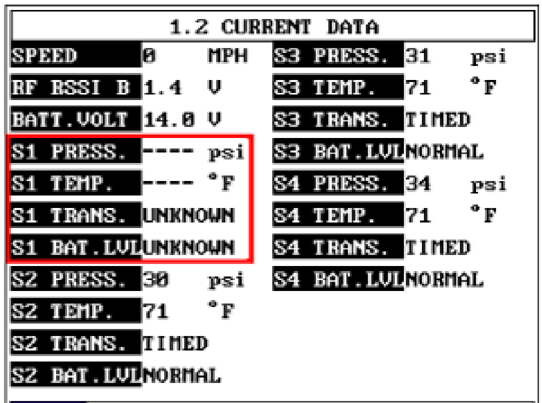


Fig 2 Sensor current data (failure)

6. Is parameter normal?

YES

- Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.
- Go to "Verification of vehicle Repair" procedure.

NO

- Go to "Component Inspection" procedure.

Component Inspection

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
3. Execute "SET SENSOR STATUS" of each wheel.

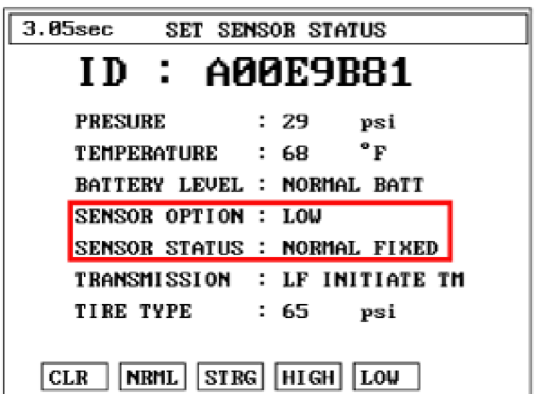


Fig 1 Sensor status (normal)


Executing "SET SENSOR STATUS"

4. Is data unable to be retrieved for any sensor?

YES

- Check for damaged of TPMS sensor on affected wheel.
- Replace TPMS sensor if necessary and register sensor ID with 'TPMS exciter'.
- Go to "Verification of Vehicle Repair" procedure.

NO

- Substitute with a known-good TPM receiver module and check for proper operation.
- If the problem is corrected, replace TPM receiver module and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.

4. Are any DTCs present ?

YES

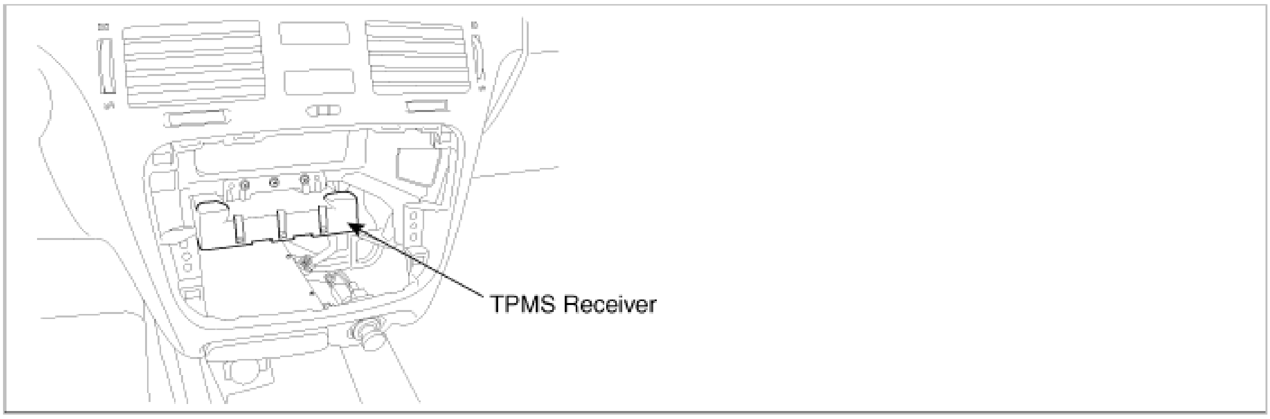
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Suspension System > Troubleshooting > C1660

Component Location



General Description

TPM Receiver is integrated with the TPM module installed at the bottom of the steering column. The operating battery of TPM module is supplied from the vehicle battery. Data such as Tire pressure, Tire Temperature, TPM sensor battery status and TPM sensor valve ID from TPM sensors are transmitted to TPM receiver in the form of RF signal. TPM module accomplishes Tire Monitoring and Warning Logic with received data.

DTC Description

This DTC indicates that the receiver has not received any RF messages. The most likely cause is receiver RF circuit failure / RF screening.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Internal RF circuit check of Receiver module	• Low Line - all sensors in storage state and no other RF transmissions received • Low Line - receiver RF shielding • Faulty TPMS Receiver module
Enable conditions	• No valid RF data for 12 min from any sensor • RF messages and the signal levels are unexpected	
Threshold value	• Internal RF circuit fault	
Diagnosis time	• 12 ~13 minutes	

Component Inspection

【Check status of all TPM sensor】

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
   Execute "SET SENSOR STATUS" of each wheel.

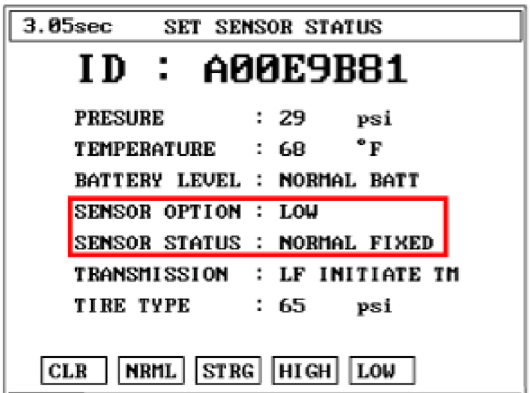


Fig 1 Sensor status (normal)


Executing "SET SENSOR STATUS"

3. Are status of all sensors "normal"?

YES

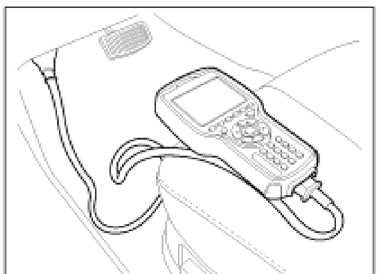
- Check TPM receiver RF shielding.
- If it is OK, go to "Check TPM receiver" as fellows.
- Repair if necessary and go to "Verification of Vehicle Repair" procedure.

NO

- Change status of all TPM sensors into "normal" status with 'TPMS exciter'.
- Go to "Verification of Vehicle Repair" procedure.

【Check TPM receiver】

1. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).


Connect the DLC for 'TPMS exciter'

2. Clear DTC.
3. IG OFF & IG ON. Wait 4 minutes.
4. Execute "Diagnostic Trouble Codes(DTCs)".
5. Is 'C1660' present ?

YES

- Substitute with a known-good TPM Receiver module and check for proper operation.
- If the problem is corrected, replace TPM Receiver module and go to "Verification of vehicle Repair" procedure.

NO

- TPM receiver complete successful Auto-Learn.
- System is OK.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

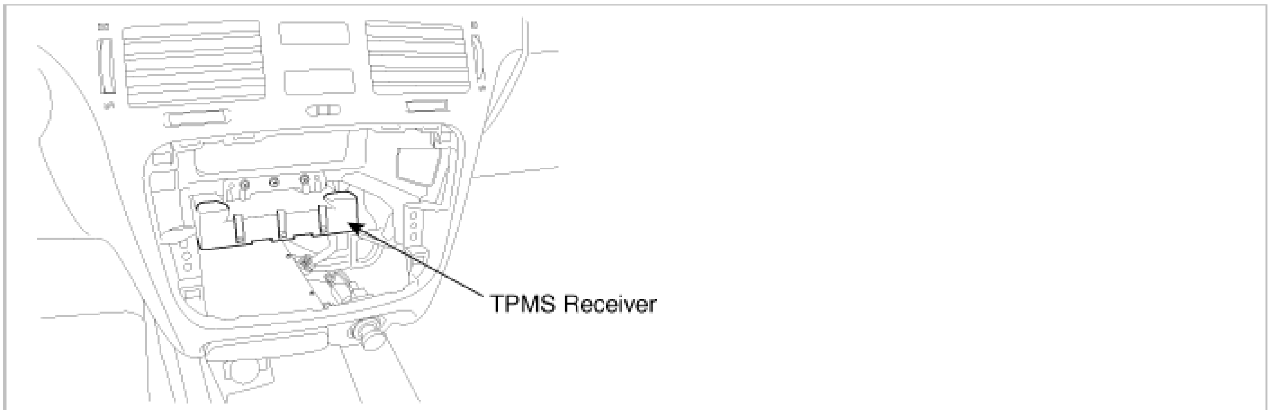
- Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Suspension System > Troubleshooting > C1661

Component Location



General Description

TPM Receiver is integrated with the TPM module installed at the bottom of the steering column. The operating battery of TPM module is supplied from the vehicle battery. Data such as Tire pressure, Tire Temperature, TPM sensor battery status and TPM sensor valve ID from TPM sensors are transmitted to TPM receiver in the form of RF signal. TPM module accomplishes Tire Monitoring and Warning Logic with received data.

DTC Description

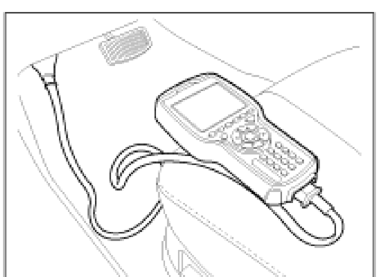
This DTC indicates that the receiver has a problem reading or writing to EEPROM.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Receiver module check	• Transient over voltage due to vehicle fault (fault would typically recover) • Faulty TPMS Receiver
Enable conditions	• Reading or writing problem to EEPROM	
Threshold value	• EEPROM in the receiver module fault	
Diagnosis time	• < 10 sec.	

Component Inspection

1. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).


Connect the DLC for 'TPMS exciter'

2. Clear DTC.
3. IG OFF & IG ON. Wait 4 minutes.
4. Execute "Diagnostic Trouble Codes(DTCs)".

5. Is 'C1661' present ?

YES

▶ Substitute with a known-good TPM Receiver module and check for proper operation.
▶ If the problem is corrected, replace TPM Receiver module and go to "Verification of vehicle Repair" procedure.

NO

▶ TPM receiver complete successful Auto-Learn.
▶ System is OK.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

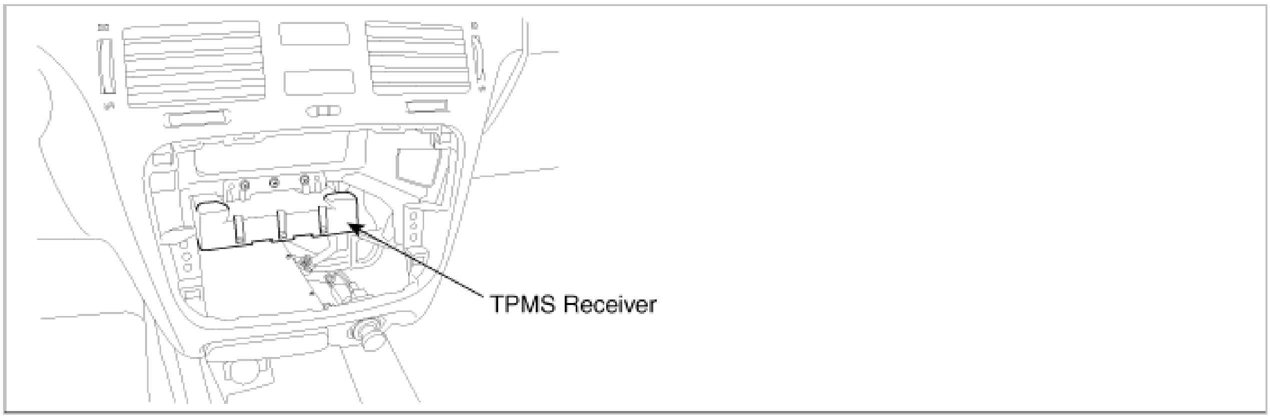
▶ Go to the applicable troubleshooting procedure.

NO

▶ System performing to specification at this time.

Suspension System > Troubleshooting > C1668

Component Location



General Description

TPM Receiver is integrated with the TPM module installed at the bottom of the steering column. The operating battery of TPM module is supplied from the vehicle battery. Data such as Tire pressure, Tire Temperature, TPM sensor battery status and TPM sensor valve ID from TPM sensors are transmitted to TPM receiver in the form of RF signal. TPM module accomplishes Tire Monitoring and Warning Logic with received data.

DTC Description

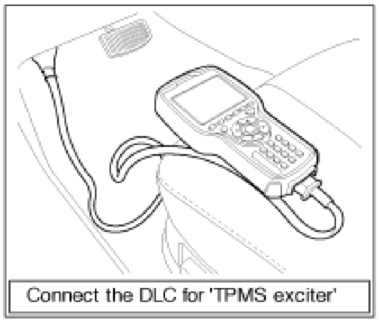
This DTC indicates that the receiver has detected an internal error.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Receiver module check	• Transient over voltage due to vehicle fault (fault would typically recover) • Faulty TPMS Receiver
Enable conditions	• An Internal error	
Threshold value	• TPMS Receiver module fault	
Diagnosis time	• < 3 sec. - Carried out once at Ignition ON	

Component Inspection

1. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



2. Clear DTC.
3. IG OFF & IG ON. Wait 4 minutes.
4. Execute "Diagnostic Trouble Codes(DTCs)".
5. Is 'C1668' present ?

YES

▸ Substitute with a known-good TPM Receiver module and check for proper operation.
▸ If the problem is corrected, replace TPM Receiver module and go to "Verification of vehicle Repair" procedure.

NO

▸ TPM receiver complete successful Auto-Learn.
▸ System is OK.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

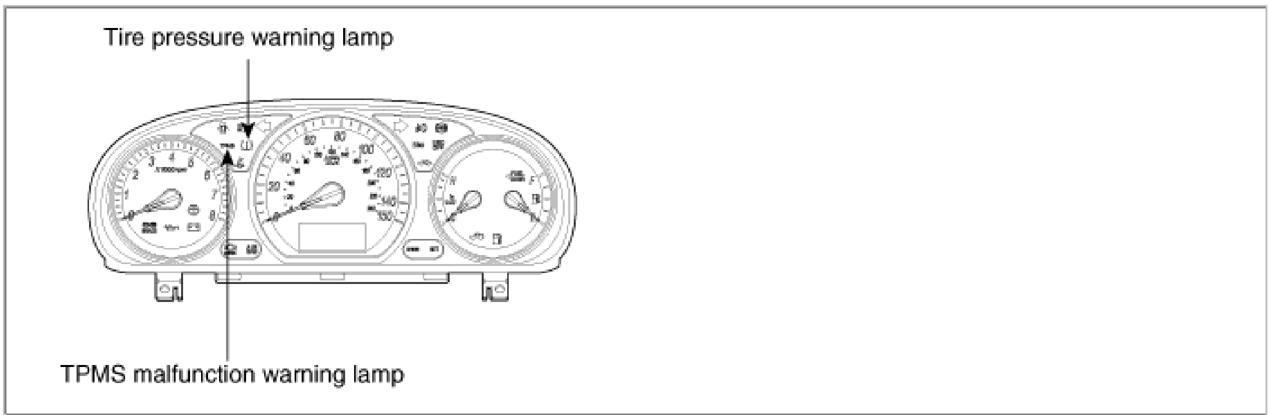
▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.

Suspension System > Troubleshooting > C2510

Component Location



General Description

The TPMS receiver unit must provide two outputs continuously to drive the indicator lamps. One of the output turn the TREAD indicator lamp on when pressure in one or more tires associated with the TPMS receiver unit have reported a pressure below the warning level threshold. The other output turn the TPMS Warning indicator bulb on when the TPMS receiver unit has detected a system fault.

【Turn the TREAD indicator lamp on】

1. When tire pressure is below allowed threshold.
2. When rapid leak is detected by the sensor.
3. Indicates that tire needs to be re-inflated to placard pressure / repaired.

【Turn the TREAD indicator lamp off】

1. Under-inflation : When tire pressure is above (warning threshold + hysteresis).
2. Leak : When tire pressure is above (leak warning threshold) OR on Ignition cycle off to on.

DTC Description

This DTC indicates that the TREAD(Tire Under Inflation / Leak Warning) / DTC Warning lamp is short circuit and therefore cannot be turned on. The most likely failure is harness / instrument cluster / connector / receiver short circuit.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Input lamp current check	• Short circuit to 12 V between lamp and TPMS receiver
Enable conditions	• TREAD / Diagnostic lamp circuit short to 12 V	
Threshold value	• TREAD / Diagnostic lamp - 200 mA allowed each (after in rush time). 50 mA margin built in.	
Diagnosis time	• < 3s	

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminal condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/or damage.
3. Has a problem been found?

YES

▸ Repair if necessary and then go to "Verification of Vehicle Repair" procedure.

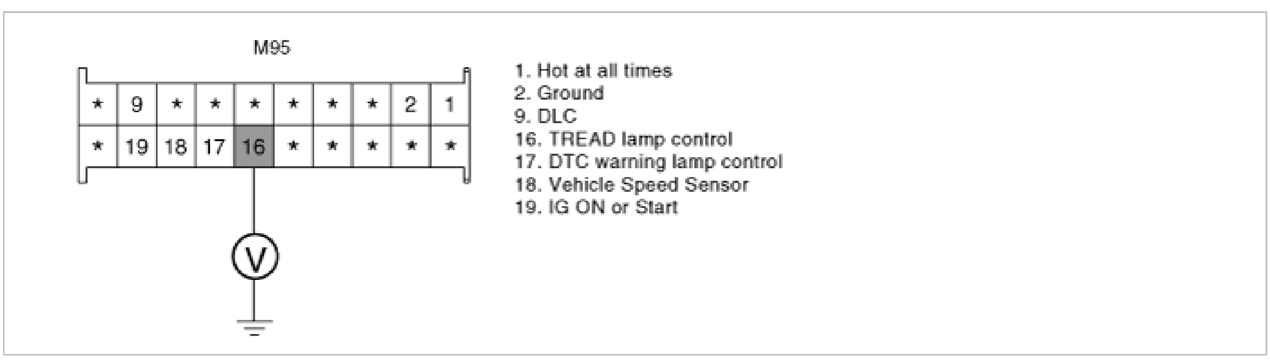
NO

▸ Go to "Control Circuit Inspection" procedure.

Control Circuit Inspection

1. Engine "OFF".
2. Disconnect instrument cluster connector and TPM receiver connector.
3. Engine "ON".
4. Measure voltage between terminal "16" of TPMS receiver harness connector and chassis ground.

Specification : 0 V



5. Is the measured voltage within specifications?

YES

- Substitute with a known-good TPM receiver and check for proper operation.
- If the problem is corrected, replace TPM receiver and then go to "Verification of Vehicle Repair" procedure.

NO

- Check for short to power in control harness.
- Repair if necessary and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

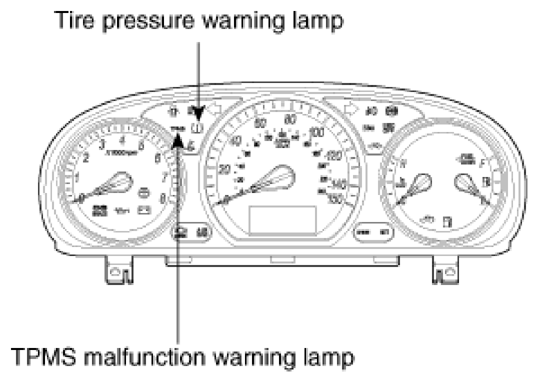
- Go to the applicable troubleshooting procedure.

NO

- System performing to specification at this time.

Suspension System > Troubleshooting > C2511

Component Location



General Description

The TPMS receiver unit must provide two outputs continuously to drive the indicator lamps. One of the output turn the TREAD indicator lamp on when pressure in one or more tires associated with the TPMS receiver unit have reported a pressure below the warning level threshold. The other output turn the TPMS Warning indicator bulb on when the TPMS receiver unit has detected a system fault.

【Turn the TPMS DTC Warning indicator lamp on】

1. When the system detects a fault that is external to the receiver / sensor.
2. When the system detects a receiver fault.
3. When the system detects a sensor fault.

【Turn the TPMS DTC Warning indicator lamp off】

1. If the fault is considered as 'critical', then the lamp is held on throughout the current Ignition cycle (even if the DTC has been demoted). This is because it is important to bring the problem to the drivers attention. On the following Ignition cycle, the demotion conditions will be re-checked. If the demotion conditions occur, the lamp will be turned off. It will be held on until DTC demotion checking is completed.
2. 'Non critical' faults are those that can occur temporarily e.g. vehicle battery under voltage. The lamp is therefore turned off when the DTC demotion condition occurs.

DTC Description

This DTC indicates that the TREAD(Tire Under Inflation / Leak Warning) / DTC Warning lamp is short circuit and therefore cannot be turned on. The most likely failure is harness / instrument cluster / connector / receiver short circuit.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Input lamp current check	• Short circuit to 12 V between lamp and TPMS receiver
Enable conditions	• TREAD / Diagnostic lamp circuit short to 12 V	
Threshold value	• TREAD / Diagnostic lamp - 200 mA allowed each (after in rush time). 50 mA margin built in.	
Diagnosis time	• < 3s	

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminal condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/or damage.
3. Has a problem been found?

YES

▶ Repair if necessary and then go to "Verification of Vehicle Repair" procedure.

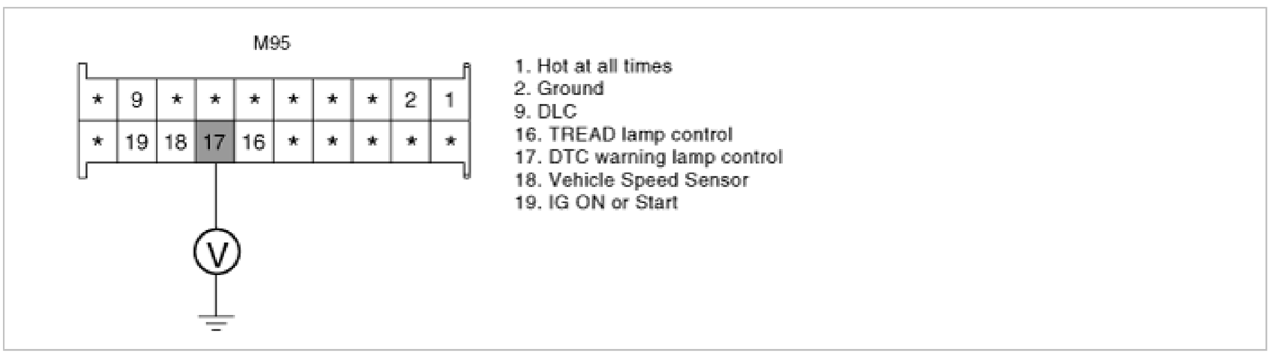
NO

▶ Go to "Control Circuit Inspection" procedure.

Control Circuit Inspection

1. Engine "OFF".
2. Disconnect instrument cluster connector and TPM receiver connector.
3. Engine "ON".
4. Measure voltage between terminal "17" of TPMS receiver harness connector and chassis ground.

Specification : 0 V



5. Is the measured voltage within specifications?

YES

▶ Substitute with a known-good TPM receiver and check for proper operation.
▶ If the problem is corrected, replace TPM receiver and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Check for short to power in control harness.
▶ Repair if necessary and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.

3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

▸ Go to the applicable troubleshooting procedure.

NO

▸ System performing to specification at this time.